Atlantic States Marine Fisheries Commission

Executive Committee

February 1, 2017
8:00 – 9:30 a.m.
Alexandria, Virginia

Draft Agenda

1. Welcome/Call to Order (*D. Grout)*
2. Committee Consent
   - Approval of Agenda
   - Approval of Meeting Summary from October 2016
3. Public Comment
4. Review and Consider Approval of FY16 Audit *(L. Leach)* **Action**
5. Finalize Standard Meeting Practices *(R. Beal)* **Action**
6. ACCSP Update
7. Other Business/Adjourn

Please Note: Breakfast will be served at 7:45 a.m.

The meeting will be held at the Westin Alexandria; 400 Courthouse Square; Alexandria, VA; 703.253.8600

Vision: Sustainably Managing Atlantic Coastal Fisheries

MEETING SUMMARY OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

EXECUTIVE COMMITTEE

Harborside Hotel
Bar Harbor, ME
October 25, 2016

INDEX OF MOTIONS

ATTENDANCE

Committee Members

Pat Keliher, ME (AA)
Doug Grout, NH (AA)
Dennis Abbott, NH (LA Chair)
David Pierce, MA (AA)
David Simpson, CT (AA)
Jason McNamee, RI (AA)
Jim Gilmore, NY (AA)
Brandon Muffley, NJ (AA proxy)
Andy Shiels, PA (AA proxy)
John Clark, DE (AA proxy)
Roy Miller, DE (GA Chair)
David Blazer, MD (AA)
John M.R. Bull, VA (AA)
Braxton Davis, NC (AA)
Robert Boyles, SC (AA)
Spud Woodward, GA (AA)
Jim Estes, FL (AA proxy)

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Other Commissioners

Nancy Addison, GA (GA)
Eric Reid, RI (LA Proxy)
Ed O'Brien, MD (LA proxy)
Ritchie White, NH (GA)

Staff

Bob Beal
Pat Campfield
Laura Leach
Toni Kerns

Others

Charles Lynch, NOAA

CALL TO ORDER

The Executive Committee of the Atlantic States Marine Fisheries Commission convened in the McMurtry Room of the Harborside Hotel in Bar Harbor, Maine October 25, 2016. It was called to order at 8:00 a.m. by Chair Doug Grout.

APPROVAL OF AGENDA

The agenda was approved with the addition of a discussion on MRIP/Economic Survey.

APPROVAL OF PROCEEDINGS

The summary minutes from the August 2, 2016 meeting were approved as presented.

PUBLIC COMMENT

There was no public comment.

AOC REPORT

AOC Chair Jim Gilmore noted that the Commission used a new auditing firm this year, Smith, Burdette and Bish, and found the auditing process to be challenging. The firm noted some findings that staff does not agree with, and staff has retained an independent auditing firm to assist with contesting these findings. Because of this, staff requested that action on the audit be deferred until the Winter Meeting. The Executive Committee approved this request.

CONSERVATION EQUIVALENCY

Staff presented the revised Conservation Equivalency document, and a motion was made by Mr. Boyles and seconded by Mr. Simpson "to approve the Conservation Equivalency document for action by the Policy Board." The motion passed unanimously.

STANDARD MEETING PRACTICES DOCUMENT

Staff presented the revised standard meeting practices document and there was discussion on several issues.

Executive Director Beal explained that the entire document is not binding; running the meeting is still subject to the discretion of the Chair; however established Quorum and Voting procedures are not subject to the Chair's discretion. The document is intended to document the Commission's best management practices for running board meetings.

Mr. Shiels recommended that the document be separate into two sections; the first section is binding and the second section are guidelines. Staff will revise the document accordingly. It will be added to the Commissioner Manual, and added to the website with other standard materials.

A motion was made by Mr. Keliher and seconded by Mr. Woodward to approve the Standard Meeting Practices document as revised by staff. The motion passed unanimously.

AWARDS COMMITTEE REPORT

Mr. Woodward, Awards Committee Chair, reported that the Committee met at the August meeting to discuss changing the name of the Hart Award. After lengthy discussion, and upon finding out that the Commission's 75 year history would be dedicated to Pat White, the Committee does not recommend changing the name of the David H. Hart Award.

PERFORMANCE APPRAISAL/MERIT INCREASE PROTOCOL

With the Commission continuing to hire employees for the states, staff is recommending that we align performance appraisals/merit increases with the states for employees housed in the states. Executive Committee members agreed, and asked staff to develop a document with guidelines for state-housed employees.

RESTATEMENT OF RETIREMENT PLAN

Because of the number of part-time and seasonal employees the Commission is hiring to conduct the APAIS survey in the states, staff requested the Executive Committee approve restating the Commission's retirement documents to exclude employees who work less than 1,040 hours in a year. A motion was made by Mr. Blazer and seconded by Mr. Boyles that the Executive Committee adopt the resolution allowing for restatement of the Commission's retirement plan. The motion passed unanimously.

MRIP INTERCEPT SURVEY

Several Committee members expressed concern with adding socio-economic questions to the intercept survey, especially in the first year the states will be conducting the APAIS interviews. Executive Director Beal suggested that staff talk with Gordon Colvin and the MRIP staff to see if we can adjust the timing of the socio-economic survey.

ADJOURN

CHAIR DOUG GROUT adjourned the Executive Committee meeting at 9:40 a.m.

ASMFC Standard Operating Procedures for Meetings

February 1, 2017

As established by the Interstate Fisheries Management Program Charter, the Atlantic States Marine Fisheries Commission (Commission) generally uses Roberts Rules of Order to conduct its business. There are some deviations from Roberts Rules adopted by the Commission. The following operating procedures are provided to make Commission meetings more effective and efficient.

Required Elements

The following voting and quorum provisions are established in the Commission guiding documents and are not subject to the discretion or interpretation by the meeting chair.

Quorum – The following quorum provisions are included in the Commission guiding documents. These provisions are not subject to the meeting chair's discretion.

- The presence of Commissioners representing a majority of the state members (>50%) constitute a quorum at a meeting of the Commission.
- Any state shall be recorded as present when represented by one or more of its Commissioners.
- A quorum for any Commission group shall be a majority of the members of such body, provided that any such body may petition the Executive Committee in advance for approval of an alternative quorum procedure.

Voting – The following voting provisions are included in the Commission guiding documents. These provisions are not subject to the meeting chair's discretion.

- The Commission's Business Session, and management boards and sections shall be by state (or by jurisdiction or federal agency) with one vote per state. A state's vote shall be determined by the majority of that state's delegation of Commissioners who are present. Based on the number of delegates present, votes may be cast in favor, in opposition, in abstention, or null. A null vote occurs when only two state delegates are present and they do not agree on a position. A null vote can also occur if three state delegates are present and one delegate abstains from participating in the state caucus and the other two delegate do not agree on a position.
- No person may, by proxy, vote more than once on any issue.
- Any Commissioner or Commissioner Proxy or duly authorized representative of a jurisdiction or agency that is a member of a management board/section may make or second any motion; provided the maker of the motion and second (when necessary) must each come from a different state, jurisdiction, or agency.
- Any meeting-specific proxy appointed by a Legislative or Governors' Appointee Commissioner may not vote on a final action being considered by a management board/section. Meeting-specific proxies may vote on preliminary decisions such as issues to be included in a public hearing draft or approval of public information documents.
- A final action is defined as: fishery specifications (including but not limited to quotas, trip limits, possession limits, size limits, seasons, area closures, gear requirements), allocation, final approval of FMPs/amendments/addenda, emergency actions, conservation equivalency plans,

and non-compliance recommendations. A meeting-specific proxy may participate in the deliberations of the meeting, including making and seconding motions.

- The roll must be called for all final actions unless there is no objection to the motion.
- A two-thirds majority, which is required for an emergency action, extending a management action, or amending/rescinding a final action, is defined by the entire voting membership. However, federal agency abstentions do not count when determining the total number of votes.

Discretionary Elements

The following process recommendations are meeting best management practices for use by a meeting chair to effectively and efficiently run Commission meetings.

Process – The meeting chair has the discretion to manage the meeting conduct and application of the following best management practices.

- All board members should have the opportunity to speak once prior to anyone speaking a second time.
- An individual may not be recognized to speak on a motion more than two times during a single board meeting.
- If the chair believes there may not be opposition to the motion, he/she will seek board consent of the action by asking "If there is no objection, this item will be adopted." After pausing for any objections, the chair states "As there are no objections, this item is adopted unanimously." It is not necessary to ask for a show of hands.
- If the chair determines too much time is being consumed by speakers, he/she can set a time limit on such speeches.
- The meeting chair can use either of the following options for "one in favor/one against":

Options for use of "one in favor/one against":

Option 1: At any time in the meeting based on concern regarding limited time availability to conduct the full business of the board/section or in cases when extensive debate on an issue has occurred, the chair can limit debate to one in favor/one against.

Option 2: After all members have had the opportunity to speak on a motion twice, the chair will limit debate to one in favor/one against. If there is no one left to speak in favor/against the chair will call the vote on the motion.

Atlantic States Marine Fisheries Commission

Business Session/ACCSP Coordinating Council

February 1, 2017
10:45 a.m. - 12:15 p.m.
Alexandria, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(D. Grout)* 10:45 a.m.

2. Board Consent *(D. Grout)* 10:45 a.m.
   - Approval of Agenda
   - Approval of Proceedings from October 2016

3. Public Comment 10:50 a.m.

4. Review and Discuss the National Academies of Sciences Report *Review of the Marine Recreational Information Program* 11:00 a.m.

5. Other Business/ djourn 12:15 p.m.

The meeting will be held at the Westin, 400 Courthouse Square, Alexandria, Virginia; 703-253-8600

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

BUSINESS SESSION

The Harborside Hotel
Bar Harbor, Maine
October 26, 2016

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ATTENDANCE

Board Members

Patrick Keliher, ME (AA)
Sen. Brian Langley, ME (LA)
Steve Train, ME (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Doug Grout, NH (AA)
Ritchie White, NH (GA)
Bill Adler, MA (GA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Jason McNamee, RI, proxy for J. Coit (AA)
David Borden, RI (GA)
Rep. Melissa Ziobron, CT, proxy for Rep. Miner (LA)
David Simpson, CT (AA)
Lance Stewart, CT (GA)
James Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
Brandon Muffley, NJ, proxy for D. Chanda (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Andy Shiels, PA, proxy for J. Arway (AA)
Loren Lustig, PA (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
David Blazer, MD (AA)
Rachel Dean, MD (GA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
John Bull, VA (AA)
Michelle Duval, NC, proxy for B. Davis (AA)
David Bush, NC, proxy for Rep. Steinburg (LA)
Robert Boyles, SC (AA)
Malcolm Rhodes, SC (GA)
Pat Geer, GA, proxy for Rep. Nimmer (LA)
Spud Woodward, GA (AA)
Sen. Ronnie Cromer, SC (LA)
Jim Estes, FL, proxy for J. McCawley (AA)
Martin Gary, PRFC
Wilson Laney, USFWS
Kelly Denit, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Bob Beal
Toni Kerns
Mark Robson
Pat Campfield
Laura Leach
Tina Berger
Mike Cahall

Guests

The Business Session Board of the Atlantic States Marine Fisheries Commission convened in the Stotesbury Grand Ballroom of the Bar Harbor Club, Harborside Hotel, Bar Harbor, Maine, October 26, 2016, and was called to order at 11:52 o'clock p.m. by Chairman Douglas E. Grout.

CALL TO ORDER

CHAIRMAN DOUGLAS E. GROUT: Welcome to the commission's Business Session.

APPROVAL OF AGENDA

We have an agenda before us. Are there any changes to the agenda? Seeing none; is there any objection to approving the agenda as is? Seeing none; the agenda is approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN GROUT: We also have in our meeting packages, the proceedings from our August, 2016 meeting.

Are there any edits or changes to that meeting summary? Seeing none; is there any objection to approving the proceedings from the August, 2016 meeting? Seeing none; I see those proceedings approved.

PUBLIC COMMENT

CHAIRMAN GROUT: This is also the time for public comment. Is there anybody that would like to make public comment to the business session at this point?

ELECTION OF THE COMMISSION CHAIR AND VICE-CHAIR

CHAIRMAN GROUT: Seeing none; we'll move on to the next agenda item. I'll turn it over to Bob Beal for election of the commission Chair and Vice-Chair.

EXECUTIVE DIRECTOR ROBERT E. BEAL: The nominating committee communicated with a number of commissioners, and I will call on Roy Miller to provide a report from the Nominating Committee.

MR. ROY W. MILLER: The Nominating Committee this year consisted of Robert Boyles, David Borden and myself. I think Bob, you're putting up a motion that I would like to offer on behalf of the Nominating Committee. **On behalf of the Nominating Committee, I move to nominate Doug Grout as the ASMFC Chair for 2017.**

EXECUTIVE DIRECTOR BEAL: Thank you, Roy. Since this is coming from a committee, it does not need a second. **Is there any objection to the nomination from the Nominating Committee to have Doug serve a second term as our Chair? Seeing none; congratulations, you are reinstated unanimously.** Mr. Miller, do you have a report on the Vice-Chair?

MR. MILLER: It would be my pleasure to do that. **On behalf of the Nominating Committee, I move to nominate Jim Gilmore as the ASMFC Vice-Chair for 2017**.

EXECUTIVE DIRECTOR BEAL: **Any objections to having Jim Gilmore serve a second term as Vice-Chair? Seeing none; congratulations, Jim, unanimously reelected.**

CHAIRMAN GROUT: Thank you all very much. I appreciate your trust in the Grout-Gilmore team.

REVIEW AND CONSIDER THE APPROVAL OF THE 2017 ASMFC ACTION PLAN

CHAIRMAN GROUT: Next item on the agenda is Review and Consider the Approval of the 2017 ASMFC Action Plan, and I am going to turn this over to senior staff to go through it with us.

MS. TONI KERNS: Goal 1 is the goal to rebuild, maintain and fairly allocate Atlantic coastal fisheries, which falls mainly under the ISFMP

department, and I am going to go through the strategies by each of the species; and just highlight those strategies that are either just started recently or that are new for 2017, and I'll answer any questions at the end. American eel, we will complete the 2017 stock assessment update, and consider management response to the assessment findings.

For lobster, we will develop and implement an addendum to improve catch and biological reporting in the lobster fishery. We'll monitor the trap reductions from the southern New England lobster fishery, and implementation of the addenda that relates to trap reductions; and determine the need and extent of any further management action within the region.

We'll review analysis by a Technical Committee on the Gulf of Maine stock, and determine the need and extent of any management actions for that region. Moving on to Atlantic herring, we'll review the performance of the GSI-30 spawning based monitoring pilot program and consider its use for future years. We'll consider management action to meet the goals and objectives of the Area 1A fishery based on tomorrow morning's discussion of management for within those three states for 1A.

In Atlantic menhaden, under the first task that's looking at ecological-based reference points, there was a request to hold a workshop to discuss and review potential ERPs that might be included in Draft Amendment 3. For this task there was not sufficient funding in the budget to hold this workshop, so if this is something that we would like to occur, we would need to figure out a way to find funding for the workshop.

Also for menhaden, we'll finalize and implement Amendment 3, to revisit quota allocation and address ERPs. We'll complete the 2017 stock assessment update, and consider management response to the assessment findings. Under striped bass, we'll initiate the benchmark 2018 stock assessment, and this will include fleet and sex-specific analyses as well as regional models.

Under Atlantic sturgeon, we will be finalizing the 2017 benchmark stock assessment, and we'll consider management response to this assessment if necessary; as well as transmit the assessment findings to NOAA Fisheries for their consideration in the five-year ESA status review for sturgeon.

Under coastal sharks, we will monitor and engage in the development of Amendment 5 for dusky shark management and review and consider the dusky benchmark assessment management, and consider the management response to these findings. We did just hear about the assessment results from Karol yesterday.

We weren't sure if we were going to have all that information available yet or not, so we can alter this ever so slightly. For horseshoe crab, we'll engage the biomedical community towards finding the solution regarding confidential data in order to enhance the stock assessment and scientific advice for management.

Under northern shrimp, we will complete the 2017 benchmark stock assessment and consider management response to those findings; as well as establish specifications for the 2017/2018 season, and consider industry test tows to collect biological data as we have in the past couple years if necessary, and as resources allow. So far, we do not have money in the budget for those test tows, but it comes from a different funding source than ACFCMA, so if we can find that funding, we will do our best to help out in northern shrimp. For shad and river herring, we'll complete the 2017 river herring stock assessment update, and initiate the development of the 2018 shad stock assessment update. We'll review the updated Sustainable Fishery Management Plans and

Habitat Plans, as required by Amendment 3 and 2.

For Atlantic croaker, we will complete the 2017 benchmark assessment and consider a management response, if necessary. Under cobia, we will finalize the development of the FMP, and work with the South Atlantic Management Council and NOAA to insure complementary regulations between the state and federal waters.

Under red drum, we'll consider management response to the 2016 assessment finding, and the Technical Committee's Working Group responses to the board's tasks. For spot, we will complete the 2017 benchmark stock assessment and consider a management response to those assessment findings.

Under summer flounder, we will continue to work with the Mid-Atlantic Council on the Comprehensive Summer Flounder Amendment, as well as develop and implement an addendum to consider management approach which includes regional options for the 2017 fishery and potentially beyond.

For scup, we will collaborate with the council on a next amendment if initiated by the Mid-Atlantic in 2017. For black sea bass, we will collaborate with the council to consider the management response to the 2016 benchmark stock assessment findings, modify the 2017 specifications, as needed, based on the results of that assessment and set 2018 specifications.

We'll also consider developing and implementing an addendum to look at recreational fishing measures for 2018 and beyond. Then we will also convene the Climate Change Working Group to develop white papers addressing fishing impacted by climate change; and we'll have a little more about that tomorrow at the Policy Board.

Then we will also consider approval of the Risk and Uncertainty Work Group Draft Policy for management and implementation. Then the last two are establish a Policy Board Working Group to consider options to more effectively review progress in achieving the commission's vision.

This is sort of a question that we posed to the AFC as well as Doug and Jim about whether or not we are most effectively using the survey that we do at the beginning of the year to commissioners, and if that is providing good feedback to you all on how well we're performing, as well as the review of the annual performance of the stocks in August.

What we decided is that we would pull together a working group to best get at answers to those questions, so that staff can help the commissioners have the most effective feedback. Then lastly, we'll review advisory panel guiding documents to include Chair term limits for advisory panels.

CHAIRMAN GROUT: That is a very busy and ambitious action plan, at least for Goal 1, considering those are just the new things we're going to be doing. Are there any questions for Toni on this particular section? Yes, Adam.

MR. ADAM NOWALSKY: Would it be possible, under summer flounder, Toni, to look at combining 1.1.85 and 1.1.86 regarding the current stock status update and development of the sex-specific stock assessment to acknowledge the fact that that model development has been completed, and based on the discussion at the NRCC, we hope to actually see that translate into a benchmark in the near future.

MS. KERNS: We can do that, Adam.

MR. WILLIAM A. ADLER: On Page 4, where we have finalize and implement Amendment 3 to revisit quota allocations, and also, the Atlantic

menhaden, basically. Do you anticipate that we would be able to get an Amendment 3 through its process, which is usually like the PID, then back and forth, all within 2017?

MS. KERNS: That is what the timeline is set up for currently, Bill. It would be final action at the annual meeting next year.

MR. ADLER: Okay, it just seems like to do all of that on menhaden in one year and get it implemented is a little bit -- but okay.

MS. KERNS: Implementation to the states would be 2018, but final action by this commission would be end of the year 2017.

CHAIRMAN GROUT: Dave Pierce.

DR. DAVID PIERCE: Not a question but I have a suggestion for a task related to 1.2, so at the appropriate time, I would like to make that suggestion.

CHAIRMAN GROUT: It sounds like this would be an appropriate time.

DR PIERCE: This is an important part, well it's all important, but this one strikes me as especially important. Section 1.2 reads; strengthen state and federal partnerships to improve comprehensive management of shared fisheries resources. Then task 1.2.3 goes on to say; work with the regional fishery management councils and NOAA Fisheries to improve alignment between state and federal fishery management programs.

I would like to add another task that is related to that one. It is very specific to something that has just happened, and it is very relevant to ASMFC business and how we interact with our federal counterparts. That would be National Standard Number 1. I would suggest that another task be, work with the regional fishery management councils and NOAA Fisheries to review changes in National Standard Number 1 Guidelines and their implications for alignment of state and federal fishery management programs.

One might assume that National Standard Number 1 review implications for us would be under Task 1.2.3; but not necessarily so. I would like to make that very specific. The final guidelines have just come out. No one, I don't think, has really taken a close look at them to determine if anything has changed. If there aren't implications for how we align with federal fisheries management programs, I would like to be very specific with regard to that. I don't think it would involve much work or expense, but it would be a valuable task for ASMFC; again, working with our federal partners. I can make that in the form of a motion, if you would like, Mr. Chairman.

CHAIRMAN GROUT: I thought you were.

DR. PIERCE: No, I didn't say, I move. Well, I would move to add another task to Section 1.2 and it would read; work with the regional fishery management councils and NOAA Fisheries, to review changes in National Standard Number 1 Guidelines and their implications for alignment of states and federal fishery management programs. That is my motion, Mr. Chairman.

CHAIRMAN GROUT: We'll get it up there, and once we get it up there, I'll see if we have a second to that motion.

DR. PIERCE: National Standard Number 1 Guidelines.

CHAIRMAN GROUT: Does that wording capture your motion, David?

DR. PIERCE: Yes, that does. I make the motion, in part, because it follows up somewhat nicely with the plenary session at the beginning of this meeting, in that we spoke about the progress we have made, where we are right now, and

what we need to do in the future. What we didn't highlight at that time was state directors notably are a bit of a Dr. Jekyll and Mr. Hyde, in that we are federal fisheries managers. We are members of the federal councils, and we are ruled, therefore, by the National Standard Guidelines.

But then we take off that hat, if we can. We come to ASMFC board meetings, and now we are state directors that are not ruled by those guidelines or by that federal fisheries law. Therefore, the changes that have been made in the National Standard Number 1 Guidelines have implications for how we do our business, and how we interact with other states and also with the federal government. This will help us better understand if there any implications. There may be none, but I think there might be.

CHAIRMAN GROUT: Is there a second to this motion? Jay McNamee. Further discussion on this motion? Okay, do you need a time to caucus? **Does anybody need time to caucus on this? Seeing no heads nodding, all those in favor of this motion, raise your hand, all opposed: abstentions, null votes; the motion carries unanimously.** Representative Ziobron, excuse me, I mispronounced your name.

MS. MELISSA ZIOBRON: That's okay.

CHAIRMAN GROUT: Welcome and you had a question.

MS. ZIOBRON: Yes. My question, especially as someone that is very new to this board, is I understand now that in this plan, the bold faced tasks are new tasks, so thank you for that. But I'm curious on how you prioritize these tasks. Are they prioritized based on the number sequence of how they appear, or are there any priorities within this plan?

MS. KERNS: They are not prioritized in any specific order; they are just all the tasks that we plan on getting done in 2017.

CHAIRMAN GROUT: Any other questions for Toni? Brandon and then John.

MR. BRANDON MUFFLEY: Just one under Jonah crab, and maybe I don't know what the final outcome of tomorrow's meeting will be in regard to Jonah crab, but it is specific to Addendum II. There are discussions about also addressing bycatch definitions there. I don't know if that needs to be added. Again, we don't know. That hasn't been specifically decided yet by the Lobster Board, but I'm assuming that it will get approve to be included in this addendum.

MS. KERNS: We can add bycatch to the task if the board includes it in there, since it hadn't been officially included, we did not align it in.

CHAIRMAN GROUT: John McMurray.

MR. JOHN McMURRAY: Just going back to menhaden for a minute. You mentioned the ERP Workshop and the lack of funding. Is that kind of off the table now? Are you looking for funding? The second part of my question is, was that part of the timeline for menhaden now, or was that something new that was introduced fairly lately?

MS. KERNS: It was not something that was in the original timeline when we first started developing Amendment 3; it was something that had come up a couple of months ago, I guess. Since the issue has come up, there have been some folks, who originally had asked us to do the workshop, said, oh we don't need a workshop any more, and then there are other folks that still are interested in a workshop. I think that there is mixed view on whether a workshop is necessary or not. If the board definitely wants to have a workshop then, we would need that direction, and then we would need to figure out a way to fund it.

CHAIRMAN GROUT: Any other questions for Toni? Seeing none; we'll go to Goal 2, Pat Campfield.

MR. PATRICK A. CAMPFIELD: Goal 2 covers the stock assessment activities for 2017, as well as all of the fishery science surveys underlying fisheries research that feed into the stock assessments. Starting with Task 2.1.2, the benchmark assessments that are planned for completion for 2017 include croaker, sturgeon, shrimp and spot.

In addition for assessment updates, we will do river herring, menhaden, eel, bluefish, scup, black sea bass and summer flounder. Again, a lot of stock assessment activity in 2017. Task 2.1.3 covers the peer reviews that the commission will organize, again for benchmarks of sturgeon, shrimp and spot and croaker.

Also, a newer activity under Task 2.1.4 is related to southern flounder. As you may recall, last year in the action plan, there was a request for the commission to support some early data gathering and assessment feasibility coordination among the South Atlantic states, to see if a regional stock assessment could be done for southern flounder; and those states have asked the commission to support a couple more workshops in 2017. Again, this is another activity that we currently don't have funding for, and we would have to reprioritize activities in order to support southern flounder assessment work.

Then 2.1.7 is a new activity to work with the assessment science committee to conduct a data best practices workshop, as well as expand our fishery-independent survey database to promote more rapid completion of stock assessments and their reports. It would build off a very productive data best practices workshop that SEDAR had a year or two ago. Again, it would sort of streamline how data come into assessments and how decisions are made about which surveys and other data sources to use in assessments.

Sometimes that can slow down the process. Task 2.1.10 pertains to the risk and uncertainty policy that a workgroup has been developing, and we'll hear more about this at the Policy Board tomorrow. We hope to bring that draft policy forward to the board for consideration and approval in 2017, and tied to that, hold a commissioner workshop on management risk and uncertainty; to work through some examples and how the policy may work out.

All of the activities under Strategy 2.2 are related to the ASMFC Research Priorities. The commission has maintained a long and growing list of research priorities; both by species, across species, and some specific sections on habitat research as well as social and economic research. We will update that again in 2017.

It has been a few years since we've updated it from recommendations from individual assessments. In order to expand the network that those research priorities are provided to, we have a task 2.2.2 to organize a workshop with the Sea Grant research directors from all of the different states, to get that information to the Sea Grant programs, hopefully to promote more coordination and funding support through Sea Grant.

Again, in the parenthetical, we can see that that is currently not in the budget, but something that we would have to prioritize. Task 2.2.3.3 is to monitor and participate in the Mid-Atlantic Council's redesign of their research set-aside program. As you all know that was sort of turned off a couple years ago, due to some issues, and so we will continue to work with the Mid-Atlantic Council and its members to hopefully bring that program back online.

Moving down to 2.2.6 that pertains to the northeast area monitoring and assessment program, the new task there is to develop and

implement a strategy to figure out future funding needs; in order to address some shortfalls that have been experienced, certainly this year and are anticipated for 2017. For both the Mid-Atlantic/southern New England trawl survey, as well as the Maine/New Hampshire trawl survey under the EMAP Program.

Also, we intend to have a NEMAP summit, which would bring together the NEMAP Operations Committee, the NEMAP Board, as well as the various technical groups under NEMAP; to reassess the program structure and committee functions, and determine the path forward. NEMAP is now about a decade old, and so we want to evaluate our future direction.

Task 2.2.7 covers the southeast area monitoring and assessment program, SEAMAP. That has been around for almost three decades, I think, and so, not a whole lot of new activities, but we do have a new five-year SEAMAP management plan that we will begin to implement next year. Moving down to Task 2.2.10, this covers all activities under MRIP. We plan to participate in the development of an MRIP strategic plan, as well as track the MRIP new effort survey review and time series calibration. It has been touched on earlier this week, but that will have implications both for upcoming stock assessments, as well as tracking quotas and considering changes to management.

We experienced delays in some of the wave data this past year, and so the commission will continue to highlight our concerns related to those delays and final annual estimates. Task 2.2.11 covers the fish aging research and activities of the commission. The plans are to hold an aging workshop on American eel next year. Some of that work has already begun with an exchange that our staff has organized.

Moving down to economics and social sciences under 2.2.13, we plan to begin developing and providing basic socioeconomic information within the FMPs, amendments and addenda, and also the Atlantic menhaden socioeconomic study is due to wrap up early in 2017, and so the Economics Committee will provide guidance and translation of those results to the Menhaden Board and PDT during development of Amendment 3.

Task 2.3.4 is a new activity related to citizen science initiatives. There have been a number of new initiatives taking place up and down the coast. The Atlantic Communications Committee that Tina and others coordinate had a nice session on this about a month ago. We're going to track some of the activities that the South Atlantic Council has already had underway, as well as explore opportunities for citizen science to feed information into commission assessment and other processes. I think that concludes all the new activities under Goal 2.

CHAIRMAN GROUT: Any questions for Pat on this goal?

MS. JASON McNAMEE: Yes, quick question, Pat. I might be off, too, so the recalibration of MRIP is going to trigger a set of assessment something updates, I'm not sure what they're calling them. I think it is slated for 2018, but I have to imagine there is going to be a set of tasks that are going to begin in 2017. I just offer that comment, and maybe you've already thought about it. But it might be something that needs to be considered, to work into the 2017 task.

MR. CAMPFIELD: There are a number of venues where both commission staff as well as folks on the Technical Committees are plugging in. For example, the MRIP Transition Team, which Toni serves on, they've got a timeline laid out, and I think many of us have seen it; but it includes as that male-based-fishing-effort survey moves into its third year in 2017.

Recalibrating, I think that is the recalibration work is being led by the Science Centers but

other folks are involved, in terms of reviewing that work. I think it will be peer reviewed by the Center for Independent Experts. Then as we have discussed with the councils and at the NRCC table, we're setting aside time on those assessment schedules to dedicate towards the new MRIP numbers and perhaps, some candidate recreational species that we should address first. I think that's also true for the South Atlantic species under SEDAR.

CHAIRMAN GROUT: Brandon and then John.

MR. MUFFLEY: Just a question or a clarification under Task 2.1.2 regarding striped bass is going to have an update assessment? It is not under the action plan for striped bass, and they just did one this past year, and they're getting ready for the peer review; so I'm just wondering if that is on the agenda for next year.

MR. CAMPFIELD: That is an error, and a holdover from last year, so there will not be a striped bass update next year.

MR. JOHN CLARK: Pat, I have a question about 2.2.131, develop and provide basic socioeconomic information for inclusion in the FMPs. What exactly are you planning to put in there? Are we going to be looking at actual economic impacts of management decisions, or is it just going to be more of a description of whose fishing and what might happen?

MR. CAMPFIELD: More of the latter. It would be data that's readily at hand, dockside values, number of vessels participating in a fishery. We have done some preliminary work with ACCSP to see what they have on hand, in terms of economic and social data, including demographics of a fishing fleet or participants. It would really be that just basic level of information. It wouldn't be an analysis, but more a description of current status of the fishery.

CHAIRMAN GROUT: Follow up.

MR. CLARK: Just briefly. I mean just using it as an example, we've heard this week again about the impact that the striped bass size limits have had in the Chesapeake. This would seem to be something that could be quantified fairly simply. We have people that want to give us their information on that. Could data like that be incorporated into this task?

MR. CAMPFIELD: As the task states, it could be folded into addenda to FMP, so it may be dependent on the timing of the next one for striped bass. But it sounds like that is the nature of those data is readily on hand, and so when the timing is right, they could be plugged in for each species.

MR. CLARK: I just wanted to check on it.

CHAIRMAN GROUT: Any other questions for Pat? Loren.

MR. LOREN W. LUSTIG: Considering what you said toward the end of your report, sir, regarding citizen science. In my own personal background, I've had experience with such science efforts in freshwater environments, in terms of management and assessment; sometimes by advanced placement high school students, sometimes by interested retired scientists, et cetera. Would this be the kind of thing that we would anticipate for the marine system also, under what you described?

MR. CAMPFIELD: The current examples are like fish tagging efforts. South Carolina DNR, for example, has been very active in having angler groups in that state tag fish working closely with the state biologist to do it in a certified, correct manner. We've learned in the last couple weeks that there is a similar program up here in Maine, to have anglers take pictures of striped bass, and sometimes those data-like lengths can be used to supplement a stock assessment; and there are other examples up and down the coast. That is the nature of some of the citizen science activities that we're aware of now. But I

don't think there is any limitation on what would be considered. We're just trying to get a better sense of what is going on up and down the coast, and sometimes the data are useful, sometimes they aren't. But I don't think it would be limited to some of the groups that you talked about.

MR. LUGSTIG: Just to add that sir, if I could, I certainly appreciate the opportunities that exist and the fact that such efforts enhance credibility of this organization in the eyes of the general public.

CHAIRMAN GROUT: We are at a hard stop right now, where we do need to go to our luncheon at this point. Roy, I know you have a question. Okay. If anybody has another question for Pat, we can take it up after the dinner, or the lunch. We'll be coming back here. We'll finish up the Business Session and then go into menhaden. Just so you all know, the luncheon will be at the same facility that we were at last night for the dinner. We'll see you all down at the Hart Award dinner.

(Whereupon a recess was taken.)

CHAIRMAN GROUT: All right, if commissioners could take their seats, and we'll finish up the business session here. The last one in, please close the back door. Keep all the heat we have in here, there's not much. Just to check, were there any more questions for Pat on Goal Number 2? Seeing none; we'll turn it over to Toni and Goal Number 3.

MS. KERNS: Goal 3 is to promote the compliance with the fishery management plans to insure sustainable use of the Atlantic coastal fisheries; and this is our Law Enforcement goal. The Law Enforcement Committee will be focusing on evaluating and reporting out on compliance issues associated with newly implemented plans. Some of those will focus on lobster, tautog, Jonah crab and any other species that have newly implemented programs that come up next year. We'll continue to work with the Tautog Enforcement Committee to review and evaluate the effectiveness of a commercial tagging program and user acceptance if that program were to be adopted.

The committee will advance the recommendations of the American Lobster Enforcement Subcommittee to enhance cooperative funding and enforcement activities for commercial fisheries and nearshore and offshore waters, as well as advance any recommendations from the Aerial Enforcement Subcommittee that would support or enhance existing state and federal enforcement for commission-managed species. Are there any questions?

CHAIRMAN GROUT: Questions for Toni on this goal. Seeing none; we'll move on to Goal Number 4.

MS. KERNS: For Goal 4, it is to protect and enhance fish habitat and ecosystem health through partnership and education, and this goal focuses on the commissions Habitat Committee as well as the Atlantic Coast Fish Habitat Partnership. The Partnership as well as the Habitat Committee met last week down in Portland, and the Habitat Committee had made two changes to their strategies to achieve their goal, so I will note those. If you want to see them we can change the screen over and I can show you the words for those, if needed. But highlighting their activities will be cosponsoring an artificial reef symposium at AFS in 2017 in Tampa, and we'll support participation by the commission staff being at the committee and Artificial Reef Subcommittee members if we have funding available for them.

We will have our new habitat management series, which will be Living Shorelines and Submerged Aquatic Vegetation. Then under

Task 4.4.1, The Committee has asked to add two new words to this task, so it is provide information or comment on Atlantic Coast projects, plans policies and permits; in accordance with ASMFC project review protocols, so they added the words plans and policies to that.

They also asked to have a new task added under 4.5, and that is to communicate with the assessment science committee and other relative entities to better link habitat and stock productivity. This is a continuation on at the last annual meeting Jake had presented to the Policy Board about finding ways to include habitat in stock assessments.

We continued that conversation at this last Habitat Committee, which I'll report out on a little bit more at Policy Board. But this is just to further that recommendation that the Policy Board had last year. Lastly, in addition to identifying gaps in coastal regulatory planning, recording climate change impacts, we'll make recommendations to increase resiliency in state activities. Any questions?

CHAIRMAN GROUT: Questions on this goal for Toni? Okay, we will move on to Goal Number 5, and this is Tina.

MS. TINA BERGER: Goal 5 is on strengthen stakeholder and public support for the commission. New activities for 2017 are under Task 519, prepare brief, simplified stock assessment overviews for posting on YouTube and the Fishery Science 101 Page, and our focus will be on black sea bass and Atlantic sturgeon. Task 5.10 will be explore use of story mapping and photo journaling to better communicate science and management activities.

On the website you can find links to a couple of examples in case you have questions exactly on what story mapping and journaling is. Task 5.1.11 is to solicit outside sources, develop short video clips on fisheries management and science activities. Moving on to 5.2.1, we will continue to publish our annual report and focus on the 2016 activities; 5.2.2 will be preparing stock assessment overviews with the focal species that will be undergoing a benchmark and assessment updates.

Those are black sea bass, croaker, red drum, spot, sturgeon, shrimp, menhaden and river herring. Under Task 5.2.5, we will develop a fisheries management 101 page, very similar to the fisheries science 101 page. Under Task 5.3.2, we will conduct an annual training workshop for science and ISFMP staff on the very issue we talked about earlier, which is story mapping and photo journaling to expand staff's skill set and enhance communication tools. Those are the new activities for outreach.

CHAIRMAN GROUT: Questions for Tina on this particular goal and the actions under this goal? Okay, seeing none; we'll move to Goal Number 6, Bob Beal.

EXECUTIVE DIRECTOR BEAL: Goal 6 is largely unchanged from last year. It is the legislative agenda for the commission and the activities on Capitol Hill and interacting with our elected officials. Overall, as I said, it is unchanged. We're going to continue the work that Deke and I do on the Hill relating to the offices there, and making the commissions' priority known, as well as tracking a number of legislative activities that are going on in Capitol Hill.

We'll continue to try to get the commissioners as engaged as you are willing to be on Capitol Hill. Any time you are in town, and you want us to help you go to meetings, we're more than happy to set those up and bring you to Capitol Hill. There are a couple items in here that are in bold, 6.1.4.

Apparently, there is an election going on in a couple weeks. I haven't heard much about it, but I guess we've got to deal with that. Basically, this just says we're going to react to

the new administration and the 115th Congress once they're seated, and reach out to the new folks, especially the folks on Appropriation Committees and committees that deal with natural resources and ocean and fishery issues.

We'll do that. And Item 6.2.3 the bold language includes – well, there is a long list of the priority activities for ASMFC, and the funding areas and fisheries information networks have been added to that list. This is a reflection of the governance change for ACCSP. Since ACCSP is now a program within the commission, the FIN will become a priority funding area for the commission.

We'll continue to work with the Pacific States Commission, the Great Lakes Commission and the Gulf Commission to highlight the priorities that go around the whole country and FINS and SEAMAP and NEMAP and council and commission lines and a number of other things that are always on that joint list. We'll keep doing that work, and the last bit of Goal 6 is tracking legislation on Capitol Hill. That is a quick summary of what's included in Goal 6, Mr. Chairman.

CHAIRMAN GROUT: Questions for Bob on this goal, any of the actions? Seeing none; we'll turn to Goal 7, Laura Leach.

MS. LAURA C. LEACH: As you know, Goal 7 is, basically the administration of the commission. Most of it is ongoing. We do have some new tasks, and I'm not going to read all of them; but I'm going to hit some highlights. We'll be launching our inventory module and our accounting software, just so we continue to get more and more equipment with APAIS and that. We want to make sure we have perfect track of that.

We'll be fully incorporating ACCSP in the commission under the new governance structure. We're going to appoint an investment committee for the commission's retirement program; that is a formality, basically that our retirement broker asked us to do this year. Basically, the committee will be Bob and I, because we do it anyway, but he wants to formalize it.

We will be revising the commission's retirement plan documents to ensure qualifications for participation in the plans are clearly and accurately defined. Again, that is an outgrowth of the APAIS and the temporary and seasonal employees that we hire. We will be developing a commission compensation plan with updated job classifications and salaries based on location, again, because of APAIS. Developing SOPS that detail HR policies for Arlington-based and state-based employees. We will be conducting a comprehensive review and revision of our employee handbook. We'll be documenting our standards for electronic records retention, and develop a site map of the commission's electronic filing system. We will communicate our HR support available to state-based employees, and make sure the state-based employees know all of the services that we provide for them.

We will continue to update, obviously, we do it all the time now, on an ongoing basis, the commissioner manual, and making sure that we inform you all when the update is substantial; but no less than twice a year. We will continue to work with an HR attorney to ensure that all HR practices are consistent with state laws. That's my update.

CHAIRMAN GROUT: Any questions on these action item goals for Laura? Okay, ACCSP, Mike.

MR. MIKE CAHALL: I'm all excited. I'm making my debut before the entire commission. The FY17 Action Plan for ACCSP is essentially taken from, those of you who are members of the ACCSP Coordinating Council. This is essentially the plan that you just approved a few hours ago

as part of the funding requests for ACCSP, and it is based on the ACCSP Strategic Plan.

As you may recall from our Transition Plan, we will be folding the Strategic Plans together. ACCSPs happen to renew at the same times that the ASMFCs does, and it is at that point we'll merge them together. This is a little bit different in the sense that it was created in a little bit of a different way, and I'm not going to go through every single one, since to many of you this will be new.

Goal 8.1 is essentially to pull together the best available data that we can. We'll continue to maintain our data warehouse feeds and work to populate the newer modules in our data warehouse. We also have just deployed a new query interface, and we're going to be monitoring that to make sure that it provides services that we expect it to, and to continue to make adjustments to it, as needed, based on a feedback that we get from our end users.

We'll keep working with our partners. In 8.2 we will work with our partners to improve the data collection programs, either ones that are managed by ACCSP or potentially to provide technical assistance to folks who are working on their own systems. We'll be working on upgrades to SAFIS as I articulated to the council a little while ago.

We'll continue to manage the APAIS and the other data related tools. We built a suite of tools to help support APAIS as part of the work that we've been doing. We're going to be working on the SAFIS redevelopment process, and many of those of you who are fisheries managers, your staff people will be directly working with us.

The lobster system that we built a couple of years ago for the Lobster Technical Committee will continue to be operated. We are gradually enhancing that as we get lessons learned about how to best utilize it. Every year we get together and talk about how did it work well and what does it need, and where didn't things work as well as they could?

That system will continue to be managed. We'll keep working on the tablet, and now soon I hope, phone-based systems of SAFIS. We've had a lot of demand for folks to build phone-based applications. The tricky bit is we're asking for a lot of data, and so we have to find some way to stuff all that into a phone. In 8.3, we're going to continue to work to look for additional funds. ACCSP has the opportunity to pursue funding through the FIS and other ways. We'll continue to track the performance of our funded projects, and we'll be making some adjustments to the funding decision process.

For those of you who aren't familiar, ACCSP has an independent process that determines the allocation of the funds that were given to it through both ACFCMA and through the FIN line at the NMFS budget, and we'll continue to make revisions on our processes as needed; based on input that we get from our constituents.

We'll continue to maintain executive leadership and collaborative involvement with our partners through our various committees, which means that we'll continue to have our Coordinating Council meet at the regular commission meeting weeks. This will help keep folks informed, and keep folks plugged into the processes that we're working on.

Our technical and policy level committees, and there are several, will continue to meet regularly and, in fact, will probably be a little bit busier next year, because we're looking at some adjustments to our standards as well as a new systems development. Then 8.5 monitor and improve the usefulness of our products.

We do have metrics that we manage. We look at how well our systems perform, how many times they are being used, where we're cited in

publications and those kinds of things, so that we can tell whether our data are being used, and of course, we request feedback from our end users all the time. Our systems actually have methods to provide comments or questions directly to us.

We'll continue to work hard to maintain clear lines of communications between staff and our constituents, and we'll also make sure that we have clear feedback loops in place; so that we're aware of issues as they happen, or problems and conundrums that folks run into, especially as the role of ACCSP continues to expand.

In 8.6 we'll work with our program partners to provide materials and outreach to help them in looking out for funding. Our processes that we already have for outreach, so many of you have been receiving our annual reports, our fisheries files, and our various different publications. Those are going to continue.

We are going to be looking towards merging some of those in with existing commission documents. Most likely, the annual report will be folded into the commission's report and that kind of thing. But those certainly will continue to be published. We'll also participate in fisheries-related events where they're appropriate, and send our staff or others to them to help represent the program.

We'll also work – we, a lot of times, have found that sometimes the best plan is to just show up, so we keep track of who is doing what and where we might be able to at least listen in on processes, so sometimes, we may just go to a conference or sit by the side and listen or participate, so we continue to keep track of all that stuff. We, also in 8.7, directly participate in the nationwide systems that are part of Magnuson-Stevens. Those right now are FIS and MRIP primarily. I sit on one of the governing boards of FIS, and also MRIP. We're going to be transitioning that MRIP work most likely to Geoff. Then we'll continue to provide data for the Atlantic coast to the fisheries information system, and also, therefore, to fisheries of the U.S. annually, as we have been in prior years. That covers us.

CHAIRMAN GROUT: Any questions for Mike on the goals of ACCSP and the action plan? Seeing none; **we have a motion from the Administrative Oversight Committee to approve the 2017 Action Plan as presented. It doesn't need a second, but I would like to add one little phrase to it; as amended today, because of the amendment we did.**

Is there any objection to that friendly amendment being added on to the motion? **Seeing none; is there any objection to approving the motion as amended? Seeing no objection, the motion passes unanimously.** Thank you very much, staff for putting this together. I appreciate that.

ADJOURNMENT

CHAIRMAN GROUT: Is there any other business to come before the Business Session today? Seeing none; I see this meeting adjourned.

(Whereupon the meeting adjourned at 2:28 o'clock p.m. on October 26, 2016.)

Review of the Marine Recreational Information Program

DETAILS

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Committee on the Review of the Marine Recreational Information Program

Ocean Studies Board

Division on Earth and Life Studies

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Preface

In 2004, National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) requested that the National Research Council (NRC; now referred to as the National Academies of Sciences, Engineering, and Medicine, or "the National Academies"), review data collection for marine recreational fisheries in the United States, and specifically the Marine Recreational Fisheries Statistical Survey (MRFSS). The NRC formed a committee comprising ten experts in fishery science and statistics, which released its report, *Review of Recreational Fisheries Survey Methods*, in 2006. Together, the recommendations of the 2006 report called for a considerable redesign of the entire survey program to update survey methods in ways that would reduce bias, increase efficiencies, and allow for greater stakeholder trust and better relations with the recreational angling community.

Since 2007, in response to the NRC report, NMFS has been working to improve the survey program, primarily by transitioning from the MRFSS to the redesigned Marine Recreational Information Program (MRIP). A decade after the release of NRC's 2006 report, NMFS approached the National Academies requesting a second study to evaluate on how well and to what extent they have addressed NRC's recommendations. The current report is a result of this latest effort.

The need for this evaluation is clear. Provisions in the 2006 reauthorization of the Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA) greatly increased the demand for high-quality and timely data that can be used for assessment and management of marine fish stocks. However, because of the shortcomings of MRFSS, NMFS faced a lack of confidence in providing the quality data needed for managing recreational fisheries. Having an independent and objective review of the progress made since starting the implementation of MRIP should address many of the previous concerns and help reassure anglers and stakeholders.

Producing this report was a difficult challenge because of the complexity and multidisciplinary nature of the issues involved. The committee sent numerous questions to NMFS over the period of its study and NMFS was always responsive to the requests. In particular, we thank MRIP staff for their patience and openness in addressing questions about the program, and Dr. Ned Cyr, director of the Office of Science and Technology, for setting the stage for this review.

The committee is also grateful to the many individuals who played a role in the completion of this study. The committee met four times and would like to extend its gratitude to all of the individuals from regional councils, state fisheries agencies, recreational and commercial fisheries organizations, environmental conservation organizations, and others who appeared before the full committee or otherwise provided background information and discussed pertinent issues.

Finally, the committee sincerely thanks the National Academies' staff for their valuable support and extra efforts to facilitate the rapid completion of the report without compromising quality: Stacee Karras (Study Director), David Policansky (Scholar), Michael Cohen (Senior Program Officer), Payton Kulina (Senior Program Assistant), and Allie Phillips (Program Assistant).

Cynthia Jones and Luiz Barbieri, Committee Co-Chairs

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This report was also greatly enhanced by discussions with participants at the Committee's meetings as part of this study. The committee would like to acknowledge, especially, the efforts of those who gave presentations at the Committee meetings: Rob Andrews (NOAA), Michael Armstrong (Massachusetts Division of Marine Fisheries), David Bard (NOAA Contractor), Tom Baum (New Jersey Department of Fish and Wildlife), Bob Beal (Atlantic States Marine Fisheries Commission), Harry Blanchet (Louisiana Department of Wildlife and Fisheries), David Blazer (Maryland Department of Natural Resources), John Boreman (Mid-Atlantic Fishery Management Council, Scientific and Statistical Committee), Zack Bowen (Charter Boat Captain), Richen Brame (Coastal Conservation Association), Gregg Bray (Gulf States Marine Fisheries Commission), Jay Breidt (Colorado State University), Kenneth Brennan (NOAA), Mike Brown (California Department of Fish and Wildlife), John Carmichael (SAFMC), Brittany Chudzik (Mississippi Department of Marine Resources), Gordon Colvin (NOAA Contractor), Roy Crabtree (Southeast Regional Office), Ned Cyr (NOAA), E.J. Dick (Southwest Fisheries Science Center, NOAA), Lauren Dolinger Few (NOAA), Michelle Duval (South Atlantic Fishery Management Council) , Daniel Erickson (Oregon Department of Fish and Wildlife), Mark Fisher (Texas Parks and Wildlife), Brad Floyd (South Carolina Department of Natural Resources), John Foster (NOAA), John Froeschke (Gulf of Mexico Fishery Management Council), Chad Hanson (The Pew Charitable Trusts), Michael Kelly (CLS America), Kathy Knowlton (Georgia Coastal Resources Division), Mike Leonard (American Sportfishing Association), Chris Macaluso (Theodore Roosevelt Conservation Partnership), Richard Merrick (NOAA), Doug Mumford (North Carolina Division of Marine Fisheries), Corey Niles (Washington Department of Fish and Wildlife), Jean Opsomer (Colorado State University), Todd Phillips (The Ocean Conservancy), Clay Porch (Southeast Fisheries Science Center), Beverly Sauls (Florida Fish and Wildlife Conservation Commission), Leah Sharpe (NOAA Contractor), Tom Sminkey (NOAA), Lynne Stokes (Southern Methodist University), David Van Voorhees (NOAA), Geoff White (Access Point Angler Intercept Survey), and Dan Wolford (Coastside Fishing Club).

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the process. We wish to thank the following individuals for their review of this report:

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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the report's conclusions or recommendations, nor did they see the final draft of the report before the release. The review of this report was overseen by **John Dowling**, Harvard University and **Andrew Solow**, Woods Hole Oceanographic Institution. They were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

Contents

Summary

The National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) is responsible for collecting information on marine recreational angling. It does so principally through the Marine Recreational Information Program (MRIP), a survey program that consists of an in-person survey at fishing access sites and a mail survey, in addition to other complementary or alternative surveys. Data collected from anglers through MRIP supply fisheries managers with essential information for assessing fish stocks. In 2006, the National Research Council (NRC; now referred to as the National Academies of Sciences, Engineering, and Medicine, or "the National Academies") provided an evaluation of MRIP's predecessor, the Marine Recreational Fisheries Statistics Survey (MRFSS). That review, *Review of Recreational Fisheries Survey Methods*, presented conclusions and recommendations in six categories: sampling issues; statistical estimation issues; human dimensions; program management and support; communication and outreach; and general recommendations.

After spending nearly a decade addressing the recommendations, NMFS requested another evaluation of its modified survey program (MRIP). This report, the result of that evaluation, serves as a 10-year progress report (Box S.1). The committee met on four occasions, in Washington, D.C.; Charleston, South Carolina; New Orleans, Louisiana; and Irvine, California. At each meeting, the committee heard from state and federal employees as well as regional stakeholders. The committee also received written input from stakeholders during the study process. The resulting report recognizes the impressive progress that NMFS has made, including major improvements in the statistical soundness of its survey designs. It also highlights some remaining challenges, and provides recommendations for addressing them. This report principally focuses on the Fishing Effort Survey (FES) and the Access Point Angler Intercept Survey (APAIS) that form the backbone of MRIP, but recognizes the role that other survey programs play in MRIP and discusses them as they relate to coordination, certification, continuity, and other important aspects of MRIP.

Fisheries Surveys and Management

Recreational fishing is a favorite pastime in the United States. Recreational anglers throughout the nation fish from beaches and piers, as well from private, rental, or charter boats. Although recreational anglers each may take only a small number of fish, collectively, they can have a significant impact on the overall abundance of a stock. In some fisheries, the recreational catch exceeds the commercial catch.

Several attributes of recreational fisheries make them difficult to assess. Recreational fisheries include a large number of participants using many fishing modes at or from many diverse access points. Some recreational anglers travel great distances to fish, while others fish from their private property. Some anglers fish often, while others seldom fish. These characteristics make recreational anglers difficult to characterize and monitor. To complicate matters further, recreational anglers release some of their catch, and because discard mortality is difficult to assess, the overall impact on fish stocks also is hard to assess.

BOX S.1
Statement of Task

An ad hoc NRC committee will assess progress in updating marine recreational fisheries data collection through the Marine Recreational Information Program (MRIP) referencing the recommendations in the 2006 NRC report Review of Recreational Fisheries Survey Methods. Based on this assessment, the committee will identify potential areas for improvements or changes of direction that would substantially increase data quality for fisheries management, taking into consideration potential loss of information from disruption of the time series. The committee's report will:

1. Describe the approach and effectiveness of steps taken by NMFS to improve the quality and accuracy of marine recreational fisheries catch, effort, and participation statistics (in response to NRC 2006), including, but not limited to:
    a. Establishing registries of anglers and for-hire vessels and using the registries appropriately as sample frames for recreational catch and effort surveys;
    b. Improving the effectiveness and appropriateness of sampling and estimation procedures, applicability to various kinds of management decisions, and usefulness for social and economic analyses; and
    c. Providing for ongoing technical evaluation and modification, as needed to meet emerging management needs and changes in communication technologies (e.g. smart phone apps, internet-based social networking).
2. Assess the strength of the scientific process, including the engagement of external scientific and technical expertise, used by NMFS in developing, testing, reviewing, and certifying new sampling and estimation procedures.
3. Evaluate the communication of information on survey method development, survey method descriptions, and survey results to stakeholders and application of stakeholder input in the design and implementation of new sampling and estimation procedures. Stakeholders include at least three distinct sub-groups (with some overlap among them):
    a. Data collection partners, such as the Atlantic Coast Cooperative Statistics Program (ACCSP) and the Fishery Information Networks (FINs);
    b. Data customers (parties that use NMFS data for stock assessments, management actions, social and economic studies);
    c. Entities affected by the estimates (anglers and recreational fishing businesses, commercial fisheries, non-consumptive users, etc.);
4. Determine if the degree of coordination among federal, state, and territorial survey programs is sufficient to provide a clear, national perspective on marine recreational fisheries; and
5. Evaluate plans for maintaining continuity of data series to minimize disruption of management programs and stock assessments. This will include evaluation of the strategy for moving from the phone based survey to a mail and web-based survey as a means to estimate fishing effort.

Marine Recreational Fisheries Statistics Survey

In 1979, NMFS established MRFSS as a national program for gathering standardized and comparable data on marine recreational fisheries in the United States. MRFSS primarily consisted of two independent but complementary surveys, a coastal household telephone survey using random-digit-dialing to sample potential anglers, and an in-person intercept survey that sampled anglers where they completed their fishing trips.

Data collected from telephone surveys were used to produce estimates of effort (i.e., number of angler trips taken), and data collected from intercept surveys were used to establish estimates of catch per unit effort (CPUE). Estimates of total catch are derived using the product of effort and CPUE. Catch estimates are crucial for stock assessment and management (i.e., avoiding overfishing or to rebuild overfished stocks).

In addition to the telephone and intercept surveys, the MRFSS program allowed for alternative or supplemental region-, state-, species-, or sector-specific surveys. Alaska has never been part of the MRFSS program, and Texas has not been since 1985; both conduct their own surveys.

Since MRFSS was established, the context for conducting marine recreational fishing surveys has changed. Demand for active management on more narrow temporal and spatial scales has increased and the mix of recreational and commercial fishing has changed for some species and regions. By the early 2000s, many anglers, managers, and fishery scientists were concerned that the use of data produced by MRFSS in management exceeded the original design and purposes of MRFSS. Specifically, there were concerns that the precision, robustness, and timeliness of data were misaligned with management needs. Social and technological changes were also impacting the surveys' effectiveness and efficiency.

The conclusions and recommendations from the 2006 NRC report called for a considerable redesign of the survey program to reduce bias, increase efficiencies, and allow for greater stakeholder relations. However, the 2006 report also acknowledged the considerable complexity and challenges associated with such changes and supported making additional resources available for this purpose. In 2007, Congress called for implementation of the recommendations in the report to the extent feasible.

Marine Recreational Information Program

Since 2007, NMFS has been working to improve the survey program by transitioning from the MRFSS program to MRIP. Like MRFSS, MRIP is composed predominantly of an intercept survey (Access Point Angler Intercept Survey; APAIS) to gauge catch per unit effort and a separate off-site Fishing Effort Survey (FES) to determine effort. However, both surveys have undergone significant changes in terms of methodologies and statistical analyses. For example, the off-site FES has been transitioning from the telephone survey to a mail-based survey that employs address-based sampling.

MRIP also funds a variety of region-, state-, species-, and sector-specific surveys that either supplement or serve as alternatives to the APAIS and FES (see Figure S.1). NMFS has had to consider how to continue providing flexibility for these other surveys, which are tailored for specific circumstances, while retaining sufficient data consistency to maintain a national perspective.

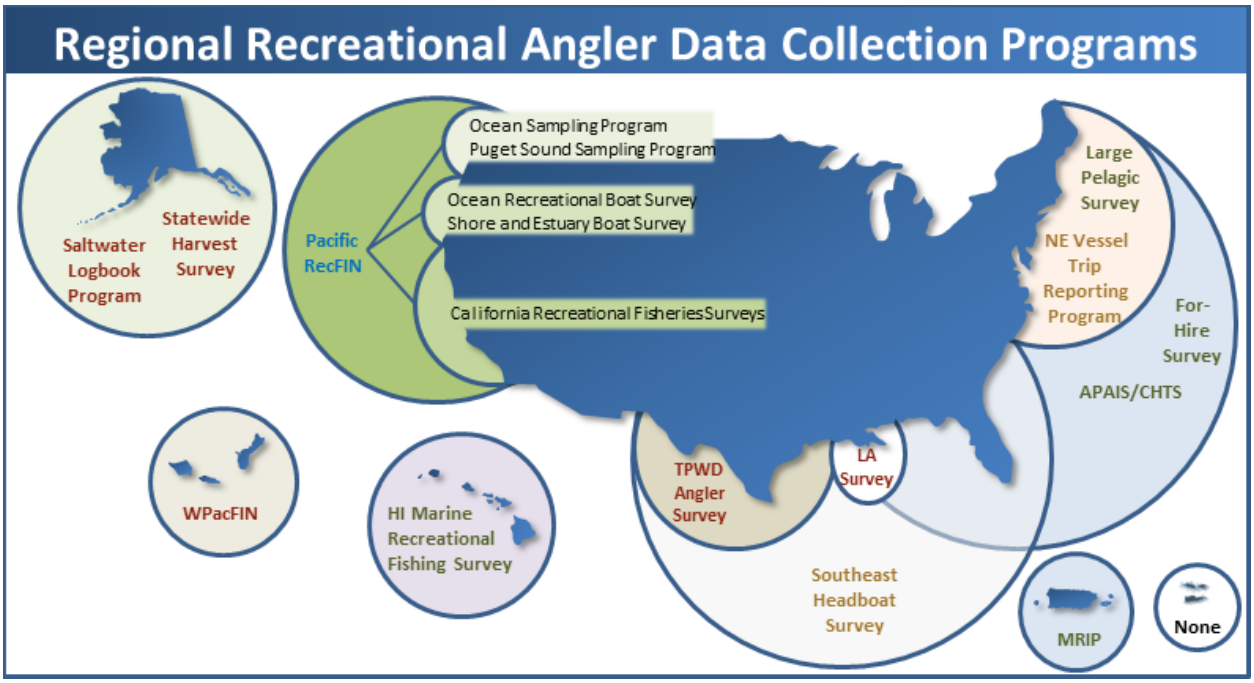

FIGURE S.1 A visualization of where various recreational fisheries surveys are implemented within the United States. Most are at least in part supported by the MRIP program. The Texas Parks and Wildlife Department survey and both surveys conducted in Alaska, however, are not supported by MRIP funds. Represented in the individual circles (from left to right) are Alaska, Guam and Samoa, Hawaii, Puerto Rico, and the United States Virgin Islands. Source: NMFS, 2014a.

Fishing Effort Survey

Sample Design and Data Collection

Fishing effort has historically been estimated with data collected from the telephone survey. The 2006 report cited a growing number of issues affecting the bias and precision of estimates. These included potentially low data quality because of undercoverage bias from increasingly fewer households having landline phones, in addition to already low responses rates, which were projected to further decrease over time. That report suggested a national angler registry as a possible solution, as it could serve as a list to sample from (also referred to as a sample frame).

The 2007 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act required NMFS to create the National Saltwater Anglers Registry (NSAR). The statute and regulations provide an exemption for states with saltwater license registries. State license frames could serve to meet federal requirements. Pilot studies conducted by NMFS indicated that the NSAR is not an ideal sample frame though, because most states have exemptions in their license requirements, and hence, coverage is not uniform. Instead, NMFS developed an innovative mail survey that uses address-based sampling enhanced by the NSAR to improve effectiveness and appropriateness of fishing effort estimation. A pilot test with this frame resulted in impressive improvements over the telephone survey used in MRFSS, and the committee commends NMFS's innovative use of the registry. This important shift from a phone survey to a mail survey also addresses societal trends such as the increasing reliance on cell phone and declining use of landlines. The enhanced sampling frame enabled a direct link to coastal households through

geolocation information. Additionally, this new approach provides another level of stratification for sampling associated with license status (Yes vs. No / Unknown). The methodologies associated with the current FES, including the address-based sampling mail survey design, are major improvements from the original Coastal Household Telephone Survey.

Survey material

The mail survey includes a relatively short, questionnaire, a cover letter, frequently asked questions, a prepaid return envelope, and a small cash incentive. The questionnaire contains 10 household-wide questions regarding whether anyone in the household has been fresh- or saltwater fishing in the past 12 months and other household details. Six questions regarding demographics, whether they saltwater fished from shore or boat, and the number of days fished by location in the designated preceding two-month period are asked of at most five individuals within the household. Adding a question on the use of public versus private access points may help discern whether fishing behavior at private sites varies from those at public sites.

Recommendation: The MRIP should add a question on the Fishing Effort Survey questionnaire to ask whether the anglers have used a private site or public-access site.

The two-month recall period was set for consistency with the periods covered by intercept survey. Several factors, however, determine the anglers' ability to recall the number of fishing trips and the number and types of fish caught.

Recommendation: NMFS should evaluate prospective data collection methodologies to reduce concerns regarding angler recall. For example, one possibility could be to ask people in advance to document fishing trips planned over the next two months.

Data Quality

Changes in fishing effort trends may suggest problems with nonresponse bias or quality of the responses, or could indicate actual change over time. However, without additional data, explanations can only be speculative.

Recommendation: As recommended in the 2006 report, NMFS is encouraged to continue research on survey panels, where a portion of the sampled households is retained for one or more interviews, for the Fishing Effort Survey alone or for an effort-catch combined study. The purpose of the survey panel would be to assess trends and any anomalies in those trends, to assess any improvements in data collection efficiency through increased participation, and possibly to lower measurement error associated with, for example, trip recall with a more engaged sample of anglers.

Web questionnaires and mobile phone applications may be a viable option to increase production of fishing effort estimates with data that are evaluated in real-time.

Recommendation: As recommended in the 2006 report, electronic data collection should be evaluated further as an option for the Fishing Effort Survey, including smartphone apps, electronic diaries for prospective data collection, and a web option for all or just panel members.

Missing responses also lower the quality of the fishing effort estimates. Missing items from an otherwise complete questionnaire can be addressed with imputation, where the missing value is replaced with a valid response using a defined model. Also, as an enhancement to the standard FES design, NMFS could evaluate a nonresponse follow-up, where a random subsample of nonresponding households are re-contacted using, for example, an additional incentive to improve response and to evaluate nonresponse bias.

Recommendation: NMFS should consider conducting targeted annual nonresponse studies as a standard component of MRIP. The purpose of these studies would be to continually monitor correlates of nonresponse and nonresponse bias in an effort to control its damaging effects on data quality.

Weighting and Estimation

The FES weighting methodology includes key components to reduce sampling and nonsampling errors in the estimates. NMFS could additionally evaluate a separate unknown-eligibility weight adjustment for nonresponding households. Further, collaboration with other federal agencies to obtain estimates of anglers to enhance the poststratification methods can improve data quality.

Precision for estimated fishing effort in the FES is calculated with methods that only account for a portion of the adjustment applied to the analysis weights. Thus, the sampling variance for the estimates may be too small.

Recommendation: Other variance estimation methods should be evaluated for fishing effort estimates to account for weight adjustments, especially those associated with nonresponse. These include replication methods and the so-called reverse approach.

Access Point Angler Intercept Survey

The second component of MRIP is the APAIS. Although MRFSS also relied on an intercept survey, it lacked a proper statistical foundation. The APAIS is also an on-site survey, but it takes into account the probabilistic aspects of the intercepts such that the on-site surveys now have a solid statistical basis.

Data Collection

The two main data collection tasks of the APAIS are counts of completed angler fishing trips and angler-intercept interviews. The angler interviews are obtained by intercepting marine recreational anglers at shore or boat access points after they've been fishing. Interviewers obtain information about the completed trip, including fishing locations, the species and number of fish caught, the gear used, and the length of the trip. Interviewers have the opportunity to observe, weigh, and measure the length of the catch, also confirming species identification. Sampling in the party (or head) boat mode may include having observers on the boats. The interviewers obtain some demographic data about the anglers and record the number of fish that were released and not landed. Interviewers are instructed to count all anglers completing their trips, even those that are not interviewed.

The APAIS sampling frame and site registry are major improvements from MRFSS. Each interviewer's assignment now consists of a fixed time interval at a particular site, with the frequency of sampling that time and place being dependent on the historical number of trips, such that the busiest sites and times are sampled with the greatest frequency. Interviewers attempt to obtain the largest possible number of completed interviews for a given assignment. In a major improvement over MRFSS, MRIP interviewers are strictly scheduled, all time periods of the day are eligible to be sampled including nights, and there are no caps on the number of interviews that samplers should take. Interviewers are no longer allowed discretion of which sites to sample. Additionally, field staff visit sites and update the site registry periodically to ensure that the registry is current and covers all public sites.

Some data are missed, because some anglers refuse to be interviewed or refuse to answer particular questions, or because of language barriers. Anglers might also be missed if there are too many at the access point at the same time for all to be interviewed. Collecting as much information as possible about these non-responding anglers may help explain refusals and address concerns that such parties have a different CPUE than the responding anglers. As was noted in the 2006 report, because private access sites generally can't be sampled, the use of CPUE from public access sites for the calculation of total catch rests on the strong assumption that private access CPUE and target species does not differ from public access. As noted above, NMFS could add a question to the FES to ascertain public or private access.

Survey Material

Each interview is conducted with a scripted questionnaire that records catch, release, and trip information. The responses are mostly recorded on paper then subsequently coded and entered into a database to be quality controlled for out of range answers. The committee sees value in moving to electronic recording of these data which will improve acquisition time for managers and permit immediate quality control of input. Some anglers are also eager to input their data to MRIP regardless of whether they are intercepted. While this is admirable, such non-probabilistic sampling can be highly unrepresentative of the general angling public and hence statistically problematic. MRIP and their consultants have investigated approaches that might help resolve the considerable statistical difficulties in using such data, and the committee encourages this endeavor into the future.

Because on-site interviews are conducted in person, there is opportunity to clarify the questions asked of anglers. Moreover, the interviewer observes the catch and the number of trips so there is no problem with recall bias as there is in the FES. However, this also means that the interviewer is the public face of MRIP. With oversight by NMFS, interviewer training is largely done by state partners, and along the Atlantic coast, by the Atlantic Coastal Cooperative Statistics Program. State agency personnel now conduct interviews, thus enhancing confidence in this component of the survey. Still, good interview training is critical.

Data Quality

The statistical soundness of the intercept survey has been considerably strengthened since the 2006 review due to the previously discussed improvements to data collection methods. The APAIS also provides valuable information on the number of anglers that are intercepted who

reside in non-coastal households. These data are used to scale up the effort estimates from the FES. Still, challenges remain, including difficulty in estimating the number, species, and fates of fish released rather than landed, and the difficulty of dealing with private access sites, which cannot be sampled and so have to be estimated. Generally, the statistical validity of the survey can be further strengthened through additional analyses, obtaining some small amount of additional information in the interviews, and improving methods of estimating and validation of the numbers, species, and fates of fish discarded by anglers.

Weighting and Estimation

With the new APAIS design, the inclusion probabilities corresponding to angler trips can be easily computed. The weights used in the estimation procedures are obtained as the inverse of the inclusion probabilities. The resulting point and variance estimators are, to a good approximation, design-unbiased.

Framework for Continued Scientific Evaluation, Review, and Certification

In addition to providing specific recommendations for improving the effort and intercept surveys, the 2006 report identified the need for an improved framework for continual scientific evaluation, review, and certification of the methods, protocols, and procedures used for data collection. NMFS has made substantial progress toward such a framework. As MRIP's focus evolves from developing and testing survey improvements to increasingly putting new methods to practice in the field, the timeliness of the survey review and certification process could benefit from additional attention.

Capacity and Scientific Evaluation

The 2006 report recommended that a survey office devoted to the management and implementation of marine recreational surveys be developed. Since 2006, the number of MRIP staff has increased from six to 12 full-time staff. The program has also invested in formal training of existing staff, including providing opportunities to earn advanced degrees or take courses in topics such as survey methodology. MRIP's staff expansion appears to have greatly increased its ability to expand technical support and achieve better regional coordination.

MRIP has benefited greatly from the independent research group of statisticians and survey methodologists who not only assess the general adequacy of MRIP but also provide technical advice to regional and state programs. If NMFS is able to expand the existing capacity in this pool of consultants both in number and in expertise (e.g., experts in cognitive issues, including angler recall), duplication of effort would be reduced and the provision of technical and scientific support would be facilitated. In addition, the MRIP certification process would be streamlined. Any such group would further benefit from being periodically refreshed to include new researchers with a variety of interests and expertise.

MRIP has either organized or been involved in the organization of several workshops or symposia, which have been attended by highly trained statisticians and fishery scientists. These meetings have facilitated review and discussion of MRIP issues by a broad range of experts, promoting an exchange of ideas, and giving MRIP technical staff, as well as regional and state

partners, an opportunity to explore a variety of recreational fisheries issues under different scenarios. The Committee commends MRIP for this outreach.

Pilot Projects

In 2008, MRIP established a pilot studies program for developing, testing, reviewing, and eventually certifying new sampling and estimation procedures to be applied under the MRIP umbrella, mostly in collaboration with state and regional partners. The MRIP pilot studies program is implemented in three concurrent phases: (1) evaluation of current methods, (2) innovation to identify and test new methods, and (3) implementation of proven methodologies. The MRIP Operations Team solicits and reviews research proposals and provides recommendations for funding. The program constitutes an appropriate and effective mechanism for providing highly specialized technical and scientific support toward the development, review, and certification of surveys.

Use of New Technology

Traditionally, recreational fishing survey responses have been recorded using paper and pencil survey forms. However, recently there has been a great deal of interest in the recreational fishing community in identifying scientifically sound, statistically robust methods for using electronic reporting (e.g., using smartphones and tablets). These new technologies could potentially improve the timeliness and accuracy of data and reduce costs and paperwork burdens.

Electronic data-collection could be integrated into the MRIP program in four separate and distinct ways:

1. Using electronic log-books for the for-hire sector;
2. Enabling interviewers to capture and submit data electronically;
3. Allowing anglers to self-report data electronically; and
4. Using electronic monitoring to validate self-reported data

Evaluation and testing of new technologies for MRIP fisheries data collection is being accomplished through several MRIP-funded pilot studies, often structured according to Regional MRIP Implementation Plans. Despite these efforts, portions of the private angler and for-hire sectors feel that implementation of electronic reporting is not occurring fast enough.

Recommendation: MRIP should develop a strategy to better articulate the complexities, costs, and timelines needed for implementation of new and emerging technologies in recreational fisheries data collection and monitoring. This communication strategy should focus not only on regional partners but also address questions and concerns expressed by private anglers and for-hire operators. It should involve both the MRIP communications team and the NMFS Office of Communications.

MRIP Certification Process

By developing a certification process, MRIP made substantial progress toward implementing key relevant recommendations of the 2006 NRC report. MRIP has invested in the development of a well-structured process for continued scientific evaluation, review, and certification of the

recreational fisheries surveys. This certification process provides a framework for maintaining a national perspective for recreational fisheries data collection and for evaluating whether the regional and state efforts meet the basic MRIP requirements for stock assessment and management. Further, it affords a mechanism for providing highly-specialized technical and scientific support for the development, review, and certification of regional- or state-specific surveys and enhances MRIP's ability to address regional and state needs for stock assessment and fisheries management. Although MRIP's partners indicate they are appreciative of this increased capability and support, some are also concerned about the timeliness of the review and certification process and the uncertainties associated with additional funding needs for implementation of survey improvements required for MRIP certification.

Degree of Coordination

The multi-jurisdictional nature of marine fisheries management, which in most regions of the country involves not just regional fisheries management councils but multiple states and institutions, presents significant coordination challenges to data collection, data management, stock assessment, and ultimately fisheries management. To collect recreational fisheries data that meet required standards for assessment and management in this complex, multi-jurisdictional system, MRIP surveys are conducted in cooperation with a variety of regional and state agencies as well as other institutional partners. Also, U.S. marine recreational fisheries show wide-ranging regional differences, and in many cases differences among various fisheries within each region. These differences can be attributed to a number of factors, including: the amount and shape of the coastline and other ocean features, species composition and diversity, and socioeconomic and demographic factors. Accommodating these regional differences requires MRIP to adopt an implementation approach that incorporates the flexibility required to address unique regional and state needs while at the same time maintaining the standardization, and national-level cohesion recommended by the NRC report.

Despite the lingering public perception of a centralized, top-down implementation approach MRIP has been responsive to regional and state needs. Progress has been achieved in expanding and strengthening coordination and the provision of financial, logistical, and technical support to state partners, in part through regional Interstate Marine Fisheries Commissions and their associated Fisheries Information Networks and the Atlantic Coast Cooperative Statistics Program. As a result, the program has evolved to become a compilation of regionally based data collection programs and is better prepared to address data needs at regional and state levels.

Challenges remain. Some state needs—e.g., development of catch and effort estimates at small spatial scales for assessment or management of state-managed species, or in season monitoring of compliance with Annual Catch Limits—have been difficult to address. This is particularly true when they require a disproportionate increase in sampling effort and become cost-prohibitive, or are so specialized that they become difficult to integrate into the standard MRIP. The Pacific coast states (Washington, Oregon, and California) are currently working with MRIP to certify their surveys, and continued coordination, technical support, and integration of Pacific coast state surveys into the MRIP framework are warranted. Furthermore, flat or reduced funding has made implementation of recommended survey improvements difficult. If this problem persists, advances in the states' sampling programs through the MRIP certification process potentially will be at risk.

At a regional level, increased coordination with the fishery management councils and their scientific and statistical committees (SSC's) would provide increased opportunities for identifying and addressing data needs for stock assessment and management. Closer coordination with the SSC's would provide MRIP with an additional avenue for communicating with the councils.

It is also worth noting that the timeliness of MRIP support is also dependent on capacity and funding.

Communications

Overall, MRIP has made significant advances in improving its communications and outreach strategy since the NRC's 2006 report. Perhaps its strongest advances have been with its website and its communications with some of its data-collection partners, such as the regional Interstate Marine Fishery Commissions and state fishery agencies. Its communications with some other groups, most notably anglers, but also some stock-assessment and management groups, have been less successful.

MRIP's purpose is to estimate catch in recreational fisheries. Since fisheries management is a complex, multistage process involving many agencies and stakeholders, MRIP should not be held responsible for explaining all facets of fisheries management.

Recommendation: NMFS should develop and lead an integrated communications strategy involving state and federal partners to explain and seek support for the management of the nation's fisheries within which the role of MRIP is clearly defined. The MRIP communication plan should be an element—albeit for species in which removals are dominated by recreational fisheries, an essential component—of such a broader, integrated overall communication plan.

MRIP's communication efforts are guided by their Communication and Education Team and three NMFS staff (two full-time equivalents), who are tasked with the development, implementation, and coordination of MRIP's communications strategy nationwide. The success of MRIP depends on clear, accurate, and timely communications and on engaging all the various stakeholder groups, including anglers. Therefore, MRIP would benefit from additional staff resources in this area.

Strategic Communications Plan

Three aspects of the 2016 MRIP Strategic Communications Plan were particularly striking to the committee. First, according to the plan, NMFS views MRIP as a combination of state, regional, and federal efforts rather than a monolithic federal program. This is appropriate and reflects the reality that MRIP has multiple partners who play key data collection roles. However, this also requires a level of coordination among partners that has not been fully demonstrated.

Second, there is a lack of a needs assessment to help identify and prioritize the current communications challenges. While elements of a needs analysis are evident in other NMFS documents, an integrated, comprehensive needs analysis should be in the plan. Third, the plan lacks an implementation component, which will be essential given the challenge of reaching multiple partners and audiences. Some additional details are provided in the annual

implementation plan updates on the MRIP website. However, it appears that a detailed implementation plan remains to be developed.

Audiences

This review considered three potential audiences: data-collection partners, data users, and stakeholders impacted by data, primarily anglers. MRIP has made significant progress in expanding and strengthening the communication and coordination with regional and state data collection partners, especially from a logistical and survey implementation point of view.

Data users include stock assessment analysts, Council SSCs and Advisory Panels, and Council and NMFS Regional Office staff who use MRIP data to implement catch limits. Assessment analysts broadly recognize the improvements in MRIP and have found MRIP staff to be responsive to their requests for data, but would benefit from additional coordination. Engagement of the SSCs by the MRIP appears to be in the early stages and needs more emphasis. Communication to groups with responsibilities similar to the SSCs within the Interstate Marine Fishery Commissions and states can also be improved.

A major challenge confronting MRIP is the use of recreational data in the management arena—specifically in implementing catch limits. Tension develops, because a survey designed for one purpose is being used for another purpose, requiring that some inferences be made. This issue was also highlighted in the 2006 report on MRFSS. Moreover, uncertainties associated with catch estimates become critically important and may impact the timing of fishery closures. The committee also heard frustration from regional managers over the lack of timeliness of MRIP estimates for implementing catch limits—particularly when fisheries have short seasons or bursts of activity (i.e., pulses), as many recreational fisheries do. These issues can be complex and reinforce the need for an integrated communications strategy to alleviate concerns. In general, evidence presented to the committee indicated that MRIP could be more proactive in communicating with managers and data-users.

MRIP has generally deferred communications with the anglers to the states and regions. Regional RecFIN programs and state fish and wildlife agencies conduct the majority of the outreach and education efforts apparently without much structured and deliberate guidance from MRIP.

A major issue for the anglers the committee heard from is the credibility of the MRIP survey data and the data-gathering process. There are many possible reasons for their impressions, some of which can be addressed by explaining basic survey principles. Communication shortcomings have exacerbated anglers' concerns about MRIP's value in ensuring sustainable management of recreational fish stocks. The success of the MRIP program depends on gaining the confidence of these stakeholders.

Recommendation: MRIP should take a more active role in communicating with anglers, whether through its partners or through its own efforts. The committee recognizes that MRIP defers to the states and regions in communications with anglers. Further, the committee recognizes that an approach coordinated with the states may be most successful in building trust and aligning the understanding of these stakeholders with the reality of how MRIP is deployed. However, MRIP should play a leading role in providing the vision and implementation strategies that partners can follow.

For-hire captains are more likely than individual anglers to engage with MRIP and become full partners. Currently, MRIP has communication products aimed directly at this group, which offer direct benefits from engagement and indirect benefits arising from the operators' interactions with their clients.

A critical aspect of communication with all audiences, but especially anglers, is that it be a two-way dialogue. MRIP's communication to date has focused largely on providing information. The program would benefit from greater emphasis on continually and actively collecting and incorporating feedback and input.

Strategies

Four principal strategies for communication have evolved within MRIP. They are: (1) the MRIP website, (2) MRIP Newscast, (3) engagement of data collection partners and data users, and (4) print and social media products.

The committee commends NMFS on the development of the MRIP website. It is well laid out, reasonably easy to navigate, and very informative. It is thorough and detailed, and NMFS appears to be developing audience-specific navigation pathways on the website to help users find information at the appropriate level of technical detail, an improvement the committee supports. In addition, the website would be further improved if it provided an opportunity for the public to provide input. The MRIP website provides opportunities to query their data and to view their access site register, and the committee applauds this transparency.

The second mechanism for communication is the MRIP Newscast newsletter. It has been produced since 2008, and is a high quality digital newsletter that provides updates and news items to recipients.

The third mechanism for communication calls for engagement of data collection partners, data users, and others at Council and Commission meetings. These are appropriate audiences to engage, though they do not represent a comprehensive list of those that should be engaged. As stated above, these engagements should include an opportunity to listen to stakeholder input.

The communications strategic plan proposes, as the fourth mechanism, to continue to produce both traditional and social media products that explain forthcoming changes to MRIP, though few details were provided.

Continuity

There is a need for continuity in the recreational fisheries data used for assessment, management, and allocation, because changes in time series can create challenges for management. Many important components of management are dependent on these catch and effort estimates, including stock assessment, development of harvest policies, in-season management, and catch allocation. In addition, the allocation of resources for the production of catch statistics is itself dependent on the estimates of catch produced by the MRIP. The historical time series of recreational catch and effort produced with the outdated MRFSS procedures therefore requires calibration to the estimation processes used in MRIP, so that a combined time series of total removals may be used to inform these processes.

The MRIP convened two workshops to address the calibration issues. Both of these workshops clearly recognized that calibration was critical in allowing stock assessments to differentiate true changes in stock status from changes in the estimation procedures producing the data used in the assessments. They also identified issues that affect the sampling error of estimates, based on changes to the survey designs over time. The workshops identified several calibration approaches, all of which invoke assumptions about effort distribution throughout a 24 hour period. The calibrations are not straightforward due to the limited side-by-side estimation using previous and current methodology for almost all areas. The Committee believes that uncertainty about process and observation error could be reduced if additional side-by-side comparisons were conducted. Continued research on calibration methodology would be useful to reducing uncertainty about stock management reference points.

Future efforts to develop calibrated time series of recreational catches will be most useful if accompanied with advice on the implications of the calibration method to stock assessment and reference points for stock management. In particular, simulation analyses of alternative methods will be helpful. As the time since a change in methodology for estimating recreational catches lengthens, the calibration method will have less influence on the understanding of current stock status. Stock status will be influenced more strongly by recent data than by historical shifts in estimation methodology for catch. However, since the calibration methodology does influence the understanding of reference points for management, the effect of the calibration will be a persistent element of fisheries management.

Recommendation: MRIP should continue development of a statistically sound calibration methodology as improvements to the Access Point Angler Intercept Survey and Fishing Effort Survey methodologies are incorporated. In the interim, the existing ratio-based calibration should be continued. For statistical catch-at-age based (SCA) assessments, scientists should employ alternative catchability functions applied to the combined time series as a means to accommodate potential imprecision in the calibration of MRFSS data to MRIP data. For non-SCA assessments, assessment scientists should exercise caution in the interpretation of trends in catch data.

Chapter 1
Introduction

Over the past several decades, interest in the impact of marine recreational fishing on fish stock size and composition has increased (NRC, 1999; 2000; 2006; Lucy and Studholme, 2002; Coleman et al., 2004; Ihde et al., 2011). The recreational sector accounts for a substantial portion of the total catch in several fisheries, even exceeding the commercial catch for some species (Figure 1.1). However, several attributes of the recreational sector make it more difficult to assess and evaluate than the commercial fishing sector (NRC, 2006). This is, in large part, because there are many more recreational anglers than commercial fishermen, and the recreational sector uses a much larger number of access and landing points, on both public and private property.

Comparison of Recreational Harvest with Commercial Harvest for Ten Species

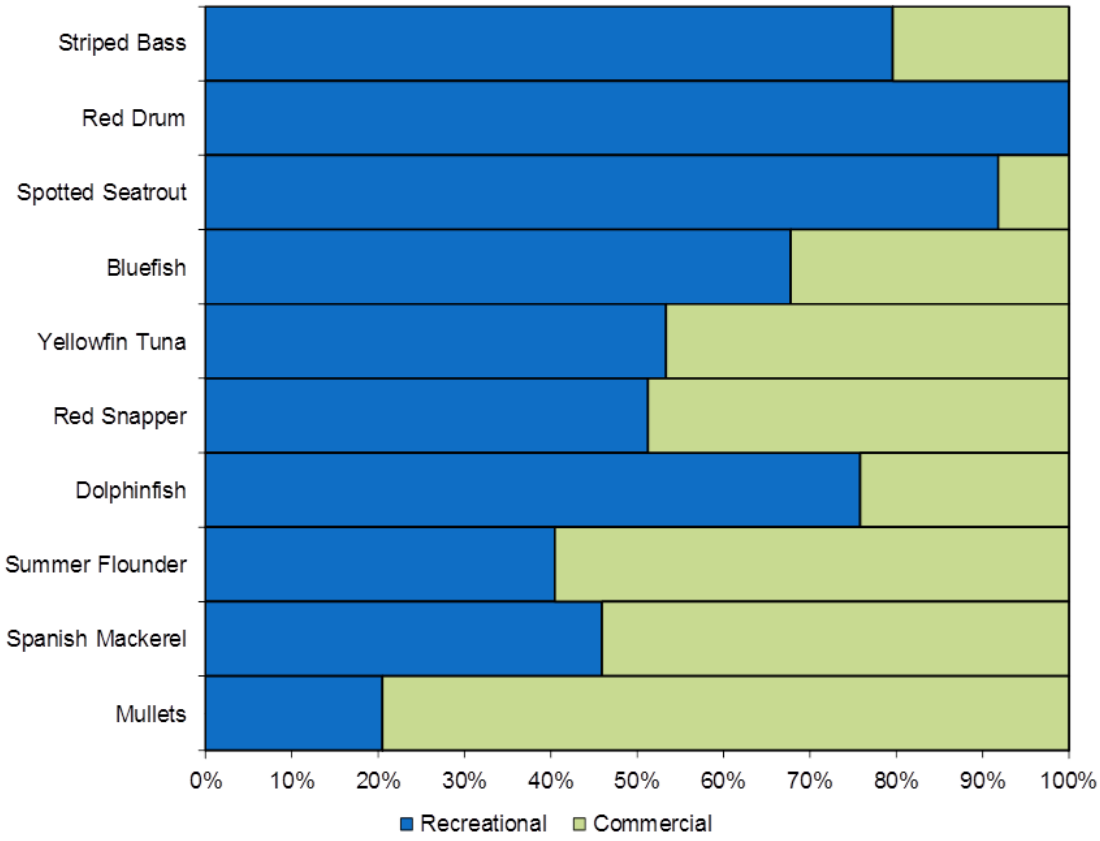

FIGURE 1.1 Comparisons of recreational harvest and commercial harvest by weight for ten popular recreational species. This figure does not include data from Alaska or Texas as recreational weight data were not provided by those states. Source: NMFS, 2015.

The Fisheries Management Context

Because of the increasing concern about the effects of recreational fishing on fish stocks, the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) has been trying for more than three decades to collect and analyze data on recreational fishing. It has done this mainly through survey programs; first, the Marine Recreational Fisheries Statistics Survey (MRFSS), and then, following a review of that program by the National Academies in 2006, through the Marine Recreational Information Program (MRIP).

Obtaining reliable data is a challenge, for the reasons mentioned above. In addition, recreational fisheries are only part of the overall fishery-management endeavor in the United States, which is a complex and multifaceted set of activities among federal, state, and joint organizations. As a result, MRIP is not implemented in a vacuum and cannot be evaluated that way. It is, and should be seen as, an integral part of the larger U.S. fishery-management endeavor.

To complicate matters further, the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), the federal statute under which marine fisheries are managed, was re-authorized in 2007 with a new emphasis on avoiding overfishing and on rebuilding overfished stocks. It achieves these goals by implementing annual catch limits. This changed the context of fishery management in the United States by providing demands to limit catch, including recreational catch. As described in more detail below and in Chapter 6, this new fishery-management context changed the way marine recreational fishery data are used. Below is a brief summary of the context for marine recreational fishery data (i.e., MRIP) within the broader and more-complex endeavor of fishery management in the United States.

Federal Fisheries Management

Marine fisheries management is a complex, inter-disciplinary challenge (Figure 1.2). It involves numerous stakeholders including fishers, environmental stakeholders, social and natural scientists, and managers. All agents in Figure 1.2 play essential roles by providing data, analyses, or advice and/or by implementing regulation. The figure emphasizes the involvement of recreational fisheries in the management process.

MRIP is but one component of the fisheries management challenge depicted in Figure 1.2. MRIP's role is to estimate recreational catch and discards of fish from the population. Discards are the fish that are released, and include those released relatively unharmed as well as those that are dead or will not survive. The total number of fish that die as a result of being caught or discarded is termed the removals. Recreational catch is estimated using statistical approaches to estimate the number of recreational angler fishing trips (effort), the average catch per trip (catch per unit effort; CPUE) and the average number of discards per trip. The product of effort and CPUE provides an estimate of the recreational catch. The product of effort and discards per trip is weighted by an estimate of the mortality rate to estimate the total discard mortality. Additionally, CPUE in the recreational fishery is often used as an index of the abundance of the targeted species, because it is often hard to develop reliable estimates of abundance independent of the fishery for many recreational species.

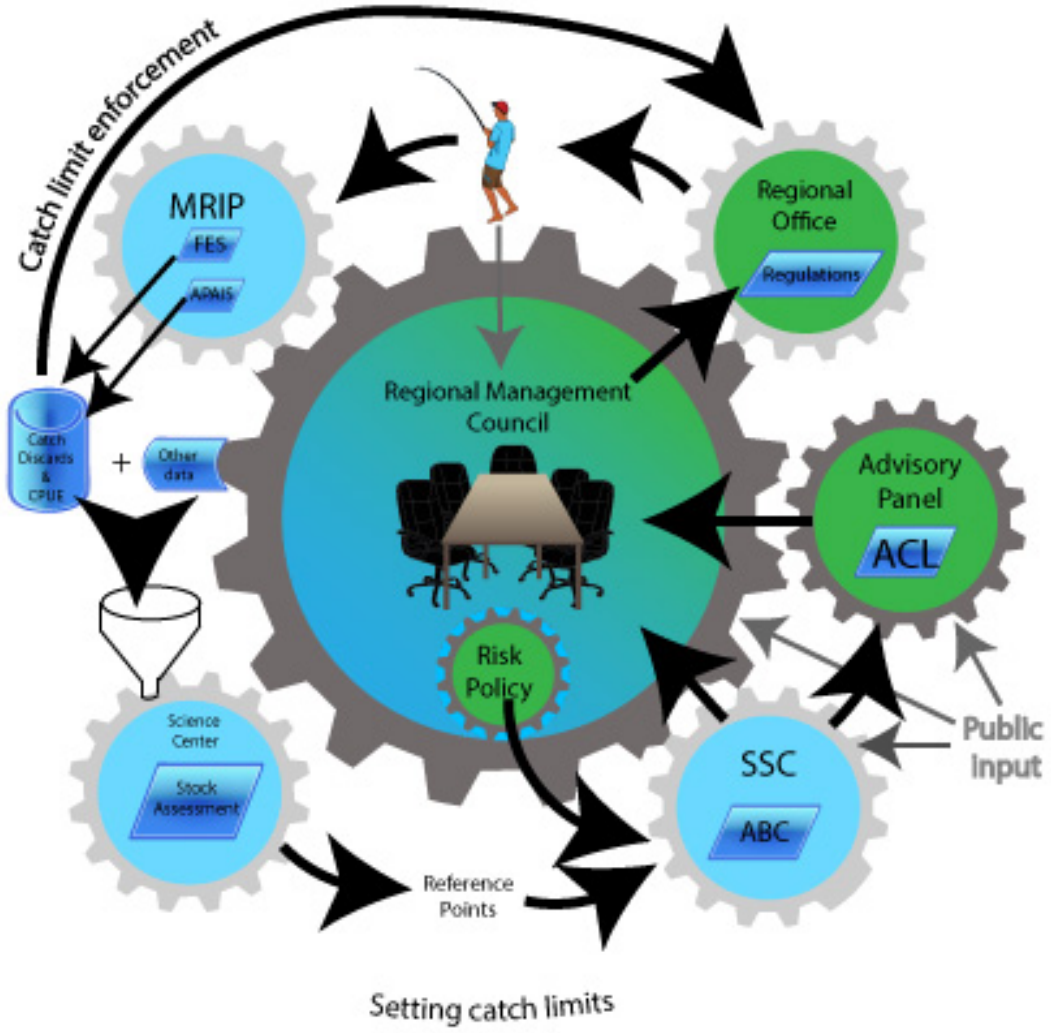

FIGURE 1.2 Schematic of the fisheries management process for recreational fisheries in federal waters. Each step of the process is represented by a separate cog in the overall system. Cogs that are primarily science based are shown as blue, those that involve societal goals are shown as green. Abbreviations used in the diagram are: MRIP—Marine Recreational Fisheries Program, FES—Fishery Effort Survey, APAIS—Access Point Angler Intercept Survey, CPUE—Catch per unit effort, SSC—Scientific and Statistical Committee, ABC—Acceptable Biological Catch, ACL—Annual Catch Limit. Source: Committee.

The outputs from the MRIP are used by stock assessment analysts to assess the status of the exploited fish population (Figure 1.2). A stock assessment is a mathematical representation of the population, the components of which are estimated statistically by fitting the model to observed data (Quinn and Deriso, 1999). In addition to the data from MRIP, a stock assessment typically involves fishery-dependent data on removals (catches and discards) in commercial fisheries, data from fishery independent surveys of abundance of the targeted species, and biological data on the targeted species. The objective of the assessment is to estimate the population abundance, fishing mortality, and stock status. The assessments are further used to determine maximum sustainable exploitation rate (when expressed as catch this is termed the

overfishing limit or OFL) and the minimum abundance that is sustainable for the species (termed the overfished limit). These estimates are termed reference points and are at the heart of federal fisheries management under the MSFCMA, which requires fisheries managers to avoid overfishing (i.e., not exceeding the OFL) and rebuilding stocks that are below the overfished level (MSFCMA; NMFS National Standard 1 Guidelines).[1]

The MSFCMA requires that each of the eight regional fishery management Councils establish fishing policies that limit to 50% or lower the risk of exceeding OFL for each managed species. This is termed the Council's risk policy (Figure 1.2). It is the responsibility of each regional management Council's Scientific and Statistical Committee (SSC) to use the best available science to provide a recommended acceptable biological catch (ABC), which integrates the most up to date understanding of the status of the population of the exploited species and the Council's risk policy such that the ABC ≤ OFL to account for scientific uncertainty.[2] Each council appoints suitable qualified people, often highly trained quantitative scientists, to the SSC.

Implementation of a recommended ABC is unlikely to be perfect because of structural difficulties in regulating catch—particularly for recreational species. Accordingly, the regional management Councils are required to establish an annual catch limit (ACL), such that ACL ≤ ABC ≤ OFL.[3] Councils may account for uncertainty in the implementation of their management actions by establishing an annual catch target (ACT). In many Councils, the task of establishing ACLs and ACTs is undertaken by an advisory panel comprising a diverse set of stakeholders that might include recreational fishers (Figure 1.2).

Ultimately the ACL and ACT adopted by the Council are provided to the regional NMFS office who, acting on behalf of the Secretary of Commerce, determine the acceptability of the recommended ACL and ACT and promulgate regulations.

The MSFCMA introduced new requirements that mandate accountability measures should the ACL be exceeded.[4] For species subject to recreational fisheries, this has placed a new demand on estimates of recreational catch—to be used not only to develop OFLs, but also to ensure compliance with Council-established catch limits (Figure 1.2). The temporal and spatial demands on estimates of total annual removals for stock assessment purposes may not match the scale needed to assess when catch limits have been exceeded requiring implementation of accountability measures.

Combined Federal and State Jurisdiction

Many species subject to recreational fishing are subject to joint federal and state jurisdictions. In such cases, the fisheries are managed cooperatively by a combination of appropriate agencies. However, the federal model described in Figure 1.2 is increasingly being used to manage fisheries under joint federal-state jurisdictions and even for fisheries solely under state jurisdiction. Often a single stock assessment is conducted that assumes a single, well-mixed population that is uniformly distributed throughout the region of interest, although increasingly spatially explicit models are being explored. The integrated assessment model generates a single,

[1] 16 U.S. Code § 1851; 50 C.F.R. 600.310 (2009).
[2] 16 U.S.C §§1852(g)–(h).
[3] 16 U.S.C §1852(h).
[4] 16 U.S.C §§1853(a).

stock-wide ABC. These are translated through regulatory bodies into single, stock-wide ACLs and ACTs, together with regional or sector-based allocations of the ACT to each partner jurisdiction. The allocation of the ACT to regions is often based on historical patterns, and in the rapidly evolving recreational fishing sector, these allocations can be contentious (Morrison and Scott, 2014).

A separate consideration involves species managed under international governance, e.g., Pacific salmon and Pacific halibut. Although the process of arriving at annual catch limits may be somewhat different from domestic processes, the underlying data collection and stock assessments follow similar science-based approaches used by U.S. agencies. However, there remains an important role for MRIP data in informing domestic allocations in such internationally managed stocks.

Marine Recreational Fisheries Statistics Survey (MRFSS)

In 1979, NMFS established the Marine Recreational Fisheries Statistics Survey (MRFSS) as a national program for obtaining standardized and comparable estimates of participation, effort, and catch within the marine recreational fisheries of the United States. The stated objective of MRFSS was the development of a reliable national database that could be used to estimate the impact marine recreational fishing has on marine resources.[5]

MRFSS collected data using two independent but complementary surveys, a telephone survey and an in-person intercept survey (NRC, 2006). NMFS used the telephone survey to gather information about individual anglers' fishing trips to determine the amount and types of fishing that occurred within a two-month period, including the number, modes, access types, and dates of recreational fishing trips. The surveys inquired only about the preceding two months, assuming that anglers' recollections of their activities beyond two months were not sufficiently reliable.

The second survey used by MRFSS was an in-person intercept survey, whereby anglers were interviewed by trained field staff at sites where anglers access and leave the water, such as marinas, docks, piers, or beaches (NRC, 2006). These intercept surveys were used to collect information on catch, including species, weight, length, and number of fish caught by anglers. In some cases, the on-site intercept survey was also used to collect additional biological information or samples.

Because the in-person intercept survey did not capture all anglers, and because little was known about the characteristics of the anglers sampled and those missed (to assess bias in the survey results), it was not possible to get a reliable estimate of total catch from the in-person intercept survey alone (Chapter 2 discusses this and other sampling issues in detail). Instead, the intercept survey was used to estimate CPUE, i.e. the number of fish likely to be caught for a given unit of fishing activity. The telephone survey was required to obtain an independent estimate of angler fishing effort (E). Together, the data collected from the two surveys were used to provide estimates of total participation, effort, catch, and CPUE for six two-month periods each year.

In addition to the intercept and telephone surveys designed and implemented by the MRFSS program, there were at least 13 other supplemental or component surveys conducted by federal

[5] See http://www.st.nmfs.noaa.gov/recreational-fisheries/MRIP/program-evolution.

or state agencies to ascertain marine recreational fishery catch and effort. These additional surveys were funded at least in part through the MRFSS program and were intended to produce data that were compatible with MRFSS objectives, although the methodologies and statistical techniques often varied from the core telephone and intercept surveys conducted under MRFSS. These additional surveys were developed as a means to better meet the data needs of a particular region or sector (NRC, 2006). Alaska has never been part of the MRFSS program, and Texas has not been since 1985; both conduct their own surveys.

Since the development of the MRFSS program in 1979, the context for conducting recreational fisheries surveys and the uses of survey data have changed significantly for the nation's fisheries. As exploitation levels increased, fisheries became more highly regulated and management decisions were increasingly made at finer spatial and temporal scales (NRC, 2006; Breidt, 2013). Additionally, the mix of recreational and commercial fishing has changed over the years in many regions and for many species. By the early 2000s, some stakeholders had expressed concern that recreational data collected through MRFSS and other recreational fishing surveys were being incorporated into management in ways that exceeded the original design and purposes. Concerns regarding the precision, robustness, and timeliness of the data collected through MRFSS relative to the data needed for effective management were also expressed (NRC, 2006).

2006 Study: Review of Recreational Fisheries Survey Methods

In 2004, NMFS requested that the National Research Council (NRC; now known as the National Academies of Sciences, Engineering, and Medicine) review data collection for marine recreational fisheries in the United States, and specifically, MRFSS (see appendix B). The NRC assembled a committee of ten experts in fishery science and statistics, which released its report, *Review of Recreational Fisheries Survey Methods*, in 2006 (NRC, 2006). The report recommendations were categorized as sampling issues; statistical estimation issues; human dimensions; program management and support; communication and outreach; and general recommendations.

Overall, the 2006 report called for a considerable redesign of the survey program to modernize the survey methods to reduce bias, increase efficiency, and build greater trust and relationships with the recreational angling community. The report acknowledged the tremendous complexity of the challenges associated with implementing a survey program like MRFSS and in performing statistical analyses with the resulting data. Given these challenges, the report concluded that substantial, additional resources would be necessary to revise and improve the survey program.

The Current Review

The Fishery Conservation and Management Act of 1976 has been amended and reauthorized multiple times, and is now known as the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). In the last reauthorization[6] Congress called for a "regionally

[6] Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Publ. L. No. 109-479; 16 U.S.C. §§ 1801-1884.

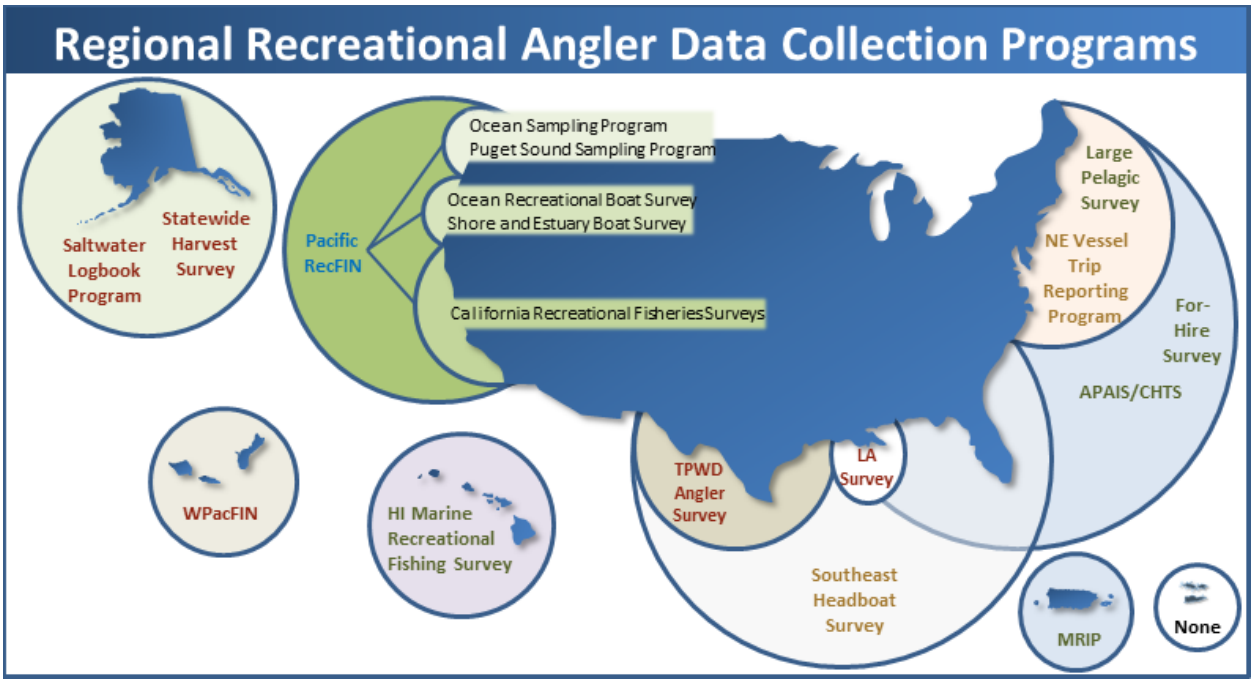

FIGURE 1.3 A visualization of where various recreational fisheries surveys are implemented within the United States. Most are at least in part supported by the MRIP program. The Texas Parks and Wildlife Department survey and both surveys conducted in Alaska, however, are not supported by MRIP funds. Represented in the individual circles (from left to right) are Alaska, Guam and Samoa, Hawaii, Puerto Rico, and the United States Virgin Islands. Source: NMFS, 2014a.

based registry program for recreational fishermen in each of the eight fishery management regions."[7] The act further mandated that the Secretary of Commerce, "in consultation with representatives of the recreational fishing industry and experts in statistics, technology, and other appropriate fields" develop a program for making improvements in the quality and accuracy of MRFSS.[8] The legislation particularly called for the program to implement, to the extent feasible, the recommendations of the NRC's 2006 report (see Appendices B and C).

Since 2007, NMFS, in response to the reauthorization, has been working to improve the survey program by developing a national saltwater angler registry and transitioning from the MRFSS program to the redesigned Marine Recreational Information Program (MRIP). The redesigned MRIP program includes a separate off-site Fishing Effort Survey (FES) to assess effort and an Access Point Angler Intercept Survey (APAIS) to gauge CPUE. Although the basic structure is similar to MRFSS, major changes have been made to the methodologies and statistical analyses used for both FES and APAIS.

The MRIP program also funds and provides technical support for a variety of region-, state-, species-, and sector-specific surveys that either supplement or serve as alternatives to the APAIS and FES (Figure 1.3). A challenge that NMFS has had to consider is how to allow for these individual surveys, which may be better tailored for specific circumstances, while also maintaining sufficient data consistency for management.

[7] 16 USC Sec 1881(g)(1).
[8] 16 USC Sec 1881(g)(3)(a).

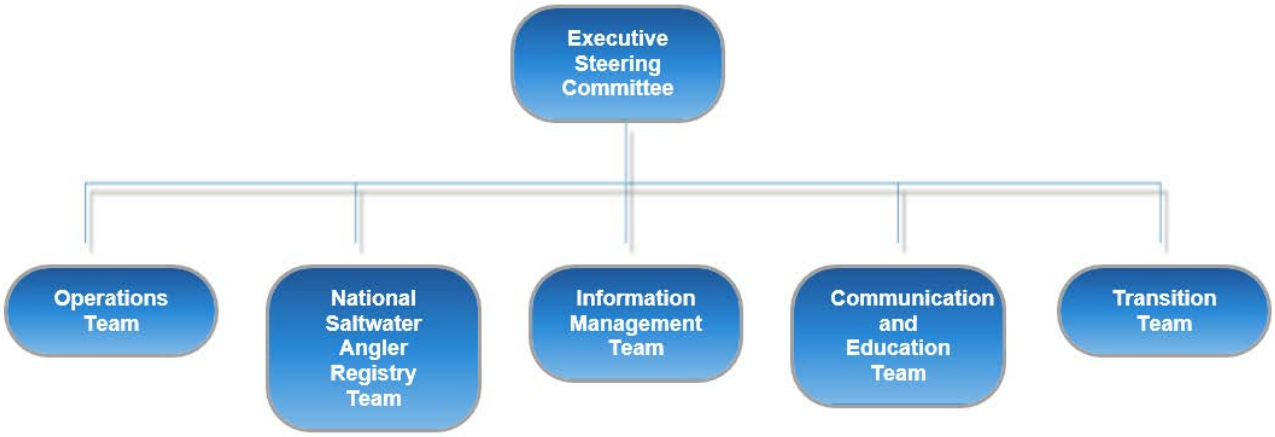

FIGURE 1.4 The team structure used to manage MRIP. Different teams focused on various aspects of the program integrate participation of federal, regional, and state agencies and institutions. Source: NOAA.[9]

To assist with this more inclusive and integrative implementation approach MRIP is managed via a team structure, under the guidance of an Executive Steering Committee (ESC). To assure transparency and to achieve customer and stakeholder support, the ESC and the MRIP Teams comprise members from NMFS headquarters, its Regions and Fisheries Science Centers, and of state agency and Interstate Marine Fishery Commissions staff. In addition, the Teams are joined by participants from the regional Fishery Management Councils and key stakeholder organizations such as national recreational fishing organizations like the Coastal Conservation Association. The Communications and Education Team also includes a representative from NOAA Sea Grant (Figure 1.4).

Now, a decade after the release of the 2006 report, NMFS requested the National Academies of Sciences, Engineering, and Medicine conduct a second review to assess progress NMFS has made in addressing the recommendations from the 2006 report. In addition, NMFS asked the Academies to consider other aspects of the survey redesign such as the strength of the scientific process and engagement with stakeholders (see Box 1.1 for complete Statement of Task).

The ad hoc committee assembled to address this task was composed of nine experts in fisheries science, fisheries management, stock assessment, statistics and survey design, and social sciences. They met on four occasions, in Washington, D.C. (February 24-26, 2016); Charleston, South Carolina (April 25-26, 2016); New Orleans, Louisiana (May 26-28, 2016); and Irvine, California (July 11-13, 2016). At each meeting, the committee heard from representatives from federal and state government, including MRIP staff and contractors; MRIP consultants; and regional stakeholders, such as anglers, nongovernmental organizations, and representatives from fishing associations and organizations. The committee also received documents from NMFS and written input from stakeholders during the study process.

This report provides a general discussion of survey design and estimation considerations in Chapter 2. Chapters 3 and 4 provide more technical analyses of the statistical survey design and

[9] http://www.st.nmfs.noaa.gov/recreational-fisheries/MRIP/organization

BOX 1.1
Statement of Task

An ad hoc NRC committee will assess progress in updating marine recreational fisheries data collection through the Marine Recreational Information Program (MRIP) referencing the recommendations in the 2006 NRC report Review of Recreational Fisheries Survey Methods. Based on this assessment, the committee will identify potential areas for improvements or changes of direction that would substantially increase data quality for fisheries management, taking into consideration potential loss of information from disruption of the time series. The committee's report will:

1. Describe the approach and effectiveness of steps taken by NMFS to improve the quality and accuracy of marine recreational fisheries catch, effort, and participation statistics (in response to NRC 2006), including, but not limited to:
    a. Establishing registries of anglers and for-hire vessels and using the registries appropriately as sample frames for recreational catch and effort surveys;
    b. Improving the effectiveness and appropriateness of sampling and estimation procedures, applicability to various kinds of management decisions, and usefulness for social and economic analyses; and
    c. Providing for ongoing technical evaluation and modification, as needed to meet emerging management needs and changes in communication technologies (e.g. smart phone apps, internet-based social networking).
2. Assess the strength of the scientific process, including the engagement of external scientific and technical expertise, used by NMFS in developing, testing, reviewing, and certifying new sampling and estimation procedures.
3. Evaluate the communication of information on survey method development, survey method descriptions, and survey results to stakeholders and application of stakeholder input in the design and implementation of new sampling and estimation procedures. Stakeholders include at least three distinct sub-groups (with some overlap among them):
    a. Data collection partners, such as the Atlantic Coast Cooperative Statistics Program (ACCSP) and the Fishery Information Networks (FINs);
    b. Data customers (parties that use NMFS data for stock assessments, management actions, social and economic studies);
    c. Entities affected by the estimates (anglers and recreational fishing businesses, commercial fisheries, non-consumptive users, etc.);
4. Determine if the degree of coordination among federal, state, and territorial survey programs is sufficient to provide a clear, national perspective on marine recreational fisheries; and
5. Evaluate plans for maintaining continuity of data series to minimize disruption of management programs and stock assessments. This will include evaluation of the strategy for moving from the phone based survey to a mail and web-based survey as a means to estimate fishing effort.

estimation procedures for the FES and APAIS, respectively. Chapter 5 discusses a framework for continued scientific evaluation, review, and certification. Chapter 6 explores the degree of coordination between the MRIP program and other state and federal partners, and an evaluation of MRIP's communication, outreach, and education efforts is provided in Chapter 7. Finally,

Chapter 8 looks at plans for maintaining continuity of the data series despite changing methodologies. The appendices in this report include: the summary of NRC (2006); a table of the 2006 recommendations indicating the most relevant chapter in this report for each and the committee's ranking of NMFS responses; an excerpt from the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006; copies of the survey instruments; excerpts from the 2014 Calibration Workshops; and a list of acronyms.

Chapter 2
Study Design and Estimation Considerations for MRIP

Introduction

Estimation of recreational harvest has become increasingly important with the passage of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSFCMA). Moreover, the 2006 NRC report, *Review of Recreational Fisheries Survey Methods*, centered on the validity of the Marine Recreational Fisheries Statistics Survey (MRFSS) sampling for catch and effort, such as the lack of probability-based sampling in major components of the survey. In response to this and other recommendations in the 2006 NRC review report the National Marine Fisheries Service (NMFS) redesigned the survey and implemented the Marine Recreational Information Program (MRIP) to provide valid statistical estimates of recreational fisheries effort and catch. The following chapters review the Fishing Effort Survey (FES; Chapter 3) and the Access Point Angler Intercept Survey (APAIS; Chapter 4), which are two components of MRIP, and assume technical knowledge of survey sampling concepts that may not be common knowledge. The purpose of this chapter is to provide perspective on data collection, sample design, and estimation relevant to MRIP to help the reader who is not familiar with statistical methods for survey sampling of recreational fisheries.

Contact Methods

Surveys of recreational fishing to obtain metrics of catch and effort rely on seven possible methods of contacting anglers (Pollock et al., 1994; Jones and Pollock, 2013). Anglers can be contacted (1) on-site at public access points, (2) by roving through the water body to seek out anglers, or (3) by aerial surveys (which capture effort only). In these situations the field agent records the trip, its completion time, and the number of anglers and asks the anglers about the trip duration, species sought, species caught and number, and number released following a scripted questionnaire. Oftentimes, the agent can observe and measure the catch.

Alternatively, anglers can be contacted off-site (4) by telephone, (5) mail, (6) electronically (e.g., web, email), or (7) door-to-door (door-to-door is rarely used). In a mail survey, the angler receives a questionnaire that requires reporting dates, trips, trip locations, and in some surveys the species and catch numbers. Querying for catch is less commonly asked, because the species and catch numbers must be remembered correctly over the past months.

In measuring catch and effort, these contact methods have different strengths and weaknesses. Off-site methods obtain information that is self-reported by the angler and is not independently verified. On-site methods, most commonly an access point survey, are able to verify trips and landed catches because they are observed by field agents. However, even on-site methods rely on angler self-reporting of released fish (Jones and Pollock, 2013; Groves, 1989). Released fish can be counted and verified when boats are large enough to carry an observer, such as with a

Box 2.1
Censuses versus Surveys

In surveys, the interest lies in estimating finite population parameters of the population under study. Most often, the interest lies in estimating a population total (e.g., total catch) or a population mean. Ideally, one would conduct a census to collect information from all the units in the population. Typically, only a fraction of the population—a sample—is randomly selected. Reasons for conducting a sample survey rather than a census include: (1) censuses are more subject to nonsampling errors than sample surveys are, since sample surveys can often afford to allocate more resources (human and financial) to reducing nonsampling errors such as nonresponse; (2) census costs more than a sample, since all members of the population are surveyed, and the data collection process is one of the most expensive steps; and (3) often the data must be gathered, processed, and results disseminated within a relatively short time frame. Censuses require considerably more time to carry out these operations than a sample survey.

In a sample survey, each population unit is assigned a strictly positive selection probability, and these probabilities may vary from one unit to another. The sample is randomly selected to satisfy the selection probabilities fixed prior to sampling. The sample design consists of all the steps to be carried out when selecting a sample. Depending on the type of survey to be conducted and the information available prior to sampling, the sample design may span from relatively simple to fairly complex designs. Complex sampling designs usually involve stratification and clustering. Both FES and APAIS involve some relatively complex designs.

headboat or charter boat. MRIP relies on contacting anglers on-site at public access points to obtain measures of catch per unit effort (CPUE) and off-site by mail and by telephone to obtain measures of effort. These measures are then combined to estimate total catch. This approach is used throughout the United States' Atlantic and Gulf of Mexico coasts.

Since the 2006 report was published, there have been major advances in the use of technology by the public that has the potential to alter the way surveys are done. Even though the 2006 report requested that NMFS explore electronic reporting, the agency has only recently expanded testing the use of electronic reporting of for-hire logbook, electronic capture of on-site intercepts, and web-based surveys (Kelly, 2016). For example, Liu and his colleagues (Liu et al., 2016) undertook a project to determine whether smartphone applications (apps) could be used to estimate recreational red snapper catch in Texas. Anglers reported their catches using the iSnapper app, and some of those app users were also intercepted in a probability-based on-site interview. The total catch was subsequently estimated by a modified mark-recapture method. This approach shows promise, and the committee encourages NMFS to pursue this area of research. However, self-motivated anglers reporting catches with apps present challenges to statistical estimation, because those people who self-report may not be representative of the target population. The committee discusses this topic further in Chapter 4.

Challenges with Data Collection

The choice of survey method is dependent on the time frame in which data are needed and the funds available to conduct the survey; both timeliness and funding issues were raised as concerns by state agencies during our current review of MRIP. The off-site methods using telephone and mail surveys are generally less expensive than on-site methods because of the need for trained personnel in the field (Jones and Pollock, 2013; Groves, 1989). Some methods, such as telephone

surveys, can obtain data quickly, while mail surveys take more time. Both are complicated when the response rate is low because of the potential for nonresponse bias. Nonresponse bias occurs when respondents and nonrespondents to the survey differ with respect to the characteristics of interest (see, e.g., Lohr, 2010). For example, if those people who caught fish respond while people who caught nothing think that their information isn't needed, the CPUE would be estimated as higher than what actually occurred. On-site surveys can cost more per interview, but nonresponse is typically low. The use of electronic tablets for on-site surveys decreases the reporting time and, with added software, can increase data quality (Kelly, 2016).

Surveys are subject to biases beyond that of nonresponse (Groves et al., 2009; Pollock et al., 1994). Off-site surveys are subject to recall bias because of the delay between the fishing trips and receiving a questionnaire, telephone call, or electronic message. Unless anglers keep a log or diary, they may not remember trips or catch accurately. Species identification and number of fish caught can be inaccurately reported and are not verifiable. Direct biological measurements of fish needed to estimate length and age relationships and the extraction of scales or otoliths for ageing are not available. On-site public access surveys are subject to avidity bias (that is, avid anglers who are better at catching fish might be overrepresented in on-site surveys) and also lack coverage of anglers using private access when interviews are generally done from public access sites. The lack of intercept information from most private access means that the use of CPUE requires the strong assumption that catch and effort are equal between anglers using public and private access sites (Ashford et al., 2010; 2013; Ashford et al., 2011). Additionally, the error structures will differ with the type of data collection (e.g., self-administered in mail surveys versus interviewer administered in telephone surveys); this topic is discussed in Chapters 3 and 4 as it pertains to FES and APAIS, respectively. Note that there are other sources of error, such as item nonresponse in returned questionnaires that are also discussed in subsequent chapters.

Sources of Survey Error

Surveys are designed to provide estimates for a possibly large number of characteristics of interest. Typically, the interest lies in estimating finite population parameters (i.e., means, percentages, ratios, etc.) of the target population, which are those describing some aspect of the finite population (e.g., total effort). Estimates of these population parameters are calculated from information collected on the sample, which are subject to several types of errors (Groves, 1989). The committee defines the total error of an estimate as the difference between the estimate and the true population value, the latter being unknown. The total error can be expressed as the sum of sampling and nonsampling errors (Groves et al., 2009; Biemer, 2010). Sampling errors occur because the desired information is only observed for a part (sample) of the population.

Nonsampling errors can be divided into four broad groups: (1) coverage errors; (2) nonresponse errors; (3) measurement errors; and (4) processing errors. Coverage error occurs when there is frame imperfection. This includes undercoverage (some units in the target population are not in the sampling frame) and overcoverage (some units are not in the target population but are in the sampling frame). Andrews et al. (2013) suggested that "undercoverage due to unlicensed fishing activity may be as high as 70 percent in some states for certain types of fishing activity" (see discussion of the National Saltwater Angler Registry in Chapter 3).

Nonresponse errors occur because the desired information is only observed for a part of the sample. The committee distinguishes unit nonresponse from item nonresponse. Unit nonresponse

is the complete lack of information on a given sample unit. It occurs, for example, when the sampled person is not at home when a telephone interviewer calls or refuses to participate in the survey. When some characteristics are missing for units for which other characteristics are responded to, that is referred to as item nonresponse. The latter occurs, for example, because the sampled person refuses to respond to sensitive items such as fishing location, may not know the answer to some items, or because of edit failures, e.g. incorrect telephone number. Missing values may also be generated when the collected data are invalid or inconsistent.

Misresponse or measurement error occurs when the responded values are different from what values would have been correct for the respondent. Measurement errors can be caused by a poorly designed questionnaire or because the respondent does not recall the requested information. Another example of measurement error is digit bias, the tendency for respondents to round upward or downward (e.g., if a respondent actually catches 7 fish but responds with either 5 or 10), also known as rounding errors (Scholtus, 2011).

Finally, processing consists of all the handling data activities after data collection and before estimation. Processing errors occur during data coding (which is the process of assigning a numerical value to a response) and data capture.

Sampling Frames

Recreational angler surveys use sampling frames to randomly select, with known probabilities of selection, households or fishing sites and times to contact. To contact households with anglers off-site to determine effort, two approaches have been commonly used in marine fisheries (Jones, 2001). MRFSS, MRIP's predecessor, used a telephone survey that relied on randomly dialing non-commercial telephone numbers with a coastal county prefix. In this case, the sampling frame was any household that had a landline telephone number with an appropriate coastal prefix. The efficiency of random-digit-dial (RDD) telephone surveys declined over time as fewer households had landlines, more individuals switched to only having cell phones, caller ID resulted in fewer calls answered, and telephone numbers became portable. With the portability of telephone numbers, a previous coastal county resident might move inland and no longer fish. Similarly, someone from a landlocked state with that area code and prefix may move to a coastal county and become an avid angler. Using coastal county prefixes would result in both overcoverage (anglers have moved away) and undercoverage (people have moved to the coast) of the target population. Furthermore, because there are restrictions on surveys dialing cell phones, the use of telephone surveys has become more problematic (AAPOR, 2016). In its 2006 report, the NRC committee recommended that alternate sampling methods be developed to address these issues of nonresponse and inefficiencies. Specifically, the report recommended that the NMFS develop a national registry of all marine anglers as a sampling frame that would consist of names, telephone numbers (including cell numbers), and addresses. A sampling frame is a list from which a sample can be selected. Such a sample frame would provide a targeted and efficient list for sampling.

When an effort survey such as FES has undercoverage (anglers can come from states far from the coast) it is dealt with by re-weighting sampling units (e.g., angler trips) with data available from the on-site survey. The on-site survey includes all anglers, both coastal and noncoastal. The proportion of noncoastal is used to expand the effort estimate of the off-site survey. This would be unbiased assuming that the characteristics of the people on the frame are similar to those not

on the frame. Further, the reliability of a survey from such a licensed-based frame declines when exemptions to requiring a license are allowed, such as for retirees, military personnel, and for persons under 16. Exemptions such as these cause frame undercoverage. There is also frame overcoverage, which results from people who are on the list who no longer fish. Undercoverage is likely the greater problem.

For an intercept survey, the frame consists of a list of public fishing access sites, mainly piers and boat launching sites, crossed by time of day. Then returning anglers are interviewed to determine their total catch for each species. Typically the design uses selection probabilities proportional to estimated fishing effort (e.g., site/time combinations with more effort have a higher probability of being sampled) to efficiently select the access sites for interviewing. Undercoverage occurs when access sites are excluded and overcoverage occurs when non-marine sites are included. When combined with an offsite survey to determine effort, undercoverage of the effort survey can be addressed through use of the responses to the intercept survey, by determining the percentage of anglers that were contacted that were not included on the effort survey. The primary assumption that this complemented approach is based on is that those missed by the intercept survey (for example, fishing on private piers) have the same average CPUE as those included on the intercept survey, which can be an incorrect assumption depending on the target species. Therefore, the assumption is made that both public and private access users have similar fishing patterns (Ashford et al., 2010; 2013).

Introduction to Sample Estimation of Total Catch

Although catch and effort can be expanded directly in a few situations, the general approach widely used to estimate the total catch of saltwater fish by recreational anglers is to split the problem into two surveys. The importance of having these two surveys is that FES only obtains effort in the relevant states, and because of the difficulties with self-reporting, does not obtain data on catch. Meanwhile, APAIS does obtain data on anglers with residences outside the coastal states and is also able to observe catches. First, from the FES one estimates angler effort $\left(\hat{E}\right)$, the total number of trips spent saltwater fishing, using a survey of all anglers within the household, asking the respondents, in a given time period, for the total number of occasions during which they have fished in saltwater either from the shore of their coastal state or from a boat that returned to the shore of their coastal state. Second, from APAIS one estimates the catch per unit effort ($\widehat{CPUE}$), which is the number of fish caught per angler trip on each occasion, and the discard species and discard rate. If both angler effort and catch per unit effort are well estimated for a given species, region, and period, one can calculate the total catch for that species (and region and period; see Box 2.2). Total catch (also termed total harvests in other contexts) and total discards are estimated from two surveys, one offsite and one onsite. Total discards (obtained from the onsite survey) are used subsequently to calculate dead discards (total discards times discard mortality rate). Stock assessment analysts sum the total catch and total dead discards to estimate the removals from the fish population.

Using the equations given in Box 2.2, total catch contains the following components: 1) fish that are landed whole and can be measured and identified, 2) fish that were filleted or discarded dead, and 3) fish that were discard alive but subsequently die from capture-related mortality. Landed catch consists of 1) plus 2).

For stock assessment, an additional fraction of the catch released alive that subsequently dies is estimated by obtaining a discard mortality rate times the fish in category 3). Equations used in the estimation of removals, catch, effort, and CPUE by MRIP are included in Box 2.2.

BOX 2.2
MRIP – Estimated Removal

Population Total Removals

$$R = A + B_1 + \left(B_2 \times DMR\right), \quad (1)$$

where R = removal from fish population
A = available catch (observed harvest)
B_1 = unavailable catch (unobserved harvest)
B_2 = discard
$A+B_1$ = total catch / harvest
DMR = discard mortality rate
$B_2 \times M$ = dead discard

Abbreviations

PSU = primary (first stage) sampling unit, such as site in the APAIS (see Chapter 4)
SSU = secondary (second stage) sampling unit, such as angler or boat within site in the APAIS
TSU = tertiary (third stage) sampling unit, such as angler within selected boat in the APAIS

Indexes

d = domain of interest such as state, region, fishing mode (shore, private/rental boat, for-hire), fishing area (inland, state territorial sea, Federal exclusive economic zones), sampling strata
h = mutually exclusive sampling stratum by study (e.g., state by date within 2-month wave APAIS, or state by geographic distance from the short for FES)
i = household (FES PSU)
j = site (APAIS PSU)
k = boat/angler and, if applicable, angler group within boat (see Chapter 4)

Estimated effort obtained from FES, CHTS, and the like:

Estimated effort = $\hat{E}$, defined as the estimated total number of single-day angler trips spent saltwater fishing

$$\hat{E} = \sum_h \sum_i w_{hi} e_{hi} , \quad (2)$$

where e_{hi}= number of angler trips per household i in state (region), stratum h (i.e., household hi)

w_{hi}= final analysis weight for household hi

Estimated catch per unit effort obtained from APAIS and similar studies:

(1) Estimated total catch per unit effort for species *f* for domain *d* =

$$\widehat{CPUE}_{df} = \frac{\sum_h \left(\sum_j \sum_k w_{hj} w_{k|hj} c_{hjk}^{(f)} \delta_{dhjk} \right)}{\sum_h \left(\sum_j \sum_k w_{hj} w_{k|hj} e_{hjk} \delta_{dhjk} \right)} \quad (3)$$

where e_{hjk} = number of angler trips per SSU *hjk*
$c_{hjk}^{(f)}$ = total catch ($A + B_1$) for species *f* per SSU *hjk*
δ_{dhjk} = zero-one variable indicating membership in domain *d*
$w_{k|hj}$ = SSU-level final analysis weight conditional on selection of site *hj*
w_{hj} = final analysis weight for PSU *hj*

(2) Estimated total discard per unit effort for species *f* for domain *d* =

$$\widehat{CPUE}_{df} = \frac{\sum_h \left(\sum_j \sum_k w_{hj} w_{k|hj} d_{hjk}^{(f)} \delta_{dhjk} \right)}{\sum_h \left(\sum_j \sum_k w_{hj} w_{k|hj} e_{hjk} \delta_{dhjk} \right)} \quad (4)$$

where $d_{hjk}^{(f)}$ = discards per SSU *hjk*. All other symbols are defined for $\widehat{CPUE}_{df}$.

Estimated Totals

Estimated $(A + B_1)$, total catch for species *f*, is $(\hat{A} + \hat{B}_1) = \hat{E} \times \widehat{CPUE}_{df}$,
where $\hat{E}$ is defined in (2) and $\widehat{CPUE}_{df}$ is defined in (3).
Estimated B_2, total discards for species *f*, is $\hat{B}_2 = \hat{E} \times \widehat{DPUE}_{df}$
where $\hat{E}$ is defined in (2) and $\widehat{DPUE}_{df}$ is defined in (4).
Estimated R, total removal from population, is

$$\hat{R} = (\hat{A} + \hat{B}) + (\hat{B}_2 \times \widehat{DMR})$$
$$= (\hat{E} \times \widehat{CPUE}_{df}) + ([\hat{E} \times \widehat{DPUE}_{df}] \times \widehat{DMR})$$

where $\widehat{DMR}$= discard mortality rate estimated via independent studies (see Chapter 4).

Bias and variance of an estimator

To assess the quality of an estimator, two important measures are usually considered: bias and variance. For simplicity, the committee assumes that estimates are only subject to sampling errors and that the nonsampling errors either are negligible or are adjusted for prior to estimation. By sampling errors, the committee means that each sampling event is just one possible result of many that could have occurred. In practice, only one sample is selected, but there are many other possible samples that could have been selected from the population. Suppose that it would be possible to select all the possible samples using the same sampling design from the target population. In each sample, an estimate of the characteristic of interest (e.g., total catch) could then be computed from the observed data. The bias is then defined as the difference between the average of the estimates produced from all of the possible samples and the corresponding

(unknown) true value for the target population. The population sampling variance is a measure of the variability of the estimates about their average that would have been observed had all the possible samples been selected from the target population.

An estimator is said to be precise (or efficient) if it exhibits a small variance. Factors affecting the variance include the variance if the target population, the sampling design used to select the sample from the target population, as well as the sample size. For a given sample design, the variance decreases as the sample size increases. Since the population variance refers to all the possible samples that could be selected from the population, it is typically unknown, but it can be estimated from the selected sample. Survey statisticians use measures such as the estimated standard error (which is defined as the square root of the estimated variance) or the estimated coefficient of variation (which is defined as the ratio of the estimated standard error to the estimate). Another name for the coefficient of variation is the Proportional or Relative Standard Error (PSE).

Assuming no nonsampling error, bias is generally not an issue as survey statisticians typically use unbiased (or approximately unbiased) estimators. Bias is generally caused by the presence of nonsampling errors as is discussed above. Depending on the source of the bias (nonresponse error, coverage error, and measurement error), a number of weighting procedures are used to reduce the bias as much as possible.

Weighting Methodology

The data collected in the field are typically stored in a data file that contains rows corresponding to sample units (e.g., an angler) and columns that each represents characteristics of interest (e.g., number of trips taken in the past two months). The file includes a column of weights that account for the sample design, coverage errors, and nonresponse, and which together constitutes a weighting system. Estimates are obtained by applying the weighting system to a characteristic of interest.

The typical weighting process consists of three major stages (see, e.g., Valliant et al., 2013). In Stage 1, each sample unit is assigned a design (or base) weight, which is defined as the inverse of its inclusion probability in the sample, a characteristic of the sampling design. Stage 2 of the weighting process aims to reduce the potential bias due to unit nonresponse. This bias may be large when respondents and nonrespondents are different with respect to the characteristics of interest, especially if the nonresponse rate is high. For example, the most common way of dealing with unit nonresponse is to eliminate the nonrespondents from the data file and to adjust the design weights of the respondents to compensate for the elimination of the nonrespondents. To that end, the basic weights of respondents are multiplied by a nonresponse adjustment factor, which is defined as the inverse of the estimated response probability. Key to achieving an efficient bias reduction is the availability of powerful auxiliary information, which is a set of fully observed variables. Finally, in Stage 3, the weights adjusted for nonresponse are further modified so that survey weighted estimates agree with known population totals available from external sources (e.g., the census or administrative data). This process is known as calibration and can be effective at reducing the biases due to undercoverage. The resulting weights are often referred to as final weights and the corresponding weighting system as the final weighting system.

In some cases, the weighting process involves an additional stage during which the final weights undergo further modification. Most often, it consists of smoothing or trimming the weights in order to improve the efficiency of survey estimates. This is often encountered in the context of highly variable weights that are poorly related to the characteristics of interest. In such cases, the resulting estimators may exhibit a large variance (i.e., low precision). Weight trimming consists of reducing the weight values above a given threshold. These weights are set to the value of that threshold.

A point estimate for a given characteristic of interest is readily obtained by applying the final weighting system to the column corresponding to this characteristic of interest. The associated (proportional) standard error also uses the final weights but with a more complex formula than is appropriate for this report—see, for example, Wolter 2007 for additional material on variance calculations.

Chapter 3
Sampling and Statistical Estimation for the Fishing Effort Survey

Introduction

Fishing effort, a key component required for the estimation of fishery removals, historically had been estimated with data collected from a random-digit-dial (RDD) landline telephone survey within the Marine Recreational Fisheries Statistical Survey (MRFSS). The 2006 NRC report cited a growing number of biases affecting the accuracy and precision of estimates with this study design. These included, for example, decreasing coverage of the angler population with an ever-increasing proportion of cell phone-only households, decreasing participation in telephone surveys in general, and increasing inefficiencies through limited information to target households with one or more anglers. The National Marine Fisheries Service (NMFS) response to these challenges was the development of an innovative mail survey design through an enhanced sampling frame to improve effectiveness and appropriateness of fishing effort estimation for the Marine Recreational Information Program (MRIP).

This chapter discusses NMFS's initiatives implemented to research and address the 2006 recommendations, along with the present committee's evaluation of those initiatives, recommendations for future pilot studies, and areas of focus to guide continuing improvements for MRIP.

Data Collection and Sampling Frames

The 2006 NRC report included several recommendations for improving the estimation of fishing effort including a call for research to identify a "comprehensive, universal sampling frame with national coverage" and to address ever-decreasing response rates that limit the utility of the data. NMFS accepted this challenge and conducted a series of informative pilot studies in consultation with independent survey statisticians and survey methodologists. The committee briefly summarizes the findings presented in Andrews et al. (2014) below, beginning with relevant background on the original effort survey

The Coastal Household Telephone Survey

The original fishing effort study, the Coastal Household Telephone Survey (CHTS), was a telephone survey conducted on a targeted random sample drawn from a list-assisted, landline RDD sampling frame. The intended population was all residents living in coastal county households identified by pre-specified telephone area codes and exchanges associated with the geographic areas. The specific goal was to collect information from anglers regarding their fishing activities during the previous two-month period (referred to as a wave). The 2006 NRC report pointed to potentially low data quality because of problems such as undercoverage bias

from a growing proportion of households without a landline phone (Blumberg and Luke, 2015; McCarthy, 2015; Boyle et al., 2009), in addition to already low response rates, which were projected to further decrease over time (e.g., Keeter et al., 2006; Curtin et al., 2005). Owing to data already available for many states, the 2006 committee suggested a national angler registry as one solution to the sampling frame problem that could provide considerable efficiencies for sampling and data collection, and improved data quality over the current RDD design.

National Saltwater Angler Registry

NOAA established the National Saltwater Angler Registry (NSAR) on January 1, 2010 (Barclay 2009). States with saltwater license registries were allowed to sign a memorandum of agreement (MOA) whereby their existing license frames could serve to meet the federal requirements. In accordance with the MOA, states agree to share data regarding their license holders or registrants, and in return, NMFS does not require anglers who fish in those states to register federally.[10] These states, however, had (and still have) varying rules for certain exemptions from having a license. As a result, coverage of the angler population is not consistent throughout the NSAR. Table 3.1 provides a summary of coverage issues for the NSAR related to exemptions. To address the viability of using NSAR as a sampling frame, NMFS conducted a targeted pilot study summarized below.

Several steps can be taken to address the issues of undercoverage in the sampling frame (and non-response to the mail survey). For example, to address undercoverage, people with license exemptions can be interviewed at access sites, and a correction factor can be applied to the FES. Also, when people do not return a mail survey questionnaire, then survey personnel can try to contact the non-respondent by email or telephone.

[10] 500 CFR §600, Subpart P

TABLE 3.1 Sources of Undercoverage due to the Registry Requirements of the NSAR by State. Source: Modified from NMFS[a].

State	Basic License Requirement	Exception for Fishing on Licensed For-hire Vessel?	Exception for Anglers 16 and Under?	Other Major Exceptions?
Alabama	Salt Water License	Y	Y	N. License-exempt residents over age 64 and anglers fishing on state-licensed piers must obtain a state saltwater angling registration.
Alaska	Fishing License	N	Y	N. Residents over age 60 are exempt, but must obtain a Senior Alaska Resident card
California	Fishing License	N	Y	Fishing on a public fishing pier.
Connecticut	Salt Water License	Y	Y	N
Delaware	Fishing License + FIN # Registra-tion. Anglers declare intent to fish in salt water on FIN registration.	Y	Y	N (Persons exempted from license requirement must still have FIN #)
Florida	Salt Water License	Y	Y	Residents over age 65. Anglers fishing from state-licensed piers.
Georgia	Fishing License + Saltwater Information Program (SIP) registration	Y	Y	N
Hawaii	None	-	-	-
Louisiana	Salt Water License	N	Y	Persons who turned 60 yrs of age before 6/1/00 are exempt. Persons who turned 60 after 6/1/00 must have a senior license.
Maine	Saltwater fishing registration OR Freshwater License + state they fished in saltwater	Y	Y	N
Maryland	Bay and Coastal Fishing License OR Bay Boat License OR Bay and Coastal Registration if exempt (e.g. unlicensed angler on licensed boat)	Y	Y	Fishing from commercial pier. Piers provide list of users to registry. Persons otherwise exempted from license must obtain registration.
Massachusetts	Salt Water Permit	Y	Y	N
Mississippi	Salt Water License	N	Y	N

Table 3.1 (continued)

State	Basic License Requirement	Exception for Fishing on Licensed For-hire Vessel?	Exception for Anglers 16 and Under?	Other Major Exceptions?
National Saltwater Angler Registry[b]	Registration	Y	Y	Any person currently licensed by, or a resident exempted from the state's license requirements by, an Exempted State; persons angling for non-anadromous species in state waters.
New Hampshire	Salt Water License	Y	Y	N
New Jersey	Salt Water Registration	Y	Y	N
New York	Salt Water Registration	Y	Y	N
North Carolina	Coastal Recreational Fishing License	Y	Y	Grandfathered lifetime license holders as of 1/1/2006; anglers fishing on licensed piers
Oregon	Fishing License	N	Y (under 12)	N
Pennsylvania	Fishing License + Pennsylvania Saltwater Angler Registration (lower Delaware River only)	`N	Y	N
Rhode Island	Salt Water License	Y	Y	N
South Carolina	Salt Water License; Senior Fishing License	Y	Y	Anglers fishing on licensed piers.
Texas	Fishing License + a Saltwater Stamp	N	Y (under 17)	Persons born before 1/1/1930 are exempt.
Virginia	Tidal Waters Fishing License OR Boat License OR Fishing Information Program (FIP) Registration if exempt (e.g. fishing on licensed boat)	Y	Y	N. Anglers exempt from licensing must get FIP registration.
Washington	Fishing License	N	Y (under 15)	N

[a] https://www.countmyfish.noaa.gov/register/.
[b] Per www.countmyfish.noaa.gov/register: "Starting January 1, 2011, if you have a saltwater recreational fishing license or registration from any state or U.S. territory EXCEPT Hawaii, Puerto Rico, or the U.S. Virgin Islands, you are AUTOMATICALLY registered and do not need to take further action." (NMFS Communication to 2016 committee, 22 June 2016.)

Pilot Study – Angler License Directory Telephone Survey

NMFS conducted pilot studies in several states with established angler registries, including the Angler License Directory Telephone Survey (ALDS). The data collection methodology for the ALDS was similar to CHTS as both were telephone surveys, but the sampling methodology was different. CHTS samples were drawn from randomly generated telephone numbers in designated coastal area codes and exchanges but no household information (e.g., name, angler license status) was available. The ALDS sample, by contrast, was randomly selected from the licensure database with associated contact information that was sometimes incomplete or out of date. Thus, the pilot study afforded a direct comparison of the two sampling frames—landline RDD for CHTS and the angler registry for ALDS. Though the ALDS response rates were only "marginally higher" than CHTS, the new sampling frame resulted in significant data collection efficiencies through an increased number of interviews from the target population of saltwater anglers (Andrews et al., 2014). This research, however, also suggested that sizeable coverage issues existed with the registries related to errors in contact information (e.g., old/incorrect telephone numbers), state-specific exemptions, and anglers that should have a license but did not, ranging as high as 70% in some states.

Pilot Study – Dual-frame Telephone Survey

In addition to the angler registry, the 2006 report also suggested a general dual-frame approach to increase coverage of the target population for estimation of fishing effort (Brick et al., 2011; Lohr, 2007) and to increase data collection efficiencies with already identified anglers, regardless of the chosen data collection mode (telephone, mail, etc.). Building on the results of the ALDS pilot, NMFS next examined the combination of the angler registry with a landline RDD survey. Acknowledging that anglers could be listed in either or both sampling frames, NMFS selected independent samples from each frame (CHTS RDD and ALDS registry) and then weighted the results from each frame to produce a series of unified estimates (e.g., Lohr and Rao, 2000). Response rates from the pilot survey were low and similar in magnitude to CHTS; undercoverage concerns noted for the ALDS design remained. There was also insufficient information to determine if a sampled household/angler was listed in both frames to construct efficient weighting adjustments to lower nonresponse bias and coverage bias associated with those not present in either frame. Consequently, NMFS abandoned this alternative design.

NMFS neither evaluated a landline/cellular dual-frame RDD design for the estimation of fishing effort, nor a telephone survey using cell phone numbers alone. Instead, they assessed prior research on telephone surveys for characteristics relevant to the needs of MRIP. For example, since May 2004, residents may "port" their landline (or wired) numbers to a cellular (wireless) carrier and device (FCC, 2016). Also, cellular phone numbers are allowed to travel, meaning that the number assigned upon activation need not change when a person moves to another area in the United States. Thus, ported-landline and cellular phone numbers introduce inefficiencies in data collection because they are not necessarily linked to the geographic areas targeted by MRIP (e.g., Keeter et al., 2015).

Fishing Effort Survey

The ALDS research uncovered sampling and data collection efficiencies in using the NSAR as a sampling frame (as suggested in the 2006 report), but NMFS also noted that the remaining undercoverage could limit the quality of the fishing effort estimates. Additionally, the general, ongoing decline of response rates to telephone surveys was a growing challenge. Brick et al. (2011), for example, discovered that the coverage of the CHTS was only about 50 percent in the aggregate of Florida, Massachusetts, New York, and North Carolina, and that the aggregate response rate was around 10 percent, while a test mail survey resulted in a response rate of over 30 percent. Consequently, NMFS evaluated the feasibility of a mail survey.

Address-based sampling (ABS) frames have been available to the public since the early 1990s (Iannacchione, 2011). These frames are developed from commercially available versions of the U.S. Postal Service's Computerized Delivery Sequence (CDS) file, the route taken by postal carriers to deliver mail. The CDS, like the NSAR, alone is not a complete list and is therefore subject to undercoverage. The CDS may be supplemented with information to produce a more complete sampling frame. Supplemental files include, for example, the No-Stat file, a file containing over seven million primarily rural mailing addresses not listed on the CDS (Shook-Sa et al., 2013), and ancillary data from public and private sources related to population demographics and other characteristics (AAPOR, 2016). With augmentation of the No-Stats file alone, ABS sampling frames provide near-complete coverage of the U.S. household population (Iannacchione, 2011).

NMFS then tested a new list that incorporated the coverage benefits of ABS and state-specific licensure database (NSAR) for the new Fishing Effort Survey (FES). All ABS addresses in relevant East and Gulf Coast states were retained, excluding grouped quarters without individual unit addresses (e.g., correctional and nursing facilities; Reist, 2012) and known businesses. Additional records found on the NSAR not matching to information on the ABS address list were also retained, including those with addresses outside the coastal state. Addresses on the new FES sampling frame were then stratified (grouped) within state to allow differential sampling by (1) coastal counties (specified distance from the coast) vs. non-coastal counties, and (2) NSAR exact match (address and/or telephone number, if available) vs. no match (Andrews et al., 2014). This is referred to in the sampling literature as a single-stage stratified design (e.g., Valliant et al., 2013).

The FES pilot test using the new address frame resulted in impressive improvements over its predecessor survey, CHTS (Andrews et al., 2014). The augmented-ABS frame enabled a direct link to coastal households through geolocation information; this provided efficient sampling and data collection methods to target angler households. Additionally, this new approach provided a new level of stratification for sampling associated with licensure status (Yes vs. No / Unknown). Then, samples in the matched strata were drawn at a higher rate to gain efficiency under the assumption that this stratum has higher rates of saltwater anglers. Finally, a subsample of nonrespondents was contacted again to assess nonresponse bias; data collected on the nonresponse follow-up sample participants did not show any detectable levels of nonresponse bias, suggesting high-quality data. Note that many studies include nonresponse follow-up components to their study designs in order to measure and adjust for nonresponse bias following guidance provided in *Standards and Guidelines for Statistical Surveys* from the U.S. Office of Management and Budget (OMB, 2006).

FES documentation to date is not clear on the level of augmentation of the sampling frame beyond the NSAR such as the No-Stats file. This suggests an area of future research toward ensuring maximal coverage of the coastal-state household population especially for those with private boat docks. Additional augmentation of the FES frame could afford further targeted sampling and associated data collection efficiencies if information say from market research vendors proved fruitful.

The 2006 report recommended that a dual-frame survey (i.e., using more than one sampling frame to draw a probability sample) "should be used wherever possible to reduce sample bias" associated with undercoverage noted for the single sampling frame design (see Chapter 2 discussion). Although not a true dual-frame design as suggested by the 2006 report, NMFS correctly argues that the advantage of their approach is that it avoids biases in the dual-frame estimator resulting from identification of households listed on multiple frames (Andrews et al., 2014). These records can be identified either prior to sample selection through frame matching or post data collection through respondent-provided information such as whether they have a saltwater fishing license. Here, the frame matching errors create modest efficiency loss but do not create any bias since the weights remain the inverse of the probability of selection and all households are covered by the frame.

Results from the FES pilot study were striking. The new study design produced a 1.6-fold increase in the likelihood of surveying a household with at least one angler over the other pilot designs evaluated. There was also a 3-fold increase in the response rate, along with a 4.1-fold increase in "the mail survey estimate of total fishing effort" relative to CHTS survey (Andrews et al., 2014). Note that the sizeable increase in estimated effort from this pilot does not necessarily suggest higher-quality data (e.g., lower nonresponse bias) but could indicate a true change over time; without a "gold standard" (from another survey or source) on which to compare, the reason for the change is only speculative.

NMFS officially launched the FES in January 2015 in tandem with CHTS for states in the Atlantic and Gulf coast regions (NMFS, 2016). Administering the two surveys simultaneously is part of the three-year plan to transition from CHTS to FES while gathering needed information to re-calibrate historical CHTS estimates to adjust the data series. The FES achieved an overall response rate of 35.1% (ranging from 32.3% to 44.7%), almost 28 percentage points higher than CHTS (7.3%, ranging from 4.6% to 11.2%). As with the pilot study, fishing effort estimated from FES was 4.7 times larger than the value tabulated from CHTS responses.

Other Data Collection Research

The 2006 NRC report also mentions the need to investigate other modes such as electronic data collection. Though much has been accomplished, to our knowledge NMFS has yet to investigate the role of electronic data collection (e.g., a web-based survey) either alone or in combination with an initial mode of data collection. This investigation, however, should proceed with caution. For example, providing participating households access to a web instrument (in lieu of completing the mail questionnaire) may provide cost-savings and reduce the time needed to key and process the data. But, the digital divide (Horrigan, 2015) may very well result in coverage bias by excluding lower income households, suggesting this option is not viable for full implementation. Data collection via a smartphone application (app) or text messaging may supplement the web option in a mixed-mode survey as long as the questionnaire remains

relatively short (Link et al., 2014); coverage bias is less likely a concern here because approximately 92% of adults in the U.S. are estimated to have a cell phone (Anderson, 2015).

However, mixed-mode surveys, those with multiple ways for a respondent to provide information (e.g., mail back a hardcopy questionnaire or use the web instead), have several advantages and disadvantages (Dillman and Messer, 2010). Advantages include reduction of errors associated with non-negligible nonresponse and possibly reduction of survey costs. Disadvantages include mode effects (differential patterns of reported information associated with the data collection methods), lower data quality (Sakshaug et al., 2010) and possibly lower participations rates (Medway and Fulton, 2012).

Fishing Effort Estimates from the For-Hire Surveys

The CHTS includes only households with a landline area code and exchange linked to coastal counties of the United States. The FES sampling frame is much larger, being comprised of all addresses in the East and Gulf Coast states. Note that unlike the pilot study, the FES sampling frame excludes anglers identified from licensure databases who live outside these coastal states. Consequently, undercoverage in the FES frame will remain if this list does not adequately cover non-coastal state anglers. Because MRIP's scope covers recreational angler fishing effort regardless of where the person lives, both CHTS and FES may include some level of undercoverage in the fishing effort estimates if the adjustment for non-coastal anglers estimated from the Access Point Angler Intercept Survey (APAIS) is somehow insufficient (Fisheries Statistics Division, 2016). The committee welcomes on-going analyses of FES coverage, both before and after the APAIS adjustment is applied, along with the direct evaluations of the APAIS non-coastal adjustments.

The For-Hire Surveys (FHS) were designed to collect information on "fishing effort and catch by marine recreational anglers fishing on professionally licensed for-hire vessels (including charter, guide, and large party boats)" simultaneously (Sauls et al., 2008). FHS was initially "developed to resolve undercoverage of charter and head boat angler effort" inherent in the CHTS for the Atlantic and Gulf Coasts (NMFS, 2014b). The committee presumes that the FHS may also provide an undercoverage adjustment for the FES used to either confirm or supplement the APAIS adjustment. NMFS states in the handbook that most anglers who take these types of boat trips do not live in coastal states.the handbook that most anglers who take these types of boat trips do not live in coastal states.

Unlike CHTS and FES, the FHS includes samples of for-hire vessels selected from a "comprehensive directory of for-hire boats" stratified by vessel type, state, and week within the data collection wave. To date, the committee is unaware of studies to assess and address the coverage properties of the FHS sampling frame and agrees with a consultants' report that stresses the need for a comprehensive list (Chromy et al., 2009). The handbook notes that an adjustment factor from APAIS is applied to the FHS effort estimates to account for angler trips on for-hire vessels not on the sampling frame. Details of the undercoverage adjustment and other survey weight components are found in Sauls et al. (2008). Evaluative studies along with documentation on sampling, frame coverage and other measurement issues for the FHS would benefit MRIP and provide needed information to the public.

A vessel representative is contacted by telephone to relay details of the fishing trips that occurred during the prior week, including the number of customers who fished for a particular fishing period. Upon inspection of the questionnaire, the committee notes that the respondent is not asked to identify the number of anglers living outside the coastal areas, or whether they had their own fishing license (and hence captured on the NSAR). Thus, the committee cannot confirm or refine the statement that most anglers on Atlantic/Gulf Coast for-hire vessels are from non-coastal areas. Gathering such information may be feasible from a cost and burden prospective if NMFS collects electronic logbook information from the vessel captains as recommended in a consultants' report (Chromy et al., 2009). Additional information on the FHS is discussed in Chapter 4.

Survey Materials

The 2006 report did not provide key recommendations for the study questionnaire used to estimate effort. However, noting that interviewer-assisted questionnaires are different from self-administered ones (Dillman et al., 2014; Groves et al., 2009), both in form and in content, NMFS set out to develop and test a new questionnaire (also called the survey instrument) for the FES.

NMFS used cognitive testing (Groves et al., 2009) to evaluate changes in the short CHTS instrument to improve, for example, the angler's ability to report on saltwater fishing sites at the exclusion of freshwater sites. NMFS also focused on telescoping errors where respondents inadvertently include or exclude fishing trips from the designated two-month reporting period (Gaskell et al., 2000). Pilot studies conducted by NMFS suggest that these challenges have been reduced, though they recognize that some "residual reporting errors" may still exist.

As with the CHTS questionnaire, the FES questionnaire is relatively short, covering both sides of one page. The FES questionnaire contains 10 questions on weather information, whether anyone in the household has been fresh- or saltwater fishing in the past 12 months, the type of telephone service, household tenure (rent, own, etc.), length of stay and household size. Non-fishing questions were included in the FES questionnaire based on research that shows such items increase participation from non-angler households (NMFS, 2014). Six questions are asked of, at most, the five oldest members of the household: demographics, whether they saltwater fished from shore/boat, and the number of days fished by location in the designated 2-month period and within the past 12 months. Because of the undercoverage of private access anglers in the intercept survey, an additional question to determine whether respondents used public or private access would provide valuable information to MRIP.

Materials included with the mail questionnaire are a cover letter containing details to enable informed consent to participate in FES, along with frequently asked questions, a prepaid return envelope, and a small cash incentive. Noting challenges with respondents distinguishing fresh-from saltwater locations, NMFS could evaluate the utility of including a state map with identified saltwater access points. This may also improve angler recall.

Another item of note is the two-month recall period common to both the CHTS and FES. Limited documentation is available on the historic decision to set two months as the recall period (Groves et al., 2009; see also Chapter 1) for CHTS other than methodological studies conducted in the 1970's that suggested a recall period longer than two months would result in unreliable estimates (NMFS, 2014). Presentations from NMFS to the committee in open meetings suggest

that reducing the size of the data collection wave and recall period could increase the FES sample size and consequently the cost of the study. NMFS will soon comment on results from a recent pilot experiment to compare results from a one-month recall period against the standard two-month period. Any design changes to address non-negligible recall bias should be made in light of sample size (cost) implications, along with effects on when estimates are made available to the public.

Noting problems associated with recall bias, research has been conducted using prospective data collection techniques. For example, the Migratory Bird Hunter Survey requests sample members to maintain a prospective diary to record hunting trips during the season (USFWS, 2016). However, some research suggests a higher participant burden with prospective diaries leading to lower response that should be evaluated through a pilot study (Fricker and Tourangeau, 2010).

Prospective electronic data submission by a household respondent, say through smartphone or tablet apps, may ease these concerns and could be a focus for future research. The ability to "capture data in the moment" has benefits for eliminating recall bias, a concern expressed for CHTS and FES, provided that the respondent burden does not effect of participation rates (Link et al., 2014). Therefore, NMFS is encouraged to consider a prospective design with electronic data collection as a future pilot study. As discussed in Chapter 8, NMFS should consider implications on the data series when evaluating the pros and cons and introducing enhancements to the FES.

Sample Design

The CHTS sample design is described as a stratified simple random sample of RDD landline telephone numbers associated with targeted coastal areas and subareas. The study telephone numbers are randomly selected from banks of 100 numbers with at least one working residential landline phone (1+ banks), excluding those designated as a business (Link et al., 2008). Biases associated with undercoverage (excluding, for example, cell phone only households) and cognitive burden in recalling fishing trips in the past two months during a brief telephone interview are a few challenges noted in the 2006 report and by NMFS (Andrews et al., 2014).

The FES sample design, by contrast, is a stratified simple random sample selected bi-monthly from an ABS frame of addresses in Atlantic and Gulf Coast states. Mutually exclusive strata (groups of addresses) are defined by the interaction of county proximity to the coast and NSAR match (yes/no) within each state under the FES purview, all important characteristics to the estimation of the annual fishing effort. NMFS uses differential sampling rates to target strata with a higher likelihood of interviewing anglers without sacrificing coverage (Andrews et al., 2014). Just prior to data collection, NMFS augments the sample with state-specific license registry data linked to the NSAR to ensure current contact information such as telephone number (Fisheries Statistics Division, 2016). Documentation on the augmentation could benefit from additional clarity regarding the point at which the frame is updated with critical information such as the NSAR match (yes/no; see also Chapter 7 recommendation regarding enhanced documentation).

The FES is designed to produce cross-sectional (i.e., yearly) fishing effort estimates by state. As noted in documentation provided to this committee by NMFS, the state-level annual estimates are expected to be precise, assuming a coefficient of variation (= 100 × standard error of the

fishing effort estimate divided by the estimate) no greater than 20 percent and historic response rates (Fisheries Statistics Division, 2016). An optimal allocation methodology determines the distribution of cases across strata within each state. Requiring the FES to produce precise estimates for in-season estimation is not feasible given time and funding constraints and instead would require specialized surveys for this purpose—consider, for example, the red snapper survey field tests being conducted in Alabama, Florida, Mississippi, and Texas in collaboration with NMFS (Sharpe, 2016)—and/or specialized statistical methodology.

The 2006 report recommended the evaluation of panel designs for estimation of effort, noting both pros and cons of this alternative design. With survey panel designs all or a portion of the sample are interviewed across multiple data collection periods (e.g., Lavrakas, 2008). The 2006 committee focused specifically on the benefits of a rotating panel design where change between two years of the study can be estimated along with cross-sectional changes as currently implemented. Also mentioned in the 2006 report were the potential benefits of a rotating panel design (multiple panels of sample members are brought in and removed from the study at a designated frequency) for maintaining or even increasing response rates e.g., Lavrakas, 2008). To date, panel pilot studies have been conducted in Texas to evaluate the utility of the iSnapper app for prospective collection of catch data on Red Snapper (Stunz et al., 2014; NOAA, 2016) and in North Carolina and Florida to assess the feasibility of collecting catch and effort simultaneously (NOAA, 2016).

NMFS is cognizant of bias associated with nonresponse and has included design components to mitigate this challenge. All FES sampled households that do not respond within a specified period of time are sent a reminder postcard. The third and final mailing to remaining nonrespondents includes a nonresponse conversion letter, a second questionnaire and a post-paid return envelope, delivered together via first-class mail. Additionally, the pilot studies that served in the development of the current FES design included an evaluation of nonresponse bias (Groves and Couper, 1998). NMFS conducted a small nonresponse follow-up study on a random subsample of nonrespondents (see, for example, Valliant et al., 2013 for a discussion of nonresponse follow-up studies). This subsample was contacted again using priority mail and an additional cash incentive. Comparison of the “fishing prevalence” estimates did not uncover substantial differences in the initial and follow-up respondents. However, the documentation does not discuss changes in fishing effort. NMFS should evaluate the utility of including a nonresponse follow-up as part of the standard FES design as an on-going evaluation of nonresponse bias.

Weighting

Historically, fishing effort was estimated with CHTS as the weighted number of saltwater fishing trips made by coastal-area residents inflated to include an estimate for non-coastal area residents tabulated from the Access Point Angler Intercept Survey (Chapter 4). With FES, nonresident anglers—those on the NSAR and without a corresponding address on the ABS frame—contribute data for the nonresident estimates, while those listed on the ABS frame provide the core effort estimate. These surveys are referred to as the FES Nonresident Angler Survey (NAS) and the FES Resident Angler Survey (RAS) in some documentation (NMFS, 2013).

Regardless of the survey, the base weights (inverse selection probabilities) are adjusted for nonresponse to mitigate biases potentially present in the respondent data if those declining

participation have differing levels of effort (e.g., Lohr, 2010; Valliant et al., 2013). NMFS uses a nonresponse weighting class adjustment with classes formed by information available for all sampled households, namely, the interaction of state, coastal/non-coastal area, and additionally with FES, match/nonmatch with NSAR, and presence of a telephone number linked to the sampled ABS address. Note that survey weights are generated independently for RAS and NAS. With this methodology, respondents and nonrespondents ideally respond similarly for key study questions within groups formed by the weighting classes (Valliant et al., 2013; Haziza and Lesage, 2016). This is a strong assumption made for all surveys using this approach.

As noted previously, the FES ABS frame appears to contain only information appended from the NSAR and no other source. NMFS may find that a nonresponse model enhanced with NSAR information could prove of benefit for the matched sample if item nonresponse and data quality were sufficient to warrant investigation. Additional model covariates may be obtained through supplemental information provided on the ABS frame (e.g., indicator for a seasonal home) or market research vendors (AAPOR, 2016).

In the final step, NMFS calibrates the nonresponse-adjusted weights for the study respondents to the estimated number of households by sub-state sampling strata from the American Community Survey (ACS; Fisheries Statistics Division, 2016). Not only does this procedure align the estimated number of households with the ACS, but also weight calibration has been shown to lower both sampling and non-sampling errors if relevant variables are available for respondents and from the population (Kott, 2016; Kott and Chang, 2010). Data obtained through the FES questionnaire, such as household tenure, may prove advantageous to enhance the calibration model. Also, as noted in the 2006 report, a rotating-panel survey could afford detailed variables for nonresponse adjustment for panel members who participated in the first year of the study but not the second.

In summary, FES weighting methodology includes three key components: inverse probability of selection, an adjustment for nonresponse, and poststratification. Documentation to date does not suggest any treatment for mail packets returned as undeliverable or weight adjustments for ineligibility (e.g., vacant households). NMFS could consider a separate unknown-eligibility adjustment especially if the proportion of the sample with no contact is large. Otherwise, the fishing effort estimates could be overinflated because the weighting methodology must assume the same rates of recreational fishing for unoccupied households as calculated from responding households. We assume that the population control totals do not include unoccupied households and therefore address this issue. However, enhanced documentation on the weighting methodology would benefit NMFS now and in the future, as well as provide additional information for the public at large.

Additionally, if NMFS further expands the bi-monthly design to include a nonresponse follow-up, then further research is needed to evaluate the weighting methodology in light of a two-phase design, where phase 1 is the current FES design and phase 2 is the nonresponse follow-up. For example, correlates of nonresponse may differ by phase, suggesting a different nonresponse adjustment for the follow-up study. Enhancing the complexity of the design and/or the weighting methodology must be carefully evaluated to determine relative gains in efficiency and data quality without delaying release of the estimates or affecting continuity of the data series (see Chapter 8).

NMFS also could use the FES to estimate the number of households with at least one angler in U.S. coastal states. If these FES estimates do not align with the population, then estimated effort could be severely biased low or high. Consider this generic example: Unbeknownst to the research team, the FES sampling frame had 25 percent undercoverage of the angler population, a conservative estimate given the 70 percent result cited in Andrews et al. (2013). A higher proportion of sample addresses was drawn from the NSAR-matched cases in keeping with the current design. Owing to leverage-saliency theory where sample members who are interested in the survey topic are more likely to participate (Groves et al., 2000), the response rate from angler households was 2.5 times higher than from non-angler households. For convenience and simplicity, we ignore the effect of measurement error in the data provided by the participating households. Instead, we focus on the final weight calibration step noted above. If the base weights are adjusted to the frame totals, then the estimated number of angler trips (effort) could be underestimated because of the undercoverage bias. Conversely, if the base weights are adjusted to the ACS totals, then the estimated number of angler trips could be overestimated because of nonresponse bias.

As demonstrated through this simple example, comparison of the estimated number of households from FES with other sources is very important. However, such information to our knowledge is non-existent. Consequently, NMFS should consider collaborating on other federal agencies' surveys to include items to estimate the number of recreational saltwater anglers or households with at least one angler, such as the American Time Use Survey. These external estimates could be used to verify the estimates or as covariates in an FES weight calibration model to reduce nonsampling biases (Dever and Valliant, 2010).

Data Quality and Missing Data

Data quality is defined by many components, including coverage, nonresponse (both item and unit), questionnaire content, data entry, and sampling error. Biemer and Lyberg (2003) provide a framework for assessing quality through the lens of total survey error (see also Chapter 2 discussion). NMFS has made great strides in redesigning the effort survey to lower bias and improve data quality. However, the assessment of data quality must be an on-going evaluation such as including a nonresponse follow-up as a standard component of the FES design.

There are yet other potential issues including respondent compensation, respondent perceptions and the validity of retrospective data. The wave follow-up methods in use (e.g., reminder postcard) appear adequate and fit within the framework of standard mail-out survey methodologies. Based on findings of an MRIP-sponsored pilot study NMFS determined the optimal compensation to surveyed households to be $2.00 (Andrews et al., 2014). The findings of the study appear reasonable and the choice of $2.00 reflects a careful consideration of the tradeoffs between nonresponse reduction and survey cost. Another potential problem is respondent perceptions. Respondents' perceptions of government, the value of the MRIP survey, and the effectiveness of management efforts at various levels may vary by state. Variations in response rates across states, taken into account when determining the final sample size for each state, should be monitored and assessed on a regular basis. In states with particularly low response rates efforts should be made to research underlying reasons (e.g., insufficient incentive), say through a nonresponse follow-up, and to develop appropriate strategies for mitigating the problem.

Although discussed earlier, concerns about the validity of retrospective data certainly need further scrutiny. There is at least one pilot project that is looking into the measurement error and validity of the two-month reference for estimating effort in the mail-out surveys. Potential measurement error is certainly one problem. However, the problem is somewhat more complicated by the fact that one person from each FES household is likely reporting on the fishing efforts of the other members of the household, just like the CHTS design. There is the potential for measurement error both for the respondent's self-reporting of effort within the two-month timeframe and for the reporting of other household member's effort in that same time frame. Thus, measurement error in this case can take various forms.

One area of data quality not covered in the current FES documentation is item nonresponse, i.e., missing responses from an otherwise completed questionnaire (Haziza, 2009). Item nonresponse can be addressed with imputation, where the missing value is replaced with a valid response using a defined model. Conversely, missing values can be excluded from the household-level estimates; in the case of fishing effort, this assumes no effort (fishing trips) for one or more household members. NMFS is encouraged to report on the level of item nonresponse and to identify procedures to address the incomplete information, as it has direct implications on estimation. Methods could include weighted hot-deck imputation (Cox, 1980) with predefined classes for quick implementation, or more advanced techniques for questions with high item nonresponse or increased likelihood for rounding bias (.g., Huttenlocher et al., 1990).

Variance Estimation

A standard error for estimated effort is calculated through Taylor expansion procedures per information provided to the committee by NMFS (Fisheries Statistics Division, 2016; Wolter, 2007). The Taylor expansion approach does not account for nonresponse as available for other methods such as replicate variance estimation (e.g., Valliant, 2004). If the sampling fraction (i.e., proportion of households selected for the study out of those on the FES sampling frame) is small, the so-called reverse approach of Shao and Steel (1999) is also another option (see also Haziza, 2009; Kim and Rao, 2009). Software is available to analyze both sets of weights, though the generation of replicate weights requires additional time to generate and research to dictate the number of replicates to generate (e.g., Wolter, 2007; Valliant et al., 2008).

Conclusions and Recommendations

Conclusion: The methodologies associated with the current Fishing Effort Survey, including the address-based sampling mail survey design, are major improvements from the original Coastal Household Telephone Survey that employed random-digit-dialing to contact anglers. This is a reflection of an immense amount of effort on the parts of the NMFS staff, contractors, and consultants.

Conclusion: The two-month recall period for Coastal Household Telephone Survey (CHTS) was set for consistency with the seasonal time periods captured by the on-site intercept surveys, such as the Access Point Angler Intercept Survey. This same recall period was chose for the Fishing Effort Survey to match CHTS. Several factors, however, are related to the quality of angler recollections, including number of fishing trips and the frequency around the beginning/end of the data collection wave.

Recommendation: NMFS should continue to evaluate the cognitive properties of a 2-month recall period to confirm or update research on this topic conducted in the 1970s.

Recommendation: NMFS should consider evaluating a prospective data collection methodology, such as asking people in advance to document fishing trips planned over the next two months, to reduce concerns about angler recall.

Conclusion: Survey material initially sent to the sampled household includes a small cash incentive in appreciation of the adult respondent's time to complete the questionnaire. Incentives have been shown to be effective in reducing nonresponse. Nonresponse, however, will be an on-going challenge for all surveys, which can lower quality and precision.

Recommendation: NMFS should consider conducting targeted annual nonresponse studies as a standard component of MRIP. The purpose of these studies would be to continually monitor correlates of nonresponse and nonresponse bias in an effort to control its damaging effects on data quality.

Conclusion: Maintaining comparability across the years is important for evaluating trends in fishing effort. Changes in fishing effort can result from actual change over time. They can also result from measurement errors such as nonresponse bias, from procedural changes such as new survey questions, or from ineffective adjustments to the survey weights. Without data on respondents who are repeatedly surveyed over the time period of interest, it can be difficult to determine the extent to which a change is real or results from these other sources.

Recommendation: As recommended in the 2006 report, NMFS is encouraged to continue research on survey panels, where a portion of the sampled households is retained for one or more interviews, for the Fishing Effort Survey alone or for an effort-catch combined study. The purpose of the survey panel would be to assess trends and any anomalies in those trends, to assess any improvements in data collection efficiency through increased participation, and possibly to lower measurement error associated with, for example, trip recall with a more engaged sample of anglers.

Recommendation: NMFS should evaluate the benefits of collaboration with another federal survey (e.g., the American Time Use Survey) to include items related to fishing effort. These external estimates could provide corroboration of the fishing effort estimates and possibly provide useful variables for an enhanced Fishing Effort Survey weight calibration model to address sampling and nonsampling biases.

Conclusion: Collecting data for fishing effort estimates through electronic modes (e.g., web questionnaire, smartphone app) may reduce study costs associated with keying and processing the questionnaires. Additionally these vehicles may be a viable option to increase release of fishing effort estimates with data that is evaluated in real-time.

Recommendation: As recommended in the 2006 report, electronic data collection should be evaluated further as an option for the Fishing Effort Survey, including smartphone apps, electronic diaries for prospective data collection and a web option for all or just panel members.

Conclusion: Weight adjustments have proven effective in lowering biases in survey estimates such as those associated with nonresponse and frame coverage errors. The effectiveness is only as great as the association of the adjustment covariates with nonresponse and important measures of the survey. The Fishing Effort Survey weighting methodology borrows on the strength of the new sampling design to include, for example, an indicator for at least one licensed angler in the

household. Consequently, the use of additional variables that are associated with fishing effort and/or survey participation might prove beneficial for the weight adjustment models.

Recommendation: Current or augmented variables on the addressed-based sampling frame should be evaluated to improve the efficiency of the Fishing Effort Survey weighting methodology.

Conclusion: Variance estimation is a critical component to any survey. Methods that do not account for all components of the sampling design and weight adjustments will typically underestimate the sampling variance. This is especially important for surveys without a high level of response such as with Fishing Effort Survey (~40 percent).

Recommendation: Other variance estimation methods should be evaluated for fishing effort estimates to account for weight adjustments, especially those associated with nonresponse. These include replication methods and the so-called reverse approach.

Chapter 4
Sampling and Statistical Estimation for the Angler Intercept Survey

Introduction

One important component of recreational fishing surveys is the intercept survey. As noted by the National Research Council's (NRC's) 2006 study, the intercept survey for the Marine Recreational Fisheries Statistics Survey (MRFSS) used a stratified multi-stage sampling design, but the (point and variance) estimation procedures were not accounting for the complex design features, potentially leading to biased estimates. Also, the previous MRFSS design did not provide adequate coverage of night fishing. Finally, the previous MRFSS design used the concept of "alternate site," which did not support the calculation of well-defined inclusion probabilities. To address the 2006 review recommendations, the intercept survey underwent a complete redesign in terms of both sampling and estimation procedures. The current methods used in the Access Point Angler Intercept Survey (APAIS) for the Marine Recreational Information Program (MRIP) are a vast improvement over the previous sampling and estimation procedures and reflect state of the art methods in survey sampling.

This chapter contains a discussion of the initiatives implemented to address the recommendations, the current committee's evaluations of those initiatives, and recommendations for future studies and improvements.

Data Collection and Sampling Design

The target population for the intercept survey consists of the marine recreational angling fishing trips that are taken during a given two-month data collection period, or wave. For these purposes, a "trip" is generally considered to be each time an angler engages in fishing and then subsequently leaves a particular site. It is estimated that there are between 5 million and 20 million fishing trips taken during a given wave. The newer APAIS is conducted for two-month waves in 16 states bordering the Atlantic Coast and Gulf of Mexico (excluding Texas, and Louisiana), as well as in Puerto Rico (Breidt and Chromy, 2016). Depending on the state, the number of waves ranges from three to six.[1] The objective of the intercept survey is to estimate the catch per unit effort (CPUE), by species, catch category (harvested or released dead or alive), and fishing mode (Charter Boat, Party Boat, Private or Rental Boat, Shore fishing), of anglers participating in marine recreational fishing in the study states.

The two main data collection tasks of the APAIS are counts of completed angler fishing trips and angler-intercept interviews. The angler interviews are obtained by intercepting marine recreational anglers at shore (SH), private/rental boat (PR), and charter boat (CH) access points. Sampling in the party (or head) boat (HB) mode includes riding on the boats during fishing days

[1] See http://www.st.nmfs.noaa.gov/recreational-fisheries/Surveys/coverage.

(no overnight fishing trips are sampled). The interviewers ask anglers about their fishing day and obtain some demographic data about the anglers, as well as data on any fish released or already filleted. It also involves examining the catch for species identification and enumeration, and potentially weighing and measuring the catch.

The current APAIS sample design is a multistage stratified design. The population is first stratified based on site-group (beach-bank, artificial structures, charter boat, private/rental boat, and the special offshore group), state, wave, region, month, type of day (weekday and weekend) and 6-hour blocks within a 24-hour day (2AM-8AM, 8AM-2PM, 2PM-8PM, 8PM-2AM, 11AM-5PM). The 11AM to 5PM interval, which corresponds with peak fishing activity, was added in 2014, due to lower activity in the early morning and late afternoon/evening resulting in a small number of completed interviews (Breidt and Chromy, 2016). That interval overlaps with the time intervals 8AM to 2PM and 2PM to 8PM; however, the inclusion probabilities are adjusted in order to account for the overlap so that double counting does not occur. This interval corresponds to peak fishing activity. Before 2014, the APAIS used the fishing mode as a stratification variable. In 2014, APAIS transitioned from fishing mode-stratified sampling assignments to mixed-boat-mode and shore mode sampling, and in 2016 it transitioned to fully mixed-mode sampling to ensure adequate sampling in all modes of eligible fishing anglers (Breidt and Chromy, 2016). The current APAIS design uses the site-group as a stratification variable to ensure sufficient sample size for all modes of eligible fishing anglers. This decision was made to improve productivity in terms of number of completed interviews.

The first-stage sampling frame is from a spatio-temporal list of site-days (defined as a combination of a fishing site or cluster of sites and a day), which is constructed from the public access fishing site register (SR). Field observations are entered into a web application upon return from the field. In some instances, a site may permanently close (e.g., out of business, destroyed by a storm, etc.). In this case, a site is retired but remains on the SR. A primary sampling unit (psu) is a site-day within a given six-hour time slice stratum (Breidt and Chromy, 2016). The SR is a database of all known public access sites from Maine to Mississippi, and Puerto Rico with fishing activity. Each site on the SR is assigned an identification number, which remains the same over time. The SR is updated regularly by field observation. The site status is coded as retired, making the site ineligible for sampling.

Each psu consists of either a single site or two sites. Each site is assigned a fishing pressure that corresponds to a prediction of the mean number of angler fishing trips that an assigned interviewer would encounter based on the site's most common form of fishing (shore fishing, charter boat, etc.; Table 4.1). The assigned pressure for a given site is time-interval dependent. That is, a given site may be labeled as a high-pressure site for a given interval block (e.g., 11AM-5PM) and labeled as low-pressure time for another interval block (e.g., 8PM-2AM). Only sites with a pressure of "3" or less can be clustered with one additional site as long as the driving time between the two sites is less than 60 minutes and both sites belong to the same county. These are referred to as "two-site assignments." Undercoverage is an important issue in the current APAIS as the first-stage sampling frame contains almost exclusively public-access sites. As a result, private sites cannot be selected in the sample as they have zero probability of inclusion. If the proportion of private sites is large and the behavior of private sites is different from that of public-access sites in terms of catch, estimators of *Total Catch* (see Chapter 2) may suffer from large biases (e.g., Särndal et al., 1992; Särndal and Lundström, 2005).

At the first stage, a sample of site-days is selected from the spatio-temporal list according to a probability proportional-to-size (PPS) sampling design. That is, the inclusion probability of a given site is proportional to its fishing pressure. Table 4.1 shows the pressure and associated size measure used in the PPS procedure. The latter is expected to lead to efficient estimates if the psu inclusion probabilities are (approximately) proportional to the psu catch. However, PPS procedures tend to be vulnerable to the presence of influential units when this "proportional relationship" is not satisfied. In other words, influential units may be the high-pressure sites with low catch or low-pressure sites with high catch. These units tend to make the classical estimators unstable in the sense that they have a large variance. One way to check whether or not the PPS procedure is appropriate is to plot the pressure measure used against the total estimated catch for each site—hour combination and to check if the relationship is linear and goes through the origin. If this plot is not approximately linear through zero, it indicates using the pressure measure as indication fishing activity may result in inefficient estimates.

To meet operational constraints (e.g., interviewers not available on the selected dates), a rejective sampling procedure (Fuller, 2009) was developed, whereby a very large number of samples is first selected through PPS sampling, and only those samples satisfying the operational constraints are kept. A sample is selected through simple random sampling among the set of samples that satisfy the operational constraints. The inclusion probability of a psu at the first stage is then approximated through Monte Carlo methods (Breidt and Chromy, 2016). That is, the inclusion probability of a psu was obtained as the proportions of samples that contained that psu among the samples satisfying the operational constraints. For two-site assignments, the inclusion probabilities are adjusted in order to account for the overlap so that double counting does not occur. Without additional information on sample allocation used at the first stage, the committee was not able to assess its effect on the efficiency of the estimates.

TABLE 4.1 Pressure category and corresponding size measure

Pressure Category	**Expected Range of Number of Angler-trips**	**Size Measure Assigned to Pressure Category**
0	1-4	0.5
1	5-8	2.5
2	9-12	9
3	13-19	13
4	20-29	20
5	30-49	30
6	50-79	50
7	80+	80
8	Unable to determine	0
9	Mode not present at site or inactive sites	0

Source: Breidt et al., 2012.

Depending on the type of fishing (shore or boat fishing), there are one or two additional stages of sampling. Sampling of shore fishing is based on a two-stage sampling design, where the secondary sampling unit (ssu) is an angler trip within each psu. Sampling of boat fishing is based on a three-stage sampling design, where the second stage consists of selecting boat trips within a selected site-day and the third stage consists of selecting angler groups within each boat trip selected at the second stage. The angler groups are the tertiary sampling units (tsu). When possible, field staff try to achieve a census within a psu. That is, on a given site-day, all the anglers present on the site are interviewed. However, a census is generally not possible because of refusals, language barriers, and missed eligible participants (see below). For a cluster consisting of two sites, a census is never possible as the interviewers, the intercepted ssu's, and the intercepted tsu's are treated as if they were selected according to simple random sampling without replacement at the second and third stages, even if this is not the case in practice. Therefore, the validity of the estimates in terms of bias depends on how well simple random sampling without replacementserve as a good approximation of the actual but unknown design.

An assignment consists of a time interval, a cluster of fishing sites with activity in at least one mode, the order in which those sites are to be visited (in the case of a two-site cluster), and date/time on which the cluster is to be visited. Assignments are sampled, and field staff are assigned to a date/time period assignment.

The APAIS instrument is relatively short (NOAA, 2016c). In the previous MRFSS design, the field sampling procedures allowed for considerable flexibility on the part of the survey staff. Also, samplers have been allowed to obtain interviews from alternate fishing modes and/or sites in order to increase productivity and minimize the survey costs; see (Breidt et al., 2012). As a result, the inclusion probabilities were difficult to compute, making design-based type estimation a difficult task. As recommended in the 2006 report, samplers do not decide where and when to conduct an interview in the current design. Instead, each assignment corresponds to a fixed time interval. For two-site assignments, the sampler is told in which order he/she will visit the sites. With the new design, it is relatively straightforward to compute the inclusion probabilities that will be used in the estimation procedures. Following the recommendation of the 2006 report, the alternate sites have been eliminated. Finally, unlike in the previous MRFSS design, there is no cap on the number of interviews. Samplers attempt to obtain the largest possible number of completed interviews for a given assignment. Over the years, the number of completed interviews has varied from approximately 6,800 to 25,800 for a given wave in the states where APAIS is conducted. Sampling in the party (or head) boat (HB) mode includes riding on the boats during fishing days. The interviewers ask anglers about their fishing day and obtain some demographic data about the anglers, as well as data on any fish released or already filleted. It also involves examining the catch for species identification and enumeration, and potentially weighing and measuring the catch. For at-sea sampling on headboats, the interviewer remains on the boat throughout the trip, collecting data on the catch as long as fishing continues.

The APAIS uses face-to-face interviews, which makes it possible for the interviewer to clarify unclear questions and to gain the respondent's confidence. Some characteristics of the interviewer may affect the willingness of angler's to be interviewed. Although a potential problem, this is probably less of an issue in the APAIS given the non-sensitive nature of the types of questions being asked. There will be variations in interviewer effects due to interviewer experience, training, and skills. These factors may affect the nonresponse and measurement errors.

The training of interviewers is largely the joint responsibility of NFMS and its data collection partners: the Atlantic Coastal Cooperative Statistics Program (ACCSP), the Gulf States Marine Fisheries Commission (GSMFC), and the Atlantic and Gulf state agencies. Training programs must be approved by NMFS. However, it seems that NMFS has limited control on the actual implementation of interviewer training and testing as it is currently conducted. Details about the training program can be found in the APAIS Statement of Work (2016) and Chapter 5 of this report.

More specifically there are a suite of issues impacting data quality, including various interviewer effects and interviewer related variance. As mentioned earlier, face-to-face interviewing, as compared to mail-out surveys, have the possibility of introducing additional sources of error and bias through interviewer and interviewer-respondent interactions. Some interviewers are more skilled than others, for example, and such differences can affect inter-interviewer variance a potential source of non-sampling error. Inter-interviewer differences can be related to similarities and differences between interviewers and respondents (e.g., ethnicity). Thus, there are characteristics of the interviewer that may affect the willingness of fisher's to be interviewed or respond to certain types of questions. Although a potential problem, this is probably less of an issue in the APAIS given the nature of the types of questions being asked (e.g., nonpolitical questions).

There will be variations in interviewer effects due to interviewer experience, training, and adherence to protocols. Experience will have an impact on interviewer confidence, proper survey pace, and methods for gaining access to respondents. Also, experience can inform interviewer's abilities to build rapport with respondents and respond to questions about MRIP in a positive and informative manner. This is particularly important in the MRIP given some of the existing confusion and distrust among some constituents. Further, some interviewers are more skilled than others in asking questions, which will influence interviewer error and variance. Interviewers may vary in their abilities to probe during open ended questioning. An example of this comes from question 12 in the North Carolina APAIS. Respondents are asked about where most of their fishing effort took place on the current trip in either the Atlantic Ocean or other. For the "other" responses, interviewers are to probe and code responses according to DMF waterbody codes. This requires both knowledge on the part of respondents and familiarity on the part of interviewers to elicit valid and reliable responses.

Besides being important for collecting high quality data, interactions between interviewers and respondents are critical for promoting the program and ensuring fisher participation. A positive experience by a fisher respondent could yield future benefits by creating goodwill on the part of fishers. Fishers talk to other fishers and a positive message conveyed about the program through fisher's informal social networks and in social media is critical. The attitudes of interviewers will impact interview success in terms of unit nonresponse, item nonresponse, measurement error and ultimately interviewer variance.

Naturally interviewer behavior and how it is perceived and interpreted is important. Through no fault of their own, for example, interviewer's behavior might be misperceived as a waste of tax payer dollars. The requirements of the sampling design often create situations where interviewers are idle between interviews or they are assigned to a sampling window at a given site during bad weather when no or very few fishers are present. This idleness may erroneously be perceived as a waste of tax payer money. Ways of mitigating these possible misperceptions need to be explored and engaging in alternative activities at the site during idle periods (e.g., cleaning the

area) or engaging in other behaviors relevant to recreational fishing (e.g., qualitative interviews with available fishers). Interviewer appearance is, of course, important in terms of how they are perceived. Dress, the outward display of government symbols (e.g., government symbols on shirt), and the display of official government identification will all influence the interview outcome. Professionalism is important, but the degree and nature should be tailored to the state and regional setting in which the interviews are taking place. Although not a true interviewer effect issue, weather (e.g., temperature) can have an impact on respondent's willingness to be interviewed as some studies have found that high temperatures are associated with higher nonresponse rates and more measurement error (Cohen and Krueger, 2016).

Missing Data

APAIS estimates are subject to missing data. For example, in the Atlantic and the Gulf of Mexico, approximately 20% of the data are missed because not all eligible anglers complete the interviews (Breidt and Chromy, 2016). Four sources leading to missing data can be identified: (1) refusals: occur when an angler or party refuses to participate in the survey; (2) mid-interview refusals, which occur when some key questions are not answered by the angler or party; (3) language barriers: some anglers do not speak the same language as the interviewer (mostly only English speaking); and (4) missed eligibles, which occurs when interviewers are busy with other anglers or parties (NMFS Statement of work, Access Point Angler Intercept Survey). NMFS believes that the most common language barrier situation involves a Spanish-speaking angler being approached by an English-only speaking interviewer. If an agent is too busy to interview all anglers, then as long as there is no selection of party type (e.g., larger parties are avoided), then no bias is introduced as long as all anglers not interviewed are counted. A different situation exists when anglers refuse an interview, because this can be indicative of other issues (e.g., illegal catches). The committee is not aware of the proportion of missing data due to each of the reasons (1)-(4).

Interviewers should attempt to collect some paradata, which are variables about the data collection process (e.g., Kreuter, 2013). Paradata may include variables such as the number of anglers in the party, approximate age of the anglers, gender, and fishing mode. These variables may be incorporated in the estimation procedures, which may help in reducing the potential bias due to missing data.

Weighting and Estimation

Prior to 2006, the features of the complex survey design were not accounted for in the estimation procedures. As noted in the 2006 report, the validity (in terms of bias) of the estimates relied heavily on some (implicit) model assumptions. Thanks to the new sampling design, the inclusion probabilities and the sampling weights are well-defined, making the use of design-based type procedures possible. The weighting process is thus completely new since the 2006 report. The base weights at the first stage are defined as the inverse of the cluster inclusion probabilities. For a cluster consisting of a single site, the base weight of the site is equal to the base weight of the cluster. For a cluster consisting of two sites, a weighting methodology was developed accounting for the duration of the visit of each site. When a census is possible the weight of an angler group is equal to the weight of the cluster. When a second stage and a third stage of sampling is

involved, the weights are equal to the weights that would have been assigned had the ssu and the tsu been selected according to simple random sampling without replacement. As a result, the validity of estimators in terms of bias depends on whether or not this assumption holds. Based on the weighting system described above, an estimate of *CPUE* (defined as the estimated number of fish caught or discarded per angler on a single saltwater fishing trip) is readily obtained, where the *CPUE* is defined as the ratio of the estimated *Catch* to the estimated *Effort,* and *Effort* is the total number of single-day angler trips spent saltwater fishing (see Chapter 2). The CPUE, produced by the APAIS, is computed at state-fishing mode/wave/fishing area level.

An estimate of the variance of the point estimates is obtained through Taylor expansion procedures by assuming that the clusters at the first stage are selected with replacement. In practice, the clusters are selected without replacement within stratum. As a result, it is anticipated that the variance estimators will exhibit an upward bias (slightly larger than necessary), although the affect is likely to be small if the first-stage sampling fraction is small (i.e., the proportion of PSUs chosen out of the total available for the study is small; Wolter, 2007; Särndal et al., 1992). In the APAIS, the first-stage sampling fraction is small as the total number of psu's in the population is very large in comparison to the number of selected psu's. Therefore, it is expected that the variance estimator will perform well in terms of bias.

Discard Estimation

NMFS estimates that a substantial quantity of recreational catch is discarded rather than retained and landed. Discards include fish released relatively unharmed and those that are dead or will not survive. In 2014, approximately 60% of the national recreational catch was discarded before landing due to regulation or angler choice (NMFS, 2015). Of that total, approximately 63% occurred in the Southeast region of the U.S. (Table 4.2).

An understanding of the magnitude of the discard issue for an individual species basis can be gained using data from red snapper recreational fisheries in the Gulf of Mexico region (Table 4.3). For this fishery, the percentage of the total catch discarded at sea is estimated to range from

TABLE 4.2 Estimated total recreational catch and percentage released at sea for the entire U.S. and the Southeast Region, 2014. Source: MRIP presentation to Fishery Management Council Coordination Committee, 2015.

AREA	Total Catch (number of fish in thousands)	Harvested	Released	Percent Released
Nationally	392,285	155,248	237,037	60%
Southeast Region (SER)	248,797	96,866	151,931	61%
SER Relative Contribution	63%	62%	64%	

TABLE 4.3 Estimated recreational harvest and discards of red snapper in the Gulf of Mexico region, 2010-2015. Source: MRIP data query 7/9/16.

Estimate Status	Year	Region	Total Harvest (A+B1)	Released Alive (B2)
FINAL	2010	SOUTH ATLANTIC	62	102,867
FINAL	2010	GULF OF MEXICO	333,689	1,435,847
FINAL	2011	SOUTH ATLANTIC	1,049	56,455
FINAL	2011	GULF OF MEXICO	520,269	1,521,243
FINAL	2012	SOUTH ATLANTIC	7,148	106,454
FINAL	2012	GULF OF MEXICO	590,804	1,425,044
FINAL	2012	CARIBBEAN	3,842	0
FINAL	2013	SOUTH ATLANTIC	18,393	83,507
FINAL	2013	GULF OF MEXICO	1,241,780	2,824,058
FINAL	2014	SOUTH ATLANTIC	88,817	285,306
FINAL	2014	GULF OF MEXICO	391,079	1,786,360
FINAL	2014	CARIBBEAN	39,914	31
FINAL	2015	SOUTH ATLANTIC	1,111	508,196
FINAL	2015	GULF OF MEXICO	584,008	1,542,998
FINAL	2015	CARIBBEAN	34,685	125

0-99%, but there is little verification of the quantities estimated as discarded. This leads to a somewhat illusory precision in the estimated quantities of discarded fish. Estimated discard mortality associated with these fisheries varies by region, depth, and release method. For recreational red snapper fisheries, estimated discard mortality rates range from 10-22%, meaning that mortality from discarding at sea rivals that from removals landed by recreational anglers.

From a programmatic perspective, the primary elements needed for assessment and management are the number or biomass of fish that are caught and landed and the number or biomass of those that are caught and released but which subsequently die as a result capture effects. For fisheries management purposes, the mortality of these discarded fish is either assumed or estimated via a discard mortality rate (DMR) and subsequently converted to biomass using an estimated weight for the discarded fish (usually an average weight). The cumulative sum of these elements is the total mortality required for assessment purposes; in MRIP terms these are A + B1 + DMR(B2).

MRIP estimates the number of fish released in the recreational fisheries (B2) in several stages, depending on region In almost all regions, the primary method of estimating the number of discarded fish is through the APAIS, and the basic data are either self-reported by anglers or reported in mandatory logbooks in the Northeast Region for-hire program and in the Southeast Region charter boat logbook program. There have been only limited attempts to validate the

quantities and size composition of discarded fish reported by anglers, thus the estimates of discarded numbers and sizes are subject to considerable uncertainty (Benaka et al., 2014). There is also considerable uncertainty about the estimated mortality of these discarded fish. While determining discard mortality is not a unique responsibility of MRIP, they are responsible for determining discard rates. A major review of current knowledge, ongoing research, and data gaps conducted by NMFS in 2013 (Benaka et al., 2014) catalogued the mortality estimates currently used in fisheries management by species and regions. For recreational fisheries, the mortality estimates range from 0-100 percent, depending on species, region, and research basis for the mortality of released fish. These estimates can be strong and influential assumptions for both stock assessment and fisheries management. The problem of unknown or highly uncertain estimates of both the quantity of discarded fish and the discard mortality rate for many species is common throughout the U.S. The committee notes that research into the correct DMRs for use in fisheries assessment and management is not the responsibility of MRIP, but the committee also notes that close coordination between the MRIP and the agencies that are directly responsible for estimating DMRs for recreational fishery releases would be valuable to the stock assessment process.

The issue of total mortality estimation, including discard mortality, was also noted in NRC (2006). While significant improvements in the APAIS have been made in the MRIP program, uncertainty in the estimation of mortality and biomass of fish discarded in recreational fisheries remains a hurdle for management of many species. Because the quantities of discarded fish that die can be of similar magnitude to those that are landed for many species, the implications of this uncertainty for both the determination and management of annual catch limits are profound. Uncertainty and the possible downward bias in the estimates of total mortality for species that is associated with the current framework will result in underestimates of the underlying productivity of stocks and misspecification of reference points for fishery management. Management of annual catch limits may also be compromised by inaccurate accounting of total removals.

Improvement to the estimation of total mortality is needed on four issues:

- Validation of angler-/logbook-reported discard quantities
- Comprehensive estimation of the size composition of discarded fish
- Additional research on and application of DMRs for released fish
- Additional research on statistical properties of discard mortality estimates

The committee understands that MRIP is not solely responsible for all of these elements. MRIP should be concerned with the validation of discarded numbers and their size composition since they directly affect the ultimate estimates of total removals. The calculation of DMRs is a broader responsibility of fisheries management. Recognizing the importance of the discard mortality issue, the NMFS undertook a national process to develop an Action Plan for fish release mortality science in 2015 (Benaka et al., 2016). The broad goals of this action plan were to:

1. Support the use of planning tools such as the SMART (Benaka et al., 2016) tool to help managers, scientists, and other stakeholders determine which fish species, complexes, and/or fisheries would benefit most from improved mortality rate estimates. The SMART tool assesses and scores the impact of discarding species based on several criteria: restricted or rare status,

vulnerability to exploitation, economic impact, political sensitivity and stakeholder engagement, and discard ratio.
2. Facilitate the development of improved mortality rate estimates.
3. Support effective and efficient research that leads to reduced release mortality for high-priority species, complexes, and/or fisheries.
4. Ensure that improved mortality rate estimates are incorporated effectively into existing management processes.

These objectives pertain in part to MRIP programs of discard estimation, technology evaluation, research funding, and communication/outreach with the angler community. Therefore, there is considerable opportunity within MRIP for improvements in discard mortality estimation and its use in stock assessment.

The mortality resulting from the discard of recreationally caught fish is the ultimate metric of importance to stock assessment and management. The production of more accurate estimates depends on a more comprehensive understanding of discard mortality from future research initiatives, some within NMFS and some within academic institutions, but also involves MRIP activities and mandates. We see the primary MRIP responsibility as the production of reliable estimates of the number and size composition of discarded fish. Estimation of the mortality associated with these discards will require coordinated research on DMRs with other components of NMFS and partner agencies. However, verification of self-reported discards is an important role for the MRIP, and additional efforts using electronic and human-based observations are required. For example, electronic monitoring could provide a cost-effective and less intrusive option for verification than human observers, and directly addresses the responsibility of MRIP to estimate quantities of discards rather than quantities and DMR.

Combining the FES and the APAIS

Estimates of *Effort* in the FES and *Total Catch* in APAIS are obtained by combining both surveys. On the one hand, estimates of *Effort* produced by the FES are based solely on in-state residents and do not account for out-of-state residents. On the other hand, the APAIS collects information on angler trips for both in-state and out-of-state residents. As a result, it is possible to determine an estimate of the proportion of out-of-state residents from the APAIS. This estimated proportion is then used to correct the estimated *Effort* produced by the FES.

An estimate of *Total Catch* is obtained as

$$Total\ Catch = Effort \times CPUE,$$

where *Effort* is the total number of single-day recreational angler trips spent saltwater fishing and is imported from FES, and *CPUE* is the estimated number of fish caught or discarded per angler on a single saltwater fishing trip. As mentioned above, the *CPUE*, produced by the APAIS, is computed at the state/fishing mode/wave/fishing area level. Therefore, the estimator of Total Catch can be viewed as a stratified ratio estimator, where the stratification is by state/fishing mode/wave/fishing area, and provides an improved estimation of effort from FES, multiplied by number of fish caught from APAIS divided by APAIS estimation of effort. Since the estimated Effort from the FES is not expected to suffer from significant undercoverage because of the new sampling frame and adjustments for out-of-state angler trips, it is hoped that this estimator will help ameliorate the problem raised by the absence of private sites on the first-stage sampling

frame for APAIS (e.g., Sarndal and Lundstrom, 2005). The underlying assumption relied on is that private sites and public-access sites share the same behavior in terms of CPUE. While this is unlikely to be observed in practice, it is not clear at this point whether or not it is critical source of bias. This assumption needs to be studied. The variance of *Total Catch* is estimated through Taylor expansion procedures taking into account the fact that the *Effort* produced by the FES is an estimate (Goodman, 1960). NMFS has developed a computer program that allows data users to get domain estimates for any domain of interest to the users. However, if the domain is too small (i.e., with a very sample size), the point estimates may not be reliable. In this case, small area estimation techniques may prove useful for finer domains. The committee raised some concerns about the fact that some data users may be using the program developed by NMFS for fine scale domains (which are those exhibiting a small sample size), resulting in unreliable estimates.

For-Hire Surveys

Prior to the recommendations of the NRC 2006 report, NMFS recognized difficulties in obtaining catch and effort data from the for-hire fishery. There are several components to the for-hire fishery: guide boats, small charter boats often called six-packs, and larger charter and headboats. How these components are effectively sampled depends on whether they are moored at specific ports and on their hours of egress and ingress. Smaller vessels, such as guide boats, can use public launches or docks and may not operate on rigid schedules. Their catches are intended to be captured in the APAIS. Licensed vessels are sampled in the For-Hire Survey (FHS). Note that unlicensed vessels are intended to be identified during the on-site surveys. Larger vessels that are located a specific sites and operate on defined schedules (e.g., leave at 6 AM return at 5 PM) are sampled in the For-Hire Survey (FHS) along the U.S. east coast, The Southeast Headboat Survey, the NE Vessel Trip Report, the Large Pelagic Survey, or through state programs depending on the region of the U.S. (Chromy et al., 2009). Anglers on for-hire vessels often may be non-coastal residents and the random pps sampling can be a mismatch when their return times follow strict schedules of departure and return to dock, so their catch and effort might not be well sampled through APAIS. The FHS was not well sampled in the MRFSS/CHTS and NMFS developed a separate survey for the Gulf Coast in 2000 and the Atlantic coast in 2005. West Coast states and Texas retained their programs and their sampling designs have been reviewed by MRIP (Chromy et al., 2009).

The sampling frame for the effort component of the FHS is a comprehensive directory of for-hire boats, stratified by vessel type, state, and week. According to the MRIP website, *"Data collection is conducted on a weekly basis"* The vessel's contact person that has been chosen that week is mailed a notice and a log sheet. Within a stratum, sampling is done as a systematic random sample without replacement from the stratified list frame (NMFS Statement of work, For-Hire and Large Pelagic Telephone Survey). The respondent can FAX the report, use a toll-free telephone number, or wait to be called by NMFS contractors. *"Respondents are asked to report vessel fishing activity for the prior week, and then asked to profile each for-hire fishing trip. Information obtained for each trip includes area fished, number of anglers who fished, hours of actual fishing activity, method of fishing, and target species, if any."… "Effort estimates are produced from the average number of angler-trips per vessel-type per week and the number of vessels per vessel-type in the sampling frame. Adjustment factors for active for-hire fishing boats that are not in the sample frame (new to fleet, no contact information known, etc.) are*

produced from APAIS questions and applied to the raw effort estimate." This sampling represents a stratified systematic random sample and such sampling is well understood with well-known variance properties. The sampling unit is the vessel and 10% of the sampling units are chosen from the frame each week (NMFS Statement of work, For-Hire and Large Pelagic Telephone Survey). CPUE estimates are obtained from the interviews of intercepted for-hire trips in the MRIP APAIS survey. The improvements to this on-site survey compared to that of MRFSS address the concerns that were expressed in the 2006 NRC report. The on-site survey that obtains CPUE for the FHS is now a probability sample. MRIP now recognizes that site data should be seen as a cluster, not as a simple random sample of anglers.

The FHS frame for VA-ME includes vessels with a Highly Migratory (HMS) permit and also includes vessels with a Large Pelagic permit. The survey questionnaire for the FHS queries vessels that caught large pelagics and highly migratory species. A separate bi-weekly telephone survey is conducted using the FHS frame to estimate large pelagics taken by private boats with HMS permits.

The FHS overlaps with other surveys on the Atlantic coast, The Northeast Fisheries Science Center's Vessel Trip Report (VTR) program from Maine to Virginia and the Southeast Regional Headboat Survey (SRHS), and also state logbook programs. The MRIP website states that "The VTR data are not used for preliminary wave-by-wave estimates, but they are included at the end of the year when the VTR data are most complete. For all federally-permitted charter boats and headboats, the total trips reported in the VTRs are used to produce an unadjusted number of angler trips. These boats are treated as a separate "VTR boats" stratum within each for-hire boat mode. All FHS data obtained for those vessels are removed, and FHS estimates of the numbers of angler trips on non-VTR boats are re-run for each wave using the remaining FHS data. The resulting FHS estimates represent a second "non-VTR boats" stratum for each mode." Initially the VTR reports were evaluated on a yearly basis, but NMFS seeks to obtain these data bimonthly for inclusion in wave-by-wave estimates.

The 2006 NRC review recommended that the for-hire sector be handled as a separate commercial sector. However, the heterogeneity of the for-hire vessel types complicates a singular approach to estimating catch and effort. Size of boats, passenger capacity, whether the boat has a regular docking site, species targeted and permits needed for targeted species vary by region and state. States and the U.S. Coast Guard (vessels carrying 10 or more passengers) require licensing to operate charter vessels, thus providing a potential list frame for sampling. Additionally, charter vessels targeting highly migratory species must have a federal permit to enter this fishery. For-hire vessels that fish for reef fish or pelagics, among other species must also hold special federal permits. The advantage in having a for-hire license is the ability to mandate reporting of effort and catch as a provision of license renewal. Note, however, that with a list frame catch is self-reported and not directly verifiable without an on-site validation. Moreover, the value of these data relies on enforcement of the reporting provisions in a timely manner. The level of enforcement varies depending on the regulatory agency and the robustness of its laws.

In a pilot study of electronic logbooks in the Gulf of Mexico for-hire fleet, Kaiser et al. (2013) noted that when a vessel was out of compliance throughout the year, it was allowed to file a year-end report, but might often continue this practice of reporting only at year end. Without penalties for this practice, data quality can be compromised because of a lack of validation. Kaiser et al (2013) recommended in their report that year-end only reporting be penalized, that

reporting be done weekly, and that late or missing reports be quickly identified and participants notified quickly of their non-compliance. They also emphasized the importance of field validation, such as using on-board observers depending on vessel size and cooperation, and through on-site intercepts.

Total catch estimation from the FHS mirrors that of MRIP in being a complemented design. Effort is obtained from sampling or censusing a list frame of vessel captain business telephone numbers. Catch is estimated as CPUE from the APAIS. The proportion of unlisted boats is also adjusted based on a ratio derived from intercepts in the APAIS of angler trips on for-hire vessels that are not on the FHS frame. While the reliance on telephone contact has become problematic for accessing the general population, as businesses holding state and federal licenses, the FHS telephone survey should be more reliable as a sampling or census frame.

Conclusions and Recommendations

Conclusion: The new Access Point Angler Intercept Survey design is a substantial improvement on the MRFSS intercept survey methodologies.

Conclusion: The new Access Point Angler Intercept Survey design uses probability proportional-to-size (PPS) sampling at the first-stage. It is expected that this design will lead to efficient estimates if the cluster inclusion probabilities are (approximately) proportional to the cluster catch. However, PPS sampling designs tend to be vulnerable to units whose pressure estimates are poor—high-pressure sites with low catch or low-pressure sites with high catch—and can potentially cause high variance estimates.

Recommendation: The appropriateness of probability proportional-to-size sampling should be evaluated and alternative sampling designs should be considered if needed. For example, with a stratified design (based on the site pressure as a stratification variable), one may avoid very small selection probabilities, which in turn, may lead more stable estimates. Otherwise, methods dealing with influential values should be considered. These methods include weight smoothing (Beaumont, 2008) and weight trimming procedures (Potter, 1990).

Recommendation: For data users requiring domain estimates at a fine level, design-based estimators tend to exhibit very large variances. To address this, small area estimation procedures should be investigated for obtaining estimates for small domains.

Conclusion: Private sites have zero inclusion probability in the sample. A ratio estimator is used to compensate for the undercoverage. However, the validity of the ratio estimator relies on the assumption that the behavior of private sites is similar to that of public-access sites. Otherwise, the ratio estimator may be biased, especially if the proportion of private sites is appreciable.

Conclusion: An additional question on the Fishing Effort Survey that inquires as to whether anglers have used private or public-access sites will permit stratifying the set of respondents in Fishing Effort Survey into two strata: a stratum of anglers who have used private sites and a stratum of anglers who have used public-access sites. Selecting a sample from each stratum and asking the selected households about their catch will make it possible to assess differences between private and public-access sites in terms of catch per unit effort. This will provide some insight about the quality of the ratio estimator used for obtaining an estimate of *Total Catch*.

Recommendation: NMFS should conduct pilot studies to determine the optimal method for collecting accurate information on total catch differences between public and private access points. For example, NMFS could add a question to the Fishing Effort Survey questionnaire to ask whether the anglers have used a private site or a public-access site. Geographic maps used to identify public access points within the state (see Chapter 3) could help distinguish public from private sites.

Conclusion: Missing data in the Access Point Angler Intercept Survey occur because of refusals (or mid-interview refusals), language barriers or missed eligible anglers. Missing values may lead to biased estimators if the behavior of nonresponding anglers is different from that of responding anglers.

Recommendation: Interviewers administering the Access Point Angler Intercept Survey should attempt to collect some paradata, to help in reducing the potential bias due to missing interview data.

Recommendation: There is a growing interest from anglers to report their catches electronically (use of tablets and smart phones). NMFS should conduct a study for comparing anglers reporting catch using an app with anglers reporting catch through a traditional interview.

Conclusion: The magnitude and fate of fish discarded by recreational anglers remains highly uncertain. This conclusion was also reached by the 2006 National Research Council committee. While some technological changes (e.g., iSNAPPER) have been incorporated into MRIP data collection, lack of validation of discard estimates contributes significantly to the uncertainty in assessing the impact of discard mortality on stock productivity estimates and management of stock removals.

Conclusion: Initiatives by other branches of NMFS to address discard mortality estimation have not been integrated into MRIP design or operational procedures.

Recommendation: The MRIP should develop and incorporate validation programs for the estimation of the numbers of fish discarded at sea by recreational anglers. These efforts should integrate with other NMFS initiatives concerning estimation of discard mortality.

Conclusion: Recent pilot studies have demonstrated the value of using electronic logbooks to record catch and effort in sectors of the for-hire fisheries. Advances in technology have reduced costs of this equipment, increased the ease of use, and provide value-added benefits to sectors of the for-hire fleet.

Recommendation: The MRIP should expand this program to cover the majority of the large charter and for-hire fleets, through outreach training in electronic logbook use, and implementation of software to run of standard tablets or smart phones.

Conclusion: In the past ten years, there have been a substantial number of methodological studies/improvements/modifications to both the Fishing Effort Survey and Access Point Angler Intercept Survey. However, the available documentation is not always clear and up-to-date.

Recommendation: The MRIP should invest some time and effort in providing and organizing up-to-date documentation, describing in detail each step of both the Fishing Effort Survey and Access Point Angler Intercept Survey methodologies and any changes that are made to them.

Chapter 5
Framework for Continued Scientific Evaluation, Review, and Certification

Introduction

In its 2006 *Review of Recreational Fisheries Survey Methods* the National Research Council (NRC) identified the need for the development of an expanded and better structured framework for continued scientific evaluation, review and certification of the methods, protocols, and procedures used for recreational fisheries data collection. Implicit in this advice was the notion that MRIP would need to be flexible and adaptive if it were to become the umbrella framework under which to provide recreational fisheries data for assessment and management at the national level. In other words, an improved program for collecting recreational fisheries data would need to take the wide-ranging regional differences in U.S. recreational fisheries—and in many cases differences among various fisheries within each region— into account. It would need to develop the capacity to continually assess the strength of the scientific process, including the engagement of external scientific and technical expertise, used in developing, testing, reviewing, and certifying new sampling and estimation procedures. More specifically, the 2006 NRC report recommended that a permanent and independent research group should be established and funded to continuously evaluate the statistical design and adequacy of recreational fishery surveys and to guide necessary modifications or new initiatives. The report went further to say that 'human dimensions' expertise should be included as well. This chapter discusses the extent to which these recommendations were addressed and evaluates whether the framework for continued scientific evaluation, review, and certification established by MRIP is sufficient and adequate for effective implementation of U.S. marine recreational fisheries surveys.

Development of Technical Expertise

One specific recommendation from the 2006 NRC report was that a survey office devoted to the management and implementation of marine recreational surveys be developed. This recommendation was based on the recognition that coordination and implementation of marine recreational surveys nationwide is a large and complex task that requires focused and dedicated attention and that expanding staff capacity and developing technical expertise were key to implementing the programmatic improvements recommended by the NRC review committee. Below the committee discusses the degree to which this recommendation was addressed.

Staffing Improvements

MRIP has made significant progress in expanding the number of staff dedicated to the program. Since 2006, the number of MRIP staff has increased from six to 12 full-time staff, and the program also has six full-time contractors. The program has also invested in formal training of existing staff. For example, most of the current MRIP staff have taken graduate-level courses on

high-level technical topics such as survey methodology, sampling theory, and survey operations through the Joint Program in Survey Methodology (JPSM).[1] Further, two MRIP staff have completed a Master's Degree in Survey Methodology through JPSM. Our discussions with regional and state partners indicated that MRIP's staff improvements have greatly increased its ability to expand technical support and achieve better regional coordination. In this regard, the MRIP has achieved a desired level of competency and in conjunction with consulting of external experts, has made excellent progress since 2006.

One area that could still benefit from additional staffing is the MRIP Communication and Education Team (CET). In terms of staffing, the CET is currently supported by only one full-time contractor and two contractors providing part-time support, tasked with the development, implementation, and coordination of MRIP's communications strategy nationwide. The success of MRIP depends to a large degree on clear, accurate, and timely communications and on engaging all the various stakeholder groups, including anglers. Therefore, MRIP should consider expanding its communications staff to better address this important component. A more complete review and discussion of MRIP's communications and outreach program is presented in chapter 7 of this report.

Workshops, Conferences, and Symposia

MRIP has either organized or been closely involved in the organization of several recreational fisheries workshops or symposia conducted either in coordination with regional partners (e.g., the Recreational Fisheries Information Networks and the Atlantic Coast Cooperative Statistics Program) or conducted as part of national or international level scientific conferences (Table 5.1). These workshops and symposia have been attended by highly trained specialists and experts in the field and, therefore, facilitated review and discussion of MRIP issues by a broad range of scientists, promoted cross-pollination and exchange of ideas, and exposed MRIP technical staff, as well as regional and state partners, to a variety of recreational fisheries issues under different scenarios.

Consultants

The 2006 NRC report recommended that a permanent and independent research group should be established and funded to continuously evaluate the statistical design and adequacy of recreational fishery surveys and to guide necessary modifications or new initiatives. In response, MRIP has developed and maintained a high-end cadre of statistical consultants that has greatly benefited survey revisions and improvements, facilitated faster and broader implementation of the MRIP certification process, and increased the efficiency of providing technical advice and guidance to regional and state partners.

[1]Founded in 1993, JPSM is the nation's oldest and largest program offering graduate training in the principles and practices of survey research. JPSM is sponsored by the Federal Interagency Consortium on Statistical Policy and located at the University of Maryland. To date, it has more than 240 graduates working in government agencies, academic settings, and private survey research firms.

TABLE 5.1 List of workshops and symposia organized by MRIP on recreational fisheries issues. Source: Committee

Name of Event	Date
MRIP workshop: Recreational Fisheries Statistics Requirements Management Framework Workshop	September, 2006
MRIP workshop: Marine Recreational Information Initiative Operations Team Workshop	August, 2007
International Council for the Exploration of the Seas (ICES) Annual Science Conference Session on Survey Methods for Recreational and Artisanal Fisheries	September, 2008
MRIP workshop: Review of For-Hire Recreational Fisheries Surveys	March, 2008
ICES Workshop on Survey Methods for Recreational Fisheries	June, 2009
New Zealand Workshop on Recreational Fisheries Survey Methods	August, 2009
Workshop of ICES Planning Group for Recreational Fisheries Surveys (PGRFS)	June, 2010
Norway Workshop on Recreational Fisheries Survey Methods	June, 2010
MRIP workshop: Review of Oregon Recreational Fisheries Surveys	July, 2010
MRIP workshop: Review of Washington Recreational Fisheries Surveys	November, 2010
MRIP workshop: Addressing the Fishery Management Need for More Timely Recreational Data	March, 2011
Workshop of ICES Planning Group for Recreational Fisheries Surveys (PGRFS)	April, 2011
MRIP workshop: Review of California Recreational Fisheries Surveys	June, 2011
6th World Recreational Fisheries Conference Session on "New Methodological Tools to Survey and Assess Recreational Fisheries"	August, 2011
American Fisheries Society (AFS) Symposium: Improving Survey Methods for Monitoring Recreational Fishing Effort and Catch	September, 2011
MRIP workshop: Volunteer Angler Survey Workshop-Inventory Existing Programs and Assess Utility of volunteer angler surveys	February, 2012
MRIP workshop: MRFSS/MRIP Calibration Workshop	March, 2012
Workshop of ICES Working Group for Recreational Fisheries Surveys (WGRFS)	April, 2012
MRIP workshop: A Review of the Current Sampling and Estimation Methods of the Hawaii Marine Recreational Fishing Survey (HMRFS)	July, 2012

MRIP workshop: Evaluation and Improvement of the Current Sampling and Estimation Methods for the Puerto Rico Recreational Fishing Survey	September, 2012
MRIP workshop: Development of a Survey Design(s) for Collecting Recreational Fishing Data in the US Virgin Islands	September, 2012
MRIP workshop: MRIP Methods and Data Seminar with NY Stakeholders	April, 2013
Workshop of ICES Working Group for Recreational Fisheries Surveys (WGRFS)	April, 2013
MRIP workshop: Design effort surveys for shoreline fishing in Highly Migratory Recreational Fisheries Surveys	July, 2013
MRIP workshop: Marine Recreational Information Program Executive Steering Committee Implementation Workshop	July, 2013
ICES Annual Science Conference Session on Marine Recreational Fisheries: Understanding impacts and consequences for management	September, 2013
MRIP workshop: Gulf of Mexico Red Snapper Recreational Catch Accounting Methods Workshop	November, 2013
MRIP workshop: Gulf of Mexico Red Snapper Recreational Catch Accounting Methods Workshop II	March, 2014
Workshop of ICES Working Group for Recreational Fisheries Surveys (WGRFS)	June, 2014
MRIP workshop: Proportional Standard Error and Management Uncertainty in Recreational Data Collection on the Atlantic Coast	September, 2014
MRIP workshop: MRIP Calibration Workshop II	September, 2014
MRIP workshop: Gulf of Mexico Red Snapper Recreational Catch Accounting Methods Workshop III	December, 2014
MRIP workshop: Peer Review of Louisiana Creel Survey Program	June, 2015
AFS Symposium: Survey Methods for Monitoring Recreational Fisheries in Support of Stock Assessments and Fisheries Management	August, 2015
MRIP workshop: Peer Review of Alabama Snapper Check Survey Program	December, 2015
MRIP workshop: For-hire Programs: Inventory, Certification, and Integration Planning	May, 2016
MRIP workshop: Peer Review of Mississippi Tails ‘n Scales Survey Program	June, 2016

An issue still to be addressed is the need for additional consultant support. Feedback received during regional meetings of this committee indicated that despite the high quality of the input and advice being provided by consultants, the process of review and certification is relatively slow, mainly because so many regional and state partners have been requesting advice on survey improvements or submitting documentation for certification of new surveys. Meanwhile, the same pool of consultants also assists MRIP in other capacities as well, for example, by creating and testing new survey methods and improving on existing survey designs. Expanding the pool of experts serving as MRIP consultants would allow a faster, more efficient review process, as well as ensuring a continuous infusion of energy and ideas.

Developing, Testing, and Implementing New Techniques

In 2008 MRIP established a Pilot Studies Program for developing, testing, reviewing, and eventually certifying new sampling and estimation procedures to be applied under the MRIP umbrella. Most of these pilot studies have been developed and implemented in collaboration with state and regional partners, usually by efforts coordinated through the regional Interstate Marine Fisheries Commissions and their associated Fisheries Information Networks (FINs) (see Box 5.1).

The MRIP Pilot Studies Program is implemented in three concurrent phases: (1) evaluation of current methods, (2) innovation to identify and test new methods, and (3) implementation of proven methodologies. Funding—about $14.7 million over the period 2008-2015—has been largely provided by NMFS through a grants program coordinated through the regional FINs and ACCSP. The MRIP Operations Team solicits and reviews research proposals and provides recommendations for funding based on resources available (Table 5.2).

BOX 5.1
Regional Interstate Marine Fisheries Commissions and the Fisheries Information Networks (FINs)

In the 1940s, the federal government authorized by statute the establishment of three interstate compacts, each creating a regional marine fisheries commission to better utilize and protect fisheries within the consenting states' jurisdiction. The three separate commissions represent the Atlantic (Atlantic States Marine Fisheries Commission, ASMFC), the Gulf of Mexico (Gulf States Marine Fisheries Commission, GSMFC), and the Pacific states (Pacific States Marine Fisheries Commission, PSMFC), respectively.

The regional Fisheries Information Networks (FINs) and the Atlantic Coast Cooperative Statistics Program (ACCSP) are state-federal cooperative programs in which NMFS participates as a partner with the state fisheries agencies, interstate marine fisheries commissions, regional fishery management councils, and other federal agencies, such as the U.S. Fish and Wildlife Service. These partnerships engage in cooperative programs to collect, aggregate, and manage state and federal fisheries data (both commercial and recreational) to support fishery managers and associated agencies. The regional FINs and ACCSP also serve as liaisons for identifying state and regional data needs and are, therefore, well-positioned for coordinating the funding and implementation of regional MRIP pilot studies.

Table 5.2 Summary of the processes lead by or functions provided by different organizations, institutions, and entities involved in the development and implementation of MRIP pilot projects. Source: Committee.

Institution or Organization	Function or Process
MRIP Team (Executive Steering Committee, NMFS Office of Science and Technology)	• Develop and conduct pilot studies • Manage peer reviews • Identify and recommend best practices • Facilitate regional implementation • Manage implementation (certain regions)
Regional Partners (States, Interstate Fisheries Commissions, RecFINs, Councils, NMFS Regional Offices and Science Centers)	• Identify region-specific data needs and priorities • Adapt certified methods to meet regional needs, and, as necessary, secure additional resources • Manage implementation
Stakeholders (Anglers, Charter boat owners/operators, Non-governmental organizations)	• Work with MRIP team to identify research needs and, as appropriate, lead or participate in pilot studies • Work with regional partners to identify data needs and priorities, and, as appropriate, assist with resource acquisition

Table 5.3 provides examples of recent MRIP pilot projects funded and the various data or methodological needs they have addressed. A total of 105 regionally based pilot projects have been conducted since the program was implemented in 2008 in response to the NRC 2006 review.

Our review of the MRIP pilot-study program indicates that it constitutes an appropriate and effective mechanism for providing highly specialized technical and scientific support (including access to technical consultants) towards the development, review, and certification of regional- or state-specific surveys. This increased capability implemented since the 2006 NAS report greatly enhances MRIP's capability to address regional and state needs for stock assessment and fisheries management.

Use of New Technologies

Traditionally, recreational fishing surveys have been conducted using paper and pencil survey forms in which a trained sampler interviews anglers to collect very specific information about their fishing trip and the nature of the species they landed and released. However, recently there has been a great deal of interest throughout the recreational fishing community in identifying scientifically sound, statistically robust methods for using electronic reporting (e.g., using smartphones and tablets) of recreational fisheries data. The use of these new technologies could potentially improve the timeliness and accuracy of recreational fisheries data, as well as reduce costs and paperwork burdens (e.g., nightly submissions of data collected to increase the timeliness of recreational catch and effort estimates to the public).

Table 5.3 Examples of recent pilot projects funded by MRIP and a summary description of what various data or methodological needs they have addressed. Source: Committee.

Pilot Project Title	Summary Description
Alaska For-Hire Electronic Logbook Census	Implementing new electronic logbook program targeting fishing guides and guide businesses in Alaska.
Hawaii On-site Private Boat Catch Survey	Building on work that has taken place in the Gulf of Mexico and Atlantic Coasts, design and test an appropriate on-site survey to estimate catch rates from private fishing boats in Hawaii.
North Carolina and South Carolina For-Hire Electronic Logbooks	Developing NC and SC for-hire industry logbook reporting programs, with supporting validation survey design that can be used to meet any existing federal logbook reporting requirements.
Alabama Private Boat Electronic Red Snapper Fishing Census	Refining the reporting methods and field validation protocols for reporting recreational red snapper landings by Alabama private recreational vessels.
Testing the Impacts of One-Month Waves	Assessing the potential for bias resulting from measurement error in the Fishing Effort Survey and evaluating the impact of one-month vs. two-month reference waves on the precision and timeliness of estimates on the Gulf of Mexico and Atlantic Coasts.

MRIP has been evaluating and testing the use of these new technologies, primarily according to four distinct initiatives:

1. **For-hire electronic logbooks**. MRIP indicated that it has developed a comprehensive road map for implementing electronic reporting in the for-hire sector that will be activated throughout 2016. It incorporates the work of three separate pilot studies, and identifies the minimum requirements for ensuring such a program is successful. These requirements include compliance measures, the need for hardware and software development standards, and the need for statistically sound designs for how electronic logbook data are combined with data collected in independent dockside and/or at-sea surveys for the purposes of validation.

2. **Angler electronic data reporting**. With increases in smartphone use and internet access, intense interest in the use of electronic reporting technologies by individual anglers has arisen. MRIP seems engaged in developing and expanding the use of electronic reporting to provide angler-provided catch data that are usable and statistically valid, exploring options that can be incorporated into existing surveys as well as options that would be supplemental to them. Building on previous work in this area, MRIP is currently funding several separate pilot studies examining electronic reporting options for to allow anglers to self-report data electronically.

3. **Sampler electronic data capture and submission**. MRIP has also been testing the use of tablets and other electronic data collection platforms to allow dockside samplers to capture and submit data electronically. Besides the advantages of providing more timely data, the use of electronic data collection platforms brings the added benefit of improved data quality by avoiding or decreasing data transcription errors, and facilitating implementation of real time checks of data ranges that allows corrections to be made at the data collection stage—i.e., automated quality assurance and quality control (QA/QC).

4. **Use of electronic monitoring for validation purposes**. The committee has noted earlier that validation of self-reported data on discards of recreationally-caught fish at sea is an important need in providing accurate estimates of total removals by the recreational fishery. While observers can provide both validation and biological sampling of discarded fish, the recreational fishery is not well suited to deployment of observers. The use of cameras to validate total catch is becoming more common in commercial fisheries (Wallace et al., 2015) and cameras provide the potential to improve estimates of discards within recreational fisheries. Pilot studies have been conducted where electronic monitoring systems have been deployed on even small charter vessels (< 30 ft) with good success. The committee believes that MRIP could benefit from increased consideration and application of electronic monitoring for some sectors of recreational fishing.

In practice, evaluation and testing of new technologies for MRIP fisheries data collection is being accomplished through implementation of several MRIP-funded pilot studies, often structured according to Regional MRIP Implementation Plans. For example, researchers and stakeholders in Florida are testing the use of a smartphone- and Internet-based electronic reporting tool called iAngler to collect and report data on recreational effort and catch. A similar project is also being implemented in Texas to test the use of an electronic reporting tool called iSnapper for collection of self-reported recreational fisheries catch data.

Despite these efforts, input the committee received from stakeholders indicates that the perception by large portions of the private angler and for-hire sectors is that implementation of electronic reporting or the adoption of smart-phone applications for volunteer angler self-reporting are not being implemented fast enough. Mostly, this seems to be a communications issue—i.e., anglers and for-hire captains are acutely aware of the developments in smart-phone, tablet, and other portable technologies, and see the potential to optimize data collection methods and maximize their opportunities to provide data. MRIP and its partners, given their more technical role, see the advantages of electronic reporting but consider this primarily a statistical issue, i.e., they are choosing to err on the side of caution so as not to risk compromising the statistical robustness of survey estimates in the name of sampling efficiency and increased participation. As a result, MRIP's implementation of electronic reporting has been mostly exploratory and primarily focused on testing different formats and platforms, and developing statistical techniques for integrating electronic-based data collection programs into the existing survey estimation procedures (see Table 5.3 above for some examples).

Input the committee received from regional partners, anglers, and for-hire operators suggest that the delay in implementing electronic platforms for collection of recreational fisheries data is perceived differently by different groups. Fisheries scientists and managers as well as regional partners—i.e., regional coordinating staff associated with the RecFINs and ACCSP—are more understanding of MRIP's decision to proceed cautiously and not start full implementation of electronic reporting until statistical methods for scientifically valid estimation techniques are

fully developed and properly tested. A large component of the private angler and for-hire sectors feels differently, probably because the statistical complexities of integrating electronic reporting data into the standard MRIP estimation procedures are highly technical and far from intuitive. Thus, there again appears to be an issue for the communications team.

Other challenges exist. The flexible and distributed MRIP model—i.e., surveys are developed and conducted according to regional implementation plans and with close coordination and input from state partners—makes adoption of electronic reporting and electronic platforms for data capture by MRIP samplers (i.e., instead of pencil and paper) more complicated. Issues such as the willingness of state partners to comply with or accept the use of electronic platforms for data capture and the costs involved in implementing these platforms nationally still exist.

In general, given the many complexities and challenges involved, MRIP has done a good job evaluating the use of new and emerging technologies for electronic reporting in recreational fisheries data collection. However, the perception by many that MRIP is moving too slowly in incorporating these technologies needs to be addressed. The committee also sees potential for gains in accuracy through electronic monitoring of discards. MRIP should develop a strategy to better articulate the complexities, costs, and timelines associated with the implementation of new and emerging technologies in recreational fisheries data collection. This communication strategy should focus not only on regional and state partners but also address questions and concerns expressed by private anglers and for-hire operators (see chapter 7 of this report for a broader discussion of MRIP's communication and outreach).

The MRIP Certification Process

The 2006 NRC report recommended that a permanent and independent research group should be established and funded to continuously evaluate the statistical design and adequacy of recreational fishery surveys and to guide necessary modifications of new initiatives. In response to this recommendation MRIP has established a rigorous and systematic peer review process for assuring that new survey and estimation methods are scientifically sound before they are 'certified' and made available for use in stock assessments and fisheries management. Further, the MRIP certification process incorporates detailed QA/QC requirements to reduce errors in the estimates produced by these add-on or supplementary surveys. Once certified, methods are available for use by MRIP and its partners.

The process for MRIP certification seems fair and appropriate. In general, MRIP only supports projects (i.e., financial and logistical support, including access to technical staff and statistical consultants) applying methods that have been MRIP-certified. MRIP may support use of methods that are not certified if a plan to certify those survey methods is in place and is being followed. The certification process is focused on evaluating new or replacement survey and estimation methods, and modifications or recommended improvements to existing methods. To be granted final MRIP certification survey methods being evaluated must:

- Adhere to applicable MRIP standards and best practices (specific documentation for these standards are available at the MRIP website);
- Be peer-reviewed and supported by the results of the review;
- Be approved by the MRIP Operations Team, MRIP Executive Steering Committee, and NMFS leadership.

Our review of the criteria and procedural steps involved in the MRIP certification process (Table 5.2), as well as input from, and discussions with multiple MRIP regional and state partners, indicates that, in general, the process is working well. For example, in 2010 MRIP funded a full review of the Oregon Department of Fish and Wildlife Marine Resources Program's Ocean Recreational Boat Survey and the Washington Department of Fish and Wildlife's Ocean Sampling program and Puget Sound Sampling Program, and in 2011 MRIP funded a review of the California Recreational Survey Program. The feedback the committee received was that partners greatly appreciated the input and reviews. The process was very interactive, involved multiple consultations with MRIP staff and statistical consultants, and provided an opportunity for those state agencies to make significant progress on developing and testing potential survey improvements. In early 2015, both the Oregon Department of Fish and Wildlife Marine Resources Program and the Washington Department of Fish and Wildlife submitted materials detailing their survey designs and programs for MRIP review and certification. Similar processes are being undertaken by the states of Hawaii and Louisiana.

The only major concerns the committee heard regarding MRIP certification were related to the length of time associated with the process (i.e., perceived delays, lack of timeliness), and the uncertainty regarding the level of funding required to implement review recommendations. For example, Pacific coast states base level of survey funding has been flat for many years, representing less than 50% of the overall costs of the marine recreational angling surveys. Flat or reduced funding has made implementation of recommended survey improvements difficult and in some cases impossible for states to accomplish.

Lack of timeliness in the MRIP certification process seems to be related to a need for increased capacity in the number of people involved in technical reviews or serving as statistical consultants (statisticians, survey methodologists, data collection experts, human dimension and cognitive scientists). As pointed out above (under the heading **Development of Technical Expertise**), the significant expansion in the number of MRIP staff since the 2006 NRC report has been greatly beneficial to the program and highly praised by MRIP regional and state partners. Also, the high level of expertise shown by the group of statistical consultants MRIP has engaged in the review and certification process is highly commendable. The problem seems to be a need to further expand the number of people involved in this process so the multiple survey programs being simultaneously evaluated in different regions can be reviewed and certified in a more timely yet consistent fashion. Most programs are implemented in part through funding/governance by state Marine Fisheries Commissions (e.g., PSMFC). As such, the implementation of any alterations resulting from certification review would need to be coordinated with such agencies and there is a strong argument for the simultaneous certification of state programs.

The review committee also discussed whether there are mechanisms in place to confirm that surveys are being implemented according to certified protocols and that there are assessments of data quality before state or regional survey data are incorporated into the MRIP database. Fortunately, because the vast majority of surveys certified by MRIP are implemented through Regional Implementation Plans several mechanisms are in place (e.g., regional RecFIN meetings, MRIP Wave meetings, regional stock assessment panel meetings) to make sure approved survey protocols and the quality of data collected are meeting quality standards.

Training of interviewers

Chapter 3 discussed some of the challenges surrounding interviewer effects and interviewer variance and its impact on non-sampling error. One of the ways to minimize errors due to interviewer variance is through proper and rigorous interviewer training (Dahlhamer *et al*., 2010). Standardized training will also facilitate the comparison of data at the state, regional, and national levels. A number of MRIP documents reflect concern on the part of the program to produce well-trained interviewers. These include an outline of training structure, coordination and quality control (NOAA, 2016c) and procedures for interviewer training (Procedures Manual: Access Point Angler Intercept Survey, January 2014). The documents reflect a genuine concern for maintaining training standards. The major focus of these documents, particularly the procedures manual, is interviewer knowledge (e.g., fish identification), concept definitions, basic sample design, survey data collection procedures, the structure of the survey, conducting the creel survey, administrative issues, materials and supplies, etc. Although there is some limited practical information on dealing with, for example, possible respondent hostility on-site, the manual and statement of work focus primarily on the technical aspects of conducting the APAIS survey. The following topics have not been directly addressed in documents; they need further consideration.

Not everyone is cut out to be an interviewer: Recruitment of competent interviewers is critically important, particularly in this highly charged political context. This is a human resource problem and should be dealt with as such.

Better QC through statistical assessment: Aspects of quality control (QC) in relation to interviewer training, evaluation and monitoring are discussed in the documents, particularly the SOW. They mostly concern QC with regards to interviewer knowledge (e.g., fish identification), on-site monitoring, telephone verification of intercept surveys, and data quality checking. However, with respect to data QC the documents are primarily concerned with error checking through the use of error checking software. Such an approach generally looks for outlier entries which are flagged for further scrutiny. Although these methods can improve data quality by finding recording errors and data entry errors, it does little in the way of detecting and dealing with errors due to the interviewers themselves. As discussed in chapter 3 statistical methods that can detect and model interviewer error should be considered as a supplemental method for increasing data quality in the QC efforts.

Not all training is purely of a technical nature: Although the training materials are technically sound they are limited in the amount of practical experiential knowledge that is conveyed. In part, interviewing is an art and thus needs training materials that can provide more qualitative insights and guidelines for interviewers in the training process. It might be useful to produce a "handbook of interviewing" in the MRIP context that documents interviewer's experiences and methods for dealing with the vagaries of interviewing in the field. This would constitute an interviewer's field guide with information on potential problems and solutions for interviewing in the APAIS context. The committee believes development of this handbook would greatly benefit from input and expertise provided by the MRIP CET.

Conclusions and Recommendations

Conclusion: NMFS has benefited from access to an independent group of statisticians and survey methodologists with substantive experience during the pilot study phase of the Fishing Effort Survey. The ever-changing world of survey research will require continuous evaluation of the FES, including experimentation, to ensure high-quality estimates in a timely manner.

Conclusion: If NMFS is able to expand the existing capacity in this pool of consultants both in number and in expertise (e.g., experts in cognitive issues, including angler recall)), duplication of effort would be reduced and the provision of technical and scientific support would be facilitated. In addition, the MRIP certification process would be streamlined. Any such group should be periodically refreshed to include new researchers with a variety of interests and expertise.

Conclusion: With the development of a certification process MRIP made substantial progress toward implementing relevant key recommendations of the 2006 National Research Council report. MRIP has invested in the development of a well-structured process for continued scientific evaluation, review, and certification of the recreational fisheries surveys conducted under its umbrella. This process also affords a mechanism for providing highly specialized technical and scientific support (including access to technical consultants) towards the development, review, and certification of regional- or state-specific surveys.

Conclusion: The existing capacity in the pool of consultants involved in providing technical advice and guidance to regional and state programs does not appear to be sufficient to avoid duplication of effort, facilitate the efficient and timely provision of technical scientific support, and streamline the MRIP certification process.

Conclusion: MRIP has made progress evaluating and testing the use of new technologies (i.e., smart phones, tablets, and other electronic data-capture platforms) as a way to implement electronic reporting, avoid or decrease data transcription errors, and increase the timeliness and reliability of recreational fisheries data collection. Still, the impression among many private anglers and within the for-hire sector is that implementation of these technologies is not occurring quickly enough.

Recommendation: MRIP should develop a strategy to better articulate the complexities, costs, and timelines needed for implementation of new and emerging technologies in recreational fisheries data collection and monitoring. This communication strategy should focus not only on regional partners but also address questions and concerns expressed by private anglers and for-hire operators. It should involve both the MRIP communications team and the NMFS Office of Communications.

Chapter 6
Degree of Coordination

Introduction

The multi-jurisdictional nature of marine fisheries management, which in most regions of the country involves not just the regional fisheries management councils but multiple states and institutions, presents myriad coordination challenges to data collection, data management, stock assessment, and ultimately fisheries management. To collect recreational fisheries data that meet required standards for assessment and management in this complex, multi-jurisdictional system, MRIP surveys are conducted in cooperation with a variety of regional and state agencies and with the assistance of other institutional partners. NRC's 2006 report recommended that a much greater degree of standardization among state surveys, and between state surveys and the central MRFSS, should be achieved. Implicit in this recommendation is the need for a much greater degree of cooperation and coordination among the managers of the various surveys. This chapter evaluates whether the degree of coordination among federal, state, and territorial survey programs conducted under the MRIP umbrella is sufficient to support implementation of survey methodologies that address the diversity of regional and state needs while at the same time maintaining a clear, cohesive perspective on the nation's marine recreational fisheries (Task 4 of the committee's Statement of Task).

Unique Needs at Regional and State Levels

U.S. marine recreational fisheries show wide-ranging regional differences, and in many cases differences among various fisheries within each region. These differences can be attributed to inter-regional variability in a number of factors, including: the amount and shape of the coastline and other ocean features, biogeographic patterns in species diversity, and socioeconomic and demographic factors. For example, the South Atlantic and Gulf of Mexico regions have high species diversity, as well as broad, shallow continental shelves and a number of estuaries, which help explain their dominance in the magnitude of marine recreational fishing trips nationwide.

The relative importance of individual recreational fishing modes (i.e., private/rental boat, shore-based, and charter/for-hire) also varies widely among US regions. As a result, some regions and states have specific survey needs for different stocks. For example, in the Gulf of Mexico red snapper have relatively short recreational fishing seasons that present significant challenges to MRIP, both in estimating catch and effort as well as in monitoring landings. Other stocks may represent 'rare-event species' that occur sporadically in the catch and are not properly estimated by the standard MRIP survey approach. In some cases, states in a region have significantly different proportions of different fishing modes. For example, areas where there are marked differences in the proportion of private anglers versus the charter/for-hire sector require the implementation of more customized MRIP sampling draws so data collection across the region can be reflective of these intra-regional differences.

Accommodating these regional differences requires MRIP to adopt a regional implementation approach that incorporates the flexibility required to address unique regional and state needs while at the same time maintaining the standardization, and national-level cohesion recommended by the 2006 NRC report.

Has MRIP Been Addressing Regional and State Needs?

Despite the lingering public perception of a centralized, top-down implementation approach MRIP has, by and large, been responsive to regional and state needs. The 2015-2016 MRIP Implementation Plan Update[1] describes the program as a collaborative, multi-institutional effort focused on developing and implementing a system of surveys that provides the best possible scientific information for use in the management of the nation's marine recreational fisheries. The plan also states that given the dynamic nature of fisheries and fisheries management practices, MRIP must be:

- Flexible enough to be updated, modified, expanded, or contracted to meet specific regional or local informational needs;
- Robust enough to provide the most precise and least biased information possible;
- National in scope but regionally specific, recognizing that each region has unique informational needs and data collection issues; and
- Inclusive and transparent, providing scientists, managers, and stakeholders an opportunity to participate in its development and use.

Our review of the MRIP Implementation Plan as well as input from, and discussions with multiple MRIP regional and state partners, indicate the program has made robust progress in achieving these goals. In particular, great progress has been achieved in expanding and strengthening the coordination, and provision of logistical and technical support to state partners through regional Interstate Marine Fisheries Commissions and their associated Fisheries Information Networks (FINs), as well as the Atlantic Coast Cooperative Statistics Program (ACCSP). Development, coordination, and implementation of regional- and state-specific recreational fisheries surveys conducted under the MRIP umbrella have been largely accomplished through the regional FINs and the ACCSP, often through the establishment of MRIP Regional Implementation Teams. Each Regional Implementation Team is responsible for identifying regional needs and developing a plan to implement improved data collection designs that address both regional and national needs. Regional MRIP Implementation Plans, which are reviewed and approved by MRIP's Operations Team and the Executive Steering Committee, provide estimated implementation costs, and attempt to reach consensus among regional partners with respect to regional needs and implementation priorities.

Expansion in the number of state fish and wildlife agencies that participate as contractors to conduct the APAIS survey under MRIP protocols has further helped increase coordination between MRIP and the states as well as expand opportunities for the development of survey adjustments that address specific regional and state needs. For example, during the past several years MRIP and the Gulf States Marine Fisheries Commission, working closely with the five

[1] See http://www.st.nmfs.noaa.gov/Assets/recreational/pdf/FINAL-updated-implementation-plan-3.22.16.pdf.

Gulf of Mexico states, conducted a series of workshops that led to the development and implementation of coordinated pilot studies to evaluate a number of survey methodologies and approaches for estimating catch and effort for Gulf red snapper, a fishery characterized by short federal fishing seasons (e.g., in 2016 the season was 9 days for private anglers and 46 days for the charter-for hire sector) that is unlikely to be properly sampled by the standard MRIP survey protocols. Likewise, recreational fishing surveys in the Western Pacific Territories are conducted by the territorial governments with support from the Western Pacific Fisheries Information Network (WPacFIN) and the NMFS Pacific Islands Fisheries Science Center. In Hawaii and Puerto Rico MRIP has been coordinating with the state fish and wildlife agencies to develop an enhanced survey design to meet the unique needs of the Caribbean Region and island fisheries.

Challenges remain. Some state needs—e.g., development and implementation of recreational fisheries catch and effort estimates at small spatial scales for the purpose of assessment or management of state-managed species, or in season monitoring of compliance with Annual Catch Limits (ACLs)—have been difficult to address. This is particularly true when they require a disproportionate increase in sampling effort and become cost-prohibitive, or because they are so specialized (i.e., focused on addressing non-traditional, very specific needs) that they become difficult to integrate into the standard MRIP, i.e., might have negative impacts on the general survey implementation or compromise the estimation process. For example, marine recreational fishing surveys in Alaska and Texas are administered by state fish and wildlife agencies outside of the MRIP framework. Reasons for this are several but largely stem from the feeling by those states that the MRIP survey—or family of surveys—is not able to provide estimates of recreational fisheries catch and effort needed for assessment and management at smaller temporal and spatial scales, are not capable of addressing some unique, highly specialized fisheries, or because pre-MRFSS/MRIP surveys already in place were addressing their data needs and implementation of a completely new survey protocol was thought to be unnecessary by those states. The Louisiana Department of Wildlife and Fisheries has also been implementing an independent saltwater recreational fisheries survey called LA Creel[2] since 2013. However, they have been in discussions with MRIP consultants since then and have applied for MRIP certification. The objective is to make sure that LA Creel data are compatible with MRIP and other regional data for stock assessment and management purposes.

However, the committee highlights the importance for alternative surveys, both under the auspices of MRIP and those of individual states, to be statistically sound. It was apparent in some public testimony to the committee and the committee's internal review that surveys in some areas are not designed to provide estimates with either the precision assumed or the unbiased nature presumed. As such, management of broad-ranging species may be compromised.

Programs in different parts of the country are in different stages of evolution. For example, MRIP has been working with the Pacific coast states (Washington, Oregon, and California) to evaluate and test modified survey methodologies that can lead to MRIP certification. However, continued coordination, technical support, and integration of Pacific coast state surveys into the MRIP framework are warranted. Despite noticeable progress on regional coordination, Pacific coast states still perceive MRIP as only a partial solution to their long-term recreational data collection needs. Further, Pacific coast states base funding from MRIP for surveys has been flat for many years, representing less than 50% of the overall costs of their marine recreational

[2] See http://www.wlf.louisiana.gov/lacreel.

angling surveys. Flat or reduced funding has made implementation of recommended survey improvements difficult and in some cases impossible for the states to accomplish. If this problem persists any meaningful gains to the states' sampling program through the MRIP certification process are potentially at risk.

Finally, it is important to keep in mind that MRIP was developed primarily to provide estimates of recreational fishing catch and effort for fisheries stock assessment and management at the regional scale (i.e., at the Regional Fisheries Management Council and Interstate Marine Fisheries Commission jurisdictional scales). Development of estimates at smaller geographic scales, although in many cases possible and warranted, might require additional investments at the state or local levels. It is our perception that the increased logistical and technical support being provided by MRIP as well as the process of MRIP certification allow for better coordination and integration of new, more specialized surveys into the MRIP survey framework and that regional and state partners are, by and large, satisfied with the level of support and coordination provided.

Other Survey Programs

There are a number of more specialized surveys conducted by NMFS, states, and territorial survey programs that are not strictly conducted under the MRIP umbrella but that require close coordination with MRIP. This is particularly true when these other surveys are addressing specific fisheries species not likely to be well sampled by MRIP, when they are being implemented in states where MRIP does not operate, or when they represent critical complementary components to MRIP because they are focused on specific recreational fisheries sectors. The paragraphs below provide a brief description of these surveys and a discussion of the coordination between them and MRIP aimed at providing a clear, national perspective on marine recreational fisheries.

Large Pelagics Survey (LPS)

Large pelagic and highly migratory species (HMS) like tunas, billfishes, and some sharks present a special challenge for recreational fisheries surveys. This is because many of these species are part of "rare event" or "pulse" fisheries that are only caught on a small proportion of all fishing trips, and activity often happens in bursts, as opposed to across a longer season. This necessitates the use of a separate, dedicated survey that is both focused on the characteristics of large pelagic and HMS fisheries, but also well-coordinated with MRIP. On the Atlantic Coast from Maine to Virginia, NMFS uses the Large Pelagics Survey (LPS) to measure the total recreational catch of these species. The LPS includes two complementary survey components. The Large Pelagics Intercept Survey interviews randomly selected anglers and for-hire captains returning from fishing trips targeting large pelagic fishes and measures average catch per trip, average size of kept fish, and number of fish released alive. The Large Pelagics Telephone Survey interviews randomly selected recreational anglers and for-hire captains who hold permits to fish for HMS. It produces the estimates of fishing effort, or the total number of trips taken for large pelagic species during a given period of time. Additional biological information is gathered through the Large Pelagics Biological Survey. This supplemental dockside survey is used primarily for recreationally landed bluefin tuna, targeting both private and for-hire boats. The survey collects

length, weight, and body part samples that are used by scientists in studies of fish populations and stock assessments. These surveys are all administered by NMFS with input from the HMS Advisory Panel to the NMFS Office of Sustainable Fisheries under close coordination and oversight by MRIP.

Southeast Headboat Survey (SEHS)

The Southeast Headboat Survey is a logbook and port sampling program designed and operated by NMFS, Southeast Fisheries Science Center, Beaufort Laboratory, North Carolina. It includes monthly logbook submission of trip-level reports of marine recreational fishing on head boats that target reef fishes and a dockside biological data collection program for targeted species. MRIP has supported several pilot projects to improve the documentation and estimation for this program, and is currently coordinating a pilot-test for an electronic data capture platform for headboat logbook data submission.

Alaska

Four programs funded and fielded by the Alaska Department of Fish & Game (ADFG), Division of Sport Fish, provide the recreational fishing catch and effort data, and biological data (age, size and sex composition), necessary to support the North Pacific Fishery Management Council, and NMFS (Alaska Fisheries Science Center, Alaska Region) for federal and international management, primarily of halibut and groundfish. All management of recreational salmon fishing in Alaska is delegated to the state of Alaska through the North Pacific Fishery Management Council and Pacific Salmon Treaty authorities and regulatory processes. All management of recreational salmon fishing in Alaska is delegated

The U.S.-Canada International Pacific Halibut Commission (IPHC) is responsible for conservation of halibut. Harvest biomass and biological characteristics of Pacific halibut by the recreational sector in Alaska and the Pacific coast are used by the IPHC, PFMC, and NPFMC to assess the coast-wide abundance of Pacific halibut and to allocate Pacific halibut harvests between the recreational for-hire and commercial sectors in IPHC areas 2C and 3A in Alaska and to all users on the Pacific coast. Independent anglers in Alaska are subject to less restrictive individual angler catch measures, as well as the lack of total catch restriction. The catch and biological data are transmitted to the IPHC annually in October in the form of a memo that is incorporated into the halibut stock assessment and the Fishery Removals section of the Report of Assessment and Research Activity (RARA) as well as to the NPFMC in the form of an oral report and accompanying tables.

Harvest biomass and release mortality biomass of demersal shelf rockfish by the recreational fishery in the Outside District of southeast Alaska are integrated into the stock assessment of DSRs in this area. These data are transmitted via email to ADF&G Commercial Fisheries Division each October for development of the Stock Assessment and Fishery Evaluation (SAFE) report for this stock.

The ADFG salmon surveys not only provide salmon catch, effort, and biological data, but also produce data on recovery of coded-wire tags for estimating hatchery and wild stock contributions of salmon.

Alaska has not traditionally participated in MRFSS or MRIP activities. In large measure, this occurred because of a perception that management of resources in this area was restricted to concerns solely within the State but also because the methodology used to estimate recreational catch has been well-developed for some time (see Mills, 1979 et seq.; Mills et al., 1986). The methodology used is similar to MRIP, with a mail survey used to estimate fishing effort and an intercept survey for CPUE. Enhancements over time have included both mandatory charter logbook regulations and electronic reporting. In this sense the Alaska program has anticipated the methodology currently used by MRIP. The committee believes that examination of the estimation methodology used in Alaska by MRIP's statistical consultants would be of value, particularly concerning the APAIS survey. There have been recent contacts between MRIP and Alaska Department of Fish and Game staff in an effort to harmonize recreational catch accounting between the two bodies.

Texas

Texas Parks and Wildlife Department (TPWD) manages and administers the Texas Marine Sport Harvest Monitoring Program which includes an access-point angler intercept survey and roving counts of boats and trailers to produce estimates of private and charter boat fishing landings of finfishes. The year runs in two 6-month seasons from May 15-May 14 and estimates are produced for each of the two six-month periods. Annual estimates are available six months after year-end.

The TPWD survey began 5 years before MRFSS and was never integrated into the MRFSS/MRIP survey framework. Survey data and estimates are provided to the Gulf RecFIN database and are available to data users upon request, but are not loaded into the regional website for data queries of marine recreational fishing catch and effort.

Unfortunately, no comparison of results between the Texas survey and MRIP exist. Texas chose not to become part of MRFSS/MRIP because its survey was already in place when MRFSS started, because it prefers roving counts over telephone surveys for effort estimation, and because its survey allows bay-specific estimates that can be used for assessment and management of state-managed species.

A full review of the Texas Marine Sport Harvest Monitoring Program is beyond the scope of this report. However, based on a presentation to the committee about the survey as well as discussions with regional partners and stakeholders it is questionable whether the estimates produced by Texas are comparable to MRIP. At the very least, it is highly advisable that the Texas survey be reviewed by an independent review panel so its applicability to regional fisheries assessment and management can be objectively assessed.

Human Dimensions

The 2006 NRC review of recreational survey methods (NRC, 2006) paid considerable attention to examining human dimension aspects of marine recreational surveys and data. That report recommended, among other things, that there should be the development of an independent national trip survey to support social and economic research and the continuation of add-on surveys, but in a more focused manner to better meet management and data needs. There is clearly a need for human dimensions data such as demographics, angler attitudes and

perceptions, expenditures and motivations. Discussion surrounding the development of an independent survey to support human dimension research is beyond the scope of this report. The inclusion of an add-on type human dimensions surveys has the potential to create further data collection challenges relating to such things as increases in respondent burden, increased nonresponse, and item nonresponse rates that could potentially impact stock assessment accuracy and validity. In light of this, the inclusion of human dimension add-on surveys would require careful consideration and, if included, should be focused and designed to minimize any potential data collection problems, while still meeting human dimension data needs. Expanding the survey should be considered at length keeping in mind that such an expansion could threaten the potential reliability and validity of both types of data (e.g., effort and human dimensions). Given these challenges, further research would be needed to explore aspects of add-on survey design that will adequately address these potential issues.

Continued Need for a "National Perspective" (Consistent and Comparable Data)

Despite a deliberate and intentional focus on adopting an implementation approach that incorporates the flexibility required to better address regional and state needs, MRIP seems to have been conscious of the need to maintain a 'national perspective' for the implementation of the nation's recreational fisheries surveys. Such a national view is explicitly called for in the 2006 reauthorization of the Magnuson Stevens Fishery Conservation and Management Act (Sec 301(a)). National standards ensure consistently high data quality that can be uniformly trusted, thereby helping to ensure the provision for equity among states. However, regional implementation ensures that the specific data needs of different parts of the country, each with its unique fisheries, management concerns and priorities, can be effectively and efficiently met. As the MRIP team certifies new methods, it works with regional and state partners, and stakeholders to determine how best to incorporate these methods into practice at the local level. Specifically, priority for MRIP's support for the development and implementation of regional or state surveys is based upon the extent to which surveys, alone or in combination, can address the following criteria:

- Use MRIP-certified survey designs or methodologies;
- Achieve MRIP standards for survey coverage and basic data elements, as well as any future standards adopted by the program;
- Provide recreational catch estimates for fisheries managed under the Magnuson Stevens Fisheries Conservation and Management Act—including Atlantic Highly Migratory Species—or jointly by the states and NMFS that are sufficient to:
    - Contribute to reliable stock assessments;
    - Support development of acceptable biological catch recommendations, annual catch limits (ACLs), and accountability measures that meet Magnuson Stevens Fisheries Conservation and Management Act requirements;
    - Support development of recreational regulations that minimize triggering of accountability measures; and
    - Allow reasonably precise tracking of recreational catch against ACLs.

Therefore, this national perspective seems to have been deliberately kept at the level of applying main guiding principles in survey implementation and estimation procedures. In other words, surveys addressing regional and state needs might have variances or adjustments warranted by differences in regional stocks or particular fisheries but are still structured with the same component parts (i.e., APAIS + FES) and required to be based on statistically valid sampling protocols and robust estimation procedures. Adoption of these national standards ensures that, regardless of the specific decisions made by each region with respect to data collection priorities and implementation, all recreational fisheries survey and estimation methods will withstand a rigorous independent peer review, and the resultant fisheries statistics will meet a baseline (best available science) for quality sufficient for stock assessment and fisheries management. Further, implementation of the "MRIP Certification" process (see Chapter 5) for acceptance of regional- or state-specific surveys provides a framework for evaluating whether these regional and state efforts meet the needed standards.

Conclusions and Recommendations

Conclusion: The management landscape has changed significantly since the 2006 National Research Council report with the reauthorization of the Magnuson-Stevens Act which mandated catch limits for all managed species. The implementation of annual catch limits together with accountability measures that are enforced if the catch limits are exceeded has created additional tension in many fisheries, but particularly in recreational fisheries. Concerns from analysts, managers and stakeholders over the use of data from MRIP in estimating both catch limits and in determining whether they have been exceeded have been expressed.

Recommendation: Evaluate whether the design of MRIP for the purposes of stock assessment and the determination of stock management reference points is compatible with the needs of in-season management of annual catch limits. If these needs are incompatible, the evaluation should determine an alternative method for in-season management.

Conclusion: MRIP coordination with regional and state partners has improved substantially since the National Research Council's 2006 report. In particular, great progress has been achieved in expanding and strengthening coordination, and the provision of financial, logistical and technical support (including access to consultants) to state partners through regional Interstate Marine Fisheries Commissions and their associated Fisheries Information Networks, and the Atlantic Coast Cooperative Statistics Program. The timeliness, of this support, which may be improved, is dependent on capacity and funding.

Conclusion: Increased communication and coordination with the Regional Fishery Management Councils and their Scientific and Statistical Committees (SSCs) has high potential to provide increased opportunities for identifying and addressing data needs for stock assessment and management at the regional level. Further, closer coordination with the SSCs would provide MRIP with additional resources for communication and coordination with the councils.

Recommendation: MRIP should continue and expand the investments made in coordination, financial, logistical and technical support with regional Interstate Marine Fisheries Commissions and state partners.

Conclusion: MRIP has adopted a regional implementation approach that incorporates the flexibility required to address unique regional data needs. As a result, the program has evolved to

become a compilation of regionally based data collection programs and is better prepared to address data needs at regional and state levels. Continued coordination, technical support, and integration of Pacific coast state surveys (Washington, Oregon, and California) into the MRIP framework are warranted. Despite noticeable progress on regional coordination, Pacific coast states still perceive MRIP as only a partial solution to their long-term recreational data collection needs. Further, flat or reduced funding has made implementation of recommended survey improvements difficult and in some cases impossible for Pacific coast states to accomplish. If this problem persists any meaningful gains to the states sampling program through the MRIP certification process are potentially at risk.

Recommendation: MRIP should continue to support effective communication and coordination with Pacific coast states. Coordination should be focused not only on continuing the logistical and technical support needed for survey improvements and subsequent MRIP certification but also to better articulate the benefits of a flexible regional approach to data collection, and interstate survey coordination for broad-scale stock assessment and fisheries management.

Conclusion: MRIP has continued to maintain a national perspective for development and implementation of recreational fisheries data collection by establishing and maintaining a certification process for acceptance of regional- or state-specific surveys. This certification process provides a framework for evaluating how the regional and state efforts meet the basic MRIP requirements and produce outputs suitable for stock assessment and management advice.

Recommendation: MRIP should increase efforts to clearly articulate to regional and state partners, as well as anglers and other user groups, the meaning, significance, and importance of the current approach used to implement its national perspective on recreational fishing surveys. MRIP should also be clear that this national approach incorporates the appropriate amount of flexibility required to meet unique regional and state needs. The benefits of a cohesive, integrated, and statistically robust recreational fisheries survey framework to stock assessments and regional fisheries management should be made clear.

Chapter 7
Communication and Outreach with Stakeholders

Introduction

In its 2006 report, the NRC recommended that outreach and communication of the Marine Recreational Fisheries Statistics Survey (MRFSS) be improved in several ways, including incorporating the views of anglers and angler organizations into survey design, data collection, and participation in survey advisory groups. As the National Marine Fisheries Service (NMFS) developed the Marine Recreational Information Program (MRIP) to replace the MRFSS, it specifically tried to address as many of the NRC's 2006 recommendations as possible. Therefore, in requesting the current study, the NMFS included a request for an evaluation of "the communication of information on survey method development, survey method descriptions, and survey results to stakeholders and application of stakeholder input in the design and implementation of new sampling and estimation procedures" (committee statement of task). This chapter provides that evaluation.

What Should Be Communicated and to Whom

The multi-jurisdictional nature of combined federal and state management (see Chapter 1), which in some regions of the country necessarily involves multiple states, presents challenges to data collection, data management, assessment and ultimately catch allocation. For example, management of summer flounder, an important recreational species along the U.S. northeast coast from Virginia to Massachusetts, necessarily involves NMFS, and seven state jurisdictions that cooperate within the Atlantic States Marine Fisheries Commission (Atlantic States Marine Fisheries Commission 2015). In contrast, fisheries for Pacific rockfishes on the west coast involve no more than three state agencies and one federal agency (Pacific Fishery Management Council 2016). This differential complexity in the management of recreational fisheries is inherent to our nation's geography, but it should not be ignored in trying to understand why some recreational fisheries present greater challenges than others.

It is necessary to know specific areas of authority and responsibility within the fishery management process to understand what should be communicated and to whom it should be communicated. An obvious point from the complexity of fisheries management depicted in Figure 1.2 is that MRIP is a component, but not the entirety of any plan for communicating fishery management issues. Thus any communication plan must reflect this complexity.

There has been a substantial response by NMFS to the previous NRC report (2006), which has greatly improved the theoretical underpinnings and implementation of the elements of MRIP. Here we assess whether similar improvements have occurred with MRIP communication capacity and planning. The committee sought to determine to what extent the MRIP communication plan clearly identifies appropriate audiences and messaging. This assessment includes the important idea that communication is at least a bilateral endeavor involving communicating to and listening to the targeted audience.

The MRIP Strategic Communications Plan

To assist its deliberations, the committee received the MRIP Strategic Communications Plan (NMFS, 2016), copies of MRIP's scientific and public presentations, copies of its newsletter "Newscast" and several unpublished, internal documents (NMFS, 2012a; 2012b). In addition, the committee also evaluated material on the MRIP website that clearly targets communication to an external audience. Here we focus on the 2016 MRIP Strategic Communication Plan, produced by the MRIP Communication and Education Team (CET) as it provides a comprehensive overview of current and planned activities. The committee notes that there is an earlier 2008 Communication Plan (referred to in the Sharp and Bard 2016 presentation to the committee) that was not made available to the committee, which sought to respond directly to the 2006 NRC report. Under that 2008 plan, MRIP developed tutorial videos and a MRIP Newscast newsletter, and also held several regional "road shows" (NMFS, 2012a; 2012b). In 2014 MRIP communications were "rebooted" (Sharp and Bard 2016) and a new 2016 communication plan was developed (NMFS, 2016). Three aspects of the new 2016 plan are striking. The first is that the plan makes very clear that the NMFS views the MRIP as being a combination of state, regional, and federal efforts rather than a monolithic federal program (Chapter 6). This aspect of the plan is appropriate and reflects the reality that MRIP has multiple partners who play key data collection roles. However, this begs the question of how communication about MRIP will be coordinated among the key members of the effort.

The committee was also struck by the lack of a needs assessment a decade on from the recommendation in the 2006 National Research Council report (NRC, 2006) report that would help identify the current communications challenges and help prioritize how these challenges will be addressed. Elements of a needs analysis are evident in two documents that reflect on lessons learned from specific public outreach efforts (NMFS, 2012a; 2012b). But, an integrated, comprehensive needs analysis appears to be lacking.

The third aspect is that the plan is largely a vision of what communication and outreach strategies will be in the future. It lacks an implementation component, which will be essential given the challenge of reaching multiple partners and audiences. A few additional details are provided in the annual implementation plan updates on the MRIP website. However, it is the committee's perception that a detailed implementation plan remains to be developed, although the committee notes that the 2016 Communications Plan (NMFS, 2016) does identify metrics for success. It simply lacks details on how and which strategies will be used to attain the desired metrics for success. Since the implementation details obviously will be very important, the committee's evaluation at this stage can only use broad brush strokes.

Objectives

The overall objective of the plan is

> "to position NOAA as a trusted recreational fishing data source as well as an active and engaged partner with the appropriate expertise to lead and facilitate data collection, analysis, and reporting. The communications team works to align the *understanding* of MRIP with the *reality* of MRIP (i.e., the scope of program, the data it produces, and the uses of that data). This

> includes more effectively communicating and fostering dialogue on the improvements that MRIP has made to NOAA Fisheries' recreational fishing data collection processes, methods, and reporting." (NMFS, 2016)

The committee agrees that this is an appropriate overriding objective for MRIP. However, this broad objective focuses on external partners without explicitly or fully recognizing the complexity of modern fisheries management (Chapter 1, Figure 1.2) , which will require coordinated communications among the multiple partners and stakeholders in the fisheries if we are to align *understanding* with *reality* over broad issues in fisheries management.

The plan seeks to achieve its overall objective by implementing the following strategies:

- "More effectively engage partners and key stakeholders in all aspects of the MRIP program, including priority-setting, resource allocation, and implementation.
- Provide tools and resources that partners can use to more effectively communicate MRIP policies, developments, and accomplishments with their respective audiences, members, and constituents.
- Build greater awareness and understanding of the interconnectedness among data collection, science, and management functions with respect to ensuring sustainable fisheries.
- Increase confidence, enhance internal, partner, and key stakeholder understanding of the MRIP process, how it works, how it is producing more accurate and precise catch statistics, who is involved, how priorities for the program are set, and opportunities for engagement and input.
- Enhance communications, dialogue, and understanding with congressional members and staff tied to recreational data collection and program funding as part of ensuring the sustainability of recreational fishing.
- Broaden angler and for-hire operator understanding of fishing participants in the current regional recreational survey programs and increase interest and participation in those programs; recognizing that the two groups have different understandings, goals, and outreach needs.
- Improve NOAA Fisheries understanding of stakeholder's perspective on MRIP." (NMFS, 2016)

There is little discussion of how the communication will, might, or should be differentiated, although there is a clear recognition that different audiences have different skills, needs, and other attributes. Despite the first bulleted item above ("engage partners and key stakeholders in all aspects of the MRIP program"), the document focuses primarily on communication from the MRIP to partners and stakeholders, and there is little focus on receiving feedback, and input from the various audiences. The committee supports MRIPs strategy of focusing on receiving feedback, and input as critical components of both the strategic vision and the implementation of the communication plan. This exchange of communication is essential to help MRIP prioritize future investments in human resources and technology most effectively to improve time lags

between data collection and management response which have been shown to impact management effectiveness (Sylvia et al., 2016).

Audiences

The MRIP communication plan seeks to concentrate its efforts on several audiences that include internal agency partners, state fisheries agencies, the regional fishery management councils, interstate commissions, the Fisheries Information Networks, Congress, the recreational fishing community, and environmental non-governmental organizations (eNGOs) (NMFS, 2016). Within this spectrum of audiences, most effort will be focused on internal and external partners. Less effort will be focused on other key stakeholders where the MRIP CET will focus on communicating to "those that have strong, positive influence and stature among their peers." (NMFS, 2016).

In considering the communication plan, the committee found it easier to think of the specific roles that stakeholders play, rather than the organizations they represent *per se*. For example, a state fishery management agency is likely to be both a data provider (collecting data from intercept interviews as a component of MRIP) and a data user (agency staff may be involved in stock assessments and ACT determinations). A communication strategy that does not identify these separate roles will likely be less effective than one that targets communication to stakeholders based on the role they represent.

Communication with Data-Collection Partners

In terms of regional operations and on-the-ground execution, the suite of surveys conducted under the MRIP umbrella is implemented in close collaboration with state and regional partners, usually by efforts coordinated through the regional Fisheries Information Networks (FINs), each of which serve a regional Interstate Marine Fisheries Commissions.[1] The regional FINs (including ACCSP) are state-federal cooperative programs in which NMFS participates as a partner with the state fisheries agencies, interstate marine fisheries commissions, regional fishery management councils, and other federal agencies, such as the U.S. Fish and Wildlife Service. These partnerships engage in cooperative programs to collect, aggregate, and manage state and federal fisheries data to support fishery managers and associated agencies. The regional FINs also serve as liaisons for identifying state and regional data needs and are, therefore, well-positioned for serving as coordinating entities for regional MRIP implementation. In this capacity, they effectively function as the main conduit of information and communication between MRIP and states participating in the survey.

As noted in the previous chapter, the MRIP has made significant progress in expanding and strengthening the communication and coordination with regional and state partners, especially from a logistical and survey implementation point of view (Chapter 6; Beal, 2016; Crabtree, 2016; Dickinson, 2016). For example, discussion and implementation of pilot studies to test concepts and address specific regional needs, training of state agency staff who conduct the

[1]Between 1942-1949, the federal government authorized by statute three interstate compacts, each creating a regional marine fisheries commission to better utilize and protect fisheries within the consenting states' jurisdiction. The three separate commissions represent the Atlantic, Gulf, and Pacific states, respectively.

survey, as well as support for data base management and data systems maintenance have been successful in large part due to increased and improved communication between MRIP and regional partners. MRIP's broad communications strategy defers much of the communications with individual anglers, or angling groups to the states and regional authorities. For example, regional RecFIN programs and state fish and wildlife agencies conduct the majority of the outreach and education efforts related to APAIS, effort surveys, and catch estimates, but apparently without structured and deliberate guidance from MRIP.

Communication with Data Users

Recreational fisheries data collected through MRIP surveys are used by a variety of agencies, institutions, and other user groups. For the purposes of this review the committee recognizes three broad categories of data customers: stock assessment analysts who use MRIP data to establish management reference points (OFL and the overfished level primarily), Council SSCs and Advisor Panels who use MRIP data to help develop catch limits (ABC, ACL and ACTs), and Council and NMFS Regional Office staff who use MRIP data to implement catch limits.

Stock Assessment Partners

The primary, direct users of MRIP information are assessment analysts who integrate estimates of catch and sometimes catch per unit effort of recreational anglers into stock assessments (Chapter 1, Figure 1.2). Presentations to the committee and discussions between the committee and stock assessment analysts indicated that the assessment analysts broadly recognize the improvements made in MRIP since 2006 (e.g., Dick, 2016). Assessment analysts found MRIP staff to be responsive to requests to provide data used in developing catch limits and knowledgeable over the underlying data (e.g., Carmichael and Duval, 2016). Communication here is typically one-on-one, often relying on personal relationships developed over years between MRIP staff and assessment analysts.

Overall, the committee encourages continued efforts by MRIP for two-way communication with customers who use data to generate ABCs, ACLs and ACTs. The benefits that would accrue to MRIP staff from such communication include improved understanding of how data are used in the assessment process, enhanced effectiveness of survey query tools, and prioritization of design improvements. The committee judges that similar improvements in understanding of the strengths and weaknesses of MRIP data by assessment analysts would accrue also. Finally, the committee recognizes that this communication will continue largely to be peer-to-peer, but MRIP should seek opportunities to engage assessment analysts in group situations wherever possible.

Partners Who Establish Catch Limits

Since the 2006 report, the Magnuson-Steven Act reauthorization assigned specific responsibility to the Scientific and Statistical Committees (SSCs) of each regional management council in setting ABCs for management species.[2] Because the SSCs are required to allow for scientific

[2] (Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 16 USC Sec. 1852(g)).

uncertainty in developing their catch recommendations, these bodies have become an important new user of MRIP information. More so than assessments analysts, who may need to limit the uncertainty allowed in catch estimates in their assessments to an arbitrary low figure for analytic purposes (e.g., 5% for red snapper in SEDAR, 2103; and Boreman, 2016), the SSCs must fully consider the uncertainty in catch and CPUE estimates. Based on presentations to the committee (Boreman, 2016; Dick, 2016), the committee observed that engagement of the SSCs by the MRIP is in the early stages needs to be emphasized more than it has been previously. Groups with responsibilities similar to the SSCs also exist within the fishery commissions and sometimes within individual states (Beal, 2016). These groups would also benefit from improved communication with MRIP.

The bodies that subsequently establish ACLs and ACTs must account for management uncertainty rather than scientific uncertainty. Here too, improvements in how MRIP communicates with these bodies would be helpful in aligning the understanding of recreational fisheries with the reality of managing them.

Lastly, there is a separate category of data users that regulate trans-boundary resources, e.g., the Pacific Salmon Commission and the International Pacific Halibut Commission (IPHC). For these bodies, historical transmission of recreational catch data for stock assessment purposes has been through State agencies. There has not been a transition of information transfer from MRIP to these bodies for two reasons. First, the major information for recreational catch of these species has been the Alaska Department of Fish and Game, which has not traditionally participated in MRIP. Second, the IPHC does not itself conduct any in-season management of recreational halibut catch limits; instead, it relies on agencies of the contracting parties for such management.

Partners Who Set and Enforce Catch Limits

From the evidence the committee heard, the biggest single challenge confronting MRIP is the use of its data in the management arena—specifically in implementing catch limits (Figure 1.2). This is a new requirement of the Magnuson Stevens Fishery Conservation Management Reauthorization Act (2006). MRIP includes multiple complex surveys collectively producing two population estimates—effort and catch per unit effort—that are collected at specific sites and at specific times. As outlined in Chapter two, these data collected at specific places and times are aggregated to broader spatial areas and into two-month waves (Box 2.2). Moreover, for most stock assessment purposes these data are further aggregated to annual estimates for a single region. For this application of MRIP the impacts of lags in data entry, data processing, QA/QC procedures and reporting inherent in this aggregation are relatively minor, because all data entering into assessments are typically from the previous complete fishing year (Sylvia et al., 2016). However, in sharp contrast, when MRIP data are used to enforce catch limits, inferences are made for limited spatial areas (e.g., States) and at very specific times (e.g., on what day will (or was) the ACT reached). This creates a tension in the fishery management process in which a survey that was designed for one purpose is being used for another purpose, for which its design may not be optimal. Moreover, because of the need for regional management councils to avoid overfishing, the uncertainties associated with catch estimates become of critical importance possibly leading to fisheries closures long before the point estimate is reached to ensure that ACLs are not exceeded (Baum, 2016). The committee also heard frustration from regional managers over the timeliness of MRIP estimates for implementing catch limits—particularly

when fisheries are pulsed as is the case for many recreational fisheries (Carmichael and Duval, 2016; Crabtree, 2016). There was also concern expressed, and perhaps a lack of understanding, over the estimates of uncertainty (Proportional Standard Errors, or PSEs) that accompany the individual catch estimates (Carmichael and Duval, 2016; Crabtree, 2016).

In general, the committee found that communication challenges continue to exist with regard to data users (Baum, 2016; Boreman, 2016; Crabtree, 2016). For example, perceptions of poor communication in the Gulf have generated support for development of a Regional MRIP Communications Committee within the GSMFC's RecFIN structure. This committee is to be populated by a Gulf States Marine Fishery Council (GSMFC) staff plus representatives from each of the five Gulf states.

Communication with Affected Users

Effective communication with affected users is clearly essential to ensure maximal cooperation with MRIP survey instruments, compliance with the fishing regulations that are subsequently derived from MRIP estimates and support for the MRIP program overall. In oral presentations (Martin et al., 2016; Mumford, 2016; Carmichael and Duval, 2016; Crabtree, 2016) and written submissions, the committee heard clearly that there remains scope for substantial improvements in communications about MRIP generally, and its role in the overall setting of catch limits and in enforcing catch limits specifically.

Recreational Anglers

MRIP has indicated that it expects most of the effort to communicate with anglers will be through its state and regional partners (Sharp and Bard, 2016). Whether it works through partners or directly, a major issue for anglers is the credibility of the MRIP data-gathering process and the data themselves. The most common issues the committee heard were that many anglers have rarely, if ever, been surveyed, that anglers wonder why the APAIS is conducted at times and places where the fishing is poor or there are few anglers, and that the data reported by MRIP don't seem to conform to their individual experiences (e.g., Baum, 2016). The committee also heard anglers say that they are catching a lot of fish but that MRIP is reporting low catch rates, or vice versa. There are many possible reasons for these impressions, and some of the reasons can be explained from a first principles understanding of the survey. For example, a statistically valid sample of millions of anglers likely will still miss most of the anglers who are actually fishing, giving them the false impression that the survey is inadequate. And an angler's individual experiences might not match the collective experience of all anglers, leading MRIP's data to appear to miss what that individual angler has experienced. Although these and other fundamental concerns over the design and implementation of MRIP may be easily explained, they are real perceptions of MRIP by recreational anglers that can only be addressed by proactive engagement of these key stakeholders on multiple fronts. The committee heard that communication shortcomings to date have exacerbated these concerns to the point where some stakeholders question the value of MRIP in ensuring sustainable management of the nation's marine living resources (Martin et al., 2016; Carmichael and Duval, 2016). Addressing these concerns is a primary concern. The committee recognizes that an approach coordinated with the states may be most successful in building trust and aligning the understanding of these

stakeholders with the reality of how MRIP is deployed. But MRIP must play a leading role in providing the vision and implementation strategies that partners can follow to ensure that affected users regain confidence in MRIP's data products.

For-hire Sector

The for-hire sector, which includes charter boats, head-boats, and guided small boats (e.g., flats and skiffs), is in effect a commercial sector, but unlike other commercial fisheries it makes its profits from paying clients rather than selling fish themselves. Many in the for-hire sector hold strong views regarding fisheries management in general, and on MRIP and its predecessor MRFSS in particular. For-hire captains tend to be better informed about fisheries and fishery-management issues than individual anglers, and often (but not always) are willing to cooperate in data collection. Many are directly involved in the fisheries management process because fishing is not recreation for them, but their livelihoods. They tend to belong to associations and tend to have a broader view of their sectors of recreational fisheries than do individual anglers.

The potential for for-hire captains to be fully cooperating partners is likely greater than that for individual anglers. These partners are more likely to be motivated to actively seek out communications from MRIP. Although the issues they are concerned about are similar to those of individual recreational anglers, they often have different experiences and knowledge bases. As a result, the style and content of MRIP communication to this sector should be different than those targeting individual anglers. Currently, MRIP does have communication products aimed directly at this group (e.g., MRIP Angler Catch Surveys: Information for Marinas and For-Hire Operators[3]). These directed communication efforts should be continued both because of direct benefits from an engaged for-hire sector, but also because of the indirect benefits arising from the operators' interactions with clients. Further, MRIP should allow the for-hire captains a method to review *their own* data submittals to provide further quality assurance of these data. The committee recognizes that MRIP must follow federal regulations to maintain data privacy and anonymity. The committee also recognizes that this additional step for data submittal would assuage concerns for an important fishing sector about the quality and accuracy of their own data that were expressed to the panel.

The committee heard particular concerns from the for-hire sector over delays in adopting self-reporting of catch through mobile or web-enabled devices (e.g., Brennan, 2016). As noted in Chapter 4, there can be serious statistical design issues over self-reporting, whether by individual anglers or charter captains, related to avidity, reporting bias, and representativeness of reporting that must be addressed. However, there are also obvious advantages including timeliness, auditing, gaining longitudinal data on variation and characteristics of catch which could improve the management process and the committee encourages MRIP to address the statistical issues associated with self-reported data. Some pilot programs are being conducted to evaluate the feasibility of such options, but the pressure from stakeholders to adopt self-reporting systems can be expected to increase. From a communications viewpoint, this can be addressed by ensuring that materials that explain the statistical issues associated with self-reported data are a priority in the MRIP communication plan. Though the for-hire sector has expressed a particular interest in

[3] See http://www.st.nmfs.noaa.gov/Assets/recreational/pdf/FINAL-2016-Marina-Charter-Boat-Handout.pdf.

the implantation of electronic self-reporting options, individual anglers may also benefit from this material.

Other Recreational Fishing Businesses

These businesses include marinas, bait and tackle and fly-fishing shops, boat-rental operations, fishing piers, general sporting-goods stores, local grocery stores and restaurants, and others. The degree of interest in MRIP and potential involvement as partners varies with the degree to which they are directly involved in recreational fishing. Thus marinas and tackle stores are likely to be more involved than grocery stores and restaurants. But to leverage the potential of these commercial operators will require directly tailored communication products.

Communication Strategies

The MRIP communication strategies are continuing to evolve. As this occurs, the committee suggests that it will be important to distinguish between passive and interactive communication activities. Passive and one-way activities involve the passing of information from one entity to another. This form of communication involves such things as newsletters, magazines, posters, pamphlets, and websites, to name a few. Because this mode of communication relies on people choosing to engage with MRIP it necessitates communication materials be visually appealing, clearly written and void of jargon. This is particularly important for the MRIP case given the need to convey rather complex scientific and statistical information to a generally non-scientific constituency. The materials need to be written and presented in such a way as to pique interest and increase trust in the overall enterprise. Nonetheless, although good, clear passive communications are an essential part of any communications plan, they are not sufficient.

The concepts of active communication and outreach are used almost synonymously throughout the MRIP Communication plan. The committee does not attempt to distinguish between the concepts here, but instead the committee discusses aspects of communication and outreach that appear to be critically important, whatever they are called. Interactive communications have the intent of reaching out to a broader audience using communication methods that are two-way and involve more give and take. Activities of this form involve such things as presentations at public events, workshops, and booths at recreational fishing shows, to name a few. In addition, interactive communications often are achieved by including interactive features on a web site. Thus, for example, the website could invite users to share their thoughts, offer them opportunities to partner in data collection, offer users opportunities to provide input into the communications plan and other aspects of MRIP, and so on. The MRIP Communication Plan contains elements of both one-way and two-way communication but there is little in the way of specifics, particularly with respect to two-way communication. As stated earlier in this chapter, the plan focuses primarily on communication from the MRIP to partners and stakeholders with little to no discussion of efforts involving collaboration, feedback, and input from the various audiences and methods for engaging with partners and stakeholders more interactively.

Four principal modes of communication can be recognized with in the MRIP Communication Plan (NMFS, 2016).

The MRIP Website

The MRIP website (http://www.st.nmfs.noaa.gov/recreational-fisheries/index, also reachable at http://www.countmyfish.noaa.gov), is well laid out, reasonably easy to navigate, and extremely informative. It provides information on survey methods, fishery data collected through MRIP, documentation, and other aspects of the program. The material is laid out under major categories with drop-down menus for each category. The committee judges the information to be detailed and likely accessible to any interested person. NMFS appears to be developing audience-specific navigation pathways on the website to help users find information at the appropriate level of technical detail. As noted above, the committee also encourages MRIP to use web-based technologies to stimulate active, two-way communication on its website.

The committee recognizes that the surveys and communication materials have gone through many rounds of changes and improvements. However, the committee has struggled to locate detailed information on the technical basis for current estimations and procedures. This information may not be sought by all audiences, but for groups (such as state partners, the FINs, the ACCSP, as well as some individual anglers and angler groups) interested in the technical details of the survey, it would be helpful if this documentation were readily available. It also would be helpful to include the date it was produced and whether there is a more recent version currently in use. Thorough documentation of the statistical practices would support continued evaluation and improvements to the system.

MRIP Newscast

The MRIP Newscast newsletter has been produced since 2008 and is made available electronically to interested stakeholders. The Newscast provides a range of topical information related to MRIP and recreational fisheries generally. The standard and information content of the newsletter is high. Because the newsletter is delivered electronically, the MRIP CET plan to use web (number of opens, click through rates, points of origin) to understand and presumably target its audience better (Shard and Bard, 2016).

Engaging Data Collection Partners and Data Users

A component of the 2016 MRIP Communication Plan (NMFS, 2016) calls for engagement of data collection partners and data users at Council and Commission meetings to build understanding of the changes and improvements in MRIP. These are appropriate audiences to engage, and reflect mainly data collection partners and constituents who use the MRIP data to enforce ACLs and ACTs. Details of how this engagement will occur were largely lacking. Additionally, engagement of constituents who use the data to generate reference points and ABCs was not described.

Print and Social Media Products

The 2016 MRIP strategic communication plan proposes to continue to produce both traditional and social media products tied to explaining forthcoming changes to MRIP. Few details were provided.

Staffing the MRIP CET

The 2016 Communication plan identifies a two-tiered structure (NMFS, 2016; Sharp and Bard, 2016) involving both a national team and regional teams. The national team is to be comprised of the MRIP communication staff (2 FTEs) and representatives from other NOAA offices and regional Interstate Commissions. Similarly, regional teams are to be comprised of representatives from the states, Councils and Commissions and finally other key regional partners. This structure appears a reasonable one to develop and implement a communication plan that calls for emphasis of regional connections and differences (NMFS, 2016). The extent to which the regional teams have been created was unclear.

The committee recognizes the challenge with undertaking the broad portfolio of communication discussed in the MRIP communication plan with current staff. MRIP has made excellent use of statistical consultants in responding to the previous NRC review of recreational fishery surveys. MRIP has already begun to use a communications consulting firm. Further benefits may accrue were MRIP to work more fully with external communication professionals to help them develop and implement their communication plan moving forward.

Conclusions and Recommendations

Conclusion: Fisheries management in state and federal waters is a complex, multi-disciplinary, multi-stakeholder process. Communications about MRIP have to be undertaken in the context of the entire fishery management process. The MRIP communication plan cannot be expected to explain to stakeholders all the complexities of fisheries management alone. The MRIP communication plan cannot and should not be expected to communicate to all audiences the comprehensive nature of fisheries management.

Recommendation: NMFS should develop and lead an integrated communications strategy involving state and federal partners to explain and seek support for the management of the nation's fisheries within which the role of MRIP is clearly defined. The MRIP communication plan should be an element—albeit for species in which removals are dominated by recreational fisheries, an essential component—of such a broader, integrated overall communication plan.

Conclusion: MRIP's communications plan lacks a clear needs analysis and an implementation plan. The plan identifies broadly what MRIP wishes to achieve, but there is little discussion of specific and practical matters that MRIP and its predecessor, the MRFSS, from which MRIP must have learned. The plan lacks details about specific and practical matters such as where to place information, what outlets to use for different kinds of information (e.g., newspapers, angling magazines, local television, tackle shops, and so on), and how to ascertain what MRIP users and those affected by MRIP think of the plan and what they would like to learn more about. It is not enough to produce a detailed, extensive, and informative website, no matter how good that website might be.

Recommendation: MRIP should further develop its communications plan, include a specific needs analysis and develop a specific and detailed implementation plan. Greater emphasis should be placed on interactive (two-way) communication, which may involve spending time in the field with anglers, than is currently in the plan.

Conclusion: The MRIP Communication plan identifies a hierarchical structure with both national and regional teams. This seems appropriate given the regional-state and federal nature of the MRIP partnership. In response to concerns regarding statistical aspects of the survey expressed by the National Research Council (NRC, 2006), MRIP established a large team of statistical experts, both in-house and as consultants, to help with the redesign of its sampling methods, analyses, and surveys. A similarly experienced team of experts has not been established to support the MRIP communication and outreach activities.

Recommendation: The success of MRIP depends to a large degree on clear, accurate, and timely communications; and on engaging all the various stakeholder groups, including anglers. Therefore, whether as permanent full-time equivalents or as consultants, MRIP should consider expanding its communications team to support the required needs analysis and implementation plans identified by the committee. One way of achieving this expansion would be to partner with national and regional organizations, such as the Sea Grant colleges, who already have communications capacity and expertise, and who would be able to identify opinion leaders and constituencies.

Conclusion: MRIP has made significant advances in improving its communications and outreach strategy since the National Research Council's 2006 report. Perhaps its strongest advances have been with its website and its communications with some of its data-collection partners, such as the regional interstate marine fishery commissions and state fishery agencies. Its communications with some other groups, most notably anglers, but also some stock-assessment and management groups have been less successful. Significant communications challenges remain unaddressed.

Conclusion: There is a need for increased and regular coordination and communication with regional fishery management councils and its Scientific and Statistical Committees (SSC's), and the regional stock assessment programs. This increased communication would provide opportunities for identifying and addressing data needs for stock assessment and management at the regional level.

Recommendation: NMFS should develop a system for indexing and cross-referencing documentation of survey methods and statistical analysis. Because of the evolving nature of the program that includes many different elements, maintaining the organization of the technical documents is a challenge. NMFS should increase its efforts to ensure the documentation includes key pieces of information. For example, NMFS should ensure that the statistical basis for the stratified and total estimates of total effort, catch per unit effort, and their variances for all fisheries and areas are readily available and consistent among current documents.

Recommendation: MRIP should take a more active role in communicating with anglers, whether through its partners or through its own efforts. The committee recognizes that MRIP defers to the states and regions in communications with anglers. Further, the committee recognizes that an approach coordinated with the states may be most successful in building trust and aligning the understanding of these stakeholders with the reality of how MRIP is deployed.

However, MRIP should play a leading role in providing the vision and implementation strategies that partners can follow.

Recommendation: MRIP should allow the for-hire captains a method to review *their own* data submittals to provide further quality assurance of these data. The committee recognizes that MRIP must follow federal regulations to maintain data privacy and anonymity. The committee also recognizes that this additional step for data submittal would assuage concerns for an important fishing sector about the quality and accuracy of their own data that were expressed to the panel.

Chapter 8
Plans for Maintaining Continuity

Introduction

The MRIP developed improved methodologies for the estimation of both fishing effort (the FES) and catch per unit effort (the APAIS) by recreational anglers. The resulting estimates of catches differed from those produced by MRFSS and created the need to link and calibrate previous information collected under MRFSS with the new information from MRIP, in order to create a continuous time series of equivalent data. In this chapter, the committee describes and evaluates the methods developed for this linking process and its implications for the assessment and management of stocks utilized by recreational anglers.

The Need for Continuous Data Series

The MRIP calibration workshops, presentations to the Committee, and substantial public testimony have highlighted the need for continuity in the recreational fisheries data used for assessment, management, and allocation. The three different processes have differing capabilities to accommodate changes in historical estimates. The stock assessment process can use recreational catch and effort statistics in two ways: as part of the raw data inputs on removals, and as indices of relative abundance. Changes in time series resulting from design and estimation changes can generally be accommodated inside assessment models using temporal blocks with different catchabilities for the two components of the time series (MRFSS/MRIP). The alternative approach is to calibrate the two time series to each other external to the assessment model and use the calibrated estimates directly. Each approach has its merits, and while the internal assessment model treatment is more robust to uncertainty, the need for a common time series to use in other applications (management, allocation) argues in favor of the external calibration approach.

For assessment and management programs where there is no statistical model used for assessment and where the annual catch limits (ACLs) may be based on historical trends, the calibrated approach is essential as a consistent yardstick for calculation of long-term averageand their variance. The MRIP calibration workshops clearly identified that modifications of the survey methodology required historical estimates to be calibrated to current methodology, rather than the opposite. The implications of an adjusted time series of catch estimates could be significant in the allocation arena and some aspects of this issue are detailed in following sections. Likewise, adjusted time series of catch or effort statistics can influence the development of control rules for fishery removals. For example, calculation of season lengths or bag limits designed to maintain historical angler success or access will be sensitive to the input data. Existing control rules used for input management control may need to be re-assessed in light of the adjusted time series of catch estimates by time or area.

Transition from Phone-Based to Mail-Based Effort Survey

The CHTS was an extremely problematic element of the MRFSS program due to a number of potential and realized biases in a methodology based on random-digit dialing of landlines. The 2006 NRC report noted the inherent difficulty of estimating fishing effort using such methodology, in the absence of an adequate list frame of anglers to increase the efficiency and accuracy of the effort estimation. The MRIP has clearly heeded the NRC advice and developed a dual-frame methodology using both a list frame of anglers and a secondary list frame based on the US Postal Service address-based frame of households (Chapter 3). The MRIP undertook substantial design and testing of the new effort estimation methodology. The results of implementing the new procedures were different estimates of fishing effort, often by large amounts, for some areas and time periods. Andrews et al. (2014; Table 3, p. 18) document differences in fishing effort of approximately four times higher for the improved FES compared with the previous CHTS methodology. Because these estimates resulted in much higher estimates of total catch for species in these areas and times, the Committee has invested considerable effort in examining their validity.

Chapter 3 of this report examines the MRIP effort estimation methodology in detail and makes a number of recommendations to address issues of nonresponse and recall biases, weighting of the strata responses, and correct incorporation of variance in the components of the ultimate estimates. These recommendations are significant to the estimation of fishing effort, catch per angler, and the ultimate calculation of accurate values for total catch. While addressing these recommendations may change the scale of the MRIP time series of total catch amounts for some areas and species, the choice of a method for calibration of the MRFSS and MRIP time series is not likely to be sensitive to these changes. This is because the changes contemplated by this report will affect primarily the degree of offset between the two time series, which the calibration is designed to bridge. However, it is important that MRIP staff be cognizant of any changes in methodology that affect the determination of peak fishing effort periods, since all calibration methods currently contemplated involve the use of peak effort periods to calibrate MRFSS estimates to MRIP estimates.

Development of Calibration and Bridging Among Data Series

The 2006 NRC report on the MRFSS program (NRC, 2006) recommended a number of improvements to the program which would reduce the potential for bias in both effort and catch estimation. Largely as a result of the NRC report the NMFS initiated a complete re-design of both the effort and catch components of the MRFSS program. The two elements of MRIP (the intercept survey [APAIS] and the Fishing Effort Survey [FES]) were implemented with different degrees of rigor, largely dictated by the relatively higher expense of the intercept survey. The APAIS survey was evaluated in a side-by-side comparison with the previous MRFSS methodology in only a single year and for a single area. As such, our knowledge of the relationship of the estimates arising from the two methods is somewhat limited. In contrast, a carefully staged implementation of an improved mail-based FES was more temporally and spatially extensive. Nonetheless, the combined MRIP methodologies resulted in estimates of recreational catches that differ from the previous MRFSS estimates, generally by small amounts but substantially for some species-area units (Andrews et al., 2014). These differences between MRFSS and MRIP estimates ranged from consistent biases to apparently random variation.

The new methodologies employed in calculating the MRIP estimates are more statistically valid than those used in the MRFSS program (Chapters 3 and 4). Many important components of recreational fisheries management are dependent on these catch and effort estimates, including stock assessment, development of harvest policies, in-season management, and catch allocation (Figure 1.2). In addition, the allocation of resources for the production of catch statistics is itself dependent on the estimates of catch produced by the MRIP. The historical time series of recreational catch and effort produced with the outdated MRFSS procedures therefore requires calibration to the estimation processes used in MRIP, so that a combined time series of total removals may be used to inform these processes.

The MRIP convened two workshops to address the calibration issues. The first, in 2012, was designed to develop a method to calibrate 2004-2011 catch rate estimates based on the unweighted MRFSS estimation methods to catch estimates based on a new MRIP weighted method, demonstrate its use in hind-casting estimates prior to 2004, and to develop a plan for implementing the calibration into benchmark stock assessments. The workshop identified a simple ratio estimator (MRFSS/MRIP) using 2004-2011 data, which could be used as a constant for hind-casting data prior to 2004, or trended using auxiliary information. The second workshop, in 2014, was convened to re-visit the calibration issue in light of changes to the APAIS made in 2013 and 2014. That workshop identified three potential alternatives for calibration (discussed below), an interim methodology to use while the three methods were evaluated fully, and recommended procedures to follow if survey methodology were to change in the future.

Both of these workshops clearly recognized that calibration was critical in allowing stock assessments to differentiate true changes in stock status from changes in the estimation procedures producing the data used in the assessments. Both workshops also identified a number of issues that affect the sampling error of the catch estimates, based on changes to the survey designs of both MRFSS and MRIP over time.

The Committee reviewed the workshop reports and other MRIP documents to determine the current status of calibration and plans for updating or improving the calibration method. Appendices 1 and 2 of the 2014 Calibration Workshop report (MRIP 2014) outline the three suggested alternatives for calibrating pre-2013 estimates to the post-2013 estimates. Importantly, the workshop also considered the opposite calibration, i.e., calibrating the post-2013 estimates to the historical time series. The workshop concluded that the former process (calibrating historical to present) was the preferred calibration method because harvest control methodology requires coherence with catch estimation methodology.

The three alternative methods were examined thoroughly by the 2014 workshop. Their construction and merits are detailed in Appendix 1 of the workshop report, and are only summarized here (MRIP, 2014).

1. Direct catch ratio estimator. In basic concept, the simple ratio estimator takes advantage of the improved coverage of peak periods in the 2013 MRIP ($C_{p,\ 2013}$) and scales the catches prior to 2013 by the ratio of peak catches to total catches in 2013 ($R_{2013} = C_{total\ 2013}/C_{p\ 2013}$). The scaled estimate for total catch ($C_{tot,y}$) in prior year *y* is then based on applying the 2013 ratio to the peak catch in the prior year, *y*. Thus,

$$C_{tot,\ y} = R_{2013} * C_{p,y.}$$

The scaling is based on post-facto identification of peak periods prior to 2013 and makes no use of data for non-peak periods.

2. Complex ratio estimator. Since the MRIP program produces estimates of effort distribution throughout the day, it provides an opportunity to scale the effort distribution in 2013 to match the truncated effort estimate from the more limited sampling in prior years. This is achieved by adjusting the weighting of effort in temporal bins for 2013 to match the effort for the more restricted temporal bins that existed in previous years. The ratio of the catch in the truncated 2013 bins ($C_{tr\ 2013}$) to the total catch in 2013 (C_{2013}) is defined as $R_{c/tr,\ 2013}$. Similar to the simple ratio method, the $R_{c/tr,\ 2013}$ is then applied to the available catch estimate (C_y) from a prior year *y*, to obtain an adjusted estimate of catch for that year. Thus,

$$C_{y,\ adj} = R_{c/tr,\ 2013} * C_y.$$

This adjusted estimate is assumed to be the estimate that would have been obtained if more complete MRIP-style sampling had been conducted in previous years. This estimator assumes a constant distribution of catch and effort over time and area, relative to that in 2013. Further, estimates of total effort for years prior to 2013 are obtained from the CHS, which have unknown properties.

3. The regression-based estimator. This estimator is more involved than the ratio estimators and is in some measure the reverse of the complex ratio estimator. It uses 2013 data to estimate and predict the distribution of Morning, Peak, and Evening categories of catch/effort for 2013, based on characteristics of the catch or demographics from the APAIS. This modeled relationship is then applied to target year data to derive a pseudo distribution of categories for that year, which matches the 2013 distribution. These pseudo proportions are used to produce adjusted estimates of catches for the target year. There are a number of extensions to this method outlined in the report.

   The primary assumption of this method, and it is a strong one, rests on the stationarity of the catch and effort process over time and space. In other words, it assumes that the effort and catch distribution throughout any given day can be captured by this single model relationship. The Committee appreciates the conceptual investment in this approach and commends the workshop for its innovative thinking. However, the committee has strong concerns about the ability to validate such an approach, because the quantity being predicted, i.e., the distribution of categories, cannot be observed. This quantity is defined by 2013 characteristics and imputed to the target years.

The Committee notes that all three methods are actually model-based estimators—all involve an underlying estimation model and vary only in the influence of the assumptions involved for each. The workshop consultants recognize that the calibration was not straightforward due to the limited side-by-side estimation using previous and current methodology for almost all areas. The Committee agrees with the consultants' concern in this regard and believes that uncertainty about process and observation error could be reduced if additional side-by-side comparisons were conducted. While the consultants also suggested that time-series or small-area spatial analyses might also be conducted, the Committee is doubtful that such analyses would yield significant improvements in a general calibration method. Nonetheless, such analyses could be conducted with available data and would be worth some investment of analytical resources.

Appendix 2 of the 2014 workshop also identified an interim approach (the simple ratio) to be applied while a full evaluation of the three alternatives was conducted. The Appendix detailed the drawbacks to this method, notably that the relationship of peak period catch to total catch is constant, and that none of the data outside of the peak catch period for years prior to 2013 are used. Both the 2012 and the 2014 calibration workshops provided guidance to stock assessment scientists concerning the use of a calibrated time series for the combined MRFSS-MRIP data. In particular, they suggested increasing the assumed variance in the time series to account for uncertainty in the calibration process.

Anticipating Impacts on Assessment and Management Programs

An accurate calibration of MRFSS data to MRIP data has implications for both assessment and management. Statistical catch-at-age (SCA) stock assessments, while not immune to differences, are the least sensitive to calibration issues because the assessment models can accommodate some imprecision in calibration through alternative catchability functions. Imprecise or biased calibration does affect the calculation of reference points related to unfished biomass, hence optimum harvest rates and control rules. In SCA frameworks, calibration issues may increase uncertainty in these quantities, though these influences will be less strong than in other assessment/management frameworks.

In non-SCA stock assessment frameworks, and particularly in data poor assessments, where the time series of total catch is a prime determinant of harvest levels (ACLs) and reference points, the method of calibrating MRFSS to MRIP data is likely to be more influential than in SCA frameworks. In the former, both the trend and scale of stock changes are informed totally by the calibrated time series and, in turn, the understanding of stock status is similarly governed. In these instances, the calibration process will have a much larger influence on the understanding of current stock status and appropriate reference points for stock management. The Committee notes that these influences will not be uniform and will affect recreational fisheries management much more strongly in some areas that others, directly linked to nature of how ACLs are determined.

For data poor assessments the estimation of common reference points for stock management, e.g., unfished equilibrium biomass B_0, biomass depletion level, and target harvest rate, are not well determined, or may be precluded, by time series of catches alone. The estimated B_0 is a quantity of considerable uncertainty for even technically sophisticated assessments. In turn, a poor understanding of target harvest rates will increase the uncertainty associated with ACLs. Calibration affects primarily the scale of estimated removals but may also influence its trend. In the absence of auxiliary information on trend, management is therefore critically dependent on simple catch time series. These issues are not uniquely associated with the methodology for calibrating data series resulting from changed estimation methodologies, but imprecision in calibration will increase uncertainty in fisheries management.

Future efforts to develop calibrated time series of recreational catches will be most useful if accompanied with advice on the implications of the calibration method to stock assessment and reference points for stock management. In particular, simulation analyses of alternative methods will be useful. As the time since a change in methodology for estimating recreational catches lengthens, the calibration method will have less influence on the understanding of current stock status. The understanding of stock status will be influenced more strongly by recent data than by

historical shifts in estimation methodology for catch, when removals are substantial proportions of available yield. If removals are a small proportion of available yield, then the calibration will continue to influence understanding of stock status. However, since the calibration methodology does influence the understanding of reference points for management, the effect of the calibration will be a long-term element of fisheries management. This is an important element to consider when contemplating any changes in survey and estimation methodology and underscores the point that any such change should be thoroughly evaluated prior to implementation.

Conclusions and Recommendations

Conclusion: The low number of side-by-side comparisons between the angler intercept portions of the MRFSS and MRIP methodologies limits the ability to develop a more precise calibration between the time series of data produced by the two programs.

Conclusion: None of the methods proposed to calibrate the two intercept time series is completely satisfactory because of the necessary assumptions and/or *post hoc* data stratifications that must be applied when using the methods.

Conclusion: For stocks with substantial removals, the calibration between the two intercept data sets will diminish in importance for some stock assessment purposes over time as more recent data dominate the determination of stock status. Nonetheless, uncertainty in the estimation of reference points for harvest policy determinations will remain sensitive to the calibration process.

Conclusion: The calibration of the two data time series is extremely important to multiple aspects of fishery stock assessment, catch management, and allocation processes. For stock assessment modeling, the absence of a fully satisfactory calibration can be addressed through alternative estimates of catchability over the combined time series. For simpler stock assessments, the calibration may be more influential.

Recommendation: MRIP should continue development of a statistically sound calibration methodology as improvements to the Access Point Angler Intercept Survey and Fishing Effort Survey methodologies are incorporated. In the interim, the existing ratio-based calibration should be continued. For statistical catch-at-age based (SCA) assessments, scientists should employ alternative catchability functions applied to the combined time series as a means to accommodate potential imprecision in the calibration of MRFSS data to MRIP data. For non-SCA frameworks, assessment scientist should exercise caution in the interpretation of trends in catch data.

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Appendix A
Committee and Staff Biographies

Committee

Luiz Barbieri (*Co-chair*) is the science and research director for the Marine Fisheries Research Program at Florida's Fish and Wildlife Research Institute, based out of St. Petersburg, FL. He has an extensive background in marine fisheries science and policy and serves as a key representative on several scientific advisory panels and committees including the Atlantic States Marine Fisheries Commission, the Scientific and Statistical Committee (SSC) for both the Gulf of Mexico and South Atlantic Fishery Management Councils, and as a senior advisor to the Fisheries Leadership and Sustainability Forum, Nicholas Institute for Environmental Policy Solutions at Duke University. Dr. Barbieri received a B.S. in biology from Santa Ursula University, a M.S. in biological oceanography from Rio Grande University, and a Ph.D. in marine fisheries science from the College of William and Mary.

Cynthia M. Jones (*Co-chair*) is a professor and eminent scholar in the Ocean, Earth, and Atmospheric Sciences department of Old Dominion University. Her research interests include demography of fish based on age evaluation, stock assessment, recreational angler surveys, simulation modeling, and quantitative statistics. Dr. Jones has been the recipient of multiple awards and honors, including: AAAS Fellow, Outstanding Virginia Scientist, Outstanding Professor, and Fulbright Senior Scholar Award. Dr. Jones served on the National Research Council (NRC) Ocean Studies Board from 2005-2007. She was also a member of multiple previous NRC studies, including the Committee for Review of the National Marine Fisheries Service: Use of Science and Data in Management and Litigation, which she chaired. Dr. Jones received her B.A. in zoology from Boston University. She received her M.S. and Ph.D. in oceanography from the University of Rhode Island.

Jill A. Dever is senior survey statistician at RTI International in Washington, DC. Her current research interests include statistical and methodological issues for dual-frame random-digit-dial and address-based sample surveys, along with nonprobability studies and survey weight calibration with estimated population value. In addition, her experience includes creating software for optimizing complex sample designs; constructing linearization and replicating analysis weights using calibration techniques; and analyzing data from complex surveys. To date, she has worked on a variety of surveys that address pertinent issues of our times in the areas of health care, education, and the U.S. Military. Dr. Dever received her B.S. in mathematics from the University of Louisville, located in her hometown. She received her M.S. in biostatistics from the University of North Carolina Chapel Hill and her Ph.D. in survey methodology from the Joint Program in Survey Methodology at the University of Maryland College Park.

David Haziza is a professor in the Department of Mathematics and Statistics at the Université de Montréal. His research interests include theory and application of survey sampling, and

specifically, inference in the presence of missing data or influential units, resampling methods, and calibration. Dr. Haziza received his Ph.D. in statistics from Carleton University.

Jeffrey C. Johnson is a professor of anthropology at the University of Florida. His research interests include network models of complex biological systems and the application of continuous time Markov chain and exponential random graph models to the study of trophic dynamics in food webs. His most recent work involves the development of methods for the reliable tagging, coding and network modeling of large corpora of related texts. He has published extensively in anthropological, sociological, biological and marine science journals and was the founding editor of the Journal of Quantitative Anthropology, and co-editor of the journal Human Organization. He is currently an associate editor for the Journal of Social Structure and the journal Social Networks. Dr. Johnson received his Ph.D. in anthropology from the University of California, Irvine.

Bruce M. Leaman is currently the Executive Director of the International Pacific Halibut Commission and has been since 1997. His research interests have included fisheries management, stock assessment, reproductive biology, and population dynamics. Dr. Leaman served on the 2006 National Research Council Committee on Review of Recreational Fisheries Survey Methods. Dr. Leaman received his B.Sc. from Simon Fraser University. He also received his M.Sc. and Ph.D. from the University of British Columbia.

Thomas J. Miller is a professor of fisheries and bioenergetics and population dynamics, as well as the Director of the Chesapeake Biological Laboratory at the University of Maryland's Center for Environmental Science. Dr. Miller's research interests include recruitment and population dynamics of aquatic animals, fish early life history, and blue crabs. His relevant National Research Council service includes membership on the Committee on Sustainable Water and Environmental Management in the California Bay-Delta and the Panel to Review California Draft Bay Delta Conservation Plan. He is also currently serving as a member of the Panel on Life Sciences. Dr. Miller received his B.Sc. in human and environmental biology at the University of York. He later received his M.S. at North Carolina State University in ecology, and his Ph.D. in zoology, also from North Carolina State University.

Sean P. Powers is a professor and chair of marine sciences at the University of South Alabama and senior marine scientist at the Dauphin Island Sea Lab. His research focuses on the ecology of coastal/estuarine fishes and benthic invertebrates, particularly those that support commercial and recreational fisheries. The goal of his research program is to provide scientifically sound information to direct conservation and restoration efforts of marine fisheries and the habitats that these species rely upon. He has served on one National Research Council committee, the Committee on U.S. Army Corps of Engineers Water Resources, Science, Engineering, and Planning. Dr. Powers received his Ph.D. in zoology from Texas A&M University.

Steve Williams is a Senior Program Manager for the Pacific States Marine Fisheries Commission. Mr. Williams is primarily responsible for program oversight of the Pacific RecFin database program as well as several other Columbia River and Pacific coast marine projects dealing with salmon and highly migratory species management issues. Mr. Williams spent 39

years as both a fish and a wildlife manager for the Oregon Dept. of Fish and Wildlife. His management experience covers a broad range from field sampling of both marine and freshwater fisheries to a period as Deputy Director of the Oregon Department of Fish and Wildlife. He served as the Oregon state representative to the Pacific Fishery Management Council for approximately 5 years. Mr. Williams received his B.S. in fisheries from Oregon State.

Staff

Susan Roberts became the Director of the Ocean Studies Board in April 2004. Dr. Roberts received her Ph.D. in Marine Biology from the Scripps Institution of Oceanography. Prior to her position at the Ocean Studies Board, she worked as a postdoctoral researcher at the University of California, Berkeley and as a senior staff fellow at the National Institutes of Health. Dr. Roberts' research experience has included fish physiology and biochemistry, marine bacterial symbioses, developmental cell biology, and environmentally-induced leukemia. Dr. Roberts specializes in the science and management of living marine resources. She has served as study director for eighteen reports produced by the National Research Council on topics covering a broad range of ocean science, marine resource management, and science policy issues. She is a member of the U.S. National Committee for the Intergovernmental Oceanographic Commission (IOC) and serves on the IOC panel for the Global Ocean Science Report. Dr. Roberts is a member of AAAS, American Geophysical Union, and the Association for the Sciences of Limnology and Oceanography. She is an elected Fellow of the Washington Academy of Sciences.

Stacee Karras is a program officer with the Ocean Studies Board. She joined the National Academies of Science, Engineering, and Medicine in 2012 as a fellow, and served as a Research Associate for the Ocean Studies Board between 2013 and 2015. She then served as an Associate Program Officer until 2016, when she took on her current role. She received her B.A. in marine affairs and policy with concentrations in biology and political science from the University of Miami in 2007. The following year she received an M.A. in marine affairs and policy from the University of Miami's Rosenstiel School of Marine and Atmospheric Science. In 2012, she earned her J.D. from the University of Virginia, School of Law.

Michael Cohen is a senior program officer for the Committee on National Statistics. He has led or served as contributing staff on a wide range of studies on the U.S. census and the modeling and reliability of defense systems. He also serves as a consultant on statistical analysis for other divisions in the National Academies of Sciences, Engineering, and Medicine. Previously, he was a mathematical statistician at the Energy Information Administration and held positions at the School of Public Affairs at the University of Maryland and at Princeton University. His general area of interest is the use of statistics in public policy, with particular focus in census undercount, model validation, and robust estimation. He is a fellow of the American Statistical Association and an elected member of the International Statistical Institute. He has a B.S. in mathematics from the University of Michigan and an M.S. and a Ph.D. in statistics from Stanford University.

David Policansky received his Ph.D. in biology from the University of Oregon, where he studied evolutionary biology and ecology. He has published on life-history transitions, including the cost and timing of sexual reproduction in plants and animals; he also has published on fisheries and the interface between science and policy and on the inheritance of asymmetries in flounders. In his more than 30 years at the National Academies of Science, Engineering, and Medicine he has been involved in more than35 reports, many as project director. His work has

focused on management of natural resources, natural restoration, information for environmental decision making, reviews of large federal programs, and on endangered species, among other topics.

Payton Kulina (until September 2016) joined the Ocean Studies Board in June 2013 as a Senior Program Assistant. He graduated from Dickinson College in 2010 receiving a BA in Policy Management. He is currently pursuing a MS degree in Finance through the Kogod School of Business at American University. Prior to this position, Payton worked as a coordinator with BP Alternative Energy, also in Washington, DC.

Allie Phillips (starting September 2016) graduated in May 2016 from Colby College in Waterville, Maine where she received a BA in Environmental Studies: Policy. As an undergraduate, she held internships at the Environmental League of Massachusetts (ELM) and the New England Aquarium. She joined the Ocean Studies Board as a Program Assistant in September 2016.

Appendix B
Review of Recreational Fisheries Survey Methods (NRC, 2006)
Summary

Introduction

Recreational fishing in the United States is an important social and economic component of many marine fisheries. However, in some cases, recreational fishing takes more fish than commercial fishing, and in an increasing number of cases, recreational fishing is the main source of fishing mortality. In addition, current assessments indicate that some marine recreational fisheries have exceeded their quotas, raising concern because fishing effort in marine recreational fisheries is projected to increase. It is important that catch monitoring systems are adequate for timely management of these fisheries.

Marine recreational fisheries are not monitored with the same rigor as commercial fisheries. However, as concerns about the effects of all types of fishing have grown, more attention has been paid to the possible impacts of marine recreational fishing. The growing interest in the effects of recreational fishing on fish stock size and composition has led to increased demands for timely and accurate data. Although the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration implemented the Marine Recreational Fisheries Statistics Survey (MRFSS) in 1979 to obtain statistics about marine recreational fisheries, management goals and objectives have changed since then, as has the complexity of the recreational fishing sector. The need for and use of marine recreational fishery statistics in science and management have changed as well. This committee has identified several areas in which designers of sampling programs, data collectors, and users of recreational fisheries data appear to have incomplete communication, mismatched criteria, or other obstacles.

The MRFSS has two major components: an onsite component, in which anglers are intercepted and interviewed on the water or at sites such as marinas where they access the water; and an offsite component, in which anglers are contacted and surveyed by telephone after their trips are completed. There has been widespread criticism of the nature and use of the MRFSS information. The MRFSS was (and is) intended to be a national program, but not all coastal states participate. In some cases, states have their own surveys of recreational fish landings instead of the MRFSS; in other cases, states have surveys that complement the MRFSS. In addition to this lack of uniformity of coverage, the quality of the MRFSS data for management purposes has also been questioned.

Indeed, it is much more difficult to collect data on recreational saltwater anglers than on commercial fishing operations. There are far more saltwater anglers than commercial fishermen—approximately 14 million anglers fished annually in recent years—and they do

not land their catches at specific points where there are dealers, as do commercial fishermen. In addition, there are many modes of fishing (e.g., anglers who fish from head boats or charter boats, with guides,[1] from shore, on private boats, from private property), and many anglers release fish they catch. Some anglers travel far to fish and often fish only a few times each year, which makes them difficult to encounter in surveys. Others, who live within 50 miles of the coast, are much more likely to be intercepted by the MRFSS. Finally, most surveys of anglers depend to some degree on the anglers' recall and willingness to volunteer valid information. As a result, designing a survey that will provide accurate and timely information, with good coverage and at acceptable cost, is a major challenge.

Despite the complexity of the challenge and its importance for fishery management, the MRFSS staff have been severely handicapped in their efforts to implement, operate, and improve the MRFSS, including implementing the recommendations of earlier reviews. It is not reasonable to expect such a small staff—and one that lacks a Ph.D.-level mathematical statistician—to operate a national survey of such complexity, despite the dedication of the small staff the MRFSS does have.

In addition, the MRFSS is severely limited by the lack of a universal sampling frame for all saltwater anglers, a lack that is not of the MRFSS's own making. To make matters even more difficult, some of the data that the MRFSS depends on are collected by states, which use a variety of data-collection and sampling protocols. Finally, the financial resources allocated to the MRFSS are modest in comparison to the challenge. This committee's findings and recommendations should be viewed with this in mind.

The Present Study

To help identify solutions to some of the above problems, NMFS asked the National Academies to assemble a committee to review current marine recreational fishing surveys and to make recommendations for improvements—especially to the MRFSS—and to recommend the implementation of possible alternative approaches. (See Box B.1 for the committee's statement of task.)

In response, the National Research Council (NRC) of the National Academies established the Committee on the Review of Recreational Fishing Survey Methods, composed of experts in survey design and statistics, biological statistics, fishery management, and the economics and sociology of recreational fishing. The background and support for the conclusions and recommendations presented below are found in subsequent chapters.

[1] Head boats, also called party boats, take large groups of anglers (sometimes as many as 100) on fishing trips; the groups usually are not pre-formed. Charter boats (also occasionally called party boats) take smaller groups of anglers, usually four to eight, most often in pre-formed groups. Guided trips are trips in which a guide takes one or two anglers in a smaller boat. These different categories operate under different U.S. Coast Guard and state license requirements. Throughout this report, these sectors are collectively referred to as the for-hire sector.

BOX S.1
Statement of Task

This study will critically review the types of survey methods used to estimate catch per unit effort and effort in recreational fisheries, including state and federal cooperative programs. The committee will examine representative survey types but will not evaluate every regional or state survey method currently in use. The study will consider the match or mismatch between options for collecting recreational fisheries data and alternative approaches for managing recreational fisheries.

In particular, the committee will assess current types of survey methods giving consideration to:

- The suitability for monitoring different types of fishing (e.g., charter boats versus private boats, offshore versus near-shore species, fisheries with temporally or spatially restricted fishing seasons).
- The adequacy for providing the quality of information needed to support various approaches for managing recreational fisheries, with reference to how the management approach might be restricted by the type of survey method, stratification scheme, and sample size required. For example, is the management time frame (in-season, annual, or multi-year) consistent with temporal design of the survey? Is the geographic scale of management (e.g., state versus regional) appropriate for the resolution provided by the survey? How would the survey design need to be modified to match the requirements of the management approach?
- Make recommendations regarding possible improvements to current surveys and/or possible implementation of alternative approaches, including setting priorities for revising monitoring methods that will yield the greatest improvements in effort and catch per unit effort estimates.

Current survey methods and recommended alternatives will be compared with relation to costs, sources of bias, precision, and timeliness.

Conclusions and Recommendations

General Conclusions

The committee agrees with conclusions of previous NRC committees that marine recreational fishing is a significant source of fishing mortality for many marine species and that adequate scientific information on the nature of that mortality in time and space is required for successful management of those species.

- Marine fisheries management goals, objectives, and context have changed since the MRFSS was begun in 1979. Management decisions are often made at finer spatial and temporal scales than they were earlier, the mix of recreational and commercial fishing has changed for many areas and species, and stock-assessment models now make greater use of data from recreational fisheries.
- The MRFSS is in need of additional financial resources so that technical and practical expertise can be added to assist in a major overhaul of the design, implementation, and analysis of data from the MRFSS. Both the telephone and access components of the current approach have serious flaws in design or implementation and use inadequate analysis methods that need to be addressed immediately. This committee's review has focused primarily on the MRFSS, but many of the component surveys of the MRFSS conducted by state agencies (with various degrees of federal funding) suffer from the

same shortcomings as does the central MRFSS. As a result, many of this committee's recommendations apply to state surveys as well as to the MRFSS.

- Many of the independent surveys conducted by the states, as well as state-run surveys that are components of the MRFSS, are different from each other and from the central MRFSS in important ways, including sampling, data collection, and preparation of estimators.
- The committee concludes that users' concerns about the use of the MRFSS in fishery management are justified by the above-mentioned weaknesses, but they also result from inadequate communication and outreach on the part of the MRFSS managers at NMFS.
- The for-hire sector of marine recreational fisheries (i.e., charter, guide, and head boat operations) is more like a commercial sector than it is like the private-angler sector.

General Recommendations

- The MRFSS (as well as many of its component or companion surveys conducted either indirectly or independently) should be completely redesigned to improve its effectiveness and appropriateness of sampling and estimation procedures, its applicability to various kinds of management decisions, and its usefulness for social and economic analyses. After the revision is complete, provision should be made for ongoing technical evaluation and modification, as needed, to meet emerging management needs. To improve the MRFSS, the committee further recommends that the existing MRFSS program be given a firm deadline linked to sufficient program funding for implementation of this report's recommendations.
- A much greater degree of standardization among state surveys, and between state surveys and the central MRFSS, should be achieved. This will require a much greater degree of cooperation and coordination among the managers of the various surveys. The for-hire sector of marine recreational fisheries should be considered a commercial sector, and survey methods and reporting requirements for that sector therefore should be different from those for private anglers.

Sampling Issues Conclusions

- The committee concludes that the current methods used in the MRFSS for sampling the universe of anglers and for determining their catch and effort are inadequate. Sampling of each group of anglers (i.e., private, guided, head boat, charter boat) presents challenges that can differ across the groups. Two complementary methods of sampling are used in the MRFSS. One is onsite (i.e., intercepting anglers while they are fishing or at their access [landing] points). The other is offsite, which includes a variety of sampling techniques for contacting anglers after they have completed their trips. Both onsite and offsite methods suffer from weaknesses that may lead to biases in catch and effort estimation. Finally, the estimation procedure for information gathered onsite does not use the nominal or actual selection probabilities of the sample design and therefore has the potential to produce biased estimates for both the parameters of interest and their variances.

- Onsite methods fail to intercept anglers who have private access to fishing waters or intercept them only sporadically. It is impossible, using current methods, to obtain information on the target species of anglers who have private access. In addition, various physical, financial, and operational constraints often lead to spatial or temporal biases in onsite sampling coverage that are not adequately accounted for in the estimation equations.
- Offsite sampling methods that rely on telephone interviews are complicated by the increasing use of cellular telephones, especially in surveys of residents of coastal counties. This is because cellular telephones are not restricted to a geographic region as are landline telephones. If cellular telephones are excluded, then undercoverage of the survey will be increasingly problematic over time as the number of people who use only cellular telephones is growing.The existing random digit dialing (RDD) survey suffers in efficiency from the low proportion of fishing households among the general population and may allow bias in estimation from its restriction to coastal counties only.
- The existing random digit dialing (RDD) survey suffers in efficiency from the low proportion of fishing households among the general population and may allow bias in estimation from its restriction to coastal counties only.
- Reliance on fishing license-based lists of saltwater anglers is not yet feasible as a means of improving offsite sampling methods to avoid the inefficiency of RDD, undercoverage due to cellular telephone use, and restriction to coastal counties. Although many states collect angler information when a saltwater fishing license is purchased, there are license exemptions based on age, residence, access points, existence of a boat license, mode of fishing, and other factors. As a result, angler information for those states is incomplete. Some states have more complete information than others, and in the states that have no saltwater license, there is no list of saltwater anglers. The lack of a universal sampling frame (registry or license requirement) for all saltwater anglers is a major impediment to the development of a reliable and accurate survey program.
- Catch and release fishing (release of fish that survive capture) is increasingly common in many marine recreational fisheries. Although some fish survive capture and release, mortality may be high, in some cases exceeding 50 percent. The survey fails to provide a valid and reliable method of adequately accounting for fish caught and *not* brought to the dock (including fish released alive or dead, as well as fish caught for bait or given away before reaching the dock). This shortcoming affects estimates of catch and total removals.
- The correct identification of fish species, especially in places with diverse fish faunas, is a difficult challenge, both for many anglers and for those conducting surveys. Incorrect identification obviously has the potential to lead to incorrect conclusions from survey data.

Sampling Issues Recommendations

- A comprehensive, universal sampling frame with national coverage should be established. The most effective way to achieve this is through a national registration of all saltwater

anglers or through new or existing state saltwater license programs that would allow no exemptions[2] and that would provide appropriate contact information from anglers fishing in all marine waters, both state and federal. Any gaps in such a program (e.g., a lack of registration in a particular region or mode, exemptions of various classes of anglers) would compromise the use of the sampling frame and, hence, the quality of the survey program. An updated, complete registration list would greatly improve sampling efficiency in terms of time and cost. Although these savings might not cover the entire cost of maintaining such a database, the benefit from the increased quantity and quality of the data would be worth the extra cost, especially if there is an associated increase in public confidence in the final estimates.

- Future telephone surveys should be based on the above universal sampling frame.
- Charter boat, head boat, and other for-hire recreational fishing operations should be required to maintain logbooks of fish landed and kept, as well as fish caught and released. Providing the information should be mandatory for continued operation in this sector, and all the information should be verifiable and made available to the survey program in a timely manner.
- Additional studies are needed to understand the extent to which fish are kept and inspected, as well as the extent of catch not available for inspection to improve the accuracy of catch estimates.
- Panel surveys, which contact individual anglers repeatedly over time, should be considered in recreational fishing surveys to gather angler trend data and to improve the efficiency of data collection.
- The onsite sampling frame for the MRFSS should be redesigned. The estimation procedure critically depends on the assumption that catch rate does not vary according to the nature of the access point. In particular, small or private access points that most likely are missed might have different catch rates than larger access points, which would lead to bias in the resulting estimators. In addition, the sampling process requires greater quality control (less latitude on the part of the samplers) than it has at present. (See the recommendation below for the establishment of an independent research group to investigate matters such as these.)
- Dual-frame procedures should be used wherever possible to reduce sample bias. For example, if a state has an incomplete list frame based on licenses, the use of an additional sampling frame of the state's residents (e.g., RDD) would reduce the bias. The existence of a universal frame described above would make this approach unnecessary for offsite sampling.
- Internet surveys should be considered for their potential use in recreational fishing surveys, especially in panel surveys, as a way for anglers to submit information.

[2] There is no scientific reason that a state should not continue to allow certain groups (e.g., seniors) to fish for free, as long as everyone is required to register in the universal sampling frame or have a state saltwater license.

Statistical Estimation Issues Conclusions

- The designs, sampling strategies, and collection methods of recreational fishing surveys do not provide adequate data for management and policy decisions. Unknown biases in the estimators from these surveys arise from reliance on unverified assumptions. Unless these assumptions are tested and the degree and direction of bias reliably estimated, the extent to which the biases affect final estimates will remain unknown.
- The statistical properties associated with data collected through different survey techniques differ and often are unknown. The current estimators of error associated with various survey products are likely to be biased and too low. It is necessary, at a minimum, to determine how those differences affect survey results that use differing methods.

  Current analysis procedures used in the MRFSS do not exploit the current knowledge of finite population sampling theory. The current estimates are particularly deficient when applied to small areas because they do not use information in adjoining areas or time periods, nor do they consider relationships between species that occur together. Therefore, they are of lower precision than would be possible if this information were used. Improvements in these estimates would be of great use to managers who need to make quick decisions concerning spatial areas that are smaller than typical in the early years of the MRFSS.

Statistical Estimation Issues Recommendations

- The statistical properties of various sampling, data-collection, and data-analysis methods should be determined. Assumptions should be examined and verified so that biases can be properly evaluated.
- A research group of statisticians should design new analyses based on current developments in sampling theory. These examinations should include experimentation, such as specific sampling of activities like nighttime fishing or fishing from private property, whose current underrepresentation in the MRFSS sampling has the potential to create bias.

Human Dimensions Conclusions

- The MRFSS was not designed with human dimensions data (i.e., collection of social, behavioral, attitudinal, and economic data) in mind. The qualities of social, economic, and other human dimensions data have been compromised for many of the same reasons that the biological data have been compromised, including such issues as those related to coastal populations, telephone surveys, and sampling protocol. The human dimensions data have been further compromised by simply being added onto the biological data collection efforts that have different sampling requirements and survey design needs. Current surveys are largely focused on biological factors (e.g., numbers, sizes, and species of fish landed) and not on human dimensions factors. The statistical and sampling problems associated with social, behavioral, attitudinal, and economic data often can be considerably different from those associated with biological factors.

If the number of marine fishing trips increases, it is likely that additional fishing access sites will be developed. In addition, social and environmental changes (e.g., changes in the distribution and numbers of people, a major hurricane) also can affect the availability and use of access sites. To ensure adequate coverage of the recreational fishery, a periodic updating of lists and descriptions of fishing locations and access sites is needed.

Human Dimensions Recommendations

- An independent national trip and expenditure survey should be developed to support economic valuation studies, impact analyses, and other social and attitudinal studies. The sampling and survey procedures of the independent survey should be designed for the purpose of social and economic, not biological, analyses.
- Add-on surveys for human dimensions should be continued but in a more focused way than currently is done to target specific management needs and to supplement the national data as needed.
- The national database on marine recreational fishing sites and their characteristics should be enhanced to support social, economic, and other human dimensions analyses. Sites should be defined at levels as fine as possible. The data set should include site characteristics that matter to anglers in making fishing choices, such as boat ramps, facilities, natural amenities, parking, size, and type (e.g., beach, pier, launch point). To account for changes in the number and patterns of trips and the changing characteristics of sites, a periodic updating of the data should be conducted.

Program Management and Support Conclusions

- A large number of complex technical issues associated with surveys of marine recreational fishing remain unsolved, and a significant investment in intellectual and technical expertise is needed.
- A greater degree of coordination between federal, state, and other survey programs is necessary to achieve the national perspective on marine recreational fisheries that is needed.
- The recommended changes to the design and operation of the MRFSS and its continued development and operation will require additional funding above current levels.

Program Management and Support Recommendations

- A permanent and independent research group should be established and funded to continuously evaluate the statistical design and adequacy of recreational fishery surveys and to guide necessary modifications or new initiatives. Human dimensions expertise should be included as well.
- Additional funding is needed for a survey office devoted to the management and

implementation of marine recreational surveys, including coordination between surveys conducted in various state and federal agencies.

Communication and Outreach Conclusions

- It is difficult for individual anglers to see the effects of recreational fishing on their target species and to distinguish daily and seasonal fluctuations from trends. As a result, no matter how well designed and implemented a marine recreational survey is, it will not fully succeed without the cooperation of anglers. Unless anglers believe that the survey is well designed and implemented and that it is being used intelligently to address appropriate management issues, they are unlikely to participate.
- In particular, anglers need to have a basic understanding of the relationship between a statistically based sampling scheme and the frequency with which each of them is (or is not) contacted by a data collector.
- If anglers believe that their input is influencing the design and use of surveys, they are more likely to be satisfied with those surveys than otherwise.
- If anglers understand the basic purposes and decisions to which recreational fishing survey data are being applied and how those data are interpreted and used, they are more likely to feel confident that the approaches used are legitimate and are more likely to participate willingly and provide valid information.

Communication and Outreach Recommendations

- Outreach and communication should be improved in several ways. The MRFSS managers should advise anglers and data users on the constraints that apply to the use of the data for various purposes. Managers and anglers also should be informed clearly about any limitations of the data.
- Outreach and communication should be institutionalized as part of an ongoing MRFSS program so their importance is acknowledged and appropriate expertise can be developed.
- Angler associations should be engaged as partners with survey managers through workshops, data collection, survey design, and participation in survey advisory groups. Many NRC and other reports stress the importance of using local and traditional knowledge, capacity building, and local communities in knowledge-gathering and dissemination activities. These recommendations apply, as well, to the recreational fishing community.

Appendix C

Table of National Research Council (2006) Recommendations

TABLE C-1. 2006 National Research Council recommendations and Ranking of NMFS responses. The first column is a list of recommendations from the 2006 NAS review, second column lists the primary chapter(s) in this report that discuss the matters raised in those recommendations (recognizing that some topics are discussed in multiple chapters), and the third column is a list of this committee's general evaluations of MRIP's responses to the 2006 report. Five "+"s indicates that the response has been comprehensive and has addressed the major components of the recommendation. Between two and four "+"s indicates some progress but NMFS had not fully addressed the recommendation. This may include consideration of difficult technical issues not yet solved, as well as partial or incomplete responses from MRIP. A single "+" means that there has not been substantial progress for various reasons. In circumstances where technological advances, new approaches, or new information have decreased the applicability or relevance of the 2006 recommendation, "N/A" is used.

2006 Recommendations	Relevant Chapter(s) in Current Report	Ranking
GENERAL		
1. The MRFSS (as well as many of its component or companion surveys conducted either indirectly or independently) should be completely re-designed to improve the effectiveness and appropriateness of sampling and estimation procedures, applicability to various kinds of management decisions, and usefulness for social and economic analyses. After the revision is complete, provision should be made for ongoing technical evaluation and modification as needed to meet emerging management needs. To improve the MRFSS, the committee further recommends that the existing MRFSS program be given a firm deadline linked to sufficient program funding for implementation of this report's recommendations.	All chapters, especially 3-8.	+++++
2. A much greater degree of standardization among state surveys, and between state surveys and the central MRFSS, should be achieved. This will require a much greater degree of cooperation and coordination among the managers of the various surveys.	Chapters 5,6	++++
3. The for-hire sector of marine recreational fisheries should be considered a commercial sector and survey methods and reporting requirements for that sector should therefore be different from those for private anglers.	Chapter 4	+
4. A comprehensive, universal sampling frame with national coverage should be established. The most effective way to achieve this is through a national registration of all saltwater anglers or through new or existing state saltwater license programs that would allow no exemptions and that provide appropriate contact information from anglers fishing in all marine waters, both state and federal. Any gaps in such a program (for example, a lack of registration in a particular region or mode, exemptions of various classes of anglers, and so on) would compromise the use of the	Chapters 2, 3	+++

sampling frame and hence the quality of the survey program. An updated, complete registration list would greatly improve sampling efficiency in terms of time and cost. Although these savings might not cover the entire cost of maintaining such a database, the benefit from the increased quantity and quality of the data would be worth the extra cost, especially if there is an associated increase in public confidence in the final estimates.		
5. Future telephone surveys should be based on the above universal sampling frame.	Chapter 3	+++++
6. Charter, party, and other for-hire recreational fishing operations should be required to maintain logbooks of fish landed and kept as well as fish caught and released. Providing the information should be mandatory for continued operation in this sector, and all the information should be verifiable and made available to the survey program in a timely manner.	Chapters 4, 5	+
7. Additional studies are needed to understand the extent to which fish are kept and inspected as well as the extent of catch not available for inspection to improve the accuracy of catch estimates.	Chapter 4	++
8. Panel surveys, which contact individual anglers repeatedly through time, should be considered in recreational fishing surveys to gather angler trend data and to improve the efficiency of data collection.	Chapter 3	+
9. The onsite sampling frame for the MRFSS should be re-designed. The estimation procedure depends critically on the assumption that catch rate does not vary according to the nature of the access point. In particular, small or private access points that most likely are missed might have different catch rates than larger access points, which would lead to bias in the resulting estimators. In addition, the sampling process requires greater quality control (less latitude on the part of the samplers) than it has at present. See the recommendation below for the establishment of an independent research group to investigate matters such as these.	Chapters 2, 4	++++
10. Dual-frame procedures should be used wherever possible to reduce sample bias. For example, if a state has an incomplete list frame based on licenses, the use of a different sampling frame of the state's residents (e.g., random telephone dialing) would reduce the bias. The existence of a universal frame described above would make this approach unnecessary for offsite sampling.	Chapters 2, 3, 5	++++
11. Internet surveys should be considered for their potential use in recreational fishing surveys, especially in panel surveys as a way for anglers to submit information.	Chapters 3, 4	++

Table C-1 (continued)

2006 Recommendations	Relevant Chapter(s) in Current Report	Ranking
STATISTICAL ESTIMATION ISSUES		
12. The statistical properties of various sampling, data-collection, and data-analysis methods should be determined. Assumptions should be examined and verified so that biases can be properly evaluated.	Chapters 2-5	++++
13. A research group of statisticians should design new analyses based on current developments in sampling theory. These examinations should include experimentation, such as specific sampling of activities like nighttime fishing or fishing from private property, whose current under-representation in the MRFSS sampling has the potential to create bias.	Chapters 3, 5	++++
HUMAN DIMENSIONS		
14. An independent national trip and expenditure survey should be developed to support economic valuation studies, impact analyses, and other social and attitudinal studies. The sampling and survey procedures of the independent survey should be designed for the purpose of social and economic, not biological, analyses.	Chapter 6	N/A
15. Add-on surveys for human dimensions should be continued, but in a more focused way than is done currently to target specific management needs and to supplement the national data as needed.	Chapters 3, 4	N/A
16. The national database on marine recreational fishing sites and their characteristics should be enhanced to support social, economic, and other human dimensions analysis. Sites should be defined at levels as fine as possible. The data set should include site characteristics that matter to anglers in making fishing choices, such as boat ramps, facilities, natural amenities, parking, size and type (beach, pier, launch point, and so forth). To account for changes in the number and patterns of trips and the changing characteristics of sites, a periodic updating of the data should be conducted.	Chapters 3, 4	+++++
PROGRAM MANAGEMENT AND SUPPORT		
17. A permanent and independent research group should be established and funded to continuously evaluate the statistical design and adequacy of recreational fishery surveys and to guide necessary	Chapter 5	++++

modifications or new initiatives. Human dimensions expertise should be included as well.		
18. Additional funding is needed for a survey office devoted to the management and implementation of marine recreational surveys, including coordination between surveys conducted in various state and federal agencies.	Chapters 5, 6	++++
COMMUNICATION AND OUTREACH		
19. Outreach and communication should be improved in several ways. The MRFSS managers should advise anglers and data users on the constraints that apply to the use of the data for various purposes. Managers and anglers also should be informed clearly about any limitations of the data.	Chapter 7	++
20. Outreach and communication should be institutionalized as part of an ongoing program, so that their importance is acknowledged and appropriate expertise can be developed.	Chapter 7	++
21. Angler associations should be engaged as partners with survey managers through workshops, data collection, survey design, and participation in survey advisory groups. Many NRC and other reports stress the importance of making use of local and traditional knowledge, capacity building, and involving local communities in knowledge-gathering and dissemination activities. Those recommendations apply, as well, to the recreational fishing community.	Chapter 7	+

Appendix D

Excerpt from Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006

TITLE II--INFORMATION AND RESEARCH

SEC. 201. RECREATIONAL FISHERIES INFORMATION.

Section 401 (16 U.S.C. 1881) is amended by striking subsection (g) and inserting the following:

(g) Recreational Fisheries-

(1) FEDERAL PROGRAM- The Secretary shall establish and implement a regionally based registry program for recreational fishermen in each of the 8 fishery management regions. The program, which shall not require a fee before January 1, 2011, shall provide for--

(A) the registration (including identification and contact information) of individuals who engage in recreational fishing--

(i) in the Exclusive Economic Zone;

(ii) for anadromous species; or

(iii) for Continental Shelf fishery resources beyond the Exclusive Economic Zone; and

(B) if appropriate, the registration (including the ownership, operator, and identification of the vessel) of vessels used in such fishing.

(2) STATE PROGRAMS- The Secretary shall exempt from registration under the program recreational fishermen and charter fishing vessels licensed, permitted, or registered under the laws of a State if the Secretary determines that information from the State program is suitable for the Secretary's use or is used to assist in completing marine recreational fisheries statistical surveys, or evaluating the effects of proposed conservation and management measures for marine recreational fisheries.

(3) Data collection-

(A) IMPROVEMENT OF THE MARINE RECREATIONAL FISHERY STATISTICS SURVEY- Within 24 months after the date of enactment of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, the Secretary, in consultation with representatives of the recreational fishing industry and experts in statistics, technology, and other appropriate fields, shall establish a program to improve the quality and accuracy of information generated by

the Marine Recreational Fishery Statistics Survey, with a goal of achieving acceptable accuracy and utility for each individual fishery.

(B) NRC REPORT RECOMMENDATIONS- The program shall take into consideration and, to the maximum extent feasible, implement the recommendations of the National Research Council in its report Review of Recreational Fisheries Survey Methods (2006), including--

(i) redesigning the Survey to improve the effectiveness and appropriateness of sampling and estimation procedures, its applicability to various kinds of management decisions, and its usefulness for social and economic analyses; and

(ii) providing for ongoing technical evaluation and modification as needed to meet emerging management needs.

(C) METHODOLOGY- Unless the Secretary determines that alternate methods will achieve this goal more efficiently and effectively, the program shall, to the extent possible, include--

(i) an adequate number of dockside interviews to accurately estimate recreational catch and effort;

(ii) use of surveys that target anglers registered or licensed at the State or Federal level to collect participation and effort data;

(iii) collection and analysis of vessel trip report data from charter fishing vessels; and

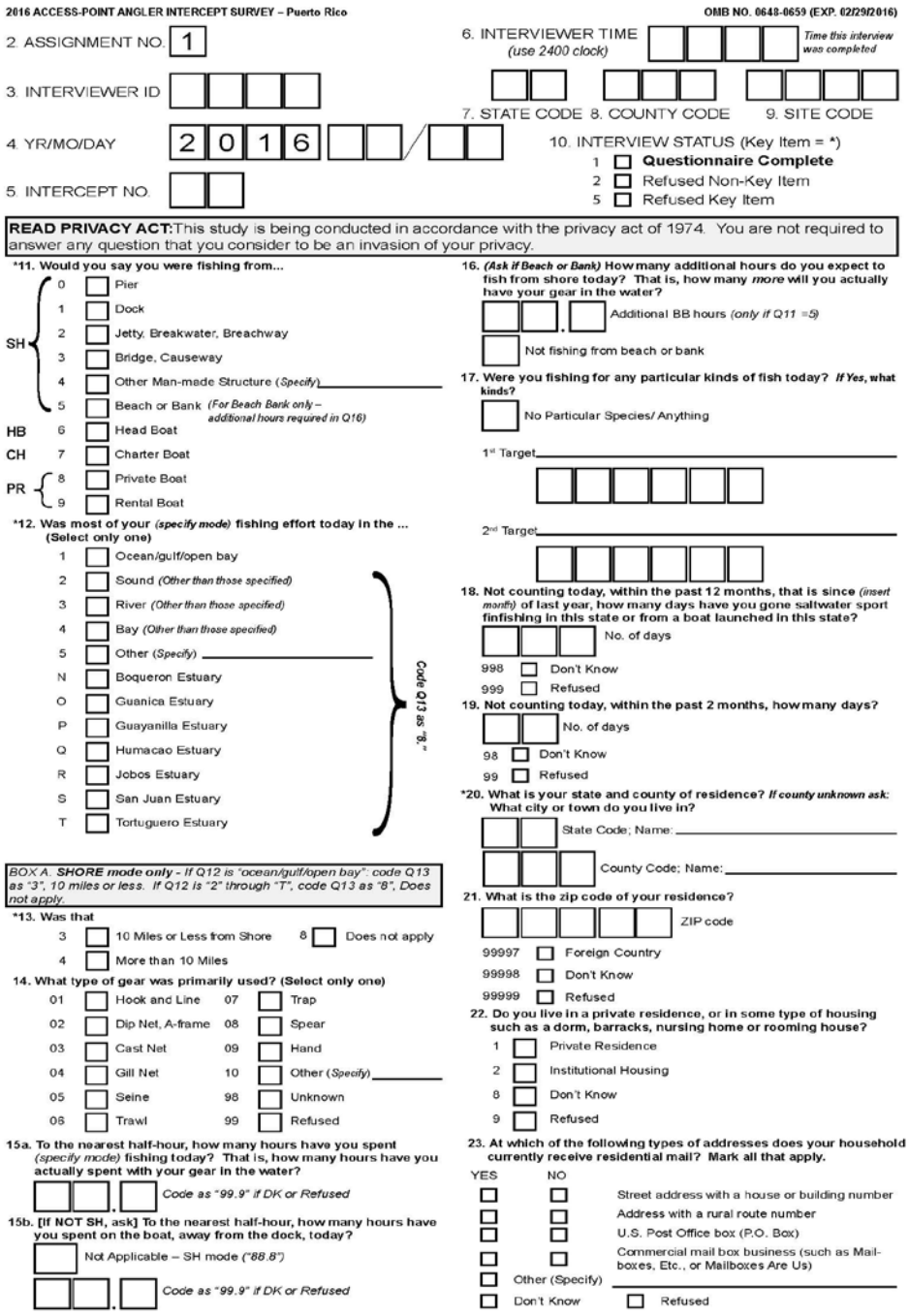
(iv) development of a weather corrective factor that can be applied to recreational catch and effort estimates.

(D) DEADLINE- The Secretary shall complete the program under this paragraph and implement the improved Marine Recreational Fishery Statistics Survey not later than January 1, 2011.

(4) REPORT- Within 24 months after establishment of the program, the Secretary shall submit a report to Congress that describes the progress made toward achieving the goals and objectives of the program.

Appendix E
Survey Instruments

Puerto Rico



2016 ACCESS-POINT ANGLER INTERCEPT SURVEY – Puerto Rico

OMB NO. 0648-0659 (EXP. 02/29/2016)

2. ASSIGNMENT NO. 1

3. INTERVIEWER ID

4. YR/MO/DAY 2016 / /

5. INTERCEPT NO.

6. INTERVIEWER TIME (use 2400 clock) — Time this interview was completed

7. STATE CODE 8. COUNTY CODE 9. SITE CODE

10. INTERVIEW STATUS (Key Item = *)
1 Questionnaire Complete
2 Refused Non-Key Item
5 Refused Key Item

READ PRIVACY ACT: This study is being conducted in accordance with the privacy act of 1974. You are not required to answer any question that you consider to be an invasion of your privacy.

*11. Would you say you were fishing from...
SH 0 Pier; 1 Dock; 2 Jetty, Breakwater, Breachway; 3 Bridge, Causeway; 4 Other Man-made Structure (Specify) ____; 5 Beach or Bank (For Beach Bank only – additional hours required in Q16)
HB 6 Head Boat
CH 7 Charter Boat
PR 8 Private Boat; 9 Rental Boat

*12. Was most of your (specify mode) fishing effort today in the ... (Select only one)
1 Ocean/gulf/open bay
2 Sound (Other than those specified)
3 River (Other than those specified)
4 Bay (Other than those specified)
5 Other (Specify) ____
N Boqueron Estuary
O Guanica Estuary
P Guayanilla Estuary
Q Humacao Estuary
R Jobos Estuary
S San Juan Estuary
T Tortuguero Estuary
Code Q13 as "8."

BOX A. **SHORE mode only** - If Q12 is "ocean/gulf/open bay": code Q13 as "3", 10 miles or less. If Q12 is "2" through "T", code Q13 as "8", Does not apply.

*13. Was that
3 10 Miles or Less from Shore; 8 Does not apply
4 More than 10 Miles

14. What type of gear was primarily used? (Select only one)
01 Hook and Line; 02 Dip Net, A-frame; 03 Cast Net; 04 Gill Net; 05 Seine; 06 Trawl
07 Trap; 08 Spear; 09 Hand; 10 Other (Specify) ____; 98 Unknown; 99 Refused

15a. To the nearest half-hour, how many hours have you spent (specify mode) fishing today? That is, how many hours have you actually spent with your gear in the water?
. Code as "99.9" if DK or Refused

15b. [If NOT SH, ask] To the nearest half-hour, how many hours have you spent on the boat, away from the dock, today?
Not Applicable – SH mode ("88.8")
. Code as "99.9" if DK or Refused

16. (Ask if Beach or Bank) How many additional hours do you expect to fish from shore today? That is, how many more will you actually have your gear in the water?
. Additional BB hours (only if Q11 =5)
Not fishing from beach or bank

17. Were you fishing for any particular kinds of fish today? If Yes, what kinds?
No Particular Species/ Anything
1st Target ____
2nd Target ____

18. Not counting today, within the past 12 months, that is since (insert month) of last year, how many days have you gone saltwater sport finfishing in this state or from a boat launched in this state?
No. of days
998 Don't Know
999 Refused

19. Not counting today, within the past 2 months, how many days?
No. of days
98 Don't Know
99 Refused

*20. What is your state and county of residence? If county unknown ask: What city or town do you live in?
State Code; Name: ____
County Code; Name: ____

21. What is the zip code of your residence?
ZIP code
99997 Foreign Country
99998 Don't Know
99999 Refused

22. Do you live in a private residence, or in some type of housing such as a dorm, barracks, nursing home or rooming house?
1 Private Residence
2 Institutional Housing
8 Don't Know
9 Refused

23. At which of the following types of addresses does your household currently receive residential mail? Mark all that apply.

YES	NO	
☐	☐	Street address with a house or building number
☐	☐	Address with a rural route number
☐	☐	U.S. Post Office box (P.O. Box)
☐	☐	Commercial mail box business (such as Mail-boxes, Etc., or Mailboxes Are Us)
☐		Other (Specify) ____
☐		Don't Know ☐ Refused

24. In the event that my supervisor wishes to verify that I have been conducting interviews here today, may I have your name and a phone number?

Angler Name _____

D or N PHONE # ☐☐☐ – ☐☐☐ – ☐☐☐☐

(If name and/or phone number not given, Q10 = Status 2)
☐ Name and/or phone number not given
☐ Angler aged 16 years or younger (*Check both boxes*)

*25. UNAVAILABLE CATCH Did you catch any fish that are not here for me to look at? For example, any that you may have thrown back or used for bait? NOT GROUP CATCH - Only catch from Angler being interviewed.

Disposition Codes for Q25		
1 Thrown back alive	4 Used/plan to use for bait	6 Thrown back dead/plan to throw away
3 Eaten/plan to eat	5 Sold/plan to sell	7 Some other purpose

TYPE 2 RECORDS: *(CATCH UNAVAILABLE IN WHOLE FORM; FILLETS ARE UNAVAILABLE CATCH.)*

	Species Name	Species Code						# of Fish			Disp.
1.											
2.											
3.											
4.											
5.											
6.											
7.											

*26. Did you catch any fish while you were fishing that I might be able to look at?
1 ☐ Yes
2 ☐ No - *Code Q27, Q28, Q29 as " Not Applicable"*
3 ☐ Yes, BUT fish on another angler's form – *Fill in interview # where fish are listed* ☐☐ *Code Q27, Q28, Q29 as "Not Applicable"*

*27. Did you catch these yourself or did someone else catch some of them?
1 ☐ All Caught by Angler - *Code Q28, Q29 as "Not Applicable"*
2 ☐ *Other Contributors* 8 ☐ Not Applicable

*28. Can you separate out your individual catch?
1 ☐ Yes – *Code 29 as "Not Applicable"*
2 ☐ No 8 ☐ Not Applicable

*29. How many anglers including yourself have their catch here? Please do not include anyone who did not catch fish. Only count those who have their catch here.
☐☐ No. of Contributors 88 ☐ Not Applicable

BOX C. If Q11 is SH mode, code Q30 as "888, " and Code Box D as "8."

*30. How many people fished on your boat today?
☐☐☐ No. of People 888 ☐ Shore Mode

**BOX D. If response to Q30 is 1, code as "Not Applicable." Otherwise, is this the first angler from this boat that I have interviewed?*
1 ☐ Yes 8 ☐ Not Applicable
2 ☐ No – *Record interview # of 1st angler in the fishing party.* ☐☐

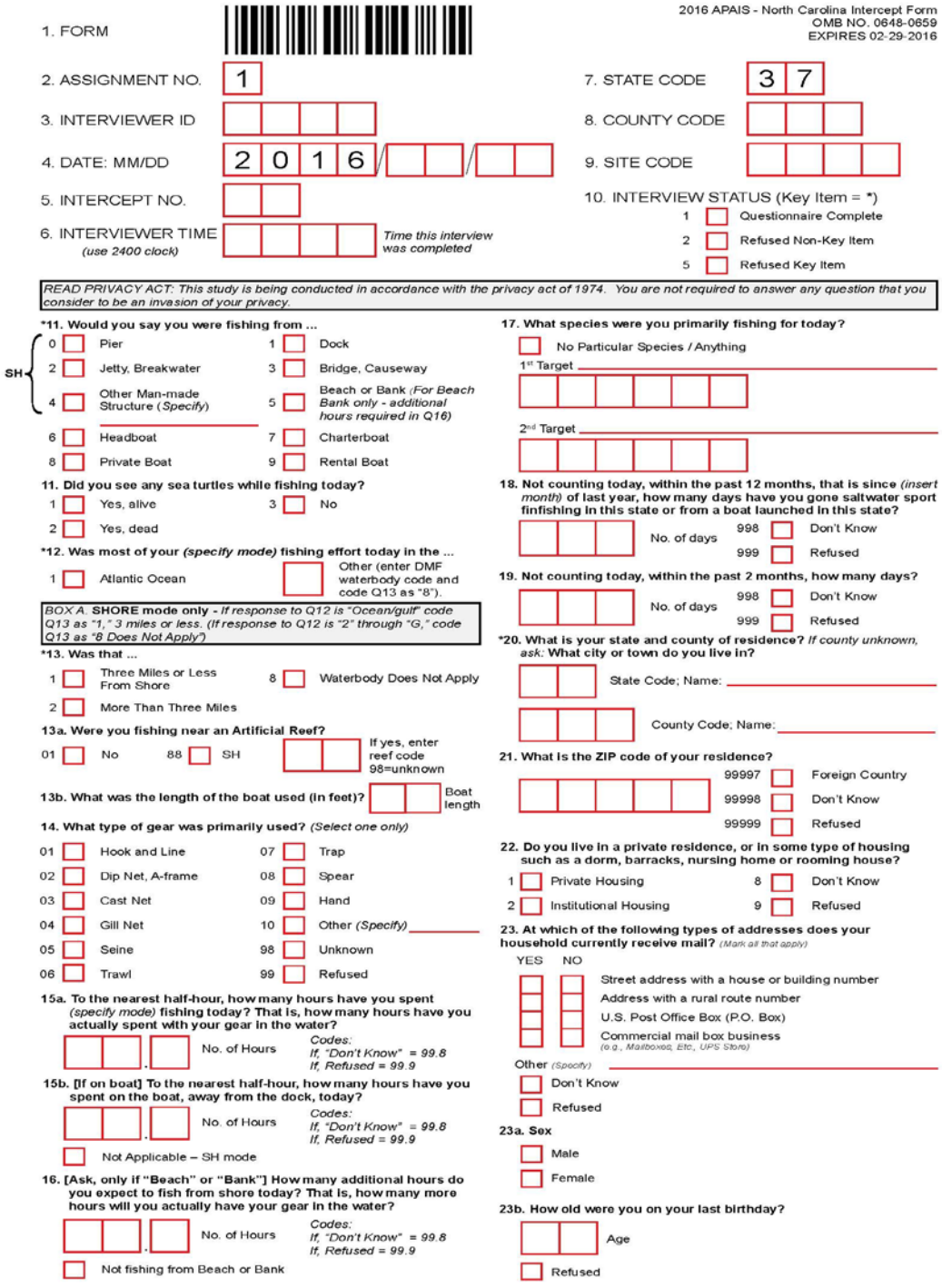
*31. AVAILABLE CATCH – ASK: May I look at your fish? What do you plan to do with the MAJORITY of the (species)?

Disposition Codes for Q31		
3 Eaten/ plan to eat	5 Sold / Plan to sell	7 Some other purpose
4 Used/plan to use for bait	6 Thrown back dead / Plan to throw away	

TYPE 3 RECORDS: *(INDIVIDUAL CATCH AVAILABLE IN WHOLE FORM)*

	Species Name	Species Code						# of Fish			Length (mm)				Weight			(kg)		Disp.
1.																				
2.																				
3.																				
4.																				
5.																				
6.																				
7.																				
8.																				
9.																				
10.																				
11.																				
12.																				
13.																				
14.																				
15.																				

North Carolina



2016 APAIS - North Carolina Intercept Form
OMB NO. 0648-0659
EXPIRES 02-29-2016

1. FORM
2. ASSIGNMENT NO. 1
3. INTERVIEWER ID
4. DATE: MM/DD 2016 / /
5. INTERCEPT NO.
6. INTERVIEWER TIME (use 2400 clock) — Time this interview was completed
7. STATE CODE 37
8. COUNTY CODE
9. SITE CODE
10. INTERVIEW STATUS (Key Item = *)
1 Questionnaire Complete
2 Refused Non-Key Item
5 Refused Key Item

READ PRIVACY ACT: This study is being conducted in accordance with the privacy act of 1974. You are not required to answer any question that you consider to be an invasion of your privacy.

*11. Would you say you were fishing from ...
SH
0 Pier
1 Dock
2 Jetty, Breakwater
3 Bridge, Causeway
4 Other Man-made Structure (Specify)
5 Beach or Bank (For Beach Bank only - additional hours required in Q16)
6 Headboat
7 Charterboat
8 Private Boat
9 Rental Boat

11. Did you see any sea turtles while fishing today?
1 Yes, alive
2 Yes, dead
3 No

*12. Was most of your (specify mode) fishing effort today in the ...
1 Atlantic Ocean
Other (enter DMF waterbody code and code Q13 as "8").

BOX A. SHORE mode only - If response to Q12 is "Ocean/gulf" code Q13 as "1," 3 miles or less. (If response to Q12 is "2" through "G," code Q13 as "8 Does Not Apply")

*13. Was that ...
1 Three Miles or Less From Shore
2 More Than Three Miles
8 Waterbody Does Not Apply

13a. Were you fishing near an Artificial Reef?
01 No
88 SH
If yes, enter reef code 98=unknown

13b. What was the length of the boat used (in feet)? Boat length

14. What type of gear was primarily used? (Select one only)
01 Hook and Line
02 Dip Net, A-frame
03 Cast Net
04 Gill Net
05 Seine
06 Trawl
07 Trap
08 Spear
09 Hand
10 Other (Specify)
98 Unknown
99 Refused

15a. To the nearest half-hour, how many hours have you spent (specify mode) fishing today? That is, how many hours have you actually spent with your gear in the water?
No. of Hours
Codes: If, "Don't Know" = 99.8 If, Refused = 99.9

15b. [If on boat] To the nearest half-hour, how many hours have you spent on the boat, away from the dock, today?
No. of Hours
Codes: If, "Don't Know" = 99.8 If, Refused = 99.9
Not Applicable – SH mode

16. [Ask, only if "Beach" or "Bank"] How many additional hours do you expect to fish from shore today? That is, how many more hours will you actually have your gear in the water?
No. of Hours
Codes: If, "Don't Know" = 99.8 If, Refused = 99.9
Not fishing from Beach or Bank

17. What species were you primarily fishing for today?
No Particular Species / Anything
1st Target
2nd Target

18. Not counting today, within the past 12 months, that is since (insert month) of last year, how many days have you gone saltwater sport finfishing in this state or from a boat launched in this state?
No. of days
998 Don't Know
999 Refused

19. Not counting today, within the past 2 months, how many days?
No. of days
998 Don't Know
999 Refused

*20. What is your state and county of residence? If county unknown, ask: What city or town do you live in?
State Code; Name:
County Code; Name:

21. What is the ZIP code of your residence?
99997 Foreign Country
99998 Don't Know
99999 Refused

22. Do you live in a private residence, or in some type of housing such as a dorm, barracks, nursing home or rooming house?
1 Private Housing
2 Institutional Housing
8 Don't Know
9 Refused

23. At which of the following types of addresses does your household currently receive mail? (Mark all that apply)
YES NO
Street address with a house or building number
Address with a rural route number
U.S. Post Office Box (P.O. Box)
Commercial mail box business (e.g., Mailboxes, Etc., UPS Store)
Other (Specify)
Don't Know
Refused

23a. Sex
Male
Female

23b. How old were you on your last birthday?
Age
Refused

24. In the event that my supervisor wishes to verify that I have been conducting interviews here today, may I please have your name and phone number?

Angler Name _____

D or N
PHONE # ☐☐☐ ☐☐☐ ☐☐☐☐

(If name and/or phone number not given, Q10 = Status 2)
☐ Name and/or phone number not given
☐ Angler aged 16 years or younger *(Check both boxes)*

BOX B. [If headboat ride-along:] Is this one of the anglers you monitored for discard (Type 9) catch? ☐ Yes ☐ No ☐ Not a HB ride

***25. UNAVAILABLE CATCH Did you catch any fish that are not here for me to look at? For example, any that you may have thrown back or used for bait? NOT GROUP CATCH - Only catch from Angler being interviewed.**

Disposition Codes for Q25

1 - Thrown back alive	3 - Eaten/plan to eat	5 - Sold/plan to sell	7 - Some other purpose
2 - Thrown back - not legal	4 - Used/plan to use for bait	6 - Thrown back dead/plan to throw away	

TYPE 2 RECORDS: ***(CATCH UNAVAILABLE IN WHOLE FORM; FILLETS ARE UNAVAILABLE CATCH.)***

	Species Name	Species Code	# of Fish	Disp.
1.				
2.				
3.				
4.				
5.				

***26. Did you catch any fish while you were fishing that I might be able to look at?**
1 ☐ Yes
2 ☐ No - *Code Q27, Q28, Q29 as " Not Applicable"*
3 ☐ Yes, BUT fish on another angler's form – *Fill in interview # where fish are listed* ☐☐ *Code Q27, Q28, Q29 as "Not Applicable"*

***27. Did you catch these yourself or did someone else catch some of them?**
1 ☐ All Caught by Angler - *Code Q28, Q29 as "Not Applicable"*
2 ☐ *Other Contributors* 8 ☐ Not Applicable

***28. Can you separate out your individual catch?**
1 ☐ Yes – *Code 29 as "Not Applicable"*
2 ☐ No 8 ☐ Not Applicable

***29. How many anglers including yourself have their catch here? Please do not include anyone who did not catch fish. Only count those who have their catch here.**
☐☐ No. of Contributors 88 ☐ Not Applicable

BOX C. If Q11 is SH mode, code Q30 as "888, " and Code Box D as "8."

***30. How many people fished on your boat today?**
☐☐☐ No. of People 888 ☐ Shore Mode

BOX D.** ***If response to Q30 is 1, code as "Not Applicable." Otherwise, is this the first angler from this boat that I have interviewed?
1 ☐ Yes 8 ☐ Not Applicable
2 ☐☐ No – *Record interview # of 1st angler in the fishing party.*

***BOX E: IS THIS VESSEL ON LIST? YES / NO** ***NAME OF VESSEL:** _____

☐ **Check box if vessel has no name AND record Registration Number to determine "on list" status. If "on list" cannot be confirmed, Q10 = Status 5.** ***(Note: BOX E must be completed for ALL charter and head boat interviews, regardless of mode of assignment).***

***31. AVAILABLE CATCH – ASK: May I look at your fish? What do you plan to do with the MAJORITY of the (species)?**

Disposition Codes for Q31

3 - Eaten/plan to eat	6 - Plan to throw away
4 - Used/plan to use for bait	7 - Some other purpose
5 - Sold/plan to sell	

NOTES/COMMENTS:

TYPE 3 RECORDS: ***(INDIVIDUAL CATCH AVAILABLE IN WHOLE FORM)***

	Species Name	Species Code	# of Fish	Length (mm)	Weight (kg)	Disp.
1.					.	
2.					.	
3.					.	
4.					.	
5.					.	
6.					.	
7.					.	
8.					.	
9.					.	
10.					.	
11.					.	
12.					.	
13.					.	
14.					.	
15.					.	

Gulf of Mexico

2016 MRIP INTERCEPT SURVEY — **OMB NO. 0648-0659 (EXP. 02/29/16)**

2. ASSIGNMENT NO. ☐ Write 1 or 2

6. INTERVIEW TIME (use 2400 clock) ☐☐☐☐ Time the interview was completed

3. INTERVIEWER ID. ☐☐☐☐

4. YR/MO/DAY ☐☐ ☐☐ ☐☐

7. STATE CODE ☐☐ 8. COUNTY CODE ☐☐☐ 9. SITE CODE ☐☐☐☐

5. INTERCEPT NO. ☐☐☐

10. INTERVIEW STATUS (Key Item = *)
1 ☐ Questionnaire Complete
2 ☐ Refused Non-Key Item
5 ☐ Refused Key Item

READ PRIVACY ACT. This study is being conducted in accordance with the privacy act of 1974. You are not required to answer any question that you consider to be an invasion of your privacy.

***11. Would you say you were fishing from.....**

1 ☐ Pier, Dock
2 ☐ Jetty, Breakwater, Breachway
SH 3 ☐ Bridge, Causeway
4 ☐ Other Man-made Structure (Specify)_____
5 ☐ Beach or Bank
PC 6 ☐ Headboat
7 ☐ Charterboat
REFER TO Q. 11a
PR 8 ☐ Private or Rental Boat

Vessel ID

***11a. Is vessel on Good List** 1 ☐ YES 2 ☐ NO ☐☐☐☐☐☐☐☐

***12. Was most of your (specify mode) fishing effort today in the.....**

1 ☐ Ocean/gulf/open bay
2 ☐ A sound *(Other than those specified)*
3 ☐ River *(Other than those specified)*
4 ☐ Bay *(Other than those specified)*
5 ☐ Other *(Specify)*_____
G ☐ Abermarle/Pamilco Estuary
H ☐ Biscayne Estuary
I ☐ Whitewater Estuary
J ☐ Sarasota Estuary
K ☐ Tampa Estuary
L ☐ Mobile Estuary
M ☐ Atchafalaya Estuary

Code q.13='8'

BOX A. Refer to q. 12. If response is NOT "1" code q. 13 as "8", Not applicable

***13. Was that** *West Florida Only*

1 ☐ 3 Miles or less from shore
2 ☐ More than 3 Miles
3 ☐ 10 Miles or less from shore
4 ☐ More than 10 miles
8 ☐ Not Applicable

14. What type of gear was primarily used?

01 ☐ Hook and Line
02 ☐ Dip Net, A-frame
03 ☐ Cast Net
04 ☐ Gill Net
05 ☐ Seine
06 ☐ Trawl
07 ☐ Trap
08 ☐ Spear
09 ☐ Hand
10 ☐ Other (Specify)_____
98 ☐ Unknown
99 ☐ Refused

15. To the nearest half-hour, how many hours have you spent (specify mode) fishing today? That is, how many hours have you actually spent with your gear in the water?

☐☐ . ☐ No. of hours

16. How many additional hours do you expect to fish from shore today? That is, how many more hours will you actually have your gear in the water?

☐☐ . ☐ Additional BB Hours

17. Were you fishing for any particular kinds of fish today? *If Yes,* **what kinds?**

☐ No Particular Species/Anything

1st Target _____ ☐☐☐☐☐☐

2nd Target _____ ☐☐☐☐☐☐

18. Not counting today, within the past 12 months, that is since (insert month) of last year, how many days have you gone saltwater sport finfishing in this state or from a boat launched in this state?

☐☐☐ No. of Days
998 ☐ Don't know
999 ☐ Refused

19. Not counting today, within the past 2 months, how many days?

☐☐ No. of Days
98 ☐ Don't Know
99 ☐ Refused

20. What is your state and county of residence?** ***If county unknown ask: **What city or town do you live in?**

☐☐ State Code; Name _____
☐☐☐ County Code; Name _____

21. What is the zip code of your residence?

☐☐☐☐☐ Zip Code
99997 ☐ Foreign Country (Skip to Q.25)
99998 ☐ Don't Know
99999 ☐ Refused

22. Do you live in a private residence, or in some type of housing such as a dorm, barracks, nursing home or rooming house?

1 ☐ Private Residence
2 ☐ Institutional Housing
8 ☐ Don't know
9 ☐ Refused

23. At which of the following types of addresses does your household currently receive residential mail? Mark all that apply.

YES	NO	
☐	☐	Street address with a house or building number
☐	☐	Address with a rural route number
☐	☐	U.S. Post Office box (P.O. Box)
☐	☐	Commerical mail box business (such as Mailboxes etc or Mailboxes Are Us)

☐ Other (Specify) _____
☐ Don't Know ☐ Refused

24. In the event that my supervisor wishes to verify that I have been conducting interviews here today, may I have your name and a phone number?

ANGLER'S NAME

☐ Name and Phone Number Not Given

☐ D OR ☐ N

PHONE # (☐☐☐) ☐☐☐ - ☐☐☐☐

***25. UNAVAILABLE CATCH. Did you land any fish that are not here for me to look at? For example, any that you may have thrown back or used for bait? IF YES, COMPLETE TYPE 2 RECORD FOR THIS INDIVIDUAL ANGLER, NOT GROUP CATCH. NOTE: FILLETS ARE UNAVAILABLE.**

DISPOSITION CODES FOR Q. 25

1 Thrown back alive/legal	3 Eaten/plan to eat	5 Sold/plan to sell	7 Other purpose
2 Thrown back alive/not legal/legality refused	4 Used for bait/plan to use for bait	6 Thrown back dead/plan to throw away	

TYPE 2 RECORDS: ***(INDIVIDUAL CATCH UNAVAILABLE IN WHOLE FORM)***

	SPECIES CODE	# OF FISH	DISP.
1.	☐☐☐☐☐☐	☐☐☐	☐
2.	☐☐☐☐☐☐	☐☐☐	☐
3.	☐☐☐☐☐☐	☐☐☐	☐
4.	☐☐☐☐☐☐	☐☐☐	☐
5.	☐☐☐☐☐☐	☐☐☐	☐

***26. Did you catch any fish while you were fishing that I might be able to look at?**

1 ☐ **Yes**

2 ☐ **No** Code q. 27, 28, 29 as "8's," Not applicable

3 ☐ **Yes, BUT fish are on another angler's form** - *Fill in interview # where fish are listed **

☐☐☐ Code q. 27, 28, 29 as "8's," Not applicable

***27. Did you catch these yourself or did someone else catch some of them?**

1 ☐ **All caught by Angler** - Code q. 28, 29, as "8's," Not applicable

2 ☐ **Other Contributors** 8 ☐ **Not applicable**

***28. Can you separate out your individual catch?**

1 ☐ **Yes** - Code q. 29 as "88"

2 ☐ **No** 8 ☐ **Not applicable**

***29. How many anglers including yourself have their catch here? Please do not include anyone who did not catch fish. Only count those anglers who have their catch here.**

☐☐ **No. of Contributors** 88 ☐ **Not applicable**

***30. How many people fished on your boat today?**

☐☐☐ **No. of People**

888 ☐ **Shore Mode**

***BOX D. If response to q. 30 is 1 angler or "88" Shore Mode, check not applicable and skip to q. 31. Otherwise, is this the first angler from this boat that I have interviewed?**

1 ☐ **Yes** 8 ☐ **Not applicable**

2 ☐ **No** - Record interview # of 1st angler in the fishing party ☐☐☐

***31. AVAILABLE CATCH. COMPLETE TYPE 3 RECORD BY ASKING: May I look at your fish? What do you plan to do with the MAJORITY of the (species)?**

DISPOSITION CODES FOR Q. 31

3	Eaten/plan to eat	5	Sold/plan to sell	7	Some other purpose
4	Used for bait/plan to use for bait	6	Thrown back dead/plan to throw away	9	Refused

	SPECIES CODE	# OF FISH	LENGTH (mm)	WEIGHT (kg)	DIS
1.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
2.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
3.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
4.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
5.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
6.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
7.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
8.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
9.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
10.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
11.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
12.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
13.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
14.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐
15.	☐☐☐☐☐☐	☐☐☐	☐☐☐☐	☐☐☐.☐☐	☐

Atlantic States

1. FORM

2016 APAIS - Atlantic Intercept Form
OMB NO. 0648-0659
EXPIRES 02-29-2016

2. ASSIGNMENT NO. 1

3. INTERVIEWER ID

4. DATE: MM/DD 2016 / / /

5. INTERCEPT NO.

6. INTERVIEWER TIME (use 2400 clock) *Time this interview was completed*

7. STATE CODE

8. COUNTY CODE

9. SITE CODE

10. INTERVIEW STATUS (Key Item = *)
1 Questionnaire Complete
2 Refused Non-Key Item
5 Refused Key Item

READ PRIVACY ACT: This study is being conducted in accordance with the privacy act of 1974. You are not required to answer any question that you consider to be an invasion of your privacy.

***11. Would you say you were fishing from ...**

SH
0 Pier
1 Dock
2 Jetty, Breakwater
3 Bridge, Causeway
4 Other Man-made Structure *(Specify)*
5 Beach or Bank *(For Beach Bank only - additional hours required in Q16)*
6 Headboat
7 Charterboat
8 Private Boat
9 Rental Boat

***12. Was most of your *(specify mode)* fishing effort today in the ...** *(Select only one)*

Q13 as 8
1 Ocean/gulf
2 Sound *(other than listed)*
3 River *(other than listed)*
4 Bay *(other than listed)*
5 Other *(Specify)*
V Cape Cod Bay
A Narragansett Estuary
B Buzzard's Bay Estuary
C Long Island Estuary
D Hudson/Raritan Estuary
E Delaware Estuary
F Chesapeake Estuary
G Albemarle/Pamlico Estuary

BOX A. **SHORE mode only -** *If response to Q12 is "Ocean/gulf" code Q13 as "1," 3 miles or less. (If response to Q12 is "2" through "G," code Q13 as "8 Does Not Apply")*

***13. Was that ...**
1 Three Miles or Less From Shore
2 More Than Three Miles
8 Waterbody Does Not Apply

14. What type of gear was primarily used? *(Select one only)*
01 Hook and Line
02 Dip Net, A-frame
03 Cast Net
04 Gill Net
05 Seine
06 Trawl
07 Trap
08 Spear
09 Hand
10 Other *(Specify)*
98 Unknown
99 Refused

15a. To the nearest half-hour, how many hours have you spent *(specify mode)* fishing today? That is, how many hours have you actually spent with your gear in the water?
No. of Hours
Codes: If, "Don't Know" = 99.8 If, Refused = 99.9

15b. [If on boat] To the nearest half-hour, how many hours have you spent on the boat, away from the dock, today?
No. of Hours
Codes: If, "Don't Know" = 99.8 If, Refused = 99.9
Not Applicable – SH mode

16. [Ask, only if "Beach" or "Bank"] How many additional hours do you expect to fish from shore today? That is, how many more hours will you actually have your gear in the water?
No. of Hours
Codes: If, "Don't Know" = 99.8 If, Refused = 99.9
Not fishing from Beach or Bank

17. What species were you primarily fishing for today?
No Particular Species / Anything
1st Target
2nd Target

18. Not counting today, within the past 12 months, that is since *(insert month)* of last year, how many days have you gone saltwater sport finfishing in this state or from a boat launched in this state?
No. of days
998 Don't Know
999 Refused

19. Not counting today, within the past 2 months, how many days?
No. of days
998 Don't Know
999 Refused

***20. What is your state and county of residence?** *If county unknown, ask:* **What city or town do you live in?**
State Code; Name:
County Code; Name:

21. What is the ZIP code of your residence?
99997 Foreign Country
99998 Don't Know
99999 Refused

22. Do you live in a private residence, or in some type of housing such as a dorm, barracks, nursing home or rooming house?
1 Private Housing
2 Institutional Housing
8 Don't Know
9 Refused

23. At which of the following types of addresses does your household currently receive mail? *(Mark all that apply)*

YES	NO	
		Street address with a house or building number
		Address with a rural route number
		U.S. Post Office Box (P.O. Box)
		Commercial mail box business (e.g., Mailboxes, Etc., UPS Store)

Other *(Specify)*
Don't Know
Refused

24. In the event that my supervisor wishes to verify that I have been conducting interviews here today, may I please have your name and phone number?

Angler Name _____

D or N PHONE # ☐☐☐ ☐☐☐ ☐☐☐☐

(If name and/or phone number not given, Q10 = Status 2)
☐ Name and/or phone number not given
☐ Angler aged 16 years or younger *(Check both boxes)*

BOX B. [If headboat ride-along:] Is this one of the anglers you monitored for discard (Type 9) catch? ☐ Yes ☐ No ☐ Not a HB ride

*25. UNAVAILABLE CATCH Did you catch any fish that are not here for me to look at? For example, any that you may have thrown back or used for bait? NOT GROUP CATCH - Only catch from Angler being interviewed.

Disposition Codes for Q25

1 - Thrown back alive	3 - Eaten/plan to eat	5 - Sold/plan to sell	7 - Some other purpose
2 - Thrown back - not legal	4 - Used/plan to use for bait	6 - Thrown back dead/plan to throw away	

TYPE 2 RECORDS: *(CATCH UNAVAILABLE IN WHOLE FORM; FILLETS ARE UNAVAILABLE CATCH.)*

	Species Name	Species Code	# of Fish	Disp.
1.				
2.				
3.				
4.				
5.				

*26. Did you catch any fish while you were fishing that I might be able to look at?
1 ☐ Yes
2 ☐ No - *Code Q27, Q28, Q29 as " Not Applicable"*
3 ☐ Yes, BUT fish on another angler's form – *Fill in interview # where fish are listed* ☐☐
Code Q27, Q28, Q29 as "Not Applicable"

*27. Did you catch these yourself or did someone else catch some of them?
1 ☐ All Caught by Angler - *Code Q28, Q29 as "Not Applicable"*
2 ☐ *Other Contributors* 8 ☐ Not Applicable

*28. Can you separate out your individual catch?
1 ☐ Yes – *Code 29 as "Not Applicable"*
2 ☐ No 8 ☐ Not Applicable

*29. How many anglers including yourself have their catch here? Please do not include anyone who did not catch fish. Only count those who have their catch here.
☐☐ No. of Contributors 88 ☐ Not Applicable

BOX C. If Q11 is SH mode, code Q30 as "888, " and Code Box D as "8."

*30. How many people fished on your boat today?
☐☐☐ No. of People 888 ☐ Shore Mode

*BOX D. If response to Q30 is 1, code as "Not Applicable." Otherwise, is this the first angler from this boat that I have interviewed?
1 ☐ Yes 8 ☐ Not Applicable
2 ☐☐ No – *Record interview # of 1st angler in the fishing party.*

*BOX E: IS THIS VESSEL ON LIST? YES / NO *NAME OF VESSEL: _____

☐ Check box if vessel has no name AND record Registration Number to determine "on list" status. If "on list" cannot be confirmed, Q10 = Status 5. *(Note: BOX E must be completed for ALL charter and head boat interviews, regardless of mode of assignment).*

*31. AVAILABLE CATCH – ASK: May I look at your fish? What do you plan to do with the MAJORITY of the (species)?

Disposition Codes for Q31

3 - Eaten/plan to eat	6 - Plan to throw away
4 - Used/plan to use for bait	7 - Some other purpose
5 - Sold/plan to sell	

NOTES/COMMENTS:

TYPE 3 RECORDS: *(INDIVIDUAL CATCH AVAILABLE IN WHOLE FORM)*

	Species Name	Species Code	# of Fish	Length (mm)	Weight (kg)	Disp.
1.					.	
2.					.	
3.					.	
4.					.	
5.					.	
6.					.	
7.					.	
8.					.	
9.					.	
10.					.	
11.					.	
12.					.	
13.					.	
14.					.	
15.					.	

Appendix F
2014 Calibration Workshops

MRIP Calibration Workshop II

Appendix 1. Detailed Implementation Steps for the Calibration Methods Proposed During the Workshop.

Summary Report: NOAA Calibration Methods Workshop - Charleston, SC
September 8-10, 2014
Lynne Stokes, Ken Pollock, Ginny Lesser
December 18, 2014

The new MRIP Access point survey has replaced the original MRFSS Access Point Survey. A variety of design changes have been made. One major consequence is that the new survey covers the fishing day more effectively than the original MRFSS Access Point Survey. Because the time series of recreational catch rate estimates form the basis of so many important fisheries stock assessments, there is the need to develop methods which "calibrate" the original time series of MRFSS estimates to the new time series of MRIP estimates. This is a difficult statistical estimation and prediction issue because both surveys were not run in parallel in any years (except for one pilot test in NC). The new estimates can be very different from the old estimates causing an abrupt change in the time series.

The purpose of this document is to outline the steps involved in implementing several model dependent calibration approaches to re-estimate catch that were discussed at the Charleston workshop. In addition, we discuss their assumptions. The first two methods use ideas of ratio estimation and assume that the major changes between the two surveys are due to a better temporal coverage of the fishing day in the new MRIP survey. The third method is a regression prediction modeling approach that will take longer to develop. None of these methods incorporate any analysis of spatial patterns or include time series methods, which might improve estimates. This would be worth exploring to determine if time series or small area estimation techniques for this short time series might provide improved estimates.

1. Direct Catch Ratio Adjustment
    - Steps in approach (for each subregion, state, mode, species.):
        i. Define peak period for each of the domains (excluding species). Peak period is defined using two criteria: 1) the contiguous range of hours during which weighted hourly proportions of total trips in the MRFSS years (prior to 2013) were greater than or equal to the corresponding weighted hourly proportions of total trips in 2013, and 2) the peak period accounted for at least 75% of the intercept data (trips) in the MRFSS years.
        ii. Estimate peak and total catch using the 2013 data based on the MRIP survey method where both the peak and total fishing periods were sampled adequately. Denote these by $c_{p,2013}$ and $c_{total,2013}$, respectively.

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iii. Calculate the ratio $R_{2013} = c_{total,w2013}/c_{p,2013}$. This estimate and its large sample variance, based on standard Taylor series methods, can be calculated from survey sampling software packages such as SAS.

iv. Denote the estimator of catch based on the MRFSS method during the peak period in earlier year y (e.g., y = 2012, 2011, etc.) by $c_{p,y}$. Then the estimator of adjusted total catch for year y (i.e., a prediction of what would have been obtained if MRIP had been run) will be calculated as the product of the ratio from year 2013 and the catch for the peak period in year y; i.e.,

$$c_{tot,y} = R_{2013} * c_{p,y}.$$

iv. The variance of the adjusted catch $c_{tot,y}$ can be calculated using the expression for the variance of a product of two independent random variables introduced by Goodman (1960): .

$$var(c_{tot,y}) = var(R_{2013})(c_{p,y})^2 + var(c_{p,y})(R_{2013})^2 - var(R_{2013})var(c_{p,y})$$

By substituting estimates for each of the components in this equation, the variance can be estimated.

- Assumptions:
  i. Relative distribution of catch throughout day (i.e., between peak and total) is constant between 2013 and the year that is being adjusted for each domain

- Advantages:
  i. Simple to apply.

- Disadvantages:
  i. Information that is available for non-peak hours are not used.

- Two variations of this approach:
  i. Keep a fixed peak time the same (note this will vary by state and mode)
  ii. Use different peak times (allow this to vary by state, mode and year since this was allowed to vary in these groups)

2. Complex Ratio Method Based on Fishing Effort Distributions

- Steps in approach (for each subregion, state, mode, species etc.):
  i. The 2013 daily relative distribution of total fishing effort is obtained and also the relative distribution of total fishing effort data for the year to be compared to (for example, for y = 2012, 2011, etc.). Total fishing effort is estimated as the fishing effort estimate from separate telephone surveys (CHTS, FHS) that is subsequently expanded by coverage correction factors estimated from APAIS.

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ii. The 2013 sampling weights are then adjusted (up or down weighted) so that the 2013 relative distribution matches the year y relative distribution. This is to be done by using discrete temporal bins with the exact bin widths yet to be determined. The adjustments made to the 2013 sample weights are a ratio style adjustment of the form:

$$w_{dti|y} = w_{dti} * \frac{\hat{p}_{dt,y}}{\hat{p}_{dt,2013}}$$

where w_{dti} is the unadjusted 2013 sample weight for angler-trip *i* in time bin *t* in subregion, state, mode domain *d*,
$\hat{p}_{dt,2013}$ is the original 2013 weighted proportion for time bin *t* of total trips in domain *d*,
$\hat{p}_{dt,y}$ is the year *y* weighted proportion for time bin *t* of total trips in domain *d*, and
$w_{dti|y}$ is the 2013 sample weight for angler-trip *i* in time bin *t* in domain *d* adjusted to year *y*.

From initial evaluations of bin width, it appears that a 3-hour bin is the smallest bin that results in no data gaps or mismatches in 2013 (data present in a bin in a prior year but not in 2013) for all state by mode domains. However, additional work could be done to fine tune bin widths for each domain cell.

iii. Use the MRIP survey method to estimate catch for the complete 2013 data and denote it by c_{2013}. Also calculate catch for the 2013 data weighted to match the truncated distribution of effort for year y data (step ii above), and denote this estimator by $c_{tr,2013}$
iv. Calculate the ratio of 2013 complete to truncated catch based on the MRIP survey; i.e., $R_{c/tr,2013} = c_{2013}/c_{tr,2013}$.
v. Multiply this ratio by the year y estimate of catch c_y to obtain the adjusted year y catch estimate (i.e. what would have been obtained if MRIP survey had been run) $c_{y,adj} = R_{c/tr,2013} * c_y$.
vi. A similar approach can be used to adjust all other years one by one or alternately down weight 2013 compared to the pooled temporal distribution of all other years and get one overall ratio which can be used to adjust all the years.
vii. Explore computation of the variances of the calibrated estimates by either using a bootstrap or delta method.

- Assumptions:
  i. Assumptions for this approach, such as constant relative distribution of trip/catch characteristics between years in the comparison/adjustment, must be investigated to determine if assumptions are met and will lead to consistent estimators.

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- Advantages:
  i. Information that is available for non-peak hours are used unlike in the previous method.

- Disadvantages:
  i. Information from non-peak hours will be limited and may be highly variable or impacted by incomplete coverage compared to information from peak hours.
  ii. The assumptions under which this estimator will be consistent (that is, will provide an unbiased estimate for a sufficiently large sample size) are unknown at this time. For example, if the (strong) assumption needed for Method 1 is assumed, the estimator will still not necessarily be consistent.

- Other ideas to consider as variations of above
  i. Recalculate catch after effort has been readjusted. Therefore, both catch and effort are readjusted. The calibration methods make use of the MRIP public-use or micro datasets. The records included in these datasets come from APAIS. However, the sample weights in these datasets include a post-stratification adjustment such that the sum of the sample weights equals the MRIP estimate of total effort in domain cells defined by year, subregion, state, wave, mode, and area. To more fully approximate the effect of temporal coverage changes on catch, the MRIP estimates of total effort must be recalculated since they also include coverage correction factors estimated from APAIS. Once total effort has been recalculated, sample weights may be post-stratified to the new effort totals, and then revised catch estimates may be calculated as weighted sums using sample weights that have been adjusted to both a prior year daily distribution of effort as well as the resultant new effort total.
  ii. Apply temporal distribution either year-by-year or as an average across a range of years (say 2004-2012). Then multiply this ratio by MRFSS estimates of catch in previous years. NOTE: If use each year separately, then there is no assumption that the relative distribution of catch is constant throughout the day across years, only the two years that are compared. So if only one year violates this assumption, then conducting an aggregate analysis could bias the estimator for the other years, while if it was done separately, only it would be biased by that assumption violation. Conversely, using a multi-year average distribution may work to smooth results in cases where annual level distributions may be more variable.

3. Regression Model-Based Approach
   - Steps in approach:
     i. Develop a regression model using 2013 intercept data (perhaps other years as well) to predict and classify trips into either morning, peak, or evening as predicted from

their characteristics, such as type of catch and other demographic and behavior characteristics of the anglers that are available from the intercept questionnaire. Cross-validation could be used to check the model. For example, one could use approximately 75% of the data to develop the model. Then Bayes' Information Criterion (or other model fit statistic) could be used to develop the best fitting model. Once the model is built, the remaining 25% of the data could be used to predict the response variable. A statistic, such as the Press statistic, could be calculated to document how well the model is predicting the response categories. A replication approach might also be considered to look at model robustness or stability.

ii. Use the model to predict Morning, Peak and Evening trips for 2012, 2011, etc. These classifications won't be "true" morning, peak, and evening categories, since they won't be aiming to identify when the trip took place. Rather, they will be trying to predict when a trip is similar, based on catch and demographic and behavior characteristics of anglers, to trips in 2013 in those categories.

iii. Determine the proportion of Morning, Peak, and Evening trips in 2013. Adjust the 2012, 2011, data so that the Morning, Peak, Evening proportions are identical to the 2013 data. These are adjusted proportions. In addition to 2013 data, control proportions for prior years may be developed using trip time data from the CHTS and FHS effort surveys, which would be available for a range of years prior to 2013.

iv. This new weight, the inverse of the 'adjusted proportions', is multiplied by the existing weights for 2012, 2011, etc. to create the adjusted weight.

v. Data are now analyzed using the adjusted weights.

vi. A bootstrap method could be used to calculate variances.

- Assumptions:
  i. Reasonable predictive model can be developed using 2013 data to reasonably predict catch period type (i.e., Morning, Peak, and Evening).
  ii. The demographic characteristics of the angler/catch predict the characteristics of the catch through a "label" we are assigning about time of day.
  iii. Assumes that true time and latent time are identical in 2013 (see below for definition of latent.)

- Disadvantages:
  i. More work is required to develop the prediction model.
  The model is not designed to predict the observable characteristic (time of day), but is rather predicting whether the trip "resembles" a trip made during that time of day, which is a latent variable. Because of this, the model checking done on the 2013 data to see how well the model works is not like the target years, since we can't observe the latent variable even for 2013. It may be that some of the trips

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made in the morning in 2013 do not resemble morning trips, and yet the model will be examined for its accuracy in predicting true time. If we were really interested in predicting true time, we would simply use the true time as a predictor in previous years!

- Advantages
  i. A number of important explanatory variables can be incorporated in the model to better predict trips.
  ii. Approach incorporates the calibration into the sample weights, which maintains the current usability of MRIP public-use datasets for analysts.

- Other comments:
  i. As more data is collected using the MRIP design, the model development should be repeated to improve prediction.

Catch can also be added to model, but need to be careful of applying 2013 year affects to previous years.

References:

Goodman, Leo A., "On the exact variance of products," *Journal of the American Statistical Association*, December 1960, 708–713.

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Appendix 2. Recommended Interim Calibration Approach, suggested for use in Assessments Conducted in Winter 2014/15.

October 30, 2014
Summary Report: Recommended NOAA Calibration Method
Lynne Stokes, Ken Pollock, Ginny Lesser

Introduction

The new MRIP Access Point Angler Intercept Survey (APAIS) has replaced the original MRFSS Access Point Survey. A variety of design changes have been made. One major consequence is that the new survey covers the fishing day more effectively than the original MRFSS Access Point Survey. Because the time series of recreational catch rate estimates form the basis of so many important fisheries stock assessments, there is the need to develop methods which "calibrate" the original time series of MRFSS estimates to the new time series of MRIP estimates. This is a difficult statistical estimation and prediction issue because the two surveys were not run in parallel in any years (except for one pilot test in NC). The new estimates can be very different from the old estimates causing an abrupt change in the time series. Three methods of producing a calibration were suggested at the workshop in Charleston, SC held in September. Since that time, the statistical consultants have worked on investigating the properties of the three methods, and John Foster has implemented two of the three methods for some areas/species, in order to see how they perform. The purpose of this document is to describe our recommended method and to explain our choice.

Our recommendation

Our recommendation at this time is to use the method that was referred to as "Method 1" at the workshop. Our decision is based on two main factors. One is that the method is the easiest to explain and to understand of the three methods. It is based on an assumption that the ratio of catch in the peak period to total catch is stable over time. The method referred to as "Method 2" at the workshop is also a ratio method, but it is more complex (a negative feature) and uses the data from prior years more fully (a positive feature). Our reluctance to recommend Method 2 at this time is that we have not yet been able to determine the assumptions under which this estimator is consistent. For example, the strong assumptions required for consistency of the method 1 estimator are not sufficient to ensure consistency

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of the method 2 estimator. It is also clear that the method 2 estimator requires estimation of more parameters than Method 1. As a result, we are not confident that the one year of new MRIP APAIS estimates available at this time will be sufficient. Finally, Method 3 considered at the conference is a regression prediction modeling approach that will take longer to develop and also need more data. (It is the one method not yet applied to any of the data by John Foster.)

Description of the method

Here we describe the basic assumption used to justify Method 1, and then outline the steps required for implementation. First, the justification of the method requires the assumption that in years previous to 2013, there is a period of the day that can be considered to have been fully covered by the MRFSS survey, and that the bias in its estimates occurs due to undercoverage in the non-peak periods. This is a very strong, but necessary assumption for this method. Second, the method requires the assumption that the ratio of peak catch to total catch stays constant across years for subregion, state, mode, and species. So for each of these domains, the calibrated total catch for year *y* is made as

$$\hat{C}_{tot,y} = \hat{R}_{2013}\hat{C}_{p,y} \quad (1)$$

where $\hat{C}_{p,y}$ is the estimated peak-period catch for year *y* calculated from reweighted MRFSS data and $\hat{R}_{2013} = \hat{C}_{tot,2013} / \hat{C}_{p,2013}$ is the ratio of the total to peak catch for year 2013, which is calculated from MRIP data. $\hat{C}_{tot,y}$ is thus our estimate of the catch total for the domain that would have been estimated if MRIP had been conducted in year *y*.

The steps in producing this estimate are outlined below.

Step 1. Define peak period for each of the domains (subregion, state, mode). In the pilot implementation by John Foster, peak period was defined using two criteria: 1) the contiguous range of hours during which weighted hourly proportions of total trips in the MRFSS years (prior to 2013) were greater than or equal to the corresponding weighted hourly proportions of total trips in 2013, and 2) the peak period accounted for at least 75% of the intercept data (trips) in the MRFSS years.

Step 2. Calculate $\hat{C}_{p,y}$, the catch in the peak period for all years $y < 2013$ for which calibration is needed.

Step 3. Estimate peak and total catch using the 2013 data based on the MRIP survey method where both the peak and total fishing periods were sampled adequately. Calculate its ratio $\hat{R}_{2013}$.

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Step 4. Calculate the estimator $\hat{C}_{tot,y}$ shown in (1).

The variance of this estimator can be calculated using standard statistical methods.

Discussion

There are at least three substantial criticisms possible for this method. First is that the method uses none of the data collected outside the peak period in years prior to 2013. The second is that the method requires an assumption that the ratio of catch in the peak period to total catch is constant across years. We are not sure if this is defensible from a scientific point of view. Third, the method assumes that the estimate of total catch for the peak period made from the reweighted MRFSS data in years prior to 2013 is unbiased. On the other hand, some type of unverifiable assumption will be necessary in order to carry out any calibration because of the lack of side-by-side data collection for the MRIP and MRFSS APAIS sampling designs.

Some variations on Method 1 are possible. For example, the choice of how the peak period is defined will affect the estimates. Peak can be determined individually for each year or based on an aggregation of years and/or domains. We believe that this definition will be difficult to specify in advance, and must be based on characteristics of the data.

We recommend that investigation continue on the remaining two methods. It is possible that one of them will be determined to be better at some future date.

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Appendix G
Acronym List

AAPOR	American Association of Public Opinion Research
ABC	Acceptable Biological Catch
ABS	Address-based sampling
ACCSP	Atlantic Coast Cooperative Statistics Program
ACL	Annual Catch Limit
ACS	American Community Survey
ACT	Annual Catch Target
ADFG (sometimes ADF&G)	Alaska Department of Fish and Game
ALDTS	Angler License Directory Telephone Survey
APAIS	Access Point Angler Intercept Survey
ASMFC	Atlantic States Marine Fishery Commission
CDS	Computerized Delivery Sequence
CET	Communications and Education Team
CH	Charter fishing boat mode
CHTS	Coastal Household Telephone Survey
CPUE	Catch Per Unit Effort
DMR	Discard Mortality Rate
eNGO	Environmental Nongovernmental Organization
ER	Electronic Reporting
FCC	Federal Communications Commission
FES	Fishing Effort Survey
FIN	Fishery Information Network
FMCA	(Magnuson-Stevens) Fishery Conservation and Management Act
FWS	(U.S.) Fish and Wildlife Service
GSMFC	Gulf States Marine Fishery Commission
HB	Head boat (party boat) mode
HMS	Highly Migratory Species

IPHC	International Pacific Halibut Commission
LPBS	Large Pelagics Biological Survey
LPS	Large Pelagics Survey
MRFSS	Marine Recreational Fishery Statistics Survey
MRIP	Marine Recreational Information Program
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act (sometimes FMCA)
NAS	National Academy of Sciences
NGO	Nongovernmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
NRC	National Research Council
NSAR	National Saltwater Angler Registry
ODFW	Oregon Department of Fish and Wildlife
OFL	Overfishing Limit
ORBS	Oregon Recreational Boat Survey (of ODFW)
OSP	Ocean Sampling Program (of ODFW)
PPS	Probability Proportional to Size sampling design
PR	Private/Rental boat mode
PSE	Proportional Standard Error (reported in percent)
PSMFC	Pacific States Marine Fishery Commission
PSSP	Puget Sound Sampling Program (of WDFW)
PSU	Primary Sampling Unit
QA	Quality Assurance
QC	Quality Control
RARA	Report of Assessment and Research Activity
RDD	Random Digit Dialing telephone survey
RecFIN	Recreational Fishery Information Network
SAFE	Stock Assessment and Fishery Evaluation
SH	Shore mode
SOT	Statement of Task
SOW	Statement of Work

SR	Site Registry
SSC	Scientific and Statistical Committee (of regional fishery management councils)
SSU	Secondary Sampling Unit
TPDW	Texas Parks and Wildlife Department
TSU	Tertiary Sampling Unit
USFWS	United States Fish and Wildlife Service (sometimes FWS)
WPacFIN	Western Pacific Fishery Information Network

Atlantic States Marine Fisheries Commission

ISFMP Policy Board

February 1, 2017
12:15-2:00 p.m.
Alexandria, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(D. Grout)* 12:40 p.m.

2. Board Consent *(D. Grout)* 12:40 p.m.
   - Approval of Agenda
   - Approval of Proceedings from October 2016

3. Public Comment 12:45 p.m.

4. Update from Executive Committee (*D. Grout*) 12:55 p.m.

5. Discuss Illegal Fishing Activities and Policies for How It Impacts Quotas (*J. McNamee*) 1:05 p.m.

6. Discuss Possible Policy Implications of Safe Harbor Landings Guidance Document (*J. Gilmore*) 1:20 p.m.

7. Update on the Climate Change Working Group *(D. Grout*) 1:35 p.m.

8. Coastal Sharks Update (*A. Harp*) 1:40 p.m.
   - Set Commercial Possession Limit for Blacknose Sharks South of 34˚00' **Final Action**
   - Discuss NOAA Fisheries Proposal to List the Oceanic Whitetip Shark as Threatened

9. Review non-Compliance Findings, if Necessary **Action** 1:50 p.m.

10. Other Business 1:55 p.m.

11. Adjourn 2:00 p.m.

The meeting will be held at the Westin, 400 Courthouse Square, Alexandria, Virginia; 703-253-8600

MEETING OVERVIEW

ISFMP Policy Board Meeting
Wednesday February 1, 2017
12:15-2:00 p.m.
Alexandria, Virginia

Chair: Doug Grout (NH) Assumed Chairmanship: 10/15	Vice Chair: Jim Gilmore (NY)	Previous Board Meeting: October 27, 2016
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (19 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 27, 2016

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Executive Committee Report (12:55-1:05 p.m.)

Background

- The Executive Committee will meet on February 1, 2017

Presentations

- D. Grout will provide an update of the committees work

Board action for consideration at this meeting

- none

5. Discuss Illegal Fishing Activities and Polices for How it Impacts Quotas (1:05-1:20 p.m.)

Background

- State have different policies for fish that are seized from illegal activities. Questions have come up regarding differences in how states address this issue for commercial and recreational harvest as well as how the harvest gets counted for quotas, stock assessments, and landings reports.

Presentations

- T. Kerns and J. McNamee will review white paper on illegal fishing activities and policies (**supplemental materials**)

Board discussion for consideration at this meeting

- Should the commission consider developing policy recommendations for fish that are seized from illegal activities

6. Discuss Possible Policy Implications of Safe harbor Landings Guidance Document (1:20-1:35 p.m.)

Background

- New York has developed a guidance document for vessels requesting safe harbor landings in New York. (**Briefing Materials**)

Presentations

- J. Gilmore will present the guidance document and lead a discussion of possible policy implications for other states

Board action for consideration at this meeting

- none

7. Update on Climate Change Working Group (1:35-1:40 p.m.)

Background

- The Climate Change Work Group was tasked with developing science, policy and management strategies to assist the Commission with adapting its management to changes in species abundance and distribution resulting from climate change impacts.
- In fall of 2016 the Work group met via conference call to brainstorm how to address the Policy Board task.
- On January 30, 2017 the working group met to make recommendations to include in the white papers to address the Policy Board task

Presentations

- D. Grout will review the Climate Change Workgroup Progress

Board action for consideration at this meeting

- none

8. Coastal Sharks Update: Set Blacknose Possession Limit and Discuss NOAA's Proposal to List Oceanic Whitetip Shark as Threatened (1:40-1:50 p.m.) Final Action

Background

- NOAA Fisheries published a final rule establishing a commercial retention limit of 8 blacknose sharks for all Atlantic shark limited access permit holders in the Atlantic region south of 34˚00' N. latitude effective January 13, 2017 (**Briefing Materials**).
- NOAA Fisheries has completed a comprehensive status review under the Endangered Species Act for the oceanic whitetip shark in response to a petition from Defenders of Wildlife to list the species. Based on the best scientific and commercial information available, and after taking into account efforts being made to protect the species, we have determined that the oceanic whitetip shark warrants listing as a threatened species. (**Briefing Materials**)

Presentations • A. Harp will review NOAA published Blacknose Possession Limit and Oceanic Whitetip Proposal
Board action for consideration at this meeting • Set 2017 Blacknose Possession Limit

9. Review Non-Compliance Findings, if Necessary Action

10. Other Business

11. Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ISFMP POLICY BOARD

The Harborside Hotel
Bar Harbor, Maine
October 27, 2016

These minutes are draft and subject to approval by the ISFMP Policy Board
The Board will review the minutes during its next meeting

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ATTENDANCE

Board Members

Patrick Keliher, ME (AA)
Sen. Brian Langley, ME (LA)
Steve Train, ME (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Doug Grout, NH (AA)
Ritchie White, NH (GA)
Bill Adler, MA (GA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Jason McNamee, RI, proxy for J. Coit (AA)
David Borden, RI (GA)
Rep. Melissa Ziobron, CT, proxy for Rep. Miner (LA)
David Simpson, CT (AA)
Lance Stewart, CT (GA)
James Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
Brandon Muffley, NJ, proxy for D. Chanda (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Andy Shiels, PA, proxy for J. Arway (AA)
Loren Lustig, PA (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
David Blazer, MD (AA)
Rachel Dean, MD (GA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
John Bull, VA (AA)
Michelle Duval, NC, proxy for B. Davis (AA)
David Bush, NC, proxy for Rep. Steinburg (LA)
Robert Boyles, SC (AA)
Malcolm Rhodes, SC (GA)
Pat Geer, GA, proxy for Rep. Nimmer (LA)
Spud Woodward, GA (AA)
Sen. Ronnie Cromer, SC (LA)
Jim Estes, FL, proxy for J. McCawley (AA)
Martin Gary, PRFC
Wilson Laney, USFWS
Kelly Denit, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Bob Beal
Toni Kerns
Mark Robson

Guests

The ISFMP Policy Board of the Atlantic States Marine Fisheries Commission convened in the Stotesbury Grand Ballroom of the Bar Harbor Club, Harborside Hotel, Bar Harbor, Maine, October 27, 2016, and was called to order at 8:09 o'clock a.m. by Chairman Douglas E. Grout.

CALL TO ORDER

CHAIRMAN DOUGLAS E. GROUT: Good morning everybody. Welcome to the Policy Board. The first thing I would like to do is turn to our Resolutions Committee Chair, and I do believe we have a resolution that the Policy Board needs to take up; Brandon Muffley.

75TH ANNUAL MEETING RESOLUTION

MR. BRANDON MUFFLEY: It is my pleasure to read in the 75th Annual Meeting Resolution. Whereas the Atlantic States Marine Fisheries Commission celebrated its historical 75th Annual Meeting in the beautiful coastal New England town of Bar Harbor, Maine; which provided an exceptional location for the commissioners, law enforcement, and commission staff to deliberate and discuss fisheries issues of mutual concern.

And whereas the chilly air and beautiful views of the changing leaves reminded us all that another year of successfully managing our fisheries resources is quickly coming to a close. And whereas Jim Long and Bonnie Bick received the Melissa Laser Award for the work in the Mattawoman Creek Watershed Conservation, and whereas the open plenary session brought commissioners together from the ASMFCs past and present; to provide a fantastic overview of the commission's accomplishments and its commitment to cooperative management.

It also brought out the competitive nature of the commissioners. The loosing Jeopardy team is still complaining that the judges were biased, and would not let them use their phone-a-friend lifeline to call on fellow commissioner from Delaware, to help them answer the biomedical product produced by horseshoe crabs.

And whereas the spouse and guest tour of Acadia National Park and downtown Bar Harbor, by all accounts was a successful gathering; and where the store owners were happy to report robust end-of-season sales shortly after the tour ended. And whereas the annual dinner provided a deliciously prepared, classic Maine feast; including a couple of v-notched lobsters that after some law enforcement investigative work, was determined to be lobsters harvested from the outer Cape.

Whereas the 26th annual David Hart Award recognized Bill Goldsborough for his lifelong commitment to protecting and enhancing fisheries habitat, and his unwavering support to pursue ecological-based reference points in fisheries management, and where Laura Leach was recognized for her 35 years of tireless work for the commission and her never ending love and support to all the commissioners. She truly is the diamond on this 75th Anniversary of the ASMFC. And whereas, due to the constant chill in the meeting room, commissioners were thankful for their new ASMFC vests and history was made when Dr. Duval made the first motion by a commissioner wearing winter gloves. And whereas the various management boards met, and the states came together as they always seem to do, to make the tough and challenging decisions facing our fisheries resources, for cobia and menhaden, southern New England lobster, and tautog; just to name a few.

And now, therefore be it resolved that the Atlantic States Marine Fisheries Commission expressed their deep appreciation to the Maine commissioners, Pat Keliher, Stephen Train, and Senator Brian Langley; as well as Maine DMR staff, Jeff Nichols and Terry Stockwell, and the commission staff for their outstanding support and assistance in making the 75th Annual Meeting a tremendous success. In closing, and

in an eight word sentence to summarize in a terrible Maine accent, a pissah of a good time was had by all.

CHAIRMAN GROUT: Is there any objection to approving this by unanimous consent? Seeing none; thank you very much, Brandon. It is so therefore resolved. This resolution will go into our resolutions.

APPROVAL OF AGENDA

CHAIRMAN GROUT: We have an agenda here. I have a few things already that have already been asked to add to the agenda, so it is going to make it busy.

Under other business we have three items to take up. I just want to make you aware of this. We have a letter from the Coastal Sharks Board that they would like approval for; regarding dusky sharks. There is also a letter from the Fluke, Black Sea Bass and Scup Board regarding black sea bass transit.

Then all of you received an e-mail from Bob Beal regarding the AFS document challenges we face in 2017 and beyond. I'll give you a quick report on what transpired with that. Is there anything else, any other changes to the agenda? Seeing none; is there any objection to approving the agenda as amended? It is approved by unanimous consent.

PUBLIC COMMENT

CHAIRMAN GROUT: This is now the time that we have on the agenda for public comment. I don't have anybody signed up. Is there anybody that wants to make public comment to the Policy Board right now?

EXECUTIVE COMMITTEE REPORT

CHAIRMAN GROUT: Seeing none; we'll go to the next agenda item, which is a report about the Executive Committee meeting we had earlier this week.

We made some final edits and approved the Conservation Equivalency Guidance Document. That is something that's going to be brought up to the Policy Board here under the next agenda item for your consideration and approval. We also reviewed a document that was put together by staff regarding ASMFC standard meeting practices.

This was an outgrowth of our meeting with Colette, where we were talking about Roberts Rules of Order and how we do business. She recommended that the commission do this. Then we went on and staff provided a review and a discussion of performance appraisals and merit increase protocol.

This came about because as the commission is now responsible for APAIS, we now have more employees that are part time, and are located in different state offices; as opposed to in the commission offices. They just want some clarification on how performance appraisals were going to be conducted, and merit increases would be determined. Essentially what the decision was by general consent was that the supervisors in the state offices would do the performance appraisals, and then consult with the commission about any merit increases for those employees. We were also asked to take up a new resolution regarding revisions to the retirement plan. This is again a result of us taking on part-time employees. This was not something that the commission used to have, and we needed to make some modifications to the retirement plan, so that we didn't have to pay retirement fees for people that were part time.

We also reviewed the change to the action plan where we added an ACCSP goal, and we addressed that at the Business Session. Finally, there was concern brought up about MRIP, in the fact that this was a year in which the economic survey is done in the intercept. There was concern brought up by several state commissioners that this being the first year that the states were taking over the process.

There was concern about them having the impression that would be given, where people were going to be asking questions about how much you were spending on trips. Bob Beal is going to be talking with Gordon Colvin about that and bringing that issue up with him, and we'll discuss it at a later date. That is all that I had from the Executive Committee. Are there any questions about any of those items? Bill.

MR WILLIAM A. ADLER: Just a little format. You approved the agenda, and I assume the minutes were in that?

CHAIRMAN GROUT: You're right. I'll do that immediately after this. Thank you for pointing out my missing that. Are there any other questions on the Executive Committee?

APPROVAL OF PROCEEDINGS

CHAIRMAN GROUT: Okay thank you, Bill, and we have proceedings from our August, 2016 meeting. Are there any changes or edits to those minutes? Seeing none; is there any objection to approving the minutes by unanimous consent? They are approved.

REVIEW REVISIONS TO THE CONSERVATION EQUIVALENCY GUIDANCE DOCUMENT

CHAIRMAN GROUT: Now we'll go to Agenda Item Number 5, Revisions to the Conservation Equivalency Guidance Document; Toni Kerns, and this is a final action.

MS. TONI KERNS: Over the past several months we've been working on making changes to the Conservation Equivalency Guidance Document, to reflect the current practices of the commission; and to put some better guidance on areas where we lacked some guidance for the states. Just to refresh everybody's memory, we started this with the ASC and MSC, brought it to the Executive Committee, made some changes, and are here today to make final changes to the document.

Conservation equivalency allows the states flexibility to develop management, to address state or regional differences, while still achieving the goals of the FMP. It allows us to tailor regulations, really when one-size management doesn't work for the states. For commission document we really use conservation equivalency in two areas.

One is an alternative management process outside of the FMP, and the other is within the fishery management plans. When conservation equivalency is used within the fishery management plan, it is the Plan Development Team that makes the conservation equivalency recommendations of what measures can be used and the guidelines and rules that follow it; and that is all then located within the plan amendment or addendum.

Conservation equivalency plans are not required if a state is making a change that is more restrictive, unless that is combined with a change that is less restrictive. When you're combining more and less restrictive, then we do ask that states submit a conservation equivalency program. For proposals the Plan Review Team is the clearing house, and we request that all states when submitting proposals send them to the Plan Review Team Chair. For the standards and protocols, each state needs to submit a conservation program that has a rationale, so why the alternative management program is needed.

It can be a number of reasons why a state is submitting conservation equivalency for social and economic reasons, fish distribution considerations, fish size in state waters; the number of possibilities is limitless. Then a description of how the alternative management program will meet all the relevant fishery management plan goals and objectives.

Then it also would include a description of the datasets that are used in the analysis, and the data collection method for the conservation equivalency program. The Technical Committee

is the ones that would determine the acceptable level of precision for all landings data, and other data that are used in the programs.

The states are allowed to ask the TC to provide that information ahead of submission of the proposals; but you are not required to. Also included in the program should be the length of time the state is requesting conservational equivalency for, and the review schedule for any measures that are implemented within the plan; as well as if the state does not intend to have an expiration data, then they should make that clear in the proposal.

There should be a justification for any deviations from the conservation equivalency procedures that are detailed in the FMP or in this document, and the plan should describe a monitoring of reporting requirements, as well as documentation of evaluating the impacts of the conservation equivalency measures.

Then further, review process and timing, the conservation equivalency should be approved by the management board and they should be, where possible, implemented at the beginning of the fishing year. A state that submits a proposal outside of the implementation plan process, meaning that it is not a part of a fishery management plan program should follow the following guidelines.

All conservation equivalency plans should be submitted within two months of the next board meeting to be reviewed at that meeting; and that is to ensure that we have enough time to bring that plan forward to the respective committees that need to review it and provide feedback to the board.

If the plan is turned in between two months and two weeks of the next board meeting, it is up to the Chair's discretion as whether or not that conservation equivalency program will be brought forward to the board at the next board meeting. If it is brought forward two weeks before the next board meeting, it will not be reviewed at the next meeting, but it will have to wait until the following board meeting.

The PRT notifies the state that the plan is complete. If there is anything missing then we would let the state know. The PRT will determine which committees it is necessary to distribute the program to, different conservation equivalency programs are different and sometimes they may not require review by all the committees; but the committees that we would most likely distribute to are the Technical Committee, the Law Enforcement Committee, and SESC. The review includes a description of the impacts on or from adjoining entities, enforcement, economics, as well as other issues. Then the PRT will take all the information that is compiled by the committees, and forward those on to the AP for them to consider and make recommendations to the board.

If there are times when we don't have sufficient time to get the committee recommendations to the AP before they're finalized, we may ask the AP to make a recommendation without those committee reports. Then the PRT will forward everything to the board for their consideration and approval.

For the review process, each state should describe and evaluate the programs as part of their state compliance report on an annual basis, and the PRT will evaluate each state's conservation equivalency program within the FMP review and report back to the board, unless a different timeframe had been established. Lastly, the document describes with joint management plans, it could be complimentary.

But any plans that we engage with NOAA Fisheries and Fish and Wildlife Service or the Fishery Management Councils, we would make sure we coordinate with them; whether that is asking to have complementary EEZ regulations or changes in federal regulations. We should

note that the federal agencies have different protocols in terms of process of putting forward regulations, and we should take those into consideration as we make those requests. That is all, I'll take any questions.

CHAIRMAN GROUT: Questions on this for Toni? Adam and then Wilson.

MR. ADAM NOWALSKY: The one question I had was in the memo; it outlined the concern that states may submit proposals that are deemed to be more restrictive. In the past we've just gone ahead and approved those, but the comments from the ASC/MSC were that there may be other implications such as discards, and that all follow-up CE proposals should go through review.

Is that language in the revised document now, as it is, and could you give us an idea how that would actually play out? I know through summer flounder when we've done conservation equivalency in the past we've approved methodologies; and not specific regulations. But I just wanted to get clarification on that all proposals should be reviewed.

MS. KERNS: From what my understanding of what the Executive Committee talked about, Adam, was that any regulation that is more restrictive, a single regulation that is more restrictive, is fine for a state to implement without a conservation equivalency program; but when you combine a more restrictive with a less restrictive.

You do a more restrictive size limit in order to open up your season longer, then that has to come forward to the commission. Even if those two things add up to be more restrictive, it still would need to come back to the board. But anything on its own would not require a conservation equivalency program.

CHAIRMAN GROUT: The Executive Committee, when we were putting this together, took MSC/ASCs suggestion into consideration and this is what we decided would be a better, more smooth way to deal with conservation equivalency; because things like going from say a 10 fish bag limit to a 5 fish bag limit, because a state decides they want to be more conservative, is pretty straightforward.

But if you're combining it with something that may change a season around, because effort is different through different times of the year, that is something that we were trying to get at that it could potentially be less conservative. If you combined a bag limit and season change, yes that would have to go through it. Wilson, you had a question?

DR. WILSON LANEY: Well, it is a question and a comment, Mr. Chairman. On Page 2 at the top of the page in the first full paragraph there, where it has a list of things that the PDT should consider when they are doing these reviews. The first one is stock status, which we typically think of in terms of whether a stock is overfished or not.

I was wondering if it wouldn't be advisable to add another term after that one, which would be stock structure; which could capture both the age structure of the stock, which I know has been of interest to at least some of the species management boards. Striped bass comes to mind, where Amendment 6 sought to broaden that stock structure.

But also in view of our cobia discussion, if you use the term stock structure, I think that would also capture the genetic component of stocks or perhaps growth differences; such as we see exhibited with black sea bass north and south of Cape Hatteras. To me those are important factors that would merit consideration as well.

When you're trying to decide on conservation equivalency, especially in a case like South Carolina where you have a cobia DPS inshore, which the state has elected to choose some more conservative management measures. If

that could be added, I think that would be a good addition.

CHAIRMAN GROUT: Is there any objection from the board to adding that wording? Seeing none; we'll add that in, any other questions about the document? Seeing none; this is a final action so we need a motion to approve this document for commission use. Michelle Duval.

DR. DUVAL: **I move that we approve the Conservation Equivalency Guidance Document as modified.**

CHAIRMAN GROUT: Seconded by Tom Fote; any further discussion on the document? This is a final action so this will be a roll call vote, but I am going to check first to see if there is any objection to approving this document as modified today. **Seeing none; the document is approved by consensus.**

UPDATE ON THE CLIMATE CHANGE WORKING GROUP

CHAIRMAN GROUT: The next will be an update on the Climate Change Working Group that we put together. We've had one conference call so far on this. Now that we've approved the action plan, we have a workshop planed too; excuse me, another face-to-face meeting.

MS. KERNS: In your supplemental materials you have the draft notes from the Climate Change Working Group call. I think we had a nice call, where we did some brainstorming on the following questions, where we discuss some science strategies and what are our priorities for the science strategies, and can we establish climate change impacts on terms of reference within ASMFC stock assessments. We talked a lot about the different tools that are out there and the different research and projects that are going on in climate change with different agencies and states; in places that we can work with our partners to get more information.

Then we also talked about how different ASMFC species have started to include climate change terms of reference already in the terms; like species such as lobster where we in the southern New England stock group, we've looked at how temperature is impacting that lobster stock, and that we can continue to add a climate change term of reference as we move forward with ASMFC stock assessments.

When we get together to have our in-person meeting this coming year that we'll do some further strategizing for each of these topics that we brainstormed on at the meeting. Then under policy and management strategies, we're looking for some policy guidance on climate change; including tools that the commission can utilize when resources have impacts that are clearly tied to ocean warming and/or ocean acidification.

How we would manage them differently than what we're doing now, and how will fisheries management adapts to current and future changes in climate and ocean? Some of the specifics that we touched on were species distribution and movement. How can we design and implement flexible allocation strategies?

How we can incorporate a periodic review of state allocations in our FMPs, and how can we change possibly permitting approaches or landings regulations along the coast, to help us be more adaptable and adjust for each of the states and their fishermen; as these species start to move around.

We also discussed recruitment and abundance impacts from climate change, and looking at the precautionary management decisions in anticipation of shifting distributions and productivity. Looking at the different reports that we can use, including Jon Hare's report on the species of vulnerability, there is a social and economic report out that looks at coastal communities and how they're being impacted by climate change.

Then lastly, are there different strategies that we would employ for species that are biologically sensitive; that are just more vulnerable to climate change than others. Do we need to collect more additional data to provide information on how these species are being impacted by climate change?

For example, species like northern shrimp, where management is responding to declining stocks, but the species are not responding to that management very well, and so how do we adjust? The group is, based on our brainstorming sessions, going to pull together some white papers on each of these topics for the Policy Board to look at and review after we meet at our working group meeting this spring.

CHAIRMAN GROUT: Questions about this, Jason.

MR. JASON McNAMEE: Yes, more of a comment than a question. I just think in particular with what you concluded with there, Toni, there is a nexus with this and the stuff we're going to talk about next; the risk and uncertainty stuff. I just wanted to kind of point that out so people are connecting the two, because they are related. Just as a very clear example, you could actually use the work by Jon Hare et al to kind of categorize the species you're dealing with, and adjust that risk you're willing to take with it accordingly. Then one other, I guess this is a question and I'm sorry if you said this. You talked about shifting in allocation and that sort of thing, but what about, I think another important aspect is productivity and productivity regimes.

That would be, I think an important thing to do first is look into; there has been some work on how to identify and quantify whether or not a regime change has occurred. That would be something to look at, and then again this idea of characterizing the stock that you're working with, and whether that has actually happened. I think that's another kind of common thread that comes up.

MR. NOWALSKY: Thank you for both the summary as well as the presentation on it today. Within the summary there are a number of underlined items, which I believe are potential action items. What would the strategy be moving forward for potentially taking action on them? Is it the charge of the working group moving forward to prioritize and select those items; and then come back to this board or another relevant board to task a group to get an answer on them? What would be the step forward with highlighting all of those potential working items?

CHAIRMAN GROUT: I think at our in-person meeting that is one of the things that we're going to try to craft together into the white paper that we would bring to the Policy Board for consideration, and it's some of these action items we would put forward for approval by the board. Now whether it would be an action item that the board would have to take on a general policy nature, or if there is something specific that the Policy Board might task a specific species management board with dealing with.

I think that is what our intent here is to come up with something that we can bring to the full commission here for consideration. Clear? Anything else? We'll be reporting back to you again at a future meeting on this. Hopefully we'll have some action items for you.

RISK AND UNCERTAINTY POLICY WORKING GROUP'S WHITE PAPER

CHAIRMAN GROUT: Next item on the agenda is the Risk and Uncertainty Policy Working Group's white paper. I'm going to turn it over to Jason McNamee.

MR. McNAMEE: Good morning everyone; my name is Jason McNamee from Rhode Island DEMs Marine Fisheries Program. I have a moderately-lengthed presentation here that I'll kind of tick through. I'll try to go through it relatively quickly, but it's an update. Then we

do have a couple of questions at the end for you all.

Back in August the Policy Board approved continuing on with the development of the commission's Risk and Uncertainty Policy, and one of the things we offered you at that last meeting, was our purpose statement that we had kind of built. When I'm saying we, I'm talking about the Risk and Uncertainty Working Group, which has commissioners, ASC and MSC members; it is a good group. I enjoyed the meeting that we had back in September.

But at the August meeting we showed you the purpose statement that we had come up with. I think in general, people were relatively comfortable with it, but wanted some more time to kind of look at it, think about the language. But at that time you all asked us to continue on, keep working on it; so we did that. The working group met in September, and one of the main tasks that we were looking to finish at that meeting was to work through some examples of how to actually apply a risk policy. I'm going to go through a couple of slides with things like goals. But in the meeting materials there was a white paper, and so there is a lot more detail in there. I encourage you to take a look at that if you haven't had the chance to yet.

Here is the first slide on the goals, like why are we doing this? One of the main top reason is a comprehensive risk and uncertainty policy would provide guidance on a range of issues, important issues like choosing biological reference points, where to set the risk levels for those reference points; because there is always going to be uncertainty in that estimated metric that you get.

You could use the policy and apply it when you're setting quotas for data-poor species or even data-rich species; all those kinds of things. If we were to take this and apply it now across the entirety of all of the commission's responsibilities that is a long term goal. That is going to require some significant time and a lot of work, a lot of resources devoted to it.

That would be more extreme if we were to do so in an omnibus kind of all-at-once fashion. What we're suggesting what we discussed was, we should do this in phases. We shouldn't do it all at once. What we're talking about is kind of stepping through this, going maybe even FMP by FMP. We might be able to hit one or two at a time, but not to try to do it all at once.

I guess what we suggested, a good start would be, and I'm going to talk about this in much more detail further on in the presentation, but we have this decision tree, this structured decision making kind of approach. We think a good kind of first step to take would be to apply this decision tree approach to some data-rich species, species that we have decent stock assessments for; before we try and challenge ourselves with less informed management decisions.

On the next slide here, a couple more goals. What we want to do with this risk policy is adequately account for uncertainty at all levels of the commission's management process. The idea is so that we're maximizing our informed decision making, and we can clearly articulate why we've made decisions on each of these topics.

Another really important goal that came up at our working group meeting, and some of the other discourse we've had on this is, this should be consistent amongst all of the commission species. We don't want to have some where it is being applied and others where it is not. We want this policy to be broad enough and comprehensive enough, to be able to apply to all species, even if they're very different; data rich, data poor, long lived, short lived.

It should be flexible enough to accommodate all of the species, so that we have this very transparent process across species. That's the next very important goal, transparency. What

we want to do is not leave people wondering how we got to that decision; we want to be able to articulate how we got to that decision very specifically.

Another really important one is the incorporation of flexibility. This is a dynamic system that we work in. Conditions change all the time, even without major perturbations like climate change. It was still dynamic before we were talking about that. We don't want to have a system that locks us in, and we're very cognizant of that at the working group. We don't want to be constrained and have our hands tied, we want to have the ability to maintain flexibility. How do we meet those goals? How do we get there from here? In this case I think we can get there from here. The goals of the policy will be achieved through this structured decision making process, so that is kind of how we're envisioning this to work. You could make sure this process is undertaken each time, by developing it as a term of reference that gets put into all ASMFC stock assessments; as one example.

You have this term of reference, and it basically has that technical group assessment committee, whatever it is, requires them to step through a decision tree with a predefined set of questions for that species. I'm going to show you a visualization of this as well, but just to kind of show you some of the questions that would be in this structured decision making process.

They are pretty straightforward. What do we know about stock status? Do we have a stock status determination? Sometimes we don't. That would be really a high level right off the top kind of question to ask. Then we get into more of the stock status type of questions. Is the stock overfished, depleted, is overfishing occurring? Where are we with regard to the reference points for SSB and/or fishing mortality?

What kind of job have we done with characterizing the sources of uncertainty in the assessment? Do we have all of them accounted for, probably not? Do we have a lot of them accounted for, or are we really left in a very uncertain situation? How about the diagnostics of the assessment? Is the assessment something we can really lean on?

Is it a solid assessment that we've been running for multiple years that kind of hangs together year to year, or is it one that seems like it's a little bit unstable? Then kind of a concluding questions here, what about the species? Is it a fast-growing, short-lived species? Is it something that takes 30 years, 40 years to reach maturity; these kinds of important questions all factor into the risk we're willing to apply to a species?

Once we step through these questions, we end up with a series of probabilities. The example that we're going to talk about, this would be with regard to being at or below the fishing mortality target. This is probably a good one to start with, it is something we're all familiar with, fishing mortality, and it's something we use a lot.

Right now we have a really broad range, and so this will be one of the questions. Do we want to constrain this range or do you like it? Right now we have probabilities going all the way from 30 percent being at or below the fishing mortality target, all the way up to 75 percent; and so less conservative to more conservative.

The next series of slides, I'm going to kind of step through the example that we worked through and I'll answer the questions. But you can see in each case you can go one direction or the other. The way to think of this as your trickling down the decision tree, you're kind of swinging to the right or to the left; depending on the answer yes or now of your question.

You're heading towards being more risky of being less risky. I've got a better picture. We'll

zoom in on this, so I'm not expecting you, but we wanted to give you a look at what the tree kind of looks like as you bounce down it. Again, this is answered for a specific species; that I'm not supposed to tell you is bluefish. The black line on there is just a page break. It's nothing important about that answer to that question. We're zoomed in, and as I mentioned, what do we know about stock status? Do we know anything about stock status? Our first answer to that question was yes. That drops us down to our next question. It is kind of like; remember the "choose your own adventure" books you read as a kid, so you don't know where you're going to end up at the end. It is all very exciting.

You answer yes, we know stock status and you end up, is the stock overfished or depleted, yes or no? For our example we say no, so that now gets us to our next question. Is overfishing occurring; yes, no? Again, there is always this we don't know aspect too, and so depending on which answer you go right, left or straight down.

Here we're going to say no again. Overfishing is not occurring. Is SSB above the target, yes or no? For this one you actually end up at the same question either way; but it will determine which leg of the decision tree you go down. Is SSB above the target, yes or no? You still end up at is F below the target; your other biological reference point.

In this example we're going to say no. The next question is about F, and for the F target here we said yes. The next question that you then ask yourself is, are major sources of uncertainty captured in the assessment. For our example we though, yes they did a pretty good job of characterizing uncertainty.

Now we get into these diagnostic questions. Is there a strong negative retrospective bias, yes or no? The answer there was no. You get the idea. You kind of bounce down answer questions, and it pushes you towards being more risky or less risky. At the end you end up in a box, a flexible box. Don't get worried.

You can see we have that range, 30 percent up to 75 percent for your levels of risk that you choose. Right underneath those there are some multicolored boxes there with some other things. We talked very, kind of mechanistically about stock assessment, but there is all this other stuff; management uncertainty, socioeconomic information, ecosystems, the importance of that species in the ecosystem.

Flexibility, this is where we kind of incorporate flexibility. That was a key element of the risk policy. We talked about that as one of the goals. There are those multicolored boxes. These are these metrics where right now we don't have a good quantification for them; they're qualitative more or less.

That is okay, I think some of these can be quantified, some of them maybe we want to leave them qualitative. We want to have that flexibility built into there, and that's where we incorporate that kind of flexibility. The thing to think about with all of those metrics is, some of them we will, we can assign numbers; as metrics are developed for them.

But at this time they're mainly qualitative, and so what we're asking you to think about with these is, these are areas where you can be flexible. You can kind of say, well our management system is pretty uncertain, ad so we want to be less risky for this species. That's how you can do that.

But we could also, management uncertainty can be quantified, and maybe we develop that into a specific metric and move forward with that one as more of a quantitative element; build it right into the decision tree or not. That's something to kind of think about as you're thinking about this is, management uncertainty is one for you. We want you to quantify that one. But the ecosystem information we want you to keep that one qualitative, so that we

have some flexibility in how we think about that. That was just an example.

All right, next steps, we've ticked a couple off the to-do list. We established our working group and we've met a couple times. We developed a policy statement. The board tentatively approved that. We met in September and we started to kind of work through some examples to kind of operationalize the risk policy. Now we're on the red line there presenting some examples to the board during the annual meeting.

Our big ask from this is, do you want us to keep moving forward on this? Do you like what you've seen so far, and if so what we think the best approach would be, is to have a standalone workshop; where we actually work together and kind of step through an example. We're suggesting, we thought about this a little bit, but at first we thought we could be a little bit ambiguous and you guys could tell us what species you want.

But we thought it might be more hopeful if we offered a species that we thought might be a good one, and so we're offering striped bass. That was actually early on in this. That was an example that we had kind of thought about. We moved away from that and now we're back to striped bass, which seems to be where we always end up.

We think it's a good one for a couple of reasons, Number 1, striped bass will be going into a benchmark in a couple years, so you could actually build this with that in mind and you could apply it. It's a data-rich species, so we've got a lot of information to work with. We've got a good solid assessment to work with, so we think it might be a good kind of first example to use.

But again, we've got another example in our back pocket if you hate that. All right, the last slide and I will stop talking; just a set of questions to kind of think about, if and when we sort of deliberate on this. What do you think about the decision tree process, do you think it's flexible enough? Do you like the idea?

Are there any of those qualitative metrics that you think we can and should quantify and build directly into the decision tree? What do you think about the range of risks? We just tried to be broad to have sort of that again maximum flexibility for you all to think about, but maybe someone offers. We don't ever want to be 70 percent uncertain that we're going to meet our targets.

Maybe that one drops out, but it is completely up to you. Then the most important one, the one that we hope you answer specifically for us today is, would the board be interested in a stand-alone workshop focused on striped bass? We'll sit here and work through the example just like we did at the working group meeting. Thanks for listening to me talk about risk and uncertainty again; and that's it for me, Mr. Chair.

CHAIRMAN GROUT: Are there any questions for Jason about this? Go to John Clark and then Dave Borden.

MR. JOHN CLARK: Thank you, Jason that is really interesting. I'm just curious. Two of the goals are to be consistent, another one is to be flexible; and they seem a little incongruous there. Obviously there is a lot of uncertainty in those extra variables there. Have you though through what approach that would be taken, so that you have some flexibility, yet we can say we used the uncertainty policy consistently from species to species?

MR. McNAMEE: Excellent question. They seem sort of counterintuitive. When we were talking about consistency, we're talking about it in a very broad context. To put it at the very highest level, you apply some sort of decision tree across species; and so that would be consistency. I think we can get a little more, you know not leave it at that really high level.

I think we can get more consistent in the categories of questions that we're asking as we work down the tree. That's another level of consistency. But in the end what we want to recognize is, a striped bass and northern shrimp are different. You know the questions, the specific questions that you end up going through, they are going to be different species-to-species; but that framework will be consistent. You know we can create different legs for the different types of species that we have to deal with.

CHAIRMAN GROUT: Follow up?

MR. CLARK: Just quickly. I just was concerned about if in different species we start weighting things differently, then certain groups might feel they're being disadvantaged by the way we're considering this aspect for this species as compared to another species.

MR. McNAMEE: I think it's a good point, but I think that exists now as well. What this does is makes us really specify why we're treating them differently.

MR. DAVID V. BORDEN: A couple comments and then a question for Jason, I guess. Comments, I like what I've seen so far, I think we should continue with this. I like the idea of a workshop; especially if it's conducted in conjunction with one of our main meetings; in other words, just take a portion of a day and do a workshop, rather than have separate travel arrangements.

But I guess my question for Jason is, and I realize there is some uncertainty with this, because it hasn't all been worked through. Each of the council's has brisk policies, as I understand it. On joint plans, what is the potential for us to end up with a different risk level than the council, and how do we ensure that that doesn't take place?

MR. McNAMEE: That is an awesome question, and one that we discussed at the meeting. I think what we basically said was, we would not be duplicating any existing risk policy that is out there. For instance, for summer flounder, Mid-Atlantic Council has a risk policy that they apply to it. We wouldn't duplicate that.

MR. ROY W. MILLER: It seems to me that in the past couple days we've heard about a few species where we had zero risk of exceeding SSB, or something of that nature. The range of 30 to 70, how did you decide on that and not go from say 0 risk to 70 percent, or something of that nature?

MR. McNAMEE: I appreciate your question, because this was probably one of, we were sort of at the bottom of the decision tree and got to this question. We were trying to be less than arbitrary. We ended up being arbitrary, so we just kind of tried to capture a range. I'm being a little facetious.

It wasn't completely without thought, and we just tried to think of examples of other species and the types of uncertainty that people have applied to them at the regional councils or whatever. That is where we kind of got. What we wanted to do was bound the issue. We thought that range was probably the extremes of where the board would probably be comfortable going.

But what we also discussed is, if you are interested, what we would do subsequent to this is begin to do a Meta-analysis. Look at other species that are out there, and that would give us a little better, less arbitrary mechanism for long-lived slow-growing species that are out there. They've never had anything above a 50 percent probability applied to them. That is information that we can use to better characterize the probabilities that we want to end up at.

MR. MUFFLEY: Thanks, Jason. I really like where the group's been going on this and I certainly support it. Maybe my question is a little bit further down the road I guess, in terms

of just thinking that this is going to continue to move forward. I was wondering what roles are being played, in terms of the decision tree itself?

Is this taking place at the Technical Committee level, because some of these are sort of technical questions; in terms of how biased or how uncertain the model is? It's not going to happen, I don't think, at the board. In terms of making those decisions or maybe it is. I'm just trying to think of where the decisions happen and get us to certain places, like the council structure, the SSC has obviously a lot of say in terms of some of the uncertainties. Is that going to happen at the TC level? Just kind of thinking through how the decision tree actually plays itself out.

MR. McNAMEE: Awesome question, Brandon. One of the nice things about the commission is we have a lot more flexibility with regard to this. The way that we've envisioned this is, there is going to be a set of codified questions that are for the TC. The TC is going to go through; we're going to look at those.

We're going to approve them at some point, and they're going to get to a spot. Then it is going to come back to the board, and that is where the flexibility comes in. It is not as if we're suggesting you need to be bound by wherever the TC ends up. What we're suggesting is, now there is going to be these other things.

Let's just use an example, economics. The TC ended up at 50 percent, but now a board member says yes, but there are severe economic consequences for whatever decision is going to be made. We can offer suggestions as to what that buffer, one way or another could or should be. But now the board can take those other pieces of information that are out there, that are qualitative or it could be quantitative as well; and you then apply them to what came from the Technical Committee to adjust.

That gives you flexibility, but the other nice thing it does is makes you say why you're adjusting, very explicitly. I think that is what we're talking about with the transparency of the process. There is flexibility to kind of account for indirect things, things we don't have good quantitative information on, or things we haven't considered in the decision tree. We can adjust, but we have to say why we're adjusting in a very explicit way.

MR. RITCHIE WHITE: Great presentation. Fully support a board workshop, and striped bass I think is the perfect species to pick. I would suggest that it be structured in the meeting week when the full commission is here; so between meetings that everyone would have the ability to be present, not at one end of the meeting week.

CHAIRMAN GROUT: I think that's a good idea.

MR. NOWALSKY: As we've labeled it presently as a policy. That would imply that when constructed for a given species, we shall follow it as opposed to potentially labeling it guidance; whereas that might give us more flexibility to deviate from it as a board? Can you talk a little bit about what the implication of labeling it a policy would be in constructing it, in terms of that constraint versus considering it as guidance instead, and giving us a starting point for discussions?

MR. McNAMEE: Yes. I kind of see it as both. You have this really structured part of it, so that you know what's going to happen as the information comes out. That's kind of the more rigorous part of the policy, where you follow as set of operating procedures that you've built a priori and agreed to. But then it also for the board, it is guidance.

The board has an opportunity to adjust from that. But at the very least, the benefit is, it gives you a solid and well informed starting point; and also forces us, the board, to really characterize why you want to move away from

that predefined guidance very explicitly. I am kind of having trouble answering your question, because I kind of see it living in both worlds.

It has kind of a formal, not a very constraining formal, but a formal process that gets undertaken and then there is more flexibility at the end to adjust. But you've ended up in that first part of the process at a good starting point. You shouldn't be way over on the other side of the decision tree, because of all of the things we talked about. But then there is room to buffer one way or the other.

MR. THOMAS P. FOTE: I feel a lot more comfortable after hearing your explanation how we use it, because we're usually risk averse with black sea bass, summer flounder. The councils have set up and trying to figure out, and spending the last two years trying to figure out how to change that; because the SSC blames the council and the council blames the SSC. I don't want to go through that headache, but I see where this could be very helpful, as long as we understand that it is flexible by the board, because I don't want something that's inflexible.

MR. DANIEL McKIERNAN: I understand that attraction of running striped bass through this as a test case, but given what we're facing in southern New England lobster, did you consider that?

MR. McNAMEE: Lobster did not come up. Well, I don't remember talking about lobster. We talked about a couple other species. The broad categories we were thinking about was like data-rich, data-poor, and so on the data-rich side we were talking about bluefish, striped bass. I think we were pretty finfish focused, more or less. I'm looking for some support from over there. The answer is, no. We certainly could. I don't know that we would be able to get through this process in time to make it relevant for what's going on with lobster. But there is no reason why. Obviously we think we can apply this at some point to all the commission species.

CHAIRMAN GROUT: Any other questions? David.

MR. DAVID BLAZER: Great work, Jay. Sounds like a pretty impressive and thorough job that you guys have done. You may have answered my question, just by your general comments a second ago about data-rich and data-poor. Thinking about menhaden and using a tool like this, and other species in the future. Is there any reference, or did you guys talk about ecological reference points and how to build that in? Just want to hear a little response on that.

MR. McNAMEE: Yes. We definitely did. As it stands now, one of our colored boxes there on that one slide that I had, ecosystem is one of them. In this period of time when we don't have ecological reference points, we can think about ecosystem considerations in a different way, and a kind of general risk types of frames.

But if we ended up with ecological reference points explicit, we can certainly build those in. That might be another leg of the decision tree that would be at least in part, you could branch off if those are like nontraditional reference points. It's certainly something we talked about and have thought about. I'm optimistic we could definitely accommodate that.

MR. ADLER: I want to return for a second to Tom Fote's thing, because I think it's very important. While this would be very helpful, I don't want to get stuck, as Tom said, with the SSC discussion where you can't change anything. As guidance, absolutely, as a policy that we have to trip over, no!

I just did want to reiterate what Tom was saying that we need the flexibility; that is what's actually helped the Atlantic states more so than the federal councils. I think we should maintain that. Use it; I don't know what you call policy,

but guidance absolutely! But I think it is very important that we keep the flexibility.

CHAIRMAN GROUT: I agree with you. I think a good way to use this is to inform our decision making. Any other questions, what are your thoughts on this having a workshop in one of the meeting weeks? Is everybody supportive of that? Is everybody good with striped bass just as a first shot? Okay that sounds good, anything else?

MR. McNAMEE: Just one more clarification, starting to think sort of operationally about this, and that is – and Roy asked the question, you know about those probabilities – that is something else we could potentially look into in a little more detail. We could drop some out right now, maybe it's too heavy a lift.

But maybe the idea could be what I'm looking for clarity on is; do you want us to do a little more research? In particular if we're going to focus on striped bass, we can think about that specific example and come up with the probabilities that work for that species in a more kind of informed way, or do you like this broad range and you want the ability to kind of have them all on the table? That's the clarification I wouldn't mind getting.

CHAIRMAN GROUT: Any comments on that? From my own personal perspective I would like – go ahead – I would appreciate – go ahead, Dave.

MR. SIMPSON: I think the range you're talking about is helpful. Maybe after the workshop we'll feel differently, but I think that's helpful. I would just underscore what Tom and Bill said; that I think at the top of this document we need to be really explicit that this is guidance and that we are free to take less or more risk as we see fit.

In terms of analysis, I don't know that it's available, but it would be great to look at a case study. Summer flounder I think for a long time, I could be wrong, but we picked that 50 percent probability of doing our job, so to speak; and how has that played out over history? If there's a stock out there, whether it's on this coast or another coast where a management body has stuck with a model-based expected success rate.

How did it actually play out over time? Because there are some stocks where you say, well the tendency is always going to be a problem with unaccounted for catch. That doesn't get incorporated into the risk probability assessment, but it comes home to roost on you after a few years.

Then I think there is other cases where we simply want to be more conservative of we just need flexibility based on the conditions, trends in recruitment or anything to that affect. One, a disclaimer at the top that this is guidance and doesn't lock us in to no less than 30 percent and no more than 70 percent, and if there is a case study out there I think it would be really instructive for how this plays out long term.

CHAIRMAN GROUT: Further input for Jason? I would concur with what Dave was saying, a broader at least a broader suite of things at this point.

HABITAT COMMITTEE REPORT

CHAIRMAN GROUT: We're on to the Habitat Committee report. Our habitat coordinator, Lisa Havel is off getting married, so Toni will be giving her report for her.

MS. KERNS: I'm going to pinch hit for Lisa, as Doug said. I was at the Habitat Committee meeting, but Wilson, I know you were there as well; so if there is anything, details I leave out, please feel free to help me out. For the Habitat Committee there are going to be two documents that we'll need to consider approval of today, just as I go through.

One of those is the Sciaenid Habitat Source Document, and then the other is Consideration of the Letter to BOEM. Both of those documents were in your meeting materials. The Habitat Committee met last week in Portland, at the Gulf of Maine Research Institute, and we're very appreciative of them hosting us.

We had presentations from our new Habitat Committee member, Oliver Cox, on the habitat of Maine; did a great job, as well as a presentation from Riley Young Morse of GMRI, who is doing a data portal of climate change in the Gulf of Maine/Mid-Atlantic area. In that portal, they're still testing it.

But once it's released I think it's going to be something that the states are going to be really interested in seeing and using. There are a lot of interactive uses for that. We also had a discussion with Katie Drew on the feasibility of incorporating habitat into stock assessments, which is a discussion I think the committee would like to have an ongoing process with, as well as an update on ACFHP and their meeting previously, which Pat Campfield will give information on later. The committee reviewed their action plan goals from last year, as well as west the action plan goals for this upcoming year.

REVIEW THE DRAFT LETTER TO BOEM REGARDING SEISMIC TESTING

MS. KERNS: For the letter that is drafted in your meeting materials for BOEM, this is based on the Habitat Committee's request to the Policy Board to consider a letter at the last meeting. They took the board's feedback from August, and drafted the current letter that we have. It is very similar in scope that the South Atlantic and the Mid-Atlantic Councils had drafted previously and sent to BOEM.

In the letter it highlights that fish and other marine resources depend on sound for their vital life functions. There is insufficient information on how these seismic surveys that is ongoing in ocean waters and their activities affect fisheries and their ecosystems, as well as the structure and function.

It also states that the commission believes it's important to fund the research in order to get a better understanding of how these activities are impacting the fishery resources that we manage, and the consequences of their activities. Then lastly, it offers a seat to BOEM on the Habitat Committee, to have better engagement with the group.

We would hope that this would also help to give us a better heads up of the different activities that are ongoing with BOEM.

REVIEW STATE REPORTS ON CLIMATE CHANGE INITIATIVES

MS. KERNS: In addition, in your meeting materials there was a document that looked at climate change from the committee. Habitat Committee members identified ongoing practices in each of their states for their coastal regulatory planning that addressed climate change impact.

There are still a couple of states that are making edits and changes to their particular sections, so it will be a living document. Then their plan is for next year to identify the gaps in the regulatory planning process, and make recommendations back to each of the states on how to make improvements. Their idea is to create a matrix, so it is a little bit more user friendly of what's available in the resources for each of the states.

REVIEW AND CONSIDER THE SCIAENID HABITAT SOURCE DOCUMENT

Then we also have the completed Sciaenid Habitat Source Document. Alison Dreary finalized this document and made all the edits and recommendations. We're very grateful for her help. The contributions were then

approved by the Habitat Committee, and if approved by the Policy Board, we'll format and make all the changes and publish it on to the commission website.

The Habitat Source Document covers the biology, the habitat needs, the habitat research needs, and habitat stresses for all of the ASMFC managed sciaenids, which include croaker, black drum, red drum, spot, spotted sea trout and weakfish. It also includes the same information for northern kingfish, southern kingfish, and Gulf kingfish.

The document identifies the major threats to sciaenids as beach renourishment, degradation of water quality, coastal development, navigation and dredging, fishing and climate change. The document makes the following recommendations to mitigate these threats. HAPCs should be accompanied by the requirements that limit habitat degradation. States should enhance and coordinate water quality monitoring. That states should minimize wetland loss and the windows of compatibility should be established, especially in regard to avoiding adverse activities during the spawning season for sciaenids. Fishing gear is known to negatively impact HAPCs, and they should be prohibited in those areas. Research on the role of submerged aquatic vegetation and sciaenid productivity should be conducted.

Restoration efforts should be enacted to restore critical habitat, and bio accumulating compounds should be limited to maintain sciaenid health. Dams that threaten freshwater flows to the nursery and spawning areas should be identified and targeted for recommendations during FERC relicensing, and we should continue with education and outreach activities that explain management measures.

Then 2017 is the 20th anniversary of the commission's SAV policy. For 2017 the Habitat Hotline major theme will be submerged aquatic vegetation, and the group is going to look at reviewing and updating their 1997 SAV Policy Document. Lisa is going to help cosponsor an artificial reef symposium at AFS this coming year, and she'll serve on that steering committee.

Then as I had said before, the committee would like to stay engaged with the Assessment Science Committee, and any other relevant committees or groups to better link habitat and stock productivity for commission managed species; and really just try to continue to advance ways to incorporate habitat information into our stock assessment process.

Then the Habitat Committee itself has two new members, one is Oliver Cox from Maine, and then the other is Denise Sanger, from South Carolina DMR. Then on the Artificial Reef Committee, Michael Malpezzi from Maryland DNR has joined the group. I will take any questions.

MR. FOTE: It seems like they're doing a lot of work. It's a shame that we can't sit in on the committee meetings like we used to. I was sitting here thinking about it. The first meeting of the Habitat Committee, before Bill Goldsborough was the Governor's appointee from Maryland, it was actually Al Goetz; and Al Goetz from Maryland and me started the Habitat Committee, basically pushed for it, with the pushing of Gordon and Phil Coates back then.

The first meeting of the Habitat Committee, we decided to make it big, when we basically reached out to the Mid-Atlantic Council. We were trying to mirror what the Mid-Atlantic Council was doing back then, and basically had a joint meeting with them where we invited all the federal agencies in. We had EPA, we had the Army Corps of Engineer, and we had the Bureau of Land Management.

Maybe it's about time to have a workshop that we do that to bring up a number of issues. I mean I'm just thinking about what we're talking

about. There are two issues there; the other issue is basically because of beach replenishment and sand mining. We are now basically destroying a lot of the lumps, old fishing grounds off the coast.

There are a whole bunch of issues, and maybe it wouldn't be, as I said, a bad idea. When we formed the Habitat Committee, it was actually all the Governors appointee, Legislative appointees and state directors. It was actually one of the most popular committees back then. We've kind of changed the direction of it, which is a good thing. But maybe it's the time, as I said, bring the Habitat Committee, maybe get a joint meeting with the Mid-Atlantic Council Habitat meeting, and try to get all three agencies or four agencies; whatever the federal agency we need to bring in, and talk about these numerous issues that are impacting fisheries like climate change. We've got a lot of problems, and it is not just climate change now. Because of climate change it's causing other problems like sand mining. Just a thought and I would like to ask that the Habitat Committee would think about that.

CHAIRMAN GROUT: Okay, we'll have Lisa bring that to the Habitat Committee again; any other questions for Toni? Loren.

MR. LOREN W. LUSTIG: I was very interested as we discussed habitat to consider the educational component. I believe that topic is of particular interest to that group of people who are our colleagues in the educational field. My question is, is there any evaluation instrument that we have in place to consider the effectiveness of these educational efforts? Perhaps that would lead us to enhancing what we're producing in that regard.

MS. KERNS: Loren, are you referencing in particular to the Sciaenid Source Document or just in general on our efforts to provide education resources on habitat issues?

MR. LUSTIG: It's more of a general question, just to assure ourselves that the efforts that we put into education are actually effective, and try to maximize that effectiveness.

MS. KERNS: I think the only evaluations that we do is that we track the number of people that we send the Habitat Hotline out to, which is a major source of educational material for the Habitat Committee. We may be able to track how many people download the habitat fact sheets off of the website, I'm not 100 percent sure if that is possible or not, at least the number of people that click to that link on the page. But beyond that I don't think that we do any additional evaluations.

DR. LANEY: It is an excellent question, Loren, and we have discussed it at length. As Toni noted, we have limited ability to track some of the educational materials that we put out there through the Habitat Hotline, and also downloads. I think, Toni, we can track downloads of the habitat management series of documents too; I'm not 100 percent sure about that.

But we have had several lengthy discussions about the fact that we are concerned about how the educational materials are used in trying to maximize the effectiveness of those materials, as well as maximizing the effective use of our time when we consider what to create. One of the things that we haven't done yet, but we did talk about at the last meeting was trying to increase our use of social media.

We discovered that Deke is the designated commission tweeter. We were thinking well, are there things the Habitat Committee might want to tweet out there that would resonate. We were advised that we could send Lisa perspective tweets and that she would work with Deke to maybe get those out there.

We've discussed it a lot, and it's been a concern I think of the committee that we were uncertain about the effectiveness of those materials. I

assure you, we'll continue to discuss that. If you have ideas about things that you think would increase the effectiveness of those materials, please share those with the Habitat Committee. We're very receptive.

CHAIRMAN GROUT: Further questions for Toni on the Habitat Committee report? Okay seeing none; we do have a couple action items here. **We need a motion to approve the Sciaenid Habitat Source Document.** Do we have a motion for that? Tom Fote, are you making that motion?

MR. FOTE: Since it's a committee report do we need a motion? Shouldn't the motion just come from the committee? That's what I'm asking.

MS. KERNS: In the past with the source documents we've approved the document or accepted the source document for use, and then we publish that on the website. It's just for the source document itself.

CHAIRMAN GROUT: I think he's talking about the Habitat Committee made a motion to approve it; do we need a motion and a second at this point? They don't make motions.

MR. FOTE: Then I'll make the motion.

CHAIRMAN GROUT: Thank you, Tom, is there a second to that motion; Wilson.

DR. LANEY: Second, Mr. Chair. Could I ask that the motion reflect the fact that we need to give editorial discretion to staff on that? Because we had a pretty extensive discussion during the meeting about the authorship, which we agreed I believe to change, Toni, if memory serves. We just need editorial discretion on the document.

CHAIRMAN GROUT: Can we have the motion reflect that? Got it, any further discussion on this motion? Is there any objection to approving the motion? **The motion is approved by unanimous consent. The other item that we are looking for action on is the draft letter to BOEM regarding seismic testing.** That is in your briefing materials. Tom.

MR. FOTE: I so move.

CHAIRMAN GROUT: Is there a second to that? David Blazer. Further discussion on the letter? Thank you, Eric Reid.

MR. ERIC REID: Exactly who is going to get this letter? That's my question. I'm sorry I didn't ask it earlier. How many people are going to get this?

MS. KERNS: Currently it is directed to the Regional Director in the Gulf of Mexico. I believe, and I would have to go back and double check with Lisa, and Wilson, you may know the answer to this. But he is the individual that is dealing with the seismic acoustic research or activities. We can confirm that there isn't a similar person in the Atlantic that gets this as well, or if it's just this one individual.

DR. LANEY: Yes, Toni, that is correct. The unit that deals with all the seismic testing off the east coast and the Gulf of Mexico is based in the Gulf of Mexico. That is to whom the letter is addressed, and I believe, Michelle can help me out here maybe. I think that both the Mid-Atlantic and South Atlantic Council have sent letters to the same entity, I believe.

DR. DUVAL: That's correct. The letter from the South Atlantic Council was sent to Mr. Goeke, I don't know if that's a correct pronunciation, but the same person.

MR. REID: I would strongly suggest that we send it to senators, governors, et cetera; because anybody that has had any experience with BOEM, let's talk about the New York Wind Farm that's my best example. They don't listen and they don't care. I think we need to send these letters out to people who might listen and might care, because it is my opinion BOEM doesn't care. That is my suggestion. We've got

to disseminate this information to people much higher up in the food chain.

MR. FOTE: As soon as we have the commission letter, I will be basically sending it to my senators and my congressmen from the state of New Jersey, and ask what is the government doing about this? They already sent letters already, so it just follows it too. Probably we'll send one to the President under my heading, with a copy of your letter to the President that says, I would like a reply on this as a commissioner.

CHAIRMAN GROUT: I guess my question is whether the commission should be sending it to all senators and governors, or whether the commissioners themselves should be taking this letter that is being sent out and providing it to their governors and senators themselves; just looking for something that might be more effective.

MR. FOTE: I think with letters like this over the years, we have not done that because some of the state agencies sitting around the table, and this is for other topics, didn't feel comfortable signing a letter to go to the senators but they felt sending them to the agencies. I don't know if the feelings have changed.

But I know that is historically why we didn't do it. Also, some of the states didn't want to – on the opposite side of the table on some of these issues – even the other agencies weren't in this state or the governor was. That's why I'm saying that it gets difficult when you do that.

CHAIRMAN GROUT: Any further thoughts? Eric, would that be a way of handling it, or do you think it's important that the commission send it directly to all governors and senators?

MR. REID: I don't have a problem with the individual delegation sending this to their own congressional delegation; so that's fine with me. But I do think it's interesting we're only talking about a process question. Nobody is disagreeing with me that BOEM is running amuck amongst us. I think it is critical that we put that in check.

If it means each one of us sending these letters to our senators that's fine, you guys have been doing this much longer than I have, and I'm a relatively new kid on the block. Whether or not it is a more powerful statement coming directly from the commission or it is more effective coming from each delegation to congressional delegations. I'll leave that up to the Chair.

CHAIRMAN GROUT: Roy and then Ritchie.

MR. MILLER: Just to follow up on Eric's suggestion. It seems to me that if we have such a letter that come February, or perhaps in the spring when we're in Alexandria for our commission meetings; and many of us avail ourselves of the opportunity of meeting with our congressional delegations while we're in D.C. at that time of year. Having such a letter in hand, and being able to personally place it in the staffers hands, would be an effective way to convey the message.

MR. WHITE: I would think both. I would think that the commission sends a letter out, as Eric has suggested, and then have the individual states follow up with that; and then even follow up as Roy has suggested. The more they hear the same type of consistent input, the more important it is to them.

DR. DUVAL: I am a little uncomfortable with sending a letter like this, I think directly to governors. I work for the governor of North Carolina, and I'm just concerned about how that might be received; given that our agency participates in the coastal zone consistency review for projects from BOEM.

I appreciate that letter, and I think it's consistent with what has been sent by the fishery management councils and sends a correct message, in terms of offering BOEM a seat at the table so that we can increase

communication and information exchange, and ensure that the commission's concerns are being considered. I definitely appreciate what Eric's trying to do. I think just from a state agency perspective, I'm a little bit uncomfortable with that; just being an executive branch agency.

CHAIRMAN GROUT: Further thoughts on this and whether the commission should send letters directly or let the commissioner's forward this to our congressional delegations and governors? David.

MR. SIMPSON: I agree with Michelle. Don't send it to our governor.

CHAIRMAN GROUT: I am getting the sense that there is enough concern my some delegates about the commission sending a letter directly; that it would be best to let the delegation, the commissioners decide when and how to deliver the letter. Does everybody agree with that sense here? Does anybody object to that? All right, I think we've got a good letter here. I think it will be the responsibility of our commissioners to forward this to our governors and speak with our senators about this; because it is an important issue.

MR. FOTE: I would like to have a copy of the South Atlantic letter, and also the Mid-Atlantic letter to basically include in the packet, when I send out from the commission; so I can say it is a whole bigger body than that. If Michelle would send it out to all the commissioners and basically have it, so we can have it in our hands.

CHAIRMAN GROUT: Toni will send that out to all the commissioners when we're sending out this letter. Okay anything else on this agenda item? **All right we need a motion to formally approve this letter. I think we had a motion and a second. Is there any objection to sending this letter? Seeing none; it is approved by unanimous consent**.

ATLANTIC COASTAL FISH HABITAT PARTNERSHIP REPORT

CHAIRMAN GROUT: The next agenda item is Atlantic Coastal Fish Habitat Partnership report by Pat.

MR. PATRICK CAMPFIELD: I'll be providing a quick report from the Atlantic Coastal Fish Habitat Partnership, which also met last week in Portland, Maine. The focus of the partnerships fall meeting was the further development of their new five-year conservation strategic plan. The committee reviewed drafts of several plan sections, including habitat conservation priorities, science and data to inform habitat restoration priorities, outreach and communications, and a section on finance. The overall plan section objectives and strategies were finalized, and the committee intends to finish the specific tasks within those strategies by December, to begin implementing the plan at the beginning of 2017.

This is important because the new plan will guide on-the-ground habitat restoration priorities for the next five years for the partnership. In addition to the strategic planning session, we received presentations from scientists at the Gulf of Maine Research Institute, covering a number of their coastal ecosystem monitoring projects.

Highlights included an inshore sea herring survey, an acoustic survey that they've conducted for the last five years, as well as projects on fish monitoring pre and post monitoring around dam removals in Maine. We also had a presentation covering work by the Great Bay Estuary Partnership, including the Exeter Dam Removal Project, which was endorsed by ACFHP.

The last major item that the partnership covered was to finalize FY 2017 funding recommendations to the Fish and Wildlife Service. We also after the meeting went on field site visits to a couple of fish passage

projects, including the Kennebec River, Edwards Dam Removal, and Coopers Mill Dam.

The next couple of slides are just pictures that we took. I think everyone has heard about the Edwards Dam Removal, but a very impressive project. You can see hopefully on the far side of the project the remnants of the old dam, but I think this was over an 800 foot large dam that was taken out in the Kennebec River. Since then of course fish passage has improved dramatically, and if I understood correctly this now hosts the largest alewife run on the east coast.

Conversely this Coopers Mill Site, there is still a dam at this site. Because of the very low flow this year, we anticipate problems for diadromous fish recruitment. Essentially the low flow has meant that there will be no downstream passage for young-of-year alewife and other stocks. These two site visits really show a juxtaposition of the value of fish passage; which leads into a quick summary of the FY17 funding recommendations from the partnership.

ACFHP received nine proposals for habitat restoration projects. They came from all of the four regions, the northeast, Mid-Atlantic, South Atlantic and south Florida. These are relatively small pots of funds, up to $50,000.00. The major proposal criteria are to meet ACFHPs conservation priorities that the projects leverage separate funding; that the projects are shovel-ready and that they have a relatively short time to completion.

The committee evaluated and scored these projects and I'll quickly overview the top three, which included one oyster reef and salt marsh restoration project and two dam removals. These are the projects that we're putting forth to the Fish and Wildlife Service. The top ranked project is to remove the Coopers Mill Dam that we just showed a picture of, as well as a partial removal of another dam on the Sheepscott System here in Maine.

If that project moves forward, it would open 71 miles of river habitat to alewife, Atlantic salmon, and other species. Also notable, the Sheepscott is the southernmost river designated as critical Atlantic salmon habitat. The project team requested $50, 000.00 but also had a much larger, substantial amount of match to complete this project. The second ranked proposal is for Oyster Reef and the Estuarine Shoreline Restoration in Bogue Sound, North Carolina, where the project team if funded, would use recycled oyster shells and place them along the shoreline to promote salt marsh accretion. This would provide nursery habitat for sea bass and red drum; as well as feeding grounds for flounder. They requested a slightly smaller amount and about $38,000.00 and have a similar amount of matching funds.

The last proposal that we'll put forward to the service would be the removal of the upper and lower Sawyer Mill Dams. This would open over five miles of habitat for alewife, eel, and lamprey. They also requested $50,000.00 and had a much, much larger amount of matching funds from other partners. Again, those funding recommendations will go forward to the Fish and Wildlife Service, and they will make their decisions in the spring. That concludes the ACFHP report.

CHAIRMAN GROUT: Any questions for Pat? Okay thank you, Pat that was excellent. We are now down to Agenda Item Number 11, and this is something that Jim Gilmore brought up, the National Park Service Management Policies. Oops, sorry, I checked off Law Enforcement Committee before it was done. Go ahead, Mark.

LAW ENFORCEMENT COMMITTEE REPORT

MR. MARK ROBSON: The Law Enforcement Committee did meet this week on Monday and Tuesday. I would like to thank all of the staff and members of the commission that attended the meeting at different times, and really contributed to the deliberations; especially Pat

Keliher, Dennis Abbot, Ritchie White, Dan McKiernan, and Dave Borden for your help with the Law Enforcement Committee deliberations.

There is a written meeting summary that we made available. It has more details. I'm just going to try to cover some of the highlights. Dealing with species issues, and of course the first two that I mention here are species that we're going to be talking about later today, American lobster and Jonah crab.

But just to give you a quick summary of some of the issues, we were briefed on the upcoming addition for the southern New England stock and some of the possible management options that may be under consideration. The LEC will certainly keep a close eye on that and be prepared to contribute any recommendations as early as needed.

We also talked a lot about the current work of the enforcement subcommittee. As you know, we've been working now for a little while on developing recommendations for enhancing enforcement of the American lobster fishery offshore and inshore as well. You will recall that we had recommended a letter that was drafted for NOAA Law Enforcement to consider in reevaluating their prioritization process for American lobster.

The feeling of the subcommittee and supported by the LEC, of course, was that this letter would help to draw attention to the need for American lobster being a higher priority in the NOAA enforcement ranking system or process. There were some questions, I guess about that letter as to the timing, and what impact it might have.

We revisited that in our meeting this week, and the LEC reconfirmed with some input from NOAA Law Enforcement that the timing is good for going ahead and submitting that letter. NOAA Law Enforcement will be going through their reprioritization process for their next five-year cycle, which is going to be from 2018 to 2023. But we were advised that this is a good time to go ahead and start providing input to NOAA as to what we see as needs for priority issues for the Atlantic States Marine Fisheries Commission. The letter would be timely if we go ahead and submit it.

If there were also concerns about, you know when you make these changes in prioritizing species work, which has a bearing on NOAA Law Enforcement funding to the states through the joint enforcement agreements. Are you in danger of robbing Peter to pay Paul? To some extent that is covered through their process, because they have overarching national priorities, but there are also regional priorities that are established.

For example, there is a whole suite of northeastern district priorities that NOAA sets, and these help to inform the specific needs of a particular part of the coastline; and then even within that NOAA works on a state-by-state basis to make sure that priorities are met that also address state needs in dealing with federal supported species.

We also talked a little bit about the next steps for recommendations for enhancing enforcement work on American lobster, and there was a strong sense that one of the next best hanging fruit might be to endorse the development or the expansion of a VMS requirement or system for that lobster fishery.

There are lots of constraints on the ultimate ability of vessels through vessel size or trap-hauling capabilities to work in some of these more remote areas where the fishery is occurring now. But it was felt that this is the next best step in addition to trying to get increased funding and priorities from NOAA to improve and enhance our ability to enforce. We'll talk more about that I guess today during the lobster committee meeting.

The next species, I believe is Jonah crab, and again we'll talk about that later today. We've kind of reiterated support for a whole crab only

harvest; even though we do recognize that the commission is desiring to move towards a claw harvest as well. We supported a five-gallon volume allowance. We have a real concern about a bycatch definition that's based on percent catch composition, which appears to be part of the management options.

We'll skip over that for now and talk more about that with the Lobster Board. With regard to the previous discussions that were held on the North Carolina aquaculture permit for glass eels. I know there were some questions about the removal of the provision in the updated application for warrantless search.

The Law Enforcement Committee took another look at that, discussed it at length really with our colleagues from North Carolina, and we continue to support that revised proposal. It was felt that there are tight permit conditions overall; that because of reporting and the limited application of this permit to a single Permittee, that we feel that those overcome any concerns about not being able to conduct a warrantless search.

As it was pointed out, it's really in the best interest of the Permittee, when asked to be inspected, or if an officer asks to take a look at their gear or their facilities or their catch. It is in their best interest to accede to that request and to do that. There are still mechanisms in place for reasonable cause or probable cause to conduct searches. In this particular circumstance we felt that there was really no concern with the loss of that warrantless search provision. However, in discussing this in a general way, there was concern expressed by the members of the LEC about any possible trend that states or other jurisdictions might have in moving in the direction of prohibiting warrantless searches, particularly in cases where they apply to somebody who has been issued a permit or a special license.

It was pointed out that this is really a very fundamental part of the enforceability of permits and licenses, the ability to go ahead when you place a condition that that Permittee is agreeing to be searched or inspected at any time. That is really a very strong component of permit conditions, and in fact when we go back and look at the enforceability guidelines that we presented, permits in general are among the highest ranked of the management measures that you all can employ.

The primary reason for that is because of that typical condition that allows for warrantless search. Again, another species issue that we took up, we did have a pretty busy meeting this week. We also talked about summer flounder. The staff updated the LEC on upcoming amendment, the comprehensive amendment to address summer flounder; with the expectation that there will be some discussion of safe harbor or dual or multi state landings or landings flexibility in that amendment.

There have been a number of times when the LEC has discussed this issue, particularly for summer flounder in the last year or two, and the increasing use of safe harbor request by members of the summer flounder fleet. There is some concern about that increasing amount of safe harbor requests, particularly for that one individual fishery.

When we talked about this concern, we had to be clear that safe harbor requests are a very fundamental tool that you have to be able to employ. It is a safety-at-sea issue many times. You want to make sure that people in the fishing community are able to come to port when they need to, and you can't just turn them away obviously.

Some of the states have policies now addressing how to handle safe harbor requests, and there was a lot of discussion about the desirability of having a standardized policy in place among all the states; so that it takes away some of the confusion as to how you address a request for safe harbor, what conditions those can be accepted, and how those are managed.

We certainly endorse developing such a standardized safe harbor policy. The issue of using safe harbor request, and then perhaps using that as a mechanism for offloading or handling of a catch from another state, if you should take safe harbor landing in a state different from where you have a catch from.

That is a little different, and we have some concerns about how that may be being mixed up in terms of safe harbor requests and at the same time, particularly with the summer flounder fleet, coming to ports and either offloading or creating difficulties in quota transfers and coordination in that regard.

There is some concern among the LEC members that safe harbor can be abused, potentially abused for business or convenience purposes. We need to be vigilant about that and in general that as you consider landings flexibility, and as you increase landings flexibility, whether it is aggregate landings, multi or dual state landings flexibility or other provisions like that; you are inevitably increasing the cost or the difficulty of enforcement. I don't mean monetary cost, but there is an enforcement cost to having that increased flexibility; either on the water or particularly at the docks, in terms of monitoring and keeping track of all those landings. That is just something to be aware of from the enforcement perspective.

Just real quickly, I'm just going to cover a few other issues that we talked about. We went through our 2017 action plan review, particularly for Goal 3, which are all the enforcement standards that we want to take a look at. Just to reemphasize how important those action plan tasks are to the LEC, we try to make sure that we address those in the course of the year.

Even though we only meet twice a year, we do try to address those throughout the year, either through teleconference calls or other work. We also had a really healthy discussion about the interstate wildlife violator's compact; this is something that's been in place for many years. But there is a lot of variability in how it's applied, either to fish or particularly to marine fish and also whether or not it is applied to commercial versus recreational activity.

Essentially this is a compact that allows someone, if someone has a license suspension or other type of penalty imposed on them that the cooperating state or the member state of the compact would also recognize that license suspension in another state. There is a lot of variability in how that works. We're going to continue to develop the information on what's out there, in terms of individual states and a national policy; and look at that in more depth in the next year.

We also had a request from the state of Massachusetts, the Commonwealth of Massachusetts to take a look at regulations throughout the Atlantic states area regarding how we deal with the combination of recreational and commercial landings in a single trip or on a single vessel. As with other types of regulations, we found that there is a lot of variation also in how states deal with this.

We are in the process of pulling together the various statutory or regulatory-language from the states on how they address or even no allow at all, the mixing of recreational and commercial landings; and provide that to the Commonwealth. We also have an Aerial Subcommittee that had been formed, mainly a result of some questions that were raised about our enforceability guidelines and the seemingly low rankings for aerial enforcement.

We're taking another hard look at that; possibly recommending that we revisit the enforcement matrix that we provided, and we actually were recommending that we remove the aerial enforcement component as a stand-alone feature. The argument being that it is basically one of the tools in a suite of tools, like vessels, vehicles and other types of equipment that are

part of how enforcement does either at-sea or dockside enforcement.

It affects those rankings, but it doesn't really fit as a stand-alone rating. We are probably going to be reevaluating that matrix, and perhaps updating the summary survey that we did with the current LEC staff or LEC members, and provide that back to you for another review and look to see if you would approve that revised guideline. I think that's it.

CHAIRMAN GROUT: Any questions for Mark? Loren.

MR. LUSTIG: Mark, thank you for that report. I was especially interested in your dialogue regarding safe harbor. You alluded to cost thereof, perhaps some of those costs being actually monetary cost. Is it possible to pass those monetary costs, if they exist, to the vessels that indeed avail themselves of safe harbor?

MR. ROBSON: Well, that was a poor choice of a word. When I meant enforcement cost, I meant the actual loss of enforceability, as you increase flexibility of landings. That is the cost that I was referring to. As to monetary cost, I don't have enough information to be able to tell you what that cost is. Obviously if you have someone who comes to port with a large number of fish that are perhaps legal to land in one state, but not legal in the state they've come to safe harbor in, or if it's an amount that's over the quota of the state where they've sought safe harbor.

There is an amount of monitoring that has to go on to make sure that those fish either stay onboard, or if there is a process of quota transfer that all that gets tracked. In terms of monetary cost, it is part of the cost of the enforcement officers having to keep track and monitor those vessels while they're in safe harbor to continually keep tabs on that.

But I don't know that that is an excessive monetary amount. I can't answer that right now. I don't know how you would pass that along to the individual vessels. Again, in many cases they are making a request under a safety consideration. Obviously the enforcement branches are very sensitive to that. We're sensitive to safety-at-sea, and so you try to be as accommodating as possible.

MR. BORDEN: A couple of comments. I attended the session on Tuesday, as Mark indicated. I just wanted to go on the record and complement both Mark and the Committee for a lot of fine work. I thought the discussion at the LEC meeting was excellent. I liked the dynamic there, and how they're all working together to try to standardize things.

The other comment I would make, and these are all brief points, and we're going to get into this in the lobster discussion that is going to follow, is there is a discussion about having a line at the 70 degree line in the next addendum. I think we should try to integrate the recommendation about VMS, as far as an option in the public hearing document.

I would also make the observation that what I would envision for the Lobster Board meeting is that there is going to be a continuing discussion about adding other options to that document. I think it is important to get the LEC to review those options before we take it out to public hearing.

My final point is that both the LEC and the Lobster Board recommended formalized positions recommending that we raise the priority of lobster enforcement, in terms of the JEA agreement. The NOAA officials at the meeting the other day, basically provided very clear guidance to all of us that now is the time to finalize those recommendations.

I think that since we've had both the LEC and the Lobster Board make this recommendation, **I think the Policy Board should endorse that**

recommendation and send a letter to NOAA, asking that the priority of lobster trap enforcement be raised. I would defer to you, Mr. Chairman. Do you want a motion on that or could we resurrect the motion that the Lobster Board dealt with and discussed, or I'll give you another alternative, Mr. Chairman. If we need time to craft a motion then we could resurrect it a little bit later in the session.

CHAIRMAN GROUT: I would suggest you craft a motion, it could be very simple.

MR. BORDEN: Megan, do you have a motion?

CHAIRMAN GROUT: Go ahead, Dan, while you're at it.

MR. McKIERNAN: While we're waiting for the motion to come up. I just want to make a comment, and I appreciate Mark Robson's insights into the so called safe-harbor problem. I just want to point out to my Mid-Atlantic colleagues that this is really a manifestation of the fluke quota system being kind of outdated and awkward now.

We have summer flounder in the winter, which are predominantly more north and more east than they have been in the past. We have a migration of not just fluke, but of fluke permits. Permits for North Carolina landings, for Virginia landings are finding themselves in the possession of New Bedford vessels, for instance.

Guys are making business decisions to fish on the North Carolina quota six miles off Nantucket. On a windy, January day they can't get back to where the fish are supposed to go, and it puts all kinds of pressure on the enforcement folks, the permitting folks, and then we get these doctors notes about the injury and the Coast Guard reports. I think the solution is to readdress the winter fluke fishery in a more comprehensive way. It isn't necessarily to solve the down-in-the-weeds issue about safe-harbor.

CHAIRMAN GROUT: Is that a motion you would like to make, Mr. Borden?

MR. BORDEN: **That's the motion, Mr. Chairman.**

CHAIRMAN GROUT: Is there a second to this motion, Pat. We have a modification, hold on. Okay we have a motion and a second. Just to give the board sort of a process of this we'll go through, since we don't have a letter in front of us right now is, once staff crafts this letter they'll bring it to the LEC Chair and the Lobster Board Chair for them to review it. Then we will send it out to the Policy Board once it's been approved by those two Chairs for consideration, and we'll have probably an e-mail vote on it, on whether to actually send it out.

MS. KERNS: We need the motion on the record.

CHAIRMAN GROUT: I'll be glad to. I'm going to read the motion and I'm going to take comment on it. **Move to send a letter to NOAAs Office of Law Enforcement asking for lobster to become a high priority through their Joint Enforcement Agreements Program. Motion by Mr. Borden, seconded by Mr. Keliher**; do you want to have first shot at any further discussion on this?

MR. PATRICK C. KELIHER: I just want it to be clear for the record, when we're talking about increasing this as a priority that we're talking about offshore enforcement in offshore Area 1 and Area 3; just so that it is clear for the record.

CHAIRMAN GROUT: That is true. Is there other discussion on this motion? Dave.

MR. SIMPSON: Law enforcement is important for every species, and when we say making lobster a high priority that necessarily means it pushes something else down. Given the great deal of work and effort we've made on, for example quota managed species; summer flounder, black sea bass, striped bass.

Which of those are we suggesting become a lower priority so that lobsters can become a higher one? I can appreciate in the Gulf of Maine lobster is probably their Number 1 and their Number 2 and their Number 3 and their Number 4 concern. But in southern New England where we're taking really less – there isn't a lot of conservation going on with lobsters that require law enforcement.

We have a mandatory v-notch program that in some areas can't be enforced, it can't be checked, and it can't be verified. I am concerned that we're going to ask for something that is going to hurt us in another area. If the Striped Bass Board were meeting, how would they feel about that becoming a lower priority than lobster? I just think we have to look at a list and say, where does lobster fall in our priorities as a full commission? I don't support the motion.

MR. KELIHER: I appreciate David's concerns. When I think of this as a high priority issue, lobster is Number 4 in our state of Maine JEA agreement right now, Number 4. Groundfish and herring are still one of the highest priorities within that document. From the state of Maine's perspective, what we're looking for is a shift upward.

We should be offshore doing the lobster work, and while we're doing lobster work a byproduct of that enforcement work would be checking herring, checking groundfish boats. I really think it becomes, at the end of the day OLEs prerogative on how they're going to shift that priority within each states agreement; because it is not a single agreement across states. Each state has a little bit different agreement. For Maine, New Hampshire and Mass, lobster might rise up but something else may go down; but it may not impact Connecticut's agreement at all.

MR. BORDEN: I'll make this really fast. That is really an important point. In other words, my response to David would have been when Connecticut writes their JEA Agreement, they don't have to have lobster enforcement to be a high priority. They have the flexibility to tailor make that to put the emphasis on other species.

MR. SIMPSON: Then I guess it begs why the Full Commission is making this motion, if this is an individual state preference, then why is the Full Commission saying to OLE, make lobster a high priority? I'm even more confused now. I guess I would say from a commission perspective, if lobster is doing so well in the Gulf of Maine and groundfish are doing so poorly, why would we take law enforcement attention away from the most troubled stocks and put them on the healthiest stock?

Again, I think if it's an individual state thing then we shouldn't be talking about it. I shouldn't bring up Gulf of Maine and lobster sitting here in Maine. Again, for southern New England, we just have much higher priorities than lobster, clearly. We've worked much more diligently and suffer much more with things like black sea bass than lobster right now.

MR. ROBSON: I will try to shed a little light on it. I'm not fully aware of how the process works, but as it was described in the LEC meeting, the NOAA Office of Law Enforcement through this planning process, develops sort of an overarching national set of priorities that they want to address.

But the real meat of it is in; I think their district or their regional priorities that are established. For example, Tim Donovan, who is the NOAA representative on the LEC, provided us with a copy of the current enforcement priorities for the Northeast Division. It is broken down by a variety of very specific activities, high priority, medium priority, low priority.

The concern about, particularly in the northeast division, was that American lobster really wasn't in that picture for the region, hardly at all as a priority. They do also work beyond the regional enforcement priorities, or the district.

They do work with each individual state through the development of those specific joint enforcement agreements.

I don't know to what level they modify or tailor the priorities for the states. The states may have capabilities or limitations that dictate what they can do for meeting these NOAA priorities, but they still have to sort of fall back to those regional and those overarching national requirements to address key species.

In the case of one of the caveats in the NOAA document, is that high priority items include those items that have low rates of compliance or areas, where there could be significant impact to the resources for noncompliance. Part of the concern with American lobster is this growing potential for lack of compliance with trap tagging and so forth; that it seems to be warranting more of a high priority rating.

NOAA does say in their caveat here, NOAA will enforce any and all violations of the laws we are able to, and all of these items are a priority for us, even the low priority items. The other factor in this that was important to the LEC was that the NOAA Office of Law Enforcement through their new director, they are starting to reevaluate how they focus NOAA funding through joint enforcement agreements on these priorities.

They are going to be paying more attention to directing funds or directing reimbursement to activities that specifically target the higher priority or the mid priority items that is in their list. I don't know if that helps or not. I'm not completely privy to the NOAA process for their priority ratings.

MS. KELLY DENIT: I think between Pat and Mark you've hit it. Essentially there are three tiers, if you will. There is the national prioritization, then there are regional priorities that are identified based on conversations and inputs from the states and the councils; and then there is the mechanism through the JEAs by which priorities are even further refined.

The board may wish to think about how they want to frame that in the sense of, where are you really looking to provide your input as it relates to lobster specifically; into each of those three tiers or is it in one or only one or two?

CHAIRMAN GROUT: Dan.

MR. McKIERNAN: Yes, I would just like to comment that the draft addendum that we're going to review later this morning shows that in southern New England for the first time in 2012, the majority of lobsters were caught in federal waters. I think that trend is only become more exacerbated over the last four years. We all are feeling this void of rules that need to be enforced in some capacity, and it's increasingly in the federal domain. That's why we think it's appropriate to bring this up, since it's the Joint Enforcement Agreement between the states and NMFS.

MS. KERNS: If this motion was to pass and we could draft this letter more specific, what it sounds like to me is the regions that you would like us to put that higher priority on. But from my understanding of what Dan just said is that we're seeking higher priorities in the offshore areas in particular. We're going to be moving forward with regulations in southern New England, which would cover portions of Area 3, which we would want offshore enforcement in.

That would be the New England region as well as, I don't know what the middle region is called, if it's called the Mid-Atlantic or whatever that central region would be. That's where we would be looking to put a higher priority on lobster for in the offshore waters. Is that correct? Would we want Area 3 as well though, based on what Dan just suggested?

MR. BORDEN: With the indulgence of the Chair, can I ask Mark a question? My understanding from the discussion the other day was that the

LEC was going to review all of the priorities at some point. Is that going to take place? Then offer comments on those priorities, is that going to take place before the next commission meeting?

MR. ROBSON: In the past, we have had that opportunity to review the NOAA priorities documents. We actually provide recommendations on either adding or modifying those priorities back to the ASMFC Policy Board as official input from the ASMFC on what those NOAA priorities are. That's how it has been done in past efforts.

This upcoming iteration is going to be a five-year NOAA planning process. As we understood it, they are already in a mode of taking in input. But I don't know when through our official ASMFC commenting process we would be able to look at that whole thing. But certainly the LEC is the group that could offer the first set of recommendations on any priorities as a total list.

MR. BORDEN: I guess my suggestion, Mr. Chairman is to pass the motion and then check on the specific deadline that NOAA requires input. If in fact the period of time that we have available coincides with our next meeting, then the Policy Board could actually look at a recommendation from the LEC and then look at the actual priorities and try to do a more comprehensive recommendation on this. But in the event that they need this input prior to that time, we would at least have one recommendation into them.

MR. ROBSON: In thinking about this, and certainly we can check with the NOAA staff. They are at sort of the early stages of gathering up ideas and suggestions for priorities, and I don't know when. It may be a longer period before they actually have a draft document for that 2018-2022. Maybe towards the end of 2017 before there is an actual draft document that we would officially review and comment on.

MS. DENIT: As far as I know this process hasn't even officially started. I think we're at the very early stages. I think there is going to be plenty of opportunity to have the process that Mark outlined. As far as I understand it we're going to pursue a similar process as we have in the past, where we would produce somewhat of a draft, come and get input from the commission, the councils, state partners et cetera.

I think this would be an opportunity for the commission, if it wanted to, to get in on the earlier side of that of identifying what it considers to be at least one of its priorities to start. You could include as part of your letter, if you wanted to, acknowledging that the board might want to have more extensive conversations across all of its species; as Dave was alluding to, and provide further feedback to OLE in the future.

CHAIRMAN GROUT: That sounds like a process that I think we can move forward with. Is there further discussion on this motion? Dave.

MR. SIMPSON: Based on what Kelly said and the time that we have. I would move to postpone action on this motion until the Full Commission has an opportunity to look at the priorities and weigh in on the relative priorities for the whole commission by species. At this point I look at it and I don't know necessarily if lobster moves to high then something moves out of high. I think the commission wants to know what drops. **I think we need to take a step back and look at our commission species, and make a more holistic motion; in terms of the commission's view on priorities, so I move to postpone.**

CHAIRMAN GROUT: To what time? You need a time certain.

MR. SIMPSON: **Until a draft set of priorities is developed for each region in the commission's range.**

CHAIRMAN GROUT: Is there a second to this motion? Jim Gilmore.

MS. KERNS: Kelly, question. Then that would mean, because what I think you were just suggesting is that we could send some early comments to try to influence the process at the beginning, in the early stages, and then come back and recommend once the priorities have been published; I'm assuming in the Federal Register. This would preclude us from doing so, not preclude us, but we would have to wait until everything is published for official public comment, not going in on the early side.

MS. DENIT: I don't think historically we have done the process through the Federal Register. I think it has been a document that has been circulated and shared with the commissions and councils. I guess the one comment I would offer is I just don't know when that draft set of priorities would be available.

It's possible that it is up to a year from now. It could be shorter than that. I just have no idea, so I don't want to provide any wrong expectations, in terms of what postponing it would mean. But I'm trying to see if I can get a hold of Tim right now, to see if I can get a better sense of that.

CHAIRMAN GROUT: Pat and Ritchie.

MR. KELIHER: I just feel like we're tying the hands of the commission to not be able to comment on an issue with OLE. It is a recommendation to make it a higher priority. There will be a lot of time for input for other issues and other species, as Dave suggested. Why everything looks tranquil right here in Bar Harbor.

While everybody has been sitting around this table, I've been dealing with the biggest trap war in the history of the state of Maine. With more than a half a million dollars in gear loss; and we're getting ready to announce a $15,000.00 reward associated with this. As Dan McKiernan said, everything is shifting offshore.

The need for more dollars and more support for lobster enforcement, we're at a critical stage. If it helps to craft this to make it more specific towards the northeast, I'm fine with that. But I would hate to postpone this and wait for OLE to react. Then we're reacting to what they have. I think it's better to get in early and comment early. If it means we need to get ahead of the game with other species over the next few meetings, then we should do that.

MR. WHITE: I agree with Pat. When I attended the meeting there was a lot of discussion about the problems, both Area 3 and offshore Area 1. I have heard from a lot of lobstermen in southern Maine and New Hampshire and northern Mass that call the outside of Area 1 the Wild West. Maine law enforcement talked about hauling ghost gear with 40 trap trawls with no tags on it, and that that type of fishing is commonplace out there now.

The ability of the states right now to enforce that area is very difficult, almost nonexistent; due to the size of vessels needed. I think this is critical. I think that we can always adjust this going forward. But I think being in early to the service, showing how important this is for the northern states. I think it is worthwhile going ahead, so I am going to oppose the motion to postpone.

MR. STEPHEN TRAIN: I think for me this isn't about the lobster so much, even though I'm a lobsterman. This is about priorities. I think everyone is familiar with Suttons Law, even if they didn't know what it was. When they asked Willie Sutton why he robbed banks, he says because it is where the money is.

The cheating is going to go on in the fishery that has the money in it. We may have other priorities in a region, but right now this is a lucrative fishery, and this is the fishery that needs a priority on enforcement. I oppose

delaying anything on this, and I would say the same thing if it was sea bass that we were delaying, and that's where the money was. Right now we need to get on this and we need to get on it quickly.

MR. GILMORE: I completely support you guys, but that first motion is very generic. If you modify that to include the areas of maybe northern Mass, New Hampshire, you know whatever offshore areas, I could be more supportive of it. Right now in the world of law enforcement that I understand, you say something simple like that it means everywhere.

I agree 100 percent with Dave; lobster off of New York is not a big priority as other things. I was just trying to postpone it to perfect it more, so that we understand where the priority is. Again, if you wanted to go back and limit that to a specific area, I could support that and we could vote on that today.

MR. BORDEN: Just a quick point, Mr. Chairman that I'm opposed to the motion to postpone. One of the principal reasons is, I don't want to wait until the end of this process and then evaluate the priorities. The enforcement personnel at that meeting the other day have already been sent from the Office of Enforcement, documents outlining the existing priorities. There is no reason that we can't look at that same document and formalize a position.

CHAIRMAN GROUT: Obviously we're at a point where we can't amend that motion, because we have a motion to postpone on the board. Yes sir, Dave.

MR. SIMPSON: Just as a point of order, is a motion to postpone debatable?

CHAIRMAN GROUT: Just the time in which you postpone to, so at this point I would love to have more discussion on this, but called it. We're going to have to take a vote on this. Do you need time to caucus? Does anybody need time to caucus on this? I see some people caucusing so I'll give you 30 seconds to caucus.

Okay on the motion to postpone; move to postpone the motion until a draft set of priorities is developed for each region within the commission's range. Motion by Mr. Simpson and seconded by Mr. Gilmore. All states and jurisdictions in favor raise your hand. All opposed. Are there any abstentions, any null votes; one null vote. The motion fails 6 to 8 to 1. We're now back to the motion, the underlying motion here.

MR. BORDEN: With the agreement of the seconder, I would suggest it would be more appropriate if we added after make high, instead of high, higher. I think that is more consistent with the NOAA standards. In other words they don't have the, in fact I think the LEC looked at that language and recommended higher originally.

CHAIRMAN GROUT: Is the seconder okay with that?

MR. KELIHER: I would be okay with that; but based on comments from Mr. Gilmore, do you think we should also at the same time, since we're trying to perfect this, include within the northeast region? Does that get to what you were looking at, Jim?

CHAIRMAN GROUT: I see an agreement between the maker and seconder. Is there any objection to making this change from the board? Seeing none; we now have a motion. Is there further discussion on this motion? Do you need time to caucus on this? I am not seeing anybody saying yes so we'll go right into it**. All those in favor of this motion as written raise your hand. All those opposed same sign. Any abstentions, two abstentions. Any null votes? The motion carries 11 to 3 to 2 to 0.** Any other discussion on this item? Dave.

MR. BORDEN: I apologize for continuing to bring up points. Recognizing Jim and David's concerns, I think the staff should get whatever information is currently available on the priorities and circulate it to all parties.

CHAIRMAN GROUT: Sounds like a good suggestion.

CONSIDER COMMENT ON THE NATIONAL PARK SERVICE MANAGEMENT POLICIES

CHAIRMAN GROUT: All right, we are now onto Item Number 11, Consider Comment on the National Park Service Management Policies. Jim Gilmore.

MR. GILMORE: I'll try to compress this down so we can catch up a little bit. There is a Director's Order from the National Park Service on fishing, which includes marine surface waters. There are 88 of the 409 National Parks actually have marine waters. This order is derived from a 2006 Park Service Management Policy, so it's not entirely new.

But there seems to be a lot of interpretation as to what some of the information is, and actually there is a lot of discretion from the individual park superintendants. There was a call on October 12th, and I had one of my staff sit on it with the Association of Fish and Wildlife Agencies; which went into a little bit of details on the slide show that is at the end of the supplemental material goes into some of what was presented at this meeting.

The intent of the Director's Order is to make park policies on fishing more consistent. However, there are some things that raise some flags with me, and I think some other folks maybe with the agency. First off, recreational fishing is generally allowed. However, commercial fishing is generally prohibited.

The flag during the meeting that came up was they consider for-hire, party and charterboats are considered commercial fishing under the NPS regulations. But just a note, this morning I got an e-mail that was updating that a little bit, and they're saying that charterboats may not be considered commercial, but they may require a commercial youth authority permit from the National Park Service.

They are going to be fishing within the waters of the National Park System. Now I have two in my region, I have Fire Island and I have Gateway. The boundaries for those parks extend 4,000 feet into the Bay, the Great South Bay, and 1,000 feet into the ocean. If those recreational fisheries are excluded, then essentially those boats cannot go in there.

Some of the good news is the park superintendants are required to work with the state and local representatives when setting regulations, because they can set their own regulations. I'm not exactly sure how they would do that. John suggested during the call that they also engage both the commission and NOAA Fisheries, because some of their interpretations may be inconsistent with what we and the federal government have defined, particularly for recreational fisheries.

The parks can take action if they determine unacceptable impacts from fishing are occurring. But what impacts are not well defined, but in New York they actually shut the horseshoe crab harvest down within Fire Island National Seashore a couple years ago, or at least got it shut down; which really caused a great deal of consternation in New York.

The DO states that they must do monitoring, which they're not doing, so there is a whole lot of weird things with this thing that they can only do some of these requirements if they do due diligence on their part. But again, the superintendants can set their own limits. Right now this just simply boils down to; I guess we were contacted by AFWA.

I think maybe Bob Beal talked with them, and the suggestion is that right now the commission

provides feedback through AFWA, or at least commenting on what their policies are in this new Director's Order, just to get clarification that we're not at odds with some of the things they're suggesting. The crunch point on this though is that comments are due back by October 31st. I had talked to Ryan Roberts and see if there is an extension on that. I mean the other option is we can also respond back directly to the Park Service. They are representatives too, but I think if we get a communication back to AFWA would be the most efficient way to do it. Just additionally, each one of the states obviously can comment back, and if you've got a national park in your backyard, you may want to review this a little bit more in more detail.

Regardless of what we do today, you should be talking directly to the park superintendants, and meeting with them; because they may be coming up with things that maybe are inconsistent with your state fishing practices. On that I'll take any questions if there is, Mr. Chairman.

MR. KELIHER: You are basically surrounded by a national park right here. There is one right across the Bay, as far to the lands is part of Acadia. The state of Maine has been embroiled in a pretty heated conversation that has been tempered as of late, regarding access to shellfish and marine worms; where Mr. Gilmore is correct, rules prohibit commercial take and commercial harvest.

We have agreed that they're not going to work on those rules. Representative Poliquin, the second district Congressman from this area has submitted a bill on that fact. Maine and Massachusetts are in a little different place; because of colonial law regarding fishing, fouling and navigation; which is I think a cornerstone of that particular piece of legislation.

In conversations with the superintendent here, these superintendants don't want to butt heads with the states. They don't want to see federal legislation on this to change these rules. I don't think we want to see it, frankly, because I'm not sure when Friends of Acadia and Friends of everyplace, Yellowstone and everyplace else comes up, I think commercial extraction loses.

However, I'm not really comfortable with commenting on this through AFWA. I think the commission, if this is a real issue, which it is a real issue. I think the commission should be contacted directly and we not use AFWA as a vehicle for our voice. While some people here may engage with AFWA, I think they are going to be much more focused on the need for protecting recreational access than commercial access. I think it is going to be a much different conversation going through them than commenting directly.

MR. ROBERT H. BOYLES, JR.: Jim, thank you for bringing this up. I was not able to participate in the AFWA call. Mr. Chairman, I would suggest this is an issue of great importance to the commission. Along with Pat Keliher's comment, I might phrase it in the sense of sovereignty and states authority and sovereignty to manage these resources.

I will suggest to you that we have issues in my state with another interior department bureau, with Fish and Wildlife Service over these very kinds of issues. It grieves me to suggest that the various properties approaches tend to vacillate over time, depending on who the superintendent is, who the manager is.

Mr. Chairman, I might suggest, rather than try to get into another letter writing exercise. You might consider appointing a small group of us to look at this issue, the various aspects of it with respect to sovereignty, access and insuring that we have a very transparent and inclusive process to deal with these issues.

CHAIRMAN GROUT: Obviously we're not going to be able to have any comment particularly on the rules, because of the timeframe. Do we

have people that would like to participate in this workgroup? Jim, all right keep your hands up; Dan McKiernan, Jim Gilmore, Jim Estes, Robert Boyles, David Blazer, and Patrick Keliher. We have a workgroup. I'm sure we'll have staff try and organize a conference call to start off with.

I think you have some basic information, Jim that you can provide to start it. I'll put you in charge, Jim. All right thank you very much for a good discussion on this.

OTHER BUSINESS

OVERVIEW OF EFFECT OF AFS DOCUMENT SUBMITTED FOR COMMENT

We have a few other items under Other Business. First what I would like to do is just give people a very brief overview of what transpired with the AFS document that the Executive Director submitted via e-mail for comment.

We did receive comment back from a few of the commissioners that had concern about the commission signing on. When we go those comments I asked the Executive Director to check with AFWA to see if we can have a delay in when we needed to sign on, because I felt given the issues that were brought up by a few of the commissioners that we needed to have a full discussion at the Policy Board.

They responded that no, they didn't have the time to wait another four days. At that point I said, I don't think without a full and thorough discussion that the commission should be signing on to this at this point. We are not going to be signing on, and that's my report on that. Yes, go ahead, Bob.

EXECUTIVE DIRECTOR ROBERT E. BEAL: AFS did say you know if the commission would like to send a letter of support about that document on the elements that we could agree on, we can do that. But I am not sure if it lends a whole lot to that document. That option is still out there, but I'm not sure we necessarily need to go down that road.

CHAIRMAN GROUT: Does anybody have any thoughts on that whether we should take the time to put some comments in on that document? Again, probably at this point would have to take a little bit of a working group. Not seeing a lot of people raising their hands for this. I think we'll just move forward with no signing onto it. Okay the next one will be a letter from the Coastal Sharks Board regarding dusky sharks. Okay go ahead, Toni, and then John Clark.

RECOMMENDATION FROM THE COASTAL SHARKS BOARD

MS. KERNS: There is a recommendation from the Coastal Sharks Board to submit comments to NOAA Fisheries on Dusky Sharks Amendment 5B. Those comments would be based on information that the states send to Ashton by November 15th. If we don't get any comments then we would not send a letter. It's strictly based on the states sending in comments to us.

CHAIRMAN GROUT: We would still need a motion from this board to consider sending a letter. What Toni is suggesting is that as long as there is no opposition to the staff drafting this letter based on comments that would be provided by the states. She will go ahead and do that and then send that out to the Policy Board via e-mail for an e-mail vote.

Is there any objection to moving forward with that process for this letter? Okay seeing none; that is how we'll move forward with this.

LETTER FROM THE SUMMER FLOUNDER, SCUP, AND BLACK SEA BASS BOARD REGARDING BLACK SEA BASS

CHAIRMAN GROUT: Finally we have a letter from the fluke, black sea bass and scup board

regarding black sea bass, and Jim Gilmore is going to handle that.

MR. GILMORE: If I can do this quickly, and just the map that is up on the board. Pay attention to the green area. The mustard on the right was actually a New York Congressman trying to redefine the EEZ that didn't go anywhere. Right now, essentially the green areas if you're fishing in Long Island Sound or Block Island Sound and you have striped bass.

You can't fish in that area, but you can transit the area between the water bodies. If you're going to Montauk to Block Island Sound or back to Connecticut, you essentially have free passage. However, we've gotten reports now that the same situation with black sea bass. Boats are being pulled over for having black sea bass illegally in our transit zone.

Since this is a NOAA rule or whatever in terms of that. The suggestion was that we would ask them to add black sea bass for a similar situation in the transit zone; that they would be able to go back and forth with their not fishing there, but have fish onboard so that they would not get ticketed or even pulled over.

CHAIRMAN GROUT: Okay so the Black Sea Bass Board is requesting that this letter be crafted. This would be again another situation where staff would craft the letter and then we would send it out to the Policy Board for approval via e-mail vote. Adam.

MR. NOWALSKY: I understand that it's particularly an issue with black sea bass right now, due to the federal waters closure. But should we be considering a more general policy that would also cover summer flounder, scup. Should we potentially have issues there? I mean with the significant cuts we're facing with summer flounder this year,

I don't know what the outcome is going to be there. But the issue in question is transiting closed state waters with recreational harvest taken from legally opened state waters, when federal waters are closed. Should we be considering this in a more general sense, would be my question.

MR. SIMPSON: Thanks for that comment, Adam, because I think that is looking down the road at what may be coming this year; if I get my wish that someday the federal government will actually engage in some conservation of summer flounder in federal waters. It could happen here and they could have a closed season.

Closing the waters that is perfectly fine, but allow transit, otherwise Rhode Island is in a fix for having waters that are only open to the couple hundred residents of Block Island. I think it really does make a lot of sense. They cannot fish in there, but they have to be able to transit.

CHAIRMAN GROUT: Is there any objection to moving forward with a broader letter that would reflect being able to transit that zone with fish that are legally caught in state waters, any species that are legally caught in state waters? Seeing no objection to that is there any objection to the process that I laid out here that a letter will be drafted and then forwarded to the Policy Board for approval via e-mail vote. Seeing no objection to that; we'll move forward with that process.

ADJOURNMENT

CHAIRMAN GROUT: I believe that brings us to the end of the Policy Board here. Any other items to come before the board, seeing none; this meeting is adjourned.

(Whereupon the meeting adjourned at 11:03 a.m. on October 27, 2016.)

Safe Harbor Guidance

This Safe Harbor Guidance is intended to guide commercial fishing vessels in need of safe harbor for reasons described herein.

August 10, 2016

Sea going commercial fishing vessels who cannot legally enter New York waters will be allowed to enter New York waters and/or dock in a New York port under the following declared circumstances:

- Mechanical Breakdown: A commercial fishing vessel having a mechanical problem that makes the continuation of the voyage unsafe and poses risk to life and property.
- Unsafe weather conditions: A commercial fishing vessel facing an extended period of high winds (35+knots), waves (10+ feet), ice or other adverse condition that makes the continuation of the voyage unsafe and poses risk to life and property.
- Loss of essential equipment: A commercial fishing vessel losing essential gear such as support system that renders the vessel unable to remain at sea or safely fish.
- Significant medical emergency: one which requires immediate medical attention necessary to protect the health of any person on board.

The New York State Department of Environmental Conservation (NYSDEC) may require the vessel captain to independently verify the reason for the unscheduled dockage with a mechanic deemed qualified by New York State, the National Weather Service or a medical professional, as appropriate.
Sea going commercial fishing vessels wishing to enter New York waters and/or dock in a New York port under one of the above declared circumstances must seek prior permission from New York State. A commercial fishing vessel seeking permission to enter New York waters and/or dock in a New York port:

- **SHALL** immediately notify the NYSDEC by calling the 24 hour dispatch at 1-844 DEC ECOS (1-844-332-3267), declare the need for safe harbor and:
  Identify the caller;
  - Identify the vessel captain's name;
  - Identify the home state in which they are licensed to commercially fish;
  - Describe the nature of the problem;
  - Identify the port they intend to enter and the approximate time of arrival;
  - Verbally declare the type and amount of fish on board; and
  - Provide a call back phone number or other method of contact.
- **SHALL NOT** offload cargo without the express authorization of and supervision by personnel of the NYSDEC Divisions of Marine Resources or Law Enforcement. Authorization to offload fish may be granted where the fish on board the vessel will become unmarketable due to the unscheduled dockage. Authorization will be limited

according to the willingness of the vessel's home state to accept the fish under that state's fish allocation.

Sea going commercial fishing vessels seeking refuge under this Safe Harbor Guidance are subject to inspection by the United States Coast Guard, other federal agents, and police or peace officers authorized by New York State law to ensure compliance with all laws and regulations.

Sea going commercial fishing vessels must be in compliance with Federal Marine Fisheries Law and the law of the vessel's home state. Fish possession limits will be evaluated subject to the possession limits of the state that the vessel is licensed to land in.

This guidance is not intended to disregard other circumstances that may prevent a vessel's entry to a New York port. For example, a sinking vessel, or a vessel leaking oil or fuel, or a port's capacity to accommodate a vessel, may prevent or delay entry to a port. Additionally, NYSDEC may consult with other Federal and State agencies before granting safe harbor to a sea going commercial fishing vessel.

This guidance does not create any rights enforceable by any party and does not restrict or alter the authority or enforcement discretion of the NYSDEC Commissioner or the Commissioner's designee.

Atlantic States Marine Fisheries Commission

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MEMORANDUM

December 20, 2016

TO: **Coastal Sharks Management Board, Advisory Panel, and Technical Committee**

FROM: **Ashton Harp, Fishery Management Plan Coordinator**

RE: **Blacknose Shark Commercial Retention Limit South of 34˚00' N. Latitude**

NOAA Fisheries published a final rule establishing a commercial retention limit of 8 blacknose sharks for all Atlantic shark limited access permit holders in the Atlantic region south of 34˚00' N. latitude **effective January 13, 2017**. As specified in Addendum II to the Coastal Sharks FMP, the Coastal Sharks Management Board (Board) can set possession limits for the harvest of blacknose sharks in state waters. **Should the Board choose to complement the federal management measures, action would need to be taken by the Interstate Fisheries Management Policy Board at the Winter Meeting since the Board is not scheduled to meet then.**

The blacknose and non-blacknose small coastal shark (SCS) fisheries south of 34˚00' N. latitude are quota-linked under current regulations, meaning if landings of either fishery are projected to exceed 80% of the available commercial quota then the both fisheries will close. In May 2016, both fisheries closed because blacknose shark landings exceeded the 80% threshold, however, less than 20% of the non-blacknose SCS quota had been harvested at that time. This action is expected to increase the utilization of available non-blacknose SCS quota and aid in rebuilding and ending overfishing of Atlantic blacknose sharks.

As long as the blacknose and non-blacknose shark fisheries are open, directed shark limited access permit holders can continue to land non-blacknose SCS without a retention limit, while incidental shark limited access permit holders continue to be limited to no more than 16 SCS or pelagic sharks per trip combined. Effective January 13, 2017, a person operating a vessel south of 34˚00' N. latitude cannot retain, possess or land more than 8 blacknose sharks. Keeping with current regulations, a person operating a vessel north of 34˚00' N. latitude may not possess, land or sell any blacknose sharks.

The Federal Register notification can be found at: https://www.federalregister.gov/d/2016-29984.

If you have any questions, please contact me at aharp@asmfc.org or 703.842.0740.

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 223

[Docket No. 151110999–6999–02]

RIN 0648–XE314

Endangered and Threatened Wildlife and Plants; Proposed Threatened Listing Determination for the Oceanic Whitetip Shark Under the Endangered Species Act (ESA)

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS has completed a comprehensive status review under the Endangered Species Act (ESA) for the oceanic whitetip shark (*Carcharhinus longimanus*) in response to a petition from Defenders of Wildlife to list the species. Based on the best scientific and commercial information available, including the status review report (Young *et al.,* 2016), and after taking into account efforts being made to protect the species, we have determined that the oceanic whitetip shark warrants listing as a threatened species. We conclude that the oceanic whitetip shark is likely to become endangered throughout all or a significant portion of its range within the foreseeable future. Any protective regulations determined to be necessary and advisable for the conservation of the species under ESA section 4(d) would be proposed in a subsequent **Federal Register** announcement. Should the proposed listing be finalized, we would also designate critical habitat for the species, to the maximum extent prudent and determinable. We solicit information to assist in this listing determination, the development of proposed protective regulations, and the designation of critical habitat in the event this proposed listing determination is finalized.

DATES: Comments on this proposed rule must be received by March 29, 2017. Public hearing requests must be requested by February 13, 2017.

ADDRESSES: You may submit comments on this document, identified by NOAA–NMFS–2015–0152, by either of the following methods:

- *Electronic Submissions:* Submit all electronic comments via the Federal eRulemaking Portal. Go to *www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2015-0152,* click the ''Comment Now!'' icon, complete the required fields, and enter or attach your comments.
- *Mail:* Submit written comments to Chelsey Young, NMFS Office of Protected Resources (F/PR3), 1315 East West Highway, Silver Spring, MD 20910, USA. Attention: Oceanic whitetip proposed rule.

Instructions: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NMFS. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address, etc.), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. NMFS will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous).

You can find the petition, status review report, **Federal Register** notices, and the list of references electronically on our Web site at *http://www.nmfs.noaa.gov/pr/species/fish/oceanic-whitetip-shark.html.* You may also receive a copy by submitting a request to the Office of Protected Resources, NMFS, 1315 East-West Highway, Silver Spring, MD 20910, Attention: Oceanic whitetip proposed rule.

FOR FURTHER INFORMATION CONTACT: Chelsey Young, NMFS, Office of Protected Resources, (301) 427–8403.

SUPPLEMENTARY INFORMATION:

Background

On September 21, 2015, we received a petition from Defenders of Wildlife to list the oceanic whitetip shark (*Carcharhinus longimanus*) as threatened or endangered under the ESA throughout its entire range, or, as an alternative, to list two distinct population segments (DPSs) of the oceanic whitetip shark, as described in the petition, as threatened or endangered, and to designate critical habitat. We found that the petitioned action may be warranted for the species; on January 12, 2016, we published a positive 90-day finding for the oceanic whitetip shark (81 FR 1376), announcing that the petition presented substantial scientific or commercial information indicating the petitioned action of listing the species may be warranted range wide, and explaining the basis for those findings. We also announced the initiation of a status review of the species, as required by section 4(b)(3)(a) of the ESA, and requested information to inform the agency's decision on whether the species warranted listing as endangered or threatened under the ESA.

Listing Species Under the Endangered Species Act

We are responsible for determining whether species are threatened or endangered under the ESA (16 U.S.C. 1531 *et seq.*). To make this determination, we first consider whether a group of organisms constitutes a ''species'' under section 3 of the ESA, then whether the status of the species qualifies it for listing as either threatened or endangered. Section 3 of the ESA defines species to include ''any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.'' On February 7, 1996, NMFS and the U.S. Fish and Wildlife Service (USFWS; together, the Services) adopted a policy describing what constitutes a DPS of a taxonomic species (61 FR 4722). The joint DPS policy identified two elements that must be considered when identifying a DPS: (1) The discreteness of the population segment in relation to the remainder of the species (or subspecies) to which it belongs; and (2) the significance of the population segment to the remainder of the species (or subspecies) to which it belongs.

Section 3 of the ESA defines an endangered species as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a threatened species as one ''which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' Thus, in the context of the ESA, the Services interpret an ''endangered species'' to be one that is presently at risk of extinction. A ''threatened species,'' on the other hand, is not currently at risk of extinction, but is likely to become so in the foreseeable future. In other words, a key statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either now (endangered) or in the foreseeable future (threatened). The statute also requires us to determine whether any species is endangered or threatened as a result of any of the following five factors: The present or threatened destruction, modification, or curtailment of its habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or

predation; the inadequacy of existing regulatory mechanisms; or other natural or manmade factors affecting its continued existence (ESA, section 4(a)(1)(A)–(E)). Section 4(b)(1)(A) of the ESA requires us to make listing determinations based solely on the best scientific and commercial data available after conducting a review of the status of the species and after taking into account efforts being made by any State or foreign nation or political subdivision thereof to protect the species. In evaluating the efficacy of existing protective efforts, we rely on the Services' joint *Policy on Evaluation of Conservation Efforts When Making Listing Decisions* (''PECE''; 68 FR 15100; March 28, 2003) for any conservation efforts that have not been implemented, or have been implemented but have not yet demonstrated effectiveness.

Status Review

We convened a team of agency scientists to conduct the status review for the oceanic whitetip shark and prepare a report. The status review report of the oceanic whitetip shark (Young *et al.,* 2016) compiles the best available information on the status of the species as required by the ESA and assesses the current and future extinction risk for the species, focusing primarily on threats related to the five statutory factors set forth above. We appointed a biologist in the Office of Protected Resources Endangered Species Conservation Division to undertake a scientific review of the life history and ecology, distribution, abundance, and threats to the oceanic whitetip shark. Next, we convened a team of biologists and shark experts (hereinafter referred to as the Extinction Risk Analysis (ERA) team) to conduct an extinction risk analysis for the species, using the information in the scientific review. The ERA team was comprised of a natural resource management specialist from NMFS Office of Protected Resources, a fishery management specialist from NMFS' Highly Migratory Species (HMS) Management Division, and four research fishery biologists from NMFS' Southeast, Northeast, Southwest, and Pacific Island Fisheries Science Centers. The ERA team had group expertise in shark biology and ecology, population dynamics, highly migratory species management, and stock assessment science. The status review report presents the ERA team's professional judgment of the extinction risk facing the oceanic whitetip shark but makes no recommendation as to the listing status of the species. The status review report is available electronically at *http://www.nmfs.noaa.gov/pr/species/fish/oceanic-whitetip-shark.html.*

The status review report was subjected to independent peer review as required by the Office of Management and Budget Final Information Quality Bulletin for Peer Review (M–05–03; December 16, 2004). The status review report was peer reviewed by five independent specialists selected from the academic and scientific community, with expertise in shark biology, conservation and management, and specific knowledge of oceanic whitetip sharks. The peer reviewers were asked to evaluate the adequacy, appropriateness, and application of data used in the status review as well as the findings made in the ''Assessment of Extinction Risk'' section of the report. All peer reviewer comments were addressed prior to finalizing the status review report.

We subsequently reviewed the status review report, its cited references, and peer review comments, and believe the status review report, upon which this proposed rule is based, provides the best available scientific and commercial information on the oceanic whitetip shark. Much of the information discussed below on oceanic whitetip shark biology, distribution, abundance, threats, and extinction risk is attributable to the status review report. However, we have independently applied the statutory provisions of the ESA, including evaluation of the factors set forth in section 4(a)(1)(A)–(E), our regulations regarding listing determinations, and our DPS policy in making the 12-month finding determination.

Life History, Biology, and Status of the Petitioned Species

Taxonomy and Species Description

The oceanic whitetip shark belongs to the family Carcharhinidae and is classified as a requiem shark (Order Carcharhiniformes). The oceanic whitetip belongs to the genus *Carcharhinus,* which includes other pelagic species of sharks, such as the silky shark (*Carcharhinus falciformis*) and dusky shark (*C. obscuras*), and is the only truly oceanic (*i.e.,* pelagic) shark of its genus (Bonfil *et al.,* 2008). The oceanic whitetip shark has a stocky build with a large rounded first dorsal fin and very long and wide paddle-like pectoral fins. The first dorsal fin is very wide with a rounded tip, originating just in front of the rear tips of the pectoral fins. The second dorsal fin originates over or slightly in front of the base of the anal fin. The species also exhibits a distinct color pattern of mottled white tips on its front dorsal, caudal, and pectoral fins with black tips on its anal fin and on the ventral surfaces of its pelvic fins. The head has a short and bluntly rounded nose and small circular eyes with nictitating membranes. The upper jaw contains broad, triangular serrated teeth, while the teeth in the lower jaw are more pointed and are only serrated near the tip. The body is grayish bronze to brown in color, but varies depending upon geographic location. The underside is whitish with a yellow tinge on some individuals (Compagno 1984).

Current Distribution

The oceanic whitetip shark is distributed worldwide in epipelagic tropical and subtropical waters between 30° North latitude and 35° South latitude (Baum *et al.,* 2006). In the western Atlantic, oceanic whitetips occur from Maine to Argentina, including the Caribbean and Gulf of Mexico. In the central and eastern Atlantic, the species occurs from Madeira, Portugal south to the Gulf of Guinea, and possibly in the Mediterranean Sea. In the western Indian Ocean, the species occurs in waters of South Africa, Madagascar, Mozambique, Mauritius, Seychelles, India, and within the Red Sea. Oceanic whitetips also occur throughout the Western and Central Pacific Ocean, including China, Taiwan, the Philippines, New Caledonia, Australia (southern Australian coast), Hawaiian Islands south to Samoa Islands, Tahiti and Tuamotu Archipelago and west to the Galapagos Islands. Finally, in the eastern Pacific, the species occurs from southern California to Peru, including the Gulf of California and Clipperton Island (Compagno 1984).

Habitat Use and Movement

The oceanic whitetip shark is a highly migratory species of shark that is usually found offshore in the open ocean, on the outer continental shelf, or around oceanic islands in deep water, occurring from the surface to at least 152 meters (m) depth. Although the oceanic whitetip can be found in decreasing numbers out to latitudes of 30° N and 35° S, with abundance decreasing with greater proximity to continental shelves, it has a clear preference for open ocean waters between 10° S and 10° N (Backus *et al.,* 1956; Strasburg 1958; Compagno 1984; Bonfil *et al.,* 2008). The species can be found in waters between 15 °C and 28 °C, but it exhibits a strong preference for the surface mixed layer in water with temperatures above 20 °C, and is considered a surface-dwelling shark. It

is however, capable of tolerating colder waters down to 7.75 °C for short periods as exhibited by brief, deep dives into the mesopelagic zone below the thermocline (>200 m), presumably for foraging (Howey-Jordan *et al.,* 2013; Howey *et al.,* 2016). However, exposures to these cold temperatures are not sustained (Musyl *et al.,* 2011; Tolotti *et al.,* 2015a) and there is some evidence to suggest the species tends to withdraw from waters below 15 °C (*e.g.,* the Gulf of Mexico in winter; Compagno 1984).

Little is known about the movement or possible migration paths of the oceanic whitetip shark. Although the species is considered highly migratory and capable of making long distance movements, tagging data provides evidence that this species also exhibits a high degree of philopatry (*i.e.,* site fidelity) in some locations. To date, there have been three tagging studies conducted on oceanic whitetip sharks in the Atlantic. Mark recapture data (number tagged = 645 and recaptures = 8) from the NMFS Cooperative Shark Tagging Program between 1962 and 2015 provide supporting evidence that the range of movement of oceanic whitetip sharks is large, with potential for transatlantic movements (Kohler *et al.,* 1998; NMFS, unpublished data). Maximum time at liberty was 3.3 years and the maximum distance traveled was 1,225 nautical miles (nmi0 (2,270 kilometers (km0). These data indicate movements from the northeastern Gulf of Mexico to the Atlantic Coast of Florida, from the Mid-Atlantic Bight to southern Cuba, from the Lesser Antilles west into the central Caribbean Sea, from east to west along the equatorial Atlantic, and from off southern Brazil in a northeasterly direction. In the Bahamas, oceanic whitetips tagged at Cat Island stayed within 500 km of the tagging site for ~30 days before dispersing across 16,422 km² of the western North Atlantic. Maximum individual displacement from the tagging site ranged from 290–1,940 km after times at liberty from 30–245 days, with individuals moving to several different destinations (*e.g.,* the northern Lesser Antilles, the northern Bahamas, and north of the Windward Passage). Many sharks returned to the Bahamas after ~150 days and estimated residency times within the Bahamas Exclusive Economic Zone (EEZ), were generally high (mean=68.2 percent of time; Howey-Jordan *et al.,* 2013). Oceanic whitetip sharks showed similar movement patterns and site fidelity in a tagging study conducted in Brazil. Although individuals tended to travel long distances before returning to the tagging area, tagging and pop-up sites were relatively close to each other. In fact, five out of eight sharks ended their tracks relatively close to their starting points, even after traveling several thousand kilometers (Tolotti *et al.,* 2015a).

In the Indo-Pacific, two tagging studies of oceanic whitetip shark have been conducted: one in the central Pacific and one in the western Indian Ocean. In the central Pacific, oceanic whitetip sharks showed a complex movement pattern generally restricted to tropical waters north of the North Equatorial Countercurrent near the tagging location. Maximum time at liberty was 243 days, but the largest linear movement was 2,314 nmi (4,285 km) in 95 days (Musyl *et al.,* 2011). Similar to previously discussed studies, long distance movements were also observed in the Indian Ocean, with one tag that remained attached for 100 days. This individual displayed extensive horizontal movement covering a distance of approximately 6,500 km during the monitored period, moving from the Mozambique Channel up the African east coast of Somalia and then heading back down towards the Seychelles (Filmalter *et al.,* 2012). Overall, the available tagging data demonstrates that oceanic whitetip sharks are capable of traveling great distances in the pelagic environment, but also show a high degree of site fidelity in some locations.

Diet and Feeding

Oceanic whitetip sharks are high trophic-level predators in open ocean ecosystems feeding mainly on teleosts and cephalopods (Backus *et al.,* 1956; Bonfil *et al.,* 2008), but studies have also reported that they consume sea birds, marine mammals, other sharks and rays, molluscs, crustaceans, and even garbage (Compagno 1984; Cortés 1999). Backus *et al.,* (1956) recorded various fish species in the stomachs of oceanic whitetip sharks, including blackfin tuna, barracuda, and white marlin. Based on the species' diet, the oceanic whitetip has a high trophic level, with a score of 4.2 out of a maximum 5.0 (Cortés 1999). The available evidence also suggests that oceanic whitetip sharks are opportunistic feeders. In the Bahamas, large pelagic teleosts (*e.g.,* billfish, tunas, and dolphin fish) are abundant and oceanic whitetips are anecdotally reported to feed heavily on recreationally caught teleosts in this region. In a recent study of an oceanic whitetip shark aggregation at Cat Island, Bahamas, SIA-based Bayesian mixing model estimates of short-term (near Cat Island) diets showed more large pelagic teleosts (72 percent) than in long-term diets (47 percent), showing a spatiotemporal difference in oceanic whitetip feeding habits. Thus, the availability of large teleost prey and supplemental feeding from recreational sport fishermen may be possible mechanisms underpinning site-fidelity and aggregation of oceanic whitetips at this location (Madigan *et al.,* 2015).

Size and Growth

Historically, the maximum length effectively measured for the oceanic whitetip was 350 cm total length (TL; Bigelow and Schroder 1948 cited in Lessa *et al.,* 1999), with ''gigantic individuals'' perhaps reaching 395 cm TL (Compagno 1984), though Compagno's length seems to have never been measured (Lessa *et al.,* 1999). In contemporary times, Lessa *et al.* (1999) recorded a maximum size of 250 cm TL in the Southwest Atlantic, and estimated a theoretical maximum size of 325 cm TL (Lessa *et al.,* 1999), but the most common sizes are below 300 cm TL (Compagno 1984). The oceanic whitetip has an estimated maximum age of 17 years, with confirmed maximum ages of 12 and 13 years in the North Pacific and South Atlantic, respectively (Seki *et al.,* 1998; Lessa *et al.,* 1999). However, other information from the South Atlantic suggests the species likely lives up to ~20 years old based on observed vertebral ring counts (Rodrigues *et al.,* 2015). Growth rates (growth coefficient, K) have been estimated similarly for both sexes and range from 0.075—0.099 in the Southwest Atlantic to 0.0852–0.103 in the North Pacific (Seki *et al.,* 1998; Lessa *et al.,* 1999; Joung *et al.,* 2016). Using life history parameters from the Southwest Atlantic, Cortés *et al.* (2010; 2012) estimated productivity of the oceanic whitetip shark, determined as intrinsic rate of population increase (*r*), to be 0.094–0.121 per year (median). Overall, the best available data indicate that the oceanic whitetip shark is a long-lived species (at least 20 years) and can be characterized as having relatively low productivity (based on the Food and Agriculture Organization of the United Nations (FAO) productivity indices for exploited fish species, where $r < 0.14$ is considered low productivity), making them generally vulnerable to depletion and potentially slow to recover from overexploitation.

Reproduction

Similar to other Carcharhinid species, the oceanic whitetip shark is viviparous (*i.e.,* the species produces live young) with placental embryonic development. The reproductive cycle is thought to be

biennial, giving birth on alternate years, after a lengthy 10–12 month gestation period. The number of pups in a litter ranges from 1 to 14 (mean = 6), and a positive correlation between female size and number of pups per litter has been observed, with larger sharks producing more offspring (Compagno 1984; Seki *et al.,* 1998; Bonfil *et al.,* 2008; IOTC 2015a). Age and length of maturity estimates are slightly different depending on geographic location. For example, in the Southwest Atlantic, age and length of maturity in oceanic whitetips was estimated to be 6–7 years and 180–190 cm TL, respectively, for both sexes (Lessa *et al.,* 1999). In the North Pacific, there are two different estimates for age and length of maturity. Seki *et al.,* (1998) estimated that females reach sexual maturity at approximately 168–196 cm TL, and males at 175–189 cm TL, which corresponds to ages of 4 and 5 years, respectively (Seki *et al.,* 1998). However, more recently Joung *et al.* (2016) determined a later age of maturity in the North Pacific, with females reaching maturity at 190 cm TL (approximately 8.5–8.8 years) and males reaching maturity at 172 cm TL (approximately 6.8–8.9 years old). In the Indian Ocean, both males and females mature at around 190–200 cm TL (IOTC 2014). Size at birth also varies slightly between geographic locations, ranging from 55 to 75 cm TL in the North Pacific, around 65–75 cm TL in the northwestern Atlantic, and 60–65 cm TL off South Africa, with reproductive seasons thought to occur from late spring to summer (Bonfil *et al.,* 2008; Compagno 1984).

Tropical Pacific records of pregnant females and newborns are concentrated between 20° N and the equator, from 170° E to 140° W. In the Atlantic, young oceanic whitetip sharks have been found well offshore along the southeastern coast of the United States, suggesting that there may be a nursery in oceanic waters over this continental shelf (Compagno 1984; Bonfil *et al.,* 2008). In the southwestern Atlantic, the prevalence of immature sharks, both female and male, in fisheries catch data suggests that this area may serve as potential nursery habitat for the oceanic whitetip shark (Coelho *et al.,* 2009; Tambourgi *et al.,* 2013; Tolotti *et al.,* 2013; Frédou *et al.,* 2015). Juveniles seem to be concentrated in equatorial latitudes, while specimens in other maturational stages are more widespread (Tambourgi *et al.,* 2013). Pregnant females are often found close to shore, particularly around the Caribbean Islands. One pregnant female was found washed ashore near Auckland, New Zealand. These points suggest that females may come close to shore to pup (Clarke *et al.,* 2015b). In the southwestern Indian Ocean, oceanic whitetip sharks appear to mate and give birth in the early summer. The locations of the nursery grounds are not well known but they are thought to be in oceanic areas.

Population Structure and Genetics

To date, only two studies have been conducted on the genetics and population structure of the oceanic whitetip shark, which suggest there may be some genetic differentiation between various populations of the species. The first study (Camargo *et al.,* 2016) compared the mitochondrial control region (mtCR) in 215 individuals from the Indian Ocean and eastern and western Atlantic Ocean. While results showed significant genetic differentiation (based on haplotype frequencies) between the eastern and western Atlantic Ocean ($\Phi ST = 0.1039$, $P < 0.001$; Camargo *et al.,* 2016), pairwise comparisons among populations within the regions revealed a complex pattern. Though some eastern Atlantic populations were significantly differentiated from western Atlantic populations ($FST = 0.09 - 0.27$, $P < 0.01$), others were not ($FST = 0.02 - 0.03$, $P > 0.01$), even after excluding populations with sample sizes of less than 10 individuals (Camargo *et al.,* 2016). Additionally, the sample size from the Indian Ocean (N = 9) may be inadequate to detect statistically significant genetic structure between this and other regions (Camargo *et al.,* 2016). Furthermore, since this study only used mitochondrial markers, male mediated gene flow is not reflected.

In the second study, Ruck (2016) compared the mitochondrial control region, a protein-coding mitochondrial region, and nine nuclear microsatellite loci in 171 individuals sampled from the western Atlantic, Indian, and Pacific Oceans. Using three population-level pairwise metrics (PhiST, FST, and Jost's D), Ruck (2016) did not detect fine-scale matrilineal structure within ocean basins, but mitochondrial and nuclear analyses indicated weak but significant differentiation between western Atlantic and Indo-Pacific Ocean populations ($\Phi ST = 0.076$, $P = 0.0002$; $FST = 0.017$, $P < 0.05$ after correction for False Discovery Rate). Therefore, Ruck (2016) suggests that oceanic whitetip sharks consist of a minimum of two contemporary, distinct genetic populations comprising sharks from the western Atlantic and the Indo-Pacific (this study did not have any samples from the eastern Atlantic). However, although significant inter-basin population structure was evident, it was associated with deep phylogeographic mixing of mitochondrial haplotypes and evidence of contemporary migration between the western Atlantic and Indo-Pacific Oceans (Ruck 2016).

As noted previously, although Ruck (2016) did not initially detect fine-scale matrilineal structure within ocean basins, after comparing and analyzing the genetic samples of the two studies together (*i.e.,* samples from Camargo *et al.,* 2016 and samples from Ruck 2016), Ruck (Unpublished data) detected significant maternal population structure within the western Atlantic that provides evidence of three matrilineal lineages in the western Atlantic. However, the data showing population structure within the Atlantic relies solely on mitochondrial DNA and does not reflect male mediated gene flow. Thus, while the current (albeit unpublished) data supports three maternal populations within the Atlantic, this data is preliminary and information regarding male mediated gene flow would provide an improved understanding of the fine-scale genetic structuring of oceanic whitetip in the Atlantic.

The best available information indicates that the oceanic whitetip shark has relatively low genetic diversity. Compared to eight other circumtropical elasmobranch species, including the basking shark (*Cetorhinus maximus*), smooth hammerhead (*Sphyrna zygaena*), great hammerhead (*Sphyrna mokarran*), tiger shark (*Galeocerdo cuvier*), blacktip reef shark (*Carcharhinus limbatus*), sandbar shark (*Carcharhinus plumbeus*), silky shark (*Carcharhinus falciformis*), and the whale shark (*Rhincodon typus*), the oceanic whitetip shark ranks the fourth lowest in global mtCR genetic diversity (0.33 percent ± 0.19 percent; Ruck 2016), with diversity similar to the smooth hammerhead (0.32 percent ± 0.18 percent (Testerman 2014) and greater than basking sharks (Hoelzel *et al.,* 2006). The mtCR genetic diversity of the oceanic whitetip is about half that of the closely related silky shark (0.61 percent ±0.32 percent; (Clarke *et al.,* 2015a)) and about a third that of the whale shark (1.1 percent ± 0.6 percent; (Castro *et al.,* 2007). Ruck (2016) noted that the relatively low mtDNA genetic diversity (concatenated mtCR–ND4 nucleotide diversity $\pi = 0.32$ percent ±0.17 percent) compared to other circumtropical elasmobranch species raises potential concern for the future genetic health of this species. Camargo *et al.,* (2016) also observed low levels of

genetic variability for the species throughout the study area, and noted that these low genetic variability rates may represent a risk to the adaptive potential of the species leading to a weaker ability to respond to environmental changes (Camargo *et al.* 2016).

Current Status

Oceanic whitetip sharks can be found worldwide, with no present indication of a range contraction. Although generally not targeted, they are frequently caught as bycatch in many global fisheries, including pelagic longline (PLL) fisheries targeting tuna and swordfish, purse seine, gillnet, and artisanal fisheries. Oceanic whitetip sharks are also a preferred species for their large, morphologically distinct fins, as they obtain a high price in the Asian fin market, and thus they are valuable as incidental catch for the international shark fin trade.

In 2006, the International Union for Conservation of Nature (IUCN) classified the oceanic whitetip shark as Vulnerable globally based on an assessment by Baum *et al.,* (2006) and its own criteria (A2ad+3d+4ad), and placed the species on its ''Red List.'' Under criteria A2ad, 3d and 4ad, a species may be classified as Vulnerable when its ''observed, estimated, inferred or suspected'' population size is reduced by 30 percent or more over the last 10 years, the next 10 years, or any 10-year time period, or over a 3-generation period, whichever is the longer, where the reduction or its causes may not have ceased or may not be understood or may not be reversible, based on a direct observation and actual or potential levels of exploitation. The IUCN's justification for the categorization is based on the species' declining populations. The IUCN notes that the species' regional trends, slow life history characteristics (hence low capacity to recover from moderate levels of exploitation), and high levels of largely unmanaged and unreported mortality in target and bycatch fisheries, give cause to suspect that the population has decreased by over 30 percent and meets the criteria to be categorized as Vulnerable globally. As a note, the IUCN classification for the oceanic whitetip shark alone does not provide the rationale for a listing recommendation under the ESA, but the classification and the sources of information that the classification is based upon are evaluated in light of the standards on extinction risk and impacts or threats to the species.

Distinct Population Segments

As described above, the ESA's definition of ''species'' includes ''any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate fish or wildlife which interbreeds when mature.'' As stated in the joint DPS policy, Congress expressed its expectation that the Services would exercise authority with regard to DPSs sparingly and only when the biological evidence indicates such action is warranted. NMFS determined at the 90-day finding stage that the petition to list the global species of oceanic whitetip shark was warranted. As such, we conducted the extinction risk analysis on the global oceanic whitetip shark population.

Assessment of Extinction Risk

The ESA (section 3) defines an endangered species as ''any species which is in danger of extinction throughout all or a significant portion of its range.'' A threatened species is defined as ''any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' Neither we nor the USFWS have developed formal policy guidance about how to interpret the definitions of threatened and endangered with respect to what it means to be ''in danger of extinction.'' We consider the best available information and apply professional judgment in evaluating the level of risk faced by a species in deciding whether the species is threatened or endangered. We evaluate both demographic risks, such as low abundance and productivity, and threats to the species, including those related to the factors specified in ESA section 4(a)(1)(A)–(E).

Methods

As we described previously, we convened an ERA team to evaluate extinction risk to the species. This section discusses the methods used to evaluate threats and the overall extinction risk to the oceanic whitetip shark. For purposes of the risk assessment, an ERA team comprised of fishery biologists and shark experts was convened to review the best available information on the species and evaluate the overall risk of extinction facing the oceanic whitetip shark, now and in the foreseeable future. The term ''foreseeable future'' was defined as the timeframe over which threats could be reliably predicted to impact the biological status of the species. After considering the life history of the oceanic whitetip shark, availability of data, and types of threats, the ERA team decided that the foreseeable future should be defined as approximately 3 generation times for the oceanic whitetip shark, or approximately 30 years. A generation time is defined as the time it takes, on average, for a sexually mature female oceanic whitetip shark to be replaced by offspring with the same spawning capacity. This timeframe (3 generation times) takes into account the time necessary to provide for the conservation and recovery of the species. As a late-maturing species, with slow growth rate and relatively low productivity, it would likely take more than a generation time for any conservative management action to be realized and reflected in population abundance indices. In addition, the foreseeable future timeframe is also a function of the reliability of available data regarding the identified threats and extends only as far as the data allow for making reasonable predictions about the species' response to those threats. Since the main threats to the species were identified as fisheries and the inadequacy of existing regulatory measures that manage these fisheries, the ERA team felt that they had the background knowledge in fisheries management and expertise to confidently predict the impact of these threats on the biological status of the species within this timeframe.

The ability to measure or document risk factors to a marine species is often limited, where quantitative estimates of abundance and life history information are often lacking altogether. Therefore, in assessing extinction risk of a data limited species, it is important to include both qualitative and quantitative information. In assessing extinction risk to the oceanic whitetip shark, the ERA team considered the demographic viability factors developed by McElhany *et al.,* (2000) and the risk matrix approach developed by Wainwright and Kope (1999) to organize and summarize extinction risk considerations. The approach of considering demographic risk factors to help frame the consideration of extinction risk has been used in many of our status reviews (see *http://www.nmfs.noaa.gov/pr/species* for links to these reviews). In this approach, the collective condition of individual populations is considered at the species level according to four demographic viability factors: Abundance, growth rate/productivity, spatial structure/connectivity, and diversity. These viability factors reflect concepts that are

well-founded in conservation biology and that individually and collectively provide strong indicators of extinction risk.

Using these concepts, the ERA team evaluated demographic risks by assigning a risk score to each of the four demographic risk factors. The scoring for these demographic risk criteria correspond to the following values: 0—unknown risk, 1—low risk, 2—moderate risk, and 3—high risk. Detailed definitions of the risk scores can be found in the status review report.

The ERA team also performed a threats assessment for the oceanic whitetip shark by evaluating the effect that the threat was currently having on the extinction risk of the species. The levels included ''unknown,'' ''low,'' ''moderate,'' and ''high.'' The scores were then tallied and summarized for each threat. It should be emphasized that this exercise was simply a tool to help the ERA team members organize the information and assist in their thought processes for determining the overall risk of extinction for the oceanic whitetip shark.

Guided by the results from the demographic risk analysis and the threats assessment, the ERA team members were asked to use their informed professional judgment to make an overall extinction risk determination for the oceanic whitetip shark. For this analysis, the ERA team considered three levels of extinction risk: 1—low risk, 2—moderate risk, and 3—high risk, which are all temporally connected. Detailed definitions of these risk levels are as follows: 1 = Low risk: A species or DPS is at low risk of extinction if it is not at a moderate or high level of extinction risk (see ''Moderate risk'' and ''High risk'' below). A species or DPS may be at a low risk of extinction if it is not facing threats that result in declining trends in abundance, productivity, spatial structure, or diversity. A species or DPS at low risk of extinction is likely to show stable or increasing trends in abundance and productivity with connected, diverse populations; 2 = Moderate risk: A species or DPS is at moderate risk of extinction if it is on a trajectory that puts it at a high level of extinction risk in the foreseeable future (see description of ''High risk''). A species or DPS may be at moderate risk of extinction due to projected threats or declining trends in abundance, productivity, spatial structure, or diversity. The appropriate time horizon for evaluating whether a species or DPS is more likely than not to be at high risk in the foreseeable future depends on various case- and species-specific factors; 3 = High risk: A species or DPS with a high risk of extinction is at or near a level of abundance, productivity, spatial structure, and/or diversity that places its continued persistence in question. The demographics of a species or DPS at such a high level of risk may be highly uncertain and strongly influenced by stochastic or depensatory processes. Similarly, a species or DPS may be at high risk of extinction if it faces clear and present threats (*e.g.,* confinement to a small geographic area; imminent destruction, modification, or curtailment of its habitat; or disease epidemic) that are likely to create present and substantial demographic risks. The ERA team adopted the ''likelihood point'' (FEMAT) method for ranking the overall risk of extinction to allow individuals to express uncertainty. For this approach, each team member distributed 10 ''likelihood points'' among the extinction risk levels. This approach has been used in previous NMFS status reviews (*e.g.,* Pacific salmon, Southern Resident killer whale, Puget Sound rockfish, Pacific herring, and black abalone) to structure the team's thinking and express levels of uncertainty when assigning risk categories. Although this process helps to integrate and summarize a large amount of diverse information, there is no simple way to translate the risk matrix scores directly into a determination of overall extinction risk. Other descriptive statistics, such as mean, variance, and standard deviation, were not calculated, as the ERA team felt these metrics would add artificial precision to the results. The scores were then tallied and summarized.

Finally, the ERA team did not make recommendations as to whether the species should be listed as threatened or endangered. Rather, the ERA team drew scientific conclusions about the overall risk of extinction faced by the oceanic whitetip shark under present conditions and in the foreseeable future based on an evaluation of the species' demographic risks and assessment of threats.

Evaluation of Demographic Risks

Abundance

While a global population size estimate or trend for the oceanic whitetip shark is currently unavailable, numerous sources of information, including the results of a recent stock assessment and several other abundance indices (*e.g.,* trends in occurrence and composition in fisheries catch data, catch-per-unit-effort (CPUE), and biological indicators) were available to infer and assess current regional abundance trends of the species. Given the available data, and the fact that the available assessments were not conducted prior to the advent of industrial fishing (and thus not from virgin biomass), the exact magnitude of the declines and current abundance of the global population are unknown. However, based on the best available scientific and commercial data, the ERA team concluded, and we agree, that while the oceanic whitetip shark was historically one of the most abundant and ubiquitous shark species in tropical seas around the world, numerous lines of evidence suggest the species has not only undergone significant historical declines throughout its range, but likely continues to experience abundance declines of varying magnitude globally.

Across the Pacific Ocean, several lines of evidence indicate significant and ongoing population declines of the oceanic whitetip shark. In the eastern Pacific Ocean (EPO), the oceanic whitetip shark was historically the third most abundant shark species after blue sharks (*Prionace glauca*) and silky sharks (*C. falciformis*). The oceanic whitetip comprised approximately 20 percent of the total shark catch in the tropical tuna purse seine fishery from 2000–2001 (Roman-Verdesoto and Orozco-Zoller 2005) and averaged 9 percent of the total shark catch from 1993–2009 (with silky sharks comprising 84 percent, the hammerhead complex comprising 5 percent, and other sharks comprising 2 percent; Hall and Román 2013). However, if only the more recent period from 2005–2009 is considered, then the proportion of silky sharks is 93 percent, followed by the scalloped hammerhead shark (1.6 percent), and the smooth hammerhead shark (1.5 percent). The changes are the result of a rapid decline in oceanic whitetip sharks (Hall and Román 2013). Data for the oceanic whitetip shark in the EPO is available from the Inter-American Tropical Tuna Commission (IATTC), the Regional Fishery Management Organization (RFMO) responsible for the conservation and management of tuna and tuna-like species in the IATTC Convention Area. The IATTC Convention Area is defined as waters of the EPO within the area bounded by the west coast of the Americas and by 50° N. latitude, 150° W. longitude, and 50° S. latitude.

Nominal catch data from the IATTC shows that purse seine sets on floating objects, unassociated sets and dolphin sets all show decreasing trends of oceanic whitetip shark since 1994 (IATTC 2007). In particular, presence of oceanic whitetip sharks on sets with floating objects, which are responsible

for 90 percent of the shark catches in the EPO purse seine fishery, has declined significantly (Hall and Román 2013). Based on nominal catches per set as well as the frequency of occurrence of oceanic whitetip sharks in floating object sets, the species has practically disappeared from the fishing grounds, with a seemingly north to south progression. Similar trends are also seen in dolphin and school sets. These declines in nominal CPUE or the frequency of occurrence translates to a decline of 80–95 percent from the population levels in the late 1990s (Hall and Román 2013). Although there are various potential reasons for such reductions, including changes in fishing areas or methods, higher utilization rates, or some combination of factors, the increasing rarity of this species in EPO purse seine sets likely tracks closely with their relative abundance (Hall and Román 2016).

Similar levels of decline have also been observed across the Western and Central Pacific Ocean. Like the eastern Pacific, the oceanic whitetip shark was once one of the most abundant pelagic shark species throughout the tropical waters of the region. For example, tuna longline survey data from the 1950s indicate oceanic whitetip sharks comprised 28 percent of the total shark catch of fisheries south of 10° N. (Strasburg 1958). Likewise, Japanese research longline records during 1967–1968 indicate that oceanic whitetip sharks were among the most common shark species taken by tuna vessels in tropical seas of the Western and Central Pacific, and comprised 22.5 percent and 23.5 percent of the total shark catch west and east of the International Date Line, respectively (Taniuchi 1990). However, numerous sources of information indicate significant and ongoing abundance declines of oceanic whitetip sharks in this region. For example, a recent stock assessment conducted in the Western and Central Pacific, based on observer data from the Secretariat of the Pacific Community (SPC), estimated an 86 percent decline in spawning biomass from 1995 to 2009, with total biomass reduced to just 6.6 percent of the theoretical equilibrium virgin biomass (*i.e.,* a total decline of 93.4 percent; Rice and Harley 2012). Based on the results from the oceanic whitetip stock assessment, the median estimate of oceanic whitetip biomass in the Western Central Pacific as of 2010 was 7,295 tons (Rice and Harley 2012), which would be equivalent to a population of roughly 200,000 individuals (FAO 2012). An updated assessment analyzing various abundance indices, including standardized CPUE, concluded that the oceanic whitetip shark continues to decline throughout the tropical waters of the Western and Central Pacific (Rice *et al.,* 2015), indicating a severely depleted population of oceanic whitetip shark across the region with observations of the species becoming increasingly rare. Similar results were found in analyses of CPUE data from the Hawaii-based PLL fishery, where oceanic whitetip shark showed a decline in relative abundance on the order of ≥90 percent from 1995–2010 (Clarke *et al.,* 2012; Brodziak *et al.,* 2013). It must be recognized that the closeness of the agreement between the trends in observer data from Hawaii and the observer data from the SPC for the entire Western and Central Pacific Ocean may be partly due to the use of datasets that partially overlap for years prior to 2005. Still, even after 2005, the trends show similar results suggesting that the patterns are representative of regional trends in oceanic whitetip abundance. A preliminary update of the Brodziak *et al.* (2013) study with 4 additional years of data (2011–2014) indicates a potential relative stability in the population size at a post-decline depressed state (Young *et al.,* 2016). Nonetheless, the ERA team concluded, and we agree, that the levels of significant and ongoing population decline observed in these studies indicate that these declines are not just local or regional, but rather a Pacific-wide phenomenon, with no significant indication that these trends have reversed.

In the Northwest Atlantic, the oceanic whitetip shark was described historically as widespread, abundant, and the most common pelagic shark in the warm parts of the North Atlantic (Backus *et al.,* 1956). Several studies have been conducted to determine trends in abundance of various shark species, including the oceanic whitetip shark. Baum *et al.,* (2003) analyzed logbook data for the U.S. PLL fleets targeting swordfish and tunas, and reported a 70 percent decline in relative abundance for the oceanic whitetip shark from 1992 to 2000. Similarly, Baum and Myers (2004) compared longline CPUE from research surveys from 1954–1957 to observed commercial longline sets from 1995–1999, and determined that the oceanic whitetip had declined by more than 150-fold, or 99.3 percent (95 percent; Confidence Interval (CI): 98.3–99.8 percent) in the Gulf of Mexico during that time. However, the methods and results of Baum *et al.* (2003) and Baum and Myers (2004) were challenged on the basis of whether correct inferences were made regarding the magnitude of shark population declines in the Atlantic (see discussions in Burgess *et al.,* (2005b) and Burgess *et al.,* (2005a)). Of particular relevance to the oceanic whitetip, Burgess *et al.,* (2005b) noted that the change from steel to monofilament leaders between the 1950s and 1990s could have reduced the catchability of all large sharks, and the increase in the average depth of sets during the same period could have reduced the catchability of the surface-dwelling oceanic whitetip (FAO 2012). Later, Driggers *et al.,* (2011) conducted a study on the effects of different leader materials on the CPUE of oceanic sharks and determined that with equivalent methods but using a wire leader, the catch rates of Baum and Myers (2004) for the recent period would have been 0.55 rather than 0.02 (as estimated by Baum and Myers (2004) using nylon leaders). Comparing the recent 0.55 value with the Baum *et al.* (2003) value of 4.62 for the 1950s gave an estimated extent of decline of 88 percent (FAO 2012). In a re-analysis of the same logbook dataset analyzed by Baum *et al.* (2003) for the Northwest Atlantic using a similar methodology, Cortés *et al.,* (2007) reported a 57 percent decline from 1992–2005. The decline was largely driven by a 37 percent decline from 1992 to 1993 and a subsequent decline of 53 percent from 1997 to 2000, after which the time series remained stable (2000–2005). However, an analysis of the observer dataset from the same fishery resulted in a less pronounced decline than that of the logbook analysis, with a 9 percent decline in abundance from the same period of 1992–2005. Finally, the ERA team conducted an updated analysis (1992–2015) using the same observer data analyzed by Cortés *et al.* (2007). Similar to previous analyses, there was high variability in the initial years of the time series, but overall, the analysis conducted by the ERA team showed ~4 percent decline over the time series, with the overall trend indicative that the population may have stabilized (Young *et al.* 2016). Although observer data are generally regarded as more reliable than logbook data for non-target shark species (Walsh *et al.,* 2002), it should be noted that the sample size of oceanic whitetip shark in the observer data was substantially smaller than for other species, and thus the trends estimated should be regarded with caution. Additionally, although misreporting and species misidentification are likely to be much more prevalent in logbooks,

which can obscure abundance trends, misidentification is not considered an issue for the oceanic whitetip, whereas it is more problematic for other species such as night shark and other *Carcharhinus* species. It should also be noted that fishing pressure on the oceanic whitetip shark began decades prior to the time series covered in these studies (with the exception of the Baum and Myers (2004) study), thus the percentage declines discussed here do not represent percentage declines from historical virgin biomass. Therefore, given all of the caveats and limitations of the studies and analyses discussed above, it is likely that the oceanic whitetip shark population in the Northwest Atlantic and Gulf of Mexico experienced significant historical declines; however, relative abundance of oceanic whitetip shark may have stabilized in the Northwest Atlantic since 2000 and in the Gulf of Mexico/Caribbean since the late 1990s at a significantly diminished abundance (Cortés *et al.* 2007; Young *et al.* 2016).

In other areas of the oceanic whitetip shark range, robust and reliable quantitative abundance data are limited or lacking altogether. In the South Atlantic, the oceanic whitetip has been characterized as one of the most abundant species of pelagic shark in the southwestern and equatorial region. For example, the oceanic whitetip was the third most commonly caught shark out of 33 shark species caught year-round in the prominent Brazilian Santos longline fishery, and one of 7 species that comprised >5 percent of total shark catches from 1971–1995 (Amorim 1998). In Itajai, southern Brazil, oceanic whitetip sharks were considered ''abundant'' and ''frequent'' in the surface longline and gillnet fleets, respectively, from 1994–1999 (Mazzoleni and Schwingel 1999). Likewise, in equatorial waters off the northeastern coast of Brazil, the oceanic whitetip shark was historically reported as the second most abundant elasmobranch species, outnumbered only by the blue shark (*P. glauca*), in research surveys conducted within the EEZ of Brazil, and comprised 29 percent of the total elasmobranch catch in the 1990s (Lessa *et al.,* 1999). From 1992–2002, oceanic whitetip CPUE in this area averaged 2.18 individuals/1,000 hooks (Domingo *et al.,* 2007); more recently, however, the average CPUE recorded in this same area from 2004–2010 of 0.1–0.3 individuals/1,000 hooks (Frédou *et al.,* 2015) is much lower. Additionally, none of the other areas within this region exhibit CPUE rates comparable to the rates seen in the 1990s. Further, demographic analyses from the largest oceanic whitetip shark catching country in the South Atlantic (*i.e.,* Brazil) indicate abundance declines similar to the Northwest Atlantic of 50–79 percent in recent decades (Santana *et al.,* 2004; ICMBio 2014) and coincide with significant declines in catches of oceanic whitetip shark reported by Brazil to the International Commission for the Conservation of Atlantic Tunas (ICCAT). As a result of these declining trends, the oceanic whitetip shark was designated as a ''species threatened by overexploitation'' in 2004 by Brazil's Ministério do Meio Ambiente (Ministry of Environment), and listed under Annex II of Brazil's Normative Ruling No. 5 of May 21, 2004 that recognizes endangered species and species threatened by overexploitation, including aquatic invertebrates and fish. In 2014, Brazil finalized its national assessment regarding the extinction risk of Brazilian fauna, and listed the oceanic whitetip shark as Vulnerable under Brazil's ''Lista Nacional Oficial de Espécies da Fauna Ameaçadas de Extinção—Peixes e Invertebrados Aquáticos'' (National Official List of Endangered Species of Fauna—Fish and Aquatic Invertebrate; ICMBio 2014).

Elsewhere across the South Atlantic, the oceanic whitetip shark appears to be relatively rare, with low patchy abundance. For example, in 6 years of observer data from the Uruguayan longline fleet (1998–2003), catches of oceanic whitetip shark were described as ''occasional'' with CPUE rates of only 0.006 individuals/1,000 hooks (Domingo 2004). However, during this study, the Uruguayan longline fleet operated between latitudes 26° and 37° S. and within sea surface temperatures ranging between 16° and 23 °C, which are largely lower than the temperature preferences of the species. Domingo (2004) noted that it is unknown whether the species has always occurred in low numbers in this region of the South Atlantic, or whether the population has been affected significantly by fishing effort. More recently, Domingo *et al.* (2007) found similar results, with the highest CPUE recorded not exceeding 0.491 individuals/1,000 hooks. In total, only 63 oceanic whitetips were caught on 2,279,169 hooks and 63 percent were juveniles. All catches occurred in sets with sea surface temperatures ≥22.5 °C (Domingo *et al.,* 2007). Again, this data does not indicate whether a decline in the population has occurred, rather, it clearly reflects the low abundance of the species in this area (Domingo *et al.,* 2007). The low abundance of oceanic whitetip in this area may be the result of the species' tendency to remain in warmer, tropical waters farther north. Alternatively, it could be a result of historical fishing pressure in the region.

Finally, in a study that synthesized information on shark catch rates (based on 871,177 sharks caught on 86,492 longline sets) for the major species caught by multiple fleets in the South Atlantic between 1979 and 2011, catch rates of most species (with the exception of *P. glauca* and *A. superciliosus*), including oceanic whitetip, declined by more than 85 percent (Barreto *et al.,* 2015). However, it should be noted that there are some caveats and limitations to this study, including high and overlapping confidence intervals, raising the possibility that the trends may be noise rather than truly tracking abundance. Nonetheless, while robust abundance data is lacking in the South Atlantic, the best available information, including demographic analyses and fisheries data across the region from 1979–2011, indicate the oceanic whitetip shark has potentially experienced a significant population decline ranging from 50–85 percent (Santana *et al.* 2004; ICMBio 2014; Barreto *et al.* 2015). Overall, the ERA team concluded, and we agree, that the oceanic whitetip population in the South Atlantic has likely experienced historical declines similar to levels seen in the Northwest Atlantic, and this population decline is likely ongoing, although we acknowledge some uncertainty regarding the available data from this region.

Abundance information from the Indian Ocean is relatively deficient and unreliable. Nonetheless, historical research data shows overall declines in both CPUE and mean weight of oceanic whitetip sharks (Romanov *et al.,* 2008), and anecdotal reports suggest that oceanic whitetips have become rare throughout much of the Indian Ocean over the past 20 years (IOTC 2015a). The Indian Ocean Tuna Commission (IOTC) also reports that despite limited data, oceanic whitetip shark abundance has likely declined significantly over recent decades. Furthermore, a few quantitative studies provide some additional information indicative of declining trends of oceanic whitetip in the Indian Ocean. For example, data from an exploratory fishing survey for large pelagic species conducted off the eastern seaboard of the Maldives from 1987–1988 reported that oceanic whitetips represented 29 percent of the sharks caught by longline and 10 percent of the sharks caught by gillnet in all fishing zones (Anderson and Waheed 1990). During this survey, the

average CPUE for all sharks was 48.7 sharks/1,000 hooks. Applying the percentage of oceanic whitetips in the catch to the total CPUE, it is estimated that the CPUE of oceanic whitetip in this period was about 1.41 individuals/100 hooks (FAO 2012). More recently, Anderson *et al.* (2011) estimated that the average CPUE of oceanic whitetip in the shark longline fishery was only 0.20 individuals per fishing vessel (or approximately 0.14 sharks/100 hooks), and estimated the species contributed only 3.5 percent of the shark landings. This would represent a 90 percent decline in abundance between 1987–1988 and 2000–2004. Such a level of decline would be consistent with the decrease in the proportion of oceanic whitetip in the catch (from 29 percent of longline shark catch in 1987–1988 to just 3.5 percent of landings in 2000–2004) and also with anecdotal information reporting a marked decrease in sightings of oceanic whitetip sharks off northern and central Maldives (Anderson *et al.,* 2011; FAO 2012). The IOTC Working Party on Ecosystems and Bycatch (WPEB) noted the following on the aforementioned studies: ''Data collected on shark abundance represents a consistent time series for the periods 1987–1988 and 2000–2004, collected with similar longline gear, and that the data was showing a declining trend in oceanic whitetip shark abundance, which is a potential indicator of overall stock depletion.'' The WPEB further noted that it could be related to localized effects, although this was deemed unlikely as oceanic whitetip sharks are wide-ranging and abundance trends from long-term research conducted by the former Soviet Union between the 1960s and 1980s indicate a similar decline of oceanic whitetip sharks, and that ''sightings of this species in Maldives and Réunion islands is now quite uncommon'' (IOTC 2011).

Similarly, surveys of the tuna longline fishery in India indicate a likely decline of oceanic whitetip shark abundance. In Andaman and Nicobar waters, where catches of sharks are prominent and contribute 35.15 percent of the catch by number and 51.46 percent by weight, John and Varghese (2009) reported that the oceanic whitetip shark comprised 4.6 percent of the total shark catch from 1984–2006. However, in more recent surveys, Varghese *et al.,* (2015) report that oceanic whitetip shark comprised only 0.23 percent of the total shark catch from 2004–2010 in this area, which is significantly lower than what John and Varghese (2009) reported previously. Off the West Coast of India in the eastern Arabian Sea, the percentage of oceanic whitetip sharks in the overall shark catch also declined slightly from 0.6 percent to 0.45 percent. Overall, Varghese *et al.* (2015) shows that the index of relative abundance of sharks was considerably lower than that found in earlier studies, indicating a decline in abundance over the years. While the lack of standardized CPUE trend information for oceanic whitetip in these studies makes it difficult to evaluate the potential changes in abundance for this species in this region, based on the best available information, it is likely that the oceanic whitetip has experienced some level of population decline in this region. Additionally, it is important to note that India has objected to IOTC Resolution 13–06, which prohibits the retention of oceanic whitetip sharks (since 2013) in IOTC managed fisheries, and thus this Resolution is not binding on India. Therefore, oceanic whitetip sharks may still be retained in Indian fisheries.

Other studies on the abundance trends of oceanic whitetip shark in the Indian Ocean, including analyses of standardized CPUE indices from Japanese and Spanish longline fisheries, also indicate potential population declines, although trends are conflicting. Two studies estimate standardized CPUE for oceanic whitetip shark in the Japanese longline fleet operating in the Indian Ocean (Semba and Yokawa 2011; Yokawa and Semba 2012). In the first 2011 study, CPUE reached its peak in 2003 and then showed a gradually decreasing trend thereafter. Prior to 2003, large fluctuations in oceanic whitetip CPUE are attributed to changes in reporting requirements rather than the actual trend of the stock, as those years represent the introduction phase of a new recording system. The data showed low values in 2000 and 2001 (attributed to extremely low catches), and a gradual decreasing trend from 2003 to 2009. The authors interpreted a 40 percent decline in CPUE as an indication of a decrease in abundance of the population (FAO 2012; Semba and Yokawa 2011). Yokawa and Semba (2012) updated the data to 2011 using a modified data filtering method, which produced a rather similar and somewhat flattened trend.

Standardized CPUE of the Spanish longline fishery from 1998 to 2011 showed large historical fluctuations and a general decreasing trend of oceanic whitetip shark from 1998–2007, followed by an increase thereafter in the last 4 years of the time series. Overall, the magnitude of decline in this study was estimated to be about 25–30 percent (Ramos-Cartelle *et al.,* 2012); however, it should be noted that due to the high variability of the standardized catch rates between consecutive years and limited availability of specimens in some years, this index could be representative of a particular period rather than a plausible indicator of the stock abundance at large (Ramos-Cartelle *et al.,* 2012). Specifically, the data yielded support for the relatively low prevalence described for this species in the commercial fishery of surface longline fleets targeting swordfish in waters with temperatures generally lower than those selected by this species as its preferred habitat (García-Cortés *et al.,* 2012; Ramos-Cartelle *et al.,* 2012).

Finally, a study that incorporated data from the tropical French and Soviet Union purse seine fisheries analyzed the interaction between oceanic whitetip sharks and the tropical purse seine fisheries in terms of occurrence per set (not taking into account the number of individuals caught per set) from the mid-1980s to 2014. Results showed a marked change in the proportion of fish aggregating device (FAD) sets with oceanic whitetips present, fluctuating around 20 percent in the mid-1980s and 1990s, and then dropping to less than 10 percent from 2005 onwards. Taking into account that the number of FADs has greatly increased since the 1990s (Dagorn *et al.,* 2013; Maufroy *et al.,* 2015; Tolotti *et al.,* 2015b), the change in the proportion of FADs with oceanic whitetip sharks by more than 50 percent could indicate an important population decline (Tolotti *et al.,* 2015b). Alternatively, the decline of oceanic whitetip shark occurrence per FAD could be the result of a sharp increase of FAD densities combined with a small and stable population size. In this scenario, the proportion of oceanic whitetips/FAD would simply decrease because there aren't enough sharks to aggregate around that many FADs. However, although the analyzed data does not provide a straightforward interpretation (as both hypotheses seem plausible), given the declines indicated in other studies throughout the Indian Ocean, it seems more plausible that the marked decline observed in Tolotti *et al.* (2015b) is indicative of a declining abundance trend rather than a small, stable population.

Despite the varying magnitudes of reported declines of oceanic whitetip shark in the Indian Ocean, the ERA team agreed that given the significantly high fishing pressure and catches of oceanic whitetip shark in the Indian Ocean (which are likely severely underreported), combined with the

species' high at-vessel mortality rates in longlines in this area and the species' low-moderate productivity (see the *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes* section below for more details), it is likely that the species will continue to experience population declines in this region into the foreseeable future.

Overall, in areas where oceanic whitetip shark data are available, trends from throughout the species' global range show large historical declines in abundance (*e.g.,* Eastern Pacific, Western and Central Pacific, Atlantic and Indian Oceans). Recent evidence suggests that most populations are still experiencing various levels of decline due to continued fishing pressure and associated mortality. Further, the potential stabilization of the abundance trends at depleted levels seen in observer data from the Northwest Atlantic and Hawaiian PLL fisheries represents a small contingent of the global population. Thus, the best available scientific and commercial data available suggest that the global population of oceanic whitetip continues to experience various levels of decline throughout the majority of its range.

Growth Rate/Productivity

The ERA team expressed some concern regarding the effect of the oceanic whitetip shark's growth rate and productivity on its risk of extinction. Sharks, in general, have lower reproductive and growth rates compared to bony fishes. The ERA team noted that this species has some life history parameters that are typically advantageous, and some that are likely detrimental to the species' resilience to excessive levels of exploitation. For example, in comparison to other shark species, the oceanic whitetip is relatively productive, with an intrinsic rate of population increase (r) of 0.094–0.121 per year (Cortés 2010; 2012). The oceanic whitetip also ranked among the highest in productivity when compared with other pelagic shark species in terms of its pup production, rebound potential, potential for population increase, and for its stochastic growth rate (Chapple and Botsford 2013). Although the oceanic whitetip shark has a relatively high productivity rate compared to other sharks, it is still considered low for a fish species (r <0.14). Additionally, the species has a fairly late age of maturity (~6–9 years for females depending on the location), has a lengthy gestation period of 9–12 months, and only produces an average of 5–6 pups every two years. Thus, while this species may generally be able to withstand low to moderate levels of exploitation, given the high level of fishing mortality this species has experienced and continues to experience throughout the majority of its range, its life history characteristics may only provide the species with a limited ability to compensate. Therefore, based on the best available information, these life history characteristics likely pose a risk to this species in combination with threats that reduce its abundance, such as overutilization.

Spatial Structure/Connectivity

The oceanic whitetip shark is a relatively widespread species that may be comprised of distinct stocks in the Pacific, Indian, and Atlantic oceans. The population structure and exchange between these stocks is unknown; however, based on genetic information, telemetry data, and temperature preferences it is unlikely that there is much exchange between populations in the Atlantic and Indo-Pacific Oceans. However, recent genetic data suggests potentially significant population structure within the Atlantic, which may be underpinned by the fact that this species exhibits a high degree of philopatry in some locations (*i.e.,* the species returns to the same site for purposes of breeding or feeding, etc.). While the population structure observed in the Atlantic, despite no physical or oceanographic barrier, could result in localized depletions in areas where fishing pressure is high (*e.g.,* Brazil), habitat characteristics that are important to this species are unknown. The species is highly mobile, and there is little known about specific migration routes. It is also unknown if there are source-sink dynamics at work that may affect population growth or species' decline. There is no information on critical source populations to suggest spatial structure and/or loss of connectivity are presently posing demographic risks to the species. Thus, based on the best available information, there is insufficient information to support the conclusion that spatial structure and connectivity currently pose a significant demographic risk to this species.

Diversity

As noted previously in the *Population Structure and Genetics* section, recent research suggests the oceanic whitetip shark has low genetic diversity (0.33 percent ± 0.19 percent; Ruck 2016), which is about half that of the closely related silky shark (0.61 percent ± 0.32 percent; Clarke *et al.,* (2015a)). The ERA team noted that the relatively low mtDNA genetic diversity of the oceanic whitetip raises potential concern for the future genetic health of this species, particularly in concert with steep global declines in abundance. Based on the fact that exploitation of the oceanic whitetip shark began with the onset of industrial fishing in the 1950s, only 5–7 generations of oceanic whitetip have passed since the beginning of this exploitation. Thus, the low genetic diversity of oceanic whitetip shark likely reflects historic levels, and the significant global declines are not yet reflected genetically (Ruck 2016). The ERA team noted that this may be a cause for concern in the foreseeable future, since a species with already relatively low genetic diversity undergoing significant levels of exploitation may increase the species' risk in terms of reduced fitness and evolutionary adaptability to a rapidly changing oceanic environment as well as potential extirpations. The ERA team also noted that low genetic diversity does not necessarily equate to a risk of extinction in and of itself for all species; but, in combination with low levels of abundance and continued exploitation, low genetic diversity may pose a viable risk to the species in the foreseeable future.

Summary of Factors Affecting the Oceanic Whitetip Shark

As described above, section 4(a)(1) of the ESA and NMFS' implementing regulations (50 CFR 424.11(c)) state that we must determine whether a species is endangered or threatened because of any one or a combination of the following factors: The present or threatened destruction, modification, or curtailment of its habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; the inadequacy of existing regulatory mechanisms; or other natural or manmade factors affecting its continued existence. The ERA team evaluated whether and the extent to which each of the foregoing factors contributed to the overall extinction risk of the global oceanic whitetip shark population. We summarize information regarding each of these threats below according to the factors specified in section 4(a)(1) of the ESA. Available information does not indicate that destruction, modification or curtailment of the species' habitat or range, disease or predation, or other natural or manmade factors are operative threats on this species; therefore, we do not discuss those further here. See Young *et al.* (2016) for

additional discussion of all ESA section 4(a)(1) threat categories.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Threats to the oceanic whitetip shark related to overutilization stem from mortality in commercial fisheries, largely driven by demand of the international shark fin trade, bycatch-related mortality, as well as illegal, unreported, and unregulated (IUU) fishing. The oceanic whitetip shark is generally not a targeted species, but because of its tendency to remain in the surface mixed layer of the water column (0–152 m depth) and in tropical latitudes where fishing pressure is often most concentrated for target species such as tuna, the species is frequently encountered and suffers high mortality rates in numerous fisheries throughout its global range. The oceanic whitetip shark is also considered a preferred species for the international fin trade because its large, morphologically distinct fins obtain a high value in the Asian fin market. The high value and demand for oceanic whitetip fins incentivizes the retention and subsequent finning of oceanic whitetip sharks when caught, and thus represents the main economic driver for retention and mortality of this species in commercial fisheries throughout its global range. In fact, growth in demand from the fin trade during the 1990s coincided with a pattern of soaring catches of oceanic whitetip sharks in numerous fisheries across the globe. Catches generally peaked from 1995 to 2000 and were followed by precipitous declines over the next 10 years due to severe overfishing (Hazin *et al.,* 2007; Lawson 2011; Clarke *et al.,* 2012; Hasarangi *et al.,* 2012; Brodziak *et al.,* 2013; Hall and Román 2013). The oceanic whitetip is regularly caught incidentally with PLLs, purse seines, handlines, troll and occasionally pelagic and even bottom trawls (Compagno 1984). In addition to mortality as a result of retention and finning in commercial fisheries, oceanic whitetip sharks experience varying levels of bycatch-related fishing mortality, including at-vessel and post-release mortality. Finally, recent reports of illegal trafficking of oceanic whitetip shark fins suggest the species may be heavily impacted by IUU fishing activities. Therefore, the ERA team assessed the following factors that may have contributed or continue to contribute to the historical and ongoing overutilization of the oceanic whitetip shark: Retention and finning in commercial fisheries for purposes of the international fin trade, incidental bycatch in commercial fisheries (including impacts of at-vessel and post-release mortality), and IUU fishing activities.

In the EPO, the oceanic whitetip shark is caught on a variety of gear, including longline and purse seine gear targeting tunas and swordfish. They are also believed to be taken in artisanal fisheries in many countries around the EPO (IATTC 2007). To date, the IATTC has not conducted a stock assessment for the oceanic whitetip shark. However, species-specific catch estimates based on observer data from the purse seine fishery are available from the IATTC observer database. As noted previously in the *Demographic Risk Assessment—Abundance section,* the oceanic whitetip was the second most abundant shark in the catches behind the silky shark, and comprised approximately 9 percent of the total shark catch from 1993–2009 (Hall and Román 2013). In floating object sets, which are responsible for 90 percent of oceanic whitetip shark catches, capture probability of the species has decreased over time from a high of 30 percent capture rate per set between 1994 and 1998, to less than 5 percent from 2004 to 2008 (Morgan 2014). Estimated catches of oceanic whitetip sharks in all purse seine sets peaked with approximately 9,709 individuals caught in 1999; however, within 10 years catches dropped dramatically to an estimated 379 oceanic whitetip sharks caught in 2005. Estimated catches of oceanic whitetip shark continue to decline in the EPO tropical tuna purse seine fishery, with only 120 individuals caught in 2015. This drastic decline in oceanic whitetip catches is in stark contrast to catches of the closely related silky shark, which have remained relatively constant over the same time period. Further, size trends in this fishery show that small oceanic whitetip sharks <90 cm, which comprised 21.4 percent of the oceanic whitetips captured in 1993, have been virtually eliminated (Hall and Román 2013), indicating the possibility of recruitment failure in the population. During this same time period, there was an increase in both the total catch of tunas by purse seiners that employ drifting FADs and the number of FADs deployed (Eddy *et al.,* 2016; Hall and Román 2016). Over the past decade, the total number of FADs deployed per year has continued to increase steadily, from about 4,000 in 2005 to almost 15,000 in 2015 (Hall and Román 2016). The total number of sets deployed has also continued increasing, with 2015 being the highest record observed. Thus, given the continued increase in fishing effort and expansion of the tropical tuna purse seine fleet in the Eastern Pacific, fishing pressure and associated mortality of oceanic whitetip sharks are expected to continue.

Oceanic whitetip sharks are also sometimes a significant component of the bycatch in EPO longline fisheries, and are thought to be taken by local artisanal fisheries as well. While observer data is not available from these fisheries, some limited information is available from the various countries that fish in these waters. For example, the oceanic whitetip shark was identified as one of several principal species taken by Mexican fisheries targeting pelagic sharks (Sosa-Nishizaki *et al.,* 2008). Farther south, the oceanic whitetip shark has also been recorded in the catches of the Ecuadorian artisanal fishery. In an analysis of landings from the five principal ports of the Ecuadorian artisanal fishery from 2008–2012, 37.2 mt of oceanic whitetip shark were recorded out of a total 43,492.6 mt of shark catches (Martinez-Ortiz *et al.,* 2015). Although limited, this information confirms that in addition to significant fishing pressure by the tropical tuna purse seine fishery, oceanic whitetip sharks are taken in longline and artisanal fisheries in unknown quantities. Based on the foregoing information, the ERA team concluded, and we agree, that overutilization of the oceanic whitetip shark is ongoing in this region, with no indication that these pressures will cease in the foreseeable future.

In the Western and Central Pacific Ocean (WCPO), the oceanic whitetip shark commonly interacts with both longline and purse seine fisheries throughout the region, with at least 20 member nations of the Western and Central Pacific Fisheries Commission (WCPFC; the RFMO responsible for the conservation and management of tuna and tuna-like species in the region) recording the species in their fisheries. As noted previously, the oceanic whitetip historically comprised between 20–28 percent of the total shark catch in some industrial longline fisheries during the 1950s and 1960s (Strasburg 1958; Taniuchi 1990). In this region, where sharks represent 25 percent of the longline fishery catch (Molony 2007), more recent observer data show that the oceanic whitetip shark represented only 6.3 percent of the total shark catch from 1991–2011(with blue shark comprising the large majority at ~80.5 percent; Lawson 2011). In the purse seine fishery, the oceanic whitetip was once the second most common species of shark caught as bycatch in the WCPO,

and comprised approximately 4.2 percent of the total shark catch from 1994–2011 (Lawson 2011). In addition to being caught indirectly as bycatch, observer records indicate that some targeting of oceanic whitetip shark has occurred historically in the waters near Papua New Guinea, and, given the high value of oceanic whitetip fins and low level of observer coverage in the region, it is likely that targeting has occurred in other areas as well (Rice and Harley 2012). Based on nominal and standardized catch rates for longline and purse seine fisheries, records of oceanic whitetip sharks in both fisheries have become increasingly rare over time, with catches of the species significantly declining since the late 1990s (Lawson 2011; Clarke *et al.,* 2011a). For example, estimated catches of oceanic whitetip shark in the WCPO longline fishery suggest that catches peaked in 1998 at ~249,000 individuals and declined to only ~53,000 individuals in 2009 (Lawson 2011). It should be noted that catches by the fleets of Indonesia and the Philippines were not included because neither observer nor effort data were available for these fleets. Over the same time period (from 1995 to 2009) rates of fishing mortality consistently increased, driven mainly by the increased effort in the longline fleet, and remained substantially above the maximum sustainable yield (MSY) (*i.e.,* the point at which there would be an equilibrium) for the species (Rice *et al.,* 2015). The previously discussed stock assessment report (Rice *et al.,* 2015) attributed the greatest impact on the species to bycatch from the longline fishery, and lesser impacts from target longline activities and purse-seining (Rice and Harley 2012). In fact, Rice *et al.* (2015) determined that fishing mortality on oceanic whitetip sharks in the WCPO has increased to levels 6.5 times what is sustainable, thus concluding that overfishing is still occurring.

As a result of continued and increasing fishing pressure in the WCPO, size trends for oceanic whitetip have also declined, which is indicative of overutilization of the species. For example, declining median size trends were observed in all regions and sexes in both longline and purse seine fisheries until samples became too scarce for analysis. These size trends were significant for females in the longline fishery (Regions 3 and 4; See Figure 1 in Clarke *et al.,* 2011a for the regional map), and for the purse seine fishery (Region 3). Regions 3 and 4 (*i.e.,* the equatorial region of the WCPO) represent the species' core habitat areas, and contain 98 percent of the operational-level reported purse seine sets and the majority of longline fishing effort (Clarke *et al.,* 2011a; Rice *et al.,* 2015). The decline in median size of female oceanic whitetip sharks is particularly concerning due to the potential correlation between maternal length and litter size, which has been documented in the Atlantic and Indian Oceans (Lessa *et al.* 1999, Bonfil *et al.* 2008). While Rice *et al.* (2015) more recently report that trends in oceanic whitetip median length are now stable, the majority of sharks observed are immature. In fact, 100 percent of oceanic whitetips sampled in the purse seine fishery have been immature since 2000 (Clarke *et al.,* 2012).

In the U.S. Pacific, the oceanic whitetip shark is a common bycatch species in the Hawaii-based PLL fishery. This fishery began around 1917, and underwent considerable expansion in the late 1980s to become the largest fishery in the state (Boggs and Ito 1993). This fishery currently targets tunas and billfish and is managed under the auspices of the Western Pacific Fishery Management Council (WPFMC). From 1995–2006, oceanic whitetip sharks comprised approximately 3 percent of the total shark catch (Brodziak *et al.,* 2013). Based on observer data from the Pacific Islands Regional Observer Program (PIROP), oceanic whitetip shark mean annual nominal CPUE decreased significantly from 0.428 sharks/1,000 hooks in 1995 to 0.036 sharks/1,000 hooks in 2010. This reflected a significant decrease in nominal CPUE on longline sets with positive catch from 1.690 sharks/1,000 hooks to 0.773 sharks/1,000 hooks, and a significant increase in longline sets with zero catches from 74.7 percent in 1995 to 95.3 percent in 2010. As discussed previously in the *Evaluation of Demographic Risks—Abundance* section, oceanic whitetip CPUE declined by more than 90 percent in the Hawaii-based PLL fishery since 1995 (Walsh and Clarke 2011; Brodziak *et al.,* 2013). Brodziak *et al.* (2013) concluded that relative abundance of oceanic whitetip declined within a few years of the expansion of the longline fishery, which suggests these fisheries are contributing to the commercial overutilization of oceanic whitetip within this portion of its range. It should be noted that while the Hawaii-based PLL fishery currently catches oceanic whitetip shark as bycatch, the majority of individuals are now released alive in this fishery and the number of individuals kept has been on a declining trend. For example, according to the U.S. National Bycatch Report First Edition Update 2 (see *www.st.nmfs.noaa.gov/observer-home/first-edition-update-2*) the shallow-set fishery released alive an estimated 91–96 percent of all oceanic whitetip sharks caught from 2011 to 2013. During the same time period, the deep-set fishery released alive an estimated 78–82 percent of all oceanic whitetip sharks caught. However, it is unknown how many of these sharks survived after being released. Nonetheless, this particular fishery may be less of a threat to the oceanic whitetip shark in the foreseeable future. However, across the WCPO as a whole, given the ongoing impacts to the species from significant fishing pressure (with the majority of effort concentrated in the species' core tropical habitat area), including significant declines in CPUE, biomass, and size indices, and combined with the species' relatively low-moderate productivity, it is likely that overutilization has been and continues to be an ongoing threat contributing to the extinction risk of the oceanic whitetip shark across the region.

The oceanic whitetip shark was also once described as the most common pelagic shark throughout the warm-temperate and tropical waters in the Atlantic and beyond the continental shelf in the Gulf of Mexico (Mather and Day 1954; Strasburg 1958). Oceanic whitetip sharks are taken in the Atlantic Ocean by longlines, purse seine nets, gillnets, trawls, and handlines; however, the large majority of the catch from 1990–2014 reported to ICCAT was caught by longline gear (Young *et al.,* 2016). Oceanic whitetip sharks have exhibited a range of at-vessel mortality rates in longline gear in the Atlantic Ocean between 11–34 percent (Beerkircher *et al.,* 2002; Coelho *et al.,* 2012; Fernandez-Carvalho *et al.,* 2015) and have been ranked as the 5th most vulnerable pelagic shark in an Ecological Risk Assessment that assessed 11 species of pelagic elasmobranchs (Cortes *et al.,* 2010). In total, approximately 2,430 mt of oceanic whitetip catches were reported to ICCAT from 1990–2014; however, this is likely a severe underestimation of the total amount of oceanic whitetip sharks taken from the Atlantic. For example, Clarke (2008) calculated trade-based estimates that indicate between 80,000–210,000 oceanic whitetip sharks were sourced from the Atlantic Ocean in 2003 alone to supply the Hong Kong fin market, which translates to approximately 3,000–8,000 mt.

In the Northwest Atlantic, the oceanic whitetip is caught incidentally as bycatch by a number of fisheries,

including (but not limited to) the U.S. Atlantic PLL fishery, the Cuban ''sport'' fishery (''sport'' = private artisanal and commercial), and the Colombian oceanic industrial longline fishery operating in the Caribbean (E-CoP16Prop.42, 2013). In the United States, oceanic whitetip sharks are caught as bycatch in PLL fisheries targeting tuna and swordfish in this region, with an estimated 8,526 individuals recorded as captured in U.S. fisheries logbooks from 1992 to 2000 (Baum *et al.,* 2003) and a total of 912 individuals recorded by observers in the NMFS Pelagic Observer Program from 1992–2015. Relative to target species, oceanic whitetip sharks are caught infrequently and only incidentally on PLL vessels fishing for tuna and tuna-like species. Landings and dead discards of sharks by U.S. PLL fishers in the Atlantic are monitored every year and reported to ICCAT. Overall, very few oceanic whitetip sharks were landed by the commercial fishery, except for two peaks of about 1,250 and 1,800 fish in 1983 and 1998, respectively, but otherwise total catches never exceeded 450 fish (NMFS 2009). Commercial landings of oceanic whitetip sharks in the U.S. Atlantic have been variable, but averaged approximately 1,077.4 lb (488.7 kg; 0.4887 mt) per year from 2003–2013. Although oceanic whitetip sharks have been prohibited on U.S. Atlantic commercial fishing vessels with pelagic longline gear onboard since 2011, they can still be caught as bycatch, caught with other gears, and are occasionally landed. However, since the ICCAT retention prohibition was implemented in 2011, estimated commercial landings of oceanic whitetip declined from 1.1 mt in 2011 to only 0.03 mt in 2013 (NMFS 2012; 2014). As discussed previously, the oceanic whitetip population size has likely declined significantly in this region due to historical exploitation of the species since the onset of industrial fishing (refer back to the *Demographic Risk Assessment—Abundance* section); however, results of the ERA team's analysis show that the oceanic whitetip shark population in this region has potentially stabilized since the 1990s/early 2000s (Young *et al.,* 2016). The potential stabilization of oceanic whitetip sharks occurred concomitantly with the first Federal Fishery Management Plan for Sharks in the Northwest Atlantic Ocean and Gulf of Mexico, which directly manages oceanic whitetip shark under the pelagic shark group, and includes regulations on trip limits and quotas. This indicates the potential efficacy of these management measures for reducing the threat of overutilization of the oceanic whitetip shark population in this region; therefore, under current management measures, including the implementation of ICCAT Recommendation 10–07 (see *Factor D—Inadequacy of Existing Regulatory Mechanisms* for more details), the threat of overutilization is not likely as significant in this area relative to other portions of the species' range.

In Cuba, some evidence suggests a historical decline of oceanic whitetip shark may have occurred, although this is uncertain. In the 1960s, the oceanic whitetip shark was characterized as the most abundant species off the northwestern coast of Cuba, but since 1985, a substantial decline was observed in some species, including the oceanic whitetip. Variations in fishing effort and changes in the fishery make it difficult to assess the present condition of the resource, but since 1981 there has been a tendency towards decline (Claro *et al.,* 2001). Recent monitoring studies of a prominent fishing base in Cojimar, Cuba recorded the oceanic whitetip shark comprising only 2–5 percent of the shark landings from 2008–2011 (Cuba Department of Fisheries 2016). In contrast, Valdés *et al.,* (2016) show a steady pattern of abundance for the oceanic whitetip shark in Cuban fishery landings along the northwestern coast from 2010 to 2016. However, sharks caught in Cuban fisheries are never discarded, but rather utilized for either human consumption or bait. Cuba is not a member of ICCAT, and thus ICCAT Recommendation 10–07 on the retention prohibition of oceanic whitetip sharks is not applicable in Cuban waters. Further, evidence suggests there is a prevalence of small, immature individuals in Cuban catches, which suggests the possibility of an important nursery area for this species in the region. However, because these animals are small and of less value to the fishermen, they are typically using the juvenile *C. longimanus* as bait while at sea, a practice which is likely in conflict with sustainable fisheries management and conservation objectives (Valedz *et al.,* 2016) and may be contributing to overutilization of the species.

Farther south, it is likely that overutilization is an ongoing threat in the South Atlantic. Although fishing effort has been high and began intensifying in the southern Atlantic Ocean after the 1990s (Camhi *et al.,* 2008), there is limited information on the catch rates or trends of oceanic whitetip sharks in this region. Oceanic whitetip sharks are taken as bycatch in numerous fisheries operating in the South Atlantic, including Brazilian, Uruguayan, Taiwanese, Japanese, Venezuelan, Spanish and Portuguese longline fisheries; however, the largest oceanic whitetip catching country in this region is Brazil. As noted in the *Evaluation of Demographic Risks—Abundance* section of this proposed rule, oceanic whitetips were historically reported as the second-most abundant shark in research surveys from northeastern Brazil between 1992 and 1997 (FAO 2012), with a high CPUE rate of 2.18 individuals per 1,000 hooks (Domingo *et al.,* 2007). More recently, however, average CPUE in this same area has seemingly declined. It also appears that the percentage of mature sharks has declined in recent years compared to surveys conducted in the 1990s. For example, the frequency of mature sharks ≥180 cm was higher in the 1990s than in years 2005–2009. It should be noted that the data from 2005–2009 represents a much larger area of the southwestern and equatorial Atlantic and has a much larger sample size (n = 1218; Tolotti *et al.,* 2013) than the results from the surveys conducted in the 1990s (n = 258; Lessa *et al.,* 1999). However, the two study areas do overlap and provide some indication that the size composition of oceanic whitetip sharks in the southwestern Atlantic may be shifting downwards. Catches of oceanic whitetip in the Brazilian tuna longline fishery have also shown a substantial decline, decreasing from ~640t in 2000 to only 80t in 2005 (Hazin *et al.,* 2007). According to the ICCAT nominal catch database, catches of oceanic whitetip shark by Brazilian vessels continued to decline, with 0 mt reported from 2009–2012 and only 12 mt from 2013–2014. Although robust standardized CPUE data are not available for the species, making it difficult to evaluate whether the decline in catches resulted from decreased abundance or from changes in catchability, related, for instance, to targeting strategies (Hazin *et al.,* 2007), a recent tagging study indicates that the preferred horizontal and vertical habitat of oceanic whitetip shark, including potential nursery areas, is heavily impacted by the industrial longline fishery. Telemetry data provides evidence that the equatorial region off Northeast Brazil is an area where the oceanic whitetip shark shows a high degree of philopatry (*i.e.,* site fidelity). This same area also happens to be where the highest level of fishing effort is concentrated. For example, from 1999–2011, despite a wide distribution

of fishing sets, the area with the highest effort concentration by the Brazilian longline fleet was bound by the 5° N. and the 15° S. parallels and by the 040° W. and 035° W. meridians (*i.e.,* the equatorial region of Northeast Brazil). Thus, the majority of fishing effort by the Brazilian fleet directly overlaps the preferred habitat area of oceanic whitetip sharks (Tolotti *et al.,* 2015a). Further, many studies show a substantially high percentage of juveniles in the catches from this region (Coelho *et al.,* 2009; Tambourgi *et al.,* 2013; Tolotti *et al.,* 2013; Frédou *et al.,* 2015), which suggests the presence of nursery habitat. For example, Tambourgi *et al.* (2013) found that 80.5 percent of females were immature and 72.4 percent of males were immature in the Brazilian pelagic longline fishery between December 2003 and December 2010. Thus, it is likely that the intensive fishing pressure of oceanic whitetip across its preferred vertical and horizontal habitat, including nursery areas in Brazilian waters, is negatively impacting oceanic whitetip sharks at all life stages, and contributing to the overutilization of the species. In addition to information from Brazil, a recent study that synthesized information on shark catch rates for the major shark species caught by multiple fleets in the South Atlantic from 1979 and 2011 (*e.g.,* Belize, Bolivia, Brazil, Canada, Spain, Guyana, Honduras, Iceland, Japan, Saint Kitts and Nevis, Korea, Morocco, Panama, Portugal, Taiwan, United Kingdom, Uruguay, United States, Saint Vincent and the Grenadines, and Vanuatu) concluded that declines of many shark species, including the oceanic whitetip, coincided with significant fishing effort expansion, a lack of regulatory measures to deal with shark bycatch, finning and directed fishing for sharks by some fleets (Barreto *et al.,* 2015). Based on the foregoing information, the ERA team concluded, and we agree, that overutilization in the South Atlantic Ocean is likely a threat contributing to the oceanic whitetip's risk of extinction in the foreseeable future.

Overutilization is also likely a threat to oceanic whitetip sharks in the Indian Ocean. The oceanic whitetip is reported as bycatch in all three major fisheries operating in the Indian Ocean; the species is considered ''frequent'' in both longline and purse seine fisheries, and ''very frequent'' in the gillnet fishery (Murua *et al.,* 2013b), with gillnet fisheries reporting the highest nominal catches of sharks in 2014, and making up nearly 40 percent of total catches (Ardill *et al.,* 2011; IOTC 2015a). Although information from this region is limited and catch data are severely underreported, the IOTC (the RFMO that manages tuna and tuna-like species in the Indian Ocean and adjacent waters) reports that catches of oceanic whitetip shark are ranked as ''High,'' meaning the accumulated catches from 1950–2010 make up 5 percent or more of the total catches of sharks recorded (Herrera and Pierre 2011). In fact, a recent study estimated that the oceanic whitetip shark comprises 11 percent of the total estimated shark catch in the Indian Ocean (Murua *et al.,* 2013a). It is also ranked as the 5th most vulnerable shark species caught in longline fisheries in the region (out of 16 species assessed) and the most vulnerable shark species caught in purse seine gear due to its high susceptibility (Murua *et al.,* 2012; IOTC 2015a). Oceanic whitetip sharks also exhibit relatively higher at-vessel mortality rates in longlines in this region compared to other regions (*i.e.,* 58 percent; IOTC 2015a) and likely have high mortality rates in purse seine and gillnet fisheries as well.

The main fleets catching oceanic whitetip in the Indian Ocean in recent years (2011–2014) include: Indonesia, Sri Lanka, I.R. Iran, EU (Spain), China, Madagascar, and Seychelles. The reporting of catches of oceanic whitetip sharks shows an unusual trend in 2013 and 2014, with 5,000+ mt reported to the IOTC. These trends are dominated by the Sri Lankan combination longline-gillnet fisheries, and an addition of proportionately very large catches by India (IOTC 2015b). Prior to the unusual trend in 2013 and 2014, the trend in oceanic whitetip catch shows a substantial increase throughout the 1990s, which likely corresponds with the rise in the shark fin trade (Clarke *et al.,* 2007), a peak at 3,050 mt in 1999, followed by a sharp and continued decline in the 2000s. Although the IOTC database is constrained by a number of limitations, information from some fleets catching oceanic whitetip shark indicate declines in catches as well. For example, from 1996–2004, landings of oceanic whitetip in Sri Lanka peaked at approximately 3,000 mt in 1999 and show a declining trend thereafter (Hasarangi *et al.,* 2012) to less than 300 mt in 2014. It is only in the last two years (2013 and 2014) that annual shark production has seen a significant decline in Sri Lanka due to regulatory measures (Jayathilaka and Maldeniya 2015). Most recently, Sri Lanka reported only 88 mt of oceanic whitetip shark catches to IOTC in 2015. Thus, the decline in oceanic whitetip catches in Sri Lanka occurred prior to the implementation of any regulatory measures, and may therefore be indicative of a population decline in Sri Lankan waters as a result of overutilization. Similarly, the substantial decline of oceanic whitetip sharks in the Maldives, from comprising 29 percent of the longline shark catch in the 1980s to only 3.5 percent of landings from 2000–2004 (refer back to the *Demographic Assessment—Abundance* section of this proposed rule), is likely the result of overutilization of the species. In fact, Anderson *et al.* (2011) determined that the shark stocks that supported the shark fishery were sequentially overfished, with the decline in pelagic shark catches the result of high (and likely unsustainable) levels of fishing by overseas fisheries.

The IOTC's Working Group on Ecosystems and Bycatch stated that at current catch levels (*i.e.,* average of 347 mt prior to 2013), the Indian Ocean stock of oceanic whitetip was at considerable risk. Given the previous discussion regarding likely abundance declines in this region, combined with the high level of fishing pressure on oceanic whitetip sharks in the Indian Ocean and the species' low-moderate productivity, it is therefore likely that the substantially high catches of oceanic whitetip sharks in the Indian Ocean (5,000+ mt estimated for 2013 and 2014) are in excess of what is sustainable and are likely contributing to overutilization of the species in the Indian Ocean.

Finally, the ERA team determined that demand from the international shark fin trade is the main economic force driving the retention and subsequent finning of oceanic whitetip sharks taken as bycatch in commercial fisheries worldwide, as they are considered a preferred species for their fins, command high prices in the international market (U.S. $45–85/kg; E-CoP16Prop.42 (2013)) and make up part of the ''first choice'' category in the China, Hong Kong Special Administrative Region (SAR) fin market (Vannuccini 1999). From 2000 to 2011, China, Hong Kong SAR maintained its position as the world's largest trader of shark fins, controlling the majority of global trade. In order to determine the species composition of the shark fin trade, Clarke *et al.,* (2006a) analyzed 1999–2001 Hong Kong trade auction data in conjunction with species-specific fin weights and genetic information to estimate the annual number of globally traded shark fins. Using this approach, the authors discovered that oceanic whitetip sharks are sold under their own category ''*Liu Qiu*'' and represent approximately 1.8 percent of the Hong Kong shark fin

market (Clarke *et al.,* 2006a). This level of oceanic whitetip shark fins in the trade translates to an estimated median of 700,000 oceanic whitetip sharks (range: 200,000–1,200,000 individuals), with an equivalent median biomass of around 21,000 mt (range 9,000–48,000 mt), traded annually (Clarke *et al.,* 2006b). The lack of estimates of the global population makes it difficult to put these trade-based estimates into perspective. However, given the minimum estimate of ~9,000 mt traded annually is in excess of the total biomass estimated for oceanic whitetip for the entire Western and Central Pacific Ocean in 2010 (*i.e.,* 7,295 mt), the effect of the removals (for the shark fin trade) on the ability of the overall population to sustain this level of exploitation is likely substantial.

In more recent years, genetic testing conducted in various fish markets provides additional confirmation of the ongoing utilization of oceanic whitetip shark in the shark fin trade. For example, a genetic sampling study conducted on shark fins collected from several fish markets throughout Indonesia determined that oceanic whitetip shark fins were present and comprised approximately 1.72 percent of the fins tested (Sembiring *et al.,* 2015). In a genetic barcoding study of shark fins from markets in Taiwan, the oceanic whitetip was 1 of 20 species identified and comprised 0.38 percent of average landings from 2001–2010 (Liu *et al.,* 2013). In another genetic barcoding study of fins at the Deira fish market in Dubai, United Arab Emirates (with sharks originating from Oman), oceanic whitetip shark comprised 0.45 percent of fins tested (Jabado *et al.,* 2015). Although it is uncertain whether these studies are representative of the entire market within each respective country, results of these genetic tests confirm the continued presence of oceanic whitetip shark fins in various markets throughout its range.

Recent studies indicate that due to a waning interest in fins as well as increased regulations to curb shark finning, the shark fin market is declining. In fact, the trade in shark fins through China, Hong Kong SAR, which has served as an indicator of the global trade for many years, fell by 22 percent in 2012. Additionally, current indications are that the shark fin trade through Hong Kong SAR and China will continue to contract (Dent and Clarke 2015). The pattern of trade decline closely matches the pattern in chondrichthyan capture production and thus suggests a strong link between the quantity harvested and the quantity traded. However, a government-led backlash against conspicuous consumption in China, combined with global conservation momentum, appears to have had some impact on traded volumes as well (Eriksson and Clarke 2015). Despite the potential improvements in the trade, it is clear that the shark fin trade has asserted and continues to assert significant pressure on oceanic whitetip sharks. Given that oceanic whitetip fins are among the most prized in the international shark fin trade and obtain a high value per kg, combined with recent evidence of oceanic whitetip fins in several prominent markets, the incentive to take oceanic whitetip sharks for their fins remains high and is an ongoing threat contributing to the overutilization of the species. This is further evidenced by recent incidents of illegal trafficking of oceanic whitetip fins, which indicate that oceanic whitetip sharks are still sought after for their fins and continue to experience pressure from demands of the fin trade (see *Inadequacy of Existing Regulatory Mechanisms* section below for more details). In addition, a surge in the trade of shark meat has occurred in recent years. This could be the result of a number of factors, but taking the shark fin and shark meat aggregate trends together indicate that shark fin supplies are limited by the existing levels of chondrichthyan capture production, but shark meat is underutilized by international markets (Dent and Clarke 2015). This suggests that historically underutilized chondrichthyan species will be increasingly utilized for their meat. The ERA team considered whether the recent shift in demand away from shark fins to shark meat would have any considerable impact on the oceanic whitetip shark. Although there are markets for low-value shark meat such as oceanic whitetip, the retention bans for the species in all relevant RFMOs will likely dampen this threat. Thus, the ERA team did not think this increase in demand for shark meat would create a significant new threat to the species.

Overall, based on the best available information, the ERA team concluded, and we agree, that overutilization is the single most important threat contributing to the extinction risk of the oceanic whitetip shark. Due to the paucity of available data from some regions, the ERA team acknowledged that there are some uncertainties in assessing the contribution of the threat of overutilization to the extinction risk of the oceanic whitetip shark throughout its range. As results from the Cortés *et al.* (2012) and Murua *et al.* (2012) Ecological Risk Assessments demonstrated, the threat of overutilization of oceanic whitetip sharks may be exacerbated by the species' low-moderate productivity combined with the species' tendency to remain in the surface mixed layer of the water column (*i.e.,* 0–152 m) and within warm, tropical waters where the majority of fishing effort is often most concentrated. The severity of the threat of overutilization is dependent upon other risks and threats to the species, such as its abundance (as a demographic risk) as well as its level of protection from fishing mortality throughout its range. Given the above analysis and best available information, as well as evidence that the species' current trends in abundance place its future persistence in question due to overutilization, we find that overutilization for commercial purposes is a threat that places the species on a trajectory towards being in danger of extinction in the foreseeable future throughout all or a significant portion of its range.

Inadequacy of Existing Regulatory Mechanisms

The ERA team evaluated existing regulatory mechanisms to determine whether they may be inadequate to address threats to the oceanic whitetip shark. Existing regulatory mechanisms assessed include federal, state, and international regulations for commercial fisheries, as well as the international trade in shark products. Below is a description and evaluation of current and relevant domestic and international management measures that may affect the oceanic whitetip shark. More information on these management measures can be found in the status review report (Young *et al.,* 2016) and other recent status reviews of other shark species (Miller *et al.,* 2013; 2014). The following section will first discuss U.S. domestic regulatory measures applicable to the oceanic whitetip shark, followed by international regulations that may affect sharks in general, as well as the oceanic whitetip shark in particular.

U.S. Domestic Regulatory Mechanisms

In the U.S. Pacific, highly migratory species (HMS) fishery management is the responsibility of adjacent states and three regional management councils that were established by the Magnuson-Stevens Fishery Conservation and Management Act: The Pacific Fishery Management Council (PFMC), the North Pacific Fishery Management Council, and the Western Pacific Fishery Management Council (WPFMC). The PFMC manages highly migratory species

off the coasts of Washington, Oregon, and California; however, the oceanic whitetip shark is not one of the species they actively manage, as its distribution favors more tropical waters. The PFMC is, however, actively engaged in international fishery management organizations that manage fish stocks that migrate through the PFMC's area of jurisdiction. In 2011, NMFS published a final rule (76 FR 68332) issuing regulations to implement decisions of the IATTC, including the Resolution Prohibiting the Retention of Oceanic Whitetip Sharks (C–11–10), which is described in more detail below in the International Regulatory Mechanisms section of this proposed rule. According to the final rule mentioned previously, U.S. fisheries that target highly migratory species rarely retain, transship, land, or sell this species in the IATTC Convention Area.

The WPFMC has jurisdiction over the EEZs of Hawaii, Territories of American Samoa and Guam, Commonwealth of the Northern Mariana Islands, and the Pacific Remote Island Areas, as well as the domestic fisheries that occur on the adjacent high seas. The WPFMC developed the Pelagics Fishery Ecosystem Plan (FEP; formerly the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region) in 1986 and NMFS, on behalf of the U.S. Secretary of Commerce, approved the Plan in 1987. Under the FEP, the oceanic whitetip shark is designated as a Pelagic Management Unit Species and is subject to regulations. These regulations are intended to minimize impacts to targeted stocks as well as protected species. Fishery data are also analyzed in annual reports and used to amend the FEP as necessary. In Hawaii and American Samoa, oceanic whitetip sharks are predominantly caught in longline fisheries that operate under extensive regulatory measures, including gear, permit, logbook, vessel monitoring system, and protected species workshop requirements. In 2015, NMFS published a final rule to implement decisions of the WCPFC to prohibit the retention of oceanic whitetip sharks in fisheries operating within the WCPFC's area of competence (or Convention Area), which comprises the majority of the Western and Central Pacific Ocean. The regulations were published in the **Federal Register** on February 19, 2015 (80 FR 8807) and include prohibitions on the retention of the oceanic whitetip shark, as well as requirements to release any oceanic whitetip caught. These regulations are applicable to all U.S. fishing vessels used for commercial fishing for HMS in the Convention Area (PIRO 2015). As noted previously in the *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes* section of this proposed rule, oceanic whitetip sharks are still caught as bycatch in this fishery, but the majority of individuals are now released alive. Though post-release survival rates are unknown, it is likely these regulations are helping to reduce overall mortality of the species to some degree.

In the Northwest Atlantic, the U.S. Atlantic HMS Management Division within NMFS develops regulations for Atlantic HMS fisheries, and primarily coordinates the management of Atlantic HMS fisheries in Federal waters (domestic) and the high seas (international), while individual states establish regulations for HMS in state waters. The NMFS Atlantic HMS Management Division currently manages 42 species of sharks (excluding spiny dogfish) under the Consolidated Atlantic HMS FMP (NMFS 2006). The management of these sharks is divided into five species groups: Large coastal sharks, small coastal sharks, pelagic sharks, smoothhound sharks, and prohibited sharks. Oceanic whitetip sharks are managed under the pelagic sharks group. One way that the HMS Management Division controls and monitors commercial harvest is by requiring U.S. commercial Atlantic HMS fishermen who fish for or sell sharks to have a Federal Atlantic Directed or Incidental shark limited access permit. These permits are administered under a limited access program, and NMFS is no longer issuing new shark permits. As of October 2015, 224 U.S. fishermen are permitted to target sharks managed by the HMS Management Division in the Atlantic Ocean and Gulf of Mexico, and an additional 275 fishermen are permitted to land sharks incidentally (NMFS 2015). Under a directed shark permit, there is no directed numeric retention limit for pelagic sharks, subject to quota limitations. An incidental permit allows fishers to keep up to a total of 16 pelagic or small coastal sharks (all species combined) per vessel per trip. Current authorized gear types for oceanic whitetip sharks include: Bottom longline, gillnet, rod and reel, handline, or bandit gear. There are no restrictions on the types of hooks that may be used to catch oceanic whitetip sharks, and there is no commercial minimum size limit. The annual quota for pelagic sharks (other than blue sharks or porbeagle sharks) is currently 488 mt dressed weight. NMFS monitors the different shark quota complexes annually and will close the fishing season for each fishery after 80 percent of the respective quota has been landed or is projected to be landed. Atlantic sharks and shark fins from federally permitted vessels may be sold only to federally permitted dealers. Logbook reporting is required for selected fishers with a federal commercial shark permit. In addition, fishers may be selected to carry an observer onboard, and some fishers are subject to vessel and electronic monitoring systems depending on the gear used and where they fish. In terms of processing sharks landed, the head may be removed and the shark may be gutted and bled, but the shark cannot be filleted or cut into pieces while onboard the vessel and all fins, including the tail, must remain naturally attached to the carcass through offloading.

In 2011, NMFS published final regulations to implement decisions of ICCAT (*i.e.,* Recommendation 10–07 for the conservation of oceanic whitetip sharks), which prohibits retention of oceanic whitetip sharks in the PLL fishery and on recreational (HMS Angling and Charter headboat permit holders) vessels that possess tuna, swordfish, or billfish (76 FR 53652). The implementation of regulations to comply with ICCAT Recommendation 10–07 for the conservation of oceanic whitetip sharks is likely the most influential regulatory mechanism in terms of reducing mortality of oceanic whitetip sharks in the U.S. Atlantic. It should be noted that oceanic whitetip sharks are still occasionally caught as bycatch and landed in this region despite its prohibited status in ICCAT associated fisheries (NMFS 2012; 2014), as retention is permitted in other authorized gears other than pelagic longlines (*e.g.,* gillnets, bottom longlines); however, these numbers have decreased. Prior to the implementation of the retention prohibition on oceanic whitetip, an analysis of the 2005–2009 HMS logbook data indicated that, on average, a total of 50 oceanic whitetip sharks were kept per year, with an additional 147 oceanic whitetip sharks caught per year and subsequently discarded (133 released alive and 14 discarded dead). Thus, without the prohibition, approximately 197 oceanic whitetip sharks could be caught and 64 oceanic whitetip sharks (32 percent) could die from being discarded dead or retained each year (NMFS 2011). Since the prohibition was implemented in 2011, estimated commercial landings of oceanic whitetip declined from only 1.1 mt in

2011 to only 0.03 mt (dressed weight) in 2013 (NMFS 2012; 2014). In fact, from 2013–2014, NMFS reported a total of 81 oceanic whitetip interactions, with 83 percent (67 individuals) released alive and 17 percent (14 individuals) discarded dead (NMFS 2014; 2015). While the retention ban for oceanic whitetip does not prevent incidental catch or subsequent at-vessel and post-release mortality, it likely provides minor ecological benefits to oceanic whitetip sharks via a reduction in overall fishing mortality in the Atlantic PLL fishery (NMFS 2011).

In addition to general commercial fishing regulations for management of highly migratory species, the United States has implemented a couple of significant laws for the conservation and management of sharks: the Shark Finning Prohibition Act and the Shark Conservation Act. The Shark Finning Prohibition Act was enacted in December 2000 and implemented by final rule on February 11, 2002 (67 FR 6194), and prohibited any person under U.S. jurisdiction from: (i) Engaging in the finning of sharks; (ii) possessing shark fins aboard a fishing vessel without the corresponding carcass; and (iii) landing shark fins without the corresponding carcass. It also implemented a five percent fin to carcass ratio, creating a rebuttable presumption that fins landed from a fishing vessel or found on board a fishing vessel were taken, held, or landed in violation of the Act if the total weight of fins landed or found on board the vessel exceeded five percent of the total weight of carcasses landed or found on board the vessel. The Shark Conservation Act was signed into law on January 4, 2011, and implemented by final rule on June 29, 2016 (81 FR 42285), and, with a limited exception for smooth dogfish (*Mustelus canis*), prohibits any person from removing shark fins at sea, or possessing, transferring, or landing shark fins unless they are naturally attached to the corresponding carcass.

As expected, U.S. exports of dried shark fins dropped significantly after the passage of the Shark Finning Prohibition Act. In 2011, with the passage of the U.S. Shark Conservation Act, exports of dried shark fins dropped again, by 58 percent, to 15 mt, the second lowest export amount since 2001. This is in contrast to the price per kg of shark fin, which was at its highest price of ~$100/kg, and suggests that existing regulations have likely been effective at discouraging fishing for sharks solely for the purpose of the fin trade. Thus, although the international shark fin trade is likely a driving force behind the overutilization of many global shark species, including the oceanic whitetip, the U.S. participation in this trade appears to be diminishing. In 2012, the value of fins also decreased, suggesting that the worldwide demand for fins may be on a decline. For example, a decrease in U.S. fin prices coincided with the implementation of fin bans in various U.S. states in 2012 and 2013, and U.S. shark fin exports have continued on a declining trend (Miller *et al.,* 2013). However, it should be noted that the continued decline is also likely a result of the waning global demand for shark fins altogether. Similarly, many U.S. states, especially on the West Coast, and U.S. Flag Pacific Island Territories have also passed fin bans and trade regulations, subsequently decreasing the United States' contribution to the fin trade. For example, after the State of Hawaii prohibited finning in its waters and required shark fins to be landed with their corresponding carcasses in the state in 2000, the shark fin exports from the United States into Hong Kong declined significantly in 2001 (54 percent decrease, from 374 to 171 t) as Hawaii could therefore no longer be used as a fin trading center for the international fisheries operating and finning in the Central Pacific (Clarke *et al.,* 2007). With regard to oceanic whitetip sharks, the finning regulations introduced in 2001 in the U.S. Hawaii-based longline fishery have acted to reduce mortality on oceanic whitetip and other large shark species (Walsh *et al.,* 2009). Prior to the ban, from 1995–2000, the fins were taken from a large proportion of captured oceanic whitetip with the remaining carcass being discarded (72.3 percent in deep sets and 52.7 percent from shallow sets), as was the case with other large sharks (Walsh *et al.,* 2009). From 2004–2006, following the implementation of the new regulations, almost all sharks were released, although some were dead on release. Overall, minimum mortality estimates declined substantially as a result of the finning regulations, from 81.9 percent to 25.6 percent in deep sets and from 61.3 percent to 9.1 percent in shallow sets (Walsh *et al.,* 2009). However, aside from this example, there is little information on the level of compliance with the various fisheries management measures for sharks, including oceanic whitetip, with compliance likely variable among other countries and regions.

Overall, regulations to control for overutilization of oceanic whitetip sharks in U.S. waters, including fisheries management plans with quotas and trip limits, species-specific retention prohibitions in PLL gear, and finning regulations are not in and of themselves inadequate such that they are contributing to the global extinction risk of the species. In fact, it is likely that the stable CPUE trend observed for the oceanic whitetip shark in the Northwest Atlantic is largely a result of the implementation of management measures for pelagic sharks under the U.S. HMS FMP. However, because oceanic whitetip sharks are highly migratory and frequently move beyond U.S. jurisdiction, these regulatory mechanisms are limited on the global stage in that they only provide protections to oceanic whitetip sharks while in U.S. waters. While this does not make them inadequate in terms of their purpose of protecting oceanic whitetip sharks while in U.S. waters, finning and retention bans are likely inadequate in other parts of the world to prevent further population declines of oceanic whitetip as a result of overutilization (as discussed in detail below). Therefore, given the significant abundance declines observed for the species as a result of overutilization, and the fact that regulatory mechanisms are largely inadequate elsewhere across the species' range, it is unlikely that U.S. regulatory mechanisms alone are enough to mitigate for threats contributing to the species' global extinction risk.

International Regulatory Mechanisms

Regarding international regulatory mechanisms, the ERA team expressed significant concern regarding existing regulations to control bycatch-related mortality, finning of oceanic whitetip sharks for the international shark fin trade, and illegal fishing and trafficking activities. The ERA team recognized that the number of international regulatory mechanisms for sharks in general, and the oceanic whitetip shark in particular, have been on the rise in recent years. For example, the oceanic whitetip shark was listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) in 2014. CITES is an international agreement between governments, with the aim of ensuring that international trade in specimens of wild animals and plants does not threaten their survival. International trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate. No import permit is necessary for these species under CITES (although a permit is needed in some countries that have taken stricter measures than CITES requires).

However, recent data from Hong Kong's Agriculture Fisheries Conservation Department (AFCD) suggests that these measures are not adequately implemented or enforced by all CITES Parties with respect to the oceanic whitetip shark. Specifically, since the oceanic whitetip shark was listed under CITES Appendix II in 2014, approximately 1,263 kg (2,784 lbs) of oceanic whitetip fins have been confiscated upon entry into Hong Kong because the country of origin did not include the required CITES permits and paperwork. Since 2014, confiscated oceanic whitetip fin shipments included 940.46 kg from Colombia, 10.96 kg from the Seychelles, and 272.49 kg from the United Arab Emirates (AFCD, Unpublished data).

In addition to trade regulations, finning bans have been implemented by a number of countries, including the European Union (EU), as well as by nine RFMOs. These finning bans range from requiring fins remain attached to the body, to allowing fishers to remove shark fins provided that the weight of the fins does not exceed 5 percent of the total weight of shark carcasses landed or found onboard. In fact, all of the relevant RFMOS prohibit fins onboard that weigh more than 5 percent of the weight of sharks to curb the practice of shark finning (*i.e.,* the fins-to-carcass ratio). Although the fins-to-carcass weight ratios have the potential to reduce the practice of finning, these regulations do not prohibit the fishing of sharks and a number of issues associated with reliance on the 5 percent fins-to-carcass weight ratio requirement have been identified, including: the percentage of fins-to-carcass weight varies widely among species, fin types used in calculation, the type of carcass weight used (whole or dressed) and fin cutting techniques; under the fins-to-carcass weight ratio measure, sharks that are not landed with fins attached to the body make it difficult to match fins to a carcass (Lack and Sant 2009). There are also issues with using the ratios for dried vs. fresh fins, which can change the ratio substantially. Further, despite their existence, laws and regulations are rapidly changing and are not always effectively enforced by countries and RFMOs (Biery and Pauly 2012).

Numerous RFMOs and countries have also implemented various regulations regarding shark fishing in general, which are described in detail in the Status Review Report (Young *et al.,* 2016). A number of countries have enacted complete shark fishing bans (*i.e.,* bans on retention and possession of sharks and shark products), with the Bahamas, Marshall Islands, Honduras, Sabah (Malaysia), and Tokelau (an island territory of New Zealand) adding to the list in 2011, the Cook Islands in 2012, and the Federated States of Micronesia in 2015. These ''shark sanctuaries'' (*i.e.,* locations where harvesting sharks is prohibited) can also be found in the Eastern Tropical Pacific Seascape (which encompasses around two million km^2 and includes the Galapagos, Cocos, and Malpelo Islands), in waters off the Maldives, Mauritania, Palau, French Polynesia, New Caledonia and Raja Ampat, Indonesia. However, it should be noted that sharks can still be caught as bycatch in these areas and enforcement is likely difficult; thus, their efficacy for reducing bycatch-related mortality of sharks is uncertain.

In addition to international regulatory mechanisms for the conservation of sharks in general via shark finning and fishing bans, a number of species-specific measures have been implemented for the conservation of oceanic whitetip sharks in particular. Specifically, the oceanic whitetip is the only shark species that has a no-retention measure in every tuna RFMO, which underscores the species' conservation status. However, the ERA team noted that international regulations specific to oceanic whitetip sharks are likely inadequate to mitigate threats that will result in further population declines throughout the species' global range. Notably, these measures likely have varying rates of implementation and enforcement and they do not prevent oceanic whitetip sharks from being caught in the first place, nor the subsequent at-vessel and post-release mortality that may result from being captured. Additionally, evidence suggests illegal trafficking and exportation activities of oceanic whitetip sharks are ongoing.

In 2011, the IATTC adopted Resolution C–11–10 for the conservation of oceanic whitetip sharks, which provides that IATTC Members and Cooperating non-Members shall prohibit retaining onboard, transshipping, landing, storing, selling, or offering for sale any part or whole carcass of oceanic whitetip sharks in the IATTC Convention Area. However, this measure is not likely adequate to prevent capture and a substantial amount of mortality in the main fishery that catches oceanic whitetip sharks in this region (*i.e.,* the tropical tuna purse seine fishery). Though published mortality rates of the oceanic whitetip shark in purse seine fisheries are not available, it is likely the species experiences high mortality rates similar to congener *C. falciformis* during and after interactions with purse seine fisheries (*i.e.,* ~85 percent in Western and Central Pacific and Indian Ocean tropical purse seine fisheries; Poisson *et al.,* (2014); Hutchinson *et al.,* (2015)). Given that oceanic whitetip sharks are captured in a net where they are unable to swim, and they are also subjected to the weight of whatever tonnage is on top of them, the sharks likely experience high levels of stress that can lead to mortality even if they are released alive. In addition, rough handling techniques utilized after sharks are brought onboard can also increase mortality. Thus, the ERA team concluded, and we agree, that the retention prohibition enacted for oceanic whitetip sharks in the eastern Pacific, particularly for the tropical tuna purse seine fishery, is not likely effective in reducing the threat of overutilization in this region.

In the Western and Central Pacific, the WCPFC also has regulatory measures for the conservation of sharks in general, as well as specific measures for the conservation of oceanic whitetip sharks. Likely the most influential management measure for the conservation of oceanic whitetip sharks in the Western and Central Pacific is Conservation Management Measure (CMM) 2011–04, which prohibits WCPFC vessels from retaining onboard, transshipping, storing on a fishing vessel, or landing any oceanic whitetip shark, in whole or in part, in the fisheries covered by the Convention. However, observations from the longline fishery have shown that CMM 2011–04 for the retention prohibition of oceanic whitetip is not being strictly followed (or not yet fully implemented), with non-negligible proportions of oceanic whitetips still being retained or finned. In fact, both in number and proportionally more oceanic whitetip sharks were retained in 2013 (the first year of the CMM) than 2012 in the longline fishery (Rice *et al.,* 2015). In addition, observations from the Western and Central tropical tuna purse seine fishery suggest similar issues discussed previously for the eastern Pacific purse seine fishery: Even if live release is strictly practiced in purse seine fisheries, the number of sharks surviving is expected to be low.

In addition to finning controls and species-specific retention bans, the WCPFC has also adopted some conservation measures related to fisheries gear to reduce bycatch of oceanic whitetip sharks in the first place. For example, CMM 2014–05, which became effective in July 2015, requires each national fleet to either ban wire leaders or ban shark lines, both of which have potential to reduce shark

bycatch. However, while it is predicted that oceanic whitetip shark mortality may be reduced by up to 40 percent if both measures are used, this CMM allows flag-states to choose which fishing technique they exclude. Using Monte Carlo simulations, Harley and Pilling (2016) determined the following: if flag-states choose to exclude the technique least used by their vessels, the median predicted reduction in fishing-related mortality is only 10 percent for the oceanic whitetip shark. If flag-states exclude the technique most used by their vessels, this would reduce the fishing mortality rate by 30 percent. This compares to a reduction of 40 percent if choice was removed and both techniques are prohibited. Therefore, given the high levels of fishing mortality experienced by this species, it is unlikely that the options under CMM (2014–05) of either banning shark lines or wire traces will result in sufficient reductions in fishing mortality (Harley *et al.,* 2015). Thus, based on the foregoing information, the ERA team concluded, and we agree, that despite the increasing species-specific management measures in this region, given the severely depleted state of the oceanic whitetip population and the significant levels of fishing mortality the species experiences in this region, less-than-full implementation will erode the benefits of any mitigation measures.

In the Atlantic Ocean, ICCAT is the main regulatory body for the conservation and management of tuna and tuna-like species. In 2010, ICCAT developed Recommendation 10–07, which specifically prohibits the retention, transshipping, landing, storing, selling, or offering for sale any part or whole carcass of oceanic whitetip sharks in any fishery; however, like other previously described retention bans, the retention ban implemented by ICCAT does not necessarily prevent all fisheries-associated mortality. Although oceanic whitetip sharks have a relatively higher at-vessel survivorship rate than other pelagic sharks in the Atlantic, some will still likely die as a result of being caught. As previously discussed in the *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes* section of this proposed rule, Brazil is one of the top 26 shark-catching countries in the world and the largest oceanic whitetip catching country in the Atlantic Ocean, comprising 89 percent of the total oceanic whitetip catch reported to ICCAT from 1992–2014. Thus, the following text focuses on existing regulatory mechanisms and their efficacy for reducing fishing pressure on oceanic whitetip sharks in Brazil. Since the implementation of ICCAT Recommendation 10–07, Brazil reported 12 mt of oceanic whitetip from 2013–2014, which indicates the species is still being caught and continues to experience fisheries-related mortality in this portion of its range. In addition to ICCAT regulations, sharks in Brazil must be landed with corresponding fins and a 5 percent fin to carcass weight ratio is required. In addition, all carcasses and fins must be unloaded and weighed and the weights reported to authorities. Pelagic gillnets and trawls are prohibited in waters less than 3 nm (5.6 km) from the coast; however, given that the oceanic whitetip is a pelagic species, a gillnet ban within 3 nm of the coast is not likely going to be beneficial to the species. Further, it is generally recognized that these regulations are poorly enforced (Chiaramonte and Vooren 2007). In December 2014, the Brazilian Government's Chico Mendes Institute for Biodiversity Conservation approved the National Plan of Action for the Conservation of Elasmobranchs of Brazil (No 125). However, this plan will not be fully implemented until 2019, and it focuses on a list of 12 priority species that does not include the oceanic whitetip shark. As noted previously, the oceanic whitetip shark was designated as a ''species threatened by overexploitation'' in 2004 by Brazil's Ministry of Environment, and listed under Annex II of Brazil's Normative Ruling No. 5 of May 21, 2004. In 2014, Brazil finalized its national assessment regarding the extinction risk of Brazilian fauna, and listed the oceanic whitetip shark as ''Vulnerable'' under Brazil's National Official List of Endangered Species of Fauna—Fish and Aquatic Invertebrate (ICMBio 2014). Species listed as ''Vulnerable'' enjoy full protection, including, among other measures, the prohibition of capture, transport, storage, custody, handling, processing and marketing. The capture, transport, storage, and handling of specimens of the species shall only be allowed for research purposes or for the conservation of the species, with the permission of the Instituto Chico Mendes. However, whether these regulations are adequately implemented and enforced is unclear. In fact, there is strong opposition from the fishing industry and some ordinances guaranteeing protection to endangered species in the country have recently been canceled (Di Dario *et al.,* 2014). Additionally, systematic data collection from fleets fishing over Brazilian jurisdiction ended in 2012, and onboard observer programs have been cancelled, which renders any further monitoring of South Atlantic shark populations difficult or impossible (Barreto *et al.,* 2015). Given the foregoing information, it appears that existing regulatory mechanisms in Brazil may not be adequate to effectively manage the significant threat of fishing pressure and associated mortality on oceanic whitetip sharks in this region.

The ERA team also identified several issues with regulations in the Indian Ocean. The IOTC, the main regulatory body for managing tuna and tuna-like species, has management measures in place for sharks in general, and also specifically for the oceanic whitetip shark. In 2013, the IOTC passed Resolution 13–06 that prohibits the retention, transshipment, landing, or storing of any part or whole carcass of oceanic whitetip sharks. However, unlike similar regulations implemented by other RFMOs, the IOTC retention prohibition of oceanic whitetip shark exempts ''artisanal fisheries operating exclusively in their respective EEZ for the purpose of local consumption.'' However, the definition of artisanal vessels in the IOTC encompasses a wide array of boats with vastly different characteristics. They range from the pirogue that fishes close to shore for subsistence with no motor, no deck and no holding facilities, to a longliner, gillnetter or purse seiner of less than 24 m with an inboard motor, deck, communications, fish holding facilities, and in some cases chilling or freezing capabilities. This latter vessel could potentially conduct fishing operations offshore, including outside its EEZ (Moreno and Herrera 2013). For example, in 2014 and 2015 the Islamic Republic of Iran and Sri Lanka reported 239 mt of oceanic whitetip sharks caught by gillnets that fall under the definition of ''artisanal fisheries.'' Additionally, while some no-retention measures ban the ''selling or offering for sale'' of any products from the specified shark species, the IOTC oceanic whitetip shark measure does not (Clarke 2013). Further, this measure is not binding on India, which is one of the main oceanic whitetip shark catching countries identified by the IOTC in the Indian Ocean. Finally, IOTC Resolution 13–06 was passed as an interim pilot measure; therefore, it is highly uncertain as to whether this measure will be ongoing into the foreseeable future. As a result, it appears that the retention ban of oceanic whitetip in the Indian Ocean is limited in scope relative to other RFMO no-retention measures, and only

partially protective depending on whether the measure is adequately implemented and enforced. For example, in Indonesia, which is the largest shark fishing nation in the world, oceanic whitetip sharks are protected in order to comply with IOTC Resolution 13–06. However, evidence suggests that this Resolution may not be strictly adhered to. For instance, in a genetic barcoding study of shark fin samples throughout traditional fish markets in Indonesia from mid-2012 to mid-2014, oceanic whitetip shark was identified as present (Sembiring *et al.,* 2015) despite being prohibited in 2013. In addition, authorities confiscated around 3,000 oceanic whitetip shark fins from sharks caught in waters near Java Island as recent as October 2015 (South China Morning Post 2015). Thus, while it generally appears that the IOTC has increased its number of management measures for sharks, including the oceanic whitetip, these regulations are likely inadequate to prevent further population declines of the oceanic whitetip shark in this region as a result of overutilization.

It is clear that many countries and RFMOs have implemented shark finning bans or have prohibited the sale or trade of shark fins or products, and have even prohibited the retention of oceanic whitetip sharks in their respective fisheries, with declining trends in finning and catches of oceanic whitetip sharks evident in some locations as a result of these regulations (*e.g.,* Fiji, Australia and the United States; see Young *et al.,* 2016 for more details). It also evident that the international trade in shark fins may be gradually slowing. In fact, as described previously, the trade in shark fins through China, Hong Kong SAR, which has served as an indicator of the global trade for many years, fell by 22 percent in 2012. Additionally, current indications are that the shark fin trade through Hong Kong SAR and China will continue to contract (Dent & Clarke 2015). However, although the overall situation regarding the shark fin trade appears to be improving due to current regulations (*e.g.,* increasing number of finning bans) and trends (*e.g.,* waning demand for shark fins), and it may not be as severe a threat to some species of sharks compared to others, evidence suggests that oceanic whitetip fins are considered to be preferred or ''first choice'' in the Hong Kong market (Vannuccini 1999; E-CoP16Prop.42 2013) and the high demand for oceanic whitetip fins is ongoing. This is evidenced by recent genetic studies that confirm the presence of oceanic whitetip shark fins in several markets throughout its range, as well as several recent incidents of illegal finning and trafficking of oceanic whitetip fins despite national and international regulations. For example, in February 2013, oceanic whitetip fins were found in a large seizure of fins from a Taiwanese vessel illegally fishing in the Marshall Islands. In 2014, illegal oceanic whitetip shark fins were discovered in a random sample inspection of three 40 kg sacks slated for export from Costa Rica to Hong Kong (Tico Times 2014). Additionally, and as previously noted, Indonesian authorities seized 3,000 shark fins belonging to oceanic whitetip sharks that were reportedly caught in waters around Java Island in October 2015. The fins, which were about to be flown to Hong Kong, were seized at the international airport that serves the capital Jakarta. This haul was worth an estimated U.S. $72,000 in Indonesia, but would reportedly fetch several times that amount in Hong Kong (South China Morning Post 2015). Therefore, it is clear that the oceanic whitetip shark is subject to illegal fishing and trafficking, particularly for its valuable fins. Given the recent downturn in the shark fin trade (Dent & Clarke, 2015; Eriksson & Clarke 2015), the threat of this IUU fishing for the sole purpose of shark fins may not be as significant into the future. However, based on the best available information on the species' declining population trends throughout its range, as well as current utilization levels, the present mortality rates associated with illegal fishing and its impacts on oceanic whitetip shark populations may be contributing to the overutilization of the species. Therefore, based on the foregoing information, the ERA team concluded that despite national and international regulations to protect the oceanic whitetip, illegal finning and exportation activities are ongoing. As such, and based on the best available information, existing regulatory mechanisms to control for overutilization by the shark fin trade are likely inadequate to significantly reduce this threat to the oceanic whitetip shark at this time.

Overall, and based on the above review of regulatory measures (in addition to the regulations described in Young *et al.,* 2016), the ERA team concluded, and we agree, that existing regulatory mechanisms to control for overutilization are largely inadequate to significantly reduce this global threat to the oceanic whitetip shark at this time. The ERA team acknowledged that in some locations, regulatory measures may be effective for reducing the threat of overutilization to some degree. For example, as noted in the U.S. Domestic Regulatory Mechanisms section, in the U.S. Northwest Atlantic and Pacific Island States and Territories oceanic whitetip sharks are managed under comprehensive management plans and regulations with trip limits, quotas, logbook and protected species requirements, and other various fishing restrictions. In the Northwest Atlantic, oceanic whitetip sharks are managed under the pelagic species complex of the Atlantic HMS FMP, with commercial quotas imposed that restrict the overall level of oceanic whitetip sharks taken in this part of its range. Pelagic longline gear is heavily managed and strictly monitored. The use of pelagic longline gear (targeting swordfish, tuna and/or shark) also requires specific permits, with all required permits administered under a limited access program. Presently, no new permits are being issued; thus, persons wishing to enter the fishery may only obtain these permits by transferring the permit from a permit holder who is leaving the fishery, and transferees are currently subject to vessel upgrading restrictions. These national regulations, as detailed in the 2006 Consolidated HMS FMP and described in this Status Review Report, combined with ICCAT's Recommendation 10–07 on the retention prohibition of oceanic whitetip shark, have likely led to the recent stabilization of the Northwest Atlantic population. In Hawaii, finning and no-retention regulations have resulted in a significant decline in the number of oceanic whitetip sharks finned and an increase in the number of sharks released alive. Thus, these U.S. conservation and management measures in and of themselves are not inadequate such that they contribute to the extinction risk of the oceanic whitetip shark by increasing demographic risks (*e.g.,* further abundance declines) or the threat of overutilization (*e.g.,* unsustainable catch rates) currently and in the foreseeable future. However, the oceanic whitetip shark is highly migratory and often moves beyond U.S. jurisdiction. For example, in just one tagging study conducted in the Northwest Atlantic, five tagged oceanic whitetip sharks made transboundary movements, spending time in waters managed by different countries (United States, Cuba, and several of the windward Caribbean islands) or the high seas that are managed by international bodies (Howey-Jordan et al. 2013). Additionally, the ERA team emphasized that regulatory mechanisms

to control for overutilization of the species are largely inadequate throughout the rest of the species' global range. Therefore, based on the best available information, and given the significant global abundance declines of the oceanic whitetip shark as a result of overutilization, the inadequacy of existing regulatory mechanisms is likely a threat contributing to the species' risk of extinction throughout its range.

Overall Risk Summary

Guided by the results and discussions from the demographic risk analysis and threats assessment, the ERA team members used their informed professional judgment to make an overall extinction risk determination for the oceanic whitetip shark now and in the foreseeable future. The ERA team concluded, and we agree, that the oceanic whitetip shark currently has a ''moderate'' risk of extinction globally. The ERA team was fairly confident in determining the overall level of extinction risk of the oceanic whitetip shark, placing more than half of their likelihood points in the ''moderate risk'' category. To express some uncertainty, particularly regarding the lack of robust abundance trends and catch data for populations in certain areas (*e.g.,* South Atlantic and Indian Ocean), as well as potential stabilizing trends observed in two areas (*e.g.,* Northwest Atlantic and Hawaii), the team placed some of their likelihood points in the ''low risk'' and ''high risk'' categories as well. Likelihood points attributed to the overall level of extinction risk categories were as follows: Low Risk (20/60), Moderate Risk (34/60), High Risk (6/60). The ERA team reiterated that the once abundant and ubiquitous oceanic whitetip shark has likely experienced significant historical population declines throughout its global range, with multiple data sources and analyses, including a stock assessment and trends in relative abundance, suggesting declines greater than 70–80 percent in most areas. The ERA team concluded that declining abundance trends of varying magnitudes are likely ongoing in all three ocean basins.

In terms of threats to the species, the ERA team noted that the most significant threat to the continued existence of the oceanic whitetip shark in the foreseeable future is ongoing and significantly high rates of fishing mortality driven by demands of the international trade in shark fins and meat, as well as impacts related to incidental bycatch and IUU fishing. The ERA team emphasized that the oceanic whitetip shark's vertical and horizontal distribution significantly increases its exposure to industrial fisheries, including pelagic longline and purse seine fisheries operating within the species' core tropical habitat throughout its global range. In addition to declines in oceanic whitetip catches throughout its range, there is also evidence of declining average size over time in some areas, which is particularly concerning given evidence that litter size is potentially correlated with maternal length. With such extensive declines in the species' global abundance and the ongoing threat of overutilization, the species' slow growth and relatively low fecundity may limit its ability for compensation. Related to this, the low genetic diversity of oceanic whitetip is also cause for concern and a viable risk over the foreseeable future for this species. This is particularly concerning since it is possible (though uncertain) that a reduction in genetic diversity following the large reduction in population size due to overutilization has not yet manifested in the species. Loss of genetic diversity can lead to reduced fitness and a limited ability to adapt to a rapidly changing environment, thus increasing the species' overall risk of extinction.

Finally, the species' extensive distribution, ranging across entire oceans and across multiple international boundaries complicates management of the species. The ERA team agreed that implementation and enforcement of management measures that could reduce the threat of overutilization to the species are likely highly variable and/or lacking altogether across the species' range. The ERA team acknowledged a significant increase in species-specific management measures to control for overutilization of oceanic whitetip shark across its range; however, the ERA team also noted that most of these regulations, particularly the retention prohibitions enacted by all relevant RFMOs throughout the range of the species, are too new to truly determine their efficacy in reducing mortality of oceanic whitetip shark. Despite this limitation, and with the exception of the Northwest Atlantic and Pacific Island States and Territories, the ERA team was not confident in the adequacy of these regulations to reduce the threat of overutilization and prevent further abundance declines in the foreseeable future. First, the ERA team discussed the fact that retention prohibitions do not prevent at-vessel and post-release mortality, which is likely high in some fisheries. In addition, the biggest concern to the ERA team with regard to these regulatory mechanisms going forward is the lack of full implementation and enforcement. The ERA team noted that proper implementation and enforcement of these regulations would likely result in a reduction in overall mortality of the species over time. However, the best available information suggests that this may not currently be the case. Given the species' depleted state throughout its range, the ERA team agreed that less than full implementation and enforcement of current regulations is likely undermining any conservation benefit to the species.

Based on all of the foregoing information, which represents the best scientific and commercial data available regarding current demographic risks and threats to the species, the ERA team concluded that the oceanic whitetip shark currently has a moderate risk of extinction throughout its range. We concluded that the species does not currently have a high risk of extinction because of the following: The species has a significantly broad distribution and does not seem to have been extirpated in any region, even in areas where there is heavy harvest bycatch and utilization of the species' high-value fins; there appears to be a potential for relative stability in population sizes on the order of 5–10 years at the post-decline depressed state, as evidenced by the potential stabilization of two populations (*e.g.,* NW Atlantic and Hawaii) at a diminished abundance, which suggests that this species is potentially capable of persisting at a low population size; and the overall reduction of the fin trade as well as increasing management regulations will likely reduce the threat of overutilization to some extent, and thus reduce the species' overall risk of extinction. However, given the species' significant historical and ongoing abundance declines of varying magnitudes in all three ocean basins, slow growth, low fecundity, and low genetic diversity, combined with ongoing threats of overutilization and largely inadequate regulatory mechanisms, the ERA team concluded that the oceanic whitetip shark currently has a moderate risk of extinction throughout its global range. In other words, due to significant and ongoing threats of overutilization and largely inadequate regulatory mechanisms, current trends in the species' abundance, productivity and genetic diversity place the species on a trajectory towards a high risk of extinction in the foreseeable future of ~30 years.

Conservation Efforts

Section 4(b)(1)(A) of the ESA requires the Secretary, when making a listing determination for a species, to take into account those efforts, if any, being made by any State or foreign nation to protect the species. In judging the efficacy of protective efforts, we rely on the Services' joint ''Policy for Evaluation of Conservation Efforts When Making Listing Decisions'' (''PECE;'' 68 FR 15100; March 28, 2003). The PECE is designed to guide determinations on whether any conservation efforts that have been recently adopted or implemented, but not yet proven to be successful, will result in recovering the species to the point at which listing is not warranted or contribute to forming a basis for listing a species as threatened rather than endangered. The purpose of the PECE is to ensure consistent and adequate evaluation of future or recently implemented conservation efforts identified in conservation agreements, conservation plans, management plans, and similar documents developed by Federal agencies, State and local governments, Tribal governments, businesses, organizations, and individuals when making listing decisions. The PECE provides direction for the consideration of such conservation efforts that have not yet been implemented, or have been implemented but have not yet demonstrated effectiveness. The policy is expected to facilitate the development by states and other entities of conservation efforts that sufficiently improve a species' status so as to make listing the species as threatened or endangered unnecessary. The PECE established two basic criteria: (1) The certainty that the conservation efforts will be implemented, and (2) the certainty that the efforts will be effective. Satisfaction of the criteria for implementation and effectiveness establishes a given protective effort as a candidate for consideration, but does not mean that an effort will ultimately change the risk assessment for the species. Overall, the PECE analysis ascertains whether the formalized conservation effort improves the status of the species at the time a listing determination is made.

The concern regarding the practice of finning and its effect on global shark populations has been growing both domestically and internationally. Notably, the push to stop shark finning and curb the trade of shark fins is evident overseas and even in Asian countries, where the demand for shark fin soup is highest. For example, in a recent report from WildAid, Whitcraft *et al.* (2014) reported the following regarding the declining demand for shark fins: An 82 percent decline in sales reported by shark fin vendors in Guangzhou, China and a decrease in prices (47 percent retail and 57 percent wholesale) over the past 2 years; 85 percent of Chinese consumers surveyed online said they gave up shark fin soup within the past 3 years, and two-thirds of these respondents cited awareness campaigns as a reason for ending their shark fin consumption; 43 percent of consumers responded that much of the shark fin in the market is fake; 24 airlines, 3 shipping lines, and 5 hotel groups have banned shark fins from their operations; there has been an 80 percent decline from 2007 levels in prices paid to fishermen in Tanjung Luar and Lombok in Indonesia and a decline of 19 percent since 2002–2003 in Central Maluku, Southeastern Maluku and East Nusa Tenggara; and of 20 Beijing restaurant representatives interviewed, 19 reported a significant decline in shark fin consumption. While there seems to be a growing trend to prohibit and discourage shark finning domestically and internationally, it is difficult to predict at this time whether the trend will be effective in reducing the threat of overutilization to the oceanic whitetip shark. Nonetheless, we conclude that these conservation measures are not likely to be effective in reducing current threats to oceanic whitetip shark to the point that listing would no longer be warranted.

There are also many other smaller national and international organizations with shark-focused goals that include advocating the conservation of sharks through education and campaign programs and conducting shark research to fill data gaps regarding the status of shark species. Some of these organizations include: The Pew Environment Group, Oceana, Ocean Conservancy, Shark Trust, Bite-Back, Shark Project, Pelagic Shark Research Foundation, Shark Research Institute, and Shark Savers. More information on the specifics of these programs and groups can be found on their Web sites. Important research on oceanic whitetip sharks is also being conducted in a joint partnership by Nova Southeastern University and the Guy Harvey Research Institute. To facilitate conservation and management efforts for oceanic whitetip sharks, the Guy Harvey Research Institute/Guy Harvey Ocean Foundation and their project partners are using integrative approaches to investigate the population connectivity of this species, including ongoing studies of the global stock structure of oceanic whitetip sharks by using genetic techniques, as well as migration patterns of this species in the western Atlantic with the aid of satellite tracking technologies. All of these conservation efforts and non-regulatory mechanisms are beneficial to the persistence of the oceanic whitetip shark. The implementation of many of these efforts, especially the shark research programs, will help to fill current data gaps in oceanic whitetip abundance, genetics, and movement patterns, which can ultimately help inform other conservation and management measures. However, it is too soon to tell whether the collective conservation efforts of both non-governmental and academic organizations will be effective in reducing threats to the species, particularly those related to overutilization of the oceanic whitetip shark.

Proposed Determination

Section 4(b)(1) of the ESA requires that NMFS make listing determinations based solely on the best scientific and commercial data available after conducting a review of the status of the species and taking into account those efforts, if any, being made by any state or foreign nation, or political subdivisions thereof, to protect and conserve the species. We have independently reviewed the best available scientific and commercial information, including the petition, public comments submitted on the 90-day finding (81 FR 1376; January 12, 2016), the status review report (Young *et al.,* 2016), and other published and unpublished information, and we have consulted with species experts and individuals familiar with the oceanic whitetip shark. We considered each of the section 4(a)(1) factors to determine whether it contributed significantly to the extinction risk of the species on its own. We also considered the combination of those factors to determine whether they collectively contributed significantly to the extinction risk of the species. Therefore, our determination set forth below is based on a synthesis and integration of the foregoing information, factors and considerations, and their effects on the status of the species throughout its range. With respect to the term ''foreseeable future,'' we accept the ERA team's definition and rationale of approximately 30 years as reasonable for the reliable prediction of threats on the biological status of the species. That rationale for a foreseeable future of approximately 30 years was provided in detail previously (refer back to the

Assessment of Extinction Risk—Methods section of this proposed rule).

We conclude that the oceanic whitetip shark is not presently in danger of extinction, but is likely to become so in the foreseeable future throughout all of its range. We summarize the factors supporting this conclusion as follows: (1) The best available information indicates that the species has experienced significant and ongoing abundance declines in all three ocean basins (*i.e.,* globally); (2) oceanic whitetip sharks possess life history characteristics that increase their vulnerability to harvest, including slow growth, relatively late age of maturity, and low fecundity; (3) the species' low genetic diversity in concert with steep global abundance declines and ongoing threats of overutilization may pose a viable risk to the species in the foreseeable future; (4) due to the species' preferred vertical and horizontal habitat, the oceanic whitetip shark is extremely susceptible to incidental capture in both longline and purse seine fisheries throughout its range, and thus experiences substantial levels of fishing mortality from these fisheries; (5) the oceanic whitetip shark is a preferred species in the international fin market for its large, morphologically distinct fins, which incentivizes the retention and/or finning of the species; and (6) despite the increasing number of regulations for the conservation of the species, existing regulatory mechanisms are largely inadequate for addressing the most important threat of overutilization throughout a large portion of the species' range. We conclude that the species is not presently in danger of extinction as a result of the following supporting factors: (1) The species is broadly distributed over a large geographic range, and does not seem to have been extirpated in any region, even in areas where there is heavy harvest bycatch and utilization of the species' high-value fins; (2) there appears to be a potential for relative stability in population sizes on the order of 5–10 years at the post-decline depressed state, as evidenced by the potential stabilization of two populations (*e.g.,* NW Atlantic and Hawaii) at a diminished abundance, which suggests that this species is potentially capable of persisting at a low population size; (3) there is no evidence of a range contraction and there is no evidence of habitat loss or destruction; (4) the overall reduction of the fin trade as well as increasing management regulations will likely reduce the threat of overutilization to some extent in the foreseeable future, and thus reduce the species' current overall risk of extinction; (5) there is no evidence that disease or predation are contributing to an increased risk of extinction of the species; and (6) there is no evidence that other natural or manmade factors are contributing to an increased risk of extinction of the species.

As a result of the foregoing findings, which are based on the best scientific and commercial data available, we conclude that while the oceanic whitetip shark is not presently in danger of extinction throughout all or a significant portion of its range, it is likely to become so within the foreseeable future. Accordingly, the oceanic whitetip shark meets the definition of a threatened species, and thus, the oceanic whitetip shark warrants listing as a threatened species at this time.

Effects of Listing

Conservation measures provided for species listed as endangered or threatened under the ESA include the development and implementation of recovery plans (16 U.S.C. 1533(f)); designation of critical habitat, if prudent and determinable (16 U.S.C. 1533(a)(3)(A)); a requirement that Federal agencies consult with NMFS under section 7 of the ESA to ensure their actions do not jeopardize the species or result in adverse modification or destruction of designated critical habitat (16 U.S.C. 1536); and prohibitions on ''taking'' (16 U.S.C. 1538). Recognition of the species' plight through listing may also promote conservation actions by Federal and state agencies, foreign entities, private groups, and individuals.

Identifying Section 7 Consultation Requirements

Section 7(a)(2) (16 U.S.C. 1536(a)(2)) of the ESA and NMFS/FWS regulations require Federal agencies to confer with us on actions likely to jeopardize the continued existence of species proposed for listing, or that result in the destruction or adverse modification of proposed critical habitat. If a proposed species is ultimately listed, Federal agencies must consult on any action they authorize, fund, or carry out if those actions may affect the listed species or its critical habitat and ensure that such actions do not jeopardize the species or result in adverse modification or destruction of critical habitat should it be designated. Examples of Federal actions that may affect the oceanic whitetip shark include, but are not limited to: Alternative energy projects, discharge of pollution from point sources, non-point source pollution, contaminated waste and plastic disposal, dredging, pile-driving, development of water quality standards, vessel traffic, military activities, and fisheries management practices.

Critical Habitat

Critical habitat is defined in section 3 of the ESA (16 U.S.C. 1532(3)) as: (1) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the ESA, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination that such areas are essential for the conservation of the species. ''Conservation'' means the use of all methods and procedures needed to bring the species to the point at which listing under the ESA is no longer necessary. Section 4(a)(3)(a) of the ESA (16 U.S.C. 1533(a)(3)(A)) requires that, to the extent prudent and determinable, critical habitat be designated concurrently with the listing of a species. Designations of critical habitat must be based on the best scientific data available and must take into consideration the economic, national security, and other relevant impacts of specifying any particular area as critical habitat. If we determine that it is prudent and determinable, we will publish a proposed designation of critical habitat for the oceanic whitetip shark in a separate rule. Public input on features and areas in U.S. waters that may meet the definition of critical habitat for the oceanic whitetip shark is invited.

Protective Regulations Under Section 4(d) of the ESA

We are proposing to list the oceanic whitetip shark, *Carcharhinus longimanus,* as a threatened species under the ESA. In the case of threatened species, ESA section 4(d) leaves it to the Secretary's discretion whether, and to what extent, to extend the section 9(a) ''take'' prohibitions to the species, and authorizes us to issue regulations necessary and advisable for the conservation of the species. Thus, we have flexibility under section 4(d) to tailor protective regulations based on the needs of and threats to the species. The section 4(d) protective regulations may prohibit, with respect to threatened species, some or all of the acts which section 9(a) of the ESA prohibits with respect to endangered species. We are

not proposing such regulations at this time, but may consider potential protective regulations pursuant to section 4(d) for the oceanic whitetip in a future rulemaking. In order to inform our consideration of appropriate protective regulations for the species, we seek information from the public on the threats to oceanic whitetip shark and possible measures for their conservation.

Role of Peer Review

The intent of the peer review policy is to ensure that listings are based on the best scientific and commercial data available. In December 2004, the Office of Management and Budget (OMB) issued a Final Information Quality Bulletin for Peer Review establishing minimum peer review standards, a transparent process for public disclosure of peer review planning, and opportunities for public participation. The OMB Bulletin, implemented under the Information Quality Act (Pub. L. 106–554), is intended to enhance the quality and credibility of the Federal government's scientific information, and applies to influential or highly influential scientific information disseminated on or after June 16, 2005. To satisfy our requirements under the OMB Bulletin, we obtained independent peer review of the status review report. Independent specialists were selected from the academic and scientific community for this review. All peer reviewer comments were addressed prior to dissemination of the final status review report and publication of this proposed rule.

Public Comments Solicited on Listing

To ensure that the final action resulting from this proposal will be as accurate and effective as possible, we solicit comments and suggestions from the public, other governmental agencies, the scientific community, industry, environmental groups, and any other interested parties. Comments are encouraged on this proposal (See **DATES** and **ADDRESSES**). Specifically, we are interested in information regarding: (1) New or updated information regarding the range, distribution, and abundance of the oceanic whitetip shark; (2) new or updated information regarding the genetics and population structure of the oceanic whitetip shark; (3) habitat within the range of the oceanic whitetip shark that was present in the past, but may have been lost over time; (4) new or updated biological or other relevant data concerning any threats to the oceanic whitetip shark (*e.g.,* post-release mortality rates, finning rates in commercial fisheries, etc.); (5) current or planned activities within the range of the oceanic whitetip shark and their possible impact on the species; (6) recent observations or sampling of the oceanic whitetip shark; and (7) efforts being made to protect the oceanic whitetip shark.

Public Comments Solicited on Critical Habitat

We request quantitative evaluations describing the quality and extent of habitats for the oceanic whitetip shark, as well as information on areas that may qualify as critical habitat for the species in U.S. waters. Specific areas that include the physical and biological features essential to the conservation of the species, where such features may require special management considerations or protection, should be identified. Areas outside the occupied geographical area should also be identified, if such areas themselves are essential to the conservation of the species. ESA implementing regulations at 50 CFR 424.12(g) specify that critical habitat shall not be designated within foreign countries or in other areas outside of U.S. jurisdiction. Therefore, we request information only on potential areas of critical habitat within waters under U.S. jurisdiction.

Section 4(b)(2) of the ESA requires the Secretary to consider the ''economic impact, impact on national security, and any other relevant impact'' of designating a particular area as critical habitat. Section 4(b)(2) also authorizes the Secretary to exclude from a critical habitat designation those particular areas where the Secretary finds that the benefits of exclusion outweigh the benefits of designation, unless excluding that area will result in extinction of the species. For features and areas potentially qualifying as critical habitat, we also request information describing: (1) Activities or other threats to the essential features or activities that could be affected by designating them as critical habitat; and (2) the positive and negative economic, national security and other relevant impacts, including benefits to the recovery of the species, likely to result if these areas are designated as critical habitat. We seek information regarding the conservation benefits of designating areas within waters under U.S. jurisdiction as critical habitat. In keeping with the guidance provided by OMB (2000; 2003), we seek information that would allow the monetization of these effects to the extent possible, as well as information on qualitative impacts to economic values.

Data reviewed may include, but are not limited to: (1) Scientific or commercial publications; (2) administrative reports, maps or other graphic materials; (3) information received from experts; and (4) comments from interested parties. Comments and data particularly are sought concerning: (1) Maps and specific information describing the amount, distribution, and use type (*e.g.,* foraging or migration) by the oceanic whitetip shark, as well as any additional information on occupied and unoccupied habitat areas; (2) the reasons why any habitat should or should not be determined to be critical habitat as provided by sections 3(5)(A) and 4(b)(2) of the ESA; (3) information regarding the benefits of designating particular areas as critical habitat; (4) current or planned activities in the areas that might be proposed for designation and their possible impacts; (5) any foreseeable economic or other potential impacts resulting from designation, and in particular, any impacts on small entities; (6) whether specific unoccupied areas may be essential to provide additional habitat areas for the conservation of the species; and (7) potential peer reviewers for a proposed critical habitat designation, including persons with biological and economic expertise relevant to the species, region, and designation of critical habitat. We seek information regarding critical habitat for the oceanic whitetip shark as soon as possible, but no later than March 29, 2017.

Public Hearings

If requested by the public by February 13, 2017, hearings will be held regarding the proposal to list the oceanic whitetip shark as a threatened species under the ESA. If hearings are requested, details regarding location(s), date(s), and time(s) will be published in a subsequent **Federal Register** notice.

References

A complete list of all references cited herein is available upon request (see **FOR FURTHER INFORMATION CONTACT**).

Classification

National Environmental Policy Act

Section 4(b)(1)(A) of the ESA restricts the information that may be considered when assessing species for listing and sets the basis upon which listing determinations must be made. Based on the requirements in section 4(b)(1)(A) of the ESA and the opinion in *Pacific Legal Foundation* v. *Andrus,* 675 F. 2d 825 (6th Cir. 1981), we have concluded that ESA listing actions are not subject to the environmental assessment requirements

of the National Environmental Policy Act (NEPA).

Executive Order 12866, Regulatory Flexibility Act, and Paperwork Reduction Act

As noted in the Conference Report on the 1982 amendments to the ESA, economic impacts cannot be considered when assessing the status of a species. Therefore, the economic analysis requirements of the Regulatory Flexibility Act are not applicable to the listing process.

In addition, this proposed rule is exempt from review under Executive Order 12866. This proposed rule does not contain a collection-of-information requirement for the purposes of the Paperwork Reduction Act.

Executive Order 13132, Federalism

In accordance with E.O. 13132, we determined that this proposed rule does not have significant Federalism effects and that a Federalism assessment is not required. In keeping with the intent of the Administration and Congress to provide continuing and meaningful dialogue on issues of mutual state and Federal interest, this proposed rule will be given to the relevant state agencies in each state in which the species is believed to occur, and those states will be invited to comment on this proposal. We have considered, among other things, Federal, state, and local conservation measures. As we proceed, we intend to continue engaging in informal and formal contacts with the state, and other affected local or regional entities, giving careful consideration to all written and oral comments received.

List of Subjects in 50 CFR Part 223

Endangered and threatened species, Exports, Imports, Transportation.

Dated: December 22, 2016.

Samuel D Rauch, III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR part 223 is proposed to be amended as follows:

PART 223—THREATENED MARINE AND ANADROMOUS SPECIES

■ 1. The authority citation for part 223 continues to read as follows:

Authority: 16 U.S.C. 1531–1543; subpart B, § 223.201–202 also issued under 16 U.S.C. 1361 *et seq.;* 16 U.S.C. 5503(d) for § 223.206(d)(9).

■ 2. In § 223.102, in paragraph (e), add a new entry for ''Shark, oceanic whitetip'' under Fishes in alphabetical order by Common Name to read as follows:

§ 223.102 Enumeration of threatened marine and anadromous species.

* * * * *

(e) * * *

Species [1]			Citation(s) for listing determination(s)	Critical habitat	ESA rules
Common name	Scientific name	Description of listed entity			
*	*	*	*	*	*
FISHES					
*	*	*	*	*	*
Shark, oceanic whitetip ...	*Carcharhinus longimanus*	Entire species	*[Insert **Federal Register** page where the document begins], [Insert date of publication when published as a final rule].*	NA	NA
*	*	*	*	*	*

[1] Species includes taxonomic species, subspecies, distinct population segments (DPSs) (for a policy statement, see 61 FR 4722; February 7, 1996), and evolutionarily significant units (ESUs) (for a policy statement, see 56 FR 58612; November 20, 1991).

[FR Doc. 2016–31460 Filed 12–28–16; 8:45 am]

BILLING CODE 3510–22–P

Atlantic States Marine Fisheries Commission

Atlantic Menhaden Management Board

February 1, 2017
2:15 – 5:45 p.m.
Alexandria, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(R. Ballou)*	2:15 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from October 2016	2:15 p.m.
3.	Public Comment	2:20 p.m.
4.	Review Socioeconomic Study of the Atlantic Menhaden Commercial Fishery *(J. Harrison; J. Whitehead)*	2:30 p.m.
5.	Public Comment Summary of Draft Amendment 3 Public Information Document • Review Public Comment *(M. Ware)* • Review Advisory Panel Report *(J. Kaelin)*	3:25 p.m.
6.	Provide Guidance to Plan Development Team on Draft Amendment 3 *(R. Ballou)* **Possible Action**	4:15 p.m.
7.	Consider Renewal of Provision Which Allows Cast Nets to Harvest Under the Amendment 2 Bycatch Provision *(M. Ware)* **Possible Action**	5:30 p.m.
8.	Review and Populate Advisory Panel Membership (*T. Berger*) **Action**	5:40 p.m.
9.	Other Business/Adjourn	5:45 p.m.

The meeting will be held at the Westin Alexandria, 300 Courthouse Square, Alexandria, Virginia; 703.253.8600

Vision: Sustainably Managing Atlantic Coastal Fisheries

MEETING OVERVIEW

Atlantic Menhaden Management Board Meeting
Wednesday-February 1, 2017
2:15 – 5:45 p.m.
Alexandria, Virginia

Chair: Robert Ballou (RI) Assumed Chairmanship: 05/16	Technical Committee Chair: Jason McNamee (RI)	Law Enforcement Committee Representative: Capt. Kersey (MD)
Vice Chair: Russ Allen (NJ)	Advisory Panel Chair: Jeff Kaelin (NJ)	Previous Board Meeting: October 26, 2016
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (18 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2016

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Socio-Economic Study of the Atlantic Menhaden Commercial Fishery (2:30-3:25 p.m.)

Background

- In March 2016, the Board initiated a socio-economic study to characterize coastwide commercial fisheries, including the bait and reduction sectors and the fishing communities they support. The study was headed by Dr. John Whitehead of Appalachian State University and Dr. Jane Harrison from North Carolina Sea Grant.
- The study has been completed and an executive summary of the results is ready for Board review. Information from this study will be incorporated into draft Amendment 3.

Presentations

- Socio-economic study overview by J. Harrison and J. Whitehead (**Briefing Materials)**

5. Amendment 3 Public Information Document (3:25-4:15 p.m.)

Background

- In May 2015, the Board initiated Amendment 3 to the Atlantic Menhaden FMP to review allocation and consider ecological reference points.
- As a first step in the process, the Board approved the Amendment 3 PID for public comment in October 2016. Public hearings were conducted in ME, NH, MA, RI, CT, NY, NJ, DE, MD, PRFC, VA, NC, and FL. Over 25,000 written comments were submitted on the PID.

Presentations

- Public comment summary by M. Ware **(Briefing Materials)**
- Advisory Panel Report by J. Kaelin **(Supplemental Materials)**

6. Draft Amendment 3 (4:15-5:30 p.m.) Possible Action

Background

- As the next step in the amendment process, the PDT will begin writing draft Amendment 3. This draft Amendment will be presented to the Board in August 2017.
- The Board needs to provide direction to the PDT on what management alternatives and issues should be included in the document.

Presentations

- Board discussion on management alternatives to include in draft Amendment 3 by R. Ballou

7. Cast Net Fishery Bycatch Allowance (5:30 -5:40 p.m.) Possible Action

Background

- At its February 2014 meeting, the Board passed a motion to manage the cast net fishery under the Amendment 2 bycatch provision for 2014 and 2015.
- In November 2015, the Board approved a motion to continue managing the cast net fishery under the bycatch provision for 2016.
- The Board needs to consider if they would like to further extend this cast net provision.

Presentations

- Overview of cast net fishery by M. Ware

Board actions for consideration at this meeting

- Extend management of cast net fishery under the bycatch provision until final action on Amendment 3.

8. Advisory Panel Membership (5:40 -5:45 p.m.) Action

Background

- Chris Hole from Maine has been nominated to the Atlantic Menhaden Advisory Panel.

Presentations

- Nominations by T. Berger **(Briefing Materials)**

Board actions for consideration at this meeting

- Approve nomination of Chris Hole to Menhaden AP.

9. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC MENHADEN MANAGEMENT BOARD

The Harborside Hotel
Bar Harbor, Maine
October 26, 2016

These minutes are draft and subject to approval by the Atlantic Menhaden Management Board
The Board will review the minutes during its next meeting

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INDEX OF MOTIONS

ATTENDANCE

Board Members

Terry Stockwell, ME, proxy for P. Keliher (AA)
Sen. Brian Langley, ME (LA)
Steve Train, ME (GA)
Cheri Patterson, NH, proxy for D. Grout (AA)
G. Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Bill Adler, MA (GA)
David Pierce, MA (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Robert Ballou, RI, proxy for J. Coit (AA)
David Borden, RI (GA)
David Simpson, CT (AA)
Rep. Melissa Ziobron, CT, proxy for Rep. Miner (LA)
Lance Stewart, CT (GA)
Jim Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
Sen. Phil Boyle, NY (LA)
John McMurray, NY, Legislative proxy
Russ Allen, NJ, proxy for D. Chanda (AA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Tom Fote, NJ (GA)
Loren Lustig, PA (GA)
Andy Shiels, PA, proxy for J. Arway (AA)
Tom Moore, PA, proxy for Rep. Vereb (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Roy Miller, DE (GA)
Rachel Dean, MD (GA)
Dave Blazer, MD (AA)
Bill Goldsborough, MD, proxy for Del. Stein (LA)
John Bull, VA (AA)
Rob O'Reilly, VA, Administrative proxy
Kyle Schick, VA, proxy for Sen. Stuart (LA)
Cathy Davenport, VA (GA)
Michelle Duval, NC, proxy for B. Davis (AA)
David Bush, NC, proxy for Rep. Steinburg (LA)
W. Douglas Brady, NC (GA)
Malcolm Rhodes, SC (GA)
Robert Boyles, Jr., SC (AA)
Sen. Ronnie Cromer, SC (LA)
Patrick Geer, GA, proxy for Rep. Nimmer (LA)
Spud Woodward, GA (AA)
Nancy Addison, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Martin Gary, PRFC
Derek Orner, NMFS
Wilson Laney, USFWS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Jason McNamee, Technical Committee Chair
Jeff Kaelin, Advisory Panel Chair
Rob Kersey, Law Enforcement Representative

Staff

Bob Beal
Shanna Madsen
Toni Kerns
Megan Ware

Guests

Tim Sartwell, NOAA
Chris Wright, NMFS
Vincent Balzano, NEFMC
Diedre Boelke, NEFMC
Matthew Gates, CT DEEP
Nichola Meserve, MA DMF
Lynn Fegley, MD DNR
Greg Peterson, MA F&G
Doug Christel, MD F&G
Mike Luisi, MD DNR
Mark Belton, MD DNR
Michael Luisi, MD DNR
Diedre Gilbert, ME DMR
Meredith Mendelson, ME DMR
Stewart Michels, DE DFW
Heather Corbett, NJ DFW
Steve Heins, NYS DEC
Mark Gibson, RI DEM
Joe Cimino, VMRC
Jerry Morgan, ACCSP
Bill Trotter, Bangor Daily News

Ben Martens, CCCFA
Raymond Kane, CCCFA
Emily Tucker, CCCFA
Jim Dow, MLA
Patrice McCarron, MLA
Lawrence Manning, MSBA
Edwin Tully, MSBA
Wayne Correia, MSBA
Norman Cohen, MSBA
Derven O'Shea, MSBA
Jim Reeves, MSBA
Jonathan O'Connor, MSBA
Ken Himnam, Wild Oceans
Shaun Gehan, Omega Protein
Ben Landry, Omega Protein
Pete Himchak, Omega Protein
Monty Diehl, Omega Protein
Peter Baker, PEW
Katherine Deuel, PEW
Morgan Callahan, PEW
Aaron Kornbluth, PEW
Zak Greenberg, PEW
Greg Weiss, PEW
Christine Fletcher, PEW
Joseph Gordon, PEW
Bob Vanesse, Saving Seafood
Simon Dean, Solomons, MD
Raymond Kane, CHOIR
Pat Augustine, Coram, NY
Arnold Leo, E. Hampton, NY
Michael Gordon, Bar Harbor, ME
Jennie Bichrest, Topsham, ME
Chris Hole, Harpswell, ME
Emily Morse, Harpswell, ME
Jimmy Kellum, Kellum Maritime
Jonathan Atwood, Ofc. Asm Andrzejczak
Bob Brown, MD Watermens Assn.
Rob Winkel, NJ Sportsmens Fed.
Zack Klyver, ME

he Atlantic Menhaden Management Board of the Atlantic States Marine Fisheries Commission convened in the Stotesbury Grand Ballroom of the Bar Harbor Club, Harborside Hotel, Bar Harbor, Maine, October 26, 2016, and was called to order at 2:35 o'clock p.m. by Chairman Robert Ballou.

CALL TO ORDER

MR. ROBERT BALLOU: I would like to call this meeting of the Menhaden Management Board to order; my name is Bob Ballou, I have the honor of serving as board Chair. Before we begin, I would just like to note that we have a very full agenda, and three hours to get through it; so I ask for the board's and the public's assistance in being as concise as possible with questions and comments.

I also want to remind the board that the one item on our agenda today involving final action would be the 2017 Specifications. Any meeting specific proxies will be able to fully engage with the caveat that they will not be able to participate in the final voting by the board on the final action item.

APPROVAL OF AGENDA

CHAIRMAN BALLOU: Item 2 on our agenda is the approval of the agenda itself. Are there any additions to the agenda? Seeing none; is there any objection to approving the agenda as proposed? Seeing none; the agenda as approved stands approved by consent.

APPROVAL OF PROCEEDINGS

CHAIRMAN BALLOU: The next item is the approval of the proceedings from the August, 2016 board meeting. Are there any changes to those minutes? Yes, Emerson Hasbrouck.

MR. EMERSON C. HASBROUCK: I noticed that in the proceedings, starting on Page 1 or Page 2, the header indicates that it is for the February, 2016 board meeting. The cover says it was for the August, 2016 meeting. I would just suggest that the header on each of the individual pages be updated to indicate that it is the August, 2016 meeting.

CHAIRMAN BALLOU: That's a controversial suggestion, but I'm going to take it as a very fair and reasonable modification to the minutes. Is there any objection to approving the minutes as just modified? Seeing none; the minutes as modified stand approved by consent.

PUBLIC COMMENT

CHAIRMAN BALLOU: Public comment is the next item on the agenda.

This is an opportunity for anyone from the public who wishes to comment on any issue that is not on today's agenda to do so; which means that if your comments pertain to either the 2017 Specifications or the Draft PID for Amendment 3, now is not the time to comment. There will be opportunities to comment on at least one of those issues when we get to them, the PID in particular. We do have a signup sheet, and we have three people signed up, so I will go in order; beginning first with Mr. Robert T. Brown.

MR. ROBERT T. BROWN: Robert T. Brown; President of the Maryland Watermen's Association. I want to thank the Chair and the Commissioners for allowing me to speak today on menhaden. First, I would like to thank the Commission for allowing two quota bycatch per vessel per day. This has allowed our fishermen to continue work this year; and they thank you, as well.

A majority of the menhaden in Maryland are caught by pound nets, which is a stationary gear. In Maryland, our quota is only 1.37 percent of the overall quota. Fishing management is not a precise science, and it has so many unknowns and assumptions. The Technical Committee uses the best science available at the time to make proposals to this Commission.

If the Technical Committee determines that the spawning stock is in decline and determines action needs to be taken, the Commission acts promptly. Now, the Technical Committee proposes an increase up to 40 percent without harming the fishing stock. I ask the Commission to act swiftly and promptly today. Thank you.

CHAIRMAN BALLOU: Thank you, Mr. Brown. Next, I have John McMurray.

MR. JOHN G. McMURRAY: I'm going to pass, Mr. Chairman. I signed the wrong sheet, apparently.

CHAIRMAN BALLOU: Then the next and last would be Zack Klyver.

MR. ZACK KLYVER: I had signed up to speak to menhaden, as well.

CHAIRMAN BALLOU: Now is the time.

MR. KLYVER: I am very excited that you're all here. Welcome to Bar Harbor. I know you've been welcomed many times to Maine. My name is Zack Klyver, and I work as a naturalist for the whale watch company here in Bar Harbor. It is very appropriate that we're talking about menhaden in the context of Bar Harbor.

Historically, these islands that are right out offshore from here, a hundred years ago there were many fish shacks on them and in the fish shacks were pogy presses; and there they would squeeze the menhaden down for oil. If the wind was blowing in the right direction, it would blow the fish smell all over the town of Bar Harbor, and it wasn't very popular with the summer residents.

But it was a fish run that made it a lot of times up into Frenchman Bay. I want to congratulate you on the work you've done recently to increase the stock of menhaden in the Atlantic Ocean. The fact that we had menhaden coming up to Portland this summer was very exciting. We're hopeful that the menhaden stock will continue to expand, and eventually make its way back up into Frenchman Bay in large numbers.

We did have a year back in the early nineties when we had a lot of menhaden here. It was an incredible thing; there were whales in the Bay, tremendous amounts of runs of fish up into Frenchman Bay. I hope you'll continue to consider the tourism industry in all that you do with fisheries. Tourism here in Maine is a $7 billion industry.

It is more than all of fisheries, forestry and agriculture put together. The more we can expand the stock, that is great for tourism. It's also good for the lobster industry. We know that quite a few of the fishermen were able to catch bait this summer. I hope, as the population continues, that it will benefit the Maine lobster industry tremendously, as well. Thank you.

CHAIRMAN BALLOU: Is there anyone else from the public who wishes to address the board? Yes, Ma'am in the back.

MS. JENNIE BICHREST: I'm Jennie Bichrest; I'm from here in Maine. I don't know if this is the appropriate place or time to ask about this, but I was wondering if, perhaps, it might be time to think about a possible control date for menhaden. Unless it's for the future, we talk about redistributing the allocations that at least in Maine we have, you might as well say, no quota; and we have in the past caught an incredible amount of fish.

At least if we're not going to get redistribution of the coastwide quota, we may need to look at possibly limited entry in the future or at least a control date; so we can discuss it so that we can move forward with everyone able to make money. The more boats and boats that are in this, it is just ridiculous; you can't make money allowing every last person into the fishery when

they're closed out of everything else. I guess that's it.

CHAIRMAN BALLOU: Thank you very much for that suggestion. It sounds like the type of suggestion that could be included in Amendment 3, and we will be taking up that matter later in this meeting. Is there anyone else from the public who would like to address the board?

OVERVIEW OF THE TIMELINE OF MENHADEN ACTIVITIES THROUGH 2019

CHAIRMAN BALLOU: Seeing no hands, we'll move on to the next agenda item, which is an overview of the timeline through 2019. The board has a very busy year ahead, dominated by the Amendment 3 process, but also involving several other issues and actions.

That active pace will continue through 2018 and 2019. To ensure that the board is clear on what is ahead; that is what's in the cue and how the various pieces and pending actions relate and will sequence. Staff has put together a comprehensive timeline, which Megan is about to present. We just have about ten minutes on this item, so this is just a quick overview; really an FYI intended item. But Megan, I'm sure, will be happy to take questions, after her presentation.

MS. MEGAN WARE: I'll just reiterate that the purpose of this timeline is to one, show the immense amount of action that is before this board in 2017. Not only do we have Draft Amendment 3, but we have a stock assessment update, we have a socioeconomic study, we have the ongoing work of the BERP working group.

I just wanted to highlight to everyone what's ahead, and also set uniform expectations for what's going to happen at each of the board meetings. Today I'm just going to go through the board meetings for 2017. But if you want a more detailed look at the committee meetings that are going to happen, or what might happen in 2018 and 2019, please refer to that timeline.

If everything goes according to plan today, we will be reviewing public comment on the PID at our next meeting in February, so that will include both written comment and public hearings. The ultimate goal of this meeting is for the board to provide direction to the PDT what management options should be included in Draft Amendment 3. We'll go through the PID later, but some of those issues, such as the small scale fishery and incidental catch issue, have quite a number of management options currently included in the PID. It would be great to try and narrow those down. Other issues, such as quota rollovers, we just have public comment questions; and so it would be great to hear from the board about specific management options to include in that draft amendment.

We will also review the results of the socioeconomic study, and that information will be included in Draft Amendment 3. Our next meeting will be May, 2017. This is going to be a bit of a lighter board meeting, but I think it will be a good break. We're going to focus on the FMP review. The PDT will still be drafting Amendment 3.

We'll go over 2016 landings, overages, transfers, as well as quotas for 2017. I'm also going to ask the board to provide projection runs for the 2018 TAC. The TC, I think, found it really useful to have some idea of what the board is considering. I think we should try and use that method again this coming year. Then we'll hear a BERP working group update, as well.

Our August, 2017 meeting is going to be quite a big lift for this board, and that is because we have three major actions that we're going to be taking here. The first will be considering Draft Amendment 3 for public comment. The PDT will have finished writing that. We'll review it

as we're going to review the PID today and hopefully approve it for public comment.

Our second action item is going to be to consider approval of the 2017 stock assessment update for management use. In the New Year the TC is going to start work on our stock assessment update. Right now, this is scheduled for presentation to the board in August. The reason we're scheduling it for this time is I think it is just too much of a lift for the board to consider a stock assessment update as well as final action on Amendment 3; trying to spread out the workload of the board here, so we can talk about each item in an effective manner.

Finally, we are going to try and set fishery specifications for 2018 at this August meeting. There are a couple of reasons for this; the first is I've just heard the 2017 stock assessment updates. The board is going to be well informed as to the current status of the stock. The other reason is, given our ongoing robust discussion on the 2017 TAC, there is a bit of hesitation in starting this discussion after taking final action on Amendment 3 at the annual meeting.

At the very least, I would like to begin discussion on this topic. Ideally, we would like to set a TAC. I will just note that if the board, after they take final action on Amendment 3, wants to reconsider that TAC, that is an option. But we would like to have something in place. Finally, our annual meeting in 2017 will be devoted to final action on Amendment 3.

We'll be reviewing the public comment, selecting final management options, and an implementation deadline. This is the last slide here. We've gotten a number of questions as to how the BERP Working Group's actions are going to fit in with the management actions of this board, and Shanna is going to provide a thorough and detailed overview of their upcoming timeline.

But I just wanted to kind of throw up some highlights, so everyone has a good idea of where we're going. In 2017, they are going to continue to have in-person meetings and conference calls, and they are going to be focusing on two of the four models they're considering; the multispecies catch-at-age model, and the production model with time-varying parameters. In 2018 there are going to be two data workshops held, and this will be followed by two assessment workshops in 2019. This is really the start of what we typically say is a formal assessment process. Then those multispecies models will be peer reviewed at the end of 2019. I will note that this also does include a review of the single species BAM model, so 2019 is a benchmark stock assessment year for menhaden.

The TC will begin work on the BAM model, so when we go to peer review, we're going to have a complete package of both the multispecies models and the single species model, so we can get the best recommendations from the peer review panel. With that, I'll take any questions.

CHAIRMAN BALLOU: Questions for Megan. Yes, Jim.

MR. JIM ESTES: Megan, thank you for your report. Did I understand correctly that we will not be having a board meeting in February?

MS. WARE: We most certainly will to review public comment on the PID.

CHAIRMAN BALLOU: Additional questions for Megan? Seeing none; thank you, Megan, we do have a very busy year ahead of us. I certainly am intending to keep us on track. It is an ambitious timeline, but I think it is important that we try and do our best to reach a decision point one year from now on Amendment 3, which is the big one, and then, as well, feed in those other pieces that Megan referred to.

SET 2017 ATLANTIC MENHADEN FISHERIES SPECIFICATIONS

CHAIRMAN BALLOU: That's where we are, and that's where we're looking to go. With that, we're on to Agenda Item 5, Fisheries Specifications for 2017, a familiar topic. This is a final action. We have slated 30 minutes for this action, and I have every hope and intention of staying well within that 30 minute timeframe. This is an item carried over from the last board meeting in August.

At that meeting, after a series of votes by the board on motions that did not carry, the board approved a motion to postpone the matter until the board's next meeting. When the motion to postpone was improved, the pending motion, which was the main motion, was to set the 2017 coastal TAC for the menhaden fishery at 225,456 metric tons; which would be a 20 percent increase over the current TAC. Given the nature of the motion to postpone, no additional motion is needed to bring the main motion back before the board today, this being our next meeting.

As such, it is now back, and serves as our starting point. Before we reengage in the spec setting process, we have a brief Technical Committee report; which first refreshes the board on the projection runs for the 2017 specifications, and then provides some updates on recruitment trends in the fishery in response to the board's request in August for additional information on that issue. For that report, we have our TC Chair, Jason McNamee keyed up and ready to go, so Jason, the floor is yours.

REVIEW OF STOCK PROJECTIONS AND RECENT JAI TRENDS

MR. JASON McNAMEE: Jason McNamee; Rhode Island DEM Marine Fisheries. I've got a brief presentation here. I'm going to hit two slides on stock status. I'm going to show you two tables on some of the projection information, so you'll have 5,000 numbers bouncing around in your head again. We can come back to any of these slides at any point, if people need them when you get into your deliberations. With that I will jump right in. The first slide here is on current stock status with regard to fishing mortality. You can see from this slide that we are both below the target and the threshold for fishing mortality for menhaden. This is, of course, generated from the last stock assessment. The next slide -- this is actually fecundity; but that is like our biomass proxy for menhaden. Here you can see we're above the threshold, and we're bounding around the target up there at the top.

Summation of those two slides is that stock status is in pretty good shape right now. The board had us run a number of projections. This first table here was a set of increases to the current TAC. That first row was what the current TAC was in the previous year, and then a series of increases from that so 5 percent, 10 percent, 20, 30, 40.

You can see how the TAC increases as you go down the rows. Just to the right of the TAC column is the risk of exceeding the F target, and then to the right of that is the risk of exceeding the F threshold. Perhaps, not shockingly, as you go up in TAC the risk of exceeding the F target increases. But for all of these runs that we did, the risk of exceeding the F threshold was 0 percent.

The next table was another series of projections that were requested, same setup for this table. These were probabilities of being below the F target, and different levels of risk; so 50 percent, 55 percent and a 60 percent probability of being below the F target in 2017. You can see the TACs that are associated with those risk levels.

Since we had set them to be at these risk proportions, that's just a little math there, but again, all the way to the right the risk of exceeding the F threshold for these projections

was zero. The next couple of slides, I'll call it TC fine print for projections. There are a lot of caveats, a lot of assumptions that go into projections. They are highly uncertain.

Really quickly, I'm actually not going to dig into these too much. I've shown them to you, me personally to this board, probably 10 times over the past few years. There is no structural uncertainty incorporated. There are a lot of functional forms, things like recruitment that condition the projection model.

The allocations are assumed to be carried forward; and what we mean by that is the amount of fish that are being used in these two fishery sectors, bait and reduction. We assume that those carry forward, and that has a lot to do with the selectivity and where these fish are being taken for these different fisheries.

I think this is a final slide on this. If there is a run of poor recruitment or anything like that that can affect the outcome of these projections; and the projections apply the Baranov Catch Equation. This is assuming a couple of different things, such as catches occurring throughout the year, not during specific seasons. Anything that changes that would change the outcome of the projections.

At the August meeting, when you were deliberating on the TAC for 2017, one of the things that had come up during your discussions was a request to look at recruitment trends. I think what folks were asking for specifically was, can you get us an updated recruitment trend for our next meeting. Unfortunately, recruitment is generated by the BAM model; it's not something that can be easily done. That would take a full update, and we, of course, did not have time to do that.

We were trying to think what else we might be able to provide you to give you some kind of information. What we came up with was a series of juvenile abundance indices that we kind of collect and look at. They are from up and down the coast, and so that is what I'm going to show you in the next series of slides; just some graphs of abundance indices, and these are specific to young-of-the-year indices.

We ended up getting eight indices from six different states that were able to be updated in time for this meeting. These indices are presented in an attempt to provide the board with some information on the juvenile portion of the menhaden population. I'm going to click now through these indices, but then I've got some more TC fine print for you at the back end, so bear with me on that.

The first one is the Rhode Island Seine Survey. This is in the northern extent of the stock, and you can see that there is a period of low recruitment in the late eighties and a period of kind of higher, variable recruitment there as you got around the year 2000. Dropped back down again and then we had a couple of good years these past two years in particular, in 2015.

Information from Connecticut, this is also a seine survey. This is from the Connecticut River. Connecticut is not too far away from Rhode Island, so not shockingly, there is a similar trend there with 2014 and 2015 having some high recruitment numbers. Another Connecticut seine survey, this one in the Thames River, a little bit further to the east in Long Island Sound.

A little bit different information, a shorter time series as well though; so those kind of high years are coincident with the higher years from Rhode Island and the other Connecticut survey, and then it kind of drops down and then 2014 and 2015 are higher than it had been; although it didn't reach the peaks that you saw in the previous couple of slides.

One more from Connecticut, this is from the trawl survey. I believe this is truncated to just

the young-of-the-year information. Again, you can see at the tail end of the time series, which I think is what people are most interested in, one average and one above average recruitment numbers there.

Okay, New York seine survey, again a period of higher abundance and variability for juveniles in the New York area. I believe this is the Western Long Island Sound Seine Survey. Then it kind of drops down and then 2014 and 2015 you had some higher numbers. Delaware, so now we're moving a little further south.

What you see from Delaware is kind of a different signal, a lot of variability; pretty flat overall. You had a pretty big spike there in the early nineties, maybe another period of higher abundance, above average anyways towards 2000, but it's been basically oscillating around the average since about 2000.

Okay, the Maryland Seine Survey. This one goes back further. It has a longer time series than what I've been showing you, so far. This one goes back to 1959, so in the early part of the time series pretty low, and then you had this really productive high juvenile period in the seventies and the early eighties, and then it kind of tails off.

What you see is from about 1995 to present. It has been pretty low recruitment in the Maryland area. This is the Virginia Seine, so early on in the time series -- much shorter time series than we just looked at. You had some high catch-per-haul numbers, and then it kind of drops down. You had a little spike up there in 2010, but it has been pretty low relative to those higher years.

Okay, so that was all of the indices that we had available to us. We hope that that was helpful for you, gives you some information on at least the last couple of years. But a couple of things from the TC, we wanted to highlight that these indices do not provide a comprehensive picture of juvenile abundance along the coast. They are very specific and particular seine surveys. If anyone is familiar, you kind of roll up to a beach and it's a very small sample in a very specific area.

I have to assume that most of them are all fixed station surveys. This is not a comprehensive picture of juvenile abundance. There is a reason why we do big complex stock assessments; you can kind of synthesize a lot more information to give you a clearer picture.

As a result of that, the TC is not able to provide a very direct statement on recruitment in 2015, nor are we able to predict the magnitude of the young-of-the-year population in 2015.

There were some blips up on 2014, 2015, but how that ends up translating into the population, you need to run a stock assessment to determine that. That is all I have on that, and I am happy to take any questions. I've got a couple other slides, but I can just pop them up if the information is asked for as the deliberations start.

CHAIRMAN BALLOU: Questions for Jason. Yes, in the back.

MR. ANDREW L. SHIELS: Yes, thanks, Jason, for your presentation. Did you graph all of those individual indices onto a single graph?

MR. McNAMEE: No, we did not.

MR. SHIELS: Could you draw any conclusions from any trends that you saw from those individual states indices?

MR. McNAMEE: Yes, as far as what the indices were doing, there is certainly a block to the north where you had kind of consistent signals in that early 2000 period, and then at the tail end you had what looked like a pretty healthy recruitment event. I will offer that the signal is from Connecticut and Rhode Island. While we

think they're great and the biggest states in the nation, they are in fact a very small area along the coast. There is a northern signal there in the most recent years, but when you go to the south, that signal was not as clear, or there at all.

DR. WILSON LANEY: Jason, does the Technical Committee -- have you all looked at the estuarine areas that constitute nursery area for menhaden; and can you give us a sense of where most of those lie geographically? I mean, you just referenced the fact that some of the areas up north where we're seeing a strong, positive signal or relatively small. I'm guessing that areas like Chesapeake Bay and Pamlico Sound, Albemarle Sound would be much larger in extent. Historically, where does most of the recruitment come from; geographically, I guess, is what I'm asking.

MR. McNAMEE: I would suggest that in general what is believed, it is sort of recorded in most of our stock assessment reports and things like that. The southern areas; Chesapeake Bay, North Carolina areas, those are, I believe to be, certainly spatially larger than the estuaries to the north. But those were areas that were believed to produce the most menhaden. That is kind of the answer to your question.

Just to offer a little more insight into what it looks like in the northern areas, so the Rhode Island survey, that is Narragansett Bay; small estuary in the north. Then you've got the estuaries of the Thames and the Connecticut River within Long Island Sound is where that other information was coming from.

New York, that Western Long Island Sound Seine Survey that is kind of tucked in, I think it sort of straddles that Hudson area both inside Long Island Sound and just outside. But again, when you put those in the context of something like Chesapeake Bay, they are all very small estuaries.

DR. LANEY: Follow up, so looking at the Chesapeake Bay Index that you showed for Maryland, I think, and looking back into the seventies and eighties, and seeing bars that appeared to be considerably taller than those that we have today; and trying to put that in context of statements to the effect that the stock is in really good shape.

It appears that, historically, there was a much higher level of recruitment. Does the TC have any thoughts on those historic levels of recruitment versus today's levels of recruitment versus the present SSB? Are we not seeing the positive signal that we should see in those much larger southern estuaries, relative to what the present spawning stock biomass is; and again trying to put that in some sort of historical context here.

MR. McNAMEE: I'm not going to go too far down that road. We had a lot of discussion on that during the stock assessment discussion. I think your observation that the recruitment in that very important estuary in the Mid-Atlantic has been low. That is certainly talked about a lot. But there are different signals in some of the other estuaries up and down the coast, and it depends on the year, as well.

MR. WILLIAM A. ADLER: It is curious that the northern ones are tending up. As you just said, they are not a big area like they are down further south. Further south, they all seem to be just sort of there, they are not going up at all. I wonder why. Are the northern statistics that you get that show that they're up in Connecticut and Rhode Island like a fluke (and I don't mean summer flounder). Is that like a fluke issue, because it wasn't there before? Any reason why it would be better up there than down Mid-Atlantic?

MR. McNAMEE: It's a great question, probably a million dollar question. We've seen this variability through time though where I can speak directly about Rhode Island where we get

these big pulses of peanuts in Narragansett Bay. It happens one year, two years and then they kind of disappear.

You actually see that in the information. Why that happens, the environmental conditions line up, and these environmental conditions can be all sorts of things; wind currents advecting eggs into the bays, temperature. Whatever it is -- a fish passing by at just the right time; there are probably a million variables there. But it is not an uncommon thing. It happens periodically, and you can sort of see that in the time series.

CHAIRMAN BALLOU: Any other questions for Jason? Yes, Rob O'Reilly.

MR. ROB O'REILLY: I certainly understand your last slide about the Technical Committee talking of being limited, and this dataset really is limited as well. I don't know the machinations of the Beaufort Assessment Model, but you do. My question is, based on what the benchmark did, how would you characterize these surveys that you just presented in terms of their impact on the status of the stock; and that might be a tough thing to think about without everything available to you? But nonetheless, I want to ask that question.

MR. McNAMEE: I appreciate the question; I'm going to dance around it a little bit. I hope you don't mind, because I don't know the answer. In fact, there is a multi-layered approach to how that information even goes into the stock assessment. We do a hierarchical model on all of the juvenile abundance indices.

Then they kind of go in as an aggregated index. There is no way to be able to predict just by looking at some information, some noisy information in some cases, how it's going to translate into population information out the end of the pipe. It is nothing I can even conjecture about.

CHAIRMAN BALLOU: Rob, quick follow up.

MR. O'REILLY: Very quick. In the BAM model, there is a weighting scheme as well for these indices.

MR. McNAMEE: That's correct; there is a Bayesian Hierarchical Approach that weights them based on their variability.

CHAIRMAN BALLOU: Any other questions? Seeing none; thank you, Jason, appreciate the report and the responses to what were a series of good questions.

CONSIDER POSTPONED MOTION TO SET THE 2017 TOTAL ALLOWABLE CATCH

CHAIRMAN BALLOU: Okay, now it is time to pick up where we left off on the setting of specifications for the 2017 fishery. Let me attempt to set the stage and go so far as to offer a recommended strategy forward.

From a parliamentary perspective, the board may proceed today as it sees fit. The board may propose amendments to the main motion and such amendments may be different than or identical to the amendments offered at the last meeting. That said, because this matter was vetted extensively at our last meeting, I suggest that it would behoove the board to avoid retreading the same bumpy ground that we covered in August, and focus instead on reaching a final decision tout suite, or at least touter and suiter than attempted in August.

Allow me to offer a recommended strategy that I think can get us to a final decision today, in a way that is both fair and direct. Fair in that it will enable all board members to cast votes that are generally consistent with their perspectives on what the 2017 TAC should be, and direct in that the final decision can be reached via three votes. My strategy is based on the recognition derived from the discussion, motions and votes taken at the August meeting that the board essentially has three options.

The first is a relatively large increase to the TAC, the second is a relatively modest increase to the TAC, and the third is status quo; that is maintaining the 2017 TAC at its current level. The distinction between a large and modest increase can be parsed ad infinitum, as revealed at our August meeting. But I sense that there is little interest in reengaging in such parsing today. I would like to proceed as follows:

We will start with the main motion, which I would like to ask staff to put back up on the screen, from our August meeting; that is the proposed 20 percent increase. Based on the discussion, motions and votes taken at that August meeting, it seems evident that the board views 20 percent as a relatively large increase.

I will reopen board deliberation on the issue momentarily, by entertaining a motion to amend. If anyone on the board wishes to move to amend, by proposing a relatively modest increase to the TAC that is something less than 20 percent, I would welcome that. If such a motion is made and receives a second, I will afford some brief, very brief discussion, and then we will vote on the motion.

That vote should be viewed solely as a vote on whether the board supports a relatively large increase, or a relatively modest increase to the TAC. If the motion passes it will become the main motion, if it fails the proposed 20 percent increase will remain as the main motion. Regardless of the outcome of that vote, I will then entertain another motion to amend.

If anyone on the board wishes to move to amend by proposing status quo; that is a zero increase to the TAC, I would welcome that. If such a motion is made and receives a second, I will allow for some additional brief discussion and then we will vote. That vote will be a straight up or down vote on whether the board supports increasing the TAC or not increasing the TAC.

If the motion passes, it will become the main motion. If it fails, the proposed 20 percent increase will remain as the main motion; and at that point, I will be very inclined to entertain a final vote on the main motion, whatever that may be, and then we will be done. I do not intend to provide for any additional public input, since we had extensive input on this same matter at our last meeting.

Now, if any board member wishes to pursue a different course of action, for example, by moving to amend in some other way; that can happen, and the process can go on, and on and on. But my hope is that the board will see fit to proceed in the manner just described. With that, and with the main motion up on the screen and back before the board, I will now entertain a motion to amend. Dr. Rhodes.

DR. MALCOLM RHODES: Thank you for all the information earlier**. I move to amend the motion to set the 2017 coastal total allowable catch for Atlantic menhaden at 200,000 metric tons,** and if I get a second, I would just like to speak briefly.

CHAIRMAN BALLOU: Moved by Dr. Rhodes and seconded by Terry Stockwell. Dr. Rhodes, let's make sure we have the motion up correctly, and I would be curious and I think it might be helpful to know what percent increase that 200,000 metric ton represents. I don't know if Megan has that immediately available. Maybe we'll get to that after you present your comments; Dr. Rhodes, to you.

DR. RHODES: Since we're in Maine, I will try to follow our late leader George Lapointe's brevity being next to cleanliness, being next to godliness remarks. At the last meeting we had very good discussion with the pros and cons of remaining at the status quo or raising this. This small tyrant fish obviously creates a lot of emotion in people. We went through a series, just to remind the board very quickly, of not

voting for status quo, 1 percent, 5 percent, 10 percent and 19 percent increases.

During the course of those actions between the 5 percent and the 10 percent there seemed to be a shift in several of the states, which made me believe that if we had a removal that was somewhere in that area; and 200,000 metric tons is 6.5 percent. That seems to be an area that most of the states could work at.

It is not going to be what some states want, and it's obviously not what other states want. But of necessity, we must create a TAC for this species. As Mr. Goldsborough very well pointed out at the last meeting where we got to this point, as we're trying to get to Amendment 3 and to get to the multispecies, we created a two-year TAC and we had no fallback position at that.

If we did not create a TAC at this meeting, it is undefined, which to me means unlimited. It's my hope that we can support this motion, go on to Amendment 3, and then as we were informed earlier, over the next two or three years be able to look at this, instead of a single species fishery, a multispecies fishery.

CHAIRMAN BALLOU: I'm game to take some very limited discussion on this. My preference would be two who are opposed to the motion, and another who would be in support. We just heard from the maker of the motion. I would not like to see by a show of hands, is there anyone who would like to speak in opposition to the motion? I would like to just take two. Who might be the lucky two? If not, I would be game to take another comment in support of the motion, and I would just like to take one additional comment. Terry, you were the seconder, so the floor is yours.

MR. TERRY STOCKWELL: I surely appreciate the approach that you've taken to the board today. I think we have a good chance of getting through the afternoon. But like most everybody else around the table, I lost track of the number of motions we made in August. But my sense is that the motion on the board of 6.5 percent is a workable compromise to move us ahead in 2017.

While this percentage or any other increase in the quota does absolutely nothing for the state of Maine, it modestly acknowledges the current status of the stock while we focus our collective time on the development and implementation of the much needed reallocation of the menhaden stock in Amendment 3, so I strongly support the motion.

CHAIRMAN BALLOU: I'm inclined to take just a couple more comments on this. I did see Michelle's hand up and I saw one other hand up. That would be Rob. I'll take those two comments. I would then like to have this voted upon, and then there will be an additional opportunity for comment, if and when there is a subsequent motion, which I anticipate there will be; so for now, Dr. Duval.

DR. MICHELLE DUVAL: Thank you, Mr. Chairman, for allowing me the opportunity to speak. I will be brief. I am speaking in support of the motion. I will note that there has been a lot of conversation about this back home, and for the record, I would like to note that the department does support an increase of up to 10 percent for the 2017 TAC.

MR. O'REILLY: I would say the comments of Malcolm were very good, and Virginia is not alone, there are some states that are before now looking forward to having the baseline where it really was before the 20 percent reduction. However, I think there is an acute awareness of everyone looking down to Amendment 3 and that process. With that, Virginia does support the motion.

CHAIRMAN BALLOU: With that, I'm going to call for a vote on the motion to amend. It has been requested that every vote on these proposed

amendments shall be roll call votes, so I will be calling upon Megan momentarily to call the roll. Keep in mind that there will be an opportunity, I'm just reiterating now, immediately following this vote to offer a status quo proposal.

Therefore, this vote should be viewed solely as a reflection of the board's preference for either a relatively large increase to the TAC reflected by a no vote on the motion, or a relatively modest increase to the TAC reflected by a yes vote on the motion. I'll allow for a 30 second caucus. Okay, is the board ready? If so, I would like to have Megan call the roll, going south to north.

MS. WARE: Florida.

MR. ESTES: That surprised me. Yes.

MS. WARE: Georgia.

MR. PATRICK GEER: Okay, that threw us for a loop. Yes.

MS. WARE: South Carolina.

SENATOR RONNIE W. CROMER: Aye.

MS. WARE: North Carolina.

DR. MICHELLE DUVAL: Yes.

MS. WARE: Virginia.

MR. O'REILLY: Yes.

MS. WARE: Potomac River.

MR. KYLE SCHICK: Yes.

MS. WARE: Maryland.

MS. LYNN FEGLEY: Yes.

MS. WARE: Delaware.

MR. ROY W. MILLER: Yes.

MS. WARE: Pennsylvania.

MR. LOREN W. LUSTIG: Yes.

MS. WARE: New Jersey.

MR. RUSS ALLEN: Yes.

MS. WARE: New York.

MR. JAMES J. GILMORE: Yes.

MS. WARE: Connecticut.

MR. DAVID G. SIMPSON: Yes.

MS. WARE: Rhode Island.

MR. ERIC REID: Yes.

MS. WARE: Massachusetts.

MR. ADLER: Yes.

MS. WARE: New Hampshire.

MS. CHERI PATTERSON: Yes.

MR. STEPHEN TRAIN: Maine votes yes.

MS. WARE: NMFS.

MR. DEREK ORNER: Yes.

MS. WARE: U.S. Fish and Wildlife.

DR. LANEY: Yes.

CHAIRMAN BALLOU: **The motion passes unanimously; it now becomes the main motion.** Would anyone else on the board like to offer any other motions to amend? Bill Goldsborough.

MR. WILLIAM J. GOLDSBOROUGH: Anticipating this opportunity, I didn't raise my hand a

moment ago. I feel like maybe I should have. **I would like to, for consideration of the board, offer a motion to amend to set the 2017 coastal total allowable catch for Atlantic menhaden at the current level, which I believe is 187,000 metric tons.**

CHAIRMAN BALLOU: Yes, we'll put the exact number up, but I understand the nature of your motion is a motion to amend to keep the 2017 specification at status quo, the current level. Is there a second to that; seconded by Ritchie White. Bill, would you like to speak to your motion?

MR. GOLDSBOROUGH: Yes, thank you, Mr. Chairman. We should not be at this point, is the first thing I want to say. It was not our intent. The current science before us is the benchmark assessment reported to this board a year ago in the spring. At that time we deliberated long and hard, and we took action. We took two primary actions, the first one was we increased the quota for 2015 and 2016 by 10 percent. The second thing we did was we decided to develop a new plan, Amendment 3, to take effect in 2017.

There was a sequence in mind there. It had two major elements to it that addressed two major problems that we knew we had. The first one was the commitment that this commission made 15 years ago to account for menhaden's ecological role. That would be done through the development of ecological reference points, to be adopted in Amendment 3.

The second was to revisit allocation, because as we have experienced, since the quota was put in place in 2013, we either chose the wrong baseline period, we didn't have enough data in some states; or whatever the reason. We know that a number of states were shortchanged, and that caused a lot of problems.

Many states, we want to address those problems any way we can, I understand that. But later last year, actually with that in mind, we considered that we had a socioeconomics study we were undertaking to inform that decision making in Amendment 3. We realized at the annual meeting a year ago that that was going to take us a year.

We decided that it would be better to have that in hand when we have the discussion of a new allocation framework, and so we pushed back the timeline for Amendment 3 by a year to 2018. That just by chance, opened up next year, 2017 as a year that we had not specified would be at the same quota level as we had set for 2015 and '16, and I think that was just by chance.

I think our intent all along was to keep the quota at that level after we had fully vetted that assessment and decided a 10 percent increase was appropriate; keep it at that level until we adopted Amendment 3. I think we should stay that course. I think that is good management. I know that we do want to address the shortfalls in the bait industry. To me, that is one of our highest priorities, especially in the small scale states; and that's most of us.

I don't think, by increasing under the current allocation framework, we're going to do much toward that end. I don't think we're going to make much difference. Instead, I think what we're going to do is preempt what progress we could really make under a more fair and balanced allocation framework in Amendment 3.

I would urge us to keep that in mind and wait; keep our powder dry. I would also like to say that a lot of people are distilling down the circumstance we're in right now as being one in which the science recommends an increase. One speaker earlier actually even said the TC recommended an increase, and I think that's in error.

The TC did projections for us to inform our decision making on an increase, and they are pretty compelling projections, I have to admit. But we need to keep in mind; they are based on that same assessment. They aren't new science, they're based on that assessment that we've already made a judgment on and the reference points in that assessment.

Those reference points are single species reference points. They do not take into account all the needs of the ecosystem the way we want to do in the ecological reference points. In fact, a year ago at the annual meeting, we considered a motion to divert from the course of Amendment 3, and undertake an addendum to make those reference points the ones we would use going forward. We voted that motion down. We decided to stay the course at that point, because we did believe that it was the best way to address those fundamental problems that we have.

Ecological reference points to deal fully with the issue we committed to 15 years ago, and a new allocation framework that would be fairer to all the states, especially the small-scale-bait states where there really is a need. At this point, this accidental circumstance we find ourselves in, in which there is a lot of talk about how there are more fish out there, and it seems like there are. But that is not science. That is not a survey that is verifying that; that is anecdote, very compelling, I would admit.

But this commission has always shied away from making management judgments based on anecdote; always. That goes way back. With respect to the needs of certain states, we've been trying to meet those over the last couple of years with some sharing of quota between the states, with the episodic event option. I would hope that we could just go one more year getting by doing that and have a real thorough resolution of these issues, the way we set out to do just last year, and not make a decision now based on, to overstate it perhaps, anecdote and expediency.

CHAIRMAN BALLOU: A show of hands those with a burning desire to speak in opposition to the motion. I'll take those five comments. Actually, leave your hands up, Megan can you note those, please? Keep your hands up, I'm going to take those five, and then I'll take four others who would like to speak in support; Nicola, Andy, Wilson and Robert. Let me go back to in opposition. Who was in opposition? We'll start with Bill Adler.

MR. ADLER: I speak in opposition to this proposed amendment. I'm looking at a lot of issues here. First of all, the science basically has said there is no risk. Science says the stock is in good shape. Sometimes I find it difficult that we can deal with overfished, overfishing; we can do a very good job of cutting things down.

Then we have a success model and we don't know what to do with it. We can't deal with success, maybe. Now I agree that Amendment 3 is necessary and needed and should be done; but not until 2018. Meanwhile, what is being proposed here is a small increase, and I don't see the problem with the stock. I don't see the problem with bumping it up; similar like the 6.45 percent. I wouldn't go hog wild. I wouldn't go to 20.

But the 6.45 shows that the stock is okay, it's good. We have success. It won't help Massachusetts very much if we do go up, but still. In fairness to the entire menhaden system, I think that it deserves to be able to be bumped up a little and then when Amendment 3 comes through, we could do other types of changes. But waiting until 2018 to do anything, I don't think it's necessary for that. I'm in opposition to this particular motion to amend.

CHAIRMAN BALLOU: Next, I have Andy Shiels.

MR. SHIELS: I'll be very brief. When you think about this as an investment in the environment, and as an investment in the ocean, it is the investment in the communities up and down the coast. It is an investment in the folks who have never seen menhaden in their waters at the extreme ends of the range. When you make investments, any wise investor has a nest egg or has a principal; you do not spend your dividends on your principal the first year they get dividends. Most people with a wise investment strategy take their time, they look at the long view, and they reinvest those dividends. I think all that's being asked here is to reinvest the dividends of what looks to be a year of some increased abundance of menhaden into the long term picture.

I wasn't here when you created the plan and the process you're working on now, which is a three-year plan in the process. You set forth on a process, what is the urgency to depart from that process all of a sudden so you can spend your dividend? I think we're talking about success. Your best chance of success of making that plan that you've put forward happen, is to ensure that you give it the time to build the stock; which is what you're doing right now.

You're going to have a good stock to work with to set your ecological reference points, and to reset your allocation process. You're going to have a bigger pie or a bigger pot when the reallocation discussions happen in a year or so than you will now. You won't have lost the ground that you've gained in the past year or two, when you get into that ERP process and the reallocation process. I guess to summarize, I would say have patience, you put together a good plan, stay the course and allow your investment to pay off when the time is right.

MR. ADAM NOWALSKY: I'm going to briefly speak in opposition to the motion to amend. I'll start by beginning with Mr. Goldsborough, our recent Hart Award recipient, in agreeing with him that we don't respond anecdotally, we respond based on science. Going back to our last meeting, the question was asked of the TC Chair, can you let us know when the last time every run you did for a species generated a 0 percent chance of overfishing?

The answer from our Technical Chair was, I think the answer is I don't know that I've ever experienced that personally. Responding to the science here would be an increase. Now, I'm also going to have to take the opportunity to disagree with the assertion that we are debating between a moderate increase, because what we're really looking at here is a relatively small number.

A large increase would be the 40 percent number that still generates 0 percent probability of overfishing. A moderate increase would be the 20 percent number we started the discussion with; 6.45 percent is a very small number; and I encourage this body to vote against the motion to amend and vote in favor of the motion that is the original motion at this point.

MS. NICHOLA MESERVE: Consistent with the remarks of Dr. Pierce at the last board meeting, DMF continues to prefer status quo for the menhaden TAC for next year; a couple reasons: As already stated by Bill Goldsborough, we prefer to have the TAC reevaluated in light of the 2017 stock assessment and also paired with possible reallocation in 2018.

The 10 percent increase was already based on the 2015 assessment results at a terminal year of 2013. The Technical Committee hasn't been able to provide us with clear guidance on the juvenile recruitment since then. In Massachusetts, we see that menhaden are still regaining their full range.

While there were reports of menhaden being more abundant south of Cape Cod; that was not uniformly so north of Cape Cod, and only for one year. The TC may have demonstrated that

there is no coastwide risk of overfishing from the analyzed options, but there may be a regional cost in the northeast of increasing exploitation, given our geographical position in the species range. A wide age structure and a high population size promote the migration of menhaden to New England waters. Again, we prefer to stay the course for 2017 and wait until 2018.

CHAIRMAN BALLOU: Next, I have Kyle Schick.

MR. SCHICK: The history that was given earlier was a little brief. We need to really go back to where we needlessly cut 20 percent on bad science; on a kneejerk reaction that was motivated by politics. That is where it really starts, and then we get good science and we bring back 10 percent; which was still way lower than it could be.

The rumors of increased stock and juvenile increase, it is not being overfished. It never has been overfished. Overfishing has never occurred since we've been talking about this. No other stock have we ever talked about, have we had the luxury of complaining about trying to reduce mortality on a fish that is not being overfished and overfishing has not occurred.

We're arguing about something that doesn't occur here. Multispecies, hopefully we'll get that in 2018. We don't know what's going to come. We're going to put out two different multispecies scenarios, along with the single species scenario. We're going to put it out to public. To hear some people in this room, it is a foregone conclusion that we're going to have to decrease the TAC for multispecies approach. We don't know that.

We have no science that says that. TAC is what we can do today with the information we have today, which is the best information we've had on menhaden in the history of tracking it; and a 6.5 percent increase is miniscule. I agree, we should be up to 10 percent or 15 percent, and we could solve everybody's problem. But we've come to the point where we'll hopefully be able to compromise on a 6.5 percent and help some folks out, get some more fish; and see how things go for next year. That is what we should be doing, and I am not in favor of this motion, for sure.

DR. LANEY: I certainly support the comments by Mr. Goldsborough, by Mr. Shiels and Ms. Meserve. I would encourage us to think about the fact that we're not just talking menhaden here, we're talking an entire ecosystem; and while we don't have all the insights we would like to have about the forage needs of the rest of the ecosystem for menhaden, I think we can all acknowledge that menhaden is one of the principal prey species that is used by other ASMFC and council managed species, such as striped bass; which is sort of our flag ship species, as well as weakfish, as well as bluefish.

If you think about that juvenile abundance series for the Bay that Jason projected awhile ago, and look at the 1970 and 1980 levels and note that there hasn't been an uptick in what is probably one of the principal menhaden nursery areas on the east coast, along with Pamlico Sound probably to the south. There have been some positive signals to the north, but we still don't see a positive signal in that southern area.

I also think about the fact that we have striped bass diseases that have manifested themselves in recent years; that we have striped bass that are showing lower condition factors than striped bass from a decade or two ago, and that we also have diet studies which show us that striped bass are now more reliant on smaller, less nutritious species like bay anchovies; as opposed to Atlantic menhaden. For all of those reasons, I think the prudent course of action is to maintain status quo until we get the results of the socioeconomic study, until we have generated some ecological reference points, until we get the results of multispecies

modeling; so we have more information in front of us before we issue any increase in the TAC.

CHAIRMAN BALLOU: David Bush.

DAVID E. BUSH JR: No disrespect to the folks that have spoken before me, and I apologize, I'm coming into this after having someone that I replaced from your last meeting. I would like to point out that 2014, 2018 strategic plan identified eight values to guide this bodies' operations and activities, and I'd like to point two of them out.

Timely response to new information through adaptive management, I mean, you hear that constantly from fishermen; and also balancing resource conservation with the economic success of coastal communities.

While I can certainly appreciate the perspective of those in the farther reaches of this species range, the effort in this fishery is and has been well below half, actually one quarter of its peak, for quite some time. I'm aware that it's a forage fish and not to imply that there was absolutely no impact by those peak levels of effort.

But we still have those that rely on it for forage, even after decades, almost a century even of a major reduction fishery. The stock appears to be expanding and that's a good thing for the ecosystem. I have however, not seen any scientific evidence presented at this point that even suggests that a reasonable increase would put this expansion in jeopardy.

What we do have is solid science that supports an increase of up to 40 percent. Of those that I have spoken to in order to better understand the viewpoints, it seems that there is substantial support for an increase; but it is the value of that increase that is in question. I feel that we should be discussing the scientifically supported impacts of a 20 percent increase.

But after having spoken to the fishermen and others in the industry, as well as those that generally do not support an increase, I think we could find a middle ground of sufficient support at the 10 percent level that accomplishes our goals. I understand that that is not your amended main motion up there.

But quibbling over the difference between 10 percent and 200,000 metric tons for the sake of having a round number is nonsense. We don't manage fisheries with a goal of having round numbers. That being said, we're still discussing a small percentage increase based on landings from a fishery that is a shadow of its former self, not a percentage of its peak harvest numbers; when dependent predators may have been impacted.

The best available science, which appears to be very solid, says an increase in this range is safe, and has a 0 percent chance of causing an overfishing situation. Why wait for it to be addressed in the next action in some respect in Amendment 3, which is not expected to be effective before sometime in 2018?

Our fishermen want stability tempered with some level of adaptability. An increase at this point is scientifically supported and would by no means be a kneejerk reaction. Otherwise, when would the science ever be good enough to support an increase? The other argument concerning allocation is a completely different discussion that will be addressed. Keep in mind that the TAC is the TAC regardless of who catches it. Having to fight for every single point of a justified increase is disappointing, considering the commission stated values I mentioned earlier.

CHAIRMAN BALLOU: Remaining in the queue I have Rob O'Reilly in opposition, Robert Boyles in support; and there was one other hand that I had recognized in support, but I didn't get the name down. Is there someone else in support that had raised their hand who hasn't yet

spoken? Then maybe I missed that. Let me go to Rob O'Reilly next.

MR. O'REILLY: I know we say we'll be brief, but I will be brief. It is my hope that we don't prolong this need for bait needlessly. It certainly should be all of our hopes that no one has been short changed. If you think about it, the actions of this board, which were very well intended back through 2010, 2011 leading up to 2012, certainly aren't at fault.

But everyone wants good science. We have good science. I contend that we brought this bait need onto ourselves with our actions, as well as the short change that is there. My desire is that we get back to the true baseline, the 212 plus thousand metric tons; and that really that is the status quo to me. That is really all I have, Mr. Chairman.

MR. ROBERT H. BOYLES, JR.: Many of you spoke to the board in making the original motion back in August. I will do my best not to repeat my interest in a status quo, and my support of a status quo motion. I will say this is extraordinarily difficult. Mr. Chairman, thank you for the order within which you've brought us to these very deliberate discussions and conversations. I am going to go back to something that was said early on.

Clearly, a lot of people interested in this fishery, a lot of people interested in this resource, a lot of communities dependent upon this resource. My support for a status quo for 2017 really stems from a hopeful vision; if you will, Mr. Chairman. With Amendment 3 that we can have a fishery that satisfies bait needs, satisfies the important reduction fishery that satisfies the important ecosystem components of this fishery, and that has spillover effects to satisfy other species that are important to this commission.

I am a little concerned, I guess I'm risk averse in my interest in maintaining status quo for the moment, because I'm concerned that we, with a long view towards a final adoption of Amendment 3, that we may potentially find ourselves inadvertently into a game of regulatory whiplash. That's a phrase that has been used around this table more than once. I think status quo is a precautionary approach. I think it leaves us an ability to smooth out the bumps long term and the future of this fishery. For that reason I support the motion.

CHAIRMAN BALLOU: With that, I'm going to call for a vote on this motion. I'll allow for a one minute caucus. Okay, is the board ready to vote? Let's be ready to vote, and let me call for Megan to call the role moving north to south.

MS. WARE: Changing it up here. Maine.

MR. TRAIN: Maine votes no.

MS. WARE: New Hampshire.

MS. PATTERSON: Yes.

MS. WARE: Massachusetts.

MS. MESERVE: Yes.

MS. WARE: Rhode Island.

MR. REID: No.

MS. WARE: Connecticut.

MR. SIMPSON: Yes.

MS. WARE: New York.

MR. STEPHEN HEINS: No.

MS. WARE: New Jersey.

MR. ALLEN: No.

MS. WARE: Pennsylvania.

MR. LUSTIG: Yes.

MS. WARE: Delaware.

MR STEWART MICHAELS: No.

MS. WARE: Maryland.

MS. FEGLEY: No.

MS. WARE: Potomac River.

MR. SCHICK: No.

MS. WARE: Virginia.

MR. O'REILLY: No.

MS. WARE: North Carolina.

DR. DUVAL: No.

MS. WARE: South Carolina.

MR. BOYLES: Yes.

MS. WARE: Georgia.

MR. GEER: Yes.

MS. WARE: Florida.

MR. ESTES: Yes.

MS. WARE: NMFS

MR. ORNER: No.

MS. WARE: U.S. Fish and Wildlife.

DR. LANEY: Yes.

CHAIRMAN BALLOU: **The motion fails, 8 in favor, 10 opposed**. Therefore, the motion on the board remains the main motion. I am prepared to now call for a final vote on this main motion. If the board is comfortable with that, I would like to go right to that vote. I don't know if there is any need to caucus. **This would be the final vote on the main motion to set the 2017 fishery specifications for menhaden.** With that, I'll ask Megan to call the role and we'll go north to south again.

MS. WARE: Maine.

MR. TRAIN: Maine votes yes.

MS. WARE: New Hampshire.

MS. PATTERSON: Yes.

MS. WARE: Massachusetts.

MR. ADLER: Yes.

MS. WARE: Rhode Island.

MR. REID: Yes.

MS. WARE: Connecticut.

MR. SIMPSON: Yes.

MS. WARE: New York.

MR. GILMORE: Yes.

MS. WARE: New Jersey.

MR. ALLEN: Yes.

MS. WARE: Pennsylvania.

MR. LUSTIG: No.

MS. WARE: Delaware.

MR. JOHN CLARK: Yes.

MS. WARE: Maryland

MS. FEGLEY: Yes.

MS. WARE: Potomac River.

MR. SCHICK: Yes.

MS. WARE: Virginia.

MR. O'REILLY: Yes.

MS. WARE: North Carolina.

DR. DUVAL: Yes.

MS. WARE: South Carolina.

DR. RHODES: Yes.

MS. WARE: Georgia.

MR. GEER: Yes.

MS. WARE: Florida.

MR. ESTES: Yes.

MS. WARE: NMFS.

MR. ORNER: Yes.

MS. WARE: U.S. Fish and Wildlife.

DR. LANEY: No.

CHAIRMAN BALLOU**: The motion passes 16 to 2;** thank you very much. Good work on that, and I think we covered that issue well over the course of two meetings. Let's just take a two minute break to stretch, and then we'll come back and take on the Draft Amendment 3 PID; back in three minutes.

(Whereupon a recess was taken.)

CONSIDER DRAFT AMENDMENT 3 PUBLIC INFORMATION DOCUMENT FOR PUBLIC COMMENT

CHAIRMAN BALLOU: I'm going to call the meeting back to order. We are on to Item 6 on our agenda, which is the Draft Amendment 3 Public Information Document, or PID. This is an action item. As Megan noted earlier, during her review of the timeline, the board is poised today to formally launch the Amendment 3 process via approval of this PID.

The board briefly discussed an initial outline of the document at our August meeting, and offered some preliminary comments. Additionally, the Menhaden Advisory Panel reviewed and commented on an early draft of the document, and some changes were made in response to those comments.

The Plan Development Team has done an excellent job pulling everything together, resulting in the draft that is now before us. Our mission this afternoon is to work through the draft and finalize it, so it can go out to public hearing over the next couple of months. For those members, who may not be familiar with the amendment process, the PID represents the first formal step in the process.

It is essentially a scoping document informing the development of the draft amendment, via public input on the options to be considered in the draft amendment. In keeping with the purpose of Amendment 3, the PID essentially does two things; first it scopes a suite of potential tools to manage the menhaden resource; using ecological reference points or ERPs.

Second, it scopes a suite of potential options for reconfiguring the methodology used to allocate the coastwide TAC. Here is how we plan to proceed on this agenda item. Megan will first give a presentation, and answer any questions. It is about a 20 minute presentation, it runs through the entire document.

Jeff Kaelin will then summarize the AP report and answer any questions. I will then lead the board through the process of considering changes to the document. When we get to that

point, I have some guidelines on the process I would like to follow for considering and approving changes. We have a lot to get through. We've got an hour and 20 minutes set aside to get through this, so with that lead in, Megan, the floor is yours.

REVIEW OF MANAGEMENT OPTIONS

MS. WARE: I will be going through the management options in the PID for Amendment 3. The Chairman actually did a really good job of going over what my first slide is here, but I'll just reiterate that the public information document is supposed to be a broad scoping document. The purpose of this is to announce the commission's intent to gather information concerning Atlantic menhaden, and to provide the public with an opportunity to identify major issues or management alternatives.

This is in contrast to the draft amendment, which is a bit more narrow and specific. I just wanted to kind of put that out there when we talk about how we got to where we are today on this PID. This is the timeline for the draft amendment. Again, I've already been through a timeline today, so I'm going to be pretty brief here. But we are considering this for public comments. If that is approved, our public comment period would be from November, 2016 through January, 2017. Again, looking long term we're hoping to take final action on Amendment 3 a year from now.

Before you is a list of the issues currently included in the PID. Some of the names have changed, but the actual issues are still the same ones that were presented in August. My plan for today's presentation is to go through each one of these issues, kind of give a brief overview of why it's included in the PID, and then I'll go through the management options or public comment questions that are associated with that issue.

We'll start with reference points. The stock is currently managed by single species reference points from the 2015 stock assessment; and those were intended to provide a better measure of sustainability in the fishery. The board has expressed an interest in managing the Atlantic menhaden stock with ERPs; and currently the BERP Working Group is developing menhaden-specific ERPs, which will be peer reviewed in 2019.

There are also existing guidelines for managing forage fish species that the board can look to in their consideration here. We have the 75 percent rule of thumb, which recommends that forage fish populations be maintained at three-fourths of their unfished biomass levels. We also have the Lenfest Proposal by Pikitch et al. which recommends that F does not exceed one-half of natural mortality; and that fishing is prohibited when biomass falls below 40 percent unfished biomass.

We also have a third ERP that is included here. Between Jeff and I, we'll, hopefully, be able to provide a bit of context as to how this was added. But this was recommended on the advisory panel call for inclusion in the PID. The actual reference point is an F target to achieve a 75 percent unfished biomass, and that fishing is prohibited when biomass falls below 40 percent unfished biomass.

We'll put some more language up there to further clarify that. But in the PDTs discussion of this, they decided to include it in the PID as another example of how forage fish can be managed. They also felt somewhere in the realm of the 75 percent rule of thumb and the Lenfest Proposal, so it was kind of in the range of where we were speaking.

Both Jeff and I will continue to discuss this, and we'll be able to answer questions by the board to provide a little more context on that. These are the current options for reference points. Option A is the single species reference points from the 2015 stock assessment. If the board decides to use this option, the board will direct

the BERP to stop work on menhaden-specific ERPs.

Option B is to use existing guidelines for forage fish species. This could include something like the 75 percent rule of thumb or the Lenfest Proposal. Again, if this is chosen the board will direct the BERP to stop work on menhaden-specific ERPs. Option C and D are the board agreeing to follow the BERP in their menhaden-specific ERPs.

Option C is saying we're going to continue to use the single species reference points until those ERPs are developed by the BERP, and then Option D says we're going to instead implement existing guidelines for forage fish species; until those BERP ERPs are developed. Again, those existing guidelines can include the 75 percent rule of thumb, the Lenfest Proposal, or that new harvest control rule. Our second issue is quota allocation. Amendment 2 established a TAC for menhaden and divided this among the states.

In revisiting this allocation there are a couple of concerns that have come up. The first concern is that the current TAC may not strike a balance between gear types and regions. This has posed a problem as we increase the TAC. This seems to have limited benefit for small scale fisheries. Another concern is as the stock continues to expand and grow, especially in the northeast; historical catch could limit states with minimum quota from participating in this growing fishery.

As a result, the board has stated an interest in exploring other allocation strategies, and in May, 2015 there was an allocation working group established to try and address some of these issues. The allocation options currently included in the document are from that workgroup. We have quite a few quota allocation options. The first is jurisdictional allocation, which would be our status quo.

Option B is jurisdictional allocation with fixed minimum quota, so an example here might be that each state gets 1 percent of the coastwide TAC, and then the rest is distributed. Option C is a coastwide quota. Option D is a seasonal quota, Option E is regional quotas, and we have sub options for a 2, 3, or 4 region split.

Option F is disposition quota, so that would be between the bait and the reduction fisheries. Option G is a fleet capacity quota, and again here we have sub options for a two-fleet or three-fleet option. I'll note here for the small fleets there is an option for a soft quota to try and provide a bit more flexibility to those small scale fisheries.

Intricately tied with the allocation method is the allocation timeframe. The question here is whether the current timeframe represents a fair and equitable picture of coastwide menhaden catch. We have three options here. Option A is our status quo, so that is 2009 to 2011. Option B would be to expand that to a longer time series.

That can include adding 2012 catch information or it can mean going back further in time to 2005 or 1985, so there is a large umbrella there of what that could mean. Option C is weighted allocations. This tries to consider long term trends, as well as recent changes in harvest. Allocation would be weighted over two time periods.

Our next issue is quota transfers and overage payback. Amendment 2 allows for quota transfers among jurisdictions. Just as a practical matter, transfers are a very useful way to address overages in the fishery. However, the timing of some states may disadvantage them from being able to fully participate in this transfer process.

There are also no guidelines to what a state should do if they receive multiple requests at the same time. We can try and look to other

FMPs to see what they do for these issues. If we look at some such as the black sea bass FMP, it allows for quota reconciliation; where if the coastwide TAC is not exceeded, state specific overages are forgiven. It also provides examples of what to do when the coastwide TAC is exceeded, and in that case if at least one state has an underage, then that state could transfer their unused quota to a common pool, and then that could be distributed to states with an overage. For this issue we have public comment questions, so I'm going to just read those off here. The four questions are, should the process for quota transfers be further defined or replaced with quota reconciliation? Should state specific overages be forgiven in years when the coastwide TAC is not exceeded?

If the coastwide TAC is exceeded, but at least one jurisdiction has an underage, should unused quota be pooled and distributed to states with an overage? Should there be accountability measures for a state which exceeds its quota by a certain percentage, or repeatedly participates in quota reconciliation?

Our next issue is quota rollovers. Amendment 2 does allow for unused quota to be rolled over into the subsequent year, if the stock is not overfished and overfishing is not occurring. However, the specifics of that program were not defined in Amendment 2, and at the time of final action we weren't meeting those criteria.

However, from the 2015 stock assessment we now do meet that criteria, and so quota rollovers are allowed. However, those specifics were never defined. The board agreed to tackle this issue in Amendment 3. Again here we have public comment questions. We have three of them. Should unused quota be rolled over into the subsequent year?

If yes, should the amount rolled over be limited to a percent of quota? Should all sectors of the fishery be allowed to rollover quota? Our next issue is incidental catch in small scale fisheries. In August when I presented this, this was called bycatch. The PDT decided to make a conscious choice to try and use incidental catch instead of bycatch; and there were a couple of reasons for that.

The first is we felt that there were a bunch of different definitions of bycatch, and so we were getting a bit confused as to what we were actually talking about. Really the intent of this is for incidental catch, and so we wanted to try and represent that in the PID. That is why you may see incidental catch more frequently in this document.

Currently, under Amendment 2, all catch goes towards the quota before a state reaches that quota; but once you reach that quota, your directed fishery shuts down and we move into a bycatch fishery. Amendment 2 established a bycatch allowance of 6,000 pounds per vessel per trip for these non-directed fisheries.

There are a couple of concerns that have come up with this allowance. The first concern is that bycatch under this allowance does not count towards the quota, and so there is some concern that this could undermine the coastwide TAC that we set each year. There is also no definition of bycatch or non-directed fisheries provided; and so there are some questions of who should actually be allowed to participate in this allowance.

It has also raised concerns that the bycatch allowance may be supporting a small scale fishery rather than incidental catch. There is also concern that the bycatch provision dissuades cooperative fishing. We tried to address this with Addendum 1, where we allowed two permitted individuals to land 12,000 pounds of menhaden.

However, there may be other ways to address this in a more holistic view through Amendment 3. Again here we're back to management options. Option A would be our status quo, so

that is a catch limit per vessel. Option B is an incidental catch limit per permitted individual. The idea here is that this would try and solve the issue about cooperative fishing, because the catch limit would be per person rather than per vessel.

Option C is to have the incidental catch included in the quota, so incidental catch would count towards the quota, and once that quota is met no landings would be allowed. Again, the idea here is to try and account for our incidental catch in the coastwide TAC; so we're not undermining that value.

Option D is an incidental catch cap and trigger. There would be a harvest cap for incidental catch, and if that is exceeded by a certain percentage in one year or two consecutive years, then management action would be triggered to reduce incidental catch. Option E is that incidental catch be defined by a percent composition.

The amount you could land would depend on what else you're catching at that time. Then Option F is for a small scale fishery set-aside, so here a portion of the TAC would be set aside for gears participating in small scale fisheries. This is very similar to an option in the quota allocation issue.

But the reason it's also included under this issue is that regardless of what allocation method the board chooses, there is still an option for a small scale fishery set-aside to deal with some of the issues we're seeing in the bycatch fishery. Our next issue here is episodic events. Amendment 2 sets aside 1 percent of the TAC for episodic events.

Then we had Technical Addendum I, which outlined the specifics of this program and specified that participation in this program was for the New England states. Since 2013, we've seen an increasing amount of menhaden landed under this program, as well as increased participation from the states.

In 2014 only 8 percent of the set-aside was used. This year so far 92 percent of the set-aside has been used; also this year we had New York request and be approved, to harvest under the episodic event program, even though they are not technically considered a New England state. This has prompted questions about the size and the geographic spread of the program. We're back to public comment questions for episodic events. Our questions are, should a percentage of TAC be set aside for episodic events?

If yes, what percentage of the annual TAC should be set aside? If yes, which jurisdictions should be allowed to participate in this program? Does the episodic event program need to be reconsidered as the distribution of menhaden changes? How should states demonstrate that an episodic event is occurring in state waters?

Our final issue here is the Chesapeake Bay Reduction Cap. Currently, the Chesapeake Bay reduction fishery is limited by a harvest cap; and the intent of this harvest cap is to prevent all of the reduction fishery from occurring in the Chesapeake Bay, which is an important nursery ground for menhaden. However, the reduction fishery consistently underperforms this cap, and so it has raised questions to whether this is really a vital tool to the management of menhaden. Our two questions are, should the Chesapeake Bay reduction fishery cap be maintained? Is it an important tool for management of Atlantic menhaden? With that, I'll take questions.

CHAIRMAN BALLOU: We're open to questions now, but if your questions have even a hint of a suggested change, I would ask you to hold the thought, because what we're going to do immediately following this question Q & A portion, is go back through the document

section by section, and entertain any suggested changes.

ADVISORY PANEL REPORT

CHAIRMAN BALLOU: Right now, does anyone have any questions for Megan on her presentation, with the understanding that we're going to go back over this document thoroughly in a moment? Seeing no hands, we will move to the AP report on the PID; and I think Jeff Kaelin is ready to offer that.

MR. JEFF KAELIN: Good afternoon members of the Menhaden Board. I'm Jeff Kaelin; I work with Lund's Fisheries in Cape May, New Jersey. We are in the purse seine fishery for bait in New Jersey. Megan has done an excellent job of providing you with a written overview of the AP call that we had in October, actually I guess it was in September.

But she has also provided some slides, which I'm going to go through quickly; as quickly as possible, because some of the issues that were raised by the AP have already been addressed in the document. I'll try to blow through this quickly. We did have 14 AP members on the call, so we had a very robust discussion of a whole variety of issues that I think are captured in our report.

There was no discussion about preferred management alternatives at this time, and I believe that there will be another AP call prior to your February meeting; when the AP will have an opportunity to review the PID hearing results, and provide another update to you. On the next slide, the stock status information, human use of menhaden, the balance of the discussion has already been addressed by Megan.

I think the scale of the fishery issue probably will be addressed with the socioeconomic report, which also will be before you in February, and probably with an opportunity for the AP to comment on that prior to your February meeting. The standards by which ASMFC manages the species are going to be included.

The next slide is on reference points. As Megan mentioned, there were at least two AP members who brought forward this additional option for consideration as one of the alternatives as an interim reference point. I believe it was Mr. Hinman and Mr. Paquette who advocated for this additional option.

The AP felt that it was appropriate to ask the PDT to evaluate its inclusion in the document. The reference for that option is included, Smith et al. There was some discussion about a manuscript in process by Hilborn et al, alternative to Pikitch that focuses more on the environmental linkages to recruitment for Atlantic menhaden or the forage fish.

Hopefully, that will be published before this process ends. On the quota allocation slide, both of these have been addressed in the PID. There were some language changes relative to the language concerning equitable balance between gear types and regions, which Megan commented on earlier; and the seasonal quota option is in the document. There was some discussion about the winter quotas value, and allowing sampling of the adult population perhaps. Then on allocation timeframe, there was a pretty good discussion about perhaps using a longer time series for the reallocation or the weighted reallocation down the road; and there were two periods that were suggested, 2006 to 2012, and '85 to 2012 for analysis.

Hopefully, the board could agree to have the technical people look at those options. On quota transfers and overage payback, I think both of the issues on this slide have been addressed by the staff; and are reflected in the document. We appreciate that I think as an AP generally. Next slide on episodic events, similarly the first two bullets I think have been addressed by staff.

The third bullet was that perhaps a specific increase in the episodic event allowance of 2, 5, or 10 percent could be performed to determine whether the small scale fisheries needs could be addressed in that way. There is a similar option in the PID; I think that looks at things in that way. On the Chesapeake Bay reduction cap piece, what does this say? There has been an underperformance and some history of landings has been requested, although this is difficult because of the confidential nature of the data.

As far as other comments go, these are relatively minor. There were a couple AP members who thought a research program and priority portion should be a part of the PID. As the AP Chair, I would hope that you might add that; because I think we need to look down the road, so that the public and everybody has a better idea of what's going on out there, the best idea possible.

Then the second bullet has to do with an appendix table. I think the staff has addressed that as well. That is my report, and thank you, Megan very much for your summary. It has been very good working with her. Our AP is being reconstituted. I think you have several AP members to consider later. We appreciate that very much. That ends my report, Mr. Chairman.

CHAIRMAN BALLOU: Questions for Jeff on the AP report? Seeing none; I just want to say, I know I speak for everyone on the board in thanking the AP for their engagement and very helpful contributions to the process; which I know are going to be continuing as we move through the Amendment 3 process, and thank you for your leadership, Jeff.

We are now about to open the floor to suggested changes to the document. To save time, if members have suggestions for clarifying language changes that are not substantive in nature, you do not need to get those on the record this afternoon. You can simply convey those to Megan, provided you do so by the close of business on Friday.

That's her deadline. She really needs to get this document finalized. If you just have editorial suggestions, non-substantive in nature; please get those to Megan. You don't need to get those on the record today. But you do need to get those to her by Friday. I'll just note that I have already availed myself of that option, by providing Megan with some suggested edits last week.

With regard to substantive changes, which we are now about to consider, Amy has been kind enough to offer to itemize the suggestions as they are made; by putting them up on the board. We'll seek to develop the list by consensus. If anyone is uncomfortable with a suggestion or has a different angle, weigh in and we'll work through it.

Once everyone on the board has had the opportunity to offer suggested changes, I'll take some public comment. Actually, I think I'll offer two opportunities for public comment. I think it might be easier to do it this way, one on the issue of reference points and then another on the various issues associated with allocation. At the very end I'll come back to the board for a motion and a vote. That is how I plan to proceed.

First, so we'll go section by section, we'll open up the floor to comments and suggested changes; and then move right through the document in the order that Megan had presented. First, with regard to the introductory sections of the document, does anyone have any comments or suggested changes pertaining to the document up through Page 5; that is up to Issue 1, Reference Points, which we're about to take up?

Does anyone have anything that they would like to offer on anything up to the very first issue, so that would be up through Page 5? Seeing no

hands, we'll move to Issue 1, Reference Points; suggested changes on that, Lynn Fegley.

MS. FEGLEY: I admit that I hesitate with menhaden. I'm not sure what qualifies as substantive. I hope this does, but if it doesn't, please stop me. In the option that involves the 40 percent unfished biomass, there is language in there that states that references the Pacific Fishery Management Council in sardines.

It says in parens, although it's not set at 40 percent of the unfished biomass level in that fishery, for the sake of the public, and if it were me reading this, what is that sardine fishery set at; and why are we choosing 40 percent? I just wonder if it wouldn't be helpful for the public to know. The way it's worded to me, may make that 40 percent seem arbitrary.

Unless it's in that Smith et al paper that's referenced, which it might be. I'm just looking for a little help for the public in understanding where that particular number came from, and how it might compare to the Pacific number; also, and maybe not necessary but interesting, how it compares to the menhaden stock status.

MS. WARE: I'll try and tackle that, Lynn. To the first question of what the sardine council is using, I don't know it off the top of my head, but I do know it's lower. I can add that to the document if you feel that would answer some questions that you think might be posed by the public. I'm happy to do that. In terms of where the 40 percent came from, it came from the Lenfest proposal. That is why that paragraph there is kind of talking about a combination of the Lenfest proposal and the 75 percent rule of thumb.

MR. CLARK: Just kind of a follow up on Lynn's point. I was just wondering if, in the options themselves, it might be possible just to put in there what F we're looking at under some of these other guidelines, as compared to what our current single species guidelines are. I know you discuss it in the big intro to it.

But like a lot of people, I just started looking at the options. It would be hard for the public to tell by looking at the options what the F would be for going to the 75 percent rule of thumb. Just to have what the actual F would be in there, I think, would be helpful.

CHAIRMAN BALLOU: Duly noted, thank you. Additional comments suggested changes on the reference point portion of the PID. As you're thinking, or perhaps as we near a conclusion, I'll just note a thought that I had; and that is on Page 7, there is a fairly hefty paragraph that summarizes the BERP Working Group's review of the Lenfest related ERPs proposed by Pikitch et al. It is the response to the BERP Working Group offered by the Lenfest Forage Fish Task Force.

If the board is comfortable with that, I think there should be a very decent attempt to summarize the back and forth on the issue; so be it. But as food for thought, it occurred to me that the document could just say that the BERP Working Group issued a memo highlighting several concerns with the approach, and then site that memo that is in the appendix.

It is in now, and it would remain in. Then say that the Lenfest Task Force subsequently responded to the TC memo, and then site that response in the appendix; where it currently is, and leave it at that. In lieu of attempting to summarize the issues and the positions of the TC and the Task Force relative to them, just essentially let the memos speak for themselves. Again, just a thought, I don't feel particularly strongly about the issue one way or the other, but I just wanted to float the thought, for what it's worth.

It just sort of struck me that it was a decent attempt to summarize an important issue. If the board is comfortable with it as proposed, fine, I just wanted to let you know that had

been something that occurred to me. I'm not offering it as a suggested change. I'm just offering it as a thought that I had when I read through the document.

Are there other thoughts, either in response to that comment or on any other issues under reference points? If not, I'll go to the public now. Does anyone from the public wish to comment on any of the issues in the PID that relate to reference points? This is going well.

Back to the board, and we'll move on to Issue 2, and that is Quota Allocation. We'll go through these one by one. Well, Quota Allocation is Issue 2, so I'm sorry, I got ahead of myself. Does anyone have any suggested changes pertaining to that issue? Yes. Terry Stockwell.

MR. STOCKWELL: First, a question and then a suggestion. Has there been any discussion about an RSA with the working group under the quota allocation section?

MS. WARE: As far as my knowledge on the working group's discussions, I didn't see one on that; and the PDT did not discuss one.

MR. STOCKWELL: Well, pending discussion of the board, I would be interested in consideration of an RSA option. The second issue is under the fleet size composition and the fleet capacity quotas. I want to note in Maine that Maine has several small capacity purse seiners; they are not large capacity, so you have a list of smaller gears. There are at least two of them here today. I would request that small capacity purse seiners be considered as an option, as well.

CHAIRMAN BALLOU: Duly noted. Yes, Dr. Duval.

DR. DUVAL: Just in the preamble to the quota allocation issues, it is the last paragraph on the bottom of Page 9; where it's giving some examples of different types of allocation. It notes the golden tilefish fishery being allocated by gear type. That is specific to the South Atlantic, and it might be good to just note that; because it is an IFQ program in the Mid-Atlantic.

CHAIRMAN BALLOU: I'm sorry, what page were you on there?

DR. DUVAL: It's just at the bottom of Page 9; that paragraph that talks about the examples, just noting that for golden tilefish that is specific to the South Atlantic and Mid-Atlantic and is an IFQ.

CHAIRMAN BALLOU: Duly noted; additional, yes, David Simpson.

MR. SIMPSON: Just clarification on what Terry said. The notes I'm looking at, the small capacity gear is to be considered as an option. You were speaking particularly of small capacity purse seiners, right? We need that clarification.

MR. STOCKWELL: To that point, yes. On the three-fleet-capacity allocation, the small capacity fleet not limited to cast net, trawl, trap pot, haul seine, fyke net, hook and line. There are small capacity 35, 40 foot purse seiners as well.

MR. SIMPSON: Okay, that's great, and the added clarity of it being a 35 to 40 foot boat helps me a lot to understand it as a small capacity gear.

MR. STOCKWELL: Not necessarily limited to that, but 40 foot range, yes.

CHAIRMAN BALLOU: Dave, do you want to offer a thought on what you would like to see in terms of maybe some clarification?

MR. SIMPSON: Yes, it would be helpful to me to understand what is meant by a small capacity purse seine, because it is sort of, with my limited background in that fishery, a contradiction in terms. But I understand in Maine those exist. Maybe you could put some

sideboards on it, whether it was now or later. But a tonnage capacity or something of that nature, I think would help the PID a lot.

MR. STOCKWELL: I feel more comfortable about talking with our industry and getting back to Megan with an answer to that, and the board can review it at our upcoming meeting. Likewise, a medium capacity fleet, we do have some large seiners, but they are not on the scale of the reduction vessels.

CHAIRMAN BALLOU: Additional comments, thoughts. Yes, Rob O'Reilly.

MR. O'REILLY: I provided Megan with what may be an additional quota allocation option. But of course, we need to talk about it, if Megan can place that up there for everyone to look at, that would be great.

CHAIRMAN BALLOU: I think she's working on that as we speak.

MR. O'REILLY: In the meantime, I'll just say that when you look through the allocation options, they are all mechanistic. Option F, disposition quotas talks about the split between bait and reduction a little bit; Option G, the fleet capacity quota speaks to the idea that it can be used to allocate to different sectors, but there is not really an indication of what triggers these allocation changes.

What I have up there is the idea that there has to be some variable allocation issue included. In other words, it's based on the quota itself. As you heard me earlier, I hope it is not just my thought, but the 212,500 metric tons really is looked at as the starting point. The reason for that is that when allocation came about and was passed, along with the 20 percent reduction, it was in a manner different than some other allocation schemes.

Usually, when you have an allocation situation, you have at least time for states to start limited entry proposals. Of course, with menhaden some states do already, some states don't. What that did was it really induced the short changing effect that was mentioned earlier, and in another sense it also didn't really look at the capacity down the road.

In general, what this item will show is that there is a way that, depending on the strength of the quota, the magnitude of the TAC that the allocation to different sectors, whether it be bait or reduction or regional or in whatever manner, should be influenced by that magnitude of reallocation. I think the public at least needs to see an idea of where this quota is possibly going to go? Where is the TAC possibly going to be distributed?

Now, granted, there may not be consensus on the middle there that you have to get back to where we were in 2012, before the 20 percent reduction to consider allocation, but I have to tell you when we had those numerous calls led by Robert Boyles on allocation, I think there were seven, he might tell me eight; I don't know. But the first call was involved with everyone trying to figure out the difference between allocation and reallocation.

I think Bill Goldsborough, who was on the call as part of the public, said let's not play with semantics, it is reallocation. But realistically, given the background of how this allocation came about, I think that probably we should build some biomass here, which we have, and from that we should build our TAC; which we have incrementally.

But not even to get back to where we have a slate that existed before all these reductions. Definitely take some comments on that; but I think there is some good information here about the public being able to see the various ways that the TAC can be distributed, and it is a little less vague than perhaps Options F and G.

CHAIRMAN BALLOU: Thank you; let's leave that up on the screen. Does anyone from the board have any comments or concerns regarding the recommendation to add a new Option H, as indicated? I'll give you a minute to just make sure you've digested it. My understanding, Rob, is that this would be added to the document as presented here. This would be the actual language that would be inserted. It would be a new option, and that would be the clarifying language as indicated on the screen, in terms of what the option seeks to do.

MR. O'REILLY: That is correct; Mr. Chairman, and also Megan gave a little helping hand, because the original quota allocation scenario was confusing maybe to the public; in that it mixed up TAC and quotas, and I think that's been straightened out. This would be what is proposed, and again, it is a little different in that it talks about the magnitude of the quota and actions that might happen after that.

CHAIRMAN BALLOU: I don't see any hands going up, so we can come back to this, but for now, I'm going to ask Amy to pull this back and just add, as a bullet, a new Option H with the title that it had; and I actually forget what it said. But that will be a proposed addition; other thoughts, comments, Lynn?

MS. FEGLEY: Just going back to Terry's comment about the small capacity purse seines. There are a couple things that might be worth doing with that. One of them is in the document; Table 3 breaks down the landings by gear. I think one of the points of that table is to illustrate to the public the magnitude of the specific gears; you know, how much of the harvest that they are proportionately catching.

The purse seines are at 94 percent. Clearly, I would imagine that the Maine small capacity purse seiners would be lumped into that purse seine category, which makes it very hard. I think it's going to be confusing. One thing, there are two ways, I think, that maybe could make this easier and get the board better input. In the description of the fleet capacity allocation option, it talks about the idea that you could define your small capacity fleet through trip limits. In other words, if you're a small capacity fleet boat, you're not harvesting more than 20,000 pounds at a shot; and I'm making that number up.

But one of the things maybe we could do is add into the public comment questions, what would be a suitable small capacity trip limit, in order to make sure that we are doing a good job defining that capacity; because I worry when we start overlapping these gears. I'm not arguing with Terry's point, I think it is going to start to get confusing. Maybe one way to get at that is just crystal clear, asking what we are talking about here for a trip limit.

CHAIRMAN BALLOU: That sounds like a good suggestion to me. Terry, does that work for you?

MR. STOCKWELL: I'm not sure yet. I don't want to lose sight of the fact that we have an effort that I don't feel is fully recognized in the draft document at this point.

CHAIRMAN BALLOU: Okay. Working through these issues, any other thoughts or comments either on what has already been discussed, or anything new under this issue? I'll just note that under the public comment questions, it struck me that we might have been jumping the gun a little bit in the way they were teed up.

If you move to those comments, I'm wondering if the board has any opposition to adding two additional questions, one at the very beginning, which would be should the board maintain or revise the allocation formula currently used to manage the commercial Atlantic menhaden fishery. It seems to me that is the first sort of open ended question, but it tees up well what follows.

Then as the last question, are there other options besides those offered in this document that the board should consider. Again, just really trying to make sure we've rounded out this very important issue. If there are no objections, I would like to suggest adding those two questions under the public comment questions portion of Issue 2. Is there anything else on Issue 2? Dave.

MR. SIMPSON: Following up on Lynn's suggestion, I thought that was a good one actually, just asking questions. When we say small scale, what do we mean? What is the public's perception of what is small, what is medium, what's large; so we get that out on the table and understand.

I think it is good to consider another type of gear that we haven't thought about, but I would need to know myself, is that a small scale gear that is capable of taking 100,000 pounds or 10,000 pounds? Does it meet my definition of small scale and my perception? I think they would be very helpful comments to add, or questions to add, rather.

CHAIRMAN BALLOU: Anything else? If not let's move on to Issue 3, Allocation Timeframe; comments, recommended changes to that? Yes, Jim Gilmore.

MR. GILMORE: As I was looking through these, in some respects it's hard to figure out if they're going to fix the problem or not. As I went through B and C, it kind of reminded me, for all you folks around, when we were doing spiny dogfish. We took different time series and we got into this little bit of a quandary.

Because some folks liked the early eighties, some folks liked the late seventies; because it all came down to what was giving them a better deal. The suggestion I have, and I'm not sure if there are problems with it to add an Option D, is why we couldn't use the most recent five years. I mean, we're looking backwards, and I think where we want to go is to use most recent data.

Why we couldn't put in an option that we would use the landings from 2013 through 2017? Actually, I think part of the problem, at least for New York, was we weren't recording landings. We fixed that probably in 2011/2012, and I think the other states probably ramped up too, so that might give us a more accurate picture of what the actual distribution is.

MS. WARE: Jim, just a quick comment on that. We won't have 2017 landings finalized by the time we take final action on this. My guess would be the board would want to know what each states allocation would be; depending on which time series or method we use. We wouldn't be able to do that analysis for that option. Maybe 2012 to 2016, would that be okay?

MR. GILMORE: Yes, that would be fine. Whatever most recent previous five years we would look at which is the most recent data.

CHAIRMAN BALLOU: Just to state the obvious, those landings have been constrained by the state quotas. It is what it is, but I think as long as that's clearly stated in characterizing that option, I think it makes sense to me to offer it.

MR. GILMORE: Yes, I und1erstand that Bob, but remember with the transfers we had you could probably get, even though you're constrained by those quotas, there still is a better picture of how much transferring was going on. It is just another option to give us maybe a better way to get out of the box, so we don't get back to spiny dogfish again.

CHAIRMAN BALLOU: I think it is a good suggestion, and I just think as long as that clarifying or explanatory language is added to help the public understand the context; that seems fine.

MR. MILLER: Just to add to that; by using that recent period it would also factor in the bycatch landings, which really should be considered in any quota reallocation.

CHAIRMAN BALLOU: Good point. I like that idea; yes, Emerson.

MR. HASBROUCK: To add to what Jim and Roy had said, I would say and in the bycatch numbers as well as the episodic event landings as well.

CHAIRMAN BALLOU: Yes, all duly noted. I actually don't see what's going on up on the screen, but I know Megan is writing everything down, and I know Amy is doing her best to capture the thought. But it all makes sense to me, so far.

MR. NOWASLKY: Just as a general comment, I think that there are some great minds getting information out, and certainly, the public consumption element of it is important. But we're starting to add an awful lot that almost looks like the draft itself. I think one of the important things we want to make sure we do is leave open general comments, as we put in all these specific issues, options.

Sometimes it gets the public to key in, latch on to one of those options, and it doesn't generate the free thought that sometimes we can get out of these. I don't know how we encompass that. Again, I certainly don't want to dismiss the thoughtfulness that's going around, but I hear and see all these options that are being generated; and it's almost starting to look like the amendment itself to me. I just wanted to put that forward.

CHAIRMAN BALLOU: Sure, we could do a PID that just asks, what do you think we should do with menhaden? But no, I take your point. I think it is a point well taken, Adam. I didn't mean to be too facetious. I think the open ended questions are in here, but I take your point that they are followed by a bunch of specific options. We need to be careful about making sure we've got the right balance between open ended questions that we really want to solicit good thinking and good brainstorming on, versus here is the limited number of options that you have to consider.

We don't want to do that. We want to make sure the public gives us all their thoughts on the full range of issues that they would like us to consider. I think it is a point well taken. If anyone has any specific suggestions for -- Adam, I'm not sure if that was just sort of a general comment, or whether you had a specific request to change something. I think your point is well taken. I'll just leave it at that. Jim.

MR. GILMORE: Just a quick clarification for Amy. It is actually adding Option D to that issue.

MS. FEGLEY: I still sometimes wake up in a cold sweat remembering the allocation conversation that we had in 2012, when we talked about the various reference periods that we could use. In that conversation in 2012, the reference period that we ultimately chose was justified in part by the quality of the data.

There was a lot of conversation about the fact that the data quality from earlier time periods just wasn't there. I just wonder if the document should speak to that a little bit, so the public isn't working under the assumption that all of those years are created equal in terms of the data quality. I mean, clearly, that was an issue for New York. It concerns me a little, but I just don't want to lose sight of that; because we did use it as justification for a reference period.

CHAIRMAN BALLOU: Good point, well taken. I would like to revisit just a quick Q & A which I had with Megan, just on the record. I'll make sure she's listening to me. I had asked her at

the end of the first paragraph under Issue 3, there is a sentence that reads; regardless of the allocation scheme chosen in Issue 2, historic landings will be used to allocate the TAC. I think my point blank question to her was what exactly does that mean? I would like to give her a chance on the record to answer; in terms of her interpretation, and then make sure the board is comfortable with that language.

MS. WARE: The question was added following the advisory panel call, during our call with the PDT. On the AP call there were some questions going back to the allocation method, there was a sentence that said there is concern that this is not a fair and equitable allocation method that we're currently using. There was some consternation over that sentence; especially the fair and equitable part.

Noting that we're using historic landings to allocate, how could that not be fair and equitable. We tried to reword that. But I think also try and address some confusion on what else would we use besides historic landings. At that point we were just trying to clarify that we are still using historic landings to set the TAC, regardless of the method chosen. It is just what method and what years we use.

CHAIRMAN BALLOU: I guess I'll just say that I'm trying to think that through and make sure it is reconciled with the ERP section of this. If the board is comfortable, fine. If not, I was just struck by the potential awkwardness of that sentence.

MR. G. RITCHIE WHITE: I guess I have a problem with that wording. I guess I would rather have maybe used something like in part, historic landings will be used in part, so it doesn't tie us to this process. If we figure out some new method we decide on, we shouldn't be locked in with that.

CHAIRMAN BALLOU: Ritchie has offered a suggestion that we amend that sentence to read, in part. We'll add that up as a suggested change.

MR. SIMPSON: Where is this exactly, so I can catch up with it.

CHAIRMAN BALLOU: I don't know if I have the right page. For me, I have Page 15, it is Issue 3. It is Page 13, Issue 3; Allocation Timeframe Background. There is a paragraph there, and the last sentence in that paragraph reads, regardless of the allocation scheme chosen. Do you see that now?

MR. SIMPSON: There were alternatives that would not require any historical basis. In other words, I think, in particular, the size of the fishery, small scale fisheries, medium scale fisheries, large scale fisheries, would not necessarily have to be history based. You could argue that a small scale fishery there is a cap at 2 percent. That is what we're picking and that is what will be allocated, and it will be shared among all the states that have small scale fisheries. It will get us out from under the concern that this or that state with their small scale fisheries didn't have proper accounting of landings. I would like to remove that sentence, because I think there are clear alternatives that don't require any look into history. I think we can do it without that.

CHAIRMAN BALLOU: We have a couple of suggestions, one would be to remove that sentence entirely; the other would be to amend it to insert in part.

MR. DAVID V. BORDEN: I would just like to go on record as supporting the comment that both David and Ritchie made. It may be more accurate if we said something like; historic landings may be used, depending upon the alternatives selected.

CHAIRMAN BALLOU: That sounds fine too. I find myself starting to wonder, what are we really trying to say, if anything, that isn't already

evident in the document? I mean is there really a need to say anything? I'm leaning toward the sentence doesn't really need to be there. That is my sense.
Is there any strong objection to just removing that sentence, with the understanding that the options speak for themselves; in terms of whether they rely upon historic landings or not. It doesn't seem like there is any objection, so we'll remove that sentence. Other thoughts or any other suggested changes on Issue 3? I want to make sure I covered my own comments here. Yes that was the only one I had, so we're on to Issue 4; Quota Transfers and Overage Payback. Anything on that? Ritchie.

MR. WHITE: I don't have the document in front of me, because I don't have web coverage. The rollover provision, I would like to see something in there that a state would have the option to not have their unused quota rolled over; in other words, if a state wanted to be more conservative, and I would give the example of striped bass.

New Hampshire has a small commercial striped bass quota. New Hampshire chooses not to use it. We could allocate that to recreational fishing if we so desired, but we choose to not harvest it as a conservation measure. I think there ought to be that opportunity for the public to weigh in on that in this instance.

MS. WARE: Ritchie, maybe we could formulate that into a question, so if it were something like, should states be required to transfer unused quota to a common pool or could that be voluntary? Something along that line, would that be okay? Okay.

CHAIRMAN BALLOU: Other suggestions on this issue? Seeing none; we move to the next issue, which is Quota Rollovers. Any changes to the document on the issue of quota rollovers, seeing none; and if anyone thinks of something as we get closer to the end here and they want to go back, that would be fine. But we'll just continue on to Issue 6; Incidental Catch and Small Scale Fishery Allowance.

I'll just note right up front that I think it might be misleading to say that the intent of the bycatch allowance is to account for incidental catch. That is the wording currently used. Since that implies that bycatch is accounted for as part of the TAC and since that is not the case, I think it might be more accurate to say that the intent of the allowance is to accommodate and track incidental catch; really just a sort of subtlety there.

But I think it's more accurate to say that we account and track incidental catch via the bycatch. We don't account, because it just, again, suggests that it is accounted for as part of the TAC. That was one thought I had. Then I just wondered whether Option A should be characterized as status quo, since it reflects the current state of affairs under Addendum I. Megan and I have gone back and forth on this. You can either look at Addendum I currently as status quo, because it has been adopted and is, indeed, a part of our program under Amendment 2.

On the other hand, is it more of an interim measure until we tackle it again under Amendment 3? Again, a subtlety there, but I just was wondering if the board had any thoughts on whether we want to. We sort of do that throughout the document where we offer options. Option A tends to be status quo, so I just found myself wondering whether we should do that here. Those were just the two thoughts I had; additional thoughts from the board? Yes, John.

MR. CLARK: I agree with you. I would like to see status quo in there, so states where this is an important part of the fishery would understand that's what it is. I just found in the whole description here, it is a little confusing. I understand wanting to go to incidental catch from bycatch; but the two terms are used

throughout the description, and it does get a little confusing.

I think, if we're going to change it to incidental catch, explain that in the first paragraph, define it, and then use it consistently; because I said, it goes back and forth. Even when we get to the statement of the problem, it says incidental bycatch limit. Then when you go to the options, it is incidental catch. Consistency here would really help the public, I think.

CHAIRMAN BALLOU: Very good point, I think; yes, Lynn.

MS. FEGLEY: I am still struggling with this one a little bit. With Amendment 2, when this came up, really the crux of the issue here was, there is a difference between a fishing gear that is completely passive that only encounters what swims through it, as compared to something that you can actually go out and seek out menhaden to set on.

The problem with the stationary gear is really, initially when we were going through Amendment 2, is that call it targeted or call it bycatch or call it incidental, call it what you will. These gears, they don't move and the end result of shutting them down for a menhaden quota, might be shutting down the other fisheries that those fish harvest or really ugly discards of dead menhaden.

I guess I am throwing it out to the board for conversation. I don't know if it would be helpful to have a clear explanation of sort of the issue here, why bycatch was identified as what it is. I'm not sure I'm making sense, and I might just have to think about it; and maybe Megan sends you some stuff. I feel like we're confusing bycatch and we're confusing the gear issue. There are sort of two separate conflating issues going on here; for what it's worth.

CHAIRMAN BALLOU: Rob.

MR. O'REILLY: It seems that we all participated in characterizing our bycatch, and ASMFC staff has that. Maybe next time that we meet, or whenever, we can go over that and sort of delineate exactly what Lynn is talking about, in terms of the passive gears versus others. The ASMFC staff has the characterization of the bycatch, by gear type. That is something we can look at and there could be a determination that certain gears might be under a cap, which is one of the options here, Option D; incidental catch and trigger, and other gears may not. But since we just left an issue where we're thinking that if we try and change the timeframe from 2009 to '11 to anything else; that we would include the bycatch, you know the 6,000 pound allowance in that. We'll have to sort all that out.

CHAIRMAN BALLOU: I think I followed you. Are you just commenting on the challenge of addressing this issue, or do you have any suggested changes for the document?

MR. O'REILLY: The change I think would be under D, there is a cap. But there are gears that are stationary, and it may be that those gears are treated differently than those that aren't stationary. I don't know how you would word that; because it is really a combination of D and C.

CHAIRMAN BALLOU: I know Megan is scribbling down everything you're saying, and I think she is going to give it her best shot to try to take your suggestion. She's nodding yes, so I think she is going to put her brain to work on that one. Is that good with you for now?

MR. O'REILLY: I think that's fine. I think what the intent here is that we know there has been growth in unexpected fisheries, and we know that in a lot of areas there aren't limited entry, so that growth is going to be there; but how do we address that? One way we already talked about is to include the bycatch as part of the total jurisdiction or state landings.

The second idea is that perhaps there is a cap for those gears that are not stationary, and that the stationary gears really have a situation where they are status quo to the Amendment 2, where you have that 6,000 or 12,000 pounds with two licensees. I think we can work that out later, but that is the gist of it.

MR. THOMAS P. FOTE: Are we overcomplicating this? I mean we're getting into the nuts and bolts altogether. I thought this was a draft amendment to go out for public information. We're sitting here trying to go through all the nuts and bolts that we basically can think of. We're going out to find out what the public thinks we should add to this document, and then we'll sit around and do this.

We could sit here and micromanage what we're going to send out to a public information document. But we're really looking for the comments from the public. As long as we give them a general idea of what we're doing, but we shouldn't be this specific.

CHAIRMAN BALLOU: That is certainly consistent with Adam's comment, and it is a tough balance here. You want to provide open ended questions, but you want to give the public something to go on; in terms of thinking through the various options. It is a balance, and I appreciate the comments on both sides of the table; Tom, a follow up?

MR. FOTE: Is the public going to read that 87 page document it looks like we're putting toge1ther here? It is like when Kirby sent out the stuff on summer flounder, it was concise, it was easy to ready. I even understood all of it. It was not that badly written, but we get too complicated, too many pages, we're going to basically scare the people from actually opening their mouths. I would like to get a shorter document so the public can read it and get the answers of what they want.

MR. CLARK: Sorry to complicate things further, but I was just wondering under what Rob was just talking about, if that could be changed to active and passive gears; because I know a lot of our bycatch comes from drift gillnets, which are not stationary.

CHAIRMAN BALLOU: Any objection, Rob, to active and passive?

MR. O'REILLY: I'll come back to your simplification under the quotas, and there may just be a question. Does stationary fixed gear need to have their incidental catch counted against the states landings or states quota? Maybe that is just a question then, and that would be the easiest thing for people to respond to.

CHAIRMAN BALLOU: I like that thought. Roy.

MR. MILLER: Mr. Chairman, I need your opinion on this. It seems to me that we have to keep our goals in mind here. A problem in our particular state has been that more than 100 percent of our landings have been bycatch. In other words, our total landings have been averaging around 150,000 pounds, yet our quota allocation is, let's say 50,000 pounds; just to round the numbers off. We've got to avoid that. Is what we've outlined in Issue 6 a way to get out of that conundrum, in your view?

CHAIRMAN BALLOU: Well, I appreciate the question. I think you hit the nail on the head, in terms of we are trying to address what has been a very confusing issue in our management program, and that is how we're handling bycatch. I think absolutely, positively, Issue 6 is intended to get at this issue. Again, this is really, I'm not sure I'm prepared to offer a yes or no answer. It is our goal. It is our goal, Roy.

Yes, that is the goal or this issue, is to ensure that we have given the public an opportunity to comment on how we can better address the issue that you just spoke to, in terms of what is

a very important one for Delaware, and frankly up and down the coast. I look to the board for thoughts on whether this is perfectly presented, or whether we can do anything to better present it. But the goal is, indeed, to try to fix the bycatch issue. I'll just leave it at that for now.

MR. SIMPSON: I was going to say, Roy, this is the section I am hoping resolves a lot of this and a lot of the issues of state-by-state allocation; and that's Option F in particular is what I was looking to, to get us out from under that. There is a coastwide set-aside for a subset of gears that we define in this amendment.

Whatever they catch under some determined trip limit, 6,000 pounds or whatever it is. That counts toward this overall set-aside. It is accounted for, but you're not having two-thirds of your catch outside of your quota. Clearly it is part of this coastwide set-aside, and the states are relieved from having to monitor a menhaden quota.

CHAIRMAN BALLOU: Thank you, I think that helped a lot. Other thoughts on this issue, I think we've got two more; the next being Episodic Events Set-Aside Program. Thoughts on that issue as currently presented in the PID. Any suggested changes? I think there is a fairly good range of options offered. Well, actually a fairly good number of questions offered; in terms of it could be better configured. Has the issue been adequately addressed? Seeing no hands; I'm going to assume the answer is yes, and we'll move on to the last issue and that is the Chesapeake Bay Reduction Fishery Cap; any requests or comments regarding that? Seeing none; why don't we pause the board discussion and see if anyone from the public has any comments that they would like to offer to the board on any of the issues as set forth in the PID. Yes in the back.

MS. BICHREST: Hi, Jennie Bichrest from Maine, and I'm also on the AP. I guess I just want to make sure before we leave this meeting today that there are going to be other options back in the allocation, because you have not been that specific. I understand this is just the draft, but I also don't want to leave here today not knowing that there is going to be an option that includes historical landings; because we are one of those states who, we don't have a fishery all the time, but we had huge landings back in the eighties. They were very significant.

I just want to make sure that those years that there is going to be an option in the document that includes those. You've mentioned it in here. But I don't want to leave here today not knowing that the board is at least in agreement that that should definitely be an option provided to the public, because we really got hurt in this. If you don't include some of those years, if you include the most recent years, which I heard somebody suggest, yes those are very still inhibited by the quota reduction and the allocations the way it came out.

We could have had a lot of fish this year, but we thank God, had the episodic event that we could work on. But we could have caught a heck of a lot more fish if we had a quota to begin with. To go with the most recent catch numbers is a joke too, we're still not going to get any quota. I would please encourage you to make sure you've included some that includes some historical landings.

CHAIRMAN BALLOU: I would represent that under Issue 2, Option B, it is called longer time series average. It is an open ended option that would allow for comments on what a longer time series might be. My take is that the document does indeed invite that sort of comment and input on that issue. Thank you for that and I feel comfortable that the document covers it, but that's just my own opinion. If any board member has a different opinion, I'll let them speak to it.

MR. STOCKWELL: I share your level of comfort and want to point out to Jennie that Option C, the weight allocation, also offers two different time periods; one more distant, one more recent. I think we have the options in here to look at alternatives other than at the status quo.

CHAIRMAN BALLOU: Other comments from the public? Seeing none; we'll come back to the board. At this point, well let me just ask, are there any other comments from the board on any other issues in the PID or aspects? Yes, Wilson.

DR. LANEY: I would just ask that we do take the AP recommendation that we add a section on research programs and priorities. I think those, Megan, are already available; or did we already do that? If we haven't done it, you know the AP suggested it, and I certainly would support that. I think we already have those, Megan, you know we do the compilation every two years, I think, of all the research needs; and then we prioritize those for each species. I think that is just a matter of cut and paste from what we already have on that particular topic.

MS. WARE: Wilson, I hadn't looked back at those research recommendations for menhaden, but what I'm hearing just conferring at the table is those might be a bit old for menhaden. But we do have the 2015 stock assessment that had research recommendations. If you're comfortable with that we'll put those in.

DR. LANEY: Yes Ma'am, I am fine with that. Perhaps we might just run those by the TC real quickly, just to see if they have any suggested updates to those.

MS. WARE: I can try and do that, Wilson. Just so the board knows, we're on a pretty tight turnaround time to get this out. The PID does have to be out for 30 days before we can hold a public hearing, and 14 days after. With the holidays that really does put some crunch on this document. The goal is to get it out Monday or Tuesday of next week. I will send an e-mail to the TC, and see if there are any comments, Wilson.

CHAIRMAN BALLOU: Again, this is a PID; this is not the draft amendment. I don't think it's so vital that we capture all the research recommendations; that would be a draft amendment issue. For the PID it is really, should the amendment include research recommendations, and perhaps reference those that have already been offered through the stock assessment and leave it at that. I don't think we necessarily need to have an updated list before the PID goes out, because we're really just scoping the issues, not trying to resolve them as has been noted here today.

MS. MESERVE: Perhaps that section could also address Terry's suggestion, with a question about should part of the quota be set aside for research.

CHAIRMAN BALLOU: I like that combo approach, thank you, good suggestion; anything else? If not, I know Amy, I haven't been looking over my shoulder, but I have full faith and confidence that Amy has been doing a yeoman's job capturing the comments as they've been offered.

What I'm going to ask for is a motion that would be a motion to approve the Public Information Document for Amendment 3 to the FMP for Atlantic Menhaden, including the changes agreed to by the board at its October, 2016 meeting or we could say, with the following changes and list everything that is up on the board.

It is really your preference, in terms of how you want to handle it. I know when we did Amendment 2 I went back and the motion included all of the changes. Whether we just reference the changes and use the record of

this meeting, or whether the motion includes all the changes; that's your call. Robert.

MR. BOYLES: I'm going to take up my colleague, Dr. Rhodes, and suggest that brevity, what is it brevity is the soul of the whit or something**. I would move to approve the Atlantic Menhaden PID, with the additions suggested and discussed by the board here today; and approve it for public hearing.**

CHAIRMAN BALLOU: Is there a second to that? Seconded by Jim Gilmore; so moved by Robert Boyles, seconded by Jim Gilmore to approve the public information document for Amendment 3 to the FMP for Atlantic menhaden, including the changes agreed to by the board at its October, 2016 meeting; comments on the motion. Cheri.

MS. PATTERSON: I would just like to recommend that we add to that that not just these suggested changes, but also editorial changes that you have allowed to continue until Friday.

CHAIRMAN BALLOU: Would you like the motion amended to reflect that?

MS. PATTERSON: Yes, I would.

CHAIRMAN BALLOU: Robert, are you comfortable amendment the motion to include editorial changes submitted to the FMP coordinator by the close of business Friday. That's a wordy motion, but I think that is what I just heard recommended.

MR. BOYLES: Absolutely I would be more comfortable with a substitute, no – that's fine. Yes, I'm comfortable.

CHAIRMAN BALLOU: Jim, as the seconder are you comfortable? Okay, so let's amend that motion accordingly. I like that because it puts a date certain on when the changes need to be into Megan, anything after Friday, close of business too late, too late; other comments on the motion.

Is the board ready to vote on the motion? If so, is there any objection to the motion? Seeing none; the motion passes unanimously by consent. Thank you very much, I thought that was an awesome job working through the document, and away we go with the Amendment 3 process.

TECHNICAL COMMITTEE REPORT
REVIEW OF "THE FATE OF AN ATLANTIC MENHADEN YEAR CLASS"

CHAIRMAN BALLOU: We're on to Item 7, the Technical Committee Report on the paper titled "The Fate of an Atlantic Menhaden Year Class," and for that I will go to our TC Chair, Jason McNamee.

MR. McNAMEE: Hello, so I have a brief presentation here, I'll try to go real quick. We had a Menhaden Technical Committee Conference Call, and that is what this is in reference to. We reviewed the updated analysis for the paper, The Fate of an Atlantic Menhaden Year Class by Peter Himchak. We had originally reviewed this analysis that Mr. Himchak did back in June.

We gave him some feedback, we also offered that feedback to the board, and then in August you all requested that we catch back up with Pete, he had worked on the feedback, incorporated I think a lot of it, and so we re-reviewed it. The Technical Committee commended Mr. Himchak's efforts to analyze impacts of fishing mortality on the menhaden stock.

We also appreciated the fact that in this, one of the things we had offered him was, it was important to include natural mortality in the updated analysis, which he did. We're just going to offer a couple of additional thoughts. It is important to understand that this analysis

provides one perspective on how a hypothetical year class erodes over time.

But it would be helpful to provide a parallel calculation, which focuses on the mature portion of the population. Just to get into a little more detail on that. Menhaden reach 50 percent maturity at Age 2. The roughly 13 billion fish, which are removed from the population, due to natural mortality, before they mature; never really contribute to the recruitment of the stock. They are not involved in that part of the population dynamics.

We felt it was more appropriate to understand the harvest as a percent of the mature population and not the entire population, including the juveniles, the young-of-the-year in those earliest years. Additionally, given selectivity, a focus on the ages 2 and older, this would address our previous recommendation of evaluating the impact on the harvestable portion of the population. That was a piece of feedback that we had given Pete before as well. The analysis highlights the large impact that natural mortality has on the juvenile portion on the menhaden stock. You can see that in the analysis that Mr. Himchak did.

But it is important to put that in context, and so while the estimate of M at age from the 2015 benchmark assessment is the best available science, that is why we used it. There is still a lot of uncertainty in this calculation, in fact its time and varying in a way that we used it, and we know that is not the case.

As a result, the calculation of M in the analysis is only as good as the estimates from the assessment. These calculations of M, thinking kind of down the road a little bit, could be improved, and hopefully, we'll have some better information on natural mortality; based on the work being conducted by the biological and ecological reference point working group.

Just a final slide here, and as I kind of reread this, it sounds kind of finger waggy, and that is actually not how we meant it, it was actually more of a constructive comment from the TC. I'm not going to read any of these, but I'll offer you what we actually meant. We received this analysis kind of without much context, and so what we were struggling with was how to approach our comments.

We certainly offered feedback back to Mr. Himchak that was obvious enough. But if there had been some larger context, if the board was thinking about this analysis, they wanted to, I don't know, just to offer an example, use it as a model external type of analysis that you wanted to look at. That could have focused our comments a little better. In the end what we want to provide you is what you want to know from our review, and so that's what those bullets mean there. With that I'm happy to take any questions anyone has.

CHAIRMAN BALLOU: I know Mr. Himchak is here, and I would like to invite him up to the microphone to just offer some brief comments. Pete.

MR. PETER HIMCHAK: Thank the Commission and the Technical Committee for affording me the opportunity to get grilled during two webinars by the Technical Committee. It is not something I would like to do on a regular basis. But this product came out in February; I did it for the Menhaden Fisheries Coalition.

Basically, I mean I set at this board for seven or eight years, and the numbers are mind boggling; the numbers of fish in the population at each age, the harvest at each age. It is all in the assessment document. What I was trying to do is put some context in 1 percent or a metric ton. How many fish is that and what does that represent in the overall scheme of the population?

I took the assessment document, you can follow any year class, and I recommend you do this. You take the SEDAR 40 document, you follow a year class from 0 to 6 plus, and you look up the reduction landings from 0 to 6 plus, and you'll come up with some analyses like this. You'll see, well we started out with 15.4 billion zeros that were recruited to the fishery, and we ended up with 171 million six year old fish.

Well, what happened to all the other fish? There were just under a billion, just under a billion were harvested from primarily 2, 3, 4, and 5s. Where did all the other fish go? I agree with the Technical Committee. You want to look at fishing pressure. Certainly the two to four year old fish, that is where the Fs are calculated, that is most appropriate. But my message was more to define what the ecosystem is taking out of a year class.

If you look, and again I welcome you to just take the assessment document, it is not complicated math, by any means, and track a year class. You'll find that you lose 10 billion or so going from 0s to 1s. Well, where do they go? Natural mortality, and yes the data are only as good as what's in the assessment document. But I mean that is what exists.

In essence I agree with the Technical Committee on their first bullet. My responses are in a six page document that is in the supplemental materials. I welcome you to read that. Yes the TC was reining me in on exploitation rates. I didn't want to go there. Basically we came to an understanding, I think. My message was a little more based on the year class and not on the fishery. As far as assessing fishing impact, all I did was measure what occurred over a ten year period, from 2004 to 2013. That's all I did. I'll take any questions.

CHAIRMAN BALLOU: Thank you, any questions for either Jason or Peter? Seeing none; is there any further tasking that the board would like the TC to undertake on this issue? Emerson.

MR. HASBROUCK: Not directly related to this issue, but someone tangential to it. I don't know if the request is better directed to the Technical Committee or to the committee looking at the biological, ecological reference points; that working group. I'll raise it now. You can direct it wherever you feel it most appropriate, if you feel it's appropriate.

Something I've been thinking about relative to an ecological approach to menhaden is, how do we explore the impact that menhaden has on other species? We know that menhaden are filter feeders, and they graze on plankton. But some percentage of that diet is ichthyoplankton. They are being distributed further and further along the coast now.

What I keep thinking about – and I've tried to look into this and haven't gotten very far – is what is the impact on other species, things like striped bass, weakfish, maybe tautog; other species as well? What is the impact of grazing on ichthyoplankton, of another species, of a larger and larger biomass of menhaden? How do we get at that and how is it relative to this ecological approach discussion?

CHAIRMAN BALLOU: Jason.

MR. McNAMEE: I appreciate the thought. I'll say a couple of things. There is some information on what menhaden are filtering by way of particle size and things like that. I don't know if it gets down into species specific stuff, but folks like Kevin Friedland and other researchers have looked at this.

It is certainly something we can look at. I think in a very, not as a specific way as you're thinking about, Emerson, but one of the things that we're working on with the BERP group is feedback. As prey populations decline there is often believed to be a feedback that will then have the predator population decline. I think we mainly think about it by way of constraining growth and that. But there may be something

we can think about there; all of that being said, it's very interesting. It is really not an element of what we currently have on our plate that we're analyzing for this current push. I'll just offer there is potentially something there; we're not working on that specifically right now. If that were something that people wanted to look at, I would suggest you might want to let us get through this first sluggo work before we add in new elements. But it is up to the board.

MR. HASBROUCK: Yes, I realize that it's not something that the Technical Committee is currently working on. It is just something that I've been thinking about in terms of the grazing potential, if you will, of menhaden on ichthyoplankton and how that may affect other species. It is part of an ecological approach. How we get at that and how we utilize that I am not sure. I guess the first step might be for the Technical Committee to provide some guidance back to the board on how we can do that.

CHAIRMAN BALLOU: Does the board wish to task the TC with following up on Emerson's suggestion? I would like to get some comments on that. Bill.

MR. GOLDSBOROUGH: This issue was brought up several years ago, was looked at, and was, if I'm not mistaken, considered to be not a significant problem. But if it is going to be looked at, I guess I would suggest that we look back at the record of that deliberation and whatever analyses did take place at the time. I probably have some of that in my file, so I could take a look too. But it was not considered to be a big issue when all that work was done. I did have another comment on Mr. Himchak's paper when it's appropriate.

CHAIRMAN BALLOU: I'm going to come right back to you on that. My sense, Emerson, whatever Bill was just referencing will be pulled out, provided to the board and then we'll circle back to this issue after we've had a chance to digest what's already been done; and then we'll sort of see how that looks, and whether we feel like it is something that we want to pursue.

Does that make sense as a short term response? Okay, I see a nod yes. Bill, if you don't mind, if you could provide Megan with what you have or what you know of. We'll do our best to circulate that to the board and we'll revisit this at a subsequent meeting. If anyone has any objection to that approach, let me know. If not, I would like to proceed in that way. Bill, you had another comment?

MR. GOLDSBOROURH: Yes. I just wanted to comment that I think there is value in looking at menhaden abundance, as Mr. Himchak's analysis did, and note that that is something that the conservation community has advocated for many years, because it is the general view that numbers of prey is really the most important variable for predators.

One option would be to evaluate the degree to which reference points could be constructed around abundance, but we've never seen an avenue toward that; so maybe it's not really feasible. But I did want to note though that if we look at the results of the last assessment, the terminal value for abundance is near the all-time low. Our current state, as it were, is not good in terms of numbers of menhaden. The ecosystem does feel that effect.

CHAIRMAN BALLOU: Rob.

MR. O'REILLY: I just wanted to, if I may, Mr. Chairman, ask Jay a question. One of the slides, Jay, indicated that the biological and ecological group will be working towards a better understanding of natural mortality. With the work that was done by Mr. Himchak, is it your take from the Technical Committee process that there is a stimulus provided by that paper that Mr. Himchak did?

MR. McNAMEE: How to answer this. I guess what I'll offer, Rob, is what Mr. Himchak did

was use the natural mortality that was already in the assessment. That is what he applied to it. I don't mean to denigrate what he did by any means, I'm just saying it's sort of, he took that from the assessment, he said that himself. He didn't offer anything new with regard to natural mortality, I guess. Maybe I could say it that way.

CHAIRMAN BALLOU: Additional comments, seeing none; I think we'll move on. There is one more comment? Oh, David, sorry I didn't see your hand.

MR. BUSH: No worries. Quick question for you, I remember in one of your earlier portions of the earlier presentation. You had mentioned the potential for an allocation shift if we were to deal with it in the future that selectivity that leads to a stable recruitment event might be changed. I don't know if you've put anything out on that already, and I apologize if I haven't caught it yet, but maybe that might be something for folks to take into consideration when considering an allocation change as well. That might be a little off the beaten path, but I figured I better ask.

CHAIRMAN BALLOU: Okay, thanks, duly noted. Before we move on to the next item, I failed to sort of do my little quick wrap up on the PID. Pardon me for jumping back one item, but I'm not jumping back to the PID item. I just want to make sure the board is clear on where we go from here. Megan will aim to finalize the document by next week. I will seek the assistance of our Vice-Chair Russ Allen in reviewing the final document, to ensure that it accurately reflects all of the changes agreed to by the board today. Megan will then need to quickly coordinate with state directors on hearings.

If you wish to hold a hearing on the PID in your state, please let Megan know ASAP, ideally by the end of this week, if not sooner. Within the next week or so, a public notice will be issued with a link to the final document, and listing the dates, times and locations of all the public hearings. This is going to roll pretty quickly, and Megan does need to know as soon as possible.

She wasn't suggesting we do a show of hands now, she just was asking that you please contact her within the next day or two, if possible, to let her know whether you would like to have a public hearing on the PID in your state. Again, I wanted to let you know that Russ has agreed to assist me in reviewing the final document to make sure that it's good. We're going to roll with this thing. I think the goal is to have all the public hearings completed by the end of the calendar year, is that accurate?

MS. WARE: Yes, I'm hoping by before Christmas. That will give us enough time to enjoy Christmas, and then also for the public comment period to wrap up and be able to summarize the written comments we received.

BERP WORKING GROUP PROGRESS REPORT

CHAIRMAN BALLOU: Thank you, and again, my apologies for forgetting to wrap that into the end of our items; back to the order of the agenda. We are now onto Item 8, which is a Progress Report on the status of the BERP Working Group's efforts to develop ERPs for Atlantic menhaden. Shanna.

MS. SHANNA MADSEN: I see we're all saving the best for last here. To start off with, I just want to put a slide up, kind of reminding everyone of the BERP Work Group's timeline over these next few years; and this coincides with the timeline that Megan had given you earlier. As a reminder, last year we had reported out on the outcome of the Ecosystem Management Objectives Workshop, which established management objectives moving forward for menhaden.

After that point, the BERP had a meeting where we kind of identified the intersection of those goals and objectives, and the actual modeling

approaches that we were considering. From there we kind of honed down those modeling approaches, selected a few, and we presented those to the board.

The board did recommend that the BERP move forward with those modeling approaches, so we actually met this past March to put together a general timeline that I presented to you during spring meeting week. The first thing that I have up there is kind of a big, red reminder that this is the first time that we're really attempting to do this level of multispecies modeling to generate ERPs.

The timeline that we have up there is a very ambitious one. We're essentially doing multiple models with multiple species in the same timeframe that you typically do a single species assessment. I just really want to take the time to kind of point out that the group that I'm working with is an amazing group of people.

They're working really hard. We understand how imperative it is for the board to have these answers, and we're trying to go as quickly as we possibly can. If you want to make people go faster, I suggest maybe we give everybody raises; but that's beside the point. I am very cautiously confident in our ability to get this done by 2019, and have it wrapped up and go to peer-review with a BAM model.

To start off with what we decided to do, is that we're going to hold modeling workshops. Essentially, this is a way to give the committee some time to get to know these new modeling approaches. They're very novel. We have some that are being externally developed, so it gives us some time to sit down, understand the back end of these models and kind of tear them apart and provide some suggestions.

We started that off this year in 2016 with the Steele-Henderson Workshop, which was completed back in July; and I'll talk about that in just a second. I have two more scheduled for next year. One is our multispecies statistical catch-at-age model. That one is being developed by none other than Jason McNamee.

We have another production model in development externally that we'll also be reviewing in 2017; that is the TVR workshop that you see up there. In 2018 we anticipate probably having about two data workshops. Again, I know this is a little bit different than what you're used to seeing, reason being that we'll need probably two data workshops, because we're compiling data for so many different species, not just one. That's going to take some time and some vetting. Then in 2019 we anticipate being able to get through our assessment workshops, and eventually put that all through to the peer review with the BAM model at the end of 2019.

A brief update on what happened at our July modeling workshop. As I mentioned earlier, we were focusing in on our Steele-Henderson Production Model. We had a subcommittee that was essentially trying to convert this modeling approach to a format that was a little bit more easily accessible to the rest of our committee, so they could take the time to really sit down and look at the model and understand it.

We vetted that model very thoroughly. I have to say it took some time. I know, Bob, you sat in and listened in on that one. We tested the stability of the model and made some suggestions for the model set up. At the end of that meeting the group decided that we wanted to try and shift that model into another framework, and some of our other leads are working on doing that right now.

We heard a couple of updates from some of our external models that are being developed, as well as had an update from some of our other modeling leads. From there, we had a call in October, and we ran through modeling

simulations with that external production model that Dr. Jenny Nesslage is working on.

Our near future plans, we will be having a call; I think I set that one for December now. I wrote this before I set that call. We have a call in December to discuss further progress on that Steele-Henderson Model. From there, moving into next year, we hope to hold our next modeling workshop to review Jason's model; obviously once he's all wrapped up with his dissertation, so no pressure, Jay.

As we previously outlined before, we're going to try to make sure that we keep you guys completely informed of the situation each May, meeting week, and each meeting week that we have during annual meeting; just letting you know where we're at and keeping you in the loop on everything that we've been working on. With that, I would be happy to take any questions.

CHAIRMAN BALLOU: Questions for Shanna? I think it is hopefully abundantly clear that we have a process going on that does not sync with the Amendment 3 process. We just have to ensure that we're going forward with eyes wide open, and I think these regular updates help remind the board as to where this process is, and what the timeline is associated with it.

I appreciate the update; any questions for Shanna? Seeing none; we're on to our last agenda item.

REVIEW AND POPULATE ADVISORY PANEL MEMBERSHIP

Maybe if one of you guys wants to allow Tina Berger to come up, I would like to have her joint us up front for this last item, AP Membership. There are two issues to be addressed by the board; one is nominations to fill current vacancies on the AP. I believe there are eight nominees being recommended to fill existing vacancies.

Then there is a request from Virginia to add a third seat; that being a nontraditional stakeholder with experience in all sectors of the fishing industry, recreational, for-hire and commercial. That request requires the board to evaluate the current configuration of the advisory panel, and decide how it wants to proceed. We may need two motions on these two separate but related issues. But I just first want to take a quick step back and review where we are with regard to the configuration of the Menhaden AP. I actually did a little work here on looking at how it's currently configured. If the eight nominees pending before the board are all approved, the AP will have a total of 24 members; 11 commercial, 10 recreational, 2 what I would call sort of hybrids, they are both commercial and recreational, sort of a combo there, and 1 conservation.

One state will have three members. Seven states will have two members. Seven states will have one member, and one state will have no membership on the panel. That's the current configuration. My read is that that represents a pretty good balance on the AP with regard to recreational and commercial representation, but there are some obvious differences in the number of panelists from each state.

What is the pleasure of the board? Is the board comfortable with the current configuration? Is the board comfortable with the eight nominees? How does the board want to handle the request from Virginia to add a seat? I am intending those to be thoughtful questions, because I think we need to kind of come to terms with sort of the two pieces there.

One is the current nominees that have been put forward. By the way, I failed to note, I think, the excellent job that Tina did with her memo that essentially addresses these same issues, and offers the board some ways forward. Now is the time to offer thoughts on a way forward. Robert.

MR. BOYLES: I don't have the benefit of having done work, and I appreciate your laying that out for us. My reaction is 24 members on the advisory panel is a very, very large advisory panel; to say nothing of who is on the panel or who is potentially going to be appointed. It makes me go mmm, we have that many folks. I'm grateful again for as much interest, but I wonder is that a good number? It seems high to me.

CHAIRMAN BALLOU: Of course, this being a coastwide resource that we're managing, it seems no surprise that this might be one of the larger APs. But I take your point. Other thoughts on the issue, and I'm happy to take this in the form of two separate motions, one being a motion on the eight nominees that are before the board for consideration, and then a second motion or discussion on the Virginia request. Actually, let me go to Dr. Duval, and then I'll come back to you, Bill.

DR. DUVAL: I am prepared to make a motion with regard to the eight nominees. I did just want to, before I do that, quickly say that North Carolina, we are one of the states that has two seats; but if these nominees are approved, we will have only one appointee to the advisory panel. Our open seat would be a commercial seat.

Given the interest, I would still want the opportunity to be able to fill that. **With that; my motion is move to approve Bob Hannah, Patrick Paquette, Dave Monti, Meghan Lapp, Paul Eidman, Leonard Voss, Peter Himchak and Scott Williams to the Atlantic Menhaden Advisory Panel**.

CHAIRMAN BALLOU: Is there a second to that motion? Seconded by Bill Adler, moved by Dr. Duval and seconded by Bill Adler to add the eight nominees, whose names are up on the board right now? Discussion on that motion, Nichola.

MS. MESERVE: If this motion is approved, then it looks like Virginia will have two commercial representatives, and I was just looking for some staff input on what the recommended split is, if there are guidelines for that.

MS. TINA BERGER: Yes, I will note that of their representatives, Jimmy Kellum represents both, even though it is not specified here, the purse seine industry, so it is reduction and he also is bait industry. He represents sort of two sectors. Then one Peter Himchak obviously would represent the reduction fishery. Then Jeff Deem is a recreational. There is a difference in representation based on those three, and it is up to the board's pleasure how they want to proceed on that.

MS. MESERVE: Just to follow up, from the paperwork it looks like Jeff Deem is being appointed as a nontraditional stakeholder, but it sounds more like Virginia is looking to add a third seat that would be more of a recreational for-hire seat, which I'm more comfortable with, given Mr. Deem's background. It doesn't seem to fit the nontraditional role, in my opinion.

MS. BERGER: Yes, as staff explored and really looked at where Jeff Deem best fit, it was our initial thought that it would go under a nontraditional, but as we thought about it, other recreational fishermen are represented on the panel and he fits into that pretty well, so that's why our recommendation at a later point was that Virginia include him as a third representative.

CHAIRMAN BALLOU: Cheri, did you have a comment?

MS. PATTERSON: Yes, my comment was going to refer to Jeff being a recreational person and not a nontraditional. I think we should just call a spade a spade, and make sure that they're placed in the appropriate category.

CHAIRMAN BALLOU: I just want to remind the board that that issue is going to follow. The motion currently up on the board does not address that Virginia issue. That is going to follow with a subsequent motion. Bill Adler.

MR. ADLER: Speaking of Jeff Deem, he is not on that thing. Is that deliberate? He is not on that motion.

CHAIRMAN BALLOU: No, we're going to vote on two issues. The first is eight nominees to fill eight existing vacancies, and then a second motion to create an additional position on Virginia for Jeff Deem. On the motion that is up on the board, John.

MR. CLARK: Sorry to delay this further. I just wanted a clarification. I noticed that most of these applications only have one signature from commissioners on it, and the form requests all three commissioners to sign on that. That is not something you're requiring, you just want to get that?

MS. BERGER: You know procedurally it is difficult to get all three commissioners to literally sign the document. What we ask is that the submitting person, with their signature they have spoken to the other commissioners and have the consent of them in the signing of that document.

CHAIRMAN BALLOU: I'm sorry, to that point I'll note that two nominees from Rhode Island were both agreed to by all members of the Rhode Island delegation. I don't think we signed the sheet, so our bad, but it is to Tina's point that that is the expectation. It was fulfilled in spirit, not in letter in our case. Other comments on the motion, Adam.

MR. NOWALSKY: I'll offer the same comment with regard to New Jersey's nominee. The same happened there.

CHAIRMAN BALLOU: It sounds like all the nominees have been advanced with the full support of the state delegations that have nominated them. Any further discussion on this motion? **Is the board ready for the question? Is there any objection to the motion? Seeing none; the motion is approved by consent** and we now need a second motion on, I see Rob O'Reilly's hand up.

MR. O'REILLY: Yes, I think Jeff Deem being a for-hire guy; he would be very surprised about that. Let me tell you a little bit about Jeff Deem. Jeff Deem has served two different three-year terms on the Mid-Atlantic Council. He has also been the Chairman of our Finfish Advisory Committee at VMRC for about six years.

He was an instrumental force with the wind energy development that didn't happen, but a lot of work was done there. He is involved in a lot of environmental issues. What happened, there was a bit of confusion on my part when I received the roster from Tina and I saw all these different names. I even thought, well Ken Hinman is a Virginian, so he is one of our members.

Obviously, in terms of what we had in the past, we've always had one from the reduction fishery and one from the bait fishery; although Mr. James Kellum does do a little bit of both, but primarily has the bait interest. I thought with us moving forward with Amendment 3, I really would like to see Jeff Deem involved, because we're going to be going to areas that we haven't been before; in terms of the biological and ecological reference points.

Mr. Deem is very savvy about a lot of those issues, so that is where the third nominee came from. At first I didn't know it was going to be a third nominee, but working with Tina, I finally straightened that out**. That is a little bit about Mr. Deem, and I would certainly move to add him as a third member for Virginia.**

CHAIRMAN BALLOU: Do we need to clarify the nature of that position, Tina?

MS. BERGER: I think your discussion is clear.

CHAIRMAN BALLOU: **A motion has been made to appoint Jeff Deem, from Virginia, as a third member from Virginia to the Atlantic Menhaden Advisory Panel. Is there a second to that motion? Seconded by Nichola Meserve; any discussion on the motion? This would be creating a third AP position for Virginia and filling it.** It is doing two things, creating the third position and filling it with Jeff Deem. That is the two upshots of this motion, if I understand it correctly; discussion on the motion, Dave.

MR. SIMPSON: He certainly sounds like a good individual to add. I'm just wondering in terms of policy and for other boards, I thought our policy or rule was that there were a maximum of two per state, but Tina is saying no. If this doesn't create a president for other boards then I am fine with it.

MS. BERGER: Actually, when the AP was created, there was a different number of seats per state based on the needs of those states. It's not always a standard two per state.

CHAIRMAN BALLOU: Any further discussion on this motion? **Is there any objection to the motion? Seeing none; the motion is approved by consent, and I believe we have reached the end of our meeting**.

ADJOURNMENT

CHAIRMAN BALLOU: Is there any other business to be brought before the board? Seeing none; is there any objection to adjourning? Seeing none; we are adjourned. Thank you very much.

(Whereupon the meeting adjourned at 6:01 o'clock p.m. on October 26, 2016.)

Socioeconomic Analysis of the Atlantic Menhaden Commercial Bait and Reduction Fishery

EXECUTIVE SUMMARY

January 2017

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1. Overview

This document summarizes the primary findings from a study to characterize the socioeconomic dimensions of Atlantic menhaden fisheries stakeholders. Collection and analysis of primary and secondary data, both quantitative and qualitative, are used to describe the Atlantic menhaden commercial and recreational markets. All data were collected in 2016. The study addresses the distributional consequences of management change on the Atlantic menhaden commercial bait and reduction fisheries. Outputs include analysis of industry economic impacts, industry composition and salient themes, and public opinion surveys.

2. Industry Economic Impacts

Given data limitations and the focus on menhaden quota during 2015 we direct our analysis to the economic impacts of alternative menhaden quotas. Economic impacts are the changes in income that arise from changes in economic activity. In this draft summary we are only reporting direct expenditures (i.e., impacts).

We analyze several secondary data sets that were provided by ACCSP and NMFS Beaufort Lab. The ACCSP provided three data sets. The first data set contains county level annual landings (pounds, dollars, trips) from 1985 to 2015. The second data set contains county level annual landings (pounds, dollars, trips) and disposition (bait, reduction) from 2000 to 2015. The third data set contains state level annual landings (pounds, dollars, trips) and disposition (bait, reduction) from 1950 to 2015. Value data is not available from 1950 to 1961.[1]

The economic analysis that can be supported by these data is limited, relative to that described in the proposal, due to missing variables. The data can be used to assess trends in landings, ex-vessel prices, effort, technology (i.e., catch per unit effort) and their interrelationships.

[1] There are two other data sets available for analysis. The NMFS Beaufort Lab provided data on the reduction fishery from 1985 to 2015. ACCSP provided effort in the bait fishery for Virginia. While analysis of these data can potentially provide information on production and technological change, these data are of limited use for this project since they do not contain any economic variables (price, cost) or identifiers for linking with the other data sets.

Given that the second data set includes disposition of landings and covers the time period over which data is considered most reliable, we have focused most of our attention here. The sample size is 1546 county/year combinations. Sixty-one percent of these are for bait, 14% are for food and 21% are unknown. The remaining 4% include personal use (n=28), reduction (n=21), kept (n=5), no catch (n=3) canned pet (n=1), animal food (n=1) and aquarium (n=1). For the entire sample there are 3.6 million tons of menhaden landed. The bait and reduction fisheries account for 16% and 74% of the total landings. The unknown disposition accounts for 8% of the landings. The remaining 2% include personal use, kept, no catch, canned pet, animal food and aquarium landings.

Given that the reduction fishery is a vertically integrated industry, we focus our analysis of the determinants of ex-vessel price on the bait fishery. In order to analyze the data as a panel (i.e., cross-section, time-series) we exclude any county that appears in the data only once (n = 25 counties) and several that are coded "unknown".

We delete a number of outliers in order to improve the analysis. First, we delete one observation with a catch per unit effort (CPUE = pounds/trips) that is greater than two times (2.1 million pounds) the next largest (0.9 million pounds) CPUE. Second, we observe that there are a number of cases with high ex-vessel value per pound. The ex-vessel price per pound is approximated by dividing ex-vessel revenue by pounds landed. We adjust for inflation by the consumer price index so that all values are expressed in 2015 dollars. The mean price over 840 observations is $706 per ton with a range from $0.10 to $22,000. In order to trim outliers we consider the state level annual distribution of prices from the third data set. We delete all of the county level observations in the 1% tails of the distribution. Fifty four cases are deleted with a price per ton greater than $1478 and 5 cases are deleted with a price per ton less than $79.

The sample size available for analysis is 777. The number of counties with menhaden bait landings varies from 41 (year 2004) to 55 (year 2015) by year. The mean price is $265 per ton with a range from $82 to $1476. The mean tons landed is 673 with a range of 0.001 to 29,626. Considering the reduction fishery (n=21), the mean price reported in the ACCSP data is $172 per ton with a range from $135 to $234. The mean tons landed is 128 thousand with a range of 5942 to 222 thousand.

We estimate an inverse demand ex-vessel menhaden bait price function of the form: $P_M = f(Q_M, P_H, Y)$, where P_M is the menhaden ex-vessel bait price per ton, Q_M is menhaden landings (in tons), P_H is the herring ex-vessel price and Y is income. The menhaden price is the annual price per county. The herring price is the annual price for all Atlantic Coast landings and obtained from the National Marine Fisheries Service commercial fishery statistics. Income is measured as U.S. Gross Domestic Product.

Since market price is determined by both demand and supply we estimate the model as two-stage least squares with menhaden landings corrected for endogeneity. The predictive equation for landings is $Q_M = f(P_H, Y, T_M, G)$ where the instrumental variables are menhaden bait trips, T_M, and gear, G. We approximate gear by coding a dummy variable equal to 1 if the catch per unit effort is greater than the 90% percentile (15,507.25 pounds) in an attempt to capture purse seine trips.

Each of the models are estimated using the unbalanced panel data. We include county level fixed effects to account omitted variables. The functional form is log-linear which allows the regression coefficients to be interpreted as elasticities. The regression model is:

$$lnQ_{Mit} = \alpha_i + \alpha_1 lnP_{Hit} + \alpha_2 lnY + \alpha_3 lnT_M + \alpha_4 G + e_{it}$$

$$lnP_{Mit} = \beta_i + \beta_1 lnP_{Hit} + \beta_2 lnY + \beta_3 \widehat{lnQ_M} + u_{it}$$

where the hat (^) indicates the variable is predicted from the landings model.

In the landings model, the coefficient on the herring price is negative and statistically significant. This indicates that as herring prices rise (fall), menhaden landings decrease (increase).[2] The coefficient on income is not statistically different from zero. Each of the instrumental variables are statistically significant in the landings model but statistically insignificant in the price model. Landings are positively related to the number of trips and gear.

In the price model the coefficient on the predicted landings is statistically significant. The coefficient indicates that a 10% increase in landings leads to a 0.4% decrease in price. The coefficient on the herring price is negative and statistically significant indicating that an increase in the herring price leads to a decrease in the menhaden price (and vice versa).

These results will be used to estimate the economic impacts. We initially assume that reduction fishery ex-vessel price is also insensitive to landings since there is little variation in price, relative to the bait fishery, and too few observations to estimate a model. The National Marine Fisheries Service reports menhaden landings of 442.8 million pounds and $41 million ex-vessel revenue in 2015. The average price per pound is $0.0926. Considering a stylistic 10% quota increase would lead to 44.28 million additional pounds landed and a price of $0.0889; the direct economic impact would be an additional $3.94 million in ex-vessel revenue on the Atlantic Coast. Type I and II RIMS multipliers have been ordered from the Bureau of Economic Analysis. These will be calibrated with the economic impact analysis in Kirkley et al. (2011), which uses an IMPLAN model developed for the commercial fisheries of the United States (Kirkley, 2009). Once calibrated, the additional ex-vessel revenue at various menhaden quotas will be multiplied by the sector specific Type I and II multipliers to estimate the direct, indirect and induced economic impacts.

3. Industry Composition and Salient Themes

Primary data, both quantitative and qualitative, were collected to characterize the socioeconomic dimensions of Atlantic menhaden industry members. Interview and survey data were collected in order to describe industry vessel and gear characteristics, sources of employment, level of participation in the menhaden fishery, subsidies, exits, and substitute products. The survey and interview instruments also were designed to collect information on recent market changes, 2013 state quota impacts, and industry members' fishing communities. It should be noted that interviewees and survey respondents represent those currently in the industry; data were not collected on anyone who may have exited the industry.

3.1. Industry Interview Data

Semi-structured interviews were conducted with 43 Atlantic menhaden commercial fishermen, bait dealers, and bait users in seven states – Maine, Maryland, New Jersey, New York, North Carolina, Rhode Island, and Virginia. Ten additional interviews were conducted with management personnel from Atlantic menhaden fishing and processing facilities (bait and reduction fisheries), as well as with purchasers of reduction oil and meal products. The interviews were summarized by coding the data into salient themes. Themes were primarily related to three topics: market changes, 2013 state quota impacts, and the fishing community.

[2] This result is counterintuitive. We are currently investigating the relationship between herring prices and changes in the menhaden total allowable catch.

3.1.1 Characteristics of Interviewees

Interviewees were categorized as working in small-, medium-, or large-scale operations according to the number of employees and vessel crew. Operations employees may be full or part time; many are seasonal. Small-scale operations (0-2 employees) characterized 14 interviewees, medium-scale operations (3-9 employees) characterized 10 interviewees, and large-scale operations (10+ employees) characterized 19 interviewees. Large-scale fishing operations generally use purse seines, while small- and medium-scale fishing operations rely on gill and pound nets.

3.1.2 Market Changes & 2013 State Quota Impacts

On the topic of market changes and 2013 state quota impacts, interviewees noted six salient themes: 1) *Increased Stock,* 2) *Increase in Bait Demand,* 3) *Increase in Oil & Meal Demand,* 4) *No Personal Impact due to State Quotas,* 5) *Disparate State Impacts due to State Quotas, and* 6*) Decreased Landings & Depressed Incomes due to State Quotas*. What follows are interviewees' observations on each theme.

Increased Stock
Interviewees noted increased stocks of Atlantic menhaden over the past few years. A Maryland fisherman explained, "I turn more loose than I can keep." Sizeable schools reach Maine waters, which was not the case just a few years ago. Fishermen attributed various factors to the stock increase, including the cyclical nature of most fisheries, warming waters, and state quota decreases -- a 20% reduction of the Total Allowable Catch (TAC) from the 2009-2011 catch average -- instituted in 2013. Many attested that the increased stocks are evidence that the Atlantic menhaden fishery is healthy and not overfished. They described fish kills that have occurred as a result of the preponderance of menhaden schools and lack of oxygen when they come inshore to avoid predators. New York and Rhode Island fishermen reported using the episodic event allowance to catch more than their initial quota allocation and harvest fish when a fish kill is occurring or eminent.

Increase in Bait Demand
Fishermen and bait dealers attributed increased demand for menhaden bait to shortages of other forms of bait, primarily herring. Accordingly, they were developing new markets for menhaden bait. Increased demand for menhaden bait frequently was associated with Maine lobster fishermen and the bait dealers who supply them. A New York fishermen/bait dealer explained how he spent time developing new markets saying, "I spend more time selling than fishing." Concerns over bait market saturation were raised by some interviewees: What is the ceiling on bait market demand? The increase in demand for menhaden bait corresponded with quality and cost concerns, as bait buyers in the New England states purchase bait primarily from New Jersey and other Mid-Atlantic states. Bait had to be stored, flash-frozen and refrigerated or salted, leading to product inconsistencies. Trucking costs were also significant according to interviewees, doubling bait cost depending on the distance. Fishermen and bait dealers believed that higher demand and the decrease in menhaden bait supply due to state quota decreases have led to increases in the price of menhaden bait.

Increase in Oil and Meal Demand
Menhaden oil and meal producers and purchasers cited growth of global aquaculture, animal feed, pet food, and human supplement industries as the key factors in stimulating reduction product demand. They stated that demand for healthy sources of protein will only increase with global population growth. They contended that the only suitable alternatives to menhaden oil and meal for these industries is oil and meal from another fish species, typically anchovies from Peru and Chile. Most non-fish oils (e.g. rapeseed, flaxseed) were considered poor substitutes due to lower protein and omega-3 fatty acids contents; their lower prices reflect this. Algal oil was suggested as a viable substitute but current production costs are too high to be competitive. Purchasers noted increasing prices for menhaden oil and meal in the past ten

years. A menhaden meal purchaser who supplies animal and aquaculture feed companies explained, “It [meal price] adjusts according to major trends. In 2008, there were a lot of meals on the market, so the price was lower.” Some menhaden meal purchasers reported price increases in the range of 70 to 150 percent since that time. Menhaden oil and meal purchasers explained that U.S. menhaden is considered a stable market compared to products available in other countries. Consistent product availability and quality has made menhaden oil and meal desirable products.

No Personal Impact due to State Quotas

Fishermen satisfied by the bycatch allowance -- 6,000 pounds of menhaden per day -- often had not experienced any personal impact after state quotas decreased in 2013. These small-scale fishermen relied on gill and pound nets and often fished for multiple species. Commercial bait dealers who buy and sell a more diverse mix of species also reported not being impacted by the state quotas. A North Carolina recreational bait dealer explained how he deals with many species, “I sell such a small percentage [of menhaden].” Fishermen not impacted by the quota often fish for menhaden to use as crab and fish bait; menhaden was not the ultimate species they target. Some fishermen not impacted did sell menhaden for commercial bait markets. Those selling to bait markets even saw some financial gain as bait prices increased since the 2013 state quota decreases.

Disparate State Impacts Due to State Quotas

When the new state quotas were instituted in 2013, some states lost a disproportionate amount of their TAC according to interviewees. The quota decrease resulted in overall trust lost in the fishery regulatory process by fishermen and bait dealers alike. A Virginia fisherman described his perspective saying, “They’re cutting you, and for what reason? Where’s your science? No science. It was very unjust.” Due to past-underreported landings, some states suffered in the allocation process because their TAC was based on reported historic landings. A relaxed reporting environment and fears of regulatory intrusion had contributed to a culture of underreporting according to small-scale fishermen in New York, Maryland, and New Jersey. A New Jersey fisherman gave an example saying, “You’ve got a lot of little guys in the [Delaware] Bay that catch their own bait for crabs and they weren’t required to report that.” The bycatch allowance ameliorated some initial concerns, as long as the fisherman did not require more than 6,000 pounds of menhaden per day for his operations. Menhaden bait dealers and users from states with a small proportion of the TAC and increased menhaden bait demand in recent years felt especially economically disadvantaged by the quota decreases. A Maine fisherman said, “It doesn’t make sense to be trucking them [menhaden] all the way up and paying all that added expense when they’re right in our backyard.”

Decreased Landings and Depressed Incomes Due to State Quotas

Fishermen and bait dealers in medium- and large-scale enterprises noted decreased landings and depressed incomes due to the state quotas instituted in 2013. Fishermen described income losses as high as 20 to 50 percent of their previous salaries, as well as layoffs for their peers. A Rhode Island fisherman discussed challenges in retaining crew members with the income losses they incurred. They were fishing shorter periods of the year he explained, adding, “The quota has made it very difficult to pay [crew members] by salary.” Some large-scale enterprises cut down by as many as 30 crew members, in addition to layoffs in associated processing and distribution facilities. A Virginia fisherman recalled how the 2015 fishing season ended early recalling, “We could have fished another one and a half months…which is a lot of money at the end of the year. You feel like you’re being punished.” Managers of large-scale operations described significant fixed costs; for their businesses, losses from quota decreases cannot be managed simply by a reduction in the labor force. Finally, bait dealers attributed declining menhaden bait sales and lost revenue to the new state quotas. Interviewees stated that ancillary businesses, both fishing related (e.g. welding, net repair) and others, like grocery and hardware stores, were impacted as well.

3.1.3 Fishing Community

Fishing community themes were related to two topics: 1) *Commercial Fishing Key* and 2) *Commercial Fishing Decline.* What follows are interviewees' observations on each theme.

Commercial Fishing Key
For many interviewees, particularly for those working in large-scale operations, commercial fishing represented the primary source of well-paying jobs in their community. In their communities, they noted thriving commercial fishing ports with a mix of species landed and sold (e.g. Maryland crabs, Maine lobsters, New Jersey scallops and squid, North Carolina shrimp, Virginia flounder). Interviewees in Virginia, in particular, emphasized the outsized role and economic impacts of commercial fishing where they live. A Virginia fisherman explained, "Outside of fishing, you make eight dollars an hour." Fishing is an intergenerational occupation; the majority of menhaden fishermen and bait dealers interviewed have family ties to the industry. They also viewed their co-workers as being like family, noting strong social bonds. Another Virginia fisherman described his relationship to his crew, "Those men on my boat are my family. They depend on me in the off season. A crew is like a foundation on a house. You're only as good what you have underneath you." Many fishermen stated they were their family's majority income earner, and often, they supported multiple families including aging parents and adult children. They considered the fishing industry critical to non-fishing community businesses and livelihoods as well. A Virginia fisherman pointed out, "Two-hundred and fifty jobs branch out to 2,000 jobs where I live. There are a lot of people counting on us, in this community." In some cases, they saw commercial fishing revenue as significant to the overall state's economy. Local seafood was considered a tourist draw and key export in some states. A Maine bait dealer discussed the importance of lobster and fishing industry and their multiplier effects to his state. "We're [the commercial fishing industry] critical to Maine's well-being, no question about it," he described. "Most of our lobsters are exported. That brings money into Maine and then you know the trail. The lobsterman buys equipment and that makes jobs, and they pay us and we have 25 to 40 people working, and then they go to restaurants and so on and so forth, and we all pay taxes on it."

Commercial Fishing Decline
Many interviewees noted a decline in commercial fishing and fishing culture in their communities. Generally, interviewees in small-scale operations discussed industry decline more frequently than those in large-scale operations. A Maine fisherman lamented, "The fishing community is ruled by the loss of business." High fixed costs on items like boats, trucks, and fishing equipment have made it difficult for some to continue fishing if traditional species are unavailable or not permitted to catch. Some fishermen were so discouraged by the regulatory restrictions on fishing that they didn't believe the industry would exist at all in the future. A New Jersey fisherman said, "It's a tough business. If somebody was just getting into it young now, I wouldn't want to be there." The decline in the commercial fishery sector was rarely associated with an increase in other types of well-paying jobs. Other available jobs noted were in economic sectors like service and retail, farming, and tourism, primarily, as well as the retirement industry, military, and boat building in some places. Fishermen and bait dealers reported high levels of unemployment, underemployment and drug use among the labor force. A Rhode Island bait dealer described the decline in the lobster industry, "The commercial fishing port is not as large as it used to be. Used to be 150 lobster boats, now there are 35."

3.2 Industry Survey Data

Online surveys were completed by 106 menhaden fishermen and bait dealers in seven states: Maine, Maryland, New Jersey, New York, North Carolina, Rhode Island, and Virginia (Table 1). Surveys were sent to approximately 2,000 potential fishermen and bait dealers, relying on contact databases from state environmental and fisheries agencies, which resulted in 255 surveys initiated. However, only 106

completed the majority of questions. We reported on those respondents. Survey data were primarily used to validate the interview data and other publically available data sources.

Table 1. Total respondents by state.

State	Dealers	Fishermen
Maryland	2	8
Maine	5	1
North Carolina	7	12
New Jersey	11	23
New York	3	7
Rhode Island	3	5
Virginia	5	14
SubTotal	36	70
Total Respondents	**106**	

The majority of fishermen who responded to the survey landed less than 10,000 pounds of Atlantic menhaden in 2015. They appeared to represent small-scale operations. Alternatively, bait dealers who responded were bifurcated, in that about as many (12) sold less than 25,000 pounds as those (10) who sold one million pounds or more in 2015.

Table 2. Pounds of menhaden sold (by bait dealers) and landed (by fishermen) in 2015.

Amount	Sold	Landed
1 - 9,999 pounds	8	29
10,000 - 24,999 pounds	4	9
25,000 - 49,999 pounds	3	7
50,000 - 99,999 pounds	1	4
100,000 - 249,999 pounds	3	5
250,000 - 499,999 pounds	3	3
500,000 - 999,999 pounds	2	1
1,000,000 - 4,999,999 pounds	6	2
5,000,000 pounds or more	4	3

Fishermen and bait dealers were asked whether they considered various issues important to them. Respondents ranked the issues on a scale of one to five, with one being extremely important and five being not at all important. *Health of menhaden and habitat* was considered extremely to very important (mean=1.84) and *quotas* was considered very to moderately important (mean=2.13). In contract, both *crew or labor issues* and *competition among local fishermen* were considered moderately to slightly important, with means of 3.65 and 3.77, respectively.

Table 3. Importance of issues to menhaden fishermen and bait dealers.

	Extremely Important 1	Very Important 2	Moderately Important 3	Slightly Important 4	Not at all Important 5	Mean
Health of menhaden and habitat	45	26	9	2	6	1.84
Quotas	48	12	9	7	12	2.13
Gear Restrictions	36	14	11	7	19	2.53
Overfishing	32	17	13	5	22	2.64
Cost of licensing and taxes	23	20	17	9	17	2.73
Record keeping (trip tickets, tax purposes)	17	15	25	13	16	2.95
Fuel Prices	21	16	13	12	26	3.07
Competition among fishermen from other states	16	13	18	5	37	3.38
Crew or labor issues	9	14	16	9	40	3.65
Competition among local fishermen	7	8	21	13	38	3.77

Fishermen and bait dealers indicated whether they had experienced a significant change of 25 percent or more in landings or fish sold from one year to the next during the time period 2010 to 2015. Increases in landings or fish sold were noted somewhat uniformly throughout all six years, whereas decreases were noted more frequently in years 2013, 2014, and 2015. Respondents attributed reason(s) for a change in a given year. The most frequently cited reason for a significant increase in sales or landings was availability of stock, followed by weather (e.g. recovery from Sandy) and market price of menhaden. The most frequently cited reasons for a significant decrease in sales or landings were availability of stock, change in state regulations (e.g. 2013 state quotas), and weather.

Table 4. Significant change in menhaden sales or landings since 2010.

	2010	2011	2012	2013	2014	2015
No Change	58	61	56	40	38	32
Increase	22	19	20	26	27	30
Decrease	5	3	7	19	17	20

4. Public Opinion Survey

The stated preference survey was fielded online in October using the SurveyMonkey platform and Survey Sampling International online panel. We received 2253 responses from eight Atlantic Coast states. We oversampled New Jersey and Virginia and received 495 and 475 responses from each, respectively. We receive 227, 217, 216, 236, 229 and 158 responses from Florida, Maine, Maryland, New York, North Carolina and Rhode Island. The samples are balanced by gender and ethnicity in each state except for Maine. The survey data was weighted by state population in our analysis. We will develop gender and ethnicity weights for Maine before the final analysis is conducted.

The stated preference survey consisted of three parts. The first part informed the respondent of issues pertaining to the menhaden fishery and its industry and the goals of the ASMFC. Here, information about the respondents' prior knowledge about the menhaden and the ASMFC were gathered, as well as opinions about various related matters via Likert scales.

The second section was comprised of the discrete choice questions. The respondent either received a set of 3 increase scenario questions or 3 decrease scenario questions, with varying levels of environmental and economic trade-offs. Respondents were presented a hypothetical quota change (10%, 20%, 30%) with corresponding revenue changes (dependent on the randomly assigned ex-vessel market price/pound) and were given information about whether there would be a change in four other attributes. The four attributes are: jobs (250, 500, 750), water quality (binary for whether water quality is improved/worsened), fish population (binary for increase/decrease), and water-bird population (binary for increase/decrease). In each scenario, voting against the quota change equates to choosing the status quo. To account for the heterogeneity in which scenario respondents were exposed to first, order effects were considered in the analysis.

The final section included debriefing questions to assess which attributes they claimed to care about most and how seriously they took the voting exercise. Also, some socioeconomic characteristics and information about their fishing experiences were gathered.

This survey resulted in a rich data set from which we were able to gather trends and preferences. After removing individuals who explicitly stated that they did not read the survey directions, we had 2022 respondents, and 12,132 total observations since they each answered 6 choice questions.

We estimate random parameters logit models (RPL) which capture the mean and standard deviation of each coefficient. The coefficients are not directly interpretable but are useful for determining tradeoffs among economic and ecosystem variables. Willingness-to-pay (WTP) and willingness-to-accept (WTA) values are computed by taking the absolute value of the ratio of the coefficient of the attribute of interest and dividing by the coefficient of a cost variable. Traditionally, the cost variable is an individual monetary cost (e.g., income tax increase), however in our analysis we focus on the trade-off between ex-vessel revenue and commercial fishing jobs gained/lost in the economy. In this context, WTP is a willingness to forgo additional ex-vessel revenue and jobs that would result from increased quotas.

Across the three quota increase scenarios, forty-four percent of respondents voted to increase the menhaden quota by 10%, 20% or 30% ("for"). Fifteen percent are "undecided" and 41% of the votes are "against" the quota increases. Excluding undecided votes, a majority vote in favor of quota increases. In the regression analysis we code the undecided votes as a "against." We find that increases in ex-vessel revenue and commercial fishing jobs increases the probability of a "for" vote. Increased quotas that make water quality worse and negatively affect gamefish and waterbird populations lead to a decrease in the probability of a "for" vote. While we informed respondents that increased quotas would not lead to overfishing, respondents who still expressed concern about overfishing are less likely to vote "for" a quota increase. Respondents are willing to pay $15 million, $7 million and $9 million in ex-vessel revenue to avoid negative impacts on water quality, gamefish and waterbirds, respectively. Respondents are willing to pay 969, 439 and 574 additional commercial fishing jobs to avoid negative impacts on water quality, gamefish and waterbirds, respectively.

Across the three quota decrease scenarios, forty-one percent of respondents voted to decrease the menhaden quota by 10%, 20% or 30% ("for"). Eighteen percent are "undecided" and 41% of the votes are "against" the quota increases. Excluding undecided votes, a slim majority vote against quota decreases. In the regression analysis we again code the undecided votes as a "against." We find that decreases in ex-

vessel revenue and commercial fishing jobs decreases the probability of a vote “for” the decreased quota. Decreased quotas that improve water quality and positively affect gamefish and waterbird populations lead to a decrease in the probability of a “for” vote. Respondents are willing to accept $22 million, $12 million and $9 million in ex-vessel revenue to gain positive impacts on water quality, gamefish and waterbirds, respectively. Respondents are willing to accept 365, 202 and 141 commercial fishing job losses to gain positive impacts on water quality, gamefish and waterbirds, respectively.

The RPL models are limited in their ability to incorporate “time invariant” variables (i.e., those that do not change across the three choice scenarios such as respondent socioeconomic characteristics and attitudes). In other models, the data shows that support for a policy, whether increase or decrease, is derived from more than just environment and economic trade-offs. Prior knowledge of menhaden, and actual beliefs about the contribution menhaden have to various sectors of the economy and the ecosystem play a big role in influencing tendencies to vote for or against a quota change. Also, societal involvement in the fishing industry, both in the commercially and recreationally, effect voting propensities as well.

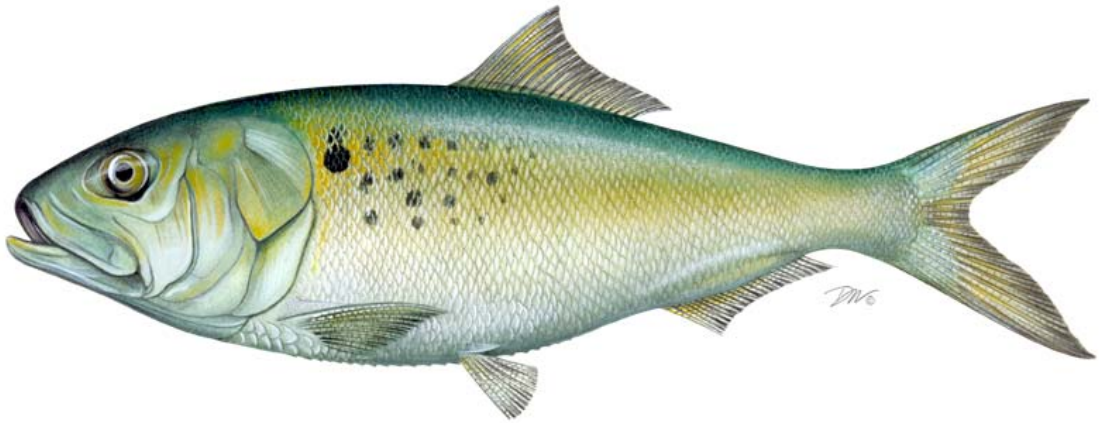
Further analysis will be aimed at assessing attribute non-attendance (ANA). For the most salient results, the models depend on respondents taking account all the information provided in the choice set. However, respondents often employ strategies such as focusing on one attribute which can skew results. Econometric methods will be applied to identify such trends to potentially clean the data and arrive at more precise results.

Atlantic States Marine Fisheries Commission

PUBLIC INFORMATION DOCUMENT

For Amendment 3 to the Interstate Fishery Management Plan For

ATLANTIC MENHADEN



November 2016

Vision: Sustainably Managing Atlantic Coastal Fisheries

The Atlantic States Marine Fisheries Commission seeks your input on the initiation of Amendment 3 to the Atlantic Menhaden Fishery Management Plan

The public is encouraged to submit comments regarding this document during the public comment period. Comments must be received by **5:00 PM (EST) on January 4, 2017.** Regardless of when they were sent, comments received after that time will not be included in the official record. The Atlantic Menhaden Management Board will consider public comment on this document when developing the first draft of Amendment 3.

You may submit public comment in one or more of the following ways:

1. Attend public hearings held in your state or jurisdiction, if applicable.
2. Refer comments to your state's members on the Atlantic Menhaden Board or Atlantic Menhaden Advisory Panel, if applicable.
3. Mail, fax, or email written comments to the following address:

Megan Ware
Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, Virginia 22201
Fax: (703) 842-0741
comments@asmfc.org (subject line: Menhaden PID)

If your organization is planning to release an action alert in response to the Amendment 3 PID, or if you have questions, please contact Megan Ware at (703) 842-0740.

YOUR COMMENTS ARE INVITED

The Atlantic States Marine Fisheries Commission (Commission) is developing an amendment to revise the Interstate Fishery Management Plan (FMP) for Atlantic Menhaden. The Commission, under the Atlantic Coastal Fisheries Cooperative Management Act, is charged with developing fishery management plans for Atlantic menhaden which are based on the best available science and promote the conservation of the stock throughout its range. The states of Maine through Florida participate in the management of this species via the Commission's Atlantic Menhaden Management Board (Board).

This is your opportunity to inform the Commission about changes observed in the fishery, actions you feel should or should not be taken in terms of management, regulation, enforcement, and research, and any other concerns you have about the resource or the fishery, as well as the reasons for your concerns.

WHY IS THE ASMFC PROPOSING THIS ACTION?

At the May 2015 meeting, the Menhaden Board initiated the development of Amendment 3 to the Atlantic Menhaden FMP to pursue the development of ecological reference points (ERPs) and revisit allocation methods.

The 2015 Atlantic Menhaden Benchmark Stock Assessment and Peer Review Report categorized the development of ERPs as a high priority for Atlantic menhaden management. Currently, the stock is assessed with single-species biological reference points, which were defined in the 2015 stock assessment. Using these reference points, the assessment found the stock is not overfished and overfishing is not occurring. While the stock assessment accounts for natural mortality, that factor alone may not adequately account for the unique and significant ecological services that menhaden provide, or how changes in the population of predator species may impact the abundance of menhaden. ERPs are intended to consider the multiple roles that menhaden play, both in supporting fisheries for human use and the marine ecosystem. Thus, they are viewed as a tool that could improve the management of menhaden.

Additionally, Amendment 2 (implemented in 2013) requires quota allocations to be revisited every three years. The Atlantic menhaden quota is currently allocated to fifteen of the sixteen Atlantic coast states and jurisdictions based on each jurisdiction's three-year average landings between 2009 and 2011. In revisiting the allocations, the Board decided to investigate different allocation methods and timeframes given concerns that the current allocation method does not strike a balance between gear types and regions, as well as current and future harvest opportunities. Some states have also expressed concerns about unreported landings during the baseline years and the administrative burden of managing small allocations, the cost of which may outweigh the value of the fishery they are allocated.

The adoption of ERPs as well as changes to the current quota allocations would require changes in the management tools used to regulate the fishery. This document proposes a suite of management tools involving different types of reference points and allocation methods.

WHAT IS THE PROCESS FOR DEVELOPING AN AMENDMENT?

The publication of this document and announcement of the Commission's intent to amend the existing FMP for Atlantic menhaden is the first step of the formal amendment process. Following the initial phase of information gathering and public comment, triggered by this Public Information Document (PID), the Commission will evaluate potential management alternatives and the impacts of those alternatives. The Board will also seek to narrow the number of proposed management options, especially in regard to quota allocation and incidental catch. The Commission will then develop Draft Amendment 3, incorporating the identified management options, for public review and comment. Following consideration of public comment, the Commission will specify the management measures to be included in Amendment 3, as well as a timeline for implementation. In addition to issues identified in this PID, the Draft Amendment may include other issues identified during the public comment period for this PID.

The timeline for completion of Amendment 3 is as follows:

	Oct 2016	Nov 2016 – Jan 2017	Feb 2017	Mar – July 2017	Aug 2017	Sept – Oct 2017	Nov 2017
Approval of Draft PID by Board	**X**						
Public review and comment on PID ***Current step***		**X**					
Board review of public comment; Board direction on what to include in Draft Amendment 3			**X**				
Preparation of Draft Amendment 3				**X**			
Review and approval of Draft Amendment 3 by Board for public comment					**X**		
Public review and comment on Draft Amendment 3						**X**	
Board review of public comment on Draft Amendment 3							**X**
Review and approval of the final Amendment 3 by the Board, Policy Board and Commission							**X**

WHAT IS THE PURPOSE OF THIS DOCUMENT?

The purpose of this document is to inform the public of the Commission's intent to gather information concerning Atlantic menhaden and to provide an opportunity for the public to identify major issues and alternatives relative to the management of this species. Input received at the start of the amendment development process can have a major influence in the final outcome of the amendment. This document is intended to solicit observations and suggestions from fishermen, the public, and other interested parties, as well as any supporting documentation and additional data sources.

To facilitate public input, this document provides a broad overview of the issues already identified for consideration in the amendment; background information on the Atlantic menhaden population, fisheries, and management; and a series of questions for the public to consider about the management of the species. In general, the primary question on which the Commission is seeking public comment is: **"How would you like management of the Atlantic menhaden fishery to look in the future?"**

WHAT ISSUES WILL BE ADDRESSED?

The primary issues considered in the PID are:

- Reference Points for Determining Stock Status
- Quota Allocation
- Allocation Timeframe
- Quota Transfers and Overage Payback
- Quota Rollovers
- Incidental Catch and Small Scale Fishery Allowance
- Episodic Events Set Aside Program
- Chesapeake Bay Reduction Fishery Cap
- Research Programs and Priorities

ISSUE 1: Reference Points

Background: Amendment 2 established single-species reference points to manage the menhaden stock. These reference points were based on maximum spawning potential (MSP) and included a measure of fishing mortality (F) and spawning stock biomass (SSB) to determine an overfishing and overfished status. Overfishing occurs when fishing is negatively affecting the stock through reduced abundance and recruitment. A stock is overfished if abundance or biomass is critically low. Per Amendment 2, overfishing was defined by a target and threshold of $F_{30\%MSP}$ and $F_{15\%MSP}$, respectively, while an overfished stock was defined by a target and threshold of $SSB_{30\%MSP}$ and $SSB_{15\%MSP}$, respectively.

In 2015, the Board approved a new Atlantic Menhaden Benchmark Stock Assessment, producing the reference points in use today. A key goal of these reference points is to provide a better measure of sustainability. As a result, the overfishing target and threshold were changed to $F_{57\%MSP}$ (0.38) and $F_{26\%MSP}$ (1.26), respectively, to provide a more conservative approach to menhaden management until multi-species reference points could be developed. Additionally, an overfished

target and threshold based on fecundity (FEC) were established at $FEC_{57\%MSP}$ (189,270 billion eggs) and $FEC_{26\%MSP}$ (86,821 billion eggs), respectively. As of 2013, the terminal year used for the 2015 assessment, the stock is not overfished (FEC=170,536 billion eggs) and overfishing is not occurring (F=0.22).

Given the crucial ecological role that menhaden play as forage fish, the Board has expressed interest in developing ecological reference points (ERPs) to manage the menhaden stock. Menhaden serve an important role in the marine ecosystem as they convert phytoplankton into protein and in turn provide a food source to a variety of species including larger fish (e.g., weakfish, striped bass, bluefish, cod), birds (e.g., bald eagles, osprey), and marine mammals (e.g., humpback whales, bottlenose dolphin). As a result, changes in the abundance of menhaden may have implications for the marine ecosystem. ERPs provide a method to assess the status of menhaden not only with regard to their own sustainability, but also with regard to their interactions with predators and the status of other prey species. This method accounts for changes in the abundance of several species when setting an overfished and overfishing threshold for menhaden. The benefit of this approach is that it allows fishery managers to consider the harvest of menhaden within a broad ecosystem context. Of course, people also extract and utilize marine resources, and are thus considered part of the marine ecosystem as well.

In May 2015, the Board tasked the Commission's Biological and Ecological Reference Point (BERP) Workgroup with developing ERPs for Atlantic menhaden. To begin this process, the Board identified fundamental objectives for the development of ERPs, including sustaining menhaden to provide for fisheries and predators. The BERP Workgroup subsequently identified four multi-species modeling approaches that could be used to successfully calculate ERPs for menhaden. These models can combine information on the abundance of menhaden and its predators to quantitatively assess ecosystem needs and set appropriate harvest targets and thresholds. Given the complexity of these models and the large amounts of data required, the BERP Workgroup does not expect to finish developing these menhaden-specific ERPs before Amendment 3 is finalized. The BERP Workgroup will be having several data, assessment, and modeling workshops over the next few years in order to complete the ERPs and have them peer reviewed by 2019.

In addition to the menhaden-specific reference points being developed by the BERP Workgroup, the Board is aware of other precautionary guidelines on developing ERPs for forage fish in general. For example, several organizations and scientific papers, such as Smith et al. (2011), support the use of a 75% rule-of-thumb, which recommends forage fish populations be maintained at three-fourths of their unfished biomass levels in order to lower impacts on marine ecosystems. This rule has been implemented by the Convention for the Conservation of Antarctic Marine Living Resources, which manages krill to maintain 75% of the unfished biomass in the water to account for the needs of predators.

The Lenfest Ocean Program, a grant-making program managed by The Pew Charitable Trusts, has also developed guidelines for the development of ERPs for forage fish. In their 2012 report by Pikitch et al., Lenfest describes how they applied a suite of 10 published models to develop a general equation to predict predator responses to specific levels of forage fish abundance. This equation proposes a control rule in which fishing mortality does not exceed half of the forage species natural mortality rate (for menhaden, 1/2 M = 0.29) and that, when biomass falls below 40% of unfished biomass, fishing is prohibited.

Another ERP option could combine these guidelines, such that the 75% rule-of-thumb is combined with a fishing mortality target consistent with achieving 75% unfished biomass, and if biomass falls below 40% of unfished biomass, fishing is prohibited. The concept of a fishing mortality cutoff for forage species is used by the Pacific Fishery Management Council in conserving sardine (although the cutoff is set at 150,000 metric tons, or roughly 10% of the average unfished population size)[1].

In 2015, as a part of an initial effort to evaluate existing ERP guidelines, the Board asked the BERP Workgroup to review the ERPs proposed by Pikitch et al. (2012). In response, the BERP Workgroup noted several concerns, namely that the Lenfest equation was developed for forage species that are a main component (> 50%) of a predator's overall diet. Although menhaden are important forage for a number of species, and may be a main food source for some species during certain seasons, they do not account for more than 20% of the overall diet for any of the finfish predators currently considered in the multispecies models being used by the BERP Workgroup. The BERP Workgroup also raised concerns that the Pikitch et al. (2012) equation assumes a stock-recruit relationship can be defined for the forage species. Available data indicate recruitment of menhaden is driven primarily by environmental factors rather than stock size. For these reasons, the BERP Workgroup advised the Board that the Lenfest equation is not an appropriate method for developing ERPs for menhaden (See Appendix 2 for BERP Workgroup Memo dated April 20, 2015). Members of the Lenfest Forage Fish Task Force responded to the concerns raised by the BERP Workgroup, stating it is not necessary for predators to be highly dependent on menhaden (>50% of diet) for the report's management recommendations to apply and that the report's reference points can be applied without a specific stock-recruit relationship. The Lenfest Forage Fish Task Force also emphasized that the reference points in Pikitch et al. (2012) offer a precautionary approach to prevent stock collapse and maintain high levels of forage fish biomass in the water (See Appendix 3 for Lenfest Forage Fish Task Force memo date May 4, 2015).

[1] Oceana. April 12, 2016. The Role of Fishing in the Pacific Sardine Collapse. http://usa.oceana.org/blog/role-fishing-pacific-sardine-collapse

Moving forward, there are several options for the Board to consider.

- Continue use of the single-species reference points approved in the 2015 stock assessment.
- Adopt ERPs based on existing guidelines for forage fish in general.
- Adopt, upon completion, menhaden-specific ERPs developed by the BERP Workgroup. Since the BERP Workgroup's ERPs will not be completed before 2019, the Board would have to identify interim reference points to manage the stock. These could include the current single-species reference points or existing guidelines for forage fish species.

Importantly, the Board is interested in considering all viable approaches for developing ERPs and invites the public to submit information on other ERPs that have been peer-reviewed and could be proposed in draft Amendment 3. In order to be considered by the Board, submissions should include information on how the ERP was developed, what species it can be applied to, if it has been previously implemented, and how it has been peer-reviewed.

Statement of the Problem: Given the ecological importance of menhaden as a forage fish, the Board is interested in developing ERPs for the stock. Current options for ERPs include existing guidelines for forage fish species and those currently being developed by the BERP Workgroup. If the Board opts to pursue the ERPs developed by the BERP Workgroup, interim reference points could to be adopted, since this modeling work will not be completed until 2019.

Option A: Single Species Reference Points

The Atlantic menhaden stock continues to be managed with the single-species biological reference points developed in the 2015 benchmark stock assessment. These set an F target and threshold of $F_{57\%MSP}$ (0.38) and $F_{26\%MSP}$ (1.26), respectively, and a fecundity target and threshold of $FEC_{57\%MSP}$ (189,270 billion eggs) and $FEC_{26\%MSP}$ (86,821 billion eggs), respectively. Under this option, the Board would direct the BERP Workgroup to stop work on the development of menhaden-specific ERPs.

Option B: Existing Guidelines for Forage Fish Species

The Atlantic menhaden stock is managed with ERPs based on existing guidelines for forage fish species (e.g., the 75% rule-of-thumb, Pikitch et al. (2012) with $F_{64\%MSP}$=0.29, or some other peer-reviewed ERP). Under this option, the Board would direct the BERP Workgroup to stop work on the development of menhaden-specific ERPs.

Option C: Single-Species Reference Points Until ERPs are Developed by the BERP Workgroup

The Atlantic menhaden stock is managed with the current single-species reference points ($F_{57\%MSP}$=0.38, $F_{26\%MSP}$=1.26; $FEC_{57\%MSP}$=189,270 billion eggs, $F_{26\%MSP}$= 86,821 billion eggs) until menhaden-specific ERPs are developed by the BERP Workgroup and adopted by the Board. It is expected that the BERP Workgroup will complete its analysis in 2019.

Option D: Existing Guidelines for Forage Fish Species Until ERPs are Developed by the BERP Workgroup

The Atlantic menhaden stock is managed with ERPs based on existing guidelines for forage fish species (e.g., the 75% rule-of-thumb, Pikitch et al. (2012) with $F_{64\%MSP}$=0.29, or a combination of these guidelines) until menhaden-specific ERPs are developed by the BERP Workgroup and adopted by the Board. It is expected that the BERP Workgroup will complete its analysis in 2019.

Public Comment Questions: Should the Board manage the Atlantic menhaden stock with single-species biological reference points or multi-species ERPs? Do you support the use of simpler, readily available ERPs until menhaden-specific ERPs are developed by the BERP Workgroup? Do you know of other approaches for establishing ERPs for menhaden that could be implemented through Amendment 3?

ISSUE 2: Quota Allocation

Background: Amendment 2 established a first-ever commercial total allowable catch (TAC) for Atlantic menhaden and divided this catch into commercial quotas for participating jurisdictions from Maine through Florida. The TAC and quota system were adopted in response to the 2011 benchmark stock assessment which found that the stock was experiencing overfishing. Since it was implemented in 2013, the quota system has maintained the harvest of menhaden below the coastwide limits set by the Board.

For 2013 and 2014, the Board set the TAC at 170,800 metric tons (mt), a 20% reduction from the average 2009-2011 coastwide landings. The 2015 benchmark stock assessment found the Atlantic menhaden stock is not overfished and overfishing is not occurring. In response, the Board raised the 2015 and 2016 TACs by 10% to 187,880 mt. The 2017 TAC was further raised to 200,000 mt after stock projections showed the increase would result in a 0% chance of overfishing. The state allocation formula established by Amendment 2 assigns each state a percentage of the TAC based on each state's average landings between 2009 and 2011. (See Table 1 in Appendix 1 for the state allocations and yearly quotas.)

Amendment 2 requires allocation to be revisited every three years. In revisiting allocations, via Amendment 3, the Board has decided to investigate different allocation methods and timelines given concerns that the approach does not strike a balance between gear types and regions, as well as the present needs of the fishery

versus future growth opportunities. For example, because 85% of the quota is allocated to Virginia, where the last remaining menhaden reduction fishery takes place, increases in the TAC provide limited benefit to the small-scale bait fisheries along the coast. Additionally, given improvements in the condition of the Atlantic menhaden stock, the process of determining allocation based on a narrow period of historical catch limits states who currently have minimal quota from participating in the growing fishery. Some states have also found evidence of un-reported landings during the reference period, meaning the quota system may have reduced their fisheries to a greater extent than originally intended.

Recognizing these concerns, the Board is interested in exploring alternative allocation strategies. Many fisheries use quotas and allocation formulas to limit harvest, offering examples of how catch can be allocated. Some fisheries are managed in a manner similar to the current system for menhaden. For example, the commercial summer flounder TAC is allocated to states via individual state percentages based on each state's average landings during a historical reference period. Others are managed differently. The Atlantic herring quota is currently allocated by season in the inshore management area. None of the quota is allocated between January and May due to spring spawning and interactions with other fisheries; 72.8% of the quota is available from June through September and 27.2% from October through December. In the South Atlantic, quota for golden tilefish is allocated by gear-type with the annual catch limit divided between the longline and hook-and-line fisheries. This was done to ensure continued participation by hook-and-line fishermen since the commercial quota was being rapidly harvested by the longline sector. Spiny dogfish uses both a regional and state allocation system with the northern region (ME–CT) receiving 58% of the quota and the states of NY through NC receiving individual state shares. This allocation system was used to allow southern states the ability to participate in the fishery before the total allowable catch is caught by the northern states.

In May 2015, the Menhaden Board established an Allocation Working Group to initiate the process of revisiting menhaden quota allocation. The Allocation Working Group considered landings history, the performance of state fisheries, and the challenges associated with the current management plan. As a result, the group created a broad range of allocation options which are presented below (Options A through G). Information on menhaden landings by jurisdiction, gear type, and disposition can be found in Tables 2 and 3 and Figure 1 of Appendix 1.

Statement of the Problem: Amendment 2 requires menhaden allocation to be revisited every three years. The Board is exploring different allocation strategies due to several concerns with the current state-by-state quotas, including inequitable access to quota among gear types and the inability for some states to participate in the growing fishery.

Option A. Jurisdictional Quotas (Status Quo)
Quotas are allocated to each state/jurisdiction in the management unit based on its landings during a selected reference period. (See Table 2 in Appendix 1 for commercial landings by jurisdiction.) The current reference period is 2009-2011. (Note that Issue 3 (pg 13) considers potential changes to this time period.)

Option B. State-Specific Quotas with Fixed Minimum
Quotas are allocated to each state/jurisdiction in the management unit based on its landings during a selected reference period; however, no state/jurisdiction receives less than a minimum fixed percent quota (e.g., 1% of the coastwide TAC). A minimum fixed-quota allocation provides growth opportunity for states that have small quotas. For example, in the American eel fishery, each state is allocated a minimum 2,000 pound quota in order to increase equity in the distribution of quota.

Option C. Coastwide Quota
There is one coastwide quota that applies to the entire Atlantic menhaden fishery.

Option D. Seasonal Quotas
The TAC is divided into designated seasons, such as a winter, spring, summer, and fall. Under this option, it may be possible to consider further allocation (e.g., regional, state by state) of the season-specific quotas to provide equitable access to the fishery. (See Figure 2 in Appendix 1 for a breakdown of commercial landings by month).

Option E. Regional Quotas
Quotas are allocated to designated regions. The intent of these geographic delineations would be to capture the spatial dynamics of the fishery. Specific regional options could include:

1. Two region split: (1) North, defined as waters north of Machipongo Inlet, VA, on the Delmarva Peninsula; and (2) South, defined as waters south of Machipongo Inlet, including the Chesapeake Bay. These regions match those used for stock assessment purposes in the 2015 Benchmark Stock Assessment.
2. Two region split: (1) Chesapeake Bay; and (2) Coast.
3. Three region split: (1) New England, defined as ME–CT; (2) Mid-Atlantic, defined as NY–DE; and (3) Chesapeake Bay South, defined as MD–FL.
4. Four region split: (1) New England, defined as ME–CT; (2) Mid-Atlantic, defined as NY–DE; (3) Chesapeake Bay, defined as MD–VA; and (4) South Atlantic, defined as NC–FL.

Option F. Disposition Quotas
Quotas are allocated to the bait and reduction fisheries separately. The intent of this option would be to capture the different dynamics that exist between the bait and reduction fisheries. Under this option, it may be possible to consider further

allocation (e.g., regional, state-by-state) of the disposition-specific quotas to provide equitable access to the fishery.

Option G. Fleet Capacity Quotas

Quotas are allocated to various fleets based on their harvest capacity, as determined by gear type. The intent of this option would be to capture the different scales of operation that exist in the fishery and their dynamics. It may be possible to consider further allocation (e.g., regional, state-by-state, disposition) of the capacity-specific quotas to provide equitable access to the fishery. Some of the specific fleet capacity options below include a "soft quota" concept, which sets a target quota but does not subject the fleet to a fishery closure. The intent of a soft quota would be to restrict the retention of menhaden but add flexibility for additional catch in years when fish are abundant.

Specific fleet options could include:

1. Two Fleet Capacity Allocation

Small Capacity Fleets:

Types of gears in the small-capacity fleet include, but are not limited to, cast net, trawl, trap/pot, haul seine, fyke net, hook and line, pound nets and gill nets. Total coastwide landings for these small-capacity gears are approximately 22 million pounds annually or 5% of coastwide landings from 2009–2012. The small-capacity fleet could be defined by a trip limit such that a vessel must land less than a certain poundage of menhaden to fish in the small-capacity fleet; otherwise they would move to the large-capacity fleet. Alternatively (or additionally), a trip limit could be established if the small-capacity fleet harvest grows to an unacceptable level. Given the small capacity of these gear types, this fleet could be managed with a soft quota, whereby harvest is allowed to fluctuate above the quota in years when fish are available (Figure 1). Flexibility in the quota would minimize menhaden discards from this fleet.

Large-Capacity Fleet:

Types of gears in the large-capacity fleet include, but are not limited to, purse seines and pair trawls. Total coastwide landings for these large-capacity gears are approximately 436.2 million pounds annually or approximately 95% of coastwide landings from 2009–2012, and include both bait and reduction fishery harvest. Given the large capacity of these gear types, this fleet would be managed with a hard quota.

2. Three Fleet Capacity Allocation

Small-Capacity Fleet:

Types of gears in the small-capacity fleet include, but are not limited to, cast net, trawl, trap/pot, haul seine, fyke net, and hook and line. Total coastwide landings for these small-capacity gears are approximately 3.14 million pounds annually or roughly 1% of coastwide landings from 2009–2012. Given the small capacity of these gear types, this fleet could be managed with a soft quota.

Medium-Capacity Fleet:

Types of gears in the medium-capacity fleet include, but are not limited to, pound nets and gill nets. Total coastwide landings for these gear types are approximately 18.92 million pounds annually or 4% of coastwide landings from 2009–2012. Given the medium capacity of these gear types, this fleet could be managed with a soft or hard quota.

Large-Capacity Fleet:

Types of gears in the large-capacity fleet include, but are not limited to, purse seines and pair trawls. Total coastwide landings for these gears are approximately 436.2 million pounds annually or 95% of coastwide landings from 2009–2012, and include both bait and reduction fishery harvest. Given the large capacity of these gear types, this fleet would be managed with a hard quota.

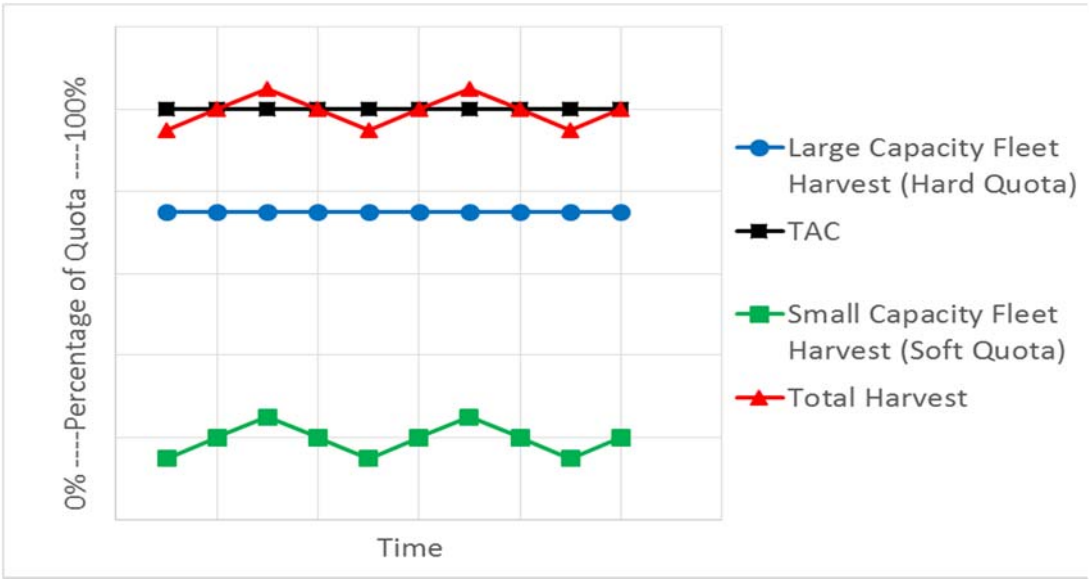


Figure 1. A graphical representation of the two fleet capacity allocation showing the fluctuating small capacity bait harvest and its impact on total harvest relative to the quota.

Option H. Allocation Strategy Based on TAC Level

The quota allocation strategy would vary depending on the amount of TAC available in each fishing year. The average landings for the years 2009–2011 (212,500 mt), from which a 20% reduction was taken in Amendment 2, would serve as the baseline. When the annual, coastwide TAC is at or below 212,500 mt, it would be allocated to jurisdictions based on average landings during 2009–2011 (i.e., the current allocation strategy).When the TAC exceeds 212,500 mt, the amount above 212,500 mt would be reallocated based upon an alternative allocation strategy, such as any of the other options presented in this section, or added to the episodic events set aside, or distributed to jurisdictions based on need or another agreement.

The intent of this option would be to ensure that each jurisdiction equally contributes to the conservation of the menhaden resource the Board determined

was necessary in adopting Amendment 2 and prevent the entire burden from being borne solely by high-quota jurisdictions. Once the TAC exceeds the baseline, however, additional harvest opportunities can be redistributed to other jurisdictions in order to address concerns expressed by proponents of reallocation.

Public Comment Questions: Should the Board maintain, or revise, the allocation formula currently used to manage the commercial Atlantic menhaden fishery? Which allocation option(s) provides for the fairest and most equitable distribution of coastwide total allowable catch? Which allocation option(s) strikes the best balance between current needs and future growth opportunities? Do you support the use of soft quotas for some user groups? What is a suitable small-capacity trip limit in Option G? How should a small-capacity gear be defined? Are there any other options, besides those offered in this document, that the Board should consider?

ISSUE 3: Allocation Timeframe

Background: As part of its required review of menhaden allocation, the Board is also considering changes to the reference period upon which the quotas are based. Amendment 2 divides the total allowable catch into jurisdictional quotas based on average landings between 2009 and 2011. A key question facing the Board is whether this timeframe represents a fair and equitable representation of coastwide menhaden catch – past, present, and future. It is important to note that the data quality of catch landings improves with time, with the most reliable bait landings available since 1985 and quota monitoring systems implemented in 2013.

Statement of the Problem: The reference period established by Amendment 2 does not consider history prior to 2009, nor recent changes in the fishery. In addition, some states have expressed concerns about underreported harvest during 2009–2011. In revisiting state-by-state quotas, the Board must decide if these three years are the most appropriate timeframe on which to base allocation.

Option A: 2009–2011 Average (Status Quo)
Quota allocation is based on the three-year average of landings between 2009 and 2011.

Option B: 2012-2016 Average
Quota allocation is based on the five-year average of total landings between 2012 and 2016. This timeframe includes the five most recent years of data and encompasses years prior to and after the implementation of a quota system. Total landings include transfers, bycatch, and landings under the episodic events program.

Option C: Longer Time-Series Average
Quota allocation is based on a longer time series average of landings. For example, quota allocation could be based on a four-year average of landings between 2009 and 2012, with 2012 being the last year before implementation of Amendment 2. Or

the allocation timeframe could be extended to include years prior to 2009, such as 2005 when the Beaufort, North Carolina reduction plant closed, or 1985 when more accurate bait landings data become available.

Option D: Weighted Allocation

Allocation is weighted over two time periods: a more distant period and a more recent period. For example, 50% of the allocation could be based on average landings between 2009 and 2012 while the other 50% of the allocation could be based on average landings between 2013 and 2015. Or, a portion of allocation could be based on landings in the 1980's while another portion of allocation could be based on landings in the 2000's. Weighting is intended to balance prior trends in the fishery with recent changes in catch.

Public Comment Questions: Should the Board consider changes to the reference period on which menhaden allocation is based? Should allocation consider prior trends as well as recent changes in the fishery? What years would you recommend as the basis for allocation?

ISSUE 4: Quota Transfers and Overage Payback

Background: Amendment 2 allows for two or more states to transfer (or combine) their Atlantic menhaden quota. Transfers often occur when a jurisdiction has exceeded its allocation for the year; rather than reduce its subsequent-year quota by the amount of the overage, as required by Amendment 2, a state can receive quota from another state that did not harvest its entire allocation. These transfers do not permanently affect a state's quota allocation. All states participating in a transfer (i.e., the donor states and the receiving states) must individually submit signed letters to the Commission, requesting approval for the transfer of a specified poundage of menhaden. Transfers are not final until written approval is granted by the ASMFC Executive Director.

As a practical matter, fisheries routinely, yet inadvertently, exceed or under perform their quota due to the challenges of quota monitoring, including delays in reporting and unanticipated changes in catch rates. Transfers are a useful technique to address these occurrences. However, some regions may be disadvantaged by the quota transfer system due to the timing of their fishery relative to other fisheries along the coast, meaning they may not know they've had an overage until late in the year when available quota has already been donated. Furthermore, there is no ASMFC guidance on how to apportion unused quota if there are multiple transfer requests at the same time.

Other FMPs allow for quota transfers and provide examples of potential management tools. The black sea bass FMP allows for quota reconciliation such that, in a year where the coastwide quota is not exceeded, any state-specific overage is forgiven in its entirety. This streamlines the transfer process and avoids the need for written approval from the individual states and the ASMFC Executive Director. This

could potentially be a viable option for the menhaden fishery given that states' harvest did not exceed the annual TAC from 2013-2015.

The black sea bass FMP also provides examples of what to do in years when the coastwide TAC is exceeded. Specifically, states that did not meet their allocation may transfer their unused quota to a common pool. This common pool quota is then redistributed to states that exceeded their quota based on the proportion of the state's overage. Any overage that remains after the redistribution of unused quota is deducted from a state's quota the subsequent year. It is important to note that quota reconciliation may not be compatible with quota rollovers (see Issue 5 on pg 15) as unused quota is used to offset overages.

Statement of the Problem: Amendment 2's procedure for quota transfers may not benefit states evenly, lacks specific guidance, and can be an administrative burden on donor and receiving states. Consequently, the Board is considering a quota reconciliation process to address quota overages, as a replacement for quota transfers for this purpose. Quota transfers could still occur for other reasons (e.g., a state grants a vessel safe harbor with catch destined for another state that is then unloaded there). In the case of the fleet capacity quota allocation options, reconciliation would not be necessary for any fleet assigned a soft quota.

Public Comment Questions: Should the process for quota transfers be further defined or replaced by an automatic reconciliation process? Should state-specific quota overages be forgiven in years when the coastwide TAC is not exceeded? When the coastwide TAC is exceeded but at least one jurisdiction has an underage, should unused quota be pooled and redistributed through a specified transfer process to states with an overage? Should states be required to contribute unused quota to a common pool or should this be voluntary? Should there be accountability measures for a state that exceeds its quota by a certain percentage or repeatedly participates in quota reconciliation?

ISSUE 5: Quota Rollovers

Background: Amendment 2 allows for unused quota to be rolled over for use in the subsequent fishing year only when the stock is not overfished and overfishing is not occurring. At the time of implementation (2013), the Atlantic menhaden stock was considered not overfished but overfishing was occurring. As a result, the amendment deferred defining the specifics of the rollover program until overfishing was no longer occurring.

In 2015, a new benchmark stock assessment was approved for management use which found the stock is not overfished and overfishing is not occurring. As a result, the stock, since 2015, has met the qualifications for quota rollovers; however, the amount of quota that can be carried into the next year has not been established. In August 2015, the Board agreed to consider the details of quota rollovers in Amendment 3. Other species, including spiny dogfish and Atlantic herring, allow for a percentage (5%

and 10%, respectively) of unused quota to be rolled over from one year to the next. For example, in the spiny dogfish fishery, if a state's annual quota is 1 million pounds, a maximum of 50,000 pounds (5%) of unused quota can be rolled over into the subsequent year.

It is important to note that the issues of quota reconciliation and quota rollover may not be compatible, such that it may not be possible to have quota overages automatically forgiven via reconciliation and unused quota roll over into the subsequent fishing year. Any unused soft quota would also not be eligible for quota rollover into the subsequent fishing year.

Statement of the Problem: The Atlantic menhaden stock is not overfished and overfishing is not occurring, thereby qualifying the stock for quota rollovers per Amendment 2. However, because the details of a quota rollover program were not specified in Amendment 2, no quota rollovers have taken place. The Board is looking to readdress and clarify the provisions via Amendment 3.

Public Comment Questions Should unused quota be rolled over into the subsequent year? Should the amount rolled over be limited to a percent of quota? Should all sectors of the fishery be allowed to roll over quota? Should quota rollover be mandatory or voluntary?

ISSUE 6: Incidental Catch & Small Scale Fishery Allowance

Background: Upon a state reaching its individual quota and closing its directed fishery, Amendment 2 provides a bycatch allowance of up to 6,000 pounds of Atlantic menhaden per vessel per trip for non-directed fisheries. The intent of this allowance is to accommodate and track incidental catch, i.e. catch that is not targeted but is harvested. As specified in Amendment 2, all landings that occur during a state-designated open season count towards a state's quota; however, menhaden caught after the closure of a state's directed fishery are considered bycatch and do not count towards the quota, nor the coastwide TAC.

Coastwide, the vast majority of menhaden harvested under the bycatch allowance is taken with stationary multi-species gears. Table 4 in Appendix 1 shows the average bycatch landings between 2013 and 2015 by gear and jurisdiction. On average, 5.7 million pounds of menhaden bycatch are landed each year, representing 1-2% of total landings in the fishery. Over 80% of the bycatch harvest comes from stationary gears, with the biggest contributors being the Maryland pound net fishery and the Virginia anchored gill net fishery. Cast nets contribute 6% of bycatch landings and represent the largest contributor from the mobile gear sector. This is followed by drift gill nets (5%) and beach seines (3.7%). Jurisdictions in the Chesapeake Bay contribute the most to bycatch landings of menhaden, with Maryland harvesting 40.7%, Virginia harvesting 24.9%, and the Potomac River Fisheries Commission harvesting 15.4% of annual coastwide bycatch landings. Between 2013 and 2015, 59.6% of bycatch trips using stationary gears landed less than 1,000 pounds of menhaden and 80.7% of trips landed

less than 3,000 pounds of menhaden (Table 5 in Appendix 1). In 2015, most menhaden landed under the bycatch allowance were landed in April (28%), September (23%), and October (21.3%). This corresponds with the closure of several states' directed fisheries in the spring and fall (Table 6 in Appendix 1).

Concerns have been raised regarding the current bycatch provision. The first is that landings under the bycatch allowance do not count toward a state's quota. As a result, bycatch landings may undermine the efficacy of the coastwide TAC since there is no yearly bycatch limit. Additionally, since neither "bycatch" nor "non-directed fisheries" is defined in Amendment 2, it is unclear who can harvest under the allowance. Many passive gears, such as pound nets, can be set to target menhaden but may also catch menhaden incidentally. Furthermore, the question arises to whether the bycatch allowance essentially supports small-scale directed fisheries rather than accommodating and tracking incidental catch. Cast nets, for example, direct on menhaden but are included in the bycatch provision.

Another concern is that the current bycatch provision dissuades cooperative fishing since the bycatch allowance is per vessel rather than permitted individual. This is particularly problematic in the Chesapeake Bay where it is traditional for multiple permitted individuals to work together from the same vessel to harvest menhaden. Addendum I (implemented in 2016) alleviated this problem by allowing two permitted individuals fishing from the same vessel using stationary multi-species gear to land up to 12,000 pounds of menhaden per trip per day (ASMFC 2016); however, there may be other ways to address this issue in Amendment 3.

Moving forward, there are several options to address concerns with the current bycatch provision. Bycatch could be defined as a percent composition to ensure it accounts for incidental landings. Bycatch could also be defined per permitted individual rather than per vessel to allow for cooperative fishing. Alternatively, bycatch could be included in the TAC or limited through a harvest cap to ensure it does not undermine the total quota. Additionally, the bycatch provision could be removed and replaced with a coastwide small-scale fishery set aside (Option F on pg 18). This would remove the administrative burden on states to closely monitor landings by small-scale fisheries, allow for flexibility in landings as abundances changes geographically and temporally, and bring the current bycatch fishery under the TAC.

In the management options presented below, the term 'bycatch' is replaced with the term 'incidental catch.' This change was made due to the various and conflicting definitions of bycatch among the states and to reflect the intent of the allowance to accommodate menhaden catch that is not targeted but is harvested.

Statement of the Problem: Under Amendment 2, there is a 6,000 pound incidental bycatch limit per vessel per trip/day for non-directed fisheries. Several issues have been identified with this allowance, namely that bycatch is not included in the TAC,

there is no definition of what constitutes bycatch, and the allowance does not support cooperative fishing.

Option A: Incidental Catch Limit per Vessel (Status Quo)
Following the closure of the directed fishery, there is an incidental catch limit per vessel per trip for non-directed fisheries. Two permitted individual fishing from the same vessel using stationary multi-species gear are allowed to land twice the allowance when working together.

Option B: Incidental Catch Allowance per Permitted Individual
An incidental catch limit would be established per person/trip, rather than per vessel/trip. As a result, multiple permitted individuals on the same vessel could each land the incidental catch limit.

Option C: Incidental Catch Included in Quota
All incidental catch of menhaden would count towards the directed fishery quota. Once the quota is reached, the menhaden fishery would be closed and no landings would be allowed.

Option D: Incidental Catch Cap and Trigger
Rather than a trip limit, incidental catch in the Atlantic menhaden fishery would be limited by a harvest cap (not part of the annual TAC). If the collective incidental landings exceed this cap by a certain percentage in a single year or by any percentage in two consecutive years, management action would be triggered by the Board to reduce incidental landings in the fishery. Separate harvest caps could be established for passive and active gears

Option E: Incidental Catch Defined by Percent Composition
Trips in the non-directed fisheries that land above a certain poundage of menhaden would be required to maintain their menhaden landings under a specific percent composition of catch. This option could be combined with either an incidental catch allowance per trip or a cap in order to limit menhaden landings in the non-directed fisheries.

Option F: Small-Scale Fishery Set Aside
A portion of the overall TAC would be set aside for gears participating in the small-scale fisheries. Trips by these gears would be limited to a certain poundage per day, and all trips conducted by these gears would count towards the small-scale fishery quota. Separate trip limits could be established for active and passive gears. If the quota is exceeded in a given year, payback could be required or the quota for the subsequent year could be adjusted up or down to meet the expected harvest by small-scale gears. While similar to Option G presented in *Issue 2: Quota Allocation*, the inclusion of this option would allow for the establishment of a small-scale fishery set aside regardless of what allocation option is chosen.

Public Comment Questions: Should there be a cap on incidental landings in the Atlantic menhaden fishery? Should incidental catch be defined as a percent composition? Should the incidental catch allowance be allocated to vessels or permit holders? Should the incidental catch provision be replaced with a small-scale fishery set aside, and if yes, what gears should be included in this sub-quota (see Table 3 in Appendix 1)? Should active and passive gears be treated differently under the incidental catch provision?

ISSUE 7: Episodic Events Set Aside

Background: Amendment 2 sets aside 1% of the overall TAC for episodic events, which are times and areas where Atlantic menhaden are available in more abundance than they normally occur. The purpose of the set aside is to enable increased harvest of menhaden during episodic events so as to minimize discards in the fishery. The details of the program, established as a pilot, were approved by the Board in May 2013 and are outlined in Technical Addendum I. In the fall of 2013, the Board extended the pilot program until further Board action. In 2016, the Board extended the program until finalization of Amendment 3.

Eligibility in the episodic events set aside program is reserved for the New England states (Maine through Connecticut). To participate in the program, these states must implement daily trip level harvest reporting, restrict the harvest and landing of menhaden under the episodic events program to state waters, and implement a maximum daily trip limit no greater than 120,000 pounds/vessel. In order for a state to declare participation in the program, a state must demonstrate it has reached its quota prior to September 1 and provide information indicating the presence of unusually large amounts of menhaden in its state waters. Any set aside quota that is not used by October 31 is returned to the coastwide quota and redistributed to the states. If the set aside quota is exceeded, overages are deducted from the next year's episodic events set aside amount.

In 2014 and 2015, Rhode Island was the only state to declare participation in the episodic set aside program, harvesting 8% of the set aside in 2014 and 45% of the set aside in 2015 (Table 1). In 2016, Rhode Island and Maine declared participation in the program, and New York sought Board approval to participate in the program. While New York is not considered a New England state under Technical Addendum I, New York highlighted the unusually large amounts of menhaden in the Peconic Bay estuary and the potential for fish kills. The Board approved New York's request to harvest under the episodic events set aside program, capping New York's harvest under the program to 1 million pounds.

Table 1: Episodic events set aside for 2013-2016 and the percent used by participating states.

Year	Set Aside (lbs)	Landed (lbs)	% Used	State	Unused Set Aside Reallocated (lbs)
2013	3,765,491				
2014	3,765,491	295,000	8%	RI	3,470,491
2015	4,142,040	1,883,292	45%	RI	2,258,748
2016	4,142,040	3,810,145	92%	ME, RI, NY	331,895

Given the increasing amounts of menhaden landed under the episodic events set aside program and New York's request to harvest under the program, the Board is considering changes to the program. Specific questions include whether the percent of TAC allocated to the set aside should be increased, which states should be allowed to participate in the program, and whether the current definition of an episodic event is appropriate. Furthermore, some allocation options presented in this document would potentially negate the need for such a set aside.

Statement of the Problem: Since 2013, participation in and landings under the Episodic Events Set Aside Program have increased. As a result, the Board is considering changes to the scope of the program, including the amount of quota allocated to the set aside and which states are qualified to participate.

Public Comment Questions? Should a percentage of the TAC be set aside for episodic events? If yes, what percentage of the annual TAC should be set aside? Which jurisdictions should be allowed to participate in this program? Does the episodic event program need to be reconsidered as the distribution of menhaden changes? How should states demonstrate that an episodic event is occurring in state waters?

ISSUE 8: Chesapeake Bay Reduction Fishery Cap

Background: The Chesapeake Bay reduction fishery is currently limited by a harvest cap of 87,216 metric tons (mt). The goal of this restriction is to prevent all of the reduction fishery harvest from occurring in the Chesapeake Bay, a critical nursery area for Atlantic menhaden. Harvest by the reduction fishery is prohibited within the Chesapeake Bay when 100% of the cap has been reached. A maximum of 10,976 mt of un-landed fish can be rolled over into the subsequent year's harvest cap. The Chesapeake Bay reduction fishery has consistently underperformed the 87,216 mt harvest cap, landing less than 50,000 mt in 2015, less than 45,000 mt in 2014, and less than 40,000 mt in 2013. Note that landings by the Chesapeake Bay reduction fishery are confidential and only approximate landings are provided.

The Chesapeake Bay Reduction Fishery Cap, which was originally implemented in 2006, was intended to prevent the localized depletion of menhaden. There was a hypothesis that the potential for localized depletion exists in the Chesapeake Bay given the concentrated harvest of the species in the area, particularly from the reduction fishery. Possible outcomes of localized depletion include compromised predator-prey relationships and chronic low recruitment of larval menhaden. The Board committed

to assessing the potential for localized depletion at its February 2005 meeting and established the Atlantic Menhaden Research Program (AMRP) to evaluate the possibility of such depletion occurring. In 2009, work completed under the AMRP was peer reviewed by the NOAA Center for Independent Experts (CIE). The peer review was unable to conclude localized depletion is occurring in the Chesapeake Bay given there were two assessment models which generated different advice. It also noted that given the high mobility of menhaden, the potential for localized depletion could only occur on a "relatively small scale for a relatively short time."
Since harvest by the reduction fishery has consistently been below the cap and there has not been conclusive evidence that localized depletion is occurring in the Chesapeake Bay, the Board would like feedback on whether this is an important management tool in the Atlantic menhaden fishery.

Statement of the Problem:
The Chesapeake Bay Reduction Fishery Cap was intended to protect menhaden nursery areas and prevent against localized depletion; however the reduction fishery has consistently under-performed its harvest cap and a peer review report was unable to conclude that localized depletion is occurring in the Chesapeake Bay. The Board would like feedback on whether this is an essential management tool.

Public Comment Questions: Should the Chesapeake Bay Reduction Fishery Cap be maintained? Is it an important tool for the management of Atlantic menhaden?

ISSUE 9: Research Programs and Priorities

Background: As a part of the 2015 stock assessment, the Board's Technical Committee outlined a series of research recommendations and priorities for the Atlantic menhaden stock. The intent of these recommendations is to help inform and support research conducted by states, institutions, and industry. Current recommendations include evaluating the productivity of different estuaries along the Atlantic coast, collecting age-specific data on movement rates of menhaden to develop regional abundance trends, updating information on maturity and fecundity, and investigating the effects of global climate change on the distribution and behavior of menhaden. While these recommendations outline a variety of research needs for the stock, there may be other pertinent research questions which could inform future management decisions. Furthermore, while none of the TAC is currently set aside for research purposes, there could be an option to establish a Research Set Aside (RSA), through which a portion of menhaden quota could be reserved for scientific studies. Other fisheries, such as Atlantic Herring, currently have a RSA to conduct research on the bycatch of river herring and better characterize catch.

Statement of the Problem: Research recommendations for the menhaden stock are currently provided as a part of the benchmark stock assessment process; however, there may be other recommendations that should be added to this list to inform future management of the resource and fishery. Furthermore, the Board could consider a RSA to help facilitate research on the stock.

Public Comment Questions: What are important research questions that need to be answered regarding the menhaden fishery and resource? How should research recommendations be prioritized? Should there be a RSA established for menhaden? If yes, what portion of TAC should be set aside for research purposes?

BACKGROUND INFORMATION ON THE MGMT & STOCK STATUS OF ATLANTIC MENHADEN

Summary of Fishery Management

The Commission has coordinated interstate management of Atlantic menhaden (*Brevoortia tyrannus)* in state waters (0-3 miles) since 1981. Management authority in the exclusive economic zone (3-200 miles from shore) lies with NOAA Fisheries. As outlined in the Commission's Charter, fishery management plans shall be designed to prevent overfishing throughout the species' range, be based on the best available science, minimize waste of fishery resources, protect fish habitat, provide for public participation, and allow for fair and equitable allocation among the states.

In 1988, the Commission initiated a revision to the FMP. The Plan revision included a suite of objectives to improve data collection and promote awareness of the fishery and its research needs, including six management triggers used to annually evaluate the menhaden stock and fishery. In 2001, Amendment 1 was passed, providing specific biological, social, economic, ecological, and management objectives for the fishery. Subsequent addenda (I-V) to Amendment 1 sought to improve the biological reference points for menhaden and cap the reduction fishery. Addendum I revised the biological reference points and changed the frequency of stock assessments. Addenda II and III instituted a harvest cap on the Chesapeake Bay Atlantic menhaden reduction fishery for the 2006 through 2010 fishing seasons. Addendum IV extended this harvest cap through 2013. Addendum V, which was approved in November 2011, established a new F threshold and target rate (based on MSP) with the goal of increasing abundance, spawning stock biomass, and menhaden availability as a forage species.

The Atlantic menhaden fishery is currently managed through Amendment 2 to the Atlantic Menhaden FMP, which was passed in 2012 and implemented in 2013. It sets a coastwide TAC for the stock and allocates this harvest into state quotas. Amendment 2 also establishes a bycatch provision which allows for the harvest of up to 6,000 pounds of Atlantic menhaden per trip for non-directed fisheries and sets aside 1% of the overall TAC for episodic events. In order to effectively implement the management measures established in Amendment 2, states are required to implement timely reporting systems to monitor catch.

Technical Addendum I outlines the provisions of the episodic events set aside program. It restricts participation in the program to the New England states and requires these states to implement daily harvester reporting, restrict harvest to states waters, and set a 120,000 pound daily trip limit in order to harvest under the set aside. Technical Addendum I also outlines a process for declaring participation in the

program. Addendum I to Amendment 2 revisits the bycatch provision and allows two licensed individuals to harvest up to 12,000 pounds of menhaden bycatch when working from the same vessel fishing stationary, multi-species gear–limited to one vessel trip per day. Stationary multi-species gears are defined as pound nets, anchored/staked gill nets, and fyke nets.

Summary of Stock Status

The latest peer reviewed stock assessment is the 2015 benchmark assessment. The assessment used the Beaufort Assessment Model, a statistical catch-at-age model which estimates population size at age and recruitment in 1955 and then projects the population forward in time to the terminal year of the assessment (2013). The model estimates trends in population dynamics, including abundance at age, recruitment, spawning stock biomass, egg production, and fishing mortality rates. The current stock assessment model configuration does not directly output the unfished biomass of the Atlantic menhaden stock.

Model results indicate the population has undergone several periods of both high and low abundance over the time series. Biomass has fluctuated over time from an estimated high of over 2,284,000 metric tons in 1958 to a low of 667,000 metric tons in the mid-1990s. Population fecundity (measured as number of maturing ova, or eggs) has also varied throughout the time series with a large number of eggs seen in the early 1960s, the 1970s, the early 1990s, and the 2000's. Fishing mortality has steadily decreased throughout the model time series. This is primarily due to a decrease in harvest in the reduction fishery which peaked in the late 1950's at over 700,000 metric tons and decreased to roughly 130,000 metric tons in 2013. In contrast, bait landings have slowly increased from roughly 30,000 metric tons in the late 1980s to over 60,000 metric tons in 2012.

Population fecundity in 2013 was estimated to be 170,536 billion eggs, well above the fecundity threshold of 86,821 billion eggs (Figure 2). As a result, the population is deemed not overfished. Overfishing is also not occurring as the fishing mortality in 2013 (0.22) is below the fishing mortality threshold of 1.26 (Figure 3).

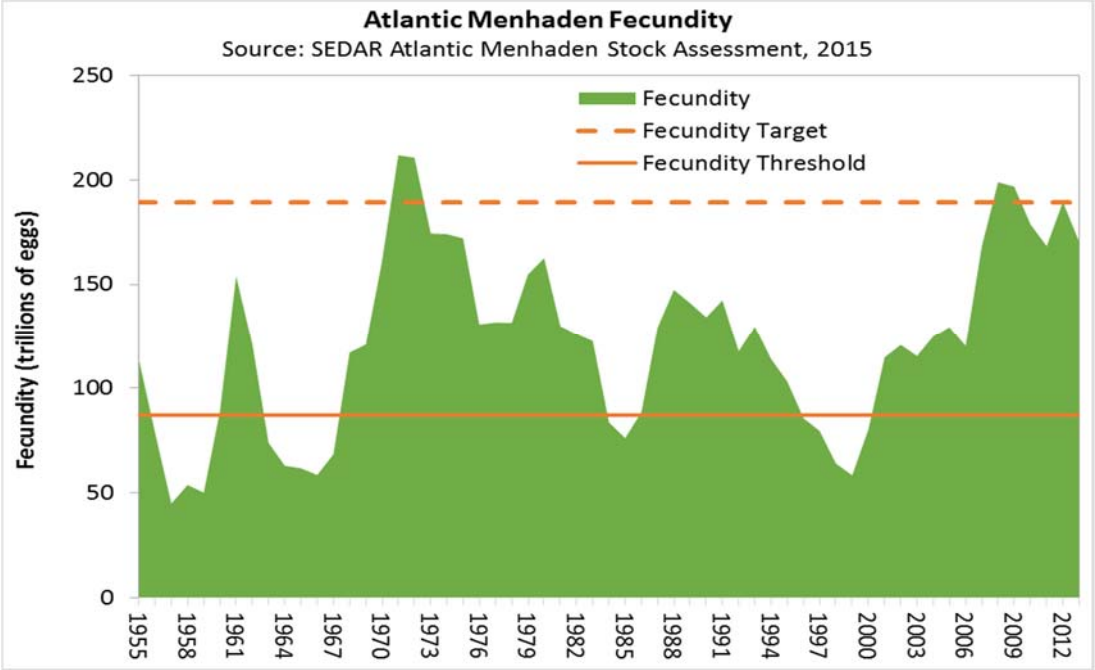


Figure 2: Atlantic menhaden fecundity target and threshold from the 2015 stock assessment. Population fecundity in 2013 was estimated to be 170,536 billion eggs, well above the fecundity threshold of 86,821 eggs.

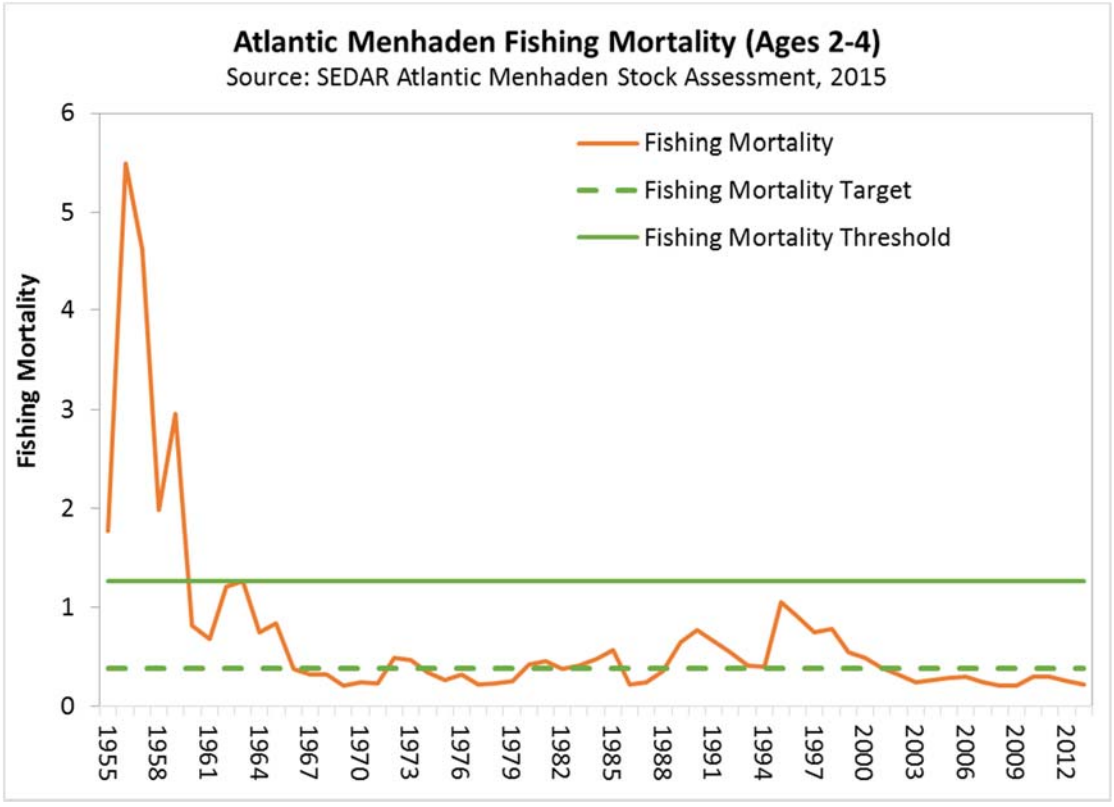


Figure 3: Atlantic menhaden fishing mortality target and threshold from the 2015 stock assessment. Overfishing is also not occurring as the fishing mortality in 2013 (0.22) is below the fishing mortality threshold of 1.26.

Social and Economic Impacts

Changes in the allocation of total allowable catch are expected to have socioeconomic impacts on affected states/jurisdictions, regions, and fishery interests. Overall, improvements in the menhaden stock which lead to increased TAC should benefit fishery participants; however, reductions in allocation to a particular area or interest could lead to reduced employment and associated reductions in the economic benefits derived from menhaden. In general, the reduction sector is expected to take fish in response to the allowable catch in relation to prices of competing oils (for example flax or other vegetable oils), and demand for oil and fishmeal products. The bait sector is expected to take fish in response to allowable catch in relation to the following factors: available fish, competing products (for example herring as bait for lobster), demand for menhaden as a primary desired bait, and prices for competing products in addition to the cost of fishing, fuel and vessel maintenance.

Currently, there is little socioeconomic data available with which to assess the specific effects of changes in allocation and other management actions. The Commission's Committee on Economics and Social Sciences (CESS) issued a request for proposals to fund research in order to characterize the coastwide commercial fisheries, including the bait and reduction sectors and the fishery communities they support. The study will gather both primary and secondary information from stakeholders to understand spatial trends in landings, the distribution of revenue, operational costs, and participation in the fishery. A project was selected early in 2016 and the research is presently being conducted. It is anticipated this data and other project deliverables will be available to the Commission and CESS early in 2017. Information from this survey will be incorporated into Draft Amendment 3.

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Appendix 1

Table 1. Atlantic menhaden allocation and quotas for 2013-2016. Current state-by-state allocation is based off of average landings between 2009 and 2011. Quota totals do not include the 1% of the TAC which is reserved for the Episodic Events Set Aside Program. Florida exceeded their quota in 2015 and this overage is deducted from their 2016 quota.

State	Allocation	2013-2014 Quota (lbs)	2015-2016 Quota (lbs)
ME	0.00039	146,787	161,466
NH	0.0000003	112	123
MA	0.00839	3,126,024	3,438,630
RI	0.00018	66,779	73,457
CT	0.00017	65,034	71,537
NY	0.00055	206,695	227,365
NJ	0.11192	41,721,164	45,893,335
DE	0.00013	49,230	54,153
MD	0.01373	5,116,874	5,628,568
PFRC	0.00621	2,314,174	2,545,595
VA	0.85322	318,066,790	349,873,884
NC	0.00493	1,836,948	2,020,645
SC	0.00000	-	-
GA	0.00000	-	-
FL	0.00018	66,995	73,695 (72,030 in 2016)
TOTAL	**-**	**372,783,605**	**410,062,453**

Table 2: Atlantic menhaden total landings (1985-2015) by jurisdiction. Landings include directed harvest, bycatch, and landings from the Episodic Events Set Aside Program. Total coastwide landings and jurisdictional percentages of total landings do not include confidential data.

	ME	NH	MA	RI	CT	NY	NJ	DE	MD	PFRC	VA	NC	SC	GA	FL	TOTAL
1985	33,192,713		3,039,625	8,388,046	234,800	901,800	2,879,766	176,135	5,372,193	16,768,889	620,118,526	97,738,403	C		7,579,674	796,390,570
1986	C		3,411,000	10,389,187	254,400	399,650	2,453,593	20,081	5,449,350	10,971,973	445,663,686	66,377,931	9,952		7,997,973	553,398,776
1987	18,668,660		1,215,175	13,609,224	94,900	206,795	2,563,163	22,034	5,793,683	13,120,698	622,988,388	55,498,571	C		2,776,777	736,558,068
1988	19,687,805	C	8,047,320	15,583,437	175,200	504,100	1,984,045	127,713	6,430,164	13,231,368	525,926,170	73,715,713	500		1,026,228	666,439,763
1989	380,619	C	1,459,402	19,033,173	148,500	449,100	2,854,361	104,382	6,166,236	8,334,174	588,063,122	66,756,288			1,372,959	695,122,316
1990	5,744,597	264,500	1,709,605	17,102,650	96,706	649,710	9,041,459	167,116	1,662,275	4,523,776	696,229,253	72,231,989			2,636,497	812,060,133
1991	16,107,463	204,000	12,798,310	5,090,375	96,300	650,150	16,597,402	278,774	3,540,179	5,376,264	636,489,011	110,528,754			2,062,983	809,819,965
1992	14,857,195	C	13,499,450	2,849,359	91,200	1,131,701	27,470,906	130,833	1,777,088	5,061,565	566,221,850	57,515,712	C		2,788,592	693,395,451
1993	19,520,455	C	1,211,569	5,146,280	195,827	1,048,993	28,296,741	164,046	2,326,613	7,884,001	296,453,210	64,711,384			2,584,766	429,547,595
1994			351,251	533,800	60,128	961,474	38,176,201	78,672	2,369,071	6,680,937	270,775,349	73,853,901			1,387,012	395,227,796
1995			2,910,613	5,873,315	255,264	1,087,978	36,572,507	101,388	4,264,754	7,002,818	360,140,489	58,374,081			687,944	477,271,151
1996			8,500	802	82,851	11,135	35,516,726	100,063	3,906,808	5,111,423	294,195,660	53,850,943			294,936	393,079,847
1997			238,500	5,750	72,329	553,953	38,118,579	55,733	3,457,237	5,757,370	267,021,139	97,727,057	C		408,492	413,416,309
1998	C	C	121,200	400	338,817	430,084	33,287,641	58,048	2,933,818	3,980,738	513,879,901	57,976,455			301,566	613,309,912
1999	C		292,800	2,330	30,298	242,886	27,753,567	78,551	4,460,534	4,860,883	374,942,360	42,799,080			288,144	455,753,158
2000	C		72,600	320,000	14,423	565,800	31,266,780	47,980	3,935,307	5,023,374	358,236,761	56,280,112			260,710	456,025,297
2001	C		144,600	-	38,865	576,426	26,375,573	53,257	3,970,243	3,329,035	484,528,580	56,012,396			179,951	575,209,116
2002	70,062		301,500	5,750	1,138,788	444,739	24,716,412	80,261	4,023,389	3,122,050	362,640,618	69,190,596			55,304	465,789,469
2003			218,255	62	46,515	384,875	17,080,463	42,593	3,163,252	2,438,790	372,486,794	48,936,502			35,810	444,833,911
2004		C	-	39,232	33,210	543,481	20,678,813	75,635	5,369,952	5,411,043	394,100,339	50,577,983			21,220	476,851,047
2005	30,302		2,177,724	14,453	30,636	871,081	17,574,826	120,658	10,635,776	4,759,905	368,988,147	13,386,245			39,404	418,629,157
2006	37,297		2,524,255	15,524	866,235	811,934	21,290,309	111,405	6,841,296	3,413,517	365,305,722	962,648			157,117	402,337,258
2007	C	C	5,543,805	8,948	90,254	483,557	37,202,485	81,850	11,370,064	5,036,906	405,836,300	1,134,167			71,373	467,054,635
2008	4,310,055	C	14,131,256	269,288	104,881	410,121	38,210,688	72,970	8,153,008	4,820,645	339,001,968	645,231			60,098	410,190,616
2009	166,942	33	6,719,048	107,548	170,907	330,496	33,329,177	69,476	7,756,192	3,191,905	335,238,841	2,124,733			52,800	389,258,097
2010	C	C	4,973,857	78,149	42,489	394,556	50,497,253	51,933	6,903,300	2,790,728	404,384,758	1,299,130			76,593	471,531,136
2011	C		116,151	83,899	26,929	279,117	74,324,485	70,326	6,506,430	2,759,597	389,652,459	3,529,967			146,534	477,551,894
2012	39,383	C	1,648,395	106,606	37,454	258,271	85,457,890	130,725	13,737,314	5,892,228	386,552,474	538,783			126,141	494,526,039
2013	C		2,314,888	99,821	26,463	1,187,525	39,819,342	125,909	7,074,727	3,295,295	316,537,921	454,172			224,872	371,168,714
2014	C		2,226,294	500,903	36,552	825,549	41,449,670	161,509	7,005,271	3,175,893	322,492,690	917,375			220,587	379,145,293
2015	C		2,932,128	1,802,089	77,003	1,468,165	47,811,837	150,542	7,551,430	2,739,035	350,524,668	839,637	C		377,729	416,275,905
% of total landings 1985-2015	0.8%	0.0%	0.6%	0.7%	0.0%	0.1%	5.7%	0.0%	1.1%	1.1%	81.2%	8.4%	0.0%	0.0%	0.2%	100.0%

Table 3: Atlantic menhaden coastwide landings averages by gear type for 2009-2012 and 2013-2014. Bycatch allowance landings are included in the 2013-2014 average. Data are preliminary and subject to change.

Landings in Pounds	2009-2012 Average	Percent by Gear	2013-2014 Average	Percent by Gear
Purse Seine	436,211,312	95.188%	353,766,645	94.207%
Pound Net	16,129,566	3.520%	13,990,507	3.726%
Trawl	2,639,414	0.576%	1,444,210	0.385%
Gill Net	2,784,530	0.608%	5,052,734	1.346%
Cast Net	213,494	0.047%	750,823	0.200%
Trap/Pots	104,775	0.023%	156,790	0.042%
Fyke Net	51,994	0.011%	3,865	0.001%
Haul Seine	64,215	0.014%	118,651	0.032%
Other	65,608	0.014%	237,735	0.063%
Total	**458,264,908**	**100%**	**375,521,959**	**100%**

Table 4: Average landings under the bycatch allowance from 2013-2015 by gear type and jurisdiction. The highlighted cells indicate the high bycatch landings in the Maryland pound net fishery and the Virginia anchored gill net fishery. (C)= confidential landings and (-)=no landings. Total confidential landings were 209,277 pounds (i.e., the sum of all C's in the table below). Note that the sum of pounds and percent of total columns do not include confidential data.

State/Jurisdiction	RI*	NY	NJ**	DE	MD	PRFC	VA	FL	Sum lbs (NonConf)	% of Total
Stationary Gears While Fishing										
Pound net	57,231	128,854	C	-	2,306,552	884,843	122,913	-	3,500,393	60.9%
Anchored/stake gill net	C	-	100,202	28,998	5,131	-	1,242,512	C	1,376,843	24.0%
Pots	-	C	-	C	10,001	-	-	C	10,001	0.2%
Fyke nets	-	-	C	-	C	-	C	-	<1000	0.0%
Mobile Gears While Fishing										
Cast Net	C	183,137	C	-	C	-	-	163,776	346,913	6.0%
Drift Gill net	-	18,175	129,620	66,117	16,082	-	57,794	-	287,788	5.0%
Seines Haul/Beach	-	206,587	-	-	C	-	5,119	-	211,706	3.7%
Trawl	C	9,733	C	-	-	-	-	-	9,733	0.2%
Hook & Line	C	-	-	-	C	-	-	C	<300	0.0%
Sum lbs (NonConf)	**57,231**	**546,485**	**229,822**	**95,116**	**2,337,766**	**884,843**	**1,428,339**	**163,776**	**5,744,572**	
% of Total	1.0%	9.5%	4.0%	1.7%	40.7%	15.4%	24.9%	2.9%		

NJ** an ad hoc method was used to split gill net data between stationary and mobile gears
RI* trips do not include those landed under the episodic events set aside because those landings are counted as part of the directed fishery.

Table 5: Total number of bycatch allowance trips landing menhaden by stationary gears from 2013-2015 by jurisdiction and percent of total trips by 1,000 pound landings bins. (C)= confidential landings.

Bins (LBS)	VA	MD	PRFC	NJ	NY	DE	RI*	FL	Total Trips	Total Bin%
1-1000	71%	35%	31%	85%	88%	91%	53%	100%	**5,350**	59.6%
1001-2000	13%	12%	21%	10%	9%	4%	14%	0%	**1,176**	13.1%
2001-3000	7%	8%	15%	3%	C	4%	18%	0%	**716**	8.0%
3001-4000	3%	7%	10%	1%	3%	1%	4%	0%	**426**	4.7%
4001-5000	3%	7%	13%	C	C	1%	3%	0%	**441**	4.9%
5001-6000	2%	14%	10%	C	C	0%	6%	0%	**519**	5.8%
6000+	0%	16%	0%	C	C	0%	3%	0%	**351**	3.9%
Total Trips	**4672**	**2057**	**1138**	**477**	**345**	**165**	**102**	**23**	**8,979**	
Total Trips %	52.0%	22.9%	12.7%	5.3%	3.8%	1.8%	1.1%	0.3%		

RI* trips do not include those landed under the episodic event set aside because those landings are counted as part of the directed fishery.

Table 6: Menhaden bycatch landings by month in 2015. Jurisdictions which landed under the bycatch allowance include Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Potomac River Fisheries Commission, Virginia, and Florida. Bycatch landings correspond to the closure of states' directed fisheries in the spring and fall. Landings under the Episodic Events Program are not included in this table. (C)=confidential landings. Note: the total sum of pounds does not include confidential landings.

	Pounds	%
January	-	
February	-	
March	C	
April	1,746,125	28.4%
May	214,409	3.5%
June	239,290	3.9%
July	160,574	2.6%
August	199,904	3.2%
September	1,416,328	23.0%
October	1,308,829	21.3%
November	640,627	10.4%
December	232,055	3.8%
Total	6,158,140	100.0%

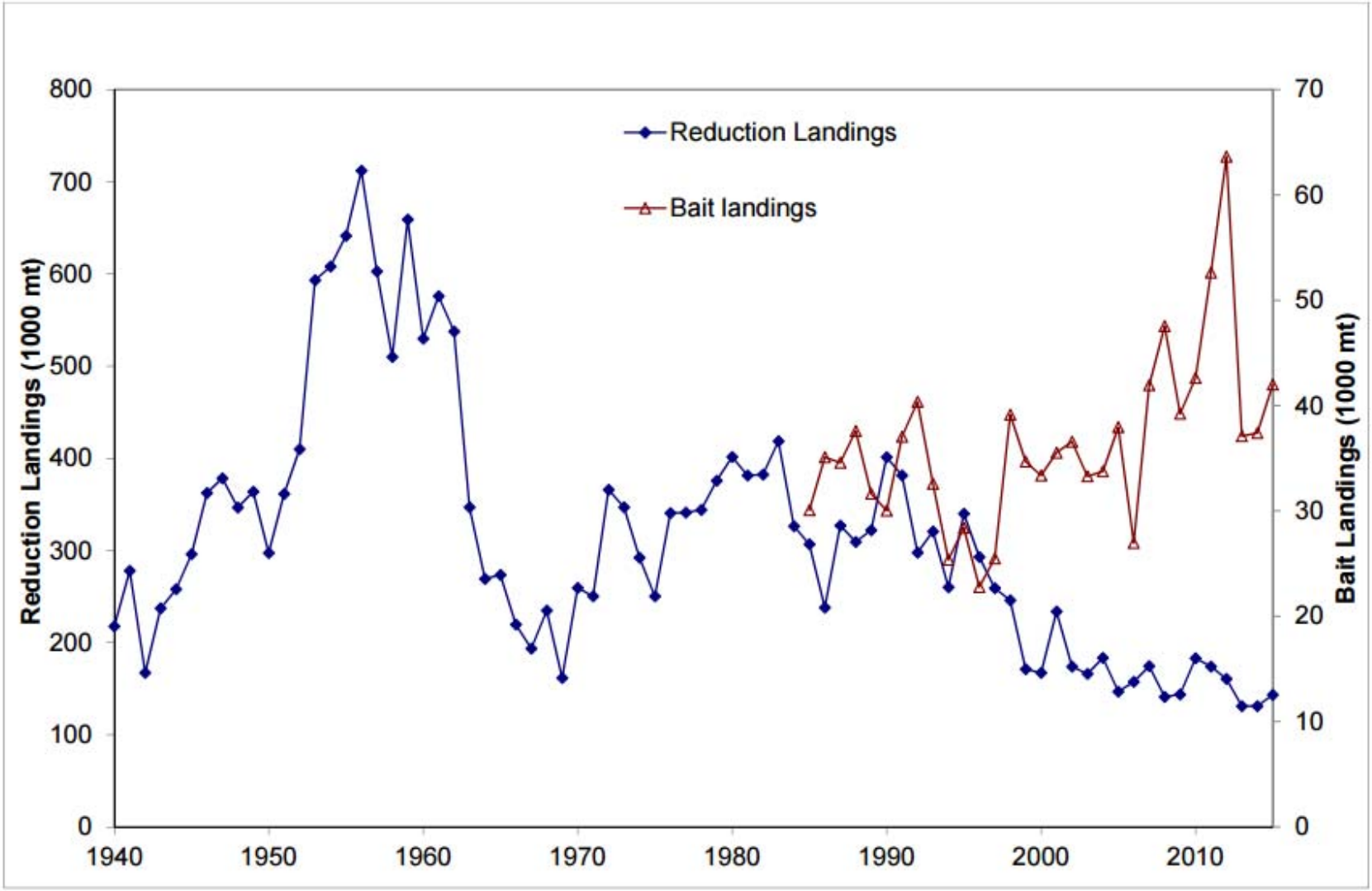

Figure 1: Landings from the reduction purse seine fishery (1940-2015) and the bait fishery (1985-2015) for Atlantic menhaden. Note the two vertical axes are on different scales.

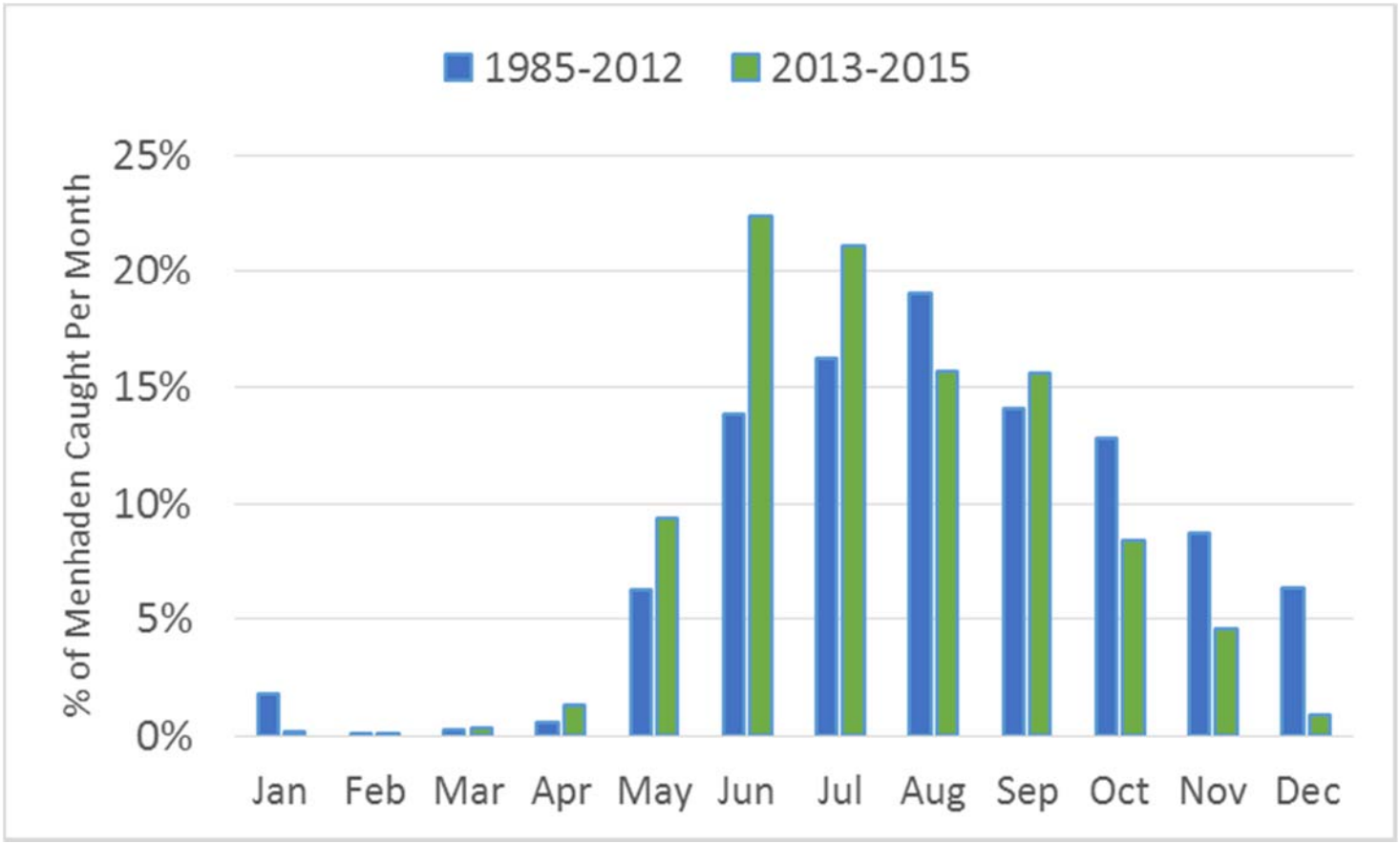

Figure 2: Percent of landings from the menhaden commercial fishery by month. Blue bars show landings from 1985 to 2012 and the green bars show landings from 2013-2015 (following the implementation of Amendment 2).

Appendix 2

Atlantic States Marine Fisheries Commission

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MEMORANDUM

April 20, 2015

To: **Atlantic Menhaden Management Board**

From: **Biological Ecological Reference Points Workgroup**

RE: **Ecological Reference Points using Pikitch et al. (2012)**

At its February meeting, the Atlantic Menhaden Management Board (Board) tasked the BERP WG with developing ecological reference points for Atlantic menhaden using Pikitch et al. (2012) as described in the ERP Report. As the Workgroup noted in the ERP Report, models or ERPs presented in the ERP report required further review by the BERP WG. To complete this task, the Workgroup reviewed the methodology by Pikitch et al. (2012) to determine which "information tier" Atlantic menhaden fit into. Subsequently, the WG evaluated the applicability of the recommended management action associated with that information tier. After detailed discussions, the WG concluded:

1. The WG recognizes that the recommendations in Pikitch et al. (2012) are based on the idea that the variable stock dynamics of forage species, like Atlantic menhaden, may require additional management precautions than other non-forage species.
2. The WG acknowledges that while the ERPs referenced in Pikitch et al. (2012) may be a bet-hedging strategy, it assumes that there must be some stock-recruitment relationship that has not yet been identified for Atlantic menhaden.
3. The WG decided that menhaden fall under the "intermediate information tier" as defined by Pikitch et al. (2012), with strong caveats (please see the attached table).
4. The intermediate information tier recommends management actions in the form of applying a hockey stick harvest control rule with $B_{LIM} \geq 0.4B_0$ and $F=0.5M$. In this scenario, fishing would be prohibited when biomass levels fall below 40 percent of unfished biomass. When biomass is greater than 40 percent of unfished biomass, the fishing mortality would not exceed half the species' natural mortality rate. The recommended fishing mortality rate from Pikitch et al. (2012) and a comparison to the 2015 Benchmark Stock Assessment single species reference points are displayed below including the terminal year F_{2013}.

Reference Points/Terminal Year F	Benchmark
$F_{26\%MSP}$ (threshold)	1.26
$F_{57\%\ MSP}$ (target)	0.38
$F_{64\%\ MSP}$ (Pikitch et al. 2012)	0.29
$F_{70\%\ MSP}$ (F in terminal year 2013)	0.22

5. The WG notes that many of the case studies examined in Pikitch et al. (2012) involved predators that were "highly dependent" (i.e., ≥50% of diet) on a single forage species, with strong trophic effects caused by changes in forage abundance. However, in the case of the coast-wide stock of Atlantic menhaden, the primary predator species are more opportunistic, consuming a diverse prey base.
6. While the WG was able to identify that striped bass may meet the Pikitch et al. (2012) predator dependency definition (with menhaden as forage) at certain times of the year and in certain areas (e.g., Chesapeake Bay in winter), the WG determined that none of our predator species of interest could fit the criteria of "highly dependent" predator (with menhaden as forage) on a coast-wide scale. Therefore, the WG does not believe the reference point recommendations in Pikitch et al. (2012) are applicable to this system.
7. Ultimately, the BERP WG does not feel that the management actions recommended in Pikitch et al. (2012) are appropriate for Atlantic menhaden specific management. Furthermore, the WG cannot evaluate if the Pikitch et al. (2012) buffers will actually provide enough forage to sustain predators of interest at desired population levels. Overall, although the ERPs in Pikitch et al. (2012) are less than ideal, predator removals are a large source of mortality for this stock. As such, through the framework of the ERP Report, the WG is working to have better ERP advice that is specific to Atlantic menhaden management.

The WG recommends that the Board form a subcommittee to collaborate with the BERP WG and industry to define more concrete ecosystem management goals and objectives. This would help the WG identify which models might be the most appropriate to achieve proposed objectives. Moving forward, the WG would like to combine the recommendations of a Board subcommittee with those of the Atlantic menhaden peer reviewers to define an objective approach to developing ERPs.

References

Pikitch, E., Boersma, P.D., Boyd, I.L., Conover, D.O., Cury, P., Essington, T., Heppell, S.S., Houde, E.D., Mangel, M., Pauly, D., Plagányi, É., Sainsbury, K., and Steneck, R.S. (2012). Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs. Lenfest Ocean Program. Washington, DC. 108 pp.

Appendix 3:

TO:

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RE:
Biological Ecological Reference Points Working Group memo dated April 20, 2015

It was brought to our attention that the Biological Ecological Reference Points (BERP) Working Group (WG) had been tasked "with developing ecological reference points for Atlantic menhaden using Pikitch et al. (2012) as described in the ERP Report." However, as the WG detailed in its memorandum to you on April 20, 2015, "the WG does not believe the reference point recommendations in Pikitch et al. (2012) are applicable to this system." Furthermore, "the BERP WG does not feel that the management actions recommended in Pikitch et al. (2012) are appropriate for Atlantic menhaden specific management.

As two co-authors of Pikitch et al. (2012), we are responding to several possible misinterpretations and flawed arguments in the WG memo. We do so by responding to the main reasons the WG gives for concluding that the Pikitch et al. (2012) recommendations are not applicable or appropriate:

1. **"The WG acknowledges that while the ERPs referenced in Pikitch et al. (2012) may be a bet-hedging strategy, it assumes that there must be some stock-recruitment relationship that has not yet been identified for Atlantic menhaden."**
   - **Brief response**: It is not necessary to identify a stock-recruitment relationship for Atlantic menhaden to apply the Pikitch et al. (2012) recommendations.

   Detailed Response: The recommendations in Pikitch et al. (2012) are not a bet-hedging strategy, but rather a precautionary approach that will reduce the odds of forage fish population collapse, keep higher forage fish biomass in the water, and, importantly, prevent or ameliorate impacts on dependent fish, marine mammal, and seabird populations that depend on forage fish. A recent paper in the *Proceedings of the National Academy of Sciences* by Essington et al. (2015) provides additional evidence of the importance of using a high minimum biomass threshold to prevent collapse and maintain high levels of forage fish in the water. The paper also finds minimal impact on fishery yields from this practice over the long term.

Regarding the stock-recruitment relationship, the WG has misinterpreted Pikitch et al. (2012). Its recommendations are derived, in part, from an assessment of the effects of forage fish on dependent predators in 10 Ecopath with Ecosim (EwE) models from around the world. EwE does contain a mathematical function that sets the renewal rate (equivalent to recruitment) for some of its trophic groups, but it does not assume a specific strength or pattern. The report's recommendations regarding reference points may therefore be applied without concern about a particular stock-recruitment relationship.

In a memo dated April 22, 2015, the Atlantic Menhaden Technical Committee offers projections based on the assumption that recruitment is independent of density and centered on median recruitment. According to the SEDAR 40 stock assessment for Atlantic menhaden, the BAM model indicates only three years with recruitment above this median in the last 23 years, so this approach is less conservative than that taken by Pikitch et al. (2012).

2. **"None of our predators of interest could fit the criteria of 'highly dependent' predator (with menhaden as forage) on a coast-wide scale."**

- **Brief response**: It is not necessary for predators to be highly dependent to apply the report's management recommendations.

Detailed response: The report defines a "highly dependent" predator as one that relies on a forage fish species for at least 50 percent of its diet. As the WG memo correctly states in the table on page three, the existence of such predators is a reason to increase the biomass limit reference point and reduce the fishing mortality limit reference point relative to the recommended hockey stick harvest control rule (HCR). When such predators are absent, as is the case when Atlantic menhaden are considered on a coast-wide basis, the report provides a clear recommendation: use a biomass limit reference point of $0.4B_0$ and a fishing mortality limit reference point of 0.5M.

It is important to note that the WG's predators of interest do not include the birds and mammals known to consume menhaden and to depend on menhaden in their diets. This is an additional argument in support of considering the biomass and fishing mortality limit reference points proposed by Pikitch et al. (2012). The WG is probably correct that none or few of the fish predators in the coastal western Atlantic are highly dependent on menhaden, as defined by Pikitch et al. (2012), at least in recent history. In the past, this might have been different, either throughout the system or in particular regions, such as the Chesapeake Bay.

3. **"The WG cannot evaluate if the Pikitch et al. (2012) buffers will actually provide enough forage to sustain predators of interest at desired population levels."**

- **Brief response**: The buffers presented in Pikitch et al. (2012) were designed to do exactly that in a precautionary sense. The WG's statement that, because the adequacy of these buffers cannot be determined, the WG proposes to adopt an even higher fishing mortality level is illogical.

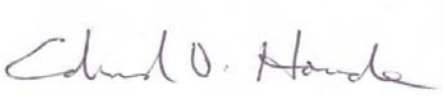
Detailed response: A key recommendation of Pikitch et al. (2012) was to use the "PREP equation" (PREP stands for "predator response to the exploitation of prey"), to predict predator declines using only the fraction of the predator's diet that is composed of the target forage fish. Since these diet data are available for predators of interest, it is appropriate to use the PREP equation to determine the biomass of forage fish necessary to achieve any desired level of predator

abundance (with a given probability of success), up to its estimated biomass of the predator in the absence of forage fish fishing. As an alternative to the PREP equation, the report recommends using data from models specific to the ecosystem. Since the WG indicates its ERP models are under development, we contend that it is appropriate to use the PREP equation at this time.[1] As noted above, the WG has proposed reference points that are less conservative than those in Pikitch et al. (2012). We do not see the logic of adopting a *higher* level of fishing mortality as a reference point on the ground that the Pikitch et al. reference points might not provide enough forage to sustain predators of interest.

4. **The report's "recommended HCR and ERPs make little sense when there is no dependent predator or stock-recruit relationship."**
   - **Brief response**: The report's recommendations are adaptable for a variety of situations, including this one.

   Detailed response: To clarify, although it is correct that there is no identified *highly* dependent predator in the system, striped bass and bluefish are dependent on menhaden for more than 10 percent of their diets. As noted above, use of Pikitch et al. (2012) recommendations does not require the existence of a stock-recruit relationship. Under the circumstances, and as an alternative approach, it makes sense to apply the Pikitch et al. (2012) HCR and ERP recommendations. The recommendations were developed to work in many circumstances, including when there are no identified highly dependent predators and when the stock-recruit relationship is uncertain. The WG was tasked to apply the Pikitch et al. (2012) approach in its charge and it should follow that directive.

Ellen Pikitch, Chair, Lenfest Forage Fish Task Force



Edward D. Houde, Member, Lenfest Forage Fish Task Force

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Essington, T., P.E. Moriarty, H.E. Froehlich, E.E. Hodgson, L.E. Koehn, K.L. Oken, M.C. Siple, and C.C. Stawitz. 2015. Fishing amplifies forage fish population collapses. Proceedings of the National Academy of Sciences. doi: 10.1073/pnas.1422020112.

[1] One of us (Houde, with co-investigators) has research under way to provide ecosystem-specific ERPs, scheduled to be delivered later this year

Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: Atlantic Menhaden Management Board

FROM: Megan Ware, FMP Coordinator

DATE: January 12, 2017

SUBJECT: Public Comment on Amendment 3 Public Information Document

The following pages represent a summary of all comment received by ASMFC on the Amendment 3 Public Information Document (PID) as of 5:00 PM (EST) on January 4, 2017 (closing deadline).

A total of 25,606 comments were received on the Amendment 3 PID. Of those comments, 75 were from organizations, 283 were from individuals, and 25,248 were from form letters (10 different letters). Included in these comments was another proposal for an ERP based off of osprey abundance. The proposal for this ERP can be found on pages 68-84.

14 public hearings were held in 13 jurisdictions. Approximately 300 individuals are estimated to have attended all of the hearings combined.

The following tables (pages 2-6) are provided to give the Board an overview of the support for specific options and issues contained in the PID. Summaries of the public hearings can be found on pages 7-67, followed by the ERP proposal based on osprey abundance. This is then followed by form letters with total petitioner count, letters sent by organizations, letters sent by individuals, and emails received from both organizations and individuals.

Public Comment Summary Tables

Issue 1: Reference Points				
	Option A	**Option B**	**Option C**	**Option D**
Individual		7	3	216
Organization	1		5	66
Form Letter				25,248
Hearings				
ME			1	2
NH			1	8
MA				16
RI	2		1	4
CT				5
NY				23
NJ				6
DE	2		1	7
MD	6			8
PRFC				1
VA		1		7
NC			4	5
FL				11
TOTAL	**11**	**8**	**16**	**25,633**

Issue 2: Quota Allocation								
	Option A	**Option B**	**Option C**	**Option D**	**Option E**	**Option F**	**Option G**	**Option H**
Individual	2	15	2	4	4	18	14	1
Organization	4	21	2	3	5	13	12	1
Form Letter								
Hearings								
ME		1	5	7	1	1		
NH		2			1	1	1	
MA		3				3	1	
RI		3			1	1		
CT		1		2	1	1	1	
NY		5		1	1			
NJ		1			1	1	1	
DE	1	1				1	1	
MD	13							
PRFC								
VA		2		1		3	1	
NC	1	1				1		
FL		1				1	1	
TOTAL	**21**	**57**	**9**	**18**	**15**	**45**	**33**	**2**

Issue 3: Allocation Timeframe				
	Option A	**Option B**	**Option C**	**Option D**
Individual	1	1	8	2
Organization	1	2	21	2
Form Letter				
Hearings				
ME			3	
NH			4	3
MA			7	2
RI			3	
CT			1	
NY		2		1
NJ			1	
DE			1	1
MD			2	
PRFC				
VA			3	1
NC			1	2
FL			2	
TOTAL	**2**	**5**	**57**	**14**

Issue 4: Quota Transfers & Overage Payback				
	No To Transfers	**Yes To Transfers**	**Yes To Quota Reconciliation**	**Yes To Accountability Measures**
Individual	5	8	3	6
Organization	1	19	2	16
Form Letter				
Hearings				
ME	1			
NH		2		2
MA	1	4		4
RI		1		1
CT	1			
NY		1		
NJ	1	1		1
DE		1	2	1
MD	1			1
PRFC				
VA	4	1		1
NC		2		2
FL	3			
TOTAL	**18**	**40**	**7**	**35**

Issue 5: Quota Rollovers			
	No To Rollovers	**Yes To Rollovers**	**Yes To Limited Rollovers**
Individual	24		
Organization	28	4	2
Form Letter	1,406		
Hearings			
ME		1	
NH	5		
MA	5		
RI	2		
CT			2
NY	12	2	
NJ	4		
DE	3		
MD	1	1	
PRFC	1		
VA	8		
NC	1	1	
FL	1	2	
TOTAL	**1,501**	**11**	**4**

Issue 6: Incidental Catch						
	Option A	**Option B**	**Option C**	**Option D**	**Option E**	**Option F**
Individual		2	37		3	34
Organization	2		23	2		27
Form Letter			2,435			2,074
Hearings						
ME						
NH			2			1
MA			3		1	
RI			2			2
NY			1			2
NJ			1			1
DE	1	1	1			1
MD	4					
PRFC			1			
VA			1	1		3
NC	1		2	1		3
FL			3			3
TOTAL	**8**	**3**	**2,512**	**4**	**4**	**2,151**

Note: Several letters commented that ASMFC should count all the catch, including incidental catch, as part of the TAC. If specific options were not provided, this statement was counted as Option C and Option F since both options provide methods to count all incidental catch in the TAC.

Issue 7: Episodic Events			
	No To Episodic	**1% Set Aside**	**>1% Set Aside**
Individual	8	1	1
Organization	16	4	2
Form Letter			
Hearings			
ME			2
NH	1		
MA	3		
RI		1	
CT	1		
NY			1
NJ	1		
DE	3	1	
MD		1	
PRFC			
VA	2		
NC			2
FL			
TOTAL	**35**	**8**	**8**

Issue 8: Chesapeake Bay Reduction Cap			
	Remove Cap	**Maintain Cap**	**Reduce Cap**
Individual	1	3	53
Organization		6	30
Form Letter			2,404
Hearings			
ME		5	
NH			2
MA		1	4
RI			1
CT		4	
NY		1	5
NJ			5
DE		4	1
MD		1	3
PRFC			1
VA		2	8
NC	2	2	
FL		3	2
TOTAL	**3**	**32**	**2,519**

Issue 9: Research		
	No To RSA	**Yes to RSA**
Individual	1	3
Organization	4	2
Form Letter		
Hearings		
ME	1	
NH		
MA		
RI		
CT		1
NY		
NJ	1	
DE		
MD	1	
PRFC		
VA	1	1
NC		
FL		
TOTAL	**9**	**7**

Comments recommended research on the following topics:

- Environmental factors that impact recruitment
- New menhaden abundance indices in light of stock expansion
- Identify and map current and historic spawning areas
- Fish kill causes and responses
- Food web dynamics with a focus on predator/prey match-ups
- The potential for, and effects of, localized depletion
- Water quality services provided by menhaden
- Identify a minimum size for allow for spawning before harvest
- Further socio-economic studies
- A focused study on the Chesapeake Bay including economic impacts of the fishery
- Bycatch in the reduction fishery and at-sea observer coverage
- Greater specification of regional abundance trends and regional stocks
- Speciation of menhaden, particularly in Florida
- Migration patterns and seasonal distributions by age class
- Stomach content analysis
- Impacts of climate change on the stock
- New fishery independent monitoring strategies for schooling fish
- Tagging and genetic studies
- Expanded surveys in Gulf of Maine
- Models of menhaden life history from egg release to estuarine nurseries
- Eco-physiological studies

Osprey as Menhaden Biomonitors: Insights into the need for Ecological Management

Monitoring of osprey populations can provide key insights into local abundance of Atlantic menhaden.

As a group of scientists who have studied osprey (*Pandion haliaetus*) for a combined total of approximately 133 years, we contend that osprey are likely the most appropriate bird species for quantitative study of menhaden abundance. These iconic birds famously dive with extended talons to take menhaden near the top of the water column. The menhaden, with its blunt head and yellow forked tail, is all "field mark" when carried in the osprey's talons or held on a feeding perch, meaning that accurate visual identification, even from a distance, is easy. We can also identify and measure prey using nest checks or nest cameras during nesting.

Ospreys in the Connecticut-New York coastal region are currently demonstrating sensitivity to the abundance of older migratory menhaden.

As the new Stock Assessment shows, the formerly large northern component of the menhaden population has been reduced in numbers and range. Adult menhaden migrate north, arriving in the coastal waters of Connecticut and New York in May, where they are a critical food source for osprey. The menhaden harvest quota instituted by ASMFC has now been operative for two years, and it is predicted to protect population age structure and the numbers of older migratory fish. Below, we document evidence of positive local results from implementation of the quota in the Connecticut River Estuary and Gardiners Island, NY, where we are seeing osprey numbers rise to levels that have been unprecedented in recent times.

Rebuilding the abundance of this coastal ecosystem component, with its economic, ecological, and cultural benefits to society is most desirable. **As it has long promised to do, it is our hope that the ASMFC will start managing menhaden in a way that accounts for the needs of these charismatic winged predators, as well as the other countless species that rely on them, instead of solely managing them based on the needs of industry.**

Connecticut River Estuary:

Historically, the Connecticut River Estuary on northeastern Long Island Sound supported a high density of nesting ospreys and provided optimal menhaden habitat given the constant, nutrient-rich freshwater input from the watershed and a place to escape predatory attacks by large bluefish and striped bass offshore. Dr. John Chadwick reported about 200 nests there in the late 1930's (Ames and Mersereau 1964, Poole 1989, Bierregaard et al. 2014), and Spitzer's recent long-term study there (Spitzer 1978, 1980, 2005, 2014; Spitzer et al. 1983) found the current active nest total to be about 100. The prey brought to these nests, 98-99+% menhaden, were abundant and easily caught, demonstrating the current high menhaden density there.

In July/August of last year in South Cove of Old Saybrook, CT, one could observe 20-30 ospreys hunting simultaneously throughout the day. The menhaden "banquet" extended until at least mid-October. An osprey feeding event of such abundance/duration is unrecorded in a century of extensive observation.

Gardiners Island, NY:

Gardiners Island, NY is historically excellent menhaden habitat. Based on field observations beginning in 1969, Spitzer found nesting ospreys on Gardiners to be especially dependent on menhaden, and thus a useful biomonitor of their local abundance: he terms Gardiners "A Menhaden Osprey Colony". From the

pioneering visit of Alexander Wilson in 1803 (Wilson 1812) until about 1950, the island supported a colony of 300 nests (Poole 1989), probably the densest concentration of ospreys ever recorded.

Although Gardiners Bay, NY, was formerly known for abundant menhaden, that has not been so apparent in recent years. The osprey colony has struggled during a prolonged period of lower menhaden numbers (Bierregaard et al. 2014). Scheibel has recorded low active nest numbers, ranging from 18 to 28 in 2003-2012; massive starvation of nestlings, resulting in complete nest failures or small brood sizes; and overall reproduction barely at Spitzer's "replacement rate" calculation of 0.8 young fledged/active nest (Spitzer 1980, Scheibel and NYSDEC unpub. 2012).

In 2013 and 2014, however, Scheibel recorded a total of 60 nests fledging 65 young, collectively. These two current improved years average 1.08 young fledged/active nest, well above the replacement rate. A better food supply may also encourage young returning ospreys to commit to breeding.

Four other charismatic bird species may also serve as biomonitors of menhaden abundance in the Chesapeake Bay: Common Loon, Bald Eagle, Gannet, and Brown Pelican. Each species predates on menhaden with great frequency and in many locations in the region. The resultant "wildlife spectacles" can be partially quantified.

Common Loons make a little-known autumn stopover on Chesapeake Bay. They form large, noisy flocks to feed cooperatively on "peanut" menhaden. From late October through November, the loons intercept them in the lower reaches of major tributaries (Spitzer 2012). Near sites such as Beaufort and Wrightsville Beach, NC, the National Audubon Society Christmas Bird Counts tally hundreds and even thousands of loons aggregated to intercept menhaden. Boat and aerial survey enable quantification of this autumn flock-feeding stopover. On Nov. 5, 2014, Spitzer tallied 400 loons (Spitzer 2015) feeding on peanuts, his best count in 20 years.

In late summer/early autumn, Bald Eagle flocks congregate at Bay vantage points to prey on menhaden. Unlike ospreys, eagles snatch them from near the surface without a plumage-wetting dive.

Flock-feeding Gannets are often abundant near the mouth of Chesapeake Bay in December and January. Stomach-content studies of large striped bass co-occurring at this season indicate that a major portion of gannet prey is also peanut menhaden.

Breeding Brown Pelicans in MD (Holland Is.), VA (Shanks Is.), and NC (Core Sound) feed their young large quantities of one- and two-year-old menhaden.

In summary, these 5 bird species' consumption of menhaden serves as a biomonitor for the entire coastal ecosystem, where unharvested menhaden perform profound ecological services for birds, fish, and humans alike. We request that the ASMFC advance its current mode of menhaden management to one that recognizes their value as a key, coastwide forage species.

Sincerely,

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The Connecticut River Estuary Osprey Colony, 2014-2016: A Proposed **Ecological Reference Point** of local Menhaden Abundance, "Fish in the Water", Based on a Current Three-year Study of Menhaden Prey Base and Young Fledged/Successful Nest (Y/SN), also known as Mean Brood Size (MBS)

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Executive Summary/Abstract: This famous historic osprey colony was eliminated by DDT and dieldrin food-chain residues in the 1950's and 1960's. From a post-DDT nadir of one active nest in the early 1970's, it has made a dramatic recovery, and is currently over 100 active nests. Many of these are on stable, predator-proof platforms. This enables easy measurement of fledgling brood size. Extensive study of local hunting patterns and prey delivery, 2014-2016, has documented fish diet of 95-100% migratory adult menhaden during the two-month period from hatching to fledging, and beyond. The very high mean brood size of 2.5/successful nest (Y/SN) serves as a biomonitor of local menhaden abundance. **This estuary's plankton-rich ecology makes it a current "Menhaden Epicenter".** Thus repeated years in which osprey reproduction falls **below 2.0 Y/SN** will serve as an **Ecological Reference Point** of menhaden depletion. (See also Spitzer, Poole, and Bierregaard, May 2015 letter to ASMFC.)

Introduction

Historically, this region supported a famous density of nesting ospreys, centered on the colony at the 500-acre Great Island tidal salt marsh in Old Lyme (Figure 1). In the 1930's, Dr. John Chadwick reported about 200 active nests in the greater region (Ames and Mersereau 1964). The DDT era, from the 1950's to its ban in 1972, extirpated these ospreys. At the low point in the early 1970's, only one nest remained active in the Connecticut River Estuary (CRE), and 9 in all of coastal CT (Spitzer 1980). By the late 1970's DDT residues were no longer sufficient to significantly impact reproduction, and population recovery had begun (Spitzer et al. 1978, 1983). I surveyed the CRE ospreys in 2005 and found 70 active nests. In my current 2014-2016 feeding study, the CRE total was about 110 nests, with 75 south of the Baldwin Bridge (I-95), including a shoreline count that stretches from nest poles in Fenwick, Old Saybrook, east to Hatchett's Point, Old Lyme.

Methods

During each osprey breeding season, 2014-2016, I chose a repetitive study sample of nests that would efficiently monitor the local CRE food regime. Thus I used high quality nest platforms, stable in weather and predator-proofed, to record data on reproduction and prey. This sample included about 25 poles on Great Island, 10 in the adjoining tidal Black Hall River, and (beginning in 2016) 7 clustered at Fenwick Point, Old Saybrook, immediately west across the mouth of the river. These latter sites had just been installed by Andrew Griswold and Sandy Sandstrom of the CT Audubon Society, in cooperation with the borough of Fenwick. The new Fenwick colony is a restoration of historic pre-DDT nest sites. These new platforms were immediately occupied by breeders—dramatic evidence of local limitation of predator-proof nest sites. Thus competition for CRE nest pole sites is intense, and most of them are occupied by experienced breeders, skilled at hunting and raising young. Thus they serve as an optimal readout of the CRE food regime. **To quantify prey abundance, I recorded brood size at fledging in successful nests (Y/SN),** also known as Mean Brood Size (MBS). I eliminated just a very few late-hatching nests from my Y/SN sample, because they imply young birds with less breeding and hunting experience.

Nests that failed outright were eliminated from the sample, because in the CRE they are not a measure of food. This stands in contrast to the Gardiners Island ERP, because that isolated, non-estuarine site has been so severely food-limited in some periods as to cause complete nest failure by nestling

starvation via "brood size reduction" (Spitzer 1977, 2016; Poole 1982, 1989). Also unlike the CRE, there are no mammalian predators or Great Horned Owls on Gardiners, so nest predation and nest site limitation are not significant variables, but weather effects on exposed Gardiners are more extreme. **Thus each "ERP Osprey Colony" has local ecological particulars, and must be monitored for menhaden abundance in that context. Thus I use the subset Y/SN in the CRE, vs. Y/AN (young/active nest)—all nests--on Gardiners:** Allowing for weather effects, all of Gardiners' active nests are a much "purer" readout of food than all active nests in the CRE. And I emphasize: At both sites, **a single nestling check prior to fledging is sufficient to calculate the Y/SN and Y/AN parameters which constitute the respective ERPs: So this is not a labor-intensive process.**

To study prey species delivery, I watched with 10X binoculars and 40X telescope from elevated Smith Neck, Old Lyme, which is adjacent to both Great Island and the Black Hall River. The male osprey brings freshly caught fish to a feeding perch close to the nest, where he takes some time to let the fish die and consumes the head and anterior portion, before bringing the rest to the female and young at the nest. This enables prey identification. On Smith Neck, I could simultaneously monitor 20 nests from the state landing—thus had great sampling efficiency. The site also enabled observation of waves of male prey deliveries to the colony: This implied information transfer about the schooling menhadens' daily CRE locations, and times of availability at the top of the water column. These clustered osprey nests can function socially as a "Menhaden-based Colony". A further advantage for human (and osprey) observers is easy recognition of adult menhaden when carried in the talons of an osprey: The fish are blunt-headed and laterally compressed, with a diagnostic yellow forked tail. Referring to birds, Roger Tory Peterson termed such species to be "all field mark".

Results

Over the three-year CRE study, the sample of successful nests consistently fledged about 2.5 young/successful nest (Y/SN, Table 1). Since the osprey's mean clutch size is slightly over 3 eggs, this is a very high rate of conversion to fledgings. It indicates an abundant food supply, and minimal nestling mortality by brood size reduction. This stands in stark contrast to many of the study years out at the food-limited Gardiners Island ERP colony (see the companion ERP proposal, Spitzer 2016).

The clustered CRE study sample of nests preyed on a common "food pot". April prey were mainly white perch *Morone americana*, catfish species *Ictalurus*, and alewives *Alosa pseudoharengus*. Eggs were laid mostly in that month. From early May into August, the observed diet was 95-100% migratory adult menhaden *Brevoortia tyrannus*, often 98-100%, taken in the CRE and nearby Long Island Sound waters. These are sanctuary waters for the planktivorous fish, with no significant commercial bait-fishery or pound-nets. But most important, menhaden are actively selecting these habitats because of nutrient influx down the Connecticut River, which generates a large local region of plankton abundance. Thus I term the CRE a consistent "Menhaden Epicenter"—as demonstrated by osprey reproduction.

Conclusions

Therefore, the ERP bar must be set high: **Below 2.0 Y/SN** would serve as a warning of local menhaden depletion, and two such consecutive years would be an extreme warning. **A single visit to the study sample late in the nestling period is adequate to make this assessment, as described in "methods".**

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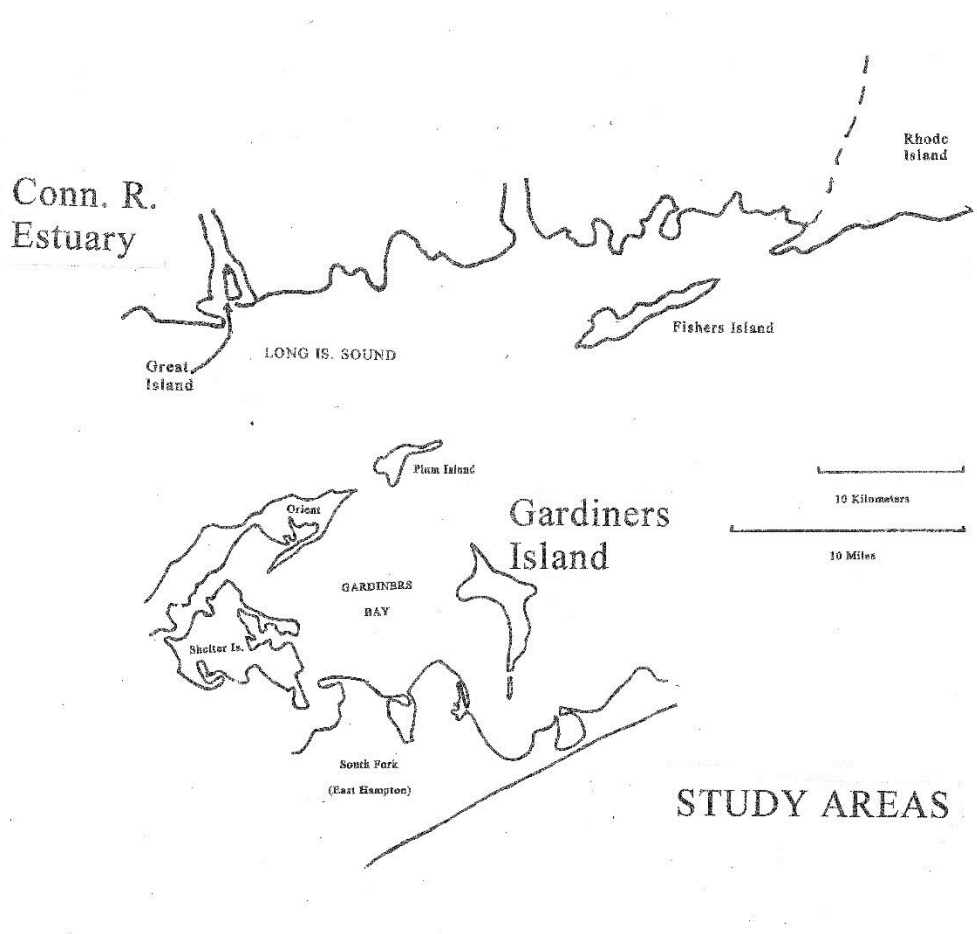

Figure 1. Location of Ecological Reference Point osprey colonies, Connecticut River Estuary and Gardiners Island.

Year	Mean Brood Size (Y/SN)	Sample Size
2014	2.5	N = 23
2015	2.4	N = 25
2016	2.5	N = 37

Table 1. Mean Brood Size (Y/SN) in successful nest samples, Connecticut River Estuary. See text “methods” for details of sample selection.

The Gardiners Island Osprey Colonys, 1969-2016: A Proposed **Ecological Reference Point** of local Menhaden abundance, "Fish in the Water", based on a 48-year time-series of active nest numbers (AN) and reproductive success (Young/Active Nest, Y/AN)

Paul R. Spitzer, PhD, 31672 Old Orchard Rd., Trappe, MD 21673 spitzer_paul@hotmail.com

Executive Summary/Abstract: For large portions of the last 48 years, 1969-2016, post-DDT recovery of this famous historic island osprey colony has been severely limited by menhaden food supply. But for the last five years, 2012-2016, reproduction has bloomed, thanks to a resurgence ofwith menhaden as prey. M(mean 1.23 young/active nest, (-Y/AN) has increased to a time-series high of 1.23, and colony size (active nests, AN) has doubled, from 22 to 44. If the current regional eastern Long Island, NY, abundance of migratory adult menhaden is maintained by proper management, I predict further restoration toward historic levels. Allowing for extreme weather, repeated years in which reproduction falls **below 1.0 Y/AN** will serve as an **Ecological Reference Point** of local menhaden depletion. (See also Spitzer, Poole, and Bierregaard, May 2015 letter to ASMFC.)

Introduction

Privately owned Gardiners Island, NY, is roughly 3,000 acres, and lies at the far eastern end of Long Island, roughly on a line between Orient village at the end of the North Fork and Montauk village on the South Fork. Its long north-south axis is roughly 7 miles, and defines Gardiners Bay to the west, with other land masses 5-10 miles distant (Orient Point, Shelter Island, and the South Fork—Figure 1). To the east lie great distances of open water: Block Island Sound and the Atlantic Ocean. In the 19th and 20th centuries, the big open waters surrounding the island were prime habitat for large schools of migratory menhaden, and supported a major menhaden fishery (Frye 1978). At that time, Gardiners was famous for its huge, dense osprey nest colonies, totaling 200-300 active nests (AN) at various time periods (Wilson 1812, Poole 1989).

My central hypothesis is that much of the ospreys' abundance is currently dependent on the abundance of menhaden. Gardiners is surrounded almost exclusively by open deep tidal waters—so alternative fish prey are not sufficiently abundant or predictable throughout the ospreys' five-month breeding season, April through August, to support such a dense colony. Thus, based on recent field observations, I consider the Gardiners Island Ospreys to currently be "A Menhaden-Dependent Colony", and that hypothesis is central to the analysis that follows.

Methods

Data on reproduction and prey base are collected by direct observation of nest contents, and by watching male prey deliveries. A total annual count of the highly visible bulky stick nests is easy on this isolated island. I started the current time-series of AN and Y/AN in 1969, at the beginning of my decade of osprey population studies that culminated in my doctoral thesis on the osprey's initial recovery from DDT, in the then geographically isolated remnant population of ~140 nests along the coast between NYC and Boston. This work also synthesized a broader understanding of osprey population dynamics, based on quantitative collection of essential parameters such as: The range of ages at first breeding; the fledging-to-breeding dispersal distances of males and females; and annual adult survival rates based on return of color-banded individuals. These are common metrics used in bird population studies. I combined these parameters in a population model which enabled estimation of replacement rate at ~0.8 young fledged/active nest (Y/AN) (Spitzer 1980, Spitzer *et al.* 1983). (Demarcated in Figure 2).

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Several colleagues assisted in this data collection, and by the mid-to-late 1970's the NY State portion had become the responsibility of Michael Scheibel as part of his nongame biologist work with NYSDEC, and subsequently with TNC. Remarkably, Michael has maintained the time-series of active nests and young fledged on Gardiners Island through 2016. The only data gaps are Y/AN in 1974 and 2006.

Results

For the purpose of this analysis, the 48-year time-series is broken into four sequential periods, which I hypothesize are driven by broad trends in menhaden abundance (Table~~s~~ 1, Figures 2 and 3~~ 2~~). I will not attempt a finer resolution of what I contend is overall food-based causality shaping the two population parameters: young fledged/active nest (Y/AN) and total active nests (AN). In the first three time periods, the MD (Chesapeake) juvenile index of menhaden production appears to be a "Signal" of migratory adult menhaden abundance available to Gardiners ospreys three years later (Table 2 and~~,~~ Figure 3). However, there is no such signal relationship in time period #4, 2012-2016. I propose that the harvest quota in place since 2013 reduces withdrawals of migratory adult fish, thus generating an increase in their availability to Gardiners Island ospreys. Immigration of new osprey breeders fledged in surrounding nesting areas (Figure 1) may also be stimulated by menhaden abundance—see the discussion of period #4.

Period 1) 1969-1975, 7 years. DDT residues are still reducing egg viability (Spitzer *et al.* 1978), and sparse menhaden food supply (depressed MD juvenile index, Table 2 and Figure 3) is influencing nestling mortality via brood size reduction (Spitzer 1978). Reproduction is consistently below replacement rate, averaging 0.63 Y/AN, and active nests gradually decline from 38 in 1969 and 1970 to a low point of 27 in 1976 (Spitzer 1980).

Period 2) 1976-1993, 18 years. **DDT residues are no longer a significant factor** (Spitzer *et al*. 1978), and for the rest of the time-series, except for occasional years of severe weather such as 1972 and 1982 (denoted by "W" in Figure 2~~1~~)~~,~~~~)~~, **the overall causal food relationship is hypothesized to be primarily the effect of varying menhaden abundance on Y/AN**, followed by an effect on AN, with some lag due to the 3-5 year maturation time of locally fledged young. The MD juvenile index (YOY) is high for 18 years, 1973-1990 (Table 2, Figure 3): I assume it is affecting the abundance of adult fish migrating to NY waters three years later. Y/AN is generally well above replacement rate of 0.8 Y/AN, averaging 1.04 Y/AN (Figure 3). AN respond to this and gradually rise to 71 in 1994 (Figure 2), the high point for the entire time-series: **This period marks the initial post-DDT recovery of the Gardiners Island osprey colony.**

Period 3) 1994-2011, 18 years. MD juvenile menhaden index declines drastically in 1992, and remains depressed through 2013 (Table 2, Figure 3), thus potentially reduc~~affect~~ing abundance of migratory adults through 2016. I term this a "regime shift", and consider that it results from the renewed abundance of predatory Striped Bass *Morone saxatilis* in Chesapeake waters and beyond (Uphoff 2003), due to recovery of the bass from a prolonged period of overharvest, during which the MD menhaden juvenile index recorded high numbers, 1973-1990 (Table 2, Figure 3). Gardiners Y/AN was not measured in 1994, but thereafter it shows severe decline, averaging 0.69, well below replacement rate. AN hold up for a couple years, probably because of recruitment from~~of~~ high Y/AN in the last years of period 2, then gradually decline to 27 in~~to the 20s by~~ 2003. AN~~They~~ remain very depressed in the 20s for the whole next decade, and stand at a very low 22 in 2012 (Table 1, ~~&~~ Figure 2). During this period there is much brood size reduction due to nestling starvation.

Period 4) 2012-2016, 5 years. MD juvenile index remains low, but Gardiners Y/AN and AN no longer track it. NMFS sampling and models from this period find high menhaden abundance. The Gardiners data agree with this estimate: Y/AN averages a high 1.23, and AN double from 22 to 44. I propose the consistent high Y/AN results from the menhaden harvest quota of 2013-2016, with more adult fish left in the water to reach NY waters. During this period of relatively abundant menhaden, the recruitment of new breeders previously fledged in adjacent areas (Orient Point, Shelter Is., and the South Fork) may help explain the rapid rise in AN, because Gardiners depressed Y/AN in the previous years 2009-2011 (Table 1) is not sufficient to explain it. These ecologically more diverse areas have a more diverse food regime, and thus are not so susceptible to menhaden depletion. In period 3 they showed better Y/AN than Gardiners, and a substantial rise in active nests while Gardiners was declining. Some current nest site saturation in those three areas, with intense competition from established breeders, may have promoted immigration to Gardiners, with its abundant unused nest sites, no mammalian predators, and currently abundant menhaden food. As the colony grows, social stimulation becomes increasingly important. Displaying males, returning from the hunt with a menhaden, transfer fresh information about the location of patchy menhaden schools to other males. If current menhaden abundance is maintained, a sustained Gardiners colony increase to approach 100 AN in 5 years is quite possible. This would mark the initial restoration of the historic large colony. As the AN sample size grows, the value of Gardiners as a long-term ERP will increase.

Conclusions, proposed Gardiners Is. ERP, and reference to a separate Connecticut River Estuary ERP

Based on the Gardiners Island osprey colony's 48-year reproductive time-series, I propose that its current and future annual reproductive performance (Y/AN) and nest numbers (AN) serve as a local ERP for "Menhaden-in-the Water" around Gardiners Island, a region of historic abundance and harvest of migratory adult menhaden. The high Y/AN and doubling AN count, 22 to 44, from 2012-2016 (Table 1, ~~&~~ Figure 2) are consistent with current NMFS coastal menhaden population assessments. In 2012, as part of state harvest quota determinations, previous annual removals were considered state-by-state. A complaint arose in NY, as some previous commercial menhaden harvest had not been reported. So it is possible that some of the previous poor reproductive years on Gardiners were caused in part by undocumented local menhaden harvest. But since 2012, the Gardiners osprey data's congruence with NMFS coastal menhaden estimates is strong.

Gardiners is an exposed site, and extreme weather can cause the osprey colony to have bad reproductive years, such as 1972 and 1982 (Table 1, ~~1 &~~ Figure 2). Allowing for that, a year in which reproduction fell **below 1.0 Y/AN** would serve as a warning of local menhaden depletion, and two such consecutive years would be an extreme warning. As in the previous 48-year time-series, annual data collection is an iterative process, and its validity as an ERP would be subject to review over time, as ASMFC comes to grips with "ecosystem management" of the fish.

I am making a second, parallel local ERP proposal for the famous historic Connecticut River Estuary, CT, osprey colony (Spitzer 2016). However, that~~e~~ local ecology, very high menhaden density, and resulting very high osprey reproductive parameters are quite different from Gardiners, so I am simultaneously submitting that second proposal as a separate document with somewhat different methodology.

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Table 1. Gardiners Island, NY, Osprey Reproductive Data, 1969-2016: A 48-Year Time-Series !!!

Year	Active Nests	Young	Y/AN	Mean Brood Size	Data Source and Comments
1969	38	25	0.66	25/17 = 1.47	Spitzer—first year of surveys
1970	38	25	0.66	25/14 = 1.79	Spitzer
1971	34	18	0.53	18/12 = 1.50	Spitzer, Hernandez
1972	33	5	0.15	5/4 = 1.25	Spitzer, Hernandez hurricane
1973	32	18	0.56	18/15 = 1.20	Spitzer
1974	34	26	0.76	26/18 = 1.44	Spitzer, Puleston
1975	31	19	0.61	19/13 = 1.46	Puleston, Spitzer

Mean of Means. Drop 1972 data, Hurricane Agnes, so **N=6** years of readout: **Y/AN = 0.63, MBS = 1.47**

1976	27	26	0.96	26/14 = 1.86	Spitzer, Poole	
1977	28	30	1.07	30/16 = 1.88	Spitzer, Scheibel	
1978	30	24	0.80	24/14 = 1.71	Spitzer, Poole, Scheibel	
1979	26	16	0.62	16/12 = 1.33	Scheibel	
1980	28	31	1.11	31/16 = 1.94	Scheibel	
1981	27	37	1.37	37/22 = 1.68	Scheibel	
1982	32	12	0.38	12/7 = 1.17	Scheibel	severe storm effects
1983	34	41	1.21	41/19 = 2.16	Scheibel	
1984	31	26	0.84	26/19 = 1.37	Scheibel	
1985	40	55	1.38	55/27 = 2.04	Scheibel	
1986	48	78	1.63	78/38 = 2.05	Scheibel	
1987	52	44	0.85	44/28 = 1.57	Scheibel	
1988	51	62	1.22	62/38 = 1.63	Scheibel	
1989	58	50	0.86	50/32 = 1.56	Scheibel	
1990	58	58	1.00	58/38 = 1.53	Scheibel	
1991	60	42	0.70	42/31 = 1.35	Scheibel	
1992	59	61	1.03		Scheibel	
1993	65	71	1.09	71/48 = 1.48	Scheibel	

Mean of Means. Drop 1982 data, severe storms, so **N = 17** years of readout: **Y/AN = 1.04, MBS = 1.70**

1994	71	?	?		Scheibel	first survey only
1995	67	26	0.39		Scheibel	
1996	68	25	0.37	25/23 = 1.09	Scheibel	
1997	57	50	0.88	50/33 = 1.52	Scheibel	
1998	56	33	0.59	33/22 = 1.50	Scheibel	
1999	47	32	0.68	32/25 = 1.28	Scheibel	
2000	42	24	0.57	24/20 = 1.20	Scheibel	
2001	36	21	0.58	21/15 = 1.40	Scheibel	
2002	37	30	0.81	30/22 = 1.36	Scheibel	
2003	27	9	0.33	9/8 = 1.13	Scheibel	
2004	28	32	1.14	32/19 = 1.68	Scheibel	
2005	25	17	0.68	17/11 = 1.55	Scheibel	
2006	27	?	?		Scheibel	first survey only
2007	24	21	0.88	21/12 = 1.75	Scheibel	
2008	22	23	1.05	23/13 = 1.77	Scheibel	
2009	22	13	0.59	13/9 = 1.44	Scheibel	
2010	18	13	0.72	13/9 = 1.44	Scheibel	
2011	22	13	0.59	13/13 = 1.00	Scheibel	

Mean of Means, no 1994 or 2006 data, so **N = 16** years of readout: **Y/AN = 0.69, MBS = 1.41**

2012	22	25	1.14	25/17 = 1.47	Scheibel
2013	27	33	1.22	33/16 = 2.06	Scheibel
2014	33	32	0.97	32/21 = 1.52	Scheibel
2015	37	53	1.43	53/29 = 1.83	Scheibel
2016	44	61	1.39	61/34 = 1.79	Scheibel

Mean of Means, **N = 5** years of readout: **Y/AN = 1.23, MBS = 1.73**

A 48-year time-series, to compare with Gardiners Island Osprey Reproductive Data, 1969-2016.
NOTES: There is a three-year lag until these "peanuts" are mature fish, migrating north to NY waters where they are potential osprey prey. This lag is shown in relation to all four "time periods" of consistent Gardiners osprey reproduction: A broad "down-up-down-up" 48-year pattern, defined in this paper. The Maryland waters of Chesapeake Bay are only one significant region of "peanut" production—and a lot can happen in three years. I view this data as a "signal" of menhaden abundance over broad time periods. I don't want to use it as an "independent variable", with Gardiners reproductive data the "dependent variable", displaying the data sets on X and Y axes. That would be an overly rigorous attempt. Also: **There may be other menhaden time-series relevant to this paper.**

In the fourth time-period of dramatic Gardiners Island recovery, 2012-2016, active nests double from 22 to 44, and the colony currently appears poised for more rapid increase. MD GMI in 2009-2013 shows only a very modest increase. But anecdotally, I heard that the overall menhaden 2010 year class was excellent, implying coastwide 2013 adult abundance. Then harvest quotas imposed by ASMFC in 2013-2016 would have left more adult fish for migration to NY waters, regardless of previous juvenile indices. Finally, at various recent ASMFC meetings, the NMFS scientists claimed their sampling and analysis showed greater recent menhaden abundance than previously thought. The last 5 years of Gardiners osprey data, 2012-2016, are consistent with that assertion. **THUS** this Gardiners data implies a recent favorable menhaden prey base for the open waters of eastern Long Island, and argues for ongoing "ecological management" of menhaden that restores this historical northern migration, and resulting food-chain productivity.

Year	N trawl samples	GeoMeanIndex	95% CL (low)	95% CL (high)

Period One, 7 years 1966-1972.

1966	132	0.32	0.12	0.54
1967	132	0.14	0.01	0.29
1968	132	0.31	0.09	0.56
1969	132	0.89	0.45	1.48

1970	132	0.16	0.03	0.30
1971	132	2.61	1.46	4.31
1972	132	2.76	1.63	4.39

Arithmetic Mean of Geometric Means, 1966-1972. **N = 7, mean GMI = 1.03**

Period Two, 18 years 1973-1990.

1973	132	4.42	2.46	7.50
1974	132	11.34	6.64	18.94
1975	132	12.11	7.13	20.15
1976	132	16.67	9.86	27.77
1977	132	15.09	8.96	25.00
1978	132	4.81	2.94	7.56
1979	132	12.01	7.18	19.70
1980	132	8.64	5.14	14.16
1981	132	11.75	7.13	18.97
1982	132	2.83	1.62	4.60
1983	132	4.34	2.52	7.09
1984	132	4.64	2.76	7.46
1985	132	8.24	4.86	13.57
1986	132	7.61	4.72	11.95
1987	132	3.55	2.16	5.55
1988	132	5.90	3.28	10.13
1989	132	2.23	1.28	3.57
1990	132	4.68	2.73	7.65

Arithmetic Mean of Geometric Means, 1973-1990, **N = 18, mean GMI = 7.83**

Period Three, 18 years 1991-2008

1991	132	3.12	1.85	4.97
1992	132	1.78	1.04	2.79
1993	132	0.62	0.32	0.99
1994	132	1.21	0.62	2.01
1995	132	0.51	0.23	0.86
1996	132	0.53	0.24	0.88
1997	132	0.87	0.43	1.45
1998	132	0.43	0.16	0.77
1999	132	0.87	0.43	1.45
2000	132	0.67	0.37	1.05
2001	132	0.69	0.31	1.18
2002	132	0.28	0.06	0.53
2003	132	0.38	0.15	0.64
2004	132	0.32	0.11	0.57
2005	132	1.40	0.70	2.37

2006	132	0.62	0.32	0.99
2007	132	0.86	0.47	1.35
2008	132	0.93	0.44	1.57

Arithmetic Mean of Geometric Means, 1991-2008, **N = 18, mean GMI = 0.89**

Period Four, 5 years, 2009-2013

2009	132	0.93	0.48	1.50
2010	132	0.96	0.52	1.51
2011	132	0.85	0.43	1.38
2012	132	1.11	0.64	1.73
2013	132	1.45	0.63	1.83

Arithmetic Mean of Geometric Means, 2009-2013, **N = 5, mean GMI = 1.06**

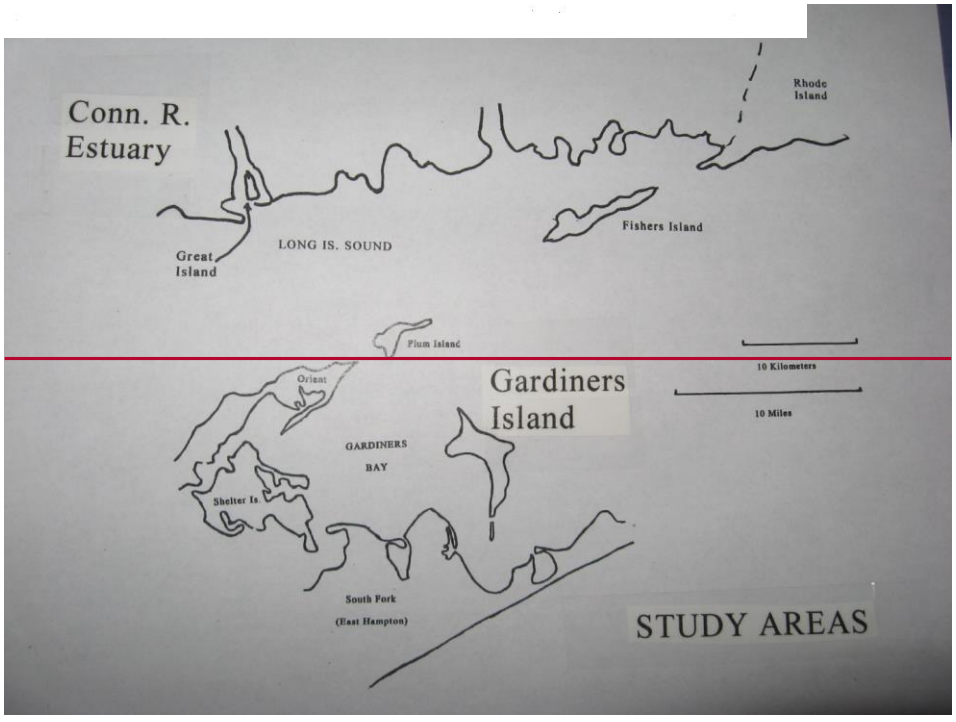
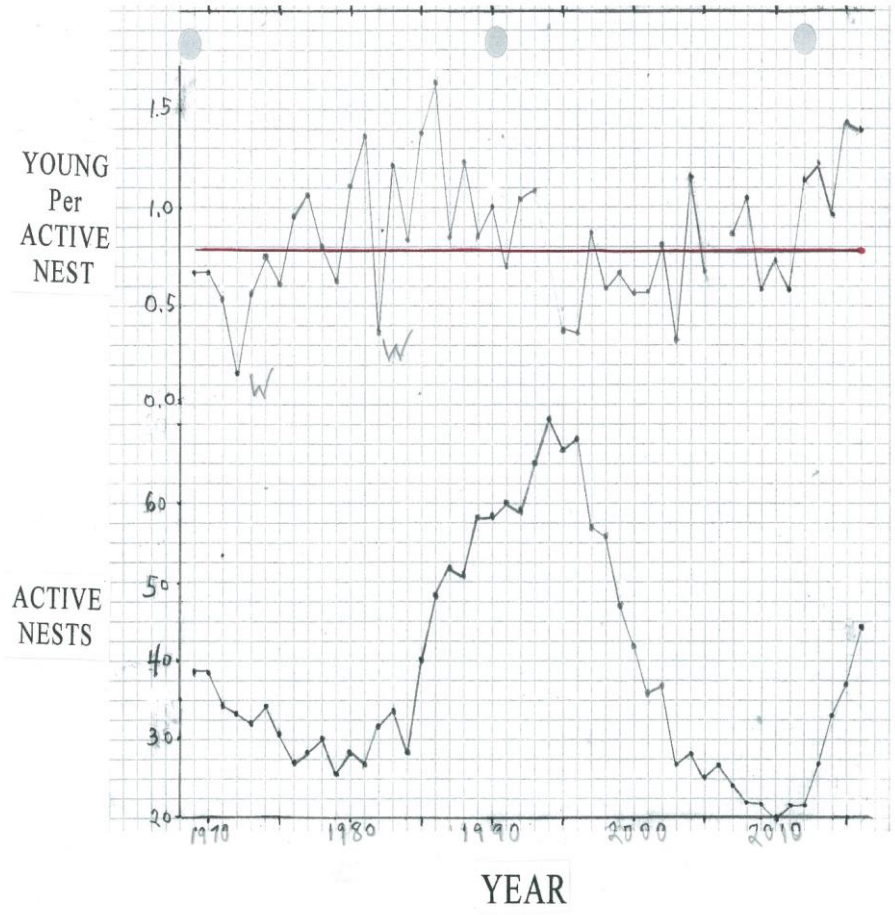


Figure 1. Location of ERP osprey colonies, Gardiners Is. and Connecticut River Estuary



Dark horizontal line marks Replacement Rate.

~~data~~

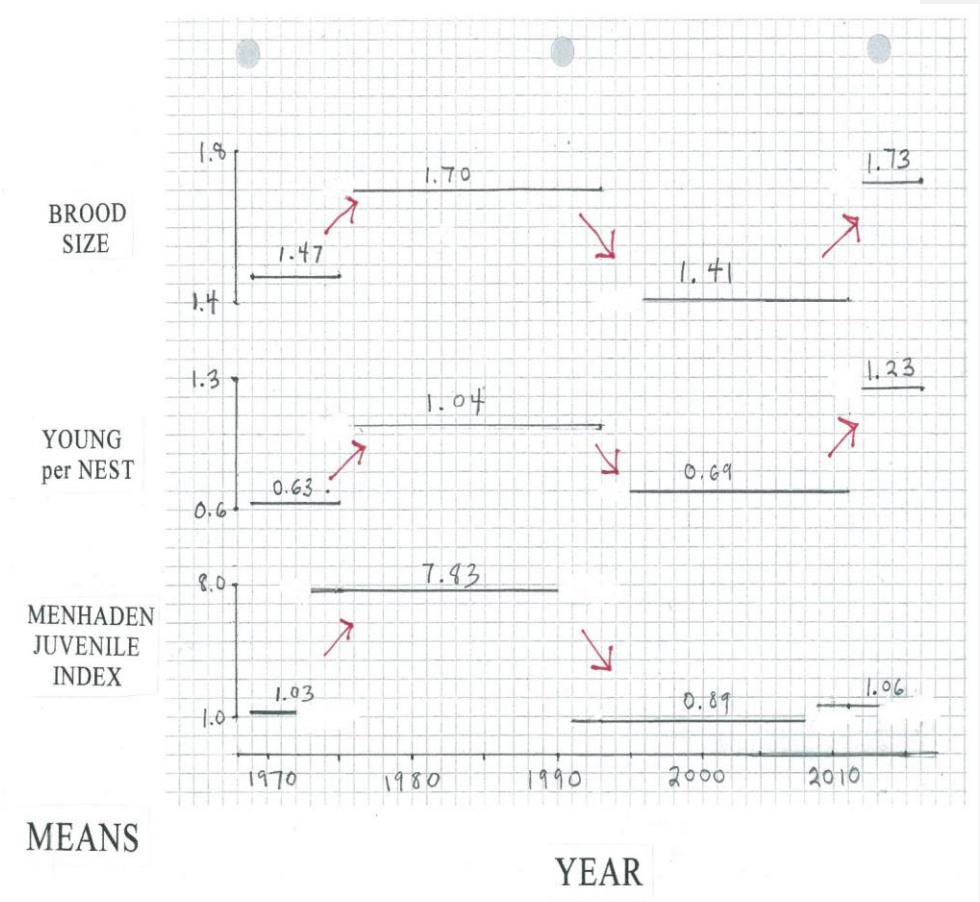


Figure 3. 48-year means~~running averages~~ of Gardiners Is. Young per Active Nest (Y/AN)~~Y/AN~~, Mean Brood Size, and

MD menhaden juvenile index (YOY),

Atlantic Menhaden Amendment 3 PID Public Hearing

December 13, 2016
Portland, Maine
18 Participants

Attendees: Robbie Begin (Harbor Bait), Steve Train, Peter Fallon, Katharine Deuel (Pew), Kathleen Reardon (ME DMR), Emily Tucker (Maine Coast Fisheries Assoc), Chris Weiner (ABTA), Patrice McCarron (Maine Lobstermen's Assoc.) Rob Bernet (Bailey Island Fish Trap), Joey Nickeson, Jennie Bichrest, Mark Bichrest, Brian Tarbox, Larry Ritch, Pam

Staff: Terry Stockwell (ME DMR), Matt Cieri (ME DRM), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: 1 individual supported Option C; 1 group and 1 individual supported Option D

- Pew and 1 individual supported Option D: Existing Guidelines for Forage Fish Species Until ERPs are Developed by the BERP as a way to manage menhaden for their role as forage fish.
- One individual supported Option C: Single-Species Reference Points Until ERPs are Developed by the BERP as she encouraged the Board to take the time in developing menhaden-specific ERPs.
- One individual did not state a preference for an option but did encourage the Board to consider the ecosystem when managing menhaden.

Issue 2: Allocation Method
Participants generally supported a coastwide quota split by seasons.

- 5 individuals supported a combination of Option C: Coastwide Quota and Option D: Seasonal Quotas. These participants felt that Maine has been under-served by the current allocation method and they supported a seasonal component to quota allocation so that fish are landed only when they are needed; they did not think it was necessary for some states to start landing menhaden in April when there is little demand for bait. One individual stated that localized depletion is being caused by the fact that two states have most of the allocation. Another felt that a coastwide quota will help distribute catch along the coast and that incidental catch should be added as another fleet to Option G: Fleet Capacity Quotas. He expressed concern about being restrained by a trip limit in the small-scale fleet. Overall, these individuals felt that more quotas should be allocated to the bait sector.
- The Maine Lobstermen's Association supported Option D and Option F: Disposition Quota. They did not support Option G because they did not want certain gear types to get painted into a corner.
- The Maine Coast Fisheries Assoc. stated that the allocation method needs to be amended as Maine did not get a great outcome and they would like to see Option B: Jurisdiction Quotas with Fixed Minimum, Option D, and Option E: Regional Quotas for

analysis in draft Amendment 3. They expressed concern that ME is at the northern end of the range and so they might be excluded the menhaden fishery if there is a simple coastwide quota.

Issue 3: Allocation Timeframe

SUMMARY: Participants supported use of a longer time series

- Three individual supported a longer time series as this will ensure that those with historic fisheries will be allocated an equitable amount of quota. One individual thought that landings from 1982 to 1992 should be included in the allocation timeframe and also supported weighting allocation over two time periods if necessary.
- MLA recommended that Option B: 2012-2016 be removed from draft Amendment 3 as the quota was implemented in 2013 and it represents an artificial limit on landings.

Issue 4: Quota Transfers and Overage Reconciliation

SUMMARY: 1 individual stated transfers may not be necessary depending on the allocation method.

- One individual stated that use of a coastwide quota would remove the need for transfers.

Issue 5: Quota Rollovers

SUMMARY: 1 individual supported quota rollovers

- One participant stated that rollovers should be allowed and 100% of unused quota should be able to be harvested in the next year. He felt that if a state is allocated a quota they should be able to catch all of it.

Issue 6: Incidental Catch and Small-Scale Fisheries

SUMMARY: Participants asked for a better definition of incidental catch and better enforcement

- One individual felt that 'incidental catch' needs to be better defined as the states are all using different definitions. She supported catch by small-scale fisheries but was concerned that the incidental catch limit could encourage the dumping of fish.
- Two individuals commented that enforcement of the incidental catch limit is poor and there is abuse of the system.
- Another participant stated that the bycatch provision is not creating a small-scale fishery but rather allowing them to survive.

Issue 7: Episodic Events Set Aside Program

SUMMARY: Participants supported a more equitable distribution of quota but if that doesn't happen, a greater allocation to the Episodic Events Program is needed

- Three individuals stated that Maine would not be so reliant on the episodic events program if quotas were distributed equitably.
- Two individuals stated that if the allocation system is not changed then the episodic events program needs much more quota, somewhere around 50 million pounds. One

participant stated that Maine will only continue to see more menhaden as the Gulf of Maine gets warmer.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: Participants supported continuation of the Cap

- 4 individuals and MLA supported the continuation of the Ches. Bay Cap as it provides a good safety valve for the reduction fishery.
- One individual asked if the Board has considered a size limit in the menhaden fishery to protect against the harvest of juvenile fish who have yet to spawn.

Issue 9: Research Programs and Priorities

1 individual supported research on environmental influences on recruitment; 1 supported greater fishermen participation

- One individual recommended greater fishermen participation in research so that the full range of the species from Maine to Florida can be studied. She did not think a RSA is necessary if active fishermen participate in aging and maturity studies.
- Another participant recommended that there be more research on the environmental factors which impact recruitment in the fishery.

Jonah Crab Draft Addendum II for Public Comment

Atlantic States Marine Fisheries Commission
December 13, 2016
Maine

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
Bobbie Begin	Harbor Bait	Boothbay Hbr
Steve Train		
PETER FALLON	WILLES & FALLON	PHIPPSBURG, ME
Katharine Dexel	PCW Charitable Trust	Boston, MA
Kathleen Reardon	DMR	Boothbay Harbor
Emily Tucker	Maine Coast Fishermen's Assoc.	Brunswick, ME
Chris Weiner	ASMFC/CCCIA	Portland
Patricia McLaughlin	MLA	Kennebunk ME
Robert Heuff	BAILEY JR. FISHTRAP	HAMPDEN

Atlantic Menhaden Amendment 3 PID Public Hearing

Portsmouth, New Hampshire
December 6, 2016
20 Participants

Attendees: Don Swanson (CCA NH), Aaron Kornbluth (Pew), Erica Fuller (Earthjustice), Pam Gromen (Wild Oceans), Peter Whelan, Morgan Callahan (Pew), Le Swiberg, Matthew Larkin, Fred Clews, Pete Tilton, Erik Anderson (NHCEA), Karen Alexander (U Mass Amherst), Bill L. (UNH), Mark Zankel (TNC), Mark Godfrey, Geno Marconi

Staff: Ritchie White (Commissioner), Dennis Abbott (Commissioner), Doug Grout (NH FGD), Toni Kerns (ASMFC)

Issue 1: Reference Points
SUMMARY: 8 participants supported Option D; 1 participant supported Option C

- Eight participants, including representatives of Pew Charitable Trusts, Earthjustice, and the Nature Conservancy, spoke in favor of Option D: Existing Guidelines for Forage Fish until BERP ERPs are Ready. These eight participants agreed that Option D is the most supportive of menhaden ecological services. Several individuals commented on the 75% rule-of-thumb and noted the scientific consensus between Smith et al (2011) and Pikitch et al (2012). Others commended the Commission for proposing options that recognize menhaden for their ecosystem role and value. One individual expressed concern over the mismatch in timing between Amendment 3 and analysis by the BERP Work Group, but noted the importance of the BERP continuing its work. This same individual felt that an outcome of the BERP's analysis might be trade-offs in predator abundance and menhaden natural mortality rather than actionable ERPs. Another commenter highlighted the importance of testing management decisions in this Amendment through a Management Strategy Evaluation.
- One individual supported Option C: Single-Species Reference Points until BERP ERPs are Ready. This individual stated that because of issues with under-reporting in some fisheries and a resulting lack of clarity on fishing mortality, Option C is the best option moving forward.

Issue 2: Allocation Method
SUMMARY: 1 participant supported Options B and E; 1 participant supported Options B, F and G

- One individual supported a combination of Option B: Jurisdictional Quotas with Fixed Minimum and Option E: Regional Quotas, with a four region split.
- Earthjustice supported revising the current allocation formula and preferred Option B, Option F: Disposition quota (with 30% of the TAC allocated to the bait fishery), and Option G: Fleet Capacity Quota, with all fleets managed under a hard quota. Earthjustice

also supported the removal of Option C: Coastwide Quota since it could cause a race to fish.

- One participant emphasized the need for greater confidence in the volume and location of harvest. If there are deficiencies, they should be noted and accounted for when allocating quotas. This participant also supported greater allocations to the bait fishery to account for the lack of historic reporting in this sector.

Issue 3: Allocation Timeframe
SUMMARY: 4 participants supported Option C; 3 participants supported Option D

- Participants generally favored a longer time-series, with 4 participants supporting Option C: Longer Time-Series Average and 3 participants supporting Option D: Weighted Allocation. One commenter suggested that historical catch records back to 1887 be used to calculate quotas. Another commenter warned that fixed timeframes can create large disparities in the industry as factors which influence catch change over time. Another participant stated that the more recent timeframes would disadvantage the New England area because there have been few fish in the area in recent years.

Issue 4: Quota Transfers and Quota Reconciliation
SUMMARY: 2 individuals supported quota transfers only if a state has not met its quota

- Two participants supported unrestricted quota transfers before a quota has been met; however, once met, transfers should be prohibited. They also commented that states should not be forgiven for their state specific overages. One commenter expressed concern that transfers can commodify quotas and lead to an ITQ system. The participant stated that each state is the owner of its quota and the state should decide how to use it. The Commission should pay close attention to those states which repeatedly exceed their quota. There was also a request that a thorough analysis be conducted on how the various quota options (transfers, rollovers, bycatch, episodic events) might lead to an overage of the TAC and how this would impact the ecosystem. A final comment was that quota transfers should not be tied to a particular event (e.g. a fish kill).

Issue 5: Quota Rollovers
SUMMARY: 5 participants did not support quota rollovers

- 5 participants, including Pew, Earthjustice, and CCA New Hampshire, spoke against quota rollovers. Participants generally agreed that quota rollovers add unnecessary risk and that it is difficult to determine how the stock changes from year to year. They felt that the leftover quota should be reserved as a conservation benefit.

Issue 6: Incidental Catch and Small Scale Fisheries
SUMMARY: 1 participant supported Option C; another felt all catch should be counted

- Earthjustice supported Option C. Pew stated that all incidental catch should be counted towards the TAC and that incidental catch could be addressed through re-allocation. One individual commended the change from the term ‘bycatch’ to ‘incidental catch’.

Issue 7: Episodic Events Set Aside Program
SUMARY: 1 individual did not support the episodic events set aside

- One individual did not support the episodic events program and recommended that the long term results of this program be considered. This participant expressed concern that if we harvest fish just as they are starting to come back to New England, their recovery in the area will be halted. This individual also recommended a better definition of episodic events be crafted by the Board.

Issue 8: Chesapeake Bay Reduction Fishery Cap
SUMMARY: 1 participant supported a reduction in the Cap, 1 participant asked for more management alternatives

- One individual recommended that this Issue be better flushed out in draft Amendment 3. She recommended that there be options to reduce the cap to a value based on landings in more recent years (ie: a 3 or 5 year average) and that there be an option which eliminates rollover of the cap. This participant stated that the cap was set too high as the Bay is a critical nursery and there is the potential for localized depletion.
- Pew commented that the Cap should be reduced. A representative stated that the Cap was arbitrarily set. Further, the Cap was set too high as it has never been reached. They would like to see an ecosystem based approach to setting the Cap, paying particular attention to the role of forage fish in the Bay.

Issue 9: Research Programs and Priorities

No comments were given

Additional Comments:

- One participated noted that it is not only important to account for the economic value of menhaden but also the social value in its decision making (ie: rebuilding social capital).
- Another participant noted that in the 1850's, fishermen petitioned Maine to protect menhaden from big seiners coming in and out of the state waters. The fishermen wanted menhaden to come close to shore so the cod would be drawn in.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 6, 2016
New Hampshire

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
Don Swanson	CCA NH	
Aaron Kornbluth	Pew	DC
Erica Fuller	Earthjustice	Ipswich, MA
Pam Gromen	Wild Oceans	Waterford, VA
Peter Whelan	Mass Ad Rail	Portsmouth NH
Ritchie White	ASMFC Gov. Apt. NH	Rye NH
Morgan Callahan	Pew	Boston, MA
Lou Wilberg	Self	Newmarket, NH
Matthew Larkin	Self	Durham, NH
Dennis Abbott	ASMFC Legis Proxy	Newmarket
Fred Clews	F+G.	Hampton
Pete Tilton Jr	Advisory Comitee	Hampton
Erik Anderson	NHCFA.	Portsmouth NH
Karen Alexander	U Mass Amherst	Amherst MA
Bill Leavenworth	UNH & UMA retired	Searsmont, ME
Mark Zankel	The Nature Conservancy	Concord, NH
Mark Godfrey		Seabrook, NH
Gene Marconi	NH Fish Authority	Fishman

Public Hearing Summary
Atlantic Menhaden Public Information Document for Amendment 3
Braintree, Massachusetts
December 20, 2016

Attendance

Public (13):

Kalil Boghdan (MA Marine Fisheries Adv. Com.)
Robert O'Neil (MA Striped Bass Assoc.)
Eric Lorentzen (MA Lobstermen's Assoc.)
Lugiano Mascari (Abyss Program Mngmt)
Peter Shelley (Conservation Law Foundation)
Patrick Paquette (MA Striped Bass Assoc.)
Wendy Paquette (MA Striped Bass Assoc.)
Zach Cockrum (National Wildlife Federation)
Katharine Deuel (Pew Charitable Trusts)
Lawrence P. Manning (MA Striped Bass Assoc.)
David Mussina (Mystic R. Watershed Assoc.)
Ray West (MA Striped Bass Assoc.)
Robert Brown (MA Striped Bass Assoc.)

MA DMF: David Pierce, Nichola Meserve

Issue 1: Reference Points
SUMMARY: 7 participants supported Option D

- Seven participants supported adoption of existing guidelines for forage fish species until ERPs are developed by the BERP (Option D). Rationale included: the need to leave more fish in the water for forage to support a healthy, balanced ecosystem; using scientific information that is available now; increased feasibility of adopting ERPs while the stock is robust; maintaining the wider age structure and distribution of menhaden seen recently; more menhaden means reduced consumption of river herring.
- One participant asked that the ASMFC be more clear on the timeline for the BERP's development of menhaden-specific ERPs (i.e., 2019 is the earliest timeframe, could easily take longer).

Issue 2: Quota Allocation
SUMMARY: 3 participants opposed Option A; 1 participant supported Options B, F, and G

- Three participants spoke in opposition to the current allocation system (Option A), particularly Virginia's share of the TAC. Rationale included: the shares are inequitable and don't represent the fishery's longer history; the shares result in a geographically narrow range for most of the harvest, in a location too close to the prime spawning grounds; and the shares have a limiting nature on other states' fisheries.
- One of these participants also commented on other options as follows:
    - State-specific quotas with a fixed minimum (Option B) should be further developed, with 1%, 2% and 5% as the fixed minimum allocation.
    - A coastwide quota (Option C) should be removed from further consideration for biological and socio-economic reasons.

- Regional quotas (Option E) raise concerns for MA. The interaction between MA and RI would need careful consideration. ME having an overage like it did in 2016 would heavily impact MA under a regional quota.
- Disposition quotas (Option F) should be further developed in interest of bringing more fairness to the allocations.
- Fleet capacity quotas (Option G) should be further developed.
- Allocation strategy based on TAC level (Option H) needs a better explanation, but should likely be removed from further consideration.

Issue 3: Allocation Timeframe
SUMMARY: 3 participants opposed Options A & B; 2 participants supported Options C & D

- Three participants opposed allocation based on the 2009–2011 average (Option A) or the 2012–2016 average (Option B). Rationale included: timeframe is only ½ the life expectancy of menhaden (specific to Option A); the timeframes don't consider enough history (e.g., decline of stock that led to industry consolidation) and benefit only a small contingent of stakeholders.
- Two participants supported further development of a longer time-series average (Option C) and a weighted allocation including a longer time-series (Option D), to support a return to more diversification of the industry as was historically present (e.g., there were 8 processing plants in New England at one time). One participant requested specific options that would include landings back to 1985, and back to the 1950s.

Issue 4: Quota Transfers & Overage Payback
SUMMARY: 1 participant opposed transfers; two participants supported greater accountability measures

- One participant opposed any transfer of unused quota to account for quota overages.
- Two participants supported there being additional requirements on states for overage-related quota transfers. These included: 1) rules for how a state manages its quota as a precondition to receive a transfer (e.g., use of quota triggers to reduce harvest as the quota is approached); 2) the transfer must be requested in advance of the overage; and 3) receiving states must demonstrate how they will prevent a similar overage in the following year(s).

Issue 5: Quota Rollovers
SUMMARY: 3 participants opposed quota rollovers

- Three participants opposed rolling over unused quota. Rationale included: concerns for stock sustainability (e.g., localized depletion; if quota is unused, it's likely due to stock decline); and unused quota serves an ecological purpose.

Issue 6: Incidental Catch & Small Scale Fishery Allowance
SUMMARY: 1 participant supported Option C

- One participant supported all incidental catch counting towards quotas (Option C). Rationale included: the loophole of the current bycatch allowance may have been

necessary when Amendment 2 was developed to not penalize small fisheries for which information may have been limited, but Amendment 3 is the time to fix it so that all harvest counts towards quotas and does not undermine the TAC, which can be done without penalizing those same fisheries if the quota allocation system is corrected. If the current approach continues, bycatch should be limited to a percent composition (Option E).

Issue 7: Episodic Events Set Aside

SUMMARY: 1 participant did not support the episodic events set aside

- One participant supported the termination of the episodic event set-aside program, due to concerns that it can lead to detrimental harvest levels.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: 1 participant supported the continuation of the cap; 2 participants supported a reduction of the cap

- Three participants supported continuation of the cap to protect the estuary/nursery grounds. Two of them also spoke in support of reducing the current level of the cap, specifically setting a 0-lb cap (i.e., no reduction harvest in the Bay) or limiting it nearer to the current harvest levels (e.g., the recent average, no more than 10% above the recent average).

Issue 9: Research Programs and Priorities

SUMMARY: 1 participant requested greater research on fish kills

- One participant requested that the subject of fish kills be a research priority, due to a lack of consistent coastwide institutional knowledge as to their history and reasons for occurring.

Atlantic Menhaden Amendment 3 PID Public Hearing

Bourne, Massachusetts
December 12, 2016
20 Participants

Attendees: Raymond Kane, Daniel McGonagle (MED), John D. (fishermen), Carol Carson (NECCA), Bill Prodouz (fishermen), Tom Weaver, Bob Hannah (AP member), Steve Barr (Fishermen), Jonathan O'Connor (rec angler), Erik Corentzen (MLA), Beth Casoni (MLA), Douglas Robertson (Friends of Mashpee Wildlife), Belinda Rubmstem, Carl Richardson (Sport Fish), Amy Hedges (NWF), Patrick Paquette (AP member)

Staff: Dan McKiernan (MA DMF), Nichola Meserve (MA DMF), Derek Perry (MA DMF), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: Participants supported Option D.

- Seven individuals and two groups (Nature Conservancy and NWF) were in favor of Option D: Existing Guidelines for Forage Fish Species until ERPs are Developed by the BERP. Participants noted the importance of menhaden in providing food for larger predators and that their value to the marine ecosystem is greater than their value to one company. One individual noted the loss of wildlife she has seen in the New England and Mid-Atlantic regions and how the abundance of menhaden needs to increase to bring back species diversity to the marine ecosystem. Another participant noted the economic benefits of greater menhaden conservation as the recreational, commercial, and tourism industries would all benefit. One participant asked that a more detailed timeline of the BERPs work be added to draft Amendment 3 since he expressed concern that models can take longer than expected to be completed.
    - One individual recommended managing menhaden to 75% of the pre-industrial stock size and requiring the population never drops below 40%.

Issue 2: Allocation Method
SUMMARY: 2 individuals supports Option B and F; 1 individual supported Option G

- Four individuals recommended that the Board revise the current allocation method. Two individuals supported Option B: Jurisdictional Allocation with Fixed Minimum Quota and Option F: Disposition Quota, with at least 30% of the TAC allocated to the bait industry. One of these individuals also supported Option G: Fleet Capacity Quotas but did not support the use of soft quotas. Participants stated that it is not equitable that one state gets 85% of the allocation and that more quota needs to be allocated to the bait sector. One participant highlighted the importance of the bait sector to local economies and the economic growth that could happen if the bait sector had more quota. Another individual thought that the most equitable distribution of quota would be to give each jurisdiction the same percentage of TAC. One participant recommended

the removal of Option C: Coastwide Quota as it creates a race to fish, Option E: Regional Quotas because it is too complex, and Option H: Allocation Based on the Level of TAC because it creates incentives not to raise the TAC. Another participant recommended that if Option H is pursued, the baseline should be the original TAC implemented in 2013, not 212,000 metric tons.

Issue 3: Allocation Timeframe
SUMMARY: 5 participants supported Option C

- Five participants supported Option C: Longer Time Series. Several individuals noted that any timeframe that accounts for less than one generation of fish is too short for management. They also felt that Option B: 2012-2016 is too short and does not consider the extensive catch histories which have occurred in some of the states. One individual supported a time-series from 1955-2016.

Issue 4: Quota Transfers and Quota Reconciliation
SUMMARY: 2 individuals supported quota transfers only if a state has not met its quota

- Two participants recommended that quota transfers be allowed only if a state has not yet exceeded its annual quota. This will ensure that states properly manage their menhaden fisheries. One individual recommended that there be a limit to the number of transfers that can occur in a 5 year time period and that if a state has an overage, it be required to take management action to ensure it does not happen the next year. He noted that MA currently uses trip limits when 75% and 95% of the state's allocation is met and other states should rise to this level of management. Another individual felt that quota transfers might not be necessary if allocation is equitable among the states.

Issue 5: Quota Rollovers
SUMMARY: 1 individual did not support quota rollovers.

- One individual did not think that quota rollovers should be allowed as there may be unintended consequences such as localized depletion. He felt that if a state doesn't meet its quota, then they don't get credit and the fishery wins.
- Another individual questioned whether a state not reaching its quota is a sign that there are not enough fish in the water.
- One participant felt it was important to consider climate change, especially in the Gulf of Maine, when crafting the future management of menhaden.

Issue 6: Incidental Catch and Small Scale Fisheries
SUMMARY: 2 individuals did not think the bycatch provision would be needed after reallocation; 1 felt all catch should be counted towards the TAC

- One individual stated that the bycatch provision will not be needed if quota is allocated in an equitable manner. He understood that the bycatch provision was created to help small-scale fisheries which were hurt by the current allocation method but he hoped that this would not be necessary in the future.

- One individual felt that the bycatch provision is a loophole which allows millions of menhaden to be landed and not counted towards the TAC. He hoped this provision would be removed.
- One participant commented that all catch should count towards the TAC.

Issue 7: Episodic Events Set Aside Program
SUMARY: 2 individual felt reallocation would negate the need for the episodic events program

- Two individuals commented that the allocation method should solve the need for this set aside. They felt that a fair allocation process with transfers is enough to manage the menhaden fishery.

Issue 8: Chesapeake Bay Reduction Fishery Cap
SUMMARY: 2 individuals supported a 50% reduction in the Cap

- Two individuals stated that the Chesapeake Bay Reduction Fishery Cap is an important tool for management and it should be reduced by 50% to reflect current catch levels. They noted that the Ches. Bay is an important nursery ground which needs to be protected.

Issue 9: Research Programs and Priorities

No comments were given

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 12, 2016
Massachusetts

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
RAIMOND KANE	ASMFC Commissioner	Chatham MA.
Daniel McGonagle	MED	Cape Cod
John Duff	Fisherman	Wellfleet
Nichola Meserve	MA DMF	Boston
Dan McKiernan	MA DMF	Boston
Carol Carson	NECCA	Middleboro
Bill Prodouz	Fisherman	Pocasset
Tom Weaver	Retired	Falmouth
Bob Hannah	AP Member	~~Marine~~ Gloucester
Steve Barr	Fisherman	Sandwich
Jonathan O'Connor	Rec Angler	Plymouth MA
Erik Lorentzen	MCA	Hull MA
Beth Casoni	MCA	
Douglas Roberson	Friends of Mashpee Wildlife Ref.	Mashpee MA
Belinda Rubinstein		Bourne, MA
Al-I Richardson	Sport Fish	Engineer Retired

Atlantic Menhaden Amendment 3 PID Public Hearing

Narragansett, Rhode Island
December 19, 2016
16 Participants

Attendees: Eric Reid (Commissioner), Richard Souza (Ark Bait), Joshua Alexander (Ark Bait), George Allen (RI Saltwater Anglers), Douglas Stephens (Woonasquatucket River Watershed Council), Zach Cochrun (NWF), Meghan Lapp (Seafreeze Ltd.), Dave Monti (RIFMC/RISAA), Rich Beil (TNC), John Nake (WRWC), David Borden (Commissioner), Rachel Calabro (Save the Bay)

Staff: Bob Ballou (RI DEM), Jason McNamee (RI DEM), Nichole Lengyel (RI DEM), Megan Ware (ASMFC)

Issue 1: Reference Points

SUMAMRY: 1 group and 1 individual supported Option A; 3 groups and 1 individual supported Option D

- RI Saltwater Anglers, Save the Bay, The Nature Conservancy, and 1 individual supported Option D: Existing Guidelines for Forage Fish until ERPs are Developed by the BERP. They stated that the Board should immediately change from single-species reference points to multi-species reference points to help menhaden abundance grow and reach its historic range. One individual noted the importance of menhaden to recreational anglers.
- Seafreeze Ltd., supported Option A: Singles-Species Reference Points but if the Board is committed to ERPs, Seafreeze Ltd., supported Option C: Single Species Reference Points until ERPs are Developed by the BERP. They stated that the menhaden fishery does not compete with predators as the fishery targets larger fish than the predators eat. Seafreeze Ltd., noted that the TC has raised concerns about the Pikitch et al (2012) reference points and as a result the Board should wait until menhaden specific ERPs are ready to make any change.
- One individual supported Option A. He stated that the Board should get the stock under control before switching to ERPs and dealing with other issues such as clean water.

Issue 2: Allocation Method

SUMMARY: 2 groups and 1 individual supported Option B; 1 group supported Option E; 1 group supported Option F

- RI Saltwater Anglers supported Option E: Regional Quotas with either a three or four region split. They stated that the current allocation formula should be revised as it is inequitable for 1 state to take 85% of the quota. They opposed Option C: Coastwide Quota as it may cause a race to fish, Option G: Fleet Capacity Quota, and Option H: Allocation Method Based on Level of TAC as it creates perverse incentives to change the TAC.
- Seafreeze Ltd., stated that the current allocation method doesn't capture the historic participation of Rhode Island and a business cannot run off of the episodic events

program. They supported Option B: Jurisdictional Quotas with Fixed Minimum so that each state gets at least 1% of the TAC. A spokesperson also supported a winter fishery so that, after a certain date, unused quota would be pooled together into a coastwide allocation for a winter fishery.
- Save the Bay recommended changes to the allocation method to get away from the near monopolization of the resource by one state. The group supported Option B or Option F and did not support Option C or Option E.
- The Nature Conservancy supported reallocation of quota.
- One individual supported Option B.

Issue 3: Allocation Timeframe
SUMMARY: 3 groups supported Option C

- RI Saltwater Anglers, Save the Bay, and Seafreeze Ltd. supported Option C: Longer Time Series. RI Saltwater Anglers felt that Option A: 2009-2011 and Option B: 2012-2016 should be removed as they exclude significant catch history of the New England states. Seafreeze Ltd. noted that in the 1980's, Rhode Island landed roughly 10 million pounds a year and the allocation percentages would be quite different if an earlier timeframe such as 1985-1992 was used.

Issue 4: Quota Transfers and Overage Reconciliation
SUMMARY: 1 group supported transfers before an overage; 1 individual did not support overage reconciliation

- RI Saltwater Anglers stated that quota transfers should be unrestricted prior to a state reaching its quota; however, if a state has already exceeded its quota, it should take action to payback the overage and it should not be allowed to accept transfers in the subsequent year.
- One individual did not support quota reconciliation as he thought that it could open Pandora's Box and encourage every state to overfish. If quotas are state managed, then the states should be responsible to shut the fishery down when the quota is met.

Issue 5: Quota Rollovers
SUMMARY: 2 groups did not support quota rollovers

- RI Saltwater Anglers and Save the Bay did not support quota rollovers as there may be unintended consequences such as localized depletion. Save the Bay did support quota overage payback.

Issue 6: Incidental Catch and Small-Scale Fisheries
SUMMARY: 2 groups supported Option C and Option F

- RI Saltwater Anglers and Save the Bay stated that the current bycatch allowance is a loophole that allows menhaden to be landed without being counted towards the TAC. The groups stated that all catch should count towards the TAC and they supported Option C: Incidental Catch Included in Catch, and Option F: Small-Scale Fishery Set Aside.

Issue 7: Episodic Events Set Aside Program

SUMMARY: 1 individual supported the set aside; 1 group was not opposed to a set aside; 1 group hoped to resolve the issue through reallocation

- One individual stated that there should always be an episodic events program. He thought a 1% set aside was fine and that participation should be allowed for the states with the least amount of quota.
- RI Saltwater Anglers did not oppose the use of the episodic events set aside.
- Save the Bay encouraged re-allocation as a way to negate the need for an episodic events program. They stated that the distribution of quota should be more equitable to avoid this cumbersome set aside.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: 1 group recommended a reduction to the Cap; 1 group recommended a coastwide ban on the reduction fishery

- RI Saltwater Anglers recommended the Cap be kept and reduced to 96 million pounds to prevent against localized depletion in the Chesapeake Bay. They noted that the Bay is a primary nursery ground for menhaden and it is also where the majority of catch is concentrated.
- Save the Bay supported a coastwide ban on the reduction fishery. They stated that the reduction fishery is damaging the resource and is a collective issue for the Atlantic states.

Issue 9: Research Programs and Priorities

SUMMARY: 1 group supported fishery independent research; 1 group recommended research on menhaden as filter feeders; 1 individual recommended research on spawning areas

- RI Saltwater Anglers recommended the Board prioritize fishery independent research to investigate historical abundance, the effects of localized depletion, and food web dynamics. The group was not opposed to the use of a research set aside.
- Save the Bay noted the important role that menhaden serve as filter feeders in Narragansett Bay and recommended research on the role of menhaden in reducing nutrients in bays and estuaries.
- One individual recommended greater research to identify menhaden spawning areas along the coast.

Jonah Crab Draft Addendum II for Public Comment

Atlantic States Marine Fisheries Commission
December 19, 2016
Rhode Island

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
ERIC REID	ASMFC (LD)	
RICHARD SOUZA	ARK BAIT CO	Fall river, MA
Joshua Alexander	ARK Bait Co	Fall river, MA
GEORGE ALLEN	Rhode Isl Saltwater Anglers	PORTSMOUTH, RI
DOUGLAS STEPHENS	WOONASQUATUCKET RIVER WATERSHED COUNCIL	PROVIDENCE
Zach Cockrum	NWF	Montpelier VT
Meghan Lapp	Seafreeze Ltd	N. Kingstown RI
Dave Monti	RIMFC/RISAA	Warwick, RI
Rick Bellavance	TNC	Middletown, RI
John Kalce	WRWC	Providence, RI

Atlantic Menhaden Amendment 3 PID Public Hearing

Old Lyme, Connecticut
December 14, 2016
11 Participants

Attendees: Kendall Barbery (Save the Sound), Tom Cleveland (Branford Land Trust), Chris Brown (Hal Brown Co.), Anthony Cherry (Mayforth Group), Katherine Deuel (Pew), Zach Greenberg (Pew), Mike Roy (Reel Cast Charters), Peter Auster (Mystic Aquarium and UConn), Valeri Bannister (freelance writer)

Staff: David Simpson (CT DEEP), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: 1 group and 4 individuals supported Option D

- Save the Sound and 4 individuals supported Option D in order to ensure there are enough menhaden in the water to fulfill their ecological role as forage fish. One individual stated that the protection of menhaden is an inclusive issue as it impacts many stakeholders such recreational fishermen, commercial fishermen, tourism industries, and birders; as a result menhaden should be managed for their role in the ecosystem. Save the Sound noted that although the current TAC in Connecticut and New York is small, we should not underestimate the impact of menhaden on the marine ecosystem. Greater protection is also needed as environmental changes such as climate change and runoff continue to impact the stock. Another participant noted that while predators consume different types of prey, menhaden is of high conservation value, and the Board needs to consider the availability, or lack thereof, of other prey species when considering the importance of menhaden.

Issue 2: Allocation Method
SUMMARY: Participants supported revisions to the allocation method through a combination of options.

- Save the Sound advocated for a more equitable distribution of menhaden quota and believed that a greater percentage of quota should be allocated to New England.
- One individual supported a combination of Option B: Jurisdictional Quota with Fixed Minimum, Option D: Seasonal Quota, Option F: Disposition Quota, and Option G: Fleet Capacity Quota.
- Another participation supported allocation options that consider the temporal and geographic spread of menhaden catch to ensure menhaden are available to predators. He recommended combining Option D with Option E: Regional Quota with a four region split. He did not support Option C: Coastwide Quota.

Issue 3: Allocation Timeframe
SUMMARY: 1 individual supported Option C

- One individual supported Option C: Longer Time Series. He recommended the Board look at the range of variation in the allocation percentages over different lengths of time to see how great the change is between the different options.

Issue 4: Quota Transfers and Overage Payback

SUMMARY: 1 individual did not support quota transfers; 1 individual expressed concern about quota reconciliation

- One individual expressed concern that quota transfers could result in localized depletion as the effects of fishing are local. As a result, transferring quota from one area to another could result in greater harvest in one region than is recommended by science and could have cascading consequences for the ecosystem.
- Another individual expressed concern that overage reconciliation may promote intentional overages by jurisdictions.

Issue 5: Quota Rollovers
SUMMARY: Two individuals supported limited quota rollovers

- One individual stated that the ability to rollover quota is based on the assumption that the stock assessment is correct. It also assumes that unused quota is the result of fish not being caught rather than a lack of fish to be caught. He felt that some percentage of rollover is fair but that it should be conservative to account for the high degree of uncertainty in the assessment.
- One individual stated that quota rollovers should occur as there may be many reasons why the quota is not caught, including poor weather. He recommended that half of the unused quota be rolled over.

Issue 6: Incidental Catch and Small Scale Fisheries
No comments given.

Issue 7: Episodic Events Set Aside Program
SUMMARY: 1 individual did not support the episodic events program

- One individual did not support setting aside 1% of the TAC for episodic events.

Issue 8: Chesapeake Bay Reduction Fishery Cap
SUMMARY: 4 individuals supported continuation of the Cap

- 4 individuals supported the continuation of the Chesapeake Bay Reduction Fishery Cap as it is an important tool for management. They expressed concern that if there is no Cap, the Bay may be further impacted.

Issue 9: Research Programs and Priorities

SUMMARY: 1 individual supported research on food web dynamics and the impacts of fishing on the distribution of menhaden

- One individual recommended research on the dynamics of fishing and how this impacts the localized distribution of menhaden. He also recommended research on how variations in the population of menhaden impact food web dynamics. He stated that a RSA could provide an underlying framework for this research and foster collaboration with the industry.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 14, 2016
Connecticut

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
Tom Cleveland	Branford Land Trust	Branford CT
Chris Brown	Hal Brown Co	Branford, CT
Anthony Chemy	Mayflower Group	
Katharine Dehel	Pew Charitable Trusts	Boston, MA
Zach Greenberg	Pew Charitable Trusts	Washington, DC
Mike Ray	Reel Cast Charters	Old Saybrook, CT
Peter Austin	Ayuntamiento de Coam	Groton, CT
Valeri Bannister	Preclaw Water	Cheshire, CT
Kendall Barberry	Save the Sound	NHV, CT

Atlantic Menhaden Amendment 3 PID Public Hearing

December 15, 2016
Freeport, New York
40 Participants

Attendees: Charles Witker, Ronald Turbin (CCA-NY), Philip Romano (Bayside Anglers Group), Margaret Kraft, Connor Burke (Eastern Bays Oysters), Louis DeRicco (NY Coalition for Rec Fishing), Bill Mead, Jesse Hornstein (NYS DEC), Elizabeth Brown-Hornstein (Safina Center), Zack Greenberg (Pew), Will Caldwell (C. Well Fish), Thomas G. (TC Fisheries Inc.), Dave Yagerman (Bayside Anglers Group), Catherine Granton (Gotham Whale), Zack Cockrum (NWF), S. Daros (HOBAS), Stella Miller (Huntington-Oyster Bay Audubon), Ross Squire (Traditional Surfcasters), Jon Semlear (comm. fishermen), John Turner (Seatuck Environmental Assoc.), Charles Temkey (Atlantic Clam Co.), Percy Brice, Sean O'Neill (Peconic Baykeeper), William Davison (Stripper Surfclub), Rob W. (Operation Splash), Jim J. Carl LoBue (Nature Conservancy), David Blindsen (North Flats Guiding), Michael Kalaun (Seahorse Dist.), Capt. Tom P., Jake Labelle (Wildlife Conservation Society), Bill Carr, James Caldwell, Margot C., Jamie Pollock, Steve Townsend (Salty Fly Rodders), Bob Skoy (Salty Fly Rodders)

Staff: Jim Gilmore (NYS DEC), John McMurray (Commissioner), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: Participants supported Option D

- 13 groups (Peconic Baykeeper, Gotham Whale, Long Island Beach Buggy, CCA, Seatuck Environmental Association, Safina Center, NY Coalition for Recreational Fishing, National Wildlife Federation, Huntington-Oyster Bay Audubon, Operation Splash, Wildlife Conservation Society, Salty Fly Rodders, Stripper Surfclub) and 10 individuals supported Option D: Existing Guidelines for Forage Fish Until BERP Completes ERPs. Many stated that menhaden need to be managed as forage fish in order to support the marine ecosystem including whales, birds, anadromous species, and larger fish. Others noted the economic benefits to recreational fishermen, commercial fishermen, tourism industries, and coastal communities that result from increases in menhaden abundance. Several felt that the ocean is healthier than it has been and recommended the Board take a conservative approach to managing menhaden. Three individuals highlighted that menhaden help filter water and improve water clarity.
- One individual expressed concern with the Pikitch et al (2012) reference point as it would allow current fishing levels to continue since, under that reference point, overfishing is not occurring.
- One individual noted that there is always a desire for precise numbers out of a population model and the Board should be warned that the BERP's model outputs will have a tremendous amount of uncertainty. This uncertainty will require a precautionary approach to managing menhaden.

Issue 2: Quota Allocation

SUMMARY: Participants supported Option B and combinations of allocation methods

- Four participants supported Option B as a way to solve many problems in the fishery including episodic events, quota transfers, and the bycatch allocation. They stated that the allocation mechanism needs to be revised as it is not equitable that one state gets 85% of quota.
- One individual did not support Option E: Regional Quotas as he felt that New Jersey would beat New York to the quota and flood the bait market.
- Another participant supported Option E if it is combined with Option B and did not support Option C: Coastwide Quota as it would result in inequitable access to the resource along the coast.
- Another individual supported a combination of Option D: Seasonal Quotas and state allocations.

Issue 3: Allocation Timeframe

SUMMARY: Participants recommended the Board look forward, not backward, in menhaden management; two individuals supported Option B

- Two individuals supported Option B: 2012-2016 as this best reflects current landings.
- Four participants did not support any of the timeframes provided. They stated that the Board should look forward, rather than backward, when setting allocation methods and the options in the PID do not allow this to happen. One individual stated that 2009-2011 represents a time when the reduction fishery was overfishing the menhaden stock and should not be used. Another participated stated that if a year must be chosen, he would recommend just looking at 2016. One individual stated that if he had to choose an option if would Option D: Weighted Allocation.

Issue 4: Quota Transfers and Overage Reconciliation

SUMMARY: 1 individual support quota transfers; 1 individual encouraged transparency

- One individual supported quota transfers but expressed concern that transfers could become a commodity as the abundance of menhaden grows.
- Another participant encouraged an open and transparent process for quota transfers.

Issue 5: Quota Rollovers

SUMMARY: 9 individuals and 3 groups did not support rollovers; 2 individuals supported limited rollovers; 1 individual recommended unused quota be rolled over into a set aside

- Nine individuals and 3 groups (Operation Splash, Gotham Whale, Huntington-Oyster Bay Audubon) did not support quota rollovers. Two individuals stated that unused quota is not a credit to use the next year. Other individuals noted that unused quota supports marine life, contributes to higher recruitment, and provides a buffer for the stock. Some questioned whether unused quota was an early sign of low stock abundance and that quota rollovers might perpetuate this problem. One individual hoped that new allocation methods would provide states enough quota to negate the need for rollovers and was concerned that quota rollovers would make stock assessments harder. Another

participant stated that quota rollovers allow states to not fish one year and fish twice as hard the next year. One individual expressed concern that if states with the largest quotas could rollover quota, they would have a larger impact on juvenile fish.

- Two participants supported quota rollovers. One participant supported limited quota rollovers similar to other fisheries that allow a percentage of quota to rollover each year. The other thought that quota rollovers should be allowed as long as there is nothing wrong with the stock biomass.
- One individual recommended that unused quota be rollover into a bank for each state to be used for episodic events or fish kills.

Issue 6: Incidental Catch and Small-Scale Fisheries

SUMMARY: 1 group supported Option C; 2 individuals and 1 group supported Option F

- 2 individuals and the Peconic Baykeeper supported Option F: Small-Scale Fishery Set Aside as it gets small-scale gears out of the shadows of a bycatch allowance and allows them to direct on menhaden. The Peconic Baykeeper stated that Option F would remove some of the administrative burden on states and would protect small-scale gears indefinitely. One individual noted that as a beach seiner, his business survives on the 6,000 lb bycatch allowance and defining incidental catch would shut him out of the fishery.
- Operation Splash supported Option C: Incidental Catch Included in Quota so that all landings count towards the TAC.
- One individual recommended that all fish be counted towards the quota but that to do this, NY needs a larger quota. He noted that the current bycatch provision was created to solve the quota allocation problem established by managers.

Issue 7: Episodic Events Set Aside Program

SUMMARY: 2 individuals recommended New England's quota be increased; 1 individual recommended NY be added to the set aside or have its own set aside

- 2 individuals stated that the best way to deal with episodic events is to increase the New England states quota. This would hopefully alleviate the need for the set aside program and provide a simple solution to this problem.
- 1 individual stated that NY should either have its own episodic events set aside (at 1% of the TAC) or be included in the New England program but have the set aside increased. He cited the numerous fish kills in New York as reason for why New York needs episodic set aside quota.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: 3 individuals and 2 groups recommended the Cap be reduced; 1 individual recommended the Cap be maintained; 1 individual did not support harvest in nursery areas

- Three individuals and two groups (Peconic Baykeeper, Huntington-Oyster Bay Audubon) felt that the Cap should be maintained and reduced to current fishing levels. One individual commented that if the reduction fishery is not meeting its Cap, the Board should investigate whether there are enough forage fish in the Chesapeake Bay.

- One individual recommended that if the reduction fishery is not meeting the Cap, then it needs to be revisited and that there should not be fishing allowed in an important nursery area.
- One participant stated that the cap should be maintained as it seems to be working since stocks are growing.

Issue 9: Research Programs and Priorities

SUMMARY: Participants supported continued research on the menhaden stock

- 4 individuals supported greater research on the menhaden stock to answer many of the questions that still remain on the biology of the species. One individual recommended research on a minimum size that would allow menhaden to spawn before being harvested.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 15, 2016
New York

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
CHARLES WITEK	—	WEST BABYLON, NY
RONALD TURBIN	CCANY - GATEWAY STRIP	LIBERTY/LYNBROOK NY
PHILIP W. ROMANO	BAYSIDE ANGLERS GROUP	FLUSHING, NY
MARGARET KRAFT		COLD SPRING HARBOR, NY
Connor Burke	Eastern Bays Oysters	Sayville, NY
LOUIS DeRICCO	NY Coalition for Recreational Fishing	Rockville Centre, NY
BILL MEAD		EAST MORICHES, NY
Jesse Hornstein	NYS DEC	
Elizabeth Brown-Hornstein	Surfing Center	Setauket, NY
Zach Greenburg	The Pew Charitable Trusts	Washington, DC
Wm P Caldwell	C Wall Fish	Hampton bays, N.Y.
Thomas Garrigan	TG Fisheries Inc	center moriches, NY
DAVE VACKERMAN	BAYSIDE ANGLERS GROUP	BAYSIDE, NY
CATHERINE GRANTON	GOTHAM WHALE	BROAD CHANNEL, NY
Zach Cockrum	National wildlife Federation	Montpelier, VT
S. DEROS	HOBAS	SYO. NY 11791
Stella Miller	Huntington-Oyster Bay Audubon	Syosset, NY
Ross Squire	TRADITIONAL SURFCASTERS	CENTEREACH, NY
JON SEMLEAR	COMM. FISHERMAN	SAG HARBOR, NY
JOHN TURNER	SEATUCK ENVIRONMENTAL ASSOC	ISLIP, NY
Charles Temkey	Atlantic Clam Co/TLC Shellfish	Patchogue NY
PERCY BRICE III		FREEPORT, NY
Sean O'Neill	DC Local Bayside	Quogue, NY
William Dawson	Striper Surf Club	Seaford NY
Rob Weltner	Operation SPLASH	Freeport NY
Jim Jenkins		Rye, NY
CARL LoBue	The Nature Conservancy	Cold Spring Harb. 11724
Dave Blanchon	North Fluke's Guides	East Hampton NY 11937
MICHAEL KALAUN	SEAHORSE DIST.	FREEPORT, NY

New York Pg 2

Name	Company/Organization	City, State
CAPT TOM POLADIAN	AMERICAN PRINCESS	NEW YORK
Jake LaBelle	Wildlife Conservation Society	New York
BILL CARR	splash	new York
James K. Crowell		East Quogue, N.Y.
Margot Collins	Intrepid	Teaneck NJ
Jamie Potter	Shark Attack	NY NY
Steve Townsend	Salty Fly Paddlers	Freeport, NY
Bob Skoy	Salty Flyrodders	Freeport
flyline@optonline.com	LI flyrodders	

Atlantic Menhaden Amendment 3 PID Public Hearing

Port Republic, New Jersey

December 8, 2016

13 Participants

Attendees: Lindsey Fuller (NJ Sea Grant), Paul Harris (NJBBA), Carole Harris (NJBBA), Peter Himchak (Omega Protein), Scott McGarey (NJOA NJ Federation), Noel Angelicci (Fortescue Anglers), Paul Eidman (Menhaden Anglers), Fred E. (GEHWA), Ron Nachmann (SSSWA), Bill Figley

Staff: Russ Allen (NJDFG), Jeff Brust (NJ DFG), Megan Ware (ASMFC)

Issue 1: Reference Points

SUMMARY: Participants supported Option D.

- Six participants supported Option D. Menhaden Defenders stated that the Board should move immediately to ERPs so that the historic range of menhaden can be restored from Maine to Florida. The group stated that single-species reference points are wrong for menhaden as they ignore the importance of menhaden in the food web. Several individuals noted the economic importance of menhaden to coastal states as recreational fishermen are drawn to the NJ beaches and spend money on food, gas, fishing line, and hotels. Without menhaden, these economies dwindle. One individual stated that the value of fish as forage is greater than their value as fish meal or oil. Another individual expressed concerns about the poor state of river herring and how this could already be limiting forage fish in the ecosystem.
    - Menhaden Defenders supported managing to the 75% unfished biomass and ensuring abundance does not fall below 40% unfished biomass.

Issue 2: Quota Allocation

SUMMARY: One group supported Option B, F, and G; 1 individual supported Option E.

- Menhaden Defenders supported Option B: Jurisdiction Allocation with Fixed Minimum Quota, Option F: Disposition Quota, and Option G: Fleet Capacity Quota. Specifically for Option B, the group supports a 30/70 split with 30% of the allocation going to the bait fishery in order to support coastal communities. Menhaden Defenders did not think it is equitable that 85% of the quota goes to one state and primarily one corporation. They recommended Options C: Coastwide Quota, Option E: Regional Quotas, and Option H: Allocation Strategy Based on TAC be removed from the draft Amendment. Option H was of particular concern as this could create incentives against increasing the TAC.
- One individual supported Option E: Regional Quotas with a four region split in order to distribute quota along the coast. He noted, however, that boats can go anywhere now and this will have to be addressed in this option.

Issue 3: Allocation Timeframe
SUMMARY: 1 group supported Option C.

- Menhaden Defenders supported Option C: A Longer Time-series with a recommendation to use data from 1955-2016. The group felt trends prior to 2009 should be considered as these earlier times reflect periods when catch was distributed more widely. They did not support Option A: 2009-2011 or Option B: 2012-2016 as they do not consider earlier time periods.

Issue 4: Quota Transfers and Overage Payback
SUMMARY: 1 group supported quota transfers with qualifications that prevent abuse of the program by states.

- Menhaden Defenders recommended that quota transfers be unrestricted if completed prior to a state exceeding its quota; however, if a transfer occurs after the quota is exceeded, states should take steps to address the overage in the following year and should not be allowed to accept a quota transfer in the next year. This will prevent states from repeatedly exceeding their quota.
- One individual recommended that quota underages be given back to the stock to improve the population.

Issue 5: Quota Rollovers
SUMMARY: Participants did not support quota rollovers.

- Four participants did not support quota rollovers. Menhaden Defenders stated that quota rollovers could lead to unintended consequences in regards to localized depletion or quota allocation. One individual stated that if you don't catch your quota in a year, it probably means there are not enough fish in the water.

Issue 6: Incidental Catch and Small Scale Fisheries
SUMMARY: 1 group and 1 individual supported Options C and F.

- Menhaden Defenders and 1 individual supported Option C: Incidental Catch Included in Quota and Option F: Small-Scale Fishery Set Aside as these options provided a way to have all catch counted towards the TAC.

Issue 7: Episodic Events Program
SUMMARY: 1 group did not think the episodic set aside will be needed; 1 individual recommended adaptive management.

- Menhaden Defenders did not think the Episodic Events Program would be necessary as long as Amendment 3 addresses the allocation issues in the fishery. There was a question of how towns should deal with fish kills which require lots of funds to clean up and will likely become more prevalent as the abundance of menhaden increases.
- One individual stated that the management program should respond to distribution of fish over time. Moreover, as the distribution changes, allocation should change.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: Participants supported a continuation and reduction of Cap.

- Five participants supported a continuation of the Chesapeake Bay Reduction Fishery Cap and a reduction by 50%. Menhaden Defenders stated that the Board needs to protect the Chesapeake Bay which is currently a sick Bay due to the pollutants and high catch rates. Given the reduction fishery's proximity to the Chesapeake Bay, participants expressed concern that harvest concentrates around the Bay and that the Cap is vital in limiting effort.

Issue 9: Research Programs and Recommendations

Summary: 1 group recommended research programs and noted the abuse of RSAs in other fisheries.

- Menhaden Defenders recommended that the Commission prioritize fishery independent research on migration, water filtration, localized depletion, and food web interactions. In addition, the group recommended additional research on impacts of large-scale menhaden fishing. Menhaden Defenders expressed some concerns with the abuse of RSA programs in other fisheries but also noted the need for research on menhaden.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 8, 2016
New Jersey

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
Russ Allen	NJDFW	Port Republic NJ
Lindsay Fuller	NJ Sea Grant	Beach Haven, NJ
PAUL HARRIS	NJBBA	BAYVILLE NJ IBSP
CAROLE HARRIS	NJBBA	BAYVILLE NJ
Peter Himchak	Omega Protein	Tuckerton NJ
Scott McGahey	NJOA NJ Federation	Forked River NJ
LUCC ANGELUCCI	FORTESCUE NJSFA / NJOA	SEWELL, NJ
PAUL Eidman	menhaden Defenders	Tinton Falls NJ
FRED AKERS	GSHTWA	GREAT BOG HARBOR ROUTE
RON NACHMANN	SJSWA, FORTESCUE	Manahawkin
BILL FIGLEY		"

Atlantic Menhaden Amendment 3 PID Public Hearing

Lewes, Delaware

December 8, 2016

18 Participants

Attendees: Chris Bason (CIB), Leonard Voss, Brenna Goggin (DE Nature Society), Amy Roe, Rich King (DE Surf Fishing), Benson Chiles (Chiles Consulting LLC), Charles Robertson, John Satterfield (waterman), Katie Peikes (DE Public Media), Joseph Smith (FiaFish Council), Sarah Cooksey (TNC), Mike Cooksey, Ed Hale (DNREC)

Staff: Max Appelman (ASMFC), John Clark (DE DFW), Roy Miller (DE Commissioner), Craig Pugh (DE Commissioner), Stuart Michels (DE DFW)

Issue 1: Reference Points

SUMMARY: 6 individuals (mostly representing environmental groups and agencies) supported Option D; 1 individual supported Option C or D; 2 individuals supported Option A

- Six people, most representing environmental groups and agencies, commented in favor of Option D: Existing Guidelines for Forage Fish Species until ERPs are Developed by the BERP Workgroup. Commenters were in agreement that single species reference points are not appropriate for a forage fish species like menhaden, and that a conservative baseline should be used while ERPs are being developed. Commenters stressed the importance of menhaden in the Chesapeake Bay; improving water quality by eating algae, exporting that energy from the Bay to other ecosystems, and as a food fish for other species. Commenters continued to mention the importance of menhaden in the marine food web. Other comments included that while menhaden are not overfished, the size of individual fish are decreasing which is indicative of stressed stock. At least two commenters agreed that more fish should be allocated to predators.
    - One commenter was in favor of either Option C or Option D. Essentially, this commenter was in favor of ERP but was indifferent to the type of reference points used in the interim.
- Two commercial fishermen commented in favor Option A: Single Species Reference Points. The commenters supported the current science to manage the species, and stated that the reference points are not causing the population to be overfished, and overfishing is not occurring. Changing the ERPs may only create more problems down the road. The commenters noted that there is always room for improvement using the status quo reference points, but there is too much unknown about the ERPs being developed. Additionally, the commenters noted that there have been huge die-offs in the Bay and other regions indicating that there are more fish than the environment can sustain.

Issue 2: Quota Allocation

SUMMARY: 1 individual supported Option B, F or G; 1 individual supported Option A; 1 individual supported redistribution of quota

- One individual (representing an environmental group) supported Options B, F, and G, mainly noting that too much of the quota is given to the reduction fishery. The commenter continued that this unfair share is discriminatory to some degree and should be allocated fairly. The individual was also in support of removing Options C, E, and H from consideration in the draft amendment.
    - One individual commented that there needs to be a redistribution of quota from reduction fishery to the DE bait fishery, but did not specify any particular option.
- One fishermen commented in favor of Option A: Jurisdictional Quotas based on a landings during a selected reference period. The commenter noted that this allocation system has not led to overfishing or overfished status, and changing the system could open the door to other issues.

Issue 3: Allocation Timeframe

SUMMARY: 1 individual (group) supported Option C; 1 individual supported Option D.

- One commenter supported Option C: Longer Time Series Average, as the allocation program should be based on what the fishery has done over the long term.
- One commenter supported Option D: Weighted Allocation, because future allocations should take into account both the historic and short term trends.
- Another comment here was that managers should turn a blind eye to historical records.

Issue 4: Quota Transfers and Overage Reconciliation

SUMMARY: commenters were in favor of quota transfers.

- One commenter was in favor of transfers so long as they were bound by geographic region (e.g., doesn't make sense to transfer quota from ME to FL when these states are likely fishing on very difference biological units)
- Two individuals commented in favor of moving to a quota reconciliation system as this would help keep states within the quota without a penalty, also noting that transfers don't really help the state of DE in any way.
- One commenter noted that perpetual overages and transfers should not be permitted. Transfers should occur well before any overage occurs.

Issue 5: Quota Rollovers

SUMMARY: 3 individuals did not support quota rollovers.

- Three commenters (two fishermen, one other) did not support quota rollovers. Rollovers are a dangerous scenario and can only lead to overfishing down the road.

Issue 6: Incidental Catch and Small-Scale Fisheries

SUMMARY: 1 individual (group) supported Option C; 1 individual supported option A, B, or F (against option C)

- One commenter (group) was in favor of Option C: Incidental Catch Included in the Quota, because all catch should count towards a state's quota. The commenter noted that if the allocation system were done correctly, then there would not be a need for a bycatch allowance.
- One commenter (fishermen) was in favor of Options A, B or F, and was against Option C, because this could create issues with bycatch mortality and should be avoided.
- One commenter noted that DE's quota is only a third of what their landings are, and that something needs to be done to address this (either changing the allocation scheme or the bycatch allowance).

Issue 7: Episodic Events Set Aside

SUMMARY: Participants were mostly against episodic events provision, but at least one was in favor of status quo.

- In general, commenters were against an episodic events provision noting that this is really a way of avoiding penalties with quota overages. Commenters felt that episodic events would be addressed by looking at a longer time series for quota allocations.
- Commenters felt episodic events should be addressed in the allocation program as these are usually occurring in the same regions (e.g., Gulf of Maine).
- One commercial fishermen preferred the status quo episodic events provision, noting these are not a regular occurrence and should be addressed on a case by case basis

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: Commenters supported maintaining the cap.

- In general, commenters supported maintaining the harvest cap to avoid any potential adverse effects of high harvest levels in the Bay in the future. One commenter noted that the cap should be lowered to be closer to what the fleet is actually harvesting

Issue 9: Research Programs and Priorities

SUMAMRY: 1 group recommended research on recruitment and food web models

- Commenters would like to see research focused on socioeconomics, and how that information can be accounted for in the allocation development process.
- Commenters would like to see fishery participants collecting data and being a platform for research

Menhaden

~~Jonah Crab~~ **Draft Addendum II for Public Comment**

Atlantic States Marine Fisheries Commission
December 8, 2016
Delaware/Maryland Joint Hearing

-- PLEASE PRINT CLEARLY --

* Pretty much everyone was there for Menhaden knowing not Jonah.

Name	Company/Organization	City, State
Katie Peikes	Delaware Public media	Dover, DE
LEONARD VOSS	WATERMAN	SMY. DE.
~~Joseph Smith~~	~~Fish Council~~	Townsend. DE
JOHN SATTERFIELD	WATERMAN	WILM, DE
RICH KING	Delaware Surf Fishing	Millsboro DE
ROY MILLER	ATL. STATES MAR. FISH	LEWES, DE
Brenna Goggin	DE Nature Society	WILM, DE
John Clark	DE Div. of Fish & Wildlife	Dover, DE
SARAH Cooksey	the Nature Conservancy	milton, DE
MIKE COOKSEY		Milton DE
Chris Bason	CIB	Rehoboth Beach, DE
Ed Hale	DNREC	Lewes, DE
Charles Robertson	Self	Wilmington DE
Benson Chiles,	Chiles Consulting	Atlantic Highlands, NJ
CRAIG Pugh		Leipsic, De

walked in during Jonah

Atlantic Menhaden Amendment 3 PID Public Hearing

Annapolis, Maryland
December 7, 2016
49 Participants

Attendees: Howard King (MAFMC), Bill Boyer (CCACBF), Bill Goldsborough (CBF), Peter Himchak (Omega Protein), John Veil (Veil Environmental, LLC), George O'Donnell (DNR), Stuyve Pierrepont (Farr, Miller, & Washington), Larry Jennings (CAA MD), Fred Menage (Pasadena Sportfishing), Larry Powley (waterman), Burl Lewis (waterman), Joseph Gordon (Pew), Sara Carley (NWF), Colton Naval (NWF), Amy Hedges (NWF), Jim Rowe (CCA), Marty Gary (PRFC), David Blazer (DNR), Lester King (CCA), Capt. Robert Newberry (DFA), Rachel Dean, Elaine Williams, Ashton Poole, Abel Fabian (CCA), Abel Fabian (MSSA), Rosella Fabian (DGGSE Program), Anna Vecchio (NWF), Vanessa Pena (NWF), Robert Brown (MWA), Peter Miller (CCA), Joe Evans (CBF), Lani Hummel, Ed Liccione (CCA MD), David Sikorski (CCA MD), F. Bonanno (CCA MD), Hugh Mealy (CBF), Helen Mealy (CBF), Millie Bryon (TNC), Jeff Brainard (Maryland Sea Grant), Levin Lihell (CCA MD), Kenneth Lewis (CCA MD), David Zajano (CCA MD), Jerry Morgan (CCA), John Vanastine (waterman), Phil Ellis (CCA), Ellie Howe, Margarette Jennings (CCA MD)

Staff: Lynn Fegley (MD DNR), Harry Rickabaugh (MD DNR), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: 4 groups and 4 individuals supported Option D; two groups and four individuals supported Option A.

- Four groups (Pew, CCA-MD, Ches. Bay Foundation, and National Wildlife Federation) and four individuals supported Option D: Existing Guidelines until ERPs are Developed by the BERP. Several groups noted that the management of menhaden should account for the needs of predators and recognize the value of menhaden left in the water. Pew expressed concern about waiting until 2019 to implement ERPs as high yields of menhaden will continue to deplete the ecosystem. Ches. Bay Foundation highlighted the importance of menhaden abundance to predators and the continued low menhaden abundance in areas around the Chesapeake Bay. CCA MD supported ERPs to ensure the expansion of the stock up and down the coast. Several individual and groups noted the importance of taking a large-scale ecosystem approach to the management of menhaden and to recognize the linkages in the marine system.
    - Pew and Ches. Bay Foundation supported the 75% rule-of-thumb and Ches. Bay Foundation recommended a fishing cutoff at 40% unfished biomass.
- Two groups (Delmarva Fisheries Assoc. and MD Waterman's Assoc.) and four individuals did not support the implementation of ERPs and recommended Option A: Single-Species Reference Points. These groups and individuals felt that ERPs are not necessary in MD as the pound net fishermen have an insignificant impact on the menhaden population. These participants noted that there is a local population of menhaden which spawn and reside in the Bay year-round and that there is nothing wrong with their local fishery.

Several individuals expressed concern with developing ERPs when the Board does not have a value for an unfished population. Others highlighted the economic impact that the 20% reduction in catch had on the local fishery as this management action almost put them out of business; these participants felt that MD should have been exempt from the reduction since they do not have an impact on the stock. Overall, those that supported Option A stated that the stock is not in danger as it is not overfished and overfishing is not occurring and that any measures in Amendment 3 should not impact the Chesapeake Bay.

Issue 2: Allocation Method

SUMMARY: 5 groups and 8 individuals supported Option A with a new quota distribution between states.

- 5 groups (CCA-MD, Ches. Bay Foundation, Delmarva Fisheries Assoc., MD Waterman's Assoc., and Pasadena Sportfishing Assoc.) and eight individuals supported Option A: State-by-State Allocation but recommend that state allocations be modified. Participants thought that state-by-state allocations worked well administratively but felt that the percentages allocated to each state were incorrect and that many small-scale gears were not treated fairly. Many stated that VA's share of allocation represents a monopoly and it should be distributed to small-scale fishermen who fish in a more sustainable manner and have no impact on the stock. Specifically, participants recommended that MD get 15 million pounds of menhaden quota each year. Several participants felt that there should be no quota in MD since the fishermen do not have an impact on the stock.
- CCA-MD opposed the use of soft quotas.
- Delmarva Fisheries Assoc. stated the Board has not been fair in its use of science as they are quick to take cuts but are unwilling to provide increases when there is a 0% chance of overfishing even if you raise the TAC by 40%.
- MD Waterman's association and the Ches. Bay Foundation highlighted the importance of the bait fisheries to coastal economies and the blue crab fishery.

Issue 3: Allocation Timeframe

SUMMARY: 1 group and 1 individual supported Option B; 2 groups and 1 individual opposed Option A.

- Delmarva Fisheries Assoc. supported Option B: 2012-2016 and opposed Option A.
- MD Waterman's Association opposed Option A and expressed concern about Option B as it would take into account the 20% reduction. The group felt the quota needs to be increased or MD should be eliminated from the system since they do not have an impact on the ecosystem.
- One individual opposed Option A: 2009-2011 since he felt this timeframe is what has created many of the allocation problems.
- Another individual supported Option B as it includes 2012 which was a banner year for MD and may give MD a bigger quota.

- One participant supported any option that will give MD more fish.

Issue 4: Quota Transfers and Overage Payback
SUMMARY: 1 group did not support quota transfers and 1 individual supported accountability measures.

- Delmarva Fisheries Assoc. did not think there is a need for quota transfers or overage reconciliation. They stated that the MD fishery has no bearing on anything coastwide.
- One individual felt that there has to be some accountability measures built into the regulations. Without accountability, the rules become meaningless and states could repeatedly exceed their quota.

Issue 5: Quota Rollovers
SUMMARY: 1 group opposed quota rollovers and 1 individual supported them.

- One individual asked why a state would not want to rollover unused quota and why there is a question of whether rollovers should be mandatory or voluntary.
- Pew was opposed to quota rollovers. They stated that there is a scientific basis for annual quotas and quota rollovers would allow these levels to be exceeded. On a state-by-state basis, there may also be localized depletion which rollovers could exacerbate. Overall, Pew stated that allocation should not exceed what scientists say is the correct amount to take out of the water each year.

Issue 6: Incidental Catch and Small Scale Fisheries
SUMMARY: Two groups and two individuals supported Option A as long as provisions of Addendum I continue; 1 group hoped allocation would negate the need for a bycatch fishery.

- Two groups (Delmarva Fisheries Assoc. and MD Waterman's Assoc.) and two individuals supported Option A: Incidental Catch Limit per Vessel. One individual expressed concern that Option B: Incidental Catch Limit per Permitted Individual may cause fishermen to 'rent' limits from others or get people to join their vessel so they can harvest more fish. Another individual expressed concern with Option F: Small-Scale Fishery Set Aside as this might create a derby style fishery where small-scale fishermen compete to harvest before the set aside is used. MD fishermen are not in a hunt and chase fishery and this would disadvantage pound net fishermen. Several participants and groups were satisfied with Option A as long as they get to keep the provisions in Addendum I, which allow two permitted individuals to harvest 12,000 pounds of menhaden when working together on the same vessel. Delmarva Fisheries Assoc. asked that the safety issues of only allowing one permitted individual on a vessel in the bycatch fishery be highlighted in draft Amendment 3.
- CCA-MD and two individuals stated that if the allocation issues are properly addressed there won't be a need for the bycatch provision. Moreover, they felt the solution is to allocate MD the proper amount of fish, such as 15 million pounds, and bycatch won't be an issue.

Issue 7: Episodic Events Set Aside Program

SUMMARY: 1 individual thought that VA might donate quota to the Episodic Events Program.

- One individual felt that the New England states should be entitles to what they need. They felt that VA might still relinquish some of their quota to the episodic events program.
- Another individual stated that if there are fish kills occurring in New England, this means there are enough fish in the water.
- Another participant noted that hypoxic conditions, which cause fish kills, can be caused by a high concentration of fish but also by lots of decaying matter.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: 3 groups recommended a 50% reduction in the Cap; 1 group recommended the cap be maintained at current levels.

- Three groups (CCA-MD, Pew, and Pasadena Sportfishing Assoc.) recommended that the Cap be maintained but reduced by 50%. They stated that the Cap should truly be a Cap and not artificially high. Pew was concerned with the possibility that reduction fishing in the Ches. Bay could increase by 50%. CCA-MD expressed concerns about localized depletion in the Bay. Pasadena Sportfishing Assoc. highlighted that the Chesapeake Bay is an important nursery ground for menhaden and this is also where most of the catch is taking place.
- One individual recommended that the Board look at the number of fish in the Bay and set the Cap based off of the local population.
- Delmarva Fisheries Assoc. recommended the Cap be maintained where it is as Omega primarily targets larger fish for their higher oil content.

Issue 9: Research Programs and Priorities

SUMMARY: Participants recommended research on bycatch and regional stocks in the Ches. Bay

- Delmarva Fisheries Assoc. recommended that the Chesapeake Bay estuary be evaluated. They also noted that science has two sides and the Board needs to listen to the TC not only when cuts are needed but also when increases in the TAC can be taken with no risk of overfishing.
- Pew recommended that the Commission look at bycatch in the menhaden fishery. Several older studies say that bycatch in the reduction may be around 1% and there are currently no at-sea observers. There is no science about what other species are being interacted with at sea.
- One individual felt that research should be conducted but that a portion of TAC does not need be set aside as a high volume of fish is not needed to accomplish this research.
- Another individual supported the development of regional abundance trends as the northern states seems to have a lot of menhaden. They also noted that all areas had episodic events in the past and that the 20% reduction in catch did not cause the recent episodic events in New England.

- One participant felt that more research is needed on the importance of menhaden for other species and the water quality services menhaden provide. He wanted to know what impact the 200,000 mt TAC is going to have on the ocean.
- Another participant asked for analysis on economic impacts on management actions. He also wanted to know how many fish are in the Bay and where they spawn.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 7, 2016
Maryland

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
HOWARD KING	MAFMC	MD
Bill Boyer	Citizen; CAC, FF, FTR Found.	MD - Dunkirk
Bill Goldsborough	Ches. Bay Foundation	Annapolis
Peter Himchak	Omega Protein	Tuckerton, NJ
John Veil	Veil Environmental, LLC	Annapolis, MD
George O'Donnell	DNR	Annapolis, Md.
Stuyve Pierrepont	Farr, Miller & Washington	Arlington, VA
Larry Jennings	CCA MD	Annapolis, MD
FRED MENAGE	PASADENA SPORTFISHING	PASADENA, MD
LARRY POWLEY	DORCHESTER	Fishing Creek, MD
Burl Lewis	Dorchester	Cambridge, Md.
Jim Gordon	CCW	Silver Spring, MD
Sara Canley	NWF	DC
Colton Naval	NWF	DC
Amy Hedges	NWF	Annapolis MD
Jim Bowe	CCA	Derwood MD
MARTY GARY	PREC	Colonial Beach, VA
Lester King	CCA	Silver Spring, MD
Capt. Robert Newberry	DFA	Crumpton, MD 21628
Rachel Dean		Lusby MD
Elaine Williams		LUSBY MD
Ashton Poole	CCA-Self	ANNAPOLIS MD
Abel Fabian	MSSA	Saint Leonard, MD.
Rosella Fabian	PDFOSI Program	Saint Leonard, MD.
Anna Vecchio	NWF	Washington, DC
Vanessa Pena	NWF	DC
Robert T. Brown	MWA	Annapolis, Md.
PETER MILLER	CCA	ANNAPOLIS, MD
JOE EVANS	CHES BAY MAGAZINE	ANNAPOLIS, MD
Lani HUMMEL	SELF	ANNAPOLIS, MD 21403

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Name	Company/Organization	City, State
Ed Liccione	CCA MD	Queenstown, MD
DAVID SIKORSKI	CCA MD	Ellicott City, MD
Frank Brannon/ Hugh + Helen Mealy	CCA MD	Baltimore, MD
Billie Byron,	CBF	Annapolis MD
Jeff Brainard	TNC	Bethesda MD
Kevin Lithgo	Maryland Sea Grant	College Park MD
KENNETH LEWIS	CCA MD	Arnold MD.
DAVID ZAJAND	CCA MD	Cockeysville, MD 21030
Jerry Morgan	CCA	PHOENIX, MD.
John VanAstine	Maryland Watermen	PHOENIX MD DUNKIRK MD
Phil Ellis	RCA	Stevensville, MD
Eddie Howard		A A Co.
Margarette Jennings	CCA MD	Annapolis MD

Atlantic Menhaden Amendment 3 PID Public Hearing

Colonial Beach, Virginia
December 6, 2016
6 Participants

Attendees: Stuart Ashton, Mindy Ashton, Zach Greenberg (Pew), John Page Williams (Ches. Bay Foundation)

Staff: Ellen Cosby (PRFC), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: 1 group supported Option D

- The Ches. Bay Foundation recommended that the Board adopt an ecosystem approach, including ERPs, to the management of menhaden. A representative stated that ERPs will help fishery managers set menhaden catch levels that ensure enough menhaden stay in the water to support species such as striped bass, ospreys, and dolphins. Specifically, the Ches. Bay Foundation supported Option D: Existing Guidelines for Forage Fish Until ERPs are Developed by the BERP.

Issue 5: Quota Rollovers
SUMMARY: 1 group did not support quota rollovers

- The Ches. Bay Foundation did not support rolling over unused quota into the subsequent year. They stated that quota rollovers cause the subsequent year's catch to exceed the ecological reference points.

Issue 6: Incidental Catch and Small Scale Fisheries
SUMMARY: 1 group supported Option C

- The Ches. Bay Foundation stated that all catch from the menhaden fisheries should count towards the TAC and supported Option C: Incidental Catch Included in Quota.

Issue 8: Chesapeake Bay Reduction Fishery Cap
SUMMARY: 1 group supported the continuation and reduction of the Cap

- The Ches. Bay Foundation supported the continuation of the Chesapeake Bay Reduction Fishery Cap and its reduction by 50%. Due to concerns about low abundance of menhaden in the Bay, the organization felt it is in the best interest of the Bay and fishermen to reduce the Cap.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 6, 2016
PRFC

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Name	Company/Organization	City, State
Stuart Ashton	[redacted]	King George, Va
Mindy Ashton	[redacted]	King George, Va
Zach Gugerty	FAW	Washington, DC
John Page Williams	Ches Bay Foundation	Annapolis, MD

Atlantic Menhaden Amendment 3 PID Public Hearing

December 5, 2016

Newport News, Virginia

33 Participants

Attendees: Mike Ruggles (Tidewater Anglers Club), Bob Mandigo (Tidewater Anglers Club), Mike Avery (VSSA), Tom Miller (FORVA), Chris Moore (CBF), Peter Himchak (Omega Protein), Steven Epstein (Ches. Bay Defenders), Lee Atkinson, Paul Ewing (Fishing Fever Charters), Bryan Stoots, Woody Poole, Rob Cowling (Pen Saltwater Sport Fish. Assoc.), Saundra Paulter, Wallace Paulter, Curtis Tomlin (VSSA), Wes Bluw, Nikki Rovner (Nature Conservancy), Vanessa Pena (NWF), Amy Hedges (NWF), David Bromley (Omega Protein), Ron Bray (Omega Protein), Burton Thrift (Omega Protein), Jane Crowther (Omega Protein), Amy Hall (Omega Protein), Joseph Gordon, Nick Sterrett (Omega Protein), Benson Chiles (Chiles Consulting LLC)

Staff: Rob O'Reilly (VMRC), Joe Cimino (VMRC), Katie-May Laumann (VMRC), Ryan Jiorle (VMRC), Megan Ware (ASMFC)

Issue 1: Reference Points

SUMMARY: Majority of participants favored Option D; one individual favored Option B.

- Majority of participants, including the Ches. Bay Defenders, Tidewater Anglers Club, Virginia Saltwater Sport Fishing Association (VSSA), National Wildlife Federation, Ches. Bay Foundation, Virginia Conservation Network, and Friends of Rivers of Virginia supported Option D: Existing Guidelines until ERPs are Developed by the BERP. Participants noted that menhaden are an important species to the marine ecosystem, including larger fish and birds, and more menhaden need to be left in the water in order to fulfill this critical role. Several noted that while the stock has been improving, recruitment in the Chesapeake Bay is still low and this is of concern. Many felt that ERPs provide an opportunity for the Board to innovate fisheries management.
    - The Chesapeake Bay Defenders and Chesapeake Bay Foundation supported the 75% rule-of-thumb as a scientifically defensible existing ERP.
- One participant supported Option B: Existing Guidelines for Forage Fish. He stated that the Board can't wait until the populations of menhaden get too low and that we need to protect our fisheries now.

Issue 2: Quota Allocation

SUMMARY: Participants noted support for Options B, C, D, E, F, and G.

- VSSA supported Option B: Jurisdictional Allocations with a Fixed Minimum Quota, Option F: Disposition Quota, and Option G: Fleet-Capacity Quota as they support current fisheries and future growth. VSSA did not support the use of soft quotas in Option G and recommended in Option F that 30% of the TAC be allocated to the bait fishery. VSSA did not recommend Option C: Coastwide Quota, Option E: Regional Quotas, and Option H: Allocation Strategy Based on TAC Level for inclusion in draft Amendment 3.

- The Ches. Bay Defenders supported Option F with a 50% split between the bait and reduction fisheries. They also supported Option E with a four region split as a way to distribute landings along the coast.
- The Tidewater Anglers Club recommended Option B and Option F, with 30% of the TAC allocated to the bait fishery. They also supported Option D, noting that the Chesapeake Bay is an important nursery ground and there should be a regional split with the Chesapeake Bay so that there can be minimal harvest in the Bay during spawning season. They also recommended that Option C be maintained in the draft Amendment as a benchmark. The organization noted that allowing one state to harvest 85% of the TAC is unfair and many of the species ecological goals have been hurt by the current allocation method. NOAA's National Standard 4 recommends allocation be fair and equitable and the menhaden fishery is not meeting this goal. The Tidewaters Anglers Club recommended Option A and E be removed from the draft Amendment.

Issue 3: Allocation Timeframe
SUMMARY: Participants supported a longer time series.

- VSSA recommended that trends prior to 2009 be considered as catches have been widely distributed and the short time series excludes essential catch history. They suggested that the time series go back to 1955.
- One individual supported a time series that goes back to 1955.
- One individual supported Options C and D as the current three year times series does not capture the range of the fish or fishery.

Issue 4: Quota Transfers and Overage Reconciliation
SUMMARY: Participants expressed concerns about quota transfers.

- VSSA expressed concern about rewarding states that mismanage their quota by providing them an opportunity to accept transfers. They recommended that transfers only be completed before a state has met its quota.
- Four individuals stated that quota transfers create a loophole in the fishery which allows states to take a riskier approach to management and promotes overfishing. They noted that states know what their quota is and how not to exceed it.

Issue 5: Quota Rollovers
SUMMARY: Participants opposed quota rollovers.

- VSSA, Tidewater Anglers Club, and Ches. Bay Foundation opposed quota rollovers. They stated there is a reason that fish aren't being caught and quota rollovers would only exacerbate the problem. They also felt that quota rollovers would upset the balance used to set ERPs.
- Four individuals were opposed to quota rollovers. Three individuals stated that if a state does not reach its quota, it means that there are not enough fish in the water as there should be. Another individual said that quota allocations are based on science and quota rollovers are not.
- One individual opposed quota rollovers for the reduction fishery.

Issue 6: Incidental Catch and Small-Scale Fisheries

SUMMARY: 4 groups recommended all catch count towards the TAC; 1 individual supported Option D

- VSSA, Virginia Conservation Network, Ches. Bay Foundation, and Nature Conservancy recommended that all landings count towards the TAC.
    - VSSA supported Options C: Incidental Catch Included in Quota and Option F: Small-Scale Fishery Set Aside.
    - Virginia Conservation Network supported Option F.
    - Ches. Bay Foundation noted that small scale fisheries are extremely important to the blue crab fishery and that it is impossible to prevent non-species specific gear from catching menhaden after the quota is reach; however, significant landings under the bycatch allowance need to be included in the TAC.
- One individual supported Option D: Incidental Catch Cap and Trigger.
- Another individual expressed concern that the incidental catch provision creates a loophole for others to abuse following the closure of the directed fishery. He stated that bycatch is a gimmick that people have been using for years to manipulate quotas and limits. He felt that fishermen are good enough at what they do to be able to avoid harvesting large amounts of menhaden once the quota has been reached.

Issue 7: Episodic Events Set Aside Program

SUMMARY: Participants felt the episodic events program won't be necessary after re-allocation.

- VSSA stated that they believe the Amendment 3 process will be successful and address the current issues/concerns with allocation and, as a result, the episodic events program will no longer be necessary.
- One individual stated the episodic events program is not necessary as the program was created as a work around to Amendment 2. If the fishery is allocated more equitably, episodic events will not be needed.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: Participants supported continuation of the Cap and a reduction in the limit.

- The Ches. Bay Foundation, Virginia Conservation Network, VSSA, Tidewater Anglers Club, Nature Conservancy, Ches. Bay Defenders, and four individuals agreed that the Chesapeake Bay Reduction Fishery Cap should be kept in place. Several stated that the Cap prevents against localized depletion and that it is an essential management tool given the current lack of ERPs and lack of a regional stock assessment. Others noted that the Cap should be considered in the context of all other species in the Bay and VSSA noted that the recreational fishery could be severely impacted by the removal of the Cap.
    - The Virginia Conservation Network, Ches. Bay Foundation, Tidewater Anglers Club, and three individuals recommended that the Cap be reduced by 50% to bring it to current harvest levels and support stock-wide recovery.
    - The Ches. Bay Defenders recommended the Cap be reduced by 70%.

- Nature Conservancy agreed the Cap should be reduced given the importance of menhaden but did not provide a specific percentage.

Issue 9: Research Programs and Priorities

SUMMARY: Participants were split on whether there should be a RSA.

- VSSA expressed concern that a RSA program has a high potential to be abused and great care should be taken in monitoring any research set aside. Suggested research programs include life history, water filtration, food web interactions, and localized depletion especially in Virginia waters.
- One individual emphasized the need for ERP studies.
- Another individual recommended at-sea observer coverage in the menhaden fishery.
- One individual recommended that there should be a RSA since there are so many questions about the stock. The research set aside should be less than 1% of the TAC.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 5, 2016
Virginia

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Name	Company/Organization	City, State
Mike Ruggles	Tidewater Anglers Club	Virginia Beach, VA
BOB MANDIGO	TIDEWATER ANGLERS CLUB	VB BEACH, VA
Mike Avery	VSSA	Hampton, VA
Tom Miller	FORVA	Lanexa, VA
CHRIS MOORE	C.B.F.	VA Beach, VA
Peter Himchak	Omega Protein	Tuckerton, NJ
STEVEN EPSTEIN	Ches. Bay defenders	
LEE ATKINSON		CHESAPEAKE VA
SHAUL ELKING	FISHING FEVER CHARTERS	VA BEACH VA
Bryan Stoots		VIRGINIA BEACH
Woody Poole		Virginia Beach.
Rob Colvin	Pen Selfwater Sportfish. Assoc	Newport News VA
Sandra Poulter		Virginia Beach
Wallace Poulter		Vir. Beach VA
Curtis Tomlin	USSA	Mechanicsville VA
Wes Blow		Newport News VA
NICK ROYNER	The Nature Conservancy	Richmond VA
Vanessa Peña	National Wildlife Federation	Washington DC
Amy Hedges	National Wildlife Federation	Washington DC
David Bromley	Omega Protein	Reedville VA.
Ron Bray	"	"
Burton Thrift	Omega Protein	Reedville VA
Jane Crowther	Omega Protein	Reedville VA
Jimmy HALL	Omega Protein	Reedville VA.
Joseph Gordon		Silver Spring MD
Nick Sterrett	Omega Protein	Reedville, VA
Benson Chiles	Chiles Consulting LLC	Atlantic Highlands NJ

Atlantic Menhaden Amendment 3 PID Public Hearing

Morehead City, North Carolina
November 30, 2016
20 Participants

Attendees: David Bush (NCFA), Steve Weeks (NCFA/CCFA), Chuck Laughridge, Scott Williams, Zack Greenberg (Pew), Louis Daniel, Corrin Flora (NCDMF), Joseph Smith, Attila Nemecz (PAWC/NCWF), Barbara Garrity-Blake (DUML), Leda Dunmire (Pew), Jack Cox (Blue Ocean Market), Bradely S. (CCFA), Caitlin Starks (DUML), Kelsey Dick (DUML), Justin Pearce (DUML), Tom Roller (CCA-NC), Paul Myers

Staff: Michelle Duval (NCDMF), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: 2 groups and 2 individuals supported Option C; 4 groups and 1 individual supported Option D;

- The Carteret County Fisheries Association, the NC Fisheries Association, and two individuals supported Option C: Single-Species Reference Points until ERPs are Developed by the BERP. Participants stated that the stock assessment shows the stock is in good condition and recent TC projections indicate the TAC could be increased by 40% and result in a 0% chance of overfishing. This shows the current reference points have been successful as they have allowed for the maintenance and growth of the menhaden stock. Others noted that the abundance of menhaden seems to be increasing and this would not happen if they were not fulfilling their ecological role. The NC Fisheries Association commented that evaluation of the ERP options all seem to provide for further conservation of the stock. It is unclear if this is the appropriate approach given that the environment is the primary driver of recruitment. Furthermore, general forage fish ERPs are not appropriate as menhaden are a unique fishery and one model does not fit all. These groups and individuals recommended the BERP continue work on menhaden-specific ERPs and when completed, these ERPs be peer-reviewed. In the meantime, the Board should manage with what they do know and not what they don't know. One individual noted that the 20% reduction taken in 2013, which was based on a flawed assessment, had many serious economic impacts along the coast (MD had to establish a bycatch fishery, NJ had to shut down its directed fishery in July, etc) and, so far, the Board has taken a precautionary approach in restoring catch to its historic levels.
- Coastal Fisheries LLC, NC Wildlife Federation, Pamlico-Albemarle Wildlife Conservationists, the Coastal Conservation Association, and one individual supported Option D: Existing Guidelines for Forage Fish Species until ERPs are Developed by the BERP. These groups and individuals recommended that the Board manage menhaden for maximum abundance rather than maximum yield. Using the current single-species reference points while waiting for the BERP's menhaden-specific ERPs will result in

cyclical abundances which are detrimental to the marine ecosystem. Instead, implementing existing guidelines for forage fish species will protect menhaden from overfishing and provide for the needs of predators. Several groups noted that menhaden are still on the road to recovery and the Board should not risk reducing the conservation gains made over the last several years. This is particularly important given the changes occurring in the ocean as the result of climate change. The CCA stated that a sustainable menhaden population also means sustainable commercial and recreational fisheries, and their economies (a $1.6 billion rec industry in NC).

- Coastal Fisheries LLC, the NC Wildlife Federation, and one individual supported the 75% rule-of-thumb to allow menhaden to perform their ecological function and support important species such as king mackerel, cobia, and striped bass.
- The Coastal Conservation Association recommended menhaden population not be reduced below 40% of their unfished biomass so that the stock can fully expand to their northern and southern ranges.

Issue 2: Quota Allocation

SUMMARY: 1 individual supported Option A; 1 group supported Option B; 1 individual supported Option F.

- The NC Fisheries Association supported Option B: Jurisdiction Allocation with a Fixed Minimum Quota. This option allows for continued fishing practices but also greater flexibility for states with limited quota.
- One individual supported Option F: Disposition Quotas. He felt it is a better strategy to distribute quota by fishery (ie: bait vs. reduction) and then consider further allocation by state and fleet.
- One individual supported Option A: Jurisdictional Quotas as he wants to protect the menhaden catch in NC. He noted that in other management plans, regional quotas have shut North Carolina out of the fishery due to timing and water temperatures.
- One individual did not state a preference for a quota allocation method but wanted to see NC have the opportunity to expand their bait fishery.

Issue 3: Allocation Timeframe

SUMMARY: 1 individual supported Option C; 1 group and 2 individuals supported Option D.

- One individual supported Option C: Longer Time Series Average, as a longer time series would better reflect the fishery and would not result in knee-jerk reactions on the part of management.
- The NC Fisheries Association and two individuals supported Option D: Weighted Allocation. They noted that the 2009-2011 timeframe does not reflect when menhaden were abundant in New England or the southern states and as a result, many of these jurisdictions got the short end of the stick. A longer time series is needed to calculate landings and allocation should be weighted between two time periods. The NC Fisheries Association noted that there must be a limit on late reporting. Some of the issues with the current quota allocation have been the result of late reporting and there must be a limit after which changes cannot be made.

Issue 4: Quota Transfers and Overage Reconciliation
SUMMARY: 1 group and 1 individual supported quota transfers.

- The NC Fisheries Association and 1 individual supported the continued use of quota transfers as they are standard operating procedures and maintain flexibility in the fishery. The NC Fisheries Association noted that overages should be forgiven but not rewarded and states should be held accountable for meeting their quota.

Issue 5: Quota Rollovers
SUMMARY: 1 group supported quota rollovers and 1 individual did not.

- The NC Fisheries Association supported quota rollovers as they can absorb overages before reaching out to others states.
- One individual did not support the use of quota rollovers. He stated that if a jurisdiction does not make its annual quota that does mean the state gets a credit.

Issue 6: Incidental Catch and Small-Scale Fisheries
SUMMARY: 1 group supported Option A, D, or F; 1 group and 1 individual supported Option C; two individuals supported Option F.

- The NC Fisheries Association supported Option A: Incidental Bycatch Limit Per Vessel, Option D: Incidental Catch Cap and Trigger, and Option F: Small-Scale Fishery Set Aside or a combination of the above. Overall, they felt it is the responsibility of the state to manage and resolve issues with the bycatch provision.
- The Coastal Conservation Association and one individual supported Option C: Including Incidental Catch in the Quota. They stated that the current bycatch allowance is a loophole as those landings do not count towards the TAC.
- Two individuals supported Option F. They felt the bycatch allowance needs to be replaced with some other strategy as current bycatch landings do not count against the quota and the allowance has supported the creation of a small-scale fishery, especially with cast nets. A small-scale fishery set aside would relieve administrative burden on the Commission and states to follow landings by non-directed gears.

Issue 7: Episodic Events Set Aside
SUMMARY: 2 individuals supported 3% of TAC allocated to Episodic Events; 1 group supported 1% maximum.

- The NC Fisheries Association stated that if a state has a quota under 1% of the coastwide TAC, 1% should be the maximum. This could be addressed with the Minimum Fixed Quota option in Issue 2.
- Two individuals supported continuation of the episodic events set aside program and that the amount of TAC set aside to the program be increased to 3%. They also felt that the states of NY through ME be allowed to participate in the program.

Issue 8: Chesapeake Bay Reduction Fishery Cap

SUMMARY: 2 groups supported the continuation of the Cap; 2 individuals supported removal of Cap.

- The NC Fisheries Association and the Coastal Conservation Association supported the continuation of the Chesapeake Bay Reduction Fishery Cap until ERPs are established. The Cap should not be removed as it keeps pressure on the reduction fishery in this area. The CCA recommends the Cap be cut in half to 96 million pounds.
- Two individual stated that the Chesapeake Bay Cap should be removed as the majority of catch is from the mouth of the Bay and off the Virginia cape.

Issue 9: Research Programs and Priorities

SUMAMRY: 1 group recommended research on recruitment and food web models

- The NC Fisheries Association recommended that research focus on what factors impact recruitment and on food web models.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
November 30, 2016
North Carolina

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Name	Company/Organization	City, State
David Bush	NCFA	New Bern, NC
Steve Weeks	NCFA / CCFA	Beaufort NC
CHUCK Laughridge	Individual	Harkers Island, NC
Scott Williams	Individual	Waxhaw, NC
Zack Greenberg	Pew	Washington, DC
[illegible]	Coastal Fish	Newport NC
Corrin Flora	NCDMF	Elizabeth City, NC
Joseph W. Smith	citizen	Morehead City, NC
Attila Nemecz	PAWC / NC WF	Washington, NC
Barbara Garrity-Blake	PUMC	Glaceden, NC 28524
Lucia Dunmire	Pew	Morehead City
Jack Cox	Blue Ocean MKT	MHC
BRADLEY STYRON	G.C. Fish	Cedar Island, NC
Caitlin Starkes	Duke University	Atlantic Beach, NC
Kelsey Dick	Duke University	Beaufort, NC
Justin Pearce	Duke University	Beaufort, NC
Tom Roller	Individual, CCA-NC	Beaufort, NC 28516
PAUL MYERS	Individual	Morehead City, NC

Atlantic Menhaden Amendment 3 PID Public Hearing

Melbourne, Florida
December 1, 2016
25 Participants

Attendees: Tim Adams (Organized Fishermen Fl.) Charlie Sembler, George Geiger, Mitch Roffer (Roffs), Aaron Adams (Bonefish Tampa Trust), Dominic Agostini (BFFA Brevard), Martin McKasty, Lisa McKasty, Duane Defreese, Cameron Jaggard (Pew), Mike Readling (Snook Gamefish Foundation), Michael Splitt (Florida Tech), Steven Lazarus (Florida Tech), R.T. 'Bo' Platt (Brevard IRL Coalition), Matt Badolato (Florida Today), Lora Lose (Space Coast Audubon), Matt Heyden (Space Coast Audubon), Rodney Smith (Angler for Conservation), Vince lamb, Lyle Zody, Terry Gibson (Northswell Media) Grayson Kyte, Dennis Long

Staff: Jim Estes (FWC), Krista Shipley (FWC), Megan Ware (ASMFC)

Issue 1: Reference Points
SUMMARY: All participants supported Option D.

- All participants supported Option D: Existing Guidelines for Forage Fish Species until ERPS are Developed by the BERP. Many participants stated that we should leave as many menhaden in the water as possible without ruining the livelihoods of the small-scale fishermen. They noted that Florida is the recreational fishing capital of the world and is home to many important bird species. As a result, menhaden are essential to the Florida ecosystem and economies. Several individuals recommended that menhaden be left in the water to do the job they are supposed to do. Participants noted that menhaden stocks have not recovered to their historic levels and ERPs could provide a way to get more fish back in Florida waters. Some felt that the single-species reference points are outdated and the Board now has the data and technology needed to support ERPs. One individual commented that there will need to be a transition period to ERPs and the Board should not wait until 2019 to start this transition. Another participant felt that implementing ERPs would help achieve the management goals of many other species which rely on menhaden for prey.
    - One individual specifically supported implementation of the 75% rule-of-thumb as a way to ensure a healthy ecosystem.

Issue 2: Quota Allocation
SUMMARY: 1 participant supported Options B, F, or G. Others recommended alternative allocation methods.

- One participant supported Option B: State-Specific Quota with a Fixed Minimum, Option F: Disposition Quotas, and Option G: Fleet-Capacity Quotas. He did not think it was fair that one jurisdiction got 85% of the quota and felt that these other options provide a better balance in the fishery.

- Several individuals did not like any of the options provided and recommend other allocation strategies.
    A. One participant recommended there be a regional quota system based off of stock definition. He felt there is a disconnect between reference points and quota allocation and that the biology of menhaden needs to be included in the allocation method. As a result, regional quotas should be based on stock units and stock assessments should further refine stock boundaries. He noted that Florida is unique in that there are multiple species of menhaden, not all of which migrate along the coast. To account for these regional differences, a greater level of speciation is needed in the quota method.
    B. Another participant recommended a step-down quota system similar to what is in place for Spanish mackerel. As the fishery gets closer to the TAC, catch limits should progressively be put in place. These catch limits would become more restrictive as the fishery gets closer and closer to the TAC. This method would ensure a longer season for the small-capacity gears as, at some point, the larger gears would have to exit the fishery due to the catch limits. He also noted that the small-capacity gears are a more sustainable fishing practice and should be allowed to continue fishing.
- Several fishermen noted that due to the net ban, fishermen in Florida are limited to using cast nets to catch menhaden. As a result, their impact on the stock is minimal as they are catching menhaden for high quality bait and not fish oil or meal.
- One individual stated that climate change has to be included into the management of menhaden.

Issue 3: Allocation Timeframe

SUMMARY: Participants favored changes to the current allocation timeframe and generally supported a longer time series.

- One individual recommended the Board use the longest time series possible to consider all aspects of the fishery. The 2009-2011 average provides very little insight into what has happened to the stock.
- Another participant noted that the 1994 net ban in Florida creates a unique situation as, in essence, the state has already had a 90% cut in landings. As of 2009, the Florida bait fishery wasn't fully up and running so the current time period does not reflect where the fishery is today. Florida also has issues with non-reporting in the fishery prior to the TAC.
- One individual recommended the Board look at the causes of fluctuations in landings by the various states. Unique circumstances like the Florida net ban need to be recognized but climate change should also be considered in stock assessments.

Issue 4: Quota Transfers and Overage Reconciliation

SUMMARY: Participants did not support quota transfers or overage reconciliation.

- Participants did not favor quota transfers in the menhaden fishery. One participant was concerned that some states intentionally exceed their quota knowing that they will get transfers from other states. Another participant noted that better quota allocation, such

as a step-down limits as the quota is reached, may negate the need for transfers as there would be fewer overages. Another participant stated that due to the migratory nature of menhaden, transfers do not make sense as the fish move throughout the year. All participants felt that quota overages should not be forgiven and did not support quota reconciliation.

- One individual suggested that the Board look at the fisheries in the North Sea to see how they deal with quota transfers and overages between different countries.

Issue 5: Quota Rollovers

SUMMARY: Majority supported quota rollovers; 1 individual did not support quota rollovers.

- The majority of participants favored the implementation of quota rollovers. They felt that if a state is allocated a specific quota they should be allowed to use it, even if it is not harvested in a single year. They also noted that overage paybacks should continue to roll over so that states are held responsible for their overages. One individual recommended that the Board keep the provision that rollovers can only occur if the stock is not overfished and overfishing is not occurring.
- One individual did not support quota rollovers. He stated that management is based on a yearly quota and so rollovers should not be allowed. He felt that banking quota is not right for the current management plan and that a conservation benefit would be lost if unused quota is harvested in a subsequent year.

Issue 6: Incidental Catch and Small-Scale Fisheries

SUMMARY: Participants favored a combination of Option C and F.

- Participants favored a combination of Option C: Incidental Catch Included in Quota, and Option F: Small-Scale Fishery Set Aside. They noted that the cast net fishery is really a directed fishery and it should be considered as such. As a result, their landings should count towards the quota in a small-scale fishery set aside. Several fishermen commented that their cast nets are some of the most sustainable gear types used in the menhaden fishery and these small-scale gears should not have to fight against large purse seiners for a spot in the menhaden fishery.

Issue 7: Episodic Events Set Aside Program

SUMMARY: Majority of participants recommended gear restrictions on episodic harvest; 1 individual recommended the 1% be set aside for non-harvest.

- The majority of participants recommended that participation in the episodic events program be reserved for small-scale gears and in-state residents. Participants were concerned that purse seiners can catch the episodic events quota so quickly that it minimizes the value to other gear types and states. The large-scale harvest by purse seines also negatively impacts local recreational fisheries as fish such as striped bass suddenly have no prey and they leave the area.
- One individual recommended that the 1% set aside for the episodic events program be reserved as a non-harvest set aside. He was concerned with the validity of the current

reference points and felt that setting aside 1% of the TAC for conservation would provide a natural buffer in the population.

- Another participant was concerned how the Board might define episodic events in a changing climate; an 'episodic event' now might just be a blimp in the population when looking at a longer time series. He noted that episodic events are really re-building of the stock to its former geographic extent.

Issue 8: Chesapeake Bay Reduction Fishery Cap
SUMMARY: Participants recommended Cap be maintained and reduced.

- All participants agreed that the Chesapeake Bay Reduction Fishery Cap should be maintained. They expressed concern that changing environmental conditions could encourage greater harvest from the Bay and the Cap would provide a safe net for this important nursery area. Several individuals felt the Cap should be reduced if the reduction fishery is consistently underperforming its limit in the area. One participant recommended the Cap be expanded to other areas along the Virginia coast.

Issue 9: Research Programs and Priorities
SUMMARY: Participants had several recommendations relating to ERPs, speciation, and regional stocks.

- Several participants recommended prioritizing ERPs for menhaden, specifically looking at prey biomass and impacts on other predators.
- One participant recommended the impact of fish kills be studied and incorporated into stock assessment models.
- One individual wanted to see environmental covariates incorporated into stock assessments.
- Several participants requested greater detail in the definition of regional stocks and in the speciation of menhaden, particularly in Florida.
- Another individual recommended that harvest by small-scale fisheries be better understood to determine what amount of menhaden would be harvested under no state quota. Right now, states such as Florida are limited in their catch due to the small jurisdictional allocation and there should be studies on how catch would change for these small gears without a limit. This could be tied in with a small-scale fishery set aside or in a step-down TAC approach.

Atlantic Menhaden Draft PID for Public Comment

Atlantic States Marine Fisheries Commission
December 1, 2016
Florida

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
TIM ADAMS	ORGANIZED FISHERMEN FL.	SEBASTIAN FL
CHARLIE JEMOLER	JEMOLER'S	SEBASTIAN FLA.
GEORGE CORIGER	SELF	SEBASTIAN FL
MITCH ROFFER	ROFFS	MELBOURNE FL
Aaron Adams	Bonefish Tarpon Trust	Melbourne Beach, FL
Dominic Agostini	JFFA Treasurer	Satellite Beach, FL
MARTIN MCKASTY	BAIT MAN	VALKARIA, FL
LISA MCKASTY	BAIT MAN	VALKARIA, FL
DUANE DEFREESE	INDIAN RIVER LAGOON NEP	ddefreese@irlcouncil.org
Cameron Taggard	The Pew Charitable Trusts	North Palm Beach, FL
MIKE Readling	SNOOK Gamefish Product	M JENSEN BEACH, FL
MICHAEL SPLITT	FLORIDA TECH	MELBOURNE, FL
STEVEN LAZARUS	FLORIDA TECH	MELBOURNE, FL
R.T. "BO" PLATT	Brevard IRL Coalition	Melbourne, FL
MATT BADOLATO	FLORIDA TODAY	INDIALANTIC, FL
Lora Losi	space Coast Audubon	Titusville FL
Matt Heyden	"	"
Rodney Smith	Anglers For Conservation	Satellite Beach
VINCE LAMB	Self	Merritt Island
LYLE ZOOK		MLB VLGE
Terry Gibson	Vero Sw. Anglers	Jensen Beach, FL 34957
Grayson Kuykendall		
Dennis Lodge		Port St. Lucie FL.

Submitted Atlantic Menhaden Public Comment can be accessed at https://asmfc.egnyte.com/dl/5u5zP0h8ZS

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

January 17, 2017

To: **Atlantic Menhaden Management Board**
From: **Tina Berger, Director of Communications**

RE: **Advisory Panel Nomination**

Please find attached one nomination to the Atlantic Menhaden Advisory Panel – Chris Hole, a commercial trap/net fisherman from Maine. Please review this nomination for action at the next Board meeting.

If you have any questions, please feel free to contact me at (703) 842-0749 or tberger@asmfc.org.

Enc.

cc: Megan Ware

ATLANTIC MENHADEN ADVISORY PANEL

Bolded names await approval by the Atlantic Menhaden Management Board

January 17, 2017

Maine
Jennifer S. Bichrest (processor/dealer)
21 Sandy Acres Drive
Topsham, ME 04086
Phone (day): 207.389.9155
Phone (cell): (207) 841.1454
jenniebplb@yahoo.com
Appt. Confirmed 10/21/08
Appt Reconfirmed 12/13/16

Chris Hole (comm trap/net; inshore/offshore)
PO Box 330
Harpswell, ME 04079
Phone (day): 207.251.0339
Phone (eve): 207.833.5751
Chrishole48@gmail.com

New Hampshire
Donald L. Swanson (rec)
84 Franklin Street
Derry, NH 03038-1914
Phone: 603.434.4593
salty4fly2@comcast.net
Appt Confirmed 8/3/10

Massachusetts
Patrick Paquette (rec/for-hire/comm)
61 Maple Street
Hyannis, MA 02601
Phone: 781.771.8374
basicpatrick@aol.com
Appt Confirmed 10/26/16

Vacancy (comm bait)

Rhode Island

Meghan Lapp (comm.)
100 Davisville Pier
North Kingstown, RI 02852
Phone: 401.218.8658
FAX: 401.295.5825
Meghan@seafreezeltd.com
Appt Confirmed 10/26/16

David P. Monti (rec/for-hire)
399 Greenwood Avenue
Warwick, RI 02886
Phone (day): 401.480.3444
Phone (eve): 401.737.4515
dmontifish@verizon.net
Appt Confirmed 10/26/16

Connecticut
Vacancy (rec)

New York
Melissa Dearborn (processor)
Regal Marine Products, Inc.
198 West 9th Street
Huntington Station, NY 11746
Phone (day): 631.385.8284
Phone (eve): 631.385.7753
FAX: 631.271.5294
regalmar@optonline.net
Appt. Confirmed 7/17/01
Appt. Reconfirmed 1/23/06
Appt Reconfirmed 5/10

New Jersey
Jeff Kaelin (comm. trawl and purse seine)
Lund's Fisheries, Inc.
PO Box 830
997 Ocean Drive
Cape May, NJ 08204-0830
Phone: 207.266.0440
jkaelin@lundsfish.com
Appt. Confirmed 9/19/09

Vacancy (rec)

Delaware
William R. Wilson (rec)
18483 Cedar Drive
Lewes, DE 19958
Phone (day): 302.644.3454
Phone (eve): 302.344.5853
FAX:(302.644.3454
birdcarver@aol.com
Appt Confirmed 12/17/03
Appt. reconfirmed 12/07

ATLANTIC MENHADEN ADVISORY PANEL

Bolded names await approval by the Atlantic Menhaden Management Board

January 17, 2017

Maryland
David Sikorski (rec)
4637 Willowgrove Drive
Ellicot City, MD 21042
Phone: 443.621.9186
davidsikorski@mac.com
Appt Confirmed 2/3/15

John W. Dean (comm/pound net)
49925 Hays Beach Road
Scotland, MD 20687
Phone: 301.904.8078
Selbysuzi1121@aol.com
Appt Confirmed 2/3/15

Virginia
Jimmy Kellum (commercial purse seine)
144 Kellum Drive
Weems, VA 22576
Phone (day): 804.761.0673
Phone (eve): 804.438.5618
FAX: 804.438.5306
Kellum.maritime@gmail.com
Appt Confirmed 11/3/09

Peter Himchak (commercial purse seine)
Omega Protein
PO BOX 85
Tuckerton, NJ 08087
peter.himchak@omegaprotein.com
Appt Confirmed 10/26/16

Jeff Deem (rec)
6701 Newington Road
Lorton, VA 22079
Phone: 703.550.9245
deemjeff@erols.com
Appt Confirmed 10/26/16

North Carolina
2 Vacancies – conservation & commercial

South Carolina
Vacancy (rec)

Georgia
Ken Hinman (conservation)
Wild Oceans
PO Box 258
Waterford, VA 20197
Phone: 703.777.0037
Fax: 703.777.1107
khinman@wildoceans.org
Appt. Confirmed 2/19/02
Appt. Confirmed 2/06
Appt Reconfirmed 5/10

Florida
Charles W. Hamaker (rec)
5648 Floral Avenue
Jacksonville, FL 32211
Phone (day): 904.630.3025
Phone (eve): 904.725.3775
FAX: 904.630.3007
charlesh@cou.net
Appt. Confirmed 7/17/01
Appt. Reconfirmed 1/2/06
Appt Reconfirmed 4/22/10

PRFC
Richard H. Daiger (comm/rec gillnet)
173 Oyster House Road
Montross, VA 22520
Phone: 804.472.2184
Appt. Confirmed 7/17/01
Appt. Reconfirmed 1/2/06
Appt Reconfirmed 5/10

ATLANTIC STATES MARINE FISHERIES COMMISSION

Advisory Panel Nomination Form

This form is designed to help nominate Advisors to the Commission's Species Advisory Panels. The information on the returned form will be provided to the Commission's relevant species management board or section. Please answer the questions in the categories (All Nominees, Commercial Fisherman, Charter/Headboat Captain, Recreational Fisherman, Dealer/Processor, or Other Interested Parties) that pertain to the nominee's experience. If the nominee fits into more than one category, answer the questions for all categories that fit the situation. **Also, please fill in the sections which pertain to All Nominees (pages 1 and 2). In addition, nominee signatures are required to verify the provided information (page 4), and Commissioner signatures are requested to verify Commissioner consensus (page 4). Please print and use a black pen.**

Form submitted by: CHRIS Hole State: Maine

(your name)

Name of Nominee: CHRIS Hole

Address: PO 330 Harpswell ME

City, State, Zip: Harpswell ME 04079

Please provide the appropriate numbers where the nominee can be reached:

Phone (day): 207/751/0339 Phone (evening): 207-833-5751

FAX: _____ Email: ChrisHole48@Gmail.com

FOR ALL NOMINEES:

1. Please list, in order of preference, the Advisory Panel for which you are nominating the above person.

   1. _____
   2. _____
   3. _____

4. _____

2. Has the nominee been found in violation of criminal or civil federal fishery law or regulation or convicted of any felony or crime over the last three years?

yes_____ no_____✓_____

3. Is the nominee a member of any fishermen's organizations or clubs?

yes _____no_____✓_____

If "yes," please list them below by name.

_____ _____ _____

_____

_____ _____

_____ _____

4. What kinds (species) of fish and/or shellfish has the nominee fished for during the past year?

lobster _____ Elvers _____ _____

_____

Menhaden _____ _____

_____ _____

5. What kinds (species) of fish and/or shellfish has the nominee fished for in the past?

Menhiden
lobster _____ Eels (elvers) _____

Shrimp _____ Scallop _____

Ground Fish _____ Tuna _____

FOR COMMERCIAL FISHERMEN:

1. How many years has the nominee been the commercial fishing business? 30 years

2. Is the nominee employed only in commercial fishing? yes ✓ no _____

3. What is the predominant gear type used by the nominee? Traps Net

4. What is the predominant geographic area fished by the nominee (i.e., inshore, offshore)?
Inshore offshore

FOR CHARTER/HEADBOAT CAPTAINS:

1. How long has the nominee been employed in the charter/headboat business? _____years

2. Is the nominee employed only in the charter/headboat industry? yes _____ no_____

If "no," please list other type(s)of business(es) and/occupation(s):_____

_____

3. How many years has the nominee lived in the home port community? 35 years

If less than five years, please indicate the nominee's previous home port community.

_____

FOR RECREATIONAL FISHERMEN:

1. How long has the nominee engaged in recreational fishing? _____ years

2. Is the nominee working, or has the nominee ever worked in any area related to the fishing industry? yes _____ no _____

If "yes," please explain.

FOR SEAFOOD PROCESSORS & DEALERS:

1. How long has the nominee been employed in the business of seafood processing/dealing?
_____years

2. Is the nominee employed only in the business of seafood processing/dealing?

yes _____ no _____ If "no," please list other type(s) of business(es) and/or occupation(s):

_____

_____

_____

_____

3. How many years has the nominee lived in the home port community? _____years

If less than five years, please indicate the nominee's previous home port community.

_____

FOR OTHER INTERESTED PARTIES:

1. How long has the nominee been interested in fishing and/or fisheries management? _____years

2. Is the nominee employed in the fishing business or the field of fisheries management?

yes _____ no _____

If "no," please list other type(s) of business(es) and/or occupation(s):

_____

_____

_____

_____

FOR ALL NOMINEES:

In the space provided below, please provide the Commission with any additional information which you feel would assist us in making choosing new Advisors. You may use as many pages as needed.

I am a life long Fisherman, I am most interested in helping with the Menhaden. There are very few of us that have done it for a career

Nominee Signature: Christopher S Hole Date: 12/6/16

Name: Christopher S Hole
(please print)

COMMISSIONERS SIGN-OFF (not required for non-traditional stakeholders)

Tim Stadwell for Pat Helibe
State Director

State Legislator

Governor's Appointee

after consultation with Maine Commissioners

Atlantic States Marine Fisheries Commission

Summer Flounder, Scup, and Black Sea Bass Management Board

February 2, 2017
8:00 – 9:45 a.m.
Alexandria, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(M. Luisi)* — 8:00 a.m.

2. Board Consent — 8:00 a.m.
   - Approval of Agenda
   - Approval of Proceedings from October 2016

3. Public Comment — 8:05 a.m.

4. Summer Flounder Draft Addendum XXVIII for Final Approval **Final Action** (*K. Rootes-Murdy*) — 8:15 a.m.
   - Review Options
   - Public Comment Summary
   - Technical Committee Report
   - Advisory Panel Report
   - Consider Final Approval of Addendum XXVIII

5. Update on 2015 Black Sea Bass Commercial Landings and 2017 Harvest Specifications (*K. Rootes-Murdy*) — 8:55 a.m.

6. Consider Scup Draft Addendum XXIX for Public Comment **Action** (*K. Rootes-Murdy*) — 9:30 a.m.

7. Set 2017 Scup Recreational Fishery Specifications **Final Action** (*K. Rootes-Murdy*) — 9:40 a.m.

8. Other Business/Adjourn — 9:45 a.m.

The meeting will be held at The Westin Alexandria, 400 Courthouse Square, Alexandria, Virginia; 703.253.8600

MEETING OVERVIEW

Summer Flounder, Scup, and Black Sea Bass Management Board Meeting
February 2, 2017
8:00-9:45 a.m.
Alexandria, Virginia

Chair: Mike Luisi (MD) Assumed Chairmanship: 10/15	Technical Committee Chair: Greg Wojcik (CT)	Law Enforcement Committee Representative: Snellbaker (NJ)
Vice Chair: Bob Ballou	Advisory Panel Chair: Vacant	Previous Board Meeting: October 25, 2016
Voting Members: ME, NH, MA, RI, CT, NY, NJ, DE, MD, PRFC, VA, NC, NMFS, USFWS (14 votes for Black Sea Bass; 12 votes for Summer Flounder and Scup)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2016

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Summer Flounder Draft Addendum XXVIII for Final Approval (8:15-8:55 a.m.) Final Action

Background

- The Board initiated Draft Addendum XXVIII at the 2016 ASMFC Annual Meeting. At the December 2016 joint ASMFC/MAFMC meeting the Draft Addendum was approved by the Board for public comment. (**Briefing Materials**)
- The draft addendum proposes management options for the summer flounder recreational fisheries for 2017 and beyond. Options include state-by-state allocations or regional management.

Presentations

- Overview of the Draft Addendum and public comment summary by K. Rootes-Murdy (**Supplemental Materials**)

Board Actions for Consideration

- Select management options.
- Approve final document.

5. Update on 2015 Black Sea Bass Commercial Landings and 2017 Harvest Specifications (8:55-9:30 p.m.)

Background

- At the 2016 Annual Meeting, the Board received preliminary state-by-state commercial quotas for 2017. 2015 landings information has been finalized and state quotas have been adjusted. (**Supplemental Materials**)
- The Board will meet with the MAFMC jointly later in February to review and respond to the 2016 benchmark stock assessment. At that joint meeting, the Board and MAFMC will consider possible changes to the coastwide harvest limit for 2017 and the 2017 recreational management measures in federal waters.

Presentations

- Overview of 2015 landings data and state-by-state commercial quotas by K. Rootes-Murdy

Board Actions for Consideration

- None

6. Consider Scup Draft Addendum XXIX for Public Comment (9:30-9:40 a.m.) Action

Background

- At the December 2016 joint ASMFC/MAFMC meeting the Board initiated a draft addendum regarding the start and end dates for the summer period of the commercial trimesters for scup. The draft addendum proposes changes to the length of each trimester to better allocate unused quota. (**Supplemental Materials**)

Presentations

- Overview of Draft Addendum XXIX by K. Rootes-Murdy

Board Actions for Consideration

- Approve Draft Addendum XXIX for public comment

7. Set 2017 Scup Recreational Fishery Specifications Final Action (9:40-9:45 a.m.)

Background

- At the December 2016 joint ASMFC/MAFMC meeting the Board approved to continue the use of regional management approaches to set state scup recreational measures for 2016. At the time, preliminary recreational harvest data for 2016 indicated that a reduction may be needed to keep harvest in 2017 under the coastwide harvest limit.
- With the release of preliminary wave 5 data in December 2016, a change in management measures is no longer needed for 2017. (**Supplemental Materials**)

Presentations

- Projected 2016 harvest and management measures performance (K. Rootes-Murdy)

Board Action for Consideration

- Approve 2017 Scup Recreational Management Measures

8. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

SUMMER FLOUNDER, SCUP AND BLACK SEA BASS MANAGEMENT BOARD

The Harborside Hotel
Bar Harbor, Maine
October 25, 2016

These minutes are draft and subject to approval by the Summer Flounder, Scup and Black Sea Bass Management Board.
The Board will review the minutes during its next meeting.

Table of Contents

INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Approval of proceedings of February 2016** by consent (Page 1).

3. **Move to initiate an addendum to consider adaptive management, including regional approaches, for the 2017 summer flounder recreational fishery** (Page 14). Motion by John Clark; second by David Simpson. Motion passes (Page 18).

4. **Motion to adjourn** by consent (Page 21).

ATTENDANCE

Board Members

Terry Stockwell, ME, proxy for P. Keliher (AA)
Sen. Brian Langley, ME (LA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Bill Adler, MA (GA)
Nichola Meserve, MA, proxy for D. Pierce (AA)
Bob Ballou, RI, proxy for J. Coit (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
David Simpson, CT (AA)
Lance Stewart, CT (GA)
Rep. Melissa Ziobron, CT, proxy for Rep. Miner (LA)
Steve Heins, NY, proxy for J. Gilmore (AA)
Emerson Hasbrouck, NY (GA)
Sen. Phil Boyle, NY (LA)
Tom Baum, NJ, proxy for D. Chanda (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Roy Miller, DE (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
David Blazer, MD (AA)
Mike Luisi, MD (Chair)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Rachel Dean, MD (GA)
Rob O'Reilly, VA, proxy for J. Bull (AA)
Kyle Schick, VA, proxy for Sen. Stuart (LA)
Cathy Davenport, VA (GA)
Braxton Davis, NC (AA)
Doug Brady, NC (GA)
David Bush, NC, proxy for Rep. Steinburg (LA)
Martin Gary, PRFC
Mike Millard, USFWS
Peter Burns, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Jason Snellbaker, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Kirby Rootes-Murdy
Mark Robson

Guests

Wilson Langley, USFWS
Kelly Denit, NOAA
Charles Lynch, NOAA
Harold Mears, NMFS
Chris Wright, NMFS
Alan Risenhoover, NMFS
Phil Langley, PRFC
Jason McNamee, RI DEM
Scott Olszewski, RI DEM
Nicole Lengyel, RI DEM
Chris Batsavage, NC DNR
Doug Christel, MA F&G
Brad Chase, MA DNR
Mike Luisi, MD DNR
Heather Corbett, NJ DFW
Kevin Sullivan, NH F&G
Matthew Gates, CT DEEP
Phil Maier, SC DNR
Jonathan Atwood, Ofc of Asm. Andrzejczak
Laura Millard
Arnold Leo, E. Hampton, NY
Pat Augustine, Coram, NY
Kevin Slattery, Onset, MA
Rob Winkel, Seaside Park, NJ
Brett Hoffmeister, Assoc. of Cape Cod
Jerry Morgan, ACCSP

The Summer Flounder, Scup and Black Sea Bass Management Board of the Atlantic States Marine Fisheries Commission convened in the Stotesbury Grand Ballroom of the Bar Harbor Club, Harborside Hotel, Bar Harbor, Maine, October 25, 2016 and was called to order at 4:12 o'clock p.m. by Chairman Michael Luisi.

CALL TO ORDER

CHAIRMAN MICHAEL LUISI: Good afternoon, everyone. Welcome to the Summer Flounder, Scup and Black Sea Bass Management Board meeting. My name is Mike Luisi; and I am Maryland's administrative representative on the commission. I'll be serving as your Chair today.

APPROVAL OF AGENDA

CHAIRMAN LUISI: I would like to call the meeting to order and begin by approving the agenda. Now, I have had a request from staff that we would remove Item Number 7 from today's agenda, in order to give us more time for the discussion of other issues. Item 7 is the FMP Review and state compliance reports.

I have been told that there are no issues regarding compliance; therefore, unless anyone opposes that modification to the agenda, I would suggest approving state compliance and FMP reviews via e-mail. Is anyone opposed to that change in modification to the agenda? Seeing none; consider the agenda modified as just mentioned.

APPROVAL OF PROCEEDINGS

CHAIRMAN LUISI: Regarding proceedings, are there any changes to the proceedings from the February, 2016 meeting? Okay, seeing none; go ahead and the proceedings will stand approved.

PUBLIC COMMENT

CHAIRMAN LUISI: Is there anyone in the audience, any public comment on any issues that are not on the agenda today? Okay, seeing no one, we'll go ahead and move on.

Now when you looked at your agenda for this meeting, and saw that the Summer Flounder, Scup and Black Sea Bass Board was meeting for an hour; it probably sounded like, oh wow, that's going to be a nice easy little thing to get through. I'll be the first to say that the issues that we're currently facing are not reflective of the time that we have here to debate and discuss the issues.

We're facing some really serious challenges ahead. Before I turn over to Kirby to begin with the presentations, I would like to just let everybody know here that, unlike the other management boards that we all work on, this management board works jointly with the Mid-Atlantic Fisheries Management Council.

We have in our sites, a meeting not only today, but this board is planning to meet in December with the Mid-Atlantic Council. There will also be a February meeting of the board during the ASMFC winter meeting, and we're planning another meeting of this board with the Mid-Atlantic Council in Kitty Hawk, North Carolina in February. Between now and the Kitty Hawk meeting in February, there are a lot of things that we're going to have to discuss and talk about and make decisions on. But just know that there will be time to have those conversations. Today is more about getting the information out there, understanding what it is that we're all facing; as far as challenges and changes that we might need to consider.

But know that we will have that time to really dig down into it and debate on where we're going to go on summer flounder, scup and black sea bass into the future. With that said, Kirby, if you're ready, we can go ahead and move to Kirby's presentation. Now Kirby has combined Number 4 and Number 5, as far as a presentation to put all that information out there.

I do plan to stop in between Items Number 4 and 5 on the agenda for questions only. I would rather hold off on any type of management conversation or questions regarding future management, until after Kirby finishes the second part of the presentation. With that, Kirby, let's go to Tom real quickly, and then we'll come back to you.

MR. THOMAS P. FOTE: Yes Mike, did I hear you talk about a February meeting at Kitty Hawk? That's a little tough that time of year to get down to Kitty Hawk. It is not convenient for anybody and it's snow time. It wasn't on the agenda, so I know I can't be there. There might be others that already have made plans for that time of year.

CHAIRMAN LUISI: Yes, because of the black sea bass assessment, and the timing of when that assessment is going to be available for discussion, we had been discussing that with ASMFC about having a meeting in Kitty Hawk. I realize it's planes, trains and automobiles to try to get down there sometimes.

That will be the opportunity that we'll have to review the assessment update and potentially change the specifications for 2017. If that assessment indicates that there could be an increase in the overall ABC, that would be the opportunity to do that. Toni, did you have anything to add? No, okay. Okay, with that, Kirby, if you could begin your presentation.

REVIEW MRIP WAVE 4 HARVEST ESTIMATES FOR SUMMER FLOUNDER, SCUP AND BLACK SEA BASS

MR. KIRBY ROOTES-MURDY: As Mike has laid out; I'm going to go through first the data that we got last Tuesday. I'm going to outline how harvest has gone this year through Wave 4; that is, again, July and August. I'm going to point out how those trends have changed relative to last year, 2015, as well as 2014.

Then how we've evaluated that harvest relative to this year's recreational harvest limit, and outline the 2017 recreational harvest limit and some of the management implications. Then I'll take any questions, briefly again, just on the data at this point. Then we'll move into talking about specifically management options and approaches for 2017.

Getting into it, starting off with summer flounder, again on Tuesday of last week preliminary recreational harvest estimates were released for summer flounder. In terms of coastwide harvest in weight, we're looking at in 2016, 5.6 million pounds have been harvested this far in the year. That puts us over our recreational harvest limit for 2016 by about 5 percent.

I've included in this comparison, not just 2015, but as I said, 2014 as well; because 2015 was somewhat of an anomalous year, in terms of harvest levels not just through Wave 4, but in the total for the year. When you look at this, you can see the percent change relative to last year was up about 32 percent, relative to where we were at this point a year ago. When we look at it relative to 2014, we're actually down by about 15 percent. Now, it gets a little confusing when you're thinking about percent changes from one year to the next; but again, '14 is in there to offer a comparison, because last year was a little weird.

Moving down to state harvest levels, what you can see here is that a number of states have gone up; relative to where they were last year, Connecticut, New York, New Jersey, Delaware, Massachusetts have all increased their harvest relative to a year ago this time. Again, 2015 was a little anomalous, but persistent. We've seen that Connecticut and New York have also increased their harvest relative to 2014, the year we think was more similar to where we are right now.

When you switch over to numbers of fish, we see this is slightly accurate, but I give the first comparison in weight; because that is what the harvest levels are held to, in terms of our joint management with the Council. When you do the conversion, you use an average fish size; that is the weight by the number of fish that have been harvested through the previous year's wave, and applying it to the next year to get that RHL.

You get slightly different percentages of the RHL that have been reached when you compare it to what it is in weight. When we're looking at 2016, it is only slightly less at 99 percent of the RHL. Even if you're going off numbers of fish, we will likely be exceeding the RHL in 2016. I offer this also by state, in terms of numbers of fish harvest.

A similar trend, you'll see that Connecticut, New York, New Jersey and Delaware have all increased their harvest relative to a year ago. Getting down to the specifics of what this means, when looking at the 2017 recreational harvest limit, the board and council voted in August to reduce that by about 30 percent to 3.77 million pounds; that is approximately 1.23 million fish, again, going off these preliminary estimates of the average fish weight and doing that conversion.

When we're talking about a coastwide reduction for 2017, we had a 30 percent reduction that the board and council agreed to take. Based on harvest estimates through Wave 6, we're looking at a 41 percent reduction; and that is factoring in projected harvest in Wave's 5 and 6. It is important to note that we're projecting out harvest in those next two waves throughout this year, in part, because we know that Rhode Island and Delaware through North Carolina, their seasons remain open through the remainder of the year.

Next, moving on to black sea bass, I offer a comparison between last year, 2015, and this year similar trends; in terms of harvest levels. No reason to go back to 2014 at this point. When looking at this on a regional level, and then zooming out to coastwide; in 2016, we have harvested so far 3.4 million pounds of a recreational harvest limit that is 2.82.

There is already an overage by approximately 23 percent. When we compare it to where we were last year, it is about a 30 percent increase. Through Wave 4 in 2015, the states had collectively harvested about 2.6 million pounds. When drilling down to look at what the harvest is in weight by state, you can see that a number of states have increased; in terms of the percentage change. Massachusetts, Rhode Island, Connecticut, Delaware and Maryland have all increased their harvest relative to last year through Wave 4. When comparing this in numbers of fish, similar trend, the percentage of the RHL that has been exceeded goes up. It's approximately 36 percent having exceeded the RHL. The regional breakdown is pretty much the same; that is Massachusetts through New Jersey increased relative to where they were last year, whereas Delaware through North Carolina decreased their harvest.

In looking at it state-by-state, Massachusetts, Rhode Island, Connecticut again and Delaware and Maryland, have all increased their harvest through Wave 4. When we compare this information to the 2017 recreational harvest limit, right now on the books we have 2.82 million pounds; the same recreational harvest limits that are in place in 2016. That is approximately 1.2 million fish, based on preliminary harvest estimates.

Coastwide reduction based on harvest for 2017 right now is around 20 percent. I would offer that this number should be looked at with a big caveat that it will likely change. As many of you may remember, this summer we were reviewing and there was a delay in getting final harvest estimates for 2015.

There is a lot of uncertainty with these estimates for sea bass through Wave 4; the reduction that is going to be needed will likely change. I have not included in this, projections for Waves 5 and 6, because of that uncertainty; and the season remains open for Maine through North Carolina, with the exception of Massachusetts.

The harvest is likely to continue to increase through the remainder of the year. Switching over to scup, just generally I am going to give you the breakdown that harvest is increased relative to last year by about 52 percent through Wave 4. We are at 65 percent of the recreational harvest limit. I'm just offering this in pounds right now.

As many of you are aware, the harvest of scup is primarily concentrated on the recreational side, between the states of Massachusetts through New York. When we look at the 2017 specifications and what harvest through 2016, so far, shows us, we're looking at a reduction in the RHL by approximately 10 percent. It's going to go down from where it's at right now of 6.09 million pounds to 5.5 million pounds.

I will just want to make clear to the board that there is the possibility that a reduction may be needed for scup coming out of this year. Through Wave 4, we've harvested, as I said, 4 million pounds. With that RHL dropping next year and a good chance that the harvest will continue to increase, there may be a needed reduction in 2017 or for the 2017 fishery; but I don't have those numbers yet. As I said, they're preliminary and we haven't quite gotten to that analysis.

I've harped on a couple of these things so far, but I just want to make sure that they're clear for the board and to keep them in mind. These are preliminary estimates; they will likely change. The analysis that has been done on them, there have been significant time restraints, as I said. The estimates came out on Tuesday of last week.

I can say that the black sea bass numbers have also changed slightly since their release on Tuesday of last week, so in less than a week the numbers have actually changed a little bit more. We have evaluated them relative to the PSEs at the state level, and we haven't evaluated harvest and catch together; we've only been looking at A plus B1 of the data. One thing to keep in mind, I highlighted this for each species, the 2016 regulations. A number of states are open through the remainder of the year for these species. As it was pointed out when we had a call regarding how to deal with management in 2017 for summer flounder, it was requested that the board be at least reminded of the changes in regulations over the last few years. For brevity purposes, I've offered kind of a short bit on how each of them has changed. For summer flounder, as many of you know, regional management measures have not changed significantly over the last three years. For black sea bass though, there have been significant changes.

In 2015, there was a 33 percent reduction to states, adjusted their measures to try to achieve that and not go over the RHL; again, we're looking at another reduction this year in addition to the one that was taken for 2016. Then for scup there have been no changes in the management measures, with the exception of Connecticut, who increased their size and possession limit back in 2015 to come in line with the other states in the northern region. At this point, I'll take any questions specific to the data update through Wave 4.

CHAIRMAN LUISI: Any questions for Kirby regarding the data, and we'll keep it to questions if we can. Rob O'Reilly.

MR. ROBERT O'REILLY: I'll see if I can get this right, but I think one of the surprises at the end of the 2015 data, was that the VTRs from the

for-hire were added in -- elements from that were added in -- and there was sort of an increase in the overall reduction that was part of the 2015 data. The second question is, MRIP has adjusted the estimate landings last year for small sample sizes, and so I wonder.

First question is, is it accurate that the VTR data now is loaded by wave rather than at the end. The second question is when you look at the situation we have with the small sample sizes, that may or may not pertain to black sea bass; but I was wondering if that part of program of MRIP continues in 2016?

MR. ROOTES-MURDY: Thanks for those questions, Rob. Honestly, at this hour, I can't remember how those changes have been adjusted for starting in this 2016 year. I know that I have a couple members from the Technical Committee who are in the audience; if they are brave enough to step up and answer them, they are welcome to. Otherwise, I can get back to you with a specific answer for both those questions.

MR. O'REILLY: That's fine, I appreciate it.

CHAIRMAN LUISI: Any other questions for Kirby? Dave Simpson.

MR. DAVID G. SIMPSON: Yes, I guess the first thing that occurs to me in looking at 2016 statistics is, this is the first year that the states and ASMFC have been conducting the APAIS Interviews. Has there been any thought given to how that might affect estimates, and how much it might be influencing what we're seeing here? With such a dramatic change in Connecticut, I'm looking for some rational explanation, because certainly the experience isn't that fishing has been five times or three times better this year than last.

CHAIRMAN LUISI: I'll take a shot from the state perspective in Maryland. We have absorbed the program, and we are operating this year. However, we are operating under the same protocols that had been used in the past. Unless, and I can't speak for all the other states as to how anything might have changed. I would look to the other states if their new APAIS program has been changed from the previous protocols; that could be a reason why estimates are being changed. However, I just didn't think that that was in the interest of the states to operate any differently than they had.

MR. SIMPSON: I guess one perspective is NOAA wanted the states involved for a reason, and that was to improve the survey. Certainly, we've had good response from the public, and our observations have been we've got some good people on and they're doing good work. I'm wondering how that might affect outcomes.

I know I may be one of the few people that has been interviewed in two different states, and the last time I got interviewed in Connecticut, it was a woman approaching the boat; three or four of us were in it, and her lead question was did you keep any fish today; which I don't think is how the survey is designed to be conducted.

I'm wondering about how these changes may have affected results for 2016. Certainly, we were looking for improvements; that doesn't mean changes in statistics, it means improvements in the conduct of the survey. That is going to come out in certain ways. It leaves a question in my mind to try to explain how we went from, what was it 82,000 fluke to 250,000 fluke in one year. It was not a particularly good fishing year.

MR. ROOTES-MURDY: Dave, I would just follow up. It is a great question and one that I planned for the Technical Committee to be getting into. We have a joint meeting with council staff in the early part of November. But given the time constraints we had with this getting this data on Tuesday, we had a call that was very focused on just management approaches and evaluating the data relative to that for 2017. But with

more time, we can definitely look into that more.

MR. STEPHEN HEINS: I just wanted to kind of speak to that point that Dave raised. I think that since we took over for the APAIS in New York, I think that we're doing a pretty good job, and we are finding that we're making improvements.

Just speaking to the question that Rob O'Reilly brought up, I think that we are not going to have that small sample size problem like we had for black sea bass in New York last year and bluefish; because of the improvements we've made. We've done a lot to bring those sample sizes up. I think that that issue has been addressed for us. Otherwise, I can't explain why our landings numbers are increasing while supposedly, the stock is declining.

MS. NICHOLA MESERVE: Regarding Kirby's point about an upcoming Technical Committee meeting, will the TC also be looking to do some black sea bass projections through the end of the year at that meeting and possibly also looking at why there is such a difference and how the states performed with the attempted 23 percent cut?

MR. ROOTES-MURDY: Yes, to that question. I mean, even today it was something we were trying to get nailed down, but there is so much uncertainty with how those estimates have even changed in the last week, given changes to the data. At this point, the smaller subset of the group that I've been consulting with on this, we felt that it didn't make sense to try to give you an estimate of what those projections are going to be, given we don't have a good handle on what the uncertainty is right now, with the change from Tuesday to the recent incorporation of, I think it was charterboat information in New York.

CHAIRMAN LUISI: Okay, seeing no other questions; before we turn to Kirby, he's already mentioned it once. Seeing this coming down the road, I took it upon myself to ask staff to help me pull together a group of all of you, a smaller group; to begin discussing, I guess, concepts that we might be able to apply to management for 2017, and maybe even beyond. But I think right now, given what we're looking at, 2017 is something that we need to deal with.

We haven't been in a situation yet as a board, where under the regional management approach, we had to look to make reductions; such that is being projected right now. Based on what we're hearing about the data and how they continue to change, what I would like for you to do, as Kirby goes through this next presentation, is to just think about applying the methodology that you'll see.

Rather than being solely focused on the values, because I think the values are ultimately going to change by the time we make the decisions, if we make the decisions, to maintain a regional approach. Numbers are going to change. Keep in the back of your mind the methods and the ways in which we're going to get from A to B for 2017, as Kirby goes through this presentation.

CONSIDER MANAGEMENT APPROACHES FOR 2017 SUMMER FLOUNDER AND BLACK SEA BASS RECREATIONAL FISHERIES

MR. ROOTES-MURDY: I'm going to go through the second part. This is Item 5, and I'm going to walk through what the FMP for the three species have in place for 2017. Next, I'm going to go over the Summer Flounder Working Group's call, specifically laying out the options the group discussed and reviewed; and then what the overall call summary was on it, next steps, and then take any questions you may have.

Under the summer flounder, scup, black sea bass FMP right now we have Addendum XXVII, which lays out for summer flounder that

regional management ends in 2016. Without an addendum in 2017, the mechanisms or tools available to the board for managing summer flounder are a coastwide set of management measures, or state-by-state conservation equivalency allocations.

For black sea bass, there is the ability to continue the ad hoc regional approach for an additional year. The board voted on this in February. I'm going to walk through the timetable in terms of the annual decision process you guys all go through. In looking at summer flounder, as Mike had laid out, there is the joint meeting between the council and the board in December.

At that meeting, the board and council have to make a decision on how to manage fluke in 2017. The options are either to go with coastwide management measures or conservation equivalency. That is usually the decision that the board makes at that point. If you want to continue adaptive regional management into 2017, you'll need an addendum.

If you want to continue state-by-state conservation equivalency with state allocations that were in place prior to regional management, you do not need an addendum. For black sea bass, the decision again is coastwide management measures or to continue the ad hoc regional approach. No addendum is required for that in 2017. Regarding scup, as I did highlight that there is the possibility of having an overage going into the 2017 season, there is not a required addendum to continue the state-by-state regional approach we've been using for the states of Massachusetts through New York. What I'm next going to go through is the preliminary analysis of these options. They are laid out. There are a total of eight options. In addition to two other ones that I received within the last 24 hours from Virginia, I will take a stab at explaining those to you; but I may lean on Rob O'Reilly to further explain some of the mechanisms or understanding behind it.

I've grouped them by kind of the categories. The first four operate under this state-by-state allocation; so it is either pooling those allocations together into a region, so it's simply summing those up; or just looking at them as straightforward state allocations as they've worked under conservation equivalency in the past.

There are then regional targets that are laid out in Options 5 and 6. These options, they have listed there a target and not a specific allocation. A distinction that technical members made in trying to pool these options together very quickly, is that they are not just a straight summing at the regional level of state-by-state allocations; they account for reductions based on recent management actions or trying to adjust for the needed reduction in 2017.

Then the last two options, Option 7 and 8 moves to offer a new region from what has been in place the last three years now. That would be combining Rhode Island with the states of Connecticut through New Jersey. Option 1 as I said is state-by-state conservation equivalency. On the board you can see what the state allocations would be in 2017, and also is listed as the projected harvest through the end of the year for summer flounder for these states.

In the far column, bolded is what the reduction would be needed for those states in 2017. Think back to 2013 and prior to that how states would manage their fishery, based on a needed reduction and adjust their management measures in order to achieve that needed reduction. That is Option 1.

Option 2 is state-by-state conservation equivalency with fish sharing, so this concept was included in Addendum XXV. It had been

used prior to that as well, and it tries to address the ability for states that may not be able to reach that reduction that is needed; while also taking into account the liberalizations that other states could be going for with their ability to stay under their target.

It lays out three possible ways to proportion those fish. One is based on allocation, so it is proportioning it based on allocation. The second is based on a needed proportion, and the third is reductions that decrease an additional 10 percent from what the set reduction would have been, otherwise.

If you have any questions on this when I get to the end, I can come back and try to explain it further; but these are just options of doing fish sharing with state-by-state allocation. Option 3 lays out a regional management approach that combines those state-by-state allocations at the regional level.

What you'll see here is that Connecticut through New Jersey is one region, Delaware through Virginia are another region, and then the other state regions are listed. This is where it is just straight pulling those state allocations when they're in a region together and coming up with what that region would be using as an allocation; and then making a management decision on the 2017. As you can see for the region of Connecticut through New Jersey there would be a 56 percent reduction. Rhode Island would be a 24 percent reduction where the other regions would not have to reduce. Option 4 lays out a regional management approach that combines the '98 allocations at that regional level with fish sharing. This tries to smooth out the ability of states that could liberalize but would stay at 2016 harvest levels into 2017; and using those additional fish that could then be shared to the regions that need them.

Therefore, they would be able to increase their harvest allowance to have less of a reduction than they would otherwise. Moving to Option 5, this is where we get to these targets; and this is where it is not simply just summing state allocations at the regional level. For this option here, it lays out the similar regions that were in place the last three years.

But because of the 41 percent reduction that is needed to address the harvest through Wave 4 in 2016, all regions would be taking a 41 percent reduction. The difference here is that the amount of fish varies by region that would be needed to get at that reduction; based on harvest levels in 2016.

Option 6 is similar to Option 5, but this approach tries to account for a minimum level of reduction that all regions would take; which would be 30 percent and that is to line up with what the board and council agreed to do back in August. But for then those regions that exceeded what their summed regional allocation would have been if you were taking those '98 allocations and summing them at the regional level; attributing an additional reduction to those regions.

For Connecticut through New Jersey it would be a 42 percent reduction. It is important to note for this option it would actually be a higher reduction for Rhode Island. I believe it is closer to a 50 percent reduction. Sorry, that was Option 7, 42 percent is in line for what the Option 6 is for Rhode Island, but again this is based on preliminary estimates.

Option 7 is the new regional approach where Rhode Island would be included with the states of Connecticut through New Jersey; and I'm seeing now that I actually made a mistake. Imagine moving that bar up and it would be Rhode Island through New Jersey, and that is where that 46 percent would be.

The thing to note here is that instead of a 46 percent reduction for Rhode Island, it would actually be closer to a 57 percent reduction;

and that is to account for different management measures that were in place the last three years, relative to the states directly south of it, Connecticut, New York, and New Jersey.

But under this option those regions that could liberalize would be staying at 2016 harvest levels, and then that fish sharing that has been mentioned in these other options would be applied to allow for a lower reduction than would otherwise be required for that region. Then the last option lays out similar to, I believe it is Option 5, where you have a set minimum 30 percent reduction for all states and regions.

Under this, you would have Massachusetts would be at a 30 percent reduction. Delaware through Virginia would be at a 30 percent reduction, and North Carolina would also be there. But Rhode Island through New Jersey would be taking an approximate 41 percent reduction. Those are the eight options that have been discussed by the Summer Flounder Working Group. Some key points to just keep in mind regarding the working group. They met last Thursday to discuss these options. They were pulled together very quickly, based on the timing of the data release. The members wanted to make note for the board that the 30 percent reduction in the 2017 recreational harvest limit, relative to 2016 levels, is based on the board action took in August of this year.

The other thing is that based on the preliminary harvest estimates through Wave 4, as I mentioned before, the coastwide reduction that's needed is about a 41 percent reduction. The group kind of coalesced around two of the options; those were Option 4, which was a regional allocation with fish sharing and Option 6, which was a regional allocation with a minimum reduction of 30 percent that was highlighted by the working group members for the board to focus on moving forward.

I'm just going to quickly walk through the additional call summary comments. There was concern about fish sharing being arbitrary at times. That is where that second option tries to lay out how fish sharing could be done, depending on what you prefer to be in place; whether it's proportional to their allocation based on '98 harvest levels or based on how they've exceeded their recent fishing performance.

Other members of the call recommended that there would be a guiding principal in place to make sure the measures that are crafted for 2017 are not extreme; that you don't run into having super high size limits or low bag limits or little to no season. Another working group member recommended that recent fishing performance should also be taken into consideration, such as the underperformance of 2016 harvest targets for a number of those states should be taken into consideration, and modified if a minimum reduction is needed; so less than 30 percent.

There was also a question regarding the 2016 region that allows for different management measures in New Jersey's side of Delaware Bay. Carrying that forward into 2017, through Wave 4 of this year New Jersey's Delaware Bay fluke harvest was about 0.9 percent of the states harvest. In walking through options at this point, it seemed to be an insignificant number of fish to be considered for the needed reduction at this point.

I only have a couple more slides here. There were two additional options that Virginia put forward. The first would be freezing Massachusetts, Maryland, Virginia, North Carolina's harvest levels at 2016 levels and distributing the additional fish proportional across states; similar to options that have been included of the eight that I walked through.

The other was to keep them at 2016 harvest levels. States not projected to exceed their

2016 allocation, Rhode Island and New Jersey, would take the 2017 allocation based on their 1998 proportions, and states projected to exceed their allocation, which would be Connecticut, New York, and Delaware; based on preliminary data, would take the reduction in 2017 proportional to the projected harvest.

With all that again, I want some key things for you to keep in mind. These are preliminary harvest estimates and analysis, so these numbers will likely change. The timeframe for turning around this analysis and these options to you have been very tight. The call was on Thursday of last week. This is not an exhaustive list of possible options. Addendum XXVII and prior addenda have laid out state-by-state conservation equivalency language regarding how states would be held to their allocations in years subsequent to the ending of regional management. That language could be included in an addendum if initiated today. Lastly, there are accountability measures that may be triggered based on harvest in 2016. I've only been able to briefly consult with my counterpart at the Mid-Atlantic Council on this.

The way it's handled is that they look at harvest and catch on a three-year basis, and they use an average from that. The other factor that's considered is the biomass relative to the biomass target, because biomass has been trending down in recent years. There is the possibility that ratio could come into effect.

The analysis has yet to be done on comparing catch over the last three years, to then determine if an accountability measure would be triggered in 2017. Some last thoughts for you to consider in whether to initiate an addendum, and if so, in considering the addendum the last three years, this board has moved to do an addendum each year for adaptive regional management.

It is important to keep in mind that there is a comprehensive summer flounder amendment that is continuing along at the same time. It might be useful to not silo work around how to manage this fishery year-to-year relative to how this comprehensive amendment is progressing, the linking up how say accountability would be considered or reductions may be useful to think in a longer timeframe.

Additionally, a longer implementation timeframe may be helpful, as well. As this has changed slightly from one year to the next over the last three years, it may be useful for any addendum that's initiated to think on a slightly longer timeframe; two to four years possibly. Lastly, considering how reductions may be handled in the future, as laid out in Addendums XXV and XXVII, there were not very concrete steps that the states would take to handle those reductions; given an overall coastwide overage.

Lastly, to account for any data uncertainty, it was laid out when we presented this information to the board in early 2015 that there was likely going to be an overage, and that a buffer may be a useful way to account for data uncertainty and changes in estimates; and then maybe building that into the addendum would be a helpful process. In terms of next steps, it is at the board's pleasure whether to initiate an addendum today for management of summer flounder in 2017. I'll take any questions at this time.

CHAIRMAN LUISI: Thanks to you and the Technical Committee for the extreme amount of work that went into putting this presentation together in the very tight turnaround, given the data challenges that we're faced with. Special thanks to you guys for that. John Clark, question?

MR. JOHN CLARK: Yes I have a question. Kirby, on the fish sharing regional options, those shared fish would be taken away from the region before the season starts. It's if the region went over that amount that was set there they could be over quota, no matter what

happened in the other regions, or does the fish share just kind of go into a pool that is used by all regions?

MR. ROOTES-MURDY: At this point, because there is no set forward procedure, it is at the board's pleasure how that would play out. We have language from previous addenda that lay out how those fish, once all the allocations would be set, would be pooled together for where the liberalized states would be pooling their shared fish, and then any state that wanted to petition the board to have a proportion of those fish applied to their harvest targets in 2017, that that would be a formal process. That language could be carried over into this addendum. But it is at the board's pleasure on how that option should play out. As staff, we would be looking for guidance on what specifically the board would want under each of these options that allow for fish sharing or keeping states at a level harvest in 2017 in applying those additional fish to other regions or states.

MR. O'REILLY: Not a question so much as I just wanted to add a little bit. We had a call on Thursday, and on Friday I submitted an option to the working group. Then by Monday that was dressed up a little bit to make it clear what the option was doing, and a second option was provided, as well.

I wanted to just elaborate if I may, very briefly that the VMRC staff did some intricate work, I think. They looked at the four states that have not had an overage in 2016, based on the projected final 2016 landings. For the other states, the other five states, the assignment of the fish that could be shared was determined by the proportion of the 2017 RHL; as goes back to the 1998 shares.

The last point to make is that it is a 38 percent reduction for those five states. That wasn't mentioned, and I realize we're all moving fast. That is why it wasn't mentioned. The second option, very briefly, probably wouldn't be very palatable; and we talked about this at the staff level, because it does assign a much higher proportion to New York than other states for the 2016 overage.

But nonetheless, I'm hoping that there will be time to look at these and we can move them with the eight options. I think once the states look at especially Option 1, we can talk about fairness next time around. But I think it is a very fair option. As long as I'm making a comment, I'll extend it and say that the staff at the Mid-Atlantic Council came up with recommendations that the SSC essentially said no, not conservative enough.

Not only are we in a lot of trouble going forward, but the stock is in a bit of trouble as well; as the SSC indicated that it was very close to becoming overfished. I think we have to keep that in mind. That doesn't take away from our problem for 2017. But the stock has been in sort of a swan dive.

CHAIRMAN LUISI: Bob Ballou.

MR. ROBERT BALLOU: Kirby, do we have an option that is a direct reflection of the performance of the regions in 2016, relative to their regional targets? I'm looking at Table 1 in the addendum that is currently in place, and comparing that to the MRIP estimates. I'm pretty sure that the Massachusetts region came in under.

The Rhode Island region came in well under. The Connecticut/New York region came in well over, significantly over. Delaware was over; they're in the region with Maryland and Virginia. I didn't actually do the math on that. I know Maryland and Virginia states came in way under, and I know North Carolina as a region came in way under. Irrespective of the '98 based allocation percentages, is there an option in here that speaks directly to the performance of the regions in 2016 relative to their targets?

MR. ROOTES-MURDY: Thank you for that question, Bob. I don't believe there is right now. The regional targets that were laid out in the addendum were specified for a condition where maybe in the future if regional management were to continue, it could be considered. But the addendum laid out that in the absence of continuing regional management within the next year, states will revert back to their state-by-state allocations. My understanding is the options that were pulled together, one through eight; do not have an option in there that considers regional performance based on those targets that were laid out.

MR. BALLOU: I would like to suggest that we explore that option. I know what we have in place now, as far as our accountability, but I also know that we're considering a new addendum that could, if I'm not mistaken, establish a new accountability. I would like to explore that option, because if we're going to talk the talk, we need to walk the walk; as far as regional management goes. I mean the whole point of moving forward with adaptive regional management was to try to configure regions that made sense.

Establish targets and then assess performance relative to those targets. My review shows that certain regions performed well; in fact, they came way under their target; other regions not as well. To be perfectly blunt, the regions that went well over are the reason why we're in the pickle that we're in. This isn't a blame game; this is just making sure that we have an option included that addresses that aspect of regional management.

CHAIRMAN LUISI: What I would say is I think where we find ourselves in trouble is that this concept of a target, we don't necessarily even have anything hardwired as to what a target is. We interchange, I think, the words target and allocation. We all have a 1998 allocation, yet the targets that we're using in these are based on the catch of a region that becomes its target under the fish-sharing model.

I would also say that I think another reason we're having a problem, is we don't have any accountability of the regions within the current plan. There is nothing to direct the traffic when the intersection gets jammed like it is right now. That is why we're having this debate today, and I think it is, in my mind it is why we need to continue having this conversation if we want to maintain this regional approach. I have Chris Batsavage and then Dave; I'll come back to you.

MR. CHRIS BATSAVAGE: Two questions, one to the option that Rob introduced, where it talks about freezing harvest. I just want to make sure I understand the difference between freezing and fish sharing. That basically it would set those states at where they were 2016, and if for some reason, the states didn't think that we would have the same harvest again next year, under the same regulations that those states would probably have to put in some measures to ensure that the landings stay at the appropriate level.

I'm just looking at North Carolina, where we're projected at 13,000 fish, but we've never had landings that low before. The last few years have been in the 40,000 "ish" range and then just before then in the 60,000 range. Second question regarding accountability measures from NOAA. Would that be applied, if indeed it needs to be applied, would it be applied in 2017 or would that kick in in 2018, due to kind of the time lag involved in getting that in place?

MR. ROOTES-MURDY: Yes, my understanding in briefly consulting with council staff on this is that it would be two years out, so we're talking in 2018. But I can also direct that question possibly to the GARFO staff who are in the room for their interpretation on that.

MR. SIMPSON: A small but 1important point. The regional catches, they are not targets, they

are expected harvest. We simply did math to calculate what the expected harvest for Rhode Island would be if they didn't change their rules. What was the expected harvest for New Jersey, New York and Connecticut if they maintained the same rules in '16 as we had in '15? It is not a target; it was a way to share fish.

It goes back to the work that the Technical Committee did, which I thought was great. Trying to quantify what reasonable access was. What is the appropriate, equivalent minimum size in Virginia to Rhode Island, given the size composition of fish you see; your release rate and that sort of thing? That is what we were trying to accomplish. I just think we need to remember these regional allocations were a way to share fish.

The idea of a payback, I suppose it has benefited us to be with the two gorillas in the room in a region, but there is this liability too that we sink with them too. Again, in 2013 Connecticut had an estimated catch of, do you remember this, 888,000 fish for Connecticut, almost three times what Rhode Island caught; and here we are again in 2016 with a great big number.

It comes back to the question of reliability, of MRIP statistics at the state level and how we deal with this. Yes, 2017 we have a problem, the stock is smaller, and we need to cut harvest from this year; 30 percent from the target, 41 percent or 2 percent from what may be the realized landings. But in 2018 we're going to be delivered a whole new set of numbers for every state.

I hope that washes away this idea that that number from almost 20 years ago, 1998, bears any relevance to a conversation today about summer flounder allocations. There are some very persistent patterns in underage and overage geographically, very persistent patterns. I really appreciate the work that the group you put together did.

I thought there was some very creative ways to approach this 30 percent reduction and the overage. I was very pleased to see that. But I think we need to be eyes open as we solve the 2017 problem that the new reality of what we all are catching and have caught, our perception of that is going to change radically in a year or two.

MR. FOTE: Kirby, could you put up the table of the regions this year, because I thought that would explain what Bob was asking about. If I looked at those tables right, Massachusetts was under, Rhode Island was over by 24, New York was over by 56, Connecticut was over and New Jersey was over by 21 percent; because this year, 2016, we had a separate region for New Jersey, because of the way we did it.

MR. ROOTES-MURDY: I think this is the option you're talking about?

MR. FOTE: What actually happened in 2016, because you know that is not set up with the regions that were in 2016. The regions in 2016 are Massachusetts by itself, Rhode Island by itself, Connecticut and New York by itself, and New Jersey. That's one of the tables you sent out; and you put it up before.

MR. ROOTES-MURDY: As I mentioned earlier on in this presentation, four of these options that were crafted, there was not one that was a New Jersey-specific option.

MR. FOTE: I'm looking at, when Bob asked what the performance was this year, and that is the result of what you put up there is the tables from this year. Rhode Island did go over, Massachusetts was under, Connecticut and New York were both under, and there was a separate amount for New Jersey; which was 26 percent.

MR. ROOTES-MURDY: I think what you're thinking of, Tom, is the state-by-state allocations under conservation equivalency;

where there is a 26 percent reduction for New Jersey.

MR. FOTE: No. There is a table that you put out that was in the form of what was actually the regulations this year in the regions that were this year. The regions this year were Massachusetts separate, Rhode Island was separate, Connecticut and New York were one region, and New Jersey was another region. You showed the overages in that table.

MR. ROOTES-MURDY: Again, Tom, I'm not familiar with what you're speaking to.

MR. FOTE: It's in the paper you sent out the other day.

CHAIRMAN LUISI: Do you have a page number on the paper that you're looking at?

MR. FOTE: I'll get it to you and then we'll go back to it.

CHAIRMAN LUISI: While you guys are working on that. What is facing the board right now is a decision about whether or not you would like to have regional management as an option for 2017. That is the question. It is not about committing to any of the examples that Kirby presented as a result of the working group call that we had.

We're not committing to regional management in any way. However, given the timing of all of the gears and everything that needs to fall in place between now and the start of next year's season, in order to keep regional management as an option for this board in moving forward, we would need to initiate an addendum today.

That addendum would begin to being developed, and then when the board meets with the council in December, that is when that decision tree falls into play. Based on the decisions made at that time, again another set of scenarios, we would be going down one path or another. If you want to have a path where regional management is part of that path, today we would need to initiate an addendum.

I ask, in order to get the conversation going I had staff draft a motion, so if we can put the motion up. **I had staff draft a motion to move to initiate an addendum to consider adaptive regional management approaches for the 2017 summer flounder fishery. John Clark, are you making that motion?**

MR. CLARK**: I am making that motion.**

CHAIRMAN LUISI: Do I have a second, Dave Simpson. Now that we have a motion, I can look to the table for discussion of the motion. Steve Heins.

MR. HEINS: Looking at the document that the working group put together, I'm assuming that most of this information will be included in development of this addendum. But some of the approaches in the document are not truly regional management. I brought that up during the call that we had with the working group.

I'm not saying that we need to remove them, but maybe we ought to consider naming the addendum conservation equivalency approaches for 2017, rather than just adaptive regional management; because we're including things potentially that are not regional management.

CHAIRMAN LUISI: I can go along with that if that is okay with the maker and the seconder of the motion. I know what Steve is referring to; it's just the straight up fish-sharing option that doesn't involve regions; if you want to keep that in play. Something that complicates all of this is that the FMP defaults to, under conservation equivalency, state-by-state allocations from 1998.

Even though there is an addendum that we would be moving forward with that would have

regions as part of that addendum, there is always the option in that conservation equivalency addendum to go with state-by-state management. I know that stakeholders often get confused when we refer to that; because here we have an addendum addressing regions; but there is a state-by-state option in it.

I don't want to confuse the matter in that we call it conservation equivalency without some initiative to keep the regions as part of it, and I think, Steve based on your comments, you would want to keep all the regional approaches in there, as well, so it would just be more inclusive of conservation equivalency.

Maybe we could use conservation equivalency/regional approaches, just to keep the regional part of that in the motion; if you're okay. I'll look to the board to see what you guys want to do. I know we drafted this, and it didn't come directly from one of you, but look for some advice on how to change this if you want to change it; before we go forward with the discussion.

MS. MESERVE: I was going to speak towards the motion as it is currently. I can support this motion. Looking at our alternatives, we have coastwide management, which we haven't used for 16 years and we moved away from for very clear reasons; or we have conservation equivalency, which has cuts ranging from plus 412 percent to minus 81 percent.

That is not a palatable option for me. It does seem that there are a number of options in this document, but also board members are looking at this; many of us for the first time today. Gears are turning, so I'm under the assumption that board members can forward other options to the Plan Development Team, and the board will make final decisions for what is included in the draft addendum at the December joint meeting.

If that's correct, my last point. There are a number of options that zero out any cuts for Mass, Maryland, Virginia, North Carolina and in some cases Delaware. I would just point out that for those states, the 2016 projected harvest are below their 2016 target, based on the regional approach. They are also below the 2016 allocations; based on 1998 harvest, and also below the 2017 allocations based on 1998 harvest. They all have state contributions to the coastwide total that are at or below 4.5 percent. Those are some of the reasons that I see for including those options that do leave those states at a 0 percent cut for next year.

MR. ADAM NOWALSKY: Did we clarify first this motion to just be adaptive management and not adaptive regional, which is still up there? Was that what we did?

CHAIRMAN LUISI: I'm comfortable with that, but I'll look to John and David to confirm if that is the way you would like to go.

MR. CLARK: I don't mind adding something to indicate that it's not just regional management, but I would like regional to stay in the motion; because I think once that's out, there is a chance it won't go back in.

MS. TONI KERNS: What if it is, initiate an addendum to consider adaptive management, including regional approaches for the 2017 summer flounder fishery?

MR. CLARK: I think that would be acceptable.

CHAIRMAN LUISI: Any other board members have any other refinements? David.

MR. SIMPSON: Well, it is related to this but sort of continuing on my theme for the last few years that usually at the December meeting, I continue to look to NOAA to set some rules in federal waters that support their FMP. I don't know how much that will help us, but I do think it is part of the solution; that we have some

conservation that is consistent in our largest partner's waters.

I think that could be set up. It could also be very protective of states with smaller minimum sizes, that in their state waters when you're fishing up in the Bay, you can fish by rules that are more appropriate to that small water body. But if you are on a boat fishing 30 miles offshore, you ought to be able to play by the big boy rules, as I've said before.

I continue to be disappointed that the council and the federal government don't step up and set rules that will make sure that people fishing in federal waters are contributing to conservation. If this were just a commission plan, I would look at it differently. This is a federal plan, and we're bound by all these federal rules; and the federal government doesn't do anything to make this happen. I really look to them to contribute something meaningfully to the EEZ component of this fishery.

CHAIRMAN LUISI: Rob O'Reilly -- did you still have -- I saw your hand.

MR. O'REILLY: I'm still here. I wanted to just say that I can support this motion, but I would also like to indicate that we really have spent a lot of time in the past with the 1998 issue of allocation. But I also want to mention, and David has the right idea, I think, about how things have worked with regional. But one way they've worked is that your landings have essentially been a de facto target. In other words, when we started out, I'll just say DelMarVa for an example, the landings we had in 2013 rolled over into 2014. The landings we had in 2014 rolled over into 2015. For the most part, that has been the mechanism of the regional. Pretty much it has worked up until now, and there are some factors that we didn't expect. But to Chris Batsavage' question, we do have an increase in the RHL for 2018, but I wouldn't count on it. You know, it is about 600,000 pounds now, but it probably won't materialize once there is further information.

Also, Chris, on the other hand, with the North Carolina situation, it applies to Virginia and Maryland, as well; that you're going to find this 2014 year class, which is the first somewhat good year class since 2009, is going to be available. It's a model driven recruitment approach, but nonetheless, it is the first good sign we've had for quite a while.

States that are already low on the landings regime could cause another problem that was unexpected, because all of a sudden the reduction in their harvest stops. You saw that a little bit with Delaware this year, and maybe they tapped into some of that 2014 year class it would have been of size. I hope we all keep that in mind as we go forward with this, but I will support the motion.

MR. NOWALSKY: We've got eight options in this document. We had two more that Virginia put forth. We've heard a couple of other comments about more coming potentially. That will get us in the neighborhood of a dozen. What is our plan to whittle that down before December? I can't see bringing a dozen options to the table, all presumably equal, at least on paper. We know some have no chance of moving forward. I would need some way to move forward leading up to December, to feel comfortable supporting this.

CHAIRMAN LUISI: If you remember, Adam, on the call I did my best to try to whittle it down and go overruled by the group. I would expect that if the board is okay with this concept; that we would continue working as that working group that we put together. We could set up a call or two between now and December to provide a recommendation and advice back to the board in December, by making an attempt at whittling some of these options down.

That would be the way. That is the only way that I see whittling it down, to provide that advice back to the board for their approval. Okay, with that, I would like to go to the audience for any comments regarding the motion that is on the board. Yes, sir. If you could come up, we have a public microphone; all the way to my left. Sir, if you could just state your name and any affiliation that you have. If you could be mindful of the time, if we could limit comment to three minutes or less, that would be fantastic.

MR. KEVIN SLATTERY: Hi, my name is Kevin Slattery; I'm a charter captain from Massachusetts. I'll take about two minutes. There are two points I would like to hit on. It is not only about flounder, it is also and more importantly to me about black sea bass. The other point is about enforcement, but first, the enforcement business.

When Dan McKiernan spoke over here he was talking about the tautog and how the enforcement factor has kind of changed the whole game; and it does, it absolutely does. In the bigger picture you need to incorporate enforcement into all these decisions. I don't know how. It is for smarter people than me.

Enforcement makes or breaks all these other numbers. Black sea bass is what I have made my living off of up until this year. The numbers have gotten whittled down, and that's part of my second point about ad hoc management. In the black sea bass world they have different levels of enforcement state-to-state, which entirely changed the game. All the other numbers matter up to a point, but for me as a charter captain and for the recreational fisherman, the enforcement is night and day.

In Massachusetts, if I'm on my charter boat and I get stopped by the Marine Police, and there is a violation found; and it could be very slight, in one fisherman's cooler. Guess who gets the ticket? Me. The Marine Police in Massachusetts have made me a cop, which is fine. New York needs to do it, too, New Jersey; because it's apples and oranges.

My fishermen that would normally fish with me go down there, they're held liable. They don't care. They couldn't care less, walk away from the cooler; take the $50.00 fine. Sea bass are worth $100.00. No problems. I ask this board or the federal government, or whoever has the power to do it, make it the same deal up and down the coast.

I pick, if you ask me, what I have in Massachusetts, because you need to enforce these laws not send them out there and see if they fly. They don't fly on their own. That is my discussion about enforcement. My other discussion is, I urge the board not to do ad hoc management again as we know it. This is a failure.

It was okay for a year or two, while we were all waiting for the stock assessment. I'm pretty well versed in what we were waiting for, and I'm not flying out of left field with it. I know we were waiting for a stock assessment. I know you had to do something, okay. But after this many years of it, it has become like a guy with vacation days, use them or lose them.

The more you grab each year the more you've got next year. If you went over 360 percent, you took a 30 percent cut, ding, ding. You've got 330 percent, nice grab. Let's try it again for next year. Now comes the stock assessment. What are we going to do with the fish we expect to get? Are we going to give -- the new baseline is what you've grabbed over the years, it's wrong.

It would be very wrong for this board to say good grab, everyone, will you pay it back? That's where you start from. I'm the example; I'm out of business as a fisherman. Massachusetts had a 99 day season or 103 days, I think; five fish. Nobody went on my boat for

five fish. They're down in New Jersey, New York for 10 and 15 fish.

Those guys are fishing today, I'm here in Maine. It didn't work out. We need to reset the numbers. Go back to some point where there was an equality here, not building overage upon overage. The other sub point to that is, to achieve these cuts this year in particular, this business of we'll make the fish one inch bigger and get, in the case of Connecticut I know 40 percent, New York, 20 odd percent. That was a farce and I think everyone should have known that.

It was not controlled for effort. You came on my boat last year when it was eight fish; it took us one hour and 15 minutes to catch our eight fish, theoretically at 14 inches. You came out this year, the 15 inch fish; it took us one hour and 25 minutes. This isn't bluefin tuna. It took us like a second longer to get those fish.

That did not result in a 40 percent cut. The 40 percent cut that some states took, gave them more season and more fish in a year when they were supposed to cut for the sake of that one inch. It was a farce. To do it again would be double wrong. I really think you knew what was going on; if you give me one second to look at my notes.

CHAIRMAN LUISI: If you can begin to just wrap up your summary here on the motion.

MR. SLATTERY: Okay, a lot of what I said applies to fluke, the same thing. The states like my own state of Massachusetts that did not go over on sea bass or on fluke; yet again we're looking at a cut. Each time they cut we have a new floor. Even like this guy from down south there, I forget where, asked if we give up these fish, what if we need them next year? We've given them up, and they're gone. We need a reset. I don't know how you're going to do it, God bless you if you can figure it out. I can't. But to continue with ad hoc, it's wrong, but thank you very much for letting me speak.

CHAIRMAN LUISI: Any other members of the audience have any comment regarding moving forward with the motion on the board? All right seeing none; we're going to come back to the table. Are there any last minute comments regarding the motion? Seeing none; do you guys need a second to caucus, 30 second caucus?

Okay, I'm going to make one last comment before I call the question. Just to reiterate Adam's point earlier about taking something that seems to be almost a little unruly and boiling it down to something manageable. Kirby and I just spoke briefly about the idea that this working group will take the options that it's presented, and likely include all of those options for review in December.

However, I would look to the working group to provide some focus, maybe select five or six out of whatever develops from the different states in going forward. I think that would put us in a good spot in December, and seeing what would be available in the addendum. Okay is the board ready for the question? I am going to read it into the record.

The motion is: move to initiate an addendum to consider adaptive management, including regional approaches for the 2017 summer flounder fishery. One second. Bob just made a point that we should probably put recreational summer flounder fishery, so after '17, I'll read it back into the record.

Move to initiate an addendum to consider adaptive management, including regional approaches for the 2017 summer flounder recreational fishery. Is the board ready for the question? **All those in favor, please indicate by raising your hand. All those opposed: same sign. Any abstentions, any null votes; the motion passes; 11 to 1 to 0 to 0.** Okay, I'm

going to go to the last item on the agenda, which is an update; second to last item on the agenda. Kirby is going to give us a very brief update on the stock assessment progress for black sea bass.

UPDATE ON STOCK ASSESSMENT PROGRESS FOR BLACK SEA BASS

MR. ROOTES-MURDY: I'll try to brief as possible with this update for the board. As I am not a stock assessment scientist, I can guarantee it will be very brief. In terms of work that has been completed, so far, for this 2016 benchmark stock assessment for black sea bass, a data workshop was held in June, 21016.

An assessment workshop was held in September, 2016. There had 111been multiple calls of the working group in between those meetings, and since; we have explored modeling techniques to try to get at spatial and unique life history characteristics and are on schedule right now to complete the assessment report in time for the December, 2016 peer review. The time table moving forward is that the assessment report will be completed by early November, 2016. The peer review is set to take place during November 29th through December 2nd, 2016.

It is important to note that this document won't be ready for the board and council to consider for management at the joint meeting in December of this year. That is going to take place in Baltimore. After the peer review, the Mid-Atlantic Council's SSC will review the peer review report, as well as the stock assessment report in January, 2017.

Once that has been completed it will be shared with the board and council, in preparation for a joint ASMFC/Mid-Atlantic Council meeting to consider the assessment and management action in February. The dates for that meeting right now are set as February 14th through the 16th, in Kitty Hawk, North Carolina. With that, I'll take any questions regarding the timetable and work completed at this point.

CHAIRMAN LUISI: Questions for Kirby on the time table of the black sea bass assessment? Bob Ballou.

MR. BALLOU: Just a related question if I can, Mr. Chair, and that is the sense of where we go from the assessment; as far as management. Is there anything teed up specifically, perhaps jointly with the Mid-Atlantic on black sea bass management, commercial and recreational, looking ahead to what would have to be 2018; I would think. In other words for reconsideration, is there any consideration of changes to the recreational and/or commercial management program for black sea bass that would follow on the assessment?

MR. ROOTES-MURDY: Right now, there is a commercial quota in place for 2017, and a recreational harvest limit in place for 2017. The board and council jointly voted on that in August; so that's in place. This joint meeting that's set for February, 2017, is going to consider the results of the assessment and depending on those results, there could be the ability to change 2017 specifications. Now at this point, without having the assessment ready, we can't speak to what changes might be possible. But that, is in part, why the meeting is scheduled to take place in February.

MR. BALLOU: Not just on specifications, but on management broadly, is there any move afoot or any consideration being given to reopening discussions on management of the black sea bass fishery; both commercially and recreationally in 2017, as a follow up to this assessment?

CHAIRMAN LUISI: What we currently have in place, the ability to continue with the ad hoc approach. We don't need to take any action on that today, because it is something that is written into the plan. It's written into the

addendum that we could go forward in 2017 with that same approach, just through a motion. We don't need a new addendum.

We do have the ability to go to the default, as well, if ad hoc approach is not what the board wants to go forward with. But those decisions will begin in December, when the council and the commission decide on whether or not to go forward with coastwide measures for black sea bass or continue with the idea of the ad hoc approach. As far as a long term outlook, I should be more up to speed on this than I might be right now, but there is an amendment that was initiated to look at the commercial fishery for black sea bass and how quotas are managed by the feds in order to mitigate the impacts of federal closures due to overages of the quota that impacts states that can land fish from state waters. When federal waters close, certain states are impacted very greatly as a result of that. That is something that has been started, but it hasn't developed to the point where you've heard too much about it at this point. Dave Simpson, do you still have a comment?

MR. SIMPSON: Yes, I think so. The assessment is taking a two, basically sub stock approach; there is a northern sub stock right, and a southern sub stock. That is how it will be assessed and the only way it will be assessed this time? Is that right?

MR. ROOTES-MURDY: As I said, I am hesitant to get into the specifics of the assessment without the report being ready yet, but I can offer that they have looked at the spatial components of the fishery, as well as trying to understand possibly sub units of the stock; both on a north/south scale as well as on an offshore/inshore component. Those have been considered, but to whether that is the specified way the assessment model is going to proceed, and what the report will be read up, I can't speak to that.

MR. SIMPSON: Okay, but my sense is, my information is that that is the approach they're taking, so that would seem to me to immediately beg the question of whether overfishing is occurring within each of the two regions. I think it is going to cause some issues for the Mid-Atlantic Council and the feds, and I could anticipate that it will really beg for a discussion here about allocation between states on a commercial fishery; if there are two different sub stocks that are exploited differentially by each state.

MR. ROOTES-MURDY: To what Mike was trying to explain before, there had been an amendment initiated by the board and council in conjunction on sea bass. Then that was shelved in light of kind of priorities going into 2016. At that joint meeting in February would be the time for the board and council to reconsider that amendment that had been initiated, and determine what other components maybe should be factored in with that amendment. If the board and council choose to have that reinvigorated and started up again.

CHAIRMAN LUISI: We're going to need to wrap this meeting up, where we're well over time. I think we're all going to have another opportunity. We're going to have many opportunities in the coming months to be together; which I look very forward to, spending as much time as possible with this group. With that, I'm going to move on to the last agenda item, which is other business. Does anybody have any other business they want to bring before the commission? Steve Heins.

MR. HEINS: Very quickly, for the past four years or so, we've had a mid-season closure in the recreational black sea bass fishery in the federal regulations, whereas in the states in the northern region have remained open. That hasn't been a problem for us, other than some initial confusion.

But this year now we've had quite a few complaints of anglers that are fishing in Rhode Island waters and then transiting back into New York; and are being intercepted in the so-called Striped Bass Transit Zone between New York and Rhode Island, and being ticketed for being in possession of black sea bass. That is a little bit of a problem, as I see it, that we're allowing people to transit that zone with striped bass, but not black sea bass that are legally harvested in Block Island waters. The question that has been presented to us is why is there additional enforcement this year? I can't answer that one. But then why not allow black sea bass to be possessed when you're in transit; in other words you're not stopped in the transit zone.

There is the same principal there for striped bass and black sea bass, I believe. From what I understand, it is simply a federal regulation that allows that transit zone; that provides for it. My request to this board is to maybe present this to the Policy Board and request a change to the federal regulation that would allow possession of black sea bass during the closed season.

CHAIRMAN LUISI: Does anybody have any objections with moving forward as Steve suggested which would be a presentation of this to the Policy Board the next time they meet? Dave Simpson?

MR. SIMPSON: No, I don't have an objection, I just want to reinforce that this has been a problem that was brought to my attention. It is basically too late for this year, but a boat fully in transit from Block Island/Rhode Island waters through federal waters back to Connecticut got stopped, and they are scratching their heads trying to figure out.

You know I asked this question two or three years ago, what's the deal? Block Island waters are open; it's a productive fishing area. Is it open? What are the feds doing about it, I got no answer. Block Island waters become an attractive nuisance in effect that you go out there but you don't dare come home. Unless it is only open to Block Island residents, we really have a problem that needs to be addressed.

MR. FOTE: Looking over the table, I was looking for Kirby, I realized what I was looking for was the performance this year of the 2016 regions as they were set up; and we basically had in place this year. I must have interpreted it by looking at the numbers, but it isn't set up that way. I would like to see the performance at the next meeting of what happened in 2016 with the regions, they were set up for 2016, which was different from 2015; and it's not one of the options put forward for 2017. I would like to see that option also put forward.

CHAIRMAN LUISI: Okay, Tom, work with Kirby and through Adam, who is representing New Jersey on our Striped Bass Working Group. All right, any objections to Steve Heins recommendation to take that issue to the Policy Board? Seeing none; Steve we'll go ahead and take care of that.

ADJOURNMENT

Is there any other business to come before this board? Okay, seeing none; thank you for all your work and this meeting stands adjourned.

(Whereupon the meeting adjourned at 5:44 o'clock p.m. on October 25, 2016.)

Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM XXVIII TO THE SUMMER FLOUNDER, SCUP, BLACK SEA BASS FISHERY MANAGEMENT PLAN FOR PUBLIC COMMENT

Summer Flounder Recreational Management in 2017

ASMFC Vision: Sustainably Managing Atlantic Coastal Fisheries

December 2016

(Revised December 23, 2016)

Draft Addendum for Public Comment

Public Comment Process and Proposed Timeline

In October 2016, the Summer Flounder, Scup, and Black Sea Bass Management Board approved a motion to initiate the development of an addendum to the Interstate Fishery Management Plan (FMP) for Summer Flounder, Scup, and Black Sea Bass. The addendum will address the recreational management of summer flounder for 2017. This draft addendum presents background on the Atlantic States Marine Fisheries Commission's (Commission) management of summer flounder; the addendum process and timeline; and a statement of the problem. This document also provides options of management for public consideration and comment.

The public is encouraged to submit comments regarding this document at any time during the public comment period. The final date comments will be accepted is **January 19, 2016 at 5:00 p.m**. Comments may be submitted at state public hearings or by mail, email, or fax. If you have any questions or would like to submit comment, please use the contact information below.

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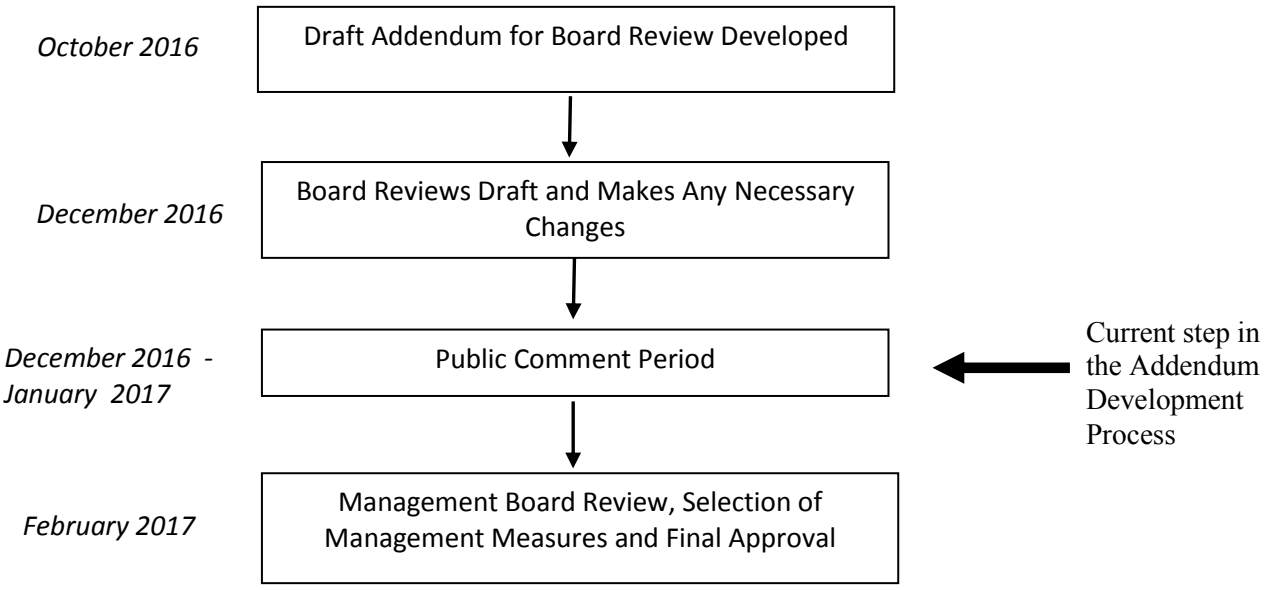


1.0 Introduction

This Draft Addendum is proposed under the adaptive management/framework procedures of Amendment 12 and Framework 2 that are a part of the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP). Summer flounder, scup, and black sea bass fisheries are managed cooperatively by the states through the Atlantic States Marine Fisheries Commission (Commission) in state waters (0-3 miles), and through the Mid-Atlantic Fishery Management Council (Council) and the NOAA Fisheries in federal waters (3-200 miles).

The management unit for summer flounder, scup, and black sea bass in US waters is the western Atlantic Ocean from the southern border of North Carolina northward to the US-Canadian border. The Commission's Summer Flounder, Scup, and Black Sea Bass Management Board (Board) approved the following motion on October 25, 2016:

> *Move to initiate an addendum to consider adaptive management, including regional approaches, for the 2017 summer flounder recreational fishery.*

This Draft Addendum proposes alternate approaches for management of the recreational summer flounder fishery for the 2017 fishing year.

2.0 Overview

2.1 Statement of the Problem

A fundamental goal of Commission FMPs is to provide recreational anglers with fair and equitable access to shared fishery resources throughout the range of each managed species. The Commission's ISFMP Charter establishes fairness and equity as guiding principles for the conservation and management programs set forth in the Commission's FMPs. While the current FMP for summer flounder does not include a goal pertaining to this concept, the Board and Council are considering a new goal for inclusion in the forthcoming Comprehensive Summer Flounder Amendment: "Provide reasonable access to the fishery throughout the management unit." With these principles and goals in mind, the challenges facing the Board (and Council) involve determining what is meant by fair/equitable/reasonable access, and how to achieve it.

Complicating the access issue for 2017 is the significant reduction to the coastwide recreational harvest limit (RHL) set by the Board and Council in August 2016 in response to the most recent Stock Assessment Update. The 2017 RHL is 3.77 million pounds, an all-time low. By way of comparison, the RHL for 2017 is approximately 30% less than 2016, 48% less than 2015, and 68% less than 2011, when it peaked at 11.68 million pounds. Using a projected recreational harvest in 2016 of 6.38 million pounds (subject to change), harvest in 2017 must be reduced by roughly 2.6 million pounds to not exceed the 2017 RHL.

This draft addendum addresses the issue that available management approaches are not viewed as providing a fair and reasonable way to constrain the 2017 recreational summer flounder fishery harvest to the RHL. <u>The Board recognizes the management options within this draft addendum will also have shortcomings with regards to addressing this problem, and thus intends the selected option to be an interim program while focusing on the development of a more comprehensive solution for the future.</u>

2.2 Background

Amendment 2 (1993) initially required each state (Massachusetts through North Carolina) to adopt the same minimum size, possession limit, and season length as established in federal waters for the recreational fishery, allowing only for different timing of open seasons. The consistent measures were intended to uniformly impact the resource and stakeholders in all state and federal waters throughout the management unit. However, the states later determined one set of management measures applied coastwide did not provide equitable access to the resource due to the significant geographic differences in summer flounder abundance and size composition.

To address this disparity, the FMP was amended in 2001 (Framework Adjustment 2) to allow for the use of state-specific "conservation equivalent" management, through which recreational harvest would be constrained the same as under coastwide management. The Council and Commission would engage in an annual process of determining whether to manage the fishery with coastwide measures or state-specific conservation equivalency; if the latter, the Commission would have the lead in approving state-specific regulations. Concurrently, the Commission adopted a series of addenda (Addenda III and IV in 2001, and Addendum VIII in 2004) implementing state-based conservation equivalency. Estimates of state recreational landings in 1998 were established as the basis for state recreational allocations- this is outlined in Addendum VIII (see Table 1) upon which state-by-state regulations could be developed. From 2001-2013, the Board and Council opted to use state-specific conservation equivalency tied to the proportion of each state's estimated 1998 recreational landings. This provided states with the flexibility to tailor their regulations—i.e., minimum size, possession, and season limits—to meet the needs and interests of their fishery, provided their targets were not exceeded.

Table 1. State summer flounder harvest in 1998 and the proportion of harvest conservation equivalency state-by-state harvest targets are based on (Addendum VIII)

State	1998 estimated harvest (thousands)	Percent of the 1998 harvest
MA	383	5.5%
RI	395	5.7%
CT	261	3.7%
NY	1,230	17.6%
NJ	2,728	39.1%
DE	219	3.1%
MD	206	3.0%
VA	1,165	16.7%
NC	391	5.6%

The Board also adopted Addendum XVII in 2005, enabling the states to voluntarily opt into multi-state regions that would set regulations based on a pooling of their 1998-based allocations. The Council followed suit with the adoption of Framework Adjustment 6 in 2006, complementing the regional approach set forth by Addendum XVII. However, no states used this optional regional conservation equivalency approach.

Re-assessing in the Face of Changing Conditions:
The use of state-by-state regulations based on estimated state harvests in 1998 succeeded, initially, in mitigating the disparity in conservation burden among states, but later became viewed as an inadequate long-term solution, given changes in resource status and fishery performance.

As 2013 came to an end, the Board identified the following problems with the use of state allocations based on estimates of recreational harvest in 1998:

1) Substantial variation in stock dynamics since 1998. These included a six-fold increase in spawning stock biomass and expansion of the age structure from including 2–3 age classes to 7 or more. These changes led to geographic shifts in the distribution of the resource; as the stock rebuilt, its range expanded. Climate change was also identified as possibly contributing to shifts in migratory patterns, spatially and temporally.
2) Substantial changes in socio-economic patterns since 1998, particularly with regard to the number and distribution of anglers along the coast. For example, estimated angler participation increased significantly, and a growing percentage of harvest was attributed to private/rental vessels in contrast to shore-based and party/charter vessel harvest. Industry advisors indicated the rising costs of fuel, bait, and other trip expenditures were impacting angler effort.
3) Possible error in the estimates of harvest for 1998. Measuring recreational catch and effort, particularly on a state-by-state basis, is challenging and not without uncertainty in the estimates. The methods used to estimate recreational catch and effort are continually evolving, resulting in more accurate and precise estimates in more recent years.
4) Major disparities in the regulatory programs among the states; for example, as recently as 2012 and 2013, no two states had the same regulations, and several neighboring states had regulations that differed significantly. A case in point was New York, whose regulations were more restrictive than any other state, and that contrasted markedly with those of New Jersey, Connecticut, and Rhode Island.

To address these concerns, the Board adopted Addendum XXV, which implemented conservation equivalency on a regional basis for 2014. Five[1] regions were established: 1) Massachusetts; 2) Rhode Island; 3) Connecticut, New York, and New Jersey; 4) Delaware, Maryland, and Virginia; and 5) North Carolina. All states within each region were required to have the same possession limit, size limit, and season length.

[1] Initially, in February 2014, the Board established four regions, one being Massachusetts and Rhode Island combined. Subsequently, in March 2014, the Board approved a request from Massachusetts and Rhode Island to split its region into individual state regions to account for the significantly different recreational fisheries of the two states.

Although the precursors to Addendum XXV (Addendum XVII and Framework Adjustment 6) envisioned a regional approach based on regional harvest limits set as the sum of the harvest limits for all the states in each region, with accountability based on the performance of each region relative to its regional limit, Addendum XXV implemented an alternative approach. Based on analysis provided by the Board's Technical Committee, the Board focused on developing regulations for each region that would lead to projected regional harvests that would collectively achieve, but not exceed, the coastwide recreational harvest limit. The projected regional harvests did not constitute the sum of the harvest limits for all the states in each region. As such, the approach constituted a de facto reallocation of recreational harvest opportunities. Nonetheless, the Board emphasized that:

> *The new approach is not intended to implement new state allocations and is not intended to set a precedent for new state allocations. Under the adaptive regional approach, states would not give up their (1998-based) allocated portion of the Recreational Harvest Limit (RHL), would not be held accountable for anything other than their allocated portion of the RHL, and would retain the future opportunity (depending on what management approach is adopted for 2015) to continue managing their fisheries in accordance with their allocated portion of the RHL.*

To achieve regulatory uniformity within each region, and to meet the coastwide harvest target, regulatory revisions were enacted for CT, NY, NJ, DE, and MD in 2014 (Table 7).

For 2015, the Board continued regional management, with the same regions, via Addendum XXVI. For all states, the same regulations in effect for 2014 were maintained for 2015 (Table 7).

For 2016, the Board again continued regional management via Addendum XXVII, with one adjustment to provide more equity in recreational opportunities for anglers in the Delaware Bay. That adjustment involved establishing New Jersey as a stand-alone region, with the caveat that New Jersey would enact separate management measures for the New Jersey portion of Delaware Bay, while maintaining regulations for the rest of its waters consistent with those of New York and Connecticut. New Jersey complied by enacting regulations for Delaware Bay that were closer to those of Delaware. For all other states the same regulations in effect for 2014 and 2015 were maintained for 2016 (Table 6).

Headed into 2017, the Board continues to have the same concern about disproportionate impacts among states from the use of 1998-based allocations and state-by-state management measures. A return to coastwide management measures is also unlikely to provide equitable access.

2.3 Description of the Fishery

In practice, the recreational fishery for summer flounder is managed on a "target quota" basis. A set portion (40%) of the total allowable landings is established as a recreational harvest limit (RHL), and management measures are established by the states that can reasonably be expected to constrain recreational harvest to this limit each year. It has historically been deemed impractical, because of the limitations of producing timely landing estimates, to try to manage the recreational fishery based on a real-time quota.

Over the past nine years, the coastwide landings exceeded the annual coastwide RHL three times: 2007, 2008, and 2014 (Table 2). The most recent overage in 2014 was by approximately 5% (approximately 380,000 pounds). Based on preliminary harvest estimates through August 2016, coastwide landings have already exceeded the 2016 RHL. The 2016 harvest estimates are subject to change as many states seasons remain open and data for wave 6 (November-December) are not yet available. Projected harvest through the end of 2016—based on state harvest trends in 2015—indicated the final harvest may be approximately 6.38 million pounds (Table 3).

Table 2. Coastwide Harvest Relative to Coastwide RHL: 2007-2016

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Coastwide Harvest (mil. lb)	9.34	8.15	6.03	5.11	5.96	6.49	7.36	7.39	4.72	6.38
Coastwide RHL (mil. lb)	6.68	6.21	7.16	8.59	11.58	8.49	7.63	7.01	7.38	5.42
Percent of RHL harvested	**139.77%**	**131.25**	84.22%	59.47%	51.43%	76.44%	96.40%	**105.41%**	63.97%	**117.00%**

*2016 Harvest is preliminary, through October only, and subject to change.

Table 3. Projected Coastwide Harvest for 2016 by states

State	Jan-Aug Estimate		Sep-Dec Projection		Projected Total Harvest	
	Weight	Numbers	Weight	Numbers	Weight	Numbers
MA	121,791	53,294	4,860	3,348	126,651	56,642
RI	278,682	89,988	6,927	2,833	285,610	92,821
CT	690,786	218,019	3,875	1,352	694,661	219,371
NY	2,238,513	712,643	55,118	18,164	2,293,630	730,807
NJ	1,904,113	609,878	573,966	181,181	2,478,080	791,059
DE	206,558	82,097	18,075	7,432	224,634	89,229
MD	42,574	18,537	9,123	4,538	51,697	23,075
VA	188,576	75,029	12,460	5,093	201,037	79,332
NC	16,870	9,605	12,152	7,469	29,021	17,074
Total	5,688,463	1,869,090	696,557	230,320	6,385,020	2,099,410

*September-December harvest are projected using proportion of landings by two-month wave by state in 2015.
**Total Projected Harvest is based on preliminary information and is subject to change as new information is made available.

Recreational Survey Estimates

The Marine Recreational Information Program, or MRIP, is a program under NOAA Fisheries which counts and reports marine recreational catch and effort. MRIP is driven by data provided by anglers and captains. MRIP replaced the Marine Recreational Fisheries Statistics Survey, or MRFSS, in 2008, which had been in place since 1979. MRIP is designed to meet two critical needs: (1) provide the detailed, timely, scientifically sound estimates that fisheries managers, stock assessors, and marine scientists need to ensure the sustainability of ocean resources and (2) address head-on stakeholder concerns about the reliability and credibility of recreational fishing catch and effort estimates. MRIP is an evolving program with ongoing improvements. Detailed information on MRIP and the improvements can be found at http://www.st.nmfs.noaa.gov/recreational-fisheries/index. All recreational catch and effort data considered in this document are derived from MRIP.

2.4 Status of the Stock

The most recent peer-reviewed benchmark assessment for summer flounder (Northeast Regional Stock Assessment Workshop 57, NEFSC 2013) was updated in July 2016. The assessment utilizes an age-structured assessment model called ASAP. Results of the assessment update indicate the summer flounder stock was not overfished but overfishing was occurring in 2015 relative to the updated biological reference points established in the 2013 SAW 57 assessment. The fishing mortality rate has been below 1.0 since 1997, but was estimated to be 0.390 in 2015, above the threshold fishing mortality reference point F_{MSY} = 0.309 (Figure 1). Spawning stock biomass (SSB) was estimated to be 88.9 million pounds (36,240 mt) in 2015, about 58% of the biomass target SSB_{MSY} = 137.555 million pounds (62,394 mt) and 16% above the biomass threshold (Figure 2). The 2015 year class is estimated to be about 23 million fish at age 0, continuing the trend of below-average year classes for the past six years (2010-2015).

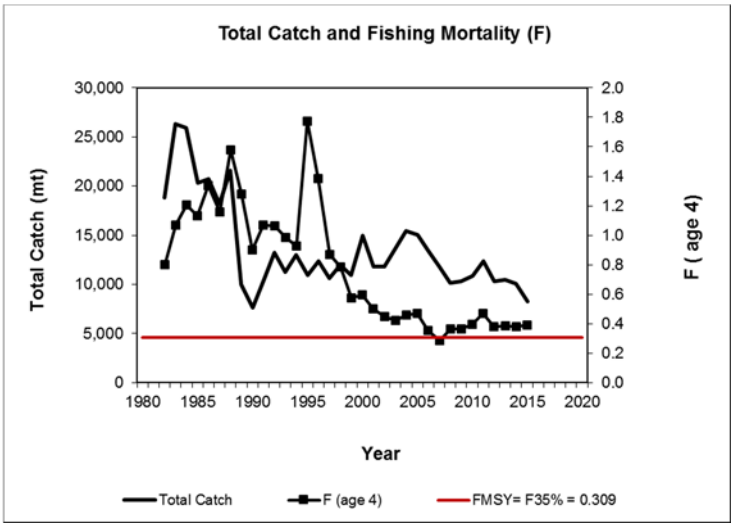


Figure 1. Total fishery catch and fully-recruited fishing mortality (F, peak at age 4) of summer flounder. The horizontal red line is the 2013 SAW 57 fishing mortality threshold reference point proxy. Source: NEFSC Summer Flounder Stock Assessment Update for 2016 (June 2016).

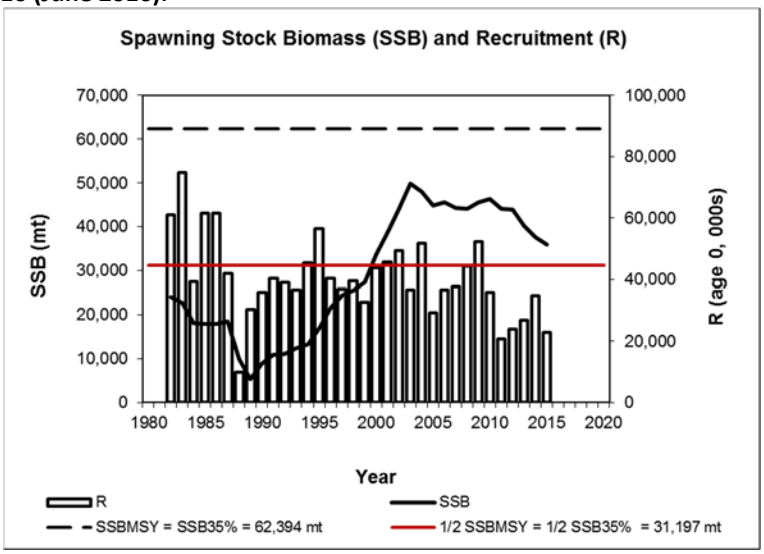


Figure 2. Summer flounder spawning stock biomass (SSB) and recruitment at age 0 (R) by calendar year. The horizontal dashed line is the 2013 SAW 57 biomass target reference point proxy; the horizontal red line is the biomass threshold reference point proxy. Source: NEFSC Summer Flounder Stock Assessment Update for 2016 (June 2016).

A breakdown of the 2017 Overfishing Limit (OFL), Acceptable Biological Catch Limit (ABC), Annual Catch Limits (ACL), Annual Catch Targets (ACT), and subsequent coastwide RHL based on the 2016 stock assessment update is included in Table 4. The 2017 proposed harvest limit is a time series low as the result of the biomass projections from the 2016 stock assessment update.

Table 4. Basis for 2017 summer flounder catch and landings limits. Numbers may not add precisely due to unit conversions and rounding.

Management Specifications	2016		2017		Basis for 2017 Limits
	mil lb.	mt	mil lb.	mt	
OFL	18.06	8,194	16.76	7,600	Stock assessment projections
ABC	16.26	7,375	11.30	5,125	Stock assessment projections/ SSC recommendation
Commercial ACL	9.42	4,275	6.57	2,982	60% of ABC landings portion (per FMP allocation) + 49% of ABC discards portion
Commercial ACT	9.42	4,275	6.57	2,982	Monitoring Committee recommendation: no deduction from ACL for management uncertainty
Commercial Quota	8.12	3,685	5.66	2,567	Commercial ACT, less projected commercial discards
Recreational ACL	6.84	3,100	4.72	2,143	40% of ABC landings portion (per FMP allocation) + 51% of ABC discards portion
Recreational ACT	6.84	3,100	4.72	2,143	Monitoring Committee recommendation; no deduction from ACL for management uncertainty
Recreational Harvest Limit	5.42	2,457	3.77	1,711	Recreational ACT, less projected recreational discards

3.0 Proposed Management Program

Analysis of options is based on an estimate of the 2017 RHL in numbers of fish. Using preliminary 2016 MRIP data to generate an average harvested fish weight of 3.04 lbs, the 2017 RHL of 3.77 million pounds is equivalent to 1,239,286 fish. This value is subject to change as additional 2016 data become available.

Analysis of options is also based on 2016 projected harvest, calculated from MRIP preliminary 2016 harvest data through October, and projected harvest for November–December (Table 3). The results will change between now and when final 2016 recreational harvest information is released in spring 2017. Based on a 2016 coastwide projected harvest of 2,099,410 fish (Table 3), and the estimated 2017 RHL of 1,239,286 fish, a coastwide harvest reduction of 41% is required. This reduction rate is preliminary and will change as 2016 data are updated.

PLEASE NOTE: Each option in the addendum includes an example of state regulations that could be implemented. These are just examples, and are based on preliminary 2016 data. The states and/or Technical Committee would develop the actual regulations for state adoption following the finalization of the addendum, subject to Board approval.

3.1 Default Management Approaches

The Board and Council selected to continue conservation equivalency for summer flounder recreational fishery in 2017 at their Joint Meeting in December 2016. Unless an alternative management approach is selected for implementation via this addendum, management of the 2017 recreational summer flounder fishery will default to state-by-state allocations/regulations based on 1998 harvest in order to restrict harvest to the RHL. Under this scenario, states would implement regulations based on their individual harvest allocations. Table 5 provides the allocations based on the 2017 RHL, and state specific reductions or liberalizations under this scenario based on projected 2016 harvest (subject to change).

Note that under any alternative to coastwide measures implemented by the ASMFC (e.g., state-by-state or regional management), NOAA Fisheries has the authority to supersede state regulations if the combined state regulations are deemed inadequate to restrict coastwide harvest to the RHL. Under this scenario the Monitoring Committee has recommended a set of "precautionary default measures" that would be imposed on any state or region that did not follow the conservation equivalency guidelines (i.e., did not develop measures that achieve the necessary reduction). The Board and Council approved in December 2016 precautionary default measures for 2017 that include a minimum size of 20 inches total length, a possession limit of 2 fish, and a season of July 1–August 31. These measures would be in place for both state and federal waters of the state or region in question. If a state or region does not implement either conservationally equivalent measures or the precautionary default measures, states can be found out of compliance with the Commission's FMP and their fishery could be closed until compliance measures are implemented.

Table 5. 2017 Projected Harvest Liberalizations or Reductions, and Example Regulations under 1998-based State-specific Conservation Equivalent Management in numbers of fish

STATE	2016 Projected Harvest	Preliminary 2017 Allocation of the RHL based on 1998 harvest	Liberalization (+) or Reduction (-) (in Bold)	Example Size Limit	Example Possession Limit	Example Season (# of days)
MA*	56,642	68,161	+20%			
RI	92,821	70,639	**-24%**	18"	4 fish	105
CT	219,371	45,854	**-79%**	21"	2 fish	53
NY	730,807	218,114	**-70%**	21"	2 fish	66
NJ	791,059	484,561	**-39%**	18"	3 fish	81
DE	89,229	38,418	**-57%**	19"	4 fish	365
MD*	23,075	37,179	+61%			
VA*	79,332	206,961	+161%			
NC*	17,074	69,400	+306%			

*For states that could liberalize their 2017 management measures, no example measures have been included at this time. The Board's Summer Flounder Recreational Working Group has recommended that no states liberalize their management measures in 2017 due to the needed reduction.

3.2. Alternative Management Approaches

The following options were developed with the goal of providing more equitable access and less disparate regulations between states than state by state allocations under the Default Management Approaches (Section 3.1). Other approaches were considered and rejected for insufficiently advancing this goal. Because of the all-time low RHL for 2017, there is no option that could be viewed as truly equitable to all.

All options fall under the category of Adaptive Regional Management, and would establish a one-year harvest "target" for each region that deviates from the sum of the 1998-based allocations that would otherwise be attributed to the state(s) in the region by sharing potential harvest across regions.

The options differ in how the 2017 regional harvest targets are developed. Several general differences to note: (1) Options 1–4 still rely in part on the 1998-based allocations for how regional harvest targets are assigned, while Option 5 moves away from the 1998-based allocations in its development of the regional harvest targets. (2) Options 1 and 3 provide the regions with more regulatory flexibility, while Options 2, 4, and 5 are more prescriptive in nature (i.e., they assign specific regulations). (3) Options 1–4 are estimated to achieve a coastwide reduction of 41%, while Option 5 is estimated to achieve an approximate 28–32% coastwide reduction (depending on which possession limit is selected).

The following options are not intended to implement new state allocations and are not intended to set a precedent for new state allocations. Under the alternative management approaches, states would not give up their (1998-based) allocated portion of the RHL, would not be held accountable for

anything other than their allocated portion of the RHL, and would retain the future opportunity (depending on what management approach is adopted for 2018) to continue managing their fisheries in accordance with their allocated portion of the RHL.

Under the alternative management approaches, states within each region would be required to implement the same possession limit(s), size limit(s), and season length. Additionally, states within a region can pursue area or mode specific measures so long as the same option is available and agreed to by all states within the region; for example, Connecticut and New Jersey have allowed for a separate shore-based set of management measures at select sites from 2014-2016 under regional management and New Jersey pursued area specific management measures in the Delaware Bay in 2016. Regions can also deviate from the example size limit measures and implement variations such as a slot limit, provided it uses methodology approved by the Technical Committee (TC) by meeting the required reduction for the region. The TC will evaluate slot limits in early 2017 and report out analysis to the Board at the ASMFC Winter Meeting.

If an alternative management approach is selected, the TC would develop proposed measures for each region according to its regional harvest target that, when combined with other regions, would constrain the coastwide harvest to the RHL. Regions could deviate from the TC proposed measures provided they use the TC-approved methodology to develop regional measures. The Board would review and only approve regional regulations that, when combined, would constrain the coastwide harvest to the RHL.

Please note: Under the following options the 2016 project harvest target and 2017 harvest target is provided in the example tables. These numbers are expected to change as 2016 data is finalized released. The measures included in the following options are <u>examples</u>.

Option 1: Fish Sharing

For each region, the included states' combined 2016 projected harvest is compared to the sum of their 1998-based allocations for 2017 (refer to Table 5). For regions with their combined 2016 projected harvest below their combined 1998-based allocations (MA, DE–VA, NC), the 2016 projected harvest becomes their 2017 harvest target. As such, these regions maintain status quo measures in 2017 to reduce the potential reduction burden of regions whose combined 2016 projected harvests are above their combined 1998-based allocations (RI, CT–NJ). These regions' 2017 harvest targets are the sum of their combined 1998-based allocations plus additional fish from other regions remaining status quo, which are distributed according to the 1998-based allocations proportionally.

Option 1: Fish Sharing

STATE	2016 Projected Harvest	2017 Harvest Target	Reduction (in Bold)	Example Size Limit	Example Possession Limit	Example Season (# of days)
MASSACHUSETTS	56,642	56,642	0%	16"	5 fish	125
RHODE ISLAND	92,821	83,985	**-10%**	18"	4 fish	118
CONNECTICUT NEW YORK NEW JERSEY	1,741,237	889,949	**-49%**	18"	2 fish	59
DELAWARE MARYLAND VIRGINIA	191,636	191,636	0%	16"	4 fish	365
NORTH CAROLINA	17,074	17,074	0%	15"	6 fish	365

Option 2: One-Inch Size Increase as a Minimum Reduction

This option starts by applying a one-inch minimum size increase to all regions, and projecting the regional harvests that would occur in 2017. For regions with their combined 2016 projected harvest below their combined 1998-based allocations for 2017 (MA, DE–VA, NC), the 2017 projected regional harvest (under a one-inch size increase) becomes their 2017 harvest target. Reduction rates for these regions are then calculated. The regions with their combined 2016 projected harvest above their combined 1998-based allocations for 2017 (RI, CT–NJ) are responsible for the rest of the coastwide reduction that is needed to not exceed the 2017 RHL. The remaining reduction is distributed among these regions according to the 1998-based allocations proportionally.

Option 2: One-Inch Size Increase as a Minimum Reduction

STATE	2016 Projected Harvest	2017 Harvest Target	Reduction (in Bold)	Example Size Limit	Example Possession Limit	Example Season (# of days)
MASSACHUSETTS	56,642	39,083	**-31%**	17”	5 fish	125
RHODE ISLAND	92,821	63,118	**-34%**	19”	8 fish	184
CONNECTICUT NEW YORK NEW JERSEY	1,741,237	976,284	**-44%**	19”	3 fish	96
DELAWARE MARYLAND VIRGINIA	191,636	140,087	**-27%**	17”	4 fish	365
NORTH CAROLINA	17,074	12,427	**-26%**	16”	6 fish	365

Option 3: 30% Reduction as a Minimum

This option starts by applying a 30% harvest reduction to all regions' 2016 projected harvest (based on the 30% reduction in the 2017 RHL). For the regions with their combined 2016 projected harvest below their combined 1998-based allocations for 2017 (MA, DE–VA, NC), the 30% reduction establishes their 2017 harvest target. The regions with their combined 2016 projected harvest above their combined 1998-based allocations for 2017 (RI, CT–NJ) are responsible for the rest of the coastwide reduction that is needed to not exceed the 2017 RHL. The remaining reduction is distributed among these regions according to the 1998-based proportions.

Option 3: 30% Reduction as a Minimum

STATE	2016 Projected Harvest	2017 Harvest Target	Reduction (in Bold)	Example Size Limit	Example Possession Limit	Example Season (# of days)
MASSACHUSETTS	56,642	39,649	**-30%**	17"	5 fish	134
RHODE ISLAND	92,821	53,348	**-42%**	18"	4 fish	88
CONNECTICUT NEW YORK NEW JERSEY	1,741,237	995,358	**-43%**	19"	3 fish	99
DELAWARE MARYLAND VIRGINIA	191,636	131,655	**-31%**	17"	3 fish	365
NORTH CAROLINA	17,074	11,952	**-30%**	16	5 fish	350

Option 4: One-inch Size Increase and 30% Reduction as Minimums

This option starts by applying a one-inch size increase to all regions, and projecting the regional harvests that would occur in 2017. For regions with their combined 2016 projected harvest below their combined 1998-based allocations for 2017 (MA, DE–VA, NC), if a one-inch size increase achieves a 30% reduction, the 2017 projected regional harvest becomes their 2017 harvest target. If less than a 30% reduction is achieved, the region must further reduce its harvest target (i.e., tighten regulations) to achieve a 30% reduction. If more than a 30% reduction is achieved, the region may increase its harvest target (i.e., loosen other regulations) to achieve a 30% reduction. The regions with their combined 2016 projected harvest above their combined 1998-based allocations for 2017 (RI, CT–NJ) are responsible for the rest of the coastwide reduction that is needed to not exceed the 2017 RHL. The remaining reduction is distributed among these regions according to the 1998-based proportions.

Option 4: One-Inch Size Increase and 30% Reduction as Minimums

STATE	2016 Projected Harvest	2017 Harvest Target	Reduction (in Bold)	Example Size Limit	Example Possession Limit	Example Season (# of days)
MASSACHUSETTS	56,642	44,684	**-30%**	17”	5 fish	134
RHODE ISLAND	92,821	53,348	**-42%**	19”	4 fish	117
CONNECTICUT NEW YORK NEW JERSEY	1,741,237	987,491	**-43%**	19”	3 fish	99
DELAWARE MARYLAND VIRGINIA	191,636	131,655	**-31%**	17”	3 fish	365
NORTH CAROLINA	17,074	11,952	**-30%**	16”	6 fish	350

Option 5: More Coastwide Consistency

This option applies a near coastwide one-inch size limit increase and bag limit reduction to 4 fish or less. (Note: North Carolina would be exempt as long as the state's harvest remains low because its fishery is confounded by three species of similar flatfish for which consistency in regulations is ideal.) This option moves away from using the 1998-based allocations to set regional targets, based on the concerns listed in Section 2.2 Background (page 3). Additionally, the past three years have shown how variable annual harvest at the coastal (50%), regional (>60%), and state (>100%) level can be despite consistent measures across the years, underscoring the difficulty of using prior year harvest to predict future year harvest. Consequently, there is doubt as to the effectiveness of crafting measures to achieve calculated reduction targets based on prior year harvest. This option thus applies broad action across all states to reduce harvest and provide for more coastwide consistency in regulations. Of particular note, Option 5 is calculated to achieve a 28–32% coastwide reduction (depending on the sub-option), less than the required reduction of 41% that Options 1–4 are designed to address. **NOTE**: Selection of this option could trigger the National Marine Fisheries Service to implement the non-preferred coastwide measures for all state and federal waters because it may not restrain harvest to the 2017 RHL.

Option 5: More Coastwide Consistency

STATE	2016 Projected Harvest	Example Size Limit	Example Possession Limit	Example Season (# of days)
MASSACHUSETTS	56,642	17"	4 fish	125
RHODE ISLAND	92,821	19"	4 fish	245
CONNECTICUT NEW YORK	950,178	19"	3 fish	128
NEW JERSEY*	782,142	19"	3 fish	128
NEW JERSEY/ DELAWARE BAY COLREGS**	8,916	18"	3 fish	
DELAWARE MARYLAND VIRGINIA	191,636	17"	4 fish	365
NORTH CAROLINA	17,074	15"	4 fish	365

*New Jersey east of the COLREGS line at Cape May, NJ will have management measures consistent with the northern region of Connecticut – New York.

**New Jersey west of the COLREGS line at Cape May, NJ inside Delaware Bay will have a similar size limit to the southern region (DE-VA), the same possession limit and the same season length as the northern region of Connecticut – New York.

Management for 2018

If the Board chooses to continue one of the alternative management approaches into 2018, the following outlines the process for setting harvest targets:

The TC will use harvest estimates and fishery performance from 2017 to evaluate the 2018 regional management approach. **If the coastwide RHL is exceeded, then region specific harvest will be evaluated, with the understanding that more restrictive management measures will be needed to constrain regional harvest in 2018**. **If the predicted 2018 combined regional harvest is higher than the 2018 RHL, regions will have to adjust their management measures in 2018.** The TC will develop proposed measures for each region that, when combined, will constrain the coastwide harvest to the 2018 RHL. Any number of size, possession, and season combinations can be evaluated when looking at regional management

3.3 Timeframe for Alternative Management Approaches

Option 1: For 2017 only
The addendum would expire at the end of 2017. After 2017, measures would revert back to the FMP status quo: The Board and Council specify coastwide measures to achieve a coastwide recreational harvest limit or conservation equivalent management measures using guidelines agreed upon by both management authorities in Framework 2 and Addenda XIV and VIII. Under conservation equivalency, states can implement state-by-state measures or adjacent/contiguous states can voluntarily enter into an agreement forming regions. Under either option, the combined measures of all the states or regions need to constrain recreational landings to the coastwide RHL.

Option 2: For 2017 and ability to extend through 2018 (One year extension)
The management program would be in place for 2017. The Board could take action, through a Board vote, to extend the addendum for one year, expiring at the end of 2018. After 2018, measures would revert back to the FMP status quo coastwide/conservation equivalency measures.

4.0 Compliance

Following the February 2017 Board Meeting, states will implement management measures through their state process to cumulatively achieve the needed coastwide reduction for 2017. Once management measures are finalized, the states must notify the Board of their final 2017 management measures by March 1, 2017. If a state or region does not implement management measures to cumulatively achieve across the regions the needed 2017 reduction, that state or region must implement the precautionary default management measures. If a state or region does not implement either sets of measures, that state or group of states may be found out of compliance.

Tables and Figures

Table 6. 2016 Summer Flounder recreational management measures. Color blocking indicates regions

State	Minimum Size (inches)	Possession Limit	Open Season
Massachusetts	16	5 fish	May 22-September 23
Rhode Island	18	8 fish	May 1-December 31
Connecticut	18	5 fish	May 17- September 21
CT Shore Program (46 designed shore sites)	16		
New York	18	5 fish	May 17- September 21
New Jersey*	18	5 fish	May 21- September 25
NJ Shore program (1 designated site)	16	2 fish	
New Jersey/Delaware Bay COLREGS**	17	4 fish	
Delaware	16	4 fish	January 1- December 31
Maryland	16	4 fish	January 1- December 31
PRFC	16	4 fish	January 1- December 31
Virginia	16	4 fish	January 1- December 31
North Carolina	15	6 fish	January 1- December 31

***New Jersey east of the COLREGS line at Cape May has management measures consistent with the northern region of Connecticut – New York.**

****New Jersey west of the COLREGS line at Cape May, NJ inside Delaware Bay has a similar size limit to the southern region (DE-VA), the same possession limit as the southern region (DE-VA), and the same season length as the northern region of Connecticut – New York.**

Table 7. State regulations, 2013–2016. 2013 represents the last year state-by-state regulations applied; regional management applies 2014–2016. Colorblocking indicates regions. Red font indicates change from prior year.

	2013	2014	2015	2016
MA	16" 5 fish May 22-Sep 30	16" 5 fish May 22-Sep 30	16" 5 fish May 22-Sep23*	16" 5 fish May 22-Sep 23 (125 day season)
RI	18" 8 fish May 1-Dec 31	18" 8 fish May 1-Dec 31	18" 8 fish May 1-Dec 31	18" 8 fish May 1-Dec 31 (245 day season)
CT	17.5"** 5 fish May 15-Oct 31	18"** 5 fish May 17-Sep 21	18"** 5 fish May 17-Sep21	18"** 5 fish May 17-Sep21 (128 day season)
NY	19" 4 fish May 1-Sep 29	18" 5 fish May 17-Sep 21	18" 5 fish May 17-Sep21	18" 5 fish May 17-Sep21 (128 day season)
NJ Coast **NJ Delaware Bay**	17.5" 5 fish May 18-Sep16 17.5" 5 fish May 18-Sep16	18"*** 5 fish May 23-Sep 27 18" 5 fish May 23-Sep 27	18"*** 5 fish May 23-Sep 26 18" 5 fish May 23-Sep 26	18"*** 5 fish May 21-Sep 25 (128 day season) 17" 4 fish May 21-Sep 25 (128 day season)
DE	17" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31 (365 day season)
MD	16" 4 fish Mar 28-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31 (365 day season)
VA	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31 (365 day season)
NC	15" 6 fish Jan 1-Dec 31	15" 6 fish Jan 1-Dec 31	15" 6 fish Jan 1-Dec 31	15" 6 fish Jan 1-Dec 31 (365 day season)

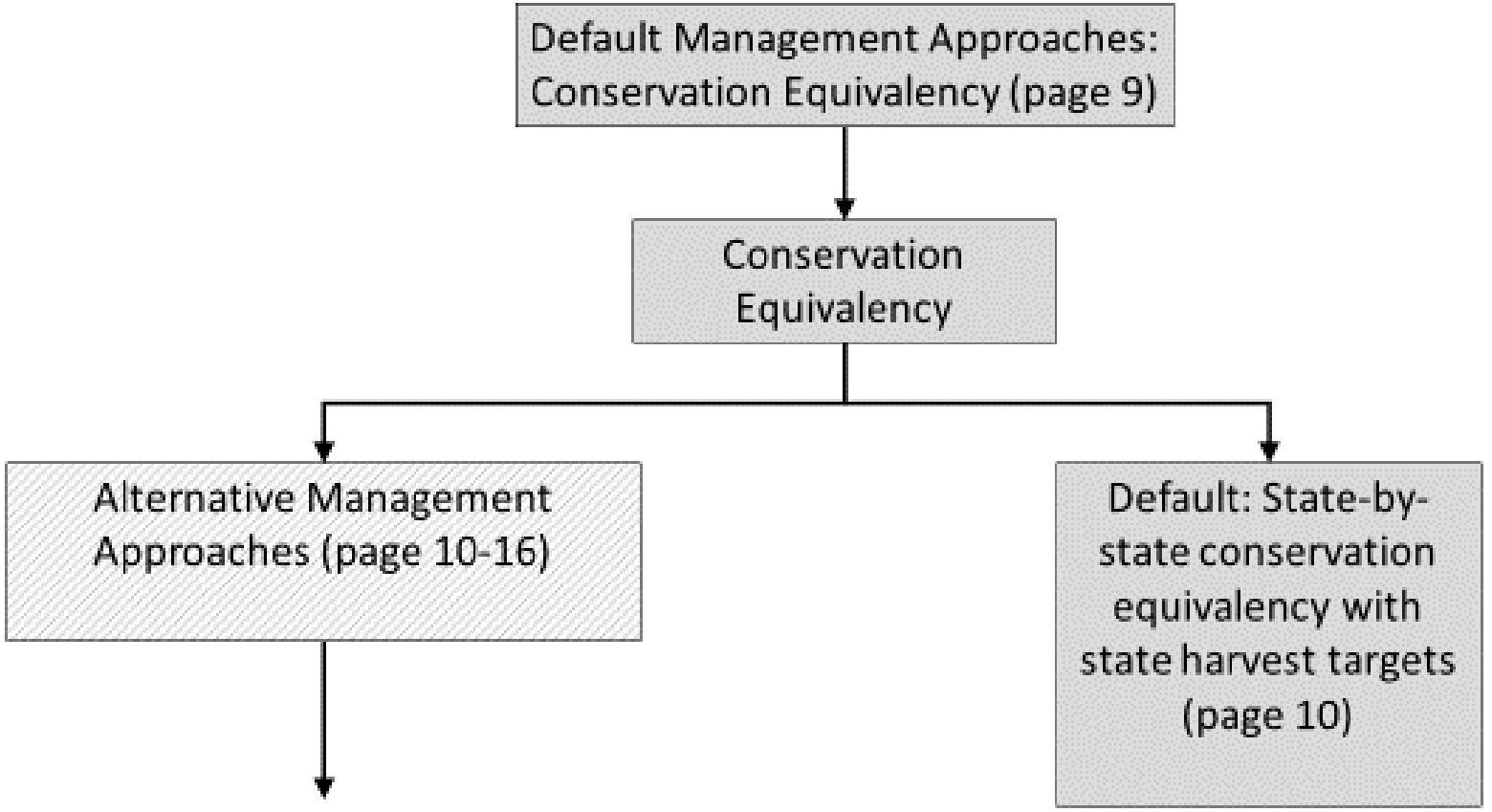
*MA change in season not due to cut, but correction of error from prior year

**CT has 45 designated coastal sites where minimum size is 16" for the 5-fish limit, 2013–2016

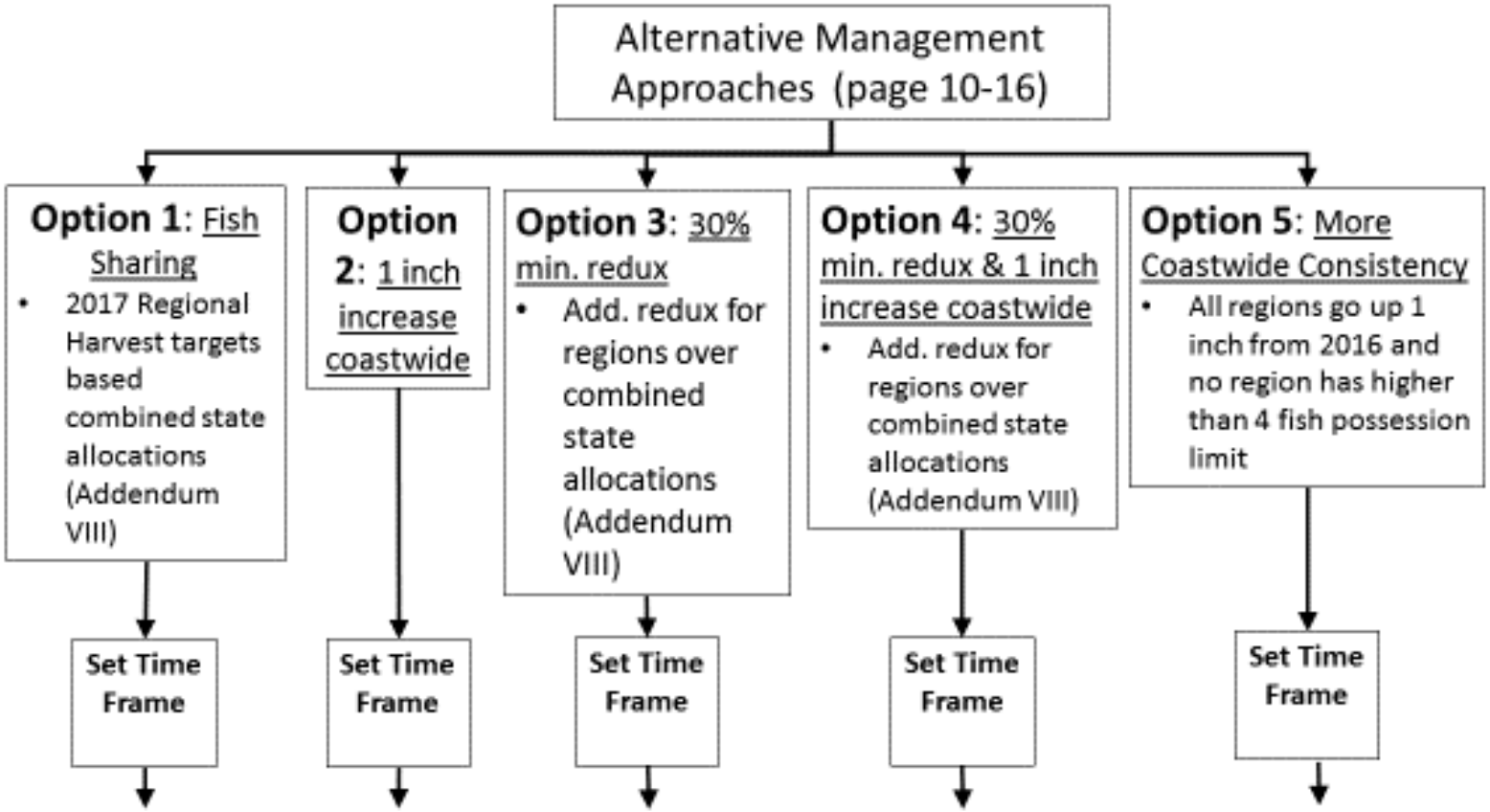
***NJ has 1 designated coastal site where 2 fish at 16" can be taken, 2014–2016 (another 3 at 18" can be taken outside of the designated site)

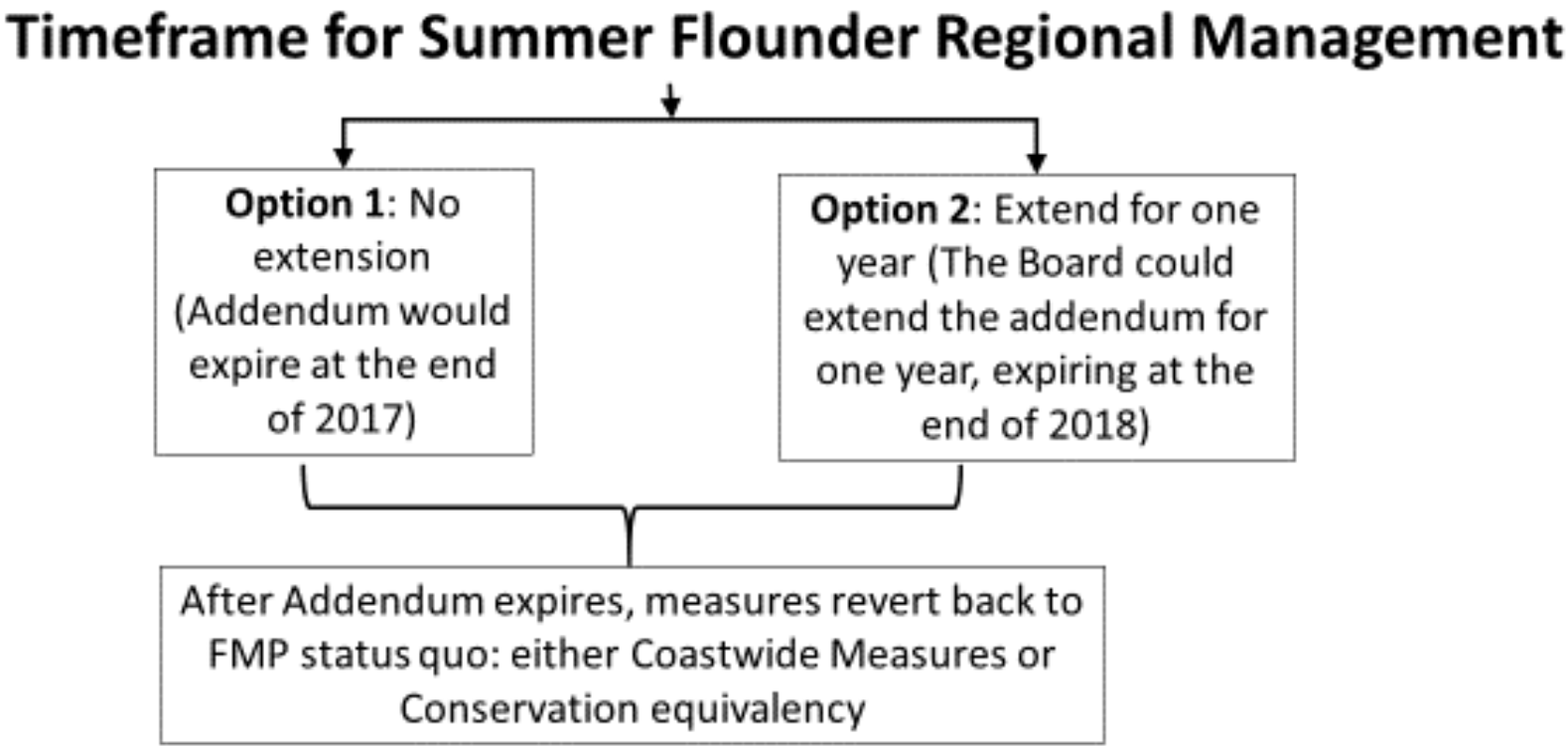
Appendix I

ASMFC Decision Tree for Draft Addendum XXVIII for Summer Flounder Recreational Management



Summer Flounder Alternative Management Options




Timeframe for Summer Flounder Regional Management
Option 1: No extension (Addendum would expire at the end of 2017)
Option 2: Extend for one year (The Board could extend the addendum for one year, expiring at the end of 2018)
After Addendum expires, measures revert back to FMP status quo: either Coastwide Measures or Conservation equivalency

Atlantic States Marine Fisheries Commission

Atlantic Striped Bass Management Board

February 2, 2017
10:00 – 11:45 a.m.
Alexandria, Virginia

Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order (*J. Gilmore*) 10:00 a.m.

2. Board Consent 10:00 a.m.
   - Approval of Agenda
   - Approval of Proceedings from October 2016

3. Public Comment 10:05 a.m.

4. Review Technical Committee Report (*N. Lengyel*) 10:15 a.m.
   - Review of Projected Fishing Mortality and Recommended Data Sets for Conservation Equivalency Proposals

5. Review and Consider Approval of 2018 Atlantic Striped Bass Benchmark Stock Assessment Terms of Reference (*K. Drew*) **Action** 11:15 a.m.

6. Review and Populate the Atlantic Striped Bass Stock Assessment Subcommittee Membership (*M. Appelman*) **Action** 11:35 a.m.

7. Other Business/Adjourn 11:45 a.m.

The meeting will be held at the Westin Alexandria; 400 Courthouse Square, Alexandria, Virginia 22314; 703.253.8600

MEETING OVERVIEW

Atlantic Striped Bass Management Board Meeting
February 2, 2017
10:00 – 11:45 a.m.
Alexandria, Virginia

Chair: Jim Gilmore (NY) Assumed Chairmanship: 02/16	Technical Committee Chair: Nicole Lengyel (RI)	Law Enforcement Committee Rep: Kurt Blanchard (RI)
Vice Chair: Russ Allan (NJ)	Advisory Panel Chair: Louis Bassano (NJ)	Previous Board Meeting: October 24, 2016
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, NMFS, USFWS (16 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2016

3. Public Comment – At the beginning of the meeting, public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance, the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Review Technical Committee Report (10:15 a.m. – 11:15 a.m.)

Background

- In October 2016, the Atlantic Striped Bass Board tasked the Technical Committee to 1) determine the percent liberalization in harvest that would increase fishing mortality (F) from the 2015 terminal year estimate of 0.16 to the FMP target F of 0.18, and 2) to recommend a preferred dataset using updated length-frequency data for states to use when preparing conservation equivalency proposals for recreational regulations.
- The Technical Committee prepared a report to address these tasks (**Briefing Materials**).

Presentations

- Technical Committee Report by N. Lengyel

5. Consider 2018 Benchmark Stock Assessment Terms of Reference (11:15 a.m. – 11:35 a.m.) Action

Background

- The Technical Committee drafted terms of reference for the upcoming benchmark stock assessment for review by the Atlantic Striped Bass Board (**Briefing Materials**).
- The Technical Committee will also review the benchmark assessment timeline.

Presentations • Review stock assessment terms of reference by K. Drew
Board Actions for Consideration • Approve stock assessment terms of reference

6. Review and Populate Stock Assessment Subcommittee Membership (11:35 a.m. – 11:45 a.m.) Action
Background • The next benchmark assessment for Atlantic striped bass is scheduled for review in 2018 • The Stock Assessment Subcommittee is repopulated prior to a benchmark assessment (**briefing materials**).
Presentations • Stock Assessment Subcommittee membership by M. Appelman
Board Actions for Consideration • Approve Stock Assessment Subcommittee membership

7. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC STRIPED BASS MANAGEMENT

The Harborside Hotel
Bar Harbor, Maine
October 24, 2016

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INDEX OF MOTIONS

ATTENDANCE

Board Members

Terry Stockwell, ME, proxy for P. Keliher (AA)
G. Ritchie White, NH (GA)
Doug Grout, NH (AA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Bill Adler, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Mike Armstrong, MA, proxy for D. Pierce (AA)
David Borden, RI (GA)
Mark Gibson, RI, proxy for J. Coit (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Matthew Gates, CT, proxy for D. Simpson (AA)
Lance Stewart, CT (GA)
James Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
John McMurray, NY, proxy for Sen. Boyle (LA)
Russ Allen, NJ, proxy for D. Chanda (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Andrew Shiels, PA, proxy for J. Arway (AA)
Loren Lustig, PA (GA)
John Clark, PA, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Mike Luisi, MD, proxy for D. Blazer (AA)
Rachel Dean, MD (GA)
Kyle Schick, VA, proxy for Sen. Stuart (LA)
Cathy Davenport, VA (GA)
Rob O'Reilly, VA, proxy for John Bull (AA)
David Bush, NC proxy for Rep. Steinburg (LA)
Chris Batsavage, NC, proxy for B. Davis (AA)
Doug Brady, NC (GA)
Martin Gary, PRFC
Derek Orner, NMFS
Wilson Laney, USFWS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Nicole Lengyel, Technical Committee Chair

Staff

Robert Beal
Toni Kerns
Katie Drew
Max Appelman
Amy Hirrlinger

Guests

Chris Wright, NMFS
Kim McKown, NYSDEC
Kevin Sullivan, NH F & G
Scott Olszewski, RI DEM
Jason McNamee, RI DEM
Jack Travelstead, CCA
David Blazer, MD DNR
Bill Goldsborough, CBF
Doug Christel, MA F & G
Joseph Gordon, PEW Trusts
Robert T. Brown, MD Watermen Assn.
Victoria M. Brown, MD Watermen Assn.
Phil Langley, MD Charterboat Assn.

The Atlantic Striped Bass Management Board of the Atlantic States Marine Fisheries Commission convened in the Stotesbury Grand Ballroom of the Bar Harbor Club, Harborside Hotel, Bar Harbor, Maine, October 24, 2016, and was called to order at 3:01 o'clock p.m. by Chairman James J. Gilmore.

CALL TO ORDER

CHAIRMAN JAMES J. GILMORE: Welcome. I'm calling the meeting to order, my name is Jim Gilmore; I'm the Administrative Commissioner from New York, and I'll be chairing the meeting today. Let's get right into it so we can get through the procedure stuff.

APPROVAL OF AGENDA

CHAIRMAN GILMORE: First, approval of the agenda, everyone got one in their briefing documents. Does anybody have any changes to the agenda? Seeing none; we'll adopt those by consensus.

APPROVAL OF PROCEEDINGS

CHAIRMAN GILMORE: Secondly, we have approval for the proceedings from August of 2016. Are there any changes to those proceedings? Seeing none; we will adopt those.

PUBLIC COMMENT

CHAIRMAN GILMORE: Before every meeting we have a session for public comment for things that are not on the agenda from our signup sheet. I have one individual who wants to make a comment prior to the full agenda, and that is Phil Langley; Mr. Langley, if you want to come up to the public microphone and make your comments, but please, keep them short.

MR. PHIL LANGLEY: Good afternoon. Before I get started, this is my first trip to Maine. I don't know what I've been missing. What a beautiful state for the people who live here in the state of Maine. Thank you for hosting this. My name is Phil Langley; I am president of Maryland Charterboat Association.

I sit on the Potomac River Fisheries Commission and the Maryland Sportfish Advisory Commission. I would like to thank you, Mr. Chair, and the board, for the opportunity to speak here this afternoon. I would like to commend you for the passion and dedication that you show in protecting our natural resources.

Addendum IV was implemented in 2015, to protect the existing spawning stocks and to ensure healthy spawning stocks in the future. Prior to 2015, most of the Chesapeake Bay summer harvest was primarily on ages 3, 4 and 5 fish. At Age 5, a large number of fish leave the Bay and enter the coastal migration.

To comply with Addendum IV reductions, the Bay states increased the minimum size from 18 to 20 inches in the summer fishery, for recreational and charter anglers. This removed Age 3 and part of Age 4 fish from the Bay fishery and left only part of Age 4 and part of Age 5 to target. With a strong 2011 year class, we saw an abundance of fish. However, most were 16 to 19.75 inches, below the legal harvest size. Most captains I've spoken with were experiencing a 20 to 1 ratio of undersized fish versus kept fish. With an assumed 9 percent mortality, this is 1.8 fish lost for each legal fish harvested. This would indicate that the charter-recreational fishery is being squeezed into part of Year 4 and part of Year 5 fish. I know the decisions made here are tough, and the results affect the livelihoods of many in all of our states. However, each species of fish affect our states differently. Striped bass to Maryland is like what lobster is to Maine.

It is a species that has an enormous impact on the Chesapeake Bay fishery. Unlike most coastal states, the Bay is limited on availability of species it has to target. With the large 2011 year class now entering the coastal migration, I hope we have accomplished the goals set forth by Addendum IV, and that the science supports that adjustment can be made to reduce the number of discards; while also lessening the economic burden experienced by the Bay states. Thank you very much for your time.

CHAIRMAN GILMORE: Thank you, Mr. Langley. Yes sir, you have a comment? Could you please state your name and affiliation?

MR. ROBERT T. BROWN: Robert T. Brown; President

of the Maryland Watermen's Association. Thank you for allowing me to speak today about rockfish mortality rates on the Chesapeake Bay and our charterboat and recreational fisheries. Changing a size limit causes an effect on the fishery that is unforeseeable at the time of implementation; by mortality rates and by handling the fish, making them more susceptible to disease and death.

For example, you would have to catch from 50 to 200 fish to catch one legal size fish in the chumming in the upper Bay. It would be far better for the fish to catch 50 fish and keep two. To me, the 20.5 reduction in the Chesapeake Bay, we were trying to be politically correct instead of a common sense approach to fish and management.

Mother Nature, on its own, limits the upper size of the fish during the migration of the spawning stock, because 95 percent of the fish 24 inches and greater migrate out of the Chesapeake Bay back to the ocean. This shortens the window of harvestable size fish 20 inches to 24 inches, a four inch window that we pretty much have.

This has caused economic hardship on our charterboat fisheries as they cannot catch their two fish per person limit during the regular season. These charterboat parties are not satisfied. Just in the last several weeks in the Tillman Island area, 12 charterboats have been surveyed for sale. Three have been sold last week.

This is putting our charterboat fishery out of business and has affected many of the families and businesses in that area. In addition, the youth of today, our future fishermen and women of tomorrow, are being disappointed, because they cannot keep the fish they catch due to the minimum size limit. I would ask the Technical Committee to strive to do additional research on this matter, as we are fishing on a recovered fishery, and our spawning stock biomass is not in jeopardy. Thank you.

TECHNICAL COMMITTEE REPORT: PERFORMANCE EVALUATION OF ADDENDUM IV

MR. GILMORE: Seeing no other public comments, we'll move right into the review of the Technical Committee Report, the Performance Evaluation of Addendum IV. Nicole Lengyel is going to give us an update. She is the new TC Chair.

MS. NICOLE LENGYEL: Good afternoon, everyone. My name is Nicole Lengyel; I work for Rhode Island DEM, Marine Fisheries Section. Today I'll be presenting a performance evaluation of Addendum IV, and regulatory measures in 2015. I'll start off by going through some Addendum IV background, just to refresh everyone's memory a little bit.

Then I'll jump right into the performance evaluation, present the results of that evaluation, and put them into context for you in the discussion. The 2013 benchmark stock assessment for striped bass showed that although the stock was not overfished and overfishing was not occurring, fishing mortality was above the target; and spawning stock biomass was below the spawning stock biomass target, which ultimately triggered management action.

This management action resulted in Addendum IV, which was approved by the board in October of 2014, with the goal of bringing F back down to the target level in 2016. This required states to implement management measures that would achieve at least a 25 percent reduction from 2013 harvest levels for ocean fisheries and a 20.5 percent reduction in harvest from 2012 levels for the Chesapeake Bay fisheries.

Addendum IV regulatory changes were implemented prior to the 2015 season. For the commercial fishery, this meant a 25 percent reduction to Amendment 6 quota allocations for the ocean fisheries. In the Chesapeake Bay the commercial quota was set at 20.5 percent less than that harvested from the Bay in 2012.

For the recreational fishery, the ocean fisheries implemented a one fish bag limit, with a minimum size of 28 inches. The Chesapeake Bay recreational fisheries implemented a suite of management options that were projected to achieve the F target. States could also implement alternative measures through the Conservation Equivalency Process.

Our preliminary analysis on the performance of Addendum IV was presented to the board in August by the Plan Review Team. They compared the 2015 harvest to the appropriate reference period and found that in the ocean fishery, although the estimated change in harvest was 29.7 percent, the actual change was a reduction of 41 percent.

In the Chesapeake Bay the estimated change was 22.1 percent, and the actual change in harvest was an increase of 53.4 percent. This prompted the board to direct the TC to investigate a little bit further and consider some of the variables that could be contributing to the discrepancies between the predicted and the observed harvest.

The Technical Committee looked at several factors; changes in size and age structure of available fish, changes in effort, and changes in the proportion of fish released alive versus total catch. Looking first at the commercial fishery for the ocean, the top table, the estimated reduction from the 2013 quota was 25 percent. The actual reduction from the 2013 quota from 2015 harvest was 50 percent. The actual reduction from 2013 harvest was 24.9 percent.

As you remember, in Addendum IV it required states to take a 25 percent reduction from the 2013 quota, not the harvest. The actual reduction of 50 percent was greater than that which was estimated due to the fact that states under harvested their commercial quota. In the Chesapeake Bay commercial fishery, the estimated reduction harvest was 20.5 percent. The actual harvest was 25.1 percent. Due to the fact that both the ocean fishery and the Chesapeake Bay fishery met the required reductions for the commercial fishery, no further analysis was conducted by the Technical Committee. Looking at recreational harvest, in the ocean fishery we estimated a 29.6 reduction. The actual change was 47 percent. In the Chesapeake Bay we calculated a 22.1 percent reduction, with the actual change being an increase of 58.4 percent.

Looking again at harvest, here we have the ocean and Chesapeake Bay recreational harvest and recreational release mortality. Here release mortality or discards is 9 percent of total releases. In the ocean fishery you can see that both harvest and dead releases decreased. In the Chesapeake Bay both harvest and dead releases increased.

The first variable that the Technical Committee looked at was size and age structure of the catch. There are two graphs here. In both these graphs you have age on the X axis, and you have proportion of the catch on the Y axis; 2015 is the red line, and then the reference year is in the blue. For both the Chesapeake Bay and the ocean fishery, you can see that Age 4 fish comprise a larger proportion of the catch than in the reference year.

Again, looking at size and age structure of the catch, this one is a little bit more complicated. For all these graphs, the X axis is fork length in inches. You have number of fish in the top two graphs, proportion of fish in the lower two graphs. Again, you have 2015 as the red line, with the reference year in blue.

You have the ocean fishery as the left two graphs, and the Bay on the right. What you want to look at is, first in the ocean fishery, and I'm going to use my pointer on this one right here. You can see that 2015 overall number of fish is decreased compared to the reference year for nearly all lengths.

Again, looking at the bottom for proportion of fish, you can see there is a slight increase in 2015 for 22 inch to 25 inch fish. This is possibly reflecting the beginning of the coastal migration of the 2011 year class. Looking on the other side of the graphs here, we have the Bay. Again, you can see that the number of fish generally increased in the 18 to 30 inch size range for the Chesapeake Bay, and that there was a shift to 20 inch fish in 2015; compared to the 18 to 19 inch in 2012.

We then looked at change in harvest patterns by wave and by mode for each state, but we saw no consistent pattern. Some states saw increases; some saw decreases, in certain waves, certain modes. The next variable we looked at were changes in effort. In the ocean fishery and the Chesapeake Bay, I'm looking at the total change in trips. These are all recreational trips in 2015 compared to the reference year.

Both fisheries experienced a decrease of 13 percent. When we look at just directed trips, where striped bass was the primary or secondary target, there was a decrease of 27 percent in the ocean fishery, and an increase of 50 percent in the Chesapeake Bay. All states in the ocean fishery had a reduced number of directed trips, with the exception of New Jersey, who had a very slight increase of 2 percent.

Again, when we looked at effort by wave and mode for each state, there was no consistent pattern. Now looking at the last variable, released alive versus total catch, here we have percent of total catch released alive in the ocean and Chesapeake Bay in 2015, compared to the reference year, both the ocean and Chesapeake Bay saw an increase in the percent of total catch released alive. This is indicating that the regulations are working, and that anglers are releasing more fish alive. Every state in the ocean and Chesapeake Bay experienced an increase in the percentage of striped bass released alive versus total catch in 2015; compared to the reference year, with the exception of Maryland, who had a very small decrease of 1 percent.

Maine, Massachusetts, Connecticut, New Jersey and North Carolina in the ocean experienced a change of less than 10 percent. For the remaining states, the percentage of total catch harvested decreased more than the percentage released. Again, indicating that anglers were releasing more fish alive.

To put this into context, again, the goal of this performance evaluation was to identify the variables that could be contributing to the differences seen in 2015 removals, compared to those that were originally estimated by the Technical Committee. We saw that the ocean recreational fishery had a larger reduction than was originally estimated by the Technical Committee. The Chesapeake Bay recreational fishery saw an increase in harvest when a decrease was expected.

We all know that size and bag limit analyses assume that effort, angler behavior, catch-per-unit-effort and the size composition and distribution of fish available to anglers, will be the same in the future. Any violation of these assumptions can lead to reductions different than those originally estimated. The TC found that the most significant variables contributing to the differences and realized harvest versus that estimated, were effort and the availability of the 2011 year class.

In regard to effort, striped bass targeted trips decreased by 27 percent in the ocean fishery, whereas, they increased in the Bay fishery. For the 2011 year class, the year class was nearly fully recruited to the Bay fishery in 2015, and the length of the 2011 year class coincided with the Bay's legal size limits.

Overall, the TC concluded that Addendum IV measures are working, and the harvest in the coastal fishery was reduced by the necessary amount. Although harvest in the Bay increased, given the availability of the 2011 year class and the increased striped bass targeting, the management measures likely did reduce harvest from what could have been taken under previous regulations. With that, I'll take any questions.

CHAIRMAN GILMORE: Do we have questions for Nicole? Rob O'Reilly.

MR. ROB O'REILLY: I wonder if the Technical Committee talked about the mismatch on the recreational fishery in terms of the years in question. In particular, we had an 8.5 hour meeting before we made this addendum active. At the time the main thought was there had been a 14 percent reduction in the Bay, and that was the reason for not choosing 2013.

But clearly, the recreational fishery was not impacted like the commercial fishery from that 14 percent reduction. In other words, no jurisdiction changed its size, its season or its possession limit. It is merely that we were under Bay wide quota from 1997 through 2013. The recreational fishery was part of that. As it turns out, the commercial fishery, I think what I saw that you presented was a little over 25 percent reduction; for the recreational fishery, a 54 percent increase; that was harvest of course. But I think if you look at 2013 and compare that to what the coast had for 2013 as well, it is about a 10

percent reduction rather than an increase. I wondered if the Technical Committee had talked about that.

MS. LENGYEL: It was noted by members of the Technical Committee that there would have been a difference had we looked at 2013 compared to 2012. You are correct that when we were developing Addendum IV, 2013 was used for the coastal fishery, but as you said, because the Chesapeake Bay had already taken a 14 percent reduction to their commercial quota in 2013, they requested to use 2012 as a reference year; and that was approved by the board. Because Addendum IV stipulates that 2012 is the reference year for the Chesapeake Bay, the Technical Committee did not analyze that year. But it was noted by some members.

MR. JOHN G. McMURRAY: One of the things that struck me, and I hadn't read this in the briefing material, but the commercial harvest or the commercial, I can't remember if it was harvest or effort, but it decreased by 50 percent or somewhere around 50 percent. Whereas, in the Bay specific, recreational effort increased 50 percent, and I'm wondering if the Tech Committee noted that and if there was any discussion on maybe that had to do with availability.

MS. LENGYEL: I believe for the commercial fishery, yes it did. There was a reduction that was off the total quota, so that was managed by the quota. In the recreational fishery, there was an increase, and that was most likely due to effort in the 2011 year class. Does that answer your question?

MR. McMURRAY: Yes, I guess it does, but I'm still not quite sure on the commercial side of things. They under fished by 50 percent, right? Did I understand that correctly?

MS. LENGYEL: No. That was the coastal fishery, not the Chesapeake Bay. The coastal fishery had to take a 25 percent reduction to Amendment 6 quotas. Ultimately, it ended up coming out to 50 percent, due to the fact that they under harvested.

MR. McMURRAY: Yes, I understand that. But I'm wondering if there was a discussion that maybe had to do with availability. I mean, the quotas are the quotas. You would think the states would meet them.

MS. LENGYEL: The Technical Committee did not discuss that. The past few years it has been consistent that they have under harvested. They under harvested in 2013, as well.

MR. MICHAEL LUISI: Thank you for your presentation, Nicole. I want to just be clear. I read in the report, and it wasn't part of the presentation. I would like to get your interpretation of performance and how that relates to success. Adding to what Rob O'Reilly had mentioned already, when you compare the 2015 catch in the Chesapeake Bay with the 2012 estimate of effort and catch; the 2012 estimate was the lowest in a 20 year time series for that comparison.

When we see numbers, an increase in harvest of 58.4 percent in the Chesapeake Bay, it kind of leads I think, board members to believe that Maryland and Virginia, Potomac River may not have contri1buted to the successful management. I stress the word success. Now, I do understand that success in my mind is understood through an evaluation of fishing mortality; which we're going to get to at some point here later this afternoon. Did the Technical Committee intentionally not make any comments regarding this performance being a basis for success?

CHAIRMAN GILMORE: Mike, I think you're right. Katie is going to do a presentation on the stock assessment. That might be a better question for her after we present that. Why don't you hold that question for a little bit? Adam Nowalsky.

MR. ADAM NOWALSKY: What were the PSEs associated with the recreational harvest estimates in the Chesapeake Bay for the years that generated this reduction, and were they substantially different from PSEs from years earlier in a time series?

MS. LENGYEL: Unfortunately, we do not have the PSE estimates in front of us at this time.

CHAIRMAN GILMORE: I think that is an "I don't know." Ritchie.

MR. G. RITCHIE WHITE: If the coastal recreational sector had just had a 25 percent reduction, would then the overall reduction have missed the target for the addendum?

MS. LENGYEL: As far as this evaluation, the Technical Committee was not evaluating whether the target of the addendum was met. It was very specific for us to just be evaluating what variables could have contributed to the differences seen between the harvest and estimated estimates. We can definitely discuss that as we get into the assessment update, but as far as this evaluation, we were just looking at the variables.

MR. MARTIN GARY: I was trying to recall the last summary slide, and I was wondering Nicole if you could go back to that for the summary for the recreational fisheries there was a paragraph that characterized the likelihood, I think, was the key word I was trying to hone in on. While you're pulling that up, I guess I'll go ahead and mention my thought is that the recreational delta increase for the Chesapeake Bay recreational fisheries was driven per your information in previous slide, by the B2s.

Is that really saying the measures likely reduced harvest from what could have been taken under the previous regulations? Is the inference there that if we hadn't changed, it's sort of a wash? I mean we may have, we likely have, we don't know by how much. Because you heard Mr. Langley and Mr. Brown and Mr. Luisi from Maryland talk a little bit about what we had to go through in the Chesapeake Bay jurisdictions. I am just trying to characterize that last bullet you have there. Again, going back to maybe the term Mr. Luisi used success. What did we achieve?

MS. LENGYEL: In terms of the last bullet on the slide that is currently up, what we were trying to say in this case, is because Maryland and the Chesapeake Bay did in fact change their management measures in 2015, although they had an increase in harvest and dead releases. Had they not changed those management measures and had the minimum size still been the 18 inches as opposed to the 20 inches, there could have been an even greater increase in harvest and dead releases.

CHAIRMAN GILMORE: Go ahead, Mike.

MR. LUISI: Thanks for a second opportunity to just provide a comment leading off of what Mr. Gary just mentioned. You know, I wanted to thank the Technical Committee for making sure to stress the point that the emergence of the 2011 year class was kind of a game changer. We were at the point when we were implementing these new measures, where we were seeing just an enormous biomass growth in the Bay, to the point where it was exploitable. I have no doubt in my mind, as I know the Technical Committee evaluated whether or not harvest reductions happened, by increasing our minimum size. I just want to read, just to strengthen the comment of the last bullet that's on the screen right there.

The actual written report that we have in our briefing materials speaks to the emergence of the 2011 year class. It reads that "the harvest in the Bay in 2015 was undoubtedly lower than it would have been, had regulations remained status quo." I just wanted to make that comment, because I believe it strengthens what was reported as kind of a likely reduction.

CHAIRMAN GILMORE: Seeing no other questions; we're going to move on to the Striped Bass Assessment Update. Sorry Doug, I missed Doug. What a faux pas. Am I fired?

MR. DOUGLAS E. GROUT: I just wanted one more clarification from the TC Chair. When you were doing your analysis to determine what was going to be needed to reduce the harvest by 25 percent. You didn't take into the consideration the fact that strong year classes were going to grow into different minimum sizes, or did you take that into consideration in your original analysis prior to the approval?

MS. LENGYEL: You are correct. That original analysis did not account for several things, effort and change

in size composition of the catch.

CHAIRMAN GILMORE: Any other questions before we move on? Thanks Tina, these guys look like they are in the witness protection program over here on the left side of the table; so that's a big help.

REVIEW THE 2016 ATLANTIC STRIPED BASS STOCK ASSESSMENT

CHAIRMAN GILMORE: Let's go move on to the Assessment Update, and Katie is going to do a presentation for that.

DR. KATIE DREW: Unfortunately, Gary Nelson couldn't be here today, because he came down sick; so I will be giving the 2016 Stock Assessment Update results for Atlantic striped bass. I'm just going to start out by going over the catch data; some of the data that were used in the assessment starting out with the catch data.

We're using MRIP estimates of harvest for the recreational catch, as well as for the amount of fish that are dead releases or die due to being released; for basically all the states from Maine down through North Carolina, but with North Carolina, of course, we're only using the ocean removals not the Albemarle Sound area removals.

For Virginia, Wave 1 estimates of harvest are included, but they have to be estimated, because MRIP is not doing dockside sampling in Virginia north during Wave 1. We use reported commercial harvest from the states that are harvesting, as well as, again, North Carolina, the ocean only removals.

We estimate commercial dead discards from tagging and MRIP data. We acknowledge that there are some missing catch data in this assessment. Catch from the major rivers like the Hudson River and the Delaware River, where MRIP does not cover that recreational, basically freshwater portion. We know there is catch harvest happening there that we're not capturing, as well as unreported catch like poaching and under reporting that we also know is going on; but we don't have a good handle on. These are total coastwide landings split commercially and recreationally. For the time series, you can see the beginning of the recreational time series in 1982 and the beginning of the commercial time series back in the late 1940s. Recreational harvest has really grown quite a bit; whereas, commercial harvest has mostly stayed steady over the last 20 years or so, due to the use of a commercial quota system to control commercial harvest.

If we look at the coastwide removals broken down into commercial harvest and discards in the dashed lines, and recreational harvest and discards in the solid lines, you can see that they are relatively similar commercial. The recreational dead releases are really what have shown a significant drop in recent years, although it has stabilized a bit.

In 2015, the recreational harvest made up about 45 percent of the total removals, recreational discards or the release mortality made up about 25 percent of total removals. Commercial harvest was 20 percent, and the commercial discards were about 10 percent. Overall, all of these sources of removals accounted for about a 27 percent decline in 2015 compared to 2014.

The model uses three separate fleets to account for some of the spatial dynamics of striped bass in their fisheries. We have here a commercial dead discard fleet, an ocean fleet that includes harvest from Delaware and New York River areas, as well as a Chesapeake Bay fleet. You can see that the Bay and the ocean about equally split, making up approximately 45 percent of total removals, and the commercial discards account for the last 10 percent.

If we look at total catch composition by age, you can really see the emergence of that strong 2011 year class, which is the solid black bar on the right hand side of these graphs. It starts showing up in 2012 when they would be one year olds, and then moving more and more into the catch, and making up more and more of that catch.

Compared to some of the earlier strong year classes in 2001 and 2003, which you can see have basically moved their way almost out of the fishery at this point. It is really the lack of the strong year classes

coming through that has caused part of the decline in SSB that we're seeing. If we just look at the overall catch-at-age composition, these graphs are probably kind of hard to see.

But I think the important part for these three graphs is really the expansion of the age classes that we've seen through the recovery of this stock; that in the early part of the time series at the front of the graph, you are catching only a very narrow age range. But even in the Chesapeake Bay, which is dominated by those younger ages, you're still seeing an expansion of the age classes that are present in the fishery in the most recent years.

The same thing for the ocean catch, as well as more buildup in the plus group and the commercial discards; all of which are signs of a recovered population. I'm going to go over some of the index data that we use to tune the model. The distribution of the indices, you can see we've got a number of different indices.

Young-of-year are indicated in pink, and sort of light aqua is the Age 2 plus or the older fish. We updated all of these indices with the most recent years of data. The New York young-of-year index has changed. If you will recall, they had to petition to change their young-of-year index due to funding and personnel consideration; so that the way that it is calculated now is slightly different. Here are the adult indices or the Age 2 plus indices of abundance, with fishery dependent indices, the MRIP CPUE, and the Virginia pound net on the left, and the fishery independent indices on the right; which for the most part do show a consistent decline in the most recent years. Here are your recruitment indices, so these are young-of-year and Age 1 indices. You can see the strong 2011 year class in here, as well as the New York and New Jersey areas saw a strong 2014 signal for that region's young-of-year signal.

I'm just going to go over a brief description of the model that we use. It's a forward projecting statistical catch-at-age model, which is estimating recruitment every year as well as fully recruited fishing mortality for these three different fleets, as well as catch selectivity. The shape of the selectivity curve for the different fleets for different regulatory periods, with the implementation of new regulations in 2015, we likely would expect the selectivity of these fisheries to change.

Unfortunately, the model didn't really have enough data to estimate that so there was almost no difference in the results, including 2015 as a separate selectivity period compared to lumping it in with the earlier selectivity period. That may change as we move forward under the new regulations and add more years of data.

We also estimate the catchability coefficients and the selectivity for the indices. Again, the data are split into three fleets based on region with the Chesapeake Bay, the coast or the ocean fishery, and the commercial discards. We can't really separate the commercial discards into ocean versus Bay because of the way they're estimated and the data that go into that.

They have to kind of be their own separate fleet. This improves the estimates of selectivity, because they are working on different sections of the population and allow us to provide sort of a partial F for how much that fleet is contributing to the total fishing mortality. We do use age specific natural mortality. This was one of the changes in the most recent benchmark, so that Age 1 has the highest natural mortality down to Age 7 plus, which has the lowest.

This is the estimate of total fully recruited fishing mortality over time. You can see the 2015 value is where the Bay was at 0.06, the ocean was at 0.12, and the commercial discard was 0.01. Basically, all fleets saw a decrease in fishing mortality in 2015 compared to 2014. This is the plot of recruitment, where you can see our lowest subpar recruitment years from about the mid-2000s.

With the stronger 2011 year class and potentially a stronger 2014 year class, although there is not really enough data to let the model have a good handle on what recruitment really was in this most recent year. Here are the estimates of Age 1 plus abundance and Age 8 plus abundance. Again, you see that uptick from the 2014 year class potentially at the end there,

but total abundance of the older spawning stock continues to decline.

There is a tiny bit of the projection going forward that suggests we may see a little bit more abundance in the younger year classes, but again, not much of a change in abundance in the 8 plus. This is total female spawning stock biomass, with the threshold there on the graph; so we are just about at the threshold. Although the decline has been slower than in some of the initial projections suggested from the earlier models, it still continues.

This is female spawning stock numbers, so total number of fish rather than biomass of fish; and you can see this has declined faster than the total biomass. The decline in biomass is being slowed somewhat by the growth of the females that are surviving, but the total number of females is dropping faster.

If we look at the retrospective analysis, we can see that there is a slight positive retrospective pattern where we are overestimating F and underestimating SSB. The more interesting thing about it is recently, these patterns have really tightened up, so that these most recent couple of years is a lot closer together than they are to the past and that the past were to each other.

Potentially, this pattern is improving to a certain extent that we're getting tighter and closer together, maybe the data are better, maybe there is something that we've managed to handle with the modeling that is making the model perform better. It is hard to say exactly, but the most recent years are showing a much less bias than later years.

In terms of status of the stock, the SSB is above the threshold, at least the point estimate is. There is about a 40 percent chance, due to the uncertainty in these estimates that it is below the threshold. But the point estimate is above the threshold, meaning the stock is not overfished. It is still below the target.

In terms of F, the F is below both the target and the threshold, indicating overfishing is not occurring and the Addendum IV measures worked. We are below the target for F. The solid line is the trajectory from this assessment; the dotted line is on the screen, but you really can't see it, which is the trajectory from the 2015 assessment update. They are virtually identical.

We also did a set of projections looking at constant catch. Number 1, if we maintain this level of catch that we saw in 2015 through from 2015 all the way through to 2018, what happens to SSB and what happens to fishing mortality? You can see under a constant catch, this is SSB relative to the threshold.

SSB increases and the probability of being overfished decreases. Right now, we are at about a 40 percent chance of being overfished, meaning a 40 percent chance that we're below our SSB threshold. That declines to about a 20 percent chance in 2018 if we maintain constant catch. On this graph we are showing in black the original assessment results.

There has been some concern or interest in adjusting these estimates for the retrospective pattern. A small retrospective pattern, I believe the average of the last five years was applied to this. You should always take this with a grain of salt though, because as we showed, retrospective patterns are not constantly over time, and they can change from year to year.

This is kind of an average retrospective correction. That doesn't mean that going forward, we can expect to see this retrospective pattern continue or continue at this magnitude. This is comparing SSB to the target. SSB will continue to increase slightly with a constant catch scenario, but the probability of being below the target is close to 100 percent; even over the next three years.

If we maintain constant catch, this is F relative to the F threshold, and the probability of overfishing, that is the probability of F being above the F threshold, will remain very low under current catch scenario. Relative to the target, we will only have at most a 20 percent chance of being above the target if we maintain constant catch over the next three to four years. We also did some scenarios looking at a constant F case, so rather than look at keeping

landings constant, if we keep fishing mortality constant, what happens?

Looking at F equals to 0.16, that is the F in the terminal year. If you do that, you can see SSB will increase slightly, and slightly stronger. But again, you'll see that we have here, we put them on two graphs just to combine them just to make your life a little more difficult. The dashed lines are the probabilities of being below the target, which again will remain significantly high for SSB; so will continue to remain below the target.

But the probability of being below the threshold will drop over time, if you maintain the 0.16. If you maintain the F target or 0.18, that increase in SSB is slowed, and there is almost no change in the probability of being below the target and below the threshold. It remains at about 40 percent chance of overfishing in the near future, if we fish at the F target. With that, I will take any questions.

MR. WHITE: Katie, it looks like we're in okay position, given that we have a constant catch at the 2015 level, about 3 million fish. New Hampshire just received their preliminary results from NOAA on our 2016 catch. New Hampshire went from 2015, 56,297 fish to 213,362. We went up by a factor of four, if these results end up being permanent.

I wouldn't suggest that New Hampshire will be representative of the coast, but I've heard that the state of Maine had an extremely good year. My understanding is the Commonwealth of Massachusetts had a very good year. My question is if the constant catch is not maintained and we go up by a factor of 2, 3 maybe 4. Then what are the chances of SSB falling below the threshold?

DR. DREW: They will be higher. I can't tell you exactly how much higher, but the TC did a very limited set of projections. If the board is interested in seeing some additional projections, we can do those and show you guys some actual hard numbers on this. Obviously, these projections are based on even a small increase, you can see here even a small increase of 0.02, in terms of fishing mortality, really arrests any benefit that we're getting from the 2011 year class moving into the SSB.

I will be honest; I'm not surprised to hear that the coastal fisheries, the ocean fisheries are now seeing the benefits of the 2011 year class, as they start to move out into those fisheries. You're probably going to have the same results that Maryland and the Bay saw, which is that it is not going to reflect the estimated reductions anymore as they become more available.

MR. O'REILLY: You partially answered something I was wondering about, Katie. With the constant catch, that indicates that you've adjusted for the 2011 year class up until it is fully recruited, is that correct?

DR. DREW: Yes. The constant catch projections do assume that the selectivity of these fisheries remain the same, but then it applies kind of that selectivity to the available population and knows that it's taking out what component of each of those year classes is it taking out to go forward.

MR. GROUT: That was partially my question, because what was seen, at least in New Hampshire, was primarily, it looked like something that was from the 2014 year class. Not to say that there wasn't 2011 year class in there, but a large part of that catch was all discarded 2014 year class. My question is, we're saying that there has been a four-fold increase in catch, but the majority of that is based on a 9 percent discard mortality rate. It's not like you're harvesting all those fish, that's just catch. Will that have less of an impact?

DR. DREW: Obviously, so it depends on, I haven't looked at the new MRIP numbers yet. If you're talking about an increase in B2s or released alive, then obviously, only 9 percent of those go into the model, so that would have less of an impact. But if it is coming from the harvest side, then you're going to have more of an impact.

CHAIRMAN GILMORE: Marty Gary. Rob's trying to sneak in. Okay, that was your hand, Rob, go ahead. Well actually, let me get to Tom Fote first. I'll come back to you, Rob.

MR. THOMAS P. FOTE: I'm happy that New Hampshire saw four-fold increase in their catch or figures this year, but I guarantee you that were not the case in New Jersey. When we get 70 degree water, 75 degree water this summer, which is about the hottest I've seen it ever off the coast of New Jersey.

We were still warm in the middle of October that we've seen no real fish inside yet. We haven't seen any striped bass along the coast yet in New Jersey. Now, something could change dramatically in December, but we are definitely not going to be four-fold; we're going to be a lot less. The catch has been down dramatically from what I've seen.

CHAIRMAN GILMORE: Rob, did you have a question?

MR. O'REILLY: I do. Katie, when was the first time that the statistical catch-at-age model was used? Was that 2010 or so, is that roughly when that started, do you know?

DR. DREW: Yes it was. The most recent 2013 peer reviewed acceptance was the second iteration of that model. The previous one in the mid-2000s ish, I believe, is the first time it was used.

MR. O'REILLY: My question is on the retrospective, and making sure that I understood what you said about the variability. Since the statistical catch-at-age model has been used, is the pattern in retrospective bias very similar, or have there really been changes on an annual basis or inner annual basis? I would expect the pattern to be that it is overestimating F in the terminal year and underestimating the spawning stock biomass. With all those lines, I'm not sure what your conclusion was.

DR. DREW: Yes, the pattern has always remained the same as you said that we underestimate SSB and overestimate F, which is a change from most of our species, where usually you see it the other way around; where you underestimate F and overestimate SSB.

But what we've noticed recently, as we've been adding more years of data, is that there seems to be a divergence in the extent of this pattern; that is you remove a couple of years and they all stay very close together. But then you start pulling off more years, and they diverge further. You can see more of a split in the two patterns, which is kind of new, and we're not really sure what is causing that. But basically what it's saying is that the most recent years of data, as we add on, are a lot closer and tighter together and have a lower degree of bias than adding on those years to older data, and we're not really sure why.

CHAIRMAN GILMORE: Mike, I've got a placeholder for your question on success. Do you want to ask that now or do you want to ask something different? Well, go ahead and ask both.

MR. LUISI: Well the question I had for Katie was, and it just relates to what is to come. I know that we have a benchmark assessment planned. I wonder if you could give us some thoughts on what the timeline for that benchmark is, and when you would expect to have results of that available for the board. After that, Mr. Chairman, I might have a follow up.

DR. DREW: We are anticipating this to be completed and peer reviewed in 2018. Right now, we are not on the SARC schedule. There are two parts to this answer. Number one, in theory, if everything goes according to plan, in 2018 probably we will have the results either for the August or for the October board meeting. If we're not on the SARC, then we can tailor that schedule. We would go through an ASMFC organized peer review, which is a little more flexible in terms of timing.

Having said that, one of the major components that we expect to change for this analysis will be the MRIP re-estimation of effort, and right now the timeline does allow us to incorporate those new data as they are released in 2018; and any kind of calibration factors that we need to recalibrate some of the most recent years. However, if that schedule changes, then we may have to come back to you guys and ask what you want to do, in terms of -- obviously, MRIP is expecting significant changes in magnitude to the landings based on the new effort estimates.

There will probably be an impact on the assessment, and on past assessment results. We'll have to deal with the question of if that timeline gets disrupted, does the board want to continue with the striped bass timeline, or does the board want to wait on that issue until that is resolved? That is kind of a worst case scenario, but that is what we're looking at right now.

MR. LUISI: I appreciate that, Dr. Drew, and I kind of anticipate there being some considerable challenges as MRIP unfolds and we begin to look at that; as far as the assessment. I guess my follow up question is a little broader in scope, and maybe it's more for the board or for you, Mr. Chairman, to consider.

But it's a question that has been posed to me time and time again over the last year. That question is what are our next steps? Are we planning to do anything with this recent information, this recent assessment update that has just been reported out on? Because the way I see it, especially, if there is any delay in the benchmark assessment, we're looking at 2020 before we would implement any new management measures.

Currently, we're operating under Addendum IV. You've heard time and time again from stakeholders from Maryland and other places where the impacts that we have felt are pretty severe and tremendous regarding the squeeze, which was referred to earlier by Phil Langley, having only a very few fish accessible to our fishermen. We're operating under Addendum IV, which had objectives and goals. The one objective was to reduce fishing mortality to the target. I think, based on this analysis and the report that we just received; we can put a check next to that objective. We've reduced fishing mortality, not just to the target but beyond the target. In the report in our materials, it actually indicated that projections would show that by 2018 that fishing mortality, if we maintained our approach, would even be reduced even further to 0.14 from 0.16.

The second objective in Addendum IV was to preserve and protect the 2011 year class. I would say that we've done that. I would say that for all intents and purposes, whatever we could have done to protect that year class in the Chesapeake Bay, we've done. I mean, we just heard testimony from states where they're seeing three and four-fold increases in available fish in areas where they haven't been in the past.

Here we are, we've accomplished the objectives of Addendum IV. We have a fishing mortality rate in the terminal year of 2015 that is lower than the target. What are the next steps? Where are we going to go from here? I have a suggestion as to what those next steps are, and if you want to continue, I would be happy to offer those suggestions at another point in time, Mr. Chairman, if you would rather continue with questions.

But that is the broader question to the board. This is the last opportunity that I'm aware of that we'll have any type of assessment update to base any type of management changes on, between now and when the benchmark is complete, which is who knows when into the future? I'll leave the question at that and look for any guidance or feedback from other board members.

CHAIRMAN GILMORE: My understanding of this is when we went down this road, the idea was that we would essentially put the reductions in and that it would essentially go for a three year period. When we got to the 2018 assessment, then we would see if we had met those goals and if they were, I guess sticking for lack of a better word.

Now we're in the second year, and I guess we have different opinions of that. Yes, we're below the mortality target, and it looks like we're on a right trajectory. But I think from Katie's presentation we're still not out of the woods yet. There is a lot of good news coming out of it, but there is still – you know the idea was to go for those three years.

I've had other questions from other commissioners and folks about well, because of that overage in the effort in the Bay, wasn't there any payback or adjustment measure, and I said no that was the same thing. If we saw exceedance, we were sticking on the three year plan to see if this was going to work or not.

It appears it is working and it's good news, but at this point if we're going to do any kind of changes I think that would be up to the board. Let me go around and get a few more comments on that; and if you want to propose something Mike, I'll come back to you. John McMurray.

MR. McMURRAY: For 2015, we're above threshold, but we're still below target, correct? There is a 40 percent chance of accuracy.

DR. DREW: Yes, for SSB we are barely above the threshold, with a 40 percent chance of being below.

MR. McMURRAY: But your projections are rosy based on the analysis of that abundance 2011 year class, and the 2015 as well; I imagine figured into that. My question really is, nobody has really brought up 2016 yet and probably there is a reason for that. It was terrible. I know that came in pretty late, and it probably wasn't figured into your analysis.

But I think, around the table, we should keep that in mind. When you look at the space of 10 years at those young-of-the-year indices, and then you look at the prior two decades two that. We're not looking at the same sort of production that we had. We maybe want to be a little cautious here moving forward, with that in mind.

MR. FOTE: I always like to remind people when we do the regression analysis, probably next year, the 2015 will actually look better than it does right now. That is the way the regression analysis also has been done over the years, that usually comes out better. I am also looking at, if you look at just the last six years instead of the last ten years, we have two year classes that are the fourth and the eighth highest.

Now I'm not proposing anything, but let's always look at figures honestly and not just pick out what we basically look at. I'm just looking at what's going on right now. I mean, yes, New Jersey actually has a good year from what I understand right now. It's looking like it is going to be higher than normal.

I think part of the thing is that we know in the Chesapeake Bay when you have extreme droughts like this, it is really not spawning stock biomass, it's water conditions and the environmental conditions that affect that young of the year when it come to this type of year. Am I wrong, through the Chair to Mike?

DR. DREW: Yes, I would agree that I think the TC would agree that environmental conditions certainly have a strong effect on recruitment. It is not solely spawning stock biomass, but spawning stock biomass is an important contributor to that recruitment, but definitely environmental conditions affect it as well.

MR. CLARK: I just want to follow up on some of the points that Mike Luisi was making. We have seen real pain to a lot of sectors, due to these reductions. I was just curious, based on the reduction you showed in the fishing mortality, if you can calculate how much things could possibly be liberalized and still stay below that 0.18? If you would look at that, it doesn't seem like a huge bit of difference there. You were showing that there was a difference in the recovery time from that; but what are we looking at in terms of harvest, if you move 2.18 from the 0.16?

DR. DREW: Those figures are in the report, but I don't have them in this presentation; or at least we didn't calculate what the predicted harvest would be for the difference between 0.16 and 0.18, but the harvest change would be small. I think the larger issue would be, especially with the recreational fishery, of being able to come up with a management measure that would give you such a small change.

MR. CLARK: Just a quick follow up. Could you estimate it in like a percentage term; how much you would be looking at in a change in the harvest?

DR. DREW: We could. I don't have that number in front of me right now.

CHAIRMAN GILMORE: Other questions for Katie? Okay, seeing none; Mike, do you want to offer up something?

MR. LUISI: I absolutely understand and appreciate

this board's interest in preserving and conserving this resource. I can't say enough about how important it is. I think you've heard time and time again from me and from stakeholders from our state and from the Chesapeake Bay region the importance of striped bass to not only our commercial, but our recreational and charter industries, as well.

John's question to Katie just a second ago alluded to the fact that if we were to move from 0.16 to 0.18, it would be a small tick, maybe a 5 to 8 percent liberalization, in terms of numbers. Maybe that's what it would be. I don't have the number to refer to in front of me. But what I'm thinking about and what I'm looking at, is the fact that perhaps just that very small change could be something that saves a few of the fishermen in my state.

A half an inch in minimum size could mean a lot to our fleets, our charterboat and recreational fleet; more so the charterboat community. I've been thinking about this and thinking about what we could do as a next step. I would hate to leave the board meeting here today having had this information, maybe not having all the information available to us.

I've thought about that maybe a potential tasking of the TC, and that tasking would be for two things. The first one would be for the TC to determine what that percent liberalization would be that would result in an increase in fishing mortality from 0.16 to 0.18. That is our fishing target. That is where we have intended, when we decided to make that the target. That's where we should be.

If we were over the target, we would be thinking potentially about reductions to get to the target. I would like to see what that means, as far as overall catch increase. How much is it? What percentage is it, and whether or not it is something that we could consider as a board maybe liberalizing catch into the future?

The second point would be a second task to the TC to recommend a new dataset, a preferred dataset using updated length frequency data for states to use when preparing potentially conservation equivalency proposals for recreational regulations. All of us have the opportunity in a given year to consider conservation equivalency proposals as modifications to our recreational regulations as it results from stakeholder engagement and stakeholder involvement.

The previous time period that we used to calculate the reductions for Addendum IV, I believe, was 2011 through 2013. Well, we now have some new information, and I think having a recommended dataset from the TC for us to use to explore alternative recreational management measures would be helpful. Those are the two tasks. I would look to the board to support that moving forward, for potentially a report at our February meeting.

CHAIRMAN GILMORE: Let me just ask Katie. In terms of workload for the TC, how much effort would this be and would this be taking away from the next assessment? I mean, that's the only concern is it is a workload issue. That request, what do you think it would involve for work for the TC?

MS. LENGLYEL: The TC could certainly do any analysis that the board tasks us with, but I would remind the board that following this meeting, the Technical Committee was planning on getting started on the 2018 benchmark stock assessment. Our next agenda item was to actually work on the terms of reference for that assessment and bring those to the board at the next board meeting. That would certainly impact our timeline, how much I can't really say, but it definitely will slow things down a little bit.

CHAIRMAN GILMORE: Okay, so let's go around for some reactions to Mike's proposal; any questions on that?

MR. McMURRAY: I'm not sure what you're recommending. Are you suggesting we don't have a threshold of fishing mortality at all; we just fish at the target F?

MR. LUISI: No, John. What I'm suggesting is that we currently are 0.02; we're underneath the fishing mortality target. When we took the reductions that we did in Addendum IV, the analysis of 2015

indicates that we overshot the target. The way I view that is it is kind of like a little cushion in what we have available to us, as far as management action to fish at the target. Fishing at the target is not a risky thing; it is the target for a reason.

I feel like we may have an opportunity to explore and just have that conversation once we're informed about what are we really talking about as far as additional catch? Maybe that little bit of additional catch could go a long way over the next few years, in helping with some of the hardships that folks have faced based on that. I'm not suggesting at all about removing the threshold. We're lower than where I think we could be, and there is a little cushion there that we might be able to exploit.

MR. CLARK: I would just like to speak in support of the ideas that Mike just put forward. I think we're talking about a small increase. Once again, these reference points, as we know, are very conservative to start with. I think what's Mike is asking could probably be figured out pretty quickly. I would like to see us proceed in that direction.

MR. MICHAEL ARMSTRONG: I very much appreciate what's going on in the Bay, although I look at the data, and I really want to talk more to you guys about it. I see and I hear the charter guys talking. But I see you catching the same number of fish as you did last year. The harvest is the same. The number of caught and release are more. I'm struggling to see the difficulty that this has created.

I'm very open to the explanation. What really worries me; it is a fool's errand to be messing around in the hundredths spot on an assessment. We're kidding ourselves if we think there is a difference between 0.16 and 0.18. But to Katie's point, we're talking 0.02 is 2 or 3 or 4 percent increase; something like that. What management measure are we going to take that we're going to craft to get 4 percent more catch? That is my concern.

MR. O'REILLY: Well, it is about a 12 percent difference if you just look at one fishing mortality rate 0.16 up to 0.18. That is 12 percent difference; I don't know what that translates to number of fish. I think it is a good idea. I think you have to appreciate that from 1997 until 2013, Chesapeake Bay was under a Bay wide quota. We were very used to making these fine point adjustments the best we can. I think we neared that quota one time. I want to say 2003. But if the harvest control model called for reductions, we took reductions. I think that, in general, we fish on a resident stock, and the way the whole system was set up and has been lost, it was on the 18 to 28 inch components. One inch even might make a big difference, may not be that much fish; but I do think it's worth us being able to see that.

In fact, everyone from our advisory boards to the charter groups to everyone else is very aware of the way management went over that time period. It is a big awakening to them to see that we're not able to make even modest changes. I certainly support it, and I have another question if you want to come back to me later, Mr. Chair, which does not relate to this issue.

MR.WHITE: I share Mike's comments. I think that this would be a kneejerk reaction. I think that, as you said, when we put these measures in place it was supposed to be for three years. I guess my concern would be, if any changes would be made, and I certainly would not support that; that the coast should be the ones that benefit.

The coast made the cut here. The Bay, as Mike said, caught the same amount of fish. If it weren't for the coast, we wouldn't be in compliance with the plan. For that, I think it is not worth risking Technical Committee's time having that impact the stock assessment work. I would oppose this.

MR. MARK GIBSON: I agree with a lot of the sentiments that Mike Armstrong spoke to. Looking at Figure 9 in the assessment report, which I think shows the partial Fs. It shows if you look at the partial Fs in that draft that the one for the Bay is flat. It hasn't come down. The partial F for the ocean, for the coast, came down substantially from the reference year and the commercial discards, as well.

If we're talking about whether Addendum IV achieved its objectives or not, I think it did partially,

but not completely. I do think we would be tinkering around with management measures that would be very unlikely to precisely achieve the small increment we're talking about. I don't know whether we're talking about an addendum here or working within what we have.

But I think the technical people should be focused on the benchmark assessment and some of the good ideas they have about proceeding with multiple stocks within the overall assessment and regional calculations and so on; and not tinkering around with what we've done, which looks to me like we've only partially been successful.

CHAIRMAN GILMORE: I think what we're discussing right now is simply to task the TC to get some additional data. I think, based upon the spread we have right now, we're probably going to have to do this in the form of a motion; but let me get a few more comments before we get into that.

MS. RACHEL A. DEAN: I think if I learned anything from the plenary session this morning, I learned that sometimes ahead of what the science is seeing is what the fishermen are seeing. As I'm thinking about that, you know I don't think that Mr. Brown or Mr. Langley would make this trip to Maine, although it is absolutely beautiful here, if they weren't seeing something that might indicate that something else is going on. I certainly understand Mike's comments about the numbers aren't really changing. The fishing didn't change. But there are certainly thoughts there that there is something happening. Again, I don't think that these gentlemen would be here if not. I think the second thing that I learned this morning, and that was probably from the first couple years of ASMFC, was the comment about the watermen from Maryland who addressed the fishermen from Massachusetts and said, you're looking at the mothers; and he said, well, you're looking at the babies.

I can certainly understand that but I want to promise this board that Maryland did what they could, because we know that we're stewards of what goes out into that ocean. I think now that the shoe might flip as we look at that 2011 stock going out onto the coast, and we might be looking at a different set of data in 2016.

All that we would really like to ask is that we could task the Technical Committee with possibly looking at those numbers, just so that we can take it back to our fishermen and say, well there might be a possibility here that we could save what it is that you came to ask for; and that is really to save your businesses.

MR. KYLE SCHICK: I'm not interested in a blame game competition, but for over two decades, the Chesapeake Bay region has managed and kept within their quotas; except for I think we came close one year, and this was on the back of our fisheries that we've done this. Now here we come around and all of a sudden now it's the Bay's fault, and if anything needs to be done it needs to be done in the Bay.

I say, you know, it was the overfishing on the coast that has caused the issue that we're trying to solve today. I think we deserve at least an opportunity to show our fishermen that maybe an inch size would make a difference, or wouldn't make a difference. I think it is worth looking into.

MR. FOTE: We're not going to do a blame game and you blame the coast. I basically look at the fact that when we look at the mortality rate as the Chesapeake Bay catch, we also used the producing areas of the Hudson River and Delaware River, and they get no credit for that in the plan or that mortality rate goes to the Chesapeake Bay.

You get the bonus of counting those fish in from the Hudson and the Delaware, since we don't have a spawning area anymore since Amendment 6, I think it was. My concerns here, as you know, I was not supporting you going to one fish; I didn't think it was necessary. As the projections are going to see, we're going to have plenty of spawning stock biomass in 2017. But again, I don't approve of kneejerk reactions no matter which way it goes.

I didn't approve this that we went to one fish; because it was a 25 year or 20-year span that we had the same regulations, which seemed to be working.

We had some projections that we might do something in 2017. We basically did that. It puts me in a difficult spot because I don't support kneejerk reactions. I think if the action is to go, it has to go on both sides of this. At this time, I can't support a separate action just for the Chesapeake Bay and not the coast.

MR. NOWALSKY: I'm not sure how I feel sitting here today about an increase or a decrease in access, but what I do know is that what initiated this action a short time ago was a very small tick in F above the F threshold. That very small tick above meant something. Again, I don't disagree with the earlier speakers that we may not be able to quantify it. With the retrospective pattern that suggested that F is generally overestimated, and that the SSB is generally underestimated. There were questions at that time.

But that small tick was enough for us to take significant management action. What is being suggested today is that a tick under the F target now, just take a look at what that could potentially mean. I don't know what my answer would be, but I would like to see what that would mean in terms of potential action for us. I would support that evaluation at this time.

MR. TERRY STOCKWELL: For the first time since I've been coming to Striped Bass Board, I can report that I didn't get a single complaint this year. To me, that is good news. It has finally taken some time for some fish to work their way into the pipeline and make it into the Gulf of Maine here.

From this piece of geography, I support staying the course on the cusp of having an assessment, and make whatever adjustments are necessary at the time. If the assessment indicates we should increase, be it the ocean fishery or the Bay fishery, I would be 100 percent supportive at that time.

CHAIRMAN GILMORE: I think we've gone around the table now, so Mike, just as I said before. I think we're going to need a motion on this, because it seems to be pretty well split here. If you could maybe propose a motion in terms of what you would want the TC to do for us, then we'll discuss it and have a vote on that.

MR. LUISI: I sent it to Max, I sent the motion via e-mail to Max, so maybe while they're working to get that up, if it would be okay, Mr. Chairman I could add a couple additional thoughts. I appreciate everybody's concern and thought on this. But what I do want to say is that I don't consider this any type of kneejerk reaction. It is a reaction.

It is a reaction to new information. That new information and the potential reaction are unknown. We don't know what. That is why we're asking the question of the TC, is to provide a thorough look at what is being asked of them, so that the board can have an opportunity with all of the information in front of them to make a decision as to whether or not we do anything or not.

I think saying right now that a small increase in harvest, while it may translate to something small in nature that I feel could potentially help the fishermen in my state. I think by making that decision without knowing what the numbers are and what we would be looking at is premature to make the decision to not move forward, given that we don't have all of the in information. I have to make one more comment.

CHAIRMAN GILMORE: Just before you go, Mike, can I get a second to this before? John Clark.

MR. LUISI: If you would like, I can read that into the record. I move to task the Striped Bass Technical Committee to one, determine the percent liberalization in harvest that would increase fishing mortality from the 2015 terminal year estimate of 0.16 to the FMP target F of 0.18, and two, recommend a preferred dataset using updated length frequency data for states to use when preparing conservation equivalency proposals for recreational regulations.

DR. DREW: Just to clarify. You just want the percent increase in catch; you're not interested in a bag or size limit or management changes that would be required to get to that point. You just want to know

how much additional catch could be taken.

MR. LUISI: That would be what I would be looking for as far as a percentage. Then if we had a new dataset to use, we could calculate our own recreational measures that would fit within each of the states; if we were to choose so and if the board were to allow for that liberalization to take place. But again, that is for a future discussion and a decision at another time.

Today's request was simply to get the information so that we can look at it and do an analysis, and decide at a later date whether or not we would make that change. Mr. Chairman, I do want to just make one more point. It was mentioned just a little while ago that it was the coastal reduction that made 2015 a successful year, as far as how it translated into catch. I have to disagree.

We managed the Chesapeake Bay quota for 20 years. We based that quota on exploitable stock biomass. As the 2011 year class grew, and got into the wheel house for fishing to happen on it, we increased the size limit by 2 inches. The quota in 2015 would have been tremendously higher than what it was in the previous years because of that 2011 year class.

Therefore I say, while maybe the catch may have been similar to the previous year, 2015 was reduced from 2014. But it had a very, very large potential. I have to disagree that the Chesapeake Bay wasn't a part of the successful nature of meeting the objectives of Addendum IV, and reducing fishing mortality. On the coast now, we have to remember we no longer are evaluated based on Chesapeake Bay catch, it's a coastwide F, and we contributed significantly.

CHAIRMAN GILMORE: We've got a lot of comments on this already, so if there are some new things you want to add on, let me go around one more time. Emerson.

MR. EMERSON C. HASBROUCK: I have a question for commission staff. It was mentioned before that there might be some impact in terms of the work to be done in the timeline on the next assessment. What would be the impact of this? How much time is it going to take staff to take a look at this? Realistically, are we pushing back the timeline for the assessment at all by looking into this?

MS. LENGYEL: I can't answer how much time exactly it will take, but it could potentially push back what we wanted to achieve at the next meeting, which was bring the board a draft version of the terms of references for approval.

MR. McMURRAY: I'm trying to figure out what's going on here. Harvest was up almost 55 percent in the Bay states, where it was supposed to be decreased by 20.5 percent. I think, during your presentation, recreational fishing effort was up 50 percent. Coastal states on the other hand went down to one fish, and our decrease was 47 percent, I think.

Now we're considering a request from the states that overfished to do an analysis so they could catch more fish. It doesn't make sense here. Nobody is discussing well, maybe we should look at the regulations that they had in place that allowed them to go 54 percent over. Instead we're considering this. I don't really understand how the conversation even got here.

CHAIRMAN GILMORE: Other questions or comments around that haven't spoken yet? Okay, Rob O'Reilly.

MR. O'REILLY: I'll try and respond to that a little bit, just a little help. We're talking about the 54 percent, but we're not talking about fishing mortality rate. We have a coastwide fishing mortality rate. We have three fleets, but we haven't ascribed an F for the Chesapeake Bay. But you realize that we had the 2011 year class among us.

For example in Virginia, the amount of discards went up from 250,000 in 2014 to 800,000 in 2015. That all counts as removals, because you take the 9 percent. Unless we have an F specific to Chesapeake Bay, we're left with what we started with in this addendum, which is a coastwide fishing mortality rate.

The other thing is, you have to realize how low is low? I'll just speak for Virginia. The recreational fishery went from 1.7 million pounds down to about 130,000 pounds by 2012 or so. Everything is relative to the position you're in. Now we understand that well there already are 2011 year class fish out on the coast, and there is going to be more.

That is the migration schedule. If we take this next year and do the same thing, it's going to look a lot different. But I think, overall, unless you're willing to consider anyone that this is a coastwide situation, and it is for fishing mortality rate; then you're nibbling at something that doesn't exist.

CHAIRMAN GILMORE: Any other question or comments from people who haven't spoken yet. I know you've got your hand up, Mike. I'll come back to you. Actually, I would like to go to the audience to see if there are any comments from the public; Arnold Leo.

MR. ARNOLD LEO: Arnold Leo, I think. I represent the fishing industry of the town of East Hampton, and I've been a very long time participant in the management process for striped bass. From the point of view that I've developed, we're looking at simply colossal, historically speaking, a colossal stock of striped bass, which is basically in a terrifically healthy condition.

Except now with the spawning stock biomass, it's sort of hovering around where it was determined that it should be. But I think we're being awfully finicky or a little bit too concerned with the very fine points of management. With this situation of this huge stock and these fishing mortality rates and the spawning stock biomass being pretty much where they wanted to be.

That we can't be flexible in our approach to management when we have a traditional user group, which is actually going out of business due to management actions and would benefit greatly by a slight loosening of the regime that was put on us with I think it was Amendment 4. I just wanted to speak in favor of Mr. Luisi's motion.

CHAIRMAN GILMORE: Any other public comment? Go ahead, sir.

MR. ROBERT T. BROWN: Robert T. Brown; President of Maryland Watermen's Association. What we don't realize here, if you go look back at our fishing practices we had over the years and years ago, the amount of fish that we used to harvest at that time compared to what we catch now. It's not a drop in the bucket.

We don't want to go back there, and we don't want to go back to a spawning class of 1982. Our spawning stock that we have right now is more than adequate. All we're asking for right now is not saying that we can go to a 0.18, but just to look at it through the Technical Committee and let's look and see what exactly it would do.

Because our fishery, especially our charterboat fishery is in real dire need, as well as the rest of our fishery is also suffering with that 20.5 cut. The only reason we got that cut at that time that 20.5 and that 25 percent on the coast was because the benchmark was changed. When you all adjusted the benchmark up that took us out of where we were between the target and the threshold. That is what put us where we were at. Since then, we have abided by it, have taken the cut, and this cut hurts; and I thank you.

CHAIRMAN GILMORE: Thank you, Mr. Brown, any other public comment? Seeing none; we're back to the board. Mike, I think you had your hand up. Oh you're done. Does anybody else want to make a comment? Russ Allen.

MR. RUSS ALLEN: Just cause I can. You know, I've heard a lot of talk around your board. I don't think anything that comes out of this change; this motion will change anybody's mind on how they want to vote on a motion that may come up at the next meeting. But I still think it's a process we need to do. We would do it for any other species. We would do it if it was flipped over the other way.

I just think it's time to sit back, let the Technical Committee do their job, let the board analyze what they have to say, and then move forward. We're not

talking that this would happen on such a quick pace that we're changing regulations in the middle of next year. You still have to go through the addendum process if we want to, and things of that nature. I would like to see you call the question pretty soon, because I've got a boat ride later.

CHAIRMAN GILMORE: Well, it's all Terry's fault, he raised his hand before, and that's why we're going to go over. I'm going to call the question now. I think we beat this one pretty well to death. I'll give you two minutes to caucus, because I think we might need that. Then we'll call the question.

Okay are you ready for the vote? All those in favor of the motion; please signify by raising your right hand. Eight in favor; all opposed, seven opposed, null votes, abstentions. Motion carries eight to seven; eight to six, sorry. Okay, moving along to our last item of business. Max is going to make a couple of comments on this before we talk about it. We should be pretty quick. Go ahead, Max.

CONSIDER ADVISORY PANEL REQUEST TO SUBMIT COMMENT TO THE MAFMC ON ITS DRAFT SQUID CAPACITY AMENDMENT

MR. MAX APPLEMAN: Very briefly, so this agenda item was requested to be on this meeting's agenda. Basically, the Mid-Atlantic Council is drafting a Squid Capacity Amendment. Some of the options that are proposed for the draft amendment are going to affect squid harvest in and around the Nantucket Sound area.

Since squid are a primary prey item for striped bass, the AP has a lot of interest in those options being considered, and they noted at their last conference call meeting that they would like the board or the AP or something along those lines to submit comment to the Mid-Atlantic Council on that draft amendment.

As I understand it, the draft amendment is not going to be released for public comment or public hearing until spring of 2017. That timeline could also change and there still seems to be a lot of discussion going on about what is actually going to be in that draft amendment.

Talking with the board chair before this meeting, we thought it might be appropriate to postpone this to the next meeting, or until more information comes available regarding that draft amendment. Of course, I continue to track the progress of that and keep the board Chair and the AP Chair in the loop.
CHAIRMAN GILMORE: Just for clarification on that, I think the way it was presented that it thought that the AP would comment directly. It would be, if we get to the point when we actually have measures under that amendment that the AP would then come back to the board and then propose comments that the board would then decide to approve or disapprove, in terms of commenting back to the Mid-Atlantic Council. John, if you wanted to add something to that, go ahead.

MR. McMURRAY: The issue that the AP discussed was A, the lack of availability for striped bass in the rips on Nantucket and Martha's Vineyard, and whether or not that had to do with the aggregation of squid boats off of Martha's Vineyard and Nantucket. They also discussed bycatch. There were a number of reports of striped bass bycatch discards, floating discards and scup and black sea bass, as well.

Part of the squid capacity amendment that the council is doing now, currently includes alternatives for buffer zones that squid fleet would have to fish outside several described buffer zones in the document. We didn't know that when we had the AP call, until Max brought it up. Frankly, I should have been the one that brought it up, but Max did. The document is still being created. It looked like, for a little while, those alternatives might not be in the document, but now it does look like they are1.

I don't think that now is really the right time for us to comment on it. But I do think we need to be aware of it, and we need to, when the draft amendment does become public, which I think it is projected to early next year, probably within the first two months; that we should have staff take a look at it and maybe have another AP meeting, and maybe have it on the agenda for the following meeting.

CHAIRMAN GILMORE: Okay, John, we will definitely consider it. Okay Eric, go ahead.

MR. ERIC REID: It is quarter to five; I've been in the squid business since 1983, so about 9:30 tonight I'm going to be done with my comments, if that's okay with you. I have no problem talking about this at a later time. But the Mid-Atlantic Council hasn't even had a committee meeting yet. I don't believe it's going to be early next year.

Maybe it's going to be late next year; maybe it's going to be the following year. But this thing is in its infancy; to the point where the inshore fishery right now is being discussed as a time, not an area, which is kind of an interesting thing to define inshore by time. But Mr. Chairman, maybe two meetings from now we can talk about this.

ADJOURNMENT

CHAIRMAN GILMORE: Thanks, Eric, and maybe I won't be Chairman then, good. With that being said, is there other business to come before the Striped Bass Board? Seeing none; I will take a motion to adjourn. It's seconded by everybody, and now I want to go to Terry Stockwell who has this fabulous announcement he's going to make to us; and I got done on time right, Terry, I saved you.

(Whereupon the meeting adjourned at 4:46 p.m. on October 24, 2016.)

Atlantic States Marine Fisheries Commission

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MEMORANDUM

January 13, 2017

To: **Atlantic Striped Bass Management Board**

From: **Atlantic Striped Bass Technical Committee**

RE: **Percent Liberalization in Harvest (0.16 to 0.18) and Dataset Recommendation for Conservation Equivalency Proposals**

In October 2016, the Atlantic Striped Bass Board (Board) tasked the Technical Committee (TC) to 1) determine the percent liberalization in harvest that would increase fishing mortality (F) from the 2015 terminal year estimate of 0.16 to the FMP target F of 0.18, and 2) to recommend a preferred dataset using updated length-frequency data for states to use when preparing conservation equivalency proposals for recreational regulations. The following represents the work completed by the TC to address these two tasks.

Task 1

Methods:
The two projection scenarios examined were:

1. Project population starting in 2015 through 2017 using preliminary removals for 2016 and fishing mortality (F) of 0.18 (i.e., F target) in 2017. Estimate total removals in 2017.
2. Project population starting in 2015 through 2017 using constant F of 0.156 in 2015 and F of 0.18 in 2016 and 2017. Estimate total removals in 2016 and 2017.

For Scenario 1, error in F and starting abundances for 2015 was assumed. For Scenario 2, only error in starting abundances was assumed. Projections were made for the uncorrected and retrospective bias-corrected estimates of F and spawning stock biomass (SSB), and 10,000 runs were made for each scenario.

Results:
Preliminary 2016 removals are estimated at 3,557,510 fish[1] which is an 18% increase in removals from 2015 (3,017,358 fish). According to the projection model (Tables 1-2), the number of harvested fish that it would take to increase F from 0.156 in 2015 to 0.18 (target F) in 2017 ranges from 303,800 fish (Scenario 2, without retrospective bias correction) to 341,186 fish (Scenario 1, with retrospective bias correction), a 10 - 11% increase in removals from 2015 (Table 3), but a reduction of approximately 6% from preliminary 2016 estimates of removals.

Discussion:
Although projections indicate harvest could increase in 2017 relative to 2015 numbers, all of the scenarios result in 2017 removals that are less than the preliminary 2016 removals.

According to the projections in Scenario 1, F increased to 0.19 in 2016 which is above the F target (0.18) indicating that current recreational and commercial regulations may result in an F of 0.18 or greater in 2016 and 2017. Also, the 2016 removals estimate for Scenario 1, although preliminary, is higher than that estimated via a constant F of 0.180 in Scenario 2. In other words, if the final 2016 removals estimate is lower than that used for Scenario 1, it is still likely that F will be estimated above the F target in 2016.

The TC also stresses that although the assessment is very good, it may not be able to distinguish between fishing mortality point estimates of 0.16 and 0.18. In other words, the upper and lower bounds of the confidence intervals for both F estimates would essentially overlap.

[1] Preliminary removals for 2016 were estimated via the sum of the 2016 preliminary MRIP harvest and dead discards estimate (A+B1+9% of B2's; waves 2-5), the 2015 wave 6 harvest and dead releases estimate from the Mid-Atlantic (wave 6 for 2016 has not been released yet), the 2015 Virginia wave 1 harvest estimate, the preliminary 2016 commercial landings estimates (except 2015 commercial landings were substituted for New York and Virginia because final 2016 landings are expected to be significantly higher for those states), and the 2015 commercial discards estimate.

Table 1. Scenario 1; preliminary 2016 removals estimate. Results of 2016 fishery independent surveys are not accounted for in the 2016 and 2017 stock status projections (F and SSB). Removals are in number of fish. *median value

No Retrospective Bias-Correction						
Year	Removals	F	*Estimated Removals	*SSB (mt)	Probability F is above the threshold	Probability SSB is below the threshold
2015	3,017,358	0.156		58,886	0.021	0.411
2016	3,557,510	0.194		58,754	0.175	0.407
2017		0.180	3,329,752	58,677	0.058	0.417
Retrospective Bias-Correction						
Year	Removals	F	*Estimated Removals	*SSB (mt)	Probability F is above the threshold	Probability SSB is below the threshold
2015	3,017,358	0.148		61,622	0.011	0.244
2016	3,557,510	0.190		61,752	0.140	0.218
2017		0.180	3,358,416	61,466	0.058	0.233

Table 2. Scenario 2; constant F of 0.156 for 2015 and F of 0.18 for 2016 and 2017. Results of 2016 fishery independent surveys are not accounted for in the 2016 and 2017 stock status projections (F and SSB). Estimated removals are in number of fish. *median value

No Retrospective Bias-Correction				
Year	F	*Estimated Removals	*SSB (mt)	Probability SSB is below the threshold
2015	0.148	3,017,230	58,847	0.417
2016	0.180	3,270,465	57,902	0.481
2017	0.180	3,321,030	58,478	0.436
Retrospective Bias-Correction				
Year	F	*Estimated Removals	*SSB (mt)	Probability SSB is below the threshold
2015	0.156	3,017,230	61,471	0.254
2016	0.180	3,318,723	60,310	0.307
2017	0.180	3,332,337	60,595	0.277

Table 3. Percent liberalization in harvest that would increase fishing mortality (F) from the 2015 terminal year estimate of 0.16 to the FMP target F of 0.18. Removals are in number of fish. *model-based estimate. ^based on 2016 preliminary removals estimate; 3,557,510 fish (see footnote above).

Scenario	2015 Removals	2017* Removals	Change in Removals	Percent Change in Removals From 2015	Percent Change in Removals From 2016^	Retrospective Bias
1	3,017,358	3,329,752	312,394	+10%	-6.4%	No
		3,358,416	341,186	+11%	-5.6%	Yes
2	3,017,230*	3,321,030	303,800	+10%	-6.6%	No
		3,332,337	315,107	+10%	-6.3%	Yes

Task 2

In November 2014, the TC set criteria for the development of conservation equivalency (CE) proposals (M14-110). The TC acknowledges that 2011-2013 data are no longer appropriate for CE proposals due to the emergence of the 2011 year class in the catch data and the change in size-frequency of the current population. The TC discussed that a length-based projection model would be the best approach for states to use to address variability concerns, and is interested in pursuing the development of the model. However, until such a model is developed, the TC recommends states use the most recent three years of size-frequency data for preparing CE proposals unless a state can justify using less data. For example, the sample size from the most recent two years (or one year) may be sufficient. States should explicitly state its justification for using less than the most recent three years of data within the CE proposal.

Atlantic States Marine Fisheries Commission

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MEMORANDUM

January 13, 2017

To: **Atlantic Striped Bass Management Board**

From: **Atlantic Striped Bass Stock Assessment Subcommittee**

RE: **Draft Terms of Reference for the 2018 Atlantic Striped Bass Benchmark Stock Assessment and Assessment Timeline**

The next Atlantic striped bass benchmark stock assessment is scheduled to be completed in the fall of 2018. The Atlantic Striped Bass Stock Assessment Subcommittee has recommended the Board consider the following terms of reference for the assessment and peer-review panel:

Terms of Reference for Stock Assessment Process:

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources.

2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries. Review new MRIP estimates of catch, effort and the calibration method if available.

3. Use an age-based model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component and sex, where possible, and for total stock complex.

4. Use tagging data to estimate mortality and abundance, and provide suggestions for further development.

5. Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY). Define stock status based on BRPs by stock component where possible.

6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.

7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

Terms of Reference for External Peer Review:

1. Evaluate the thoroughness of all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Evaluate the strengths and weaknesses of the data sources.

2. Evaluate the methods used to estimate commercial and recreational landings and discards. Evaluate the uncertainty in the data and spatial distribution of the fisheries. Evaluate new MRIP estimates of catch, effort and the calibration method if available.

3. Evaluate the methods and models used to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and evaluate their uncertainty. Evaluate retrospective analysis of the model results and historical retrospective. Evaluate estimates of exploitation by stock component and sex, where possible, and for total stock complex.

4. Evaluate estimates of mortality and abundance derived from tagging data, and provide recommendations for further development of the tagging models.

5. Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment, or, if appropriate, specify alternative methods or measures.

6. Evaluate annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.

7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

8. Prepare a peer review panel terms of reference and advisory report summarizing the panel's evaluation of the stock assessment and addressing each peer review term of reference. Develop a list of tasks to be completed following the workshop. Complete and submit the report within 4 weeks of workshop conclusion.

2018 Atlantic Striped Bass Benchmark Stock Assessment Timeline

Meeting Description	Meeting Dates and Deadlines
States to submit metadata on available sex data	✓
Data Workshop Planning Call/Webinar - Discuss Data Needs & TOR's	✓
SAS conference call – reference point guidance	✓
Board Approval of TOR's	February 2017
SAS conference call – model brainstorming	March 2017
Initial Data Submission for Assessment through 2016	June 15, 2017
SAS conference call – model brainstorming (cont.)	July 2017
Data Workshop	August 2017
Assessment/Modeling Workshop I	Nov/ Dec 2017
Updated data submission for Assessment through 2017	May 2018
Last day for final 2017 data submission	June 15, 2018
Modeling Workshop II	July 2018
Final SASC call/webinar to approve stock status determination	2nd week of Sept. 2018
All Draft Report components due to staff	1st week of Oct. 2018
Draft report distributed to TC	2nd week of Oct. 2018
Call/Webinar with TC to discuss assessment findings & approve report	Last week of Oct. 2018
Stock Assessment Report due to external peer-review panel	2nd week of Nov. 2018
Review	1st week of Dec 2018

Atlantic States Marine Fisheries Commission

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MEMORANDUM

January 13, 2017

To: **Atlantic Striped Bass Management Board**

From: **Max Appelman, Fishery Management Plan Coordinator**

RE: **Review and Populate the Atlantic Striped Bass Stock Assessment Subcommittee**

The Atlantic Striped Bass Stock Assessment Subcommittee (SAS) is repopulated prior to each benchmark stock assessment. ASMFC staff and the Atlantic Striped Bass Technical Committee reviewed potential members and recommend the following state, federal and academic representatives for SAS membership:

Michael Celestino, New Jersey Department of Environmental Protection

Justin Davis, Connecticut Department of Energy & Environmental Protection

Katie Drew, Atlantic States Marine Fisheries Commission

Edward Hale, Delaware Division of Fish & Wildlife

Hongsheng (Hank) Liao, Old Dominion University

Gary Nelson, Massachusetts Division of Marine Fisheries

Alexei Sharov, Maryland Department of Natural Resources

Gary Shepherd, NOAA Fisheries

John Sweka, U.S. Fish and Wildlife Service

Cc: Atlantic Striped Bass Technical Committee

Atlantic States Marine Fisheries Commission

South Atlantic State/Federal Fisheries Management Board

February 2, 2017
12:15 – 2:45 p.m.
Alexandria, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(J. Estes)* 12:15 p.m.

2. Board Consent 12:15 p.m.
   - Approval of Agenda
   - Approval of Proceedings from October 2016

3. Public Comment 12:20 p.m.

4. Public Comment Summary of the Draft Cobia Public Information Document (*L. Daniel*) 12:30 p.m.
   - Review Public Comment
   - Review Advisory Panel Report

5. Provide Guidance to the Plan Development Team for the Draft Cobia FMP (*J. Estes*) 12:55 p.m.

6. 2016 Red Drum Stock Assessment **Final Action** 1:25 p.m.
   - Presentation of Stock Assessment Report (*A. Giuliano*)
   - Presentation of Peer Review Panel Report (*P. Campfield*)
   - Consider Acceptance of Benchmark Stock Assessment and Peer Review Report for Management Use
   - Consider Management Response to 2016 Red Drum Stock Assessment (*J. Estes*)

7. Progress Report on the Spot and Atlantic Croaker Benchmark Stock Assessments (*J. Kipp*) 2:25 p.m.

8. Consider 2016 Fishery Management Plan Review and State Compliance for Spot (*M. Schmidtke*) **Action** 2:35 p.m.

9. Other Business/Adjourn 2:45 p.m.

The meeting will be held at the Westin Alexandria, 400 Courthouse Square, Alexandria, Virginia 22314; 703.253.8600

MEETING OVERVIEW

South Atlantic State/Federal Fisheries Management Board Meeting
Thursday, February 2, 2017
12:15 p.m. – 2:45 p.m.
Alexandria, Virginia

Chair: Jim Estes (FL) Assumed Chairmanship: 02/16	Technical Committee Chair: Red Drum: Ryan Jiorle (VA) Atlantic Croaker: Chris McDonough (SC)	Law Enforcement Committee Representative: Capt. Bob Lynn (NC)
Vice Chair: Pat Geer	Advisory Panel Chair: Tom Powers (VA)	Previous Board Meeting: October 25, 2016
Voting Members: NJ, DE, MD, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS, SAFMC (12 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 25, 2016

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4-5. Consider Draft Cobia FMP Public Information Document (PID) for Public Comment (12:30 – 1:25 p.m.) Action

Background

- The South Atlantic Council Fishery Management Council (Council) requested the Commission consider joint or complementary management of cobia with the Council.
- In 2105, 82% of the cobia harvest occurred in state waters. The ACL was exceeded by approximately 91,000 pounds.
- The Council is looking for a more flexible management approach to allow for timely adjustments of measures but still provide equitable access across multiple jurisdictions while meeting conservation goals.
- Staff to draft a white paper to outline how Cobia management would work under a joint, complementary, ASMFC only or Council only plan and the Board initiated a complementary FMP for Cobia.
- A Draft FMP PID was approved by the Board for Public Comment. Public hearings were held in December, 2016.

Presentations

- L. Daniel will present the Public Comment Summary of the Draft Cobia FMP PID (**Meeting Materials**)

- L. Daniel will present Advisory Panel recommendations on the PID (**Supplemental Materials**)

Board actions for consideration at this meeting

- Provide guidance to the Plan Development Team for the Draft Cobia FMP

6. Red Drum Stock Assessment (1:25 – 2:25 p.m.) Final Action

Background

- The 2016 update stock assessment and peer review was presented to the Board in May of 2016.
- The Board had questions/concerns regarding the assessment inputs, reference points, and model types and tasked the TC/SAS to investigate several questions.
- Following the responses and recommendations of the TC/SAS, the Board directed the SAS to complete the update stock assessment using a statistical catch-at-age (SCAA) model rather than Stock Synthesis III.
- The SAS has completed the stock assessment, and the stock assessment has undergone a desk review.

Presentations

- A. Giuliano will present the Stock Assessment Report (**Meeting Materials**)
- P. Campfield will present the Peer Review Panel Report (**Supplemental Materials**)

Board actions for consideration at this meeting

- Consider acceptance of the Stock Assessment and Peer Review Report for management use.

7. Progress Update on Spot and Atlantic Croaker Stock Assessments (2:25 – 2:35 p.m.)

Background

- A data workshop for both species was held in September 2015.
- The first of two assessment workshops we held one in February and one in September 2016.
- It is expected that both assessments will be completed in early 2017.

Presentations

- J. Kipp will present an update on these stock assessments.

8. 2016 Fishery Management Plan Review (2:35 -2:45 a.m.) Action

Background

- Spot State Compliance Reports are due on October 1. The Plan Review Team reviewed each state report and compiled the annual FMP Review. Georgia has applied for *de minimis.*

Presentations

- M. Schmidtke will present an overview of the Spot FMP Review Report. **(Meeting Materials)**

Board actions for consideration at this meeting

- Accept 2016 Spot FMP Review and State Compliance Reports.
- Approve GA *de minimis* request.

9. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

SOUTH ATLANTIC STATE/FEDERAL FISHERIES MANAGEMENT BOARD

The Harborside Hotel
Bar Harbor, Maine
October 25, 2016

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ATTENDANCE

Board Members

John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Rachel Dean, MD (GA)
David Blazer, MD (AA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Cathy Davenport, VA (GA)
Joe Cimino, VA, proxy for J. Bull (AA)
Kyle Schick, VA, proxy for Sen. Stuart (LA)
Doug Brady, NC (GA)
Chris Batsavage, NC, proxy for B. Davis (AA)
Robert Boyles, SC (AA)
Malcolm Rhodes, SC (GA)
Sen. Ronnie Cromer, SC (LA)
Patrick Geer, GA, proxy for Rep. Nimmer (LA)
Nancy Addison, GA (GA)
Spud Woodward, GA (AA)
Jim Estes, FL, proxy for J. McCawley (AA)
Martin Gary, PRFC
Wilson Laney, USFWS
John Carmichael, SAFMC

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Toni Kerns
Robert Beal
Mike Schmidtke

Guests

Lynn Fegley, MD DNR
Ross Self, SC DNR
Phil Moran, SC DNR
Trisha Cheney, ME DNR
Matthew Gates, CT DEEP
Tim Sartwell, NOAA
Kathy Knowlton, GA DNR
Kevin Sullivan, NH F&G
Diedre Boelke, NEFMC
Arnold Leo, E. Hampton, NY
Susan Shipman
John Carmichael

The South Atlantic State/Federal Fisheries Management Board of the Atlantic States Marine Fisheries Commission convened in the Stotesbury Grand Ballroom of the Bar Harbor Club, Harborside Hotel, Bar Harbor, Maine, October 25, 2016, and was called to order at 10:15 o'clock a.m. by Chairman Jim Estes.

CALL TO ORDER

CHAIRMAN JIM ESTES: I would like to call the South Atlantic State and Federal Fisheries Management Board to order, please. My name is Jim Estes; I am the Administrative proxy from Florida, and I am going to try to facilitate the meeting today. We have a new staff member that Toni is going to introduce.

MS. TONI KERNS: To my right here is Mike Schmidtke. He is coming to us from Old Dominion University, where he is just finishing up his PHD on blueline tilefish. He is going to continue to work on some of that with the South Atlantic and the Mid-Atlantic Council; so you may see him doing some blueline tilefish work in the future. A little fun fact about Mike is that he played football at NC State for the North Carolina's commissioners. You can talk to him about that. His son was recently born a couple months ago. He moved to D.C., and we're excited to have him.

CHAIRMAN ESTES: Nothing like a couple hours spent with friends, and that's what we hope to do for the next couple hours.

APPROVAL OF AGENDA

You all have an agenda. Are there any changes suggested to the agenda? Are there any objections to approving the agenda, as is? Seeing none; the agenda is approved.

APPROVAL OF PROCEEDINGS

You all should also have proceedings from our August meeting. Are there any changes suggested for those proceedings? Are there any objections to approval of those proceedings? Seeing none; the proceedings are approved.

I don't think that we have anyone signed up from the public to speak, but is there anyone from the public that would speak on items not on the agenda? Not seeing a big line of people rushing up to the microphone; we'll go on to Item Number 4, and that is Consider Draft Cobia FMP Information Document for public comment. I think Dr. Daniel is going to present that.

CONSIDER DRAFT COBIA FMP PID FOR PUBLIC COMMENT

DR. LOUIS B. DANIEL: Good morning, everybody. It is good to be with you all again. What I would like to do real quickly is go through -- you should all have a copy of the Public Information Document in your briefing materials. That was an excellent work completed by your Plan Development Team; that was developed between the last meeting and now.

I can't say enough about the help that those folks did, and everyone on the Plan Development Team was very involved and active in the development of this Public Information Document. I just would like to say that at the very end of the presentation I do have a couple of questions that were raised by the Plan Development Team members that I would like to go through real quick, to perhaps begin your discussion. Just to go over real quickly what I would like to go through today. Review the current issues, where we stand. Have a brief discussion on the 2016 South Atlantic Council meeting down in Myrtle Beach that Executive Director Beal and I attended, and review the South Atlantic's Framework 4 to the Coastal Migratory Pelagics FMP to implement accountability measures to slow harvest in 2017. That was their primary objective in that discussion.

Then review the PID and the proposed management issues for your consideration, for

going out to public meetings between now and the February meeting. Somewhat of a review from the last meeting with the white paper. As most of you know, the National Marine Fisheries Service announced a closure to the Atlantic migratory group cobia; effective June 20th of '016 for exceeding the ACL.

It was around 630,000 pounds and landings were about 1.5 million pounds. We'll have some discussion over the methodology with which the landings data were accounted. The closure impacted the fishery throughout the range of the cobia, but impacts were greatest for the outer banks of North Carolina and the states from Virginia to the northern extent of the range.

The quota ran out and it seemed to be right during peak season, particularly for Virginia that the closure occurred. North Carolina and Virginia reacted to those closures by implementing some state-specific regulations to lessen the impact of that closure in 2016. Briefly, the 2013 cobia benchmark stock assessment through the SEDAR process looked at data through 2011.

That's the most current information that we have, in terms of a peer-reviewed stock assessment. While it indicates that the stock is not overfished and overfishing is not occurring; we are seeing a fairly consistent trend in declining biomass. That was a concern raised by the Plan Development Team, and the time between the past benchmark assessment in 2011 and the possibly proposed stock assessment that will be available for management purposes probably in '18, '19, maybe even 2020.

The council has sort of modified a little bit their methodology for developing stock assessments, and it makes a lot of sense; if you think about it in terms of a research. They're looking at a research tracked stock assessment that is scheduled for 2018/2019. What they are trying to do there is to try to keep all the information together and to continue to look at these stocks, but not have those stock assessments result in any management action or management recommendations from the panel.

But then what they would do is over time they would maintain these research stock assessments for all the stocks, and then on occasion, and in this case in 2019/2020 do what they call an operational stock assessment; which would actually result in management advice coming out of the SEDAR process and out of the South Atlantic Council.

That is generally the timeline that we have for stock status and for the stock assessments coming up. There will be some questions and concerns raised by the PDT at the end of this presentation. One of the big issues that continue to -- in fact, I got two e-mails this morning from the public regarding the stock boundary. Those boundaries were established through the South Atlantic Council's Amendment 20B in March of 2015. Atlantic migratory group cobia annual catch limits apply from the Georgia/Florida line through New York. Cobia caught off the east coast of Florida are counted against the Florida east coast allocation of the Gulf of Mexico cobia annual catch limit. There is a proposal to include cobia in the Stock ID Workshop in 2017. That was done during a SEDAR discussion at the South Atlantic, where they were looking at stock ID workshops and with the interest of cobia; it was kind of thrown into the mix.

It was thrown in with multiple other species for stock ID work. There is some concern raised by some of the principal stock ID folks, primarily in South Carolina, that it is possible that a lot of the data that they're working on right now, along with the collaborative and cooperative work being done with other states, may not actually be ready in 2017.

There is some discussion there from the PDT that I'll review later. Going back to the stock boundaries section real quickly. I will say, that from talking with Dr. Denson, who is on the Plan Development Team, he had a large hand in

developing the genetic information in your public information document.

There is some really good data there, and a lot of collaborative cooperative work done with some of the other states. But they're still trying to process additional samples around that mixing zone, which tends to be that border between Florida and Georgia. It is not a knife-edge distinction, north of which is all Atlantic migratory group, south of which is Gulf.

There is some fuzz there that you have to keep in mind. The work being done, by South Carolina in collaboration with other states, will hopefully narrow the information on exactly where that line needs to be. But it may behoove the commission at some point in time to actually ask Dr. Denson to come and give the presentation that he gave to the South Atlantic Council in Myrtle Beach. It was an outstanding presentation on the analysis that he and others have done on the cobia genetic boundary.

It answers a lot of questions. The next slide with Framework Action 4, Proposed Measures, these were developed at the Myrtle Beach meeting in South Carolina. There was a lot of discussion over various options and issues, and what were submitted to the Secretary through the Council were the following measures:

To reduce the recreational bag limit from two fish down to one fish; to increase the minimum size limit from 33 inches to 36 inches fork length and to limit commercial harvest to two fish per person or six per vessel; whichever is more restrictive. As far as I know, that is now either out of the Regional Office to the Secretary or in the Regional Office still being reviewed.

The expectation, the hope was that those measures would be in place to curb harvest in 2017, recognizing that the commission would be unlikely to implement anything to curb harvest for this upcoming spring season, which primarily operates from May through July/August. Just to give you a quick, short term timeline on where we are, today we're discussing the PID for your review, approval and any edits or comments that you would like to include.

Between now and January, it would be my hope to conduct public meetings for those states that request those meetings and accept public comment. Then have those public comment summaries and the comment available for board review; and direction for FMP development at the February, 2017 meeting in the DC area.

With that, moving into the management issues for the Public Information Document, we discussed with the Plan Development Team the following management issues and questions for your consideration. I'll go through those one at a time.

Management Issue 1, one of the overarching questions relates to complementary management with the council. Complementary management of cobia is intended to increase our flexibility and management reaction time at the state level, while providing us the ability to more actively and adequately manage the fishery in your respective states.

Some of the questions that we propose putting out for public comment and review are, should the commission develop a complementary cobia FMP: a plan complementary to the South Atlantic Council's Coastal Migratory Pelagics Fishery Management Plan? What federal measures that are in place or currently proposed should be required, if any, in the commission plan?

What states should be included in the management unit? Again, the genetic analysis that has been done at least to this point, suggests, and the council has concurred that the most appropriate boundary for cobia in our region is the Atlantic migratory group from the Georgia/Florida line through New York.

I will make one note here that in the documents, you will see Rhode Island included in some of the landings information. I didn't exactly know how to handle that. It was 2 or 300 pounds every couple of years. Instead of involving the New England Council and complicating that too much, I simply note – I realize they're not in the Mid-Atlantic Council, but there are a few landings that occur in Rhode Island.

Given the upcoming genetic workshop that is proposed for 2017 at this time, should the commission plan provide the flexibility to make changes to management and stock units to reflect changes in the science? What I mean by that is if the information that is coming out of the genetics labs and the work that is being done suggests that perhaps there is a better line that may be down into the state of Florida, like some of the mackerel boundaries that occur off of Florida, would we want to be able to have the flexibility to modify our plan to coordinate and complement that new work?

The second intent and purpose is to provide a management plan that achieves the long term sustainability of the resource, and tries to implement and maintain consistent coastwide measures, while allowing our states the flexibility to implement the alternate strategies to accomplish the objectives of the plan.

Clearly, we want to provide for sustainable recreational and commercial fisheries, maximum cost effectiveness of current information gathering and prioritize state obligations to minimize costs of monitoring and management. This was an issue that was raised by the Plan Development Team, and some concerns over the cost and expense of collecting data on a fish that moves so much.

It may be that current data collection programs are about as good as we'll have at the present time; unless money is afforded to collect more data. Adopt a long term management regime, which minimizes or eliminates the need to make annual changes or modifications to management measures.

This is a very important for-hire fishery, and folks are setting up trips and the like for the following year in many cases. Changes in the quotas and changes in the potential seasonality can have significant trickle-down impacts to the fishery. The question for the public is what should be the objectives in managing the cobia fisheries through the commission? There may be others that the public would like to weigh in on.

Management Issue 3, Coastwide, Regional or State-by-State management issues. Many of the states currently manage their cobia fisheries independently. We're considering coordinating that management, in order to avoid states being disadvantaged, based on where they occur along the migratory route; while maintaining harvest at the council's ACL level.

Just using one example with spiny dogfish, when the fishery would start up in the northeast and move south, oftentimes, there weren't a lot of fish left over by the time the seasons got to Virginia and North Carolina. The commission decided to move forward with a plan that would try to mitigate some of those disadvantages by geography of losing out on those fish towards the tail end of the season.

This is sort of a reverse of that where the fishery generally starts to our south, and ends up in the northern extreme. Without some controls early in the season it is probable that some of these quotas may be taken prior to peak fisheries or primary fishing opportunities in the more northern extreme.

Questions that the PDT worked on and developed for this section would be that are consistent state-specific management measures coordinated by the commission needed for cobia? Are there regional differences in the fishery and/or resource that need to be considered when implementing management measures? Should the plan require a coastwide

closure if the council quota or ACL is met? Should the FMP require coastwide measures, for example, size and bag limits being consistent throughout the region?

Should the FMP require regional measures? Should the plan develop a suite of options for the allocation of state-specific quotas and allow states to adopt unique size, bag and season measures? One example of a point that I would bring up that is in your Public Information Document, is the work that was analyzed and put together for us by Ryan Jiorle from Virginia on the Plan Development Team that showed there is a lot of variability in the stock fishery occurring in federal and state waters.

It varies from almost no fish taken in state waters to 100 percent as you move north, because there is a lot of variability in the fishery and how it operates from Florida to the states north of Virginia. Those may need to be taken into account as we move forward with the plan.

The Management Issue 4, Commercial and Recreational Management Tools. This is where we hope to get some information on the potential tools that could be used to manage cobia. What are the appropriate commercial and recreational measures for cobia is one question we would ask. Should the plan consider gear restrictions? For example, circle hooks with live and dead bait fisheries for cobia or the prohibition on gaffing cobia. Those are being used in certain regions and locations, the effectiveness we're not totally certain of at this particular point.

But with an increase in size limit from 33 to 36 inches, that is likely going to be a more difficult fish to handle. Unless you net those fish, one of the only ways to get them in the boat to measure them would be to gaff them.

Consideration of some of the measures that have been considered in other states to require netting of those fish as opposed to gaffing is something we would like to receive some public information on. Are there other management options that should be considered, for example, slot limits, spawning season closures, et cetera? Should the plan consider some level of de minimis or threshold landings where cobia harvest is minimal or episodic; which tends to be in those states north of Virginia.

Finally, we would ask the public to comment on any other issues for consideration in the development of the commission's draft FMP for cobia. Those are the general management issues and strategies and questions that we wanted to put out to the public between now and the February meeting.

Real quickly, and there may be the expertise around the table, and certainly up at the head of the table, to discuss a couple of the issues that were raised by the PDT that I think are germane and important for your discussion here today. First, there was concern raised by the Plan Development Team membership on delay in the stock assessment.

There is a lot of concern, recognizing that the SEDAR process is lengthy and has got a lot of irons in the fire from many species that a lot of people deem very important. There was concern raised over the fact that we are dealing with a terminal year in the assessment of 2011. We're looking at a stock at this present time where there seems to be a decline in absolute biomass spawning stock; concerns being raised about the harvest.

We're looking at probably about a ten-year period, and at least another several years before we have the semblance of a new peer-reviewed stock assessment. That was one concern raised by the Plan Development Team that I'm really not sure how we address. The second issue that I wanted to bring up, and this was a discussion that was also had by the Plan Development Team, is the Stock ID Workshop timing.

I believe I completely and fully understand the reason why cobia were included in the Stock ID workshop, and I think that was a good move.

The question is, will the information from the primary data collector, which is Dr. Denson in South Carolina, will that be available either early or late in 2017? It does not appear that that may be the case.

What type of information may be gleaned from an upcoming stock ID workshop in 2017 is for the most part unknown at this particular time. Those were the two primary issues brought up by the Plan Development Team as we moved forward. Those are not issues that have to be resolved, I don't believe, here today.

The main question is, do we have the management issues accounted for in the document, and are you comfortable moving this forward for public comment? With that, I will stop and try to address any questions that the board may have related to the PID or cobia in general.

CHAIRMAN ESTES: Maybe to be efficient, let's do these questions first, and then I would like to hear a short discussion about the questions that Louis brought up. Then we can talk about what we want to do with the PID. First off are our questions.

DR. WILSON LANEY: Well not a question, Mr. Chairman. Are you looking for editorial suggestions now as well?

CHAIRMAN ESTES: Yes, I would like to hold that off. Let's exhaust the questions first and then we can do that if it's okay.

MR. JOE CIMINO: Thank you, Louis; I appreciate all the work done. You guys had a great team with the PDT, and it was good work and really also, a lot of good questions I think that came out of what we have here. As far as the questions, I am curious if the Science Center feels that a slight delay is possible in the workshop; question Number 1.

Question 2 would be, and forgive me because I am not that familiar with the new terms. It wouldn't be an update it would be a research assessment, is that right? Is that the new term? We said, it wouldn't be used for management, but if it was done and it showed overfishing, would there be a need to take some action or do we still wait for – I'm going to use the other term – benchmark, which is no longer a benchmark. Those are two questions I have.

DR. DANIEL: I'm going to ask John Carmichael to address the majority of those comments. I did fail to mention one thing that I would like to go ahead and get on the record. Dr. Michelle Duval is oftentimes a member of this board, and is the Chairman of the South Atlantic Council. I did want to bring up three points that she made, since she wasn't going to be able to be here, for your consideration. This may address some of the questions.

First off, the allocations of the commercial and recreational fishery of 92 percent recreational and 8 percent commercial, actually began and started in January of 2012, not 2016 as is reported in the PID. Then she also brought up the similar issues about the stock ID workshop being actually late 2017 as opposed to early. I'm not sure that matters for Dr. Denson's concerns.

Then the other point she made was the issue on the research versus the operational track assessments. That is certainly something that I think is new lexicon for this board; and so hopefully that will be something that John can also review and have some discussion on in his comments.

MS. KERNS: I have an additional question for the assessment timing. Can you also explain in your answer how the South Atlantic Council or SEDAR or the Southeast Regional Office has been talking about how the new MRIP information would be incorporated into the assessment timing? Currently, as it stands the MRIP information should be out in 2018. Since this is a species that is quota managed, how that new data coming out would impact the ACL or how we manage against the ACL.

MR. JOHN CARMICHAEL: I guess I'll start with the easy one first, which is probably the MRIP question. With the timing of this assessment, the recalibrated MRIP information for the new survey should be available. The intent in the assessment is to use that information directly, and not have to do anything more after that. That is the plan, certainly, and whatever that does to the estimates is what impact it will have on ACLs and allocations and everything else that comes with it.

The other issue is the Stock ID Workshop. This is somewhat new territory for us within SEDAR. The attention the stock ID is getting is somewhat driven by the issues we've dealt with lately on blueline tilefish, and also by the realization from cobia, from hogfish, from a number of recent assessments looking at the stock ID information, and realizing that these stocks can be more complicated than perhaps was assumed in the past. Also realizing that one of the important things when you're dealing with that is to make sure that everybody who is going to have a management role within that stock has an opportunity to be at the table when the assessment is done.

This is one of the issues with the previous assessment of blueline, where it was done; the stock was extended up into the area of the Mid-Atlantic jurisdiction; and folks from the Mid-Atlantic weren't really involved in that assessment along the way and that created some issues. What we're trying to do is make sure we find out where these mismatches occur between management jurisdictions and stock biological definitions early enough in the process; that everyone who needs a seat at the table during the assessment, is given a seat at the table.

Everyone who needs to make sure that their management needs are going to be met by the products from the assessment, have an opportunity to comment on things like the terms of reference or that assessment. We're working on that now with blueline, and that led us to have this realization that we needed to have this Stock ID Workshop, and then that has grown as we've seen how important it is to have that and get all these various people at the table.

This workshop was planned to do a number of species. One of the keys for doing not single species approaches but several species approaches, is it lets you get more bang for your buck, in terms of bringing people who are experts in the various pieces of data that contribute to your understanding of stock ID.

I think all of you guys probably realize that genetics data can be quite controversial, and genetics experts can vary widely in their interpretation of that data. We've certainly seen that with cobia and with pretty much every stock we've looked at. One of the keys to that seems to be to bring in as many genetics experts as you can.

To get that critical mass, it can help to have multiple species that you're working with and doing that. Blueline, again, was an example. We had a dedicated stock workshop, and it was very hard to get the competing genetics experts in that place at that time and be devoted to that topic. One of the really 'bang for the buck' we were hoping for in the multiple species is to try and overcome that problem.

That put us into having this multiple species approach, and that somewhat drives the timing of the workshop. Another thing that has affected the timing of the workshop is of course the many other things that are going on with SEDAR; and balancing the data deliverables and other things between this workshop and other assessments that we have going on.

That left us really two windows to do this, which was going to be sometime in fall, 2017, sometime in July, 2017. When we discussed this at the Steering Committee, because of a lot of the concerns with what we've experienced so far in stock ID, the recommendation was that whatever comes out of this workshop should go through some type of peer review.

We're looking forward to convening something with our SSC representatives, and CIE representatives, Center for Independent Experts, that would review that information. Because we're finding that if a council is brought into an assessment and their technical folks, their SSC or in your case your Technical Committee folks, weren't involved in that. Well, then that doesn't really build support.

That causes a lot of doubt, and when you get in situations where they say well, we're not sure we're going to go along with the recommendation of that group of experts; because none of our experts were part of that group. That led the Steering Committee to say, what we really need to have then is this peer review, so that when we go into this assessment we know what the stock boundaries are, and we have pretty good confidence in the overlap in those.

Because, if not, what happens is we get in situations like we did with blueline and others, or even cobia, where you make that recommendation early in the data workshop process. It goes through the peer review in the very end, and even if they accept it, people suddenly start having issues with it and questioning things that were done.

We've decided that it's really critical to have that decision made up front. Have it go through an independent peer review, so that you can then go into the assessment with confidence. It seems like a lot to do, something that 20 years ago in assessments we didn't hardly give a second thought to. But the reality is the stock ID is absolutely critical to everything that comes afterward in the assessment.

Models today are complicated catches modeled, indices are modeled, selectivity is modeled, catchability is modeled, and all of that is modeled on a stock-by-stock basis. All the data needs to be parsed out according to the stocks. We experienced with the first cobia assessment, delays because the stock ID changed along the way.

All the data that were put together in one set of bins had to be put together in another set of bins, and in fact they wanted to explore a couple set of bins; which was a huge demand on our data people. Because of all that, the data people are the ones who've kind of demanded, you've got to settle stock ID up front.

Something that has been relatively simple in the past is now incredibly complicated. That has affected the timing, so we're trying to get this early so we can have this peer review. Now that brings me to cobia. It has just come to my attention, certainly here, that there may be some concerns with data being collected in South Carolina that aren't going to be ready for a workshop that looks like now is going to be held in July.

Just by way of timing, the weeks were only picked about 12 days ago. There was a meeting of the folks organizing this workshop that happened after the Steering Committee approved it happening. We're early in the planning stages for this, and not everyone who is going to be participating has been reached out to. They're just working on the list of key folks now, based on the stocks.

Later this week and next week, Julia Byrd, who is the plan coordinator for all of this and making all this happen, is going to be reaching out to key people and try to find out which dates work, and certainly at that time try to find out where things stand on data. If we get in a situation where the cobia information is not going to be ready for the timing of this workshop, then I think we have to consider, perhaps doing cobia on a stand-alone or through some other way that we can make sure that information is available.

Because we certainly don't want to do this and know that there is going to be new information available six months or a year down the road. Now that could affect the overall timing of the cobia assessment, I don't know. That would really come down to when it's going to be done

and when the data is available. I guess I'll pause here, because I feel like I've been talking a long time, to see if there are any other questions about the stock ID. If we get through that, then I will talk about the research track and the timing of the cobia assessment.

MS. KERNS: Following up on the timing for the MRIP data, just to confirm. Will the Southeast Regional Science Center then develop a method to back calculate the MRIP data so that what we judge the recreational fishery on, in terms of if they achieved or did not achieve the RHL?

Because if the new estimates have the potential to be six fold higher than what we set the ACL based on, because we used the old method data, to set what it's based on. Then using the new information every year to judge until 2020 or when the new assessment comes out; so somebody would back track it?

MR. CARMICHAEL: Certainly, all my participation with the various transition teams and calibration teams is that the intent is, we would have to adjust management parameters to match the new data, or we would have to calibrate the new process to the old data; which developed the management parameters.

But everyone involved recognizes that you can't change the survey, thus change your yardstick without changing what you're trying to measure. Which way it goes, I don't think we know at this point. Whether we adjust the entire landing streams, and then managers make the change to change their ACLs, or we have a calibration of the new MRIP survey that is consistent with the way MRIP is done up to this point.

The latter is probably a little bit cleaner for management purposes, because they're not taking framework actions or what have you to change all of their ACLs. But certainly, that has to be done. Everyone knows that you can't evaluate and apply an ACL measurement on a new way of measuring your fishery without updating what it is you're trying to achieve.

CHAIRMAN ESTES: Mr. Bush, did you have a question?

MR. DAVID BUSH: Dr. Daniel, thank you for the presentation. Maybe two questions after a brief statement. I'm sure you've probably been beat up with a few e-mails asking questions about certain aspects of this, one of them being the tagging study from the Chesapeake Bay showing about 80 percent of the fish supposedly stayed there. When you were looking at biomass, did you include this biomass in that overall reduction, or reduction of biomass that you mentioned?

DR. DANIEL: You'll have to repeat the question, David; because I'm having a hard time hearing you back there.

MR. BUSH: Sorry, I'll move up here a little closer. Again, thank you for your presentation. The question I had was, the VIM study that was done out in the Chesapeake Bay showing approximately 80 percent of the tagged fish stayed there. Now that particular biomass, since you don't really have the stock IDs pinned down at this point, I know it is sort of a crystal ball-ish kind of question, but was that biomass taken into consideration when you were looking at an overall decrease in the biomass?

DR. DANIEL: I'm not exactly certain if that information specifically was used in the biomass calculations. I would tend to doubt that it was. But the issue really, if you see the presentation that was done by Dr. Denson, he does bring up these specific distinct population segments of which Chesapeake Bay actually, he believes, is a distinct population segment; along with a distinct population segment in the southern part of South Carolina.

South Carolina actually has moved forward with some management measures to protect those fish in the southern portion of South Carolina DPS. I don't know that anything yet has been done with the Virginia portion. I think, again, that any of the information related to the tagging data, the length of time that the tags

were at large, you know, certainly, those fish are moving inshore and offshore, north and south.

It would be very difficult, I think, with the information that's available to date, to be able to make any specific recommendations in terms of biomass trends based on those movements; that really are rudimentary at this point, I think. But as Dr. Denson begins to collect more samples and collects more information, which I know he's working with Virginia specifically, North Carolina and other states to collect that data.

Hopefully, a pattern there will arise. But at the present time, as John indicated, the complexity of the genetic IDs and trying to parse out the various genetic components of these stocks is extraordinarily difficult and complicated. Until that information is lock solid, I don't believe it would be use to manipulate or modify the way that the general stock assessment has been completed to this time.

MR. BUSH: My second question is sort of more for my own edification. When the ACLs were set and then the couple of northern states that were added to that list, the allocation was set kind of without those states being involved; if I understand correctly. Do we anticipate that possibly being readjusted at some point?

DR. DANIEL: Well, I think the ACL is based on the stock assessment and what number comes out. For cobias position, we're not overfished and overfishing is not occurring. The current ACL has been set as a precautionary measure to avoid overfished and overfishing occurring; which kicks in a whole new set of council and National Marine Fisheries Service protocol and requirements for the plan.

At the present time the ACL is set at a level that's precautionary to avoid those problems from occurring. I don't believe that the distribution of the catches really have played a role in the ACL at all, it is a specific number. Where you run into an issue there, potentially, is with the allocation and the current 92-8, whether or not that takes into account any of the issues that are going on say, north of Virginia.

I would be doubtful that it would have much of an effect, because of the extraordinarily low landings that are measured north of Virginia. I think once you get up there, I would be speculating at the percentage, but it is an extraordinarily low percentage that I doubt would have much of an impact on either the ACL or the allocation distribution.

But certainly, I believe -- I assume that it would be the intent of the commission if they move forward with this plan, to provide the opportunity for any state that has an interest in cobia, to make sure that their state's interests are reflected in anything that occurs at the commission level.

MR. CIMINO: I would like to follow up on Mr. Bush's question. Perhaps I didn't fully understand it. I would like John to correct me if I'm wrong. Virginia participated in the last SEDAR. We contributed quite a bit of data. We had some of the best age data on the coast, and in fact, we were responsible for increasing that maximum age. This was a statistical catch-at-age model, and I think we well represented the catch-at-age for the Chesapeake Bay harvest. As far as the last assessment, that biomass and that catch is certainly a part of that model. I just wanted to point that out.

MR. ADAM NOWALSKY: One item that I don't see in the document right now, and I'm curious if there was discussion at the PDT level. The reason we're really here is a function of what the recreational catch estimates have been in recent years. What we've learned, despite the many improvements with the MRIP program, is that individual intercepts can drive these numbers by a factor of literally hundreds of thousands individual intercepts.

When you're talking about the very low rate of intercept, that has huge implications, now I'm

not familiar with how the South Atlantic has dealt with these recreational issues in the past. I know at the Mid-Atlantic two of the FMPs we deal with, one for summer flounder, black sea bass, scup looks at a catch on an annual basis, compares it to the last year and then changes the regulations accordingly.

The bluefish plan, however, does it differently, allowing for an averaging of recent years harvest. My question right now is, did the PDT have discussion about these different methods for using the recreational catch data, and what options, if they did have that discussion, did they consider putting in the document for comment on the public on how best to try to mitigate these impacts that the MRIP data is having.

DR. DANIEL: Very good question, and then I'll make an effort and then if others want to step in, I guess, Mr. Chairman that would be okay. There was discussion at the PDT level on the landings, primarily because I messed them up in the document when I was initially putting them together. I was comparing apples and oranges using some of the MRIP data and some of the Southeast Fishery Science Service data.

We decided to go with the Southeast Fishery Science Service data, because that was what was being used to manage the quota. That information had remained relatively stable over time. The PDT is not making a determination as to which one is better or not. It is just simply that that was the number that was consistent, it was the number that was used to close the fishery in '016, and so that was the number that we were consistent with.

I think that is the key is being consistent in the methodology that you use. My understanding, and there are folks in this room that know a lot more about the MRIP specifics than I do. But one of the things that occur is that there are adjustments made to MRIP over time, and that those numbers can fluctuate.

When you go to look at the landings data, they may be 1.5 million one day and 1.7 million after some time. It does make it a little more difficult. I think, as John indicated, the intent and purpose is to try to get the MRIP data, which we've all bought into and agreed to, as the primary methodology that's used for managing and for accounting for the harvest of recreationally caught cobia. I think our concern at the present time, concentrating on cobia and not delving into the specifics of the Southeast Center's data collection programs and the MRIP collection programs, was to be consistent at least in what we presented to the board.

In terms of any kind of proposal of any kind of increases, there have been efforts and attempts to incorporate for-hire logbooks and trying to collect information on the for-hire sector that has not gone well, dealing with the for-hire folks, at least in certain regions. How to improve that data collection program on what tends to be a fairly rare species, there is information coming out right now about some of the PSEs, at least in the Virginia and the North Carolina estimates for this year that has raised some concerns.

I'm not sure that anyone and I certainly don't have the answer to those questions at this specific moment. But they are definitely issues that I'm certain will be raised throughout the public comment period and into the next several iterations of the FMP, if we move forward with one. Not a whole lot, but it just explained that there are a lot of issues and I concur with your concern.

MS. KERNS: Adam, I think what you're asking in addition is, can we add a question or two in the PID document about how we address harvest for recreational landings, and can we do averaging, can we not do averaging of that landings information; and how do we use those data, whether it be to determine whether or not we've hit the RHL or not with averaging data, or do we only use averaging data or some other format of the information to help set the measures?

We can add that question to Issue 4. What Louis did just bring up, though, is a question for this management board. Typically, when the commission pulls data for the recreational fishery, we use MRIP data from the document, or for documents that we manage. The South Atlantic Council does not use MRIP data; they use the information that comes out of the Southeast Fisheries Science Center.

I don't know, and this is a question to John, does the Southeast Fisheries Science Center go outside of the southern states for the landings? For example, as Louis said, Rhode Island has landings of cobia. They are very small, but it is still something that we should be including in our management document. It is not there right now.

If it is not done by the Southeast Fisheries Science Center, then the board needs to decide how we want to move forward. Because we will have to consider what data we use, say, you decide you want to do allocations. We have to know what set of data to use to do those allocations.

MR. CARMICHAEL: The South Atlantic is a lot like the Mid-Atlantic it sounds, we have some that use averages and some that use annual years for your first question. Cobia is one that was set up with averages, the three-year-moving average, but the clock restarts when there is a change in the ACL, so that is the situation we were in. The ACL had changed and that's why the moving average couldn't be used.

But it is certainly something that can be considered. As far as the MRIP, it is correct. The Southeast Center does some additional post processing of the MRIP data, and they use the core estimates that are available from MRIP; and their processing addresses the weight estimates from MRIP. I think if any of you have looked at an MRIP query, you know it warns you, weight data is measured with great uncertainty and is not as reliable as the estimates of the numbers of fish caught, because that is what they ask people about numbers. They measure fewer fish than what they actually see.

There is always great uncertainty in the poundage that is associated with any of those MRIP estimates. That is really a problem for many of the South Atlantic species. We manage many species; some of them are very rare in their recreational database. What the Center has done, is come up with a way to do a different sampling approach to try to fill in missing values or when there maybe is only one fish measured for a wave mode, what have you combination, perhaps within a year.

They borrow from adjacent cells, essentially, and they try to come up with a better estimate of what the actual average weight is for a given fish within a given component of MRIP. How much of that borrowing they do, obviously depends on how good the sampling is. For some species it's very little and their estimates will pretty well match, most of the time exactly what you see if you take an MRIP query and then you look at something put out by the Southeast Center for the actual poundage that is landed.

That is assuming, of course. you're only looking at the private and charterboats, because you can't forget also, within the southeast we have a separate survey that does the headboat. If you were to do an MRIP query and look at landings of recreational in the southeast, and compare it to something from the Center that included the estimates from the Southeast Headboat Survey; the two are not going to match and are never going to match, because that component is not in the MRIP query database.

We have two things that are at work here within the southeast. One is the headboat survey that has to be accounted for, so you're not going to get the MRIP exact, and the other is the alternative approach for dealing with the weights. Then the southeast also includes the Gulf, so if we have species that, depending on

how they wrap around the South Atlantic and Gulf jurisdictions, and what you're doing with Monroe County down in the Florida Keys, that could lead to other post processing things that are done to get the data to match the actual stock or the management unit, which may not make them match within the overall MRIP queries that you do.

MRIP, within the southeast, is a much more complicated beast than it is with the guy say, in the Mid-Atlantic and New England; and we're kind of jealous of that at times. Because we have so many other things that are in play, it makes it very hard to just do a simple query and get the information. But, in general, they rely on the estimates, but there are things that have to be done afterwards to make sure that they are complete and accurate.

MS. LYNN FEGLEY: Switching topics slightly. I think, under Issue 3, I just wanted to confirm that there is some room for conversation for the public for issues like the Chesapeake Bay, where we may have access to a smaller fish. I'm wondering about conservation equivalency; if the flexibilities that are mentioned under Issue 3 cover that, or if we need to have more specific language for the public to comment on something of that nature.

DR. DANIEL: That was not specifically discussed by the PDT. In the development of this, I don't recall that being brought up. Certainly, if it's something that the board wanted to consider, we could try to -- I think that the regional differences bullet, the second bullet, probably addresses that; if the board agrees that it addresses that. If not, we could make some slight modifications to the language to make sure that it addressed that if it was the desire of the board. That was not discussed or considered, but it could be.

CHAIRMAN ESTES: I think, if there is not any objection, we'll ask that that be clarified in the document.

DR. DANIEL: That's not a problem.

CHAIRMAN ESTES: Other questions. Robert. Comment?

MR. ROBERT H. BOYLES, JR. I was wondering, Mr. Chairman, if you were ready for a motion.

CHAIRMAN ESTES: Yes, but do we want to first discuss the type of data that we want to use to estimate harvest? Do we want to do that here?

MR. NOWALSKY: I appreciate the responses I received to my question, and while Toni might have most directly answered it, the information from Louis and John were extremely helpful in building on that. Based on those complexities, it gives me pause and to think that those issues should actually be described for the public; and that should be an issue that we go out to the public and get some more information on.

I would recommend -- I appreciate the suggestion of adding one bullet point under recreational management tools. But from what I've heard, I think the whole issue of recreational deserves its own issue, quite frankly. There are just so many questions about the data; how it's used. What should be used, what to use to calculate the RHL for a comparison basis, whether to trigger ACLs.

I think I've just touched the tip of the iceberg, not to take away from Dr. Steneck's presentation yesterday. I think it's an entire issue unto itself, and I would encourage consideration by this board of requesting that recreational be broken out as a separate issue, and a number of these topics that have been discussed recently be described to the public, and asked for comment on.

MS. KERNS: Adam, we can definitely separate the two issues. I just am curious, what kind of feedback will you be looking for, in terms of asking the public whether or not we should use the Southeast Regional Data versus the MRIP data? Do you think that the complexity of the issue is a decision that you all should decide. What would you be seeking us to find from the

public on them; or is that something that the board can answer for us today?

MR. NOWALSKY: Well, I would like to believe that the fishermen would have some input, as far as collaborative basis, with regard to their thoughts about what the pros and cons, the strengths and weaknesses of each of those datasets are.

Getting that feedback could potentially help inform us with the decision. Moreover, I would like to hear the thoughts about ways to help mitigate those impacts. These impacts, and we're talking directly about cobia, but the impacts of that harvest data go way beyond cobia. Any and all opportunities that we have to get some more information about how to mitigate the extreme impacts of the limitations of the data, I think we would be remiss if we didn't take advantage of that opportunity.

MR. BOYLES: Along those lines, and to keep the conversation moving along, it strikes me that if the commission customarily addresses these questions by using the MRIP data, then I, for one, would be in favor of being consistent and using the MRIP data in compiling the information for the PID.

DR. DANIEL: Obviously, we'll do whatever the board recommends. Is cobia the place to have this huge debate and deliberation? I am asking the question. This is a major issue for the commission, if we're going to move into this discussion as to what's better; Southeast data or MRIP data. Again, I will restate that the PDT, as long as we were consistent in using the various technologies and methods that we have available, was that appropriate.

What the impacts are to an individual state or an individual fisherman. I don't think we know the answer to that question at this time. In a fishery where there tends to be less interest north of Virginia, I don't want to say any more than that about it. This is a coastwide issue that we're delving into here with cobia that may not be the most appropriate place to address this question; just a comment.

CHAIRMAN ESTES: Robert, follow up?

MR. BOYLES: I want to follow Dr. Daniel's comments with something he said earlier. For the board, I think it is helpful for us to take a deep breath and remember why we're here. The latest stock assessment under which we're operating for cobia suggests we're not overfishing and the stock is not overfished.

In 2015, we blew the ACL by 2.5 times. I believe, one of the purposes here, is to get us all on the same page to help us manage and sustain and conserve this fishery; so that the next stock assessment will also reveal that we're not overfishing, and the stock is not overfished. Dr. Daniel, I appreciate your comments.

The point about the data and the veracity of the data, the representativeness of the data is in my estimation, in my opinion, is a discussion for a much broader audience. The cobia anglers that I know, not only in my state, but elsewhere, I don't think are going to be well served by that conversation. I struggle with understanding sometimes the distinction between Southeast Fisheries Science Center produced data, catch estimates and MRIP.

It is a difficult concept for me to grasp. I'm not sure that it's really necessary to go to the public with an inside baseball question. I just would, again, encourage the board to remember the purpose here. I believe, when the policy board said yes, let's develop an interstate fishery management plan, is to let's see if we can develop a framework under which and by which we may work together to sustain this resource in conjunction with the council, in a complementary fashion, so that we do not end up with this fishery overfished and overfishing.

DR. ROY CRABTREE: I agree with some of the comments Robert made. The way that the Southeast Fisheries Science Center, I think, re-stratifies and reweights some of the weights

and things, is done across all of the species that we're tracking now in the southeast. If we were going to make a change in how we do that, I think we would have to apply it across all of these species to be consistent. But at this point, I mean the Science Center is advising us that the re-stratification the way they're doing it, produces the most reliable and the best estimates. That's what we're going to have to use to track ACLs at the federal level at least; until something changes with that.

I'm not sure that going out to the public on a question like that is really going to be productive, because I think it largely gets into a highly technical statistical discussion about how to deal with, what I think, as John said, is principally the weights that are used. I don't even understand exactly how they do that myself.

I'm not sure we're going to get a lot of good input from the public on that. I think that is a larger question. As Robert pointed out, we did have a substantial ACL overrun in 2015. We have the preliminary catch estimates for 2016 through Wave 4, and it appears to me that the catches in '16 may be as high ultimately at the end of the year as they were in '15; because I'm seeing that the preliminary estimate is something on the order of 1.2 million pounds being caught at the end of August.

Again, that is off the MRIP site. There will be changes to that. As John pointed out, that doesn't include the headboat survey, so there are more catches that will be added into that. But it does, based on everything we know, look like that we're fishing this stock at a level that is not sustainable. Even with all of the uncertainties about the catches, the differences are so great that it's hard to ignore it.

I think we do have a real problem here. I think federal management alone cannot solve this problem. I think even if the EEZ was completely closed year round, I don't think it would make a great difference in the magnitude of these catches, because most of them seem to be coming out of state waters.

I think that the only way we're going to get these catches to a sustainable level is through a commission management plan. I think there is a lot of room for discussion between the commission and the council, as to what, if any, role federal management needs to play in this. But it's clear to me that successful management is going to require an ASMFC plan.

MR. CARMICHAEL: I think it will be helpful in the document to clarify the different data sources. To be clear that it's not an issue of MRIP versus Southeast Center data, they are all MRIP data. The Center just has a separate processing step applied to the MRIP data. It would certainly be helpful to clarify that to explain why an MRIP query that people can readily access may not be the same as the document.

Also, because this is probably new to many of the affected fishermen, this idea that there is this separate monitoring of the headboats of the Southeast Regions Headboat Survey; folks are accustomed to being able to go to MRIP and see the entire recreational landings in one-stop-shopping. They are not going to get that in this.

I think it would be very important for the document to at least acknowledge that; that there are separate estimates brought in from the headboat survey, and they are not available over the MRIP system. I think we would all love one day if you could get all of that information in one place consistently. But until that time, it would help to clarify what the different sources are, so that people that aren't accustomed to this aren't then coming back to you and saying, look, you don't even have the landings right. We do this a lot, just because we do face that quite often when people go to the readily accessible sites and get information and it doesn't match what's in assessments or management plans or what have you. It is important to explain it to them.

DR. LANEY: It seems like we have gotten into comments a little bit, and I did have one editorial concern, I think. If you look at Page 2 of the document, it states that there was a closure during 2016, and it did have an economic impact et cetera, et cetera. Then if you go to Page 3, it clearly states that North Carolina and Virginia came up with alternative measures so they didn't have to close.

I just think there needs to be some clarity in the document that states up front somewhere that there was a closure in federal waters, but that there wasn't a closure in state waters. We just heard Dr. Crabtree share the preliminary results for 2016. My concern is over how we say or what adjectives we use, I guess, relative to economic impact.

Clearly, if a closure is put in place in federal waters, then that has some level of impact. But if you continue fishing in state waters in North Carolina and Virginia, what's the real magnitude of the economic impact? If we have data that we could cite about numbers of trips declining or numbers of clients who canceled trips or things like that.

It would be good if we could share that information. But I do think we need to state up front, as opposed to reading something on Page 1 that implies there was a closure and then Page 2 says well, yes, but it didn't apply in North Carolina and Virginia state waters. I think we just need to fix that. It's just an editorial thing.

Oh and then, I did want to complement the PDT and Louis, I think they did a great job putting the PID together. I'm especially attuned to the genetic information that's in there. Again, I think I said it at our last meeting and I'll say it at this one. I think we, as a commission, have a responsibility, not only to look at things like age structure and SSB and distribution of fishes; but also the genetic health of the stock.

In those cases where you have stocks that are homing, and that was clearly pointed out in the PID. There are aggregations of fish that are spawning in different geographic areas that we need to be concerned about. I'm really waiting to see the outcome of the genetic work that helps us to further differentiate where there are actually different spawning stocks.

I have this fear of, well not a fear, but a desire to avoid ending up where things wound up in some parts of the northeast, where you had a whole lot of local cod stocks that were spawning locally that didn't get recognized until after they had already been fished out. Hopefully, we can avoid any sort of scenario like that.

CHAIRMAN ESTES: I think we will clarify that issue. Are there any objections to, in the document, regarding the sources of data, identifying the sources of data to be consistent use the data that we get from the Southeast Science Center? Are there any objections to doing that? Seeing none; that's what we'll do. Do we have more questions?

DR. DANIEL: Just a comment. That's what I have on my list at this particular point in time, just so everybody is clear; a distinction using the southeast data but also distinguishing between the Southeast Science Center information and the MRIP data so that that is clear, particularly bringing up the point that John raised about the headboat survey information, and addressing Wilson's point on the implication that it was closed when it really maintained openness in Virginia and North Carolina after the closure. Those are the corrections that I have for the public draft at this time.

CHAIRMAN ESTES: We've got Lynn and then Joe.

MS. FEGLEY: I think this goes into the editorial category, but it links with what Wilson was saying. It might be helpful for the public under Issue 1 to be a bit more descriptive about what exactly a complementary management plan means. In the white paper that we went through in August, there is a really nice

description of the different ways you can manage, whether it is joint or complementary or ASMFC specific.

I feel like it is not particularly clear what we're buying when we do a complementary plan. I think some clarification there, and I think it speaks to what Wilson was saying, as well. When the states are open but the feds are closed, what exactly are we doing here?

CHAIRMAN ESTES: Good point; we'll add that in there.

MR. CIMINO: I appreciate the order you chose, because this will be a follow up to Lynn's question then. When this board voted on implementing this public information document to go down this road, if I'm not mistaken Dr. Duval's motion specifically stated that this would be complementary management.

I believe the Policy Board also voted on going towards complementary management. I'm curious, since that's the first question is should this be complementary management. Is this being revisited and would the board be re-voting on whether or not that is the path we're taking?

DR. DANIEL: I'll be honest, I wasn't altogether clear on what action the board was specifically taking there; and felt that because of some of the comments that we had received that that may be something that you would want to have some public comment on. Certainly, if the board has decided that it will be complementary management with the South Atlantic, we can make some modifications to the document to reflect that.

I appreciate those comments. It is a similar issue with the management unit. The council has made the decision and the genetics data seem to confirm that that Georgia/Florida line to New York is Atlantic migratory group cobia. But we are going to provide the opportunity to the public to make some comments on that; whether it's contrary or consistent with the data or not is a tough one. I would be standing by for any suggestions on how to address that contrary to the way the document lays it out at this time.

MS. KERNS: Joe, the only other thing that I would add is we could make it clear in the document that it is the intention of the South Atlantic Board to do complementary management; does the public have a differing opinion. Because you do have the ability, since it is not a final decision until you approve the FMP, you can alter from your initial initiation of the plan.

MR. CIMINO: That works for me, thank you.

CHAIRMAN ESTES: Are there any more comments before I go to Robert, because I think he had a motion.

MR. BOYLES: Again, a nice shout-out to the Plan Development Team; with that and with the discussion around here at the board, as amended, **I would make a motion that we approve the Draft PID for public comment.**

CHAIRMAN ESTES: **As amended, did I hear you say that?**

MR. BOYLES: **Yes**.

CHAIRMAN ESTES: I thought so, thank you. Do I have a second? Lynn. Okay, I will read the motion; apparently not yet. Okay, move to accept the Draft Cobia FMP Public Information Document for public comment as amended; motion by Dr. Boyles, seconded by Ms. Fegley. **Are there any objections to the motion? Seeing none; the motion passes unanimously.** The next item is the Red Drum Working Group Report. I think that is going to be given by Jeff.

RED DRUM WORKING GROUP REPORT

MR. JEFF KIPP: Good morning, everyone. I'll be reporting on the work and recommendations for the tasks from this board to the Red Drum Technical Committee and Stock Assessment

Subcommittee following the presentation of the stock synthesis model estimates. Just a summary of those tasks, looking at the appropriateness of the current biological reference points, looking at F based reference points for juveniles only.

The validity of age-based models for red drum given some data limitations in their life history, also looking at the tag return rates from the stock synthesis models and determining how to treat the tag recapture data within those models. The final is doing continuity runs of the statistical catch-at-age models using SEDAR 18.

This is just a summary of the meetings that we've had for addressing these tasks with those highlighted in red occurring since the August meeting, when we last updated the board on the progress for these tasks. I'll just go ahead and read the tasks as they were given into the record.

The first was biological reference points; investigate whether the current biological reference point for overfishing 40 percent SPR target and 30 percent SPR threshold, is appropriate, given the species long life history.

This task is twofold in that the board is interested in whether spawning stock biomass is an appropriate metric, and whether the 30 percent threshold and 40 percent target are suitable goals. The board also requests the development for an overfished reference point recommendation.

Two of the major items that the group looked at to address this task were first, a literature review and discussion amongst the group of the theory and use of these percent SPR reference points relative to red drum life history.

In the document that was provided for meeting materials, there is kind of annotated bibliography of a lot of the reference that was reviewed by the Technical Committee relating to SPR reference points; and also some projections under various stock recruit relationships and a different percent SPR or escapement trajectories. This is just an example of what we looked at for the projections, and this actually comes from analysis Mike Murphy did for Gulf of Mexico red drum in Florida. But these figures show two equally or close to equally plausible stock recruit relationships for red drum within the purple lines.

Those stock recruit relationships are fit to biomass and recruit estimates out of models. Then also, different expected recruitment and spawning stock biomass values from a population, given that stock recruit relationship and various fishing levels at different SPR percentages, which are the different dashed line trajectories. You can see under these two equally plausible stock recruit relationships you have very different effects on the expected recruitment under those different fishing mortality regimes.

This is some of the uncertainty that the group looked at, when trying to determine if the current target and threshold are appropriate for red drum. The recommendation from the Technical Committee for this task is to maintain a 30 percent SPR threshold and 40 percent SPR target for both red drum stocks.

They did note that improved information on the stock recruit relationship is necessary before alternative percent SPR levels can be reliably evaluated for management of red drum. An overfished reference point is not recommended without reliable spawning stock biomass estimates.

But they did note since SPR is a recruit-based reference point, it is important to qualitatively consider the recruitment trend from the model estimates with SPR estimates in the absence of these biomass estimates in an overfished status. The SPR doesn't necessarily reflect any potential declines in recruitments, so it is necessary to consider this information with no biomass estimates from the models.

The F based reference point, given concerns regarding the appropriateness of the current reference point and the lack of data on adult red drum, the board would like to see an investigation of the feasibility of an F based reference point that looks strictly at the harvest of juvenile red drum.

The board looks for guidance on whether this type of reference point would provide an appropriate level of information for management. The group started with discussion around advantages and disadvantages of a potential juvenile F-based reference point. Here the advantages are listed.

We did note a strong relationship between juvenile fishing mortality estimates and SPR estimates out of the modeling approaches, which hence that you could potentially use a juvenile fishing mortality reference point or juvenile fishing mortality estimates almost as sort of a proxy for SPRs across the entire age structure.

There is the potential for improved precision for these estimates, since most of the data does come from juvenile fish. There is also potential for reliable estimates from several different approaches, which could be used to validate these alternative approaches. These figures show the relationship between the SPR estimates on the Y axis and the F estimates on the X axis from the stock synthesis models for the southern stock on the left and the northern stock on the right.

These are some of the disadvantages the group considered when looking at this task. One that's a reoccurring issue that has been discussed in past assessments for red drum, mainly around a potential use of escapement as a reference point, is the difficulty identifying the appropriate reference point; particularly without information on the stock recruit relationship, and how these different fishing mortality levels on the juvenile stock affect spawning stock biomass and subsequently future recruitment.

Another major disadvantage is that this type of a reference point would ignore fishing mortality on mature fish. The current data does support increasing fishing mortality on mature fish, mostly due to increasing catch and release across the different stocks. Also another disadvantage is the juvenile-based fishing mortality reference point would be independent of recruitment, similar to as I mentioned for the SPR reference points.

There is the potential if spawning stock biomass declines, there could be a decline in recruitment, and even though you are fishing that declined recruitment levels above the threshold or target that doesn't provide information on that declining recruitment. That wouldn't necessarily trigger management action by just using that reference point.

This just shows that increasing trend of the fishing mortality on the mature fish from the estimates from the stock synthesis models with the northern stock in the upper left hand panel and the estimates for the southern stock in the lower right hand corner. The recommendation for this reference point, the Technical Committee concluded that management with juvenile F-based reference point could lead to stock depletion.

This could occur as a result of declines in recruitment due to declines in spawning stock biomass and/or poor recruitment due to the high variability in recruitment that has been observed in red drum. The Technical Committee recommends against using a juvenile F-based reference point solely to manage the red drum stocks.

The validity of age-based models task. The board is concerned that the lack of information on adult red drum, especially in the northern stock, may impact the ability of the stock synthesis model to accurately measure stock abundance. As a result, the board asks for an

evaluation of how red drum life history and current regulations, namely the moratorium on fishing in federal waters, may limit the validity of an age-based model such as SS3.

I'll just highlight here a couple of the main points that the group discussed when discussing this task. The first is a lack of contrast in the data used to inform potential stock productivity in the models. The model time series is short relative to red drum longevity, and also the history of the fisheries. The model time series starts in 1989; due to lack of different data types prior to that year.

Also the longline indices, which provides information on the adult portion of the stock, showed little contrast and again, provides little information on the potential productivity of the stocks. All fishery selectivities are dome shaped, due to the regulations and also the life history of red drum as they move offshore and become less vulnerable to fisheries.

This can confound the estimate of selectivity where you have a descending slope of selectivity for older fish. The model can struggle to estimate what that descent is due to a decline in mortality, and what portion of that descent is due to a decline in reduced availability as those fish move offshore.

These two points here are of concern. These get more to potential data bias in the data than were used in the models. It was noted that estimated harvest of the adult fish from MRFSS back in the late eighties and early nineties is very low, in a period when harvest of these adult fish was legal. The information from tag recapture data conflicts with these estimates, suggesting that a high proportion of adult fish were actually harvested during this same time period.

Also, we used volunteer tag recapture length data as a proxy for the size structure of the dead recreational discards and the recreational CPUE. There are some limitations of using these data based on instructions that were given to recreational anglers on certain sizes that were supposed to be tagged and things like that.

The recommendation for this task is to continue using age-structured models for red drum. The Technical Committee believes that the differences in red drum life history characteristics and vulnerability to fisheries across ages, is best modeled with an age-structured model that tracks cohorts through time.

However, they do recommend addressing some of the effects that I just went over of data limitations through additional assumptions and reduced model complexity. The next task was to look at the tag return rates. Given the sensitivity of the SS3 models to the tag return reporting rate, the board asks for an evaluation of potential tag return rates for each region and to determine if the tag return data should be incorporated in new model runs.

The board is specifically interested in a run which uses an 18 percent tag return rate, per the suggestion of the desk review report. I'll note here that most of this work focused on the northern model, due to the inconsistencies between the reporting rates out of that model, and the reporting rates in previous literature looking at the tag recovery data.

Some of the things that were done to look into this task were a likelihood profile, data weighting sensitivity runs, comparison of external tag recovery model estimates to the estimates from the stock synthesis model, and model runs with simulated recapture data. For the southern stock model there were sensitivity runs that we completed looking at some of the fixed reporting rates, specifically that 18 percent that was requested. This is a likelihood profile for the northern stock, and the Y axis has the change in the negative log likelihood relative to the minimum negative log likelihood.

What this shows is for these lines here, particularly this black line, which is the total

negative log likelihood. As that line increases and gets the higher values, it suggests that the parameter values on the X axis, which are the reporting rate estimates for reporting of tagged red drum, become less likely given the data that are used in the model. As you increase the reporting rate from 10 percent, which is at the very far left of the X axis up to 95 percent. The model suggests that those estimates are less likely as you increase, given the data that you're using in the model.

However, I will note that there does appear to be some conflicts amongst the different data components that make up the total negative log likelihood; and these are the other colored lines here on this figure. If you look at the blue line, that is the length composition data, and that mostly agrees with this increase in the total negative log likelihood. But certain data components like the conditional age-at-length data, which is the green line, have a different trend and seem to conflict with some of these other data components. These are some of the estimates from the different runs in the likelihood profiling. On the left are the annual spawning potential ratios, and on the right are the Age 0 recruitment estimates, and you don't need to see the specific lines here and what they are.

But I will just note that for the lower SPR estimates all bundled up, those are from model runs where the tag reporting rate is fixed at 45 percent and lower. The one gray line in the middle are the SEDAR 18 SPR estimates, with the target SPR the dash black line. Then the other sort of group of high SPR estimates are from model runs with the reporting rate fixed at 50 percent and greater.

Similar to that for the Age 0 recruitment, you can't really see but there is a line that is much lower and there are several overlapping lines. Again, those are the estimates from the models with the reporting rate fixed at 45 percent and lower. The black dash line are the recruitment estimates from SEDAR 18, and then the other group of recruitment estimates bundled together are the recruitment estimates from the models with reporting rate fixed at 50 percent and higher.

What this shows is that the model is kind of flip flopping between two drastically different solutions here, which suggests some instability in the model when the tag recapture data are included and the reporting rates are fixed. This further shows that instability I just mentioned. On the left, again, are likelihood profile plots.

These are for the unfished recruitment estimate out of the model, and for the left figure, that is the likelihood profiling with the tag recapture data and the reporting rate fixed at different values. What this shows is that the value from the base model, which is 5.5 on the lower left hand end of the X axis on that first panel, are the most likely estimates of that parameter, given your data used in the model.

As you fix that reporting rate at higher and higher values, the data support those parameter estimates less and less. On the right side is a likelihood profile over the unfished recruitment, from the stock synthesis model without the tag recapture data. This shows a much more expected pattern in those estimates across the different values for that parameter, with a very defined lowest likelihood in the very bottom of that convex shape.

Then as you get further and further away from that most likely parameter estimate, the likelihood increases, suggesting a less likely parameter value. Given these data conflicts that were observed when we included a tag recapture data; there is the potential for different weightings of the different data components in your model to have significant impacts on your model estimates.

What we tried to do here is to adjust the weighting of the different data components, specifically the tag recapture data, to see what kind of influence that had on the model. Just a quick note here on that, the model was generally insensitive to these alternative

weighting scenarios. One tendency was to estimate a more depleted stock than the base model which we reviewed a couple meetings ago.

As the weighting of the length composition data is decreased and/or the weighting of the conditional age-at-length data is increased. Another analysis we did here was to look at external tag recapture model estimates, so we used the program MARK, which is tag recapture modeling software, and looked at what the estimates from those models were. However, this was very limited in what we could do because of how the data had to be treated, and how that was different, and how they are treated in stock synthesis. This didn't provide a lot of information on the differences in the estimates out of this type of a modeling approach and not a stock synthesis.

But it did highlight this pattern that we see here. These are the tag recapture data matrices for Age 1 fish in the top matrix, and Age 0 fish in the bottom matrix. This is a ratio of recapture rates in the tagging data that was used in Batchelor et al, 2008, which is a paper that we've referenced often with the 18 percent reporting rate estimates out of that paper; and then also the tag recapture data as it was used in stock synthesis.

This shows that the data used in that Batchelor et al paper consistently had a higher proportion of recaptures than in the stock synthesis data. This kind of suggested that possibly to explain the discrepancy in the reporting rate estimates is this data. They were using the two different analyses. What we did is we went back and we tried to manually adjust the recapture data to match the recapture rates in the Batchelor et al paper.

But that did not have much effect on the model estimates, and actually those recapture rates had to be increased significantly before this tag recapture data agreed with the other data components and stock synthesis, while returning a reporting rate that was much more expected, given the published literature studies. These other runs for the southern stock, the sensitivity runs, these are the annual SPR estimates, with the black lines showing the SPR estimates from the base model that was presented to the board. The dotted black line is the SPR estimates from the model with no tag recapture data. You can see again there is little influence of taking that tag recapture data out.

The blue line is the model run with reporting rate fixed at 18 percent. The red line is the model run with the reporting rate fixed at 60 percent, and then the dotted blue line are the SPR estimates from SEDAR 18. This model had a little bit more of the expected response to fixing that reporting rate, where it generally scaled the estimates up and down and more of a gradient as opposed to two very drastically different solutions that the model was kind of going back and forth to.

The conclusions after looking at these different analyses. The tag recapture data currently have little influence in the SS3 models, unless reporting rate parameters are fixed. Specifically for the northern model, fixing reporting rate parameters indicated model instability; when looking at the likelihood profiles.

Some conflicts in other data components are likely contributing to this model instability. The recommendation, moving forward, is to not to include tag recapture data in the current SS3 models, with fixed reporting rates. It is noted that the data conflicts that were observed need to be addressed before including the tag recapture data with fixed reporting rates.

The last task. The statistical catch-at-age continuity runs, the board asks for an investigation of whether the previous statistical catch-at-age model would be useful for management, and if so, to conduct a continuity run for both regions. The board does not specify if the continuity run should only contain data sources using SEDAR 18, and leaves it to the discretion of the investigators to

incorporate new data sources as they see fit. If it is believed additional data sources will significantly improve the performance of the statistical catch-at-age model, the board encourages these additions. We did review the statistical catch-at-age model runs with data through 2013, which was our terminal year used in the stock synthesis modeling and carried forward for this analysis.

The data changes were minimal, but they do include the addition of longline surveys now within the model, which index the adult relative abundance and also some changes to the juvenile index choices in the southern stock. The recommendation from reviewing the model estimates from this modeling framework is to use the updated statistical catch-at-age model, not as a continuity analysis, but rather as a preferred model for management advice.

This is based on some of the things that we've gone over reviewing these tasks. The data conflicts we've seen within the different data components of the stock synthesis model, and the need to determine the appropriate treatment of these data conflicts. Then also the departure of the SS3 model estimates from literature estimates, the SEDAR 18 estimates, and now the updated statistical catch-at-age model estimates.

I did note some data changes to the model relative to how it was configured for SEDAR 18, and so that will require a peer review. We'll be providing the results from these model runs to peer review for their determination on whether this is useful for management advice. We hope to provide the results of the models and the review to the 2017 ASMFC Winter Meeting. Just to bring it back and provide a summary of the recommendations. The Technical Committee recommends maintaining the SPR reference points.

They recommend against managing red drum solely using juvenile F based reference points. They do endorse the continuation of using age-structure models, and they suggest reviewing the updated statistical catch-at-age models for management advice; and recommend to not use the SS3 model estimates until data conflicts and parameter discrepancies are resolved. That concludes my presentations and I'll take any questions.

CHAIRMAN ESTES: Jeff, thank you very much for a lot of work. Are there questions? I would like to pose maybe a question to the board. Roy.

DR. CRABTREE: If we follow all of that advice and we use the statistical catch-at-age model for management advice, where does that leave us in terms of the status of the northern and southern stock; relative to overfishing?

MR. KIPP: I did not include results of the model runs in the presentation here today, just because I think the group feels that it is appropriate for the results to go to a peer review first, to get their recommendation on whether those would be useful for management or not; before providing those results.

CHAIRMAN ESTES: Other questions? You note that the data that were used here go through 2013. I think there's a question about whether we would like to have that updated through 2015 if possible, and then maybe if that is important, discuss the timing and about how we would do that. Robert.

MR. BOYLES: I was just going to go ask that question of Jeff or Toni. Can you give us a sense of timing on if we were to update the statistical catch-at-age model with data through 2015, what kind of timing we would be able to get to Dr. Crabtree's $64,000.00 question?

MS. KERNS: If we do not update the data and we just use data through 2013, we can get you the results of this peer review assessment in February; but it would only be through 2013. If we wanted to update the data and then give you the results, it depends on how much time it will take the states to pull that information

together; what type of priority you give your staff to work on that whether or not we could get that completed by the May meeting or the August meeting.

I think we can definitely do it by the August meeting, potentially by May. I think you have two avenues that you could move forward, and both avenues I think by updating the data it would either be May or August. You could follow sort of what we did with Tautog, where we had an assessment.

It was through an earlier time set, so go ahead and do it, the review; get the results with the 2013 data in February, and then immediately do an assessment update with the most recent data; which wouldn't need to be peer reviewed later. The flip side is you could task the group to get the new years of data, include it and then do your peer review. That peer review would come either May or August. In either case the most recent data would be May or August, depending on your staff's time.

MR. BOYLES: Speaking very parochially, this is a very important fishery for us in South Carolina. I think everybody recognizes that. Either of those timeframes, as you all know; you have heard me pontificate before about our legislative process. Our legislature goes home in May this year.

All else equal, given the fact that we won't have anything for us necessarily to have in our pocket as we go talk to our general assembly, I think I would just as soon update it through 2015. That would be my sense, and have the most up-to-date information that we have, so that should we need to make additional management changes we've got the benefit of the most recent data.

CHAIRMAN ESTES: Other comments about that issue? Are there any objections to updating it through 2015?

MR. CHRIS BATSAVAGE: I'm still kind of mulling through the options, the one given that was similar to what was done with tautog seems intriguing, since this has been a pretty long process to get where we are today. You have a peer review assessment in place, and then we can start soon after that on a data update.

Possibly one advantage of that is if we're into 2017, it could include 2016 information, as well. The other side of it is although data through 2013 is a little old; this is a long-lived fish. It probably lends itself better to red drum as opposed to say spot, where it would be a couple of generations past. I guess the question for whichever scenario is, how will that impact other stock assessments that are currently being done by the commission?

MS. KERNS: Most of this work has been done by Angela out of Maryland, and so that would be a question to Lynn of what her workload is. Jeff has been helping her with a couple of parts of this, and Jeff is essential in a couple other assessments that we're moving down the line. If Angela takes the brunt of that work to update, I can't answer that question. But you all have staff members that would need to be updating their datasets, and you all know how long that can or cannot take. As I said before, it would be how much of a priority you would give your staff members to work on those.

MS. FEGLEY: Really, Angela and the team as a whole, they're our heroes. They have been working very hard on this. I can't answer right now what Angela's ability would be. I would need to go back and circle back with her. I might need to medicate her. We can certainly follow up, however you want us to follow up, by e-mail or however to see what we can do.

MR. CIMINO: I would be remiss if I didn't just say thank you to everybody. There was an incredible amount of work put into this, and we would certainly do whatever needs to be done to help Angela with the update of the northern model. I just wanted to make one plug, I think, and I wouldn't stand against a motion from Robert in the opposite direction.

But for a path forward like tog, because I think it would give staff a chance to know whether or not we have any major errors and what we're dealing with before we put more work into this. There has been an incredible amount of work. If the peer review says what was done is solid, and now going forward, all we have to do is that update. I think I am pretty comfortable with that procedure.

DR. CRABTREE: This is certainly an important assessment. There is not getting around it, 2013 is getting to be a concern. But I do think this is something that we're going to need to begin to deal with the management implications sooner rather than later. I hope that we can find a path forward that allows us to begin talking about what actions need to be taken to deal with some of these issues as quickly as we can.

CHAIRMAN ESTES: Any other questions or comments before I try to summarize things? It sounded like what I heard was some interest in getting a review of the data through 2013, then immediately following up and update that through 2015 or 2016. Does that satisfy everyone? If not, let's discuss it some more. Any objections to that plan? Jeff, does that give clear direction?

MR. KIPP: Yes that's clear, thank you.

CHAIRMAN ESTES: Thank you very much for your work. Next agenda item is Jeff again; he's going to give a progress update on Spot and Croaker Stock Assessments.

PROGRESS REPORT ON SPOT AND ATLANTIC CROAKER BENCHMARK STOCK ASSESSMENTS

MR. KIPP: Since I last gave an update at the August meeting, we had, right after that, a second assessment workshop in August at our office in Arlington, and we also have had several progress calls since that assessment workshop. Right now, we're putting the final touches on a two-stage catch-survey analysis type model for spot and a stock synthesis model for croaker. We'll be having a few more calls to review that work and the additional work that needs to be done for those modeling approaches, and then putting that information into the final report; which will go to the Technical Committee, and then subsequently to peer review and then we'll be scheduling the peer review. If there are any questions on those assessments, I can take those now.

CHAIRMAN ESTES: Any questions on that? Seeing none; we'll roll right along. I think the next agenda item is Plan Review, and Amy is going to give plan reviews for Spanish mackerel, black drum and spotted sea trout.

CONSIDER FMP REVIEWS AND STATE COMPLIANCE FOR SPANISH MACKEREL, BLACK BRUM AND SPOTTED SEA TROUT

MS. AMY HIRRLINGER: We're going to go over the Black Drum 2016 FMP Review. This covers both the 2014 and 2015 fishing years. The following graphs represent black drum harvest within the management unit from New Jersey to Florida. Looking at total harvest, I wanted to point out a recent 2012 low point of less than one million pounds.

After a spike in 2013, landings again dropped 21 percent to 1.42 million pounds in 2014, which is under review, and then remained relatively constant in 2015 at 1.48 million pounds. These past two years have been about 30 percent below the previous ten-year average, which was inflated by the 2008/2009 recreational harvest spike.

Commercial harvest is relatively stable, accounting for 19 percent and 16 percent of the total in 2014 and 2015; 2014 landings decreased 8 percent from the previous year and then dropped again by 9 percent to 238,000 pounds in 2015. Florida and Virginia led the 2014 commercial harvest and Virginia led the 2015 harvest with 39 percent.

Recreational landings indicate that fewer but larger fish are being caught in recent years. The

number of fish harvested continues to drop at 166,000 fish in 2015. The catch in pounds actually rose last year to 1.25 million pounds, so this decrease in numbers can be attributed to the establishment of minimum sizes by the 2013 FMP, but the increased poundage is likely due to increased monitoring in the Mid-Atlantic region.

The 2015 harvest represents a 62 percent decrease in numbers bringing a 35 percent decrease in pounds from the previous 10-year average. Florida anglers landed 60 percent in 2015 recreational harvest. That is the longest slide we have out of all of these. Hopefully, we can get through the rest of this pretty quick.

The yellow portion of the bar shows the proportion of recreational harvest that was released. Percentage of releases has increased drastically over the last few years. From 47 percent released in 2013, releases increased to 71 percent in 2014, and again to 90 percent in 2015. Actual releases totaled 720,000 in 2014 and 1.5 million in 2015.

The recreational discard mortality is estimated at 8 percent. We can also attribute the steep increase in releases to the minimum size established by the 2013 FMP. The yellow portion of the bar shows the proportion of recreational harvest that is released. In the interest of time we can just say the FMP requires states with a declared interest to implement a maximum possession limit by 2014, and a minimum size limit of 14 inches or more by 2016. Sorry about the technical difficulties.

The PRT pulled the state specific requirements; also, it is not the possession and size limits stated by the FMP. Is that going to go now? As seen in the previous slide, the PRT finds that all states have implemented the FMP requirements and also no state requested de minimis in either 2014 or 2015. After that, hopefully, it's not too confusing review. Are there any comments or questions?

CHAIRMAN ESTES: Questions? Any actions anybody would like to take? Would you like to accept the FMP review and grant de minimis to the states that she pointed out?

DR. MALCOLM RHODES: I move that the board accept the Spanish mackerel compliance report as presented or the FMP and compliance report for black drum, I'm sorry.

CHAIRMAN ESTES: Do I have a second, Wilson. **Okay, so the motion is to move to accept the FMP review and compliance reports for the black drum 2014/2015 fishing years;** motion by Dr. Rhodes and seconded by Dr. Laney**. Are there any objections to the motion? Seeing none; the motion passes unanimously.** Okay, Amy, next.

MS. HIRRLINGER: Now we're going to go over the Spanish mackerel FMP review, which covers the 2015 fishing year. Total Spanish mackerel landings in 2015 are estimated at 3 million pounds, which is a 1.4 million pound decrease from last year, and both commercial and recreational landings have been in general decline for the past few years, aside from a few upticks.

The commercial fishery harvested approximately 7 percent of the total, and the recreational fishery about 30 percent. Coastwide commercial landings have generally been below 4 million pounds since 1995, which was when Florida banned entanglement nets, since they are historically the largest harvester.

Coastwide commercial harvest in 2015 totaled 2.3 million pounds, a 1 million pound decrease from the previous year, and Florida is responsible for 75 percent of the harvest. Now check out the trending recreational landings, because we're about to break that down. Recreational anglers harvested about 628,000 Spanish mackerel or 695,000 pounds in 2015.

This is a 29 percent decrease from last year and a 44 percent decrease from the local 2013 peak of 1.1 million pounds. North Carolina recently

passed Florida to lead recreational landings with 61 percent in number of fish in 2015, and South Carolina also passes here at 21 percent, leaving Florida in third with 13 percent.

This is the first year that South Carolina is responsible for a larger portion of the recreational landings. The percentage of recreational releases has generally increased over time, and was higher than ever before in 2015 with 65 percent of the fish released. A stock assessment was completed through SEDAR in 2012, which incorporated data through 2011.

It determined that the stock is not overfished or experiencing overfishing. To save time, here are the commission's regulations for Spanish mackerel; it includes the minimum length, bag limit and commercial trip limit. But the one important thing to note is that Addendum I introduced a pilot program which allows states to reduce the minimum size of their commercial pound net fishery from July to September.

They can lower the minimum size to 11.5 inches to reduce discards of slightly undersized fish. The reason why I brought that up was because North Carolina implemented this pilot program, and they did so from July 4th to September 30th. The state regulations table behind me is meant to illustrate that all the states are complying with the minimum size recreational creel limit and commercial trip limit. The PRT finds that all states have implemented the requirements of the FMP. Also in New Jersey, Delaware and Georgia request de minimis status, and the PRT notes that these states meet the requirements; and that's it.

CHAIRMAN ESTES: Questions, comments, actions? Malcolm.

DR. RHODES: I'll try not to have a technical glitch. **I move that the board accept the Spanish mackerel compliance reports and FMP, noting that Georgia, New Jersey and Delaware be granted de minimis status.**

CHAIRMAN ESTES: Second. John Clark. Malcolm, are you okay with saying approve de minimis?

DR. RHODES: Yes.

CHAIRMAN ESTES: The motion is move to approve the FMP review and compliance reports for Spanish mackerel 2015 fishing year, and approve the de minimis status for Georgia, New Jersey and Delaware**. Motion by Dr. Rhodes, seconded by Mr. Clark. Are there any objections to the motion? Seeing none; the motion passes unanimously.** One more time, Amy.

MS. CIMINO: Mr. Chair, before we move off Spanish mackerel, it was on the same timeline, well, the last SEDAR assessment timeline was the same as cobia; so I was just wondering if we could get an update on when Spanish mackerel may be coming back around.

MR. CARMICHEAL: We were looking into probably trying to do a standard assessment, so an update of Spanish in a couple years. I think it was fitting in either 2018 or 2019.

MS. HIRRLINGER: Okay, last one; Spotted Sea Trout 2016 FMP Review covering the 2015 fishing year. The following graphs represent sea trout harvest within the management unit from Maryland to Florida; 2015 saw one million pounds landed in total, which is 0.8 million decrease from 2014.

Commercial landings seen in blue here were 175,000 pounds, roughly half of last year's commercial total. All states saw a decrease in commercial landings except for South Carolina, which increased their commercial landings. Florida accounted for about a third of the total coastwide catch last year, and North Carolina came in second with 27 percent.

Leaders in commercial landings were North Carolina with 73 percent followed by Florida with 22. Check out the trend in growing recreational landings and the low point you see

in 2015, because the next slide will break that down. The following graphs represent sea trout harvest. Here are the recreational landings broken down by harvest and release.

Looking at catch in black, you can see a general upward trend 20.8 million fish peak in 2012. This is followed by a declining recreational catch over the past few years, so right now we're at a local low point of 5.7 million fish in 2015. Recreational harvest, which you can see in red, has remained relatively stable throughout the time series with a 1.3 million fish average, but over the past few years, we have seen a decline with a record low in 2015 at 534,000 fish.

This is 52 percent lower than last year, 71 percent lower than the 2012 peak; and Florida and Georgia both led this harvest with about 30 percent each. The low harvest in the past few years could be attributed to a recent increase in releases, which you can see in green; and these are on the rise, partly due to increasing catch-and-release trends as well as season closures and size and bag limits in place. The highest release percentage ever seen was in 2015 at 90.6 percent, and the previous 10 year average has been about 80.

The 12 inch minimum total length required by the 2011 amendments shows that all states have complied. The PRT finds that all states have implemented requirements of the FMP. Also, New Jersey and Delaware request continuation of de minimis status, and the PRT notes that these states meet the requirements of de minimis; and that is the end of the presentation.

MR. BOYLES: Amy, did you suggest spotted sea trout commercial landings are up in 2015 in South Carolina?

MS. HIRRLINGER: Let's take a look, let me see. In South Carolina commercial landings, according to the data that was submitted with the compliance reports did increase in 2015. Do you think something different? Because I can check that.

MR. BOYLES: We've not changed spotted sea trout regulations in a number of years, and it's a game fish. Hmmm. We'll have to look into that.

MS. HIRRLINGER: I can look at that and get back to you, yes I'll check that out.

MR. ROY MILLER: Amy may not be able to answer this, but I'm just curious if we know why there is an increasing trend in releases of spotted sea trout, when my recollection is that management has been fairly constant over the years for that particular fishery, or at least since early 2000s, anyway.

CHAIRMAN ESTES: Does anybody want to try that?

MS. KERNS: Roy, we can bring it back to the PRT and ask them if they have any information on why they think we're seeing these shifts and come back to the board at the next meeting and follow up.

MR. MILLER: Yes, it just kind of out of curiosity, I'm wondering if it's a paradigm shift in the way people fish or whether it's something else going on here with the increased number of releases.

MR. BATSAVAGE: I'll try to answer, at least from the fishery in North Carolina; 2015 we had another cold stun event that had an impact on the legal size fish, and actually had a cold stun in 2014 as well. The landings in North Carolina went down as a result of that. There was a pretty decent recruitment following up, which most of those fish were below the minimum size limit, and the releases were high.

In 2016, I think we'll see that those fish have moved into the minimum size limit and our harvest will be higher this year than it was last year, and probably 2014, as well. The other point, too, is although there really haven't been very many changes at the ASMFC level, as far as regulations go, the states have made changes, and North Carolina increased their minimum size limit from 12 inches to 14 inches around

2009 plus or minus a year. That certainly had an impact on the harvest in our state.

MR. CIMINO: Just a follow up. Virginia did decrease the bag limit, but I also think that there has been an increasing trend in the fishery for catch and release, as well.

CHAIRMAN ESTES: Any other questions, Dr. Rhodes, did you have something? In fact, I think we already have maybe typed up what you were thinking, if you'll just wait for a second.

MR. BOYLES: **Mr. Chairman, I would move to accept the FMP review and compliance report for spotted sea trout for the 2015 fishing year and approve de minimis status for New Jersey and Delaware.**

CHAIRMAN ESTES: Do I have a second? Pat Geer. Okay, so the motion is to move to accept the FMP review and compliance reports for the spotted sea trout 2015 fishing year and approve de minimis status for New Jersey and Delaware; motion by Mr. Boyles and seconded by Mr. Geer. **Are there any objections to approval of the motion? Seeing none; it passes unanimously**. The last item on our agenda. Shanna is going to give us an update about SEAMAP funding.

SEAMAP FUNDING UPDATE

MS. SHANNA MADSEN: I'm going to make this brief and depressing. Funding updates are not usually good. SEAMAP decided that we wanted to give a quick date to the South Atlantic Board regarding our funding. Just as a reminder, ASMFC actually coordinates the portion of the program in the South Atlantic, but SEAMAP also includes stretches through the Gulf and Caribbean, as well.

The graph that you're looking on at the screen is our overall funding for all three of those components. Obviously, since SEAMAP South Atlantic Data supports a lot of the management species in the South Atlantic Board, we thought that it was important to kind of bring some of our funding issues to your attention.

If you'll look at the graph on the screen, it represents our funding over the past few years. Our congressional appropriation to the overall program is the one that is represented in blue, while the actual funds that our program receives are in red. As you'll see, although our congressional appropriation has increased since 2013, the amount available to our surveys to actually collect the data is decreasing.

One of these reasons is because the taxes and assessments that are being levied on the program now constitute about 16 percent of our budget, when back in 2014 they were only about 5 percent. SEAMAP is also recently struggling with the impacts of just level funding. Obviously, as survey costs increase, personnel costs increase, and being consistently on level funding obviously causes a lot of funding gaps that we're trying to address.

Throughout the years, SEAMAP has historically depended on a lot of historical funding sources from either states or other granting agencies to maintain their current capacity; but obviously those funding sources are seeing a lot of the same cuts and starting to dwindle, as well. The reductions in our funding have definitely impacted our surveys greatly.

You know, that can come out as reductions in sea days, reductions in the number of stations sampled, and sometimes we're getting rid of entire programs. Essentially, the slides that I have following are going to kind of briefly outline some of the reductions that we're seeing in our SEAMAP programs since 2011.

The first. The coastal trawl survey has been in effect since 1986. It's providing long term fishery independent data, seasonal abundance, biomass; and the survey overall has provided data to Spanish mackerel, menhaden, spot, croaker; just to name a few of the species. With the reductions that we've seen in funding there, we've actually cut our sampled stations from

201 to 112. We also saw a large reduction in the collection and processing of important life history information, including the elimination of all of our diet studies for that survey.

Essentially, should SEAMAP funding remain level or continue to decrease, we're starting to think about losing one of our entire sampling seasons. We usually hit spring, summer, fall; we would get rid of one of those. Next, focusing in our reef fish survey, reef fish survey data has been included in stock assessments for black sea bass, blueline tilefish and a lot of various species in the snapper grouper complex.

Unfortunately, with the reductions in funding available to this survey, we've completely eliminated our gag ingress sampling component and reduced our sea days down from 35 to 19. We expect that should our funding remain level, this survey should see a further reduction in sea days or the loss of their entire longline sampling component.

They are also considering decreasing a lot of their life history processing. Overall, the impact on our coastal longline surveys, which are the ones that are collecting all that useful data for red drum and coastal sharks. We've seen in South Carolina, we've already reduced our sea days from 15 to 10.

Should SEAMAP remain at a level or decreased funding, we've discussed making a lot of changes to the Georgia Longline Survey, either reducing our sea days by half, modifying how we sample, or getting rid of entire sampling season or area. In North Carolina they're discussing reducing their sea days by about a week.

Some of our plans that we're going to do to try to tackle some of these issues is we are going to meet with the SEAMAP South Atlantic Committee, this is our Oversight Committee, and we'll meet in conjunction with some of the survey leads from our coastal surveys, and from our longline surveys; to discuss how we want to modify these surveys based on our budget constraints.

These aren't good modifications. It is important to note that we really don't know what's going to happen if we continue to reduce sea days and reduce stations sampled, because obviously we're losing all of that data; and that might have some unintended consequences on a lot of the stock assessments that this board is going to see in the future.

It is also worth noting that many of our surveys do anticipate an increase in their personnel cost, due to the fair labor standards act. I know a bunch of the states are facing the same issue. We might face further sampling reductions in the future, should our funding remain level or decreasing.

Essentially, since you all know where our data is coming from and it's supporting the management of the species on this board, we just wanted to bring these funding issues up front and center, to let you all know what the situation is. We are definitely, as you see in the spring, and we're going to start to discuss how to put together maybe a few letters to potentially reduce some of the taxes that are being levied on the SEAMAP program. But it's not going to cover a lot of the gaps and a lot of the struggles that we're already facing. With that, I am going to let you all be sad for a little while.

MR. CLARK: I was just curious. Where is that 16 percent in taxes going?

MS. MADSEN: Essentially, what happened was, before when we were about at the 5 percent we were only being taxed through headquarters. We were lucky enough that the Southeast Fisheries Science Center was not imposing any overhead on us, which they technically can. But just recently, they were told that they had to, and that's where the large increase in taxes is coming from.

MR. BOYLES: Shanna, thank you for the excellent presentation and representation of what's going on with SEAMAP. A question for Bob, perhaps; Bob, we learned a lot, I think, meeting with NMFSS leadership back in August, and even at the state directors meeting that perhaps one way to address this is to get programs like these added to the ATBs, the adjustments to base, it's part of the NOAA budget. Is that a realistic avenue for us to perhaps begin chipping away at this erosion of buying power?

EXECUTIVE DIRECTOR ROBERT E. BEAL: I guess the answer is hopefully. We've been focusing on Atlantic Coastal Act for the most part recently, to try to get that adjusted and more consistent with the increase that that line item has seen in the budget. We have not focused a lot on SEAMAP yet; however, Dave Donaldson from the Gulf States Commission and Randy Fisher from the Pacific States Commission and I will be meeting with the appropriations staff next Thursday, I believe it is, Deke.

One of the common areas that Dave Donaldson from the Gulf and I always bring up is SEAMAP. One of the priority areas, it affects the Gulf obviously and the Caribbean and us, and it is one of the priority areas that we try to convey the importance to the appropriations folks on the Hill.

We'll do that. I think I'll pull some of the pieces out of Shanna's presentation and let them know that where we are right now, there are real world cuts, things are disappearing pretty quickly. Stock assessments will be impacted and the ability to manage these fish will be impacted. We'll keep working on it. It's a pretty tight time to get money out of the Hill right now, but we'll just keep trying.

CHAIRMAN ESTES: Any other questions? Shanna.

MS. MADSEN: I just wanted to mention that in your meeting materials, there is actually a letter that outlines in further detail the cuts to both the South Atlantic and the Gulf programs, if anybody is interested in seeing those in more depth.

CHAIRMAN ESTES: There will be more discussion about this issue, I expect, in February when we meet. Is there any more business to come before the board? Oh, Tina, I am sorry; I forgot.

REVIEW AND POPULATE ADVISORY PANEL MEMBERSHIP

MS. TINA BERGER: I just want to quickly go over -- you have four new nominations to the South Atlantic Species Advisory Panel, they are Aaron Kelly from North Carolina, Bill Parker from South Carolina, Glen Ulrich from South Carolina and Lee Southward from Georgia; and I present them for the board's approval today.

CHAIRMAN ESTES: Okay, do we have a motion? Malcolm.

DR. RHODES**: I move the board accept Captain Bill Parker, Glenn Ulrich, Lee Southard and Aaron Kelly to the South Atlantic Advisory Panel.**

CHAIRMAN ESTES**: Second, Chris. Is there any objection to the motion? Seeing none; it passes unanimously.**

ADJOURNMENT

CHAIRMAN ESTES**:** Now let me try again, is there any more business before the board? Seeing none; do I have a motion to adjourn? I see Pat; we're adjourned, thank you.

(Whereupon the meeting adjourned at 12:36 p.m. on October 25, 2016.)

Atlantic States Marine Fisheries Commission

PUBLIC INFORMATION DOCUMENT

For the Interstate Fishery Management Plan For Cobia

November 2016

Vision: Sustainably Managing Atlantic Coastal Fisheries

The Atlantic States Marine Fisheries Commission seeks your input on the initiation of an Interstate Cobia Fishery Management Plan

The public is encouraged to submit comments regarding this document during the public comment period. Comments must be received by **5:00 PM (EST) on January 6, 2017.** Regardless of when they were sent, comments received after that time will not be included in the official record. The South Atlantic State/Federal Fishery Management Board will consider public comment on this document when developing the first draft of the Fishery Management Plan.

You may submit public comment in one or more of the following ways:

1. Attend public hearings held in your state or jurisdiction, if applicable.
2. Refer comments to your state's members on the South Atlantic State/Federal Fishery Management Board or South Atlantic Advisory Panel, if applicable.
3. Mail, fax, or email written comments to the following address:

Louis Daniel
Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, Virginia 22201
Fax: (703) 842-0741
ldaniel@asmfc.org (subject line: Cobia PID)

If you have any questions please call Louis Daniel at (252) 342-1478.

YOUR COMMENTS ARE INVITED

The Atlantic States Marine Fisheries Commission (Commission) is developing an Interstate Fishery Management Plan (FMP) for Cobia. The Commission, under the Atlantic Coastal Fisheries Cooperative Management Act, is charged with developing FMPs which are based on the best available science and promote the conservation of the stock throughout its range.

This is the public's first opportunity to inform the Commission about changes observed in the fishery, management measures the public feels should not be included in the FMP, regulation, enforcement, research, development, enhancement and any other concerns the public has about the resource or the fishery. In addition, this is the public's chance to present possible reasons for the changes and concerns for the fishery.

WHY IS THE ASMFC PROPOSING THIS ACTION?

At its August 2016 meeting, the Commission's South Atlantic State/Federal Management Board initiated the development of the first interstate Cobia FMP to be complementary with the South Atlantic Fishery Management Council's (SAFMC) Coastal Migratory Pelagic Fishery Management Plan.

Currently, the SAFMC and NOAA Fisheries manage cobia under the Coastal Migratory Pelagic (CMP) FMP through an allowable catch limit (ACL), combined with possession and minimum size limits. An overage of the recreational ACL occurred in 2015 and resulted in a shortened recreational season in 2016 for federal waters, consistent with the accountability measures (AMs) implemented by the SAFMC. The closure had measureable impacts to member states when their recreational fisheries were shut down at the peak of their season (Outer Banks of North Carolina and all of Virginia). The closures occurred at the peak of the Outer Banks fishery and the Virginia recreational fishery causing an economic loss. Concerned by these impacts and recognizing that a significant but variable proportion of reported recreational landings are harvested in state waters, the SAFMC requested the Commission consider complementary or joint management of the cobia resource.

The Commission's Interstate Fisheries Management Program Policy Board reviewed a white paper at its August 2016 Meeting and agreed Commission management of cobia was prudent. . The Commission tasked the development of an FMP to the South Atlantic State/Federal Fisheries Management Board, complementary with the SAFMC plan for cobia (*Rachycentron canadum*).

SAFMC management, based on current genetic information, addresses the management of Atlantic Migratory Group (AMG) of cobia that occur from Georgia through New York (Figure 1). Cobia that occur off the east coast of Florida are part of the Gulf stock, but the SAFMC manages the portion of that stock on the Florida east coast that occurs within its jurisdiction (Florida/Georgia (FL/GA) border to the Monroe County line). Tag recapture data suggested two main

stocks overlap at Brevard County Florida and corroborated the genetic findings. The genetic findings also determined there were two distinct population segments (DPS) in Port Royal Sound, South Carolina and Chesapeake Bay, Virginia. The main South Atlantic and Gulf stocks were separated for management purposes at the FL/GA border because genetic data suggested the split is north of the Brevard/Indian River County line and there was no tagging data to dispute this split. The FL/GA border was selected as the stock boundary based on recommendations from the commercial and recreational work groups of the Southeast Data Assessment and Review (SEDAR) 28 stock assessment (2013) as well as enforcement and administrative concerns.

Cobia occurring off the east coast of Florida are part of the Gulf Migratory Group (GMG) of cobia, but the Gulf of Mexico Fishery Management Council (GMFMC) allocated a portion of the GMG cobia ACL for the SAFMC to manage. SAFMC sets measures for the Florida east coast to achieve the sub-ACL set by the GMFMC. The Florida east coast boundary and the revised ACLs based on the stock boundary changes were implemented through Amendment 20B to the CMP FMP (GMFMC/SAFMC014). Collection of genetic samples from northern Florida (east coast) and Georgia continues and analysis will be used in a stock identification workshop planned for 2017 that will review the stock boundary between the south Atlantic and Gulf stocks.

Recreational cobia landings in 2015 were 1,565,186 pounds, well above the 2015 ACL of 630,000 pounds. This overage resulted in a June 20, 2016 closure of the fishery by NOAA Fisheries. Concern was expressed by individual states whose recreational seasons were reduced by the 2016 closure. North Carolina and Virginia developed alternate management strategies for harvest in state waters to avoid the June 20, 2016 closure enacted by NOAA Fisheries. Measures enacted by North Carolina and Virginia in 2016 resulted in a delay of state waters closures until September 30 in North Carolina and August 30 in Virginia. South Carolina recently implemented more restrictive measures to protect an inshore spawning population in southern South Carolina that was independent of the actions taken by NOAA fisheries.

Commercial cobia landings in 2015 were 71,790 pounds (landed weight) that exceeded the commercial ACL of 60,000 pounds (landed weight). Unusual fall landings occurred in 2015 that prevented a timely closure. Landings can be reported as both gutted or whole weight. Management uses “landed” weight to determine if the ACL has been met. Since landed weight includes both gutted and whole fish total weight harvested is likely underestimated.

STATEMENT OF THE PROBLEM

Historically, cobia has been managed through the federal Gulf of Mexico and Atlantic CMP FMP; the plan's measures had been considered precautionary due to the low bag limits. Both sectors of the fishery have been managed with a two fish possession limit and 33" fork length (FL) minimum size since formal management began in 1990 (under Amendment 6). The ACLs and AMs were established through Amendment 18 and then updated in Amendment 20B (GMFMC/SAFMC 2012 and 2014). The 2013 stock assessment conducted through the SEDAR process indicated overfishing was not occurring and the stock was not overfished. However, biomass/abundance had been as trending steadily downward over the previous two decades. Additionally, the stock assessment used a different stock boundary than that in the FMP. The current ACL is a conservative approach to prevent the stock from reaching an overfished status. The recent overage in 2015 exceeded the SAFMC's defined overfishing limit, meaning the stock is undergoing overfishing. Further, quota overages would continue to contribute to overfishing and could lead to the stock becoming overfished.

Efforts to more closely monitor state-specific harvest to ensure that quotas are not exceeded and that overfishing is averted is the Commission's primary focus. Further, by developing a Commission plan, the impacts of a single, federal closure may be mitigated through state-specific measures designed to maintain traditional seasons at reduced harvest rates. The proposed interstate FMP considers potential management approaches to maintain a healthy resource while minimizing the socioeconomic impacts of seasonal closures.

DESCRIPTION OF CURRENT MANAGEMENT

SAFMC management of cobia is consistent for the AMG in federal waters with a two fish possession limit and 33" FL minimum size limit for commercial and recreational harvest. To reduce recreational harvest and attempt to extend seasons, some states have recently modified their state water measures (Table 1). Because cobia found in Florida waters are not a part of the AMG, they have a different set of management measures designed to achieve the sub-ACL.

Table 1. Recreational measures in 2016 for Cobia in Virginia, North Carolina, South Carolina, Georgia**,** and Florida.

State	**Bag limit (Fish per person/ day)**	**Vessel limit (Fish per vessel per day)**	**Size Limit (inches)**	**Legal Gear**
Virginia	1 *	2	40” TL, only 1 > 50” TL	No gaffing permitted
North Carolina	1 **	For-hire: 4/vessel or 1 person when less than 4 people on board Private: 2 fish on vessels with more than 1 person on board	37” FL	
South Carolina – north of Jeremy Inlet, Edisto Island	2	None	33” FL	
South Carolina- south of Jeremy Inlet, Edisto Island	1 (June 1-Apr 30) Catch and release only May 1-May 31	3, or 1 per person, whichever is lower	33” FL	
Georgia	2	None	33” FL	
Florida	1	1 per person or 6 per vessel, whichever is less	33” FL	spears, gigs, hook and line, seine, cast net

*VA State waters close 8/30/16.

**NC State waters close 9/30/16; private recreational can only retain cobia on Mondays, Wednesdays, and Saturdays. Shore based anglers may retain 1 fish per day, 7 days per week.

In September 2016, the SAFMC recommended NOAA Fisheries approve the following measures contained in Framework 4: recreational harvest limits of one fish per person per day or six per vessel per day, and a minimum size limit of 36" fork length (FL) for recreational harvest; a commercial harvest limit of two fish per person per day or six per vessel, whichever is more restrictive, but no change to the commercial minimum size limit of 33" FL.

The SAFMC is also proposing modifications to the recreational AMs for AMG cobia. These changes are expected to be implemented in spring 2017. In December 2016, the Council will review and recommend to NOAA Fisheries approval of an amendment to change the recreational fishing year for AMG cobia, the current fishing year is January 1 – December 31. The amendment's preferred alternative would change the fishing year to May 1 – April 30.

The allocation of the SAFMC's ACL between commercial and recreational sectors is based on historical landings (50% is based on the average 2000-2008 landings and 50% is based on the average 2006-2008 landings). Beginning in 2016, the ACL is split 92% recreational and 8% commercial. The 2016 ACL for cobia is 670,000 pounds, with 620,000 comprising the recreational ACL and 50,000 comprising the commercial ACL. The ACL for 2015 was slightly higher at 690,000 pounds.

LIFE HISTORY AND STATUS OF THE STOCK

Cobia is a fast growing, moderately lived (14 years old) species, with most fish maturing by age two. Females grow faster and attain larger sizes than males, but become sexually mature later. Cobia migrate south to north as well as east to west. Spawning occurs when water temperatures reach 20-21° C from April through September with spawning occurring earlier in Florida and later in Virginia. Cobia form aggregations and spawn multiple batches of eggs throughout a relatively short season. Year class strength can be highly variable but trends in the data show a very strong year class occurs once in a decade. Both tag recapture and genetic data show cobia exhibit natal homing and are often recaptured on the same structure or in locations where they were caught years before. This natal homing and spawning aggregation behavior make them very predictable and easily located by fishermen.

The results of the SEDAR 28 stock assessment determined the FL/GA border as the demarcation between the Atlantic and Gulf of Mexico stocks. As previously mentioned, a workshop in early 2017 will evaluate all the current cobia genetic information. While cobia do frequent areas north of Virginia, the harvest is uncommon and sporadic. Landings have been episodically reported from Maryland, New York, New Jersey and Rhode Island and make up from 3-15% of the total Mid-Atlantic landings.

The SEDAR 28 stock assessment indicated overfishing was not occurring and the stock is not overfished. The current ACL is a precautionary approach to prevent

the stock reaching an overfished status. The recent overage in 2015, exceeded the Council defined overfishing limit, meaning overfishing is occurring. The stock assessment does indicate concerns. While the terminal year of the assessment was 2011, spawning stock biomass (SSB) experienced a general decline from 2002 forward (Figure 2). Further, recreational landings have increased over the latter portion of the time series that may increase potential overfishing issues in the next assessment. The Council proposed cobia be included in the 2019 SEDAR schedule for a research track assessment which will give guidance on the appropriate data and models to be used in the 2020 stock assessment.

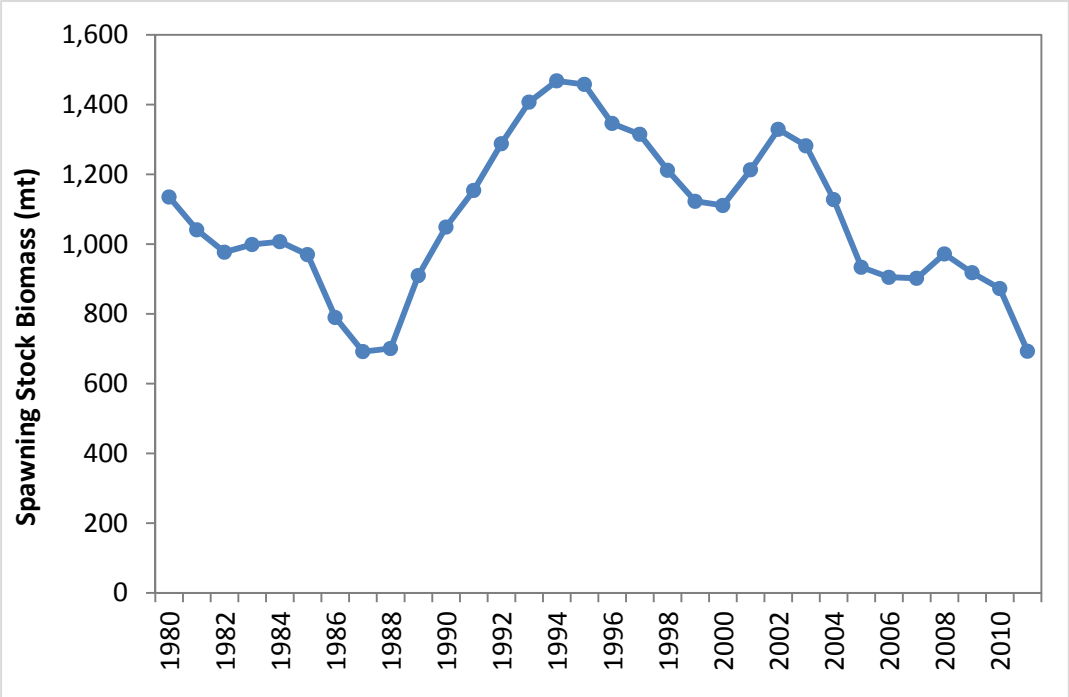

Figure 2. Cobia spawning stock biomass, 1980-2011.

DESCRIPITON OF THE FISHERY

Data collection programs vary by state and will be further described in the upcoming draft FMP. However, research efforts at the state level are confounded by the observation that cobia only occur in specific state jurisdictions in aggregations for a brief period each year and often in locations conflicting with the peak of recreational fishing. Directed sampling efforts are difficult outside of the primary recreational season that extends from April through August, because fish are migrating from spawning locations and not found in large concentrations.

Recreational Fishery

Cobia supports a valuable recreational fishery throughout the South Atlantic and into the Mid-Atlantic region. Known for their readiness to take a bait, tough fighting abilities and excellent table fare, the fishery is popular in the recreational sector. Current information indicates a variable proportion of landings come from

state waters and can range from 0 to 100% (Table 2). The 10 year average, annual percentage of cobia taken in state waters with and without east coast Florida included are 66% and 51% respectively (Tables 3 and 4).

Recreational fisheries are prosecuted similarly along the coast. The directed cobia fishery is prosecuted in two distinct ways. Bottom fishing with live or dead baits, often while chumming, in estuarine waters or around inlets or offshore around structure, buoys, markers, natural and artificial reefs. More recently, an active method of searching for fish traveling alone or in small groups on the surface or associated with schools of Atlantic menhaden or other bait fishes has grown in popularity. This newer method has resulted in the further development of the for-hire sector for cobia, as well as the development of specific artificial baits and boat modifications (e.g., towers) to facilitate spotting and catching the fish. A third method primarily prosecuted in offshore waters is to target large rays, large sharks, sea turtles or floating debris around which cobia congregate. This more active method likely confounds reported landings being in state or nearshore federal waters as vessels tend to move in and out of state and federal waters following the bait or the fish. Additionally, the Atlantic coast of Florida is starting to see more directed spearfishing pressure on cobia. Specifically, spearfishers are chumming for bull shark and then diving/free-diving to spear cobia that associate with them. Spearfishing also occurs off North Carolina, along with a popular pier fishery.

The recreational fishery also takes cobia as bycatch in offshore bottom fisheries such as snapper/grouper, nearshore trolling for king mackerel, bluefish, and dolphin and any other fishery that employs live or dead bait fished on or near the bottom. While the directed fishery appears to focus more on the spring-summer spawning migration, bycatch, especially offshore, can yield cobia virtually year-round.

Recreational landings for cobia have varied with little trend since 2005; landings did hit a time series high in 2015 resulting in a significant overage of the federal ACL (Figure 3). Since 2005, the highest landings have occurred in the east coast of Florida, North Carolina and Virginia. The three year average landings (2103-2015) in the east coast of Florida, North Carolina and Virginia were approximately 446,218, 466,944 and 429,179 pounds, respectively. In 2015, the three states with the highest recreational landings were Virginia (718,647 pounds), North Carolina (630,373 pounds) and Florida (east coast) (481,956 pounds) (Table 4).

Table 2. Percentage of cobia in the recreational fishery harvested in state waters (zero implies all were harvested from federal waters). All data are final MRIP estimates, which may differ from SEFSC estimates.

	Florida	Georgia	South Carolina	North Carolina	Virginia
2006	22	0	98	30	100
2007	9	0	0	47	100
2008	14	0	0	50	100
2009	53	0	0	58	100
2010	59	39	41	75	94
2011	33	0	0	90	50
2012	21	80	0	49	42
2013	9	0	61	79	83
2014	17	0	52	82	100
2015	13	0	6	92	97

Table 3. 10-year average percentage of cobia harvested in state waters with and without east coast Florida. All data are final MRIP estimates, which may differ from SEFSC estimates.

	Percent of Cobia Harvested in State Waters GA-NY	Percent of Cobia Harvested in State Waters FL-NY
2006	87	68
2007	52	34
2008	29	22
2009	80	71
2010	75	68
2011	56	40
2012	34	28
2013	77	59
2014	83	47
2015	85	71

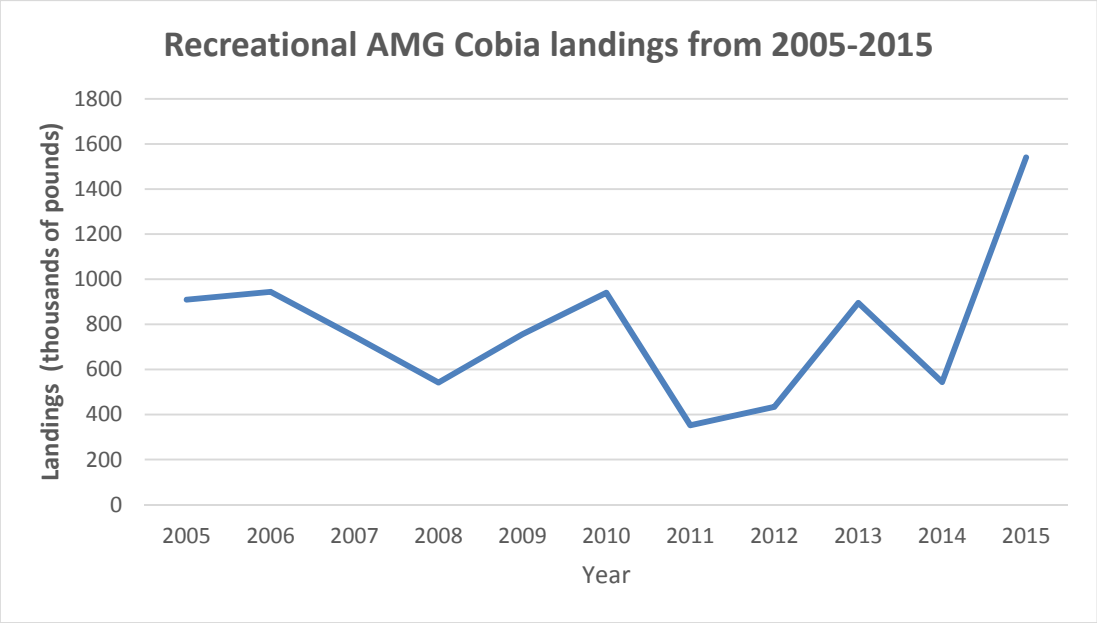

Figure 3. Recreational landings of AMG cobia (2005-2015)

Commercial Fishery

The commercial fishery has traditionally been a bycatch in other directed fisheries such as the snapper/grouper hook and line fishery and troll fisheries for various species (e.g., king mackerel, dolphin, wahoo, amberjack). Directed fisheries are generally precluded as a result of the low possession limits, but do occur, specifically Virginia's commercial hook and line fishery. Cobia from for-hire trips may also be sold commercially, depending on the state's permit requirements for selling fish.

Commercial harvest has been increasing in North Carolina since 2011 and in the Mid-Atlantic since 2012 (Figure 4). Commercial harvest has remained stable in Georgia and South Carolina since 2010. Commercial cobia landings on the east coast of Florida ranged from 57,003 to 156,069 pounds (avg. = 88,278 pounds) during the 2007-2011 time series. Commercial landings in Georgia and South Carolina were low and values for the two states were combined from 2010-2015 to avoid confidentiality issues and averaged 3,867 pounds per year (Table 5).

The commercial cobia fishery closed December 11, 2014. The 2015 overages would have been deducted if the stock were overfished; however, given they are not overfished, the commercial quota for 2016 remains 50,000 pounds (Figure 4). In 2015, North Carolina landings (52,684 pounds) accounted for nearly the entire commercial quota and would have exceeded the 2016 quota (Table 5).

Commercial landings for the Mid-Atlantic region (Virginia, Maryland, New Jersey, New York,) and Rhode Island are combined in Table 6 to avoid confidentiality issues in several Mid-Atlantic states. The majority of the Mid-Atlantic landings

come for Virginia. The average landings from 2010-2015 were 14,732 pounds per year.

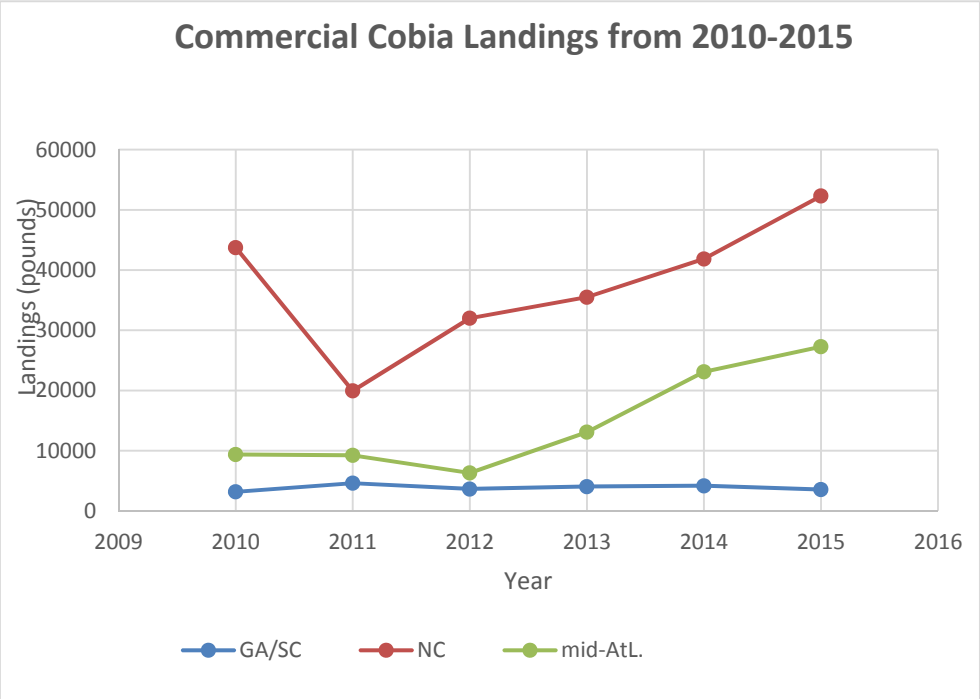

Figure 4. Commercial landings of cobia (2010-2015)

Table 4. Recreational landings of AMG cobia from 2005-2015 in pounds. Data sources: SEFSC

Year	Virginia	North Carolina	South Carolina	Georgia	Total AMG (VA-GA)	East Coast of Florida
2005	577,284	322,272	5,793	3,358	908,707	287,267
2006	733,740	104,259	101,018	4,824	943,841	493,334
2007	322,887	90,197	268,677	64,708	746,469	580,632
2008	167,949	66,258	50,108	257,690	542,006	438,621
2009	552,995	123,061	76,229	3,997	756,282	361,120
2010	232,987	561,486	65,688	79,855	940,015	745,228
2011	136,85u9	121,689	3,565	90,375	352,488	761,440
2012	36,409	68,657	224,365	105,193	434,623	370,373
2013	354,463	492,969	19,130	29,224	895,786	274,276
2014	214,427	277,489	31,927	20,642	544,485	582,423
2015	718,647	630,373	123,952	67,804	1,565,186	481,956

* There are no MRIP-estimated recreational landings of AMG cobia in states north of Virginia.

Table 5. Commercial cobia landings (pounds) and revenues (2014 dollars) by state/area, 2010-2015.

Year	GA/SC	NC	Mid-Atlantic*	Total
		Commercial Landing in Pounds		
2010	3,174	43,737	9,364	56,275
2011	4,610	19,950	9,233	33,793
2012	3,642	32,008	6,309	41,959
2013	4,041	35,496	13,095	52,632
2014	4,180	41,848	23,111	69,139
2015	3,555	52,315	27,277	71,790
Average	3,867	37,559	14,732	56,158
		Dockside Revenues (2014 dollars)		
2010	$11,377	$70,377	$19,976	$101,730
2011	$19,666	$37,893	$21,666	$79,224
2012	$15,554	$66,887	$14,597	$97,038
2013	$15,639	$79,397	$35,792	$130,828
2014	$13,320	$95,462	$67,972	$176,754
2015	$11,151	$147,160	$75,360	$233,672
Average	$14,451	$82,863	$39,227	$136,541

Georgia and South Carolina landings are combined to avoid confidentiality issues.
Source: SEFSC Commercial ACL Dataset (December 2015) for 2010-2014 data; D. Gloeckner (pers. comm., 2016) for 2015 data.
*Mid-Atlantic States include Virginia, Maryland, New York, New Jersey.

WHAT IS THE PROCESS FOR DEVELOPING A FMP?

The publication of this document and announcement of the Commission's intent to develop a Cobia FMP is the formal, first step of the FMP development process. Following the initial phase of information gathering and public comment, the Commission will evaluate potential management alternatives and the impacts of those alternatives. The Commission will then develop a draft FMP, incorporating the identified management alternatives, for public review. Following the review and public comment, the Commission will specify the management measures to be included in the FMP, as well as a timeline for implementation.

The timeline for completion of the FMP is as follows:

	Oct 2016	Nov 2016 – Jan 2017	Feb 2017	Mar – May 2017	May 2017	May – Aug 2017	Aug 2017
Approval of Draft PID by Board	**X**						
Public review and comment on PID ***Current Step***		**X**					
Board review of public comment; Board direction on what to include in the Draft FMP			**X**				
Preparation of the Draft FMP				**X**			
Review and approval of Draft FMP by Board for public comment					**X**		
Public review and comment on Draft FMP						**X**	
Board review of public comment on Draft FMP							**X**
Review and approval of the final FMP by the Board, Policy Board and Commission							**X**

WHAT IS THE PURPOSE OF THIS DOCUMENT?

The purpose of this document is to inform the public of the Commission's intent to gather information concerning the cobia fisheries, develop management measures to assist the SAFMC in maintaining harvest levels within the prescribed ACL, and provide management flexibility to the states to minimize the impact of potential closures. The PID provides an opportunity for the public to identify and/or comment on issues and alternatives relative to the management of cobia. Input received at the start of the FMP development process can have a major influence on the final outcome of the FMP. This document is intended to draw out observations and suggestions from fishermen, the public, and other interested parties, as well as any supporting documentation and additional data sources.

To facilitate public input, this document provides an overview of issues identified for consideration in the FMP, as well as background information on the cobia stock, fisheries and management. The underlying question for public comment is: **"How would you like the cobia fishery and population to look in the future?"** The Commission is looking for both general comments on cobia management in state waters and any comments specific to the issues listed in this document.

WHAT ISSUES WILL BE ADDRESSED?

The primary issues considered in the PID are:

- Complementary Management with the SAFMC
- Management Objectives
- Coastwide, Regional or State-by-State Approach to Management
- Commercial and Recreational Management Tools

ISSUE 1: COMPLEMENTARY MANAGEMENT WITH THE COUNICL

Background: The SAFMC manages cobia through the CMP FMP with consistent bag, trip and size limits in federal waters. A recent ACL has been employed to protect the resource and minimize the possibility of cobia being subjected to overfishing or becoming overfished. Complementary management of cobia is intended to increase flexibility and management reaction time, while providing states the ability to more actively and adequately manage the fishery in their respective states. It is anticipated Commission would adopt the ACLs and biological reference points established by the benchmark cobia stock assessment developed by the SAFMC.

States have historically mirrored the SAFMC's size and bag limit regulations in state waters. The recreational closure in 2015 resulted in Virginia and North Carolina modifying their regulations in order to reduce the impacts of the June 20, 2016 federal closure. South Carolina has developed various, additional regulations based on area-specific genetic work and concern over the condition of a DPS that occurs in its southern waters.

A complementary management plan separates the management processes between the two bodies (Federal/Council and ASMFC Board) and attempts to have measures that are consistent and not in direct conflict. Specifically, the Commission develops its own management documents that may contain aspects of the plan that are consistent with the Council but it is not required. Under a complementary plan, States are the responsible party for monitoring quotas and closing state waters once quota is reached. Stock assessments are conducted with the SEFSC/Council/Commission. Typically, the SEFSC is the lead for the stock assessment.

Management Questions:

- It is the intention of the Commission develop a complementary Cobia FMP to the SAFMC's CMP FMP. Do you think the Commission should have a different approach?
- What federal management measures should be required in the Commission plan?
- What states should be included in the management unit?

- Given the upcoming genetic workshop in 2017, should the FMP provide the flexibility to make changes to management and stock units to reflect changes in the science?

ISSUE 2: MANAGEMENT OBJECTIVES AND GOALS

- **Background:** The first step in proactive fisheries management is to decide what is meant by optimizing the benefits for a fishery. Goals and objectives can be divided into four subsets: biological, ecological, economic, and social, where social includes political and cultural goals. The biological and ecological goals can be thought of as constraints in achieving desired economic and social benefits. Examples of goals under each of these categories include:
- Maintain the target species at or above the levels necessary to ensure their continued productivity (biological);
- Minimize the impacts of fishing on the physical environment and on non-target (bycatch), associated and dependent species (ecological);
- Maximize the net incomes of the participating fishers (economic); and
- Maximize employment opportunities for those dependent on the fishery for their livelihoods (social).

Identifying such goals is important in clarifying how the fish resources are to be used. Without such goals, there is no guidance on how the fishery should operate, which results in a high probability of ad hoc decisions and poor use of the resources (resulting in lost benefits), and increases the probability of conflicts among user groups.

The Commission could consider the following management objectives for the Cobia FMP and is soliciting other ideas or options that could be raised.

A. Provide a management plan that achieves the long-term sustainability of the resource and strives, to the extent practicable, to implement and maintain consistent coastwide measures, while allowing the states the flexibility to implement alternative strategies to accomplish the objectives of the FMP
B. Provide for sustainable recreational and commercial fisheries.
C. Maximize cost effectiveness of current information gathering and prioritize state obligations in order to minimize costs of monitoring and management.
D. Adopt a long-term management regime which minimizes or eliminates the need to make annual changes or modifications to management measures.

Management Questions

What should be the objectives in managing the cobia fisheries through the Commission?

ISSUE 3:

Background: States currently manage their cobia fisheries independently. The Commission is considering coordinating the management of cobia in order to

COASTWIDE, REGIONAL OR STATE-BY-STATE MANAGEMENT

avoid states being disadvantaged based on where they occur along the migratory route, while maintaining harvest at the SAFMC's ACL level.

States have been disadvantaged by geography in the past when they occur on the northern or southern end of a migratory range, often resulting in early closures or no fishery at all. While consistent, coastwide measures may be desirable, they may result in disproportionate impacts to certain states.

More flexibility to individual states may be available through state-by-state allocations of the cobia ACLs. Allocations can allow limits and seasons to be imposed that maximize the individual state fishery needs, and reduce the impact of other state overages.

Management Questions:

- Are consistent, state-specific management measures, coordinated by the Commission, needed for cobia?
- Are there regional differences in the fishery and/or resource that need to be considered when implementing management measures?
- Should the FMP require a coastwide closure if the SAFMC ACL is met?
- Should the FMP require a coastwide measures (e.g., size and bag limit)?
- Should the FMP require regional measures?
- Should the FMP develop a suite of options for the allocation of state-specific quotas, and allow states to adopt unique size, bag, and season measures?
- Should states be permitted to submit proposals for alternative management that is conservationally equivalent to the required management program (e.g., a less restrictive bag limit given a more restrictive minimum size limit)?

ISSUE 4: RECRATIONAL MANAGEMENT TOOLS

Background: Cobia supports a valuable recreational fishery throughout the South Atlantic and into the Mid-Atlantic region. Current information indicates a variable proportion of landings come from state waters and can range from 0 to 100% (Table 2). The 10 year average, annual percentage of cobia taken in state waters with and without east coast Florida included are 66% and 51% respectively (Tables 3 and 4).

In federal waters there is a two fish possession limit and 33" fork length (FL) minimum size, but the states have differing measures (Table 1). A complementary recreational measures for cobia could provide the states the flexibility to respond to changes in the fishery and stock that meet their state fisheries needs without impacting federal fisherman while meeting the goals and objectives of the FMP.

Recreational cobia landings collected through the Marine Recreational Information Program, but landings estimates for this document are generated from the Southeast Fisheries Science Center (SEFSC). The SEFSC data are used for the following two reasons. The SEFSC data includes landings from the Southeast Headboat Survey that are not included in the MRIP data. In addition, MRIP data use two different methodologies to estimate landings in weight over the time series. To apply a consistent methodology over the entire recreational time series, the SEFSC implemented a method for calculating average weights for the MRIP landings, which they believe is a better representation of the weight of the cobia catch.

Management Options:

- What are the appropriate recreational measures for cobia? Potential management tools include: minimum size restrictions, maximum size restrictions, bag/trip/boat limits, seasons or gear restrictions.
- Should the FMP consider gear restrictions, e.g. circle hooks for all live and dead bait fisheries for cobia or prohibition on gaffing cobia?
- Are there other management options that should be considered (e.g., slot limits, spawning season closures, etc.)?
- When using recreational data should averaging of the data be permitted to set measures or determine if the RHL has been met? (e.g average the total harvest over 3-5 year to compare to the RHL in a given year, in some cases this could help to minimize impacts caused by overages. In other cases, years with very high overages, impacts would continue to be carried forward for several years
- Should the FMP consider some level of *de Minimis* or threshold landings where cobia harvest is minimal?

ISSUE 5: COMMERCIAL MANAGEMENT TOOLS

Background: The commercial fishery is managed consistently throughout state and federal jurisdictions with a two fish possession limit and 33" FL minimum size limit. Through the FMP process, the Commission could consider changes to the commercial fishery measures.

Management Options:

- What issues face the commercial fishery now and what potential issues could arise in the fishery?
- What tools should be included in the FMP for managers to address these issues?
- What are the appropriate commercial measures for cobia? Potential management tools include: minimum size restrictions, maximum size restrictions, bag/trip/boat limits, seasons or gear restrictions.
- Should the FMP consider some level of de Minimis or threshold landings where cobia harvest is minimal or episodic?

ISSUE 6:
OTHER ISSUES The public is asked to comment on any other issues for consideration in the development of the Commission's Draft Fishery Management Plan for Cobia.

Atlantic States Marine Fisheries Commission

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MEMORANDUM

To: **South Atlantic State/Federal Fishery Management Board**
From: **Louis Daniel, Cobia FMP Coordinator**
RE: **Public Comment on the Public Information Document for Cobia**

The following pages represent a summary of all public comment received by ASMFC by January 6, 2017 at 5:00 p.m. (closing deadline) on the Public Information Document for the Cobia Fishery Management Plan.

A total of 16 written comments were received during the public comment period. Four of those comments were from the following groups and organizations: Peninsula Saltwater Fishing Club, Coastal Conservation Association-Virginia, Virginia Saltwater Sportfishing Association, Coastal Conservation Association-North Carolina. Individual written comments were primarily submitted by recreational and for hire fishermen and their locations ranged from Virginia to Florida. A summary of the written comment is provided below and individual comment letters follow this memo.

Four states within the management unit held a public hearing: Virginia, North Carolina (2), South Carolina, and Florida. In total, approximately 60 individuals attended the public hearings. A summary of the comments received at the public hearings is provided, followed by summaries of the written comments and the specific written comments as submitted.

Review of ASMFC Public Hearings on Cobia Public Information Document

The ASMFC conducted five public meetings to gather public comments on the Public Information document for cobia. Meetings were held in Virginia, North Carolina South Carolina, and Florida. Attendees were compiled from sign in sheets and may contain misspellings.

Virginia Marine Resources Commission
December 6, 2016; 6 PM
2600 Washington Ave, 4th Floor
Newport News, Virginia 23607

ASMFC Staff: Louis Daniel
Attendees: Jonathan French, Pat Link, Wes Blow, Alex Field, Chris Obrien, Joe Cimino (VMRC), Ryan Jiorle (VMRC), Alex Aspinwall (VMRC)

Jonathan French provided a general presentation on issues and concerns consistent with his previously provided, written comments contained in briefing materials. An overall concern, shared by those in attendance, centers around the use of the best science, particularly the genetics data used to split the Atlantic Migratory Group cobia from the Gulf group cobia. Mr. French also provided detailed written comments that are included in the written comments as well.
Pat Link provided a copy of recent MRIP data, expressing concerns over the few samples observed to generate harvest estimates.
Wes Blow provided a handout on Virginia citation data and felt the number of larger fish were declining and needed to be protected. He expressed the need for ASMFC management and was concerned with Virginia's lack of representation on the SAFMC. He proposed a 2 fish boat limit but had concerns over a circle hook requirement.
Alex Field raised concerns over reporting and the need to have better catch estimates.
Chris O'Brien indicated that commercial limits from last year were fine.
A good, general discussion with the audience focused on concerns with the genetics data and catch statistics. A common issue was the need to provide a gaff exemption for piers and to take care when developing regulations not to disadvantage the unique pier fishery.

North Carolina Division of Marine Fisheries
December 8, 2016
Atlantic Beach, North Carolina

Meeting held in conjunction with the South Atlantic Fishery Management Council

ASMFC Staff: Louis Daniel (staff), Bob Beal (staff)
Michelle Duval (Commissioner)
Attendees: Bill Gorham, Mark Brown, Chris Elkins, Tom Roller, Joel Fodrie, Mel Bell (SCWMRD), Randy Gregory (NCDMF), Lara Clarke, Wilson Laney (USFWS), John Carmichael (SAFMC), Amber

Von Harten (SAFMC), Kari MacLauchlin (SAFMC), John Hadley (SAFMC), Gregg Waugh (SAFMC), Doug Haymans (GADNR).

Chris Elkins, North Carolina CCA president, read a statement from his organization that is included in written materials.
Bill Gorham introduced himself as a tackle manufacturer from Southern Shores, NC who is dependent on the cobia fishery. He expressed concerns over the current ACL and does not feel any allocation is fair.
Art Brown commented that cobia are fast growing and should be able to recover quickly.

December 15, 2016;
Manteo, North Carolina

Michelle Duval (Commissioner) conducted the meeting
Attendees: Bill Gorham, Joey VanDyke, Travis Kemp, Ann H?, Jon Worthington, Glenn Collins, John Welch, Bob Feldmans, Aaron Kelly, Louis Argiro, Steve Hussey, Tom Boyd, Reese Stecher, Casey Russell, Gerrad Otto, Joe Smith Bobby Smith, Rick Caton, Karl Helmkamp, Seth Levine, Browny Douglas, Abigail Haber, Douglas Haber, Jeff Reibel, Will Smith, Unknown Hatteras captain, Willie Etheridge, Steven Poland (NCDMF)

Bill Gorham commented to oppose ASMFC involvement. Believes the ASMFC is unable to change ACL or stock boundary that is the number one problem he has and feels those need to be changed. If ASMFC continues with management, Florida should be included. Oppose Louis Daniel being a liaison involved in the Cobia FMP.

Crowd was asked if they agreed with Mr. Gorham and they indicated by voice that they did.

Bobby Smith, charter boat captain. Prefers 2 fish at 33 inches, year round. Request that NMFS, SAFMC, and ASMFC representatives be at any future meetings on this issue.
Abigail Haber agrees with original laws and limits. Document not compatible with facts. Questioned landing whole versus gutted weight. Referenced different landings estimates from MRIP and SEFSC. Numbers don't look right in Virginia. 10 years old and wants to study these things but so far none of this seems right. If a 10 year old can see this is wrong, why cant the Board?
Reese Stecher—Charter boat captain. Supported Bill Gorham comments. Felt NMFS, SAFMC, and ASMFC representatives should be at meeting. Raised concern over data collection when waters are closed outside of miles. Why taking action when stock is not overfished. Support 2 fish per day, 33 inches. Should not be a different season for recreational fishermen (reference to NC rule).

Will Etheridge—Wanchese—supports Bill Gorham comments. Numbers from Virginia this year cannot be right.
Doug Haber agrees with Bill Gorham. Useful to have all parties attend meetings. Hold meetings on-line to ensure participation.

Will Etheridge asked for a show of hands (n = 27) who supported comments from Bill Gorham.

South Carolina Department of Natural Resources
December 12, 2016
Okatie, South Carolina

ASMFC staff: Louis Daniel
Attendees: Tony Royal, David Cargile, Captain Bill Parker, Emily Becker, Bill Hennigh, Charles Bridgham, Cole Mickey, Matt Perkinson, Sharon Stewart, Doug McGowan, Jim Dufresne, Chris Kehner, David Hartse, Dick Stewart, Captain Tim Deehard, Tony Constant, Captain Joseph Marshall, Jerry Nerad, Pat Geer (GADNR), Chris Kalinowski (GADNR), Karl Breckert, Captain Waldo A. Phinney, Jr., Michael Denson (SCWMRD), Al Stokes, Kari MacLauchlin (SAFMC), Amber Von Harten (SAFMC).

Questions about recreational landings data came up. Where do they come from? How does MRIP actually work?

Is stocking cobia an option for helping the stock to rebuild quicker and to be able to maintain a fishery? "Might be a good investment". Discussion of SCDNR past and recent stocking work in Port Royal Sound (PRS).

Discussion of SCDNR acoustic tagging work with cobia done in SC and GA with cooperating anglers (charterboat captains). Fish tagged in Port Royal Sound have been detected on acoustic receivers primarily in the vicinity of PRS. No acoustically tagged fish were detected north of Murrells Inlet as of OCT. Also discussion of SCDNR recreational tagging efforts (voluntary anglers) now and back into the early 1980's. Broad level of interest in and support for these type efforts from the fishing public. Public view such efforts as ways in which they can assist in collecting useful data related to cobia movement and defining proper stock boundaries. Voluntary tagging of cobia very desirable.

Dave Harter (Hilton Head Sport fishing Club and Port Royal Sound Foundation). "I am convinced that the states need to be regulating the cobia fishery".
Wally Phiney (charterboat captain > 33 years). "Fishing has gone to hell". Cobia should be managed in a similar fashion to Spanish and king mackerel. Interstate management is needed. Spanish and king fisheries are also not what they used to be. "We have to be able to manage across state boundaries". Offshore fishing for cobia occurs on artificial reefs like the Betsy Ross Reef. Heavy fishing pressure occurs particularly on Saturdays and Sundays and there is an assumption that people are keeping over the limit. There appears to be no Law Enforcement presence on the reefs when this is going on. More enforcement is needed.
Concerned was expressed that heavy fishing, particularly in VA could jeopardize SC local cobia fishing in the future. However, if VA is fishing too heavily on their own fish (DPS) within their own waters they may only be hurting themselves.

The methods by which charterboat data are collected was discussed. The need for reliable and improved recreational landings data was discussed. Fear was expressed that many people are using private docks to land cobia and these fish are never captured in any type of creel survey work. Sale of recreationally landed fish (directly to restaurants) is still a problem in Beaufort County.

"State by state management in the recreational cobia fishery is needed" (multiple people). Discussion about cobia movement patterns (inshore-offshore; north-south) took place. A better understanding of that could be achieved through more tagging and genetics work. Mention was made of SCDNR genetics work and ongoing efforts to get fin clips from cooperating anglers for analysis. Questions were asked about the current stock boundaries used by the SAFMC (how were they determined?).

Changes in the start date for the cobia fishery were discussed. Concern was expressed that SC not be left out (disadvantaged) in the establishment of any new fishery start date. Per new state law (May 2016) SC key state waters (Southern Cobia Management Zone) are "take and release only" for cobia during the month of May already. This is to take fishing pressure off the SC DPS of cobia that spawn in the high salinity southern sounds and rivers.
"We need to be proactive in managing this fishery". "More tagging work needs to be done". We must better understand the impacts of environmental changes, including water quality, on the health our cobia stock. "Studies on environmental impacts on habitats, food chains and cobia need to be conducted – but money is limited".

Bill Parker (charterboat captain > 31 years; South Atlantic Species AP member). Concerned that VA's heavy inshore fishing efforts on fish spawning inside the Chesapeake Bay could be an example of "the illusion of plenty" (hyperstability) in the fishery there and could have serious consequences for the overall cobia fishery in the future. Possibly similar to what may have occurred in the inshore waters of SC in recent years. Expressed concerns about increased fishing pressure and targeting of cobia in federal waters off SC, especially on well-known and very popular artificial reefs. Concerned that these fish (part of the offshore population) are also spawning when off SC. South Carolina's cobia landings have shifted from heavily inshore to heavily offshore in recent years. The boat limit in federal waters needs to be reduced to 3 fish. Concerned that raising the legal retention length to 36 inches places more pressure on females – this could prove to be an issue. Expressed real concerns about large swings in MRIP landings. Has a lack of confidence in MRIP data. Expressed concerns about Florida's lack of reporting in the charterboat fishery in state waters. SC has been reporting charterboat landings since 1993. "Reporting landings is for our own good".
Chris (Port Royal Maritime Center). "Self-reporting for all private boat anglers is needed". A system to accomplish that should be developed.
Discussion of the concept of self-reporting from the private boat sector took place. A recommendation was made to adopt something similar to what is used in the federal duck stamp program (HIP) where reporting is mandatory. Many thought it might be a good idea, but understood the challenges of getting such data from all recreational anglers that could be useful and scientifically valid.

Someone suggested that implementing lower bag limits was a reasonable solution and that a boat limit of three cobia was needed. Someone else pointed out that charterboats might need more fish to satisfy clients. Mention was also made that on artificial reefs off Port Royal Sound when the fish were aggregating, charterboats were making multiple trips per day and limiting out.

If cobia are managed through the ASMFC and some sort of formula is worked out to allocate quotas for each state concern was expressed that SC and GA could be severely disadvantaged by high landings in NC and particularly VA over the past two years where very high landings have been reported. Concern over fair allocations and the process used to determine them was expressed. "In determining allocations for VA cobia quotas should be calculated starting with a zero-based budgeting concept".

Florida Fish and Wildlife Conservation Commission
December 14, 2016
New Smyrna Beach, Florida

ASMFC staff: Louis Daniel
Attendees: Jim Estes (FFWCC), Chris Kalinowski (GADNR), Krista Shipley (FFWC), Jim Whittington (FFWC), Erica Robbins (FFWC)

No public attended the New Smyrna Beach meeting.

Cobia PID Written Comment Summary

Issue 1: Complementary Management with the Council.
Written comments were split, with 7 commenters supporting ASMFC management and 9 commenters opposed. Those opposed to ASMFC management raised concerns over the lack of confidence in the management unit split between Florida and Georgia. Several opposed commenters raised concerns that the current management unit disadvantages the states from Georgia north by reducing the available quota and that ASMFC has no ability to remedy this problem. Data was provided by one commenter (French) to support comments that the stocks of cobia along the east coast were homogeneous, suggesting they do not contain any distinct populations or are separate stocks north and south of the Florida/Georgia line.

Commenters in support of complementary management (n = 7) also supported state by state allocations (n = 5) and the flexibility of states to manage their specific quotas (n = 4).

Issue 2: Management Objectives and Goals.
Two written comments specifically expressed the need to manage cobia primarily for recreational interests and several (n=5) supported maintaining the commercial fishery as a bycatch fishery. Three commenters specifically opposed a directed commercial fishery. One commenter supported efforts to ensure predictable seasons and limits for the fishery moving forward.

Issue 3: Coast wide, regional, or state-by-state management.
Few comments directly addressed this issue. There were suggestions for various recreational and commercial management strategies but none were specifically mentioned as coast wide. As stated above, commenters that supported ASMFC involvement referenced the flexibility it provides.

Issue 4: Recreational management tools.
There were only a few specific recommendations for recreational management measures. Several supported measures to protect the larger fish (50 inches+) with slot limits. Per person limits were suggested at 1 or 2 with boat limits from 2 to 4. Individual comments included mandatory catch reporting, no circle hooks, no spearfishing or bang sticks, and prohibit gaffing.

Issue 5: Commercial Management Issues.
There were few comments specifically related to the commercial fishery**.** Specific comments (n=5) supported maintaining cobia as a bycatch fishery with a 2 fish per person limit. One commenter suggested all landings be reported in whole weight.

Cobia PID Written Comments Received

I am a charter captain in Virginia and specialize in cobia fishing. I have been fishing for cobia in Virginia for the past 25 years. Virginia's cobia fishery seems as healthy now as it has been over the last 25 years. The pressure on this fishery has increased with the advent of sight fishing in Virginia. I am pro conservation and management based on good science and data, and I truly want this fishery managed correctly. I was very involved in the federal request to close the fishery last year, and was appalled at the lack of good science and data they were using to try to close a multi-million dollar recreational fishery in our state.

I am requesting that ASMFC get on board with the management of Virginia's cobia fishery. The SAMFC does not have Virginia's interest at stake when making management decisions. Feel free to contact me if you have any questions. Thank you for your consideration in this matter.

Jorj Head
400 Claxton Creek Rd.
Seaford, VA 23696
757-262-9004

January 3, 2017

Dear Dr. Daniel

My name is Wes Blow I am a recreational fisherman in VA. I have been catching cobia in the lower Chesapeake Bay for the last 11 seasons averaging about 21 trips a year. I have caught from a few in a season my first years to about 90 a season. I have caught cobia up to 105 pounds.

Issue 1
If you use Table 4 on page 11 of the PID and add in the 2016 landings you will see that for the past 12 years VA has landed 50% of the total recreational landings north of the FL/GA line. (NC 31.7%, 10.6% and GA 7.3%) According to a MRIP catch time series query for the last 12 years 97% of the landings in VA have come from state waters and 71.8% of the landings for NC have come from state waters. So that is 89.5% of the total landings for cobia from GA north to NY for the last 12 years have come from state waters of two states. This is why I believe ASMFC should be involved in managing cobia.

I think there should be a state by state allocation system established with the individual states being able to set their own regulations and season to not exceed their allocation. I do believe a

boat limit of 2 to 3 fish per day should be established. A two fish boat limit worked in VA in 2016 and I have been told by several charter captains this was not a problem.

One item that I feel is imperative to maintain a quality fishery is a coast wide rule for only one fish of a boat limit allowed to be over 50 in TL or 46 in FL. This would be to protect the larger breeding fish. Although there are far more cobia available now in the smaller sizes I have seen a decline in the larger fish in recent years.

All east coast states to NY should be included in the management plan. MRIP is not currently reporting landings north of VA but I have heard of more and more cobia caught north of VA.

Issue 2 & 3

I believe the objective for ASMFC to manage cobia should be to develop a state by state allocation system based on historical catches that allows the individual states to set regulations not to exceed the allocations. With cobia being a pulse fishery I see no other way than a state by state allocation to effectively and fairly manage cobia.

I would like to see the FMP set a coast wide boat limit of 2 or 3 fish per day with only one allowed over 50 in TL or 46 in FL. The FMP should allow the individual states to set their own seasons and size limits other than the one large fish per boat limit previously mentioned.

Issue 4

First I question the stated numbers in the background information. When I looked at NOAA Office of Science and Technology and " Run a Data Query" I get much higher percentages of fish caught in state waters.

I believe the FMP should consider some gear restrictions. I have recently heard of multiple treble hook rigs used for cobia fishing and this type of rigs should be restricted. I adamantly would oppose being required to only use circle hooks and not allowed to use single J hooks. Hook up ratios can be poor on cobia with circle hooks and of the hundreds of cobia I have caught far less than 1% are hooked with a J hook that I could not remove.

I would support prohibiting gaffing but I feel there should be an exception for pier fisherman.

Primary spawning season closures and slot limits should be considered but by individual states. What and when something is right for VA it would not be the same for GA or other areas.

Issue 5

I believe the current federal 2 fish per person for commercial fishing should be enforced in all states. Also an across the board reporting of whole weight not gutted. Commercials should be

restricted from being allowed to harvest over a certain size. We need the bigger fish breeding. Primary spawning season closures are needed.

Issues 6

Protecting the larger fish is a very important issue. This can be done with only one fish of a boat limit allowed over 50 in TL or 46 in FL. Here in VA we are seeing a steady decline in large citation fish registered the last few years. No fish over 100 pounds in the last 5 years and 2016 we did not have any in the 90 pound range.

Thanks

Wes Blow

VMRC may be facing an unanticipated war with recreationals

I am in favor of more militant actions than most will support

When the humble citizen asks the government----

That is---asks the government bureaucracy for solutions, the drequessting pulbic should expect nothing more than a bumblign bureaucratic solution;

This exactly what recreationals got from the General Assembly several years when we asked for a recreational salt water fishing license---when is was finally signed by the governor, it was nothing like what we asked for nor what we expected

When the Finfish Committee asked VMRC staff to solve the Tilefish-Cobia- Amberjack problem....\ VMRC staff came up with a bureaucratic and paralyzing set of rules and regs which recreationals should never accept

Recreational salt water fishing in VA has collapsed and is a disaster for Tourism and the Tidewas\ter fishing community

JOhn Bull, Rob O reilly and VMRC staff have known a rebellion was brewing for two months....I sent an e mail . What have they done to ease the tensions of recreational salt water anglers? NOTHING !!

TIME TO ACT.

Bob Allen

Louis Daniel 2 January 2017
Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, Virginia 22201
Fax: (703) 842-0741
ldaniel@asmfc.org
Subject line: Cobia PID

I would like to thank you for the opportunity to comment on the Atlantic States Marine Fisheries Commission's Public Information Document for Cobia. Cobia are an important species for recreational fishers along the SE Atlantic coast, providing great sport close to shore in state waters for a few months each year. I believe they should be managed as a primarily recreational species, with an emphasis on access and abundance. Management should strive to manage the cobia resource for maximum practicable abundance

Complementary Management: it can be problematic when there is a sizeable portion of the catch in state waters, as the fishery rarely, if ever, occurs at the same time in each state, and a one-size-fits-all approach inevitably disadvantages some states. I believe a system where the SAFMC sets the overall allowable harvest level and then allows the states to tailor their harvest measures within that framework to be the best system for cobia.

Management objective: Allowing states the opportunity to set their own season and bag limits within an overall framework makes sense, as the fisheries occur at different times of the year within each state.

Coast wide, Regional or state by state approach to management: allowing the states to set their own season and bag limits within an overall framework would be preferable.

Commercial and Recreational Management Tools: The standard size limit, bag limit and season approach to managing recreational fisheries should be the proper way to manage the Atlantic cobia recreational fishery. I strongly encourage maintaining the historic bycatch management for the commercial fishery, with a 2 fish/person/day bag limit. I believe allowing a directed commercial fishery to develop would only add to problems with management, this has been seen in the State of Virginia, when the commercial regulations were liberated and the catch increased dramatically.

Thank you for the opportunity to express my comments

James D. Agee
702 Lake Dale Way

Yorktown, VA
.23693

---

2 January 2017
Louis Daniel
Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, Virginia 22201
Fax: (703) 842-0741
ldaniel@asmfc.org
Subject line: Cobia PID

The Peninsula Saltwater Sport Fisherman's Association 300 members would like to thank you for the opportunity to comment on the Atlantic States Marine Fisheries Commission's Public Information Document for Cobia. Cobia are an important species for recreational fishers along the SE Atlantic coast, providing great sport close to shore in state waters for a few months each year. I believe they should be managed as a primarily recreational species, with an emphasis on access and abundance. Management should strive to manage the cobia resource for maximum practicable abundance

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Thank you for the opportunity to express our fishing club felling about this document

David Agee

Dear sir,

Writing to express my opinion as a charter boat captain who cobia fishes on the chesapeake bay. I would like to see the ASMFC be involved n the management of cobia. I would also be in favor of a state by state allocation system based on historical catches. I would also be in favor of a coast wide boat limit with a one big fish rule such as we had here in virginia this year.

I am a virginia angler and business owner with a large investment in catching just these fish. Please consider the points i've outlined in the previous paragraph.

Thank you,
Donald Bowers
Bonita Chaser Charters

Louis Daniel
Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, Virginia 22201
Fax: (703) 842-0741
ldaniel@asmfc.org

subject line: Cobia PID

CCA VA would like to thank you for the opportunity to comment on the Atlantic States Marine Fisheries Commission's Public Information Document for Cobia. Cobia are an important species for recreational fishers along the SE Atlantic coast, providing great sport close to shore in state waters for a few months each year.
With regard to the question posed in the Public Information Document: "How would you like the cobia fishery and population to look in the future?" we believe they should be managed as a primarily recreational species, with an emphasis on access and abundance.
Recreational fisheries respond to increased abundance with increased trips and catch, and do the opposite with decreased abundance. Increased abundance and the resultant increase in trips maximize the economic value of the fishery to local communities. In recent years, the abundance of most recreational species in Virginia have been in a sharp decline with the exception of Cobia.

Management should strive to manage the cobia resource for maximum practicable abundance. This would necessarily mean defining a catch level at an optimum yield that is less than maximum sustainable yield in order to increase abundance.
The Atlantic States Marine Fisheries Commission (ASMFC) would like comment on four areas:
1. Complementary Management with the South Atlantic Fishery Management Council (SAFMC)
2. Management Objectives
3. Coast-wide, Regional or State-by-State Approach to Management
4. Commercial and Recreational Management Tools

1. Complementary Management with the SAFMC Currently management of cobia is entirely through the South Atlantic Fishery Management Council via their Coastal Migratory Pelagics Fishery Management Plan (FMP), with states adopting the Council's regulations. With species that are entirely or mostly caught in the Exclusive Economic Zone, this style of management can work. However, it can be problematic when there is a sizeable portion of the catch in state waters, as the fishery rarely, if ever, occurs at the same time in each state, and a one-size-fits-all approach inevitably disadvantages some states.
In this instance, with harvest in both state and Federal waters, **complementary management would seem to make the most sense**. This is very similar to the federal waterfowl framework, where the Federal government sets the general season length and bag limits and allows the states to pick the actual days they allow hunting and bag limits within that framework. CCA VA believes a system where the SAFMC allows the states to tailor their harvest measures within that framework to be the best system for cobia

2. Management Objectives The Atlantic cobia fishery has been primarily a recreational fishery and should be continued with that tenet in mind, first and foremost. As stated previously, that means managing for access and abundance. Allowing states the opportunity to set their own season and bag limits within an overall framework makes sense, as the fisheries occur at different times of the year within each state.

A secondary management objective might be to get to a point where the season and bag limit are predictable from year to year.

3. Coastwide, Regional or State-by-State Approach to Management If possible, allowing the states to set their own season and bag limits within an overall framework would be preferable.

4. Commercial and Recreational Management Tools The standard size limit, bag limit and season approach to managing recreational fisheries should be the proper way to manage the Atlantic cobia recreational fishery.

We strongly encourage maintaining the historic bycatch management for the commercial fishery, with a 2 fish/person/day bag limit. We believe allowing a directed commercial fishery to develop would only add to problems with management. We also believe that allowing a directed commercial fishery would reduce the significant value this fishery generates through recreational fishing.

Thanks again for the opportunity to comment on the Cobia PID

Frank A. Kearney III
CCA VA Government Affairs Committee
Hampton, VA 23669

Phone 757-723-7652

To whom it may concern:

ASMFC should be the agency setting allocations for recreationally caught Cobia. Virginia has no representation on South Atlantic Couincil and Va accounts for largest part of recreational Cobia catch along Atlantic seaboard.
Current regulations set by S A Council are an unbalanced hardship on recreational fishing industry here in VA

Respectfully,
Dr. Robert Allen
50+ years a recreatioonal angler in VA
1038 Port Harbour Arch
Hampton VA 23664
757 869 0157

In regards to the cobia PID document and questions, all answers are NO.

The overwhelming peer reviewed science and SEDAR 28 (last cobia stock assesment) proving the zone split of the ATLANTIC Cobia, and resulting low ACL are unfounded.

The ASMFC has no power or authority to change the zone boundary or ACL. Any involvement of the ASMFC is against the will of the majority of stakeholders in NC.

--

Jon Worthington
405 Japonica Drive
Camden NC 27921
252-562-2914

228th Session Graduate

I have noticed a decrease in the March, April cobia migration in the waters offshore Cape Canaveral. We have cobia more year round but overall it does seem to be on the decline. I think the stock is still healthy but I feel recreational fisherman need to realize less is more. I propose a 1 per person or 2 per boat whatever is less bag limit in State & Federal waters 25 inch minimum. No spear fishing or power head fishing. Here is the problem with spearing. These fish are on manta rays, mud rays and sharks. The big heavy fish are full of eggs and will not eat. The spear fishing pulls the trigger on these larger more important fish and several fish pull from the spear with not much chance of survival. However the 1 per person 2 per boat may solve all the problem. Same should apply for commercial harvest. These are bonus fish for commercial mackerel fishing and the bonus gets abused by loading several friends on a commercial boat and keeping per person when the fish concentrate due to thermo cline conditions and other factors up and down the East Coast. The commercial guys that keep their 1 or 2 as a bonus should be allowed to harvest them in that manner.

Captain Greg Rapp
321-794-3474
www.sealeveler.com
www.facebook.com/SeaLeveler
www.twitter.com/SeaLeveler2

Mr. French's email clearly outlined several points that we discovered during our continued research and I would like to reinforce our concern that the Atlantic States is repeating known misleading statements in their PID.

The entire issue with the managment of the "Atlantic Migratory Group" of cobia is the zone split and resulting ACL. This zone split and reduction in harvest was conceived first as a "want" within the SAFMC council. We have provided documents that clearly show the timelines and methods in which this zone split and reduction was achieved.

The Atlantic States has no authority or ability to fix, correct, or alter the zone split or ACL for cobia. Given the extremely low ACL, there is nothing the Atlantic States can do that would result in fair and equable access as compared to the East Coast of Florida. Tagging results from VA, NC, SC, and Gulf are clear in that certain portions of the cobia biomass migrate between the "Atlantic Group" and "Gulf Group" managment areas. To attempt to try joint managment at this point would be a pure waste of tax payer monies.

We ask that the Atlantic States hold off on any joint managment until a proper stock assessment, one that truly includes the most up to date Best Available Science is completed.

I have requested a detailed explanation as to the benefits of what joint managment could bring and have yet to receive any.

Until such time an explanation can be given, any involvement or actions by the Atlantic States, as it relates to the managment of cobia, is totally against the will of the majority of stakeholders.

Thank you
Daniel Burrus

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Thank you
Patrick Link

Dr. Daniels,

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Thank You

Cameron Whitaker

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Thank you
Travis Kemp

Subject: Cobia PID

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Until such time an explanation can be given, any involvement or actions by the Atlantic States, as it relates to the managment of cobia, is totally against the will of the majority of stakeholders.

Thank you,

Vandexter Williams

If you have any questions or concerns, please feel free to ask Billy Gorham or Jonathan French as they have been the forefront leaders spearheading this critical engagement in the wrong doing of our public trust.

Mr. Daniel

I am Bill Gorham owner of Bowed Up Lures and a recreational fisherman living in the Outer Banks. We have spoken via phone and met at the SAFMC meeting in South Carolina. As you know many stakeholders of who include, For Hire Captains, tackle shop owners, pier owners, rob builders, commercial watermen, and dozens of recreational anglers in NENC have entrusted Mr. French and I to speak on their behalf on matters that relate to cobia management.

Mr. French's email clearly outlined several points that we discovered during our continued research and I would like to reinforce our concern that the Atlantic States is repeating known misleading statements in their PID.

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Thank you
Bill Gorham

I did not catch any nor did many friends that fish the early migration up the coast of NC. I guess you must have observers in another state? Where did they find 1.5 million ? I would like to try that fishery.

James Canady
Building Codes Administrator
Town of North Topsail Beach
2008 Loggerhead Court
Town of North Topsail Beach, NC 28460
910-328-1349

I think the key to better management of the recreational cobia fishery is to push for (demand) that the states provide a mandatory catch reporting system to get timely and accurate data on the catch. If recreational anglers were required to report or lose their opportunity to cobia fish the following year the regulators would have reliable data to base their fish management plans on.
bobalong1939@yahoo.com

Dear Dr. Daniels and ASMFC Commissioners,

I have had an opportunity to review the ASMFC Cobia
PID http://www.asmfc.org/files/PublicInput/CobiaPID_PublicComment.pdf and would like to offer public comment.

First, there are several fundamental false assertions in the PID that fundamentally alter the management principles that should be applied. First, the PID makes the following assertion.

"SAFMC management, based on current genetic information, addresses the management of Atlantic Migratory Group (AMG) of cobia that occur from Georgia through New York (Figure 1). Cobia that occur off the east coast of Florida are part of the Gulf stock, but the SAFMC manages the portion of that stock on the Florida east coast that occurs within its jurisdiction (Florida/Georgia (FL/GA) border to the Monroe County line). Tag recapture data suggested two main 3 stocks overlap at Brevard County Florida and corroborated the genetic findings."

Unfortunately, the genetics research cited in the SAFMC rulemaking and the ASMFC advisory material is the South Carolina Department of Natural Resources Marine Resources Research Institute study titled "Population genetics of Cobia (Rachycentron canadum): implications for fi shery management along the coast of the southeastern United States" by Tanya L. Darden. The study does not conclude that there are two genetically unique populations of fish. Instead, the study determined "On the basis of a robust microsatellite data set from collections along the U.S. Atlantic coast (2008–09), offshore groups were **genetically homogenous.**"

Dr. John Gold at Texas A&M (publicly available peer reviewed academically accepted research) also refuted the idea of the Gulf fish being genetically different from Atlantic cobia. Instead, he indicated that, "Cobias that were sampled from the coastal waters of Virginia, Mississippi, and Louisiana were genetically homogeneous based on assays of microsatellite genotypes and mtDNA haplotypes. This finding is consistent with observed migration patterns and tag-and-release studies of Cobias."http://agrilifecdn.tamu.edu/gold/files/2012/05/Gold-et-al.-2013.pdf

The basic fundamental issue that that the decision to split zones is based on something that is not true based on the best science available. The "genetics" argument was used to justify a split of management zones with E. Florida broken out of the Atlantic management zone. It was used to allocate 66% of the old quota to E. Florida and the Gulf. And the remaining quota was not consistent with the historic catch data, especially in the last five years where a much larger percentage of cobia are caught in Virginia waters than south of Cape Hatteras. We have had an opportunity to present this to SAFMC, however outside of a brief public comment window that I was provided (inappropriately, as the public comment was offered AFTER a motion was made) at the May ASMFC meeting, the ASMFC membership has not been provided with these details. This information was absent from all the meeting briefing materials and was not mentioned in the PID. It calls into credibility Dr. Daniels objective leadership on the issue, and given his past actions associated with violating open meeting laws in North Carolina, we ask for him to be recused.

The cited genetics research also speculates about the presence of a genetically unique species of cobia in Virginia waters. Since this study was conducted exclusively in South Carolina and no actual intercepts were cited, we don't regard this assertion as scientifically credible. We do, however, assert that SAFMC and SEDAR (which does not survey stock in Virginia waters) has GROSSLY underestimated the size of the cobia population that spends the entire summer in the Chesapeake Bay. The corresponding ACL does not come anywhere close to representing maximum sustainable yield for that population.

For the following questions:
Are consistent, state-specific management measures, coordinated by the Commission, needed for cobia? ¬ Are there regional differences in the fishery and/or resource that need to be considered when implementing management measures? ¬ Should the FMP require a coast-wide closure if the SAFMC ACL is met? ¬ Should the FMP require a coastwide measures (e.g., size and bag limit)? ¬ Should the FMP require regional measures? ¬ Should the FMP develop a suite of options for the allocation of state- specific quotas, and allow states to adopt unique size, bag, and season measures? ¬ Should states be permitted to submit proposals for alternative management that is conservationally equivalent to the required management program (e.g., a less restrictive bag limit given a more restrictive minimum size limit)?

The answer for all these questions is simply no. ASMFC should call on SAFMC to correct the errors within Amendment 28 of the federal FMP. SAFMC is making what I hope is a good faith effort to correct these issues. SAFMC has called for a new cobia management amendment, and a new stock assessment has been scheduled for the near future. Regulating based on a fundamental falsehood is not best science available, does not achieve a maximum sustainable yield, and therefore is a prime violation of National Standard 1 and 2 of the Magnuson Stevens Act.

We ask ASMFC to act accordingly. Please review and do not take action until SAFMC addresses these issues.

Thank You,
Jonathan E. French
Falls Church, VA

Note: Mr. French submitted several emails to Commissioners during the comment period.

Virginia Saltwater Sportfishing Association, Inc (VSSA)
PO Box 28898
Henrico, VA 23228
www.ifishva.org

Atlantic State Marine Fishery Commission
1050 N. Highland Street, Suite 200 A-N,
Arlington, VA 22201

Dear Mr. Daniels,

December 22, 2016

The Virginia Saltwater Sportfishing Association (VSSA) is a growing organization of recreational fisherman in the Commonwealth of Virginia. Our mission includes representing the interests of Virginia's recreational saltwater anglers, ensuring the long-term sustainability of Virginia's fisheries, while protecting Virginia's marine, boat, and tackle industry jobs.

VSSA, along with hundreds of cobia anglers in NC and VA, **strongly oppose ASMFC joint or complimentary management of cobia** for the following reasons:

- The notion of overfishing or exceeding the Annual Catch Limit (ACL) is artificially driven by the unfair, poorly executed zone split by SAFMC granting east Florida more than their fair share of the ACL leaving GA-NY with a small fraction of what should have been allocated. The numbers clearly reflect the true Atlantic coast is not being overfished by any significant amount. There is nothing the ASMFC can do to change this situation by getting involved.
- There are only 4 states that have a vested interested, GA, SC, NC, and VA. The other voting states in ASMFC have no interest in this matter so there is no reason to force all the other states along the Atlatic coast to vote. If anything, some of the other states will want their fair share of the unfairly allocated ACL exaberating the problem even farther by ASMFC allocating an ever shrinking ACL to individual states.
- With ASMFC's authority to regulate catches in state waters, the angling public will no longer be able to influence our individual state commissioners to influence limits and seasons when the SAFMC clearly is not doing their due dilligence in managing cobia.

We respectfully request ASMFC hault any plans to jointly manage cobia with SAFMC. Once a new, fair, stock assessement is complete, then ASMFC should consider this action but not before. Additional information is enclosed.

If you have any questions, please contact me phone or e-mail, ifishva@gmail.com, or my phone: 757-329-5137.

Sincerely,

Mike Avery

Mike Avery, President

The PID makes a fundamental false assertion. The Denson/Darden South Carolina Department of Natural Resources study of cobia genetics cited by SAFMC, the PID, and the SEDAR 28 CLEARLY states "On the basis of a robust microsatellite data set from collections along the U.S. Atlantic coast (2008–09), offshore groups were genetically homogenous. However, the 2 sampled inshore aggregations (South Carolina and Virginia) were genetically distinct from each other, as well as from the offshore group." http://fishbull.noaa.gov/1121/darden.pdf

Note, SEROs own genetics science in NO WAY substantiates the justification given for the management zone split given by SEDAR28 and SAFMC. It directly refutes the claim.

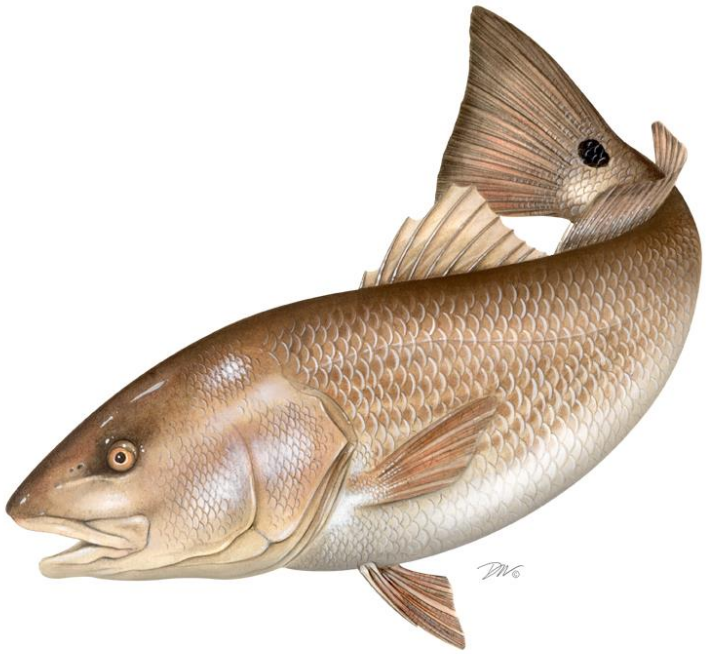
Migratory cobia being genetically homogeneous is supported by Dr. John Gold at Texas A&M (publicly available peer reviewed academically accepted research.) Instead of saying that there are two genetic groups of cobia in the Gulf and Atlantic, he indicated that, "Cobias that were sampled from the coastal waters of Virginia, Mississippi, and Louisiana were genetically homogeneous based on assays of microsatellite genotypes and mtDNA haplotypes. This finding is consistent with observed migration patterns and tag-and-release studies of Cobias."http://agrilifecdn.tamu.edu/.../2012/05/Gold-et-al.-2013.pdf

The basic fundamental issue that that the decision to split zones is based on something that is not true based on the best science available. Yet, here is the justification in the PID: "SAFMC management, based on current genetic information, addresses the management of Atlantic Migratory Group (AMG) of cobia that occur from Georgia through New York (Figure 1). Cobia that occur off the east coast of Florida are part of the Gulf stock, but the SAFMC manages the portion of that stock on the Florida east coast that occurs within its jurisdiction (Florida/Georgia (FL/GA) border to the Monroe County line). Tag recapture data suggested two main 3 stocks overlap at Brevard County Florida and corroborated the genetic findings."

The Magnuson Stevens Act MANDATES that the regional commissions use the best science available. Clearly SAFMC and SERO have not. Before ASMFC completes a complimentary fisheries management plan, SAFMC must complete the stock ID workshop and stock assessment (currently scheduled for 2017 and 2018 respectively) to correct this issue. Only then would it be appropriate for complimentary management. Our recommendation is that ASMFC immediately stop any development of a fisheries management plan until SAFMC has completed the new stock ID workshop and stock assessment so the resulting ACL and allocation appropriately reflects the best science available.

Atlantic States Marine Fisheries Commission

Red Drum Assessment for Peer Review



November 2016

Vision: Sustainably Managing Atlantic Coastal Fisheries

Atlantic States Marine Fisheries Commission

Red Drum Stock Assessment

November 2016

Prepared by the
ASMFC Red Drum Stock Assessment Subcommittee:

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Ms. Carolyn Belcher, Georgia Department of Natural Resources
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Acknowledgments

The Atlantic States Marine Fisheries Commission (ASMFC or Commission) thanks all of the individuals who contributed to the development of the red drum stock assessment. The Commission specifically thanks the ASMFC Red Drum Technical Committee (TC) and Stock Assessment Subcommittee (SAS) members who developed the consensus stock assessment report.

Executive Summary

During the SouthEast Data, Assessment, and Review (SEDAR) 44 Benchmark Stock Assessment for red drum (SEDAR 2015b), assessment models were developed with the Stock Synthesis 3 (SS3) integrated analysis framework (SS3, Methot 2013). Models using this framework were not accepted by the South Atlantic State/Federal Fisheries Management Board (Board) due to concerns with the reliability of population parameter estimates. Instead, the Board tasked the TC and SAS to evaluate the utility of the statistical catch-at-age (SCA) models used in the previous benchmark assessment (SEDAR18; SEDAR 2009) for management advice. The SAS explored several potential changes to these models, including data changes, but ultimately recommended models with minimal structural changes for management advice. This report includes results of the SCA models for both the northern and southern red drum stocks. For assessment terms of reference (TORs) and information on red drum life history, management, and data, including model data inputs, see the SEDAR 44 Data Workshop Report (SEDAR 2015b).

The northern and southern red drum stocks were assessed relative to static spawning potential ratio (sSPR) reference points defined in Amendment 2 to the Red Drum Interstate Fisheries Management Plan (ASMFC 2002). The 2011-2013 three year average sSPR was estimated to be 43.8% in the northern stock and 53.5% in the southern stock, both above the sSPR30% threshold and sSPR40% target, indicating that overfishing is not occurring. However, most of the issues that arose with the models during SEDAR18 remained. Abundance estimates of older fish continued to be more uncertain and, particularly in the southern stock, had large standard errors. Similar to SEDAR18, initial abundance estimates of older fish (ages 7^{+}) were unrealistically large for the northern stock. Abundance estimates in the south were so uncertain that they are likely indicative only of relative trends. Therefore, an abundance or biomass status (overfished/not overfished) could not be determined for either stock. In addition, the estimation of sSPR was much more uncertain in the south. Most of the sensitivity runs that were conducted for the southern model, however, suggested that the sSPR likely is above the threshold.

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1. Methods

A standard statistical catch-at-age (SCA) model was used for red drum, which included special features for capturing some information from tagging programs and restricting the selectivity estimated for older fish. These analyses were defined for the period 1989-2013 and included age-specific data for red drum ages 1 through 7^{+}.

1.1. Data Sources

The observed data used in the analyses for the southern and northern stock of red drum included the total annual harvest (landings plus release mortalities) attributed to each fishery, the estimated age-proportions in these annual harvests, indices of abundance, and for the northern model, tagging derived instantaneous fishing mortality-at-age (F-at-age) for harvested fish and full instantaneous fishing mortality (F) for released fish. For all observed data, measures of precision were available for use in the models. Data input files are in appendices A and B for the northern and southern stocks, respectively.

In the SCA framework all input data can be considered as "tuning" indices. The inputs included the 1989-2013 total annual kill of red drum by the northern fisheries: commercial gillnet and beach seine, other commercial gears (mostly pound nets and seines), recreational landings, and recreational live release mortalities. Recreational catch estimates were calibrated following methods in working paper SEDAR44-DW04. Since the commercial fishery statistics are considered a complete census of the landings, the coefficients of variation (CV = standard error / mean) for each year's landings was assumed low, at 0.01. The CVs for the annual recreational harvest and the annual live release mortalities were taken as the proportional standard errors (PSEs) estimated for the Marine Recreational Fisheries Statistics Survey's (MRFSS) and Marine Recreational Information Program's (MRIP) Type A+B1 catch (landings) and Type B2 catch (live releases), respectively. The 1989-2013 southern stock's total annual landings of red drum were grouped as: Florida recreational landings, Georgia recreational landings, South Carolina recreational landings, Florida live release mortalities, and Georgia/South Carolina live release mortalities. The CVs associated with these estimates were derived as explained above for the northern stock recreational catches.

The input data for the age compositions (SEDAR44-DW06) of the catch from the fisheries listed above were generally derived from random fish length samples taken from the catch that were then converted to ages using various age-length keys. The age data were rarely available directly for the recreational live release fisheries, but some information was available from angler-taken measurements of released fish. These data sources included the volunteer logbook program from Florida and reported recaptures of tagged fish which were released alive in North Carolina and South Carolina. These data were deemed sufficient for the South Carolina and Georgia live release fisheries but not for the northern stock or for the Florida live release fishery where North Carolina tagging study results (Bacheler et al. 2008) were used to

infer the catch age-structure. The use of South Carolina tag recapture data, rather than data from a two year log book study conducted by South Carolina, for estimating the age composition of the live release fishery is a data change since SEDAR18 (SEDAR 2009).

The age composition proportions were represented as a multinomial distribution so the number of aged fish in the annual samples indicated the precision of the observed proportions. Because these ages weren't direct random samples from the catch, the SAS used what were assumed to be independent sampling events as sample sizes (e.g., longline set, tow, etc.) with a minimum level of two used for the years when no age-length data were available. This minimum sample size of two was also used for the age composition data estimated for the Georgia/South Carolina live release fishery. These sample sizes were then scaled to a maximum of 50 to avoid assigning too much precision to the composition data relative to other data components.

Indices of abundance are used in the assessment model to "tune" agreement between the model- predicted and observed trends in abundance. For the northern stock, five indices were used to model trends in abundance (Table 1). Two indices measured young-of-the-year (age 1) abundance: the North Carolina Independent Gillnet Survey (IGNS) and the North Carolina bag seine survey, though the former was for late year age-1 red drum and the latter was for the beginning-of-the-year age-1 fish. The other juvenile indices of abundance used in the northern stock were the IGNS catch rates for age-2 red drum (mid-year) and the MRIP total catch rate (assumed to apply to the aggregate late year abundance of ages 1-3). The final index of abundance for the northern stock, which was used for the first time with this benchmark assessment, was the North Carolina longline survey which is assumed to track aggregated relative abundance of age 7^{+} fish later in the year.

For the southern stock, there were eleven indices of abundance (Table 2). Four indices measured young-of-the-year trends: the Florida small seine survey, the Georgia monofilament gill net survey, the South Carolina stop net survey, and the South Carolina trammel net survey. The Florida survey was compared to beginning-of-year abundance, the Georgia survey was compared to mid-year abundance, and the last two surveys were compared to late year abundance estimates. Other age-specific surveys included: the Florida haul seine survey used separately for age-2 and age-3 and the South Carolina trammel net survey for age-2, all compared to mid-year abundance. Finally, four pooled-age indices were used: MRIP for ages 1-3, the Georgia longline survey (ages 7^{+}), the South Carolina 1 mile longline survey (7^{+}), and the South Carolina 1/3 mile longline survey (ages 7^{+}). The MRIP survey was used to indicate mid-year abundance; the longline surveys for abundance had survey mid-points 11 months into the calendar year. Estimated annual arithmetic means or standardized year effects and their CVs were used for all indices. Index values were all scaled to means for use in the model. Index choices represent the major data changes since the last benchmark assessment (SEDAR 2009). The South Carolina electrofishing survey was used in SEDAR18 but removed in this assessment. The new indices used included the South Carolina stop net survey, the South Carolina age-1 trammel net survey, the South Carolina 1/3 mile longline survey, and the Georgia longline survey.

Less conventional "tuning" was provided by estimates of age-specific instantaneous F available from a long-term tag-recapture program conducted in North Carolina (Bacheler et al. 2008). In the northern stock, estimates for F-at-age were available for the combined harvest fisheries (commercial and recreational A+B1). These estimates and associated CVs were used to "tune" the model-estimated F-at-age for ages 1-4^+ during 1989-2004. The 1989-2004, annual fully recruited Fs estimated for the live releases were also used to compare against that fishery's fully recruited Fs estimated within the model. Only the fully recruited Fs were fit, as the selectivity-at-age information was also used to estimate the age composition of the live release fishery mortality in the northern model.

The temporal and age framework for these analyses for both the northern and southern stock models was 1989-2013 and ages 1-7^+. The assessment model was configured under the separability assumption that there was a year-specific apical F for each fishery and age-specific selectivities as portions of this fully recruited F. Selectivities were estimated for ages 1-5^+, with selectivity for age 4 and 5^+ fish estimated as proportions of age-3 selectivity (constrained to the bounds of 0 and 1). These estimated proportions of age-3 selectivity, or selectivity constraints, were assumed to be the same for all fleets and were time invariant. The selectivity blocks used for the northern stock were 1989-1991, 1992-1998, and 1999-2013 for all fisheries, chosen mostly to reflect changes in size limits in North Carolina where the vast majority of landings, on average, occur (Table 3). In the southern stock, where regulatory actions were not as coincidental among the states, constant selectivity within each fishery was assumed to occur during: 1989-2013 for the Florida recreational fisheries (both harvest and live release); 1989-1991, 1992-2001, and 2002-2013 for the Georgia recreational harvest fishery; 1989-1993, 1994-2000, 2001-2013 for the South Carolina recreational harvest fishery; and 1989-1991, 1992-2013 for the Georgia/South Carolina pooled recreational live release fishery (Table 4). Selectivity was not estimated for the Florida recreational live release fishery. The selectivity for this fishery was assumed equal to the North Carolina tagging study findings for the period 1999-2004. During this period there were generally similar size limit regulations in place in North Carolina that corresponded to the Florida selectivity period (1989-2013).

Natural mortality (M) was assumed constant over time, though varying with age, for each stock (Lorenzen 1996). M for the northern stock was the same as estimated in SEDAR18 (SEDAR 2009). For the southern stock, M was updated to match the M estimated in SEDAR44 (SEDAR 2016). In SEDAR18, one maturity schedule was used for both the northern and southern stocks (SEDAR 2009). For this assessment, maturity-at-age was determined separately for the northern and southern stocks using North Carolina and South Carolina data (SEDAR44-DW02). Weights-at-age were estimated in SS3 for each stock (SEDAR44; SEDAR 2016).

1.2. Model Configuration and Equations

The population dynamics models were based on annual fleet- and age-specific separable F :

$$F_{f,y,a} = F^{*}_{f,y} s_{f,y,a},$$

where $F_{f,y,a}$ is the instantaneous F caused by fleet f in year y on age a fish, F* is the apical F for fleet *f* in year *y*, and *s* is the selectivity, a bounded number ranging from zero to one. Given red drum's inherent reduced vulnerability after age-3 due to their movement from estuarine waters to nearshore waters and more recently to enacted maximum size limits, the selectivity for ages-4 and 5^{+} fish were restricted to be between 0-100% of the selectivity at age-3. Selectivity was therefore estimated for ages 1-3 in each of the time periods for which the selectivity was assumed not to have changed for each fishery. Selectivity for ages 4 and 5^{+} was derived from the estimated age 3 selectivity for a given time period and the proportional selectivity parameters for ages 4 and 5^{+}. These proportional selectivity parameters were assumed to be constant across selectivity blocks and fleets.

The abundances of the different age groups in the population are modeled forward in time beginning with estimates for a series of recruits ($N_{y,1}$ in 1989 through 2013) and an initial year's abundance-at-age ($N_{1989,a}$ for ages 2-7^{+}). These initial conditions were both modeled as lognormally distributed variables. From these starting abundances, older ages are sequentially modeled as:

$$N_{y+1,a+1} = N_{y,a} e^{-\sum_{f} F_{f,y,a} - M_a},$$

where M_a is the age-specific instantaneous M rate. A "plus" group abundance included survivors from both the previous year's plus group and that year's next-to-oldest age group

$$N_{y+1,A} = N_{y,A-1} e^{-\sum_{f} F_{f,y,A-1} - M_{A-1}} + N_{y,A} e^{-\sum_{f} F_{f,y,A} - M_A},$$

where *A* is age 7^{+}.

The observation model for these analyses involves total catch, the proportion of the fleet- and year-specific catch in each age group, and indices of abundance. The fleet- and year-specific predicted catch-at-age, $C_{f,y,a}$, was calculated using the Baranov catch equation:

$$\hat{C}_{f,y,a} = N_{y,a} \frac{F_{f,y,a}}{\sum_{f} F_{f,y,a} + M_a} \left(1 - e^{-\sum_{f} F_{f,y,a} - M_a}\right),$$

with the annual total catch for each fleet determined by summing across ages and the proportion-at-age in the catch determined from the age-specific catch relative to this annual total. The observed catch has an assumed lognormal error, ε_{fya}, from the true catch and the model estimates the true catch.

Indices of abundance were assumed linearly related to the stock abundance of chosen age group(s):

$$\hat{I}_{s,y} = q_s N_y,$$

where $I_{s,y}$ is the predicted index of relative abundance for the age(s) caught by survey *s* in year *y*, q_s is the proportionality constant for survey *s*, and N_y is the abundance for

the age(s) included in the index.

The objective function used to confront the observation model predictions with the observed data contained abbreviated lognormal negative log likelihoods for fleet- and year-specific total catch and annual indices of abundance where:

$$negLL\left(\mathrm{T}_f\right)=\sum_y\left(0.5\frac{\left(\ln\left(\overset{o}{T}_{f,y}+1.e^{-6}\right)-\ln\left(\sum_a\hat{C}_{f,y,a}+1.e^{-6}\right)\right)^2}{\sigma^2_{f,y}}+\ln\left(\sigma_{f,y}\right)\right)$$

where $T_{f,y}$ is the observed total number killed each year y by fleet f and $\sigma_{f,y}$ is the standard error of the total catch within each fleet each year. The variance was estimated from the reported CVs using $\sigma^2=\ln(CV^2+1)$. The CVs were available for the recreational fisheries as the proportional standard error (PSE) and were assumed low (0.01) for the commercial fisheries. Likewise, the negative log likelihoods for the indices of abundance were:

$$negLL\left(\mathrm{I}_s\right)=\sum_y\left(0.5\frac{\left(\ln\left(\overset{o}{I}_{s,y}+1.e^{-6}\right)-\ln\left(q_s\sum_a\hat{N}_{y,a}+1.e^{-6}\right)\right)^2}{\sigma^2_{s,y}}+\ln\left(\sigma_{s,y}\right)\right)$$

where $I_{s,y}$ is the observed index for the age(s) in the survey in year y, and $\sigma_{s,y}$ is the standard error of the survey index in year y, estimated from the original data or from a standardization procedure, e.g. delta lognormal method (Lo *et al*. 1992). Of course, in the case of multi-age indices, estimated abundances across these ages would be compared to the index value.

For the catch proportion-at-age, a multinomial negative log likelihood was used:

$$negLL\left(P_{f,y}\right)=-\sum_a\left(n_{f,y}\left(\overset{o}{P}_{f,y,a}+1.e^{-6}\right)\ln\left(\frac{\hat{C}_{f,y,a}}{\sum_a\hat{C}_{f,y,a}}+1.e^{-6}\right)\right)$$

where $P_{f,y,a}$ is the observed proportion-at-age a in the total catch for fleet f in year y and $n_{f,y}$ is the sample size for aged fish. These components were not included for the fleets where the selectivity estimates based on tagging were used (northern live release recreational fishery and the southern stock's Florida recreational live release fishery).

There were additional observed data derived from a long-term tag-recapture study conducted in North Carolina that was utilized in the northern stock analyses. The estimated F-at-age and their standard errors for the pooled harvest (kept) fisheries in the north during 1989-2004 were included in the northern stock's objective function as:

$$negLL\left(\mathrm{F}_{tag(y)}\right)=\sum_{y}\left(0.5\frac{\left(\ln\left(F_{tag(y,a)}\right)-\ln\left(\sum_{f}\hat{F}_{f,y,a}\right)\right)^{2}}{\sigma^{2}_{tag(y,a)}}+\ln\left(\sigma_{tag(y,a)}\right)\right)$$

where $F_{tag(y,a)}$ and $\sigma_{tag(y,a)}$ are the observed F and its estimated standard deviation for year *y* and age *a*. The estimated *F*-at-age were only tallied for the recreational kept and commercial fisheries. Likewise, F-at-age estimates for the recreational live release fishery were available for the period 1989-2004 from the tagging program. However, since the selectivity vectors from this program were used as input parameters because of the lack of observations for the catch-at-age for this fishery, only the information from its fully-recruited *F*s were used in the northern stock's analysis:

$$negLL\left(\mathrm{F}_{full(y)}\right)=\sum_{y}\left(0.5\frac{\left(\ln\left(F_{full(y)}\right)-\ln\left(\hat{F}_{full(y)}\right)\right)^{2}}{\sigma^{2}_{full(y)}}+\ln\left(\sigma_{full(y)}\right)\right)$$

where $F_{full(y)}$ and $\sigma_{full(y)}$ represent the fully recruited *F*s for the recreational live release fishery and its standard deviation.

The final component of the objective function included the sum of squares for the log of the unstandardized (to unity) selectivitities for each fleet-specific selectivity period for ages 1 through 3. These values were configured as a deviation vector whose sum equaled zero. This added stability to the solution search routine.

The resulting objective function included input weights (*λ*s) for the different likelihoods that reflected the relative perceived levels of accuracy associated with the estimation equations for the predicted values. The final objective function was:

$$ObjFunction=\sum_{f}\left(\lambda_{TC(f)}\,negLL\left(\mathrm{T}_{f}\right)\right)+\sum_{f,y}\left(\lambda_{P(f,y)}\,negLL\left(P_{f,y}\right)\right)+\sum_{s}\left(\lambda_{s}\,negLL\left(I_{s}\right)\right)+$$
$$\sum_{1989}^{2004}\left(\lambda_{Ftag}\,negLL\left(F_{tag(y)}\right)\right)+\sum_{1989}^{2004}\left(\lambda_{Ffull}\,negLL\left(F_{full(y)}\right)\right).$$

Note that the F_{tag} and F_{full} negative log-likelihoods were not part of the southern stock analyses.

1.3. Parameters Estimated

Parameters were estimated for: age 1-3 selectivity during each block of years within a fishery where selectivity was assumed constant, age 4 and age 5^{+} selectivity as a proportion of age-3 selectivity, the fully recruited instantaneous F (also referred to as apical F) for each fishery each year, the initial abundance for ages $2\text{-}7^{+}$, annual recruitment (1989-2013), and catchability coefficients for each survey. All parameters were estimated in log space. For the northern stock, 165 parameters were estimated (Table 5) and for the southern stock, 196 parameters were estimated (Table 6).

The observed data for these analyses included: total annual kill by fleet, CVs for total annual kill by fleet, proportion-at-age each year, effective number of ages sampled each year for each fleet, F-at-age for the combined "harvest" fleets during 1989-2004 (northern stock only), CVs for F-at-age for the combined "harvest" fleets during 1989-2004, fully-recruited F for recreational live release fishery during 1989-2004 (northern stock only), CVs for fully-recruited F for the recreational live release fishery during 1989-2004, annual survey catch per unit effort, and CVs for annual survey catch per unit effort. There were 783 observations (data points), not including CVs for many of the data points or aged sample-size observations, in the northern stock (Table 7) and 976 in the southern stock (Table 8).

There were a number of input parameters (part of model structure) that were assumed to be known and without error. These input parameters included: M-at-age, defined periods of constant selectivity, selectivity for all ages for Florida and northern recreational live release fisheries, release mortality, ages selected for each survey, survey time of year, and external weights for likelihoods from fleet-specific total catch.

1.4. Evaluation of Model Fits

The SAS carried over a number of hypotheses in relation to the data sets developed in the previous benchmark assessment (Tables 9 and 10) and used the total standardized residual sum of squares (RSS), visual inspection of data fits, index standardized residual sum of squares, and qualitative evaluation of age 4 and 5^{+} proportional selectivity parameter estimates (i.e., estimates away from the upper bound of 1) as criteria for choosing the most appropriate formulation.

1.5. Uncertainty and Measures of Precision

Estimated CVs (or PSEs) were used as measures of the precision for observed kill, index, and tagging F data. For the proportion-at-age data, the sample sizes and proportion indicated the precision of the observed data. For the model-estimated parameters, asymptotic standard errors were estimated during the model fitting process. The precision of important derived values, e.g., terminal three year average sSPR, was explored by describing their likelihood profiles. The implied precision from likelihood profiles is probably too great (i.e., narrow) given that there were no errors associated with input parameters, e.g., M-at-age, and the standard deviations of the standardized residuals (SDSR) often departed significantly from 1.0. This would suggest that there was additional "process error" that was not included in the model. For these reasons, the precision of the estimated parameters and derived values is almost certainly too great, i.e., confidence bands are too narrow. Iterative reweighting was done in sensitivity runs to acknowledge the additional "process error" not included in the base model and achieve "expected" fits to data (Francis 2011; SEDAR 2015a). SDSRs were calculated for each data component with input precision. Input precision was iteratively adjusted in subsequent model runs for each index and, in the north, tag data component, for those indices that had SDSRs that exceeded the upper bound suggested by Francis (2011) for a given number of observations. This process

was repeated until all SDSRs fell below their upper bounds. Additional sensitivity runs were conducted to evaluate the effects model and data assumptions had on model fits and estimates. Additionally, a five year retrospective analysis was completed to determine whether there was any directional bias in the estimates as years were removed from the model.

1.6. Benchmark and Reference Points

The ASMFC (2002) defines the overfishing threshold for red drum to be 30% static spawning potential ratio (sSPR) and a management goal (fishing target) of 40% sSPR. Due to the noisiness of the data and the general imprecision of terminal year F estimates, the reviewers in SEDAR18 recommended using a three year average for management of red drum. The benchmarks estimated for this assessment include the sSPR, three year average sSPR, and escapement rate through age-5.

The sSPR is calculated as the spawning stock biomass per recruit expected under the current year's fishing regime divided by the theoretical spawning stock biomass under no fishing. This was calculated as:

$$sSPR_y = \frac{\sum_a Mat_a B_a \prod_1^a e^{-M_a - F_{y,a}}}{\sum_a Mat_a B_a \prod_1^a e^{-M_a}}$$

where Mat_a and B_a are the maturity- and weight-at-age vectors through the maximum ages (62 years in north and 41 years in south), respectively.

A more readily "observable" metric for red drum, that is very similar to sSPR when there are low levels of F on mature adults, is the escapement rate. Past assessments (Vaughan and Carmichael 2000) presented estimates of escapement through model age-3. During the most recent benchmark assessment (SEDAR 2009), it was determined that it may be more useful to encompass more of the immature portion of the stock in the escapement estimate, so escapement estimates through age-5 are presented in this assessment. Because there are a large number of adult age groups (ages 6-62 in the north and ages 6-41 in the south) assumed to have the same low level of F as for age-5 in the sSPR calculation, escapement rates are always higher than the sSPR. If there was no F on mature adults then escapement would equal sSPR levels. Static, or year-specific, escapement (sEsc) was defined as:

$$sEsc_y = e^{\sum_{a=1}^{T} -F_{y,a}}$$

where *T* is age-5. The cohort- specific escapement (tEsc), which defines the escapement rate for the cohort completing its final "escapement" age that year, is:

$$tEsc_y = e^{\sum_{a=1}^{T} -F_{y-T+a,a}}$$

2. Results

2.1. Northern Stock

The model with the lowest RSS from the data weighting hypotheses was the model with the total catch unity weighted, the indices unity weighted, the recreational harvest proportion-at-age data downweighted by 0.01, and the tagging data unity weighted (Table 11). This was the same model weighting that was chosen as the base model in SEDAR18. The fit of the model was reasonable overall and this model met all other fitting criteria. The fit was very good for the commercial catch data with very low RSS values and low SDSRs (Table 7 and Figures 1 and 2). The fit was not as good to the recreational catch data, particularly the recreational kept fleet which had a SDSR close to 2 and had poor fit in the 1990s. However, most recreational catch estimates were within the errors of the observed recreational data (Figure 1). The SDSR of the proportion-at-age data was low indicating good model fits (Table 7 and Figure 3). The index data were generally fit well (Figures 4 and 5), though all but the adult longline survey were overdispersed (SDSRs >2, Table 7). Most indices were estimated within the errors of the observed indices. The RSS values were highest for the North Carolina JAI and the MRIP indices due to the fitted model missing some of the peaks in the observed data. For the auxiliary tagging data, the fits were relatively good for age-1 and age-2 and not as good for age-3 and age-4 (Table 7 and Figure 6). The fit was very good to the full F of the release fishery (Table 7 and Figure 7).

Recruitment in the north was marked by large year classes in model years 1998, 2008, and 2012, corresponding to the 1997, 2007, and 2011 year classes (Table 12 and Figure 8). The 2012 recruitment was particularly large, approximately twice as large as any other between 1989 and 2013. As in SEDAR18, recruitment in the northern stock was estimated very precisely.

Total abundance in the northern stock shows a marked decline due to the decline in abundance of older ages (Table 13 and Figure 9). As with recruitment, the strong 2011 year class is evident in the estimates of age 1-3 abundance and total abundance in 2012 and 2013. Similar to SEDAR18, this marked decline is due to a decline in age 7^{+} abundance and may be an artifact of the assessment model, particularly the assumption of fixed selectivities for the live release fleet and the North Carolina longline survey time series being so short (only seven years).

The selectivities for each fleet and age for the three selectivity blocks are shown in Figure 10. For the kept fisheries (commercial gill net beach seine (GNBS), commercial other, and recreational harvest), peak selectivity occurred at age-2 across all selectivity blocks. The selectivity curves in the last selectivity block (1999-2013) are the narrowest and the kept selectivities are wider in earlier time blocks (broader slot range prior to 1992). The recreational live release fishery selectivities were fixed based on external tag-based estimates (Bacheler et al. 2008) but as with the kept fisheries, the selectivity in the most recent time block also peaked at age-2 before dropping to low levels.

F by year, age, and fleet are shown in Table 14 and the total F-at-age is shown in Table 15. The highest fleet specific F rates occur in the recreational harvest and commercial GNBS fleets (Figure 11). F rates are generally very low in the commercial other and recreational release fleets. Fs were particularly high in 1989 and 1990 before declining in 1991. The F rates have been generally low in all of the fleets with the exception of peaks as year classes have moved through the fisheries.

Correlation of model parameters with absolute values greater than 0.90 are in Table 16. All correlations above this threshold are between commercial F estimates and subsequent year commercial F estimates.

2.1.1. Stock Status

Static and transitional escapement rates for ages 1-5 are shown in Table 17 and Figure 12. Escapement was low in the late 1980s and early 1990s and increased through the mid-1990s. Values have been fairly high and stable since around 2000, though there may be a slight decrease in the most recent years, particularly in 2012.

The sSPR increased throughout the 1990s (Table 18 and Figure 13). While the data is quite noisy, it appears to have been generally high in the 2000s and decreasing in recent years. In 2013, sSPR was estimated at 50.4% in the northern stock. Similar to the sSPR estimates, the average sSPR increased throughout the 1990s and peaked in 2005 before starting to decline (Table 18 and Figure 14). However, the 2011-2013 average sSPR is 43.8%, above the target (40%) and threshold (30%) values. Using ADMB's likelihood profile capabilities, the posterior probability density of the 2013 three year average sSPR was estimated. This estimation suggests that it is likely that the terminal year average sSPR estimate is above the management sSPR threshold of 30% (Figure 15).

2.1.2. Retrospective Analysis

In general, the model was very insensitive to removing years of data and estimates in recruitment and three year average sSPR were very consistent (Figure 16). The only exception was when the model only had data through 2010. In this model run, the recruitment estimates were slightly higher and the three year average sSPR was lower.

2.1.3. Sensitivity Analysis

In SEDAR18, the northern model was very sensitive to the inclusion of the tag-based F data and the TC felt that this necessitated a sensitivity run in this assessment. The removal of the tag-based F data did not affect the estimates of recruitment and resulted in slightly higher three year average sSPR estimates (Figure 17). The main effect the removal of the tagging data had was to increase the confidence intervals of the recruitment and three year average sSPR estimates. As the tagging data only span 1989-2004, it may be that the addition of nine years of data has lessened the impact the tagging data has on the model results.

Sensitivity analysis was conducted to determine the influence of each index of abundance on the model (Figure 18). Most of the model runs converged on a similar three year average sSPR value. The removal of the North Carolina IGNS age-1 index and the North Carolina JAI initially resulted in a lack of model convergence. Convergence was able to be achieved, however, by adjusting the bounds on the selectivity constraint parameters which changed the starting values of these parameters. When either the North Carolina IGNS age-1 or North Carolina JAI were removed, this resulted in lower sSPR values in the early part of the time series but similar sSPRs in the later part of the

time series. The removal of the MRIP index, by comparison, gave similar three year average sSPR estimates in the early part of the time series but resulted in lower sSPR values at the end of the time series. The removal of the MRIP index was the only one of these model runs that resulted in the terminal year estimate of three year average sSPR to fall below the management threshold.

A sensitivity run was also conducted using iterative reweighting as suggested by the review panel in SEDAR18. The CVs for all indices except the North Carolina Longline survey and the F-at-age data for ages 2-4 had to be increased to achieve SDSRs below the upper limit suggested by Francis (2011). The adjustments are in Table 19. These adjustments resulted in a better fit to the recreational harvest and age-3 harvest F, particularly in the final selectivity period (after 1998). Conversely, the fit to the age-4 harvest F deteriorated in the final selectivity period (Figure 19). Both changes in fit to the F-at-age data indicate higher F on these ages in the final selectivity period (Figure 20), resulting in higher selectivity estimates and lower sSPR estimates than the base model. Changes in the three year average sSPR are most pronounced from 2009-2013, when they start to fluctuate around the target before falling below the target in the final two years (Figure 21). The estimates do not fall below the threshold. The reweighting acknowledges some process error due to interannual variability of the index catchabilities (i.e., increased input CVs), propagating additional uncertainty into the model estimates (Table 20).

2.2. Southern Stock

The model with the lowest RSS (Table 21) in the south had a very high index RSS value. As Francis (2011) recommends fitting the abundance indices well and this model improved the fit to the total catch and proportion-at-age data at the expense of the index data, this model was not selected as the best model. Models with the next lowest RSS values were evaluated and discarded for the following reasons: high (>700) index RSS, estimated selectivity constraints for ages 4 and 5^{+} greater than 0.9 of the age-3 selectivity, and poor visual fit to the Florida live release catch. The remaining two models under consideration had the total catch and indices unity weighted and differed by how much the Georgia/South Carolina recreational discard proportion-at-age data were downweighted (0.1 vs. 0.001). As these models produced very similar results, the model with the proportion-at-age data downweighted to 0.1 was chosen as the preferred model as it was the preferred model used in SEDAR18 and the weighting was generally consistent with the northern model.

The fit of the preferred model was reasonable overall. The fit was very good for the catch data with very low RSS values and low SDSR values (Table 8 and Figures 22 and 23). All of the catch estimates were within the errors of the observed data (Figure 22). The SDSRs of the proportion-at-age data were also low indicating good model fits, though it was slightly higher for the Georgia/South Carolina release fleet (Table 8 and Figure 24). The index data were generally fit well (Figures 25 and 26) although most were overdispersed, particularly the South Carolina trammel net survey indices and the adult longline indices (Table 8). Most indices were estimated within the errors of the observed indices, though some peaks in the observed data were missed by the model.

The correlation of estimated values and parameters was explored using the correlation matrix output by ADMB. A large number of annual estimates of F for the fleets were strongly (>0.90) and positively correlated with annual F estimates from other years and fleets (Appendix C). The Florida recreational harvest fleet F and Florida discard fleet had the most correlations with other fleet and year specific Fs. There was also strong negative correlations between the recruitment estimates in 1989 and 1990 with various annual estimates of F, again particularly with the Florida fleets.

Estimated recruitment showed peaks in model years 1995, 2001, 2003, 2010 and 2013 (Table 22 and Figure 27). However, as in SEDAR18, abundance was very imprecisely estimated. Total abundance for the southern stock showed an upward trend and mirrored the trends seen in the ages 1-3 abundance (Table 23 and Figure 28). Age 4^{+} abundance has been fairly stable and exhibits a slight upward trend.

The selectivities for each fleet and age for the various selectivity blocks are shown in Figure 29. Florida's recreational kept fishery had one selectivity block which peaked at age-3. Florida's recreational release fishery's selectivity was fixed based on tag-based estimates of selectivity from North Carolina (Bacheler et al. 2008). Georgia's kept fleet (commercial and recreational) peaked at age 1 for all time blocks. In the most recent selectivity period (2002-2013), the tail of the curve decreases more rapidly than in the 1989-1991 time block, likely due to the implementation of maximum size regulations. The selectivities for the South Carolina kept fleet was similar across all selectivity blocks with the main differences seen in the age-1 selectivity estimates. The Georgia/South Carolina release fleet selectivity peaked at age-1 in the 1989-1991 time period and stayed high through age-3 while the selectivity in the 1992-2013 time period was slightly lower for ages 1 and 2 and peaked at age-3.

F by year, age, and fleet are shown in Table 24 and the total F-at-age is shown in Table 25. The highest fleet specific F rates occur in the Florida and South Carolina harvest fleets (Figure 30). A large increase in annual F can be seen in the Florida harvest fleet in recent years, though slight increases can also be seen in the Florida and Georgia/South Carolina release fleets.

2.2.1. Stock Status

Static and transitional escapement for ages 1-5 are shown in Table 26 and Figure 31. Escapement has fluctuated mostly between 0.6 and 0.7 since the early part of the time series. Since 2005, however, there has been a slight decrease in static escapement, falling to the lowest value in the time series in terminal year 2013.

Both sSPR (Table 27 and Figure 32) and three year average sSPR (Table 27 and Figure 33) have been stable throughout the early part of the time series and show a slight decrease in recent years. However, as in SEDAR18, the asymptotic confidence bounds on these values are very large making any conclusions on stock status very uncertain. The terminal year three year sSPR for the southern stock is 53.5%, above both the target and threshold values. Using ADMB's likelihood profile capabilities, the posterior probability density of the 2013 three year average sSPR was estimated. This estimation suggests that it is likely that the terminal year average sSPR estimate is above the management sSPR threshold of 30% (Figure 34).

2.2.2. Retrospective Analysis

A five year retrospective analysis was conducted to see how recruitment and the three year average sSPR values changed as years of data were removed (Figure 35). Using the full time series (through 2013) resulted in lower estimates of recruitment and three year sSPR than any other terminal year. All other terminal year model runs using data through 2009-2012 converged on similar solutions.

2.2.3. Sensitivity Analyses

Indices were removed from the model individually to determine how sensitive the model estimates of three year sSPR were to the inclusion of certain indices (Figure 36). Removal of the Florida haul seine surveys resulted in higher three year sSPR values than the base run. Removal of the South Carolina trammel net survey (both ages-1 and 2) and the MRIP survey resulted in much lower estimates of three year average sSPR. Depending on which surveys were included, a very wide range of estimates for three year average sSPR were observed, though most of these point estimates were above the management threshold.

A sensitivity run was also conducted using iterative reweighting as suggested by the review panel in SEDAR18. The CVs for all indices which had SDSR values greater than those suggested by Francis (2011) were increased using the adjustments in Table 28. Following just one iteration, all index and proportion-at-age data had SDSR values around or less than 1 (Table 29) and within the recommended bounds. Additionally, the total standardized residual sum of squares and total negative log-likelihood were reduced and the visual fits of the Georgia/South Carolina release fleet proportion-at-age data were improved. This weighting, while fitting the observed data components better, did not improve the precision of the population estimates (i.e. total abundance, abundance at age, or sSPR). Three year average sSPR values were very similar between the base model and the iteratively reweighted model, with the iteratively re-weighted model estimating slightly higher sSPR (Figure 37). Total abundance estimates between the base run and the iteratively reweighted run were divergent in the early and late parts of the time series (Figure 38). The difference in the early part of the time series was primarily driven by the estimated age 7^{+} abundance (Figure 39). This trend in the iteratively reweighted model shows a greater increase in total abundance as regulations were put in place in the early 1990s.

The M values used for the southern base model were from the SEDAR44 base runs and were estimated in SS3 with the SS3 age-2 M-at-age fixed based on external estimates. A sensitivity run was conducted using the M-at-age values from SEDAR18 to determine what effect this would have on the model results. The SEDAR18 M-at-age values were slightly higher than those estimated by SS3 for ages 1-4 and the same for ages 5-7^{+}. The model run using the SEDAR18 M-at-age values resulted in higher estimates of the three year average sSPR (Figure 40) and higher estimates of total abundance (Figure 41) when compared to the base model.

The weights-at-age used to calculate sSPR in the base model were also updated to match the values estimated by SS3 in SEDAR44. A sensitivity analysis was conducted

using the SEDAR18 weights-at-age which were estimated using a spline. As spawning stock biomass was not calculated in this assessment, following the recommendations from SEDAR18, and sSPR is calculated as the ratio of fished spawning potential to unfished spawning potential, the change in the weights-at-age data did not change the three year average sSPR estimated when compared to the base model (Figure 40). Similarly, the estimates of total abundance did not change from the base model (Figure 41).

3. Discussion

The models presented here use essentially the same codes as were used in the previous benchmark assessment (SEDAR 2009) and, other than adding the infinite series correction, the main updates to the models were in the indices used, an updated maturity schedule and M vector for the southern stock, and updated weights-at-age. Additional exploration of the models was conducted based on the SEDAR18 reviewers' comments. These included using iterative reweighting and exploring the correlation of parameters. Iterative reweighting did not change the sSPR estimates for the southern stock much but did result in better fits to the observed data components and a trend in stock abundance that intuitively makes sense. The iterative reweighting of the northern stock model did give different results in the estimated three year average sSPR, estimating a lower terminal three year average sSPR value than the base model. However, the iterative reweighting did result in poorer fits to the F-at-age data for older fish after 1998, suggesting much higher selectivity than the base model even though harvest of fish greater than 27 inches was prohibited in North Carolina starting in 1999. Correlation analysis showed few strong correlations between parameter estimates in the northern model but a large number of correlations in the southern model. Reviewer comments from SEDAR18 suggested that this could show the model is overparameterized and future work should explore how the model could be simplified (e.g. reducing the number of fleets).

Most of the analyses completed in this assessment do indicate that both stocks are being fished above the threshold of 30% sSPR. The three year average sSPR point estimates from the base models for both stocks also indicate that both stocks are being fished above the target of 40% sSPR. However, the models do estimate trends in three year average sSPR in both stocks declining towards the target since about 2005. There are no apparent trends in recruitment estimates in either stock and the largest year class occurred in 2011 and 2009 in the northern and southern stocks, respectively.

One improvement in results from this assessment is the reduced reliance of the northern base model on the externally-derived F estimates. This indicates that the other data components in the base model agree with the F estimated in the Bacheler et al. 2008 tagging study, given the model configuration assumptions. It is important to note, however, that while the northern base model was less sensitive to the exclusion of the tagging data in the base model than it was in SEDAR18, similarly drastic changes were seen in the results when unity weights were used rather than the preferred model weighting. In contrast to SEDAR18 which estimated very large sSPRs when the tagging

data were removed, the removal of the tagging data in the model with unity weights resulted in very low sSPRs. Nevertheless, the incorporation of tagging data directly into the model for both stocks, as recommended in SEDAR 18, should still be explored.

The inclusion of an adult index in the northern model and additional adult indices in the south addressed a particular shortcoming of the previous benchmark assessment. However, these indices have short time series, especially when compared to the life span of red drum, and will hopefully become more useful in the future. Despite improved information on mature fish through the new indices, the catch-at-age data are still too sparse to expand the age structure used in the model beyond an age-7 plus group and some of the concerns in the previous benchmark assessment remain in this assessment. The model still seems unable to provide realistic estimates of abundance of older ages. This was particularly true for the northern model which had very large age 7^+ estimates starting in the late 1980s. These northern model estimates for ages 7^+ also did not seem to track changes in regulation that would be expected, particularly the addition of a maximum harvest size in 1999. During SEDAR44, the year class information from the adult surveys were further explored and shown to track large year classes from the 1970s and 1980s well. Future work incorporating the age composition data for the adult indices into the SCA model could be useful.

Estimates of abundance and sSPR in the southern model continue to have very large confidence intervals. This uncertainty around the estimates makes it particularly difficult to reliably determine stock size or stock status in the south and as recommended by the reviewers in SEDAR18, the trends in abundance and sSPR are useful for only relative trends in the south.

Further work on the SCA models could be undertaken to possibly improve the models' stability and its ability to estimate abundance of mature fish. Initial work undertaken as a continuity analysis had focused on adapting the models to more closely resemble the SS3 models. The main change for this was to have the model estimate the selectivities for the release fleets rather than fixing them as was done in SEDAR18 for the northern model and for the Florida release fleet in the south. These runs, however, were found to be less stable and more sensitive to the weighting used, particularly in the south. For this reason, the SAS went back to using the original SEDAR18 codes, with the addition of the infinite series correction. However, this model configuration did show reasonable trends in the ages 7^+ abundance estimates for the northern model and may be worth further consideration. Stability to this model could be increased by estimating only one set of selectivity constraints rather than different ones for kept versus released fish. Another possibility could be coding the selectivities using a parametric equation.

Fishery selectivities remain a major uncertainty of red drum assessments. Selectivities are constrained in the model by several assumptions and directly impact the model sSPR estimates. The Bacheler et al. 2008 tagging study was used to validate these assumptions and allow the model to estimate sSPR. Additionally, more reliable data on the age structure of the removals, particularly the recreational removals, may improve the models' ability to estimate selectivity and adult abundance.

There are some conflicts in the data that result in poor fits to some data points. For example, the indices in the northern model tend to disagree about the relative abundance in some years (i.e., 2001 year class). The MRIP and NC IGNS age-1 indices indicate high relative abundance of this year class, while the NC IGNS age-2 and NC JAI indices indicate low relative abundance of this year class. The model "smoothes" over this conflict by overestimating the NC IGNS age-2 and NC JAI indices and underestimating the NC IGNS age-1 and MRIP indices. These effects should be diminished by using the three year average sSPR for management, unless there is a consistent disagreement between the data sources. There may be some spatial effects that contribute to these conflicts, as the MRIP index is the only index that incorporates relative abundance information from states north of North Carolina and is the only index that spans the entire range of red drum in the south. Spatial dynamics should be an area of focus in future assessments, particularly if additional indices of abundance from states north of North Carolina become available.

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5. Tables

Table 1. Indices used in the northern stock model.

Index	Years
NC Independent Gill Net Survey—Age 1	2001-2013
NC Independent Gill Net Survey—Age 2	2001-2013
NC Juvenile Abundance Index	1992-2013
MRFSS/MRIP Index	1991-2013
NC Longline Survey	2007-2013

Table 2. Indices used in the southern stock model.

Index	Years
FL Bagged Beach Seine Survey (YOY)	2002-2013
GA Gill Net Survey—Age 1	2003-2013
SC Stop Net Survey (YOY)	1989-1994
SC Trammel Net Survey—Age 1	1994-2013
SC Trammel Net Survey—Age 2	1994-2013
FL Haul Seine Survey—Age 2	1997-2013
FL Haul Seine Survey—Age 3	1997-2013
MRFSS/MRIP Index	1991-2013
SC 1 mile Longline Survey (Adult)	1994-2004
SC 1/3 mile Longline Survey	2007-2013
GA Longline Survey	2007-2013

Table 3. Selectivity blocks used in the northern stock model.

Fleet	Selectivity Block	Years
Commercial Gill Net and Beach Seine	1	1989-1991
Commercial Gill Net and Beach Seine	2	1992-1998
Commercial Gill Net and Beach Seine	3	1999-2013
Commercial Other Gears	1	1989-1991
Commercial Other Gears	2	1992-1998
Commercial Other Gears	3	1999-2013
Recreational Kept	1	1989-1991
Recreational Kept	2	1992-1998
Recreational Kept	3	1999-2013
Recreational Live Release	1	1989-1991
Recreational Live Release	2	1992-1998
Recreational Live Release	3	1999-2013

Table 4. Selectivity blocks used in the southern stock model.

Fleet	Selectivity Block	Years
FL Recreational Kept	1	1989-2013
GA Commercial/Recreational Kept	1	1989-1991
GA Commercial/Recreational Kept	2	1992-2001
GA Commercial/Recreational Kept	3	2002-2013
SC Commercial/Recreational Kept	1	1989-1993
SC Commercial/Recreational Kept	2	1994-2000
SC Commercial/Recreational Kept	3	2001-2013
FL Recreational Live Release	1	1989-2013
GA/SC Recreational Live Release	1	1989-1991
GA/SC Recreational Live Release	2	1992-2013

Table 5. Estimated parameters in the SCA models for red drum population dynamics in the northern stock. Parameters for each stock include those that describe fishing mortality: annual fully recruited F's (log_F) for each fishery, age 1-3 selectivities (log_sel) for each period of assumed constant selectivity, and age 4-5$^+$ selectivities as a proportion of age 3 selectivity (sel04, sel05). Abundance-estimate related parameters include recruitment (log_R), first-year abundance for ages 2-7$^+$ (log_initN), and index-of-abundance proportionality coefficients ('survey scalars' or log_q).

Northern stock

Population dynamic	Parameters estimated		Number
Fishing mortality			
Comm BS&GN	1989-2013 log_F's; 3 sets of age 1-3 log_sel's		34
Comm other	1989-2013 log_F's; 3 sets of age 1-3 log_sel's		34
Rec A+B1	1989-2013 log_F's; 3 sets of age 1-3 log_sel's		34
Rec B2	1989-2013 log_F's		25
Ages 4-5$^+$ sel	constant sel04 and sel05		2
		Total	129
Abundance			
recruitment	log_R 1989-2013		25
initial abundance	log_initN for ages 2-7$^+$		6
survey scalar	log_q's for five surveys		5
		Total	36
Grand Total			165

Table 6. Estimated parameters in the SCA models for red drum population dynamics in the northern stock. Parameters for each stock include those that describe fishing mortality: annual fully recruited F's (log_F) for each fishery, age 1-3 selectivities (log_sel) for each period of assumed constant selectivity, and age 4-5^{+} selectivities as a proportion of age 3 selectivity (sel04, sel05). Abundance-estimate related parameters include recruitment (log_R), first-year abundance for ages 2-7^{+} (log_initN), and index-of-abundance proportionality coefficients ('survey scalars' or log_q).

Southern stock

Population dynamic	Parameters estimated		Number
Fishing mortality			
FL rec A+B1	1989-2013 log_F's; 1 sets of age 1-3 log_sel's		28
GA rec A+B1	1989-2013 log_F's; 3 sets of age 1-3 log_sel's		34
SC rec A+B1	1989-2013 log_F's; 3 sets of age 1-3 log_sel's		34
FL rec B2	1989-2013 log_F's		25
GA/SC rec B2	1989-2013 log_F's; 2 sets of age 1-3 log_sel's		31
Ages 4-5^{+} sel	constant sel04 and sel05		2
		Total	154
Abundance			
recruitment	log_R 1989-2013		25
initial abundance	log_initN for ages 2-7^{+}		6
survey scalar	log_q's for eleven surveys		11
		Total	42
Grand Total			196

Table 7. Likelihood components of the northern stock base model.

Components		N	TSS	RSS	NegLL	SDSR
Total Kill						
Comm GN & BS		25	84,705.83	0.12	-115.07	0.07
Comm Other		25	165,558.94	0.00	-115.13	0.01
Rec Kept		25	140.26	110.95	22.05	1.99
Rec Release		25	350.71	43.41	-7.77	1.31
	Totals	100	250,755.74	154.48	-215.92	
Proportion-at-age						
Comm GN & BS		175			359.92	0.08
Comm Other		175			130.07	0.32
Rec Kept		175			486.48	0.12
	Totals	525			976.47	
Indices of Abundance						
NC IGNS age 1		13	207.19	58.26	7.89	2.11
NC IGNS age 2		13	309.64	74.64	19.58	2.38
NC JAI age 1		22	333.08	262.87	98.61	3.45
MRIP ages 1-3		23	855.94	256.21	74.16	3.31
NC Adult Longline		7	4.49	7.08	-8.65	1.01
	Totals	78	1,710.34	659.05	191.58	
Auxiliary Observations						
F kept at age-1		16	840.21	14.83		0.99
F kept at age-2		16	293.06	22.09		0.97
F kept at age-3		16	298.33	315.49		4.59
F kept at age-4^{+}		16	1,816.75	380.74	247.91	5.03
Full F release		16	354.87	10.47	-25.18	0.81
	Totals	80	3,603.22	743.62	222.72	
Other Deviations						
Selectivities					57.99	
	Totals				57.99	
Grand Total					1,232.84	

Table 8. Likelihood components of the southern stock base model.

Components		N	TSS	RSS	NegLL	SDSR
Total Kill						
FL Rec		25	177.51	0.67	-43.80	0.16
GA Comm/Rec		25	116.15	0.32	-38.20	0.11
SC Comm/Rec		25	86.67	1.06	-32.81	0.20
FL Releases		25	198.77	0.07	-43.17	0.05
GA/SC Releases		25	310.38	0.03	-36.83	0.03
	Totals	125	889.47	2.15	-194.81	
Proportion-at-age						
FL Rec		175			547.00	0.13
GA Comm/Rec		175			593.21	0.89
SC Comm/Rec		175			913.69	0.54
GA/SC Releases		175			116.65	1.61
	Totals	700			2170.55	
Indices of Abundance						
FL Bagged Beach Seine Survey		12	26.43	16.76	-0.79	1.17
GA Gill Net Survey—Age 1		11	71.48	34.86	-0.49	1.78
SC Stop Net Survey		6	9.99	12.22	-2.58	1.40
SC Trammel Net Survey—Age 1		20	276.83	99.33	11.90	2.23
SC Trammel Net Survey—Age 2		20	253.44	100.13	12.56	2.24
FL Haul Seine Survey—Age 2		17	28.34	52.85	-2.82	1.76
FL Haul Seine Survey—Age 3		17	20.44	54.54	3.12	1.79
MRIP Index		23	411.08	76.53	-32.81	1.82
SC 1 mile Longline Survey (Adult)		11	44.97	46.95	6.06	2.06
SC 1/3 mile Longline Survey		7	34.19	32.82	2.27	2.15
GA Longline Survey		7	32.48	30.84	5.74	2.10
	Totals	151	1,209.65	557.82	2.14	
Other Deviations						
Selectivities					34.25	
	Totals				34.25	
	Grand Total				2,012.13	

Table 9. The external hypotheses (weights) used to evaluate 'best' model fit in the northern stock. The total catch fleets were the commercial gillnet and beach seine, the other commercial gears, the recreational landed (MRIP Type A+B1) catch, and the recreational live release. The first three of these were included in the proportion-at-age weights (the age composition of the live release fishery was implied from tagging estimates). The indices were the North Carolina independent gill net survey (IGNS) age 1 index, the IGNS age 2 index, the North Carolina juvenile abundance index, the MRFSS total catch rate index, and the North Carolina Longline survey. The tag-based F weights were used for the F-at-age estimates from the recreational landed fish and the fully recruited F's for the live release fishery.

Total Catch by fleet

H_o : default

1. 1. 1. 1.

H_{a1}: live release recreational total catch estimates are suspect

1. 1. 1. 0.1

H_{a2}: live release recreational total catch estimates are really suspect

1. 1. 1. 0.01

Proportion-at-age (excludes the live release fishery)

H_o: default

catch-at-age by fleet and year all year and all fleets 1.0

H_a: the recreational age composition data is less certain than commercial

commercial fleets are 1.0 and recreational fleet is 0.01

Indices of abundance

H_o: default

1. 1. 1. 1. 1.

H_{a1}: the MRIP index is best due to larger spatial coverage

1. 1. 1. 10. 1.

H_{a2}: the YOY indices are best due to scientific design and ease of capture

10. 1. 10. 1. 1.

Tagging based F (for kept F-at-age and then full F live release recreational)

H_o: default

1. 1.

H_a: both less accurate than catch-at-age model

0.1 0.1

Table 10. The external hypotheses (weights) used to evaluate 'best' model fit in the southern stock. The total catch fleets were the Florida recreational landed (MRIP Type A+B1) fishery, the Georgia recreational landed commercial fishery, the South Carolina recreational landed/commercial fishery, the Florida live release fishery, and the Georgia/South Carolina live release fishery. All but the Florida live release fishery (in order) were included in the proportion-at-age weights (the age composition of the Florida live release fishery was implied from tagging estimates). The indices were the Florida small seine survey, the Georgia monofilament gill net survey, the South Carolina stop net survey, the South Carolina age-1 trammel net survey, the South Carolina age-2 trammel net survey, the Florida age-2 haul seine survey, the Florida age-3 haul seine survey, the MRIP index, the South Carolina 1 mile longline survey, the South Carolina 1/3 mile longline survey, and the Georgia longline survey.

Total Catch by fleet

H_o : default

1. 1. 1. 1. 1.

H_{a1}: live release recreational total catch estimates are uncertain

1. 1. 1. 0.1 0.1

H_{a2}: live release recreational total catch estimates are really uncertain

1. 1. 1. 0.01 0.01

Proportion-at-age (excludes the Florida live release fishery)

H_o: default

catch-at-age by fleet and year all year and all fleets 1.0

H_{a1}: the live release recreational age composition data is less certain than other data

landed fisheries are 1.0 and recreational live release fleet is 0.1

H_{a2}: the live release recreational age composition data is much less certain than other data

landed fisheries are 1.0 and recreational live release fleet is 0.01

Indices of abundance

H_o: default

1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.

H_{a1}: the MRIP index is best due to larger areal coverage

1. 1. 1. 1. 1. 1. 1. 10. 1. 1. 1.

H_{a2}: the YOY indices are best due to scientific design and ease of capture

10. 10. 10. 10. 1. 1. 1. 1. 1. 1. 1.

Table 11. Total standardized residual sums of squares for the northern stock weighting hypotheses. Weighting combinations with no number entered failed to converge. Bolded value is the model weighting with the lowest RSS.

Tag Based F, H0			Total Catch Hypothesis		
		Indices H0	H0	Ha1	Ha2
		PAA H0	1,657		2,434
		Ha1	**1,579**	1,605	2,096
			Total Catch Hypothesis		
		Indices Ha1	H0	Ha1	Ha2
		PAA H0		2,481	3,340
		Ha1	1,948	2,091	2,506
			Total Catch Hypothesis		
		Indices Ha2	H0	Ha1	Ha2
		PAA H0	1,966		3,855
		Ha1	2,133	2,586	3,264
Tag Based F, Ha1			Total Catch Hypothesis		
		Indices H0	H0	Ha1	Ha2
		PAA H0			4,040
		Ha1	2,224	2,856	3,688
			Total Catch Hypothesis		
		Indices Ha1	H0	Ha1	Ha2
		PAA H0	4,027	4,295	
		Ha1	3,720		
			Total Catch Hypothesis		
		Indices Ha2	H0	Ha1	Ha2
		PAA H0	3,677	5,892	6,569
		Ha1	6,684		7,068

Table 12. Estimated recruitment with 95% confidence intervals (± 1.96 SE) for the northern stock.

Year	Est	LCI	UCI
1989	175,782	91,016	339,650
1990	145,801	101,709	208,812
1991	555,709	445,922	692,509
1992	591,845	479,008	731,285
1993	267,266	186,523	382,833
1994	499,319	414,934	600,850
1995	346,625	268,850	446,799
1996	211,928	164,861	272,257
1997	501,822	391,306	643,484
1998	934,718	817,685	1,069,109
1999	576,079	493,050	673,388
2000	161,781	124,285	210,388
2001	385,771	306,421	486,008
2002	689,002	586,950	809,270
2003	81,308	62,152	106,338
2004	450,449	379,043	535,232
2005	525,445	444,431	621,772
2006	642,422	545,198	756,599
2007	269,682	217,639	334,181
2008	928,198	801,591	1,075,010
2009	265,933	216,674	326,205
2010	310,519	250,976	384,164
2011	167,042	127,584	218,742
2012	1,899,308	1,670,928	2,157,791
2013	330,711	242,990	449,664

Table 13. Estimate beginning-of-the-year abundance of red drum ages 1 – 7^+ in the northern stock during 1989-2013.

Northern	1	2	3	4	5	6	7^+	Total
1989	175,822	82,951	11,711	18,691	173,718	142,063	13,962,773	14,567,728
1990	145,733	18,145	2,401	1,712	15,325	160,129	13,130,891	13,474,335
1991	555,703	26,476	1,211	564	1,444	14,128	12,374,686	12,974,211
1992	591,855	301,275	12,391	779	505	1,332	11,543,832	12,451,969
1993	267,221	400,924	142,784	8,175	698	466	10,758,409	11,578,677
1994	499,313	162,768	141,719	81,594	7,263	644	10,018,501	10,911,802
1995	346,586	323,748	88,300	103,263	73,439	6,686	9,315,883	10,257,905
1996	211,860	241,719	193,478	67,241	93,286	67,684	8,678,335	9,553,604
1997	501,796	158,115	161,069	153,466	60,950	86,068	8,149,807	9,271,272
1998	934,984	350,391	89,925	116,860	138,314	56,205	7,670,214	9,356,892
1999	576,207	626,052	164,312	60,534	104,863	127,552	7,196,352	8,855,873
2000	161,703	448,337	375,572	140,491	55,033	96,584	6,812,266	8,089,987
2001	385,905	124,647	248,479	318,972	127,584	50,647	6,421,222	7,677,456
2002	689,203	288,104	46,575	201,779	288,823	117,377	6,013,468	7,645,328
2003	81,296	516,227	102,316	38,017	182,736	265,672	5,695,017	6,881,281
2004	450,418	64,147	320,701	88,766	34,611	168,419	5,546,430	6,673,493
2005	525,676	353,708	38,298	276,210	80,789	31,903	5,319,139	6,625,723
2006	642,259	409,233	215,033	32,910	251,084	74,376	4,975,518	6,600,414
2007	269,686	494,676	243,199	184,360	29,873	230,797	4,687,830	6,140,420
2008	928,288	207,130	274,639	206,355	167,328	27,476	4,567,248	6,378,463
2009	265,857	694,841	98,013	228,002	186,776	153,639	4,260,964	5,888,092
2010	310,509	207,585	460,355	85,152	207,266	171,826	4,100,645	5,543,338
2011	167,057	232,104	97,805	383,220	77,052	190,215	3,958,810	5,106,262
2012	1,898,819	130,108	138,828	84,186	348,348	70,925	3,855,730	6,526,945
2013	330,551	1,285,364	48,748	111,897	75,198	315,627	3,592,926	5,760,311

Table 14. Instantaneous fishing mortality, by fleet and age, for the northern stock.

	Commercial Gill net and Beach Seine					Commercial 'other' gear fishery				
	1	2	3	4	5	1	2	3	4	5
1989	0.699	1.358	0.658	0.039	0.000	0.142	0.238	0.184	0.011	0.000
1990	0.782	1.518	0.736	0.044	0.000	0.112	0.188	0.146	0.009	0.000
1991	0.107	0.208	0.101	0.006	0.000	0.041	0.069	0.053	0.003	0.000
1992	0.025	0.104	0.040	0.002	0.000	0.004	0.013	0.008	0.000	0.000
1993	0.041	0.167	0.065	0.004	0.000	0.005	0.018	0.011	0.001	0.000
1994	0.032	0.133	0.052	0.003	0.000	0.005	0.019	0.011	0.001	0.000
1995	0.038	0.158	0.062	0.004	0.000	0.010	0.035	0.021	0.001	0.000
1996	0.023	0.095	0.037	0.002	0.000	0.003	0.012	0.007	0.000	0.000
1997	0.011	0.044	0.017	0.001	0.000	0.003	0.011	0.007	0.000	0.000
1998	0.062	0.253	0.099	0.006	0.000	0.009	0.031	0.019	0.001	0.000
1999	0.024	0.222	0.035	0.002	0.000	0.001	0.006	0.004	0.000	0.000
2000	0.021	0.192	0.031	0.002	0.000	0.001	0.006	0.004	0.000	0.000
2001	0.032	0.290	0.046	0.003	0.000	0.001	0.006	0.004	0.000	0.000
2002	0.012	0.114	0.018	0.001	0.000	0.002	0.007	0.004	0.000	0.000
2003	0.007	0.066	0.010	0.001	0.000	0.001	0.005	0.003	0.000	0.000
2004	0.016	0.143	0.023	0.001	0.000	0.001	0.002	0.001	0.000	0.000
2005	0.018	0.162	0.026	0.002	0.000	0.001	0.005	0.003	0.000	0.000
2006	0.014	0.123	0.020	0.001	0.000	0.001	0.006	0.004	0.000	0.000
2007	0.019	0.173	0.027	0.002	0.000	0.002	0.009	0.005	0.000	0.000
2008	0.029	0.264	0.042	0.002	0.000	0.001	0.006	0.004	0.000	0.000
2009	0.012	0.106	0.017	0.001	0.000	0.001	0.005	0.003	0.000	0.000
2010	0.024	0.216	0.034	0.002	0.000	0.001	0.004	0.003	0.000	0.000
2011	0.011	0.104	0.016	0.001	0.000	0.001	0.005	0.003	0.000	0.000
2012	0.012	0.105	0.017	0.001	0.000	0.001	0.006	0.004	0.000	0.000
2013	0.014	0.131	0.021	0.001	0.000	0.002	0.010	0.006	0.000	0.000

Table 14 (con't). Instantaneous fishing mortality, by fleet and age, for the northern stock.

	Recreational Harvest					Recreational Live Release				
	1	2	3	4	5	1	2	3	4	5
1989	1.208	1.811	0.980	0.058	0.001	0.022	0.005	0.000	0.000	0.000
1990	0.575	0.862	0.467	0.028	0.000	0.037	0.008	0.000	0.000	0.000
1991	0.230	0.345	0.187	0.011	0.000	0.034	0.008	0.000	0.000	0.000
1992	0.144	0.492	0.267	0.016	0.000	0.016	0.008	0.001	0.000	0.000
1993	0.207	0.705	0.382	0.023	0.000	0.043	0.020	0.001	0.001	0.001
1994	0.081	0.276	0.150	0.009	0.000	0.115	0.054	0.004	0.003	0.003
1995	0.047	0.161	0.087	0.005	0.000	0.065	0.030	0.002	0.001	0.001
1996	0.047	0.161	0.087	0.005	0.000	0.019	0.009	0.001	0.000	0.000
1997	0.106	0.361	0.196	0.012	0.000	0.039	0.018	0.001	0.001	0.001
1998	0.096	0.326	0.177	0.011	0.000	0.035	0.016	0.001	0.001	0.001
1999	0.008	0.128	0.012	0.001	0.000	0.017	0.025	0.005	0.002	0.002
2000	0.015	0.229	0.022	0.001	0.000	0.023	0.034	0.007	0.003	0.003
2001	0.034	0.521	0.051	0.003	0.000	0.026	0.037	0.008	0.003	0.003
2002	0.048	0.746	0.073	0.004	0.000	0.027	0.039	0.008	0.003	0.003
2003	0.017	0.258	0.025	0.001	0.000	0.012	0.018	0.004	0.002	0.002
2004	0.014	0.224	0.022	0.001	0.000	0.011	0.016	0.003	0.001	0.001
2005	0.011	0.171	0.017	0.001	0.000	0.021	0.030	0.006	0.003	0.003
2006	0.014	0.214	0.021	0.001	0.000	0.032	0.047	0.010	0.004	0.004
2007	0.015	0.237	0.023	0.001	0.000	0.028	0.041	0.008	0.004	0.004
2008	0.019	0.289	0.028	0.002	0.000	0.041	0.060	0.012	0.005	0.005
2009	0.009	0.133	0.013	0.001	0.000	0.026	0.038	0.008	0.003	0.003
2010	0.022	0.337	0.033	0.002	0.000	0.045	0.065	0.014	0.006	0.006
2011	0.016	0.243	0.024	0.001	0.000	0.022	0.032	0.007	0.003	0.003
2012	0.034	0.531	0.052	0.003	0.000	0.143	0.209	0.043	0.019	0.019
2013	0.019	0.288	0.028	0.002	0.000	0.031	0.046	0.009	0.004	0.004

Table 15. Estimated age-1 to age-5 instantaneous fishing mortality for the northern stock during 1989-2013.

	Northern stock				
	1	2	3	4	5
1989	2.071	3.412	1.823	0.109	0.001
1990	1.506	2.577	1.349	0.081	0.001
1991	0.412	0.629	0.341	0.021	0.001
1992	0.189	0.617	0.316	0.019	0.001
1993	0.296	0.910	0.460	0.028	0.001
1994	0.233	0.482	0.217	0.015	0.003
1995	0.160	0.385	0.172	0.012	0.002
1996	0.093	0.276	0.132	0.008	0.001
1997	0.159	0.434	0.221	0.014	0.001
1998	0.201	0.627	0.296	0.018	0.001
1999	0.051	0.381	0.057	0.005	0.002
2000	0.060	0.460	0.063	0.006	0.003
2001	0.092	0.854	0.108	0.009	0.003
2002	0.089	0.905	0.103	0.009	0.004
2003	0.037	0.346	0.042	0.004	0.002
2004	0.042	0.386	0.049	0.004	0.001
2005	0.050	0.368	0.052	0.005	0.003
2006	0.061	0.390	0.054	0.007	0.004
2007	0.064	0.458	0.064	0.007	0.004
2008	0.090	0.618	0.086	0.010	0.005
2009	0.047	0.282	0.041	0.005	0.003
2010	0.091	0.623	0.083	0.010	0.006
2011	0.050	0.384	0.050	0.005	0.003
2012	0.190	0.852	0.116	0.023	0.019
2013	0.067	0.475	0.065	0.007	0.004

Table 16. Correlation coefficients between parameters with a correlation greater than 0.90 or less than -0.90 in the northern stock model.

Parameter 1	Parameter 2	Correlation
Comm Other F 1997	Comm Other F 1998	0.9074
Comm Other F 2000	Comm Other F 2001	0.9151
Comm Other F 2001	Comm Other F 2004	0.9107
Comm Other F 2004	Comm Other F 2010	0.914
Comm GNBS F 2013	Comm Other F 2013	0.942
Comm GNBS F 1999	Recruit 1998	-0.9225
Comm GNBS F 2000	Recruit 1999	-0.9157
Comm GNBS F 2003	Recruit 2002	-0.9389
Comm GNBS F 2005	Recruit 2004	-0.9309
Comm GNBS F 2007	Recruit 2006	-0.9045
Comm GNBS F 2009	Recruit 2008	-0.9611
Comm GNBS F 2011	Recruit 2010	-0.946

Table 17. sEsc, and tEsc (ages 1-5) with asymptotic SEs and CVs for the northern stock.

Year	sEsc			tEsc		
	Est	SE	CV	Est	SE	CV
1989	0.00	0.000	0.73			
1990	0.00	0.003	0.62			
1991	0.25	0.032	0.13			
1992	0.32	0.023	0.07			
1993	0.18	0.017	0.09	0.007	0.003	0.449
1994	0.39	0.018	0.05	0.084	0.018	0.213
1995	0.48	0.016	0.03	0.222	0.015	0.069
1996	0.60	0.023	0.04	0.265	0.016	0.062
1997	0.44	0.025	0.06	0.383	0.013	0.033
1998	0.32	0.017	0.05	0.465	0.012	0.026
1999	0.61	0.017	0.03	0.508	0.015	0.030
2000	0.55	0.019	0.03	0.436	0.017	0.040
2001	0.34	0.026	0.07	0.426	0.016	0.037
2002	0.33	0.037	0.11	0.518	0.014	0.027
2003	0.65	0.037	0.06	0.533	0.016	0.030
2004	0.62	0.044	0.07	0.360	0.024	0.067
2005	0.62	0.041	0.07	0.351	0.035	0.100
2006	0.60	0.055	0.09	0.610	0.031	0.051
2007	0.55	0.049	0.09	0.616	0.039	0.063
2008	0.45	0.043	0.10	0.622	0.036	0.057
2009	0.68	0.029	0.04	0.596	0.047	0.079
2010	0.44	0.038	0.09	0.540	0.042	0.077
2011	0.61	0.046	0.08	0.479	0.040	0.083
2012	0.30	0.087	0.29	0.620	0.024	0.039
2013	0.54	0.044	0.08	0.474	0.035	0.073

Table 18. Annual sSPR and three year sSPR with asymptotic SEs and CVs for the northern stock.

Year	sSPR			3 yr sSPR		
	Est	SE	CV	Est	SE	CV
1989	0.001	0.000	0.73			
1990	0.004	0.002	0.62			
1991	0.243	0.032	0.13	0.083	0.011	0.13
1992	0.316	0.022	0.07	0.188	0.013	0.07
1993	0.180	0.017	0.09	0.246	0.014	0.06
1994	0.369	0.018	0.05	0.288	0.012	0.04
1995	0.469	0.017	0.04	0.339	0.011	0.03
1996	0.596	0.023	0.04	0.478	0.012	0.02
1997	0.429	0.024	0.06	0.498	0.013	0.03
1998	0.313	0.017	0.05	0.446	0.013	0.03
1999	0.586	0.017	0.03	0.443	0.012	0.03
2000	0.525	0.019	0.04	0.475	0.011	0.02
2001	0.325	0.025	0.08	0.479	0.014	0.03
2002	0.311	0.035	0.11	0.387	0.018	0.05
2003	0.633	0.036	0.06	0.423	0.021	0.05
2004	0.602	0.043	0.07	0.515	0.025	0.05
2005	0.593	0.042	0.07	0.609	0.026	0.04
2006	0.556	0.055	0.10	0.584	0.030	0.05
2007	0.518	0.048	0.09	0.556	0.030	0.05
2008	0.408	0.041	0.10	0.494	0.031	0.06
2009	0.647	0.033	0.05	0.524	0.027	0.05
2010	0.403	0.037	0.09	0.486	0.025	0.05
2011	0.583	0.046	0.08	0.544	0.025	0.05
2012	0.228	0.071	0.31	0.405	0.034	0.08
2013	0.504	0.044	0.09	0.438	0.034	0.08

Table 19. Multiplicative weighting factors applied to input error in the northern stock assessment model to achieve SDSRs below the upper limit suggested by Francis (2011).

Data Set	Multiplicative Weighting Factor	SDSR Upper Limit	SDSR
NC Independent Gill Net Survey—Age 1	2.10	1.32	1.10
NC Independent Gill Net Survey—Age 2	2.42	1.32	1.11
NC Juvenile Abundance Index	3.44	1.25	1.02
MRFSS/MRIP Index	4.59	1.24	1.10
NC Longline Survey	1.00	1.45	1.02
Commercial GNBS	1.00	1.23	0.17
Commercial Other	1.00	1.23	0.63
Recreational Harvest	1.00	1.23	0.40
Harvest age-1 F	1.00	1.29	1.25
Harvest age-2 F	1.34	1.29	0.92
Harvest age-3 F	4.31	1.29	0.35
Harvest age-4+ F	8.99	1.29	1.25
Recreational Release Full F	1.00	1.29	0.83

Table 20. Annual sSPR and three year sSPR with asymptotic SEs and CVs for the northern stock iteratively reweighted model.

Year	sSPR			3 yr sSPR		
	Est	SE	CV	Est	SE	CV
1989	0.00	0.001	1.00			
1990	0.01	0.008	0.65			
1991	0.21	0.043	0.21	0.07	0.015	0.20
1992	0.34	0.036	0.11	0.19	0.019	0.10
1993	0.19	0.027	0.14	0.24	0.022	0.09
1994	0.39	0.027	0.07	0.30	0.020	0.06
1995	0.46	0.026	0.06	0.35	0.018	0.05
1996	0.59	0.034	0.06	0.48	0.019	0.04
1997	0.45	0.039	0.09	0.50	0.021	0.04
1998	0.35	0.027	0.08	0.47	0.021	0.05
1999	0.54	0.025	0.05	0.45	0.019	0.04
2000	0.46	0.028	0.06	0.45	0.018	0.04
2001	0.32	0.034	0.11	0.44	0.021	0.05
2002	0.23	0.047	0.20	0.33	0.025	0.07
2003	0.63	0.042	0.07	0.39	0.027	0.07
2004	0.61	0.054	0.09	0.49	0.032	0.07
2005	0.60	0.061	0.10	0.62	0.038	0.06
2006	0.56	0.067	0.12	0.59	0.045	0.08
2007	0.49	0.071	0.14	0.55	0.051	0.09
2008	0.38	0.060	0.16	0.48	0.052	0.11
2009	0.43	0.069	0.16	0.44	0.053	0.12
2010	0.33	0.062	0.19	0.38	0.053	0.14
2011	0.51	0.069	0.14	0.42	0.054	0.13
2012	0.18	0.065	0.37	0.34	0.049	0.14
2013	0.33	0.084	0.25	0.34	0.054	0.16

Table 21. Total standardized residual sums of squares for the southern stock weighting hypotheses. Weighting combinations with no number entered failed to converge. Bolded value is the model weighting with the lowest RSS and italicized number is the model chosen for the preferred base model run.

		Total Catch Hypothesis		
Indices H0		H0	Ha1	Ha2
PAA	H0	1,240	1,168	3,433
	Ha1	*1,210*	1,158	3,544
	Ha2	1,201	1,157	3,583
		Total Catch Hypothesis		
Indices Ha1		H0	Ha1	Ha2
PAA	H0	1,148	1,192	3,877
	Ha1	**850**	1,185	
	Ha2	879	1,273	5,340
		Total Catch Hypothesis		
Indices Ha2		H0	Ha1	Ha2
PAA	H0	951	1,110	7,678
	Ha1	964	2,177	7,872
	Ha2	972	2,200	7,638

Table 22. Estimated recruitment and associated bounds (± 1.96 asymptotic standard errors) for the southern stock.

Year	-1.96SE	Est	+1.96SE
1989	344,376	1,048,558	3,192,654
1990	371,890	1,051,206	2,971,397
1991	561,393	1,523,740	4,135,756
1992	515,633	1,490,653	4,309,360
1993	491,377	1,424,046	4,126,984
1994	666,042	1,794,613	4,835,483
1995	878,402	2,264,207	5,836,321
1996	409,570	1,125,957	3,095,393
1997	456,655	1,322,172	3,828,143
1998	383,079	1,132,098	3,345,642
1999	475,059	1,362,687	3,908,810
2000	326,621	869,824	2,316,427
2001	724,662	2,034,166	5,710,016
2002	592,228	1,690,145	4,823,466
2003	731,270	2,040,881	5,695,837
2004	654,140	1,740,266	4,629,779
2005	594,702	1,579,688	4,196,077
2006	411,877	1,111,477	2,999,394
2007	583,749	1,572,756	4,237,370
2008	632,733	1,782,988	5,024,308
2009	687,894	1,954,106	5,551,042
2010	1,001,036	2,597,568	6,740,375
2011	613,234	1,592,891	4,137,575
2012	386,594	1,011,298	2,645,473
2013	789,232	2,129,962	5,748,293

Table 23. Estimate beginning-of-the-year abundance of red drum ages 1 – 7^{+} in the southern stock during 1989-2013.

Southern	1	2	3	4	5	6	7^{+}	Total
1989	1,048,558	667,100	329,375	372,344	1,897,098	739,802	1,978,164	7,032,441
1990	1,051,206	786,262	486,995	260,673	313,453	1,661,009	2,421,220	6,980,817
1991	1,523,740	782,510	571,367	380,634	218,212	274,489	3,632,240	7,383,191
1992	1,490,653	1,090,488	534,229	425,208	311,719	190,480	3,476,687	7,519,464
1993	1,424,046	1,123,202	805,684	419,783	356,809	272,840	3,272,935	7,675,298
1994	1,794,613	1,061,257	834,635	644,122	355,011	312,267	3,163,403	8,165,309
1995	2,264,207	1,320,017	763,425	649,999	538,370	310,337	3,096,904	8,943,259
1996	1,125,957	1,634,147	910,247	589,016	540,999	470,662	3,036,156	8,307,185
1997	1,322,172	850,826	1,187,885	709,402	492,459	473,203	3,125,147	8,161,094
1998	1,132,098	1,006,663	633,614	959,584	602,758	430,899	3,207,939	7,973,555
1999	1,362,687	883,239	774,331	510,834	814,602	527,504	3,245,033	8,118,230
2000	869,824	1,041,250	661,546	611,171	429,542	712,367	3,361,035	7,686,735
2001	2,034,166	643,012	741,464	499,364	503,726	374,996	3,621,658	8,418,385
2002	1,690,145	1,520,240	448,040	551,517	408,866	439,567	3,554,733	8,613,108
2003	2,040,881	1,297,397	1,137,316	355,412	464,794	357,654	3,560,681	9,214,135
2004	1,740,266	1,533,199	907,247	873,408	295,195	406,243	3,490,745	9,246,303
2005	1,579,688	1,300,071	1,097,895	712,426	732,747	258,004	3,471,215	9,152,046
2006	1,111,477	1,159,300	880,292	826,375	586,457	638,983	3,315,430	8,518,313
2007	1,572,756	837,538	841,933	684,975	690,456	512,353	3,518,857	8,658,868
2008	1,782,988	1,162,262	582,209	638,212	565,619	603,001	3,587,185	8,921,477
2009	1,954,106	1,301,874	782,505	434,644	523,403	493,766	3,726,439	9,216,736
2010	2,597,568	1,502,790	982,443	626,831	367,904	458,171	3,764,483	10,300,189
2011	1,592,891	1,880,033	1,006,489	739,477	515,979	321,067	3,755,472	9,811,408
2012	1,011,298	1,187,355	1,304,045	769,036	612,809	450,695	3,629,838	8,965,076
2013	2,129,962	764,333	822,511	976,881	631,668	534,995	3,630,363	9,490,714

Table 24. Instantaneous fishing mortality, by fleet and age, for the southern stock.

	FL Rec					GA Comm/Rec				
	1	2	3	4	5	1	2	3	4	5
1989	0.004	0.024	0.028	0.013	0.001	0.025	0.024	0.018	0.008	0.000
1990	0.005	0.029	0.034	0.015	0.001	0.035	0.033	0.024	0.011	0.001
1991	0.010	0.058	0.068	0.031	0.002	0.063	0.059	0.043	0.020	0.001
1992	0.009	0.049	0.058	0.026	0.001	0.035	0.024	0.011	0.005	0.000
1993	0.005	0.028	0.034	0.015	0.001	0.043	0.030	0.014	0.006	0.000
1994	0.009	0.048	0.057	0.026	0.001	0.048	0.034	0.015	0.007	0.000
1995	0.007	0.036	0.043	0.019	0.001	0.042	0.029	0.013	0.006	0.000
1996	0.010	0.057	0.067	0.030	0.002	0.025	0.017	0.008	0.004	0.000
1997	0.005	0.026	0.031	0.014	0.001	0.017	0.012	0.005	0.002	0.000
1998	0.008	0.045	0.054	0.024	0.001	0.012	0.008	0.004	0.002	0.000
1999	0.011	0.059	0.070	0.031	0.002	0.029	0.020	0.009	0.004	0.000
2000	0.016	0.087	0.103	0.046	0.002	0.050	0.035	0.016	0.007	0.000
2001	0.016	0.090	0.107	0.048	0.002	0.035	0.024	0.011	0.005	0.000
2002	0.010	0.053	0.063	0.028	0.001	0.030	0.027	0.006	0.003	0.000
2003	0.010	0.054	0.065	0.029	0.002	0.036	0.032	0.008	0.003	0.000
2004	0.008	0.044	0.052	0.024	0.001	0.046	0.041	0.010	0.004	0.000
2005	0.012	0.066	0.078	0.035	0.002	0.040	0.037	0.009	0.004	0.000
2006	0.010	0.056	0.066	0.030	0.002	0.032	0.029	0.007	0.003	0.000
2007	0.013	0.069	0.082	0.037	0.002	0.048	0.043	0.010	0.005	0.000
2008	0.012	0.068	0.081	0.037	0.002	0.051	0.046	0.011	0.005	0.000
2009	0.006	0.030	0.036	0.016	0.001	0.023	0.021	0.005	0.002	0.000
2010	0.010	0.056	0.067	0.030	0.002	0.056	0.050	0.012	0.005	0.000
2011	0.010	0.055	0.066	0.030	0.002	0.037	0.033	0.008	0.004	0.000
2012	0.014	0.079	0.095	0.042	0.002	0.022	0.019	0.005	0.002	0.000
2013	0.023	0.124	0.148	0.066	0.003	0.028	0.026	0.006	0.003	0.000

Table 24 (con't). Instantaneous fishing mortality, by fleet and age, for the southern stock.

	SC Comm/Rec					FL Releases				
	1	2	3	4	5	1	2	3	4	5
1989	0.048	0.094	0.042	0.019	0.001	0.006	0.009	0.002	0.001	0.001
1990	0.043	0.085	0.038	0.017	0.001	0.002	0.003	0.001	0.000	0.000
1991	0.037	0.072	0.032	0.014	0.001	0.019	0.028	0.006	0.002	0.002
1992	0.028	0.055	0.024	0.011	0.001	0.007	0.010	0.002	0.001	0.001
1993	0.028	0.055	0.025	0.011	0.001	0.011	0.017	0.003	0.001	0.001
1994	0.025	0.055	0.021	0.009	0.000	0.016	0.023	0.005	0.002	0.002
1995	0.051	0.114	0.043	0.019	0.001	0.013	0.019	0.004	0.002	0.002
1996	0.029	0.063	0.024	0.011	0.001	0.011	0.016	0.003	0.001	0.001
1997	0.032	0.070	0.026	0.012	0.001	0.015	0.022	0.005	0.002	0.002
1998	0.012	0.027	0.010	0.004	0.000	0.013	0.019	0.004	0.002	0.002
1999	0.011	0.025	0.009	0.004	0.000	0.015	0.022	0.005	0.002	0.002
2000	0.010	0.022	0.008	0.004	0.000	0.021	0.030	0.006	0.003	0.003
2001	0.008	0.045	0.019	0.008	0.000	0.021	0.031	0.006	0.003	0.003
2002	0.004	0.023	0.009	0.004	0.000	0.014	0.020	0.004	0.002	0.002
2003	0.014	0.077	0.032	0.014	0.001	0.014	0.021	0.004	0.002	0.002
2004	0.009	0.051	0.021	0.009	0.000	0.019	0.027	0.006	0.002	0.002
2005	0.012	0.069	0.028	0.013	0.001	0.029	0.043	0.009	0.004	0.004
2006	0.005	0.029	0.012	0.005	0.000	0.020	0.030	0.006	0.003	0.003
2007	0.009	0.049	0.020	0.009	0.000	0.018	0.027	0.006	0.002	0.002
2008	0.013	0.074	0.030	0.014	0.001	0.019	0.028	0.006	0.002	0.002
2009	0.007	0.038	0.015	0.007	0.000	0.010	0.014	0.003	0.001	0.001
2010	0.014	0.080	0.033	0.015	0.001	0.023	0.034	0.007	0.003	0.003
2011	0.013	0.074	0.030	0.014	0.001	0.019	0.027	0.006	0.002	0.002
2012	0.012	0.067	0.027	0.012	0.001	0.019	0.028	0.006	0.002	0.002
2013	0.012	0.068	0.028	0.012	0.001	0.034	0.050	0.010	0.004	0.004

Table 24 (con't). Instantaneous fishing mortality, by fleet and age, for the southern stock.

	GA/SC Releases				
	1	2	3	4	5
1989	0.004	0.004	0.004	0.002	0.000
1990	0.009	0.009	0.009	0.004	0.000
1991	0.006	0.006	0.006	0.003	0.000
1992	0.004	0.004	0.005	0.002	0.000
1993	0.006	0.007	0.008	0.004	0.000
1994	0.010	0.010	0.012	0.006	0.000
1995	0.013	0.013	0.017	0.007	0.000
1996	0.006	0.006	0.007	0.003	0.000
1997	0.005	0.005	0.006	0.003	0.000
1998	0.003	0.003	0.004	0.002	0.000
1999	0.003	0.003	0.003	0.002	0.000
2000	0.006	0.006	0.008	0.004	0.000
2001	0.010	0.011	0.013	0.006	0.000
2002	0.007	0.007	0.009	0.004	0.000
2003	0.012	0.013	0.016	0.007	0.000
2004	0.010	0.011	0.013	0.006	0.000
2005	0.016	0.016	0.020	0.009	0.000
2006	0.015	0.016	0.019	0.009	0.000
2007	0.015	0.015	0.019	0.009	0.000
2008	0.019	0.020	0.024	0.011	0.001
2009	0.018	0.018	0.022	0.010	0.001
2010	0.020	0.021	0.026	0.012	0.001
2011	0.015	0.016	0.020	0.009	0.000
2012	0.013	0.014	0.017	0.007	0.000
2013	0.017	0.018	0.022	0.010	0.001

Table 25. Estimated age-1 to age-5 instantaneous fishing mortality for the southern stock during 1989-2013.

	Southern stock				
	1	2	3	4	5
1989	0.088	0.155	0.094	0.042	0.003
1990	0.095	0.159	0.106	0.048	0.003
1991	0.135	0.222	0.155	0.070	0.006
1992	0.083	0.143	0.101	0.045	0.003
1993	0.094	0.137	0.084	0.038	0.003
1994	0.107	0.169	0.110	0.049	0.004
1995	0.126	0.212	0.119	0.054	0.004
1996	0.080	0.159	0.109	0.049	0.004
1997	0.073	0.135	0.073	0.033	0.004
1998	0.048	0.102	0.075	0.034	0.003
1999	0.069	0.129	0.097	0.043	0.004
2000	0.102	0.180	0.141	0.063	0.006
2001	0.091	0.201	0.156	0.070	0.006
2002	0.064	0.130	0.092	0.041	0.004
2003	0.086	0.198	0.124	0.056	0.005
2004	0.092	0.174	0.102	0.046	0.005
2005	0.109	0.230	0.144	0.065	0.007
2006	0.083	0.160	0.111	0.050	0.005
2007	0.102	0.204	0.137	0.061	0.005
2008	0.114	0.236	0.152	0.068	0.006
2009	0.063	0.122	0.082	0.037	0.003
2010	0.123	0.241	0.144	0.065	0.006
2011	0.094	0.206	0.129	0.058	0.005
2012	0.080	0.207	0.149	0.067	0.006
2013	0.115	0.286	0.214	0.096	0.009

Table 26. sEsc, and tEsc (ages 1-5) with asymptotic SEs and CVs for the southern stock.

Year	sEsc			tEsc		
	Est	SE	CV	Est	SE	CV
1989	0.683	0.184	0.270			
1990	0.663	0.193	0.291			
1991	0.556	0.223	0.401			
1992	0.687	0.175	0.254			
1993	0.701	0.164	0.234	0.637	0.197	0.309
1994	0.644	0.184	0.286	0.631	0.195	0.308
1995	0.597	0.250	0.418	0.660	0.180	0.273
1996	0.669	0.200	0.298	0.679	0.177	0.260
1997	0.728	0.153	0.210	0.647	0.193	0.298
1998	0.769	0.133	0.173	0.629	0.215	0.342
1999	0.710	0.156	0.219	0.673	0.187	0.278
2000	0.611	0.189	0.310	0.712	0.160	0.225
2001	0.592	0.204	0.344	0.711	0.158	0.223
2002	0.718	0.162	0.226	0.676	0.173	0.256
2003	0.626	0.189	0.301	0.637	0.184	0.288
2004	0.659	0.174	0.264	0.634	0.185	0.292
2005	0.574	0.204	0.356	0.672	0.176	0.262
2006	0.665	0.177	0.266	0.648	0.181	0.280
2007	0.600	0.191	0.318	0.632	0.185	0.293
2008	0.562	0.209	0.371	0.607	0.192	0.316
2009	0.737	0.148	0.201	0.620	0.190	0.307
2010	0.560	0.208	0.372	0.618	0.188	0.304
2011	0.611	0.203	0.332	0.613	0.189	0.309
2012	0.601	0.204	0.339	0.642	0.186	0.290
2013	0.487	0.234	0.482	0.601	0.202	0.336

Table 27. Annual sSPR and three year sSPR with asymptotic SEs and CVs for the southern stock.

Year	sSPR			3 yr sSPR		
	Est	SE	CV	Est	SE	CV
1989	0.665	0.193	0.290			
1990	0.647	0.201	0.312			
1991	0.527	0.232	0.441	0.613	0.204	0.332
1992	0.667	0.184	0.276	0.614	0.202	0.329
1993	0.680	0.174	0.256	0.625	0.195	0.311
1994	0.618	0.194	0.314	0.655	0.182	0.278
1995	0.574	0.258	0.449	0.624	0.203	0.325
1996	0.646	0.211	0.326	0.613	0.214	0.350
1997	0.705	0.165	0.233	0.642	0.205	0.320
1998	0.746	0.145	0.195	0.699	0.171	0.245
1999	0.684	0.168	0.245	0.712	0.158	0.222
2000	0.580	0.201	0.346	0.670	0.170	0.254
2001	0.560	0.215	0.384	0.608	0.193	0.317
2002	0.694	0.174	0.251	0.611	0.195	0.319
2003	0.601	0.199	0.331	0.618	0.195	0.315
2004	0.632	0.185	0.293	0.642	0.185	0.288
2005	0.540	0.215	0.398	0.591	0.198	0.336
2006	0.635	0.189	0.298	0.602	0.195	0.324
2007	0.572	0.201	0.352	0.582	0.201	0.345
2008	0.533	0.218	0.409	0.580	0.202	0.348
2009	0.716	0.158	0.221	0.607	0.191	0.315
2010	0.530	0.218	0.410	0.593	0.197	0.332
2011	0.583	0.214	0.367	0.610	0.196	0.321
2012	0.571	0.215	0.376	0.562	0.214	0.382
2013	0.449	0.242	0.538	0.535	0.222	0.416

Table 28. Multiplicative weighting factors applied to input error in the southern stock assessment model to achieve SDSRs below the upper limit suggested by Francis (2011).

Data Set	Multiplicative Weighting Factor	SDSR Upper Limit	SDSR
FL Bagged Seine Survey	1.00	1.34	1.19
GA Gill Net Survey	1.77	1.35	1.12
SC Stop Net Survey	1.00	1.49	1.12
SC Trammel Net Survey—Age 1	2.20	1.26	1.14
SC Trammel Net Survey—Age 2	2.23	1.26	1.14
FL Haul Seine Survey—Age 2	1.77	1.28	0.91
FL Haul Seine Survey—Age 3	1.80	1.28	0.96
MRFSS/MRIP Index	1.85	1.24	1.08
SC 1 mile Long Line Survey	2.11	1.35	1.34
SC 1/3 mile Long Line Survey	2.13	1.45	0.99
GA Long Line Survey	2.09	1.45	1.04

Table 29. Likelihood components of the southern red drum assessment model following iterative re-weighting.

Components		N	TSS	RSS	NegLL	SDSR
Total Kill						
FL Rec		25	177.51	0.12	-44.07	0.07
GA Comm/Rec		25	116.15	0.05	-38.33	0.05
SC Comm/Rec		25	86.67	0.23	-33.22	0.10
FL Releases		25	198.77	0.01	-43.20	0.02
GA/SC Releases		25	310.38	0.01	-36.84	0.02
	Totals	125	889.47	0.43	-195.67	
Proportion-at-age						
FL Rec		175			543.81	0.13
GA Comm/Rec		175			588.34	0.53
SC Comm/Rec		175			907.00	0.39
GA/SC Releases		175			103.30	0.88
	Totals	700			2142.45	
Indices of Abundance						
FL Bagged Beach Seine Survey		12	26.43	17.27	-0.54	1.19
GA Gill Net Survey—Age 1		11	23.61	13.75	-5.00	1.12
SC Stop Net Survey		6	9.99	7.93	-4.73	1.12
SC Trammel Net Survey—Age 1		20	58.97	25.91	-9.46	1.14
SC Trammel Net Survey—Age 2		20	53.16	25.92	-9.02	1.14
FL Haul Seine Survey—Age 2		17	9.32	14.25	-12.69	0.91
FL Haul Seine Survey—Age 3		17	6.67	15.79	-6.77	0.96
MRIP Index		23	120.34	26.83	-43.54	1.08
SC 1 mile Longline Survey (Adult)		11	10.66	19.93	0.31	1.34
SC 1/3 mile Longline Survey		7	7.76	6.91	-5.52	0.99
GA Longline Survey		7	8.17	7.64	-1.04	1.04
	Totals	151	335.06	182.11	-98.00	
Other Deviations						
Selectivities					37.90	
	Totals				37.90	
	Grand Total				1,886.68	

6. Figures

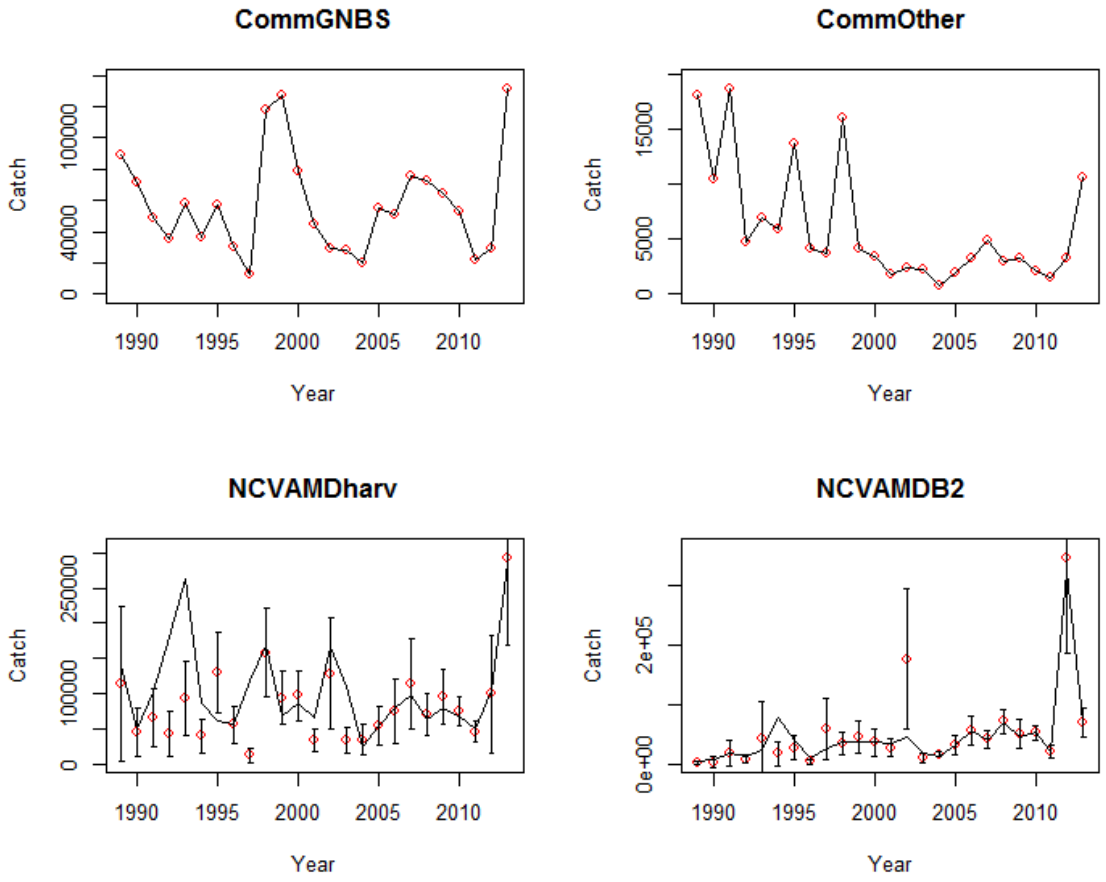


Figure 1. Observed (red circles) and model estimated (solid black line) catch, by fleet, for the northern stock. Error bars show 95% confidence intervals of observed values.

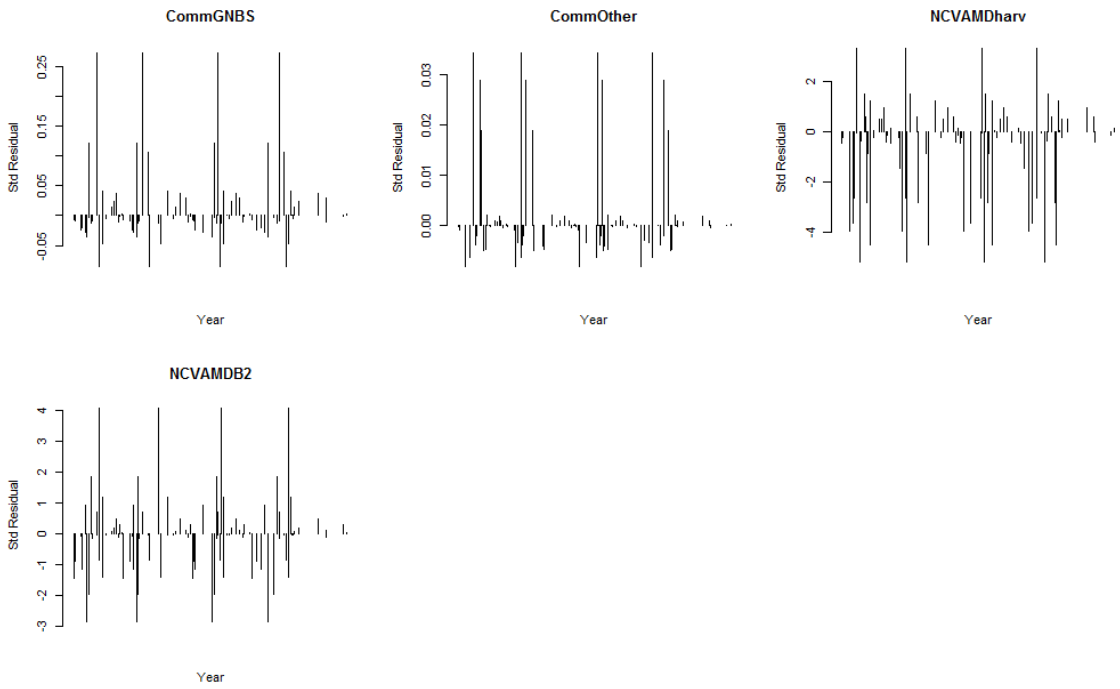


Figure 2. Standardized residuals for model fits to catch, by fleet and year, for the northern stock.

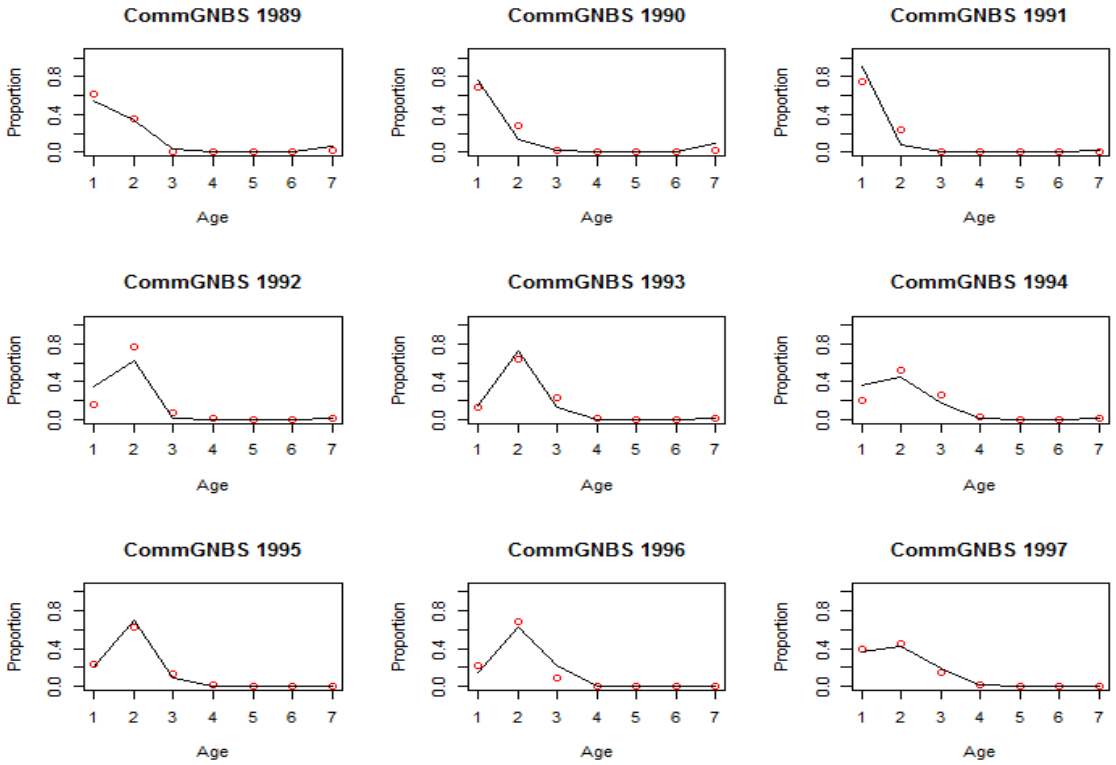


Figure 3. Northern model fits to the proportion-at-age data for each fleet and year. The recreational release fleet is not included as the selectivities were fixed based on external tagging data and the proportion-at-age data were not used in model fitting.

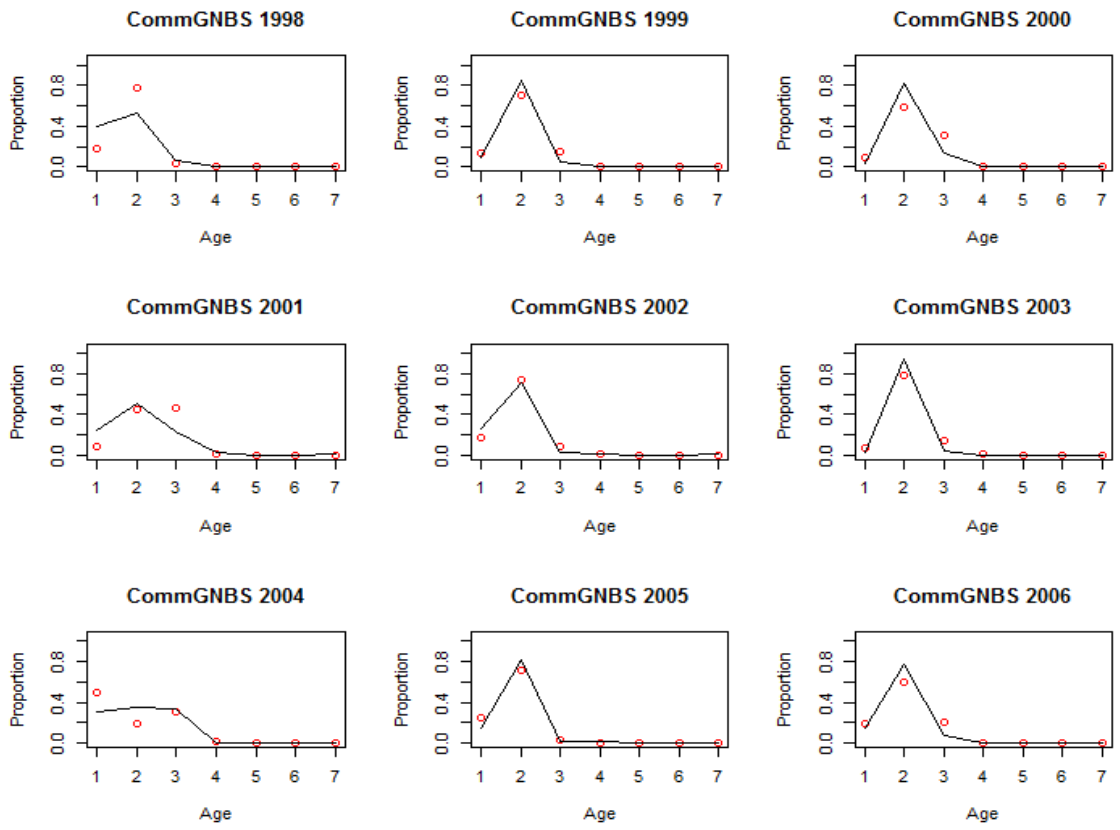


Figure 3 (con't).

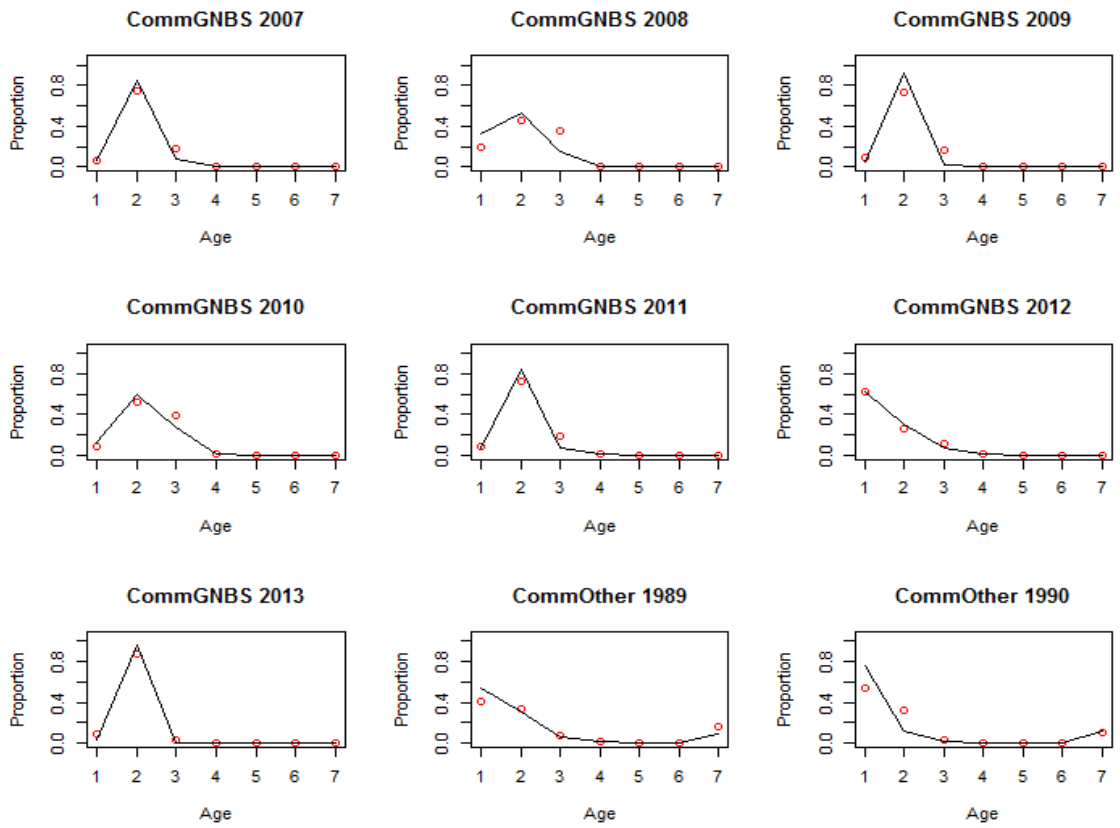
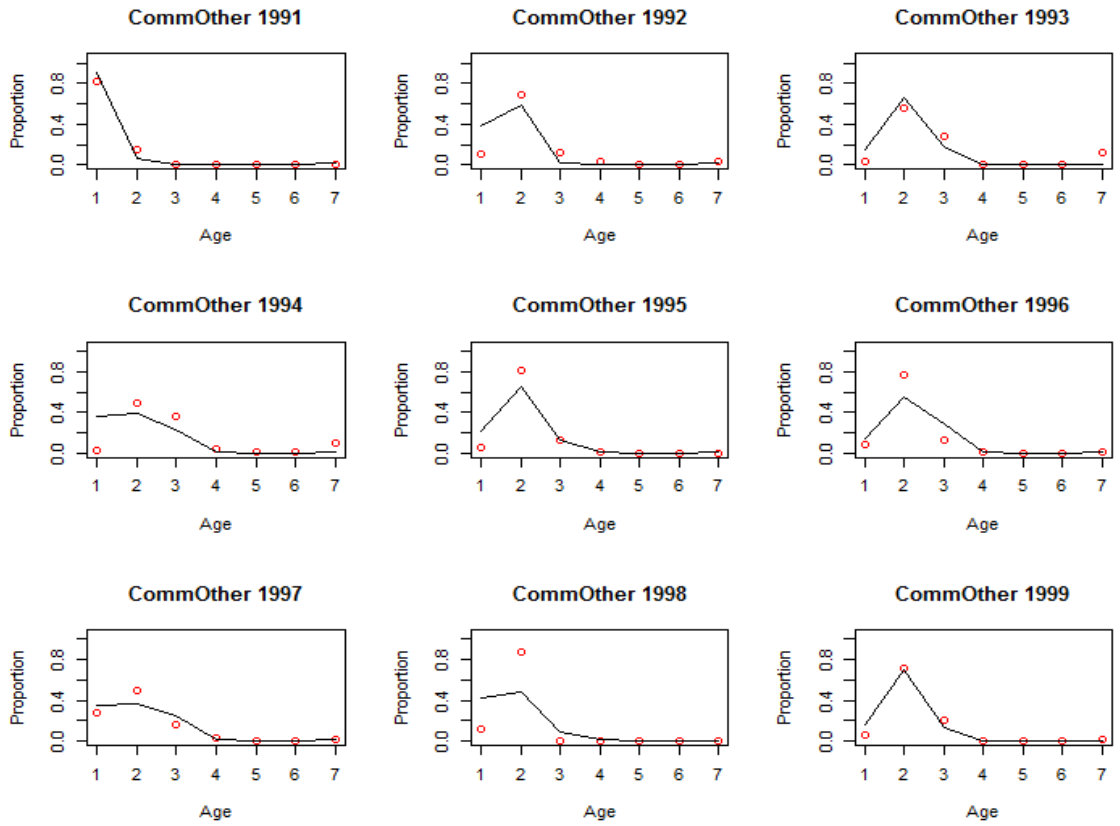


Figure 3 (con't).



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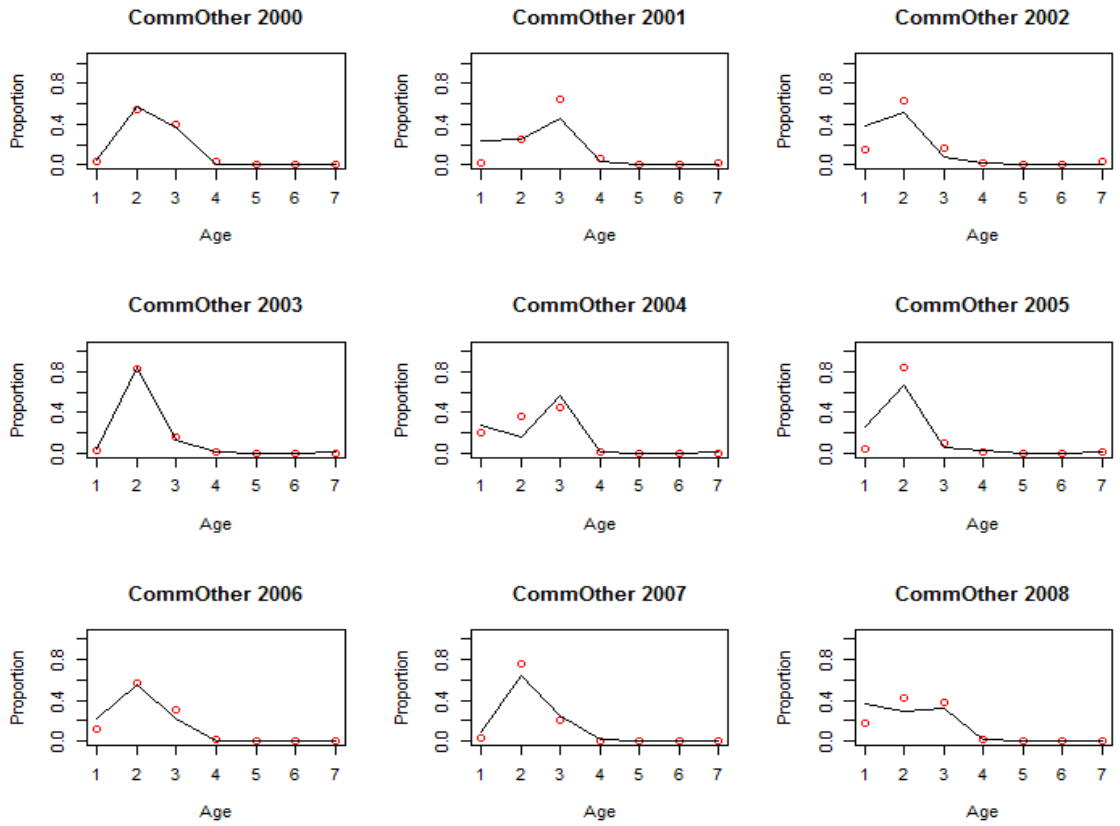


Figure 3 (con't).

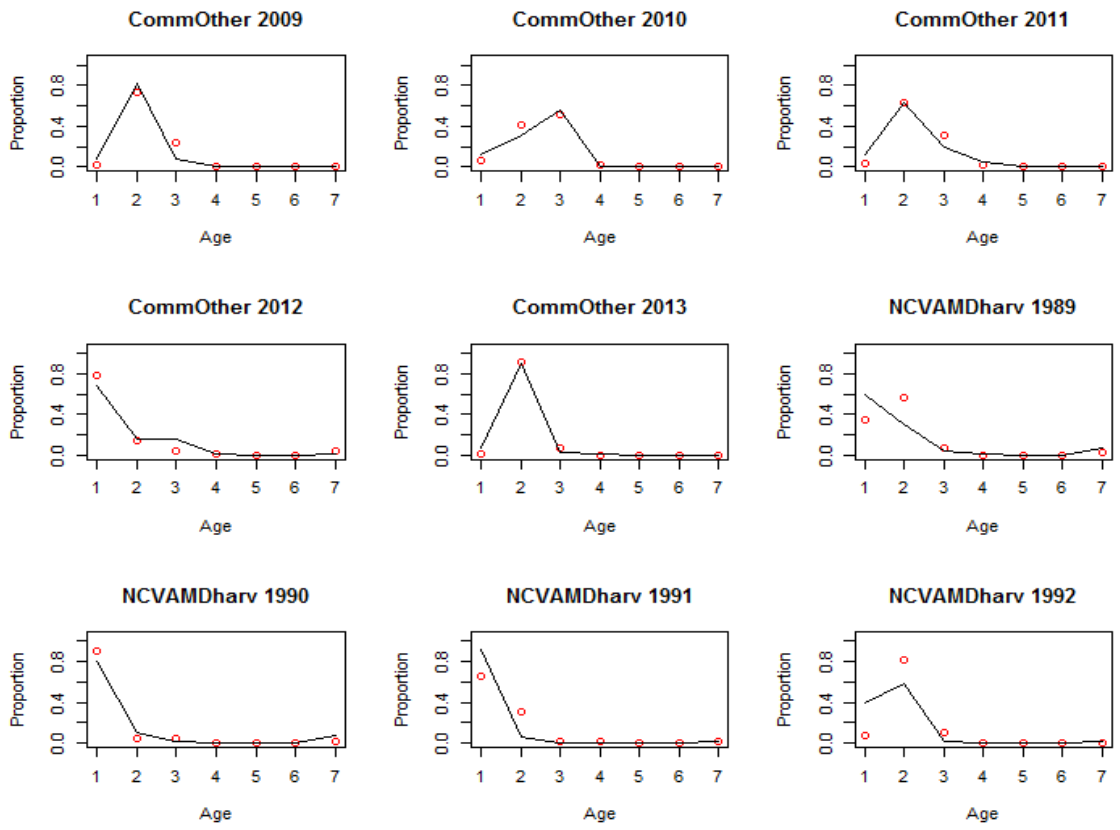


Figure 3 (con't).

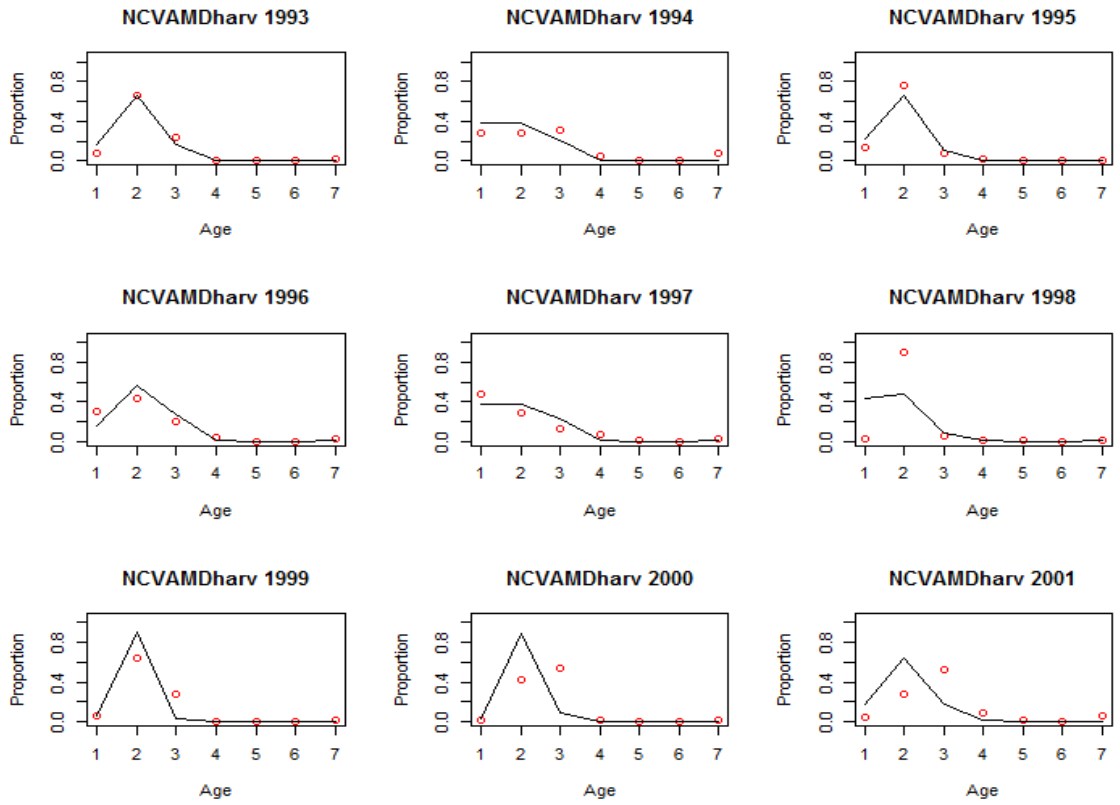


Figure 3 (con't).

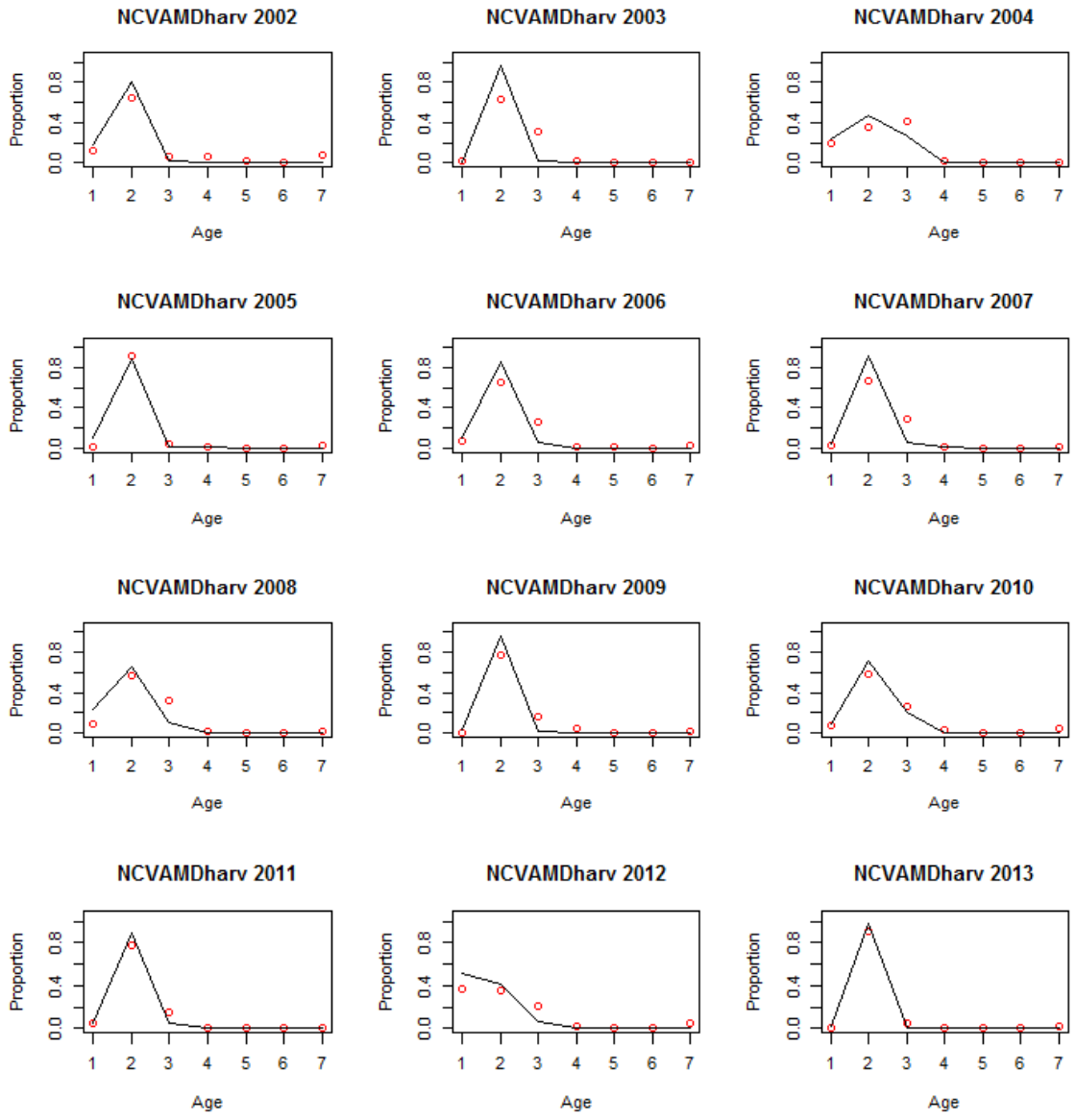


Figure 3 (con't).

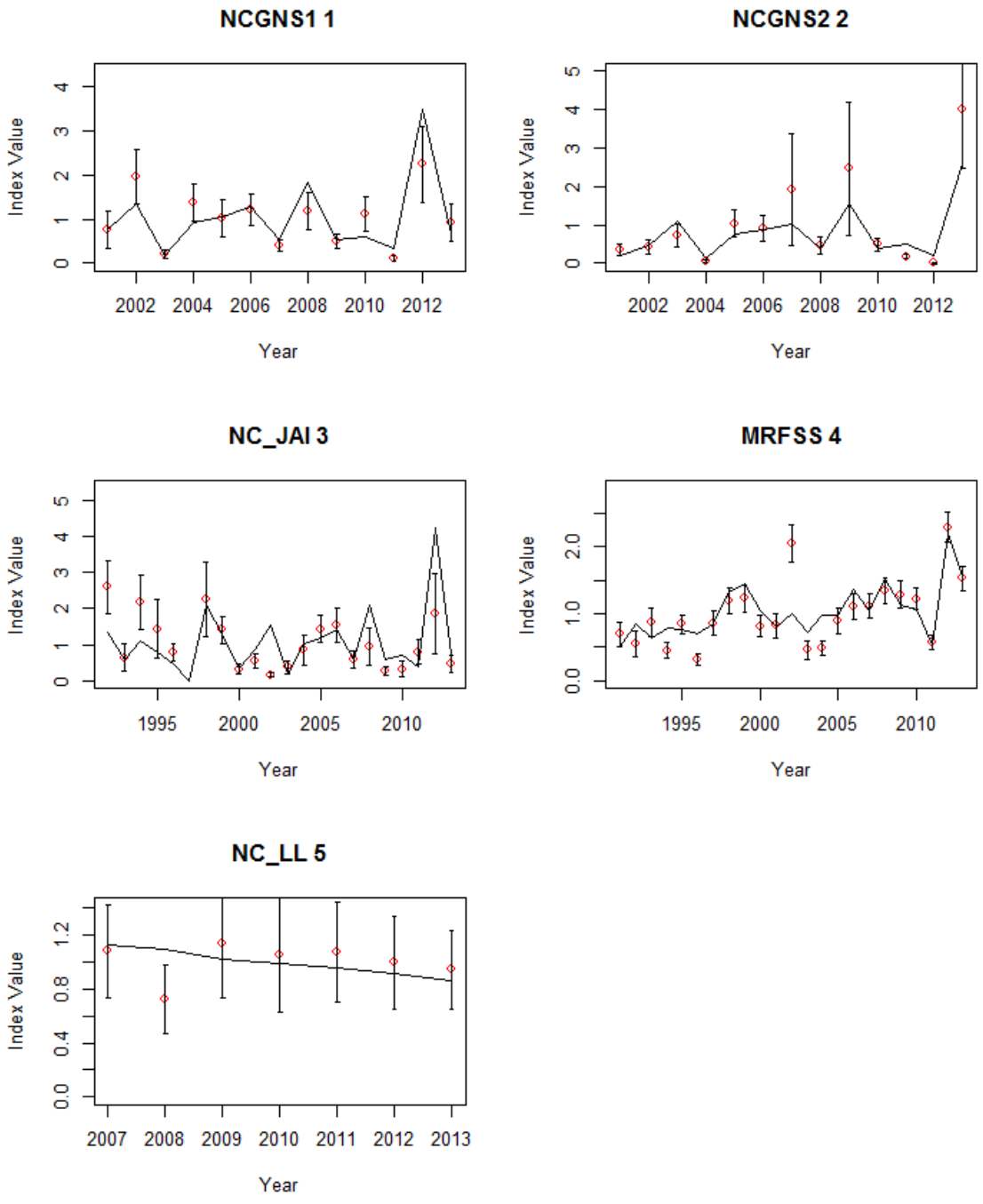


Figure 4. Observed (red circles) and model estimated (solid black line) indices of abundance for the northern stock. Error bars show 95% confidence intervals of observed values.

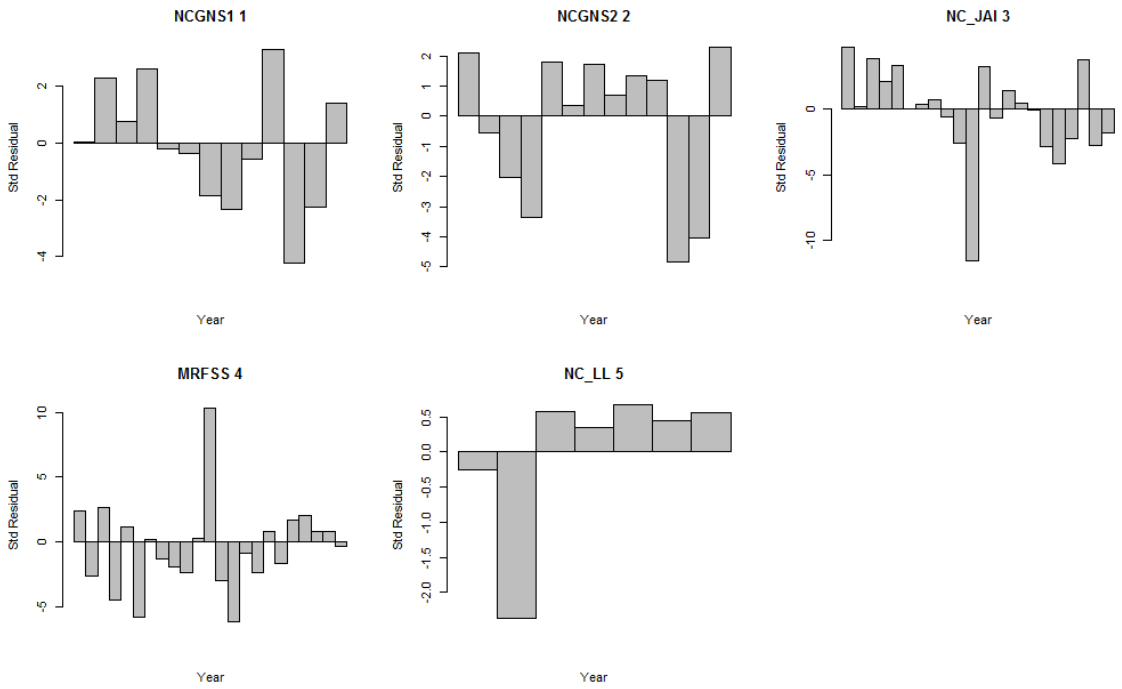


Figure 5. Standardized residuals for model fits to indices of abundance, by year, for the northern stock.

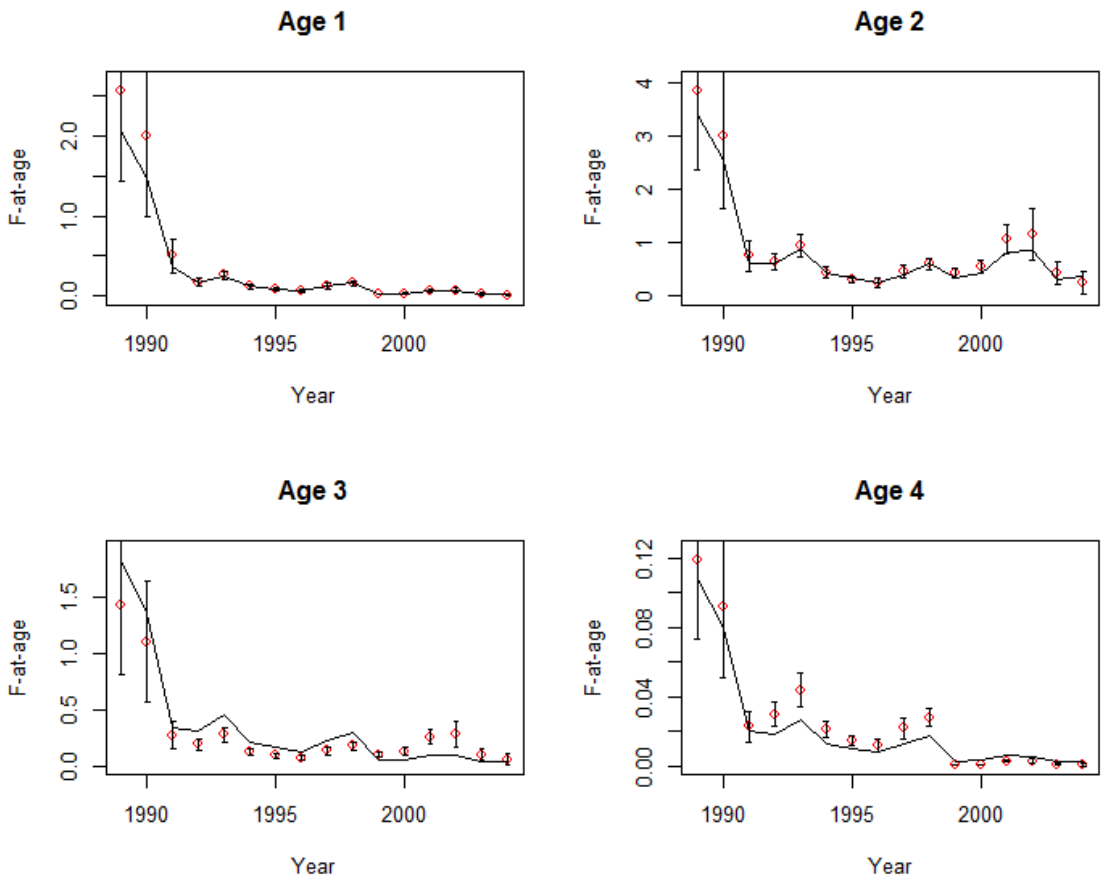


Figure 6. Observed (red circles) and model estimated (solid black line) F-at-age (ages 1-4) for the harvest fleets in the northern stock. Error bars show 95% confidence intervals of observed values.

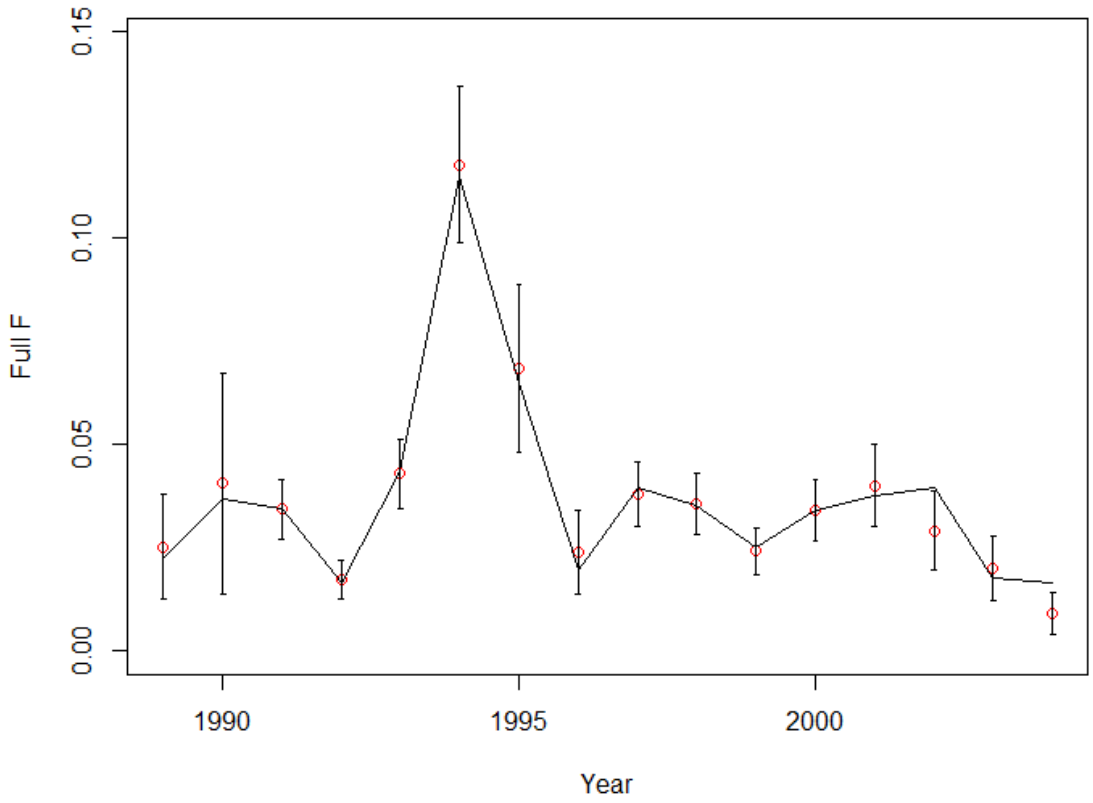


Figure 7. Observed (red circles) and model estimated (solid black line) full F for the recreational live release fleet in the northern stock. Error bars show 95% confidence intervals of observed values.

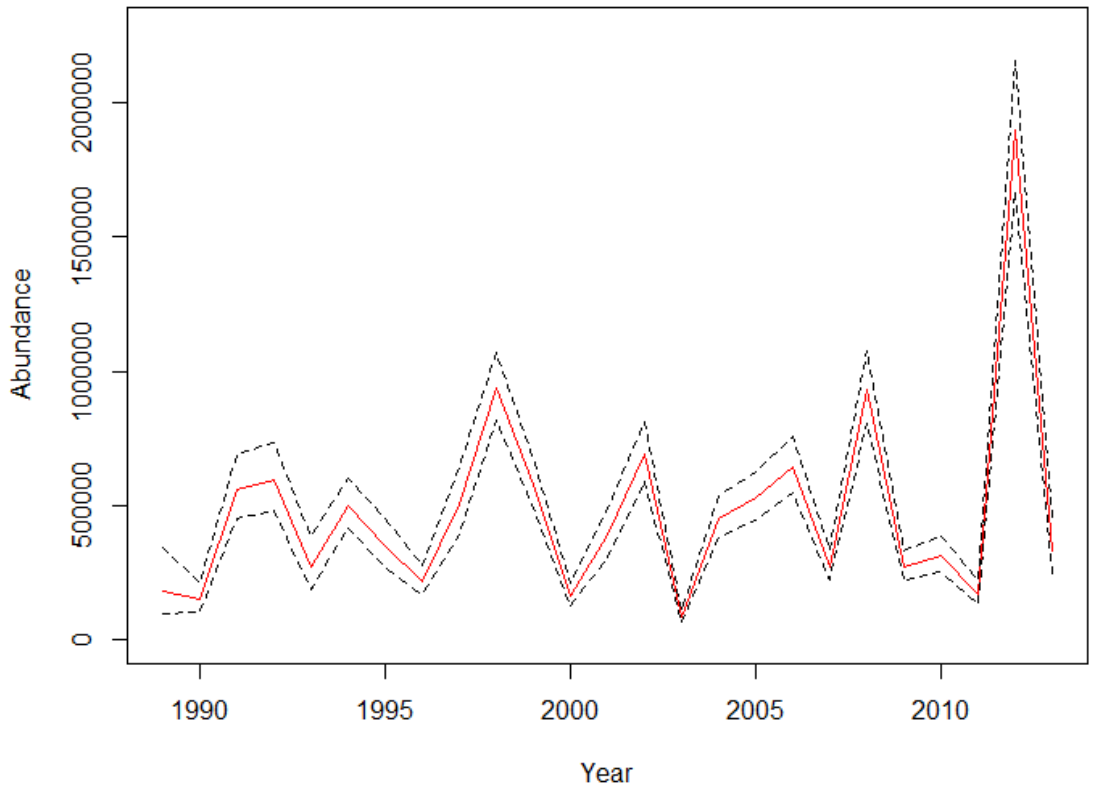


Figure 8. Predicted recruitment for the northern stock with 95% confidence intervals from asymptotic standard errors.

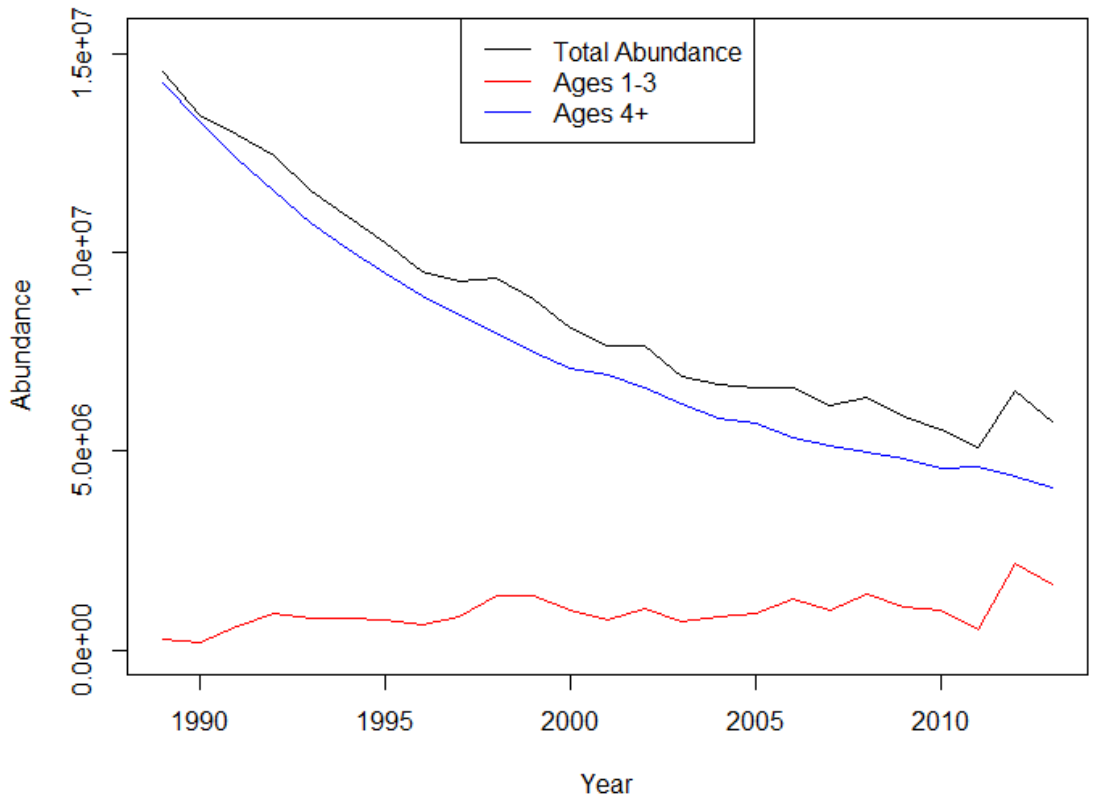


Figure 9. Abundance of red drum at various ages for the northern stock.

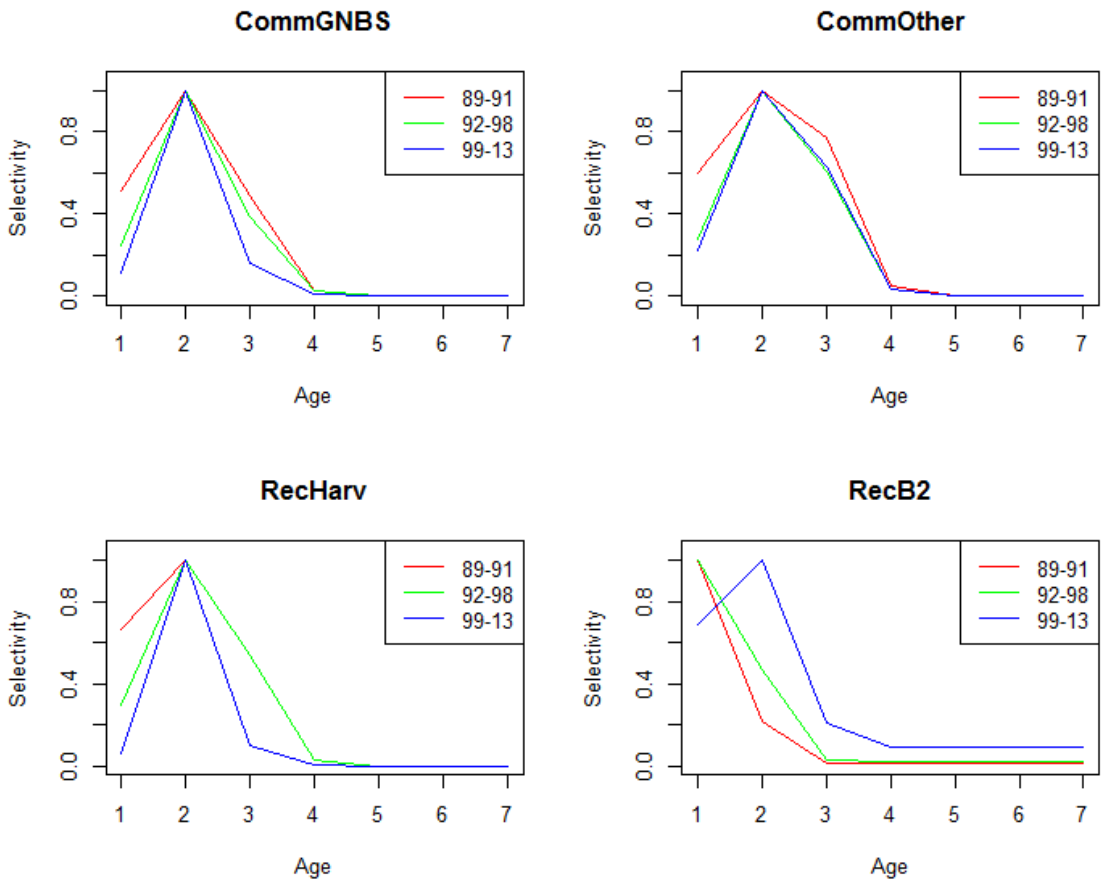


Figure 10. Selectivity curves for each fleet and selectivity block in the northern stock. The recreational live release selectivity is fixed based on external tagging analysis (Bacheler et al. 2008).

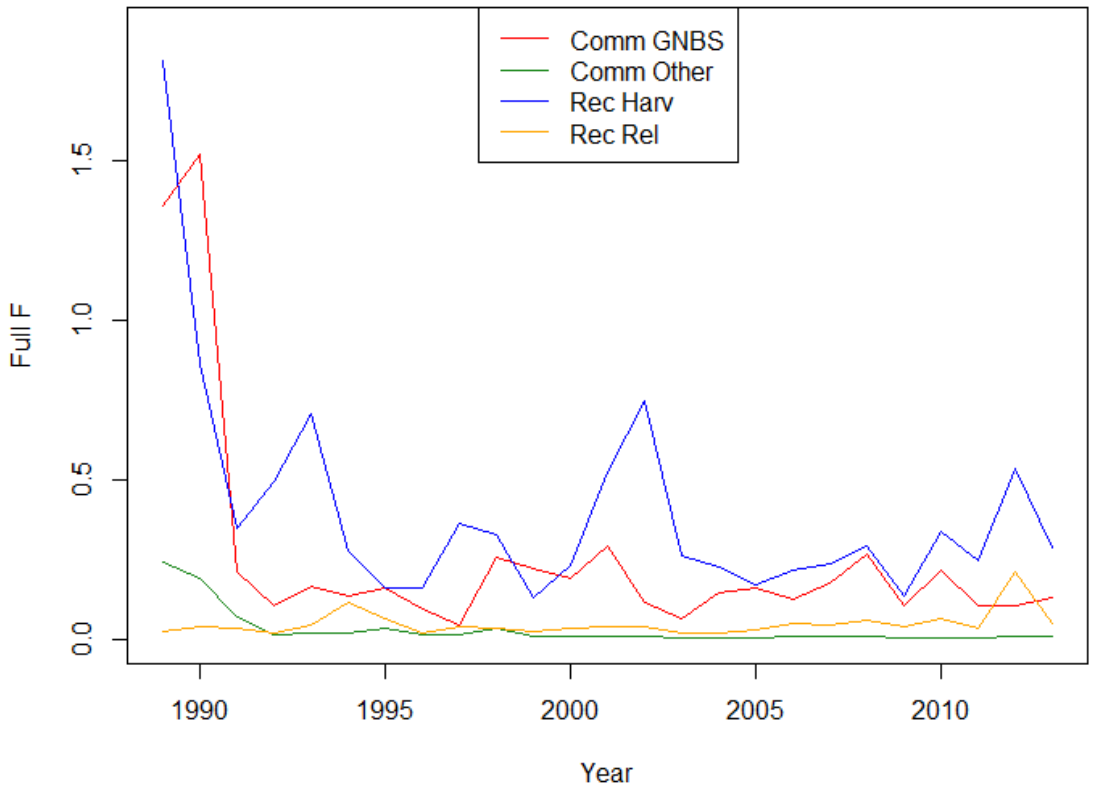


Figure 11. Fleet-specific annual fishing mortality for the northern stock.

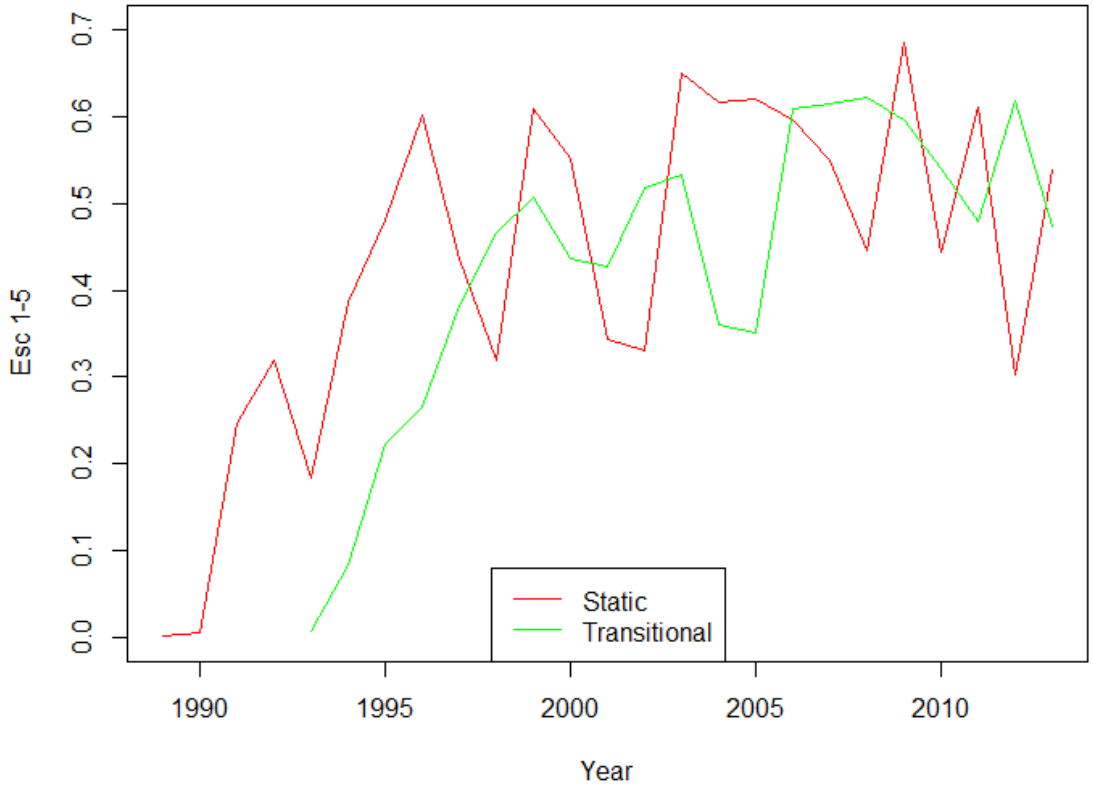


Figure 12. Estimates of static and transitional escapement for ages 1-5 for the northern stock.

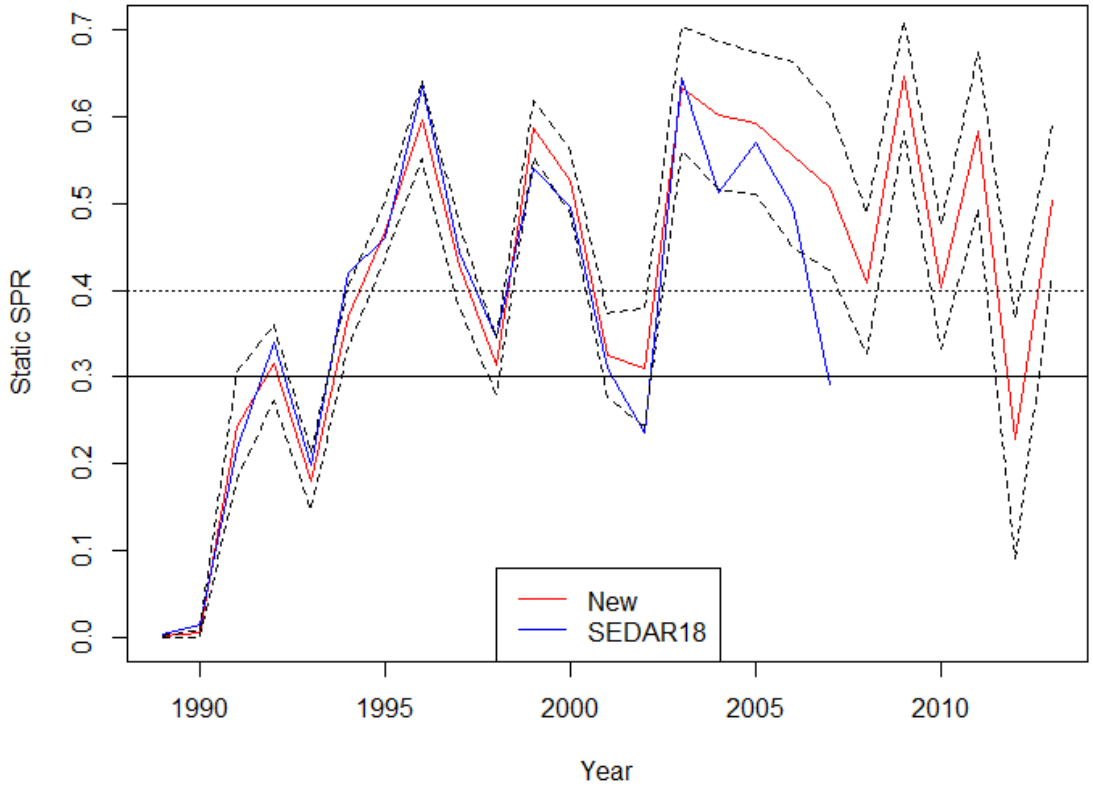


Figure 13. Annual sSPR estimates for the northern stock with 95% confidence intervals from asymptotic standard errors. Point estimates from the previous benchmark assessment (SEDAR18) are included for comparison. The target sSPR (dashed black line) is 40% and the threshold sSPR (solid black line) is 30%.

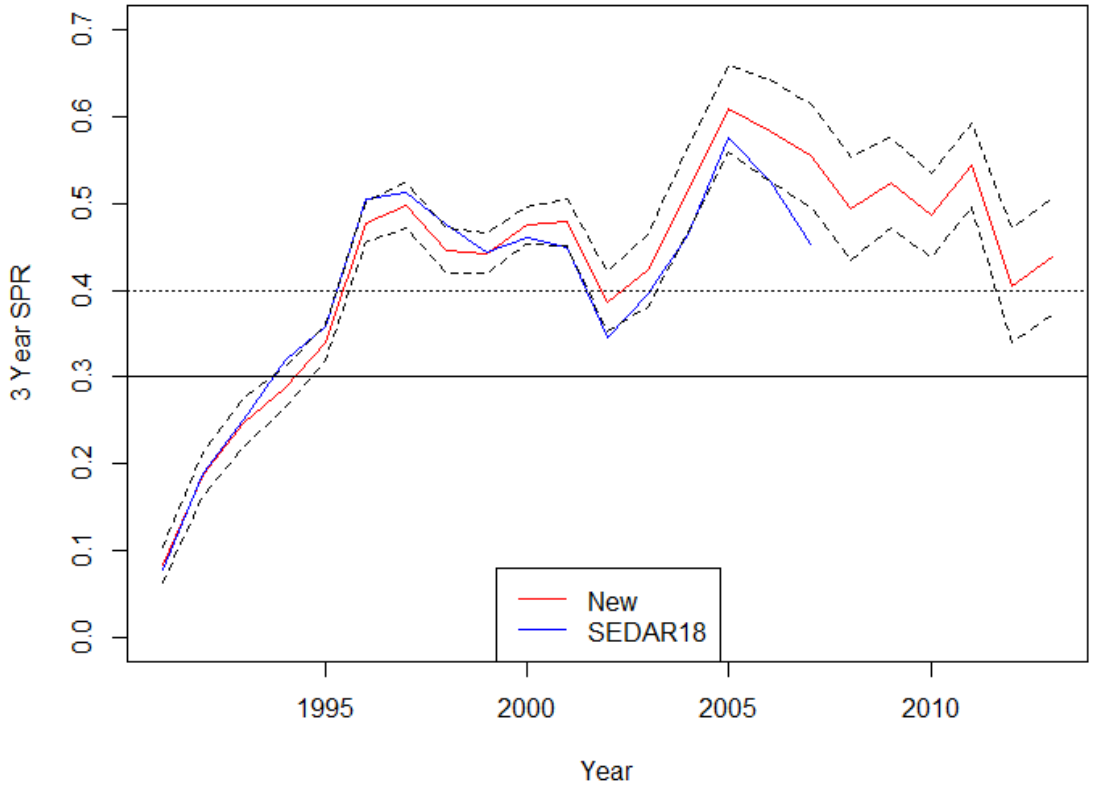


Figure 14. Three year average sSPR for the northern stock with 95% confidence intervals from asymptotic standard errors. Point estimates from the previous benchmark assessment (SEDAR18) are included for comparison. The target sSPR (dashed black line) is 40% and the threshold sSPR (solid black line) is 30%.

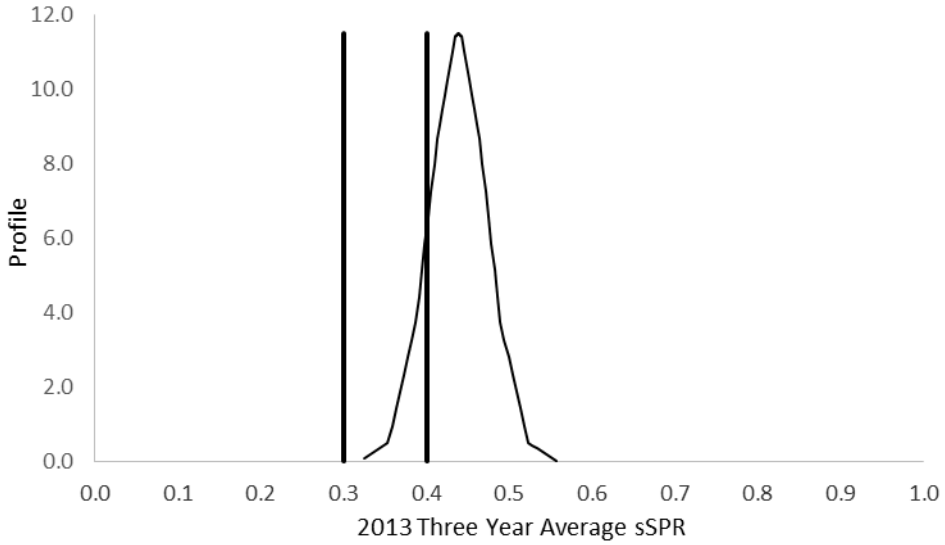


Figure 15. Estimated probability density function of the 2013 three year average sSPR for the northern stock. The target sSPR is 40% and the threshold sSPR is 30%.

Figure 16. Five year retrospective analysis of the recruitment (top) and three year average sSPR (bottom) for the northern stock.

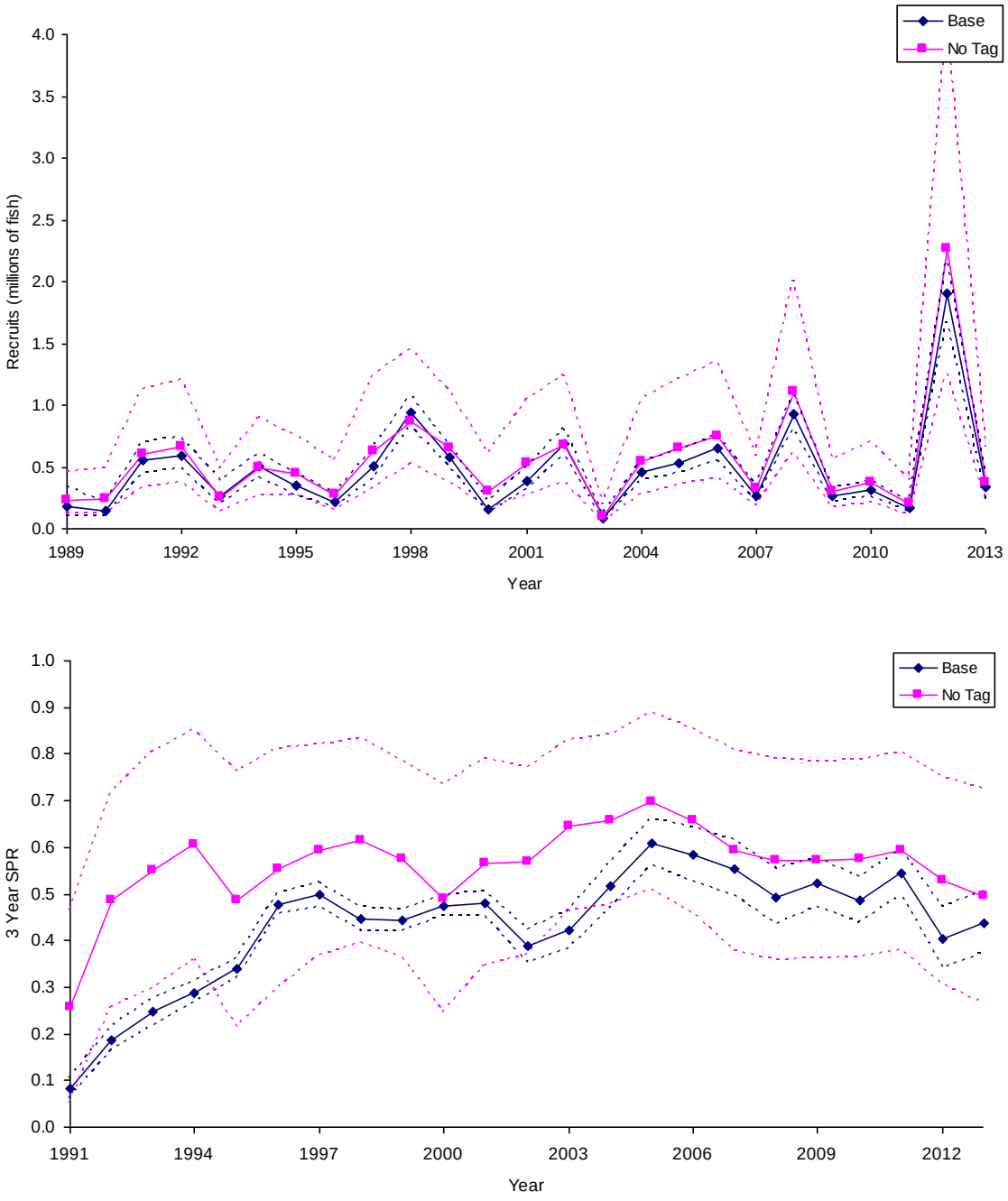


Figure 17. Comparison of the recruitment (top) and three year average sSPR (bottom) for the northern stock between the base model and when the tag-based F estimates (1989-2004) are removed.

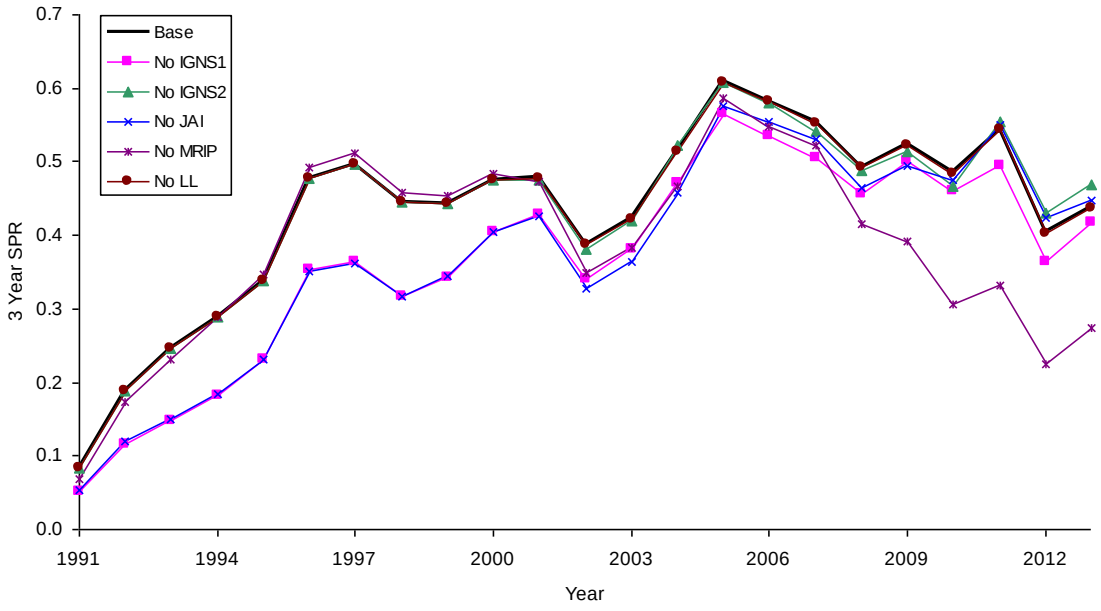


Figure 18. Comparison of the three year average sSPR for the northern stock when individual indices are removed.

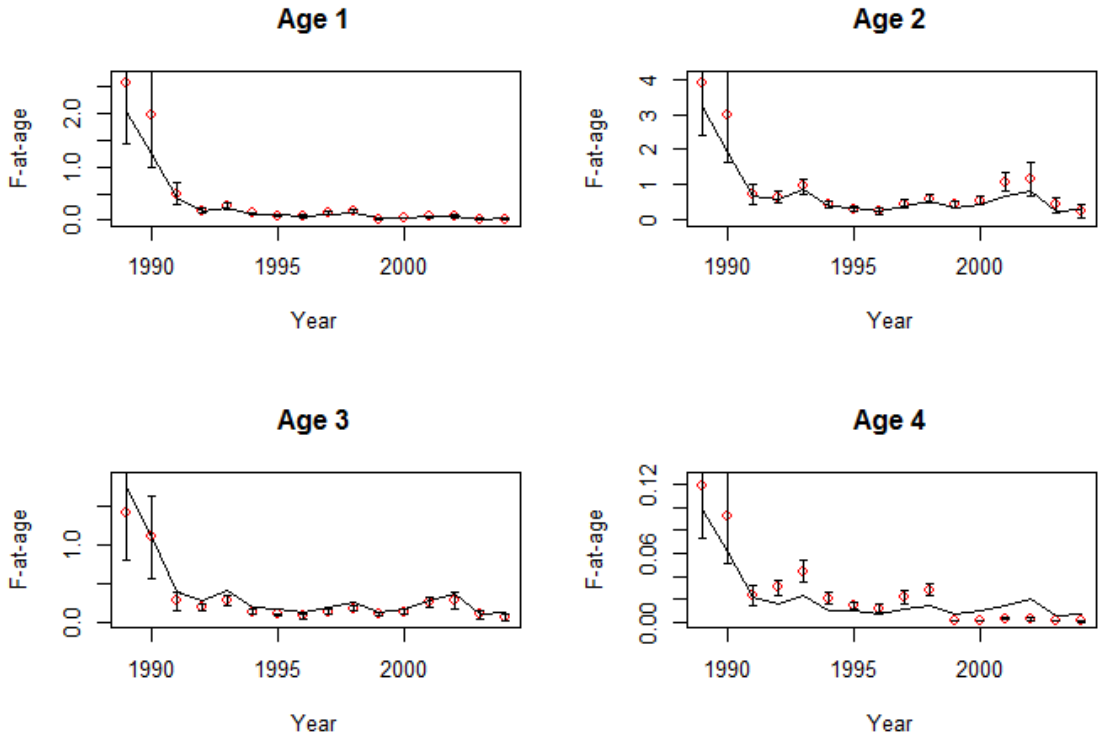


Figure 19. Observed (red circles) and model estimated (solid black line) F-at-age (ages 1-4) for the harvest fleets in the northern stock from the iteratively reweighted model. Error bars show 95% confidence intervals of observed values.

Figure 20. Comparison of the F-at-age for the northern stock for the base model and the iteratively reweighted model.

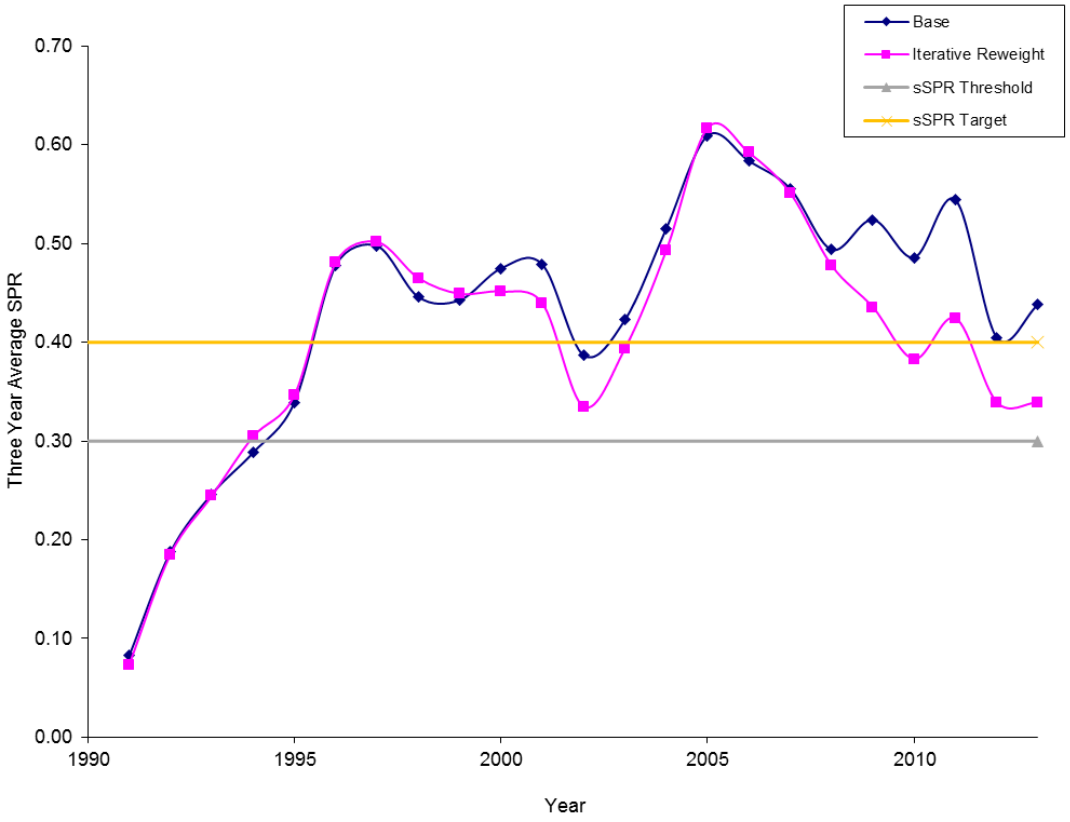


Figure 21. Comparison of the three year average sSPR for the northern stock for the base model and the iteratively reweighted model.

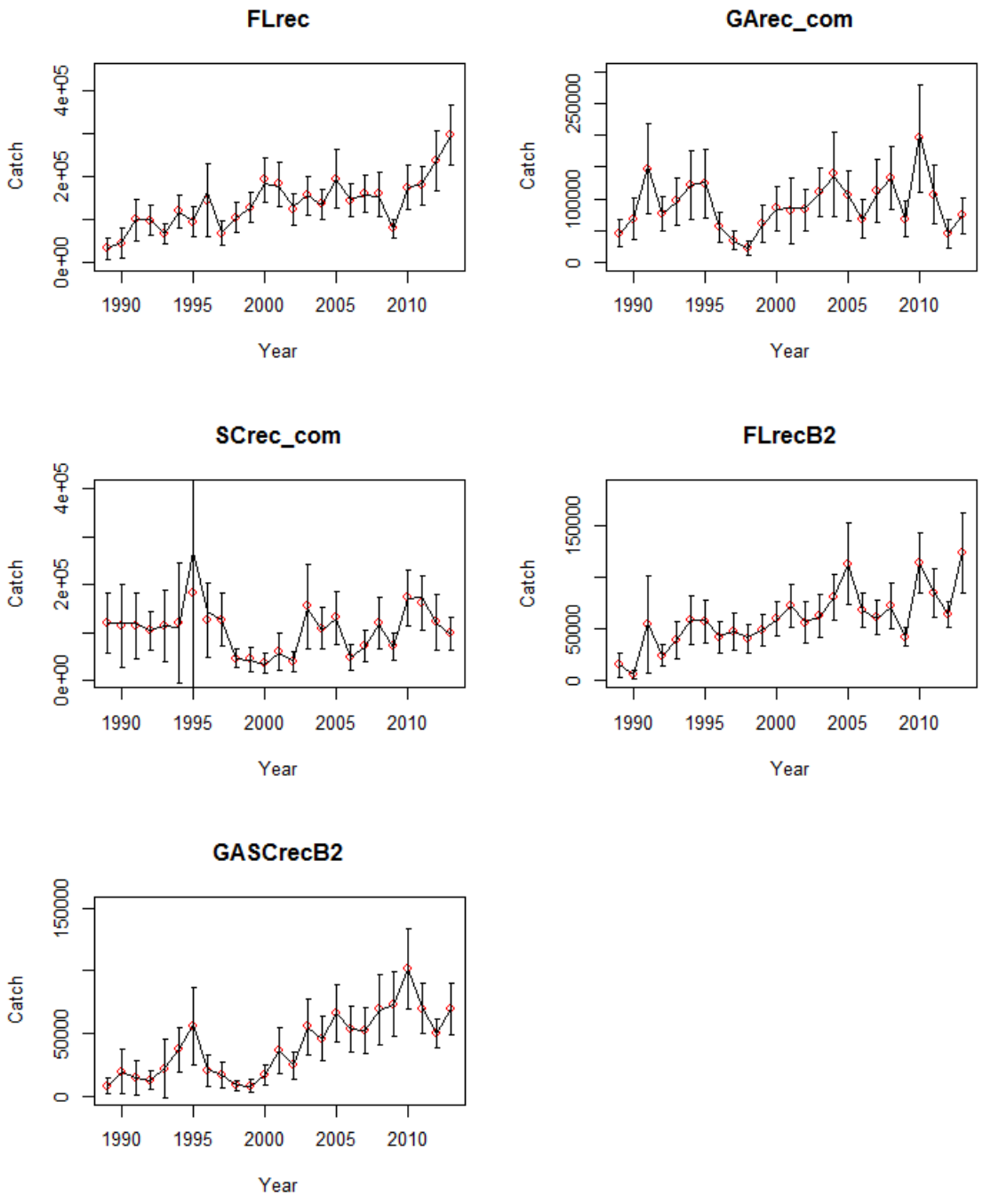


Figure 22. Observed (red circles) and model estimated (solid black line) catch, by fleet, for the southern stock. Error bars show 95% confidence intervals of observed values.

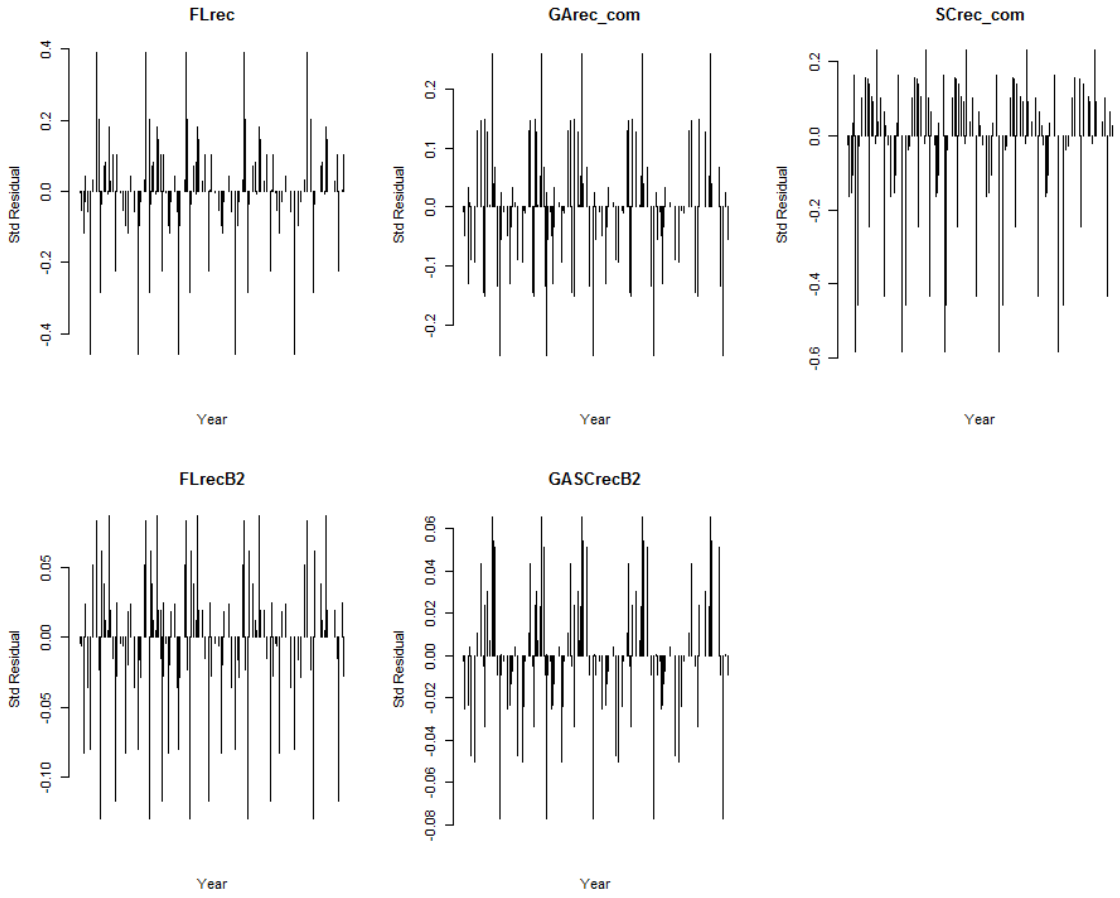


Figure 23. Standardized residuals for model fits to catch, by fleet and year, for the southern stock.

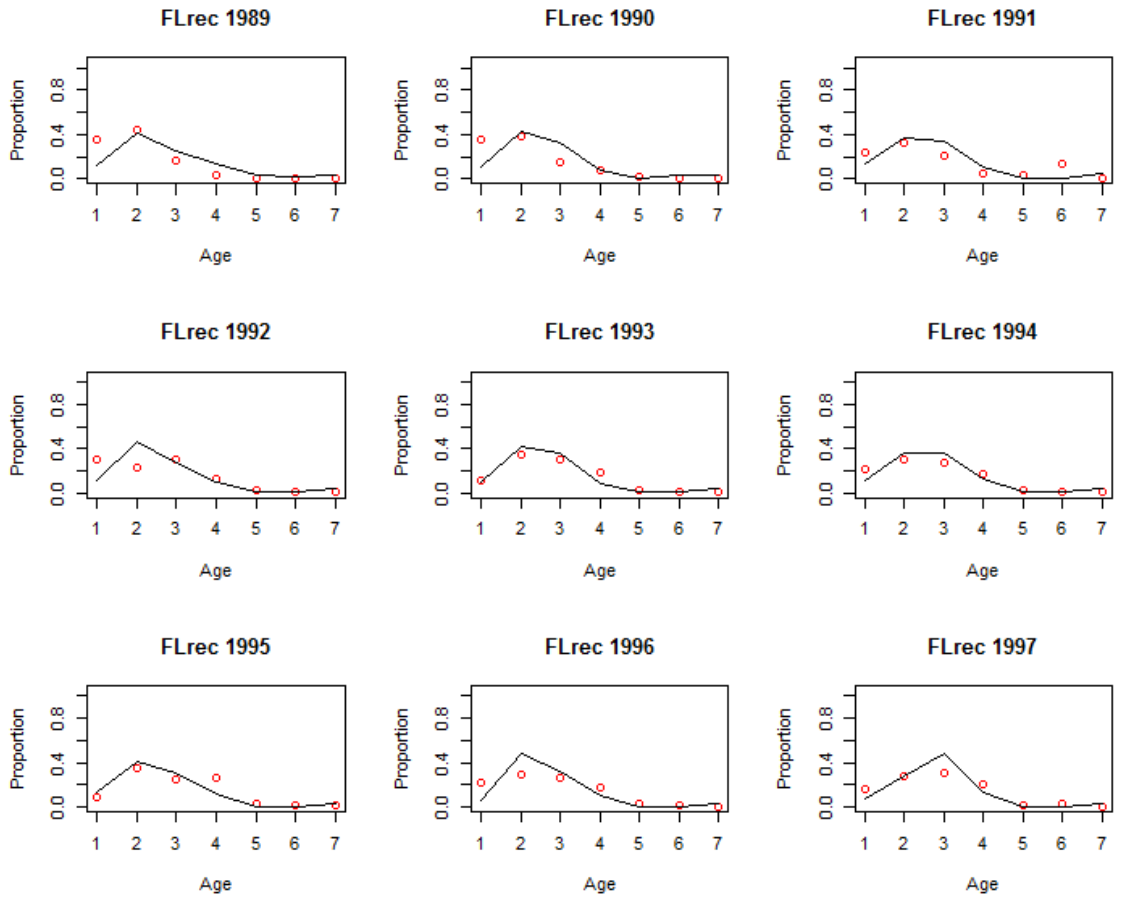


Figure 24. Southern model fits to the proportion-at-age data for each fleet and year. The Florida recreational release fleet is not included as the selectivity-at-age was fixed using tagging data from North Carolina and the proportion-at-age data was not used in model fitting.

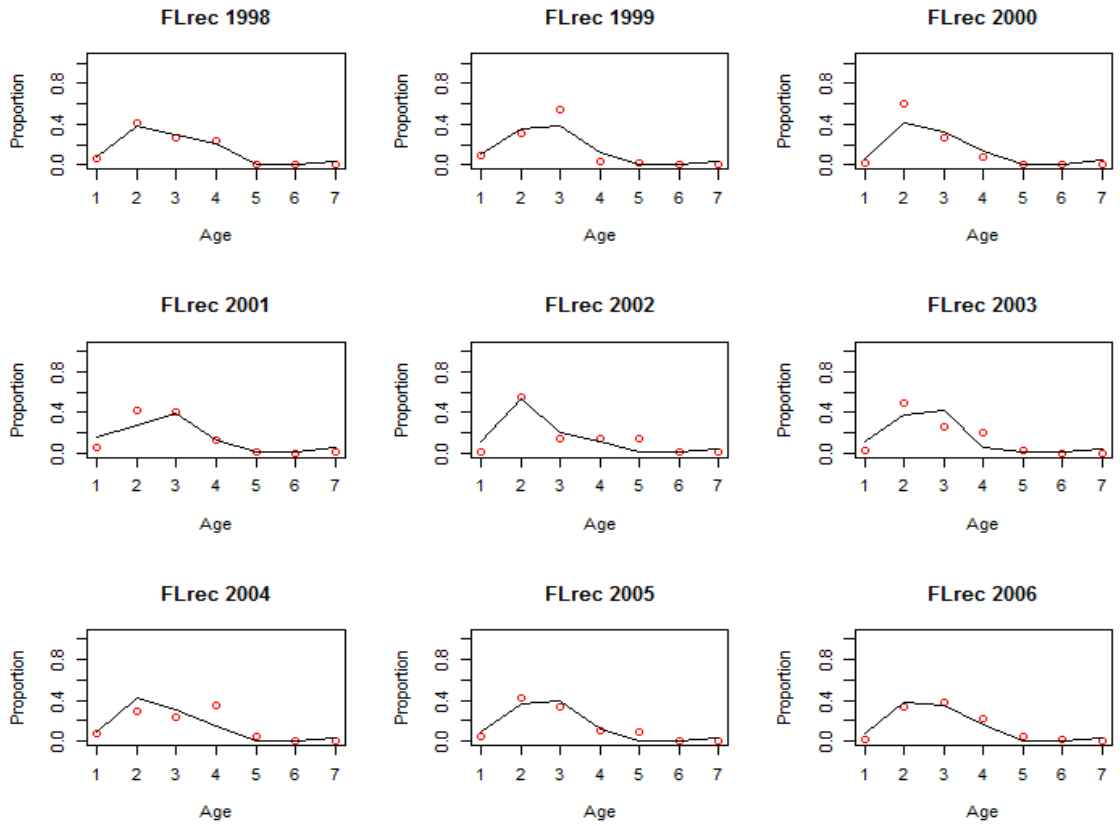


Figure 24 (con't).

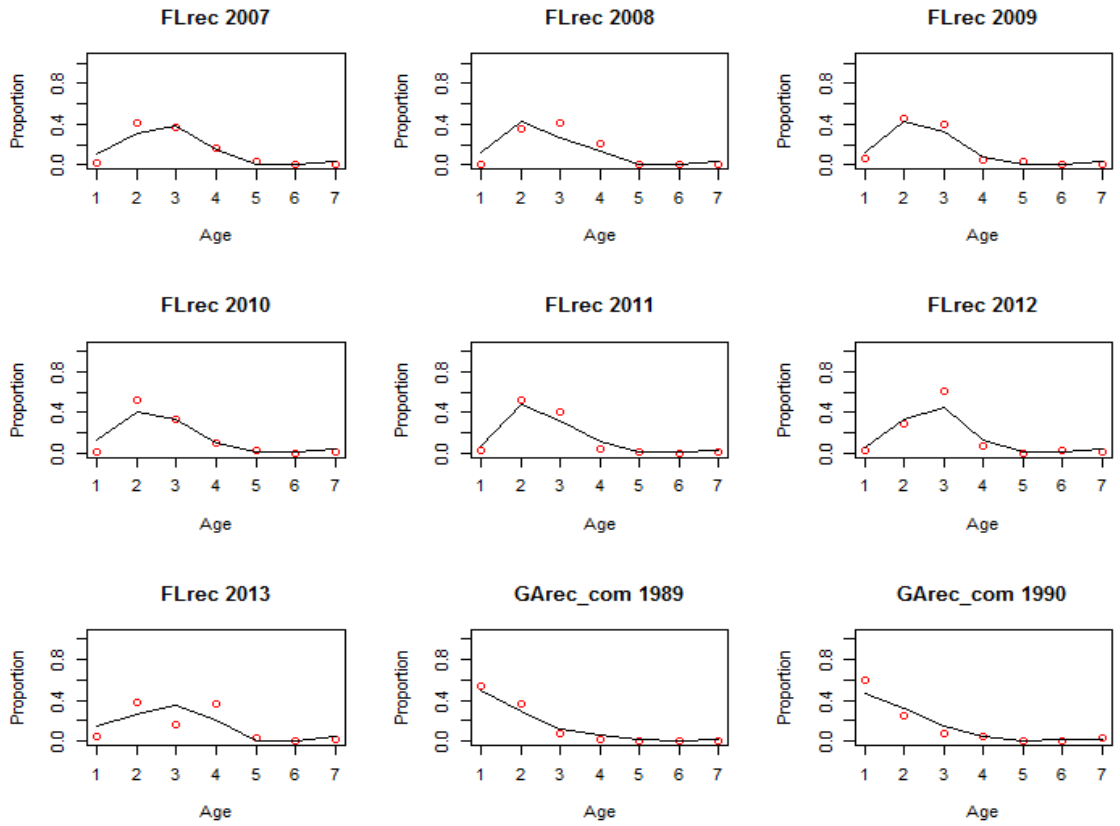


Figure 24 (con't).

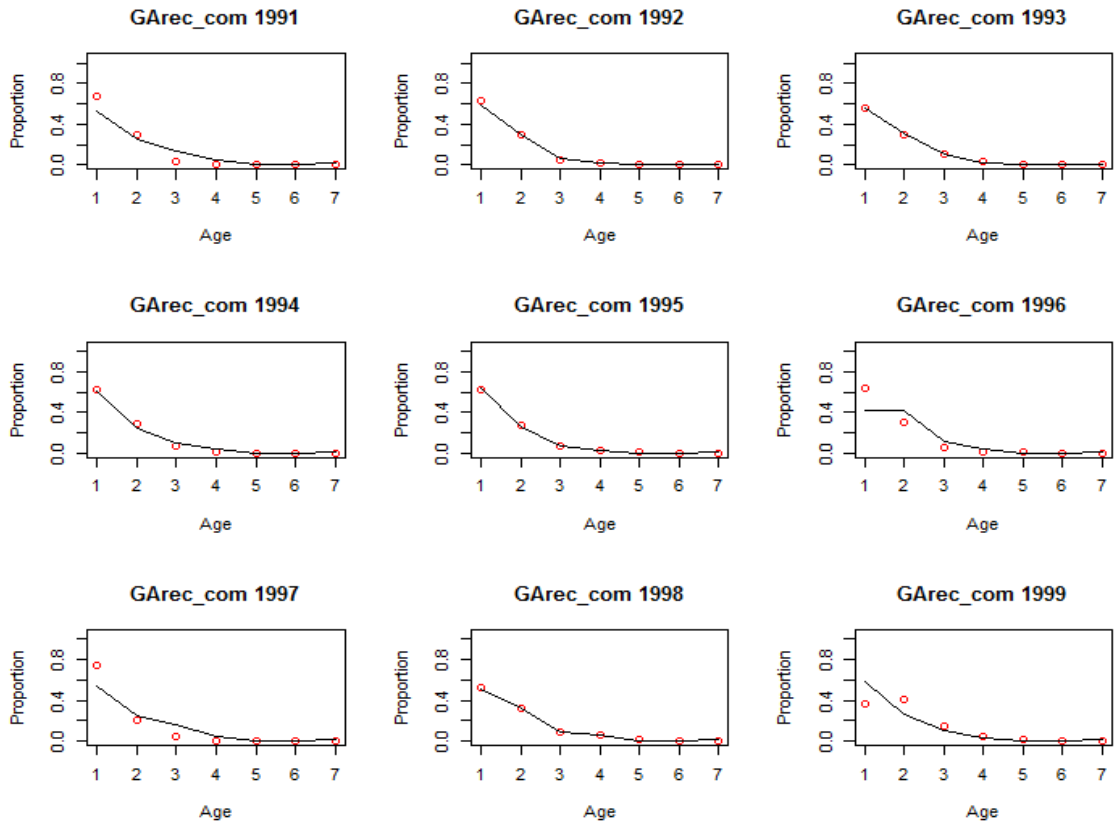
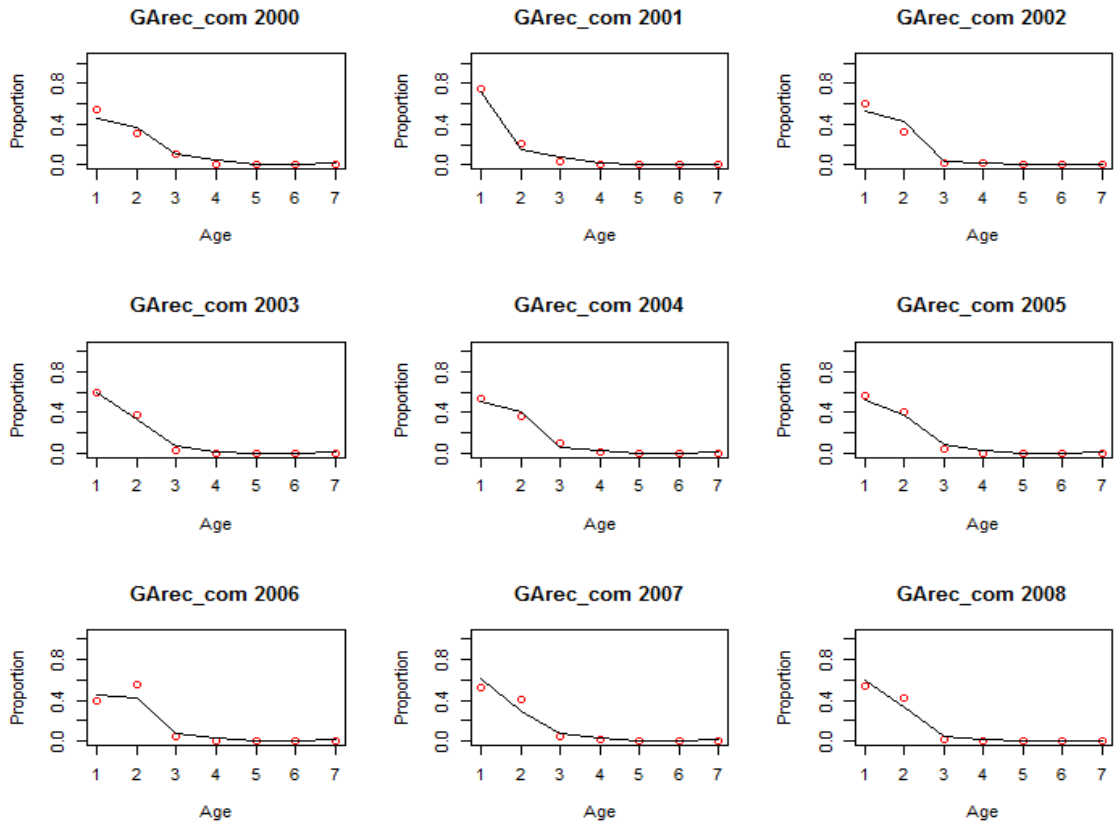


Figure 24 (con't).



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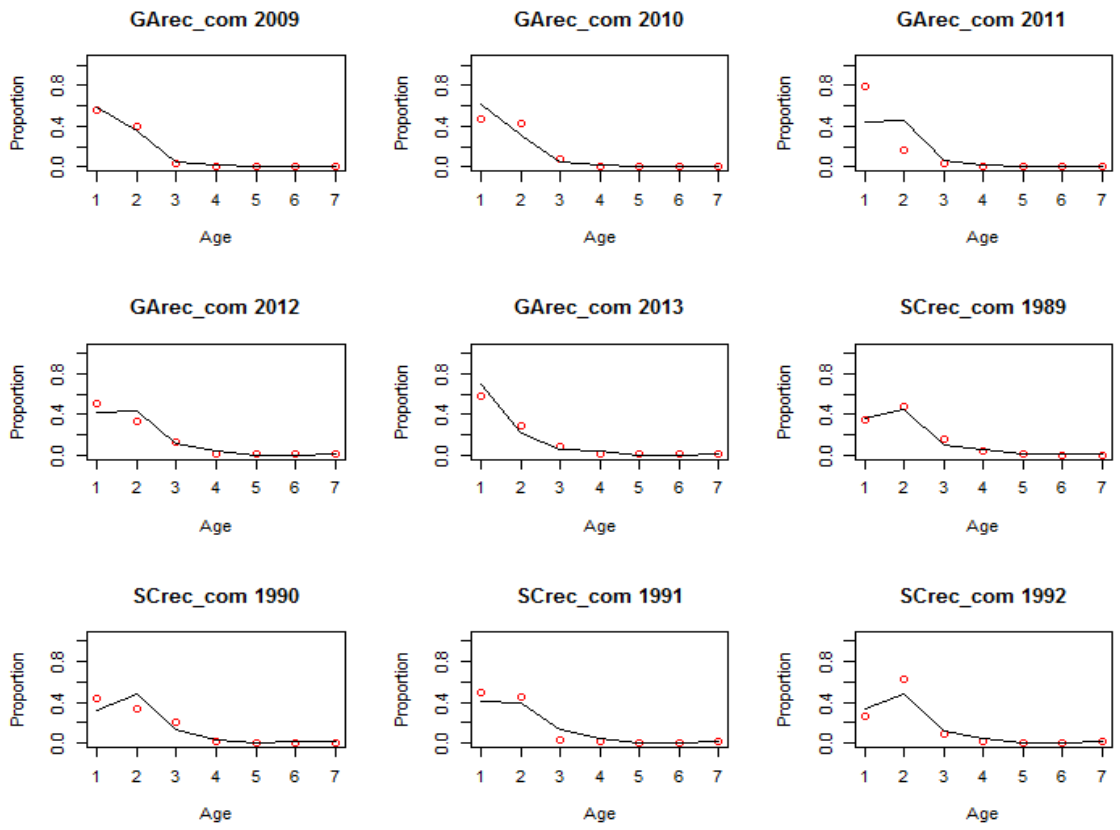


Figure 24 (con't).

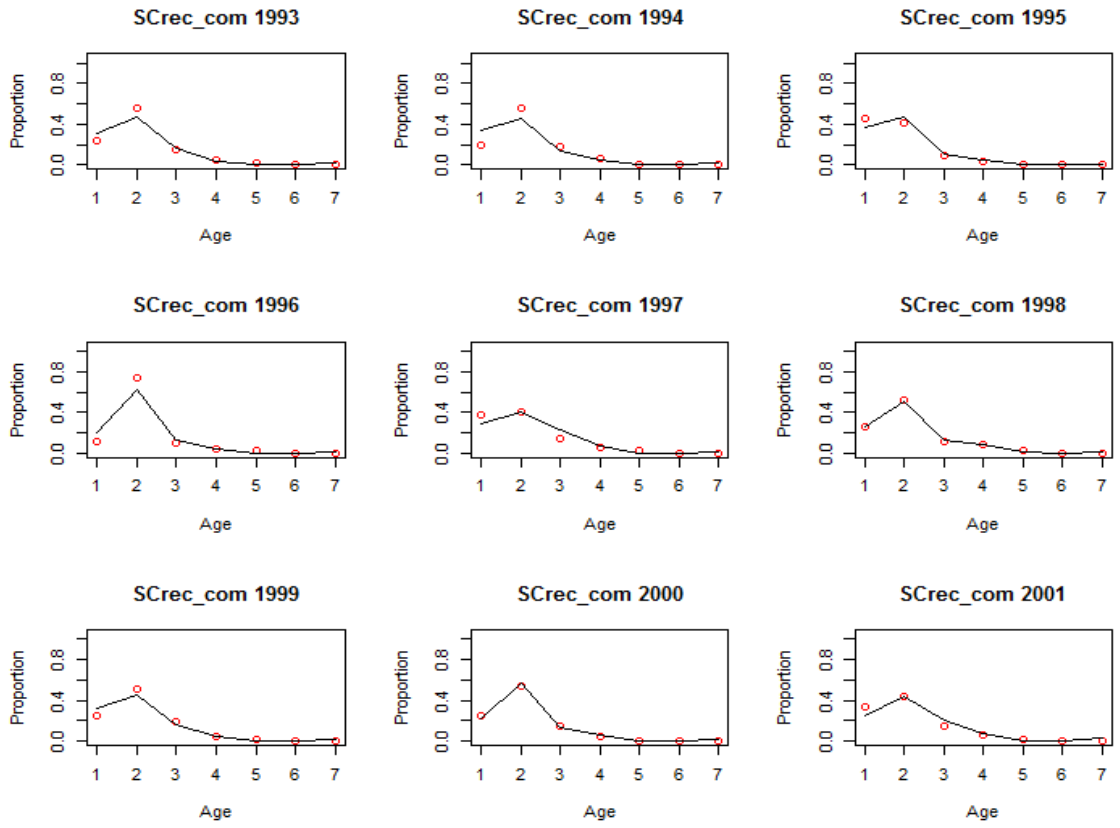


Figure 24 (con't).

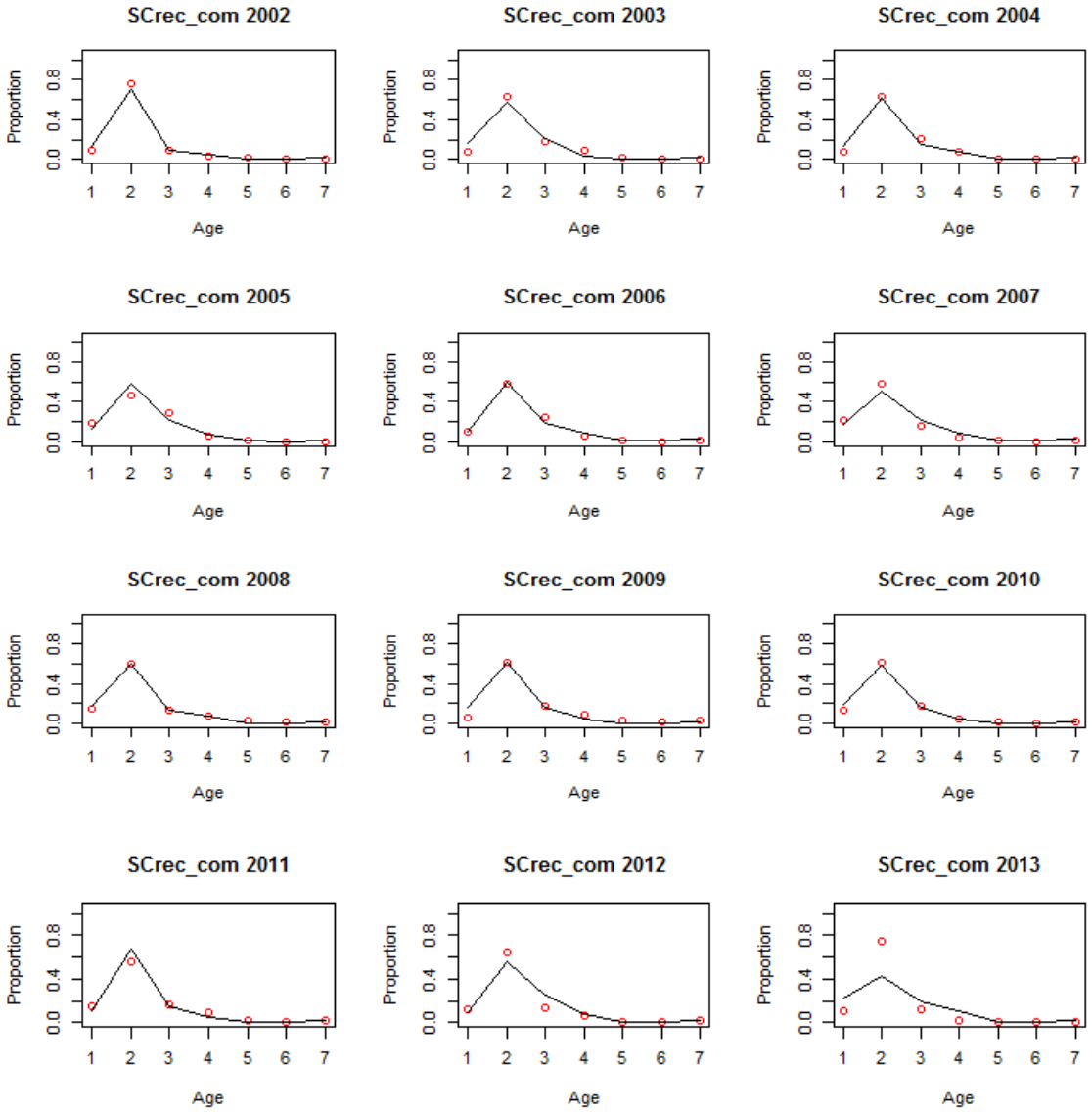
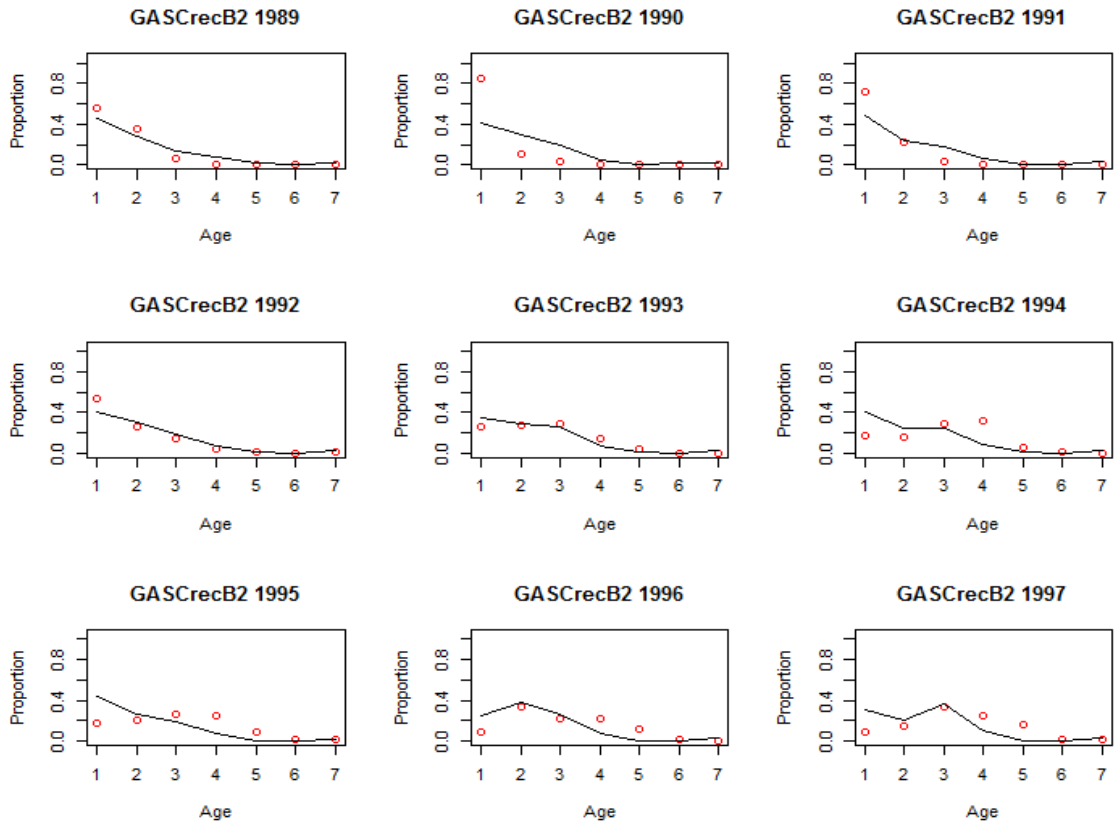


Figure 24 (con't).



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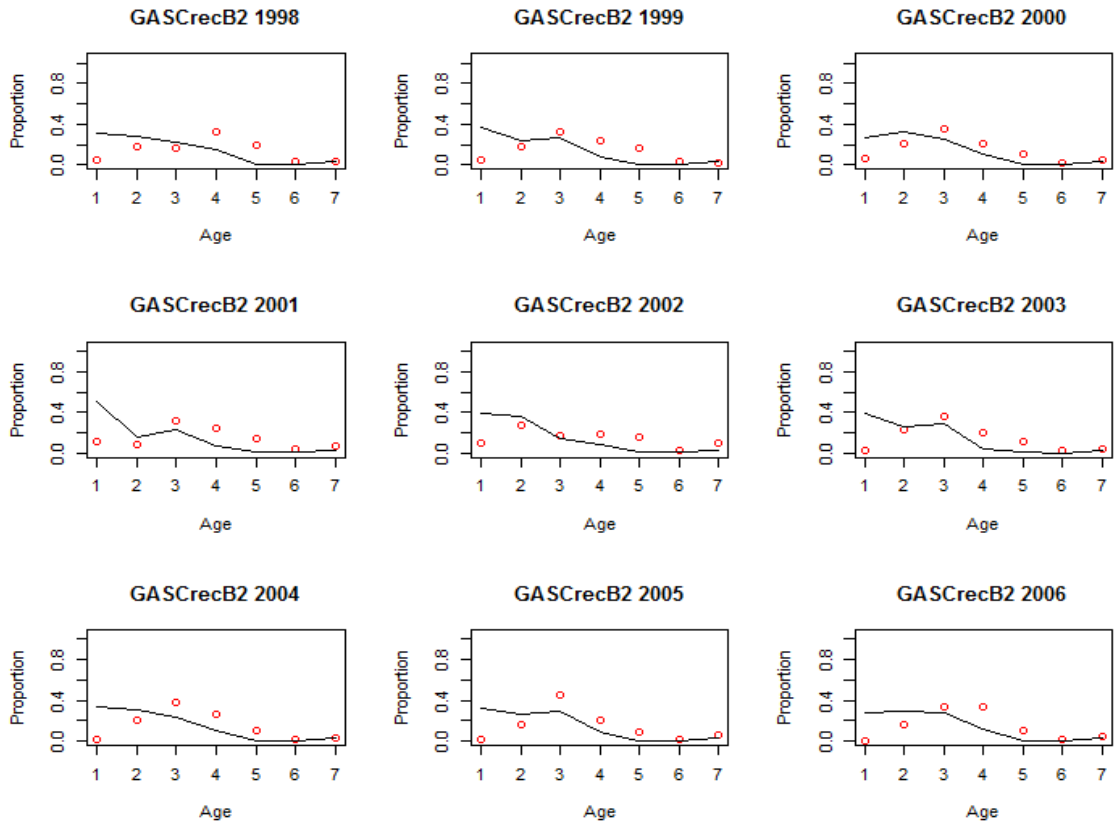

Figure 24 (con't).

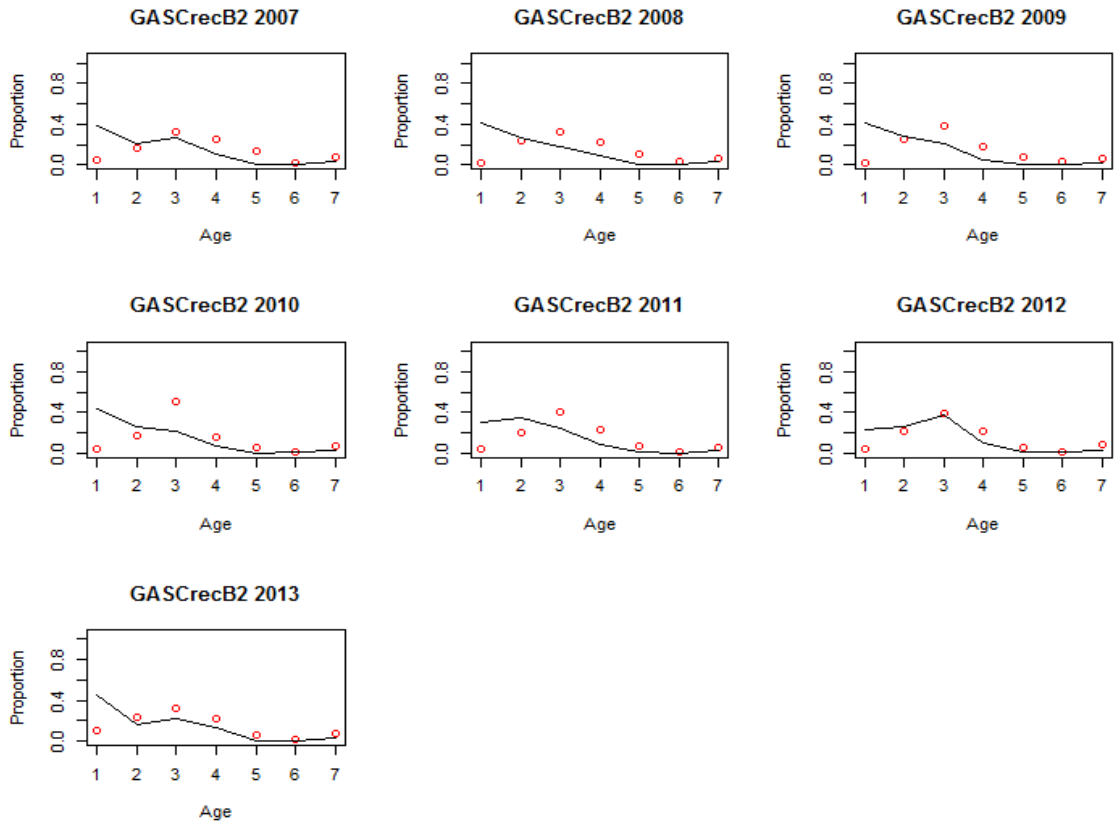

Figure 24 (con't).

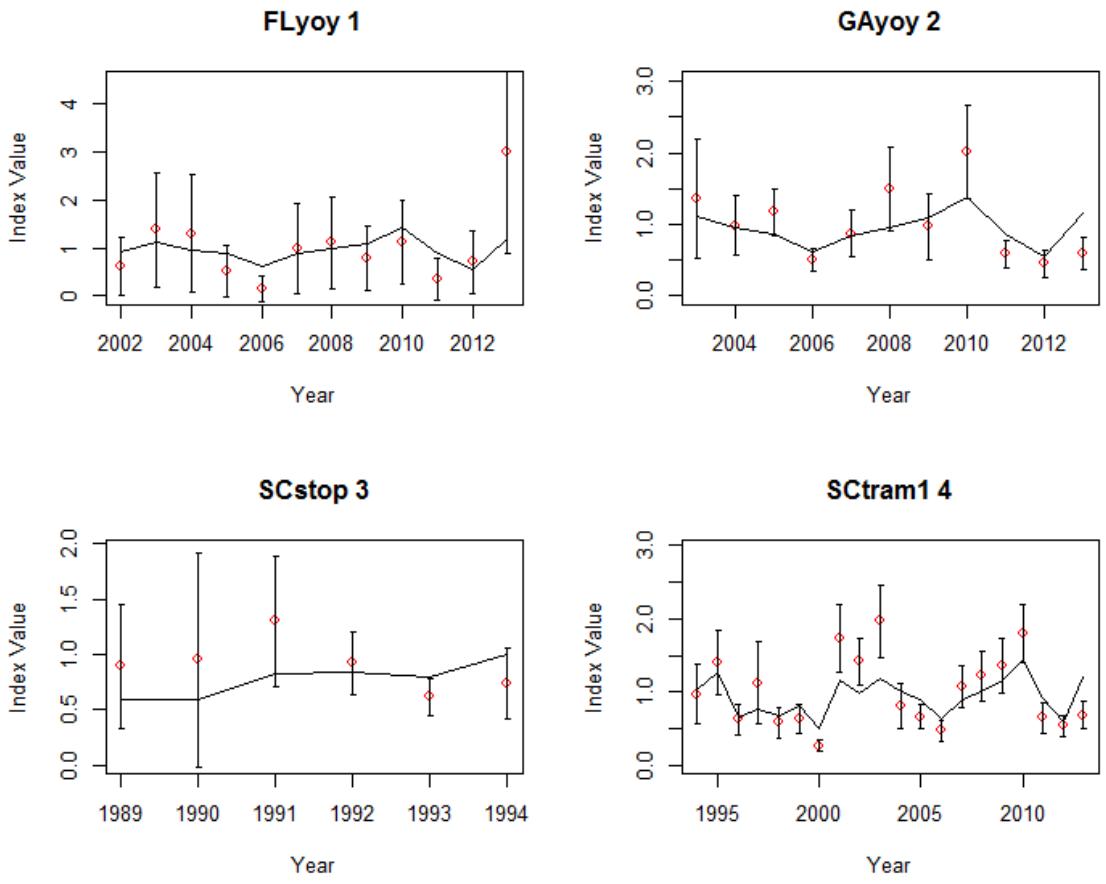

Figure 25. Observed (red circles) and model estimated (solid black line) indices of abundance for the southern stock. Error bars show 95% confidence intervals of observed values.

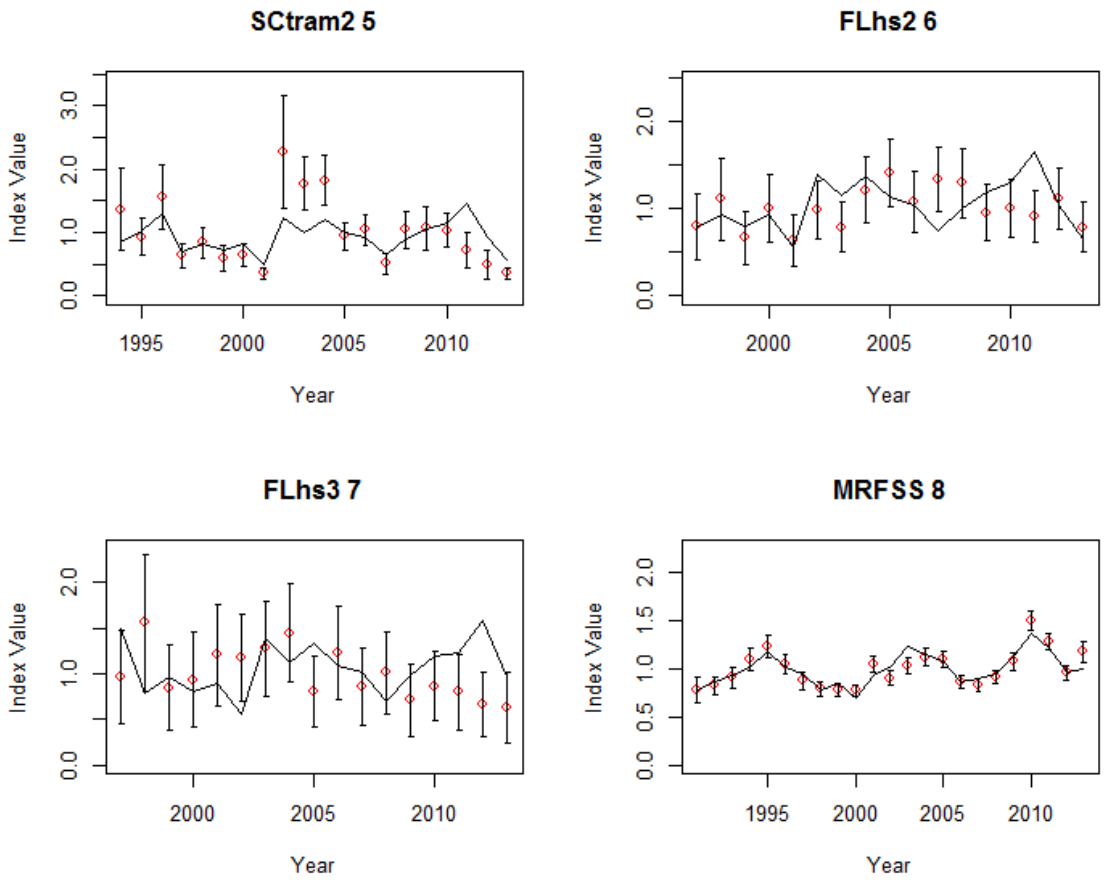

Figure 25 (con't). Index fits for the southern stock.

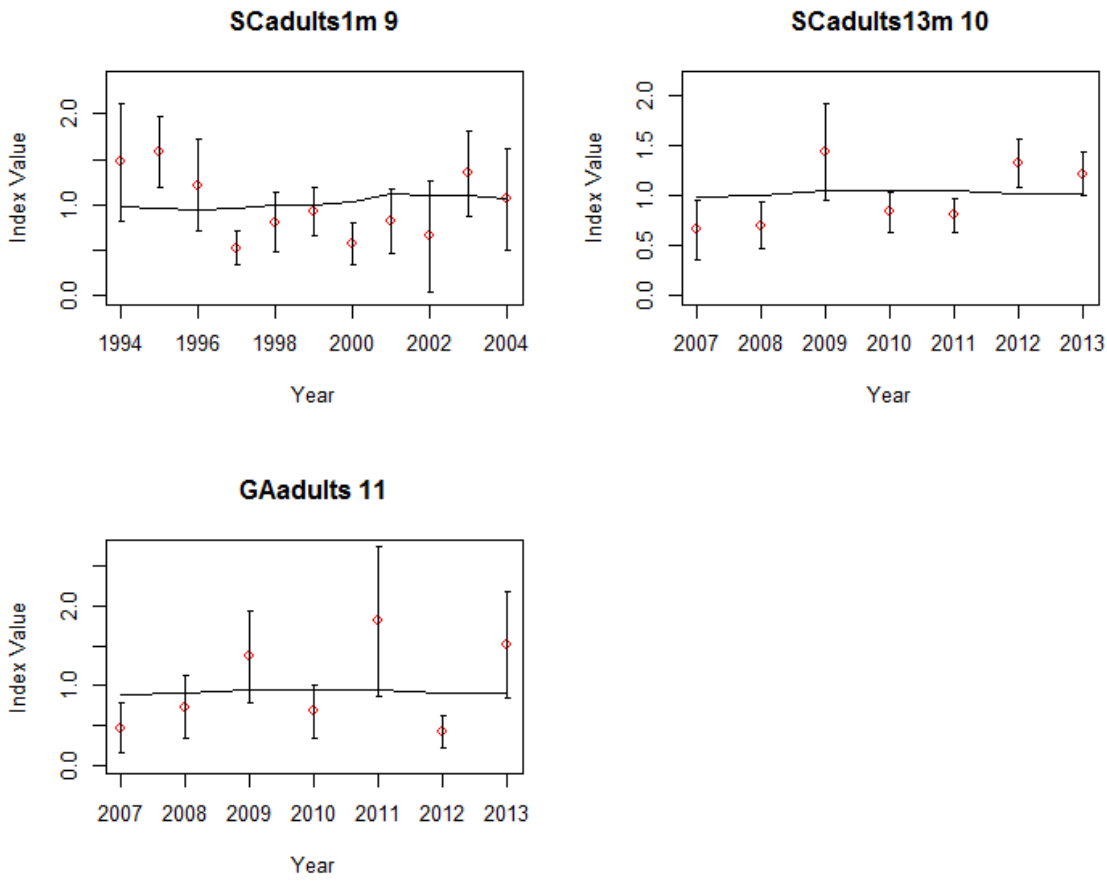

Figure 25 (con't). Index fits for the southern stock.

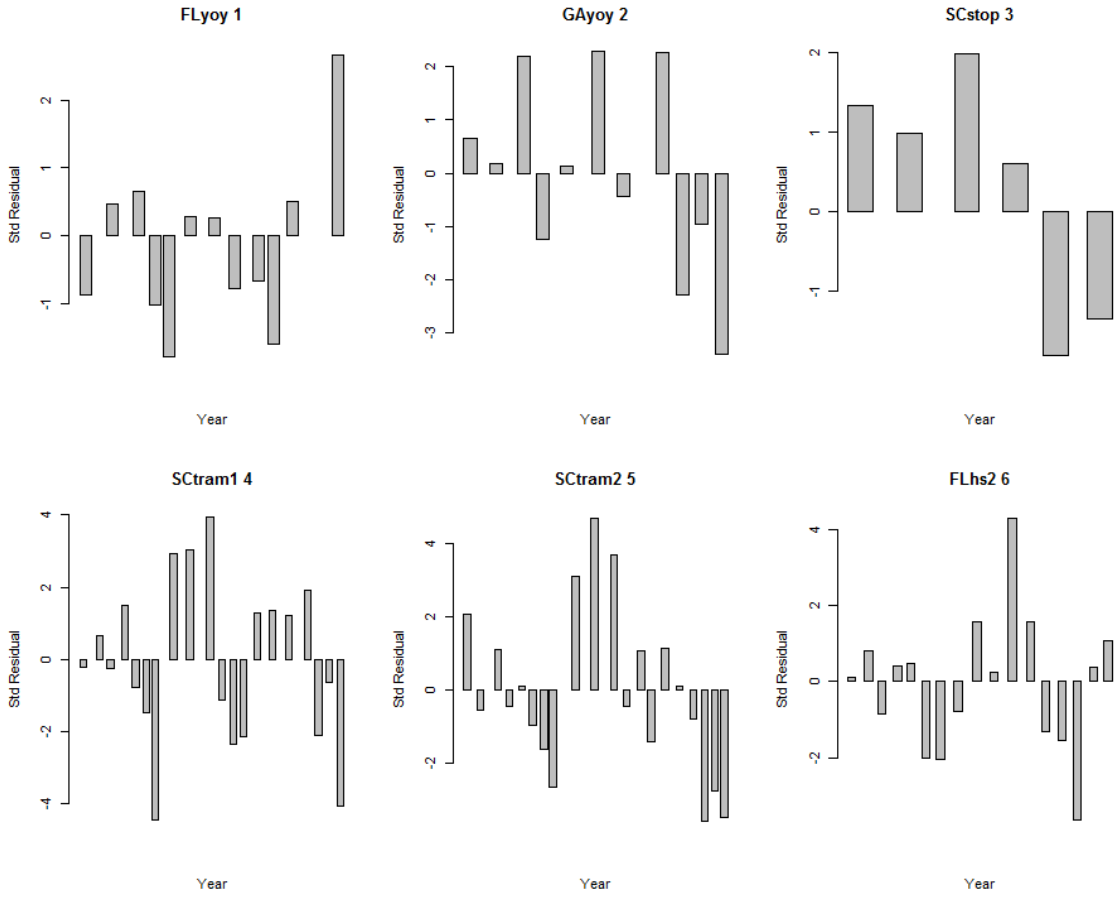

Figure 26. Standardized residuals for model fits to indices of abundance, by year, for the southern stock.

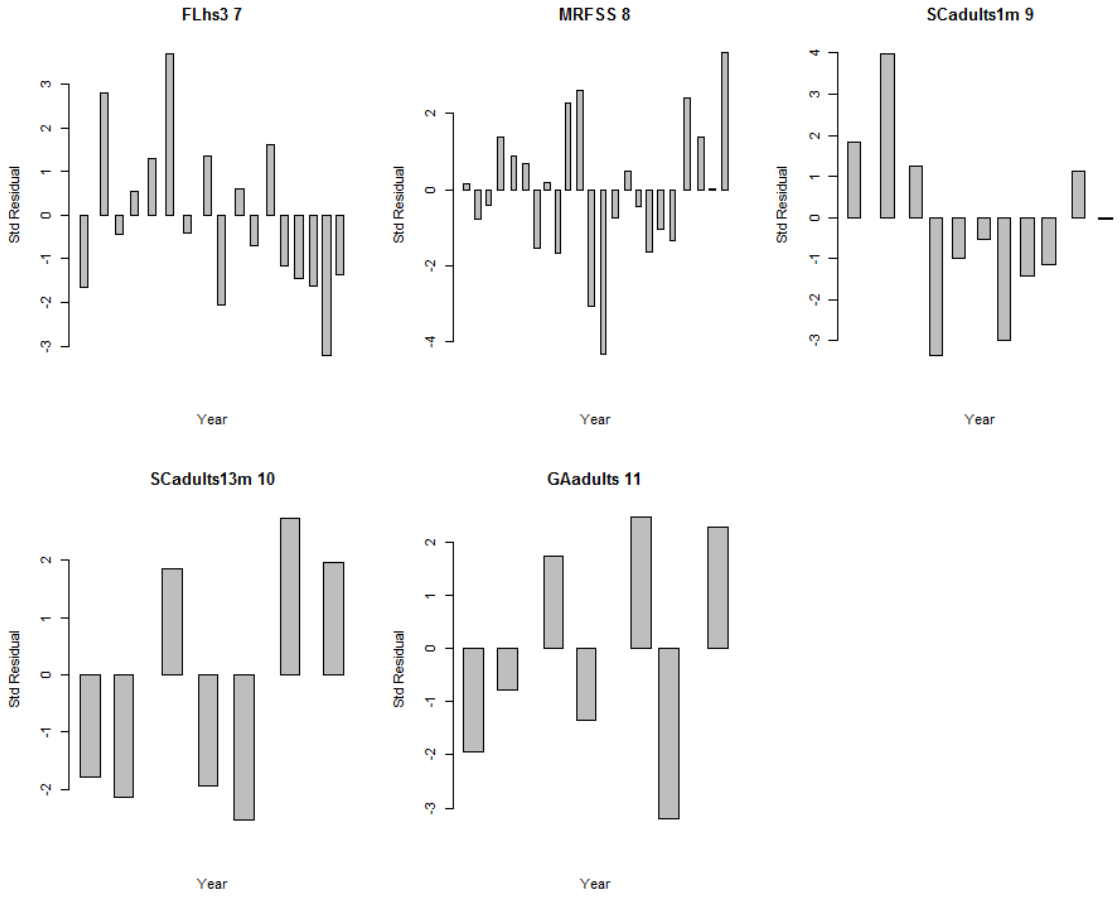

Figure 26 (con't). Standardized residuals for model fits to indices of abundance, by year, for the southern stock.

Figure 27. Predicted recruitment for the southern stock with 95% confidence intervals from asymptotic standard errors.

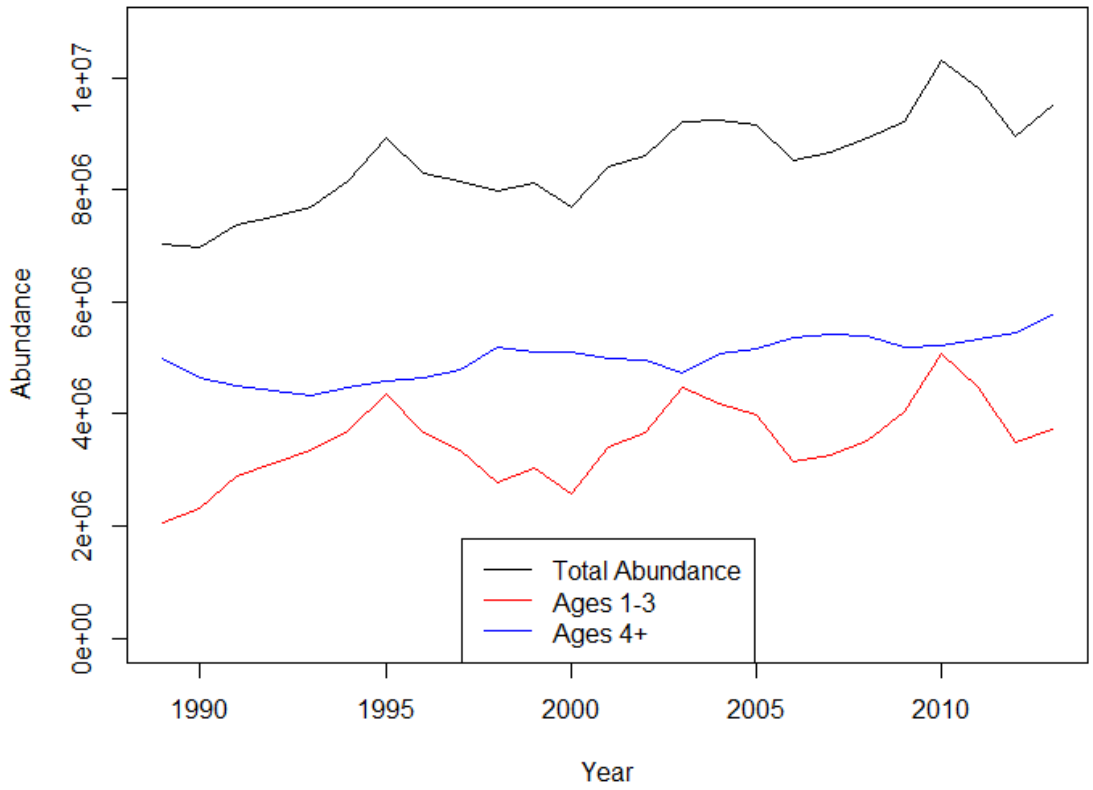

Figure 28. Abundance of red drum at various ages for the southern stock.

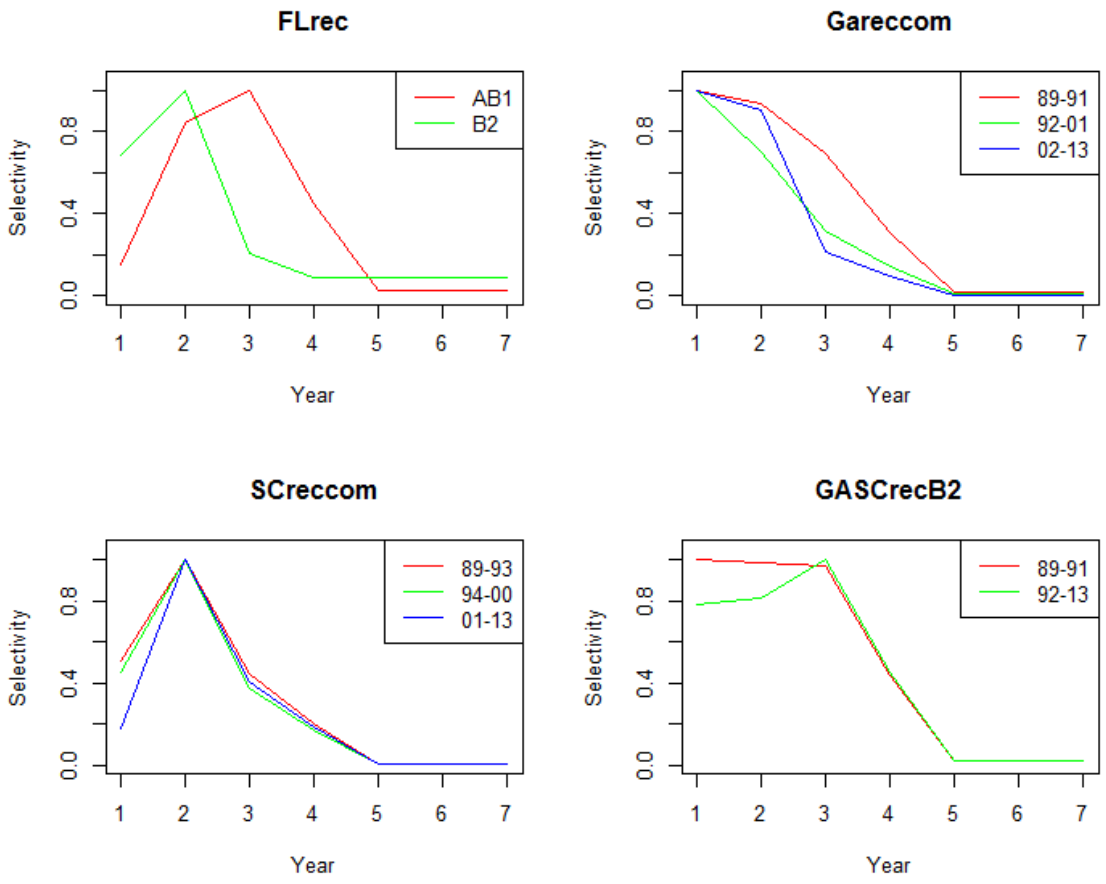

Figure 29. Selectivity curves for each fleet and selectivity block in the southern stock. The FL recreational live release selectivity is fixed based on external tagging analysis for North Carolina (Bacheler et al. 2008).

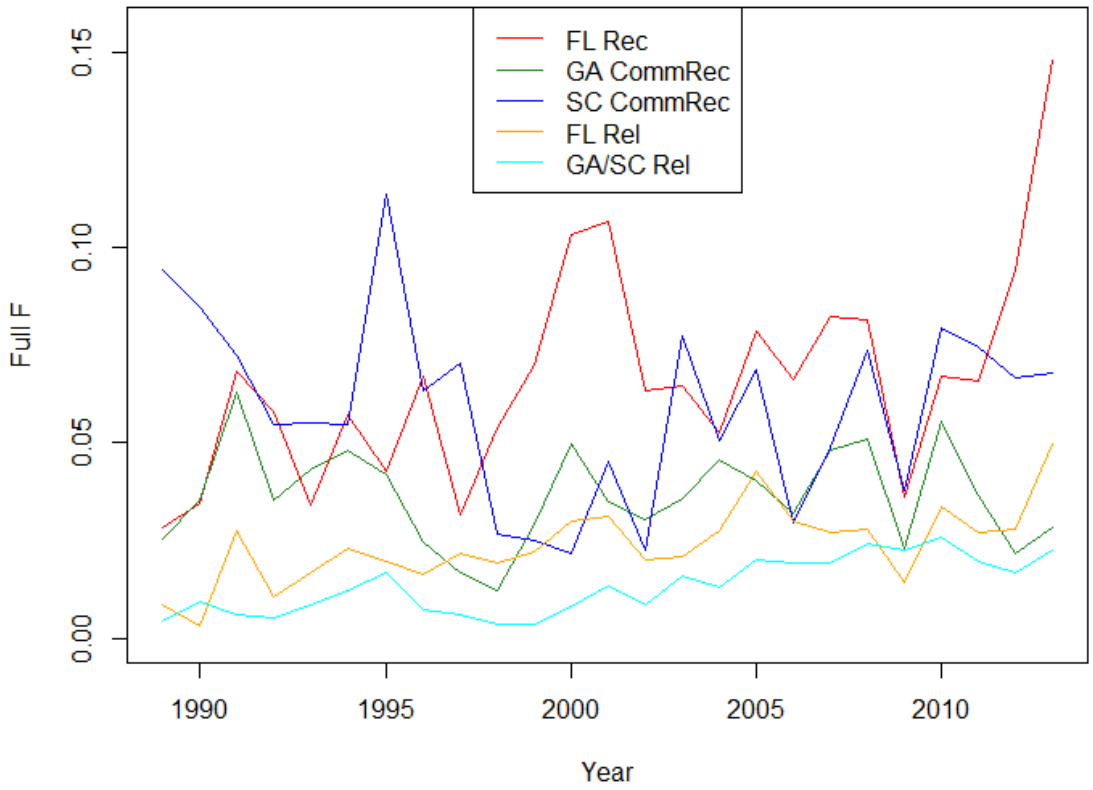

Figure 30. Fleet-specific annual fishing mortality for the southern stock.

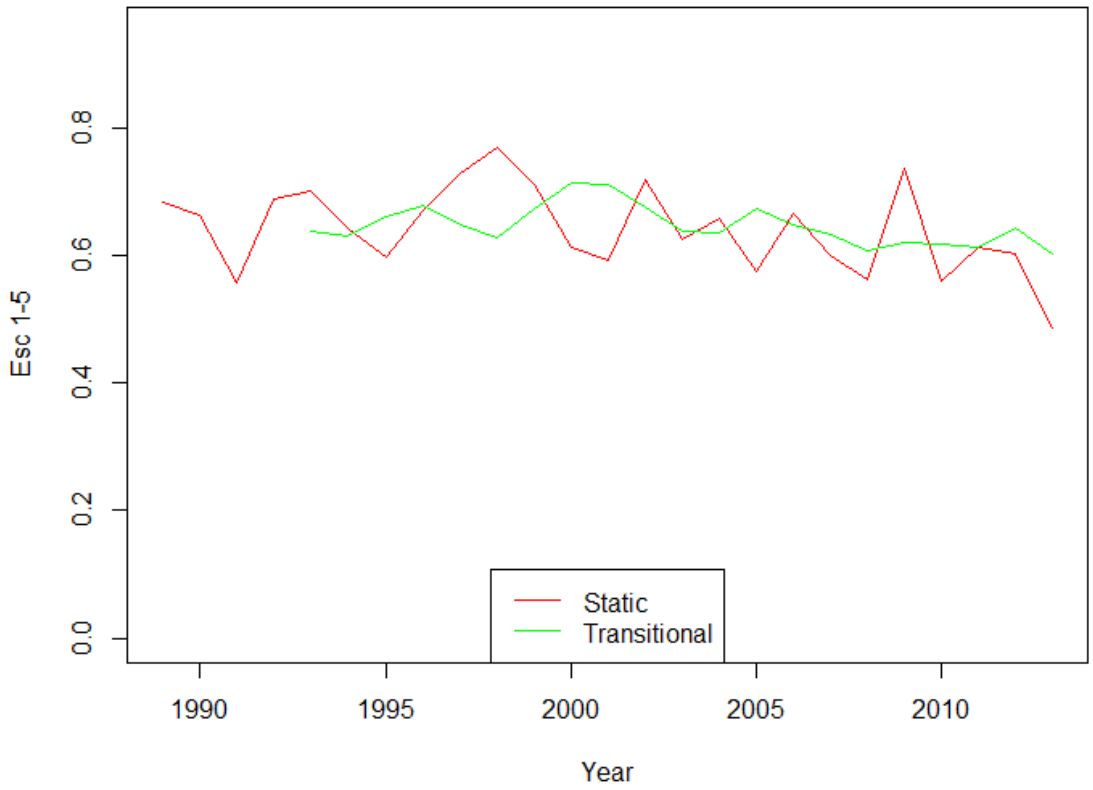

Figure 31. Estimates of static and transitional escapement for ages 1-5 for the southern stock.

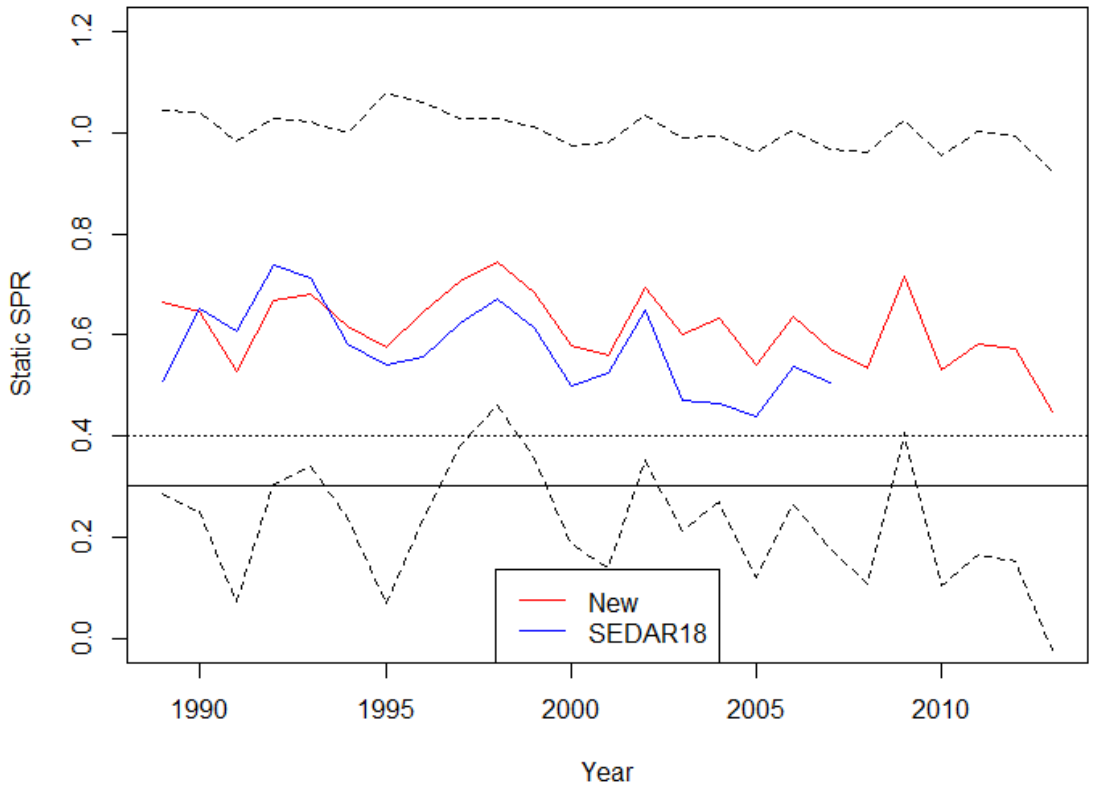

Figure 32. Annual sSPR estimates for the southern stock with 95% confidence intervals from asymptotic standard errors. Point estimates from the previous benchmark assessment (SEDAR18) are included for comparison. The target sSPR (dashed black line) is 40% and the threshold sSPR (solid black line) is 30%.

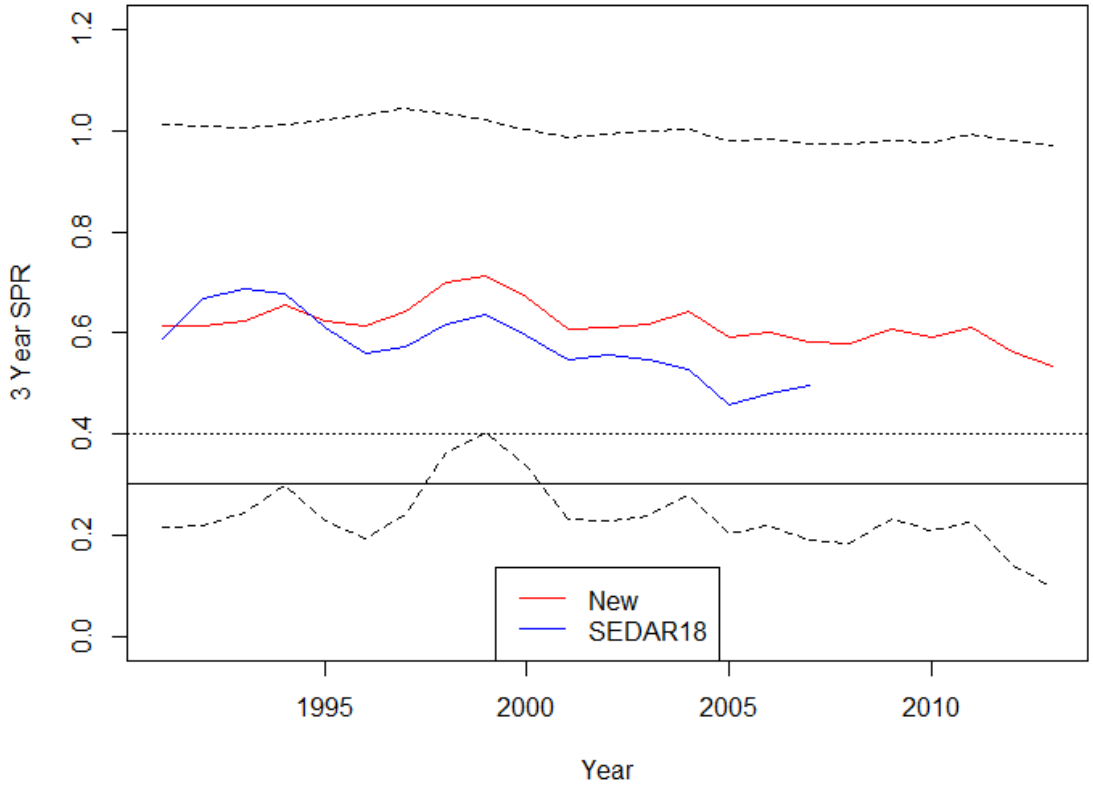

Figure 33. Three year average sSPR for the southern stock with 95% confidence intervals from asymptotic standard errors. Point estimates from the previous benchmark assessment (SEDAR18) are included for comparison. The target sSPR (dashed black line) is 40% and the threshold sSPR (solid black line) is 30%.

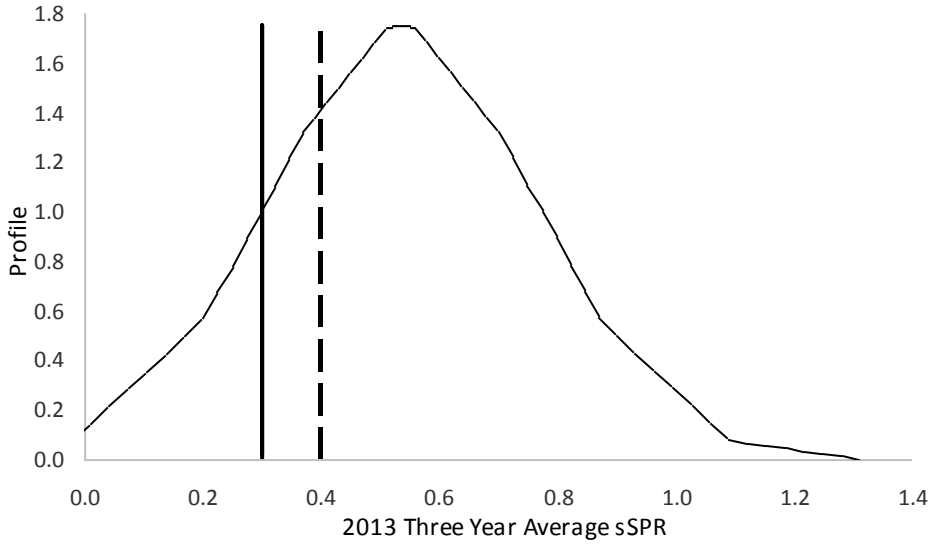

Figure 34. Estimated probability density function of the 2013 three year average sSPR for the southern stock. The target sSPR is 40% and the threshold sSPR is 30%.

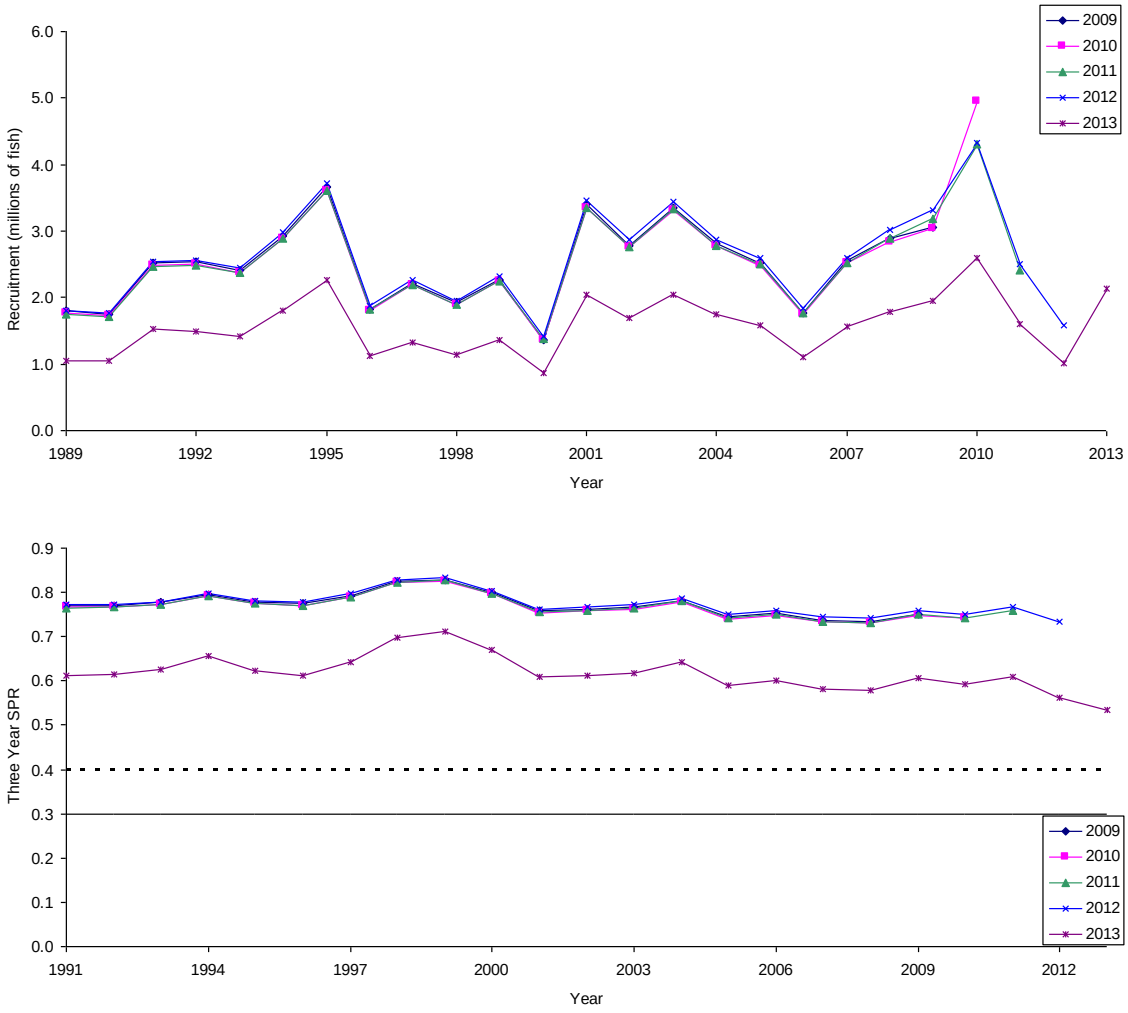

Figure 35. Five year retrospective analysis of the recruitment (top) and three year average sSPR (bottom) for the southern stock.

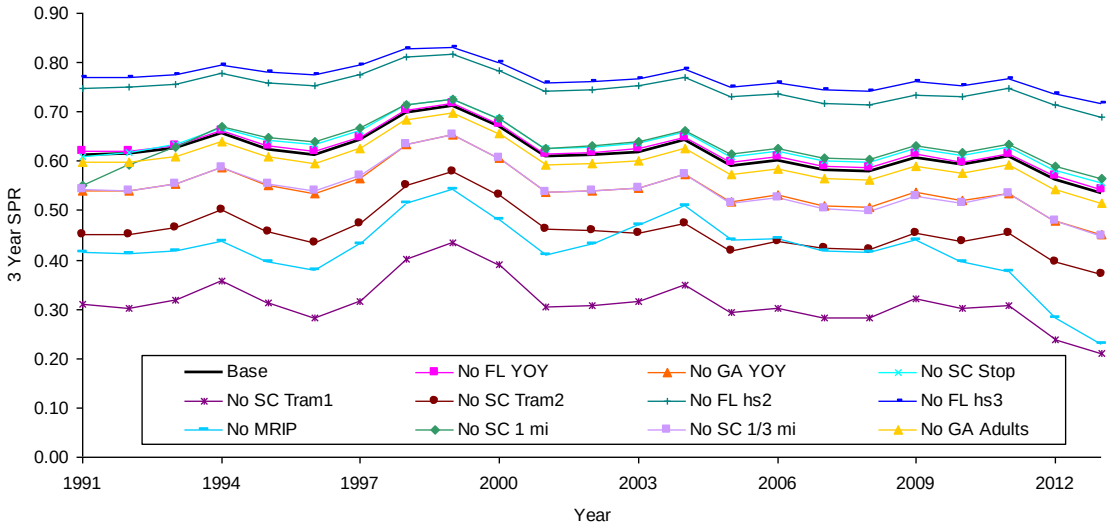

Figure 36. Comparison of the three year average sSPR for the southern stock when individual indices are removed.

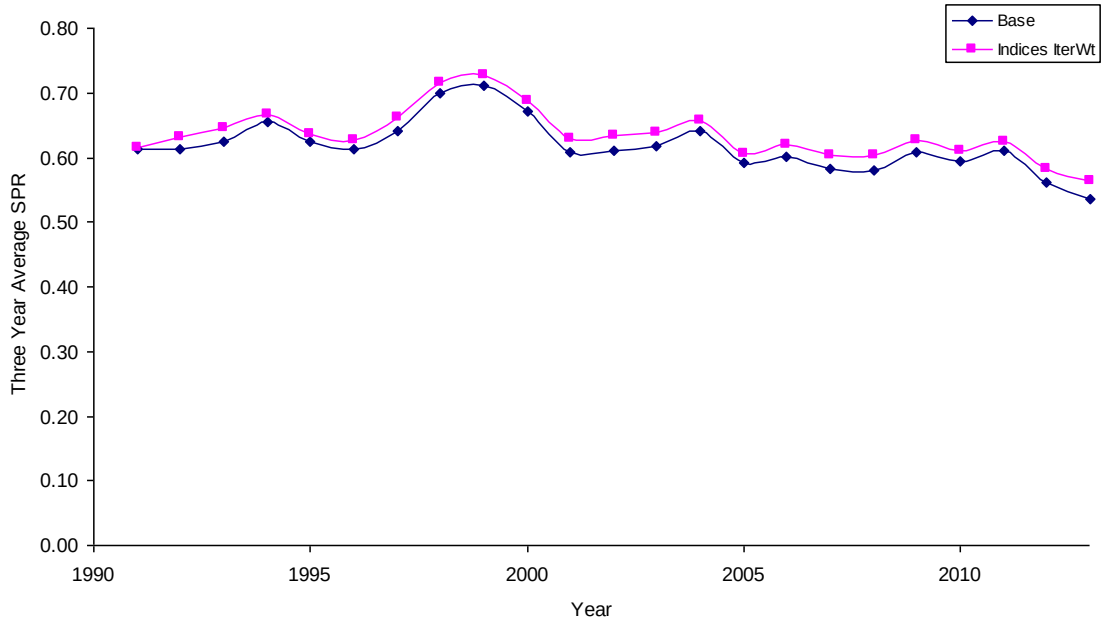

Figure 37. Comparison of the three year average sSPR for the southern stock for the base model and the iteratively reweighted model.

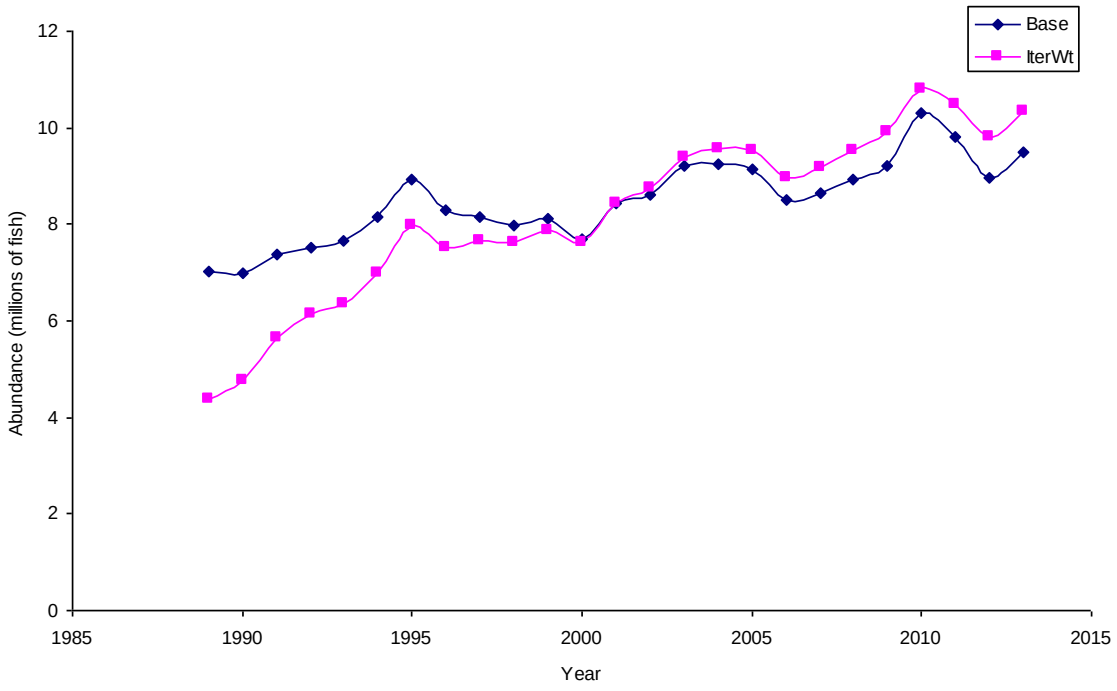

Figure 38. Comparison of the total abundance for the southern stock for the base model and the iteratively reweighted model.

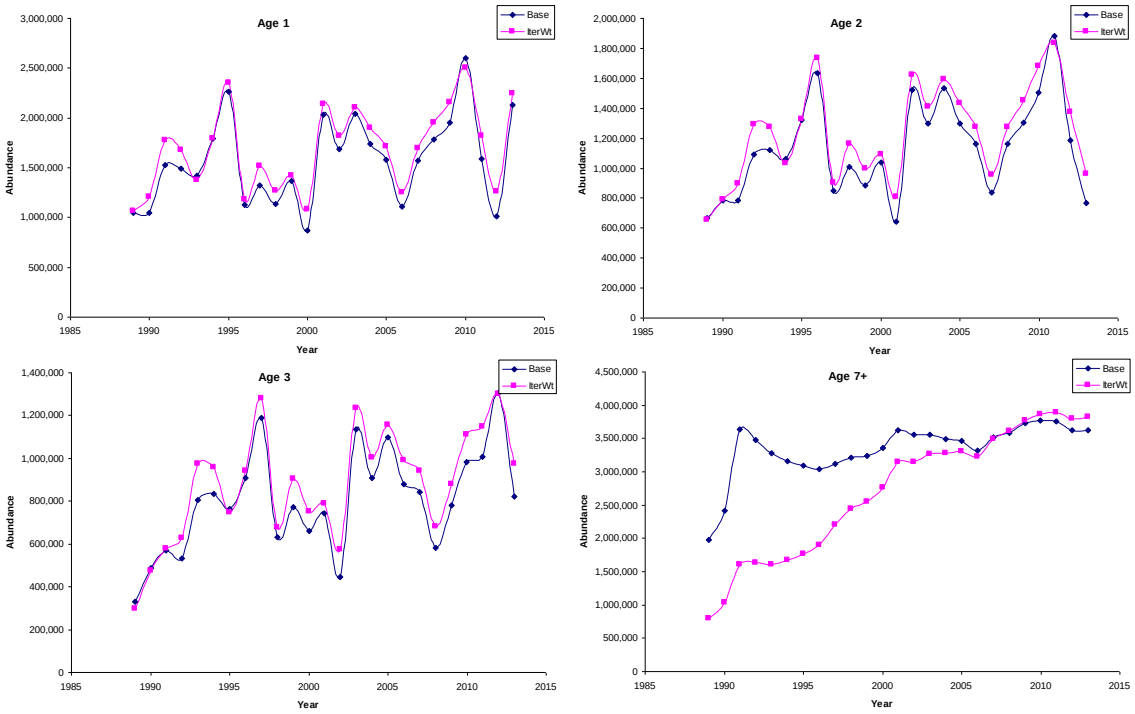

Figure 39. Comparison of the abundance for ages 1, 2, 3, and 7^{+} for the southern stock for the base model and the iteratively reweighted model.

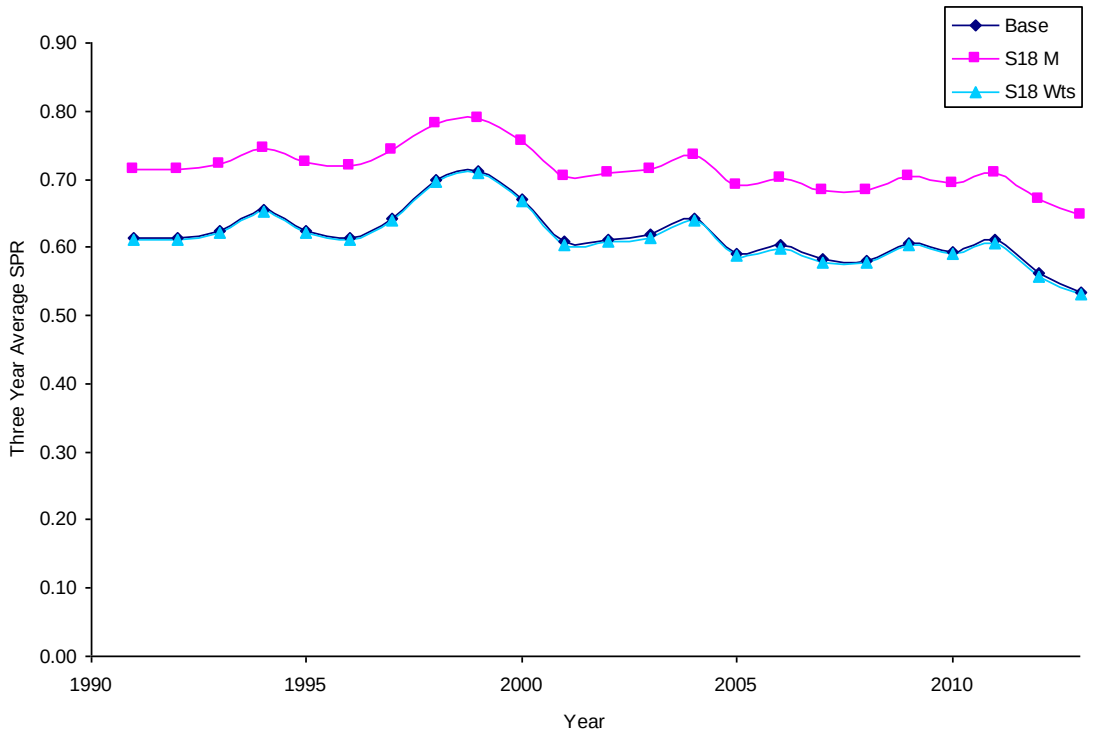

Figure 40. Comparison of the three year average sSPR for the southern stock for the base model, the model run using SEDAR18 estimates of M-at-age, and the model run using the SEDAR18 weights-at-age.

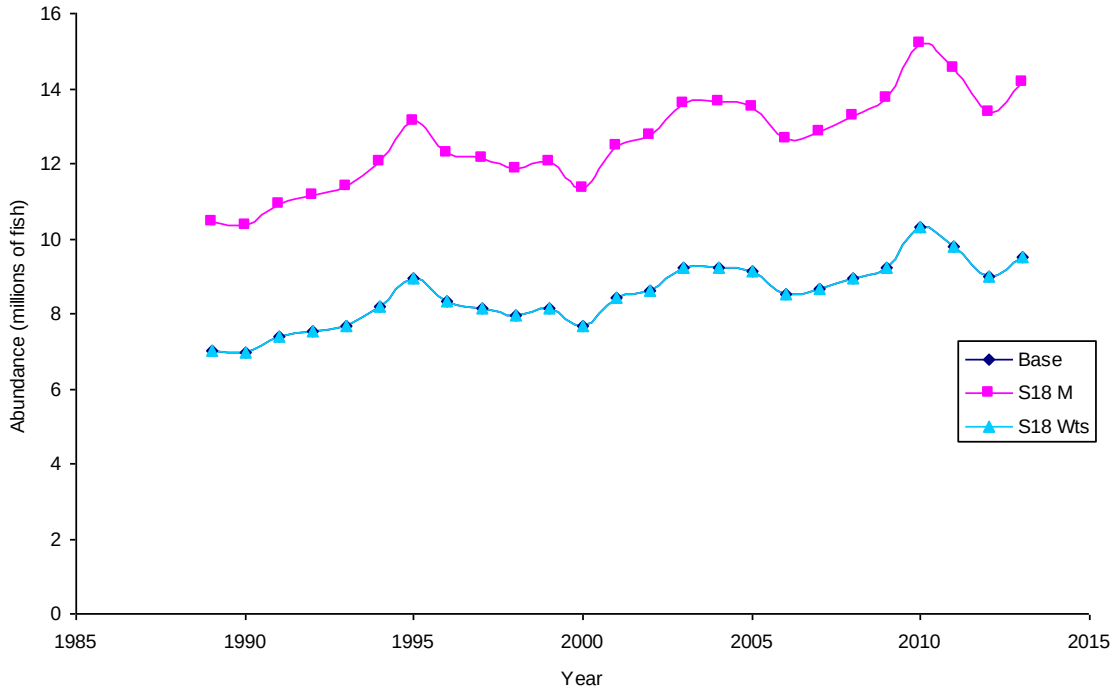

Figure 41. Comparison of the total abundance estimates for the southern stock for the base model, the model run using SEDAR18 estimates of M-at-age, and the model run using the SEDAR18 weights-at-age.

Appendix A. Model code and data inputs for the northern red drum stock assessment.

Model Code

```
TOP_OF_MAIN_SECTION
  //increase number of estimated parameters
  gradient_structure::set_NUM_DEPENDENT_VARIABLES(1000); // increasing number of parameters that can be
                        estimated to 1000 (default is 100 and must be changed if it will be exceeded)

DATA_SECTION  ////////////////////////////////////////////////////////////////////////
    !!USER_CODE ad_comm::change_datafile_name("n_base.dat");

//  init_int testing //toggle to turn on/off console output for testing, borrowed from spot code
 /////////// general dimensions and structural inputs ///////////
 // how many groups with separate fishing characteristics, fisheries?
  init_int nfleets

 // global first and last age used in the assesment
  init_int firstyr
   init_int lastyr


 // first and last years of catch data for each fishery
  init_ivector first_fyr(1,nfleets)
 init_ivector last_fyr(1,nfleets)

 // last year for tagging data
//  init_int last_tagyr

  // last year for tagging data likelihood
 //  init_int last_tag_likelihood

 // first and last age used in the assessment - last assumed plus group
  init_int firstage
   init_int lastage

 // last age that selectivity is estimated
  init_int last_sel_age

 // instantaneous natural mortality from firstage through lastage
  init_vector M(firstage,lastage)

 // selectivity blocks defined sequentially by fleet by year
  init_imatrix yr_sel_block(1,nfleets,first_fyr,last_fyr)

  /////////// observed data //////////
 // total landed catch for each fleet each year and its CV
  init_matrix obs_tot_catch(1,nfleets,first_fyr,last_fyr)
   init_matrix tot_catch_CVs(1,nfleets,first_fyr,last_fyr)

  // error debugging tools
   //  !! cout << tot_catch_CVs << endl;
   // !! exit(4);
```

```
// observed selectivity for northern live-release fishery over two
// defined time period
 init_matrix B2_select(1,3,firstage,lastage)

// additional non-landed catch that is subject to the hook-and-line
// release mortality (rel_mort)
 init_matrix tot_B2catch(1,nfleets,first_fyr,last_fyr)
  init_number rel_mort

// observed proportion at age for all 'observed' landings and  sampled live-releases
// and number of fish sampled for age each year associated with these observed proportions
 init_3darray obs_prop_at_age(1,nfleets,first_fyr,last_fyr,firstage,lastage)
  init_matrix agedN(1,nfleets,first_fyr,last_fyr)

   init_matrix kept_Fatage(1989,2004,1,4)  // northern tagging total F-at-age for all kept fisheries, rec and comm
    init_matrix kept_F_CVs(1989,2004,1,4)   // tagging total F-at-age CV's for kept fisheries

 init_vector fullF_B2rec(1989,2004)     // fully recruited F for live-release fishery
  init_vector fullF_CVs(1989,2004)      // CV for fully recruited F for live-release fishery

   // error debugging tools
   //  !! cout << fullF_CVs << endl;
  //  !! exit(4);

// number of indices used for relative abundance
 init_int n_ndx
// first and last year for each index
 init_ivector first_syr(1,n_ndx)
  init_ivector last_syr(1,n_ndx)
// first and last age included in index
 init_ivector first_sage(1,n_ndx)
  init_ivector last_sage(1,n_ndx)
// midpoint month for the survey
 init_vector survey_month(1,n_ndx)
// relative abundance by index for each year available
// and coefficient of variation
 init_matrix survey_ndx(1,n_ndx,first_syr,last_syr)
  init_matrix survey_CVs(1,n_ndx,first_syr,last_syr)

// temporary penalty for keeping early-solution-search-F up
 init_number F_brake

      // !! cout << n_ndx << endl;
      // !! exit(99);

// the weights set associated with the total catches, proportion at age, indices, tagFs
 init_ivector wt_choice(1,4)

 // matrix showing three columns - for weight (lbs), proportion mature, and natural mortality
 // for every age in the fishes life
 init_matrix wt_mat_M62(1,62,1,3)

 //init_number rewgt
 //
 //    init_vector sdnr_adj_C(1,nfleets)
 //    init_vector sdnr_adj_ndx(1,n_ndx)
```

```
   //  !! cout << wt_mat_M62 << endl;
   //  !! exit(99);

// file names for the different weighting schemes referred to in wt_choice variable
  // total catch weights
 !!USER_CODE ad_comm::change_datafile_name("n0_TC.wts");
   init_matrix totcatch_wt(1,3,1,nfleets)

  // PAA wts
 !!USER_CODE ad_comm::change_datafile_name("n0_PAA.wts");
    init_3darray PAA_wt(1,2,1,nfleets-1,firstyr,lastyr)

  // Index wts
 !!USER_CODE ad_comm::change_datafile_name("n0_Ndx.wts");
   init_matrix indx_wt(1,3,1,n_ndx)

  // TagF wts
 !!USER_CODE ad_comm::change_datafile_name("n0_tagF.wts");
   init_matrix tagF_wt(1,2,1,2)
 ////////////////////////////////////////////////////////////////////////////////

 // various statistics and manipulations of the input data
   ivector nselblocks(1,nfleets)
   int k
   number tot
   vector ave_obstC(1,nfleets)
   vector ave_obsNdx(1,n_ndx)
   matrix ave_obsPAA(1,nfleets,firstage,lastage)
   vector ave_obsFkept(1,4)
   number ave_obsFrelease
   matrix stdevPAA(1,nfleets,firstage,lastage)
LOCAL_CALCS
  for(ifleet=1;ifleet<=nfleets;ifleet++)
   {
   // how many 'selectivity blocks' are there for each fishery?
   nselblocks(ifleet) = yr_sel_block(ifleet,last_fyr(ifleet));
   }
    // special calculation for the norther rec live-release fisheries -- fleet=4 -- to calculate total kill
   for (iyr=first_fyr(4);iyr<=last_fyr(4);iyr++)
    {
    obs_tot_catch(4,iyr) = tot_B2catch(4,iyr) * (rel_mort);
    }

  // calculate various mean observed values to use in the total sum of squares [TSS = sum of squares
  //  for (mean-observed)/stdev(observed)], though this did not appear to be very helpful for
  //  'goodness of fit' evaluation where residual sum of squares [RSS = sum of squares for (observed-predicted)
  //   /stdev(observed)] was confounded by multidimensionaity of problem.

     // total catch
    for(ifleet=1;ifleet<=nfleets;ifleet++)
     {
     k = 0;
     tot=0;
    for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
      {
      k++;
      tot += log(obs_tot_catch(ifleet,iyr)+1e-6);
      }
```

```
    ave_obstC(ifleet) = tot/double(k);
   }

  // indices
 for (indx=1;indx<=n_ndx;indx++)
 {
  k = 0;
  tot=0;
  for(iyr=first_syr(indx);iyr<=last_syr(indx);iyr++)
  {
   if(survey_ndx(indx,iyr)>0)
    {
                k++;
                tot += log(survey_ndx(indx,iyr)+1.e-6);
     }
  }
  ave_obsNdx(indx) = tot/double(k);
 }

   //PAA -- this is a strech for 0.0-1.0 bound number      ---- remember fleet 4 doesn't count
for (ifleet=1;ifleet<=nfleets-1;ifleet++)
{
 for (iage=firstage;iage<=lastage;iage++)
  {
   k = 0;
   tot=0;
  for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
   {
   k++;
   tot += obs_prop_at_age(ifleet,iyr,iage)+1.e-6;
   }
 ave_obsPAA(ifleet,iage) = tot/double(k);
  }
}

// what is the standard deviation of observed PAA across years for each fleet and age?
  for (ifleet=1;ifleet<=nfleets-1;ifleet++)
  {
   for (iage=firstage;iage<=lastage;iage++)
    {
     k = 0;
     tot=0;
     for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
      {
      k++;
      tot += square( obs_prop_at_age(ifleet,iyr,iage)-ave_obsPAA(ifleet,iage) );
      }
     stdevPAA(ifleet,iage) = sqrt( tot/(double(k)-1)  );
     }
   }

  // kept F-at-age
  for (iage=1;iage<=4;iage++)
   {
    k = 0;
    tot=0;
    for (iyr=1989;iyr<=2004;iyr++)
     {
```

```
        k++;
        tot += log(kept_Fatage(iyr,iage)+1.e-6);
        }
      ave_obsFkept(iage) = tot/double(k);
      }

  // Fully recruited Frelease

     k = 0;
     tot=0;
    for (iyr=1989;iyr<=2004;iyr++)
     {
     k++;
     tot += log(fullF_B2rec(iyr));
     }
    ave_obsFrelease = tot/double(k);
END_CALCS


  // initialize various counters and temporary integers
  int sel_count
  int ifleet
  int iyr
  int iage
  int indx
  int i
  int j
  int ndx_n
  int PAA_n
  int PAA_n2
  int tC_n
  int kept_n
  int fullF_n

PARAMETER_SECTION  ////////////////////////////////////////////////////////////////////////////
 // NOTE: for convenience number of selectivities is hardwired -- does not include fleet=4, north live-release fishery
 //      when tag-based selectivity used is used ////////////////////////////not using tag-based selectivity for fleet 4
                    now //reverted back for continuity

    init_bounded_number sel04(-10.,10.,5)
    init_bounded_number sel05(-10.,10.,5)

   // init_bounded_number sel04b2(-10.,10.,5)
   // init_bounded_number sel05b2(-10.,10.,5)

  //----in get_selectivity function
 //Parameter: selectivities
  init_bounded_dev_vector fill_log_sel(1,27,-5,5,5)
   3darray log_sel(1,nfleets,1,nselblocks,firstage,lastage)
   matrix max_log_sel(1,nfleets,1,nselblocks)

 //----in get_mortality_rates function----
 //Parameter: fully recruited F's
  init_bounded_matrix log_Fmult(1,nfleets,first_fyr,last_fyr,-15,2,3)
   3darray log_Ffleet(1,nfleets,first_fyr,last_fyr,firstage,lastage)
   matrix Z(firstyr,lastyr,firstage,lastage)
   matrix tot_F(firstyr,lastyr,firstage,lastage)
```

```
//----in get_number_at_age function
//Parameters: median initial abundance ages 2-7+ and deviations from this for each age
//  init_bounded_number log_initN(8,25,1)
//  init_bounded_dev_vector log_initN_devs(firstage+1,lastage,-10,10,2)
    init_bounded_vector log_initN(firstage+1,lastage,2,18,1)

    matrix log_N(firstyr,lastyr,firstage,lastage)

 //Parameters: median recruitment by year and deviations from this for each year
// init_bounded_number log_R(8,25,1)
// init_bounded_dev_vector log_recruit_devs(firstyr,lastyr,-10,10,1)
//     vector log_recruits(firstyr,lastyr)
       init_bounded_vector log_recruits(firstyr,lastyr,5,18,1)

//----in calculate_catch function
    3darray C(1,nfleets,first_fyr,last_fyr,firstage,lastage)
    //matrix pred_catch(1,nfleets,first_fyr,last_fyr)
    sdreport_matrix pred_catch(1,nfleets,1989,2013) //////////////years have to be hard-wired for the sdreport for
                    some reason

//---- evaluate the objective function
        // indices
 //Parameter: catchability coefficient for each index
 matrix EffN(1,nfleets,first_fyr,last_fyr)
 matrix resid_ndx(1,n_ndx,first_syr,last_syr)
 matrix residmean_ndx(1,n_ndx,first_syr,last_syr)
      matrix resid_ndx2(1,n_ndx,first_syr,last_syr)
      matrix residmean_ndx2(1,n_ndx,first_syr,last_syr)
 matrix pred_ndx(1,n_ndx,first_syr,last_syr)
 vector stdev_ndx(1,n_ndx)
 vector neglogLL_ndx(1,n_ndx)
 number ndx_f
       // PAA
 3darray resid_PAA(1,nfleets,first_fyr,last_fyr,firstage,lastage)
 3darray residmean_PAA(1,nfleets,first_fyr,last_fyr,firstage,lastage)
      // fake residuals
      3darray resid_PAA2(1,nfleets,first_fyr,last_fyr,firstage,lastage)
      3darray residmean_PAA2(1,nfleets,first_fyr,last_fyr,firstage,lastage)
 vector stdev_PAA(1,nfleets-1)
 matrix neglogLL_PAA(1,nfleets,first_fyr,last_fyr)
 number PAA_f
       // total catch
 matrix resid_tC(1,nfleets,first_fyr,last_fyr)
 matrix residmean_tC(1,nfleets,first_fyr,last_fyr)
    matrix resid_tC2(1,nfleets,first_fyr,last_fyr)
    matrix residmean_tC2(1,nfleets,first_fyr,last_fyr)
 vector stdev_tC(1,nfleets)
 vector neglogLL_tC(1,nfleets)
         vector numerat(1,n_ndx)
         vector denomin(1,n_ndx)
         init_bounded_vector log_q_MLE(1,n_ndx,-18,-5,4)
 number tC_f
       //  kept F at age
 matrix pred_kept_Fatage(1989,2004,1,4)
 matrix resid_kept(1989,2004,1,4)
 matrix residmean_Fkept(1989,2004,1,4)
  matrix resid_kept2(1989,2004,1,4)
  matrix residmean_Fkept2(1989,2004,1,4)
```

```
  number stdev_kept
  vector neglogLL_kept(1989,2004)
  number kept_f
        //  fullF B2
  vector resid_fullF_B2(1989,2004)
  vector residmean_Frelease(1989,2004)
     vector resid_fullF_B22(1989,2004)
     vector residmean_Frelease2(1989,2004)
  number stdev_fullF
  number neglogLL_fullF
  number fullF_f

  // define some intermediate calculation
  number temp
  number temp2
  number avg_F
  number F_brake_penalty

    // Benchmark stuff
    // including spawning stock biomass under fishing and under no fishing,
    // spawning potential ratio, and various escapement estimates
    vector SSB_F(firstyr,lastyr)
    vector SSB_F0(firstyr,lastyr)
      number F_survival
      number F0_survival
    //vector escapement13(firstyr,lastyr)
    // vector escapement15(firstyr,lastyr)
       //transitional
    //   vector tEsc15(firstyr+4,lastyr)
     //  vector tEsc13(firstyr+2,lastyr)

    number Nu

  objective_function_value f

    sdreport_vector log_total_abundance(firstyr,lastyr)
    sdreport_vector log_N1(firstyr,lastyr)
    sdreport_vector log_N2(firstyr,lastyr)
    sdreport_vector log_N3(firstyr,lastyr)
    sdreport_vector log_Nplus(firstyr,lastyr)
    sdreport_vector expl13(firstyr,lastyr)
    sdreport_vector static_SPR(firstyr,lastyr)
    sdreport_vector three_yrSPR(firstyr+2,lastyr)
                    sdreport_vector escapement13(firstyr,lastyr)
    sdreport_vector escapement15(firstyr,lastyr)
                    sdreport_vector tEsc15(firstyr+4,lastyr)
    sdreport_vector tEsc13(firstyr+2,lastyr)

    likeprof_number three_yrSPR2013

PROCEDURE_SECTION ////////////////////////////////////////////////////////////////////////
 get_selectivities();
// if (testing==1) cout << "End get_selectivities()" << endl;
 get_mortality_rates();
// if (testing==1) cout << "End get_mortality_rates()" << endl;
 get_numbers_at_age();
// if (testing==1) cout << "End get_numbers_at_age()" << endl;
 calculate_catch();
```

```
 // if (testing==1) cout << "End calculate_catch()" << endl;
  evaluate_the_objective_function();
//  if (testing==1) cout << "End evaluate_the_objective_function()" << endl;
//  if (testing==1) cout << "Procedure section completed first cycle, now exiting"<< endl;
//  if (testing==1) exit(1); //exit if in testing phase -- runs model at initial parameter values

  // static spawning potential ratio, and various escapement rate estimates
   // calculate spawning stock biomass per recruit with current year's fishing and without any F
    for(iyr=firstyr;iyr<=lastyr;iyr++)
     {
                    F_survival = mfexp( -1. * (wt_mat_M62(1,3)+tot_F(iyr,1)) );
                    F0_survival = mfexp(-1. * wt_mat_M62(1,3));
                     SSB_F(iyr) = wt_mat_M62(1,2)*wt_mat_M62(1,1)*F_survival;
                     SSB_F0(iyr) = wt_mat_M62(1,2)*wt_mat_M62(1,1)*F0_survival;

      for(iage=firstage+1;iage<=lastage;iage++)
       {

                     F_survival *= mfexp( -1.* (wt_mat_M62(iage,3)+tot_F(iyr,iage)) );
                     F0_survival *= mfexp(-1.* wt_mat_M62(iage,3));
        SSB_F(iyr) += wt_mat_M62(iage,2)*wt_mat_M62(iage,1)*F_survival;
                      SSB_F0(iyr) += wt_mat_M62(iage,2)*wt_mat_M62(iage,1)*F0_survival;
       }
      for(iage=lastage+1;iage<61;iage++)
       {
                    F_survival *= mfexp( -1.* (wt_mat_M62(iage,3)+tot_F(iyr,lastage)) );
                    F0_survival *= mfexp(-1.* wt_mat_M62(iage,3));
        SSB_F(iyr) += wt_mat_M62(iage,2)*wt_mat_M62(iage,1)*F_survival;
                      SSB_F0(iyr) += wt_mat_M62(iage,2)*wt_mat_M62(iage,1)*F0_survival;
       }
      //Infinite Series Correction added 7/19/16 (Mike Murphy's recommendation)
      F_survival *= mfexp(-1.* (wt_mat_M62(iage,3)+tot_F(iyr,lastage)))/(1.-mfexp(-
                   1.*(wt_mat_M62(iage+1,3)+tot_F(iyr,lastage))));
                    F0_survival *= mfexp(-1.* wt_mat_M62(iage,3))/(1.-mfexp(-1.*(wt_mat_M62(iage+1,3))));

      SSB_F(iyr) += wt_mat_M62(iage,2)*wt_mat_M62(iage,1)*F_survival;
                     SSB_F0(iyr) += wt_mat_M62(iage,2)*wt_mat_M62(iage,1)*F0_survival;

       // static SPR and static (year-specific) escapement rates
       static_SPR(iyr) = SSB_F(iyr)/SSB_F0(iyr);
       escapement13(iyr) = mfexp(-1.* tot_F(iyr,1)-tot_F(iyr,2)-tot_F(iyr,3));
       escapement15(iyr) = mfexp(-1.* tot_F(iyr,1)-tot_F(iyr,2)-tot_F(iyr,3)-tot_F(iyr,4)-tot_F(iyr,5));

        // transitional (yearclass-specific) escapement rates
        if(iyr>1992)
         {
          tEsc15(iyr) = mfexp( -1.* tot_F(iyr-4,1)-tot_F(iyr-3,2)-tot_F(iyr-2,3)-tot_F(iyr-1,4)-tot_F(iyr,5) );
         }
        if(iyr>1990)
         {
          tEsc13(iyr) = mfexp( -1.* tot_F(iyr-2,1)-tot_F(iyr-1,2)-tot_F(iyr,3) );
         }
    }

    log_total_abundance=log(rowsum(mfexp(log_N)));

   for(iyr=firstyr;iyr<=lastyr;iyr++)
     {
```

```
        log_N1(iyr) = log_N(iyr,1);
        log_N2(iyr) = log_N(iyr,2);
        log_N3(iyr) = log_N(iyr,3);
        log_Nplus(iyr) = log_N(iyr,7);
        // catch across fleets
          temp=0.;
          for(ifleet=1;ifleet<=nfleets;ifleet++)
            {
            temp += C(ifleet,iyr,1)+C(ifleet,iyr,2)+C(ifleet,iyr,3);
            }
        expl13(iyr) = temp/( mfexp(log_N1(iyr))+mfexp(log_N2(iyr))+mfexp(log_N3(iyr)) );
          if(iyr>1990)
            {
            three_yrSPR(iyr) = ( static_SPR(iyr-2)+static_SPR(iyr-1)+static_SPR(iyr) )/3.;
            }
        }

        three_yrSPR2013 = ( static_SPR(2013-2)+static_SPR(2013-1)+static_SPR(2013) )/3.;

//  outputMCMC();
    // cout <<  log_Nplus  << endl;
   //  exit(99);

   ////////////////////////// Begin Population Dynamics Model ////////////////////////////////
FUNCTION get_selectivities

 //----selectivity is not described parametrically but assumed constant above some maximum age
 //----the following simply fills out the array of candidate selectivities to be evaluated
 //----in the end it is standardized to the largest selectivity

  sel_count=0;  //remember first age is one;
  for (ifleet=1;ifleet<=nfleets-1;ifleet++)
      {
       for (i=1;i<=yr_sel_block(ifleet,last_fyr(ifleet));i++)
        {

          // fill log_sel matrix using bounded vector
          for (iage=firstage;iage<=last_sel_age;iage++)
           {
           sel_count++;
           log_sel(ifleet,i,iage) = fill_log_sel(sel_count);
           }
           max_log_sel(ifleet,i) = max(log_sel(ifleet,i));

          // standardize relative to this maximum
          for (iage=firstage;iage<=last_sel_age;iage++)
           {
           log_sel(ifleet,i,iage) =  log_sel(ifleet,i,iage)-max_log_sel(ifleet,i);
           }

           // Special: for red drum, we assume that the selectivity drops after last estimated age
           // if(ifleet<4)
           //   {
            log_sel(ifleet,i,last_sel_age+1) = log_sel(ifleet,i,last_sel_age)+log(1/(1+exp(-1.*sel04)));
            log_sel(ifleet,i,last_sel_age+2) = log_sel(ifleet,i,last_sel_age)+log(1/(1+exp(-1.*sel05)));
            //   }
            //if(ifleet==4)
            //   {
```

```
          // log_sel(ifleet,i,last_sel_age+1) = log_sel(ifleet,i,last_sel_age)+log(1/(1+exp(-1.*sel04b2)));
          // log_sel(ifleet,i,last_sel_age+2) = log_sel(ifleet,i,last_sel_age)+log(1/(1+exp(-1.*sel05b2)));
          //    }

         // selectivity for older ages is set equal to oldest-aged selectivity
         for (iage=last_sel_age+3;iage<=lastage;iage++)
          {
          log_sel(ifleet,i,iage) = log_sel(ifleet,i,last_sel_age+2);
          }
       }
      }

       // Special: for the northern live-release fishery selectivites are 'observed data'
       ifleet = 4; ////////////////////////////////////////////////////commented out
       for (i=1;i<=yr_sel_block(ifleet,last_fyr(ifleet));i++) ////////////////////////////////////////////////////commented out
        { ////////////////////////////////////////////////////commented out
          for (iage=firstage;iage<=lastage;iage++)////////////////////////////////////////////////////commented out
          { ////////////////////////////////////////////////////commented out
          log_sel(ifleet,i,iage) = log(B2_select(i,iage));   ////////////////////////////////////////////////////commented out
           } ////////////////////////////////////////////////////commented out
        } ////////////////////////////////////////////////////commented out

    // use the B2's from tagging for 1998-2004

//   if(current_phase()==3)
//    {
//    cout << "no. fleets " << nfleets << endl;
//    cout << " selblocks by year,fleet " << endl;
//    cout << yr_sel_block << endl;
//    cout << mfexp(log_sel) << endl;
//    exit(99);
//    }

FUNCTION get_mortality_rates

 //----age-specific fishing mortalities is derived using estimated selectivities and year-specific F----

 for (ifleet=1;ifleet<=nfleets;ifleet++)
  {
  // fill out the fleet-, year-, age-specific F's
  for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
    {
    for (iage=firstage;iage<=lastage;iage++)
     {
     log_Ffleet(ifleet,iyr,iage)=log_Fmult(ifleet,iyr)+log_sel(ifleet,yr_sel_block(ifleet,iyr),iage);
     }
    }
  }

 // --- calculate instantaneous total mortality for convenience later
 // allow for variable M with age

     // calculate the total fishing mortality across all fisheries each year
     //remember not all years have all fleets operating -- sum available F's
     tot_F=0.0;
    for (ifleet=1;ifleet<=nfleets;ifleet++)
     {
     for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
```

```
      {
      for (iage=firstage;iage<=lastage;iage++)
       {
       tot_F(iyr,iage) += mfexp(log_Ffleet(ifleet,iyr,iage));
       }
      }
     }

   // calculate Z's
  for (iyr=firstyr;iyr<=lastyr;iyr++)
   {
     Z(iyr) = M;
      for (iage=firstage;iage<=lastage;iage++)
       {
        Z(iyr,iage) += tot_F(iyr,iage);
       }
   }

  //  if(current_phase()==3)
  //  {
   // cout << "no. fleets " << nfleets << endl;
  //  cout << " selblocks by year,fleet " << endl;
  //  cout << yr_sel_block << endl;
  //  cout << Z << endl;
  //  cout << tot_F << endl;
  //  exit(99);
 //   }


FUNCTION get_numbers_at_age

   // This fills parameter estimates for initial N's or top row and
   // numbers-at-age-1 (recruits) or left column in N-at-age matrix

  // initial year's abundance for ages-2 to 7+
  //   for (iage=firstage+1;iage<=lastage;iage++)
  //   {
  //                     if (active(log_initN_devs))
  //                       {
  //     log_N(firstyr,iage)=log_initN+log_initN_devs(iage);
  //       }
  //     else
  //       {
  //     log_N(firstyr,iage)=log_initN;
  //       }
  //  }

     // initial year's abundance for ages-2 to 7+
   for (iage=firstage+1;iage<=lastage;iage++)
   {
      log_N(firstyr,iage)=log_initN(iage);
   }

   // all year's recruitment or beginning-of-the-year abundance of age-1
   // for (iyr=firstyr;iyr<lastyr;iyr++)
   //  {
   //                    if (active(log_recruit_devs))
    //                     {
```

```
  //     log_recruits(iyr) = log_R + log_recruit_devs(iyr);
  //     log_N(iyr,firstage) = log_recruits(iyr);
  //     }
  //    else
  //     {
  //     log_recruits(iyr) = log_R;
  //     log_N(iyr,firstage) =log_recruits(iyr);
  //     }

  for (iyr=firstyr;iyr<=lastyr;iyr++)
  {
      log_N(iyr,firstage) = log_recruits(iyr);
  }

  //----from these starting values project abundances forward in time and age----
  for (iyr=firstyr;iyr<lastyr;iyr++)
  {
    for (iage=firstage;iage<lastage;iage++)
     {
     log_N(iyr+1,iage+1)=log_N(iyr,iage)-Z(iyr,iage);
     }

 //----oldest age is a plus group so, in addition to the cohort survivors for last year
 //    need to add the last year's plus-group survivors
  log_N(iyr+1,lastage)=log( mfexp(log_N(iyr,lastage)-Z(iyr,lastage))+mfexp(log_N(iyr+1,lastage))  );
  }
 //----define recruitment in the final year, this is only informed if there is a yoy index to fit----
  //                   if (active(log_recruit_devs))
 //                     {
 //        log_recruits(lastyr) = log_R + log_recruit_devs(lastyr);
 //        log_N(lastyr,firstage) = log_recruits(lastyr);
 //        }
 //       else
 //        {
 //        log_recruits(lastyr) = log_R;
 //        log_N(lastyr,firstage) =log_recruits(lastyr);
 //        }
 ////////////////////////////////// END POPULATION DYNAMICS MODEL ////////////////////////////////////////////////

 //  if(current_phase()==2)
 //   {
 //   cout << log_N << endl;
 //   exit(99);
 //   }



FUNCTION calculate_catch

  /////// for convenience need to calculate some terms to be used to calculate predicted proportion at age
  //----Use catch equation to calculate fleet-specific catch-at-age matrices----
  //    and total kill each year for each fleet
   pred_catch = 0.0;
   for (ifleet=1;ifleet<=nfleets;ifleet++)
    {
    for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {
     for (iage=firstage;iage<=lastage;iage++)
```

```
        {
        C(ifleet,iyr,iage) = (mfexp(log_Ffleet(ifleet,iyr,iage))/Z(iyr,iage))
                        * mfexp( log_N(iyr,iage) ) * ( 1.-mfexp(-1.*Z(iyr,iage)) );
        pred_catch(ifleet,iyr) +=  C(ifleet,iyr,iage);
        }
       }
      }

 //  if(current_phase()==2)
 //  {
 //   cout << pred_catch << endl;
 //   exit(99);
 //  }

 ////////////////////////////////  OBSERVATION MODEL ////////////////////////////////////
FUNCTION evaluate_the_objective_function

 // Estimate effective sample size -- ignore fleet-4; northern rec live-release ////////////////////not ignoring fleet 4
 // useful in determining the 'goodness of fit' for the multinomial prediction of proportion at age in kill
   for (ifleet=1;ifleet<=nfleets;ifleet++)
    {
    for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {
     temp = 0.;
     temp2 = 0.;
      for (iage=firstage;iage<=lastage;iage++)
       {
       temp  += C(ifleet,iyr,iage)/(pred_catch(ifleet,iyr)+1.e-13)*( 1-C(ifleet,iyr,iage)
                                                  /(pred_catch(ifleet,iyr)+1.e-13) );
       temp2 += square( obs_prop_at_age(ifleet,iyr,iage)-C(ifleet,iyr,iage)
                                                 /(pred_catch(ifleet,iyr)+1.e-13) );
       }
   EffN(ifleet,iyr) = temp/temp2;
     }
    }

  // cout << EffN << endl;
  //  exit(99);

            // in the last phase a small penalty for a small F is added to objective
            // function, in earlier phases a much larger penalty keeps solution away
            // from infinitesimally small Fs
 F_brake_penalty = 0.;
 avg_F=sum(tot_F)/double(size_count(tot_F));
 if(last_phase())
 {
   F_brake_penalty += 1.e-6*square(log(avg_F/.2));
 }
 else
 {
   F_brake_penalty += F_brake*square(log(avg_F/.2));
 }

 ////////////// minimally 'regularize' the selectivities ////////////
//   f += sel_regularize*norm2(fill_log_sel);     /// how is the regularize number chosen?
  f += 5.*norm2(fill_log_sel);     /// how is the regularize number chosen?
```

```
// ----negative log Likelihood estimation for indices----------------------------------------

 //  if(rewgt==1)
 //   {
 //        // cout << survey_CVs << endl;
 //    for(indx=1;indx<=n_ndx;indx++)
 //     {
 //     survey_CVs(ifleet) /= sdnr_adj_ndx(indx);
 //     }
 //      // cout << survey_CVs << endl;
 //      // exit(99);
 //   }

  ndx_f = 0;
  neglogLL_ndx = 0;
   for (indx=1;indx<=n_ndx;indx++)
   {
    ndx_n = 0;
    for(iyr=first_syr(indx);iyr<=last_syr(indx);iyr++)
     {
      if(survey_ndx(indx,iyr)>0)
       {
        // for aggregate indices, sum appropriate N estimates
        temp=0;
        for(iage=first_sage(indx);iage<=last_sage(indx);iage++)
        {
        temp += mfexp( log_N(iyr,iage)-Z(iyr,iage)*(survey_month(indx)/12.) );
        }

       ndx_n++;
       pred_ndx(indx,iyr) = mfexp(log_q_MLE(indx))*temp;
        // standardized residual
      resid_ndx(indx,iyr) = (   log(survey_ndx(indx,iyr)+1.e-6) - ( log_q_MLE(indx) + log(temp+1.e-6) )   )/
                          sqrt(log(pow(survey_CVs(indx,iyr),2)+1));
       // standardized residual from average -- for total sum of squares (dubious)
      residmean_ndx(indx,iyr) = (   log(survey_ndx(indx,iyr)+1.e-6) -  ave_obsNdx(indx)   )/
                          sqrt(log(pow(survey_CVs(indx,iyr),2)+1));

            // squared residuals//////////////////
      resid_ndx2(indx,iyr) = square(    (   log(survey_ndx(indx,iyr)+1.e-6) - ( log_q_MLE(indx) + log(temp+1.e-6) )   )/
                          sqrt(log(pow(survey_CVs(indx,iyr),2)+1))    );
      residmean_ndx2(indx,iyr) = square(  (   log(survey_ndx(indx,iyr)+1.e-6) -  ave_obsNdx(indx)   )/
                          sqrt(log(pow(survey_CVs(indx,iyr),2)+1))  );
           ////////////////////////////////

       // negative log-likelihood for the lognormal distribution
      neglogLL_ndx (indx) +=  0.5*square( resid_ndx(indx,iyr) ) + log(sqrt(log(pow(survey_CVs(indx,iyr),2)+1)));
        }
     }
    stdev_ndx(indx) = sqrt(  sum(resid_ndx2(indx))/double(ndx_n));
    ndx_f += neglogLL_ndx(indx)*indx_wt(wt_choice(3),indx);
   }

   // if(current_phase()==2)
   //  if(last_phase())
   // {
   //  cout << survey_CVs << endl;
   //  cout << sdnr_adj_ndx << endl;
```

```
  //   cout << obs_prop_at_age(ifleet,iyr,iage) << endl;
  //   cout << agedN(ifleet,iyr)*(obs_prop_at_age(ifleet,iyr,iage)+1.e-6) << endl;
  //   cout << (1-(obs_prop_at_age(ifleet,iyr,iage)+1.e-6))  << endl;
  //   cout << obs_prop_at_age(ifleet,iyr,iage)+1.e-6 << endl;
  //   cout << C(ifleet,iyr,iage)/pred_catch(ifleet,iyr)+1.e-6 << endl;
  //   exit(99);
  //  }

//---Likelihood estimation for catch proportions-at-age ------------------------

  // cout << EffN << endl;
  // cout << agedN << endl;
  // exit(99);


  PAA_f = 0;
  neglogLL_PAA=0;
  PAA_n = 0;
  Nu=0;
  for (ifleet=1;ifleet<=nfleets-1;ifleet++)  // these were not observed for fleet=4, north rec live-release fishery
                      ////////////////////////////
  {
    PAA_n2=0;
   for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {


     Nu = agedN(ifleet,iyr);
  //   if(rewgt==1)
  //   {
  //    Nu = EffN(ifleet,iyr);
  //    }
  //   // cout << Nu << endl;
  //   // exit(99);

     for (iage=firstage;iage<=lastage;iage++)
      {
      PAA_n++;   // just overall number of observations counter
      PAA_n2++;
       // 'residual' in multinomial sense
      resid_PAA(ifleet,iyr,iage) = (obs_prop_at_age(ifleet,iyr,iage)+1.e-6)*log(
                      (C(ifleet,iyr,iage)/pred_catch(ifleet,iyr)+1.e-6)  );
      residmean_PAA(ifleet,iyr,iage) = (obs_prop_at_age(ifleet,iyr,iage)+1.e-6)*log( ave_obsPAA(ifleet,iage)+1.e-6  );

           // squared residuals//////////////////
      resid_PAA2(ifleet,iyr,iage) = square( ( (obs_prop_at_age(ifleet,iyr,iage)+1.e-6) -
                      (C(ifleet,iyr,iage)/pred_catch(ifleet,iyr)+1.e-6) ) /
                         sqrt(  Nu*(obs_prop_at_age(ifleet,iyr,iage)+1.e-6)*(1-(obs_prop_at_age(ifleet,iyr,iage)+1.e-6)) ) );
      residmean_PAA2(ifleet,iyr,iage) = square( ( (obs_prop_at_age(ifleet,iyr,iage)+1.e-6) -
                      (ave_obsPAA(ifleet,iage)+1.e-6))/
                         sqrt(  Nu*(obs_prop_at_age(ifleet,iyr,iage)+1.e-6)*(1-(obs_prop_at_age(ifleet,iyr,iage)+1.e-6)) ) );
           ////////////////////////////////////


    //  if(current_phase()==3&iyr==1995&iage==2)
    //  {
    //   cout << resid_PAA2(ifleet,iyr,iage) << endl;
    //   cout << agedN(ifleet,iyr) << endl;
```

```
   //   cout << obs_prop_at_age(ifleet,iyr,iage) << endl;
   //   cout << agedN(ifleet,iyr)*(obs_prop_at_age(ifleet,iyr,iage)+1.e-6) << endl;
   //   cout << (1-(obs_prop_at_age(ifleet,iyr,iage)+1.e-6))  << endl;
   //   cout << obs_prop_at_age(ifleet,iyr,iage)+1.e-6 << endl;
   //   cout << C(ifleet,iyr,iage)/pred_catch(ifleet,iyr)+1.e-6 << endl;
    //  exit(99);
   //  }

        // negative log-likelihood for the multinomial distribution
      neglogLL_PAA(ifleet,iyr) -= resid_PAA(ifleet,iyr,iage)*agedN(ifleet,iyr);
      }
      PAA_f +=  PAA_wt(wt_choice(2),ifleet,iyr) * neglogLL_PAA(ifleet,iyr);
    }
   stdev_PAA(ifleet) = sqrt(  sum(resid_PAA2(ifleet))/double(PAA_n2));

   // if(current_phase()==1&ifleet==3)
   //  {
   //  cout << ifleet << endl;
   //  cout << resid_PAA(ifleet) << endl;
   //  exit(99);
   //  }
  }

   //  if(current_phase()==3)
   //  {
   //   cout << resid_PAA2 << endl;
   //   exit(99);
   //  }

// ----total catch kill ----------------------------------------

     tC_f = 0;
     neglogLL_tC = 0;
     tC_n=0;
     for(ifleet=1;ifleet<=nfleets;ifleet++)
      {
      for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
       {

 // if(rewgt==1)
 //   {
 //       //  cout << tot_catch_CVs << endl;
 //    tot_catch_CVs(ifleet,iyr) = tot_catch_CVs(ifleet,iyr)/sdnr_adj_C(ifleet);
 //        //  cout << tot_catch_CVs << endl;
 //        // exit(99);
 //    }

        tC_n++;  //just an overall total number of observations
          // standardized residual
        resid_tC(ifleet,iyr) = (  log(obs_tot_catch(ifleet,iyr)+1.e-6) - log(pred_catch(ifleet,iyr)+1.e-6)  )/
                               sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1));
          // standardized residual from average
        residmean_tC(ifleet,iyr) = (  log(obs_tot_catch(ifleet,iyr)+1.e-6) - ave_obstC(ifleet)  )/
                               sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1));

            // squared residuals//////////////////
        resid_tC2(ifleet,iyr) = square (    (  log(obs_tot_catch(ifleet,iyr)+1.e-6) - log(pred_catch(ifleet,iyr)+1.e-6)  )/
                               sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1))    );
```

```
      residmean_tC2(ifleet,iyr) = square(    (  log(obs_tot_catch(ifleet,iyr)+1.e-6) - ave_obstC(ifleet)  )/
                                sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1))    );
          ////////////////////////////////

          // negative log-likelihood for the lognormal distribution
// neglogLL_tC (ifleet) +=  0.5*square( resid_tC(ifleet,iyr) ) +
                        log(sqrt(log(pow(tot_catch_CVs(ifleet,iyr)*sdsr_fleetC(ifleet),2)+1)));
 neglogLL_tC (ifleet) +=  0.5*square( resid_tC(ifleet,iyr) ) + log(sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1)));

      }

     tC_f += neglogLL_tC(ifleet)*totcatch_wt(wt_choice(1),ifleet);
     }

 //  if(current_phase()==2)
 //  {
 //   cout << neglogLL_tC << endl;
 //   cout << sdsr_fleetC << endl;
 //   exit(99);
 //  }

// tagging information on the catch at age for the kept fisheries
    // first need sum for the pooled predicted F-at-age for the kept fleets
     pred_kept_Fatage=0.0;
     for (ifleet=1;ifleet<=3;ifleet++)
      {
      for (iyr=1989;iyr<=2004;iyr++)
       {
       for (iage=1;iage<=4;iage++)
        {
        pred_kept_Fatage(iyr,iage) += mfexp(log_Ffleet(ifleet,iyr,iage));
        }
       }
     }

      kept_f = 0;
      kept_n=0;
      neglogLL_kept=0;
    for (iyr=1989;iyr<=2004;iyr++)
    {
    for (iage=1;iage<=4;iage++)
     {
     kept_n++;
        // standardized residual
     resid_kept(iyr,iage) = (  log(kept_Fatage(iyr,iage)) - log(pred_kept_Fatage(iyr,iage))  ) /
                           sqrt(log(pow(kept_F_CVs(iyr,iage),2)+1));
        // standardized residual from average
     residmean_Fkept(iyr,iage) = (  log(kept_Fatage(iyr,iage)) - ave_obsFkept(iage)  ) /
                           sqrt(log(pow(kept_F_CVs(iyr,iage),2)+1));

          // squared residuals//////////////////
     resid_kept2(iyr,iage) = square(    (  log(kept_Fatage(iyr,iage)) - log(pred_kept_Fatage(iyr,iage))  ) /
                           sqrt(log(pow(kept_F_CVs(iyr,iage),2)+1))   );
     residmean_Fkept2(iyr,iage) = square(    (  log(kept_Fatage(iyr,iage)) - ave_obsFkept(iage)  ) /
                           sqrt(log(pow(kept_F_CVs(iyr,iage),2)+1))    );
          ////////////////////////////////

          // negative log-likelihood for the lognormal distribution
```

```
      neglogLL_kept(iyr) +=  0.5*square( resid_kept(iyr,iage) ) + log(sqrt(log(pow(kept_F_CVs(iyr,iage),2)+1)));
      }
      kept_f += neglogLL_kept(iyr)*tagF_wt(wt_choice(4),1);
    }
    stdev_kept = sqrt(sum(resid_kept2)/double(kept_n));


 // tagging information on the full F for live release fishery
       fullF_f = 0;
       neglogLL_fullF=0;
       fullF_n=0;
    for (iyr=1989;iyr<=2004;iyr++)
    {
     fullF_n++;
          // standardized residual
      resid_fullF_B2(iyr) = (  log(fullF_B2rec(iyr)) - log_Fmult(4,iyr)  ) /
                              sqrt(log(pow(fullF_CVs(iyr),2)+1));
         // standardized residual from average
      residmean_Frelease(iyr) = (  log(fullF_B2rec(iyr)) - ave_obsFrelease  ) /
                              sqrt(log(pow(fullF_CVs(iyr),2)+1));

           // squared residuals//////////////////
      resid_fullF_B22(iyr) = square(    (  log(fullF_B2rec(iyr)) - log_Fmult(4,iyr)  ) /
                              sqrt(log(pow(fullF_CVs(iyr),2)+1))    );
      residmean_Frelease2(iyr) = square(    (  log(fullF_B2rec(iyr)) - ave_obsFrelease  ) /
                              sqrt(log(pow(fullF_CVs(iyr),2)+1))    );
          ////////////////////////////////////

           // negative log-likelihood for the lognormal distribution
      neglogLL_fullF +=  0.5*square( resid_fullF_B2(iyr) ) + log(sqrt(log(pow(fullF_CVs(iyr),2)+1)));
     }
    fullF_f = neglogLL_fullF*tagF_wt(wt_choice(4),2);
   // cout << kept_f << endl;
   //  cout << fullF_f << endl;
   //exit(99);


     // full weighted estimate of sum of likelihoods
   f += ndx_f + PAA_f + tC_f + F_brake_penalty + kept_f + fullF_f;

  //  if(current_phase()==6)
  //   {
  //   cout << f << endl;
  //   exit(99);
  //   }

 /////Removed by AG and used mcmc switch instead
 //FUNCTION outputMCMC
   //--------------------------------------------------------------------------------
 //   ofstream MCMCout1("MCMC1.out",ios::app);
 //    MCMCout1 << three_yrSPR2013 << " " <<  static_SPR << endl;
 //   MCMCout1.close();
 //      ofstream MCMCout2("MCMC2.out",ios::app);
 //        MCMCout2 <<  log_recruits   <<  " " << log_Fmult <<
 //               endl;
 //       MCMCout2.close();
 //   ofstream MCMCout3("MCMC3.out",ios::app);
 //        MCMCout3 << log_N2 << " " << log_N3 << " " << log_Nplus << " " << log_initN  << endl;
```

```
//      MCMCout3.close();

  if (mceval_phase()){
    ofstream sizeout("threeyr.out", ios::app);
    sizeout<<three_yrSPR2013<<endl;
  }

REPORT_SECTION
  report << "ALL INPUT DATA" << endl;
  report << nfleets << endl;
  report << endl;
  report << firstyr << "  " << lastyr << endl;
  report << endl;
  report << firstage << "  " << lastage << endl;
  report << endl;
  report << first_fyr << last_fyr << endl;
  report << endl;
  report << last_sel_age << endl;
  report << endl;
  report << M << endl;
  report << endl;
  report << yr_sel_block << endl;
  report << endl;
  report << obs_tot_catch << endl;
  report << endl;
  report << tot_catch_CVs << endl;
  report << endl;
  report << obs_prop_at_age << endl;
  report << endl;
  report << endl;
  report << n_ndx << endl;
  report << endl;
  report << first_syr << endl;
  report << endl;
  report << last_syr << endl;
  report << endl;
  report << survey_ndx << endl;
  report << endl;
  report << survey_CVs << endl;
  report << endl;
  report << kept_Fatage << endl;
  report << fullF_B2rec << endl;
  report << fullF_CVs << endl;
  report << endl;
  report << "unwted_obj_fnctn_fit " << endl;
  report << sum(neglogLL_ndx)+sum(neglogLL_PAA)+sum(neglogLL_tC)+sum(neglogLL_kept)+neglogLL_fullF
                          +F_brake_penalty+norm2(fill_log_sel)<< endl;
  report << "Objective_function_total" << endl;
  report << setw(15) << setprecision(5) << f << endl;
  report << "Index_part_wted"<< setw(15) << endl;
  report << setprecision(5) << ndx_f << setw(15) << setprecision(5) << double(ndx_n) << endl;
  report << "PAA_part_wted" << endl;
  report << setw(15) << setprecision(5) << PAA_f << setw(15) << setprecision(5) << double(PAA_n) << endl;
  report << "total_catch_part_wted" << endl;
  report << setw(15) << setprecision(5) << tC_f << setw(15) << setprecision(5) << double(tC_n) << endl;
  report << "Fkept_part_wted" << endl;
  report << setw(15) << setprecision(5) << kept_f << setw(15) << setprecision(5) << double(kept_n) << endl;
  report << "Ffull_rel_wted" << endl;
```

```
report << setw(15) << setprecision(5) << fullF_f << setw(15) << setprecision(5) << double(fullF_n) << endl;
report << "F_brake_penalty"  << endl;
report << F_brake_penalty << endl;
// report << "initN_devs" << norm2(log_initN_devs) << endl;
report << "log_selectivity_devs" << endl;
report << 5.*norm2(fill_log_sel) << endl;
//report << " log_recruit_devs = " << norm2(log_recruit_devs) << endl;
report << endl;
report << "Look at fits" << endl;
report << "Index  Year  Pred  Std_Resid Std_Residfrommean " << endl;
 for(indx=1;indx<=n_ndx;indx++)
  {
  for(iyr=first_syr(indx);iyr<=last_syr(indx);iyr++)
   {
   report << setw(5) << setprecision(0) << indx
        << setw(5) << setprecision(0) << iyr
        << setw(10) << setprecision(5) << pred_ndx(indx,iyr)
                                << setw(10) << setprecision(5) << resid_ndx(indx,iyr)
                                << setw(10) << setprecision(5) << residmean_ndx(indx,iyr) << endl;
    }
  }

report << "Index - neglogLL - Standard Deviation of Standardized Residuals (SDSR) -  Standardized Residual Sum of
                Squares (SRSS) -  Total Standardized Residual Sum of Squares (TSRSS)" << endl;
  for(indx=1;indx<=n_ndx;indx++)
  {
                stdev_ndx(indx) = std_dev(resid_ndx(indx));
                report << setw(5) << setprecision(0) << indx
                                << setw(15) << setprecision(5) << neglogLL_ndx(indx)
                                << setw(10) << setprecision(5) << stdev_ndx(indx)
         << setw(10) << setprecision(5) << sum(resid_ndx2 (indx))
                                << setw(10) << setprecision(5) << sum(residmean_ndx2 (indx)) << endl;
  }
report << endl;
report << " proportion at age " << endl;
  for(ifleet=1;ifleet<=nfleets;ifleet++)
   {
   for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
    {
    report << setw(5) << setprecision(0) << ifleet
        << setw(5) << setprecision(0) << iyr
        << setw(10) << setprecision(5) << C(ifleet,iyr)/pred_catch(ifleet,iyr) << endl;
    }
   }

 report << "Fleet - neglogLL - Standard Deviation of Standardized Residuals (SDSR)" << endl;
for (ifleet=1;ifleet<=nfleets-1;ifleet++) //fixed so that it only goes to nfleets-1, rather than nfleets
 {
                report << setw(5) << setprecision(0) << ifleet
                                << setw(15) << setprecision(5) << sum(neglogLL_PAA(ifleet))
                                << setw(10) << setprecision(5) << stdev_PAA(ifleet) << endl;
 }

report << endl;

 report << "Fleet  Year  Pred  Std_Resid Std_Residfrommean " << endl;
  for(ifleet=1;ifleet<=nfleets;ifleet++)
   {
```

```
   for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
    {
      report.setf(ios::fixed, ios::floatfield);
                        report << setw(5) << setprecision(0) << ifleet
          << setw(10) << setprecision(0) << iyr
                                          << setw(15) << setprecision(0) << pred_catch(ifleet,iyr)
                                          << setw(15) << setprecision(5) << resid_tC(ifleet,iyr)
                                    << setw(15) << setprecision(5) << residmean_tC(ifleet,iyr) << endl;
    }
   }

report << "Fleet - neglogLL - Standard Deviation of Standardized Residuals (SDSR) -  Standardized Residual Sum of
                    Squares (SRSS) -  Total Standardized Residual Sum of Squares (TSRSS)" << endl;
   for(ifleet=1;ifleet<=nfleets;ifleet++)
    {
                        stdev_tC(ifleet) = std_dev(resid_tC(ifleet));
                        report << setw(5) << setprecision(0) << ifleet
                                          << setw(15) << setprecision(5) << neglogLL_tC(ifleet)
                                          << setw(15) << setprecision(5) << stdev_tC(ifleet)
          << setw(15) << setprecision(5) << sum(resid_tC2 (ifleet))
                                          << setw(15) << setprecision(5) << sum(residmean_tC2 (ifleet)) << endl;
    }
report << endl;
  report << "Predicted FAA for harvest fisheries" << endl;
                     report << "Year Pred_FAA Std_Resid Std_Residfrommean" << endl;
   // for (iage=1;iage<=4;iage++)
   // {
    for (iyr=1989;iyr<=2004;iyr++)
     {
                    report << setw(5) << setprecision(0) << iyr
        // << setw(5) << setprecision(0) << iage
         << setw(15) << setprecision(5) << pred_kept_Fatage(iyr)
                                    << setw(10) << setprecision(5) << resid_kept(iyr)
                                    << setw(10) << setprecision(5) << residmean_Fkept(iyr) << endl;
    }
  //  }
report << "neglogLL - Standard Deviation of Standardized Residuals (SDSR) -  Standardized Residual Sum of Squares
                    (SRSS) -  Total Standardized Residual Sum of Squares (TSRSS)" << endl;
                    report << setw(15) << setprecision(5) << kept_f
                                          << setw(10) << setprecision(5) << stdev_kept
                                          << setw(15) << setprecision(5) << sum(resid_kept2)
                                          << setw(15) << setprecision(5) << sum(residmean_Fkept2) << endl;

report << endl;
  report << "Full F Estimates for Release Fishery" << endl;
  report << "Year  Pred  Std_Resid Std_Residfrommean" << endl;
    for(iyr=1989;iyr<=2004;iyr++)
    {
     report << setw(5) << setprecision(0) << iyr
          << setw(15) << setprecision(5) << mfexp(log_Fmult(4,iyr))
                                         << setw(15) << setprecision(5) << resid_fullF_B2(iyr)
                                    << setw(15) << setprecision(5) << residmean_Frelease(iyr) << endl;
    }

 report << "neglogLL - Standard Deviation of Standardized Residuals (SDSR) -  Standardized Residual Sum of Squares
                    (SRSS) -  Total Standardized Residual Sum of Squares (TSRSS)" << endl;
                     report << setw(15) << setprecision(5) << fullF_f
                          << setw(10) << setprecision(5) << std_dev(resid_fullF_B2)
```

```
        << setw(15) << setprecision(5) << sum(resid_fullF_B22)
         << setw(15) << setprecision(5) << sum(residmean_Frelease2) << endl;

report << "Predicted population dynamics" << endl;
report << "Abundance" << endl;
   for(iyr=firstyr;iyr<=lastyr;iyr++)
    {
     report << setw(5) << setprecision(0) << iyr
          << setw(15) << setprecision(9) << mfexp(log_N(iyr)) << endl;
     }
report << endl;
report << "F at age by fleet" << endl;
  for(ifleet=1;ifleet<=nfleets;ifleet++)
    {
    for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {
      report << setw(5) << setprecision(0) << ifleet
           << setw(5) << setprecision(0) << iyr
           << setw(10) << setprecision(5) << mfexp(log_Ffleet(ifleet,iyr))
           << setw(10) << setprecision(5) << EffN(ifleet,iyr) << endl;
     }
    }
 report << endl;
 report << "Check bounded values" << endl;
 report << "fill_log_sels" << endl;
 report << setw(5) << setprecision(4) << fill_log_sel << endl;
 report << endl;
 report << "log_Fmult" << endl;
 report << setw(5) << setprecision(4) << log_Fmult << endl;
 report << endl;
 report << "log_initN" << endl;
 report << setw(5) << setprecision(4) << log_initN << endl;
 report << endl;
 report << "log_recruits" << endl;
 report << setw(5) << setprecision(4) << log_recruits << endl;
 report << endl;
 report << "log_q_MLE" << endl;
 report << setw(5) << setprecision(4) << log_q_MLE << endl;
 report << endl;
 report << "selectivities" << endl;
     for (ifleet=1;ifleet<=nfleets;ifleet++)
          {
           for (i=1;i<=yr_sel_block(ifleet,last_fyr(ifleet));i++)
            {
              report << setw(5) << setprecision(0) << ifleet
                   << setw(5) << setprecision(0) << i
                   << setw(10) << setprecision(5) << mfexp(log_sel(ifleet,i)) << endl;
                        }
         }
  report << endl;
  report << "weighting scheme for this run" << endl;
  report << "TC wt" << setw(10) << setprecision(5) << totcatch_wt(wt_choice(1)) << endl;
  report << "PAA wt" << endl;
  report << setw(10) << setprecision(5) << PAA_wt(wt_choice(2)) << endl;
  report << "Index wt" << setw(10) << setprecision(5) << indx_wt(wt_choice(3)) << endl;
  report << "tagF wt" << setw(10) << setprecision(5) << tagF_wt(wt_choice(4)) << endl;
  report << "Fbrake" << setw(10) << setprecision(5) << F_brake << endl;
  report << endl;
```

```
  report << endl;
        for (iyr=firstyr;iyr<=lastyr;iyr++)
        {
                        report << setw(5) << setprecision(0) << iyr;
         for (iage=firstage;iage<=lastage;iage++)
          {
           report << setw(12) << setprecision(5) << tot_F(iyr,iage);
                         }
                        report << endl;
         }
  report << endl;

        report << " static SPR     " << setw(15) << setprecision(5) << static_SPR << endl;
        report << " 3 year SPR    " << setw(15) << setprecision(5) << three_yrSPR << endl;
       report << " escapement 1-3 " << setw(15) << setprecision(5) << escapement13 << endl;
       report << " escapement 1-5 " << setw(15) << setprecision(5) << escapement15 << endl;
       report << " t Esc 1-3 " << setw(15) << setprecision(5) << tEsc13 << endl;
       report << " t Esc 1-5 " << setw(15) << setprecision(5) << tEsc15 << endl;

       report << "selectivity constraint (4 and 5) =" << 1/(1+exp(-1.*sel04))
              << "   " << 1/(1+exp(-1.*sel05)) << endl;
      // report << "selectivity constraint for B2 (4 and 5) =" << 1/(1+exp(-1.*sel04b2))
           // << "   " << 1/(1+exp(-1.*sel05b2)) << endl;
   //     report << "selectivity regularize constant =" << sel_regularize << endl;
  // This report section actually gives SSB per recruit, not the SSB--need to multiply by N to get actual SSB
  // report << "SSB" << setw(15) << setprecision(2) << SSB_F << endl;



RUNTIME_SECTION
 convergence_criteria 1.0e-7
 maximum_function_evaluations 10000
```

Weights Files

```
#weights
#total catch by fleet
# Ha:default
#fleet1 fleet2 fleet3 fleet4
  1.    1.    1.    1.
# Ha:B2 rec total catch estimates are suspect
#fleet1 fleet2 fleet3 fleet4
  1.  1.    1.    0.1
# Ha:B2 rec total catch estimates are really suspect
#fleet1 fleet2 fleet3 fleet4
1.    1.    1.    0.01

#PAA weights
#Ha:default
#catch at age by fleet and year (excluding the B2 release fleet4)
#1989   1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                2005   2006   2007 2008   2009   2010  2011   2012 2013
1      1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                1   1
1      1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                1   1
1      1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                1   1
```

#Ha:the B2 age compostion data is more uncertain than commercial age comp
#catch at age by fleet and year
#1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
2010 2011 2012 2013
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1
0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
0.01 0.01 0.01 0.01 0.01 0.01 0.01

#weights
#Ha:default
index weight
1. 1. 1. 1. 1.
#Ha:the MRFSS index is best due to areal coverage
index weight
1. 1. 1. 10. 1.
#Ha:the yoy indexes are best due to scientific design and ease of capture
index weight
10. 1. 10. 1. 1.

#weights
#tagging based F (showing for keptF at age and then fullF B2rec)
Ha: default
1. 1.
Ha: both less accurate
0.1 0.1

Input Data

#Northern Stock 1989-2013 - Continuity
#
#Run in testing mode: runs model at initial values and output some values to console (0=off, 1=on)
0
Defining two stockal commercial fisheries - gillnet+beachseine and other commercial gears
#
#fleets (1=VAMDNCcomGNBS, 2=VAMDNCcomSE, 3=NCVAMDrecAB1, 4=NCVAMDrecB2)
4
global first and last years used in assessment
1989 2013
#
first and last year for each fishing fleet
1989 1989 1989 1989
2013 2013 2013 2013
#
Last year of tagging data
2004
#
Last year tagging data in Likelihood for tag data F's
2004
#
#firstage lastage (same for all fleets)
1 7
#
#last age selectivity estimated for

```
 3
#natural mortality - Lorenzen scaled to Hoenig method - average integer age M, plus group is average M from 7-62
                ####Up to date#####
#  1   2   3   4   5   6   7
 0.20 0.13 0.10 0.09 0.08 0.08 0.07
#selectivity block -- only fleet1-3 used, fleet4(rec) uses tag-based input for selevtivity
#89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13
 1 1 1 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
 1 1 1 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
 1 1 1 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
 1 1 1 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
#
# total kill by fleet in numbers, except only A+B1 for fleet3 (rec) (1=VAMDNCcomGNBS, 2=VAMDNCcomSE,
                3=NCVAMDrecAB1, 4=NCVAMDrecB2) ####Up to date####
#1989   1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                2005   2006   2007   2008   2009   2010   2011   2012   2013
89433           71307   49247   34984   57680   36232   56765   29778   12344   118100   127169
                  79076   44955   28847   28543   20459   54704   51010   75590   72838   64727
                  52651   22371   28999   131805
18043           10420   18756   4815   6916   5903   13767   4204   3732   16054   4166
                  3366   1787   2395   2216   755   2017   3346   4947   2926   3293
                  2081   1464   3306   10669
114512          46091   65963   43120   93873   40203   129545   55973   12468   157861   94168
                  97493   33538   128606   34184   35021   54574   75209   113195   71656   96213
                  75100   46098   99272   292194
0               0 0   0   0   0   0   0   0   0   0   0
                  0   0   0   0   0   0   0   0   0   0
                  0   0   0

# CV's for total kill by fleet in numbers (assumed for commercial fleets, weighted average PSE from MRFSS AB1 north
                stock for fleet 3 and B2 for fleet 4)) ####Up to date#####
#1989   1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                2005   2006   2007   2008   2009   2010   2011   2012   2013
0.01            0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01
                  0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01
                  0.01   0.01   0.01   0.01
0.01            0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01
                  0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01   0.01
                  0.01   0.01   0.01   0.01
0.487           0.376   0.316   0.375   0.289   0.297   0.224   0.238   0.455   0.203   0.206
                  0.188   0.240   0.314   0.264   0.330   0.254   0.314   0.289   0.212   0.209
                  0.139   0.170   0.426   0.214
0.880           1.401   0.592   0.438   0.705   0.569   0.369   0.408   0.452   0.272   0.294
                  0.312   0.279   0.341   0.377   0.160   0.249   0.224   0.187   0.138   0.248
                  0.114   0.232   0.234   0.173

#input B2 selectivity for rec northern stock by age (columns through last_sel_age) and select period (rows)
1.000  0.221  0.012  0.012  0.012  0.012  0.012
1.000  0.467  0.031  0.023  0.023  0.023  0.023
0.6840  1.0000  0.2070  0.0890  0.089  0.089  0.089

# total release by fleet ###Up to date####
#1989   1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                2005   2006   2007   2008   2009   2010   2011   2012   2013
 0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                0    0
 0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                0    0
```

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0
21817 40539 230844 104580 552926 216398 341451 53221 726929 446907 576009
465834 349707 2204266 131752 215028 406892 709355 526917 895966 622927
666638 269027 4322513 876950

#release mortality
0.08

#proportion catch at age (age columns, year rows) by fleet ####Up to date####
#Age 1 2 3 4 5 6 7+
VAMDNCcomGNBS
0.6101 0.3574 0.0080 0.0060 0.0006 0.0002 0.0176
0.6845 0.2761 0.0123 0.0057 0.0006 0.0003 0.0205
0.7452 0.2340 0.0089 0.0083 0.0007 0.0003 0.0028
0.1514 0.7658 0.0619 0.0079 0.0002 0.0000 0.0128
0.1326 0.6303 0.2307 0.0036 0.0003 0.0002 0.0024
0.1998 0.5184 0.2513 0.0210 0.0002 0.0002 0.0092
0.2278 0.6335 0.1299 0.0082 0.0002 0.0000 0.0003
0.2188 0.6805 0.0929 0.0068 0.0002 0.0001 0.0007
0.3872 0.4476 0.1516 0.0119 0.0004 0.0001 0.0012
0.1820 0.7724 0.0383 0.0066 0.0002 0.0000 0.0005
0.1401 0.7099 0.1443 0.0050 0.0001 0.0000 0.0005
0.0960 0.5858 0.3066 0.0110 0.0002 0.0001 0.0002
0.0806 0.4469 0.4648 0.0071 0.0002 0.0000 0.0004
0.1701 0.7446 0.0776 0.0054 0.0003 0.0001 0.0020
0.0666 0.7812 0.1468 0.0051 0.0001 0.0000 0.0002
0.4977 0.1823 0.3115 0.0082 0.0001 0.0000 0.0001
0.2476 0.7169 0.0334 0.0020 0.0000 0.0000 0.0001
0.1910 0.5953 0.2081 0.0055 0.0001 0.0000 0.0000
0.0595 0.7557 0.1793 0.0051 0.0001 0.0000 0.0003
0.1883 0.4569 0.3476 0.0070 0.0000 0.0000 0.0001
0.0877 0.7411 0.1641 0.0061 0.0006 0.0002 0.0001
0.0879 0.5165 0.3928 0.0028 0.0000 0.0000 0.0000
0.0823 0.7259 0.1876 0.0037 0.0000 0.0000 0.0005
0.6290 0.2559 0.1106 0.0039 0.0000 0.0000 0.0007
0.0879 0.8808 0.0302 0.0004 0.0000 0.0000 0.0007

VAMDNCcomSE
0.4093 0.3411 0.0775 0.0109 0.0013 0.0016 0.1582
0.5385 0.3185 0.0331 0.0006 0.0017 0.0017 0.1059
0.8199 0.1524 0.0116 0.0048 0.0004 0.0001 0.0108
0.1137 0.6846 0.1172 0.0394 0.0052 0.0021 0.0379
0.0305 0.5583 0.2822 0.0007 0.0021 0.0034 0.1228
0.0221 0.4846 0.3531 0.0346 0.0035 0.0045 0.0975
0.0466 0.8145 0.1320 0.0062 0.0005 0.0001 0.0001
0.0804 0.7624 0.1335 0.0118 0.0020 0.0007 0.0092
0.2824 0.4990 0.1641 0.0253 0.0064 0.0023 0.0206
0.1175 0.8738 0.0042 0.0008 0.0015 0.0005 0.0017
0.0559 0.7119 0.2064 0.0053 0.0006 0.0009 0.0190
0.0295 0.5444 0.3934 0.0292 0.0020 0.0005 0.0010
0.0161 0.2589 0.6415 0.0570 0.0068 0.0020 0.0177
0.1450 0.6391 0.1634 0.0218 0.0025 0.0012 0.0271
0.0204 0.8279 0.1488 0.0029 0.0000 0.0000 0.0000
0.1959 0.3536 0.4418 0.0073 0.0000 0.0000 0.0013
0.0455 0.8456 0.0988 0.0060 0.0000 0.0000 0.0040
0.1186 0.5668 0.3074 0.0072 0.0000 0.0000 0.0000

0.0238 0.7545 0.2107 0.0057 0.0002 0.0001 0.0049
0.1793 0.4252 0.3783 0.0172 0.0000 0.0000 0.0000
0.0208 0.7377 0.2336 0.0078 0.0001 0.0000 0.0000
0.0570 0.4113 0.5108 0.0138 0.0000 0.0000 0.0071
0.0354 0.6271 0.3098 0.0252 0.0018 0.0006 0.0001
0.7800 0.1343 0.0434 0.0074 0.0004 0.0002 0.0343
0.0097 0.9193 0.0696 0.0014 0.0000 0.0000 0.0000

#NCVAMDrec (just A+B1 proportions)
0.3490 0.5588 0.0741 0.0003 0.0001 0.0001 0.0177
0.8982 0.0414 0.0456 0.0017 0.0001 0.0004 0.0126
0.6630 0.3021 0.0114 0.0159 0.0000 0.0000 0.0075
0.0754 0.8133 0.1048 0.0009 0.0015 0.0006 0.0036
0.0780 0.6606 0.2391 0.0006 0.0006 0.0003 0.0209
0.2791 0.2770 0.3068 0.0511 0.0021 0.0002 0.0837
0.1384 0.7577 0.0741 0.0121 0.0095 0.0000 0.0083
0.3074 0.4285 0.1990 0.0420 0.0014 0.0000 0.0218
0.4781 0.2869 0.1206 0.0718 0.0143 0.0004 0.0278
0.0240 0.8992 0.0560 0.0044 0.0044 0.0014 0.0106
0.0567 0.6477 0.2810 0.0022 0.0011 0.0010 0.0103
0.0199 0.4162 0.5440 0.0072 0.0005 0.0001 0.0121
0.0395 0.2843 0.5299 0.0803 0.0098 0.0016 0.0546
0.1282 0.6402 0.0600 0.0700 0.0147 0.0047 0.0823
0.0207 0.6358 0.3090 0.0199 0.0064 0.0014 0.0067
0.1987 0.3612 0.4156 0.0180 0.0066 0.0000 0.0000
0.0130 0.9140 0.0401 0.0037 0.0014 0.0004 0.0275
0.0625 0.6441 0.2558 0.0165 0.0030 0.0003 0.0177
0.0267 0.6659 0.2828 0.0137 0.0012 0.0004 0.0092
0.0869 0.5749 0.3174 0.0080 0.0015 0.0002 0.0111
0.0046 0.7734 0.1571 0.0489 0.0005 0.0000 0.0155
0.0771 0.5899 0.2604 0.0261 0.0062 0.0004 0.0398
0.0497 0.7768 0.1532 0.0097 0.0055 0.0017 0.0035
0.3624 0.3524 0.2150 0.0164 0.0002 0.0001 0.0536
0.0094 0.9094 0.0550 0.0068 0.0010 0.0001 0.0184

#NCVAMD B2 only
0.6405 0.2368 0.0444 0.0059 0.0000 0.0008 0.0716
0.9651 0.0197 0.0000 0.0000 0.0000 0.0000 0.0152
0.8878 0.1122 0.0000 0.0000 0.0000 0.0000 0.0000
0.3898 0.6102 0.0000 0.0000 0.0000 0.0000 0.0000
0.3473 0.4596 0.0089 0.0000 0.0000 0.0000 0.1842
0.8833 0.1042 0.0054 0.0001 0.0000 0.0000 0.0071
0.6342 0.1809 0.0326 0.0026 0.0000 0.0000 0.1496
0.3101 0.3372 0.1171 0.0155 0.0000 0.0000 0.2200
0.8606 0.1303 0.0043 0.0025 0.0005 0.0002 0.0016
0.2554 0.6151 0.0157 0.0000 0.0003 0.0108 0.1028
0.2102 0.3803 0.1466 0.0623 0.0316 0.0112 0.1578
0.1624 0.4963 0.2175 0.0343 0.0066 0.0017 0.0812
0.0404 0.2448 0.2461 0.1863 0.0382 0.0013 0.2428
0.0214 0.1052 0.1129 0.2862 0.0695 0.0176 0.3873
0.0144 0.2747 0.3206 0.1281 0.0857 0.0271 0.1495
0.3366 0.1385 0.1918 0.0580 0.0144 0.0073 0.2535
0.0774 0.5525 0.0608 0.0374 0.0140 0.0039 0.2542
0.1273 0.5570 0.2126 0.0287 0.0089 0.0023 0.0631
0.0958 0.6672 0.1101 0.0605 0.0087 0.0027 0.0550
0.1255 0.4933 0.2845 0.0430 0.0020 0.0007 0.0510

0.0316 0.4971 0.2043 0.0660 0.0062 0.0004 0.1944
0.1124 0.2636 0.1531 0.1946 0.0534 0.0011 0.2219
0.1412 0.4107 0.2154 0.0740 0.0759 0.0224 0.0604
0.3195 0.3085 0.2631 0.0264 0.0004 0.0002 0.0819
0.0503 0.6476 0.1260 0.0394 0.0100 0.0007 0.1260

#number of ages that went into catch at age calcs by fleet and year (1=VAMDNCcomGNBS, 2=VAMDNCcomSE, 3=NCVAMDrecAB1, 4=NCVAMDrecB2) ###Updated on 7/18/16 to ESS North values scaled to range in the 6-1-15 Data Inputs File###

#1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
		2005	2006	2007	2008	2009	2010	2011	2012	2013					
4		4	11	7	9	4	7	10	9	13	12	12			
			15	10	6	30	37	36	13	20	16	10			
			10	40	50										
6		6	6	7	5	3	5	4	4	5	6	5			
			5	8	4	3	3	3	8	5	9	4			
			3	4	10										
19		13		17	13	19	17	25	15	11	27	21			
			18	10	12	8	8	8	12	15	15	19			
			25	14	17	43									
2		2	2	2	2	2	2	2	2	2	2	2			
			2	2	2	2	2	2	2	2	2	2			
			2	2	2										

North stock information on F at age for age 1-4+, 1989-2004 total harvest)
#estimates
2.564 3.873 1.418 0.119
1.987 3.002 1.099 0.092
0.499 0.755 0.276 0.023
0.177 0.653 0.192 0.030
0.259 0.952 0.280 0.044
0.121 0.446 0.131 0.021
0.087 0.320 0.094 0.015
0.070 0.257 0.076 0.012
0.126 0.463 0.136 0.022
0.165 0.606 0.178 0.028
0.026 0.437 0.104 0.001
0.034 0.558 0.133 0.001
0.065 1.080 0.257 0.003
0.071 1.168 0.278 0.003
0.026 0.422 0.101 0.001
0.015 0.256 0.061 0.001

#CV's -- NOT CHANGED 2/22/15
0.226 0.196 0.220 0.196
0.254 0.228 0.249 0.228
0.224 0.194 0.218 0.194
0.123 0.121 0.127 0.121
0.113 0.110 0.116 0.110
0.117 0.114 0.120 0.114
0.103 0.100 0.107 0.100
0.171 0.170 0.174 0.170
0.142 0.140 0.145 0.140
0.097 0.094 0.102 0.094
0.116 0.116 0.118 0.116
0.114 0.113 0.116 0.113
0.129 0.128 0.130 0.128
0.208 0.208 0.209 0.208

```
0.257   0.256   0.257   0.256
0.412   0.411   0.412   0.411

#North stock information for release rec fishery,1989-2004 -- NOT CHANGED 2/22/15
#fully recruited F estimate
0.0250
0.0404
0.0342
0.0170
0.0427
0.1178
0.0683
0.0237
0.0377
0.0354
0.0240
0.0340
0.0398
0.0288
0.0197
0.0088

# CV (corrected) -- NOT CHANGED 2/22/15
0.2622
0.3376
0.1073
0.1432
0.1015
0.0818
0.1534
0.2168
0.1045
0.1068
0.1191
0.1111
0.1287
0.1696
0.2000
0.2887

# number of indices
# 1)NCIGNS1 2)NCIGNS2 3)NC JAI 4) MRFSS 5) NC longline
 5

# first year of surveys followed by last year of surveys
 2001 2001 1992 1991 2007
 2013 2013 2013 2013 2013

 # indices ages (indices in order by row showing begin, end ages)
 1 2 1 1 7
 1 2 1 3 7

# middle of survey (months)
 8  6  0  9 8

#observed index values across years (columns) ###Up to date###
#  1)NCIGNS1 2)NCIGNS2 3)NC JAI 4) MRFSS 5) NC longline
```

```
#1989            1990      1991      1992      1993      1994      1995      1996      1997      1998      1999
                   2000      2001      2002      2003      2004      2005      2006      2007      2008      2009
                   2010      2011      2012      2013

                 0.7651    1.9537    0.2006    1.3743    1.0177    1.2183    0.3937    1.1960    0.4903    1.1069
                 0.1114    2.2509    0.9211

                 0.3328    0.4159    0.7336    0.0454    1.0285    0.9151    1.9209    0.4613    2.4654    0.4840
                 0.1815    0.0076    4.0081
                           2.6006    0.6374    2.1752    1.4255    0.7932    -999      2.2572    1.4145    0.3159
                 0.5396    0.1663    0.3840    0.8611    1.4301    1.5505    0.5919    0.9392    0.2722    0.3253
                 0.8068    1.8603    0.4629
                 0.6945    0.5513    0.8793    0.4522    0.8446    0.3178    0.8617    1.1888    1.2278    0.8180
                 0.8227    2.0424    0.4612    0.4823    0.8978    1.1086    1.1130    1.3448    1.2850    1.2187
                 0.5697    2.2926    1.5251

                                                           1.0797    0.7212    1.1359    1.0568    1.0726
                 0.9934    0.9405

# estimated CV's for the index values - updated 4/9 from data input workbook
#1982  1983  1984  1985  1986  1987  1988  1989  1990  1991  1992  1993  1994  1995  1996  1997
                 1998  1999  2000  2001  2002  2003  2004  2005  2006  2007  2008      2009      2010
                   2011      2012      2013
                                                                                 0.2816    0.1597    0.2593
                 0.1568    0.2117    0.1524    0.1698    0.1801    0.1667    0.1812    0.2667    0.1947    0.2419

                                                                                 0.2273    0.2182    0.2062
                 0.3333    0.1765    0.1818    0.3898    0.2459    0.3589    0.1875    0.2083    1.000     0.1943

                                               0.1443              0.3062    0.1753    0.2909    0.1570    -999      0.2342
                 0.1363    0.2257    0.1836    0.1941    0.2362    0.2458    0.1362    0.1558    0.2108    0.2784
                 0.1902    0.3492    0.2064    0.3028    0.2645
                                     0.1352    0.1725    0.1237    0.1264    0.0874    0.1377    0.1033    0.0810
                 0.0837    0.1006    0.1092    0.0693    0.1489    0.1137    0.1092    0.0905    0.0839    0.0744
                 0.0790    0.0684    0.0978    0.0502    0.0611

                                                                                                 0.1629  0.1786
                 0.1812    0.2055    0.1774    0.1780    0.1572

#Fbrake level
 200.
# choice of weighting scheme
# TC, PAA, Ndx, tagF
  1.  2.  1.  1.
#
# weight, maturity, and natural mortality at age through age 62 - end year values (around spawning season)
                   ###Updated 7/19/16 See Maturity Estimates file and emails with Jeff and Mike###
2.23               0.00      0.20
5.93               0.00      0.13
10.41              0.07      0.10
14.95              0.99      0.09
17.64              1.00      0.08
20.13              1.00      0.08
22.40              1.00      0.07
24.42              1.00      0.07
26.22              1.00      0.07
27.79              1.00      0.07
29.16              1.00      0.07
```

30.35	1.00	0.07
31.37	1.00	0.07
32.25	1.00	0.07
33.00	1.00	0.07
33.63	1.00	0.07
34.17	1.00	0.07
34.63	1.00	0.07
35.02	1.00	0.07
35.35	1.00	0.07
35.63	1.00	0.07
35.87	1.00	0.06
36.07	1.00	0.06
36.23	1.00	0.06
36.37	1.00	0.06
36.49	1.00	0.06
36.59	1.00	0.06
36.68	1.00	0.06
36.75	1.00	0.06
36.81	1.00	0.06
36.86	1.00	0.06
36.90	1.00	0.06
36.93	1.00	0.06
36.96	1.00	0.06
36.99	1.00	0.06
37.01	1.00	0.06
37.03	1.00	0.06
37.04	1.00	0.06
37.05	1.00	0.06
37.06	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06
37.08	1.00	0.06

Appendix B. Model code and data inputs for the southern red drum stock assessment.

Model Code

```
TOP_OF_MAIN_SECTION
  //increase number of estimated parameters
  gradient_structure::set_NUM_DEPENDENT_VARIABLES(1000); // increasing number of parameters that can be
                    estimated to 1000 (default is 100 and must be changed if it will be exceeded)

DATA_SECTION ////////////////////////////////////////////////////////////////////
 //   !!USER_CODE ad_comm::change_datafile_name("so_base.dat");

      // all commented out sections in response to reviewer findings - MDM 8/21

 /////////////// general dimensions and structural inputs /////////////
 // how many groups with separate fishing characteristics, fisheries?
 init_int nfleets

 // global first and last age used in the assesment
 init_int firstyr
 init_int lastyr

 // first and last years of catch data for each fishery
 init_ivector first_fyr(1,nfleets)
 init_ivector last_fyr(1,nfleets)

 // first and last age used in the assessment - last assumed plus group
 init_int firstage
 init_int lastage

 // last age that selectivity is estimated
 init_int last_sel_age

 // instantaneous natural mortality from firstage through lastage
 init_vector M(firstage,lastage)

 // selectivity blocks defined sequentially by fleet by year
 init_imatrix yr_sel_block(1,nfleets,first_fyr,last_fyr)

 /////////////// observed data //////////////
 // total landed catch for each fleet each year and its CV
 init_matrix obs_tot_catch(1,nfleets,first_fyr,last_fyr)
 init_matrix tot_catch_CVs(1,nfleets,first_fyr,last_fyr)

 // observed selectivity for Florida live-release fishery over two
 // defined time period
 init_matrix B2_select(1,1,firstage,lastage)

 // additional non-landed catch that is subject to the hook-and-line
 // release mortality (rel_mort)
 init_matrix tot_B2catch(1,nfleets,first_fyr,last_fyr)
 init_number rel_mort
```

```
// observed proportion at age for all 'observed' landings and  sampled live-releases
// and number of fish sampled for age each year associated with these observed proportions
init_3darray obs_prop_at_age(1,nfleets,first_fyr,last_fyr,firstage,lastage)
init_matrix agedN(1,nfleets,first_fyr,last_fyr)

// number of indices used for relative abundance
init_int n_ndx
// first and last year for each index
init_ivector first_syr(1,n_ndx)
init_ivector last_syr(1,n_ndx)
// first and last age included in index
init_ivector first_sage(1,n_ndx)
init_ivector last_sage(1,n_ndx)
// midpoint month for the survey
init_vector survey_month(1,n_ndx)
// relative abundance by index for each year available
// and coefficient of variation
init_matrix survey_ndx(1,n_ndx,first_syr,last_syr)
init_matrix survey_CVs(1,n_ndx,first_syr,last_syr)

// temporary penalty for keeping early-solution-search-F up
init_number F_brake

// the weights set associated with the total catches, proportion at age and indices
init_ivector wt_choice(1,3)

 // matrix showing three columns - for weight (lbs), proportion mature, and natural mortality
 // for every age in the fishes life
 init_matrix wt_mat_M41(1,41,1,3)

      // error debugging tools
      //!! cout << F_brake << endl;
      //!! exit(4);

// file for the different weighting schemes referred to in wt_choice variable
   // total catch weights
!!USER_CODE ad_comm::change_datafile_name("s0_TC.wts");
    init_matrix totcatch_wt(1,3,1,nfleets)

   // PAA wts
!!USER_CODE ad_comm::change_datafile_name("s0_PAA.wts");
     init_3darray PAA_wt(1,3,1,nfleets,firstyr,lastyr)

   // Index wts
!!USER_CODE ad_comm::change_datafile_name("s0_Ndx.wts");
    init_matrix indx_wt(1,3,1,n_ndx)
 ////////////////////////////////////////////////////////////////////////////////

 // various statistics and manipulations of the input data
    ivector nselblocks(1,nfleets)
    int k
    number tot
    vector ave_obstC(1,nfleets)
    vector ave_obsNdx(1,n_ndx)
    matrix ave_obsPAA(1,nfleets,firstage,lastage)
    matrix stdevPAA(1,nfleets,firstage,lastage)
LOCAL_CALCS
   for(ifleet=1;ifleet<=nfleets;ifleet++)
```

```
  {
 // how many 'selectivity blocks' are there for each fishery?
  nselblocks(ifleet) = yr_sel_block(ifleet,last_fyr(ifleet));
  }

// special calculation for the B2 rec live-release fisheries -- fleet=5-6 -- to calculate total kill
 for(ifleet=4;ifleet<=nfleets;ifleet++)
  {
  for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
   {
   obs_tot_catch(ifleet,iyr) = tot_B2catch(ifleet,iyr) * (rel_mort);
   }
  }

// calculate various mean observed values to use in the total sum of squares [TSS = sum of squares
//  for (mean-observed)/stdev(observed)], though this did not appear to be very helpful for
//  'goodness of fit' evaluation where residual sum of squares [RSS = sum of squares for (observed-predicted)
//   /stdev(observed)] was confounded by multidimensionaity of problem.

 // total catch
  for(ifleet=1;ifleet<=nfleets;ifleet++)
    {
    k = 0;
    tot=0;
   for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {
     k++;
     tot += log(obs_tot_catch(ifleet,iyr)+1e-6);
     }
    ave_obstC(ifleet) = tot/double(k);
   }

  // indices
 for (indx=1;indx<=n_ndx;indx++)
 {
   k = 0;
   tot=0;
  for(iyr=first_syr(indx);iyr<=last_syr(indx);iyr++)
   {
    if(survey_ndx(indx,iyr)>0)
      {
                    k++;
                    tot += log(survey_ndx(indx,iyr)+1.e-6);
       }
   }
  ave_obsNdx(indx) = tot/double(k);
 }
   //PAA -- this is a strech for 0.0-1.0 bound number
for (ifleet=1;ifleet<=nfleets;ifleet++)
{
 for (iage=firstage;iage<=lastage;iage++)
  {
   k = 0;
   tot=0;
  for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
   {
   k++;
   tot += obs_prop_at_age(ifleet,iyr,iage)+1.e-6;
```

```
    }
  ave_obsPAA(ifleet,iage) = tot/double(k);
   }
 }

 // what is the standard deviation of observed PAA across years for each fleet and age?
  for (ifleet=1;ifleet<=nfleets;ifleet++)
  {
   for (iage=firstage;iage<=lastage;iage++)
    {
     k = 0;
     tot=0;
     for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
      {
       k++;
       tot += square( obs_prop_at_age(ifleet,iyr,iage)-ave_obsPAA(ifleet,iage) );
       }
     stdevPAA(ifleet,iage) = sqrt( tot/(double(k)-1)  );
     }
   }
END_CALCS

  // initialize various counters and temporary integers
  int sel_count
  int ifleet
  int iyr
  int iage
  int indx
  int i
  int j
  int PAA_n
  int PAA_n2
  int tC_n
  int ndx_n

PARAMETER_SECTION  ////////////////////////////////////////////////////////////////////////////

    init_bounded_number sel04(-10,10.,5)
    init_bounded_number sel05(-10,10,5)

   // init_bounded_number sel04b2(-10,10.,5)
   // init_bounded_number sel05b2(-10.,10.,5)

 // NOTE: for convenience number of selectivities is hardwired -- ////////////////////////////////////changed to
                    include FL B2
 //      when tag-based selectivity used is used
 //----in get_selectivity function
 //Parameter: selectivities
 init_bounded_dev_vector fill_log_sel(1,30,-5,5,5)
  3darray log_sel(1,nfleets,1,nselblocks,firstage,lastage)
                    matrix max_log_sel(1,nfleets,1,nselblocks)

 //----in get_mortality_rates function----
 //Parameter: fully recruited F's
 init_bounded_matrix log_Fmult(1,nfleets,first_fyr,last_fyr,-15,2,3)
  3darray log_Ffleet(1,nfleets,first_fyr,last_fyr,firstage,lastage)
  matrix Z(firstyr,lastyr,firstage,lastage)
  matrix tot_F(firstyr,lastyr,firstage,lastage)
```

```
//----in get_number_at_age function
//Parameters: median initial abundance ages 2-7+ and deviations from this for each age
//   init_bounded_number log_initN(8,15,1)
//   init_bounded_dev_vector log_initN_devs(firstage+1,lastage,-10,10,2)
   init_bounded_vector log_initN(firstage+1,lastage,2,15,1)

    matrix log_N(firstyr,lastyr,firstage,lastage)

//Parameters: median recruitment by year and deviations from this for each year
//  init_bounded_number log_R(4,19,1)
// init_bounded_dev_vector log_recruit_devs(firstyr,lastyr,-10,10,3)
//     vector log_recruits(firstyr,lastyr)
                          ///// note hard-wired number of years - 1
     init_bounded_vector log_recruits(firstyr,lastyr,5,24,2)

//----in calculate_catch function
    3darray C(1,nfleets,first_fyr,last_fyr,firstage,lastage)
    //matrix pred_catch(1,nfleets,first_fyr,last_fyr)
                    sdreport_matrix pred_catch(1,nfleets,1989,2013) //////////////years have to be hard-wired for the
                  sdreport for some reason

//---- in evaluate the objective function
        // indices
  //Parameter: catchability coefficient for each index
  init_bounded_vector log_q_ndx(1,n_ndx,-19,-4,4)
    matrix EffN(1,nfleets,first_fyr,last_fyr)
    matrix resid_ndx(1,n_ndx,first_syr,last_syr)
    matrix residmean_ndx(1,n_ndx,first_syr,last_syr)
      matrix resid_ndx2(1,n_ndx,first_syr,last_syr)
      matrix residmean_ndx2(1,n_ndx,first_syr,last_syr)
    matrix pred_ndx(1,n_ndx,first_syr,last_syr)
                    //sdreport_matrix pred_ndx(1,n_ndx,1989,2013)
    vector stdev_ndx(1,n_ndx)
    number ndx_f
    vector neglogLL_ndx(1,n_ndx)
       // PAA
    3darray resid_PAA(1,nfleets,first_fyr,last_fyr,firstage,lastage)
      // fake residuals
      3darray resid_PAA2(1,nfleets,first_fyr,last_fyr,firstage,lastage)
      3darray residmean_PAA2(1,nfleets,first_fyr,last_fyr,firstage,lastage)
    vector stdev_PAA(1,nfleets)
    matrix neglogLL_PAA(1,nfleets,first_fyr,last_fyr)
    number PAA_f
       // total catch
    matrix resid_tC(1,nfleets,first_fyr,last_fyr)
    matrix residmean_tC(1,nfleets,first_fyr,last_fyr)
     matrix resid_tC2(1,nfleets,first_fyr,last_fyr)
     matrix residmean_tC2(1,nfleets,first_fyr,last_fyr)
    vector stdev_tC(1,nfleets)
    vector neglogLL_tC(1,nfleets)

   // define some intermediate calculation
   number temp
   number temp2
   number tC_f
   number avg_F
   number F_brake_penalty
```

```
  // Benchmark stuff
   // including spawning stock biomass under fishing and under no fishing,
   // spawning potential ratio, and various escapement estimates
    vector SSB_F(firstyr,lastyr)
    vector SSB_F0(firstyr,lastyr)
     number F_survival
     number F0_survival
    //vector escapement13(firstyr,lastyr)
    //vector escapement15(firstyr,lastyr)
      //transitional
      //vector tEsc15(firstyr+4,lastyr)
      //vector tEsc13(firstyr+2,lastyr)

  objective_function_value f

   sdreport_vector log_total_abundance(firstyr,lastyr)
   sdreport_vector log_N1(firstyr,lastyr)
   sdreport_vector log_N2(firstyr,lastyr)
   sdreport_vector log_N3(firstyr,lastyr)
   sdreport_vector log_Nplus(firstyr,lastyr)
   sdreport_vector expl13(firstyr,lastyr)
   sdreport_vector static_SPR(firstyr,lastyr)
   sdreport_vector three_yrSPR(firstyr+2,lastyr)
   sdreport_vector escapement13(firstyr,lastyr)
   sdreport_vector escapement15(firstyr,lastyr)
                  sdreport_vector tEsc15(firstyr+4,lastyr)
   sdreport_vector tEsc13(firstyr+2,lastyr)

   likeprof_number three_yrSPR2013

PROCEDURE_SECTION ////////////////////////////////////////////////////////////////////////

get_selectivities();

              // error debugging tools in PROCEDURE SECTIONS
                        // cout << agedN << endl;
                     // exit(4);

get_mortality_rates();

get_numbers_at_age();

calculate_catch();

evaluate_the_objective_function();

 // static spawning potential ratio, and various escapement rate estimates
  // calculate spawning stock biomass per recruit with current year's fishing and without any F
  for(iyr=firstyr;iyr<=lastyr;iyr++)
   {
                F_survival = mfexp(-1. * (wt_mat_M41(1,3)+tot_F(iyr,1)) );
                F0_survival = mfexp(-1. * wt_mat_M41(1,3));
                 SSB_F(iyr) = wt_mat_M41(1,2)*wt_mat_M41(1,1)*F_survival;
                 SSB_F0(iyr) = wt_mat_M41(1,2)*wt_mat_M41(1,1)*F0_survival;

    for(iage=firstage+1;iage<=lastage;iage++)
     {
```

```
                F_survival *= mfexp(-1.* (wt_mat_M41(iage,3)+tot_F(iyr,iage)) );
                F0_survival *= mfexp(-1.* wt_mat_M41(iage,3));
   SSB_F(iyr) += wt_mat_M41(iage,2)*wt_mat_M41(iage,1)*F_survival;
                 SSB_F0(iyr) += wt_mat_M41(iage,2)*wt_mat_M41(iage,1)*F0_survival;
  }
 for(iage=lastage+1;iage<40;iage++)
  {
                F_survival *= mfexp(-1.* (wt_mat_M41(iage,3)+tot_F(iyr,lastage)) );
                F0_survival *= mfexp(-1.* wt_mat_M41(iage,3));
   SSB_F(iyr) += wt_mat_M41(iage,2)*wt_mat_M41(iage,1)*F_survival;
                 SSB_F0(iyr) += wt_mat_M41(iage,2)*wt_mat_M41(iage,1)*F0_survival;
  }

  //Infinite series accumulation added for plus group (Mike's recommendation 7/12/16)
  F_survival *= mfexp(-1.* (wt_mat_M41(iage,3)+tot_F(iyr,lastage)))/(1.-mfexp(-
               1.*(wt_mat_M41(iage+1,3)+tot_F(iyr,lastage))));
                F0_survival *= mfexp(-1.* wt_mat_M41(iage,3))/(1.-mfexp(-1.*(wt_mat_M41(iage+1,3))));

   SSB_F(iyr) += wt_mat_M41(iage,2)*wt_mat_M41(iage,1)*F_survival;
                 SSB_F0(iyr) += wt_mat_M41(iage,2)*wt_mat_M41(iage,1)*F0_survival;

  // static SPR and static (year-specific) escapement rates
  static_SPR(iyr) = SSB_F(iyr)/SSB_F0(iyr);
  escapement13(iyr) = mfexp(-1.* tot_F(iyr,1)-tot_F(iyr,2)-tot_F(iyr,3));
  escapement15(iyr) = mfexp(-1.* tot_F(iyr,1)-tot_F(iyr,2)-tot_F(iyr,3)-tot_F(iyr,4)-tot_F(iyr,5));

   // transitional (yearclass-specific) escapement rates
    if(iyr>1992)
     {
      tEsc15(iyr) = mfexp( -1.* tot_F(iyr-4,1)-tot_F(iyr-3,2)-tot_F(iyr-2,3)-tot_F(iyr-1,4)-tot_F(iyr,5) );
     }
    if(iyr>1990)
     {
      tEsc13(iyr) = mfexp( -1.* tot_F(iyr-2,1)-tot_F(iyr-1,2)-tot_F(iyr,3) );
     }
}

log_total_abundance=log(rowsum(mfexp(log_N)));

for(iyr=firstyr;iyr<=lastyr;iyr++)
 {
  log_N1(iyr) = log_N(iyr,1);
  log_N2(iyr) = log_N(iyr,2);
  log_N3(iyr) = log_N(iyr,3);
  log_Nplus(iyr) = log_N(iyr,7);
  // catch across fleets
    temp=0.;
    for(ifleet=1;ifleet<=nfleets;ifleet++)
     {
      temp += C(ifleet,iyr,1)+C(ifleet,iyr,2)+C(ifleet,iyr,3);
     }
  expl13(iyr) = temp/( mfexp(log_N1(iyr))+mfexp(log_N2(iyr))+mfexp(log_N3(iyr)) );
    if(iyr>1990)
     {
     three_yrSPR(iyr) = ( static_SPR(iyr-2)+static_SPR(iyr-1)+static_SPR(iyr) )/3.;
     }
  }
```

```
       three_yrSPR2013 = ( static_SPR(2013-2)+static_SPR(2013-1)+static_SPR(2013) )/3.;

//  outputMCMC();

  ////////////////////////// Begin Population Dynamics Model ////////////////////////////////
FUNCTION get_selectivities

 //----selectivity is not described parametrically but assumed constant above some maximum age
 //----the following simply fills out the array of candidate selectivities to be evaluated
 //----in the end it is standardized to the largest selectivity

 sel_count=0;  //remember first age is one;
 for (ifleet=1;ifleet<=nfleets;ifleet++)
     {
      for (i=1;i<=yr_sel_block(ifleet,last_fyr(ifleet));i++)
       {

                    // Special: for the Florida live-release fishery selectivites are 'observed data' //////////////lines
                   below commented out if not estimating FL B2 selectivity
                    if(ifleet==4)
                     {
        for (iage=firstage;iage<=lastage;iage++)
          {
          log_sel(ifleet,i,iage) = log(B2_select(i,iage));
          }
       }
      else
       {
                       max_log_sel(ifleet,i)= -99.;
         // fill log_sel matrix using bounded vector
         for (iage=firstage;iage<=last_sel_age;iage++)
          {
          sel_count++;
          log_sel(ifleet,i,iage) = fill_log_sel(sel_count);
          // retain maximum selectivity within fleet and block of year
          if(log_sel(ifleet,i,iage)>max_log_sel(ifleet,i)) {max_log_sel(ifleet,i)=log_sel(ifleet,i,iage);}
          }

          // standardize relative to this maximum
         for (iage=firstage;iage<=last_sel_age;iage++)
          {
          log_sel(ifleet,i,iage) =  log_sel(ifleet,i,iage)-max_log_sel(ifleet,i);
          }

           // Special: for red drum, we assume that the selectivity drops after last estimated age
          // if(ifleet<4)
           // {
           log_sel(ifleet,i,last_sel_age+1) = log_sel(ifleet,i,last_sel_age)+log(1/(1+mfexp(-1.*sel04)));
           log_sel(ifleet,i,last_sel_age+2) = log_sel(ifleet,i,last_sel_age)+log(1/(1+mfexp(-1.*sel05)));
           // }
           // if(ifleet>=4)
           // {
          // log_sel(ifleet,i,last_sel_age+1) = log_sel(ifleet,i,last_sel_age)+log(1/(1+mfexp(-1.*sel04b2)));
          // log_sel(ifleet,i,last_sel_age+2) = log_sel(ifleet,i,last_sel_age)+log(1/(1+mfexp(-1.*sel05b2)));
          //  }

         // selectivity for older ages is set equal to oldest-aged selectivity
         for (iage=last_sel_age+3;iage<=lastage;iage++)
```

```
          {
          log_sel(ifleet,i,iage) = log_sel(ifleet,i,last_sel_age+2);
          }
        }
       }
      }


FUNCTION get_mortality_rates

 //----age-specific fishing mortalities are derived using estimated selectivities and year-specific F's----
 for (ifleet=1;ifleet<=nfleets;ifleet++)
  {
  // fill out the fleet-, year-, age-specific F's
  for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
   {
   for (iage=firstage;iage<=lastage;iage++)
    {
    log_Ffleet(ifleet,iyr,iage) = log_Fmult(ifleet,iyr)+log_sel(ifleet,yr_sel_block(ifleet,iyr),iage);
    }
   }
  }

 // --- calculate instantaneous total mortality for convenience later
 //     allow for variable M with age

     // calculate the total fishing mortality across all fisheries each year
     // remember not all fleets operate all year -- sum available F's
     tot_F=0.0;
    for (ifleet=1;ifleet<=nfleets;ifleet++)
     {
     for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
      {
      for (iage=firstage;iage<=lastage;iage++)
       {
       tot_F(iyr,iage) += mfexp(log_Ffleet(ifleet,iyr,iage));
       }
      }
     }

   // calculate Z's
  for (iyr=firstyr;iyr<=lastyr;iyr++)
   {
     Z(iyr) = M;
      for (iage=firstage;iage<=lastage;iage++)
       {
        Z(iyr,iage) += tot_F(iyr,iage);
       }
   }

FUNCTION get_numbers_at_age

  // This fills parameter estimates for initial N's or top row and
  // numbers-at-age-1 (recruits) or left column in N-at-age matrix

   // initial year's abundance for ages-2 to 7+
//    for (iage=firstage+1;iage<=lastage;iage++)
//    {
```

```
//                      if (active(log_initN_devs))
//                       {
 //      log_N(firstyr,iage)=log_initN+log_initN_devs(iage);
 //       }
 //      else
 //       {
 //      log_N(firstyr,iage)=log_initN;
 //       }
 //   }

     // initial year's abundance for ages-2 to 7+
   for (iage=firstage+1;iage<=lastage;iage++)
    {
      log_N(firstyr,iage)=log_initN(iage);
    }

   // all year's recruitment or beginning-of-the-year abundance of age-1
  //  for (iyr=firstyr;iyr<lastyr;iyr++)
  //  {
  //                      if (active(log_recruit_devs))
  //                       {
  //       log_recruits(iyr) = log_R + log_recruit_devs(iyr);
  //       log_N(iyr,firstage) = log_recruits(iyr);
  //       }
  //      else
  //       {
  //       log_recruits(iyr) = log_R;
  //       log_N(iyr,firstage) =log_recruits(iyr);
  //       }

    for (iyr=firstyr;iyr<=lastyr;iyr++)
    {
        log_N(iyr,firstage) = log_recruits(iyr);
    }

   //----from these starting values project abundances forward in time and age----
    for (iyr=firstyr;iyr<lastyr;iyr++)
    {
     for (iage=firstage;iage<lastage;iage++)
      {
      log_N(iyr+1,iage+1)=log_N(iyr,iage)-Z(iyr,iage);
      }

   //----oldest age is a plus group so, in addition to the cohort survivors for last year
   //    need to add the previous year's plus-group survivors
    log_N(iyr+1,lastage)=log( mfexp(log_N(iyr,lastage)-Z(iyr,lastage))+mfexp(log_N(iyr+1,lastage))  );
    }
   //----define recruitment in the final year, this is only informed if there is a yoy index to fit----
//                      if (active(log_recruit_devs))
//                       {
 //       log_recruits(lastyr) = log_R + log_recruit_devs(lastyr);
 //       log_N(lastyr,firstage) = log_recruits(lastyr);
 //       }
 //      else
 //       {
 //       log_recruits(lastyr) = log_R;
 //       log_N(lastyr,firstage) =log_recruits(lastyr);
 //       }
```

```
// ////////////////////////////////// END POPULATION DYNAMICS MODEL ////////////////////////////////////////////

FUNCTION calculate_catch

  /////// for convenience need to calculate some terms to be used to calculate predicted proportion at age
  //----Use catch equation to calculate fleet-specific catch-at-age matrices----
  //    and total kill each year for each fleet
    pred_catch = 0.0;
    for (ifleet=1;ifleet<=nfleets;ifleet++)
     {
     for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
      {
      for (iage=firstage;iage<=lastage;iage++)
       {
       C(ifleet,iyr,iage) = (mfexp(log_Ffleet(ifleet,iyr,iage))/Z(iyr,iage))
                    * mfexp( log_N(iyr,iage) ) * ( 1.-mfexp(-1.*Z(iyr,iage)) );
       pred_catch(ifleet,iyr) +=  C(ifleet,iyr,iage);
       }
      }
     }

 ////////////////////////////////  OBSERVATION MODEL ////////////////////////////////////
FUNCTION evaluate_the_objective_function


// Estimate effective sample size
// useful in determining the 'goodness of fit' for the multinomial prediction of proportion at age in kill

   for (ifleet=1;ifleet<=nfleets;ifleet++)
    {
    for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {
     temp = 0.;
     temp2 = 0.;
      for (iage=firstage;iage<=lastage;iage++)
       {
       temp  += C(ifleet,iyr,iage)/(pred_catch(ifleet,iyr)+1.e-13)*( 1-C(ifleet,iyr,iage)
                                                  /(pred_catch(ifleet,iyr)+1.e-13) );
       temp2 += square( obs_prop_at_age(ifleet,iyr,iage)-C(ifleet,iyr,iage)
                                                 /(pred_catch(ifleet,iyr)+1.e-13) );
       }
   EffN(ifleet,iyr) = temp/temp2;
     }
    }

            // in the last phase a small penalty for a small F is added to objective
            // function, in earlier phases a much larger penalty keeps solution away
            // from infinitesimally small Fs
F_brake_penalty = 0.;
avg_F=sum(tot_F)/double(size_count(tot_F));
if(last_phase())
{
  F_brake_penalty += 1.e-6*square(log(avg_F/.2));
}
else
{
  F_brake_penalty += F_brake * square(log(avg_F/.2));
```

```
 }

    ////////////// minimally 'regularize' the selectivities ////////////
    f += 5. *norm2(fill_log_sel);



// ----negative log Likelihood estimation for indices----------------------------------------

         // error debugging tools in PROCEDURE SECTIONS
         //    cout << wt_choice << endl;
                        //   exit(4);


  ndx_f = 0;
  neglogLL_ndx = 0;
  ndx_n = 0;
   for (indx=1;indx<=n_ndx;indx++)
    {
     for(iyr=first_syr(indx);iyr<=last_syr(indx);iyr++)
      {
       if(survey_ndx(indx,iyr)>0)
        {
         // for aggregate indices, sum appropriate N estimates
         temp=0;
         for(iage=first_sage(indx);iage<=last_sage(indx);iage++)
         {
         temp += mfexp( log_N(iyr,iage)-Z(iyr,iage)*(survey_month(indx)/12.) );
         }
      ndx_n++; // how many index data points
      pred_ndx(indx,iyr) = mfexp(log_q_ndx(indx))*temp;
       // standardized residual
      resid_ndx(indx,iyr) = (   log(survey_ndx(indx,iyr)+1.e-6) - ( log_q_ndx(indx) + log(temp+1.e-6) )   )/
                        sqrt(log(pow(survey_CVs(indx,iyr),2)+1));
       // standardized residual from average -- for total sum of squares (dubious)
      residmean_ndx(indx,iyr) = (   log(survey_ndx(indx,iyr)+1.e-6) -  ave_obsNdx(indx)   )/
                        sqrt(log(pow(survey_CVs(indx,iyr),2)+1));

            // squared residuals//////////////////
      resid_ndx2(indx,iyr) = square(  ( log(survey_ndx(indx,iyr)+1.e-6) - ( log_q_ndx(indx) + log(temp+1.e-6) ) )/
                        sqrt(log(pow(survey_CVs(indx,iyr),2)+1))    );
      residmean_ndx2(indx,iyr) = square(  ( log(survey_ndx(indx,iyr)+1.e-6) -  ave_obsNdx(indx) )/
                        sqrt(log(pow(survey_CVs(indx,iyr),2)+1))   );
           ////////////////////////////////

       // negative log-likelihood for the lognormal distribution
      neglogLL_ndx (indx) +=  0.5*square( resid_ndx(indx,iyr) ) + log(sqrt(log(pow(survey_CVs(indx,iyr),2)+1)));
         }
      }
     ndx_f += neglogLL_ndx(indx)*indx_wt(wt_choice(3),indx);
    }

                                // error debugging tools in PROCEDURE SECTIONS
                                        //cout << agedN << endl;
                                    //exit(4);

//---Likelihood estimation for catch proportions-at-age ------------------------
  PAA_f = 0;
```

```
 neglogLL_PAA = 0;
 PAA_n2=0;
 for (ifleet=1;ifleet<=nfleets;ifleet++)
  {
    PAA_n = 0;
   for (iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
    {
      // these were not observed for fleet=5; Florida rec live-release fishery ////////////////////////comment out
                    below
                    if(ifleet==4) {PAA_f +=0;}
                          else
                           {
    for (iage=firstage;iage<=lastage;iage++)
     {
     PAA_n2++;
     PAA_n++;
      // 'residual' in multinomial sense
     resid_PAA(ifleet,iyr,iage) = (obs_prop_at_age(ifleet,iyr,iage)+1.e-6)*log(
                    (C(ifleet,iyr,iage)/pred_catch(ifleet,iyr)+1.e-6)  );

           // squared residuals//////////////////
     resid_PAA2(ifleet,iyr,iage) = square( ( (obs_prop_at_age(ifleet,iyr,iage)+1.e-6) -
                    (C(ifleet,iyr,iage)/pred_catch(ifleet,iyr)+1.e-6) ) /
                          sqrt(  agedN(ifleet,iyr)*(obs_prop_at_age(ifleet,iyr,iage)+1.e-6)*(1-
                    (obs_prop_at_age(ifleet,iyr,iage)+1.e-6)) ) );
     residmean_PAA2(ifleet,iyr,iage) = square( ( (obs_prop_at_age(ifleet,iyr,iage)+1.e-6) -
                    (ave_obsPAA(ifleet,iage)+1.e-6))/
                          sqrt(  agedN(ifleet,iyr)*(obs_prop_at_age(ifleet,iyr,iage)+1.e-6)*(1-
                    (obs_prop_at_age(ifleet,iyr,iage)+1.e-6)) ) );
         ////////////////////////////////////

       // negative log-likelihood for the multinomial distribution
     neglogLL_PAA(ifleet,iyr) -= resid_PAA(ifleet,iyr,iage)*agedN(ifleet,iyr);
     }
           PAA_f +=  PAA_wt(wt_choice(2),ifleet,iyr) * neglogLL_PAA(ifleet,iyr);
           }
    }

      // dubious standard deviation for standardzed residuals -- rather, use effective sample size
                    ////////////////comment out below
                    if(ifleet==4) { stdev_PAA(ifleet)=0;}
                          else
                           {
            stdev_PAA(ifleet) = sqrt(  sum(resid_PAA2(ifleet))/double(PAA_n));
                           }
  }


// ----total catch kill ----------------------------------------
    tC_f = 0;
    tC_n = 0;
    neglogLL_tC = 0;
    for(ifleet=1;ifleet<=nfleets;ifleet++)
     {
     for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
      {
      tC_n++;
         // standardized residual
```

```
      resid_tC(ifleet,iyr) = (  log(obs_tot_catch(ifleet,iyr)+1.e-6) - log(pred_catch(ifleet,iyr)+1.e-6)  )/
                              sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1));
         // standardized residual from average
      residmean_tC(ifleet,iyr) = (  log(obs_tot_catch(ifleet,iyr)+1.e-6) - ave_obstC(ifleet)  )/
                              sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1));

          // squared residuals//////////////////
      resid_tC2(ifleet,iyr) = square (  ( log(obs_tot_catch(ifleet,iyr)+1.e-6) - log(pred_catch(ifleet,iyr)+1.e-6) )/
                              sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1))   );
      residmean_tC2(ifleet,iyr) = square(   ( log(obs_tot_catch(ifleet,iyr)+1.e-6) - ave_obstC(ifleet) )/
                              sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1))  );
         ////////////////////////////////////

          // negative log-likelihood for the lognormal distribution
      neglogLL_tC (ifleet) +=  0.5*square( resid_tC(ifleet,iyr) ) + log(sqrt(log(pow(tot_catch_CVs(ifleet,iyr),2)+1)));
       }
     tC_f += neglogLL_tC(ifleet)*totcatch_wt(wt_choice(1),ifleet);
     }

     ////////////////////////// End of Observation Model ////////////////////////////////

  // objective function sum of likelihoods -- F_brake is near zero and could be dropped in last phase
  f += ndx_f + PAA_f + tC_f + F_brake_penalty;

 ////Removed by AG and used mcmc switch instead
//FUNCTION outputMCMC
  //---------------------------------------------------------------------------------
//   ofstream MCMCout1("MCMC1.out",ios::app);
//    MCMCout1 << three_yrSPR2013 << " " <<  static_SPR << endl;
//   MCMCout1.close();
//     ofstream MCMCout2("MCMC2.out",ios::app);
//       MCMCout2 <<  log_recruits   <<  " " << log_Fmult <<
//              endl;
//      MCMCout2.close();
//    ofstream MCMCout3("MCMC3.out",ios::app);
//       MCMCout3 << log_N2 << " " << log_N3 << " " << log_Nplus << " " << log_initN  << endl;
//      MCMCout3.close();

  if (mceval_phase()){
    ofstream sizeout("threeyr.out", ios::app);
    sizeout<<three_yrSPR2013<<endl;
  }


REPORT_SECTION
  report << " Dump ALL INPUT DATA to verify correct read" << endl;
  report << nfleets << endl;
  report << endl;
  report << firstyr << "  " << lastyr << endl;
  report << endl;
  report << firstage << "  " << lastage << endl;
  report << endl;
  report << first_fyr << last_fyr << endl;
  report << endl;
  report << last_sel_age << endl;
  report << endl;
  report << M << endl;
  report << endl;
```

```
report << yr_sel_block << endl;
report << endl;
report << obs_tot_catch << endl;
report << endl;
report << tot_catch_CVs << endl;
report << endl;
report << obs_prop_at_age << endl;
report << endl;
report << n_ndx << endl;
report << endl;
report << first_syr << endl;
report << endl;
report << last_syr << endl;
report << endl;
report << survey_ndx << endl;
report << endl;
report << survey_CVs << endl;
report << endl;
report << endl;
report << "unwted_obj_fnctn_fit " << endl;
report << sum(neglogLL_ndx)+sum(neglogLL_PAA)+sum(neglogLL_tC)+F_brake_penalty+norm2(fill_log_sel)<< endl;
report << "Objective_function_total" << endl;
report << setw(15) << setprecision(5) << f << endl;
report << "Index_part_wted" << endl;
report << setw(15) << setprecision(5) << ndx_f << setw(15) << setprecision(5) << double(ndx_n) << endl;
report << "PAA_part_wted" << endl;
report << setw(15) << setprecision(5) << PAA_f << setw(15) << setprecision(5) << double(PAA_n2) << endl;
report << "total_catch_part_wted" << endl;
report << setw(15) << setprecision(5) << tC_f << setw(15) << setprecision(5) << double(tC_n) << endl;
report << "F_brake_penalty"  << endl;
report << setw(15) << F_brake_penalty << endl;
//report << "initN_devs" << setw(15) << norm2(log_initN_devs) << endl;
report << "log_selectivity_devs" << endl;
report << setw(15) << 5.*norm2(fill_log_sel) << endl;
//report << "log_recruit_devs" << norm2(log_recruit_devs) << endl;
report << endl;
report << "Look at fits" << endl;
report << "Index  Year  Pred  Std_Resid Std_Residfrommean" << endl;
 for(indx=1;indx<=n_ndx;indx++)
  {
  for(iyr=first_syr(indx);iyr<=last_syr(indx);iyr++)
   {
   report << setw(5) << setprecision(0) << indx
        << setw(5) << setprecision(0) << iyr
        << setw(10) << setprecision(5) << pred_ndx(indx,iyr)
                                << setw(10) << setprecision(5) << resid_ndx(indx,iyr)
                                << setw(10) << setprecision(5) << residmean_ndx(indx,iyr) << endl;
    }
  }

report << "Index - neglogLL - Standard Deviation of Standardized Residuals (SDSR) -  Standardized Residual Sum of
                Squares (SRSS) -  Total Standardized Residual Sum of Squares (TSRSS)" << endl;
  for(indx=1;indx<=n_ndx;indx++)
   {
                    stdev_ndx(indx) = std_dev(resid_ndx(indx));
                    report << setw(5) << setprecision(0) << indx
                                        << setw(15) << setprecision(5) << neglogLL_ndx(indx)
                                        << setw(10) << setprecision(5) << stdev_ndx(indx)
```

```
            << setw(10) << setprecision(5) << sum(resid_ndx2 (indx))
                                        << setw(10) << setprecision(5) << sum(residmean_ndx2 (indx)) << endl;
    }

report << endl;
report << " proportion at age " << endl;
   for(ifleet=1;ifleet<=nfleets;ifleet++)
    {
    for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {
     report << setw(5) << setprecision(0) << ifleet
          << setw(5) << setprecision(0) << iyr
          << setw(10) << setprecision(5) << C(ifleet,iyr)/pred_catch(ifleet,iyr) << endl;
     }
    }

 report << "Fleet - neglogLL - Standard Deviation of Standardized Residuals (SDSR)" << endl;
for (ifleet=1;ifleet<=nfleets;ifleet++)
 {
                        report << setw(5) << setprecision(0) << ifleet
                                        << setw(15) << setprecision(5) << sum(neglogLL_PAA(ifleet))
                                        << setw(10) << setprecision(5) << stdev_PAA(ifleet) << endl;
 }

report << endl;

report << "Fleet  Year  Pred  Std_Resid Std_Residfrommean " << endl;
 for(ifleet=1;ifleet<=nfleets;ifleet++)
  {
  for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
   {
     report.setf(ios::fixed, ios::floatfield);
                         report << setw(5) << setprecision(0) << ifleet
          << setw(10) << setprecision(0) << iyr
                                        << setw(15) << setprecision(0) << pred_catch(ifleet,iyr)
                                        << setw(10) << setprecision(5) << resid_tC(ifleet,iyr)
                                   << setw(10) << setprecision(5) << residmean_tC(ifleet,iyr) << endl;
   }
  }

report << "Fleet - neglogLL - Standard Deviation of Standardized Residuals (SDSR) -  Standardized Residual Sum of
                    Squares (SRSS) -  Total Standardized Residual Sum of Squares (TSRSS)" << endl;
   for(ifleet=1;ifleet<=nfleets;ifleet++)
    {
                        stdev_tC(ifleet) = std_dev(resid_tC(ifleet));
                        report << setw(5) << setprecision(0) << ifleet
                                        << setw(15) << setprecision(5) << neglogLL_tC(ifleet)
                                        << setw(10) << setprecision(5) << stdev_tC(ifleet)
          << setw(10) << setprecision(5) << sum(resid_tC2 (ifleet))
                                        << setw(10) << setprecision(5) << sum(residmean_tC2 (ifleet)) << endl;
    }

report << endl;
report << "Predicted population dynamics" << endl;
report << "Abundance" << endl;
   for(iyr=firstyr;iyr<=lastyr;iyr++)
    {
     report << setw(5) << setprecision(0) << iyr
```

```
          << setw(15) << setprecision(9) << mfexp(log_N(iyr)) << endl;
     }
report << endl;
report << "F at age by fleet" << endl;
  for(ifleet=1;ifleet<=nfleets;ifleet++)
    {
    for(iyr=first_fyr(ifleet);iyr<=last_fyr(ifleet);iyr++)
     {
      report << setw(5) << setprecision(0) << ifleet
          << setw(5) << setprecision(0) << iyr
          << setw(10) << setprecision(5) << mfexp(log_Ffleet(ifleet,iyr))
          << setw(10) << setprecision(5) << EffN(ifleet,iyr) << endl;
     }
    }
 report << endl;
 report << "Check bounded values" << endl;
 report << "fill_log_sels" << endl;
 report << setw(5) << setprecision(0) << fill_log_sel << endl;
 report << endl;
 report << "log_Fmult" << endl;
 report << setw(5) << setprecision(0) << log_Fmult << endl;
 report << endl;
 report << "log_initN" << endl;
 report << setw(5) << setprecision(0) << log_initN << endl;
 report << endl;
 report << "log_recruits" << endl;
 report << setw(5) << setprecision(0) << log_recruits << endl;
 report << endl;
 report << "log_q_ndx" << endl;
 report << setw(5) << setprecision(0) << log_q_ndx << endl;
 report << endl;
 report << "selectivities" << endl;
    for (ifleet=1;ifleet<=nfleets;ifleet++)
        {
         for (i=1;i<=yr_sel_block(ifleet,last_fyr(ifleet));i++)
          {
            report << setw(5) << setprecision(0) << ifleet
                 << setw(5) << setprecision(0) << i
                 << setw(10) << setprecision(5) << mfexp(log_sel(ifleet,i)) << endl;
                       }
        }
 report << endl;
 report << "weighting scheme for this run" << endl;
 report << "TC wt" << setw(10) << setprecision(5) << totcatch_wt(wt_choice(1)) << endl;
 report << "PAA wt" << endl;
 report << setw(10) << setprecision(5) << PAA_wt(wt_choice(2)) << endl;
 report << "Index wt" << setw(10) << setprecision(5) << indx_wt(wt_choice(3)) << endl;
 report << "Fbrake" << setw(10) << setprecision(5) << F_brake << endl;

 report << endl;
 report << "Total F estimates by year and age" << endl;
       for (iyr=firstyr;iyr<=lastyr;iyr++)
        {
                       report << setw(5) << setprecision(0) << iyr;
        for (iage=firstage;iage<=lastage;iage++)
         {
          report << setw(10) << setprecision(5) << tot_F(iyr,iage);
                       }
```

```
                report << endl;
        }
  report << endl;


      report << " static SPR     " << setw(15) << setprecision(5) << static_SPR << endl;
      report << " 3 year SPR    " << setw(15) << setprecision(5) << three_yrSPR << endl;
      report << " escapement 1-3 " << setw(15) << setprecision(5) << escapement13 << endl;
      report << " escapement 1-5 " << setw(15) << setprecision(5) << escapement15 << endl;
      report << " t Esc 1-3 " << setw(15) << setprecision(5) << tEsc13 << endl;
      report << " t Esc 1-5 " << setw(15) << setprecision(5) << tEsc15 << endl;

      report << "sel constraint estimates (4 and 5)=" << 1/(1+mfexp(-1.*sel04)) << "   " << 1/(1+mfexp(-1.*sel05)) <<
                endl;
      //report << "selectivity constraint for B2 (4 and 5) =" << 1/(1+mfexp(-1.*sel04b2))
       //     << "   " << 1/(1+mfexp(-1.*sel05b2)) << endl;

      // report << "SSB" << SSB_F(iyr) << endl;
```

Weights Files

```
#weights
#total catch by fleet
# Ha:default
#fleet1 fleet2 fleet3 fleet4 fleet5
 1.    1.    1.    1.    1.
# Ha:B2 rec total catch estimates are suspect
#fleet1 fleet2 fleet3 fleet4 fleet5
 1.    1.    1.    0.1   0.1
# Ha:B2 rec total catch estimates are really suspect
#fleet1 fleet2 fleet3 fleet4 fleet5
 1.    1.    1.    0.01   0.01

#weights
#Ha:default
#catch at age by fleet and year
#1989   1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                  2005   2006   2007   2008   2009   2010   2011   2012   2013
1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                  1    1
1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                  1    1
1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                  1    1
0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                  0    0
1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                  1    1
#Ha:the B2 age compostion data is very uncertain
#catch at age by fleet and year
#1989  1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                  2005   2006   2007   2008   2009   2010   2011   2012   2013
1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                  1    1
1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                  1    1
1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
                  1    1
```

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0
0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1
0.1 0.1 0.1 0.1 0.1
#Ha:the B2 age compostion data is very,very uncertain
#catch at age by fleet and year
#1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
2005 2006 2007 2008 2009 2010 2011 2012 2013
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001

#weights
#Ha:default
index weight
1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
#Ha:the MRFSS index is best due to areal coverage
index weight
1. 1. 1. 1. 1. 1. 1. 10. 1. 1. 1.
#Ha:the yoy indexes are best due to scientifically design and ease of capture
index weight
10. 10. 10. 10. 1. 1. 1. 1. 1. 1. 1.

Input Data

#Southern Stock 1989-2013 - Continuity
#
Defining 5 fleets with each state's (FL,GA,SC) having A+B1 rec, and FLrec B2 fishery then combined GASC B2
no commercial landings from southern stock during model period
#fleets (1=FLrecharv,2=GArecharv,3=SCrecharv,4)FL recB2,5)GA/SC recB2)
5
global first and last years used in assessment
1989 2013
#
first and last year for each fishing fleet
1989 1989 1989 1989 1989
2013 2013 2013 2013 2013
#
#firstage lastage (same for all fleets)
1 7
#
#last age selectivity estimated for
3
#natural mortality////////////////////////////using mid year M-at-age estimated with SS3 SSVB growth estimates and
an average from age 7-42 for plus group M, updated 7/7/16
1 2 3 4 5 6 7
0.20 0.16 0.14 0.13 0.13 0.12 0.11

#
#selectivity block by fleet (each row is a fleet;1=FLrec,2=Garec/com,3=SCrec/com,4)FL recB2,5)GA/SC recB2)

```
#89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13
 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3
 1 1 1 1 1 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3
 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
#
# total kill by fleet in numbers ( ONLY A+B1 for recs -- 1=FLrec,2=Garec/com,3=SCrec/com,4)FL recB2,5)GA/SC recB2 )
#1989  1990  1991  1992  1993  1994  1995  1996  1997  1998  1999  2000  2001  2002  2003  2004
                2005  2006  2007  2008  2009  2010  2011  2012  2013
32985           45209       99336   98176   66971   119696  95198   144798  69369   105163  128499
                  193962  182701  124550  156213  136728  195550  145860  161427  159246  79635
                  175828  180001  238191  297527
46346           69122       146835  76290   96151   121655  124357  55991   35337   23449   61662
                  85222   81656   83356   110621  138893  105655  68813   113237  133107  68857
                  194826  106962  45766   73827
119686          113270      112968  103249  113460  119561  183302  124906  125771  45791   43140
                  35425   59147   39694   154111  107803  130655  48703   72261   119471  70326
                  172708  161503  121068  97386
0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
                0   0
0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
                0   0
#
# CV's for landings or releases depending on fishery ////////////////////////////////////////////used weighted
                average for SC/GA B2 fleet PSE
#1989  1990  1991  1992  1993  1994  1995  1996  1997  1998  1999  2000  2001  2002  2003  2004
                2005  2006  2007  2008  2009  2010  2011  2012  2013
0.396           0.386       0.240   0.181   0.184   0.163   0.187   0.298   0.214   0.173   0.141
                  0.136   0.142   0.155   0.147   0.128   0.177   0.130   0.140   0.168   0.146
                  0.145   0.128   0.149   0.121
0.234           0.236       0.245   0.182   0.193   0.223   0.223   0.220   0.202   0.229   0.245
                  0.212   0.317   0.201   0.178   0.242   0.187   0.228   0.220   0.187   0.205
                  0.218   0.220   0.259   0.194
0.267           0.386       0.309   0.199   0.332   0.542   0.728   0.316   0.226   0.212   0.308
                  0.294   0.343   0.273   0.294   0.206   0.216   0.282   0.234   0.227   0.198
                  0.174   0.182   0.244   0.182
0.427           0.365       0.451   0.229   0.238   0.209   0.184   0.188   0.194   0.175   0.160
                  0.145   0.150   0.183   0.169   0.140   0.181   0.123   0.138   0.159   0.109
                  0.132   0.140   0.100   0.162
0.382           0.455       0.456   0.269   0.520   0.240   0.277   0.305   0.308   0.218   0.277
                  0.238   0.254   0.220   0.200   0.191   0.173   0.175   0.175   0.203   0.176
                  0.158   0.146   0.113   0.147

#
#input B2 selectivity for rec northern stock by age (columns through last_sel_age) and year (rows) -- look to see - this
                is used for Florida
0.684  1.000  0.207  0.089  0.089  0.089  0.089

# total release by fleet (B2's)
#1989  1990  1991  1992  1993  1994  1995  1996  1997  1998  1999  2000  2001  2002  2003  2004
                2005  2006  2007  2008  2009  2010  2011  2012  2013
0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
                0   0
0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
                0   0
0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
                0   0
```

179873 71680 670400 296862 486498 720918 712927 522494 585029 506364 602572
739877 894528 698270 772792 1006814 1405967 847269 758684 889550 521659
1414115 1051143 799428 1541541
110822 250878 190598 168079 282091 468140 702511 265743 213601 117663 110762
221074 460384 313503 697313 580145 828116 676242 662781 865960 918827
1270102 878072 633855 872099

#
#release mortality
0.08
#
#proportion catch at age (age columns, year rows) by fleet ###Up to date###
#Age 1 2 3 4 5 6 7+
FLrec (AB1 prop at age)
0.3616 0.4382 0.1604 0.0347 0.0027 0.0005 0.0019
0.3481 0.3911 0.1524 0.0773 0.0130 0.0087 0.0094
0.2337 0.3253 0.2123 0.0548 0.0280 0.1409 0.0050
0.2953 0.2336 0.2964 0.1335 0.0222 0.0106 0.0084
0.1178 0.3457 0.2965 0.1863 0.0279 0.0140 0.0118
0.2173 0.2975 0.2676 0.1738 0.0230 0.0117 0.0090
0.0925 0.3459 0.2454 0.2621 0.0315 0.0109 0.0117
0.2220 0.2960 0.2669 0.1750 0.0230 0.0111 0.0059
0.1559 0.2811 0.3043 0.2054 0.0209 0.0321 0.0003
0.0643 0.4179 0.2629 0.2312 0.0115 0.0017 0.0104
0.0874 0.3149 0.5517 0.0311 0.0140 0.0002 0.0007
0.0253 0.6080 0.2729 0.0789 0.0100 0.0032 0.0019
0.0471 0.4122 0.4087 0.1253 0.0028 0.0004 0.0036
0.0098 0.5500 0.1409 0.1405 0.1428 0.0038 0.0122
0.0298 0.4844 0.2639 0.1970 0.0246 0.0000 0.0003
0.0751 0.2907 0.2304 0.3529 0.0480 0.0009 0.0019
0.0382 0.4292 0.3403 0.1010 0.0845 0.0014 0.0054
0.0116 0.3281 0.3786 0.2188 0.0499 0.0119 0.0011
0.0198 0.4068 0.3687 0.1635 0.0329 0.0047 0.0037
0.0118 0.3578 0.4100 0.2132 0.0027 0.0024 0.0022
0.0576 0.4535 0.4003 0.0479 0.0374 0.0002 0.0031
0.0162 0.5242 0.3374 0.0989 0.0181 0.0006 0.0046
0.0218 0.5131 0.4038 0.0392 0.0120 0.0008 0.0093
0.0224 0.2836 0.6048 0.0620 0.0011 0.0196 0.0065
0.0447 0.3750 0.1638 0.3677 0.0359 0.0019 0.0111

#GArec (AB1 prop at age)
0.5403 0.3716 0.0766 0.0087 0.0025 0.0003 0.0000
0.6002 0.2500 0.0768 0.0391 0.0055 0.0026 0.0259
0.6753 0.2894 0.0298 0.0049 0.0005 0.0001 0.0000
0.6326 0.2925 0.0510 0.0169 0.0043 0.0015 0.0013
0.5539 0.2984 0.0996 0.0357 0.0076 0.0019 0.0029
0.6185 0.2929 0.0745 0.0120 0.0016 0.0002 0.0002
0.6288 0.2714 0.0728 0.0195 0.0051 0.0010 0.0013
0.6356 0.3019 0.0516 0.0075 0.0029 0.0004 0.0001
0.7443 0.2073 0.0426 0.0043 0.0011 0.0002 0.0002
0.5217 0.3153 0.0895 0.0531 0.0139 0.0028 0.0037
0.3681 0.4127 0.1487 0.0421 0.0194 0.0040 0.0050
0.5513 0.3172 0.1139 0.0090 0.0053 0.0010 0.0024
0.7426 0.2145 0.0315 0.0051 0.0034 0.0008 0.0021
0.6091 0.3290 0.0236 0.0136 0.0106 0.0028 0.0114
0.5968 0.3733 0.0289 0.0004 0.0003 0.0001 0.0003
0.5416 0.3535 0.0917 0.0090 0.0022 0.0005 0.0016

0.5615 0.4025 0.0351 0.0009 0.0000 0.0000 0.0000
0.3961 0.5489 0.0503 0.0029 0.0011 0.0002 0.0006
0.5287 0.4080 0.0412 0.0098 0.0065 0.0014 0.0045
0.5418 0.4297 0.0193 0.0036 0.0028 0.0007 0.0021
0.5662 0.4011 0.0287 0.0016 0.0012 0.0002 0.0008
0.4772 0.4307 0.0790 0.0057 0.0034 0.0008 0.0032
0.7995 0.1661 0.0309 0.0019 0.0007 0.0002 0.0007
0.4997 0.3319 0.1319 0.0132 0.0103 0.0026 0.0105
0.5829 0.2873 0.0797 0.0169 0.0138 0.0035 0.0159

#SCrec (AB1 prop at age)
0.3381 0.4715 0.1488 0.0380 0.0035 0.0000 0.0002
0.4344 0.3397 0.2036 0.0208 0.0014 0.0000 0.0000
0.4954 0.4475 0.0342 0.0089 0.0020 0.0000 0.0119
0.2596 0.6299 0.0847 0.0139 0.0024 0.0002 0.0094
0.2323 0.5547 0.1543 0.0429 0.0123 0.0000 0.0035
0.1900 0.5570 0.1834 0.0635 0.0056 0.0004 0.0001
0.4526 0.4074 0.0972 0.0357 0.0067 0.0002 0.0000
0.1056 0.7362 0.0957 0.0421 0.0187 0.0014 0.0003
0.3679 0.4079 0.1361 0.0590 0.0258 0.0016 0.0016
0.2622 0.5202 0.1094 0.0820 0.0231 0.0014 0.0016
0.2497 0.5066 0.1835 0.0428 0.0142 0.0019 0.0013
0.2530 0.5378 0.1514 0.0498 0.0070 0.0005 0.0005
0.3426 0.4432 0.1461 0.0557 0.0094 0.0013 0.0017
0.0903 0.7676 0.0917 0.0282 0.0147 0.0021 0.0054
0.0724 0.6331 0.1789 0.0979 0.0159 0.0011 0.0007
0.0786 0.6265 0.2121 0.0745 0.0079 0.0004 0.0000
0.1834 0.4619 0.2833 0.0594 0.0092 0.0012 0.0016
0.0976 0.5810 0.2499 0.0541 0.0075 0.0017 0.0083
0.2119 0.5801 0.1486 0.0390 0.0126 0.0014 0.0063
0.1505 0.6027 0.1276 0.0757 0.0235 0.0088 0.0113
0.0640 0.6176 0.1702 0.0809 0.0298 0.0118 0.0256
0.1312 0.6114 0.1810 0.0487 0.0116 0.0014 0.0147
0.1450 0.5657 0.1631 0.0867 0.0205 0.0037 0.0154
0.1216 0.6487 0.1429 0.0562 0.0116 0.0023 0.0167
0.1054 0.7476 0.1233 0.0177 0.0027 0.0004 0.0029

FLrec B2 age comp ###From Mike's input files for code estimating B2 selectivity
0.6036 0.3137 0.0580 0.0242 0.0003 0.0000 0.0002
0.8021 0.1368 0.0393 0.0207 0.0005 0.0000 0.0006
0.6854 0.2405 0.0488 0.0056 0.0147 0.0039 0.0011
0.4988 0.1978 0.1806 0.0893 0.0171 0.0096 0.0068
0.2711 0.1912 0.2439 0.2167 0.0427 0.0156 0.0188
0.1723 0.1719 0.2224 0.3205 0.0618 0.0255 0.0257
0.1007 0.1790 0.2152 0.3831 0.0671 0.0244 0.0305
0.1081 0.2169 0.2609 0.2996 0.0649 0.0270 0.0227
0.1098 0.1443 0.2921 0.3393 0.0470 0.0633 0.0041
0.0395 0.2101 0.1677 0.4696 0.0537 0.0154 0.0439
0.1019 0.1276 0.4209 0.1127 0.2175 0.0043 0.0149
0.0450 0.2339 0.2286 0.2751 0.1130 0.0327 0.0717
0.0461 0.1397 0.4724 0.1819 0.0474 0.0123 0.1002
0.0286 0.2119 0.1568 0.2264 0.1754 0.0409 0.1599
0.2986 0.4115 0.1621 0.0558 0.0640 0.0005 0.0074
0.0825 0.2688 0.1468 0.3857 0.0710 0.0143 0.0308
0.0110 0.1705 0.2706 0.1664 0.2676 0.0235 0.0905
0.1691 0.2466 0.2563 0.1727 0.0629 0.0561 0.0363
0.0329 0.1900 0.2273 0.2926 0.1403 0.0424 0.0745

0.0126 0.1108 0.2219 0.4355 0.0799 0.0735 0.0658
0.1055 0.2968 0.3219 0.1175 0.0910 0.0044 0.0630
0.0257 0.2649 0.3784 0.2115 0.0521 0.0074 0.0600
0.0174 0.2436 0.4255 0.1152 0.1080 0.0071 0.0832
0.0191 0.2099 0.4241 0.1209 0.0151 0.1218 0.0891
0.1242 0.2258 0.0811 0.3866 0.0714 0.0243 0.0865

SCrec+GArec B2 age comp
0.5652 0.3518 0.0674 0.0117 0.0034 0.0004 0.0001
0.8506 0.1121 0.0353 0.0019 0.0000 0.0000 0.0000
0.7264 0.2235 0.0401 0.0084 0.0012 0.0003 0.0002
0.5343 0.2594 0.1427 0.0422 0.0158 0.0023 0.0033
0.2640 0.2730 0.2888 0.1359 0.0340 0.0020 0.0022
0.1682 0.1617 0.2897 0.3156 0.0564 0.0062 0.0022
0.1807 0.1969 0.2640 0.2513 0.0872 0.0117 0.0083
0.0919 0.3296 0.2230 0.2170 0.1236 0.0117 0.0033
0.0886 0.1400 0.3355 0.2510 0.1586 0.0134 0.0129
0.0494 0.1789 0.1692 0.3302 0.1996 0.0321 0.0405
0.0449 0.1769 0.3221 0.2385 0.1644 0.0294 0.0238
0.0567 0.2063 0.3535 0.2075 0.1130 0.0209 0.0422
0.1160 0.0873 0.3090 0.2445 0.1464 0.0331 0.0637
0.0911 0.2778 0.1646 0.1798 0.1538 0.0300 0.1028
0.0198 0.2301 0.3629 0.1945 0.1178 0.0294 0.0456
0.0146 0.2043 0.3724 0.2566 0.1068 0.0183 0.0269
0.0162 0.1574 0.4506 0.2097 0.0920 0.0208 0.0533
0.0054 0.1564 0.3407 0.3375 0.0951 0.0210 0.0439
0.0434 0.1606 0.3187 0.2563 0.1300 0.0185 0.0725
0.0213 0.2339 0.3200 0.2282 0.1035 0.0337 0.0594
0.0151 0.2460 0.3882 0.1848 0.0758 0.0275 0.0626
0.0330 0.1695 0.5076 0.1597 0.0564 0.0096 0.0642
0.0371 0.2010 0.4052 0.2275 0.0647 0.0122 0.0522
0.0368 0.2147 0.3864 0.2145 0.0574 0.0119 0.0783
0.0957 0.2287 0.3162 0.2139 0.0614 0.0116 0.0724

assumed ages sampled by fleet and year(1=FLrec,2=Garec/com,3=SCrec/com,4=B2FL, 5=B2GA/SC)###needs to be updated with FL logbook and SC tag lengths ESS###Updated with ESS scaled to range from ESS-South worksheet of data inputs file 7/8/16

#1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
2005 2006 2007 2008 2009 2010 2011 2012 2013

4 4 6 7 9 12 11 13 8 12 22 25
25 20 19 18 18 22 19 18 15 20
20 22 15

8 4 5 11 8 7 7 7 20 25 21 23
27 42 47 41 28 20 22 47 50 44
37 23 36

11 11 15 21 26 12 22 45 37 36 31
38 31 47 38 43 31 31 27 35 37
45 47 38 17

2 2 2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2 2
2 2 2

2 2 2 3 3 2 5 3 3 2 3 2
2 2 2 2 2 2 2 2 2 2 2
2 2 2

number of indices

```
# YOY's: 1)FL 2)GA 3)SC stop net 4)SC trammel age 1 ; subadult: 5)SC trammel age 2 6)FL hs 2 7)FL hs 3 8) MRFSS 9) SC
                adults 1m 10) SC adults 1/3m 11) GA adults
 11
# first year of surveys followed by last year of surveys
 2002 2003 1989 1994 1994 1997 1997 1991 1994 2007 2007
 2013 2013 1994 2013 2013 2013 2013 2013 2004 2013 2013
# indices ages (indices in order by row showing begin, end ages)
 1  1  1  1  2 2 3 1  7  7  7
 1  1  1  1  2 2 3 3  7  7  7
#
# middle of survey (months) ###Month is divided by 12 in the model code, changed inputs to month
 0 6 10 10 6 6 6 6 11 11 11
#
#observed index values across years (columns)
# YOY's: 1)FL 2)GA 3)SC stop net 4)SC trammel age 1 ; subadult: 5)SC trammel age 2 6)FL hs 2 7)FL hs 3 8) MRFSS 9) SC
                adults 1m 10) SC adults 1/3m 11) GA adults (2006 taken out based on Carolyns recommendation)
                ##Up to date###

#1989 1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                2005   2006   2007   2008   2009   2010   2011   2012   2013

                  0.615    1.377    1.299    0.525    0.156    0.990    1.102    0.784    1.114    0.339
                  0.703    2.999

                           1.360    0.987    1.170    0.501    0.872    1.504    0.971    2.014    0.583
                  0.450    0.590
0.895             0.952    1.300    0.926    0.616    0.740


                                                0.972    1.407    0.625    1.123    0.585    0.630    0.269
                  1.736    1.415    1.965    0.809    0.666    0.472    1.067    1.217    1.366    1.799
                  0.648    0.538    0.689
                                                1.369    0.931    1.555    0.636    0.836    0.595    0.654
                  0.361    2.274    1.770    1.820    0.943    1.041    0.505    1.044    1.069    1.028
                  0.713    0.493    0.361
                                                                              0.793    1.106    0.660    1.003
                  0.631    0.977    0.782    1.207    1.405    1.080    1.338    1.286    0.949    0.993
                  0.902    1.106    0.782
                                                                              0.960    1.561    0.847    0.934
                  1.203    1.182    1.275    1.446    0.804    1.232    0.862    1.009    0.712    0.863
                  0.805    0.667    0.638
                  0.790    0.829    0.914    1.101    1.238    1.056    0.877    0.796    0.790    0.778
                  1.047    0.904    1.032    1.123    1.106    0.862    0.834    0.918    1.079    1.498
                  1.287    0.964    1.180
                                                1.468    1.584    1.219    0.528    0.812    0.928    0.573
                  0.822    0.658    1.346    1.063


                                                                    0.662    0.706    1.440    0.839    0.806
                  1.325    1.221

                                                                    0.471    0.735    1.366    0.681    1.810
                  0.424    1.513

# estimated CV's for the index values
#1989 1990   1991   1992   1993   1994   1995   1996   1997   1998   1999   2000   2001   2002   2003   2004
                2005   2006   2007   2008   2009   2010   2011   2012   2013
```

0.50471 0.44332 0.48500 0.52666 0.89699 0.48697 0.44755 0.43174 0.39482 0.65788
0.47564 0.36162

0.31100 0.21900 0.14510 0.15720 0.19270 0.19880 0.24420 0.16420 0.17570
0.22250 0.19820
0.31797 0.51984 0.23095 0.15577 0.14313 0.22177

0.21319 0.16071 0.17599 0.25375 0.18534 0.16223 0.13920
0.13539 0.11711 0.13012 0.19139 0.12737 0.14720 0.13571 0.13936 0.13925 0.11130
0.16576 0.14116 0.13825
0.24178 0.15945 0.16790 0.15624 0.15480 0.18321 0.13762
0.12147 0.20198 0.12012 0.11147 0.11585 0.11812 0.17775 0.14307 0.16283 0.13335
0.20091 0.22807 0.13122
0.24497 0.21514 0.23188 0.19717
0.23551 0.17502 0.18733 0.16025 0.14182 0.16656 0.14029 0.15918 0.17153 0.17061
0.16589 0.16222 0.18549
0.27004 0.24465 0.28354 0.28356
0.23540 0.20569 0.20967 0.18945 0.24866 0.21223 0.25106 0.22837 0.27964 0.22216
0.26134 0.27085 0.30849
0.08596 0.06025 0.06203 0.05426 0.04836 0.04993 0.05209 0.05061 0.04387 0.04203
0.03983 0.04157 0.04187 0.04133 0.03920 0.04043 0.04278 0.04134 0.04088 0.03450
0.03405 0.03878 0.04509
0.22664 0.12721 0.21235 0.18073 0.20313 0.14434 0.20007
0.21702 0.47246 0.17901 0.26679

0.22820 0.16702 0.17198 0.12044 0.10686
0.09519 0.09293

0.33333 0.26818 0.21516 0.25000 0.26568
0.24409 0.22517

#Fbrake level, eliminates low F/high N bias in early phases of solution
2000.
choice of weighting scheme
TC, PAA, Ndx
1. 2. 1.
weight(lbs), maturity, and M at age through age 41, input as end year weight, end year maturity, end year M, M and Wt based on SSVB growth estimates from SS3 and maturity updated (updated 7/8/16)
2.18 0.00 0.20
5.43 0.02 0.16
9.07 0.09 0.14
12.48 0.36 0.13
15.38 0.77 0.13
17.71 0.95 0.12
19.51 0.99 0.12
20.88 1.00 0.12
21.89 1.00 0.12
23.60 1.00 0.11
24.23 1.00 0.11
24.47 1.00 0.11
24.55 1.00 0.11
24.58 1.00 0.11
24.59 1.00 0.11
24.60 1.00 0.11
24.60 1.00 0.11

24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11
24.60	1.00	0.11

Appendix C. Correlation coefficents between parameters with a correlation greater than 0.90 or less than -0.90 in the southern stock model.

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 1991	FL Rec F 1992	0.92	FL Rec F 1992	FL B2 F 2001	0.94
FL Rec F 1991	FL Rec F 1993	0.91	FL Rec F 1993	FL B2 F 2001	0.94
FL Rec F 1992	FL Rec F 1994	0.94	FL Rec F 1994	FL B2 F 2001	0.94
FL Rec F 1991	FL Rec F 1994	0.92	FL Rec F 1995	FL B2 F 2001	0.94
FL Rec F 1992	FL Rec F 1995	0.94	FL Rec F 1996	FL B2 F 2001	0.90
FL Rec F 1993	FL Rec F 1996	0.94	FL Rec F 1997	FL B2 F 2001	0.93
FL Rec F 1991	FL Rec F 1995	0.91	FL Rec F 1998	FL B2 F 2001	0.94
FL Rec F 1992	FL Rec F 1995	0.94	FL Rec F 1999	FL B2 F 2001	0.95
FL Rec F 1993	FL Rec F 1995	0.94	FL Rec F 2000	FL B2 F 2001	0.95
FL Rec F 1994	FL Rec F 1995	0.94	FL Rec F 2001	FL B2 F 2001	0.95
FL Rec F 1992	FL Rec F 1996	0.90	FL Rec F 2002	FL B2 F 2001	0.95
FL Rec F 1993	FL Rec F 1996	0.90	FL Rec F 2003	FL B2 F 2001	0.95
FL Rec F 1994	FL Rec F 1996	0.91	FL Rec F 2004	FL B2 F 2001	0.95
FL Rec F 1995	FL Rec F 1996	0.90	FL Rec F 2005	FL B2 F 2001	0.94
FL Rec F 1991	FL Rec F 1997	0.90	FL Rec F 2006	FL B2 F 2001	0.95
FL Rec F 1992	FL Rec F 1997	0.93	FL Rec F 2007	FL B2 F 2001	0.95
FL Rec F 1993	FL Rec F 1997	0.93	FL Rec F 2008	FL B2 F 2001	0.94
FL Rec F 1994	FL Rec F 1997	0.93	FL Rec F 2009	FL B2 F 2001	0.95
FL Rec F 1995	FL Rec F 1997	0.93	FL Rec F 2010	FL B2 F 2001	0.95
FL Rec F 1991	FL Rec F 1998	0.91	FL Rec F 2011	FL B2 F 2001	0.95
FL Rec F 1992	FL Rec F 1998	0.94	FL Rec F 2012	FL B2 F 2001	0.95
FL Rec F 1993	FL Rec F 1998	0.94	FL Rec F 2013	FL B2 F 2001	0.95
FL Rec F 1994	FL Rec F 1998	0.94	GA Rec F 1992	FL B2 F 2001	0.92
FL Rec F 1995	FL Rec F 1998	0.94	GA Rec F 1993	FL B2 F 2001	0.91
FL Rec F 1996	FL Rec F 1998	0.90	GA Rec F 1997	FL B2 F 2001	0.91
FL Rec F 1997	FL Rec F 1998	0.93	GA Rec F 2002	FL B2 F 2001	0.91
FL Rec F 1991	FL Rec F 1999	0.92	GA Rec F 2003	FL B2 F 2001	0.92
FL Rec F 1992	FL Rec F 1999	0.95	GA Rec F 2005	FL B2 F 2001	0.91
FL Rec F 1993	FL Rec F 1999	0.95	GA Rec F 2008	FL B2 F 2001	0.92
FL Rec F 1994	FL Rec F 1999	0.95	GA Rec F 2009	FL B2 F 2001	0.91
FL Rec F 1995	FL Rec F 1999	0.95	GA Rec F 2013	FL B2 F 2001	0.91
FL Rec F 1996	FL Rec F 1999	0.91	SC Rec F 1992	FL B2 F 2001	0.92
FL Rec F 1997	FL Rec F 1999	0.94	SC Rec F 1997	FL B2 F 2001	0.91
FL Rec F 1998	FL Rec F 1999	0.95	SC Rec F 1998	FL B2 F 2001	0.91
FL Rec F 1991	FL Rec F 2000	0.92	SC Rec F 2004	FL B2 F 2001	0.92
FL Rec F 1992	FL Rec F 2000	0.95	SC Rec F 2005	FL B2 F 2001	0.91
FL Rec F 1993	FL Rec F 2000	0.95	SC Rec F 2007	FL B2 F 2001	0.90
FL Rec F 1994	FL Rec F 2000	0.95	SC Rec F 2008	FL B2 F 2001	0.91
FL Rec F 1995	FL Rec F 2000	0.95	SC Rec F 2009	FL B2 F 2001	0.93
FL Rec F 1996	FL Rec F 2000	0.91	SC Rec F 2010	FL B2 F 2001	0.93
FL Rec F 1997	FL Rec F 2000	0.94	SC Rec F 2011	FL B2 F 2001	0.93
FL Rec F 1998	FL Rec F 2000	0.95	SC Rec F 2012	FL B2 F 2001	0.90
FL Rec F 1999	FL Rec F 2000	0.96	SC Rec F 2013	FL B2 F 2001	0.93
FL Rec F 1991	FL Rec F 2001	0.92	FL B2 F 1992	FL B2 F 2001	0.91
FL Rec F 1992	FL Rec F 2001	0.95	FL B2 F 1993	FL B2 F 2001	0.91
FL Rec F 1993	FL Rec F 2001	0.95	FL B2 F 1994	FL B2 F 2001	0.92
FL Rec F 1994	FL Rec F 2001	0.95	FL B2 F 1995	FL B2 F 2001	0.93
FL Rec F 1995	FL Rec F 2001	0.95	FL B2 F 1996	FL B2 F 2001	0.93
FL Rec F 1996	FL Rec F 2001	0.91	FL B2 F 1997	FL B2 F 2001	0.93
FL Rec F 1997	FL Rec F 2001	0.94	FL B2 F 1998	FL B2 F 2001	0.94
FL Rec F 1998	FL Rec F 2001	0.95	FL B2 F 1999	FL B2 F 2001	0.94
FL Rec F 1999	FL Rec F 2001	0.96	FL B2 F 2000	FL B2 F 2001	0.95
FL Rec F 2000	FL Rec F 2001	0.96	FL Rec F 1991	FL B2 F 2002	0.90
FL Rec F 1991	FL Rec F 2002	0.92	FL Rec F 1992	FL B2 F 2002	0.93
FL Rec F 1992	FL Rec F 2002	0.95	FL Rec F 1993	FL B2 F 2002	0.93

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 1993	FL Rec F 2002	0.94	FL Rec F 1994	FL B2 F 2002	0.93
FL Rec F 1994	FL Rec F 2002	0.95	FL Rec F 1995	FL B2 F 2002	0.93
FL Rec F 1995	FL Rec F 2002	0.94	FL Rec F 1997	FL B2 F 2002	0.92
FL Rec F 1996	FL Rec F 2002	0.91	FL Rec F 1998	FL B2 F 2002	0.93
FL Rec F 1997	FL Rec F 2002	0.93	FL Rec F 1999	FL B2 F 2002	0.94
FL Rec F 1998	FL Rec F 2002	0.95	FL Rec F 2000	FL B2 F 2002	0.94
FL Rec F 1999	FL Rec F 2002	0.96	FL Rec F 2001	FL B2 F 2002	0.94
FL Rec F 2000	FL Rec F 2002	0.96	FL Rec F 2002	FL B2 F 2002	0.94
FL Rec F 2001	FL Rec F 2002	0.96	FL Rec F 2003	FL B2 F 2002	0.94
FL Rec F 1991	FL Rec F 2003	0.92	FL Rec F 2004	FL B2 F 2002	0.94
FL Rec F 1992	FL Rec F 2003	0.95	FL Rec F 2005	FL B2 F 2002	0.93
FL Rec F 1993	FL Rec F 2003	0.95	FL Rec F 2006	FL B2 F 2002	0.94
FL Rec F 1994	FL Rec F 2003	0.95	FL Rec F 2007	FL B2 F 2002	0.94
FL Rec F 1995	FL Rec F 2003	0.95	FL Rec F 2008	FL B2 F 2002	0.93
FL Rec F 1996	FL Rec F 2003	0.91	FL Rec F 2009	FL B2 F 2002	0.94
FL Rec F 1997	FL Rec F 2003	0.94	FL Rec F 2010	FL B2 F 2002	0.94
FL Rec F 1998	FL Rec F 2003	0.95	FL Rec F 2011	FL B2 F 2002	0.94
FL Rec F 1999	FL Rec F 2003	0.96	FL Rec F 2012	FL B2 F 2002	0.94
FL Rec F 2000	FL Rec F 2003	0.96	FL Rec F 2013	FL B2 F 2002	0.94
FL Rec F 2001	FL Rec F 2003	0.96	GA Rec F 1992	FL B2 F 2002	0.91
FL Rec F 2002	FL Rec F 2003	0.96	GA Rec F 1993	FL B2 F 2002	0.90
FL Rec F 1991	FL Rec F 2004	0.92	GA Rec F 2002	FL B2 F 2002	0.90
FL Rec F 1992	FL Rec F 2004	0.95	GA Rec F 2003	FL B2 F 2002	0.91
FL Rec F 1993	FL Rec F 2004	0.95	GA Rec F 2005	FL B2 F 2002	0.90
FL Rec F 1994	FL Rec F 2004	0.96	GA Rec F 2008	FL B2 F 2002	0.91
FL Rec F 1995	FL Rec F 2004	0.95	GA Rec F 2013	FL B2 F 2002	0.90
FL Rec F 1996	FL Rec F 2004	0.92	SC Rec F 1992	FL B2 F 2002	0.91
FL Rec F 1997	FL Rec F 2004	0.94	SC Rec F 1998	FL B2 F 2002	0.90
FL Rec F 1998	FL Rec F 2004	0.95	SC Rec F 2004	FL B2 F 2002	0.91
FL Rec F 1999	FL Rec F 2004	0.96	SC Rec F 2005	FL B2 F 2002	0.90
FL Rec F 2000	FL Rec F 2004	0.96	SC Rec F 2009	FL B2 F 2002	0.91
FL Rec F 2001	FL Rec F 2004	0.96	SC Rec F 2010	FL B2 F 2002	0.92
FL Rec F 2002	FL Rec F 2004	0.96	SC Rec F 2011	FL B2 F 2002	0.92
FL Rec F 2003	FL Rec F 2004	0.96	SC Rec F 2013	FL B2 F 2002	0.92
FL Rec F 1991	FL Rec F 2005	0.91	FL B2 F 1992	FL B2 F 2002	0.90
FL Rec F 1992	FL Rec F 2005	0.94	FL B2 F 1994	FL B2 F 2002	0.91
FL Rec F 1993	FL Rec F 2005	0.94	FL B2 F 1995	FL B2 F 2002	0.92
FL Rec F 1994	FL Rec F 2005	0.94	FL B2 F 1996	FL B2 F 2002	0.92
FL Rec F 1995	FL Rec F 2005	0.94	FL B2 F 1997	FL B2 F 2002	0.92
FL Rec F 1996	FL Rec F 2005	0.90	FL B2 F 1998	FL B2 F 2002	0.93
FL Rec F 1997	FL Rec F 2005	0.93	FL B2 F 1999	FL B2 F 2002	0.93
FL Rec F 1998	FL Rec F 2005	0.94	FL B2 F 2000	FL B2 F 2002	0.94
FL Rec F 1999	FL Rec F 2005	0.95	FL B2 F 2001	FL B2 F 2002	0.93
FL Rec F 2000	FL Rec F 2005	0.95	FL Rec F 1991	FL B2 F 2003	0.90
FL Rec F 2001	FL Rec F 2005	0.95	FL Rec F 1992	FL B2 F 2003	0.93
FL Rec F 2002	FL Rec F 2005	0.95	FL Rec F 1993	FL B2 F 2003	0.93
FL Rec F 2003	FL Rec F 2005	0.95	FL Rec F 1994	FL B2 F 2003	0.94
FL Rec F 2004	FL Rec F 2005	0.95	FL Rec F 1995	FL B2 F 2003	0.93
FL Rec F 1991	FL Rec F 2006	0.92	FL Rec F 1997	FL B2 F 2003	0.92
FL Rec F 1992	FL Rec F 2006	0.95	FL Rec F 1998	FL B2 F 2003	0.93
FL Rec F 1993	FL Rec F 2006	0.95	FL Rec F 1999	FL B2 F 2003	0.94
FL Rec F 1994	FL Rec F 2006	0.96	FL Rec F 2000	FL B2 F 2003	0.94
FL Rec F 1995	FL Rec F 2006	0.95	FL Rec F 2001	FL B2 F 2003	0.94
FL Rec F 1996	FL Rec F 2006	0.92	FL Rec F 2002	FL B2 F 2003	0.94
FL Rec F 1997	FL Rec F 2006	0.94	FL Rec F 2003	FL B2 F 2003	0.94

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 1998	FL Rec F 2006	0.95	FL Rec F 2004	FL B2 F 2003	0.95
FL Rec F 1999	FL Rec F 2006	0.96	FL Rec F 2005	FL B2 F 2003	0.93
FL Rec F 2000	FL Rec F 2006	0.96	FL Rec F 2006	FL B2 F 2003	0.95
FL Rec F 2001	FL Rec F 2006	0.96	FL Rec F 2007	FL B2 F 2003	0.94
FL Rec F 2002	FL Rec F 2006	0.96	FL Rec F 2008	FL B2 F 2003	0.93
FL Rec F 2003	FL Rec F 2006	0.96	FL Rec F 2009	FL B2 F 2003	0.94
FL Rec F 2004	FL Rec F 2006	0.97	FL Rec F 2010	FL B2 F 2003	0.94
FL Rec F 2005	FL Rec F 2006	0.95	FL Rec F 2011	FL B2 F 2003	0.95
FL Rec F 1991	FL Rec F 2007	0.92	FL Rec F 2012	FL B2 F 2003	0.94
FL Rec F 1992	FL Rec F 2007	0.95	FL Rec F 2013	FL B2 F 2003	0.95
FL Rec F 1993	FL Rec F 2007	0.95	GA Rec F 1992	FL B2 F 2003	0.91
FL Rec F 1994	FL Rec F 2007	0.95	GA Rec F 1993	FL B2 F 2003	0.91
FL Rec F 1995	FL Rec F 2007	0.95	GA Rec F 1997	FL B2 F 2003	0.90
FL Rec F 1996	FL Rec F 2007	0.91	GA Rec F 2002	FL B2 F 2003	0.91
FL Rec F 1997	FL Rec F 2007	0.94	GA Rec F 2003	FL B2 F 2003	0.91
FL Rec F 1998	FL Rec F 2007	0.95	GA Rec F 2005	FL B2 F 2003	0.91
FL Rec F 1999	FL Rec F 2007	0.96	GA Rec F 2008	FL B2 F 2003	0.91
FL Rec F 2000	FL Rec F 2007	0.96	GA Rec F 2009	FL B2 F 2003	0.90
FL Rec F 2001	FL Rec F 2007	0.96	GA Rec F 2013	FL B2 F 2003	0.90
FL Rec F 2002	FL Rec F 2007	0.96	SC Rec F 1992	FL B2 F 2003	0.91
FL Rec F 2003	FL Rec F 2007	0.96	SC Rec F 1997	FL B2 F 2003	0.90
FL Rec F 2004	FL Rec F 2007	0.96	SC Rec F 1998	FL B2 F 2003	0.91
FL Rec F 2005	FL Rec F 2007	0.95	SC Rec F 2004	FL B2 F 2003	0.91
FL Rec F 2006	FL Rec F 2007	0.96	SC Rec F 2005	FL B2 F 2003	0.91
FL Rec F 1991	FL Rec F 2008	0.91	SC Rec F 2008	FL B2 F 2003	0.90
FL Rec F 1992	FL Rec F 2008	0.94	SC Rec F 2009	FL B2 F 2003	0.92
FL Rec F 1993	FL Rec F 2008	0.94	SC Rec F 2010	FL B2 F 2003	0.93
FL Rec F 1994	FL Rec F 2008	0.95	SC Rec F 2011	FL B2 F 2003	0.93
FL Rec F 1995	FL Rec F 2008	0.94	SC Rec F 2013	FL B2 F 2003	0.92
FL Rec F 1996	FL Rec F 2008	0.90	FL B2 F 1992	FL B2 F 2003	0.91
FL Rec F 1997	FL Rec F 2008	0.93	FL B2 F 1993	FL B2 F 2003	0.90
FL Rec F 1998	FL Rec F 2008	0.94	FL B2 F 1994	FL B2 F 2003	0.91
FL Rec F 1999	FL Rec F 2008	0.95	FL B2 F 1995	FL B2 F 2003	0.92
FL Rec F 2000	FL Rec F 2008	0.95	FL B2 F 1996	FL B2 F 2003	0.92
FL Rec F 2001	FL Rec F 2008	0.95	FL B2 F 1997	FL B2 F 2003	0.92
FL Rec F 2002	FL Rec F 2008	0.95	FL B2 F 1998	FL B2 F 2003	0.93
FL Rec F 2003	FL Rec F 2008	0.95	FL B2 F 1999	FL B2 F 2003	0.93
FL Rec F 2004	FL Rec F 2008	0.96	FL B2 F 2000	FL B2 F 2003	0.94
FL Rec F 2005	FL Rec F 2008	0.94	FL B2 F 2001	FL B2 F 2003	0.94
FL Rec F 2006	FL Rec F 2008	0.96	FL B2 F 2002	FL B2 F 2003	0.93
FL Rec F 2007	FL Rec F 2008	0.95	FL Rec F 1991	FL B2 F 2004	0.91
FL Rec F 1991	FL Rec F 2009	0.92	FL Rec F 1992	FL B2 F 2004	0.94
FL Rec F 1992	FL Rec F 2009	0.95	FL Rec F 1993	FL B2 F 2004	0.94
FL Rec F 1993	FL Rec F 2009	0.95	FL Rec F 1994	FL B2 F 2004	0.95
FL Rec F 1994	FL Rec F 2009	0.95	FL Rec F 1995	FL B2 F 2004	0.94
FL Rec F 1995	FL Rec F 2009	0.95	FL Rec F 1996	FL B2 F 2004	0.91
FL Rec F 1996	FL Rec F 2009	0.91	FL Rec F 1997	FL B2 F 2004	0.93
FL Rec F 1997	FL Rec F 2009	0.94	FL Rec F 1998	FL B2 F 2004	0.94
FL Rec F 1998	FL Rec F 2009	0.95	FL Rec F 1999	FL B2 F 2004	0.95
FL Rec F 1999	FL Rec F 2009	0.96	FL Rec F 2000	FL B2 F 2004	0.95
FL Rec F 2000	FL Rec F 2009	0.96	FL Rec F 2001	FL B2 F 2004	0.95
FL Rec F 2001	FL Rec F 2009	0.96	FL Rec F 2002	FL B2 F 2004	0.95
FL Rec F 2002	FL Rec F 2009	0.96	FL Rec F 2003	FL B2 F 2004	0.95
FL Rec F 2003	FL Rec F 2009	0.96	FL Rec F 2004	FL B2 F 2004	0.96
FL Rec F 2004	FL Rec F 2009	0.96	FL Rec F 2005	FL B2 F 2004	0.94

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 2005	FL Rec F 2009	0.95	FL Rec F 2006	FL B2 F 2004	0.96
FL Rec F 2006	FL Rec F 2009	0.96	FL Rec F 2007	FL B2 F 2004	0.95
FL Rec F 2007	FL Rec F 2009	0.96	FL Rec F 2008	FL B2 F 2004	0.94
FL Rec F 2008	FL Rec F 2009	0.95	FL Rec F 2009	FL B2 F 2004	0.95
FL Rec F 1991	FL Rec F 2010	0.92	FL Rec F 2010	FL B2 F 2004	0.95
FL Rec F 1992	FL Rec F 2010	0.95	FL Rec F 2011	FL B2 F 2004	0.96
FL Rec F 1993	FL Rec F 2010	0.95	FL Rec F 2012	FL B2 F 2004	0.95
FL Rec F 1994	FL Rec F 2010	0.95	FL Rec F 2013	FL B2 F 2004	0.96
FL Rec F 1995	FL Rec F 2010	0.95	GA Rec F 1992	FL B2 F 2004	0.92
FL Rec F 1996	FL Rec F 2010	0.91	GA Rec F 1993	FL B2 F 2004	0.92
FL Rec F 1997	FL Rec F 2010	0.94	GA Rec F 1996	FL B2 F 2004	0.90
FL Rec F 1998	FL Rec F 2010	0.95	GA Rec F 1997	FL B2 F 2004	0.91
FL Rec F 1999	FL Rec F 2010	0.96	GA Rec F 2002	FL B2 F 2004	0.91
FL Rec F 2000	FL Rec F 2010	0.96	GA Rec F 2003	FL B2 F 2004	0.92
FL Rec F 2001	FL Rec F 2010	0.96	GA Rec F 2005	FL B2 F 2004	0.92
FL Rec F 2002	FL Rec F 2010	0.96	GA Rec F 2008	FL B2 F 2004	0.92
FL Rec F 2003	FL Rec F 2010	0.96	GA Rec F 2009	FL B2 F 2004	0.91
FL Rec F 2004	FL Rec F 2010	0.96	GA Rec F 2010	FL B2 F 2004	0.90
FL Rec F 2005	FL Rec F 2010	0.95	GA Rec F 2011	FL B2 F 2004	0.90
FL Rec F 2006	FL Rec F 2010	0.96	GA Rec F 2013	FL B2 F 2004	0.91
FL Rec F 2007	FL Rec F 2010	0.96	SC Rec F 1992	FL B2 F 2004	0.92
FL Rec F 2008	FL Rec F 2010	0.95	SC Rec F 1997	FL B2 F 2004	0.91
FL Rec F 2009	FL Rec F 2010	0.96	SC Rec F 1998	FL B2 F 2004	0.92
FL Rec F 1991	FL Rec F 2011	0.93	SC Rec F 2004	FL B2 F 2004	0.92
FL Rec F 1992	FL Rec F 2011	0.95	SC Rec F 2005	FL B2 F 2004	0.92
FL Rec F 1993	FL Rec F 2011	0.95	SC Rec F 2007	FL B2 F 2004	0.90
FL Rec F 1994	FL Rec F 2011	0.96	SC Rec F 2008	FL B2 F 2004	0.91
FL Rec F 1995	FL Rec F 2011	0.95	SC Rec F 2009	FL B2 F 2004	0.93
FL Rec F 1996	FL Rec F 2011	0.92	SC Rec F 2010	FL B2 F 2004	0.94
FL Rec F 1997	FL Rec F 2011	0.94	SC Rec F 2011	FL B2 F 2004	0.93
FL Rec F 1998	FL Rec F 2011	0.95	SC Rec F 2012	FL B2 F 2004	0.90
FL Rec F 1999	FL Rec F 2011	0.96	SC Rec F 2013	FL B2 F 2004	0.93
FL Rec F 2000	FL Rec F 2011	0.96	FL B2 F 1992	FL B2 F 2004	0.92
FL Rec F 2001	FL Rec F 2011	0.96	FL B2 F 1993	FL B2 F 2004	0.91
FL Rec F 2002	FL Rec F 2011	0.96	FL B2 F 1994	FL B2 F 2004	0.92
FL Rec F 2003	FL Rec F 2011	0.96	FL B2 F 1995	FL B2 F 2004	0.93
FL Rec F 2004	FL Rec F 2011	0.97	FL B2 F 1996	FL B2 F 2004	0.93
FL Rec F 2005	FL Rec F 2011	0.95	FL B2 F 1997	FL B2 F 2004	0.93
FL Rec F 2006	FL Rec F 2011	0.97	FL B2 F 1998	FL B2 F 2004	0.94
FL Rec F 2007	FL Rec F 2011	0.96	FL B2 F 1999	FL B2 F 2004	0.94
FL Rec F 2008	FL Rec F 2011	0.96	FL B2 F 2000	FL B2 F 2004	0.95
FL Rec F 2009	FL Rec F 2011	0.96	FL B2 F 2001	FL B2 F 2004	0.95
FL Rec F 2010	FL Rec F 2011	0.96	FL B2 F 2002	FL B2 F 2004	0.94
FL Rec F 1991	FL Rec F 2012	0.92	FL B2 F 2003	FL B2 F 2004	0.94
FL Rec F 1992	FL Rec F 2012	0.95	FL Rec F 1991	FL B2 F 2005	0.90
FL Rec F 1993	FL Rec F 2012	0.95	FL Rec F 1992	FL B2 F 2005	0.93
FL Rec F 1994	FL Rec F 2012	0.95	FL Rec F 1993	FL B2 F 2005	0.93
FL Rec F 1995	FL Rec F 2012	0.95	FL Rec F 1994	FL B2 F 2005	0.93
FL Rec F 1996	FL Rec F 2012	0.91	FL Rec F 1995	FL B2 F 2005	0.93
FL Rec F 1997	FL Rec F 2012	0.94	FL Rec F 1997	FL B2 F 2005	0.92
FL Rec F 1998	FL Rec F 2012	0.95	FL Rec F 1998	FL B2 F 2005	0.93
FL Rec F 1999	FL Rec F 2012	0.96	FL Rec F 1999	FL B2 F 2005	0.94
FL Rec F 2000	FL Rec F 2012	0.96	FL Rec F 2000	FL B2 F 2005	0.94
FL Rec F 2001	FL Rec F 2012	0.96	FL Rec F 2001	FL B2 F 2005	0.94
FL Rec F 2002	FL Rec F 2012	0.96	FL Rec F 2002	FL B2 F 2005	0.93

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 2003	FL Rec F 2012	0.96	FL Rec F 2003	FL B2 F 2005	0.94
FL Rec F 2004	FL Rec F 2012	0.96	FL Rec F 2004	FL B2 F 2005	0.94
FL Rec F 2005	FL Rec F 2012	0.95	FL Rec F 2005	FL B2 F 2005	0.93
FL Rec F 2006	FL Rec F 2012	0.96	FL Rec F 2006	FL B2 F 2005	0.94
FL Rec F 2007	FL Rec F 2012	0.96	FL Rec F 2007	FL B2 F 2005	0.94
FL Rec F 2008	FL Rec F 2012	0.95	FL Rec F 2008	FL B2 F 2005	0.93
FL Rec F 2009	FL Rec F 2012	0.96	FL Rec F 2009	FL B2 F 2005	0.94
FL Rec F 2010	FL Rec F 2012	0.96	FL Rec F 2010	FL B2 F 2005	0.94
FL Rec F 2011	FL Rec F 2012	0.96	FL Rec F 2011	FL B2 F 2005	0.94
FL Rec F 1991	FL Rec F 2013	0.93	FL Rec F 2012	FL B2 F 2005	0.94
FL Rec F 1992	FL Rec F 2013	0.95	FL Rec F 2013	FL B2 F 2005	0.94
FL Rec F 1993	FL Rec F 2013	0.95	GA Rec F 1992	FL B2 F 2005	0.91
FL Rec F 1994	FL Rec F 2013	0.96	GA Rec F 1993	FL B2 F 2005	0.90
FL Rec F 1995	FL Rec F 2013	0.95	GA Rec F 2002	FL B2 F 2005	0.90
FL Rec F 1996	FL Rec F 2013	0.92	GA Rec F 2003	FL B2 F 2005	0.91
FL Rec F 1997	FL Rec F 2013	0.94	GA Rec F 2005	FL B2 F 2005	0.90
FL Rec F 1998	FL Rec F 2013	0.95	GA Rec F 2008	FL B2 F 2005	0.91
FL Rec F 1999	FL Rec F 2013	0.96	GA Rec F 2013	FL B2 F 2005	0.90
FL Rec F 2000	FL Rec F 2013	0.96	SC Rec F 1992	FL B2 F 2005	0.91
FL Rec F 2001	FL Rec F 2013	0.96	SC Rec F 1998	FL B2 F 2005	0.90
FL Rec F 2002	FL Rec F 2013	0.96	SC Rec F 2004	FL B2 F 2005	0.91
FL Rec F 2003	FL Rec F 2013	0.96	SC Rec F 2005	FL B2 F 2005	0.90
FL Rec F 2004	FL Rec F 2013	0.97	SC Rec F 2009	FL B2 F 2005	0.91
FL Rec F 2005	FL Rec F 2013	0.95	SC Rec F 2010	FL B2 F 2005	0.92
FL Rec F 2006	FL Rec F 2013	0.97	SC Rec F 2011	FL B2 F 2005	0.92
FL Rec F 2007	FL Rec F 2013	0.96	SC Rec F 2013	FL B2 F 2005	0.92
FL Rec F 2008	FL Rec F 2013	0.96	FL B2 F 1992	FL B2 F 2005	0.90
FL Rec F 2009	FL Rec F 2013	0.96	FL B2 F 1994	FL B2 F 2005	0.91
FL Rec F 2010	FL Rec F 2013	0.96	FL B2 F 1995	FL B2 F 2005	0.92
FL Rec F 2011	FL Rec F 2013	0.97	FL B2 F 1996	FL B2 F 2005	0.92
FL Rec F 2012	FL Rec F 2013	0.97	FL B2 F 1997	FL B2 F 2005	0.92
FL Rec F 1992	GA Rec F 1992	0.91	FL B2 F 1998	FL B2 F 2005	0.93
FL Rec F 1993	GA Rec F 1992	0.92	FL B2 F 1999	FL B2 F 2005	0.93
FL Rec F 1994	GA Rec F 1992	0.92	FL B2 F 2000	FL B2 F 2005	0.94
FL Rec F 1995	GA Rec F 1992	0.91	FL B2 F 2001	FL B2 F 2005	0.93
FL Rec F 1997	GA Rec F 1992	0.90	FL B2 F 2002	FL B2 F 2005	0.92
FL Rec F 1998	GA Rec F 1992	0.91	FL B2 F 2003	FL B2 F 2005	0.93
FL Rec F 1999	GA Rec F 1992	0.92	FL B2 F 2004	FL B2 F 2005	0.94
FL Rec F 2000	GA Rec F 1992	0.92	FL Rec F 1991	FL B2 F 2006	0.92
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FL Rec F 2003	GA Rec F 1992	0.92	FL Rec F 1994	FL B2 F 2006	0.95
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FL Rec F 2005	GA Rec F 1992	0.91	FL Rec F 1996	FL B2 F 2006	0.91
FL Rec F 2006	GA Rec F 1992	0.93	FL Rec F 1997	FL B2 F 2006	0.94
FL Rec F 2007	GA Rec F 1992	0.92	FL Rec F 1998	FL B2 F 2006	0.95
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FL Rec F 2010	GA Rec F 1992	0.92	FL Rec F 2001	FL B2 F 2006	0.96
FL Rec F 2011	GA Rec F 1992	0.93	FL Rec F 2002	FL B2 F 2006	0.95
FL Rec F 2012	GA Rec F 1992	0.92	FL Rec F 2003	FL B2 F 2006	0.96
FL Rec F 2013	GA Rec F 1992	0.93	FL Rec F 2004	FL B2 F 2006	0.96
FL Rec F 1992	GA Rec F 1993	0.91	FL Rec F 2005	FL B2 F 2006	0.95
FL Rec F 1993	GA Rec F 1993	0.91	FL Rec F 2006	FL B2 F 2006	0.96
FL Rec F 1994	GA Rec F 1993	0.92	FL Rec F 2007	FL B2 F 2006	0.96

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 1995	GA Rec F 1993	0.91	FL Rec F 2008	FL B2 F 2006	0.95
FL Rec F 1998	GA Rec F 1993	0.91	FL Rec F 2009	FL B2 F 2006	0.96
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FL Rec F 2003	GA Rec F 1993	0.92	GA Rec F 1992	FL B2 F 2006	0.93
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GA Rec F 1992	GA Rec F 1993	0.90	GA Rec F 2008	FL B2 F 2006	0.93
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FL Rec F 2004	GA Rec F 1996	0.91	FL B2 F 2002	FL B2 F 2006	0.94
FL Rec F 2006	GA Rec F 1996	0.91	FL B2 F 2003	FL B2 F 2006	0.95
FL Rec F 2007	GA Rec F 1996	0.90	FL B2 F 2004	FL B2 F 2006	0.96
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FL Rec F 2010	GA Rec F 1996	0.90	FL Rec F 1991	FL B2 F 2007	0.91
FL Rec F 2011	GA Rec F 1996	0.91	FL Rec F 1992	FL B2 F 2007	0.94
FL Rec F 2012	GA Rec F 1996	0.90	FL Rec F 1993	FL B2 F 2007	0.94
FL Rec F 2013	GA Rec F 1996	0.91	FL Rec F 1994	FL B2 F 2007	0.95
FL Rec F 1992	GA Rec F 1997	0.90	FL Rec F 1995	FL B2 F 2007	0.94
FL Rec F 1993	GA Rec F 1997	0.90	FL Rec F 1996	FL B2 F 2007	0.91

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FL Rec F 1995	GA Rec F 1993	0.91	FL Rec F 2008	FL B2 F 2006	0.95
FL Rec F 1998	GA Rec F 1993	0.91	FL Rec F 2009	FL B2 F 2006	0.96
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FL Rec F 2009	GA Rec F 1995	0.90	FL B2 F 1993	FL B2 F 2006	0.92
FL Rec F 2010	GA Rec F 1995	0.90	FL B2 F 1994	FL B2 F 2006	0.93
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FL Rec F 2000	GA Rec F 1996	0.90	FL B2 F 1999	FL B2 F 2006	0.95
FL Rec F 2001	GA Rec F 1996	0.90	FL B2 F 2000	FL B2 F 2006	0.96
FL Rec F 2003	GA Rec F 1996	0.90	FL B2 F 2001	FL B2 F 2006	0.95
FL Rec F 2004	GA Rec F 1996	0.91	FL B2 F 2002	FL B2 F 2006	0.94
FL Rec F 2006	GA Rec F 1996	0.91	FL B2 F 2003	FL B2 F 2006	0.95
FL Rec F 2007	GA Rec F 1996	0.90	FL B2 F 2004	FL B2 F 2006	0.96
FL Rec F 2009	GA Rec F 1996	0.90	FL B2 F 2005	FL B2 F 2006	0.94
FL Rec F 2010	GA Rec F 1996	0.90	FL Rec F 1991	FL B2 F 2007	0.91
FL Rec F 2011	GA Rec F 1996	0.91	FL Rec F 1992	FL B2 F 2007	0.94
FL Rec F 2012	GA Rec F 1996	0.90	FL Rec F 1993	FL B2 F 2007	0.94
FL Rec F 2013	GA Rec F 1996	0.91	FL Rec F 1994	FL B2 F 2007	0.95
FL Rec F 1992	GA Rec F 1997	0.90	FL Rec F 1995	FL B2 F 2007	0.94
FL Rec F 1993	GA Rec F 1997	0.90	FL Rec F 1996	FL B2 F 2007	0.91

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 1994	GA Rec F 1997	0.91	FL Rec F 1997	FL B2 F 2007	0.93
FL Rec F 1995	GA Rec F 1997	0.90	FL Rec F 1998	FL B2 F 2007	0.94
FL Rec F 1998	GA Rec F 1997	0.90	FL Rec F 1999	FL B2 F 2007	0.95
FL Rec F 1999	GA Rec F 1997	0.91	FL Rec F 2000	FL B2 F 2007	0.95
FL Rec F 2000	GA Rec F 1997	0.91	FL Rec F 2001	FL B2 F 2007	0.95
FL Rec F 2001	GA Rec F 1997	0.91	FL Rec F 2002	FL B2 F 2007	0.95
FL Rec F 2002	GA Rec F 1997	0.91	FL Rec F 2003	FL B2 F 2007	0.95
FL Rec F 2003	GA Rec F 1997	0.91	FL Rec F 2004	FL B2 F 2007	0.96
FL Rec F 2004	GA Rec F 1997	0.92	FL Rec F 2005	FL B2 F 2007	0.94
FL Rec F 2005	GA Rec F 1997	0.90	FL Rec F 2006	FL B2 F 2007	0.96
FL Rec F 2006	GA Rec F 1997	0.92	FL Rec F 2007	FL B2 F 2007	0.95
FL Rec F 2007	GA Rec F 1997	0.91	FL Rec F 2008	FL B2 F 2007	0.94
FL Rec F 2008	GA Rec F 1997	0.91	FL Rec F 2009	FL B2 F 2007	0.95
FL Rec F 2009	GA Rec F 1997	0.91	FL Rec F 2010	FL B2 F 2007	0.95
FL Rec F 2010	GA Rec F 1997	0.91	FL Rec F 2011	FL B2 F 2007	0.96
FL Rec F 2011	GA Rec F 1997	0.92	FL Rec F 2012	FL B2 F 2007	0.95
FL Rec F 2012	GA Rec F 1997	0.91	FL Rec F 2013	FL B2 F 2007	0.96
FL Rec F 2013	GA Rec F 1997	0.92	GA Rec F 1992	FL B2 F 2007	0.92
FL Rec F 2004	GA Rec F 1998	0.90	GA Rec F 1993	FL B2 F 2007	0.92
FL Rec F 2006	GA Rec F 1998	0.90	GA Rec F 1994	FL B2 F 2007	0.90
FL Rec F 2011	GA Rec F 1998	0.90	GA Rec F 1995	FL B2 F 2007	0.90
FL Rec F 2013	GA Rec F 1998	0.90	GA Rec F 1996	FL B2 F 2007	0.90
FL Rec F 2000	GA Rec F 2000	0.90	GA Rec F 1997	FL B2 F 2007	0.91
FL Rec F 2001	GA Rec F 2000	0.90	GA Rec F 2000	FL B2 F 2007	0.90
FL Rec F 2004	GA Rec F 2000	0.90	GA Rec F 2002	FL B2 F 2007	0.92
FL Rec F 2006	GA Rec F 2000	0.90	GA Rec F 2003	FL B2 F 2007	0.92
FL Rec F 2007	GA Rec F 2000	0.90	GA Rec F 2005	FL B2 F 2007	0.92
FL Rec F 2009	GA Rec F 2000	0.90	GA Rec F 2008	FL B2 F 2007	0.92
FL Rec F 2010	GA Rec F 2000	0.90	GA Rec F 2009	FL B2 F 2007	0.91
FL Rec F 2011	GA Rec F 2000	0.90	GA Rec F 2010	FL B2 F 2007	0.90
FL Rec F 2012	GA Rec F 2000	0.90	GA Rec F 2011	FL B2 F 2007	0.90
FL Rec F 2013	GA Rec F 2000	0.91	GA Rec F 2013	FL B2 F 2007	0.92
FL Rec F 1992	GA Rec F 2002	0.90	SC Rec F 1992	FL B2 F 2007	0.92
FL Rec F 1993	GA Rec F 2002	0.90	SC Rec F 1997	FL B2 F 2007	0.91
FL Rec F 1994	GA Rec F 2002	0.91	SC Rec F 1998	FL B2 F 2007	0.92
FL Rec F 1995	GA Rec F 2002	0.90	SC Rec F 2004	FL B2 F 2007	0.92
FL Rec F 1998	GA Rec F 2002	0.91	SC Rec F 2005	FL B2 F 2007	0.92
FL Rec F 1999	GA Rec F 2002	0.92	SC Rec F 2007	FL B2 F 2007	0.91
FL Rec F 2000	GA Rec F 2002	0.92	SC Rec F 2008	FL B2 F 2007	0.91
FL Rec F 2001	GA Rec F 2002	0.92	SC Rec F 2009	FL B2 F 2007	0.93
FL Rec F 2002	GA Rec F 2002	0.91	SC Rec F 2010	FL B2 F 2007	0.94
FL Rec F 2003	GA Rec F 2002	0.92	SC Rec F 2011	FL B2 F 2007	0.94
FL Rec F 2004	GA Rec F 2002	0.92	SC Rec F 2012	FL B2 F 2007	0.90
FL Rec F 2005	GA Rec F 2002	0.91	SC Rec F 2013	FL B2 F 2007	0.93
FL Rec F 2006	GA Rec F 2002	0.92	FL B2 F 1992	FL B2 F 2007	0.92
FL Rec F 2007	GA Rec F 2002	0.92	FL B2 F 1993	FL B2 F 2007	0.91
FL Rec F 2008	GA Rec F 2002	0.91	FL B2 F 1994	FL B2 F 2007	0.92
FL Rec F 2009	GA Rec F 2002	0.92	FL B2 F 1995	FL B2 F 2007	0.93
FL Rec F 2010	GA Rec F 2002	0.92	FL B2 F 1996	FL B2 F 2007	0.94
FL Rec F 2011	GA Rec F 2002	0.92	FL B2 F 1997	FL B2 F 2007	0.93
FL Rec F 2012	GA Rec F 2002	0.92	FL B2 F 1998	FL B2 F 2007	0.94
FL Rec F 2013	GA Rec F 2002	0.92	FL B2 F 1999	FL B2 F 2007	0.95
FL Rec F 1992	GA Rec F 2003	0.91	FL B2 F 2000	FL B2 F 2007	0.95
FL Rec F 1993	GA Rec F 2003	0.91	FL B2 F 2001	FL B2 F 2007	0.95
FL Rec F 1994	GA Rec F 2003	0.92	FL B2 F 2002	FL B2 F 2007	0.94

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FL Rec F 1995	GA Rec F 2003	0.91	FL B2 F 2003	FL B2 F 2007	0.94
FL Rec F 1997	GA Rec F 2003	0.90	FL B2 F 2004	FL B2 F 2007	0.95
FL Rec F 1998	GA Rec F 2003	0.91	FL B2 F 2005	FL B2 F 2007	0.94
FL Rec F 1999	GA Rec F 2003	0.92	FL B2 F 2006	FL B2 F 2007	0.96
FL Rec F 2000	GA Rec F 2003	0.92	FL Rec F 1991	FL B2 F 2008	0.91
FL Rec F 2001	GA Rec F 2003	0.92	FL Rec F 1992	FL B2 F 2008	0.93
FL Rec F 2002	GA Rec F 2003	0.92	FL Rec F 1993	FL B2 F 2008	0.93
FL Rec F 2003	GA Rec F 2003	0.92	FL Rec F 1994	FL B2 F 2008	0.94
FL Rec F 2004	GA Rec F 2003	0.93	FL Rec F 1995	FL B2 F 2008	0.93
FL Rec F 2005	GA Rec F 2003	0.92	FL Rec F 1996	FL B2 F 2008	0.90
FL Rec F 2006	GA Rec F 2003	0.93	FL Rec F 1997	FL B2 F 2008	0.93
FL Rec F 2007	GA Rec F 2003	0.92	FL Rec F 1998	FL B2 F 2008	0.94
FL Rec F 2008	GA Rec F 2003	0.92	FL Rec F 1999	FL B2 F 2008	0.95
FL Rec F 2009	GA Rec F 2003	0.92	FL Rec F 2000	FL B2 F 2008	0.95
FL Rec F 2010	GA Rec F 2003	0.92	FL Rec F 2001	FL B2 F 2008	0.95
FL Rec F 2011	GA Rec F 2003	0.93	FL Rec F 2002	FL B2 F 2008	0.94
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FL Rec F 2013	GA Rec F 2003	0.93	FL Rec F 2004	FL B2 F 2008	0.95
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FL Rec F 2002	GA Rec F 2005	0.91	FL Rec F 2013	FL B2 F 2008	0.95
FL Rec F 2003	GA Rec F 2005	0.92	GA Rec F 1992	FL B2 F 2008	0.92
FL Rec F 2004	GA Rec F 2005	0.92	GA Rec F 1993	FL B2 F 2008	0.91
FL Rec F 2005	GA Rec F 2005	0.91	GA Rec F 1997	FL B2 F 2008	0.91
FL Rec F 2006	GA Rec F 2005	0.92	GA Rec F 2002	FL B2 F 2008	0.91
FL Rec F 2007	GA Rec F 2005	0.92	GA Rec F 2003	FL B2 F 2008	0.92
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FL Rec F 2009	GA Rec F 2005	0.92	GA Rec F 2008	FL B2 F 2008	0.92
FL Rec F 2010	GA Rec F 2005	0.92	GA Rec F 2009	FL B2 F 2008	0.91
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FL Rec F 2013	GA Rec F 2007	0.90	SC Rec F 1998	FL B2 F 2008	0.91
FL Rec F 1992	GA Rec F 2008	0.91	SC Rec F 2004	FL B2 F 2008	0.92
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FL Rec F 1995	GA Rec F 2008	0.91	SC Rec F 2009	FL B2 F 2008	0.92
FL Rec F 1997	GA Rec F 2008	0.90	SC Rec F 2010	FL B2 F 2008	0.93
FL Rec F 1998	GA Rec F 2008	0.91	SC Rec F 2011	FL B2 F 2008	0.93
FL Rec F 1999	GA Rec F 2008	0.92	SC Rec F 2013	FL B2 F 2008	0.93
FL Rec F 2000	GA Rec F 2008	0.92	FL B2 F 1992	FL B2 F 2008	0.91
FL Rec F 2001	GA Rec F 2008	0.92	FL B2 F 1993	FL B2 F 2008	0.91
FL Rec F 2002	GA Rec F 2008	0.92	FL B2 F 1994	FL B2 F 2008	0.92
FL Rec F 2003	GA Rec F 2008	0.92	FL B2 F 1995	FL B2 F 2008	0.93
FL Rec F 2004	GA Rec F 2008	0.93	FL B2 F 1996	FL B2 F 2008	0.93
FL Rec F 2005	GA Rec F 2008	0.91	FL B2 F 1997	FL B2 F 2008	0.93
FL Rec F 2006	GA Rec F 2008	0.93	FL B2 F 1998	FL B2 F 2008	0.93
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FL Rec F 2009	GA Rec F 2008	0.92	FL B2 F 2001	FL B2 F 2008	0.94
FL Rec F 2010	GA Rec F 2008	0.92	FL B2 F 2002	FL B2 F 2008	0.93
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FL Rec F 2013	GA Rec F 2008	0.93	FL B2 F 2005	FL B2 F 2008	0.93
FL Rec F 1992	GA Rec F 2009	0.90	FL B2 F 2006	FL B2 F 2008	0.95
FL Rec F 1993	GA Rec F 2009	0.90	FL B2 F 2007	FL B2 F 2008	0.95
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FL Rec F 2009	GA Rec F 2010	0.90	GA Rec F 1995	FL B2 F 2009	0.91
FL Rec F 2010	GA Rec F 2010	0.90	GA Rec F 1996	FL B2 F 2009	0.91
FL Rec F 2011	GA Rec F 2010	0.91	GA Rec F 1997	FL B2 F 2009	0.92
FL Rec F 2012	GA Rec F 2010	0.90	GA Rec F 1998	FL B2 F 2009	0.91
FL Rec F 2013	GA Rec F 2010	0.91	GA Rec F 2000	FL B2 F 2009	0.91
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FL Rec F 2000	GA Rec F 2011	0.90	GA Rec F 2003	FL B2 F 2009	0.93
FL Rec F 2001	GA Rec F 2011	0.90	GA Rec F 2005	FL B2 F 2009	0.93
FL Rec F 2003	GA Rec F 2011	0.90	GA Rec F 2006	FL B2 F 2009	0.90
FL Rec F 2004	GA Rec F 2011	0.91	GA Rec F 2007	FL B2 F 2009	0.90
FL Rec F 2006	GA Rec F 2011	0.91	GA Rec F 2008	FL B2 F 2009	0.93
FL Rec F 2007	GA Rec F 2011	0.90	GA Rec F 2009	FL B2 F 2009	0.92
FL Rec F 2009	GA Rec F 2011	0.90	GA Rec F 2010	FL B2 F 2009	0.91
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FL Rec F 2009	GA Rec F 2008	0.92	FL B2 F 2001	FL B2 F 2008	0.94
FL Rec F 2010	GA Rec F 2008	0.92	FL B2 F 2002	FL B2 F 2008	0.93
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FL Rec F 2013	GA Rec F 2008	0.93	FL B2 F 2005	FL B2 F 2008	0.93
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FL Rec F 2010	SC Rec F 1992	0.92	FL Rec F 2000	FL B2 F 2010	0.95
FL Rec F 2011	SC Rec F 1992	0.92	FL Rec F 2001	FL B2 F 2010	0.95
FL Rec F 2012	SC Rec F 1992	0.92	FL Rec F 2002	FL B2 F 2010	0.95
FL Rec F 2013	SC Rec F 1992	0.93	FL Rec F 2003	FL B2 F 2010	0.95
FL Rec F 1992	SC Rec F 1997	0.90	FL Rec F 2004	FL B2 F 2010	0.96
FL Rec F 1993	SC Rec F 1997	0.90	FL Rec F 2005	FL B2 F 2010	0.94
FL Rec F 1994	SC Rec F 1997	0.91	FL Rec F 2006	FL B2 F 2010	0.96
FL Rec F 1995	SC Rec F 1997	0.90	FL Rec F 2007	FL B2 F 2010	0.95
FL Rec F 1998	SC Rec F 1997	0.91	FL Rec F 2008	FL B2 F 2010	0.95
FL Rec F 1999	SC Rec F 1997	0.91	FL Rec F 2009	FL B2 F 2010	0.95
FL Rec F 2000	SC Rec F 1997	0.91	FL Rec F 2010	FL B2 F 2010	0.95
FL Rec F 2001	SC Rec F 1997	0.91	FL Rec F 2011	FL B2 F 2010	0.96
FL Rec F 2002	SC Rec F 1997	0.91	FL Rec F 2012	FL B2 F 2010	0.95
FL Rec F 2003	SC Rec F 1997	0.91	FL Rec F 2013	FL B2 F 2010	0.96
FL Rec F 2004	SC Rec F 1997	0.92	GA Rec F 1992	FL B2 F 2010	0.92
FL Rec F 2005	SC Rec F 1997	0.90	GA Rec F 1993	FL B2 F 2010	0.92
FL Rec F 2006	SC Rec F 1997	0.92	GA Rec F 1994	FL B2 F 2010	0.90
FL Rec F 2007	SC Rec F 1997	0.91	GA Rec F 1995	FL B2 F 2010	0.90
FL Rec F 2008	SC Rec F 1997	0.91	GA Rec F 1996	FL B2 F 2010	0.90
FL Rec F 2009	SC Rec F 1997	0.91	GA Rec F 1997	FL B2 F 2010	0.91
FL Rec F 2010	SC Rec F 1997	0.91	GA Rec F 2000	FL B2 F 2010	0.90
FL Rec F 2011	SC Rec F 1997	0.92	GA Rec F 2002	FL B2 F 2010	0.92
FL Rec F 2012	SC Rec F 1997	0.91	GA Rec F 2003	FL B2 F 2010	0.93

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 2013	SC Rec F 1997	0.92	GA Rec F 2005	FL B2 F 2010	0.92
FL Rec F 1992	SC Rec F 1998	0.91	GA Rec F 2008	FL B2 F 2010	0.92
FL Rec F 1993	SC Rec F 1998	0.91	GA Rec F 2009	FL B2 F 2010	0.91
FL Rec F 1994	SC Rec F 1998	0.91	GA Rec F 2010	FL B2 F 2010	0.90
FL Rec F 1995	SC Rec F 1998	0.91	GA Rec F 2011	FL B2 F 2010	0.90
FL Rec F 1998	SC Rec F 1998	0.91	GA Rec F 2013	FL B2 F 2010	0.92
FL Rec F 1999	SC Rec F 1998	0.92	SC Rec F 1992	FL B2 F 2010	0.92
FL Rec F 2000	SC Rec F 1998	0.92	SC Rec F 1997	FL B2 F 2010	0.91
FL Rec F 2001	SC Rec F 1998	0.92	SC Rec F 1998	FL B2 F 2010	0.92
FL Rec F 2002	SC Rec F 1998	0.92	SC Rec F 2004	FL B2 F 2010	0.92
FL Rec F 2003	SC Rec F 1998	0.92	SC Rec F 2005	FL B2 F 2010	0.92
FL Rec F 2004	SC Rec F 1998	0.92	SC Rec F 2007	FL B2 F 2010	0.91
FL Rec F 2005	SC Rec F 1998	0.91	SC Rec F 2008	FL B2 F 2010	0.91
FL Rec F 2006	SC Rec F 1998	0.92	SC Rec F 2009	FL B2 F 2010	0.93
FL Rec F 2007	SC Rec F 1998	0.92	SC Rec F 2010	FL B2 F 2010	0.94
FL Rec F 2008	SC Rec F 1998	0.91	SC Rec F 2011	FL B2 F 2010	0.94
FL Rec F 2009	SC Rec F 1998	0.92	SC Rec F 2012	FL B2 F 2010	0.91
FL Rec F 2010	SC Rec F 1998	0.92	SC Rec F 2013	FL B2 F 2010	0.93
FL Rec F 2011	SC Rec F 1998	0.92	FL B2 F 1992	FL B2 F 2010	0.92
FL Rec F 2012	SC Rec F 1998	0.92	FL B2 F 1993	FL B2 F 2010	0.91
FL Rec F 2013	SC Rec F 1998	0.92	FL B2 F 1994	FL B2 F 2010	0.93
FL Rec F 2004	SC Rec F 2002	0.90	FL B2 F 1995	FL B2 F 2010	0.93
FL Rec F 2006	SC Rec F 2002	0.90	FL B2 F 1996	FL B2 F 2010	0.94
FL Rec F 2011	SC Rec F 2002	0.90	FL B2 F 1997	FL B2 F 2010	0.93
FL Rec F 2013	SC Rec F 2002	0.90	FL B2 F 1998	FL B2 F 2010	0.94
FL Rec F 1992	SC Rec F 2004	0.91	FL B2 F 1999	FL B2 F 2010	0.95
FL Rec F 1993	SC Rec F 2004	0.91	FL B2 F 2000	FL B2 F 2010	0.95
FL Rec F 1994	SC Rec F 2004	0.92	FL B2 F 2001	FL B2 F 2010	0.95
FL Rec F 1995	SC Rec F 2004	0.91	FL B2 F 2002	FL B2 F 2010	0.94
FL Rec F 1997	SC Rec F 2004	0.90	FL B2 F 2003	FL B2 F 2010	0.94
FL Rec F 1998	SC Rec F 2004	0.91	FL B2 F 2004	FL B2 F 2010	0.95
FL Rec F 1999	SC Rec F 2004	0.92	FL B2 F 2005	FL B2 F 2010	0.94
FL Rec F 2000	SC Rec F 2004	0.92	FL B2 F 2006	FL B2 F 2010	0.96
FL Rec F 2001	SC Rec F 2004	0.92	FL B2 F 2007	FL B2 F 2010	0.95
FL Rec F 2002	SC Rec F 2004	0.92	FL B2 F 2008	FL B2 F 2010	0.95
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FL Rec F 2005	SC Rec F 2004	0.91	FL Rec F 1992	FL B2 F 2011	0.94
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FL Rec F 2007	SC Rec F 2004	0.92	FL Rec F 1994	FL B2 F 2011	0.95
FL Rec F 2008	SC Rec F 2004	0.91	FL Rec F 1995	FL B2 F 2011	0.94
FL Rec F 2009	SC Rec F 2004	0.92	FL Rec F 1996	FL B2 F 2011	0.91
FL Rec F 2010	SC Rec F 2004	0.92	FL Rec F 1997	FL B2 F 2011	0.93
FL Rec F 2011	SC Rec F 2004	0.93	FL Rec F 1998	FL B2 F 2011	0.94
FL Rec F 2012	SC Rec F 2004	0.92	FL Rec F 1999	FL B2 F 2011	0.95
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FL Rec F 2004	SC Rec F 2005	0.92	FL Rec F 2011	FL B2 F 2011	0.96
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FL Rec F 2009	SC Rec F 2005	0.92	GA Rec F 1994	FL B2 F 2011	0.90
FL Rec F 2010	SC Rec F 2005	0.92	GA Rec F 1995	FL B2 F 2011	0.90
FL Rec F 2011	SC Rec F 2005	0.92	GA Rec F 1996	FL B2 F 2011	0.90
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FL Rec F 2001	SC Rec F 2007	0.91	GA Rec F 2008	FL B2 F 2011	0.92
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FL Rec F 2003	SC Rec F 2007	0.90	GA Rec F 2010	FL B2 F 2011	0.90
FL Rec F 2004	SC Rec F 2007	0.91	GA Rec F 2011	FL B2 F 2011	0.90
FL Rec F 2006	SC Rec F 2007	0.91	GA Rec F 2013	FL B2 F 2011	0.92
FL Rec F 2007	SC Rec F 2007	0.91	SC Rec F 1992	FL B2 F 2011	0.92
FL Rec F 2009	SC Rec F 2007	0.91	SC Rec F 1997	FL B2 F 2011	0.91
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FL Rec F 1992	SC Rec F 2008	0.90	SC Rec F 2008	FL B2 F 2011	0.91
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FL Rec F 1994	SC Rec F 2008	0.91	SC Rec F 2010	FL B2 F 2011	0.94
FL Rec F 1995	SC Rec F 2008	0.90	SC Rec F 2011	FL B2 F 2011	0.94
FL Rec F 1998	SC Rec F 2008	0.90	SC Rec F 2012	FL B2 F 2011	0.90
FL Rec F 1999	SC Rec F 2008	0.91	SC Rec F 2013	FL B2 F 2011	0.93
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FL Rec F 2002	SC Rec F 2008	0.91	FL B2 F 1994	FL B2 F 2011	0.92
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FL Rec F 2006	SC Rec F 2008	0.92	FL B2 F 1998	FL B2 F 2011	0.94
FL Rec F 2007	SC Rec F 2008	0.91	FL B2 F 1999	FL B2 F 2011	0.94
FL Rec F 2008	SC Rec F 2008	0.91	FL B2 F 2000	FL B2 F 2011	0.95
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FL Rec F 2010	SC Rec F 2008	0.91	FL B2 F 2002	FL B2 F 2011	0.94
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SC Rec F 2004	SC Rec F 2009	0.90	FL Rec F 2010	FL B2 F 2012	0.96
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SC Rec F 2004	SC Rec F 2009	0.90	FL Rec F 2010	FL B2 F 2012	0.96
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FL Rec F 2001	SC Rec F 2010	0.94	GA Rec F 1997	FL B2 F 2012	0.92
FL Rec F 2002	SC Rec F 2010	0.93	GA Rec F 1998	FL B2 F 2012	0.91
FL Rec F 2003	SC Rec F 2010	0.94	GA Rec F 2000	FL B2 F 2012	0.91
FL Rec F 2004	SC Rec F 2010	0.94	GA Rec F 2002	FL B2 F 2012	0.93
FL Rec F 2005	SC Rec F 2010	0.93	GA Rec F 2003	FL B2 F 2012	0.93
FL Rec F 2006	SC Rec F 2010	0.94	GA Rec F 2005	FL B2 F 2012	0.93
FL Rec F 2007	SC Rec F 2010	0.94	GA Rec F 2006	FL B2 F 2012	0.90
FL Rec F 2008	SC Rec F 2010	0.93	GA Rec F 2007	FL B2 F 2012	0.91
FL Rec F 2009	SC Rec F 2010	0.94	GA Rec F 2008	FL B2 F 2012	0.93
FL Rec F 2010	SC Rec F 2010	0.94	GA Rec F 2009	FL B2 F 2012	0.92
FL Rec F 2011	SC Rec F 2010	0.94	GA Rec F 2010	FL B2 F 2012	0.91
FL Rec F 2012	SC Rec F 2010	0.94	GA Rec F 2011	FL B2 F 2012	0.91
FL Rec F 2013	SC Rec F 2010	0.94	GA Rec F 2013	FL B2 F 2012	0.93
GA Rec F 1992	SC Rec F 2010	0.91	SC Rec F 1992	FL B2 F 2012	0.93
GA Rec F 1993	SC Rec F 2010	0.90	SC Rec F 1997	FL B2 F 2012	0.92
GA Rec F 2002	SC Rec F 2010	0.90	SC Rec F 1998	FL B2 F 2012	0.93
GA Rec F 2003	SC Rec F 2010	0.91	SC Rec F 2002	FL B2 F 2012	0.91
GA Rec F 2005	SC Rec F 2010	0.90	SC Rec F 2004	FL B2 F 2012	0.93
GA Rec F 2008	SC Rec F 2010	0.91	SC Rec F 2005	FL B2 F 2012	0.93
GA Rec F 2013	SC Rec F 2010	0.90	SC Rec F 2007	FL B2 F 2012	0.92
SC Rec F 1992	SC Rec F 2010	0.91	SC Rec F 2008	FL B2 F 2012	0.92
SC Rec F 1998	SC Rec F 2010	0.90	SC Rec F 2009	FL B2 F 2012	0.94
SC Rec F 2004	SC Rec F 2010	0.91	SC Rec F 2010	FL B2 F 2012	0.95
SC Rec F 2005	SC Rec F 2010	0.91	SC Rec F 2011	FL B2 F 2012	0.95
SC Rec F 2008	SC Rec F 2010	0.90	SC Rec F 2012	FL B2 F 2012	0.92
SC Rec F 2009	SC Rec F 2010	0.92	SC Rec F 2013	FL B2 F 2012	0.94
FL Rec F 1992	SC Rec F 2011	0.92	FL B2 F 1992	FL B2 F 2012	0.93
FL Rec F 1993	SC Rec F 2011	0.92	FL B2 F 1993	FL B2 F 2012	0.92
FL Rec F 1994	SC Rec F 2011	0.93	FL B2 F 1994	FL B2 F 2012	0.93
FL Rec F 1995	SC Rec F 2011	0.92	FL B2 F 1995	FL B2 F 2012	0.94
FL Rec F 1997	SC Rec F 2011	0.92	FL B2 F 1996	FL B2 F 2012	0.95
FL Rec F 1998	SC Rec F 2011	0.93	FL B2 F 1997	FL B2 F 2012	0.94
FL Rec F 1999	SC Rec F 2011	0.94	FL B2 F 1998	FL B2 F 2012	0.95

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 2000	SC Rec F 2011	0.94	FL B2 F 1999	FL B2 F 2012	0.96
FL Rec F 2001	SC Rec F 2011	0.94	FL B2 F 2000	FL B2 F 2012	0.96
FL Rec F 2002	SC Rec F 2011	0.93	FL B2 F 2001	FL B2 F 2012	0.96
FL Rec F 2003	SC Rec F 2011	0.94	FL B2 F 2002	FL B2 F 2012	0.95
FL Rec F 2004	SC Rec F 2011	0.94	FL B2 F 2003	FL B2 F 2012	0.95
FL Rec F 2005	SC Rec F 2011	0.93	FL B2 F 2004	FL B2 F 2012	0.96
FL Rec F 2006	SC Rec F 2011	0.94	FL B2 F 2005	FL B2 F 2012	0.95
FL Rec F 2007	SC Rec F 2011	0.94	FL B2 F 2006	FL B2 F 2012	0.97
FL Rec F 2008	SC Rec F 2011	0.93	FL B2 F 2007	FL B2 F 2012	0.96
FL Rec F 2009	SC Rec F 2011	0.94	FL B2 F 2008	FL B2 F 2012	0.96
FL Rec F 2010	SC Rec F 2011	0.94	FL B2 F 2009	FL B2 F 2012	0.97
FL Rec F 2011	SC Rec F 2011	0.94	FL B2 F 2010	FL B2 F 2012	0.96
FL Rec F 2012	SC Rec F 2011	0.94	FL B2 F 2011	FL B2 F 2012	0.96
FL Rec F 2013	SC Rec F 2011	0.94	FL Rec F 1991	FL B2 F 2013	0.91
GA Rec F 1992	SC Rec F 2011	0.91	FL Rec F 1992	FL B2 F 2013	0.93
GA Rec F 1993	SC Rec F 2011	0.90	FL Rec F 1993	FL B2 F 2013	0.93
GA Rec F 2003	SC Rec F 2011	0.91	FL Rec F 1994	FL B2 F 2013	0.94
GA Rec F 2005	SC Rec F 2011	0.90	FL Rec F 1995	FL B2 F 2013	0.93
GA Rec F 2008	SC Rec F 2011	0.91	FL Rec F 1997	FL B2 F 2013	0.92
GA Rec F 2013	SC Rec F 2011	0.90	FL Rec F 1998	FL B2 F 2013	0.93
SC Rec F 1992	SC Rec F 2011	0.90	FL Rec F 1999	FL B2 F 2013	0.94
SC Rec F 1998	SC Rec F 2011	0.90	FL Rec F 2000	FL B2 F 2013	0.94
SC Rec F 2004	SC Rec F 2011	0.91	FL Rec F 2001	FL B2 F 2013	0.94
SC Rec F 2005	SC Rec F 2011	0.90	FL Rec F 2002	FL B2 F 2013	0.94
SC Rec F 2009	SC Rec F 2011	0.92	FL Rec F 2003	FL B2 F 2013	0.94
SC Rec F 2010	SC Rec F 2011	0.92	FL Rec F 2004	FL B2 F 2013	0.95
FL Rec F 1999	SC Rec F 2012	0.90	FL Rec F 2005	FL B2 F 2013	0.93
FL Rec F 2000	SC Rec F 2012	0.90	FL Rec F 2006	FL B2 F 2013	0.95
FL Rec F 2001	SC Rec F 2012	0.90	FL Rec F 2007	FL B2 F 2013	0.94
FL Rec F 2002	SC Rec F 2012	0.90	FL Rec F 2008	FL B2 F 2013	0.94
FL Rec F 2003	SC Rec F 2012	0.90	FL Rec F 2009	FL B2 F 2013	0.94
FL Rec F 2004	SC Rec F 2012	0.91	FL Rec F 2010	FL B2 F 2013	0.94
FL Rec F 2006	SC Rec F 2012	0.91	FL Rec F 2011	FL B2 F 2013	0.95
FL Rec F 2007	SC Rec F 2012	0.90	FL Rec F 2012	FL B2 F 2013	0.94
FL Rec F 2009	SC Rec F 2012	0.90	FL Rec F 2013	FL B2 F 2013	0.95
FL Rec F 2010	SC Rec F 2012	0.90	GA Rec F 1992	FL B2 F 2013	0.92
FL Rec F 2011	SC Rec F 2012	0.91	GA Rec F 1993	FL B2 F 2013	0.91
FL Rec F 2012	SC Rec F 2012	0.91	GA Rec F 1997	FL B2 F 2013	0.91
FL Rec F 2013	SC Rec F 2012	0.91	GA Rec F 2002	FL B2 F 2013	0.91
FL Rec F 1992	SC Rec F 2013	0.92	GA Rec F 2003	FL B2 F 2013	0.92
FL Rec F 1993	SC Rec F 2013	0.92	GA Rec F 2005	FL B2 F 2013	0.91
FL Rec F 1994	SC Rec F 2013	0.93	GA Rec F 2008	FL B2 F 2013	0.91
FL Rec F 1995	SC Rec F 2013	0.92	GA Rec F 2009	FL B2 F 2013	0.90
FL Rec F 1997	SC Rec F 2013	0.91	GA Rec F 2013	FL B2 F 2013	0.91
FL Rec F 1998	SC Rec F 2013	0.92	SC Rec F 1992	FL B2 F 2013	0.91
FL Rec F 1999	SC Rec F 2013	0.93	SC Rec F 1997	FL B2 F 2013	0.91
FL Rec F 2000	SC Rec F 2013	0.93	SC Rec F 1998	FL B2 F 2013	0.91
FL Rec F 2001	SC Rec F 2013	0.93	SC Rec F 2004	FL B2 F 2013	0.91
FL Rec F 2002	SC Rec F 2013	0.93	SC Rec F 2005	FL B2 F 2013	0.91
FL Rec F 2003	SC Rec F 2013	0.93	SC Rec F 2008	FL B2 F 2013	0.90
FL Rec F 2004	SC Rec F 2013	0.94	SC Rec F 2009	FL B2 F 2013	0.92
FL Rec F 2005	SC Rec F 2013	0.92	SC Rec F 2010	FL B2 F 2013	0.93
FL Rec F 2006	SC Rec F 2013	0.94	SC Rec F 2011	FL B2 F 2013	0.93
FL Rec F 2007	SC Rec F 2013	0.93	SC Rec F 2013	FL B2 F 2013	0.93
FL Rec F 2008	SC Rec F 2013	0.92	FL B2 F 1992	FL B2 F 2013	0.91

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 2009	SC Rec F 2013	0.93	FL B2 F 1993	FL B2 F 2013	0.91
FL Rec F 2010	SC Rec F 2013	0.93	FL B2 F 1994	FL B2 F 2013	0.92
FL Rec F 2011	SC Rec F 2013	0.94	FL B2 F 1995	FL B2 F 2013	0.93
FL Rec F 2012	SC Rec F 2013	0.93	FL B2 F 1996	FL B2 F 2013	0.93
FL Rec F 2013	SC Rec F 2013	0.94	FL B2 F 1997	FL B2 F 2013	0.93
GA Rec F 1992	SC Rec F 2013	0.90	FL B2 F 1998	FL B2 F 2013	0.93
GA Rec F 2003	SC Rec F 2013	0.90	FL B2 F 1999	FL B2 F 2013	0.94
GA Rec F 2008	SC Rec F 2013	0.90	FL B2 F 2000	FL B2 F 2013	0.94
SC Rec F 1992	SC Rec F 2013	0.90	FL B2 F 2001	FL B2 F 2013	0.94
SC Rec F 2004	SC Rec F 2013	0.91	FL B2 F 2002	FL B2 F 2013	0.93
SC Rec F 2005	SC Rec F 2013	0.90	FL B2 F 2003	FL B2 F 2013	0.93
SC Rec F 2009	SC Rec F 2013	0.91	FL B2 F 2004	FL B2 F 2013	0.94
SC Rec F 2010	SC Rec F 2013	0.92	FL B2 F 2005	FL B2 F 2013	0.93
SC Rec F 2011	SC Rec F 2013	0.92	FL B2 F 2006	FL B2 F 2013	0.95
FL Rec F 1992	FL B2 F 1992	0.91	FL B2 F 2007	FL B2 F 2013	0.94
FL Rec F 1993	FL B2 F 1992	0.91	FL B2 F 2008	FL B2 F 2013	0.94
FL Rec F 1994	FL B2 F 1992	0.91	FL B2 F 2009	FL B2 F 2013	0.95
FL Rec F 1995	FL B2 F 1992	0.91	FL B2 F 2010	FL B2 F 2013	0.95
FL Rec F 1998	FL B2 F 1992	0.91	FL B2 F 2011	FL B2 F 2013	0.94
FL Rec F 1999	FL B2 F 1992	0.92	FL B2 F 2012	FL B2 F 2013	0.95
FL Rec F 2000	FL B2 F 1992	0.92	GA/SC B2 F 1998	GA/SC B2 F 2002	0.90
FL Rec F 2001	FL B2 F 1992	0.92	GA/SC B2 F 1994	GA/SC B2 F 2003	0.90
FL Rec F 2002	FL B2 F 1992	0.91	GA/SC B2 F 1998	GA/SC B2 F 2003	0.91
FL Rec F 2003	FL B2 F 1992	0.92	GA/SC B2 F 2002	GA/SC B2 F 2003	0.91
FL Rec F 2004	FL B2 F 1992	0.92	GA/SC B2 F 1994	GA/SC B2 F 2004	0.90
FL Rec F 2005	FL B2 F 1992	0.91	GA/SC B2 F 1998	GA/SC B2 F 2004	0.91
FL Rec F 2006	FL B2 F 1992	0.92	GA/SC B2 F 2000	GA/SC B2 F 2004	0.90
FL Rec F 2007	FL B2 F 1992	0.92	GA/SC B2 F 2002	GA/SC B2 F 2004	0.91
FL Rec F 2008	FL B2 F 1992	0.91	GA/SC B2 F 2003	GA/SC B2 F 2004	0.92
FL Rec F 2009	FL B2 F 1992	0.92	FL Rec F 2004	GA/SC B2 F 2005	0.90
FL Rec F 2010	FL B2 F 1992	0.92	FL Rec F 2006	GA/SC B2 F 2005	0.90
FL Rec F 2011	FL B2 F 1992	0.92	FL Rec F 2011	GA/SC B2 F 2005	0.90
FL Rec F 2012	FL B2 F 1992	0.92	FL Rec F 2013	GA/SC B2 F 2005	0.90
FL Rec F 2013	FL B2 F 1992	0.92	FL B2 F 2006	GA/SC B2 F 2005	0.90
SC Rec F 2010	FL B2 F 1992	0.90	FL B2 F 2009	GA/SC B2 F 2005	0.91
SC Rec F 2011	FL B2 F 1992	0.90	FL B2 F 2012	GA/SC B2 F 2005	0.91
FL Rec F 1992	FL B2 F 1993	0.90	GA/SC B2 F 1992	GA/SC B2 F 2005	0.90
FL Rec F 1993	FL B2 F 1993	0.90	GA/SC B2 F 1994	GA/SC B2 F 2005	0.91
FL Rec F 1994	FL B2 F 1993	0.91	GA/SC B2 F 1998	GA/SC B2 F 2005	0.92
FL Rec F 1995	FL B2 F 1993	0.90	GA/SC B2 F 2000	GA/SC B2 F 2005	0.91
FL Rec F 1998	FL B2 F 1993	0.90	GA/SC B2 F 2001	GA/SC B2 F 2005	0.90
FL Rec F 1999	FL B2 F 1993	0.91	GA/SC B2 F 2002	GA/SC B2 F 2005	0.92
FL Rec F 2000	FL B2 F 1993	0.91	GA/SC B2 F 2003	GA/SC B2 F 2005	0.93
FL Rec F 2001	FL B2 F 1993	0.91	GA/SC B2 F 2004	GA/SC B2 F 2005	0.93
FL Rec F 2002	FL B2 F 1993	0.91	FL Rec F 1999	GA/SC B2 F 2006	0.90
FL Rec F 2003	FL B2 F 1993	0.91	FL Rec F 2000	GA/SC B2 F 2006	0.90
FL Rec F 2004	FL B2 F 1993	0.92	FL Rec F 2001	GA/SC B2 F 2006	0.90
FL Rec F 2005	FL B2 F 1993	0.90	FL Rec F 2003	GA/SC B2 F 2006	0.90
FL Rec F 2006	FL B2 F 1993	0.92	FL Rec F 2004	GA/SC B2 F 2006	0.91
FL Rec F 2007	FL B2 F 1993	0.91	FL Rec F 2006	GA/SC B2 F 2006	0.91
FL Rec F 2008	FL B2 F 1993	0.91	FL Rec F 2007	GA/SC B2 F 2006	0.90
FL Rec F 2009	FL B2 F 1993	0.91	FL Rec F 2009	GA/SC B2 F 2006	0.90
FL Rec F 2010	FL B2 F 1993	0.91	FL Rec F 2010	GA/SC B2 F 2006	0.90
FL Rec F 2011	FL B2 F 1993	0.92	FL Rec F 2011	GA/SC B2 F 2006	0.91
FL Rec F 2012	FL B2 F 1993	0.91	FL Rec F 2012	GA/SC B2 F 2006	0.90

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 2013	FL B2 F 1993	0.92	FL Rec F 2013	GA/SC B2 F 2006	0.91
FL Rec F 1992	FL B2 F 1994	0.91	FL B2 F 2004	GA/SC B2 F 2006	0.90
FL Rec F 1993	FL B2 F 1994	0.91	FL B2 F 2006	GA/SC B2 F 2006	0.91
FL Rec F 1994	FL B2 F 1994	0.92	FL B2 F 2007	GA/SC B2 F 2006	0.90
FL Rec F 1995	FL B2 F 1994	0.91	FL B2 F 2009	GA/SC B2 F 2006	0.91
FL Rec F 1997	FL B2 F 1994	0.90	FL B2 F 2010	GA/SC B2 F 2006	0.90
FL Rec F 1998	FL B2 F 1994	0.91	FL B2 F 2011	GA/SC B2 F 2006	0.90
FL Rec F 1999	FL B2 F 1994	0.92	FL B2 F 2012	GA/SC B2 F 2006	0.91
FL Rec F 2000	FL B2 F 1994	0.92	GA/SC B2 F 1994	GA/SC B2 F 2006	0.91
FL Rec F 2001	FL B2 F 1994	0.92	GA/SC B2 F 1998	GA/SC B2 F 2006	0.92
FL Rec F 2002	FL B2 F 1994	0.92	GA/SC B2 F 2000	GA/SC B2 F 2006	0.91
FL Rec F 2003	FL B2 F 1994	0.92	GA/SC B2 F 2001	GA/SC B2 F 2006	0.90
FL Rec F 2004	FL B2 F 1994	0.93	GA/SC B2 F 2002	GA/SC B2 F 2006	0.92
FL Rec F 2005	FL B2 F 1994	0.91	GA/SC B2 F 2003	GA/SC B2 F 2006	0.92
FL Rec F 2006	FL B2 F 1994	0.93	GA/SC B2 F 2004	GA/SC B2 F 2006	0.93
FL Rec F 2007	FL B2 F 1994	0.92	GA/SC B2 F 2005	GA/SC B2 F 2006	0.94
FL Rec F 2008	FL B2 F 1994	0.92	FL B2 F 2012	GA/SC B2 F 2007	0.90
FL Rec F 2009	FL B2 F 1994	0.92	GA/SC B2 F 1994	GA/SC B2 F 2007	0.91
FL Rec F 2010	FL B2 F 1994	0.92	GA/SC B2 F 1998	GA/SC B2 F 2007	0.92
FL Rec F 2011	FL B2 F 1994	0.93	GA/SC B2 F 2000	GA/SC B2 F 2007	0.91
FL Rec F 2012	FL B2 F 1994	0.92	GA/SC B2 F 2001	GA/SC B2 F 2007	0.90
FL Rec F 2013	FL B2 F 1994	0.93	GA/SC B2 F 2002	GA/SC B2 F 2007	0.92
SC Rec F 2009	FL B2 F 1994	0.90	GA/SC B2 F 2003	GA/SC B2 F 2007	0.93
SC Rec F 2010	FL B2 F 1994	0.91	GA/SC B2 F 2004	GA/SC B2 F 2007	0.93
SC Rec F 2011	FL B2 F 1994	0.91	GA/SC B2 F 2005	GA/SC B2 F 2007	0.93
SC Rec F 2013	FL B2 F 1994	0.90	GA/SC B2 F 2006	GA/SC B2 F 2007	0.93
FL Rec F 1992	FL B2 F 1995	0.92	GA/SC B2 F 1994	GA/SC B2 F 2008	0.90
FL Rec F 1993	FL B2 F 1995	0.92	GA/SC B2 F 1998	GA/SC B2 F 2008	0.91
FL Rec F 1994	FL B2 F 1995	0.93	GA/SC B2 F 2002	GA/SC B2 F 2008	0.91
FL Rec F 1995	FL B2 F 1995	0.92	GA/SC B2 F 2003	GA/SC B2 F 2008	0.92
FL Rec F 1997	FL B2 F 1995	0.92	GA/SC B2 F 2004	GA/SC B2 F 2008	0.92
FL Rec F 1998	FL B2 F 1995	0.92	GA/SC B2 F 2005	GA/SC B2 F 2008	0.93
FL Rec F 1999	FL B2 F 1995	0.93	GA/SC B2 F 2006	GA/SC B2 F 2008	0.92
FL Rec F 2000	FL B2 F 1995	0.93	GA/SC B2 F 2007	GA/SC B2 F 2008	0.92
FL Rec F 2001	FL B2 F 1995	0.93	GA/SC B2 F 1992	GA/SC B2 F 2009	0.90
FL Rec F 2002	FL B2 F 1995	0.93	GA/SC B2 F 1994	GA/SC B2 F 2009	0.91
FL Rec F 2003	FL B2 F 1995	0.93	GA/SC B2 F 1998	GA/SC B2 F 2009	0.92
FL Rec F 2004	FL B2 F 1995	0.94	GA/SC B2 F 2000	GA/SC B2 F 2009	0.91
FL Rec F 2005	FL B2 F 1995	0.92	GA/SC B2 F 2001	GA/SC B2 F 2009	0.90
FL Rec F 2006	FL B2 F 1995	0.94	GA/SC B2 F 2002	GA/SC B2 F 2009	0.92
FL Rec F 2007	FL B2 F 1995	0.93	GA/SC B2 F 2003	GA/SC B2 F 2009	0.93
FL Rec F 2008	FL B2 F 1995	0.93	GA/SC B2 F 2004	GA/SC B2 F 2009	0.93
FL Rec F 2009	FL B2 F 1995	0.93	GA/SC B2 F 2005	GA/SC B2 F 2009	0.94
FL Rec F 2010	FL B2 F 1995	0.93	GA/SC B2 F 2006	GA/SC B2 F 2009	0.93
FL Rec F 2011	FL B2 F 1995	0.94	GA/SC B2 F 2007	GA/SC B2 F 2009	0.93
FL Rec F 2012	FL B2 F 1995	0.93	GA/SC B2 F 2008	GA/SC B2 F 2009	0.93
FL Rec F 2013	FL B2 F 1995	0.94	GA/SC B2 F 1992	GA/SC B2 F 2010	0.91
GA Rec F 1992	FL B2 F 1995	0.91	GA/SC B2 F 1994	GA/SC B2 F 2010	0.91
GA Rec F 2003	FL B2 F 1995	0.91	GA/SC B2 F 1995	GA/SC B2 F 2010	0.90
GA Rec F 2008	FL B2 F 1995	0.90	GA/SC B2 F 1998	GA/SC B2 F 2010	0.92
SC Rec F 1992	FL B2 F 1995	0.90	GA/SC B2 F 2000	GA/SC B2 F 2010	0.91
SC Rec F 1998	FL B2 F 1995	0.90	GA/SC B2 F 2001	GA/SC B2 F 2010	0.91
SC Rec F 2004	FL B2 F 1995	0.90	GA/SC B2 F 2002	GA/SC B2 F 2010	0.93
SC Rec F 2009	FL B2 F 1995	0.91	GA/SC B2 F 2003	GA/SC B2 F 2010	0.93
SC Rec F 2010	FL B2 F 1995	0.92	GA/SC B2 F 2004	GA/SC B2 F 2010	0.93

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
SC Rec F 2011	FL B2 F 1995	0.92	GA/SC B2 F 2005	GA/SC B2 F 2010	0.94
SC Rec F 2013	FL B2 F 1995	0.91	GA/SC B2 F 2006	GA/SC B2 F 2010	0.94
FL B2 F 1994	FL B2 F 1995	0.91	GA/SC B2 F 2007	GA/SC B2 F 2010	0.94
FL Rec F 1992	FL B2 F 1996	0.92	GA/SC B2 F 2008	GA/SC B2 F 2010	0.93
FL Rec F 1993	FL B2 F 1996	0.92	GA/SC B2 F 2009	GA/SC B2 F 2010	0.94
FL Rec F 1994	FL B2 F 1996	0.93	FL Rec F 2000	GA/SC B2 F 2011	0.90
FL Rec F 1995	FL B2 F 1996	0.92	FL Rec F 2001	GA/SC B2 F 2011	0.90
FL Rec F 1997	FL B2 F 1996	0.92	FL Rec F 2004	GA/SC B2 F 2011	0.90
FL Rec F 1998	FL B2 F 1996	0.93	FL Rec F 2006	GA/SC B2 F 2011	0.90
FL Rec F 1999	FL B2 F 1996	0.93	FL Rec F 2007	GA/SC B2 F 2011	0.90
FL Rec F 2000	FL B2 F 1996	0.94	FL Rec F 2009	GA/SC B2 F 2011	0.90
FL Rec F 2001	FL B2 F 1996	0.94	FL Rec F 2010	GA/SC B2 F 2011	0.90
FL Rec F 2002	FL B2 F 1996	0.93	FL Rec F 2011	GA/SC B2 F 2011	0.91
FL Rec F 2003	FL B2 F 1996	0.93	FL Rec F 2012	GA/SC B2 F 2011	0.90
FL Rec F 2004	FL B2 F 1996	0.94	FL Rec F 2013	GA/SC B2 F 2011	0.91
FL Rec F 2005	FL B2 F 1996	0.93	FL B2 F 2006	GA/SC B2 F 2011	0.90
FL Rec F 2006	FL B2 F 1996	0.94	FL B2 F 2009	GA/SC B2 F 2011	0.91
FL Rec F 2007	FL B2 F 1996	0.94	FL B2 F 2010	GA/SC B2 F 2011	0.90
FL Rec F 2008	FL B2 F 1996	0.93	FL B2 F 2012	GA/SC B2 F 2011	0.91
FL Rec F 2009	FL B2 F 1996	0.94	GA/SC B2 F 1992	GA/SC B2 F 2011	0.91
FL Rec F 2010	FL B2 F 1996	0.93	GA/SC B2 F 1994	GA/SC B2 F 2011	0.92
FL Rec F 2011	FL B2 F 1996	0.94	GA/SC B2 F 1995	GA/SC B2 F 2011	0.90
FL Rec F 2012	FL B2 F 1996	0.93	GA/SC B2 F 1998	GA/SC B2 F 2011	0.93
FL Rec F 2013	FL B2 F 1996	0.94	GA/SC B2 F 1999	GA/SC B2 F 2011	0.90
GA Rec F 1992	FL B2 F 1996	0.91	GA/SC B2 F 2000	GA/SC B2 F 2011	0.92
GA Rec F 1993	FL B2 F 1996	0.90	GA/SC B2 F 2001	GA/SC B2 F 2011	0.91
GA Rec F 2003	FL B2 F 1996	0.91	GA/SC B2 F 2002	GA/SC B2 F 2011	0.93
GA Rec F 2005	FL B2 F 1996	0.90	GA/SC B2 F 2003	GA/SC B2 F 2011	0.93
GA Rec F 2008	FL B2 F 1996	0.91	GA/SC B2 F 2004	GA/SC B2 F 2011	0.94
SC Rec F 1992	FL B2 F 1996	0.90	GA/SC B2 F 2005	GA/SC B2 F 2011	0.95
SC Rec F 1998	FL B2 F 1996	0.90	GA/SC B2 F 2006	GA/SC B2 F 2011	0.94
SC Rec F 2004	FL B2 F 1996	0.91	GA/SC B2 F 2007	GA/SC B2 F 2011	0.94
SC Rec F 2005	FL B2 F 1996	0.90	GA/SC B2 F 2008	GA/SC B2 F 2011	0.93
SC Rec F 2009	FL B2 F 1996	0.91	GA/SC B2 F 2009	GA/SC B2 F 2011	0.94
SC Rec F 2010	FL B2 F 1996	0.92	GA/SC B2 F 2010	GA/SC B2 F 2011	0.95
SC Rec F 2011	FL B2 F 1996	0.92	FL Rec F 1992	GA/SC B2 F 2012	0.92
SC Rec F 2013	FL B2 F 1996	0.92	FL Rec F 1993	GA/SC B2 F 2012	0.92
FL B2 F 1992	FL B2 F 1996	0.90	FL Rec F 1994	GA/SC B2 F 2012	0.92
FL B2 F 1994	FL B2 F 1996	0.91	FL Rec F 1995	GA/SC B2 F 2012	0.92
FL B2 F 1995	FL B2 F 1996	0.92	FL Rec F 1997	GA/SC B2 F 2012	0.91
FL Rec F 1992	FL B2 F 1997	0.92	FL Rec F 1998	GA/SC B2 F 2012	0.92
FL Rec F 1993	FL B2 F 1997	0.92	FL Rec F 1999	GA/SC B2 F 2012	0.93
FL Rec F 1994	FL B2 F 1997	0.93	FL Rec F 2000	GA/SC B2 F 2012	0.93
FL Rec F 1995	FL B2 F 1997	0.92	FL Rec F 2001	GA/SC B2 F 2012	0.93
FL Rec F 1997	FL B2 F 1997	0.91	FL Rec F 2002	GA/SC B2 F 2012	0.93
FL Rec F 1998	FL B2 F 1997	0.93	FL Rec F 2003	GA/SC B2 F 2012	0.93
FL Rec F 1999	FL B2 F 1997	0.93	FL Rec F 2004	GA/SC B2 F 2012	0.93
FL Rec F 2000	FL B2 F 1997	0.93	FL Rec F 2005	GA/SC B2 F 2012	0.92
FL Rec F 2001	FL B2 F 1997	0.93	FL Rec F 2006	GA/SC B2 F 2012	0.93
FL Rec F 2002	FL B2 F 1997	0.93	FL Rec F 2007	GA/SC B2 F 2012	0.93
FL Rec F 2003	FL B2 F 1997	0.93	FL Rec F 2008	GA/SC B2 F 2012	0.92
FL Rec F 2004	FL B2 F 1997	0.94	FL Rec F 2009	GA/SC B2 F 2012	0.93
FL Rec F 2005	FL B2 F 1997	0.92	FL Rec F 2010	GA/SC B2 F 2012	0.93
FL Rec F 2006	FL B2 F 1997	0.94	FL Rec F 2011	GA/SC B2 F 2012	0.94
FL Rec F 2007	FL B2 F 1997	0.93	FL Rec F 2012	GA/SC B2 F 2012	0.93

Parameter 1	Parameter 2	Correlation	Parameter 1	Parameter 2	Correlation
FL Rec F 2008	FL B2 F 1997	0.93	FL Rec F 2013	GA/SC B2 F 2012	0.94
FL Rec F 2009	FL B2 F 1997	0.93	GA Rec F 1992	GA/SC B2 F 2012	0.90
FL Rec F 2010	FL B2 F 1997	0.93	GA Rec F 2003	GA/SC B2 F 2012	0.90
FL Rec F 2011	FL B2 F 1997	0.94	GA Rec F 2008	GA/SC B2 F 2012	0.90
FL Rec F 2012	FL B2 F 1997	0.93	SC Rec F 2004	GA/SC B2 F 2012	0.90
FL Rec F 2013	FL B2 F 1997	0.94	SC Rec F 2009	GA/SC B2 F 2012	0.91
GA Rec F 1992	FL B2 F 1997	0.91	SC Rec F 2010	GA/SC B2 F 2012	0.91
GA Rec F 2003	FL B2 F 1997	0.91	SC Rec F 2011	GA/SC B2 F 2012	0.92
GA Rec F 2008	FL B2 F 1997	0.90	SC Rec F 2013	GA/SC B2 F 2012	0.91
SC Rec F 1992	FL B2 F 1997	0.90	FL B2 F 1994	GA/SC B2 F 2012	0.90
SC Rec F 1998	FL B2 F 1997	0.90	FL B2 F 1995	GA/SC B2 F 2012	0.91
SC Rec F 2004	FL B2 F 1997	0.90	FL B2 F 1996	GA/SC B2 F 2012	0.91
SC Rec F 2009	FL B2 F 1997	0.91	FL B2 F 1997	GA/SC B2 F 2012	0.91
SC Rec F 2010	FL B2 F 1997	0.92	FL B2 F 1998	GA/SC B2 F 2012	0.92
SC Rec F 2011	FL B2 F 1997	0.92	FL B2 F 1999	GA/SC B2 F 2012	0.92
SC Rec F 2013	FL B2 F 1997	0.91	FL B2 F 2000	GA/SC B2 F 2012	0.93
FL B2 F 1994	FL B2 F 1997	0.91	FL B2 F 2001	GA/SC B2 F 2012	0.93
FL B2 F 1995	FL B2 F 1997	0.92	FL B2 F 2002	GA/SC B2 F 2012	0.91
FL B2 F 1996	FL B2 F 1997	0.92	FL B2 F 2003	GA/SC B2 F 2012	0.92
FL Rec F 1991	FL B2 F 1998	0.90	FL B2 F 2004	GA/SC B2 F 2012	0.93
FL Rec F 1992	FL B2 F 1998	0.93	FL B2 F 2005	GA/SC B2 F 2012	0.91
FL Rec F 1993	FL B2 F 1998	0.93	FL B2 F 2006	GA/SC B2 F 2012	0.93
FL Rec F 1994	FL B2 F 1998	0.94	FL B2 F 2007	GA/SC B2 F 2012	0.93
FL Rec F 1995	FL B2 F 1998	0.93	FL B2 F 2008	GA/SC B2 F 2012	0.92
FL Rec F 1997	FL B2 F 1998	0.92	FL B2 F 2009	GA/SC B2 F 2012	0.94
FL Rec F 1998	FL B2 F 1998	0.93	FL B2 F 2010	GA/SC B2 F 2012	0.93
FL Rec F 1999	FL B2 F 1998	0.94	FL B2 F 2011	GA/SC B2 F 2012	0.93
FL Rec F 2000	FL B2 F 1998	0.94	FL B2 F 2012	GA/SC B2 F 2012	0.94
FL Rec F 2001	FL B2 F 1998	0.94	FL B2 F 2013	GA/SC B2 F 2012	0.92
FL Rec F 2002	FL B2 F 1998	0.94	GA/SC B2 F 1992	GA/SC B2 F 2012	0.91
FL Rec F 2003	FL B2 F 1998	0.94	GA/SC B2 F 1994	GA/SC B2 F 2012	0.92
FL Rec F 2004	FL B2 F 1998	0.94	GA/SC B2 F 1995	GA/SC B2 F 2012	0.90
FL Rec F 2005	FL B2 F 1998	0.93	GA/SC B2 F 1996	GA/SC B2 F 2012	0.90
FL Rec F 2006	FL B2 F 1998	0.94	GA/SC B2 F 1998	GA/SC B2 F 2012	0.94
FL Rec F 2007	FL B2 F 1998	0.94	GA/SC B2 F 1999	GA/SC B2 F 2012	0.91
FL Rec F 2008	FL B2 F 1998	0.93	GA/SC B2 F 2000	GA/SC B2 F 2012	0.93
FL Rec F 2009	FL B2 F 1998	0.94	GA/SC B2 F 2001	GA/SC B2 F 2012	0.91
FL Rec F 2010	FL B2 F 1998	0.94	GA/SC B2 F 2002	GA/SC B2 F 2012	0.93
FL Rec F 2011	FL B2 F 1998	0.95	GA/SC B2 F 2003	GA/SC B2 F 2012	0.94
FL Rec F 2012	FL B2 F 1998	0.94	GA/SC B2 F 2004	GA/SC B2 F 2012	0.94
FL Rec F 2013	FL B2 F 1998	0.95	GA/SC B2 F 2005	GA/SC B2 F 2012	0.95
GA Rec F 1992	FL B2 F 1998	0.91	GA/SC B2 F 2006	GA/SC B2 F 2012	0.95
GA Rec F 1993	FL B2 F 1998	0.91	GA/SC B2 F 2007	GA/SC B2 F 2012	0.95
GA Rec F 1997	FL B2 F 1998	0.90	GA/SC B2 F 2008	GA/SC B2 F 2012	0.94
GA Rec F 2002	FL B2 F 1998	0.90	GA/SC B2 F 2009	GA/SC B2 F 2012	0.95
GA Rec F 2003	FL B2 F 1998	0.91	GA/SC B2 F 2010	GA/SC B2 F 2012	0.95
GA Rec F 2005	FL B2 F 1998	0.91	GA/SC B2 F 2011	GA/SC B2 F 2012	0.96
GA Rec F 2008	FL B2 F 1998	0.91	FL Rec F 2004	GA/SC B2 F 2013	0.90
GA Rec F 2009	FL B2 F 1998	0.90	FL Rec F 2006	GA/SC B2 F 2013	0.90
GA Rec F 2013	FL B2 F 1998	0.90	FL Rec F 2011	GA/SC B2 F 2013	0.90
SC Rec F 1992	FL B2 F 1998	0.91	FL Rec F 2013	GA/SC B2 F 2013	0.91
SC Rec F 1997	FL B2 F 1998	0.90	FL B2 F 2006	GA/SC B2 F 2013	0.90
SC Rec F 1998	FL B2 F 1998	0.91	FL B2 F 2009	GA/SC B2 F 2013	0.90
SC Rec F 2004	FL B2 F 1998	0.91	FL B2 F 2012	GA/SC B2 F 2013	0.91
SC Rec F 2005	FL B2 F 1998	0.91	GA/SC B2 F 1992	GA/SC B2 F 2013	0.91

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SC Rec F 2008	FL B2 F 1998	0.90	GA/SC B2 F 1994	GA/SC B2 F 2013	0.92
SC Rec F 2009	FL B2 F 1998	0.92	GA/SC B2 F 1995	GA/SC B2 F 2013	0.90
SC Rec F 2010	FL B2 F 1998	0.93	GA/SC B2 F 1998	GA/SC B2 F 2013	0.92
SC Rec F 2011	FL B2 F 1998	0.92	GA/SC B2 F 1999	GA/SC B2 F 2013	0.90
SC Rec F 2013	FL B2 F 1998	0.92	GA/SC B2 F 2000	GA/SC B2 F 2013	0.91
FL B2 F 1992	FL B2 F 1998	0.91	GA/SC B2 F 2001	GA/SC B2 F 2013	0.91
FL B2 F 1993	FL B2 F 1998	0.90	GA/SC B2 F 2002	GA/SC B2 F 2013	0.92
FL B2 F 1994	FL B2 F 1998	0.91	GA/SC B2 F 2003	GA/SC B2 F 2013	0.93
FL B2 F 1995	FL B2 F 1998	0.92	GA/SC B2 F 2004	GA/SC B2 F 2013	0.94
FL B2 F 1996	FL B2 F 1998	0.92	GA/SC B2 F 2005	GA/SC B2 F 2013	0.94
FL B2 F 1997	FL B2 F 1998	0.92	GA/SC B2 F 2006	GA/SC B2 F 2013	0.94
FL Rec F 1991	FL B2 F 1999	0.91	GA/SC B2 F 2007	GA/SC B2 F 2013	0.94
FL Rec F 1992	FL B2 F 1999	0.93	GA/SC B2 F 2008	GA/SC B2 F 2013	0.93
FL Rec F 1993	FL B2 F 1999	0.93	GA/SC B2 F 2009	GA/SC B2 F 2013	0.94
FL Rec F 1994	FL B2 F 1999	0.94	GA/SC B2 F 2010	GA/SC B2 F 2013	0.95
FL Rec F 1995	FL B2 F 1999	0.93	GA/SC B2 F 2011	GA/SC B2 F 2013	0.95
FL Rec F 1996	FL B2 F 1999	0.90	GA/SC B2 F 2012	GA/SC B2 F 2013	0.96
FL Rec F 1997	FL B2 F 1999	0.93	FL Rec F 1991	Recruit 1989	-0.92
FL Rec F 1998	FL B2 F 1999	0.94	FL Rec F 1992	Recruit 1989	-0.92
FL Rec F 1999	FL B2 F 1999	0.95	FL Rec F 1993	Recruit 1989	-0.91
FL Rec F 2000	FL B2 F 1999	0.95	FL Rec F 1994	Recruit 1989	-0.92
FL Rec F 2001	FL B2 F 1999	0.95	FL Rec F 1995	Recruit 1989	-0.92
FL Rec F 2002	FL B2 F 1999	0.94	FL Rec F 1997	Recruit 1989	-0.91
FL Rec F 2003	FL B2 F 1999	0.94	FL Rec F 1998	Recruit 1989	-0.92
FL Rec F 2004	FL B2 F 1999	0.95	FL Rec F 1999	Recruit 1989	-0.93
FL Rec F 2005	FL B2 F 1999	0.94	FL Rec F 2000	Recruit 1989	-0.93
FL Rec F 2006	FL B2 F 1999	0.95	FL Rec F 2001	Recruit 1989	-0.93
FL Rec F 2007	FL B2 F 1999	0.95	FL Rec F 2002	Recruit 1989	-0.92
FL Rec F 2008	FL B2 F 1999	0.94	FL Rec F 2003	Recruit 1989	-0.93
FL Rec F 2009	FL B2 F 1999	0.95	FL Rec F 2004	Recruit 1989	-0.93
FL Rec F 2010	FL B2 F 1999	0.94	FL Rec F 2005	Recruit 1989	-0.92
FL Rec F 2011	FL B2 F 1999	0.95	FL Rec F 2006	Recruit 1989	-0.93
FL Rec F 2012	FL B2 F 1999	0.95	FL Rec F 2007	Recruit 1989	-0.93
FL Rec F 2013	FL B2 F 1999	0.95	FL Rec F 2008	Recruit 1989	-0.92
GA Rec F 1992	FL B2 F 1999	0.92	FL Rec F 2009	Recruit 1989	-0.93
GA Rec F 1993	FL B2 F 1999	0.91	FL Rec F 2010	Recruit 1989	-0.93
GA Rec F 1997	FL B2 F 1999	0.91	FL Rec F 2011	Recruit 1989	-0.93
GA Rec F 2002	FL B2 F 1999	0.91	FL Rec F 2012	Recruit 1989	-0.93
GA Rec F 2003	FL B2 F 1999	0.92	FL Rec F 2013	Recruit 1989	-0.93
GA Rec F 2005	FL B2 F 1999	0.91	GA Rec F 1992	Recruit 1989	-0.90
GA Rec F 2008	FL B2 F 1999	0.92	SC Rec F 2009	Recruit 1989	-0.90
GA Rec F 2009	FL B2 F 1999	0.91	SC Rec F 2010	Recruit 1989	-0.91
GA Rec F 2013	FL B2 F 1999	0.91	SC Rec F 2011	Recruit 1989	-0.91
SC Rec F 1992	FL B2 F 1999	0.91	SC Rec F 2013	Recruit 1989	-0.91
SC Rec F 1997	FL B2 F 1999	0.91	FL B2 F 1995	Recruit 1989	-0.91
SC Rec F 1998	FL B2 F 1999	0.91	FL B2 F 1996	Recruit 1989	-0.91
SC Rec F 2004	FL B2 F 1999	0.92	FL B2 F 1997	Recruit 1989	-0.91
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SC Rec F 2008	FL B2 F 1999	0.91	FL B2 F 1999	Recruit 1989	-0.92
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SC Rec F 2010	FL B2 F 1999	0.93	FL B2 F 2001	Recruit 1989	-0.92
SC Rec F 2011	FL B2 F 1999	0.93	FL B2 F 2002	Recruit 1989	-0.91
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FL B2 F 1992	FL B2 F 1999	0.91	FL B2 F 2004	Recruit 1989	-0.92
FL B2 F 1993	FL B2 F 1999	0.91	FL B2 F 2005	Recruit 1989	-0.91

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FL B2 F 1994	FL B2 F 1999	0.92	FL B2 F 2006	Recruit 1989	-0.93
FL B2 F 1995	FL B2 F 1999	0.93	FL B2 F 2007	Recruit 1989	-0.93
FL B2 F 1996	FL B2 F 1999	0.93	FL B2 F 2008	Recruit 1989	-0.92
FL B2 F 1997	FL B2 F 1999	0.93	FL B2 F 2009	Recruit 1989	-0.93
FL B2 F 1998	FL B2 F 1999	0.93	FL B2 F 2010	Recruit 1989	-0.93
FL Rec F 1991	FL B2 F 2000	0.91	FL B2 F 2011	Recruit 1989	-0.93
FL Rec F 1992	FL B2 F 2000	0.94	FL B2 F 2012	Recruit 1989	-0.94
FL Rec F 1993	FL B2 F 2000	0.94	FL B2 F 2013	Recruit 1989	-0.92
FL Rec F 1994	FL B2 F 2000	0.95	GA/SC B2 F 2012	Recruit 1989	-0.90
FL Rec F 1995	FL B2 F 2000	0.94	FL Rec F 1991	Recruit 1990	-0.91
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FL Rec F 1997	FL B2 F 2000	0.93	FL Rec F 1993	Recruit 1990	-0.92
FL Rec F 1998	FL B2 F 2000	0.94	FL Rec F 1994	Recruit 1990	-0.93
FL Rec F 1999	FL B2 F 2000	0.95	FL Rec F 1995	Recruit 1990	-0.92
FL Rec F 2000	FL B2 F 2000	0.95	FL Rec F 1997	Recruit 1990	-0.91
FL Rec F 2001	FL B2 F 2000	0.95	FL Rec F 1998	Recruit 1990	-0.92
FL Rec F 2002	FL B2 F 2000	0.95	FL Rec F 1999	Recruit 1990	-0.93
FL Rec F 2003	FL B2 F 2000	0.95	FL Rec F 2000	Recruit 1990	-0.93
FL Rec F 2004	FL B2 F 2000	0.95	FL Rec F 2001	Recruit 1990	-0.93
FL Rec F 2005	FL B2 F 2000	0.94	FL Rec F 2002	Recruit 1990	-0.93
FL Rec F 2006	FL B2 F 2000	0.95	FL Rec F 2003	Recruit 1990	-0.93
FL Rec F 2007	FL B2 F 2000	0.95	FL Rec F 2004	Recruit 1990	-0.94
FL Rec F 2008	FL B2 F 2000	0.94	FL Rec F 2005	Recruit 1990	-0.92
FL Rec F 2009	FL B2 F 2000	0.95	FL Rec F 2006	Recruit 1990	-0.94
FL Rec F 2010	FL B2 F 2000	0.95	FL Rec F 2007	Recruit 1990	-0.93
FL Rec F 2011	FL B2 F 2000	0.96	FL Rec F 2008	Recruit 1990	-0.93
FL Rec F 2012	FL B2 F 2000	0.95	FL Rec F 2009	Recruit 1990	-0.93
FL Rec F 2013	FL B2 F 2000	0.96	FL Rec F 2010	Recruit 1990	-0.93
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GA Rec F 1993	FL B2 F 2000	0.92	FL Rec F 2012	Recruit 1990	-0.93
GA Rec F 1996	FL B2 F 2000	0.90	FL Rec F 2013	Recruit 1990	-0.94
GA Rec F 1997	FL B2 F 2000	0.91	GA Rec F 1992	Recruit 1990	-0.90
GA Rec F 2002	FL B2 F 2000	0.91	GA Rec F 2003	Recruit 1990	-0.91
GA Rec F 2003	FL B2 F 2000	0.92	GA Rec F 2008	Recruit 1990	-0.90
GA Rec F 2005	FL B2 F 2000	0.92	SC Rec F 1992	Recruit 1990	-0.90
GA Rec F 2008	FL B2 F 2000	0.92	SC Rec F 2004	Recruit 1990	-0.90
GA Rec F 2009	FL B2 F 2000	0.91	SC Rec F 2009	Recruit 1990	-0.91
GA Rec F 2010	FL B2 F 2000	0.90	SC Rec F 2010	Recruit 1990	-0.92
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SC Rec F 1992	FL B2 F 2000	0.92	FL B2 F 1994	Recruit 1990	-0.91
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SC Rec F 1998	FL B2 F 2000	0.92	FL B2 F 1996	Recruit 1990	-0.92
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SC Rec F 2013	FL B2 F 2000	0.93	FL B2 F 2005	Recruit 1990	-0.92
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FL B2 F 1997	FL B2 F 2000	0.93	FL B2 F 2011	Recruit 1990	-0.93
FL B2 F 1998	FL B2 F 2000	0.94	FL B2 F 2012	Recruit 1990	-0.94
FL B2 F 1999	FL B2 F 2000	0.94	FL B2 F 2013	Recruit 1990	-0.92
FL Rec F 1991	FL B2 F 2001	0.91	GA/SC B2 F 2012	Recruit 1990	-0.91

Atlantic States Marine Fisheries Commission

Atlantic Red Drum Stock Assessment

Review Panel Report of the Statistical Catch-at-Age Model

Dr. Paul Rago and Dr. Matthew Cieri (Reviewers)

January 2017

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The review panel thanks members of the Red Drum Assessment Team (AT) and the many different scientists associated with preparation of the assessment reports we have reviewed. The previous reviewers for SEDAR 44 are also thanked for their lucid summaries. Finally we thank the ASMFC staff for their guidance and support, particularly for initiating a webinar meeting with members of the AT in December 2016.

Executive Summary

Overall the Statistical Catch-at-Age Stock Assessment Report and the SEDAR 44 Data Workshop Report together have met each of the terms of reference. The AT performed their work well, especially given the difficulties red drum life-history and exploitation patterns create for stock assessment analyses.

Examination of the assessment results, as well as corroborating information from the independent indices, suggest that both the Northern and Southern stocks appear to be above their management targets and limits as approved in the FMP.

However, there is a high degree of uncertainty associated with these assessments. The lack of good fishery-dependent and -independent data on the oldest and most fecund age classes, coupled with sensitivity to weightings and initial conditions suggest an overall scaling problem with both regions' assessments. The wide confidence limits in the South and the unrealistic decline in abundance over the time series in the North suggest fundamental assessment and data issues. Given the life-history and pattern of exploitation, it is unclear how these issues can be easily resolved. Certainly further work, as outlined below and highlighted by the AT, is needed.

Given the critical dependency of overfishing status determination on the F estimates for older fish, and the difficulties of estimating F when population size is indeterminate, the assessment only gives a rough measure of stock status. While there are no major signals to suggest the stocks are in trouble, it should be recognized that even small changes in the fishing mortality on age 5 and older fish could lead to rapid overfishing.

Theoretically, the Spawning Potential Ratio (SPR) analysis measures exploitation in an equilibrium context. By that measure, a small increase in F on older fish would lead to an immediate determination of overfishing. In practice, the stock dynamics would depend on the true population size of older fish. Since population size is highly uncertain, and in the North equilibrium is highly improbable, any management changes should be carefully considered. More specifically, measures that might increase fishing mortality rates on older fish should be avoided until the estimates can be verified. Moreover, the assessment cannot provide information on the potential population limits for recruitment failure as scale of the most fecund portion of the population is uncertain.

As a final note, it is important to recognize that the same concerns that were identified with the SS3 model formulation underlie the application of SCA models to the stocks. Despite its nominally less complex analytical structure, the data conflicts and instability of estimates remain in SCA, as in SS3 formulations. These issues would likewise confound any age structured modeling approach. It suggests that the overall problem is one of data and the pattern of exploitation which informs model approaches, rather than the approach itself.

Nonetheless, the SEDAR 44 recommendations to work from a simple model and gradually increase complexity remain valid. Such a process is in and of itself, a major task as model identification relies heavily on deeper insights developed over years of experience by the lead data and assessment analysts. Moreover, there is no guarantee that such a process can derive an optimal model if the underlying causes cannot be identified. More often than not, the problems lie in the data themselves. By that measure the AT and other groups assessing red drum are well poised to move forward because they have a strong understanding of the underlying data.

Evaluation of Terms of Reference (TOR)

1. Evaluate the thoroughness of data collection and the presentation and treatment of fishery-dependent and fishery-independent data in the assessment, including the following but not limited to:

a. Presentation of data source variance (e.g., standard errors).

The assessment team did an excellent job of summarizing the available data and characterizing the underlying sources of uncertainty. Methods for estimating sampling variance followed accepted methods. For major programs, such as the MRIP, measures of uncertainty followed estimates obtained from official sources. Differences often exist between sample variances and variances implied as data are used in analytical models. These differences are often expressed as "effective sample size". The authors used modern and accepted methods for estimating effective sampling size. It should be noted that these methods (e.g., the Francis method) are conditional on the analytical model used and the data ensemble included in it. Thus, these approaches are objective methods for subjectively estimating the information content of data.

b. Justification for inclusion or elimination of available data sources

The SEDAR 44 Data Workshop Report provided extraordinary details on the advantages and limitations of available data sets. One important feature of their data analyses was development of objective approaches for looking for both internal and external consistency with other data sources. Testing for the ability to follow a year class over multiple years is especially useful for eliminating indices that may be tracking availability to the sampling area rather than true abundance. We affirm the conclusions of the SEDAR panel that the process for reducing the 23 indices for the Northern stock to 5 indices and the 25 indices to 11 for the Southern stock was well done.

The general premise that data sets with "some information" should be included to improve model fit should be applied with caution. Adding marginally informative data streams can increase uncertainty of parameter estimates, as weighting of data sources ultimately undermines the application of likelihood theory in the model and is often ad hoc. This concern is not restricted to the red drum assessment and is in fact, commonly applied in fisheries assessments. While additional data streams can stabilize model performance and improve determination of status, it incurs a cost of stretching the underlying theory and underestimating the uncertainty of the results.

c. Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size)

As noted above, the AT conducted a detailed evaluation of the myriad data sets available. For the purposes of the SCA assessment, no major changes in data sources or indices estimation occurred. This is consistent with the Terms of Reference given to the AT.

d. Calculation and/or standardization of abundance indices

The analyses of the MRIP data to develop species clusters to improve estimation of the likely trips for red drum by Murphy (SEDAR44-DW12) was novel, thorough, and well done.

Assembling region or state specific abundance indices for smaller and younger fish into a coherent measure of trend is a vexing problem for many assessments of coastal stocks on the East Coast. Habitat, sampling design, and gear differences among indices are compounded by inter-annual variations in availability. Fig. 5.7.4 (pg. 139 in SEDAR 44 report) provides an excellent illustration of this challenge.

e. Estimation of discards and size composition of discards.

One potential concern is the use of the ratio estimator to hindcast historical discards. While this is an appropriate approach given the lack of data, these estimates will likely be sensitive to

changes in management. Other than a cautious note about discards, this term of reference was handled very well by the AT via the Data Workshop.

2. Evaluate the definition of stock structure used in the assessment. Is the definition appropriate given the biology and management of red drum?

Stock structure decisions in stock assessments always reflect a mixture of biological and management considerations. Practical considerations such as differences among fleets, user groups, or jurisdictions among areas often are equally important or supersede purely biological determinations. For red drum there appears to be sufficient evidence of a genetic difference between the Northern and Southern stocks. Life history differences also support the genetic distinction. Fortuitously, the boundary also corresponds to changes in ecosystems and management jurisdictions near North Carolina. Mixing of stocks in this area is common for many species owing to its oceanographic conditions. Such localized mixing is relatively unimportant for stock assessments, but should be recognized.

3. Evaluate the methods and models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, including but not limited to:

a. Evaluate the choice and justification of the preferred model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of red drum?

The AT did an excellent job of evaluating alternative hypotheses. The approach was rigorous and well executed. Within the constraints of using the SCA model and not altering its configuration drastically, the authors rendered multiple hypotheses into a manageable subset and then examined the joint effects of multiple data weightings. Methods for consideration of alternative data weighting schemes for each stock (Tables 9 and 10) and the results (Tables 11 and 21) are exceptionally lucid and well crafted.

The AT also addressed key life history information appropriately for each stock. Differences in maturation rates, natural mortality, longevity, and growth are well described. How adjacent stocks could have such dramatically different population trajectories, as implied by the model fits, received less attention from the AT. Seeking model formulations that are more consistent with each other could help improve the overall fit of both models.

One possible avenue for future exploration would be to examine a model that can fit both age and length composition data, similar to what was recently developed for Cobia using the Beaufort Assessment Model (BAM). Care would need to be taken however to ensure that appropriate weightings were given in the likelihood profile to ensure that undo weights were not assigned to the catch data.

b. Evaluate model parameterization and specification (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M, stock-recruitment relationship, choice of time-varying parameters, plus group treatment).

A critical, if not *the* critical assumption, in the modeling process is the implementation of domed shaped stock-recruitment relationship. As a result, the assessment model consists of two independent populations; an immature but heavily exploited younger group, and a reproductive but minimally exploited plus group. The plus group is essentially unbounded, as catches of fish older than age 6 are uncommon or low. When parametric selectivity curves are employed, the modeled F approaches zero, so that the dynamics of the plus group are governed almost entirely by the assumed level of F of those ages. This is clearly seen in the estimation of age 7+ group in the Northern Stock. Differences between the model estimates and a simple exponential decay curve can be demonstrated, as shown in the following section.

In the Southern Stock the plus group seems to be more consistent with the population biology. For both stocks however, the abundances of age 7+ red drum are very high. This leads to a large fraction of total biomass being essentially static and unavailable to exploitation.

Overall, the externally estimated parameters were handled well. One possible suggestion for natural mortality, in future work, would be to examine Charnov et al. (2013) which examined the descending trend of M at age in light of maturation, as opposed to survival at maximum age (which can be difficult in exploited populations).

Most importantly, the inability to establish scale (i.e., population abundance) in the model outputs is a major problem for the assessment. In theory the rate of change in abundance indices by age class can inform F estimates. It is not clear how much of the F estimate is reliant on the age compositions vs. the relationship between total catches and relative abundance indices. The best model fit for the Northern Stock fully weights the information for the tag based info, the indices of abundance, and total catch, and down weights the recreational age composition relative to the commercial fishery (Table 11). In contrast, the best model for the Southern Stock does not distinguish between the weighting on total catch for commercial and recreational, places a high weight on the MRIP relative abundance index, and also down weights the age composition of live release recreational catch.

4. Evaluate the diagnostic analyses performed, including but not limited to:

a. Sensitivity analyses to determine model stability and potential consequences of major model assumptions.

The model is highly sensitive to weightings applied to various likelihood components. Generally such sensitivity is symptomatic of conflicting information within the model wherein abundance indices suggest a pattern inconsistent with total catch or age/length compositions. Neither catch time series nor survey indices reveal high abundances of large fish. This leads to estimation of a dome shaped selectivity pattern wherein the size of the population in the plus group is essentially unverifiable. One might call such populations cryptic. This would be merely an intellectual curiosity if it were not a critical component of status determination.

If this were not an "intermediate" assessment, more could be done to explore model performance. Likelihood profile analyses would be helpful for several parameters. An important starting point would be the age-specific F estimates. Given the importance of the estimated F on the oldest fish, it would be valuable to conduct a profile analysis of estimated F for each stock. Such an approach might reveal a broader confidence interval than suggested by the asymptotic errors. More importantly, profile analysis would be valuable to examine the effects on population size and SPR for each fixed value of F in the likelihood profile. The multi-fleet structure of the SCA model might make this computation more difficult because aggregate age specific F is a composite estimate of commercial and recreational fleets. We defer to the lead analysts on how best to implement a reasonable approach.

Further examination of simple parametric relationships for the calculation of SPR would also be useful. A sensitivity analysis of SPR to F on the oldest ages is shown below. At low Fs, SPR reference points will be highly sensitive to the implied biomass in the plus groups. To illustrate this effect, the biomass in the plus group to the total population at equilibrium can be estimated from the parameters for the sSPR.

One effect of the domed-selectivity pattern in the Northern Stock is that the dynamics of the plus group are essentially uncoupled from the age 1 to 4 red drum. A simple illustration of this effect can be demonstrated by noting the trajectory of the plus group from 1989 to 2013. In the model estimates the trajectory is

Model based 7+ Abundance estimate in 1989 =13,962,773; abundance in 2013 = 3,592,926 (Table 13, p. 32).
The annual instantaneous rate of change Z = -ln(3592926/13962773)/(2013-1989)=0.06.

Using this, one can compute the predicted population size for the 7+ group as

N7+_pred(1990)=N7+_model(1989)*exp(-0.06)
….
N7+_pred(t+1)=N7+_pred(t)*exp(-0.06)

This synthetic trajectory, which excludes the effect of recruitment of age 6 fish to the 7+ group, looks surprisingly similar to the actual model predictions shown in Figure 1.

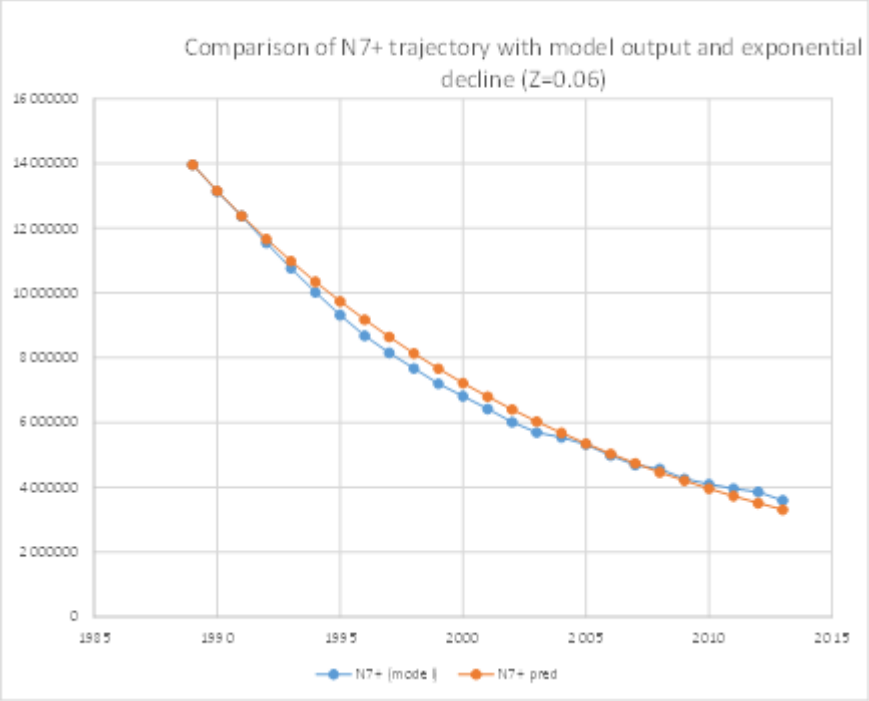

Figure 1. Comparison of SCA model output (blue dots) with predicted estimate based on simple exponential decay of the 1989 abundance estimate at Z=0.06.

This suggests that the exponential decline in 7+ is consistent with a total Z of about 0.06 which is the value used for M in the North. F on 7+ fish is minimal throughout the time series. Incoming recruitment of age 6 fish has relatively little influence on the trajectory but there is some improvement after 2010 as age 6 fish began to increase. The numerical fraction of the plus group to the total population ranges from 96% in 1989 to 62% in 2013. In contrast, the Southern Stock fluctuates around 39% without trend. The expected fraction of a population above 6 years old in a population with Z=0.06 is 0.69. This is just the sum N(a) from a=7 to 62 divided by sum N(a) from a=1 to 62. Hence the average fraction of the population in the 7+ (2011-2013) of 66% is about equal to that expected in an equilibrium population.

Another way of examining the "uncoupling" effect is to consider the ratio of the population numbers in the plus group to the average numbers of recruits (i.e., age 6) to the plus group. In 1989, for the Northern Stock the ratio of the plus group to average age 6 is 132.8. By 2013, this ratio decreases to 34.2. The overall ratio across all years is 69.5. If these numbers are true it would suggest that the initial plus group size is the consequence of a much higher historical average recruitment. Since that hypothetical epoch the stock must have had a reduced recruitment stanza. An alternative hypothesis to the dome is that the larger fish have died.

In contrast, the Southern Stock relationship between the size of the plus group and age 6 recruits reveals an overall ratio of 6.8 and a slightly increasing trend from 1989 (4.1) to 2013 (7.4). Such a pattern is more consistent with the underlying biology and the hypothesized efficacy of

management measures. It is difficult to develop a plausible explanation for these differences between stocks. While the model estimates for the Southern Stock are less precise, they have, at least by this metric, greater biological plausibility.

While the above analysis is preliminary it highlights a major concern; that the abundance estimate for age 7+ in the Northern Stock in 1989 is probably an artifact. The model estimates a very high initial population which allows it to minimize the differences between observed and predicted catches, and reduce the effects of incoming recruitment on the subsequent stock dynamics.

Comparison between the estimate of SPR in the SEDAR 18 formulation and the base model reveals large differences in Figure 2 (i.e., Figure 14 from the Assessment Report).

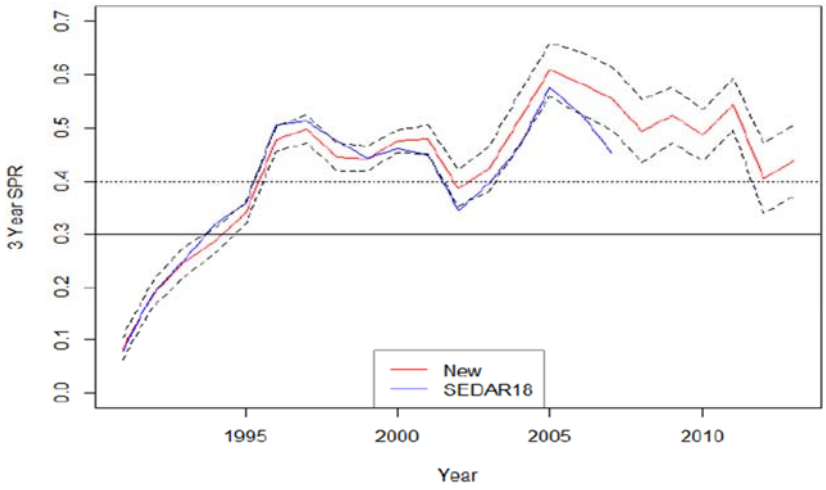

Figure 14. Three year average sSPR for the northern stock with 95% confidence intervals from asymptotic standard errors. Point estimates from the previous benchmark assessment (SEDAR18) are included for comparison. The target sSPR (dashed black line) is 40% and the threshold sSPR (solid black line) is 30%.

Figure 2. Taken from the assessment report.

This suggest that cumulative changes in the SCA assessment vs. SEDAR 18 have had a large impact on the population's trajectory. Given this and if there is time, a full continuity run, or an update of the previous model approach through 2014, is suggested. This would highlight the potential uncertainty for managers.

b. Retrospective analysis

The retrospective pattern in the assessment is particularly interesting as it reveals an apparent bifurcation of estimates with the 2010 peel in the Northern Stock and 2012 and earlier peels in the Southern Stock (Figure 3 and 4) (i.e., Figures 16 and 35, respectively, from the Assessment Report). Because these changes must be due to changes in F, it would be useful to examine the changes in age-specific F estimates for each stock.

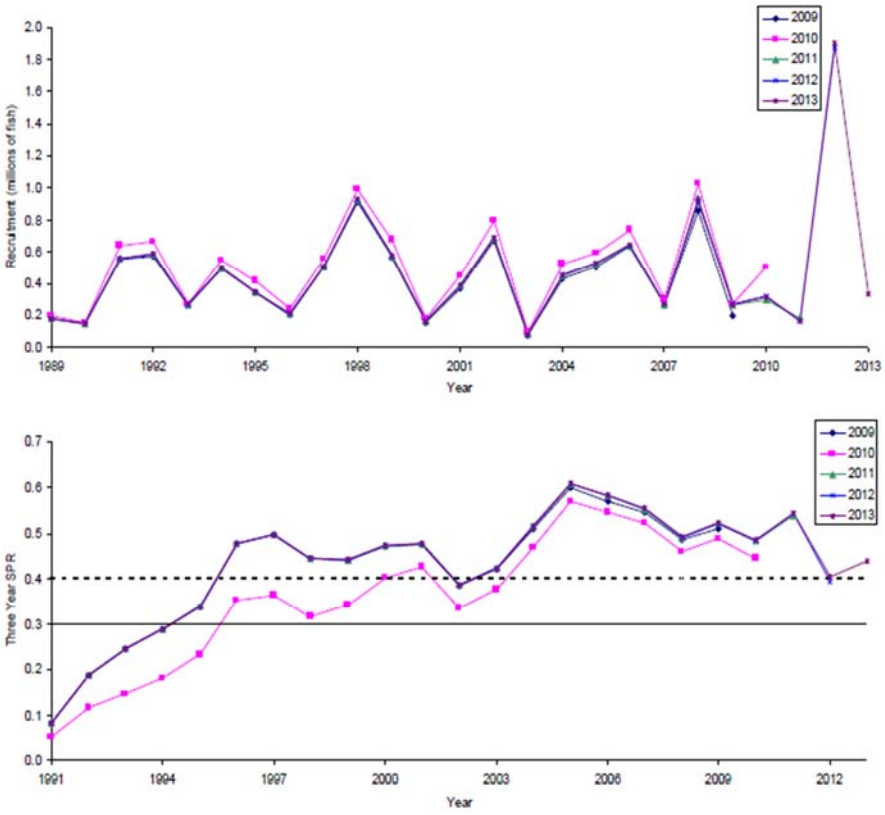

Figure 16. Five year retrospective analysis of the recruitment (top) and three year average sSPR (bottom) for the northern stock.

Figure 3. Taken from the assessment report.

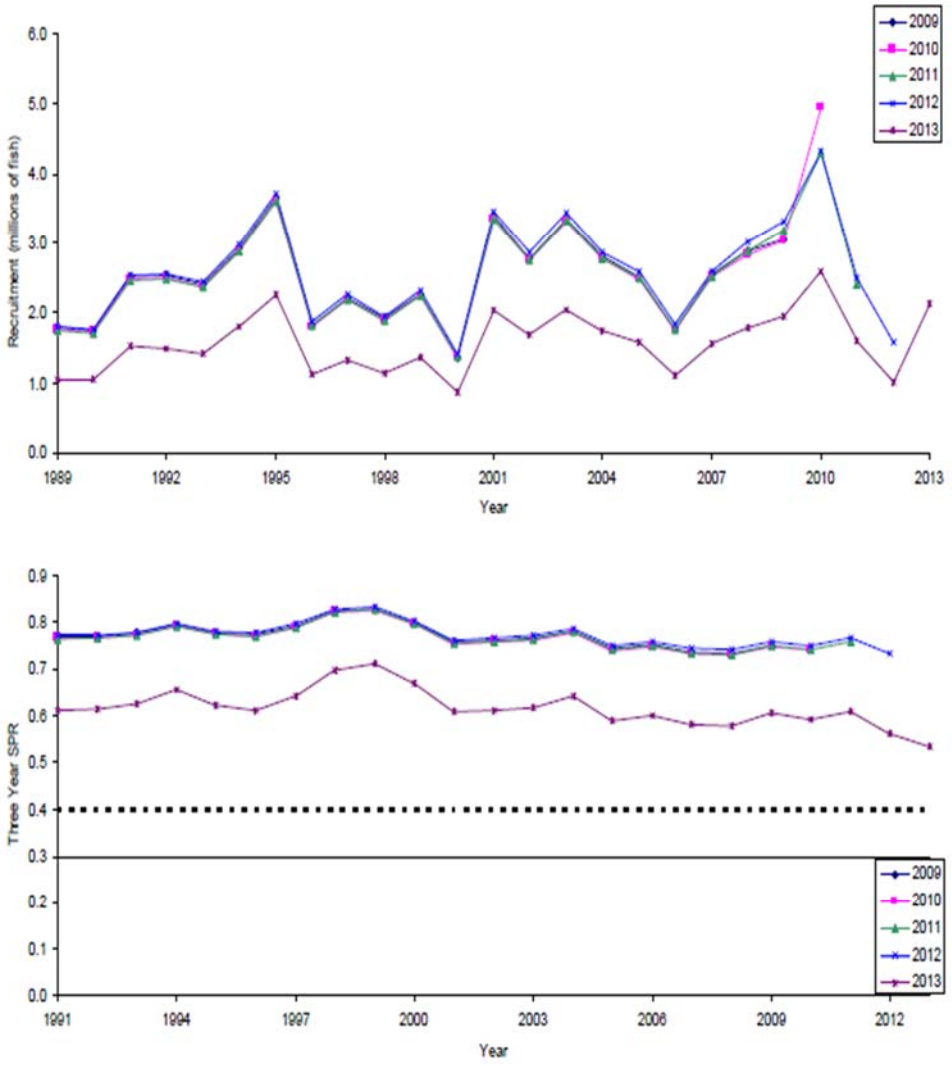

Figure 35. Five year retrospective analysis of the recruitment (top) and three year average sSPR (bottom) for the southern stock.

Figure 4. Taken from the assessment report.

The pattern in the North again highlights the sensitivity of the plus group to changes in the data, particularly with the 2010 peel. This can have implications on potential reference points. For the South, an explanation of the 2013 peel is warranted but again highlights the difficulty the SCA model has in defining population scale appropriately. In both stocks the sensitivity analyses suggest that scale is sensitive to assumptions, and poorly defined.

5. Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

The AT provides estimates of key parameters using asymptotic errors for all and MCMC for some. Both measures of uncertainty probably underestimate the true variance, as acknowledged by the AT.

The high correlation among parameters is expected given the relatively high apparent ratio of parameters to data. It is not clear why 0.9 is chosen as a cutoff for presentation. As a general consideration, it would be helpful to develop some functional equivalents to "condition indices", a metric used in general linear models to identify poorly specified models. Condition indices are functions of the eigen values and vectors of the design matrix.

6. Recommend best estimates of exploitation from the assessment for use in management, if possible, or specify alternative estimation methods.

Increasing trends in several indices suggests management measures may be working. However, the conclusion that stocks are above B_{msy}, or proxies, are tenuous given initial condition effects on plus groups. In the North this suggests that age 4+ abundance is declining throughout the time series. Overall, both stocks appear to be above management targets and limits, though the wide confidence intervals in the South, as well as model performance, suggest a higher degree of uncertainty surrounding stock status.

A relative F approach, though simplistic, may be more useful for examining trends given the model's inability to rectify scale. This approach would examine the ratio of catch to some function of the time series of relative abundance indices and could be either year-specific, or calculated as a moving average.

7. Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment, or, if appropriate, specify alternative methods/measures.

A possible alternative is to look at cohort specific SPR. This would limit overfishing definition to completed cohorts from 1989 to 2009. Estimates for cohorts from 2010 to 2013 could be obtained by assuming that the Fs estimated for 2013 continue onward for those cohorts.

The reference points as a whole would benefit from further testing. Static SPR is useful for measuring overfishing but its implementation is compromised by the same factors that led to rejection of biomass determination. If biomass and abundance estimates are unreliable due to problems in resolving scale, one cannot then conclude that the F estimates are reliable. This

occurs because the catches are fixed. The Fs are conditional on the ability to generally match the catch based on the estimated abundance indices.

The biological reference points should be evaluated with respect to varying assumptions about the magnitude of F on the plus group. The effect of increasing F(7+) from 0.004 to 0.04 will have a dramatic impact on the current state of the resource (Figure 5 and 6). As a simple illustration we examined the effects of increasing F on the age 4 to 7 range from 0.009 to 0.214 in the South and from 0.004 to 0.065 in the North. The upper bounds correspond to the respective F estimates on age 3 fish in each area. The lower bounds correspond to the F estimates on age 5 fish in the terminal year.

For the northern stock, increasing F from 0.004 to 0.04 drops SPR below 30%.

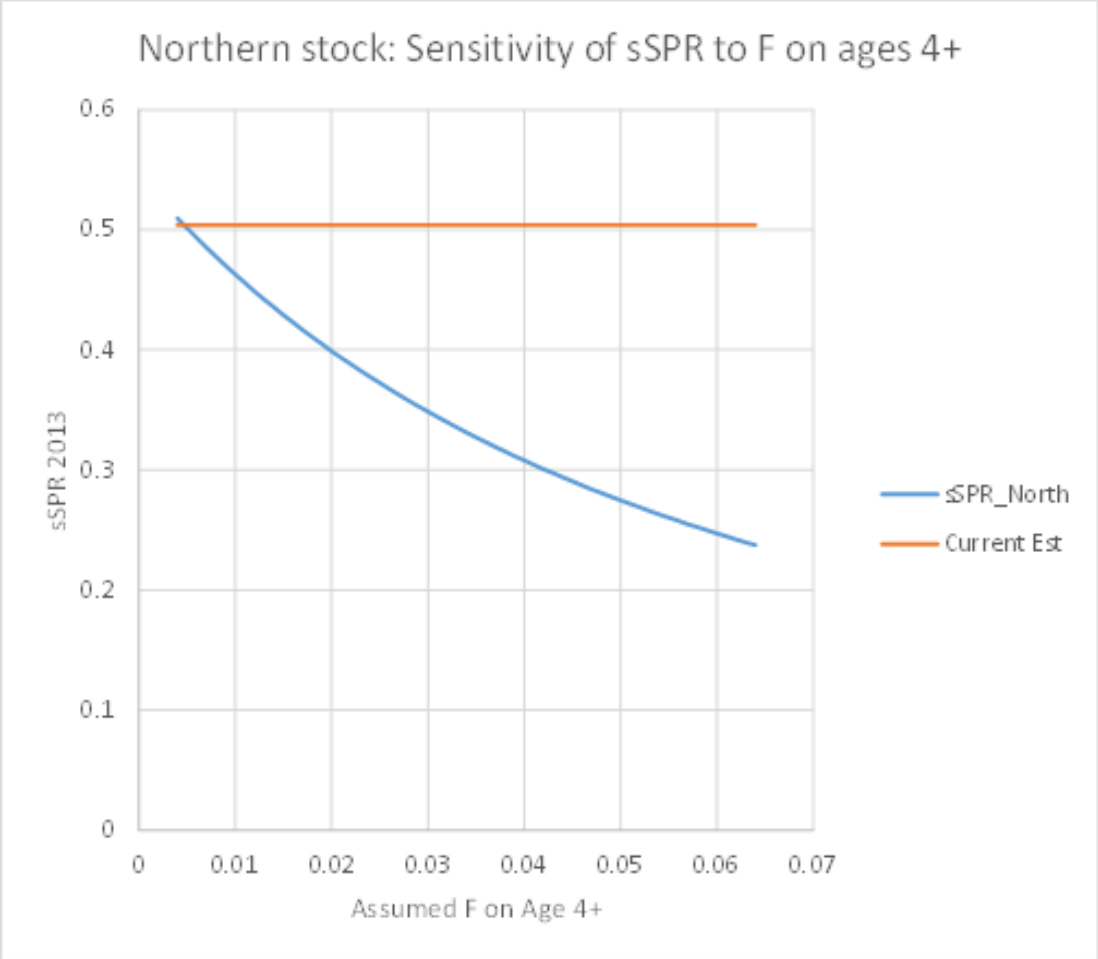

Figure 5. Sensitivity analysis of the current estimate of SPR in the Northern Stock to variation in the assumed fishing mortality estimate on ages 4 and older.

The southern stock is slightly less sensitive but increases in F to 0.06 are sufficient to drive SPR below 30% (Figure 6). Thus the status determination is highly sensitive to the estimated composite F on ages 4 and older. In the vicinity of Fs of about half the estimated M, the stock

status can sharply decline. If the current level of recruitment is in fact dependent on an extended age structure implied by the low Z on adults older than 7, resource persistence is conditional on maintenance of minimal harvest of older red drum.

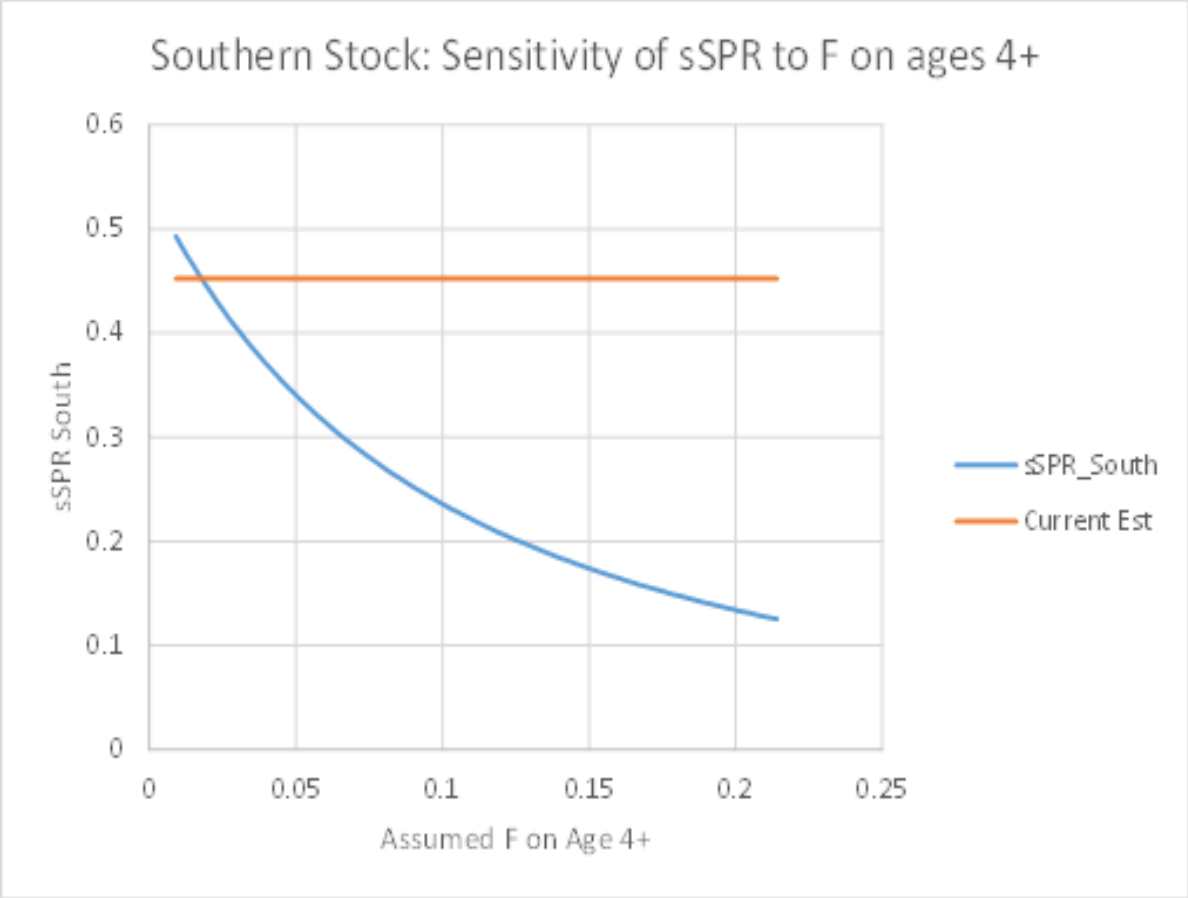

Figure 6. Sensitivity analysis of the current estimate of SPR in the Southern Stock to variation in the assumed fishing mortality estimate on ages 4 and older.

For the southern stock the fraction of sSPR in the 7+ group is 0.82 under current fishing mortality and 0.84 when F is assumed to be zero. For the Northern Stock the fraction of sSPR in the 7+ group is 0.8 under current fishing mortality and the same when F is assumed to be zero. For either stock, most of the SPR is in the plus group, and is therefore relatively unaffected by the F estimates on younger fish. The primary factor is the estimated F on age 7 fish, which is uncertain.

The ability to resolve differences in age specific Fs of less than 0.01 is problematic in any stock assessment. Differences between the current estimate and true value of F of less than 0.04 would lead to an estimate of overfishing in the Northern Stock; differences of less than 0.06 would lead to an estimate of overfishing in the South.

Thus, caution should be applied when examining stock status relative to current reference points. Any biomass or abundance based targets and limits would suffer from difficulties this approach has to estimating scale of the population, particularly, for the plus group. Further, SPR as a benchmark cannot get at minimum stock size needed for sustainable recruitment.

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2016 REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR

SPOT
(Leiostomus xanthurus)

2015 FISHING YEAR

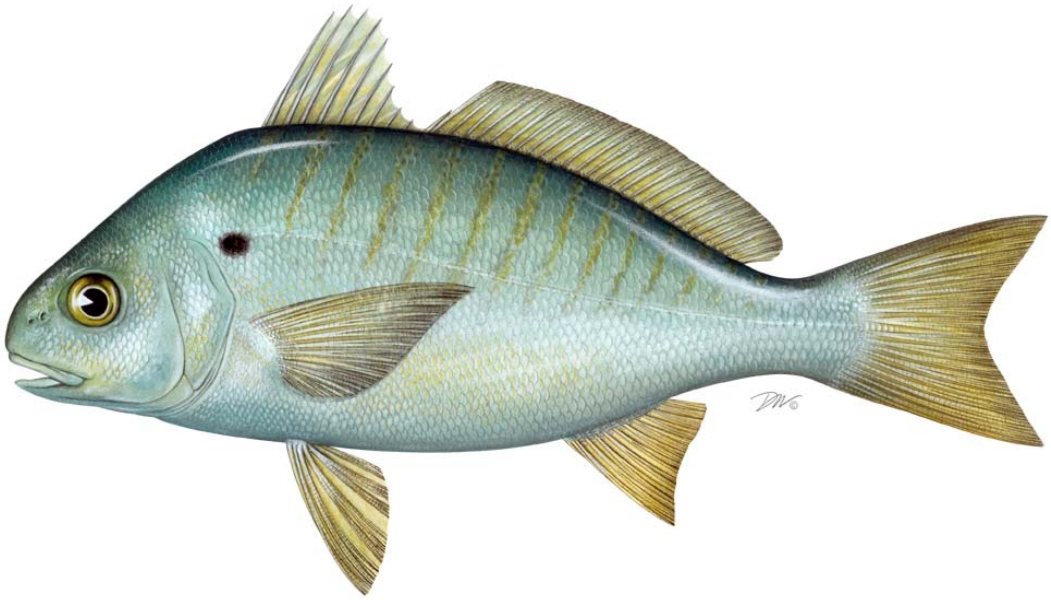

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Table of Contents

I. Status of the Fishery Management Plan

Date of FMP Approval: October 1987; Omnibus Amendment August 2011

Management Area: The Atlantic coast distribution of the resource from Delaware through Florida

Active Boards/Committees: South Atlantic State/Federal Fisheries Management Board; Spot Plan Review Team; South Atlantic Species Advisory Panel; Omnibus Amendment Plan Development Team

The Fishery Management Plan (FMP) for Spot was adopted in 1987 and includes the states from Delaware through Florida (ASMFC 1987). In reviewing the early plans created under the Interstate Fisheries Management Plan process, the ASMFC found the Spot FMP to be in need of evaluation and possible revision. A Wallop-Breaux grant from the U.S. Fish and Wildlife Service was provided to conduct a comprehensive data collection workshop for spot. The October 1993 workshop at the Virginia Institute of Marine Science was attended by university and state agency representatives from six states. Presentations on fishery-dependent and fishery-independent data, population dynamics, and bycatch reduction devices were made and discussed. All state reports and a set of recommendations were included in the workshop report (Kline and Speir 1993).

Subsequent to the workshop and independent of it, the South Atlantic State/Federal Fisheries Management Board (Management Board) reviewed the status of several plans in order to define the compliance issues to be enforced under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). The Management Board found recommendations in the plan to be vague and perhaps no longer valid, and recommended that an amendment be prepared to the Spot FMP to define the management measures necessary to achieve the goals of the FMP. In their final schedule for compliance under the ACFCMA, the ISFMP Policy Board adopted the finding that the FMP does not contain any management measures that states are required to implement. In August 2009, the Management Board expanded the initiated amendment to the Spanish Mackerel FMP to include Spot and Spotted Seatrout, creating the Omnibus Amendment for Spot, Spotted Seatrout and Spanish Mackerel. The goal of the Omnibus Amendment was to update all three plans with requirements specified under the Atlantic Coastal Fisheries Cooperative Management Act (1993) and the Interstate Fishery Management Program Charter (1995). In August 2011, the Management Board approved the Omnibus Amendment for Spot, Spotted Seatrout, and Spanish Mackerel. This Amendment did not set specific management measures for Spot but it did align management of the species with the requirements of ACFCMA.

In August 2014, the Board approved Addendum I to the Omnibus Amendment. The Addendum establishes use of a Traffic Light Analysis (TLA) to evaluate fisheries trends and develop state-specified management actions (e.g., bag limits, size restrictions, time and area closures, and gear restrictions) when harvest and abundance thresholds are exceeded for two consecutive years.

II. Status of the Stock

A stock assessment for spot is in progress and will be submitted to the South Atlantic Management Board in 2017. As an assessment is currently in progress, a TLA was not conducted for spot in 2016.

Traffic Light Approach

As part of the requirements under the 2011 Omnibus Amendment, for years in-between benchmark stock assessments, the Spot PRT was tasked with conducting annual monitoring analysis. These trigger exercises compared five data sources to the 10th percentile of the data sets' time series. If two terminal values of the five data sources (at least one of which must be fishery independent) fell below the 10th percentile, the Management Board would be prompted to consider management action.

In August 2014, the Board approved Addendum I to the Omnibus Amendment. The Addendum established the Traffic Light Approach (TLA) as the new precautionary management framework to evaluate fishery trends and develop management actions. The TLA framework replaces the management trigger stipulated in the Omnibus Amendment after concern that the triggers were limited in their ability to illustrate long-term declines or increases in stock abundance. In contrast, the TLA is a statistically-robust way to incorporate multiple data sources (both fishery-independent and -dependent) into a single, easily understood metric for management advice. It is an effective method to illustrate long-term trends in the fishery.

The TLA was originally developed as a management tool for data poor fisheries. The name comes from assigning a color (red, yellow, or green) to categorize relative levels of population indicators. When a population characteristic improves, the proportion of green in the given year increases. Harvest and abundances thresholds of 30% and 60% red were established in Addendum I, representing moderate and significant concern for the fishery. If thresholds for both population characteristics achieve or exceed a threshold for a two year period, then management action is enacted.

Analysis of the composite harvest index showed a general decline beginning in 2005 (Figure 1). This decline was driven mostly by the decline in commercial landings rather than the recreational harvest. The composite harvest index did not trip in 2013-2014. However, this index did trip in 2012-2013 with an average red percentage of 38%.

The TLA composite abundance index for adult spot (NMFS and SEAMAP surveys) was run using the 1989-2014 time period since that was when the two surveys overlapped (Figure 1). The TLA composite characteristic did trigger in 2014 with a mean red proportion for 2013-2014 of 43.5%. This reflects the drop in annual catch levels in both indexes for the last two years. During past years, the index would have tripped most years from 1989 to 2004 given the proportions of red in the index above the 30% threshold.

Overall, management triggers were not tripped in 2014 since both population characteristics (harvest and abundance) were not above the 30% threshold for the 2013-2014 time period. Nonetheless, the analysis shows that there are declining trends in the fishery independent indices for spot.

III. Status of the Fishery

Total landings of spot from NJ to FL in 2015 are estimated at 4.44 million pounds, a decrease of nearly 4,000,000 lbs from 2014 and roughly 2.8 million lbs less than the average of the last 10 years (7,189,579) (Tables 1 and 3). The recreational fishery harvested slightly more than the commercial fishery (51% and 49% respectively, by pounds). Although, historical commercial harvests were larger than recreational harvests, over the last 10 years proportions of commercial and recreational harvests have been almost equal (51% and 49% respectively, by pounds).
Commercial spot landings have ranged between 1.37 and 14.52 million pounds from 1950-2015 (Figure 2), with the 2015 landings (2.16 million pounds) being less than half of 2014 landings. Coastwide, gillnets were used to capture 47% of commercially harvested spot (Table 2). Virginia landed approximately 72% of the commercial harvest (by pounds) in 2015, followed by North Carolina with 17% of the harvest. Spot are a major component of Atlantic coast scrap landings (NCDMF 2001). A scrap fishery is one in which fish species that are unmarketable as food, due to size or palatability, are sold unsorted, usually as bait. The largest bycatch component for spot comes from the South Atlantic shrimp trawl fishery.

The recreational harvest of spot along the Atlantic coast from 1981 to 2015 has varied between 3.6 and 20.1 million fish (or 1.7 and 6.9 million pounds; Tables 3 and 4). There was an increasing trend in the recreational harvest from a low in 1999 of 1.6 million fish to 15.9 million fish in 2007. Since then, harvest has generally declined, with a 2015 harvest of 6.1 million fish, down 2.6 million fish from 2014 (Figure 3). Anglers in South Carolina were responsible for 52% of the total number of fish harvested in 2015, followed by anglers in North Carolina (17.8%) and Virginia (14.3%). Many anglers are known to catch spot to use as bait, as well as for other recreational purposes. The estimated number of spot released annually by recreational anglers has varied between 1.9 and 11.2 million fish, with 2015 releases estimated at 2.49 million fish.

IV. Status of Assessment Advice

A formal stock assessment of spot has not been completed. The 1987 FMP recognized the lack of biological and fisheries data necessary for a stock assessment and effective management of the resource.

The Spot Plan Review Team evaluated the adequacy of data for assessment purposes in 2012, and reported the following:

- Commercial landings data appear adequate for a spot assessment; however, discard data are limited. The level of commercial biological sampling is on par with other species having assessments performed.
- The adequacy of recreational harvest and harvest length data is comparable to other species which rely primarily on MRIP data. Limited discard length data are available and discard mortality rates are unknown; however, less recreational discarding of spot occurs than for many other species, potentially due to its use as a bait fish.
- The number, time series, and distribution of fishery-independent indices appear adequate for stock assessment purposes. Biological data appear ample from several surveys, although reproductive data are limited. Further, the amount and representativeness of samples from each survey has not been investigated in detail.

- Additional investigation into the quality and quantity of commercial, recreational, and indices data for a spot stock assessment would need to take place through a data workshop (this occurred in 2015).

In 2014, the PRT recommended that the Board initiate a coastwide assessment for spot. This assessment is currently underway and is expected to be completed in 2017.

V. Status of Research and Monitoring

Catch and effort data are collected by the commercial and recreational statistics programs conducted by the states and the National Marine Fisheries Service (NMFS). Biological characterization data from fishery landings are also available from several states. Specifically, age data are now available from Maryland, Virginia, North Carolina, and South Carolina. Recruitment indices are available from surveys in Delaware, Maryland, Virginia, North Carolina, and South Carolina. Adult or aggregate (mix of juvenile and older spot) relative abundance indices are available from New Jersey, Delaware, North Carolina, South Carolina, and SEAMAP (covering North Carolina through Florida). These surveys, in addition to the Northeast Fisheries Science Center Bottom Trawl Survey, the Northeast Area Monitoring and Assessment Program (NEAMAP), the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP), and the Chesapeake Bay Fishery-Independent Multispecies Survey (CHESFIMS), collect a variety of biological data elements.

Below is a description of the fishery dependent sampling conducted by states.

Maryland: Maryland conducts an onboard commercial pound net survey on the Potomac River and the Chesapeake Bay, sampling once per week from May through September and collecting length and age data.

Virginia: Virginia's Marine Resources Commission collects biological data from Virginia's commercial and recreational fisheries, with total length, weight, sex, and age measured whenever possible. The fish are aged by examining otoliths, which is done by Old Dominion University's Center for Quantitative Fisheries Ecology.

North Carolina: Commercial fishing activity is monitored through fishery-dependent sampling conducted under Title III of the Interjurisdictional Fisheries Act and has been ongoing since 1982. Data collected in this program allows the size distribution of spot to be characterized by gear/fishery. Further sub-sampling is conducted to procure samples for age determination (whole otoliths), sex ratio, reproductive condition, and weight.

South Carolina: Fishery dependent data related to Spot has been available primarily through the SCDNR State Finfish Survey (SFS), the National Marine Fisheries Service's Marine Recreational Information Program (MRIP), and a SCDNR-managed mandatory trip reporting system for licensed charterboat operators.

Georgia: The Marine Sportfish Carcass Recovery Project, a partnership with recreational anglers along the Georgia coast, was used to collect biological data from finfish. In 2015, a total of 3,696 fish carcasses were donated through this program. Spot were not present in the list of donated species for 2015.

Below is a description of fishery independent sampling conducted by states.

New Jersey: The New Jersey Bureau of Marine Fisheries conducts an Ocean Trawl Survey, Delaware River Seine Survey, and Delaware Bay Trawl Survey. Respective indices of abundance (GM) for the three surveys in 2015 were: 0.63, 0.02, and 0.19 (2014 values were: 0.31, 0.01, and 0.06, respectively).

Delaware: Annual relative abundance estimates (number/nautical mile) of spot in Delaware are monitored through the Division's adult ground fish bottom trawl survey. The relative abundance of spot decreased to 3.39 (#/nm) and was the lowest estimate of abundance since 2004. The Division monitors juvenile fish abundance through a 16-ft bottom trawl survey which has been conducted annually since 1980. Separate spot young of the year (YOY) indices are generated for the Delaware Estuary (Bay and River) and Delaware's "Inland Bays" (Indian River and Rehoboth Bays). YOY spot recruitment, 0.42 per tow (geometric mean), increased in 2015 relative to 2014 for the Delaware Estuary and was below the time series mean and median. The Inland Bays YOY index increased to 2.46 per tow, and remained below the time series mean in 2015.

Maryland: Maryland conducted a fisheries independent gill net survey on the Choptank River once per week from June 6, 2015 to August 27, 2015, with the exception of the second week in July. Experimental monofilament gill nets with stretched mesh sizes of 2.5, 3.0, 3.5 and 4.0 inches were set at four randomly selected locations within the sampling area. The 2.5 inch mesh captured the majority of spot in each year from 2013-2015, accounting for 73 - 95% of the catch annually. Fish in 200 and 210 mm length bins accounted for over 60 % of the length frequency distributions in 2013 and 2014. The distribution shifted toward larger fish in 2015, with only 24% of captured fish in the 200 and 210 mm length groups.

Finfish collected by Maryland's Chesapeake Bay Blue Crab Trawl Survey have been enumerated since 1980, (Davis et al.1995). The spot Chesapeake Bay juvenile index (JI) has been variable throughout the time series. The index increased to 16.4 in 2012, which is near the 24 year time series mean of 17.7 fish per tow, but decreased to the time series low of 0.29 fish per tow in 2015. A second JI was derived from the Striped Bass Juvenile Seine Survey (JSS). The 2015 geometric mean (GM) catch per haul was 0.06, the second lowest value of the 49-year time series. A 4.9-m semi-balloon otter trawl has also been used to sample Maryland's Atlantic coastal bays since 1972. The 2015 GM of 2.74 spot per hectare was an increase from very low values in 2013 and 2014, but was still below the 27 year time series mean of 9.48. The final juvenile index is derived from the coastal bays seine survey. The 2015 GM catch per haul was 4.59, an increase from the previous year but still below the time series mean of 7.83.

Virginia: The Virginia Institute of Marine Science (VIMS) has been conducting a monthly juvenile trawl survey since 1955 to monitor the abundance and seasonal distribution of finfish and invertebrates in the Chesapeake Bay and its tributaries. An index of age-0 spot abundance is available from 1988 up to 2015, with sampling coming from tributaries of the Chesapeake Bay (fixed and random sites) as well as the bay itself (random sites). The average index value is 13.83, and the 2015 value was the lowest in the time series.

North Carolina: North Carolina has no current fishery-independent monitoring programs specifically for spot. However, the NCDMF has conducted a stratified random trawl survey in

Pamlico Sound (Pamlico Sound Survey, Program 195) since 1987 to obtain juvenile abundance indices (JAI) for several economically important species, including spot. The 2015 spot JAI (mean number of individuals/tow) was 405.48, a slight decline from the 2014 JAI of 410.64.

South Carolina: While Spot are not necessarily a specifically targeted species for SCDNR monitoring programs or projects, they are a common component species of four fishery independent monitoring efforts conducted by the SCDNR. The Southeast Area Monitoring and Assessment – South Atlantic Program (SEAMAP-SA) is a shallow water (15 to 30 ft depth) trawl survey that monitors status and trends of numerous coastal species within the South Atlantic Bight seasonally (spring, summer and fall) from Cape Canaveral, FL to Cape Hatteras, NC. The annual stratified mean catch per tow in weight for the entire survey in 2015 was 12.3 kg/tow, a 9.2% decline from 2014 (13.5 kg/tow). The second survey is an inshore estuarine trammel net survey conducted by the SCDNR. In 2015, CPUE increased slightly (10.1%) from 2014, and remained below the long-term mean for a sixth year. The third survey was an electroshock survey conducted in low salinity brackish and tidal freshwater portions of different South Carolina estuaries. The CPUE in 2015 (4.4 ± 0.55 fish per set) declined from 2014 by 70% and was the lowest annual CPUE on record for the survey. The fourth survey is the South Carolina Estuarine and Coastal Assessment Program (SCECAP). The CPUE declined in 2015 from 2014 to the lowest value in the time series (6.9 fish per hectare) and remained well below the series long term mean.

Georgia: Spot are occasionally observed during the red drum gillnet survey and the trammel net survey. Lengths of captured spot were recorded and then fish were released. During 2015, 150 trammel and 216 gill net sets captured 171 and 452 spot, respectively. Average fork length of spot in trammel nets was 205 mm and in the gillnet survey was 197 mm. The 2015 geometric means (#/net set) from both trammel and gill nets (0.54 and 0.89) were greater than those of 2014 (0.31 and 0.25, respectively). The monthly Ecological Monitoring Survey (EMS) samples estuarine finfish from a total of 42 stations, distributed amongst 6 estuaries, from January to December. Average fork length of spot captured in this survey was 134 mm. The 2015 geometric mean (4.41 fish/standard 15 minute trawl) was lower than the 2014 geometric mean (5.12 fish/standard 15 minute trawl), but greater than the average of the last five years.

Florida: The FWC-FWRI's FIM program initiated surveys on estuarine, bay and coastal systems of the Florida Atlantic at northern Indian River Lagoon in 1990, southern Indian River Lagoon in 1997, and northeast Florida (Jacksonville study area) in 2001. Indices of abundance (IOAs) data for juvenile (YOY) spot (<30 mm standard length, SL) were available from 21.3-m seine and 6.1-m trawl samples. IOAs for YOY and sub-adult/adult spot have been low and showed little variations; except in 2010 and 2011.

VI. Status of Management Measures and Issues

The FMP for Spot identified two management measures for implementation: 1) promote the development and use of bycatch reduction devices through demonstration and application in trawl fisheries, and 2) promote increases in yield per recruit through delaying entry to spot fisheries to age one and older.

Considerable progress has been made in developing bycatch reduction devices (BRDs) and evaluating their effectiveness. Proceedings from a 1993 spot and croaker workshop summarized much of the experimental work on bycatch reduction, and many states have conducted subsequent testing. For example, North Carolina Division of Marine Fisheries (NCDMF) conducted

research on the four main gear types (shrimp trawl, flynet, long haul seine, and pound net) responsible for the bulk of the scrap fish landings in order to reduce the catch of small fish. State testing of shrimp trawl BRDs achieved finfish reductions of 50-70% with little loss of shrimp, although total bycatch numbers relative to shrimp fishery effort are still unknown. The Virginia Marine Resources Commission investigated the use of culling panels in pound nets and long haul seines to release small croaker, spot, and weakfish. The Potomac River Fisheries Commission (PRFC) also investigated the use of culling panels in pound nets, finding that the panels allowed the release of 28% of captured spot less than six inches in length.

Following favorable testing, devices have been made mandatory or recommended in several state fisheries. The use of BRDs is required in all penaeid shrimp trawl fisheries in the South Atlantic. The PRFC recommends the use of culling panels in pound nets and allows those nets with panels to keep one bushel of bycatch of flounder and weakfish. In North Carolina, escapement panels have been required in the bunt nets of long haul seines in an area south and west of Bluff Shoals in the Pamlico Sound since April 1999. However, evaluation of the beneficial effects of BRDs to spot stocks continues to need further study.

General gear restrictions, such as minimum mesh sizes or area trawling bans, have helped protect some age classes of spot. However, only Georgia has implemented a spot creel limit (25 fish, both recreational and commercial, except for shrimp trawlers).

Omnibus Amendment (Interstate)

In August 2011, the Management Board approved the development of an amendment to the Spot FMP to address three issues: compliance measures, consistency with federal management in the exclusive economic zone, and alignment with Commission standards. The updated FMP's objectives are to: (1.) Increase the level of research and monitoring on spot bycatch in other fisheries, in order to complete a coastwide stock assessment (2.) Manage the Spot fishery stock to maintain the spawning stock biomass above the target biomass levels. (3.) Develop research priorities that will further refine the spot management program to maximize the biological, social, and economic benefits derived from the spot population. The Omnibus Amendment does not require specific fishery management measures in either the recreational or commercial fisheries for states within the management unit.

Addendum I

In August 2014, the Board approved Addendum I which establishes a new management framework (i.e., Traffic Light Approach) to evaluate fisheries trends and develop state-specified management actions (i.e., bag limits, size restrictions, time & area closures, and gear restrictions) when harvest and abundance thresholds are exceeded over two years. Management measures would remain in place for two years.

Recent Changes in State Regulations

North Carolina: There are no direct restrictions on the commercial harvest of spot within coastal, joint, or inland waters of North Carolina. There are however numerous indirect restrictions that effect the commercial harvest and bycatch of spot in North Carolina. Changes to such restrictions for 2015 include: Gill net restrictions for Internal Coastal Waters pertaining to area closures/openings, gear modifications

and attendance rules to avoid interactions with endangered species and requiring the use of an additional BRD for shrimp trawlers (Proclamation SH-2-2015).

De minimis Guidelines

A state qualifies for *de minimis* status if its past 3-years' average of the combined commercial and recreational catch is less than 1% of the past 3-years' average of the coastwide combined commercial and recreational catch. Those states that qualify for *de minimis* are not required to implement any monitoring requirements, none of which are included in the plan.

De Minimis Requests

Georgia requests *de minimis* status. The PRT notes that Georgia meets the requirements of *de minimis*.

VII. Implementation of FMP Compliance Requirements for 2015

All states within the management unit have submitted compliance reports for the 2015 fishing year. The PRT found no compliance issues.

VIII. Recommendations of the Plan Review Team

Management and Regulatory Recommendation
The Spot PRT will continue to monitor the fishery through the Traffic Light Approach.

Research and Monitoring Recommendations
High Priority

- State monitoring and reporting on the extent of unutilized bycatch and fishing mortality on fish less than age-1 in fisheries that take significant numbers of spot.
- Evaluate the effects of mandated bycatch reduction devices on spot catch in those states with significant commercial harvests.
- Continue monitoring long-term changes in spot abundance, growth rates, and age structure.
- Continue monitoring of juvenile spot populations in major nursery areas.
- Improve spot catch and effort statistics from the commercial and recreational fisheries, along with size and age structure of the catch, in order to develop production models.
- Conduct age validation studies.
- Cooperatively develop criteria for aging spot otoliths and scales.
- Develop catch-at-age matrices for recreational and commercial fisheries.
- Determine the effect that anthropogenic perturbations may be having on growth, survival, and recruitment.

Medium Priority

- Cooperatively develop a yield-per-recruit analysis.
- Develop stock identification methods and investigate the degree of mixing between state stocks during the annual fall migration.
- Determine migratory patterns through tagging studies.
- Determine the onshore vs. offshore components of the spot fishery.

IX. References

Atlantic States Marine Fisheries Commission (ASMFC). 1987. Fishery Management Plan for Spot. Washington (DC): ASMFC. Fisheries Management Report #11. 90 p.

Kline LL, Speir H (editors). 1993. Proceedings of a Workshop on Spot (*Leiostomus xanthurus*) and Atlantic Croaker (*Micropogonias undulatus*). Washington (DC): Atlantic States Marine Fisheries Commission. Special Report #25. 175 p.

NCDMF. 2001. Assessment of North Carolina commercial finfisheries, 1997–2000. Final Report, North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Award Number NA 76 FI 0286, 1-3.

Spot Plan Review Team (PRT). 2012. Spot Data Availability and Stock Monitoring Report, 2009. Washington (DC): Atlantic States Marine Fisheries Commission. Report to the South Atlantic State-Federal Fisheries Management Board. 85 p.

X. Figures

Figure 1: Traffic Light Approach for spot, 2014. Top figure shows the harvest composite index and the bottom figure shows the abundance composite index.

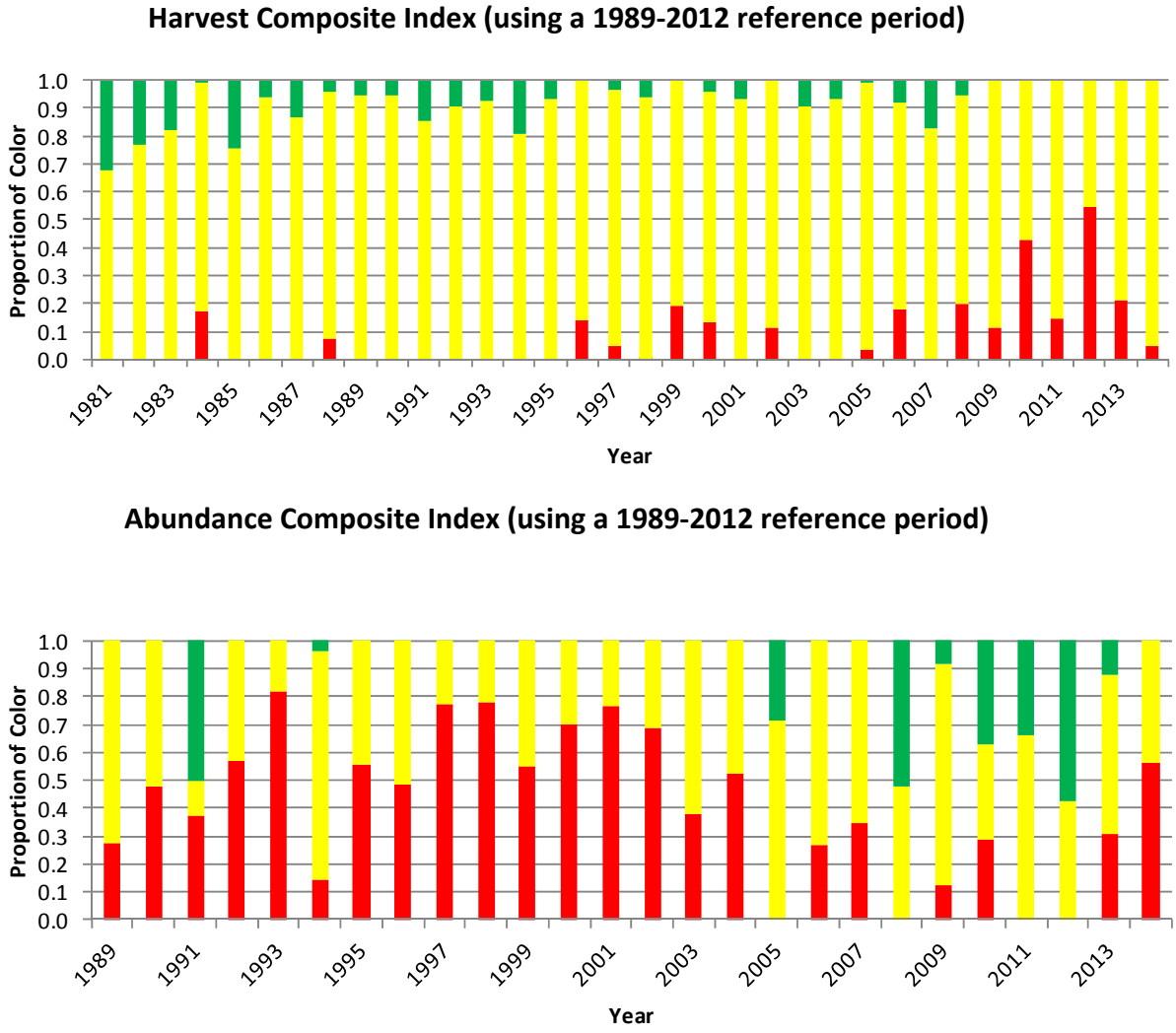


Figure 2: Spot commercial and recreational landings (pounds), 1950-2015.
(Recreational landings available from 1981-present; see Tables 1 and 3 for state-by-state values and data sources)

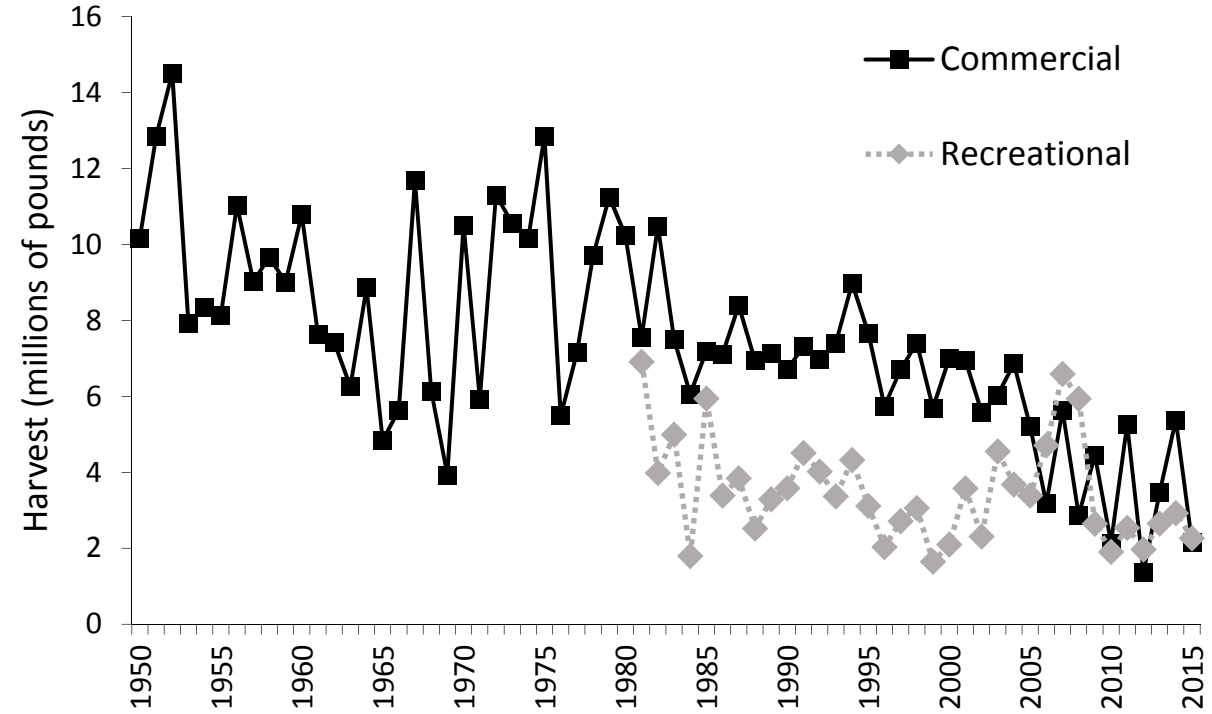
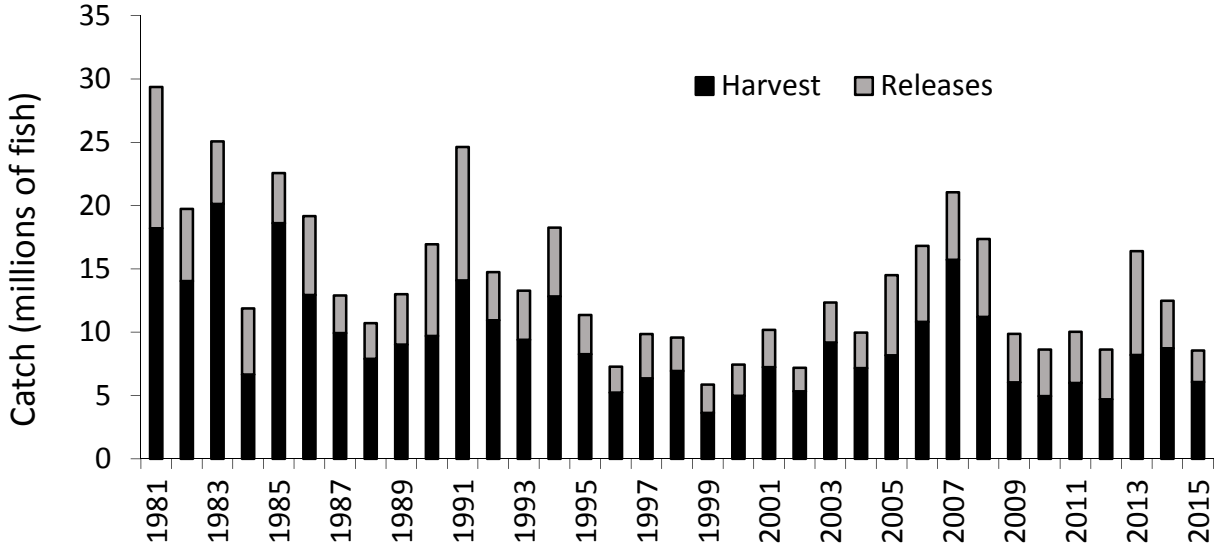


Figure 3. Spot recreational harvest and releases (numbers of fish), 1981-2015
(See Tables 4 and 5 for state-by-state values and data source)



XI. Tables

Table 1. Commercial landings (pounds) by state, and estimated value (ex-vessel), 1981-2015
[Source: NMFS Fisheries Statistics Division (queried 12/19/2016) & State Compliance Reports (received 11/01/2016)]. Starred values are confidential.

Year	NY	NJ	DE	MD	PRFC	VA	NC	SC	GA	FL	**Total**
1981		6,000	11,100	14,200	49,899	1,025,800	3,511,574	127,384	7,721	2,798,881	7,552,559
1982		1,800	2,500	6,200	45,946	1,017,100	4,918,763	62,562	292	4,431,239	10,486,402
1983		800		129,400	347,416	1,567,900	2,952,295	240,096		2,266,296	7,504,203
1984		100		43,200	165,524	735,200	3,481,920	130,265		1,508,552	6,064,761
1985		2,400	17,200	7,700	19,912	1,561,739	4,043,843	142,755		1,399,819	7,195,368
1986		6,600	86,400	104,400	148,004	1,839,500	3,354,191	655,378	124	918,875	7,113,472
1987		15,900	140,100	251,800	291,964	3,721,100	2,806,041	220,553	1,528	943,713	8,392,699
1988		1,600	38,700	58,000	53,865	1,985,500	3,080,258	376,221	644	1,344,276	6,939,064
1989		8,200	29,000	115,800	90,920	2,468,100	3,254,473	31,472	361	1,144,639	7,142,965
1990		9,039	24,900	127,882	145,535	1,630,735	3,455,460	39,957	43	1,275,729	6,709,280
1991		54,433	236,200	216,035	147,355	2,539,340	3,047,305	31,787		1,051,532	7,323,987
1992		102,213	95,000	331,837	226,335	2,497,622	2,826,138	171,959	261	740,048	6,991,413
1993	63	10,900	22,000	182,198	88,988	3,349,399	2,672,164	251,225	1,276	826,322	7,404,535
1994		31,408	100,400	166,246	181,127	4,269,402	2,937,355	288,241		1,002,887	8,977,066
1995	22	30,151	62,000		177,780	3,622,954	3,006,885	209,132	247	558,087	7,667,258
1996	318	1,149		256,711	101,670	2,982,083	2,290,040	60,574		56,423	5,748,968
1997	189	6,175	35,686	120,331	134,591	3,465,507	2,627,977	87,170		227,097	6,704,723
1998	579	27,582	140,363	225,937	117,580	4,277,256	2,397,025	63,912		161,205	7,411,439
1999		7,822	51,534	223,463	108,326	2,961,890	2,262,213	9,393		72,973	5,697,614
2000	939	13,852	32,290	176,946	120,642	3,764,679	2,829,818	8,519		57,946	7,005,631
2001	160	20,034	78,272	283,488	176,546	3,248,212	3,093,921	12,950		33,056	6,946,639
2002	5,737	1,326	13,780	138,640	140,776	3,062,211	2,184,076	23,151		20,586	5,590,283
2003	35	6,003	77,031	184,437	227,430	3,471,484	2,043,421	17,181		9,337	6,036,359
2004	98	1,652	58,502		131,605	4,338,082	2,317,215	1,876		12,792	6,861,822
2005	435	769	155,299	114,987	95,350	3,102,816	1,714,518	10,468		21,156	5,215,798
2006	2,959	3,646	7,522	34,018	40,777	1,695,985	1,364,797	5,691		22,502	3,177,897
2007	1,080	4,474	61,637	389,514	70,514	4,327,887	879,135	6,357		14,317	5,637,154
2008	650	1,942	32,496	123,571	29,835	1,976,661	737,293	1,492		9,181	2,863,714
2009	317	34,063	60,671	521,958	63,470	3,910,221	1,006,550	22,557		22,057	4,456,467
2010	447	6,048	59,800	589,560	44,025	1,023,948	572,345	3,957		13,438	2,143,898
2011	159	54,890	81,868	612,391	60,106	3,741,879	936,993	12,162		33,879	5,272,523
2012	90,141	9,935	17,752	101,677	14,563	613,337	489,708	541		36,591	1,374,245
2013	156,752	48,324	73,191	262,692	41,286	2,084,551	768,621	2,446		31,249	3,469,112
2014	2,113	29,683	107,139	320,804	148,908	3,983,384	766,245	5,917	*	16,747	5,381,160
2015	901	355	3,546	88,117	86,972	1,577,765	377,358	1,619		27,969	2,164,602

Table 2. Commercial landings (pounds) by gear, 2015

[Source: NMFS Fisheries Statistics Division (queried 12/19/2016)]

Gear	Landings (lbs)	Percent of Total
Gill nets	1,565,746	80.4%
Haul Seins	111,182	5.7%
Pound Net	133067	6.8%
Trawl	5,698	0.3%
Other	132,819	6.8%
Total	1,948,512	

Table 3. Recreational harvest (pounds) by state, 1981-2015

[Source: State Compliance Reports (received 11/01/2016)]

Year	NY	NJ	DE	MD	VA	NC	SC	GA	FL	**Total**
1981	20,348	6,175	8,047	554,986	4,625,985	1,193,537	144,600	50,734	311,406	6,915,818
1982		85,446	19,281	656,245	1,563,396	1,093,047	313,177	20,199	236,027	3,986,818
1983			4,017	354,788	2,520,125	1,630,882	293,161	28,023	167,294	4,998,290
1984		3,768	5,714	361,850	404,533	650,386	169,346	81,758	122,585	1,799,940
1985	3,415	4,255		193,266	1,955,039	3,120,532	441,808	13,071	213,042	5,944,428
1986	1,327	2,114	3,836	1,139,871	1,205,158	536,443	455,836	23,369	25,360	3,393,314
1987				1,545,691	1,336,387	690,653	226,701	14,601	32,835	3,846,868
1988		84,941	1,876	80,547	720,609	802,320	632,868	14,645	184,602	2,522,408
1989	132	606	10,368	633,150	1,400,728	929,188	288,591	7,798	23,254	3,293,815
1990		5,644	11,821	791,264	2,103,751	613,904	50,525	6,259	1,737	3,584,905
1991		19,528	48,100	634,894	2,729,698	727,463	245,661	1,786	107,256	4,514,386
1992		8,788	36,799	724,279	2,278,309	403,775	397,677	6,978	167,845	4,024,450
1993	315	2,264	844	636,032	951,766	812,810	461,447	109,317	396,632	3,371,427
1994	7,198	20,364	34,795	676,687	1,217,036	1,842,360	469,518	2,687	57,234	4,327,879
1995		1,186	22,919	485,682	1,067,637	1,247,995	242,973	7,701	42,851	3,118,944
1996		10,966	789	294,404	492,982	710,086	494,448	5,445	26,953	2,036,073
1997		8,609	50,781	401,275	1,263,447	722,868	254,794	2,072	13,962	2,717,808
1998			36,658	631,422	866,619	1,249,543	228,502	2,088	47,196	3,062,028
1999			10,886	272,292	244,499	646,662	391,402	2,275	84,511	1,652,527
2000	130,649	46,244	32,968	600,302	252,885	893,835	128,669	1,402	14,129	2,101,083
2001			20,110	629,861	523,202	1,773,671	346,878	1,720	284,706	3,580,148
2002			10,870	336,660	829,972	984,898	140,164	2,857	7,840	2,313,261
2003			14,386	1,690,502	875,729	1,714,158	227,821	5,710	26,504	4,554,810
2004			6,919	442,100	1,136,261	1,846,688	245,991	721	3,338	3,682,018
2005		14,546	68,075	658,077	1,375,629	1,103,830	158,407	917	12,751	3,392,232
2006		28,971	38,010	991,142	1,926,940	978,181	745,772	1,166	6,067	4,716,249
2007	952	0	74,531	1,282,803	3,237,069	1,378,993	605,024	2,346	12,899	6,594,617
2008	0	23,157	42,078	618,172	1,828,398	671,916	2,731,815	4,292	21,041	5,940,869
2009	0	1,882	48,465	802,395	829,245	354,375	589,027	2,493	22,169	2,650,051
2010		212,616	74,641	447,575	563,423	260,757	322,885	214	28,033	1,910,144
2011		755	52,120	314,032	1,101,847	411,243	596,679	171	62,657	2,539,504
2012		104,028	21,558	253,103	410,777	230,259	933,684	91	19,090	1,972,590
2013	6,099	118,685	107,330	280,842	1,336,913	460,928	301,307	1,614	42,267	2,655,985
2014		6,477	210,001	404,080	1,276,043	704,445	157,258	3,968	165,159	2,944,135
2015		0	3,274	187,061	378,959	395,268	1,166,210	575	134,445	2,265,792

Table 4. Recreational harvest (numbers) by state, 1981-2015

[Source: State Compliance Reports (received 11/01/2016)]

Year	NY	NJ	DE	MD	VA	NC	SC	GA	FL	**Total**
1981	44,278	28,006	17,508	948,931	11,662,684	4,023,934	562,750	124,057	799,226	18,211,374
1982		387,582	82,094	2,864,603	4,526,847	4,124,465	1,230,253	84,153	735,398	14,035,395
1983			14,464	1,600,362	12,059,247	4,880,268	970,747	112,123	488,029	20,125,240
1984		8,501	15,553	904,793	1,489,795	2,758,366	724,925	363,841	396,402	6,662,176
1985	15,494	12,692		1,028,391	5,491,918	8,789,391	2,355,044	62,338	861,700	18,616,968
1986	3,824	9,587	12,178	3,789,796	4,229,191	2,646,049	2,007,386	137,782	96,803	12,932,596
1987				3,180,704	3,864,151	2,129,146	599,807	79,487	73,833	9,927,128
1988		348,593	2,360	277,964	2,028,768	2,558,322	1,951,157	57,786	663,681	7,888,631
1989	602	1,128	45,853	1,154,314	3,714,855	2,924,299	1,078,570	34,977	67,506	9,022,104
1990		25,927	44,362	2,120,655	5,354,294	1,986,601	142,271	17,730	7,252	9,699,092
1991		88,393	138,113	1,841,555	8,820,075	2,317,095	598,290	10,281	269,628	14,083,430
1992		20,443	90,053	1,671,897	6,317,539	1,271,416	1,190,757	25,788	357,678	10,945,571
1993	1,168	7,788	3,263	1,880,043	2,836,534	2,057,440	1,437,809	228,606	946,757	9,399,408
1994	19,275	144,589	92,352	1,761,701	3,395,503	5,929,269	1,329,997	9,587	137,067	12,819,340
1995		2,949	51,695	1,099,658	2,731,242	3,329,981	875,189	27,842	140,231	8,258,787
1996		23,954	955	591,300	1,109,237	2,007,071	1,423,352	14,131	64,337	5,234,337
1997		20,148	126,089	713,657	3,328,144	1,440,661	680,842	5,471	31,987	6,346,999
1998			96,389	1,327,259	2,023,756	2,865,190	489,068	6,788	120,389	6,928,839
1999			19,911	655,289	569,250	1,308,167	801,785	5,578	264,233	3,624,213
2000	498,470	281,481	65,952	1,389,505	527,259	1,924,108	246,290	2,950	40,908	4,976,923
2001	0	0	51,096	1,088,997	1,056,365	3,650,711	735,551	3,681	652,976	7,239,377
2002	0	0	22,013	690,515	1,601,837	2,586,313	393,597	6,987	25,907	5,327,169
2003	0	0	30,166	3,300,595	1,441,002	3,796,556	524,513	11,523	84,686	9,189,041
2004	0	0	17,494	867,589	1,717,416	3,825,768	729,851	1,563	6,790	7,166,471
2005	0	46,795	150,772	1,788,679	2,781,973	3,012,872	358,550	3,199	23,796	8,166,636
2006	0	68,168	110,607	2,895,783	3,584,930	2,978,506	1,170,611	1,761	7,990	10,818,356
2007	1,813	0	176,997	3,615,346	8,203,377	3,078,346	605,024	6,529	30,184	15,717,616
2008	0	132,472	133,996	1,892,116	4,398,472	1,843,343	2,731,815	8,903	58,732	11,199,849
2009	0	6,720	128,799	2,064,326	2,146,607	1,056,346	589,027	17,948	25,391	6,035,164
2010	0	650,260	214,180	1,164,091	1,669,843	834,561	322,885	851	94,671	4,951,342
2011	0	1,370	150,650	912,704	2,967,029	1,207,335	596,680	968	152,329	5,989,065
2012	39,912	627,664	65,555	766,145	1,350,153	784,272	1,001,664	348	65,598	4,701,311
2013	13,294	326,956	248,346	945,972	4,332,620	1,464,592	732,413	6,573	132,204	8,202,970
2014		13,062	344,930	1,254,029	3,908,724	2,111,880	466,106	15,620	608,814	8,723,165
2015		0	10,277	524,079	867,365	1,081,083	3,157,322	36,684	391,653	6,068,463

Table 5. Recreational releases (numbers) by state, 1981-2015

[Source: State Compliance Reports (received 11/01/2016)]

Year	NY	NJ	DE	MD	VA	NC	SC	GA	FL	**Total**
1981		25,740	1,502	1,331,316	8,905,412	735,408	82,035	5,975	64,344	11,151,732
1982		974,847	5,061	1,677,415	1,618,065	806,851	366,650	44,091	205,387	5,698,367
1983		57,556		1,114,795	2,715,522	634,107	192,240	39,798	186,615	4,940,633
1984			13,260	1,150,599	2,607,693	952,816	346,003	17,897	130,493	5,218,761
1985	22,220	2,979		735,873	2,051,793	429,914	515,106	17,316	170,060	3,945,261
1986		79,712		2,720,343	2,250,794	816,204	331,290	20,863	10,351	6,229,557
1987			1,104	248,973	1,736,228	593,937	304,127	28,434	57,437	2,970,240
1988		110,698	4,501	716,258	762,504	995,806	110,498	16,951	110,003	2,827,219
1989		4,503	40,193	730,580	2,519,034	524,897	138,834	1,630	22,425	3,982,096
1990		14,504	10,120	1,811,434	4,441,195	921,849	13,709	4,079	30,937	7,247,827
1991		91,991	59,770	2,123,582	7,041,156	946,564	100,666	14,629	168,284	10,546,642
1992		1,324	12,553	493,597	2,091,001	841,163	279,044	16,791	64,738	3,800,211
1993			35,987	1,573,486	1,374,950	528,449	130,055	47,667	185,226	3,875,820
1994	8,140	160,380	53,078	1,037,498	2,142,198	1,363,884	320,921	22,434	335,647	5,444,180
1995		22,162	14,195	253,827	1,166,428	1,035,361	331,781	9,799	268,765	3,102,318
1996	7,178	39,448	1,128	208,897	577,847	924,204	212,920	5,329	65,083	2,042,034
1997		21,512	88,751	1,316,341	1,365,809	450,663	245,349	990	18,102	3,507,517
1998		12,542	75,985	633,914	900,352	650,157	307,480	12,286	58,264	2,650,980
1999			15,789	618,742	339,988	633,112	86,894	10,675	530,849	2,236,049
2000	157,991	16,633	30,522	1,080,310	502,923	481,995	115,682	17,376	54,388	2,457,820
2001		2,040	13,139	577,417	968,976	1,143,695	154,077	11,714	74,232	2,945,290
2002	2,127	3,331	27,220	501,111	481,765	671,669	103,914	20,038	44,584	1,855,759
2003		39,049	13,273	670,382	933,842	1,132,992	231,612	31,055	106,918	3,159,123
2004			39,998	383,292	882,136	1,257,887	210,215	12,536	9,427	2,795,491
2005		5,772	157,445	2,135,086	2,456,981	1,334,559	183,819	25,117	41,773	6,340,552
2006		65,244	92,864	1,355,280	1,371,751	2,588,647	496,870	3,774	21,755	5,996,185
2007	535	119,976	44,455	1,618,690	2,156,839	1,197,005	151,481	17,600	26,675	5,333,256
2008		1,166,532	98,304	1,737,665	1,487,665	1,322,408	188,746	25,908	128,942	6,156,170
2009		7,691	140,014	632,595	1,457,588	1,222,053	326,065	10,486	40,890	3,837,382
2010		191,745	72,216	1,155,003	1,155,882	871,054	166,679	562	57,924	3,671,065
2011		1,370	66,661	296,513	2,245,221	1,000,566	222,623	9,766	196,294	4,039,014
2012	37634	477938	60,334	919,896	1,145,960	759,081	142,093	3,968	373,916	3,920,820
2013	332	746,878	214,067	2,621,931	2,226,300	1,314,199	957,781	8,623	110,865	8,200,976
2014		15,323	78,691	565,679	1,173,748	890,831	427,049	27,224	575,251	3,753,796
2015		0	11,404	242,912	509,194	708,122	744,532	34,884	238,078	2,489,126