Atlantic States Marine Fisheries Commission

Management and Science Committee

May 21, 2013, 1 p.m. – 5 p.m.;
May 22, 2013, 8:30 a.m. – 12:00 p.m.
Alexandria, VA

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.

May 21

1. Welcome and introductions *(M. Armstrong)* 1:00 p.m.
2. Approval of agenda
3. Approval of minutes—October 24, 2012
4. Public comment

5. Discuss climate change task from Policy Board *(M. Armstrong)* 1:10 p.m.
   - Report from subcommittee

6. Discuss working with MRFSS/MRIP ratio estimators *(J. O'Hop)* 2:40 p.m.

7. Discuss Ecosystem Based Fisheries Management 3:20 p.m.
   - Report from MAFMC Forage Fish Workshop *(R. Seagraves)*
   - How to integrate EBFM in the ASMFC process

8. Other Business 4:50 p.m.
9. Adjourn 5:00 p.m.

May 22

1. Development of guidance on risk and uncertainty *(M. Armstrong)* 8:30 a.m.
   - Report from ASC on characterizing scientific uncertainty
   - Report from MSC subcommittee on management uncertainty

2. ASMFC 2013 Critical Research Priorities 10:00 a.m.
   - Update on ASMFC 2013 Research Priorities *(J. Kipp)*
   - Finalize ASMFC 2013 Critical Research Priorities *(J. Kipp/M. Paine)*
   - Discuss development of funding proposals to address critical priorities *(M. Paine)*

3. Updates 11:20 a.m.
   - Atlantic Coastal Fish Habitat Partnership *(E. Greene)*
   - Fish ageing activities *(J. Kipp)*

The meeting will be held at the Crowne Plaza Old Town Alexandria
901 N. Fairfax Street, Alexandria, VA
Tel: (800) 333-3333

- NEAMAP *(M. Paine)*
- SEAMAP *(M. Paine)*
- Cooperative Winter Tagging Cruise *(W. Laney)*

4. Other Business 11:50 a.m.
5. Adjourn 12:00 p.m.

The meeting will be held at the Crowne Plaza Old Town Alexandria
901 N. Fairfax Street, Alexandria, VA
Tel: (800) 333-3333

Management and Science Committee Meeting
Draft Minutes
October 24, 2012
Philadelphia, PA

Participants:

Mike Armstrong, Chair	Tom Miller
Brandon Muffley	Jim Gartland
Peter Burns	Linda Mercer
Joe O'Hop	Derek Orner
Mark Alexander	Cheri Patterson
Jason McNamee (phone)	

Others: Matt Cieri, David Pierce, Alison Fairbrother, Dick Brame, Bill Goldsborough

Staff: Melissa Paine, Katie Drew, Genny Nesslage, Pat Campfield, Jeff Kipp

1. Welcome and Introductions

M. Armstrong welcomed everyone to the meeting and each person introduced him or herself.

2. Approval of agenda

The group approved the agenda.

3. Approval of minutes—April 18, 2012

The minutes were approved.

4. Public comment

There was no public comment.

5. Report on ASC development of guidance on characterizing uncertainty

- **MSC to revisit task for developing guidance on risk and uncertainty**

M. Cieri said that a subcommittee of ASC has been working on addressing this task from the Action Plan, with the goal of standardizing how TCs characterize uncertainty and incorporate that guidance into advice managers can follow. He noted that the Magnuson Stevens Act requires the incorporation of management and scientific uncertainty in setting quotas. The ASC subcommittee is exploring uncertainty in the Commission's process and will establish best practices for TCs to follow. They will look at how to measure uncertainty and what to include for characterizing uncertainty. By having some standardization across stock assessments, managers can know what to look for. Another way of achieving this goal is to have a report card so managers can know where to look for uncertainty. ASC plans to hold a workshop at their next meeting in March to review uncertainty for all ASMFC managed species. They are discussing whether to have the guidance be a section in the new TC guidance document being revised currently, or be a standalone paper. They will also note which stocks do not have any estimates of uncertainty. The ASC recommended that MSC revisit the previously discussed task to determine whether they want to develop guidance on management uncertainty:

Goal: Task 1.5.2 – Develop Commission policy regarding risk and uncertainty in consideration of and in coordination with Councils approaches. Management and Science Committee to draft for Policy Board consideration.

B. Muffley asked if the subcommittee will look at where uncertainty should be applied and provide some standardization of where to look and then how to characterize it. M. Cieri said that in addition to uncertainty methodology, they will get quantitative and qualitative information through sensitivity analysis. He added that they will see which ones they have uncertainty estimates for and then what types have been done (e.g., bootstrap, Monte Carlo, sensitivity). M. Armstrong asked if the subcommittee was looking at how the Councils are handling uncertainty, and M. Cieri said that is their next step. They could provide guidance to the Policy Board on how to incorporate uncertainty in specifications. T. Miller pointed out the SSCs are not the ones to provide guidance on management uncertainty. Some Councils have a committee but it is the Council that makes the choice. M. Cieri said ASC felt that MSC should handle management uncertainty. The question is whether to break uncertainty into management and scientific uncertainty. G. Nesslage added that the summer 2013 Commissioner training workshop could focus on uncertainty so they could learn terms and be up to speed on the layman's guide. The ASC document is geared more towards TCs. T. Miller asked for clarification on who establishes risk policy. The group said that MSC makes a recommendation to the Policy Board. He noted that risk policy is for the Councils to establish and the SSCs apply the risk policy. M. Cieri raised the question of who would be the comparable group in the ASMFC process to apply that policy; should it fall to the TCs or ASC. He also noted the Commission needs to determine whether they want to account for both management and scientific uncertainty. J. O'Hop said at the South Atlantic and Gulf SSCs, each has a set of scores of uncertainty based on life history, etc. and they go through a tier process. They also use the p-star system of showing the probability of overfishing.

M. Armstrong said that the Commission needs to determine where it is heading, but the first step is in identifying commonalities. M. Cieri said the first step is to identify which stock assessments have uncertainty that we know and those where we do not know and that is the technical side which ASC can handle. The question for MSC is how to translate this to the Policy Board. The question is what kind of uncertainty do they want captured and how closely should it follow the Councils. M. Armstrong asked if they have bins of uncertainty and M. Cieri said most SSCs do. He added many stocks do not have good estimates of uncertainty. Everyone agreed that ASC is not the appropriate group to handle management uncertainty. The one issue is to establish the policy but the bigger issue is how to implement it. J. O'Hop added that the SSC does not set management uncertainty, it just sets the ABC recommendations and the Council has a management framework in place. M. Armstrong said that it would be useful to develop a list of uncertainty estimates and describe how to address them when they have them. They could just have a generic statement that there is no real policy on management uncertainty. In the Council it is an ad hoc policy. M. Armstrong suggested that a subcommittee be formed to discuss what management uncertainty is and look at how other Councils handle and report it. The subcommittee volunteers are: B. Muffley, L. Mercer, M. Armstrong, T. Miller, J. McNamee.

D. Pierce said one issue of uncertainty is what managers want to have as coverage for at-sea observers; if they concluded they want 20% observer coverage, then what kind of management uncertainty would there be associated with that. There is a buffer between the ABC value and the management uncertainty if the observer coverage is low to account for that lack of at-sea observer coverage. He questioned to what extent management measures allow for false reporting and misreporting. T. Miller noted this response was indicative of the confusion surrounding uncertainty, where observer coverage will affect the scientific uncertainty and the way policy is brought forward is how it will affect fishermen's behavior and that is all part of management uncertainty. The document has to be hand in hand for both scientific and management uncertainty in the whole process. It all needs to be accounted for so there is no double counting.

J. O'Hop said the Council agreed upon criteria for certain buffers and each time the buffer grows bigger when uncertainty is higher. They set ACLs based on the buffer, separate from scientific uncertainty. G. Nesslage encourages ASC and MSC to figure out a way to present this for each species to the Board. The Commission is not bound by MSA so it is uncertain whether they will adopt a risk policy, but the groups can still present, whether there is a policy or not, and can compare uncertainty levels between species and not just develop policy but it is better to have a framework of implementation. M. Armstrong agreed that they should bring the information first, and then come up with a policy. They can do this on an as needed basis. B. Muffley thought it important to have standardized information in a consistent approach when the stock assessment comes to the Board level. M. Cieri said ASC is planning the workshop for spring and will have presentations on what estimates of uncertainty are available and how stock assessments handle uncertainty. ASC will give a report from that workshop and MSC can recommend how managers deal with that uncertainty. MSC could make a list of potential management uncertainty measures for their discussion. Some examples are changes in fleet dynamics, allocation, and unreported catch. J. O'Hop suggested contacting Kyle Shertzer who gave a presentation on bootstrapping and season closures. M. Armstrong added that many of the ASMFC species are covered by SSCs anyway and others are very data poor, so there is a wide range of what is characterized.

6. Discuss TC Guidance Document revision and update

- **MSC review stock assessment scientist workload**
- **Public participation at meetings**
- **Independent review of alternative stock assessments**

G. Nesslage said that staff has been working to consolidate the two technical committee guidance document and benchmark guidance document into a combined and updated document. The plan is to have ASC and MSC have conference calls to accept the revised version before presentation to the Policy Board at their February meeting. MSC is being asked for their feedback on a few issues that should be clarified in the document.

M. Armstrong raised the issue of outside analyses coming in last minute during a stock assessment and how to handle those. G. Nesslage said that the Commission wants to incorporate outside input but it has to be vetted as part of the process. She suggested that language could be added to say that if there are alternative analyses, they need to go through the stock assessment process and be equally vetted by the Board. There needs to be a clear process on how they should be incorporated and the timing of that. J. O'Hop mentioned that the SSCs are dealing with third party reviews or analyses and sometimes they are not full reports but may be valid reports or may not meet the rigors of vetting the analyses. G. Nesslage asked if they should outline requirements that the analyses need to meet, such as needing to be in a peer reviewed journal. J. O'Hop felt they needed to document their data sources. M. Armstrong felt that they should be firm on the timing. G. Nesslage said that staff can add or keep strict deadlines into the document. J. Gartland agreed to keep it strict, to make it clear with all the dates so they have full knowledge of the process so that it is fair. It can be announced through the website. He thought alternative analyses were good but only if they follow the stock assessment process. B. Muffley added that they should not discourage outside reviews and it is good to challenge the TC, but if ASMFC holds itself to strict deadlines (same code has to be applied) then why not hold outside parties to the same rigor. He agreed that the policies be cleaned up so that it was very clear. J. Gartland thought it was beneficial to do outside stock assessments and it lends credibility to both TCs and those outside analyses if they go through the same stock assessment and peer review process. T.

Miller said he thinks ASMFC needs more active outreach to AP, TC, academia, industry, etc. to get involved in the stock assessment process. He felt that just laying out the timetable is not sufficient and there needs to be some flexibility. J. Gartland agreed that this flexibility could be the exception to the rule. M. Armstrong thought this policy could cover the gradient of including groundbreaking work to the other end where sniping occurs. He heard consensus from the group to firm up the process and allow flexibility. G. Nesslage said the Policy Board controls the stock assessment schedule and call for benchmark assessments. They can work backwards from that to work on a timeline. She said for the data workshop they send a memo to interested parties and they still had to be proactive to find people who they knew had data. M. Armstrong asked what guidance to give to the chair of a Board if someone wants to present their analyses. G. Nesslage said that if it is alternative information, that would be the Board's discretion, but if it was an alternative analysis, that would have to go through the process. P. Campfield noted that it can be a role for TC or SASC members to be proactive so it is not just staff. J. Gartland added it is a marketing issue and a broad net should be cast to all TCs, APs, and on the website and it should not be limited to just TCs and SASCs. J. O'Hop recommended that it still funnel to staff so that they have the contact information.

The group walked through the series of questions provided to MSC in their meeting materials.

1. Should we add integrated peer reviewer as review option?

P. Campfield said another issue is adding the option of having an embedded peer reviewer. L. Mercer thought this was a good idea as an option so long as it was not necessarily mandatory. B. Muffley thought it was a good idea in principle, but he is not sure they are there in actuality yet. He is not sure all the particulars are ironed out on when to get that person involved in the process. He would prefer to see it with structure in the document. P. Campfield said the time Joe Hightower participated, he thought it was better that he jump in when some of the analyses had already been attempted. He said that it is not a standard process and should be flexible to be species specific. The goal of an integrated peer review is to get an outside look and provide some guidance on the process. L. Mercer added it is good to have someone imbedded in the process to see all the steps. M. Armstrong said that it is good to have someone who had failed the review there to point out where the land mines are. K. Drew said they are also very careful that the integrated peer reviewer would not be part of the peer review panel. That person would just bring something fresh and new and not be the final arbiter. It is not helpful in all situations. G. Nesslage offered to add language in case of a failed or troubled stock assessment that someone from the last peer review panel could be the integrated peer reviewer. B. Muffley suggested that there are cases which did not fail where they would still want an outside look. M. Cieri wondered if there was any other process where they could get an outside opinion. B. Muffley said there are two different situations, one is a third party type analysis and the other is where the SASC is seeking input. J. O'Hop said he could see how an extra person could provide good advice. T. Miller pointed out that this is a methodology to get external expertise and it is not the peer review's role. The point is that they do not get to the end of the process and then identify something that needed to be fixed. M. Armstrong suggested a narrow definition of an integrated peer review. P. Campfield said that staff will fold in the flexibility for when an integrated peer reviewer jumps in with each occurrence and they will bring it back to MSC to decide.

2. Should we change TC/SAS membership language to "One TC member per state, SAS membership as needed?"

P. Campfield noted another issue is on the language of TC membership representation and whether it should be more restrictive to be just one member per state or agency. Some situations have multiple members from the same state. The TC is based on the number of states on the Board. For SASCs, they can try to limit it to 6-8 people but the Board has the ultimate call. The states send who they want and then the Board approves the SASC, often comprised of people outside the TC. M. Cieri asked if 6 is the right number, and P. Campfield said it was designed to strike the right balance.

3. Opinion on changed wording on PR workshop policies?

The group reviewed the old and new language on workshop participants.
New:
"For ASMFC External Peer Review Workshops, the full stock assessment subcommittee, Chair of the management board, and Chair of the advisory committee should be invited to attend the review. Stakeholders are welcome to attend ASMFC External Peer Reviews, but not as participating members; the External Peer Review Panel Chair will allow public comment only if time allows."
Old:
"For external panel reviews being conducted by the Commission, the full stock assessment subcommittee, Chair and Vice-Chair of the technical committee, Chair and Vice-Chair of the management board, and Chair and Vice-Chair of the advisory committee should be invited to attend the review. Stakeholders shall be invited to attend ASMFC External Peer Reviews, but not as panel members and the External Peer Review Panel Chair will encourage public comment. Stakeholders are encouraged to participate in all levels of the stock assessment and at the ASMFC External Peer Review process."

One difference is removing inviting Vice-Chairs, and another is in not noting the technical committee as the Chair of the TC is part of the SASC already. The original encouraged stakeholder participation at the peer review workshop, but this is not generally practiced and the public is invited at the chair's discretion. J. O'Hop said they can have time during public comment which follows along with SEDAR and have the chair use his or her discretion. L. Mercer suggested that stakeholder participation be moved to another part of the document. K. Drew suggested removing that here but not as participating members. M. Cieri thought observing would be better. The group agreed to move the wording about stakeholders to be invited to participate at all levels to earlier in the document, then add that they can observe at the peer review workshops.

4. Should approval of final SA schedule be done by MSC once gone through ASC (to more independently address workload issues)?

G. Nesslage said that ASC reports on workload issues to the Policy Board but if MSC members, who are generally the bosses of those scientists affected, say the assessments cannot be done, it would lend credence to ASC's recommendations. M. Cieri raised the issue of the clear line of each committee reporting to the Policy Board and how MSC would provide comment before ASC presents to the Board. B. Muffley suggested a hybrid approach whereby MSC could provide thoughts to the Board and to ASC. M. Armstrong thought MSC should help with the issue of workload. P. Campfield said that ASC will continue to look at workload issues and before then MSC and ASC will communicate. MSC will give a report to the Policy Board in February.

5. What are your thoughts on the Advisory Reports from the peer review panels? Is it OK if we rework Advisory Panel Report structure to make it more useful/readable? Suggestions? Staff could redraft outline to get more useful information from the panelists, rather than repeating what is in the assessment report.

III. *Advisory Report*

- Status of Stocks: Current and projected, where applicable
- Stock Identification and Distribution
- Management Unit
- Landings
- Data and Assessment
- Biological Reference Points
- Fishing Mortality
- Recruitment
- Spawning Stock Biomass
- Bycatch
- Other Comments

One issue is that the reviewers tend to just borrow information from the stock assessment report, so the group agreed the outline should be redrafted. Also they agreed to have the title just be Advisory Report rather than TOR and Advisory Report to minimize redundancy in the reports. J. O'Hop felt it was very helpful for stock assessment scientists to have the original comments and not just the consensus report. For the Advisory report they could make a better summary and remove the redundancy. G. Nesslage said they do not have individual report only consensus reports, but they could have consensus on the TORs so that if individual reviewers want to bring anything up they can in that section of the TORs. Alternatively they can just keep the consensus document. M. Alexander thought a consensus document was better to get the general thrust of the review and then also be aware of potential problems. P. Campfield suggested that J. O'Hop and others could contribute to the new outline. G. Nesslage added that staff is open to taking any ideas on what the group felt worked or did not.

6. Opinion on making clearer the tasking of committees?

"Management Boards/Sections should develop specific and clear guidance whenever tasking committees for advice. ISFMP staff, in consultation with the Board/Section Chair and technical support group Chair, should develop the written charge with input and clarification from the entire Management Board and/or Chair. The charge from the Management Boards/Sections should clearly specify all specific tasks, the deliverable expected, and a timeline for presentation of recommendations to the Board/Section."

P. Campfield noted this was brought up to resolve the issue of the Board tasking them and then time being wasted if the committees were not clear on what they wanted. In the original charter the Chair of the Board is supposed to provide a written charge to the TC. B. Muffley thought the new suggested language was good but the difficulty comes following that and in practice how to get it done. The TC usually works off the motion but it would be good to make sure it is written out. M. Alexander suggested asking the Board to provide TORs of what they want the TC to do. The language will be revised to require TORs in Board Chair memos to TCs.

7. Should we add SAW-like Rules of Engagement?

Question 7 was skipped to save time.

8. Recommended text on how/when to address Peer Review panel recommendations (updates vs. benchmark triggers).

P. Campfield said that after peer reviews, they always have panel recommendations and the question is whether they need to wait until the next benchmark assessment to address them or can it be done in an update. G. Nesslage said many times they are asked to address recommendations in the next stock assessment, but if that is an update then it is unclear if they can. Perhaps there should be language to say they will not be addressed until the next benchmark. J. O'Hop would like to see some flexibility to make revisions. L. Mercer said given limited resources they should still try to work on recommendations before the next assessment. The TC could come up with a timeline on how and when to address the recommendations. K. Drew noted that if a model is "accepted for management", it is good enough for management use and it is never conditional on addressing the recommendations and those do not need to be incorporated until the next benchmark. J. O'Hop said it ends up being a judgment call on whether it is better to go with the better current way versus an update on the former model. G. Nesslage said that if they do a timeline then some can be done for update and they can make it clear to the public when they can make changes and what takes a benchmark. The Board can modify the timeline if they want. K. Drew added they could say what is feasible in the next few years. J. O'Hope said that it would be good to give stock assessment scientists some guidance and discretion on how to approach an update and what will be required for a benchmark. P. Campfield suggested asking the peer reviewers to address what is required through an update or benchmark. M. Cieri said the Commission dictates what triggers a benchmark. The group decided that the TC must develop a timeline for addressing peer review panel recommendations after each assessment, identifying what is realistic and what is doable in the short term.

P. Campfield said that staff will make the changes suggested and send the revised document back out to you with the goal of presenting the document at the February meeting.

7. Updates

- **ASMFC Research Priorities**

J. Kipp noted that the last ASMFC prioritized research needs document was last updated in 2008. He has recently updated it with the latest stock assessments and FMP reviews. He also made minor changes to the format and changed the title to Research Priorities. He categorized the research needs into five types and added a socioeconomic needs section from the Committee on Economics and Social Sciences. He has identified 11 TCs which he will contact on how to prioritize research needs which have not yet been prioritized. M. Armstrong asked if he asked whether any of the research needs have been addressed and J. Kipp will look into that. C. Patterson suggested that those that have been addressed be added to the document. J. Gartland agreed that having a more complete list of what is currently being done would be beneficial. B. Muffley noted how much the document has expanded and J. Kipp said this was due to breaking needs down into subcategories. L. Mercer suggested that the list also be sent out to graduate schools in addition to being posted on the website or other postings. M. Alexander pointed out that some items looked more like management needs, so that may need to be addressed. B. Muffley thought it important to revisit the critical research needs once this is updated.

- **ACCSP research proposals to address ASMFC Critical Research Priorities**

M. Paine said that once the priorities were updated, staff would work to update the critical research needs list. That is what was used as a basis for submitting proposals for funding to ACCSP. ASMFC submitted two research proposals to ACCSP to continue funding observer work on small mesh otter trawls in the Mid-Atlantic, and to support at-sea and port sampling of the lobster fishery. The ACCSP Coordinating Council decided earlier that day that the lobster sampling proposal would not be funded and the otter trawl observer program would be funded at about half of what was proposed which puts it more in line with the first year of funding where no ageing samples were processed and New York was not sampled. She asked MSC what their thoughts were on continuing to submit these proposals to ACCSP. C. Patterson suggested that MSC identify one or two key proposals and make them different each year so it would draw from the new pot of funds. M. Alexander thought that one issue the proposal encountered was that they were monitoring projects outside of the core mission of ACCSP, rather than developing new programs for partners. C. Patterson thought it important that the need is coming from an ASMFC committee. T. Miller suggested that it also be identified in the research needs how long a data time series needs to be. L. Mercer asked if there was any new guidance from ACCSP in how proposals will be considered from the program review and M. Alexander said it was hard to say.

8. Updates

- **Atlantic Coastal Fish Habitat Partnership**

E. Greene provided an update on how ACFHP allocated funds for three projects. The first was in the James River to promote the population of Atlantic sturgeon. The second was in the Indian River Lagoon protecting over 10 acres of mangroves habitat. The third was in Buzzards Bay, MA where the project will replace traditional moorings with plastic moorings which has minimal impact to eelgrass. ACFHP has also developed fact sheets which are available. They also reviewed and ranked a list of proposals for FY13 funding, and they usually approve up to two proposals. They received some funding from NOAA and they are open to hearing any ideas from MSC on location of the next project. She also noted that ACFHP received a multistate grant for operational costs. The steering committee looked at different foundations for funding. The Science and Data Work Group developed a species habitat matrix which identifies what types of habitat are important to them. They are working on a draft manuscript for peer review. They are also required to do a GIS based habitat assessment and they are working on that. They will distribute these matrices to TCs, MSC and other groups.

- **Ageing workshop and manual**

K. Drew said that they had completed an exchange and workshop for tautog to see if it is aged consistently. Only MA showed significant difference than everyone else. They may be able to improve precision by using otoliths but currently they are working with opercula. J. Kipp added that they are planning a workshop for next spring on river herring. G. Nesslage asked if striped bass was moving away from using scales. K. Drew said they are trying a small exchange to see if there are geographical differences. This stock assessment is not ready to move to otoliths as they do not have a time series nor paired samples. The will try to get otoliths but this assessment is scale based.

M. Armstrong asked about the status of the manual development. K. Drew said that is a piecemeal effort where they started with the lowest hanging fruit and now have species such as bluefish and winter flounder. P. Campfield added that they will do one ageing workshop then write a chapter. He said that tautog had its assessment sidetracked because of ageing issues and the VA data was not used in the 2011 update.

The following updates would be emailed to save time during the meeting.

- **Cooperative Winter Tagging Cruise *(W. Laney)***
- **SEAMAP *(M. Paine)***
- **NEAMAP *(M. Paine/J. Gartland)***

9. Discuss Ecosystem Based Fisheries Management

- **Update on incorporating forage species into fisheries management**

M. Paine said MSC had discussed a couple years ago a means to incorporate forage species into the Commission's process. They had looked at an example with weakfish of its forage species information and considered inclusion in FMPs. The group had wanted to include a TOR in stock assessments for gathering information on forage species and wanted striped bass to be the first test case. That TOR was not included in the upcoming assessment, but in discussing this task, staff wondered if it was asking too much of stock assessment scientists in the midst of an assessment to also gather forage information and perhaps it would be better collected in off years from when the assessment is scheduled. K. Drew said there was not a formal TOR for forage species for striped bass but it will be fed into the stock assessment report, and will have a strong life history section.

B. Muffley thought that in the initial phases it would be good to do in off years then in the future it can feed into future assessment TORs. He said it is important to see what the feedback is and they need to see the follow through to say whether growth at age changes are because of a change in forage. So he felt that getting these incorporated then for TORs is important. K. Drew noted she had not discussed this with the TC but can at the next stock assessment workshop. T. Miller wondered whether this plans on going beyond the simple listing of what they eat, and for now it does not. He also asked whether there was any analysis of function or form or availability of prey to growth rate or abundance. K. Drew said as they go forward there will be those analyses but for now it is just a list of prey and any trends available. T. Miller thought this would not be that big of a task as all this is known, but K. Drew said for some species it is more difficult to quantify such as sand herring. She added that they are going back to trying to get a quantitative handle on how it relates to geography and season and need to feed into ecosystem models. T. Miller said that if the goal is a mechanistic description, then there is a lot that can be done phenomenologically. K. Drew said the group needs to identify what are the steps for getting this information into management and the goals for the data to be presented. T. Miller said it is important to have a game plan and the next step should be to try to look at trends in growth rate and size at age to explore patterns. C. Patterson suggested trying to work with weakfish to see how that works before diving into others. G. Nesslage asked if MSC should task BERP as they are looking into parameterizing feedback. They will not have that done in time for the striped bass summer peer review but they could add in trends for now and will have by region and time of year. Next year they will develop a feedback loop so the striped bass TC should not duplicate their efforts. M. Cieri added that the MSVPA gives trends of food availability which can be correlated with changes in growth by age, season, or region. C. Patterson suggested this could be a special project for seniors to do a literature search. J. O'Hop mentioned that Dave Chagaris is developing an Ecopath model in western Florida for the shelf model and suggested the group look at his work to see how he structured the data.

K. Drew said that they could take what is available now and put that into the striped bass stock assessment but then work on the longer term goals and strategies. The first step is to figure out what is known for all species, step two is phenomenological, and the third step is to bring it into

stock assessments. T. Miller thought it important to look at stockwide consumption as just focusing on diet is not the best way forward. K. Drew said that diet is just the easy first step. G. Nesslage cautioned against just putting diet into stock assessments for people to interpret themselves and maybe it would be better to just put mechanistic in there. T. Miller thought that if it was not used in the stock assessment it should not be put in there or in the FMP and if it is just data in there it does not go far. K. Drew suggested the group revisit the issue of including forage diet in the TORs. They could develop separate documentation and there could be benefit to taking a stepwise approach. P. Campfield noted that the NEFMC had a sea herring forage section and so the focus could be to create a usable outline like that. A student could do the search to accumulate the data then from these small tasks they can move forward. G. Nesslage said they can do striped bass as a proof of concept. J. O'Hop thought this was done in preparation for an ecosystem model and was done to gather information on gut content. B. Muffley said they need to get it to a point to get it to somewhere useful. The diet collection was the easy part and gathering it for the MSVPA. To have the diet is good but they have to show what it means. K. Drew said they can identify data gaps and what is available without having the striped bass TC working on what BERP is doing. M. Armstrong said the group felt they should go ahead with data collection as it does need to be gathered.

- **Update on Biological Ecosystem Reference Points Working Group**

G. Nesslage said that the MSTC and the Menhaden TC were tasked to develop ecological reference points for menhaden and formed a joint subcommittee, BERP. The reason for the task was socioeconomic and working towards ecosystem goals for menhaden. No funds were available to move forward with the decision analysis which BERP recommended. They are now working on a scientific answer to the Board's task and the question they are trying to answer is to use the revamped MSVPA and multispecies statistical catch at age model being developed to see what the minimum amount of menhaden is needed for the minimum predator biomass. They are also looking at the feedback loop between prey and predator. They will work on the age-structured issue for the next few years.

- **Revisit EBFM task from Action Plan**

P. Campfield noted that there are a few tasks in the Action Plan relating to ecosystem-based fisheries management, one of which:

Task 2.6.3 - Develop Commission approach to ecosystem science to support ecosystem-based fisheries management.

There has not been too much interest in developing an approach at the Board level thus far. The Commission has been involved in developing multispecies models and evolving those into ecological reference points. He appreciates MSC feedback on ways to better inform that effort.

J. O'Hop reiterated that Dave Chagaris and Carl Walters presented on their work taking the output of an Ecopath model and ran simulations over 50 years to see how harvest strategies impact various species. He suggested it could be a presentation for MSC or the Policy Board as it is relevant to developing harvest policies. L. Mercer said the Councils are taking different approaches, so perhaps MSC can make a recommendation of what ASMFC would want to take forward, through a bottom up effort. They could review the Council approaches and make concrete recommendations of which ones to take on. P. Campfield said that a hybrid workgroup picked up the task and they could reform that group and work from the recommendations that resulted from the workshop. C. Patterson thought they should proceed in baby steps. G. Nesslage raised the issue of how there would even be an ecosystem based part of ASMFC, how the Board structure would be. B. Muffley added that it is similar to the risk approach, where they were not

ready for a policy. They should first talk about what they are looking for outside of modeling approaches to get to where they make policy decisions. P. Burns suggested a flow chart of how to translate everything to the Board level. J. O'Hop thought it important to say what impact there is on other species. If a lot of guts put into it, then Dave Chagaris may be able to say what would be done. C. Patterson suggested reconvening the EBFM team. P. Campfield said perhaps in February the Board could discuss what has the potential to be used even before they have any products. G. Nesslage reiterated the issue of how it would be implemented at ASMFC even before they decide what they want.

10. Update on telemetry work in Chesapeake Bay and efforts to develop a database of tags
D. Orner gave an update on this work and how NOAA-Chesapeake Bay Office is trying to make this more of a coastal initiative. They installed ten buoys in the Bay for the acoustic telemetry system. In conjunction with ASMFC and VCU, NMFS initiated a pilot system in the James River to monitor sturgeon. They tagged 210 individual sturgeon and 68 over the last two months. They also have tags out on the Migratory Winter Tagging Cruise. In Chesapeake Bay they tag blue catfish. Another project is the Mid-Atlantic Telemetry Observation System which is working with MARCOOS. They have developed a GIS map. Dewayne Fox at Delaware State has developed a web based identification tool as part of the acoustic telemetry project. CBO's next steps are to look for external partners and continue to work with OOS. NERO has a contract with VEMCO for an array in Delaware Bay. J. Gartland asked if they figured out a way to use hull mounted arrays on research vessels. D. Orner asked that information to be sent to M. Paine and she can share with him.

11. Discuss need for an integrated peer review for tautog
P. Campfield said the Tautog TC is exploring the idea of having an IPR for the upcoming assessment. They need to dig up new data to see if it is data poor. One of MSC's roles is to help identify a peer review panel and they will need a subcommittee to help with that effort. T. Miller offered to be the IPR if they wanted, and the thought was that since he was on the last peer review panel, he could provide helpful insight. J. O'Hop asked who is working on stock structure and whether any samples have been solicited for genetic work. Tagging work has been done. M. Armstrong thought tautog does not seem to be data poor but he is not sure at what scale they are assessing it at. T. Miller noted some of the concerns in the last stock assessment were the spatial resolution at the coastal scale. It is the balance of the coastwide stock assessment and then the state by state survey analyses. The fundamental questions are whether they are looking at the appropriate scale. He thought there would be utility in having someone there. P. Campfield added that they are trying to model regionally. The 2009 assessment was just an update.

12. Discuss changes in stocks from increasing water temperature
M. Armstrong said that MSC will be tasked with looking at how stocks may have changed from increasing water temperatures and how that may affect quotas. He said that for example in MA the black sea bass quota is very small and it was set back in the 80's and now they get a lot of black sea bass so they fill the quota in a week. Northern shrimp is disappearing as a fishery and fluke, scup and black sea bass are moving up to ME. The first question to MSC will be is it actually occurring, and then if it is, should they reassess the methodology used decades before this current pattern. This could only apply to state by state quotas which can be reassessed every five years. Another question is if it is affecting science, such as whether the redistribution is within the weighting scheme of a trawl. The variance structure may change. T. Miller said that Janet Nye has done this work (paper in briefing materials) so he said it is definitely going on and he asked whether anyone is going state by state and doing an integrated analysis to compare across states. M. Alexander added that Penny Howell has a paper which looks at the state species

shift. T. Miller asked if the Commission would be happy with allocations based on fishery-independent catch. M. Armstrong said it would be a paradigm shift. They could build some flexibility into the quotas. T. Miller said if it was a transitory pattern that would be alright however it is likely not transitory. M. Armstrong said they could come up with a scheme to reallocate that would be palatable. L. Mercer said MSC could prepare a white paper so they are aware of it. P. Campfield said this task would come up to the Policy Board today. He asked when the coming year specifications are set and thought it was likely too late for 2013. M. Armstrong thought they should not force timelines like that. J. Gartland said the NEAMAP surveys together show spot are very high and surveys need to reevaluate not just management. For example surveys would need to change regions of inclusion for indices. They are seeing inshore/offshore shifts. If they see indices change, maybe they could take longer to leave. M. Armstrong said that the driver will be management but there is also the scientific ramification.

13. Discuss future issues MSC may address

M. Armstrong said MSC could discuss reenergizing their role with the Policy Board. M. Paine read the description of MSC in the TC guidance document to familiarize the group with its purpose.

> The Management and Science Committee (MSC) provides advice concerning fisheries management and the science of coastal marine fisheries to the ISFMP Policy Board. MSC's major duties are to provide oversight to the Commission's Stock Assessment Peer Review Process, review and provide advice on species-specific issues upon request of the ISFMP Policy Board, evaluate and provide guidance to fisheries managers on multispecies and ecosystem issues, and evaluate and provide advice on cross-species issues (e.g., tagging, invasive species and exotics, fish health and protected species issues). The MSC is comprised of one representative from each member state, the NMFS Northeast and Southeast Regions, and the USFWS Regions 4 and 5 who possess scientific as well as management and administrative expertise.

C. Patterson said that they could hold a workshop out of the temperature change and species growth and range change and look at where decisions need to be made. M. Armstrong agreed this was a perfect charge for MSC. L. Mercer added that EBFM was so nebulous that if ASMFC still wants to do that, MSC should take more of a lead since it is one of its charges. Perhaps it could be a large part of the agenda at future meetings and they could focus on a couple of big topics. M. Armstrong said it is one of their charges but they have not gone that far with it. C. Patterson said perhaps the omnibus habitat amendment out of the NEFMC is something the group could look at. J. O'Hop said temperature change is such a big topic that perhaps AFS could sponsor a symposium to look at this. L. Mercer said they are doing research on this in the Gulf of Maine. M. Armstrong pointed out that many state personnel cannot attend AFS.

M. Cieri said that ASC could say how this information would help in the stock assessment process and do the data analyses, then MSC can translate how that percolates up to the Board. For example, how species ranges change over time and how to incorporate those environmental covariants in trawl surveys. M. Armstrong asked if they are at the point now where they can say where to go with EBFM. M. Cieri said the Board is not sure where to go. M. Armstrong said it could help show the effect of harvest strategy on menhaden. M. Cieri said they can look at how food availability can affect growth rates and can do a spatial model to see how the quota is affected on a state by state basis. L. Mercer pointed out that a lot of issues go to species TCs instead of to MSC like in the old days, and there are issues that the group can tackle.

14. Report from MRIP Calibration Workshop

K. Drew reported on the MRIP workshop NMFS held on how to deal with the break in the time series between MRFSS and MRIP. They have recalculated MRFSS data from 2004 forward and so the issue is in how to deal with the split in the time series in stock assessments. ASC endorsed in the report the stock assessment side and how to deal with the data. If the quota is based on MRFSS data they have to compare it on the same scale so they should monitor it with MRFSS and once it goes through an assessment with MRIP, the quota monitoring should be done with MRIP.

ASC wanted MSC to give feedback on endorsing the report and passing it on to the Policy Board or coming up with recommendations on the quota monitoring issue. All numbers have been converted for that time frame and so now there are both MRFSS and MRIP numbers and MSC should provide guidance on which ones to pick. The TCs need to have the standards ahead of time. M. Cieri added that this will impact stock assessments that have not gone through a benchmark since the new estimates have come out. The issue is if allocations are based on MRFSS numbers, in the future how those should be converted and do they need to go back through the time series or another way. State shares may change and they may not be calibrating back to the 80s and 90s so allocations may be based on percentages from a different methodology. K. Drew thought they would try to re-estimate but it is doubtful they would go back farther than 1998. M. Cieri said for example with fluke under the old MRFSS they had 15% and new MRIP could end up with 25%. MSC agreed that what is laid out is good for the short term.

15. Discuss data management issues

- **Design databases for managed species' required data (e.g., annual compliance reports, standardized data for stock assessments)**
- **Web-based data entry system for partners to enter data annually**

C. Patterson said she raised this discussion as a way for MSC to be progressive in tackling issues. She said that since the Commission developed the lobster database then maybe something can be done for each managed species that requires compliance data. It could be an easy way to upload to the database system and would be time saving in the long run. MSC could put this database development in the ACCSP funding cycle. It would be similar to SAFIS and make the stock assessments flow easier. L. Mercer asked how well it was working for lobster as a test case. G. Nesslage is the administrator of the database and she said maintaining the data is a bear and not done annually. She uploads from the warehouse and so one of the questions to consider is who administers the database. She added that these databases are expensive to contract and maintain and there is no Oracle programmer at the Commission. If they go that route, they would need a half time Oracle programmer. The positive is that all the data would be there for every single assessment and one could go back and look at all changes. K. Drew noted that is the high end and compliance reports for striped bass would be the low end. The TC updates it every year for submission. It has catch at age for every year and every state and each state submits a spreadsheet. G. Nesslage thought that getting to the striped bass level of a locked spreadsheet or ACCESS form would be great and then it would be easier to translate to Oracle. K. Drew said they would be archiving code and input data, but they do not want to archive raw data of what was used for the index. They want the raw or index value. C. Patterson agreed the final index data is easier. K. Drew said the downside is that if they want to change something about it and recalculate the index it would be difficult. The point is to shorten the process for everyone and shorten the steps for the stock assessment. It also is to standardize and document data such as a catch at length matrix. They would need to figure out who will maintain and update the database. M. Armstrong raised the issue of continuity. K. Drew said they just started archiving for species.

She added that whatever they decide to do will take time and need modification so it is a long term commitment in terms of funding and staff.

L. Mercer suggested that the module of ACCSP for biological data could be a partial solution and ACCSP could be queried instead of ASMFC. This might not be developed for quite a while. C. Patterson pointed out that long term server space would be needed. M. Armstrong said that if it is not practical to do the lobster database for all species, would it be a waste of time to develop a template for what the TC can fill in. J. O'Hop noted they would need the code that was used to generate the data in addition to the metadata. K. Drew said each state can do their own age/length key and pass on their knowledge. It would be a big step to get to the level that striped bass is for compliance reports. For the future they could discuss something MSC can design for states to submit but it is a big time commitment. G. Nesslage said it is a good idea but how to get there is tricky. K. Drew suggested for the next meeting to look at what states submit for each species for compliance reports and see what is required versus what is missing. The striped bass template is different from state to state, and whatever design would have to be flexible.

16. Other Business
There was no other business.

17. Adjourn
The meeting adjourned at 5:15 p.m.

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

February 13, 2013

To: **ISMFP Policy Board**
From: **Mike Armstrong, Management and Science Committee Chair**
RE: **Climate change, stock distributions, and state quota allocations**

The ISFMP Policy Board charged the Management and Science Committee with investigating whether climate change and warming coastal water temperatures are causing shifts in the geographic distributions of several stocks. And, where shifts are occurring, to reconsider the state-by-state allocation schemes and need for adjustment. The Committee has outlined the following plan to address the charge:

1. Define focal species to investigate, based on state allocation scheme and region

2. Evaluate fishery-independent survey data to examine changes in stock ranges and centers of distribution; also evaluate MRIP and commercial catch data
   - Consider both North/South and inshore/offshore distribution shifts
   - Conduct a literature search for existing documentation of stock distribution shifts

3. Summarize the state of knowledge for focal species, define criteria for a significant stock distribution shift, and demonstrate distribution shifts for stocks where it is occurring.

4. Define the methods for possibly adjusting state-by-state allocations

5. Define the frequency for re-evaluating stock distribution changes and allocations

6. Task Technical Committees to re-evaluate stock distributions periodically

7. For stocks where redistribution has been demonstrated, evaluate scientific ramifications:
   - For fishery-independent survey data applications, evaluate the weighting scheme of trawl stations (and other sampling gears), area designations, etc. and the effects on index calculations
   - Evaluate the ecological costs of longer migration pathways that lower production, especially for mid-Atlantic estuarine-dependent stocks

Proposed initial focal species are black sea bass, scup, and summer flounder in the Mid-Atlantic, lobster and Northern shrimp in New England, and red drum and spot in the South Atlantic. However, after the literature search, MSC may pare down the number of species to ensure thorough and quality research that will lead to better evaluations and recommendations from the Committee within the proposed timeline.

Timeline:

	2013										2014				
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Form MSC subcommittee; begin work on steps 1, 2, 3	X	X	X												
Subcommittee report to MSC			X					X							X
Continue work on steps 1, 2, 3; begin work on steps 4 and 5			X	X	X	X	X	X							
MSC initial report to Policy Board								X							
Complete steps 1- 5, based on Board feedback and with TC consultation; draft conclusions and recommendations								X	X	X	X	X	X	X	
Subcommittee investigate step 7												X	X	X	
MSC final report to Policy Board, consider new allocations for implementation in 2015															X

MRFSS/MRIP Calibration Workshop
Ad-hoc Working Group Report

May 16, 2012

Ron Salz (Chair) – NOAA Fisheries, ST1
Tim Miller – NOAA Fisheries, NEFSC
Erik Williams – NOAA Fisheries, SEFSC
John Walter – NOAA Fisheries, SEFSC
Katie Drew – ASMFC
Greg Bray - GSMFC

One outcome of the MRFSS/MRIP Calibration Workshop was the formation of an ad-hoc working group charged with the following: 1) Establish a priority list in each region for which species assessments should be updated to incorporate the new MRIP-derived catch estimates; and, 2) Provide a technical approach (or approaches) to hind-casting and forecasting catch estimates, including examples. The ad-hoc working group included representatives from the NEFSC, SEFSC, GSMFC, ASMFC, and S&T Headquarters.

Species Prioritization

At the workshop participants discussed how priorities for conducting updated and benchmark assessments might be changed based on the results of re-estimation of 2004 to 2011 recreational catches for managed species. Although benchmark and updated assessment schedules are already set for 2012 and 2013, decisions have to be made on how to prioritize future assessments that will use the new MRIP numbers. The ad-hoc committee was asked to develop a metric that could be used to rank species based on the potential impact the switch from MRFSS to MRIP estimates could have on assessment outcomes. The metric was based on criteria related to the magnitude and significance of differences between MRFSS and MRIP catch estimates and the relative importance of the recreational catch time series in the overall assessment model. It was noted during the workshop that many other criteria, unrelated to the re-estimation of MRFSS numbers, will likely also affect scheduling species for updated and benchmark assessments (e.g., socio-economic importance, stock status, and political considerations). Nevertheless, workshop participants did see value in having an objective and understandable set of recreational data metrics that could be used as part of the stock assessment prioritization process.

Six criteria were used to rank species:

1. Total MRIP A and B1 in numbers
2. Mean percent difference between MRFSS and MRIP AB1 numbers calculated as:

$$100 * \frac{1}{n}\sum_{i=1}^{n} \frac{(\text{MRFSS AB1}_i - \text{MRIP AB1}_i)}{\text{MRFSS AB1}_i}$$

3. Mean percent difference between MRFSS and MRIP B2 numbers calculated as:

$$100 * \frac{1}{n}\sum_{i=1}^{n} \frac{(\text{MRFSS B2}_i - \text{MRIP B2}_i)}{\text{MRFSS B2}_i}$$

4. Fraction of discards to total catch

$$100 * \frac{1}{n}\sum_{i=1}^{n} \frac{\text{MRFSS B2}_i}{(\text{MRFSS AB1}_i + \text{MRFSS B2}_i)}$$

5. Multiple R^2 (Pearson correlation squared) between the annual MRIP AB1 and MRFSS AB1 values calculated from a linear regression of one versus the other or, equivalently:

$$\text{corr}(\text{MRFSS AB1}_{i,..n}, \text{MRIP AB1}_{i,...n})^2$$

6. Percent of total landings attributed to the recreational sector

The six criteria were chosen to represent a combination of factors that would be important in prioritization of species. First the total A plus B1 numbers give an idea of the magnitude of the recreational fishing mortality associated with landings. Next the percent difference between both AB1 and B2 (released alive) numbers provide an idea of the average difference between MRFSS and MRIP estimates; while noting that the average can be low if positive and negative differences cancel each other out. The fraction of discards provides a measure of the importance of discards which can be quite influential in many assessments. The correlation between the annual AB1 numbers provides an estimate of how well the estimates track each other, noting that the estimates could differ in magnitude but might still have the same trend. Finally, the percent of landings attributed to the recreational sector provide an idea of how influential the recreational landings may be in the assessment model, compared to commercial landings, and how sensitive the results may be to changes in recreational inputs.

For each of the six criterion species were initially assigned categorical ranks ranging from one through the total number of species. For example, 16 species were compared for Northeast region with one representing the lowest priority species for that criterion and 16 the highest priority. Ranks were then scaled back to a 10 point scale to provide relative ranks which could be compared across regions as follows:

Rank 10-point scale = 10 * Initial Rank/Number of Species

The overall priority rank score was calculated as the average of the categorical ranks across the six criteria. Tables 1, 2 and 3 give rankings for the Northeast, South Atlantic and Gulf of Mexico species, respectively. It should be noted that regional separations were based upon MRIP subregions (Northeast

= 4 & 5, South Atlantic = 6, and Gulf of Mexico = 7) which do not necessarily reflect the regional partitions used in all stock assessments.

Table 1. Metrics and rankings for Northeast species prioritization based on projected impact of changes in recreational time series data on stock assessments.

Northeast Region	MRIP AB1 (Number of Fish) Sum 2004-2011		Mean % Difference AB1 Catch		Mean % Difference B2 Catch		Relative Importance of Discards (B2 catch)		R2 Correlation Coefficient MRFSS and MRIP AB1		Avg % Recreational Landings (2004 - 2011)		Overall Priority Rank (higher values indicate greater priority)
Species	Value (1,000s)	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	
tautog	6,508	4.4	0.083	5.6	0.085	6.9	0.092	7.5	0.883	7.5	91%	10.0	**7.0**
scup	28,205	7.5	-0.157	9.4	-0.136	9.4	0.076	3.8	0.818	6.9	32%	4.4	**6.9**
spot	69,387	8.8	0.096	6.9	0.042	5.0	0.043	0.6	0.982	9.4	43%	5.6	**6.0**
spotted seatrout	104,875	10.0	-0.022	2.5	-0.024	3.1	0.080	4.4	0.770	5.0	87%	8.8	**5.6**
striped bass	18,350	5.6	-0.060	4.4	0.011	0.6	0.108	8.8	0.802	6.3	80%	8.1	**5.6**
weakfish	4,268	3.8	0.089	6.3	-0.014	1.9	0.090	6.9	0.991	10.0	41%	5.0	**5.6**
bluefish	52,848	8.1	0.020	1.9	0.011	1.3	0.081	5.0	0.956	8.1	71%	7.5	**5.3**
red drum	26,154	6.9	0.012	1.3	-0.041	4.4	0.089	6.3	0.748	3.8	89%	9.4	**5.3**
atlantic cod	2,908	3.1	0.242	10.0	0.313	10.0	0.086	5.6	0.516	0.6	18%	2.5	**5.3**
summer flounder	482	1.3	0.048	3.8	0.098	7.5	0.119	9.4	0.732	3.1	45%	6.3	**5.2**
atlantic croaker	82,482	9.4	-0.036	3.1	-0.048	5.6	0.074	3.1	0.796	5.6	26%	3.1	**5.0**
spiny dogfish	156	0.6	0.107	7.5	0.103	8.1	0.122	10.0	0.588	1.3	3%	0.6	**4.7**
pollock	1,348	1.9	0.121	8.1	0.064	6.3	0.054	1.3	0.968	8.8	8%	1.9	**4.7**
black sea bass	14,738	5.0	0.008	0.6	0.036	3.8	0.105	8.1	0.595	1.9	51%	6.9	**4.4**
winter flounder	1,736	2.5	0.148	8.8	0.129	8.8	0.055	1.9	0.611	2.5	5%	1.3	**4.3**
spanish mackerel	20,804	6.3	0.077	5.0	0.020	2.5	0.061	2.5	0.757	4.4	30%	3.8	**4.1**

Table 2. Metrics and rankings for South Atlantic species prioritization based on projected impact of changes in recreational time series data on stock assessments.

South Atlantic Region	MRIP AB1 (Number of Fish) Sum 2004-2011		Mean % Difference AB1 Catch		Mean % Difference B2 Catch		Relative Importance of Discards (B2 catch)		R2 Correlation Coefficient MRFSS and MRIP AB1		Avg % Recreational Landings (2004 - 2011)		Overall Priority Rank (higher values indicate greater priority)
Species	Value (1,000s)	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	
red snapper	313	3.6	0.185	8.6	0.123	6.8	0.102	9.5	0.978	8.6	74%	7.7	**7.5**
gray snapper	2,781	7.3	0.164	8.2	0.071	3.6	0.097	7.7	0.986	9.1	71%	6.8	**7.1**
mutton snapper	940	5.0	0.055	4.1	0.127	7.3	0.073	6.8	0.971	8.2	78%	8.2	**6.6**
black sea bass	4,023	8.2	0.083	5.0	0.074	4.1	0.104	10.0	0.958	7.7	36%	2.3	**6.2**
sheepshead	4,599	8.6	0.119	6.4	0.082	4.5	0.055	3.6	0.851	4.5	81%	8.6	**6.1**
wahoo	340	4.1	-0.088	5.5	-0.320	9.5	0.008	0.5	0.947	6.4	95%	9.1	**5.8**
blue runner	5,581	9.1	0.049	3.2	0.070	3.2	0.065	5.5	0.894	5.5	72%	7.3	**5.6**
red porgy	297	3.2	-0.288	9.1	-0.525	10.0	0.055	4.1	0.840	4.1	37%	2.7	**5.5**
red grouper	383	4.5	-0.369	10.0	0.028	0.9	0.087	7.3	0.900	5.9	40%	4.1	**5.5**
cero	132	1.8	0.162	7.7	-0.090	5.0	0.026	1.4	0.955	7.3	100%	9.5	**5.5**
yellow jack	60	0.9	0.123	7.3	0.052	2.3	0.049	2.7	0.988	10.0	100%	9.5	**5.5**
black grouper	29	0.5	-0.119	6.8	0.162	8.2	0.098	8.2	0.430	0.5	69%	6.4	**5.1**
greater amberjack	264	2.3	0.039	2.3	0.093	5.5	0.065	5.9	0.949	6.8	64%	5.5	**4.7**
gray triggerfish	1,072	5.5	0.045	2.7	0.095	5.9	0.066	6.4	0.748	1.8	58%	5.0	**4.5**
scamp	124	1.4	-0.319	9.5	-0.216	9.1	0.051	3.2	0.760	2.3	27%	1.4	**4.5**
spanish mackerel	7,741	10.0	0.103	5.9	0.069	2.7	0.044	2.3	0.839	3.6	34%	1.8	**4.4**
yellowtail snapper	2,005	6.4	-0.054	3.6	-0.129	7.7	0.064	5.0	0.825	2.7	16%	0.9	**4.4**
crevalle jack	2,596	6.8	-0.030	1.8	0.050	1.8	0.099	8.6	0.531	0.9	67%	5.9	**4.3**
vermilion snapper	1,303	5.9	0.067	4.5	0.099	6.4	0.057	4.5	0.651	1.4	38%	3.2	**4.3**
king mackerel	3,435	7.7	0.013	0.5	-0.032	1.4	0.034	1.8	0.987	9.5	52%	4.5	**4.2**
dolphin	7,454	9.5	0.026	0.9	-0.187	8.6	0.019	0.9	0.882	5.0	14%	0.5	**4.2**
gag	266	2.7	-0.027	1.4	0.004	0.5	0.099	9.1	0.832	3.2	38%	3.2	**3.3**

Table 3. Metrics and rankings for the Gulf of Mexico species prioritization based on projected impact of changes in recreational time series data on stock assessments.

Gulf of Mexico Region	MRIP AB1 (Number of Fish) Sum 2004-2011		Mean % Difference AB1 Catch		Mean % Difference B2 Catch		Relative Importance of Discards (B2 catch)		R2 Correlation Coefficient MRFSS and MRIP AB1		Avg % Recreational Landings (2004 - 2011)		Overall Priority Rank (higher values indicate greater priority)
Species	Value (1,000s)	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	
gray snapper	8,189	9.4	-0.088	5.0	-0.047	3.1	0.099	8.8	0.904	6.9	91%	8.8	**7.0**
gray triggerfish	1,824	5.6	-0.105	6.3	-0.306	7.5	0.049	3.1	0.978	9.4	96%	9.4	**6.9**
greater amberjack	615	3.8	-0.111	6.9	-0.212	6.9	0.089	6.3	0.905	7.5	73%	6.9	**6.4**
mutton snapper	238	2.5	-0.398	8.1	-0.851	10.0	0.069	4.4	0.865	5.6	78%	7.5	**6.4**
red grouper	1,651	5.0	-0.118	7.5	0.025	2.5	0.115	10.0	0.983	10.0	20%	1.9	**6.1**
gag	2,862	7.5	-0.055	3.8	0.013	1.9	0.111	9.4	0.968	8.8	69%	5.6	**6.1**
red snapper	6,629	8.8	-0.046	2.5	-0.100	4.4	0.090	6.9	0.957	8.1	65%	5.0	**5.9**
cero	211	1.3	-0.466	10.0	-0.540	8.8	0.022	1.3	0.809	3.8	100%	10.0	**5.8**
bluefish	1,588	4.4	0.092	5.6	0.119	5.0	0.096	8.1	0.815	4.4	63%	4.4	**5.3**
black grouper	93	0.6	-0.453	9.4	-0.508	8.1	0.096	7.5	0.652	1.9	60%	3.8	**5.2**
dolphin	2,525	6.9	-0.415	8.8	-0.646	9.4	0.033	1.9	0.562	1.3	14%	0.6	**4.8**
spanish mackerel	12,780	10.0	0.055	4.4	0.003	0.6	0.069	3.8	0.714	2.5	69%	5.6	**4.5**
cobia	298	3.1	0.047	3.1	0.062	3.8	0.081	5.6	0.763	3.1	90%	8.1	**4.5**
vermilion snapper	2,937	8.1	-0.004	0.6	-0.176	5.6	0.020	0.6	0.831	5.0	14%	0.6	**3.4**
king mackerel	2,355	6.3	0.010	1.3	-0.003	1.3	0.047	2.5	0.895	6.3	41%	3.1	**3.4**
scamp	229	1.9	-0.026	1.9	0.204	6.3	0.080	5.0	0.534	0.6	28%	2.5	**3.0**

Technical Calibration Approach

Workshop participants recognized the importance of strong, clear guidelines regarding calibration methods and how and when the methods should be used. Stock assessment scientists do not want to be in the position of developing ad hoc calibration methods on a species-by-species and region-by-region basis. While more sophisticated and time-consuming calibration approaches were discussed, workshop participants reached consensus that, prior to 2004 (or whichever year is the first year for which direct re-estimates are available, since ST is still working on re-estimation for years prior to 2004), hind-casted catch data should use a straight-forward ratio estimator (i.e., MRFSS/MRIP), either constant throughout time hind-casted time series or trended based on ancillary information. A MRFSS/MRIP ratio estimator was also suggested to approximate adjusted variances associated with the revised catch estimates.

Use of a ratio estimator approach for calibrating from MFRSS to MRIP should not preclude development of more extensive species-specific approaches as warranted. However, for many assessed species the use of a simple ratio estimator may be sufficient considering the relatively small differences found between MRFSS and MRIP numbers, and more importantly the anticipated small impact the revised recreational time series will have on assessment outcomes. The reliability and confidence in using a ratio estimator will increase considerably as more years of re-estimated MRIP numbers become available. At present, only eight years of side-by-side MRFSS-MRIP estimates (2004-2011) are available to develop ratio estimators that for some species will be applied to 23 years of data (1981-2003). ST is currently working on revised estimates for 1998-2003 and may eventually go back even further depending on the availability and quality of original data sources.

The ad-hoc working group recommends the ratio estimator be based on the “ratio of means” (across all comparison years included) rather than based on the “mean of ratios” for individual years. Based on sampling theory, the ratio of means should be less biased and more stable than the "mean of ratios" (Cochran 1977)and it also represents the least-squares estimator for a slope in a zero-intercept model when the variance of y (the MRIP estimate in this case) is proportional to x (the MRFSS estimates in this case). The estimate of the calibration factor that is a ratio of mean catches is calculated as:

Formula A

$$\hat{R}_{RM} = \frac{\bar{C}_{\text{MRIP}}}{\bar{C}_{\text{MRFSS}}} = \frac{\sum_{y=1}^{n} \hat{C}_{y,\text{MRIP}}}{\sum_{y=1}^{n} \hat{C}_{y,\text{MRFSS}}}$$

Calibrated catch estimates for 1982-2003 are then calculated as:

Formula B

$$\hat{C}_{y,\hat{R}} = \hat{R}\hat{C}_{y,MRFSS}$$

The same formulas can also be applied for calibrating variances associated with MRFSS catch estimates.

Variances of the adjusted catch estimates should include two components: 1) calibrated variance of the catch estimate, and 2) variance associated with the ratio estimator used for calibrating the catch estimate. The variance estimator for the ratio of means derived from the formula above can be approximated as:

Formula C

$$\hat{V}\left(\hat{R}_{RM}\right) = \hat{R}_{RM}^2 \left[\frac{\hat{V}\left(\bar{C}_{MRIP}\right)}{\bar{C}_{MRIP}^2} + \frac{\hat{V}\left(\bar{C}_{MRFS}\right)}{\bar{C}_{MRFS}^2} - 2\frac{\hat{C}ov\left(\bar{C}_{MRFS}, \bar{C}_{MRIP}\right)}{\bar{C}_{MRFS}\bar{C}_{MRIP}} \right]$$

Where

$$\hat{V}\left(\bar{C}\right) = \frac{1}{n} \frac{\sum_{y=1}^{n} \left(\hat{C}_y - \bar{C}\right)^2}{n-1}$$

An estimate of the variance of the calibrated estimate of catch that accounts for uncertainty in the estimate of the calibration factor is calculated as:

Formula D

$$\hat{V}\left(\hat{C}_{y,\hat{R}}\right) = \hat{C}_{y,MRFSS}^2 \hat{V}\left(\hat{R}\right) + \hat{R}^2 \hat{V}\left(\hat{C}_{y,MRFSS}\right) - \hat{V}\left(\hat{R}\right)\hat{V}\left(\hat{C}_{y,MRFSS}\right)$$

This assumes the estimate of the ratio is independent of the estimate of the catch that is to be calibrated. The variances of the catches in the above equation, $\hat{V}\left(\hat{C}_{y,MRFSS}\right)$ are the values after being calibrated.

Ratio Estimator Approach Example – Summer Flounder

To show an example of the approach suggested above we will hind-casted summer flounder landings numbers (A+B1) estimates and variances for 2003 based on a comparison of 2004-2011 MRFSS and MRIP estimates. Table 4 shows summer flounder AB1 numbers estimates and associated variances for the eight years of MRFSS and MRIP side-by-side estimates.

Table 4. Virginia through Maine MRFSS and MRIP 2004-2011 summer flounder AB1 numbers estimates, variances, variance of means, and co-variances of means.

Year	MRFSS AB1 Numbers (in 1,000s)	MRFSS Variance (in 1,000s)	MRIP AB1 Numbers (in 1,000s)	MRIP Variance (in 1,000s)
2004	4,557	33,226	4,316	67,076
2005	4,110	42,230	4,028	58,396
2006	4,052	41,047	3,951	76,508
2007	3,393	18,420	3,109	34,795
2008	2,295	13,168	2,350	44,728
2009	1,910	9,120	1,807	16,001
2010	1,484	10,791	1,502	14,433
2011	1,782	25,722	1,830	21,439
Mean 2004-2011	2,948	24,215	2,862	41,672
Variance of the Mean	185,048	22,410,864	160,925	71,527,726
Co-variance of MRFSS and MRIP Means			150,486	28,832,853

Using the "ratio of means" approach (Formula A) the ratio estimator for landings numbers is calculated as:

= 2,862 / 2,948 = 0.970756

When this ratio is applied to the MRFSS 2003 estimate of 4,559 (X 1,000) the calibrated MRIP estimate is 4,425.7 (X 1,000).

Similarly, the ratio estimator for the landings estimate variance is calculated as:

= 41,672 / 24,215 = 1.7209

When this ratio is applied to the MRFSS 2003 variance of 33,255.2 (X 1,000) the calibrated MRIP variance is 57,228.4 (X 1,000).

The next step is to calculate the variance and PSE associated with the ratio estimator.
Using the Formula C provided above, the variance is approximated as:

= 0.9708^2 * (185,048 / 2,948^2 + 160,925 / 2,862^2 – 2 * 150,486 / (2,948 / 2,862))
= 0.004964

The PSE is calculated as:

= 100 * Sqrt (Variance) / (Mean)
= 100 * Sqrt (0.004964) / (0.9708)
= 7.3 %

Finally we calculate the variance and PSE associated with the calibrated landings estimates for each year (Formula D) as:

= (4,559^2 * 0.004964) + (0.9708^2 * 57,228.4) – (0.004964 * 57,228)
= 156,821.9

The PSE for the calibrated estimate is calculated as:

= 100 * Sqrt (Variance) / (Mean)
= 100 * Sqrt (156,821.9) / (4,425.7)

= 8.95 %

Table 5. Original MRFSS AB1 landings estimates, variances and PSEs alongside hind-casted MRIP AB1 landings estimates, variances, and PSEs for summer flounder from 1982-2003.

Year	MRFSS AB1 Numbers of Fish (in 1,000s)	MRFSS Variance (in 1,000s)	MRFSS PSEs	MRFSS AB1 Numbers (in 1,000s) with Ratio Adjustment	MRFSS Variance (in 1,000s) with Ratio Adjustment	Adjusted Variance with Ratio Estimator Variance Factor	Adjusted PSE with Ratio Estimator Variance Factor
1982	15,473	16,184,368	26	15,021	27,851,679	27,296,703	34.8
1983	20,996	2,160,077	7	20,383	3,717,276	5,672,877	11.7
1984	17,475	1,954,404	8	16,965	3,363,334	4,668,685	12.7
1985	11,066	1,763,372	12	10,743	3,034,586	3,452,504	17.3
1986	11,621	661,733	7	11,282	1,138,777	1,737,870	11.7
1987	7,865	154,646	5	7,635	266,130	556,535	9.8
1988	9,960	158,723	4	9,669	273,146	748,484	8.9
1989	1,717	10,613	6	1,667	18,264	31,755	10.7
1990	3,794	23,031	4	3,683	39,634	108,607	8.9
1991	6,068	58,913	4	5,891	101,383	277,815	8.9
1992	5,002	40,032	4	4,856	68,891	188,778	8.9
1993	6,494	67,475	4	6,304	116,118	318,192	8.9
1994	6,703	71,888	4	6,507	123,713	339,002	8.9
1995	3,326	17,700	4	3,229	30,459	83,466	8.9
1996	6,997	44,062	3	6,793	75,827	314,108	8.3
1997	7,167	82,185	4	6,958	141,433	387,560	8.9
1998	6,979	77,930	4	6,775	134,110	367,494	8.9
1999	4,107	26,988	4	3,987	46,444	127,266	8.9
2000	7,801	54,770	3	7,573	94,254	390,441	8.3
2001	5,294	44,842	4	5,139	77,169	211,462	8.9
2002	3,262	17,025	4	3,167	29,298	80,285	8.9
2003	4,559	33,255	4	4,426	57,229	156,821	8.9

Guidelines for Applying Ratio Estimator Approach

The ad-hoc working group recommends the following generally guidelines for applying a ratio estimator to calibrate recreational catch and variance estimates. These guidelines may not apply, or be practical, in all cases as the impact of changes in the recreational time series data will vary by assessment or particular management need:

- Ratio estimators should be calculated using stock level aggregate data to the extent possible. Caution should be used when calculating ratio estimates at finer geographic levels or by fishing mode.
- Ratio estimators can be based on either estimated numbers of fish or weights depending on which units are used directly in the assessment model. The exception may be if ratios based on weights appear unstable due to small sample sizes of weighed fish. In such cases it may be better to calculate a ratio estimator based on numbers and apply it to the weights.
- To the extent practicable, all years for which both MRFSS and MRIP estimates are available should be used to calculate ratios. If one or two years have ratios that are different enough from the other years so as to noticeably impact the overall ratio of means, a balanced trimmed mean approach which removes both the highest and lowest ratios is preferred over simply removing just the highest or lowest year.
- Trended ratio estimators are generally not recommended at present since only eight years are available for comparison. The basic ratio estimator itself could behave poorly with very few years of paired MRFSS and MRIP observations. As additional years of side-by-side estimates are made available bias in the ratio estimator will become negligible and it may be possible to develop trended ratio estimators that better reflect different MRFSS/MRIP ratios at different parts of the time series.
- It is recommended that stock assessment scientists conduct sensitivity analyses of the hind-casted recreational catch estimates (e.g., varying them by 5, 10, 20%) and length frequencies, as available, in order to gauge the overall impact of changes in the estimates on biological reference points. If the assessment results are sensitive to changes in the recreational time series there may be justification for developing more sophisticated models for hind-casting estimates than the ratio estimator approach suggested here.
- The ad-hoc working group did not fully evaluate a ratio estimator approach for calibrating length

frequencies as data were not available at the time of this report. The group did come up with two possible options but also recognized that other options may exist: 1) Adjust the numbers at length using the same ratio as used for total numbers, or 2) Estimate length-class specific ratios and adjust by length class, then sum the adjusted length classes for an alternative adjusted total number.

References

Cochran, W. G. 1977. Sampling techniques. Third Edition. Wiley and Sons. New York.

Special Report No. _ _ of the

Atlantic States Marine Fisheries Commission

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management

2013

Atlantic States Marine Fisheries Commission

Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management

Prepared by

Jeff Kipp
Stock Assessment Scientist

Melissa Paine
Scientific Committee Coordinator

with the
Management and Science Committee

Acknowledgments

The Atlantic States Marine Fisheries Commission (Commission) would like to thank all state, federal, and academia representatives who contributed to the completion of this document. Identification and prioritization of research needs was provided by members of various Commission committees, including species stock assessment subcommittees, technical committees, advisory committees, plan development and review teams, and management boards. Input was also provided by the Commission's Habitat Committee, Committee on Economics and Social Sciences, and Management and Science Committee. The research topics listed in this publication are consistent with those developed by the National Marine Fisheries Service Northeast Fisheries Science Center for organization and classification of Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC) research recommendations. The Commission extends its appreciation to the members of the Management and Science Committee for providing oversight to the effort to identify and prioritize Commission research needs.

Table of Contents

Acknowledgements……..iii
Table of Contents……...……...…iv
Introduction……...v
List of Abbreviations and Acronyms……...……...…iv
Research Priorities by Species / Species Complex
American Eel……..9
American Lobster…….….13
American Shad / River Herring……14
Atlantic Croaker……....18
Atlantic Menhaden……...…….19
Atlantic Sea Herring…….....23
Atlantic Striped Bass…….25
Atlantic Sturgeon……..28
Black Drum……...31
Black Sea Bass…….…32
Bluefish…….....34
Costal Sharks…….....35
Horseshoe Crab…….…38
Northern Shrimp…….....40
Red Drum…….....43
Scup……...45
Spanish Mackerel……..46
Spiny Dogfish……...48
Spot……...49
Spotted Seatrout……....50
Summer Flounder……..51
Tautog……...54
Weakfish……...55
Winter Flounder……....57
Common Research Recommendations for All ASMFC Managed Diadromous Species ……...……...…62
Common Socioeconomic Research Recommendations for All ASMFC Managed Species ……....66

Introduction

Research priorities listed in this document were identified from Atlantic States Marine Fisheries Commission (Commission) fishery management plans and amendments, annual plan reviews, special reports conducted by the Commission on species technical and stock assessment issues, Commission external peer reviews, and Stock Assessment Workshop (SAW) documents by the Stock Assessment Review Committee (SARC, 1996-2012) in the Northeast US and SouthEast Data, Assessment, and Review (SEDAR, 2002-2012) process in the Southeast US in collaboration with the National Marine Fisheries Service. This publication is an update of Special Report #88 *Prioritized Research Needs in Support of Interjurisdictional Fisheries Management* published by the Commission in August 2008. Updates are periodically published via the Commission's website at www.asmfc.org.

Research priorities were prioritized by Commission stock assessment subcommittees and technical committees under the purview of the Plan Development/Review Teams. Additional input to priorities is provided periodically by Advisory Committees, Management Boards, the Habitat Committee, the Committee on Economics and Social Sciences, and the Management and Science Committee. The research priorities in this document should not supplant any prioritization conducted by Commission technical committees or management boards on an annual basis, or in any way hinder the management process.

It is the intent of the Commission to periodically update this document as research priorities are either met or as new research needs are identified. Research priorities that have been met since previous publications of this document have been moved to a separate section for each species and appropriate references have been included. The overall purpose of this document is to encourage state, federal, and university research programs to develop projects to meet the research priorities of Commission-managed species and thereby improve the overall management of these fisheries. It is also hoped that state, federal, and non-profit organizations will utilize this document in prioritization of research projects for future funding programs.

Abbreviations and Acronyms

ACCSP	Atlantic Coastal Cooperative Statistics Program
ASMFC	Atlantic States Marine Fisheries Commission
ASPIC	A Stock Production Model Incorporating Covariates
ASPM	age structured production model
BMP	best management practice
BRD	Bycatch Reduction Device
CAA	Catch-at-Age Analysis
CFD	computer fluid dynamics
CPUE	catch-per-unit-effort
CSA	Collie-Sissenwine Analysis; also Catch Survey Analysis
DFO	Department of Fisheries and Oceans (Canada)
DO	dissolved oxygen
EFH	Essential Fish Habitat
F	instantaneous fishing mortality rate
FERC	Federal Energy Regulatory Commission
FMP	Fishery Management Plan
GIS	Geographic Information Systems
GLM	generalized linear model
GLOBEC	Global Ocean Ecosystems Dynamics
GPS	Global Positioning System
HAPC	habitat areas of particular concern
IPN	infectious pancreatic necrosis
LPUE	landings-per-unit-effort
M	instantaneous natural mortality rate
MARMAP	Marine Resources, Monitoring, Assessment, and Prediction
MCMC	Markov chain Monte Carlo
MEDMR	Maine Department of Marine Resources
MRFSS	Marine Recreational Fishing Statistical Survey
MRIP	Marine Recreational Information Program
MSE	Management Strategy Evaluation
MSVPA	multispecies virtual population analysis
MSY	maximum sustainable yield
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFSC	Northeast Fisheries Science Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCC	Northeast Regional Coordinating Council
PCB	polychlorinated biphenyl
PIT	passive integrated transponder
PRFC	Potomac River Fisheries Commission
SARC	Stock Assessment Review Committee
SCA	statistical catch-at-age
SCDNR	South Carolina Department of Natural Resources

SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	SouthEast Data, Assessment, and Review
SS	Stock Synthesis
SSB	spawning stock biomass
TAL	total allowable landings
TIP	Trip Interview Program
TOR	Terms of Reference
TRAC	Transboundary Resources Assessment Committee
USFWS	United States Fish and Wildlife Service
VPA	virtual population analysis
VT	Virginia Tech University
VTR	Vessel Trip Reporting
YOY	young-of-the-year
YPR	yield-per-recruit

Research Priorities by Species / Species Complex

AMERICAN EEL

Fishery-Dependent Priorities

High

- Monitor catch and effort in bait fisheries (commercial and personal-use) and in personal-use fisheries that are not currently covered by MRIP or commercial fisheries monitoring programs.
- Improve knowledge of the proportion of the American eel population and the fisheries occurring south of the US that may affect the US portion of the stock.
- Require standardized reporting of trip-level landings and effort data for all states in inland waters. Data should be collected using the ACCSP standards for collection of catch and effort data (ACCSP 2004).
- Compare buyer reports to reported state landings.

Moderate

- Collect site specific information on the recreational harvest of American eel in inland waters, potentially through expansion of MRIP to riverine/inland areas.
- Monitor discards in targeted and non-targeted fisheries.
- Require states to collect fishery-dependent biological information by life stage, potentially through collaborative monitoring and research programs with dealers. Samples should be collected from gear types that target each life stage.[1]
- Review the historical participation level of subsistence fishers and relevant issues brought forth with respect to those subsistence fishers involved with American eel to provide information on the changing exploitation of American eels.
- Investigate American eel harvest and resource by subsistence harvesters (e.g., Native American tribes, Asian and European ethnic groups).

Fishery-Independent Priorities

High

- Maintain and update the list of fishery-independent surveys that have caught American eels and note the appropriate contact person for each survey.
- Request that states record the number of eels caught by fishery-independent surveys. Recommend states collect biological information by life stage including length, weight, age, and sex of eels caught in fishery-independent sampling programs; at a minimum, length samples should be routinely collected from fishery-independent surveys.
- Encourage states to implement surveys that directly target and measure abundance of yellow and silver stage American eels, especially in states where few targeted eel surveys are conducted.
- Develop a coastwide sampling program for yellow and silver stage American eels using standardized and statistically robust methodologies.

[1] SASC is developing a draft protocol for sampling fisheries.

- Continue the ASMFC-mandated YOY surveys; these surveys could be particularly valuable as an early warning signal of recruitment failure. Standardize sampling across all surveys. Develop proceedings document for the 2006 ASMFC YOY Survey Workshop. Follow-up on decisions and recommendations made at the workshop.

Moderate

- Develop standardized sampling gear, habitat, and ageing methods and conduct intensive age and growth studies at regional index sites to support development of reference points and estimates of exploitation.

Modeling / Quantitative Priorities

High

- Perform periodic stock assessments (every 5-7 years) and establish sustainable reference points for American eel required to develop a sustainable harvest rate in addition to determining whether the population is stable, decreasing, or increasing. Investigate if a longer time interval (8-10 years) between assessments will improve population trend estimates. Longer time periods may better reflect eel generation time.

Moderate

- Develop new assessment models (e.g., delay-difference model) specific to eel life history and fit to available indices.
- Develop GIS-type model incorporating habitat type, abundance, contamination, and other environmental factors.

Life History, Biological, and Habitat Priorities

High

- Monitor non-harvest losses due to barriers such as impingement, entrainment, spill, and hydropower turbine mortality.
- Develop, investigate, and improve technologies for upstream and downstream American eel passage at various barriers for each life stage. Identify effective low-cost alternatives to traditional passage designs. Develop design standards for upstream passage devices.[2]
- Evaluate the impact, both upstream and downstream, of barriers to eel movement with respect to population and distribution effects. Determine relative contribution of historic loss of habitat to potential eel population and reproductive capacity.
- Implement large-scale (coastwide or regional) tagging studies of eels at different life stages to determine growth, passage mortality, movement and migration, validated ageing methods, reporting rates, and tag shredding/tag attrition rates.[3]
- Identify the mechanism driving sexual determination and the potential management implications.
- Identify spatially explicit, sex specific, triggering mechanism for metamorphosis to mature adult and silver eel life stage, with specific emphasis on the size and age at onset of maturity. A maturity schedule (proportion mature by size or age) would be extremely useful in combination with migration rates.

[2] An ASMFC Eel Passage Workshop occurred in 2011 reviewing details on passage design.

[3] Current tagging studies are ongoing in the St. Lawrence River system. A tagging study to examine local and regional movement has been completed by a graduate student at Delaware State University.

- Improve understanding of the effects of contaminants on fecundity, natural mortality, and overall health (non-lethal population stressors). Research the effects of bioaccumulation with respect to impacts on survival and growth by age and effect on maturation and reproductive success.[4]
- Conduct research on the prevalence, incidence of infection, and effects of the swim bladder parasite *Anguillicola crassus* on American eel growth and maturation, migration to the Sargasso Sea, and spawning potential. Investigate the impact of the introduction of *A. crassus* into areas that are presently free of the parasite.

Moderate

- Recommend monitoring of upstream and downstream movement at migratory barriers that are efficient at passing eels (e.g., fish ladder/lift counts). Data that should be collected include presence/absence, abundance, and biological information. Provide standardized protocols for monitoring eels at passage facilities, coordinate compilation of these data, and provide guidance on the need and purpose of site-specific monitoring.
- Evaluate eel impingement and entrainment at facilities with NPDES authorization for large water withdrawals. Quantify regional mortality and determine if indices of abundance could be established at specific facilities.
- Assess available drainage area over time to account for temporal changes in carrying capacity and sex ratio. Develop GIS of major passage barriers.
- Assess characteristics and distribution of American eel habitat and value of habitat with respect to growth and sex determination. Develop GIS of American eel habitat in US. This will have to be a habitat-specific analysis based on past studies that show high habitat-specific variability in sex ratios within a drainage system.
- Improve understanding of within-drainage behavior and movement and the exchange between freshwater and estuarine systems.
- Improve understanding of predator-prey relationships, behavior and movement of eel during their freshwater residency, oceanic behavior, and movement and specific spawning location of adult mature eel in the Sargasso Sea. Determine if larger females have a size refuge during the freshwater phase.
- Examine the mechanisms for exit from the Sargasso Sea and transport across the continental shelf to determine implications for recruitment. Examine migratory routes and guidance mechanisms for silver eel in the ocean.
- Research mechanisms of recognition of the spawning area by silver eel, mate location in the Sargasso Sea, spawning behavior, and gonadal development in maturation.
- Continue investigation of the length and weight specific fecundities of American eel.
- Examine age-at-entry of glass eel into estuaries and freshwater to determine time lag between spawner escapement and glass eel recruitment.
- Improve understanding of all information on the leptocephalus and glass stages of eel, including mode of nutrition and transport/recruitment mechanisms.
- Develop a monitoring framework to collect and provide coastwide information on the influence of environmental factors and climate change on recruitment for future modeling.

Additional Habitat Research Recommendations

- Research the behavior of silver eels at downstream passages; determine specific behavior of eels migrating downstream, and research how they negotiate and pass hydropower facilities.

[4] USFWS currently has a project examining maternal transfer of contaminants in American eel.

- Research the behavior of American eel approaching hydropower dams to determine searching behavior and preferred routes of approach to confirm best siting options for upstream passage.
- Investigate how river flow, lunar phase, water temperature, and behavior near artificial lighting impact the behavior of American eel, and influence the amount of time that the eels spend at a dam.
- Investigate the impact of stream velocity/discharge and stream morphology on upstream migration of glass eel and elvers.
- Research the factors that cause American eel to initiate downstream migration and affect their patterns of movement.
- Examine the environmental conditions required for the hatching success of American eel.
- Research the changes in ocean climate and environmental quality that might influence larval and adult eel migration, spawning, recruitment, and survival, including oceanic heat transport and interactions with the atmosphere and greenhouse gas warming.
- Determine the importance of coastal lakes and reservoirs to American eel populations.
- Investigate the impact of seaweed harvesting on American eel.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Implement a special permit for use of commercial fixed gear (e.g., pots and traps) to harvest American eels for personal use. Special-use permit holders should be subject to the same reporting requirements for landings and effort as the commercial fishery.
- Coordinate monitoring, assessment, and management among agencies that have jurisdiction within the species' range.
- Perform a joint US-Canadian stock assessment.
- Improve compliance with landing and effort reporting requirements as outlined in the ASMFC FMP for American eel.

Moderate

- Continue to require states to report non-harvest losses in their annual compliance reports.
- Conduct socioeconomic studies to determine the value of the fishery and the impact of regulatory management.
- Develop population targets based on habitat availability at the local level.

American Eel Research Priorities Identified As Being Met

- ✓ Accurately document the commercial eel fishery so that our understanding of participation in the fishery and the amount of directed effort could be known. *Trip-level reporting of catch and effort became mandatory in 2007.*
- ✓ Evaluate the use of American eel as a water quality indicator.
- ✓ Investigate practical and cost-effective methods of re-establishing American eel in underutilized habitat.

AMERICAN LOBSTER

Fishery-Dependent Priorities

High

- Improve spatial and temporal consistency of commercial data through standardized 100% mandatory trip level harvester reporting.
- Identify a dedicated funding source for sea and port sampling programs, these programs are essential for characterization of the commercial catch for assessment purposes.
- Develop and utilize volunteer industry data collection program (e.g., standardize protocols and ground-truth data) as funding for sea and port sampling declines or does not exist.

Fishery-Independent Priorities

High

- Identify a dedicated funding source to continue the ventless trap survey for an accurate coastwide index of relative abundance.[5]
- Update the maturity and growth estimates for the Gulf of Maine stock.
- Establish permanent data loggers in offshore areas for all 3 stock units to collect bottom temperatures.

Moderate

- Identify a dedicated funding source to continue and expand an early life history larval survey.
- Update the maturity and growth estimates for the Southern New England and Georges Bank stock.

Modeling / Quantitative Priorities

High

- Improve reference points to ensure that they are compatible with current environmental conditions.

The University of Maine lobster model used for this assessment should be revised and enhanced in the following ways in order to improve future assessments:

High

- Explore feasibility of estimating all or a portion of the growth transition matrix.
- Incorporate trends in natural mortality, maturity, and growth, where appropriate.
- Explore incorporation of ventless trap and settlement surveys.

Moderate

- Reduce gap-filling of landings and biosamples to the extent possible and allow the model to handle data gaps statistically.

Low

- Check estimation and form of non-linear CPUE relationship with abundance, explore standardization/treatment of commercial CPUE.
- Specify number of years across which to conduct the assessment (e.g., to ease performance of sensitivity and retrospective analyses).

[5] A coastwide (Gulf of Maine to Long Island Sound) ventless trap survey was conducted from 2006-2008, but was discontinued due to lack of funding.

Life History, Biological, and Habitat Priorities

High

- Expand data collection and modeling of the impacts of oceanographic and water temperature shifts to larval and adult survival and distribution.
- Continue and expand research on ageing techniques to improve the understanding of how many year classes support the current trap fishery, how length relates to age, and how variable the age structure is temporally and spatially.[6]
- Conduct research on harvest policies for management of lobster in the face of climate change and uncertainty about future productivity.

Moderate

- Evaluate and quantify sources of variability in natural mortality rates for lobster.
- Explain changes in the abundance and distribution of sex ratios for lobster across their range.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Align stock management areas with area designations for landings.
- Explore industry based funding mechanisms for routine fishery sampling and monitoring.

Moderate

- Explore the possibility of joint US and Canadian lobster stock assessments by the TRAC.

American Lobster Research Priorities Identified as Being Met

- ✓ Calibrate NEFSC trawl survey data from old versus new vessels (Albatross versus Bigelow).
- ✓ Examine size based models to determine their ability to match length frequencies and other biological characteristics observed in local lobster populations.
- ✓ Expand the University of Maine lobster model to include any number of surveys by sex. This includes changing the structure of input data files, modifying corresponding sections of code to accommodate any number of surveys and fishery types by sex or both sexes combined, and estimation of survey selectivity by sex.
- ✓ Create graphics viewer in R for examining MCMC and projection outputs; include MCMC chain convergence criteria / diagnostics. *In progress.*

AMERICAN SHAD / RIVER HERRING

Fishery-Dependent Priorities

High

- Expand observer and port sampling coverage to quantify additional sources of mortality for alosine species, including bait fisheries, as well as rates of bycatch in other fisheries to reduce uncertainty.[7]

[6] Research on ageing techniques has been conducted in England and Australia and has been initiated in Maine and Connecticut.

[7] A prior statistical study of observer allocation and coverage should be conducted (see Hanke et al. 2012).

Moderate

- Identify directed harvest and bycatch losses of American shad in ocean and bay waters of Atlantic Maritime Canada.

Low

- Identify additional sources of historical catch data of the US small pelagic fisheries to better represent earlier harvest of river herring and improve model formulation.

Fishery-Independent Priorities

Moderate

- Develop demersal and pelagic trawl CPUE indices of offshore river herring biomass.

Modeling / Quantitative Priorities

High

- Conduct population assessments on river herring, particularly in the south.[8]
- Analyze the consequences of interactions between the offshore bycatch fisheries and population trends in the rivers.
- Quantify fishing mortality for major river stocks after ocean closure of directed fisheries (river, ocean bycatch, bait fisheries).
- Improve methods to develop biological benchmarks used in assessment modeling (fecundity-at-age, sex specific mean weight-at-age, partial recruitment vector/maturity schedules) for river herring and American shad of both semelparous and iteroparous stocks.
- Improve methods for calculating M.

Moderate

- Consider standardization of indices with a GLM to improve trend estimates and uncertainty characterization.
- Explore peer-reviewed stock assessment models for use in additional river systems as more data become available.

Low

- Develop models to predict the potential impacts of climate change on river herring distribution and stock persistence.

Life History, Biological, and Habitat Priorities

High

- Conduct studies to quantify and improve fish passage efficiency and support the implementation of standard practices.
- Assess the efficiency of using hydroacoustics to repel alosines or pheromones to attract alosines to fish passage structures. Test commercially available acoustic equipment at existing fish passage facilities. Develop methods to isolate/manufacture pheromones or other alosine attractants.
- Investigate the relationship between juvenile river herring/American shad and subsequent year class strength, with emphasis on the validity of juvenile abundance indices, rates and sources of immature mortality, migratory behavior of juveniles, and life history requirements.

[8] A peer reviewed river herring stock assessment was completed in 2012 by the ASMFC.

- Develop an integrated coastal remote telemetry system or network that would allow tagged fish to be tracked throughout their coastal migration and into the estuarine and riverine environments.
- Verify tag-based estimates of American shad.
- Continue studies to determine river herring population stock structure along the coast and enable determination of river origin of catch in mixed stock fisheries and incidental catch in non-targeted ocean fisheries. Spatially delineate mixed stock and Delaware stock areas within the Delaware system. Methods to be considered could include otolith microchemistry, oxytetracycline otolith marking, genetic analysis, and/or tagging.[9]
- Validate the different values of M for river herring and American shad stocks through shad ageing techniques and repeat spawning information.
- Continue to assess current ageing techniques for river herring and American shad, using known-age fish, scales, otoliths, and spawning marks. Conduct biannual ageing workshops to maintain consistency and accuracy of ageing fish sampled in state programs.[10]
- Summarize existing information on predation by striped bass and other species. Quantify consumption through modeling (e.g., MSVPA), diet, and bioenergetics studies.
- Refine techniques for tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock.

Moderate

- Determine the effects of passage barriers on all life history stages of American shad and river herring. Conduct studies on turbine mortality, migration delay, downstream passage, and sub-lethal effects.
- Evaluate and ultimately validate large-scale hydroacoustic methods to quantify river herring and American shad escapement in major river systems.
- Conduct studies of egg and larval survival and development.
- Conduct studies on energetics of feeding and spawning migrations of American shad on the Atlantic coast.
- Resource management agencies in each state shall evaluate their respective state water quality standards and criteria and identify hard limits to ensure that those standards, criteria, and limits account for the special needs of alosines. Primary emphasis should be on locations where sensitive egg and larval stages are found.
- Encourage university research on hickory shad.
- Develop better fish culture techniques, marking techniques, and supplemental stocking strategies for river herring.

Low

- Characterize tributary habitat quality and quantity for Alosine reintroductions and fish passage development.
- States should identify and quantify potential shad and river herring spawning and nursery habitat not presently utilized, including a list of areas that would support such habitat if water quality and access were improved or created, and analyze the cost of recovery within those areas. States may wish to identify areas targeted for restoration as essential habitat.[11]
- Investigate contribution of landlocked versus anadromous produced river herring.

[9] Genetic research currently underway in combination with otolith chemistry.

[10] River herring ageing workshop to occur in 2013.

Additional Habitat Research Recommendations

- When considering options for restoring alosine habitat, include study of, and possible adjustment to, dam-related altered river flows.
- Ascertain how abundance and distribution of potential prey affect growth and mortality of early life stages of alosines.
- Determine factors that regulate and potentially limit downstream migration, seawater tolerance, and early ocean survival of juvenile alosines.
- Determine if chlorinated sewage effluents are slowing the recovery of depressed shad stocks.
- Determine if intermittent episodes of pH depressions and aluminum elevations (caused by acid rain) affect any life stage in freshwater that might lead to reduced reproductive success of alosines, especially in poorly buffered river systems.
- ASMFC should designate important shad and river herring spawning and nursery habitat as HAPC.[11]
- When populations have been extirpated from their habitat, coordinate alosine stocking programs, including: reintroduction to the historic spawning area, expansion of existing stock restoration programs, and initiation of new strategies to enhance depressed stocks.
- When releasing hatchery-reared larvae into river systems for purposes of restoring stocks, synchronize the release with periods of natural prey abundance to minimize mortality and maximize nutritional condition. Determine functional response of predators on larval shad at restoration sites to ascertain appropriate stocking level so that predation is accounted for, and juvenile out-migration goals are met. Also, determine if night stocking will reduce mortality.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Develop and implement monitoring protocols and analyses to determine river herring and American shad population responses and targets for rivers and tributaries, particularly those undergoing restoration (passage, supplemental stocking, etc.).
- Determine the impact of directed fisheries on American shad and river herring stocks and reduce F.
- Mandate FMPs for rivers with active restoration plans for American shad or river herring.
- Improve spatial and gear specific reporting of harvest.

Low

- Conduct and evaluate historical characterization of socioeconomic development (potential pollutant sources and habitat modification) of selected shad rivers along the east coast.[5]
- Develop appropriate Habitat Suitability Index Models for alosine species in the fishery management plan. Possibly consider expansion of species of importance or go with the most protective criteria for the most susceptible species.

[11] River-specific habitat recommendations for American shad can be found in: Atlantic States Marine Fisheries Commission. 2007. American shad stock assessment report for peer review, volumes II and III. Atlantic States Marine Fisheries Commission Stock Assessment Report No. 07-01 (Supplement), Washington, D.C.

American Shad / River Herring Research Needs Identified as Being Met

- ✓ Develop comprehensive angler use and harvest survey techniques for use by Atlantic states to assess recreational fisheries for American shad. *To be accomplished through MRIP.*
- ✓ Determine the stock/recruitment relationships for American shad and river herring stocks.

ATLANTIC CROAKER

Fishery-Dependent Priorities

High

- Encourage fishery-dependent biological sampling, including extraction of ageing structures, to improve age-length keys. Age-length keys should be representative of all gear types in the fishery. Supplement underrepresented length bins with additional ageing samples to avoid the necessity of weighting length-at-age estimates by length frequencies.
- Obtain gear specific effort information and improve fishery-dependent catch and effort statistics and catch size and age structure.
- Recover detailed historical landings data from NOAA as indicated by historical summaries.

Moderate

- Develop and implement state-specific commercial scrap fisheries monitoring programs to evaluate relative importance of croaker in scrap landing.
- Conduct studies on discard mortality from varying gears in recreational and commercial fisheries.
- Assess and monitor the effects of bycatch reduction devices (BRD's) on croaker catch.
- Monitor fisheries with significant croaker bycatch and determine extent of unutilized bycatch and F on fish less than age 1.
- Determine the onshore versus offshore components of the croaker fishery.
- Increase observer coverage of commercial discards.

Fishery-Independent Priorities

Moderate

- Expand fishery-independent surveys and subsample for individual weights and ages, especially in the southern range.
- Continue monitoring juvenile croaker populations in major nursery areas.
- Develop coastwide juvenile croaker indices to clarify stock status.

Modeling / Quantitative Priorities

High

- Develop size, age, and sex specific relative abundance estimates from fishery-independent and fishery-dependent data.
- Identify and evaluate environmental covariates in stock assessment models.

Moderate

- Incorporate bycatch estimates into croaker assessment models.
- Analyze croaker YPR to establish a minimum size that maximizes YPR.

Life History, Biological, and Habitat Priorities

High

- Conduct studies on fecundity and reproductive dynamics and develop maturity schedules.[12]
- Conduct studies on growth rates and age structure throughout species range.
- Conduct collaborative coastwide genetics and tagging studies to determine migratory patterns, stock identification, and stock mixing.

Moderate

- Identify essential habitat requirements.
- Re-examine historical ichthyoplankton studies of the Chesapeake Bay for an indication of the magnitude of estuarine spawning

Low

- Determine species interactions and predator-prey relationships between croaker (prey) and predator species targeted in more valued fisheries.
- Assess the impacts of any dredging activity (i.e., for beach re-nourishment) on all life history stages of croaker.

Management, Law Enforcement, and Socioeconomic Priorities

Moderate

- Determine the optimum utilization (economic and biological) of a long term fluctuating croaker population.
- Evaluate socioeconomic aspects of croaker fisheries.

Atlantic Croaker Research Priorities Identified as Being Met

- ✓ Criteria should be cooperatively developed for ageing croaker otoliths. ***Addressed at 2008 croaker and red drum ageing workshop.***

ATLANTIC MENHADEN

**Atlantic Menhaden research recommendations are listed in chronological order: recommendations from the 2012 stock assessment update, recommendations from the 2010 benchmark stock assessment peer review panel, and recommendations from the 2008 update of this report that have not been addressed. Research recommendations from the 2012 stock assessment update are broken down into two categories: data and modeling. While all recommendations are high priority, the first recommendation is the highest priority. Each category is further broken down into recommendations that can be completed in the short term and recommendations that will require long term commitment.

2012 Stock Assessment Update Recommendations

Annual Data Collection

Long Term

- Develop a coast wide, fishery-independent index of adult abundance at age to replace or augment the existing Potomac River pound net index used in the assessment model. Possible

[12] Work by Fabrizio and Tuckey examining the effects of hypoxia on reproduction of Chesapeake Bay croaker in progress.

methodologies include an air spotter survey or an industry-based survey with scientific observers on board collecting the data. In all cases, a sound statistical design is essential (involve statisticians in the development and review of the design; some trial surveys may be necessary).[13]

- Work with industry to collect age structure data outside the range of the fishery.
- Validate MSVPA model parameters through the development and implementation of stomach sampling program that will cover major menhaden predators along the Atlantic coast. Validation of prey preferences, size selectivity and spatial overlap is critically important to the appropriate use of MSVPA model results.

Short Term

- Increase level of sampling from bait fisheries, particularly in the mid-Atlantic and New England.
- Investigate interannual maturity variability via collection of annual samples of mature fish along the Atlantic coast.
- Recover historical tagging data from paper data sheets to characterize coastwide movements and mortality estimates for adult Atlantic menhaden.
- Increase annual sampling and processing of menhaden from the PRFC pound net fishery to better characterize age and size structure of catch.
- Compare age composition of PRFC catch with the age composition of the reduction bait fishery catch in Chesapeake Bay. Upon completion of comparative analysis develop most efficient and representative method of sampling for age structure.
- Consider developing an adult index, similar to PRFC CPUE index, using MD, VA, NJ and RI pound net information including biological data.
- Explore additional sources of information that could be used as additional indices of abundance for juvenile and adult menhaden (ichthyoplankton surveys, NEAMAP, etc.).

Assessment Methodology

Long Term

- Develop a spatially-explicit model, once sufficient age-specific data on movement rates of menhaden are available.
- Develop multispecies statistical catch-at-age model to estimate menhaden natural mortality at age.

Short Term

- Thoroughly explore causes of retrospective pattern in model results.
- Explore alternative treatments of the reduction and bait fleets (e.g., spatial split, alternative selectivity configurations) in the BAM to reflect latitudinal variability in menhaden biology (larger and older fish migrating farther north during summer).
- Review underlying data and evaluate generation of JAI and PRFC indices.

[13] An industry funded feasibility study conducted in 2011 further supported the need for this work (Sulikowski et al. 2012). A subcommittee of the Menhaden Technical Committee began discussions for development of a coastwide aerial survey in 2008. As of July 2012, a contract has been awarded to develop the survey design, with results expected by the end of 2012. The Technical Committee is in consensus that an index of adult abundance is the highest priority research recommendations but recognizes that implementation of the survey will require significant levels of funding.

- Perform likelihood profiling analysis to guide model selection decision-making.
- Examine the variance assumptions and weighting factors of all the likelihood components in the model.
- Re-evaluate menhaden natural mortality-at-age and population response to changing predator populations by updating and augmenting the MSVPA (e.g., add additional predator, prey, and diet data when available).
- Incorporate maturity-at-age variability in the assessment model.

Future Research

- Evaluate productivity of different estuaries (e.g., replicate similar methodology to Ahrenholz et al. 1987).
- Collect age-specific data on movement rates of menhaden to develop regional abundance trends.
- Determine selectivity of PRFC pound nets.
- Update information on maturity, fecundity, spatial and temporal patterns of spawning and larval survivorship.
- Investigate the effects of global climate change on distribution, movement, and behavior of menhaden.

2010 Benchmark Stock Assessment Peer Review Panel Recommendations

Short Term (improvements for the next benchmark review)

- Cap effective sample size in future model specifications at 200, allow the gaps in the pound net index and bait fishery age composition where data are not available, modify the reduction and bait fleets to northern and southern fleets, and allow time-varying domed shaped selectivity for the southern region.
- Calculate fishing mortality as full F. The N-weighted fishing mortalities relative to the N-weighted F-reference points do not provide correct interpretation with regard to overfishing.
- Examine alternative reference points which provide more protection to SSB or fecundity than FMED. The Panel has concerns about the use of FMED and the fecundity associated with it as reference points. The concern is that there was no information on the relationship of the target and threshold fecundity in relation to virgin fecundity levels.
- Examine weighting of datasets in the model. As a starting point, some experts assert that the input variance assumptions should be consistent with the estimated variance of residuals. In the base model the effective sample sizes for catch-at-age data are far too high and consequently estimates of uncertainty are too low.
- Evaluate alternative use of the juvenile indices: combining relative abundance data from groups of adjacent states according to the similarity of trends in the state-specific time series; and cumulatively-combining these indices within the model. This allows for different regional patterns of recruitment to provide a stock-wide recruitment pattern.
- Examine the timing of fisheries and indices in the model. Many of the fisheries are seasonal and need to be timed appropriately with the abundance indices. Incorrect timing may affect model fits.

Recommendations from the 2008 Update of the Research Priorities Report

Fishery Dependent

Moderate

- Evaluate other measures of effort, including spotter pilot logbooks, trip length, etc. Spotter pilot logbooks should be evaluated for search time, GPS coordinates, and estimates of observed school size.

Low

- Conduct studies on bycatch and discard of menhaden in other fisheries.

Fishery-Independent Priorities

High

- Develop and implement fishery-independent surveys to estimate size of recruiting year classes.[14]

Modeling / Quantitative Priorities

Moderate

- Evaluate precision of current assessment models with Monte Carlo simulations.
- Assess the feasibility of estimating year class strength using a biologically stratified sampling design. The efforts could be supported by process studies linking plankton production to abundance of young menhaden.

Low

- Conduct growth back-calculation studies to determine historical trends in growth rate. The NMFS has an extensive database on scale growth increments which should be utilized for these studies.

Life History, Biological, and Habitat Priorities

Moderate

- Determine the effects of critical estuarine habitat loss/degradation on juvenile and adult menhaden growth, survival, and abundance.
- Evaluate the effects of selected environmental factors on growth, survival, and abundance of juvenile and adult menhaden, particularly in the Chesapeake Bay and other costal nursery areas.[15]
- Assess effects of fish disease (e.g., ulcerative mycosis and toxic dinoflagellates) on menhaden.[16]
- Determine the ecological role of menhaden (predator-prey relationships, nutrient enrichment, oxygen depletion, etc.) in major Atlantic coast embayments and estuaries.

Low

- Monitor fish kills along the Atlantic coast and use the NMFS Beaufort Laboratory as a repository for these reports.

---

[14] Ongoing research is being conducted to develop and test methods for estimating size of recruiting year classes of juveniles using fishery-independent survey techniques.

[15] Ongoing research is being conducted in the Chesapeake Bay to evaluate effects of selected environmental factors on growth, survival, and abundance of juvenile and adult menhaden.

[16] Ongoing research is being conducted to determine the effects of fish diseases (e.g., ulcerative mycosis and toxic dinoflagellates) on menhaden.

Management, Law Enforcement, and Socioeconomic Priorities
Low
- Determine effects of regulations on the fishery, the participants, and the stock.
- Monitor the socioeconomic aspects of the menhaden reduction fishery.

Atlantic Menhaden Research Needs Identified as Being Met

- ✓ Evaluate use of costal power plant impingement data as a possible means to estimate YOY menhaden abundance.

ATLANTIC SEA HERRING

Fishery-Dependent Priorities
High
- Develop (simple) methods to partition stocks in mixed stock fisheries.
- Investigate bycatch and discards in the directed herring fishery through both at sea and portside sampling.
- Continue commercial catch sampling of Atlantic herring fisheries according to ACCSP protocols.

Fishery-Independent Priorities
High
- Conduct more extensive stock composition sampling including all stocks (i.e., Scotian Shelf).
- Expand monitoring of spawning components.

Low
- Continue to utilize the inshore and offshore hydroacoustic and trawl surveys to provide an independent means of estimating stock sizes. Collaborative work between NMFS, DFO, state agencies, and the herring industry on acoustic surveys for herring should continue to be encouraged.
- Consider alternative sampling methods such as HabCam.

Modeling / Quantitative Priorities
High
- Evaluate use of length based models (Stock Synthesis and Chen model).
- Develop statistical comparison of consumption estimates and biomass from model M.

Moderate
- Develop indices at age from shrimp survey samples.
- Conduct simulation studies to evaluate ways in which various time series can be evaluated and folded into the assessment model.
- Develop new approaches to estimating recruitment (i.e., juvenile abundance) from fishery-independent data.
- Examine the possible effects of density dependence (e.g., reduced growth rates at high population size) on parameter estimates used in assessments.

Low

- Develop an industry based LPUE or some other abundance index (Industry Based Survey).
- Conduct a retrospective analysis of herring larval and assessment data to determine the role larval data plays in anticipating stock collapse and as a tuning index in the age structured assessment.
- Investigate the M rate assumed for all ages, the use of CPUE tuning indices, and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring.
- Develop objective criteria for inclusion of novel data streams (consumption, acoustic, larval, etc.) and how this can be applied.

Life History, Biological, and Habitat Priorities

High

- Consider information on consumption from other sources (i.e. striped bass in other areas) and predators inshore of the current surveys.

Moderate

- Continue tagging and morphometric studies to explore uncertainties in stock structure and the impacts of harvest mortality on different components of the stock. Although tagging studies may be problematic for assessing survivorship for a species like herring, they may be helpful in identifying the stock components and the proportion of these components taken in the fishery on a seasonal basis.
- Analyze diet composition of archived mammal and sea bird stomachs. Improve knowledge on prey size selectivity of mammals and sea birds.
- Evaluate prey field to determine what other prey species are available to predators that could explain some of the annual trends in herring consumption.
- Investigate why small herring are not found in the stomachs of predators in the NEFSC food habits database.

Low

- Research depth preferences of herring.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Evaluate the current herring spawning closure design in terms of areas covered, closure periods, catch-at-age within (before fishing prohibition in 2007) and outside of spawning areas to determine minimal spawning regulations (Maine DMR).
- Continue to organize annual US-Canadian workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

Moderate

- Develop a strategy for assessing individual spawning components to better manage heavily exploited portion(s) of the stock complex, particularly the Gulf of Maine inshore spawning component.
- Develop socioeconomic analyses appropriate to the determination of optimum yield.

Low

- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry.

Atlantic Sea Herring Research Priorities Identified as Being Met

- ✓ Evaluate the merit of acoustic surveys and other techniques to achieve sub stock complex monitoring. ***Gulf of Maine Research Institute.***

ATLANTIC STRIPED BASS

Fishery-Dependent Priorities

Moderate

- Develop studies to provide information on gear specific discard morality rates and to determine the magnitude of bycatch mortality.[17]
- Improve estimates of striped bass harvest removals in coastal areas during wave 1 and inland waters of all jurisdictions year round.
- Evaluate the percentage of fishermen using circle hooks.[18]

Fishery-Independent Priorities

Moderate

- Develop a refined and cost-efficient, fisheries-independent coastal population index for striped bass stocks.

Modeling / Quantitative Priorities

High

- Develop a method to integrate catch-at-age and tagging models to produce a single estimate of F and stock status.[19]
- Develop a spatially and temporally explicit catch-at-age model incorporating tag based movement information.[20]
- Review model averaging approach to estimate annual fishing mortality with tag based models. Review validity and sensitivity to year groupings.[21]
- Develop methods for combining tag results from programs releasing fish from different areas on different dates.
- Examine potential biases associated with the number of tagged individuals, such as gear specific mortality (associated with trawls, pound nets, gill nets, and electrofishing), tag induced mortality, and tag loss.[22]
- Develop field or modeling studies to aid in estimation of natural mortality or other factors affecting the tag return rate.

---

[17] Literature search and some modeling work completed.
[18] Work ongoing in New York through the Hudson River Angler Diary, Striped Bass Cooperative Angler Program, and ACCSP elogbook.
[19] Model developed, but the tagging data overwhelms the model. Issues remain with proper weighting.
[20] Model developed with Chesapeake Bay and the rest of the coast as two fleets. However, no tagging data has been used in the model.
[21] Work ongoing by Striped Bass Tagging Subcommittee to evaluate the best years to use for the IRCR and the periods to use for the MARK models.
[22] Gear specific survival being examined in Hudson River.

Moderate

- Develop maturity ogives applicable to coastal migratory stocks.
- Examine methods to estimate annual variation in natural mortality.[23]
- Develop reliable estimates of poaching loss from striped bass fisheries.
- Improve methods for determining population sex ratio for use in estimates of SSB and biological reference points.
- Evaluate truncated matrices and covariate based tagging models.

Low

- Examine issues with time saturated tagging models for the 18 inch length group.
- Develop tag based reference points.

Life History, Biological, and Habitat Priorities

High

- Continue in-depth analysis of migrations, stock compositions, etc. using mark-recapture data.[24]
- Continue evaluation of striped bass dietary needs and relation to health condition.[25]
- Continue analysis to determine linkages between the mycobacteriosis outbreak in Chesapeake Bay and sex ratio of Chesapeake spawning stock, Chesapeake juvenile production, and recruitment success into coastal fisheries.

Moderate

- Examine causes of different tag based survival estimates among programs estimating similar segments of the population.
- Continue to conduct research to determine limiting factors affecting recruitment and possible density implications.
- Conduct study to calculate the emigration rates from producer areas now that population levels are high and conduct multi-year study to determine inter-annual variation in emigration rates.

Low

- Determine inherent viability of eggs and larvae.
- Conduct additional research to determine the pathogenicity of the IPN virus isolated from striped bass to other warm water marine species, such as flounder, menhaden, shad, and largemouth bass.

Additional Habitat Research Recommendations

- Passage facilities should be designed specifically for passing striped bass for optimum efficiency at passing this species.
- Conduct studies to determine whether passing migrating adults upstream earlier in the year in some rivers would increase striped bass production and larval survival, and opening downstream bypass facilities sooner would reduce mortality of early emigrants (both adult and early-hatched juveniles).

[23] Ongoing work by the Striped Bass Tagging Subcommittee

[24] Ongoing through Cooperative Winter Tagging Cruise and striped bass charter boat tagging trips. See Cooperative Winter Tagging Cruise 20 Year Report.

[25] Plans for a stomach content collection program in the Chesapeake Bay by the Chesapeake Bay Ecological Foundation.

- All state and federal agencies responsible for reviewing impact statements and permit applications for projects or facilities proposed for striped bass spawning and nursery areas shall ensure that those projects will have no or only minimal impact on local stocks, especially natal rivers of stocks considered depressed or undergoing restoration.[26]
- Federal and state fishery management agencies should take steps to limit the introduction of compounds which are known to be accumulated in striped bass tissues and which pose a threat to human health or striped bass health.
- Every effort should be made to eliminate existing contaminants from striped bass habitats where a documented adverse impact occurs.
- Water quality criteria for striped bass spawning and nursery areas should be established, or existing criteria should be upgraded to levels that are sufficient to ensure successful striped bass reproduction.
- Each state should implement protection for the striped bass habitat within its jurisdiction to ensure the sustainability of that portion of the migratory stock. Such a program should include: inventory of historical habitats, identification of habitats presently used, specification of areas targeted for restoration, and imposition or encouragement of measures to retain or increase the quantity and quality of striped bass essential habitats.
- States in which striped bass spawning occurs should make every effort to declare striped bass spawning and nursery areas to be in need of special protection; such declaration should be accompanied by requirements of non-degradation of habitat quality, including minimization of non-point source runoff, prevention of significant increases in contaminant loadings, and prevention of the introduction of any new categories of contaminants into the area. For those agencies without water quality regulatory authority, protocols and schedules for providing input on water quality regulations to the responsible agency should be identified or created, to ensure that water quality needs of striped bass stocks are met.[27]
- ASMFC should designate important habitats for striped bass spawning and nursery areas as HAPC.
- Each state should survey existing literature and data to determine the historical extent of striped bass occurrence and use within its jurisdiction. An assessment should be conducted of those areas not presently used for which restoration is feasible.

Management, Law Enforcement, and Socioeconomic Priorities
Moderate

- Examine the potential public health trade-offs between the continued reliance on the use of high minimum size limits (28 inches) on coastal recreational anglers and its long-term effects on enhanced PCB contamination among recreational stakeholders.[28]

Striped Bass Research Priorities Identified as Being Met

- ✓ Continue improvements to the statistical catch-at-age model as recommended by the 46th SARC (e.g., include error from catch estimates, fit each sector of removals individually,

[26] Ongoing in New York.
[27] Significant habitat designations completed in the Hudson River and New York Marine Districts.
[28] Samples collected from two size groups ($\geq$ 28 inches and 20-26 inches) in Pennsylvania and processed by the Department of Environmental Protection to compare contamination of the two size groups.

run additional diagnostics, account for spatial differences in indices, incorporate stock-recruitment relationship).

- ✓ Evaluate to what extent rising natural mortality among Chesapeake Bay striped bass affects the existing F and SSB thresholds, which are based on a fixed M assumption (M = 0.15) . ***In progress for next benchmark stock assessment.***
- ✓ Develop simulation models to look at the implications of overfishing definitions relative to development of a striped bass population that will provide "quality" fishing. Quality fishing must first be defined.
- ✓ Evaluate the overfishing definition relative to uncertainty in biological parameters. ***In progress for next benchmark stock assessment.***

ATLANTIC STURGEON

Fishery-Independent Priorities

High

- Determine levels of bycatch and compare to F_{50} target levels for individual populations.

  Characterize Atlantic sturgeon bycatch in various fisheries by gear and season. Include data on fish size, health condition at capture, and number of fish captured.

Modeling / Quantitative Priorities

High

- Conduct assessments of population abundance and age structure in various river systems. Particular emphasis should be placed in documenting occurrence of age 0-1 juveniles and spawning adults as indicators of natural reproduction.[29]
- Conduct further analyses to assess the sensitivity of F_{50} to model inputs for northern and southern stocks.

Life History, Biological, and Habitat Priorities

High

- Continue development of genetic markers to determine the extent to which Atlantic sturgeon are genetically differentiable among rivers and that permit identification of bycatch by population origin. Interpret biological significance of findings.[30]
- Develop methods to determine sex and maturity of captured sturgeon.[31]
- Determine length, fecundity, and maturity-at-age for north, mid, and south Atlantic stocks.

[29] There are two surveys in the Hudson River estuary, one by Hudson Valley power generating companies started in 1985 and one by NYSDEC started in 2004. There is a survey in Edisto River, SC that started in 2004. Additionally, there are ongoing telemetry studies in many southeastern rivers which capture spawning adults.

[30] Work done by Tim King.

[31] Work being done by James Sulikowski investigating the use of steroid hormones to determine sex by maturity. Laparoscopic techniques have been developed to visually inspect gonads by Dr. Rob Bakal, USFWS, Aquatic Animal Health Coordinator, National Fish Hatchery System.

- Refine maturation induced spawning procedures. Refine sperm cryopreservation techniques to assure availability of male gametes.[32]
- Continue basic cultural experiments at all life stages to provide information on efficacy of alternative spawning techniques, egg incubation and fry production techniques, holding and rearing densities, prophylactic treatments, nutritional requirements and feeding techniques, and optimal environmental rearing conditions and systems.[33]
- Conduct research to identify suitable stocking protocols for hatchery fish (e.g., fish size, time of year, site, marking technique).[34]
- Conduct and monitor pilot scale stocking programs before conducting large-scale efforts that encompass broad geographic area.[35]
- Establish stocking goals and success criteria prior to development of large-scale stock enhancement or recovery programs.
- Evaluate aging techniques for Atlantic sturgeon with known age fish. Emphasis should be placed on verifying current methodology based on fin spines.[36]
- Establish tolerance of different life stages in all populations to important contaminants and environmental factors (e.g., DO, pH, temperature, salinity).[37]
- Quantify the amount and quality of sturgeon habitat in important sturgeon estuaries and rivers, including spawning and nursery habitats. Define and map bottom water quality, velocity, and substrates types for suitable sturgeon spawning and nursery habitat.[38]
- Determine behavior and effects on life history from the effects of dredging and increased suspended sediment loads.[39]
- Determine impacts of pile driving and other in-river construction on behavior and life history.

Moderate

- Analyze existing sea sampling data to characterize at sea migratory behavior. Use electronic tagging to model coastal migrations of juvenile and adult Atlantic sturgeon.[40]

---

[32] Successful spawning of wild female sturgeon in captivity has been documented at Bears Bluff National Fish Hatchery. There has been some work done on sperm cryopreservation techniques by William Wayman and Curry Woods.

[33] Transport, long-term holding, and feeding work done at Bears Bluff National Fish Hatchery. Atlantic sturgeon also being held at USFWS Northeast Fishery Center.

[34] Work has been done on long-term survival of hatchery-produced fish stocked in the Hudson River (Mohler et al. 2012).

[35] Stocking programs were initiated in the Hudson River in 1994 and 2004 and in the Nanticoke River in 1994.

[36] Work done by Stevenson and Secor, Dunton et al. in the NJ-NY region, and Balazik et al. in the James River. Work also in progress by SCDNR assessing telomeres as a possible method to age Atlantic sturgeon.

[37] Work done by Secor (D.O.), Roy et al.(contaminants) and Matsche et al. (nitrite). Work in progress by Markin and MDNR (salinity, temperature, D.O. and turbidity) for different ages and life history stages.

[38] Data on benthic substrate and telemetry of juvenile and mature fish available for the Hudson River Estuary.

[39] SCDNR is currently monitoring sturgeon behavior as part of dredging events in Savannah and Charleston.

[40] Work done by Erickson et al. and Dunton et al. with PSAT tags and trawl surveys. Work done by Laney et al. 2007 in AFS Symposium 56. Telemetry work in progress along the coast.

- Assess loss to ship/boat strikes.[41]

Low

- Identify rates of tag loss and tag reporting.
- Encourage shortnose sturgeon researchers to include data collection for incidentally captured Atlantic sturgeon.

Additional Habitat Research Recommendations

- Fish passage requirements and appropriate structures for Atlantic sturgeon are largely unknown. Research all fish passage requirements for Atlantic sturgeon.
- Passage facilities should be designed specifically for passing Atlantic sturgeon for optimum efficiency at passing this species.
- Fish passage facilities should be designed to aid in the upstream and downstream passage of all life stages of Atlantic sturgeon. Most fish ladders in Atlantic coast streams and rivers are designed to pass alosines, and the specific needs of sturgeon will need to be considered as passage facilities are improved or constructed.
- The removal of dams, or the consideration of passage efforts, should be focused on those systems where Atlantic sturgeon historical habitat loss through blockage is greatest.
- Determine appropriate water flow for spawning Atlantic sturgeon. Water flows should be restored to appropriate levels during spawning season.
- Protection or restoration of critical habitat is considered the most beneficial conservation method for the restoration of sturgeons. Restore degraded historical habitat wherever possible. Also, habitat improvements that increase the survival of YOY are likely to make a strong contribution to population growth.
- New spawning habitat should be created with the use of artificial reef materials in areas where hard substrate has been degraded. Created habitat should be evaluated for effectiveness and longevity.[42]
- ASMFC should designate important habitats for Atlantic sturgeon spawning and nursery areas as HAPC.
- Standardize PIT tagging and ultrasonic telemetry equipment and procedures.[43]
- Further develop techniques for capture, transport, and long-term holding of wild brood stock.[33]
- Standardize collection procedures, and develop a suitable long-term repository for Atlantic sturgeon biological tissues for use in genetic and other studies.[44]
- Map all known ocean captures and delineate winter range and foraging hotspots.

Atlantic Sturgeon Research Needs Identified as Being Met

- ✓ Develop and implement long-term marking/tagging procedures to provide information on individual tagged Atlantic sturgeon for up to 20 years. *PIT tags.*
- ✓ Standardize collection procedures and develop suitable long-term repository for biological tissues for use in genetic and other studies.

[41] Work done in the James River by Balazik et al. 2012. Some work done by Brown and Murphy on the Delaware River. NYSDEC maintains a log of annual losses in the Hudson River Estuary.
[42] Some work done on the James River and work proposed on the Delaware River by Brundage et al.
[43] PIT tagging has been standardized.
[44] Collection work done by Damon-Randall et al. and Kahn and Mohead. Tissue repository at CCEHBR in Charleston, SC.

- ✓ Develop the capability to capture wild broodstock and develop adequate holding and transport techniques for large broodstock.
- ✓ Establish a tag recovery clearinghouse and database for consolidation and evaluation of tagging and tag return information including associated biological, geographic, and hydrographic data. *Uncertainty whether this includes acoustic tag information.*
- ✓ Maintain database for tagged Atlantic sturgeon. *USFWS, Maryland Fishery Resources Office.*

BLACK DRUM

Fishery-Dependent Priorities

High

- Obtain better estimates of harvest from the black drum recreational fishery, especially in states with short seasons. Obtain better coverage of shore and nighttime anglers.[45]
- Conduct studies to estimate catch and release mortality estimates.
- Increase spatial and temporal coverage of age samples collected regularly in fishery-dependent sources.
- Conduct a high reward tagging program to obtain improved return rates.

Moderate

- Obtain better estimates of bycatch of black drum in other fisheries, especially juvenile fish in South Atlantic states.

Fishery-Independent Priorities

High

- Increase spatial and temporal coverage of age samples collected regularly in fishery-independent sources.
- Prioritize collection of adult age data from fishery-independent sources in states where maximum size regulations preclude the collection of adequate adult ages.
- Expand existing fishery-independent surveys temporally and spatially to better cover black drum habitats, especially adult fish.
- Continue to collect and analyze current life history data from fishery-independent programs, including full size, age, maturity, histology workups and information on spawning season timing and duration. Any additional data that can be collected on adult black drum would be highly beneficial.

Modeling / Quantitative Priorities

High

- Obtain estimates of selectivity-at-age for black drum through observer programs or tagging studies.

[45] Nighttime sampling of anglers implemented in the Marine Recreational Information Program (MRIP) beginning in 2013.

Life History, Biological, and Habitat Priorities

High

- Conduct studies to estimate fecundity-at-age coastwide and to estimate batch fecundity, especially for adults in South Atlantic.
- Analyze existing otoliths that have been collected but not aged.
- Conduct otolith microchemistry studies to identify regional recruitment contributions.
- Continue and expand current tagging programs to obtain mortality and growth information and movement-at-size data.
- Conduct new and expand existing acoustic tagging programs to help identify spawning and juvenile habitat use and regional recruitment sources.
- Collect genetic material (i.e., create "genetic tags") over long time span to obtain information on movement and population structure and potentially estimate population size.

BLACK SEA BASS

Fishery-Dependent Priorities

High

- Increase sampling of commercial landings.
- Increase sample size of at sea observers and dockside validation for headboats. Increase recreational fisheries sampling.
- Determine depth, temperature, and season specific discard mortality rates. Assess and incorporate the impact of circle hook fishing regulations on discard mortality. Obtain more depth specific information from the private recreational fleet, MRIP At-Sea observer program, and Headboat Survey in the range of the southern stock.

Moderate

- Collect better spatial information in black sea bass fisheries to determine potential localized depletion effects.

Low

- Determine the impact/landings of the historical foreign fleet in the South Atlantic.

Additional Fishery-Dependent Priorities

- Develop hard part sampling coordinated with intercept surveys.
- Expand electronic reporting of headboat logbook for full implementation.

Fishery-Independent Priorities

High

- Conduct a pot survey throughout the range of the northern management unit and consider for an index of abundance.[46]
- Expand fishery-independent surveys to sample all sizes and age classes to develop more reliable catch-at-age and CPUE.
- Expand sampling to cover the entire range of the southern stock over a longer time period.

Additional Fishery-Independent Priorities

- Conduct at sea sex sampling to determine trend of sex change timing and assess the potential influence of population size on sex switching.[47]

[46] A pilot project is ongoing and proposals are being considered for funding to expand the program.

Modeling / Quantitative Priorities

High

- Investigate the effect of sex transition rates, sex ratio, and differential M by sex on the calculations of SSB per recruit and eggs per recruit.

Moderate

- Explore alternative assessment models, including non-age based alternatives.

Additional Modeling / Quantitative Priorities

- Continue development of a standardized method for calculating incomplete weight data.
- Further develop the tagging model described by Rudershausen et al. (2010) to address the assumptions of the model.

Life History, Biological, and Habitat Priorities

High

- Analyze size or age specific spawning frequency and seasonality.
- Investigate the movement and migrations of black sea bass using otolith microchemistry, genetic studies, and expanding tagging studies.
- Conduct meta-analysis of patterns of M in protogynous fishes, specifically black sea bass. Determine sex specific mortality rates and growth rates.
- Determine the implications of removing large males on population dynamics through field studies or large scale mesocosm experiments.
- Conduct studies on the efficacy of recompression techniques such as venting to reduce discard mortality.
- Study the movement and mixing of larval and juvenile black sea bass in the southern stock.

Moderate

- Further delineate essential fish habitat (EFH), particularly in nursery areas. Further investigate possible gear impacts on EFH.
- Identify transport mechanisms or behaviors that transport early juvenile black sea bass into estuaries.
- Evaluate overwintering habitat of all black sea bass life stages.
- Evaluate feeding of black sea bass larvae and overwintering adults.
- Develop mariculture techniques.

Low

- Conduct studies determining the value of artificial reefs for increased production of black sea bass to improve potential yield estimates.

Additional Life History, Biological, and Habitat Priorities

- Continue ageing studies to provide a foundation for an age based assessment. Compare scale to otolith age estimates.
- Conduct ageing validation studies to examine the implications of sex change, as well as temperature and salinity changes associated with movement onshore and offshore, on ageing reliability.
- Continue genetics work to determine potential stock delineation in the northern range.

[47] The NEFSC and UMass-Dartmouth are working on trends in sex change timing for the northern stock and UNC-Wilmington is working on the same for the southern stock.

Management, Law Enforcement, and Socioeconomic Priorities

- Evaluate the potential influence of non-compliance on high assumed M.
- Analyze logbook programs to determine current compliance and develop recommendations for improving compliance (i.e., increased education on the effect of not reporting accurately).
- Continue evaluation of methodology for mandatory reporting in the For-hire sector (e.g., Gulf MRIP Pilot).

Black Sea Bass Research Priorities Identified as Being Met

- ✓ A tagging program should be initiated through state fisheries agencies to estimate mortality independent of traditional methods.

BLUEFISH

Fishery-Dependent Priorities

High

- Evaluate magnitude and length frequency of discards from the commercial and recreational fisheries.
- Collect size and age composition of the fisheries by gear type and statistical area.[48]
- Target commercial (especially in the northeast region) and recreational landings for biological data collection when possible.[48]
- Initiate fisheries-dependent sampling of offshore populations of bluefish during the winter months.

Fishery-Independent Priorities

High

- Increase sampling frequencies when bluefish are encountered, especially when medium size fish are encountered.[48]
- Evaluate fishery-independent surveys to determine if the state surveys can be combined or coordinated to yield broader temporal and spatial representation of the stock.[49]
- Initiate fisheries-independent sampling of offshore populations of bluefish during the winter months.

Low

- Initiate a coastal surf-zone seine study to provide more complete indices of juvenile abundance.

[48] A biological sampling program has been implemented for states that accounted for >5% of the coast wide bluefish harvest between 1998-2008. See Addendum 1 to Amendment 1 of the ASMFC Bluefish FMP.

[49] SARC-41. 2005. 41st Chair's Report from the Northeast Regional Stock Assessment Workshop (SAW-41) Stock Assessment Review Committee (SARC) Meeting, Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, Massachusetts, June 6-9, 2005.

Modeling / Quantitative Priorities

High

- Test the sensitivity of the bluefish assessment to assumptions concerning age varying M, level of age 0 discards, and selection patterns.
- Evaluate measures of CPUE under different assumptions of effective effort to allow evaluation of sensitivity of results.

Low

- Explore alternative methods for assessing bluefish, such as length based and modified DeLury models.

Life History, Biological, and Habitat Priorities

High

- Conduct research on oceanographic influences on bluefish recruitment, including information on migratory pathways of larval bluefish.

Moderate

- Study tag mortality and retention rates for American Littoral Society dorsal loop and other tags used for bluefish.
- Conduct studies on interactive effects of pH, other environmental variables, and contaminants on various biological and sociological parameters such as reproductive capability, survival, genetic changes, and suitability for human consumption.
- Initiate research on species interactions and predator-prey relationships.

Low

- Continue work on catch and release mortality.[50]

Bluefish Research Priorities Identified as Being Met

- ✓ Complete a scale-otolith age comparison study**.** *Robillard, E., et al. 2009. Age-validation and growth of bluefish (Pomatomus saltatrix) along the East Coast of the United States. Fisheries Research 95: 65-75.*
- ✓ Conduct research to determine the timing of sexual maturity and fecundity of bluefish. *Robillard, E. et al. 2008. Reproductive biology of bluefish (Pomatomus saltatrix) along the East Coast of the United States. Fisheries Research 90: 198-208.*
- ✓ Age any archived age data for bluefish and use the data to supplement North Carolina age keys.

COASTAL SHARKS[51]

Fishery-Dependent Priorities

High

- Initiate or expand dockside sampling for sharks to verify landings information and species composition.

[50] Some work completed, see: Fabrizio, et al. 2008. Factors affecting catch-and-release mortality of bluefish. *North American Journal of Fisheries Management* 28:533-546.

[51] Work with NMFS on all priorities to ensure no duplication of efforts.

Moderate

- The Atlantic menhaden fishery data should be examined to determine shark bycatch estimates, if available.
- Conduct additional length sampling and age composition collection to improve information for developing selectivities.
- Shrimp trawl observer coverage should be expanded to 2 to 5% of total effort, particularly during periods of regulatory or gear changes. The observer coverage program should strive for even spatial coverage (particularly adding more south Atlantic coverage), randomness in vessel selection and full identification of elasmobranch species (continuing on from the 2009 Bycatch Characterization Protocol).
- Increase research on post-release survivorship of all shark species by gear type.
- Continue to acquire better species specific landings information on number of species, by weight, from dealers.[52]

Fishery-Independent Priorities

High

- Investigate the appropriateness of using vertebrae for ageing adult sandbar sharks. If appropriate, implement a systematic sampling program that gathers vertebral samples from entire size range for annual ageing to allow tracking the age distribution of the catch as well as updating of age-length keys.[53]

Moderate

- Develop a fishery-independent porbeagle shark survey to provide additional size composition and catch rate data to calculate an index of abundance.
- Develop a stock wide fishery-independent monitoring program in state coastal waters for dusky sharks that includes annual samples of length and age frequencies.

Modeling / Quantitative Priorities

High

- Explore modeling approaches that do not require an assumption that the population is at virgin level at some point in time.

Moderate

- Develop empirically based estimates of natural mortality.
- Explore alternative approaches to age-length keys for estimating age from length.
- Improve estimates of removals by identifying and incorporating the sources of uncertainty (species misidentification, non-reporting).
- Quantify the uncertainty in time series of catch data.
- Perform exploratory analyses with CPUE indices to identify indices that contribute the most information on stock trends.
- Conduct simulation tests (management strategy evaluation) to assess the performance of alternative assessment methods (including the catch-free model, ASPM, ASPIC, SS, or stock

[52] All dealers must report landings by species.

[53] Recent bomb radiocarbon research has indicated that past age estimates based on tagging data for sandbar sharks may be correct and that vertebral ageing may not be the most reliable method for mature individuals. See Andrews et al. 2011.

specific models), recruitment parameterizations, harvest control rules, assessment frequency and data collection.
- Develop a two sex model for more direct estimation of the dusky and blacknose shark spawning stocks.
- Explore alternative modeling approaches in the presence of uncertain reproductive information that model reproduction as a function of the number of mature females. Integrate uncertainty in the reproductive frequency, fecundity, and pup-survival into a single parameter (the slope at the origin of the stock-recruit function) and incorporate this uncertainty via priors on the parameter.

Low
- Conduct sensitivity analyses to determine if discard survival estimates have a significant impact on the estimated status of the dusky and blacknose shark stocks in relation to MSY reference points.
- Develop a set of indicators (age-structure, total mortality estimates from catch curves, changes in abundance indices values) to determine whether dusky shark stock status has changed sufficiently to warrant a full assessment.

Life History, Biological, and Habitat Priorities

High
- Re-evaluate finetooth life history in the Atlantic Ocean in order to validate fecundity and reproductive periodicity.[54]
- Develop and conduct tagging studies on dusky and blacknose stock structure with increased international collaboration (e.g., Mexico) to ensure wider distribution and returns of tags. Expand research efforts directed towards tagging of individuals in south Florida and Texas/Mexico border to get better data discerning potential stock mixing.
- Examine female sharks during the spawning periods to determine the proportion of spawning females.[55]

Moderate
- Continue life history studies for all species of the shark complex to allow for additional species specific assessments. Particularly, natural mortality, age, fecundity, and reproductive frequency. Update age, growth, and reproductive studies of blacknose sharks, with emphasis on smaller individuals in the Atlantic and larger individuals in the Gulf of Mexico.
- Coordinate a biological study for Atlantic sharpnose so that samples are made at least monthly, and, within each month, samples would be made consistently at distinct geographic locations. For example, sampling locations would be defined in the northern Gulf, west coast of Florida, the Florida Keys (where temperature is expected to be fairly constant over all seasons), and also several locations in the South Atlantic, including the east coast of Florida, Georgia, South Carolina, and North Carolina. This same sampling design could be applied to all small coastal sharks.
- Population level genetic studies are needed that could lend support to arguments for stock discriminations using new loci and/or methodology that has increased levels of sensitivity.

[54] Work by Frazier, Belcher, and Gelsleichter is underway.
[55] Biological information indicates that females of some shark species spawn less often then annually.

Low

- Determine what is missing in terms of experimental design and/or data analysis to arrive at incontrovertible (to the extent that it may be scientifically possible) conclusions on the reproductive periodicity of the sandbar shark stock.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Conduct species specific assessments for all shark species, with a priority for smooth dogfish.

Coastal Sharks Research Priorities Identified as Being Met

- ✓ Identify EFH and nursery areas for shark species found along the Atlantic coast of the US**.** *Ongoing survey (COASTSPAN) addressing this priority. Also see McCandless et al. 2007.*
- ✓ Determine bonnethead life history in Atlantic Ocean, spanning the range of the stock. *Work done by Frazier and Driggers.*
- ✓ Conduct additional life history research on sandbar sharks to supplement or replace the available data from the mid 1990's. *See working papers in SEDAR 21.*

HORSESHOE CRAB

Fishery-Dependent Priorities

Moderate

- Characterize the proportion of states' landings that comprise crabs of Delaware Bay origin. This can be done through a directed tag/release study, genetics/microchemistry study, or both.
- Improve measures to characterize landings and bycatch in the commercial fisheries by life stage.
- Estimate fishing discard numbers and associated mortality rates.
- Investigate supplemental bait and alternative trap designs to reduce the commercial fisheries need for horseshoe crabs.

Fishery-Independent Priorities

High

- Expand or implement fishery-independent surveys (e.g., spawning, benthic trawl, tagging) to target horseshoe crabs throughout their full range including estuaries. Highest priority should be given to implementing directed surveys in the New England and New York regions.[56]
- Estimate catchability for gear used in benthic trawl surveys and determine effect of size, sex, substrate, topography, timing, and temperature.
- Investigate factors (habitat, harvest, sampling methods, etc.) that might be causing the large discrepancies between Delaware and New Jersey in egg survey numbers.

[56] Some survey design work done by Landi (2011).

Moderate

- Estimate the proportion of the Delaware Bay population that is available in time and space within existing VT benthic trawl survey area. Estimate the selectivity of gear used in the survey. These estimations should take into account age class (i.e., primiparous, multiparous).
- Ground truth sub-sampling method used in Delaware Bay spawning survey for calibration to the "population" scale.

Modeling / Quantitative Priorities

High

- Estimate age/size specific survival of all life stages (e.g., age 0 to adult) and growth rate by instar within Delaware Bay.
- Estimate size specific fecundity of Delaware Bay females.
- Model relationship between egg availability and spawning biomass/abundance.

Moderate

- Further develop catch-survey analysis and apply assessment modeling beyond the Delaware Bay region.
- Continue to conduct additional stock assessments and determine F. Use these data to develop a more reliable sustainable F.
- Estimate mortality from the entire biomedical collection process, from capture to post-return.[57]

Life History, Biological, and Habitat Priorities

High

- Assess horseshoe crab prey availability and determine whether horseshoe crab population growth will be/is limited by prey availability.
- Evaluate the impacts of beach nourishment projects on horseshoe crab populations.

Moderate

- Characterize essential horseshoe crab habitat, other than spawning habitat, in different regions.
- Further evaluate life table information including sex ratio and population age structure.
- Estimate the proportion of sub-tidal spawning and determine if this affects spawning success (i.e., egg survivability).
- Conduct tagging studies and analyze tagging data to identify costal populations, population abundance, mortality rates, migration, and other movements.[58]
- Characterize abundance and size structure of juveniles coastwide as indicators of recruitment to adulthood.
- Evaluate the effect of mosquito control chemicals on horseshoe crab populations.
- Evaluate the importance of horseshoe crabs to other marine resources such as sea turtles.
- Conduct risk assessment for the effect of oil spill (timing, location, and amount) on horseshoe crab and shorebird populations and determine best practices to reduce risk.

[57] Tagging work has been done by DeLancey and Floyd (SC DNR) in South Carolina to evaluate mortality from the biomedical bleeding process.

[58] United States Fish and Wildlife Service tagging program in progress.

Notes:
Several priority research needs are currently being addressed through the following surveys:
Delaware Bay spawning beach survey:
a) Determine sampling frame or list of beaches in the Bay with a nonzero probability of being sampled in a given year.
b) Determine how many beaches need to be surveyed on how many days to meet survey objectives.
c) Determine whether subsampling effort (no. of quadrats per beach) was adequate.
d) Consider a survey design that includes both fixed and random beaches.
Delaware Bay egg count survey:
a) Set primary objective of egg count surveys to be shorebird food availability and focus on density of eggs at the surface (< 5cm).
b) Determine survey frequency (i.e., survey eggs annually, every 3 years, every 5 years, or other?).
c) Determine where, along the beach profile, eggs should be sampled.
d) Determine sample size for sampling eggs on a beach.
e) Determine the relationship between spawning activity and density of eggs at the surface (<5cm). Is there a threshold of spawning activity below which eggs remain buried and unavailable to shorebirds?
Offshore benthic survey:
a) Design comparative surveys or experiments to determine gear efficiencies.

Horseshoe Crab Research Priorities Identified as Being Met

- ✓ Evaluate the effectiveness of currently used benthic sampling gear for stock assessment (Qualitative evaluation completed through 2006 peer review).
- ✓ Determine beach fidelity by horseshoe crabs to determine habitat use.
- ✓ Develop a YOY or age 1 recruitment index from the Delaware 16-foot trawl survey.
- ✓ Conduct economic studies to determine the value of the commercial fishery and the impact of regulatory management. Such economic studies should also include an assessment of economic impacts on other fisheries as they relate to horseshoe crabs.

NORTHERN SHRIMP

Fishery-Dependent Priorities

High

- Better characterize shrimp discards in the shrimp and other small-mesh (i.e., herring and whiting) fisheries to provide more accurate estimates of shrimp removals for modeling.
- Continue to quantify the magnitude of bycatch of other species in the shrimp fishery by area and season and take steps necessary to limit negative impacts.[59]
- Conduct ground truthing of historical commercial data gathered via Federal and state databases.

[59] Some work has been done evaluating bycatch (Eayrs 2009) and bycatch in traps (Moffet 2012).

- Improve separator and excluder devices to reduce bycatch and discard of non-targeted species and small shrimp in the shrimp fishery and fisheries targeting other species.[60]
- Evaluate selectivity of shrimp by traps and trawls.

Moderate

- Continue sea sampling efforts.
- Evaluate commercial fishery sampling design. Increase and/or redistribute sampling of commercial catches as necessary, ensuring good allocation of samples among ports and months, to provide better estimates of size composition.

Fishery-Independent Priorities

High

- Evaluate effectiveness of summer shrimp survey statistical design, including geographic coverage.

Moderate

- Explore ways to quantify age 1 and younger shrimp.

Low

- Verify that summer shrimp survey tow bottom tending times have been consistent.

Modeling / Quantitative Priorities

High

- Continue to examine values of M. Revisit older work that established M=0.25 (Rinaldo, Clark). Estimate M using various existing methods. Investigate annual and life history variation in M and potential causes.
- Continue research to refine annual estimates of consumption by predators, and include in models as appropriate.

Moderate

- Explore explicit inclusion of temperature effects in stock assessment models.
- Expand the time series of stock and recruitment data using catchability estimates from the production model.
- The CSA model requires a parameter that is the ratio of catchabilities for the two age or size classes. Sensitivity analysis on the values used would contribute to a better understanding of model stability. A thorough evaluation of possible methods for improved estimation of this parameter could reduce uncertainty in the assessment.
- Continue examination of methods for age determination to develop the possibility of using age based assessment methods.
- Develop a bioeconomic model to study the interactions between four variables: movements of shrimp, catchability of shrimp, days fished, and market price.

Life History, Biological, and Habitat Priorities

High

- Investigate application of newly developed direct ageing methods to ground truth assumed ages based on size and stage compositions.

[60] Some work has been done, see He and Balzano (2007) and Pinkham et al. (2006).

- Evaluate larval and adult survival and growth, including frequency of molting and variation in growth rates, as a function of environmental factors and population density.[61]
- Study the effects of oceanographic and climatic variation (i.e., North Atlantic Oscillation) on the cold water refuges for shrimp in the Gulf of Maine.
- Explore the mechanisms behind the stock-recruitment and temperature relationship for Gulf of Maine northern shrimp.[62]

Moderate

- Determine the short and long-term effects of mobile fishing gear on shrimp habitat.[63]
- Study specific habitat requirements and develop habitat maps for early life history stages.
- Evaluate effects of potential habitat loss/degradation on northern shrimp.
- Identify migration routes of immature males offshore and ovigerous females inshore.[64]
- Evaluate maturation, fecundity, and lifetime spawning potential. Estimates of fecundity at length should be updated and the potential for annual variability should be explored. Examine variability of egg quality with female size and stage over time.
- Investigate changes in transition and maturation as a function of stock size and individual size and temperature.[65]
- Investigate diet of northern shrimp for different life history stages.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Characterize demographics of the fishing fleet by area and season. Perform comparative analysis of fishing practices between areas.[66]
- Develop an understanding of product flow and utilization through the marketplace. Identify performance indicators for various sectors of the shrimp industry. Identify significant variables driving market prices and how their dynamic interactions result in the observed intra-annual and inter-annual fluctuations in market price for northern shrimp.
- Explore new markets for Gulf of Maine shrimp, including community supported fisheries.[67]
- Develop a framework to aid evaluation of the impact of limited entry proposals on the Maine fishing industry.[67,68]
- Develop a socioeconomic analysis assessing the importance of the northern shrimp fishery in annual activities of commercial fishing.
- Determine the relative power relationships between the harvesting and processing sector and the larger markets for shrimp and shrimp products.
- Develop an economic-management model to determine the most profitable times to fish, how harvest timing affects markets, and how the market affects the timing of harvesting.

---

[61] Some work has been done by Stickney and Perkins.

[62] Some work has been done, see Richards et al. (2012).

[63] Short term effects have been studied, see Simpson and Watling (2006).

[64] Some migration work has been done, see Schick et al. (2006) NEC

[65] Some work has been done, see Wieland (2004, 2005).

[66] Dunham and Muller at the University of Maine conducted an economic study characterizing demographics of the fishing fleet by area and season in 1976. This study should be updated.

[67] Maine Fishermen's Forum panel discussions, 2006 and 2007

[68] Maine Coastal Fishery Research Priorities, 2001, online at http://www.maine.gov/dmr/research/table_of_contents.htm

Moderate

- Perform cost-benefit analyses to evaluate management measures.

Northern Shrimp Research Priorities Identified as Being Met

- ✓ Develop a time series of standardized effort to corroborate patterns of estimated F. *In progress for next benchmark stock assessment.*
- ✓ Recover and convert older port sampling data to useable database to make data available for future queries on fishing locations, catch rates, size distributions, sex stage and timing of egg hatch, other shrimp species, etc.
- ✓ Recalculate fall survey indices for shrimp, eliminating the nighttime tows. *In progress for next benchmark stock assessment.*
- ✓ Investigate power analysis of estimates of mean weight from port sampling to optimize sample design. *In progress for next benchmark stock assessment.*
- ✓ Target and threshold reference points for northern shrimp are set equal to one another at $F = 0.22$/yr. Using a buffer of zero between target and threshold reduces the relevance of reference points to management. Specifically, the distinction between desirable exploitation rates and those that indicate overfishing is blurred. The SARC recommends dialogue with managers and industry on this matter, as well as research to illustrate whether separating threshold from target would allow more stable or robust management techniques.
- ✓ Study the possibility of using a more detailed assessment model, such as the CAA model used for Atlantic sea scallop. *In progress for next benchmark stock assessment.*
- ✓ Explore spatial, depth, and/or temperature influences on survey catchability to contribute to better standardization of the survey abundance index. *Addressed for stock assessment updates.*
- ✓ Conduct research on annual variation of size-at-age to increase precision of the assessment. *In progress for next benchmark stock assessment.*
- ✓ Evaluate alternative biological reference points and define sustainable harvest levels. *In progress for next benchmark stock assessment.*

RED DRUM

Fishery-Dependent Priorities

High

- Conduct studies and collect time series data on discard mortality from varying commercial and recreational gears in directed and non-directed fisheries. Continue and expand observer coverage (5-10%) across all gear types in commercial fisheries or volunteer angler logbooks in recreational fisheries to characterize discards. Evaluate effects of water temperature, depth of capture, and other factors on discard mortality.

Moderate

- Improve CPUE estimates and fishery-dependent biological sampling to characterize the age/size composition of removals. Increase efforts to intercept nighttime fisheries for red drum by the MRIP.[69]

[69] Nighttime sampling of anglers implemented in the MRIP beginning in 2013.

- Develop a more reliable estimate of natural and fishing mortality through directed sampling of the adult population.

Fishery-Independent Priorities

High

- Conduct fishery-independent sampling of sub-adult and adult red drum (age 4 and older) in each state from Virginia to Florida.

Modeling / Quantitative Priorities

High

- Determine escapement to the spawning population, develop an index of recruitment to age 1, and develop an estimate of adult red drum biomass.
- Integrate tagging data in assessment models.
- Develop age based estimates of abundance based on survey specific age-length keys.
- Explore the use of estimates of F directly from tagging data (i.e., northern stock) as the basis for stock assessment and guidance for fisheries management.

Moderate

- Evaluate new stock assessment techniques as alternatives to age-structured models.

Low

- Quantify relationships between red drum production and habitat.

Life History, Biological, and Habitat Priorities

High

- Continue tagging studies to determine stock identity, inshore/offshore migration patterns, abundance, and mortality.
- Refine maturity schedules for northern and southern stocks. Conduct studies on size, age, and spatial specific fecundity.

Moderate

- Conduct otolith microchemistry studies to determine the life stage linking estuarine and offshore red drum and/or regional stock differentiation.

Low

- Identify spawning areas and abiotic components of these areas through the entire range so these areas can be protected from degradation and/or destruction. Determine the impacts of dredging and beach re-nourishment on red drum spawning and early life history stages. Identify the effects of water quality degradation on the survival of red drum eggs, larvae, post-larvae, and juveniles.
- Assess the efficacy of using cultured red drum to restore native stocks along the Atlantic coast, including cost-benefit analysis.
- Determine methods for restoring red drum habitat and/or improving existing environmental conditions that adversely affect red drum production.
- Determine habitat preferences, environmental conditions, growth rates, and food habitats of larval and juvenile red drum throughout the species range along the Atlantic coast. Assess the effects of environmental factors on stock density.

Management, Law Enforcement, and Socioeconomic Priorities

Low

- Collect socioeconomic data, possibly by add-ons to the MRIP or other methods, to determine economic value of Atlantic coast recreational red drum fishery.

SCUP

Fishery-Dependent Priorities

- Continue current level of sea and port sampling of the various fisheries in which scup are landed and discarded to adequately characterize the length composition of both landings and discards. Expanded age sampling of scup from commercial and recreational catches would be beneficial , with special emphasis on the acquisition of large specimens.[70]
- Commercial discard mortality had previously been assumed to be 100% for all gear types. Studies need to be conducted to better characterize the mortality of scup in different gear types to more accurately assess discard mortality.
- Additional information on compliance with regulations (e.g., length limits) and hooking mortality is needed to interpret recreational discard data and confirm weightings used in stock assessment model.

Fishery-Independent Priorities

- Fund, support, and expand the spatial coverage of the ventless trap-based Scup and Black Sea Bass Survey of Hard Bottom Areas.
- Collect total and fork lengths from individual scup in a standardized manner throughout their size and geographic range and across gear types to improve upon the length conversion equation currently cited in the FMP (Hamer, 1979).

Modeling / Quantitative Priorities

- Continue exploration of relative biomass and relative exploitation calculations based on CPUE data from fishery-dependent data (e.g., observer, commercial, P/C VTR, MRIP, etc).
- Evaluate the current biomass reference point and consider alternative proxy reference points such as B_{MAX} (the relative biomass associated with F_{MAX}).
- Explore other approaches for analyzing survey data, including bootstrap resampling methods to generate approximate confidence intervals around the survey index point estimates.[71]
- Evaluate indicators of potential changes in stock status that could provide signs to management of potential reductions of stock productivity in the future.

Life History, Biological, and Habitat Priorities

- Conduct an ageing comparison workshop to (1) compare otoliths and scales and (2) compare state age-length keys.[72]

[70] Improved sampling intensity of landings and increased funding for the observer program since 2004 have improved discard sampling in the directed and bycatch fisheries for scup.

[71] Completed for the NEFSC surveys, could be applied to state survey data.

[72] Contact and inform Eric Robillard of NEFSC Population Biology Branch.

- Conduct biological studies to investigate factors affecting annual availability of scup to research surveys and maturity schedules.

Management, Law Enforcement, and Socioeconomic Priorities

- A Management Strategy Evaluation of alternative approaches to setting quotas, with attention paid to compliance related to minimum size, would be helpful.

Scup Research Needs Identified as Being Met

- ✓ The SARC discussed some of the reasons why the research recommendations from previous SARCs had not been adequately addressed. There is currently no mechanism for accountability, resulting in other research needs taking priority. It was suggested that summaries of research recommendations be forwarded to the NRCC for review and comment, followed by a feasibility analysis. At that point a list of priorities and perhaps assignments for research could be made. The SARC recommends that a working group be developed to assess what group would be best suited to address each research need. *This is now a TOR that must be responded to in each assessment.*
- ✓ In the absence of reliable estimates of the catch, consideration should be given to simple forward projection models that rely on trends from the survey indices in the absence of catch information. *35th SAW Consensus Summary 141. Completed in AIM, resulted in no improvement over VPA because inconstancy between fishery dependent and independent data.*
- ✓ Investigate the statistical properties of the three commercial discard estimation approaches presented for consideration in future analyses. *Completed, awaiting review at next benchmark assessment.*

SPANISH MACKEREL

Fishery-Dependent Priorities

- Increase proportion of fish with biological data within MRFSS sampling.
- Continue to develop methods to collect a higher degree of information on released fish (length, condition, etc.) in the recreational fishery.
- Require mandatory reporting for all charter boats state and federal.
- Continue development of electronic mandatory reporting for for-hire sector.
- Continue research efforts to incorporate/require logbook reporting from recreational anglers.
- Establish a review panel to evaluate methods for reconstructing historical landings (SWAS, FWS, etc.).
- Quantify historical fishing photos for use in reconstructing recreational historical landings.
- Narrow down the sampling universe. Identify angler preference and effort. Require a reef fish stamp for anglers targeting reef fish, pelagic stamp for migratory species, and deepwater complex stamp for deep-water species. The program would be similar to the federal duck stamp required of hunters. This would allow the managers to identify what anglers were fishing for.
- Continue and expand fishery-dependent at-sea-observer surveys to collect discard information, which would provide for a more accurate index of abundance.

- Implement observer coverage for the fisheries for Spanish mackerel (gillnets, castnets (FL), handlines, poundnets, and shrimp trawls for bycatch). Allocate 5-10% observer coverage by strata within states and collect maximum information from fish.
- Expand TIP sampling to better cover all statistical strata, predominantly from FL and by gillnet and castnet gears.
- Determine the tradeoff with length versus ages, need for more ages (i.e., hard parts).
- Consider the use of VMS to improve spatial resolution of data.
- Consider simplified logbook language in regard to discards (e.g., list them as dead or alive).[73]
- Develop uniform state and federal reporting systems/forms to improve the ease and efficiency of data compilation.
- Establish online reporting and use logbooks as a backup.
- Establish a mechanism for identifying age samples that were collected by length or market categories, so as to better address any potential bias in age compositions.
- Continue improving "one-stop shopping" for commercial data from NMFS, ACCSP, and states.

Fishery-Independent Priorities

- Collect and analyze fishery independent data for adult Spanish mackerel.

Modeling / Quantitative Priorities

- Using simulation analysis, evaluate the utility of including interaction terms in the development of a standardized index and identify the potential effects these interaction terms have on stock assessments.
- Establish a fishery-independent survey meant to capture the population trends of coastal pelagic in the south Atlantic.
- Examine how schooling or migratory dynamics may influence the catchability of the species. In particular, research the assumption of the hyperstability of indices that sample the schooling portion of the stock.
- Determine whether it is important to model both sexes in the population for assessment purposes.
- Investigate steepness and alternative models for the stock recruit relationship. In particular, evaluate if there is newer data available on steepness from other analyses of S-R for pelagic stocks with similar reproductive strategies.[74]

.

Life History, Biological, and Habitat Priorities

- Utilize recently developed genetic techniques to investigate the stock structure of Spanish mackerel. Microsatellite information should be explored to consider both stock identity and internal population structure.
- Collect Spanish mackerel maturity data from both regions and both sexes from specimens approximately 275 mm FL and lower to be staged via histological methods.

[73] Current logbook categories for discards (all dead, majority dead, majority alive, all alive) are not useful for informing discard mortality.

[74] The Review Panel for the 2012 SEDAR was uncertain as to how much the analysis would further inform the model or management at present

SPINY DOGFISH

Fishery-Dependent Priorities

High

- Determine area, season, and gear specific discard mortality estimates coastwide in the recreational, commercial, and non-directed (bycatch) fisheries.[75]
- Characterize and quantify bycatch of spiny dogfish in other fisheries.

Moderate

- Increase the biological sampling of dogfish in the commercial fishery and on research trawl surveys.

Low

- Further analyses of the commercial fishery is also warranted, especially with respect to the effects of gear types, mesh sizes, and market acceptability on the mean size of landed spiny dogfish.

Fishery-Independent Priorities

Moderate

- Conduct experimental work on NEFSC trawl survey gear performance, with focus on video work to study the fish herding properties of the gear for species like dogfish and other demersal roundfish.
- Investigate the distribution of spiny dogfish beyond the depth range of current NEFSC trawl surveys, possibly using experimental research or supplemental surveys.

Low

- Continue to analyze the effects of environmental conditions on survey catch rates.

Modeling / Quantitative Priorities

High

- Continue work on the change-in-ratio estimators for mortality rates and suggest several options for analyses.

Moderate

- Examine observer data to calculate a weighted average discard mortality rate based on an assumption that the rate increased with catch size.

Life History, Biological, and Habitat Priorities

High

- Conduct a coastwide tagging study to explore stock structure, migration, and mixing rates.
- Standardize age determination along the entire East Coast. Conduct an ageing workshop for spiny dogfish, encouraging participation by NEFSC, NCDMF, Canada DFO, other interested agencies, academia, and other international investigators with an interest in dogfish ageing.

Moderate

- Identify how spiny dogfish abundance and movement affect other organisms.

[75] A discard mortality study in the North Carolina near-shore trawl and gillnet fisheries conducted by East Carolina University has been considered in previous stock assessments.

Management, Law Enforcement, and Socioeconomic Priorities

Moderate

- Monitor the changes to the foreign export markets for spiny dogfish, and evaluate the potential to recover lost markets or expand existing ones.

Low

- Update on a regular basis the characterization of fishing communities involved in the spiny dogfish fishery, including the processing and harvesting sectors, based upon Hall-Arber et al. (2001) and McCay and Cieri (2000).
- Characterize the value and demand for spiny dogfish in the biomedical industry on a state by state basis.
- Characterize the spiny dogfish processing sector

Spiny Dogfish Research Needs Identified as Being Met

- ✓ Genetic analysis of spiny dogfish to determine if more than one unit stock exists along the Northwest Atlantic.
- ✓ Update maturation and fecundity estimates by length class.
- ✓ Recover and encode information on the sex composition prior to 1980 from the survey database.
- ✓ Quantify effort directed on spiny dogfish in waters outside of the US.

SPOT

Fishery-Dependent Priorities

High

- Conduct 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.
- 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.
- Determine the onshore versus offshore components of the spot fishery.
- Evaluate the effects of mandated BRDs on spot catch in those states with significant commercial harvests.[76]

Fishery-Independent Priorities

High

- Begin collection of otoliths from the NMFS and SEAMAP surveys and continue collection of otoliths from the NEAMAP survey.[77]
- Develop cooperative coastwide spot juvenile indices to clarify stock status.
- Continue monitoring long-term changes in spot abundance, growth rates, and age structure.
- Continue monitoring juvenile spot populations in major nursery areas.

[76] North Carolina began a statewide characterization study of the commercial shrimp trawl fishery in August 2012 that will be conducted through June 2014, including discard mortality data collection.

[77] Personnel to process and age these collected otoliths should be identified.

Modeling / Quantitative Priorities

High

- Develop fishery-dependent and fishery-independent size and sex specific relative abundance estimates.[78]
- Develop catch-at-age matrices for recreational and commercial fisheries.
- Develop stock assessment analyses appropriate to current data.
- Cooperatively develop a YPR analysis.

Life History, Biological, and Habitat Priorities

High

- Add the North Carolina commercial and fishery-independent (gill net survey) data that were unavailable at the data workshop to the life history analyses.[79]
- Process and read the backlog of otoliths collected from the Maryland and North Carolina commercial fisheries and the NEAMAP Survey.[80]
- Continue evaluation of size and age at maturity.[81]
- Define reproductive output based on fecundity and spawning periodicity.[82]
- Conduct age validation studies.[83]
- Organize an otolith exchange between the major spot ageing labs (ODU/SCDNR/NCDMF). If there are differences in age assignments, hold a spot ageing workshop to establish a coastwide ageing protocol.
- Determine the effect that anthropogenic perturbations may be having on growth, survival, and recruitment.
- Develop stock identification methods and investigate the degree of mixing between state stocks during the annual fall migration (genetic and tagging studies).[84]

Moderate

- Evaluate natural mortality by age once confident that otoliths have been aged consistently between labs.
- Conduct discard mortality studies for gears used in the recreational and commercial fisheries.[76]

SPOTTED SEATROUT

Fishery-Dependent Priorities

High

- Collect data on the size and age of spotted seatrout released alive by anglers and the size and age of commercial discards.
- Increase observer coverage in states that have a commercial fishery for spotted seatrout.

[78] Some recent data from South Carolina is available for this work.
[79] See Kevin Brown (NC DMF) for the available data.
[80] North Carolina backlog through 2011 is processed and aged.
[81] Age, growth, and reproduction work done in South Carolina thesis project.
[82] Some maturity schedule data available from South Carolina.
[83] South Carolina age validation study completed in 2012.
[84] Archived genetic samples available in South Carolina.

- Expand the MRIP to assure adequate data collection for catch and effort data, increase intercepts, and include state add-ons of social and economic data needs.

Moderate

- Collection of commercial and recreational landings data should be continued and expanded.
- Improve precision of effort reporting through commercial trip ticket programs.

Fishery-Independent Priorities

High

- Develop state-specific juvenile abundance indices.
- Initiate fishery-independent surveys of spotted seatrout.
- Emphasis should be placed on collecting the necessary biological data to be able to conduct stock assessments and to assist in drafting fishery management plans.

Modeling / Quantitative Priorities

High

- Utilize age structure analyses by sex in stock assessments.
- Conduct state specific stock assessments to determine the status of stocks relative to the plan objective of maintaining a spawning potential of at least 20%.
- Provide state specific batch fecundity estimates for use in stock assessments.[85]

Life History, Biological, and Habitat Priorities

High

- Identify essential habitat requirements.
- Evaluate effects of environmental factors, especially cold winters, on spawning frequency and stock density.
- Continue work to examine the stock structure of spotted seatrout on a regional basis, with particular emphasis on advanced tagging and molecular techniques.[86]
- Conduct telemetry tagging surveys to provide precise estimates of mortality attributed to winter kills.[87]

Management, Law Enforcement, and Socioeconomic Priorities

High

- Initiate collection of social and economic aspects of the spotted seatrout fishery.

SUMMER FLOUNDER

Fishery-Dependent Priorities

High

- Develop a program to annually sample the length and age frequency of summer flounder discards from the recreational fishery.

[85] South Carolina fecundity information available in Roumillat and Brouwer (2002).

[86] Masters project in progress examining the genetic structure of spotted seatrout along the Atlantic coast and the effects of winter conditions on genetic diversity of spotted seatrout.

[87] Masters project in progress examining lethal temperature thresholds of spotted seatrout.

- Collect and evaluate information on the reporting accuracy of recreational discard estimates in the recreational fishery.
- Conduct more comprehensive collection of otoliths, for all components of the catch-at-age matrix, on a continuing basis for fish larger than 60 cm (~7 years). The collection of otoliths and the proportion at sex for all of the catch components could provide a better indicator of stock productivity.
- Develop a reference collection of summer flounder scales and otoliths to facilitate future quality control of summer flounder production ageing. In addition, a comparison study between scales and otoliths as ageing structures for summer flounder should be completed.[88]
- Examine mesh selectivity patterns for a range of commonly used mesh sizes greater than the currently mandated sizes (5.5 Diamond/6 inch square).[89]
- Continue to collect and analyze age-length samples and CPUE data from the commercial and recreational fisheries throughout the range of summer flounder.

Moderate

- Research directed at evaluating the mesh exemption program should be continued, with increased sample sizes to allow reliable statistical testing of results.
- Use NEFSC fishery observer age-length keys for 1994 and later years (as they become available) to supplement NEFSC survey data in ageing the commercial fishery discard.
- Undertake research to determine hooking mortality on summer flounder by circle, kahle, and regular "J" hooks and make the results of work already completed available to the Management Board.
- Collect data to determine the sex ratio for all of the catch components.
- Develop fish excluder devices to reduce bycatch of immature flatfish in fisheries that target species other than flounder.

Fishery-Independent Priorities

High

- Collect information on overall fecundity for the stock, both egg condition and production, as a better indicator of stock productivity.[90]

[88] The SDWG reported that an exchange of aging structures between NEFSC and NCDMF was completed and a report was reviewed by the 2007 SDWG, in response to a 2005 SAW 41 high priority Research Recommendation. The SDWG noted that while the Fall 2006 ageing exchange between NC-DMF and the NEFSC indicated that the current level of ageing consistency between NC and NEFSC is acceptable, there is a need to conduct and fund these exchanges more frequently, on a schedule consistent with benchmark assessments.

[89] This research should only be a high priority if managers want to change the commercial minimum size. This research should wait until changes in minimum size are anticipated so outdated research does not have to be updated.

[90] The SDWG noted that observed change in the sex ratio in NEFSC survey samples may result in the SSB estimates not translating as directly to egg production since there are more males proportionally in those older age categories. While these trends have not been examined in the state survey catches, these trends were examined in the NEFSC spring, autumn, and winter survey data. Additional work to examine and explain these trends in greater detail should be conducted.

- Continue fishery-independent surveys and expand existing surveys to capture all sizes and age classes in order to develop independent catch-at-age and CPUE should focus on YOY and the southern region.

Modeling / Quantitative Priorities

High

- Investigate trends in sex ratios and mean lengths and weights of summer flounder in state agency and federal survey catches.

Low

- Examine the sensitivity of the summer flounder assessment to the various unit stock hypotheses and evaluate spatial aspects of the stock to facilitate sex and spatially explicit modeling of summer flounder.[91]

Life History, Biological, and Habitat Priorities

Moderate

- Develop or determine stock identification methods via meristics, morphometrics, biochemical research, and tagging (particularly off Virginia and North Carolina).

Low

- Evaluate effects of dissolved oxygen and water current requirements for adult summer flounder and summer flounder eggs.
- Evaluate the relationship between recruitment of summer flounder to nursery areas and Ekman transport or prevailing directions of water flow.
- Examine male female ratio at age 0 and potential factors (e.g., environmental) that may influence determination of that ratio.
- Conduct the basic research necessary to develop land and pen culture techniques.
- Conduct further research to examine the predator-prey interactions of summer flounder and other species, including food habitat studies, to better understand the influence of these other factors on the summer flounder population.

Management, Law Enforcement, and Socioeconomic Priorities

Moderate

- Consider use of MSE techniques to address the implications of harvest policies that incorporate consideration of retrospective patterns (see ICES Journal of Marine Science issue of May 2007).
- Conduct a detailed socioeconomic study of the summer flounder fisheries.

[91] Current ASAP model lacks the capability to do sex and spatial modeling, so Stock Synthesis version of this approach (e.g., M. Maunder 2008 SAW 47 work) would be necessary. Above all, there is a lack of sufficient time series data to sex all catch and surveys, and lack of information on spatial movement and/or recruitment patterns.

TAUTOG

Fishery-Dependent Priorities

High

- Initiate biological sampling of the commercial catch for each gear type over the entire range of the stock (including weight, lengths, age, sex, and discards).[92]
- Increase catch and discard length sampling from the commercial and recreational fishery for all states from Massachusetts through Virginia.
- Increase collection of effort data for determining commercial and recreational CPUE.
- Increase MRIP sampling levels to improve recreational catch estimates by state and mode. Current sampling levels are high during times of the year when more abundant and popular species are abundant in catches, but much lower in early spring and late fall when tautog catches are more likely.

Fishery-Independent Priorities

High

- Establish standardized state by state long-term fisheries-independent surveys to monitor tautog abundance and length-frequency distributions, and to develop YOY indices.
- Continue collecting operculum from the tautog catch as the standard for biological sampling in addition to collecting paired sub-samples of otoliths and operculum.

Life History, Biological, and Habitat Priorities

Moderate

- Define the status (condition and extent) of optimum or suitable juvenile habitats and trends in specific areas important to the species. It is critical to protect these habitats or to stimulate restoration or enhancement, if required.
- Define the specific spawning and pre-spawning aggregating areas and wintering areas of juveniles and adults used by all major local populations, as well as the migration routes used by tautog to get to and from spawning and wintering areas and the criteria or times of use. This information is required to protect these areas from damage and overuse or excessive exploitation.
- Define larval diets and prey availability requirements. This information can be used as determinants of recruitment success and habitat function status. Information can also be used to support aquaculture ventures with this species.
- Define local and regional movement patterns and site fidelity in the southern part of the species range. This information may provide insight into questions of aggregation versus recruitment to artificial reef locations. More clarification is required on what the southern part of the range is and to clarify the need for local and regional assessment.
- Define the role of prey type and availability in local juvenile/adult population dynamics over the species range. This information can explain differences in local abundance, movements, growth, fecundity, etc. Conduct studies in areas where the availability of primary prey, such as blue mussels or crabs, is dependent on annual recruitment, the effect of prey recruitment variability as a factor in tautog movements (to find better prey fields), mortality (greater

[92] Limited sampling of New Jersey hook and line and pot fisheries in progress.

predation exposure when leaving shelter to forage open bottom), and relationship between reef prey availability/quality on tautog condition/fecundity.

- Define the susceptibility of juveniles to coastal/anthropogenic contamination and resulting effects. This information can explain differences in local abundance, movements, growth, fecundity, and serve to support continued or increased regulation of the inputs of these contaminants and to assess potential damage. Since oil spills seem to be a too frequent coastal impact problem where juvenile tautog live, it may be helpful to conduct specific studies on effects of various fuel oils and typical exposure concentrations, at various seasonal temperatures and salinities. Studies should also be conducted to evaluate the effect of common piling treatment leachates and common antifouling paints on YOY tautog. The synergistic effects of leaked fuel, bilge water, treated pilings, and antifouling paints on tautog health should also be studied.
- Assemble regional reference collections of paired operculum and otolith samples and schedule regular exchanges to maintain and improve the precision of age readings between states that will be pooled in the regional age-length keys.

Low

- Define the source of offshore eggs and larvae (in situ or washed out coastal spawning).
- Confirm that tautog, like cunner, hibernate in the winter, and in what areas and temperature thresholds, for how long, and if there are special habitat requirements during these times that should be protected or conserved from damage or disturbance. This information will aid in understanding behavior variability and harvest availability.
- Calibrate age readings every year by re-reading a subset of samples from previous years before ageing new samples. States that do not currently assess the precision of their age readings over time should do so by re-ageing a subset of their historical samples.

Management, Law Enforcement, and Socioeconomic Priorities

Low

- Collect basic sociocultural data on tautog user groups including demographics, location, and aspects of fishing practices such as seasonality.

Tautog Research Priorities Identified as Being Met

✓ Sample hard parts for annual ageing from the catches of recreational and commercial fisheries and fishery-independent surveys throughout the range of the stock. *Being conducted by all participating states.*

WEAKFISH

Fishery-Dependent Priorities

High

- Increase observer coverage to identify the magnitude of discards for all commercial gear types from both directed and non-directed fisheries.[93]

[93] Some Mid-Atlantic trawl fleet observer coverage has been implemented under ACCSP funding.

Moderate

- Continue studies on temperature, size, and depth specific recreational hook and release mortality rates, particularly catches from warm, deep waters. Investigate methods to increase survival of released fish.
- Continue studies on mesh size selectivity, particularly trawl fisheries.[94]

Low

- Determine the onshore versus offshore components of the weakfish fishery.
- Collect catch and effort data including size and age composition of the catch, determine stock mortality throughout the range, and define gear characteristics. In particular, increase length frequency sampling in fisheries from Maryland and further north.
- Develop latitudinal, seasonal, and gear specific age length keys coastwide. Increase sample sizes for gear specific keys.

Modeling / Quantitative Priorities

High

- Evaluate predation of weakfish with a more advanced multispecies model (e.g., the ASMFC MSVPA or Ecopath with Ecosim) to validate estimates calculated by production models with predation-competition extensions.
- Develop a bioenergetics model that encompasses a broader range of ages than Hartman and Brandt (1995) and use it to evaluate diet and growth data.
- Analyze the spawner-recruit relationship and examine the effects of the relationship between adult stock size and environmental factors on year class strength.
- Quantify trawl bycatch. Refine estimates of discard mortality based on factors such as distance from shore and other geographical differences for all sizes including below minimum size.

Life History, Biological, and Habitat Priorities

High

- Develop a coastwide tagging program to identify stocks and determine migration, stock mixing, and characteristics of stocks in over wintering grounds. Determine the relationship between migratory aspects and the observed trend in weight-at-age.[95]
- Monitor weakfish diets over a broad regional and spatial scale.

Moderate

- Identify and delineate weakfish spawning habitat locations and environmental preferences to quantify spawning habitat.
- Compile data on larval and juvenile distribution from existing databases to obtain preliminary indications of spawning and nursery habitat location and extant.
- Examine geographical and temporal differences in growth rate (length and weight-at-age).

[94] Gillnet selectivity has been investigated by Swihart et al (2000). Some gear selectivity information in Amendment 3 to the ASMFC Weakfish FMP. Information can also be obtained from the North Carolina Pamlico Sound Independent Gill Net Survey.

[95] Tagging work to evaluate mortality, movement, stock mixing, and weakfish predator information is scheduled to begin in North Carolina in 2013. Otolith samples have been obtained by Old Dominion University, but funding has not been available for processing.

Low

- Determine the impact of power plants and other water intakes on larval, post larval, and juvenile weakfish mortality in spawning and nursery areas. Calculate the resulting impact on adult stock size.[96]

Management, Law Enforcement, and Socioeconomic Priorities

Moderate

- Assemble socioeconomic data as it becomes available from ACCSP.

Low

- Define restrictions necessary for implementation of projects in spawning and over wintering areas and develop policies on limiting development projects seasonally or spatially.

Weakfish Research Priorities Identified as Being Met

- ✓ Conduct an age validation study. *An age validation study was completed by Lowerre-Barbieri et al. (1995). (2009 SARC)*
- ✓ Define reproductive biology of weakfish, including size at sexual maturity, maturity schedules, fecundity, and spawning periodicity. Continue research on female spawning patterns: What is the seasonal and geographical extent of "batch" spawning; do females exhibit spawning site fidelity? *This work has been completed by Nye et al 2008 and Lowerre-Barbieri et al 1996.*
- ✓ Update the scale – otolith comparison for weakfish. *See work by Vaughan et al. at 1998 AFS Annual Meeting in the SARC 30.*
- ✓ Investigate alternative age based models that allow error in catch-at-age estimates (e.g., SCA) and/or are less prone to retrospective patterns (e.g., extended survivor analysis).
- ✓ Conduct spatial and temporal analysis of the fishery-independent survey data. The analysis should assess the impact of the variability of the surveys in regards to gear, time of year, and geographic coverage of their (survey) use as stock indicators. *Work by Dr. Yan Jiao of Virginia Tech University. See Winter et al. 2009.*

WINTER FLOUNDER

Coast Wide

Fishery-Dependent Priorities

High

- Increase the intensity of commercial fishery discard length sampling.
- Expand sea sampling to validate commercial discard estimates from VTR.
- Maintain or increase sampling levels and collect age information from MRIP samples.

[96] Data are available for power plants in the Delaware Bay area and North Carolina. Also see Heimbuch et al. 2007. Assessing coastwide effects of power plant entrainment and impingement on fish populations: Atlantic menhaden example. *North American Journal of Fisheries Management*. 27: 569-577.

Fishery-Independent Priorities

Moderate

- Evaluate the maturity-at-age of fish sampled in inshore surveys (i.e., MEDMR, MADMF, NEAMAP, etc.).[97]
- Encourage support for Industry Based Surveys, which can provide valuable information on stock abundance, distribution, and catchability in research surveys that are independent of and supplemental to NMFS effort.

Modeling / Quantitative Priorities

Moderate

- Investigate the skipped spawning percentage for each stock and estimate inter-annual variation when sufficient data have been collected.

Low

- Develop mortality estimates from the American Littoral Society tagging data, if feasible.
- Explore use of a more complex Stock Synthesis model with small rates of migration between stocks.
- Revise the NEFSC assessment software to include the ability to model stock-recruit functions including environmental factors with errors/probabilities.
- Develop time series of winter flounder consumption by the major fish predators of winter flounder.
- Explore development of an index of winter flounder larval abundance based on MARMAP, GLOBEC, and other time series.

Life History, Biological, and Habitat Priorities

High

- Focus research on quantifying mortality associated with habitat loss and alteration, contamination by toxins, and power plant entrainment and impingement. Examine the implications of these anthropogenic mortalities on estimation of YPR, if feasible.
- Conduct studies to delineate all major sub-stocks in terms of geographic spawning area and seasonal offshore movements (e.g., exposure to fishing pressure).[98,99]

Moderate

- Update and investigate migration rates between stocks and movement patterns. Investigate localized structure/genetics within the stocks.[98,99]

Low

- Conduct studies of flounder populations in impacted areas to quantify physiological adaptation to habitat alteration, and interactive effects, on an individual and population level.

---

[97] See McBride et al. 2013. Latitudinal and stock-specific variation in size- and age-at-maturity of female winter flounder, Pseudopleuronectes americanus, as determined with gonad histology. *Journal of Sea Research*. 75: 41-51.

[98] The most recent comprehensive tagging study was completed in the 1960's (Howe and Coates). Some telemetry work done in southern Gulf of Maine, see DeCelles and Cadrin 2010. Movement patterns of winter flounder (Pseudopleuronectes americanus) in the southern Gulf of Maine: observations with the use of passive acoustic telemetry. *Fisheries Bulletin*. 108: 408-419.

[99] See Fairchild et al. 2009. Using telemetry to monitor movements and habitat use of cultured and wild juvenile winter flounder in a shallow estuary. *Tagging and Tracking of Marine Animals with Electronic Devices.* 9: 5-22.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Investigate ways to improve compliance to help VTR. Currently about 300 of the 1,500 permitted vessels consistently under report the number of statistical areas fished.

Southern New England – Mid-Atlantic Stock Complex

Modeling / Quantitative Priorities

Low

- Quantify adult sex ratio to determine the possibility of population decline due to a skewed sex ratio.

Life History, Biological, and Habitat Priorities

Moderate

- Examine egg and larvae distribution and abundance to determine YPR to predict future biomass development for the fishery.
- Assess distribution of winter flounder during each life stage by conducting tagging methods, focusing on juvenile to adult life stages. This information would be useful for estimating YPR and helpful to find answers as to why recruitment is at a vulnerable state.[99]
- Examine winter flounder distribution, abundance, and productivity based on oceanographic and climate warming and how that impacts biomass for the fishery.

Low

- Examine predator-prey relationships due to increased populations of cormorants, seals, and striped bass (examine stomach contents of predators to get a better idea on the quantification of predation on winter flounder by these predators).

Georges Bank Stock

Fishery-Independent Priorities

High

- Examine maturity data from NEFSC strata on Nantucket Shoals and near Georges Bank separately from more inshore areas.[97]

Life History, Biological, and Habitat Priorities

High

- Investigate use of periodic gonad histology studies to validate maturity estimates, with particular attention to obtaining sufficient samples from the Georges Bank stock.[97]
- Conduct studies to better understand recruitment processes of winter flounder, particularly in the Gulf of Maine and on Georges Bank.

Moderate

- Further explore the relationship between large scale environmental forcing (e.g., temperature, circulation, and climate) for effects on life history, reproduction, and recruitment in the Georges Bank stock.

Gulf of Maine Stock

Fishery-Dependent Priorities

High

- Improve sampling for biological data (particularly hard parts for ageing) of commercial landings for winter flounder.
- Process archived age samples from surveys and commercial landings and develop analytical based assessments.[100]

Low

- Estimate and evaluate the effects of catch and release components of recreational fishery on discard-at-age.

Fishery-Independent Priorities

Moderate

- Evaluate size selectivity performance of survey gear compared to typical commercial gear and implications for estimation of commercial discards from research survey length frequency information.

Modeling / Quantitative Priorities

Low

- Evaluate the effects of smoothed length frequency distributions on the relationship between survey and commercial catches-at-length.

Life History, Biological, and Habitat Priorities

High

- Examine growth variations within the Gulf of Maine, using results from the Gulf of Maine Biological Sampling Survey (1993-94).[101]
- Conduct studies to better understand recruitment processes of winter flounder, particularly in the Gulf of Maine and on Georges Bank.

Moderate

- Further examine the stock boundaries to determine if Bay of Fundy winter flounder should be included in the Gulf of Maine stock complex.[98]

Winter Flounder Research Priorities Identified as Being Met

- ✓ Investigate the feasibility of port samplers collecting otoliths in place of scales to mitigate under ageing larger fish. *Port sampling protocols have been changed to collect otoliths from large winter flounder. The Massachusetts and Maine-New Hampshire surveys are also collecting winter flounder otoliths. Work by Thornton and Robillard evaluating the collection of otoliths was presented at the 2012 Flatfish Biology Conference (http://mi.nefsc.noaa.gov/flatfishbiologyworkshop).*
- ✓ Examine the sources of differences between NEFSC, Massachusetts, and Connecticut survey maturity (validity of evidence for younger size/age at 50% maturity in NEFSC

[100] Maine DMR has archived winter flounder otoliths since 2002.

[101] Biological data on winter flounder has been collected on the Maine DMR trawl survey from 2000-2008 and should be included.

data). Compare NEFSC inshore versus offshore strata for differences in maturity. Consider methods for combing maturity data from different survey programs. Conduct periodic maturity staging workshops involving State and NEFSC trawl survey staff. *See McBride et al. 2013. Latitudinal and stock-specific variation in size- and age-at-maturity of female winter flounder, Pseudopleuronectes americanus, as determined with gonad histology. Journal of Sea Research 75: 41-51. Also see SARC 52 (http://www.nefsc.noaa.gov/saw/saw52/crd1117.pdf).*

- ✓ Compare confidence intervals for maturity ogives. Calculate annual ogives and investigate for progression of maturity changes over time. *See SARC 52 (http://www.nefsc.noaa.gov/saw/saw52/crd1117.pdf). Also see McBride et al. 2013. Latitudinal and stock-specific variation in size- and age-at-maturity of female winter flounder, Pseudopleuronectes americanus, as determined with gonad histology. Journal of Sea Research 75: 41-51.*

Common Research Recommendations for All ASMFC Managed Diadromous Species

Dams and Other Obstructions

General Fish Passage

- States should work in concert with the USFWS and the NOAA Fisheries Service to identify hydropower dams that pose significant impediment to diadromous fish migration and target them for appropriate recommendations during FERC relicensing.
- States should identify and prioritize barriers in need of fish passage based on clear ecological criteria (e.g., amount and quality of habitat upstream of barrier, size, status of affected populations, etc.). These prioritizations could apply to a single species, but are likely to be more useful when all diadromous species are evaluated together.
- A focused, coordinated, well supported effort among federal, state, and associated interests should be undertaken to address the issue of fish passage development and efficiency. The effort should attempt to develop new technologies and approaches to improve passage efficiency with the premise that existing technology is insufficient to achieve restoration and management goals for several East Coast river systems.
- Where obstruction removal is not feasible, install appropriate passage facilities, including fish lifts, fish locks, fishways, navigation locks, or notches (low-head dams and culverts).
- At sites with passage facilities, evaluate the effectiveness of upstream and downstream passage; when passage is inadequate, facilities should be improved.
- Dams/obstructions where upstream passage structures will be installed should be evaluated for effectiveness of downstream passage. Upstream passage structures should not be installed at these sites, unless downstream passage can be made safe, effective, and timely.
- Facilities for monitoring the effectiveness of the pass should be incorporated into the design where possible.
- Before designing and constructing fish passage systems, determine the behavioral response of each species of interest to major physical factors so that effectiveness can be maximized.
- Protection from predation should be provided at the entrance, exit, and throughout the pass.
- The passage facility should be designed to work under all conditions of head and tail water levels that prevail during periods of migration.
- Passages are vulnerable to damage by high flows and waterborne debris. Techniques for preventing damage include robust construction, siting facilities where they are least exposed to adverse conditions, and removing the facilities in the winter.
- Evaluate performance of conventional fishways, fish lifts, and eel ladders, and determine features common to effective passage structures and those common to ineffective passage structures.
- Conduct basic research into diadromous fish migratory behavior as it relates to depth, current velocity, turbulence, entrained air, light, structures, and other relevant factors.
- Use information from the previous two research recommendations to conduct CFD modeling to develop more effective fishway designs.
- Research technologies (barriers, guidance systems, etc.) for directing emigrating fish to preferred passage routes at dams.

- Identify low-cost alternatives to traditional fishway designs.
- Develop effective downstream passage strategies to reduce mortality.

Upstream Fish Passage

- Diadromous fish must be able to enter the passage facility with little effort and without stress.
- To prevent fish from becoming entrained in intake flow areas of hydropower facilities, construct behavioral barrier devices and re-direct them to safer passage areas.
- Fish ascending the pass should be guided/routed to an appropriate area so that they can continue upstream migration, and avoid being swept back downstream below the obstruction.

Downstream Fish Passage

- To enhance survival at dams during emigration, evaluate survival of fish passed via each route (e.g., turbines, spillage, bypass facilities, or a combination of the three) at any given facility, and pass fish via the route with the best survival rate.

Other Dam Issues

- Where practicable, remove obstructions to upstream and downstream migration.
- Locate facilities along the river where impingement rates are likely to be lowest.
- Alter water intake velocities, if necessary, to reduce mortality to diadromous species.
- To mitigate hydrological changes from dams, consider operational changes such as turbine venting, aerating reservoirs upstream of hydroelectric plants, aerating flows downstream, and adjusting in-stream flows.
- Natural river discharge should be taken into account when alterations are being made to a river because it plays a role in the migration patterns of diadromous fish.
- Document the impact of power plants and other water intakes on larval, post-larval, and juvenile mortality in anadromous fish spawning areas, and calculate the resultant impacts to adult population sizes.
- Evaluate the upstream and downstream impacts of barriers on diadromous species, including population and distribution effects.

Water Quality and Contamination

- Maintain water quality and suitable habitat for all life stages of diadromous species in all rivers with populations of diadromous species.
- Non-point and point source pollution should be reduced in diadromous fish habitat areas.
- Implement BMPs along rivers and streams, restore wetlands, and utilize stream buffers to control non-point source pollution.
- Implement erosion control measures and BMPs in agricultural, suburban, and urban areas to reduce sediment input, toxic materials, and nutrients and organics into streams.
- Upgrade wastewater treatment plants and remove biological and organic nutrients from wastewater.
- Reduce the amount of thermal effluent into rivers. On larger rivers, include a thermal zone of passage.
- Provide management options regarding water withdrawal and land use to minimize the impacts of climate change on temperature and flow regimes.
- Discharge earlier in the year to reduce impacts to migrating fish.
- Conduct studies to determine the effects of dredging on diadromous habitat and migration; appropriate best management practices, including environmental windows, should be

considered whenever navigation dredging or dredged material disposal operations would occur in a given waterway occupied by diadromous species.
- Introduction of new categories of contaminants should be prevented.
- Determine effects of change in temperature and pH for all life stages of all diadromous species. Use this information to model impacts of climate change on species.
- Develop studies to document which contaminants have an impact on the various life stages of each diadromous species; also note the life stages that are affected and at what concentrations.
- Determine unknown optima and tolerance ranges for depth, temperature, salinity, dissolved oxygen, pH, substrate, current velocity, and suspended solids.

Habitat Protection and Restoration
- Use multi-scale approaches (including GIS) to assess indicators of suitable habitat, using watershed and stream-reach metrics if possible (it should be noted, that where site specific data is lacking, it may not be appropriate to assess at this scale).
- Use multi-scale approaches for restoring diadromous fish habitat, including vegetated buffer zones along streams and wetlands, and implementing measures to enhance acid-neutralizing capacity.
- Conduct studies on the effects of land use change on diadromous species population size, density, distribution, health, and sustainability.
- Examine how deviation from the natural flow regime impacts all diadromous species. This work should focus on key parameters such as rate of change (increase and decrease), seasonal peak flow, and seasonal base flow, so that the results can be more easily integrated into a year-round flow management recommendation by state officials.
- Investigate consequences to diadromous stocks from wetland alterations.
- When states have identified habitat protection or restoration as a need, state marine fisheries agencies should coordinate with other agencies to ensure that habitat restoration plans are developed, and funding is actively sought for plan implementation and monitoring.
- Any project resulting in elimination of EFH (e.g., dredging, filling) should be avoided.
- Substrate mapping of freshwater tidal portions of rivers should be performed to determine suitable diadromous fish habitat, and that habitat should be protected and restored as needed.
- States should notify in writing the appropriate federal and state regulatory agencies of the locations of habitats used by diadromous species. Regulatory agencies should be advised of the types of threats to diadromous fish populations, and recommended measures that should be employed to avoid, minimize, or eliminate any threat to current habitat quantity or quality.
- Each state encompassing diadromous fish spawning rivers and/or producer areas should develop water use and flow regime guidelines protective of diadromous spawning and nursery areas to ensure the long-term health and sustainability of the stocks.

Permitting
- Develop policies for limiting development projects seasonally or spatially in spawning and nursery areas; define and codify minimum riparian buffers and other restrictions where necessary.
- Projects involving water withdrawal (e.g., power plants, irrigation, water supply projects) should be scrutinized to ensure that adverse impacts resulting from impingement,

entrainment, and/or modifications of flow and salinity regimes due to water removal will not adversely impact diadromous fish stocks.
- State fishery regulatory agencies should develop protocols and schedules for providing input on Federal permits and licenses required by the Clean Water Act, Federal Power Act, and other appropriate vehicles, to ensure that diadromous fish habitats are protected.

Other

- Determine survival and mortality rates for all life stages of all diadromous species.
- Investigate predator-prey relationships for all life stages of all diadromous species.
- Determine the effects of channel dredging, shoreline filling, and overboard spoil disposal in the Atlantic coast on diadromous species.
- Define restrictions necessary for implementation of energy projects in diadromous species habitat areas and develop policies on limiting development projects seasonally and/or spatially.
- Promote cooperative interstate research monitoring and law enforcement. Establish criteria, standards, and procedures for plan implementation as well as determination of state compliance with management plan provisions.
- Diadromous fish may be vulnerable to mortality in hydrokinetic power generation facilities, and such projects should be designed and monitored to eliminate, or minimize, fish mortality.
- The use of any fishing gear that is deemed by management agencies to have an unacceptable impact on diadromous fish habitat should be prohibited within appropriate essential habitats (e.g., trawling in spawning areas or primary nursery areas should be prohibited).

Common Socioeconomic Research Recommendations for all ASMFC Managed Species

- Establish time series of social and economic data for use in management decisions. This is analogous to biological time series data that are currently being used in decision making for monitoring and fisheries management.
- Existing social and economic data sets are deficient and remedial. Develop and collect baseline of sociodemographic data for all Atlantic states by state, species, and community for commercial fishing and by state, species, community, and sector (boat, shore, and for-hire) for recreational and subsistence fisheries. Community profiles should include information on the infrastructure in support of the fisheries (e.g., provision of boat launches, haul-out yards, marine suppliers, recreational fishing docks).
- Update baseline data on a regular basis (e.g., every 3 years).
- Focus on research additional to the baseline for decisions to be made in the next few years.
- Evaluate existence value and non-consumptive use value (cultural and economic) for species that the ASMFC has protected through moratoria.

Old Comprehensive Research Needs from 2009

- *Develop a fishery-independent survey to sample offshore during winter. Abundance, aging, and stomach samples could be collected for striped bass, bluefish, weakfish, spiny dogfish, Atlantic herring, and shad.*
- *Develop a fishery-dependent survey on commercial boats (i.e., observers) to sample offshore during winter; survey dealers to sample commercial catch by the various gear types. Collect age, length, weight, sex information from the various fisheries (lobster, scup, bluefish).*
- *Develop or expand sea and port sampling/observer programs for gillnets and trawls*
    - *By area: (North, Mid-Atlantic) winter flounder, shad and sturgeon, scup and black sea bass, weakfish, lobster; (Coastwide) sharks and spiny dogfish, river herring and Atlantic sea herring; (South-Atlantic) Shrimp trawl: sharks, weakfish, spot, Spanish mackerel*
- *Recommendations to improve MRIP*
    - *Sample recreational fishery (bluefish) during Wave I*
    - *Increase recreational sampling (summer flounder, scup, tautog) by state and mode. Collect scale samples for summer flounder.*

<u>New Comprehensive research priorities – draft 2013</u>

Italics indicate same as last version of the comprehensive needs, **bold** indicates new additions. The following sections are grouped by general category, after pulling critical priorities from high priorities for each species which may have a coastwide or coordinated effort or be addressed through expanding existing efforts. Some comprehensive needs (numbered 1-5) are suggested preceding the sections which they are drawn from.

Three comprehensive needs cover the next several groupings dealing with sampling:

1. Develop a <u>fishery-independent</u> survey to collect abundance, age, and stomach samples for striped bass, bluefish, weakfish, spiny dogfish, Atlantic herring, shad, ***summer flounder, Spanish mackerel, eel, black drum, black sea bass, tautog****.* ***Expand types of samples collected on existing surveys.***

2. Develop a <u>fishery-dependent</u> survey on commercial boats (i.e., observers) to collect age, length, weight, sex information from the various fisheries (lobster, scup, bluefish, ***spotted seatrout, croaker, fluke, black drum, winter flounder, tautog****); survey dealers to sample commercial catch by the various gear types.* ***Expand types of samples collected by existing observer coverage.***

3. Recommendations to improve MRIP

- *Increase recreational sampling by state and mode for summer flounder, scup, tautog,* ***bluefish, black drum, spot, spotted seatrout, black sea bass****. Collect scale samples for summer flounder.*

Improved/expanded <u>fishery-independent</u> sampling priorities by species:

- EEL: Request that states record the number of eels caught by fishery-independent surveys. Recommend states collect biological information by life stage including length, weight, age,

and sex of eels caught in fishery-independent sampling programs; at a minimum, length samples should be routinely collected from fishery-independent surveys.

- BLACK DRUM: Increase spatial and temporal coverage of age samples collected regularly in fishery-independent sources.
- BLACK DRUM: Prioritize collection of adult age data from fishery-independent sources in states where maximum size regulations preclude the collection of adequate adult ages.
- BLACK DRUM: Expand existing fishery-independent surveys temporally and spatially to better cover black drum habitats, especially adult fish. Expand fishery-independent surveys to sample all sizes and age classes to develop more reliable catch-at-age and CPUE. Continue to collect and analyze current life history data from fishery-independent programs, including full size, age, maturity, histology workups and information on spawning season timing and duration. Any additional data that can be collected on adult black drum would be highly beneficial.
- SUMMER FLOUNDER: Continue fishery-independent surveys and expand existing surveys to capture all sizes and age classes in order to develop independent catch-at-age and CPUE; focus on YOY and the southern region.

Improved/expanded fishery-dependent sampling

- CROAKER: Encourage fishery-dependent biological sampling, including extraction of ageing structures, to improve age-length keys. Age-length keys should be representative of all gear types in the fishery. Supplement underrepresented length bins with additional ageing samples to avoid the necessity of weighting length-at-age estimates by length frequencies.
- CROAKER: Obtain gear specific effort information and improve fishery-dependent catch and effort statistics and catch size and age structure.
- BLACK DRUM: Increase spatial and temporal coverage of age samples collected regularly in fishery-dependent sources.
- BLACK DRUM: Obtain better estimates of harvest from the black drum recreational fishery, especially in states with short seasons. Obtain better coverage of shore and nighttime anglers.
- MENHADEN: Increase level of sampling from bait fisheries, particularly in the mid-Atlantic and New England.
- MENHADEN: Increase annual sampling and processing of menhaden from the pound net fishery to better characterize age and size structure of catch.
- BLUEFISH: Collect size and age composition of the fisheries by gear type and statistical area.
- BLUEFISH: Target commercial (especially in the northeast region) and recreational landings for biological data collection when possible.
- SCUP: Expanded age sampling of scup from commercial and recreational catches would be beneficial, with special emphasis on the acquisition of large specimens.
- SPOT: 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.
- WINTER FLOUNDER: Increase the intensity of commercial fishery discard length sampling.
- WINTER FLOUNDER: Improve sampling for biological data (particularly hard parts for ageing) of commercial landings for winter flounder.

- BLACK SEA BASS: Increase sampling of commercial landings. Increase recreational fisheries sampling.
- TAUTOG: Increase catch and discard length sampling from the commercial and recreational fishery for all states from Massachusetts through Virginia.
- TAUTOG: Increase collection of effort data for determining commercial and recreational CPUE.

New sampling/monitoring

- EEL: Monitor catch and effort in bait fisheries and in personal-use fisheries that are not currently covered by MRIP or commercial fisheries monitoring programs.
- LOBSTER: Establish permanent data loggers in offshore areas for all 3 stock units to collect bottom temperatures.
- SP. MACKEREL: Collect and analyze fishery independent data for adult Spanish mackerel.
- SP. MACKEREL: Collect Spanish mackerel maturity data from both regions and both sexes from specimens $\leq$ 275 mm FL to be staged via histological methods.
- SPOT: Conduct state monitoring and reporting on the extent of unutilized bycatch and fishing mortality on age 0 fish in fisheries that take significant numbers of spot.
- SPOTTED SEATROUT: Collect data on the size and age of spotted seatrout released alive by anglers and the size and age of commercial discards.
- SUMMER FLOUNDER: Develop a program to annually sample the length and age frequency of summer flounder discards from the recreational fishery.
- MENHADEN PREDATORS (e.g., striped bass, bluefish, weakfish): Validate MSVPA model parameters through the development and implementation of stomach sampling program that will cover major menhaden predators along the Atlantic coast.
- WEAKFISH: Monitor weakfish diets over a broad regional and spatial scale.
- TAUTOG: Initiate biological sampling of the commercial catch for each gear type over the entire range of the stock (including weight, lengths, age, sex, and discards).[1]
    - (1) Limited sampling of New Jersey hook and line and pot fisheries in progress.
- TAUTOG: Establish standardized state by state long-term fisheries-independent surveys to monitor tautog abundance and length-frequency distributions, and to develop YOY indices.

New targeted surveys

Do these new targeted surveys need to be species-specific, or can new surveys be developed to cover multiple species' priorities?

- EEL: Encourage states to implement surveys that directly target and measure abundance of yellow and silver stage American eels, especially in states where few targeted eel surveys are conducted.
- EEL: Develop a coastwide sampling program for yellow and silver stage American eels using standardized and statistically robust methodologies.
- MENHADEN: Develop and implement fishery-independent surveys to estimate size of recruiting year classes.
- MENHADEN: Develop a coast wide, fishery-independent index of adult abundance at age to replace or augment the existing Potomac River pound net index used in the assessment model. Possible methodologies include an air spotter survey or an industry-based survey with scientific observers on board collecting the data. In all cases, a sound statistical design is

essential (involve statisticians in the development and review of the design; some trial surveys may be necessary).

- MENHADEN: Investigate interannual maturity variability via collection of annual samples of mature fish along the Atlantic coast.
- MENHADEN: Consider developing an adult index, similar to PRFC CPUE index, using MD, VA, NJ and RI pound net information including biological data.
- BLUEFISH: Initiate fishery-dependent sampling of offshore populations of bluefish during the winter months.
- BLUEFISH: Initiate fishery-independent sampling of offshore populations of bluefish during the winter months.
- HORSESHOE CRAB: Expand or implement fishery-independent surveys (e.g., spawning, benthic trawl, tagging) to target horseshoe crabs throughout their full range, including estuaries. Highest priority should be given to implementing directed surveys in the New England and New York regions.
- SPOT: Develop cooperative coastwide spot juvenile indices to clarify stock status.
- SPOTTED SEATROUT: Develop state-specific juvenile abundance indices.
- SPOTTED SEATROUT: Initiate fishery-independent surveys of spotted seatrout.
- COASTAL SHARKS: Investigate the appropriateness of using vertebrae for ageing adult sandbar sharks. If appropriate, implement a systematic sampling program that gathers vertebral samples from entire size range for annual ageing to allow tracking the age distribution of the catch as well as updating of age-length keys.
- BLACK SEA BASS: Conduct a pot survey throughout the range of the northern management unit and consider for an index of abundance.[1]
    - (1) A pilot project is ongoing and proposals are being considered for funding to expand the program

Improved/expanded sampling

- LOBSTER: Expand data collection and modeling of the impacts of oceanographic and water temperature shifts to larval and adult survival and distribution.
- ATL. HERRING: Conduct more extensive stock composition sampling including all stocks (i.e., Scotian Shelf).
- ATL. HERRING: Expand monitoring of spawning components.
- SP. MACKEREL: Expand TIP sampling to better cover all statistical strata, predominantly from FL and by gillnet and castnet gears.
- SUMMER FLOUNDER: Conduct more comprehensive collection of otoliths, for all components of the catch-at-age matrix, on a continuing basis for fish larger than 60 cm (~7 years).
- BLACK SEA BASS: Expand sampling to cover the entire range of the southern stock over a longer time period.

(continues)

*4. Develop or expand sea and port sampling/observer programs for gillnets and trawls, **pots***

- *By area: (North, Mid-Atlantic) winter flounder, shad and sturgeon, scup and black sea bass, weakfish, lobster, **N. shrimp**; (Coastwide) sharks and spiny dogfish, river herring and Atlantic sea herring; (South-Atlantic) Shrimp trawl: sharks, weakfish, spot, Spanish mackerel; **spotted seatrout, red drum***

Sea and port sampling/bycatch, discard characterization

- LOBSTER: Identify a dedicated funding source for sea and port sampling programs, these programs are essential for characterization of the commercial catch for assessment purposes.
- WINTER FLOUNDER: Expand sea sampling to validate commercial discard estimates from VTR.
- SHAD/RH: Expand observer and port sampling coverage to quantify additional sources of mortality for alosine species, including bait fisheries, as well as rates of bycatch in other fisheries to reduce uncertainty.
- ATL. HERRING: Investigate bycatch and discards in the directed herring fishery through both at sea and portside sampling.
- ATL. STURGEON: Determine levels of bycatch and compare to F_{50} target levels for individual populations. Characterize Atlantic sturgeon bycatch in various fisheries by gear and season. Include data on fish size, health condition at capture, and number of fish captured.
- N. SHRIMP: Better characterize shrimp discards in the shrimp and other small-mesh (i.e., herring and whiting) fisheries to provide more accurate estimates of shrimp removals for modeling.
- N. SHRIMP: Continue to quantify the magnitude of bycatch of other species in the shrimp fishery by area and season and take steps necessary to limit negative impacts.
- RED DRUM: Conduct studies and collect time series data on discard mortality from varying commercial and recreational gears in directed and non-directed fisheries. Continue and expand observer coverage (5-10%) across all gear types in commercial fisheries or volunteer angler logbooks in recreational fisheries to characterize discards. Evaluate effects of water temperature, depth of capture, and other factors on discard mortality.
- SP. MACKEREL: Continue and expand fishery-dependent at-sea-observer surveys to collect discard information, which would provide for a more accurate index of abundance.
- SP. MACKEREL: Implement observer coverage for the fisheries for Spanish mackerel (gillnets, castnets (FL), handlines, poundnets, and shrimp trawls for bycatch). Allocate 5-10% observer coverage by strata within states and collect maximum information from fish.
- COASTAL SHARKS: Initiate or expand dockside sampling for sharks to verify landings information and species composition.
- SPINY DOGFISH: Characterize and quantify bycatch of spiny dogfish in other fisheries.
- SPOTTED SEATROUT: Increase observer coverage in states that have a commercial fishery for spotted seatrout.
- WEAKFISH: Increase observer coverage to identify the magnitude of discards for all commercial gear types from both directed and non-directed fisheries.
- BLACK SEA BASS: Increase sample size of at sea observers and dockside validation for headboats.

Tagging studies

Do tagging studies need to be species specific, or can they be done in conjunction with existing surveys?

- EEL: Implement large-scale (coastwide or regional) tagging studies of eels at different life stages to determine growth, passage mortality, movement and migration, validated ageing methods, reporting rates, and tag shedding/tag attrition rates.
- SHAD/RH: Develop an integrated coastal remote telemetry system or network that would allow tagged fish to be tracked throughout their coastal migration and into the estuarine and riverine environments.
- BLACK DRUM: Conduct a high reward tagging program to obtain improved return rates.
- BLACK DRUM: Continue and expand current tagging programs to obtain mortality and growth information and movement-at-size data.
- BLACK DRUM: Conduct new and expand existing acoustic tagging programs to help identify spawning and juvenile habitat use and regional recruitment sources.
- COASTAL SHARKS: Develop and conduct tagging studies on dusky and blacknose stock structure with increased international collaboration (e.g., Mexico) to ensure wider distribution and returns of tags. Expand research efforts directed towards tagging of individuals in south Florida and Texas/Mexico border to get better data discerning potential stock mixing.
- SPINY DOGFISH: Conduct a coastwide tagging study to explore stock structure, migration, and mixing rates.
- WEAKFISH: Develop a coastwide tagging program to identify stocks and determine migration, stock mixing, and characteristics of stocks in over wintering grounds. Determine the relationship between migratory aspects and the observed trend in weight-at-age.
- BLACK SEA BASS: Investigate the movement and migrations of black sea bass using otolith microchemistry, genetic studies, and expanding tagging studies.

5. ***Address age sample processing priorities:***
   -Process archived ageing samples (winter flounder, black drum)
   -Convene ageing workshops (shad/river herring, scup, spiny dogfish, spot)
   -Expand research on ageing techniques (lobster, shad/river herring, sturgeon, tautog)

Ageing

- LOBSTER: Continue and expand research on ageing techniques to improve the understanding of how many year classes support the current trap fishery, how length relates to age, and how variable the age structure is temporally and spatially.
- SHAD/RH: Validate the different values of M for river herring and American shad stocks through shad ageing techniques and repeat spawning information.
- SHAD/RH: Continue to assess current ageing techniques for river herring and American shad, using known-age fish, scales, otoliths, and spawning marks. Conduct biannual ageing workshops to maintain consistency and accuracy of ageing fish sampled in state programs.
- ATL. STURGEON: Evaluate aging techniques for Atlantic sturgeon with known age fish. Emphasis should be placed on verifying current methodology based on fin spines.
- BLACK DRUM: Analyze existing otoliths that have been collected but not aged.

- COASTAL SHARKS: Investigate the appropriateness of using vertebrae for ageing adult sandbar sharks. If appropriate, implement a systematic sampling program that gathers vertebral samples from entire size range for annual ageing to allow tracking the age distribution of the catch as well as updating of age-length keys. **(see same under New Targeted Surveys grouping)**
- N. SHRIMP: Investigate application of newly developed direct ageing methods to ground truth assumed ages based on size and stage compositions.
- SCUP: Conduct an ageing comparison workshop to (1) compare otoliths and scales and (2) compare state age-length keys.
- SPINY DOGFISH: Standardize age determination along the entire East Coast. Conduct an ageing workshop for spiny dogfish, encouraging participation by NEFSC, NCDMF, Canada DFO, other interested agencies, academia, and other international investigators with an interest in dogfish ageing.
- SPOT: Organize an otolith exchange between the major spot ageing labs (ODU/SCDNR/NCDMF). If there are differences in age assignments, hold a spot ageing workshop to establish a coastwide ageing protocol.
- SUMMER FLOUNDER: Develop a reference collection of summer flounder scales and otoliths to facilitate future quality control of summer flounder production ageing. In addition, a comparison study between scales and otoliths as ageing structures for summer flounder should be completed.
- WINTER FLOUNDER: Process archived age samples from surveys and commercial landings and develop analytical based assessments.
- TAUTOG: Continue collecting operculum from the tautog catch as the standard for biological sampling in addition to collecting paired sub-samples of otoliths and operculum.

Habitat

These priorities are encompassed by the common anadromous species priorities

- EEL: Develop, investigate, and improve technologies for upstream and downstream American eel passage at various barriers for each life stage. Identify effective low-cost alternatives to traditional passage designs. Develop design standards for upstream passage devices.
- SHAD/RH: Conduct studies to quantify and improve fish passage efficiency and support the implementation of standard practices.
- ATL. STURGEON: Quantify the amount and quality of sturgeon habitat in important sturgeon estuaries and rivers, including spawning and nursery habitats. Define and map bottom water quality, velocity, and substrates types for suitable sturgeon spawning and nursery habitat.

Industry Collaboration

- LOBSTER: Develop and utilize volunteer industry data collection program (e.g., standardize protocols and ground-truth data) as funding for sea and port sampling declines or does not exist.
- LOBSTER: Explore industry based funding mechanisms for routine fishery sampling and monitoring.
- MENHADEN: Collaborate with industry to implement surveys and sampling programs that collect age structure data outside the range of the fishery.

Continue surveys/sampling

- LOBSTER: Identify a dedicated funding source to continue the ventless trap survey for an accurate coastwide index of relative abundance.
- SCUP: Continue current level of sea and port sampling of the various fisheries in which scup are landed and discarded to adequately characterize the length composition of both landings and discards.
- SCUP: Fund, support, and expand the spatial coverage of the ventless trap-based Scup and Black Sea Bass Survey of Hard Bottom Areas.
- SUMMER FLOUNDER: Continue to collect and analyze age-length samples and CPUE data from the commercial and recreational fisheries throughout the range of summer flounder.

3. *Recommendations to improve MRIP*

- ~~*Sample recreational fishery (bluefish) during Wave I*~~ *– already being done?*
- *Increase recreational sampling (summer flounder, scup, tautog) by state and mode. Collect scale samples for summer flounder.* ***(see under Fishery Dependent Comprehensive)***
- ***Increase data collection for Spanish mackerel, spotted seatrout, winter flounder, black sea bass, tautog***

Improve MRIP

- SP. MACKEREL: Increase proportion of fish with biological data within MRFSS sampling.
- SPOTTED SEATROUT: Expand the MRIP to assure adequate data collection for catch and effort data, increase intercepts, and include state add-ons of social and economic data needs.
- WINTER FLOUNDER: Maintain or increase sampling levels and collect age information from MRIP samples.
- BLACK SEA BASS: Increase sample size of at sea observers and dockside validation for headboats. Increase recreational fisheries sampling.
- BLACK SEA BASS: Determine depth, temperature, and season specific discard mortality rates. Assess and incorporate the impact of circle hook fishing regulations on discard mortality. Obtain more depth specific information from the private recreational fleet, MRIP At-Sea observer program, and Headboat Survey in the range of the southern stock.
- TAUTOG: Increase MRIP sampling levels to improve recreational catch estimates by state and mode.

2013 ASMFC Action Plan, Ecosystem-Based Fisheries Management related tasks:

Task 2.5.2 – Continue to improve multispecies modeling efforts to support single-species assessments, including development of a new multispecies statistical catch-at-age model. Examine ecosystem based reference points as an alternative to single species reference points, using Atlantic menhaden as a test species.

Task 2.5.3 – Seek cooperative opportunities with state, federal, and university researchers to collaborate using existing data collection platforms to advance ASMFC ecosystem models (e.g. diet studies, surveys of spawning and nursery habitats).

2.6 Increase data collection and research for ecosystem-based management strategies.

Task 2.6.1 – Continue to advance Commission use of ecosystem-based approaches to fisheries management using development of Atlantic menhaden alternative reference points as a case study.

Task 2.6.3 - Develop Commission approach to ecosystem science to support ecosystem-based fisheries management.

Priorities and discussion from 2010 ASMFC EBFM Workshop:

The top 10 priorities by count are as follows:
2.3. Promote interstate programs to improve integrated management of fish, fish habitat, and water quality in regulatory and operational programs.
3.1 Develop Commission policy regarding ecosystem based approach to fisheries management.
1.1 Increase data collection and research for ecosystem based management strategies.
1.3 Describe ecosystem structure and function, habitats, species assemblages and socioeconomic patterns across the management region.
3.5 Evaluate implications of how management measures for one species may affect other managed species.
1.6 Expand multispecies model (MSVPA) to other suites of species.
1.7 Evaluate environmental influences on managed and unmanaged fish stocks (incorporation in MSVPA).
2.2 Seek cooperative opportunities with state, federal and university researchers to collaborate using existing data collection platforms to advance ASMFC ecosystem models. E.g., diet studies, surveying spawning habitats.
5.2 Effectively protect, restore, and enhance Atlantic coastal fish habitat through fisheries management programs and partnerships, such as the Atlantic Coastal Fish Habitat Partnership.
1.2 Develop Commission approach to ecosystem science to support ecosystem-based fishery management.

L. Mercer asked the group what their highest priorities were amongst this list. G. Lapointe said that everything begins with data collection, so collection of new data should rank higher. T. Fote added that existing data should be compiled to see where the data gaps are. M. Duval noted that many of the data gaps have been identified, and she agrees with G. Lapointe's suggestion of a high priority for data collection. T. O'Connell suggested that there needs to be a strategic plan to forward information and available science to decision makers, especially land use managers, such as what the socioeconomic values of the fishery are as that drives use.

L. Mercer noted that in general it appears from the prioritized list that there is a lot of agreement amongst the groups. She asked the groups whether they identified any recommendations not on the list. G. Lapointe suggested that partnerships should embody a broader set of collaborators. L. Mercer asked the participants what next steps they would like to see the EBFM workgroup take on and what the impediments might be as they move forward. A.C. Carpenter suggested that task 3.5 (Evaluate implications of how management measures for one species may affect other managed species) is a tangible task which can be done on a shorter term basis. T. Stockwell supported task 4.1 (Facilitate coordination and distribution of information for ecosystem-based management and marine protected (managed) area activities) as he does not want to move forward in a vacuum.

G. Lapointe suggested that task 3.1 (Develop Commission policy regarding ecosystem based approach to fisheries management) would be important to develop and then the other recommendations can be separate components identified underneath that policy. He noted that the discussion during the Menhaden Management Board meeting the previous day involved EBFM, but the Board was unsure as what that means. He thought it wise to consider a step wise approach to identify how to move forward and developing this structure will be useful for the managers to understand what is needed, especially in tasking TCs more effectively. D. Grout agreed that the development of this plan is most important, and then the top five or six ways to address it will fall out under that. B. Adler also likes task 3.5, as he sees it as actually happening, and it would be good to have a plan to see what will happen to other species. L. Mercer noted that task will fit nicely in the development of the plan. J. Duren recommended that the word 'evaluate' be removed in 3.5 and it should just be done. M. Duval noted that they are at various stages of evaluating how implementing management measures are quantitatively affecting other species. G. Lapointe added that there is a lot of qualitative discussion on these effects, but there is not a lot of information to evaluate them quantitatively.

L. Mercer asked the group how they see ASMFC interfacing with other regional activities. G. Lapointe said that is a logical part of task 3.1 in developing policy that supports information flow without redundancy by coordinating with research and management entities. L. Mercer reiterated that it sounded like the group supports developing that policy and fitting in top priorities into that and there was general agreement. She asked again for any guidance or direction for the workgroup. T. Stockwell asked how coordination is carried out now, and she answered that there has not been any work done yet. He suggested that they should start working with the Councils and NEFSC to marry ASMFC efforts and needs with theirs. M. Fogarty noted that the NEFMC SSC had developed a white paper on moving towards EBFM and he emphasized that it has to be a joint effort. He said the nearshore domain is where ASMFC involvement is critical where there are estuaries and spawning areas. He has proposed the formation of a working

group with members of ASMFC and the Councils. He noted the difficulty facing ASMFC as the Commission has the greatest number of FMPs, but they should be looked at as interconnected parts. M. Fogarty said that integrated FMPs for ecological regions would be a tremendous stride forward. He added that ecosystems are not simple, but this effort should start simply and keep pulse of what is happening so they can make course corrections. J. Geiger noted that this workshop has provided good examples of pilot efforts in the ASMFC area, and the group can begin by looking at these pilot studies to see how aspects or combinations of these existing efforts may meet the needs of ASMFC. He added that it is important to have well defined management objectives, and then work towards implementing them. D. Grout said they should seek help from people from NEFSC and NMFS who know how to integrate these efforts. M. Fogarty noted that he is happy to help in any way he can.

L. Mercer said that this has been helpful to her as a member of the EBFM workgroup to consider next steps. The workgroup will work on the draft strategy and present it during the ASMFC Annual Meeting in November. P. Campfield asked for feedback on the workshop via the questionnaire distributed to participants, on what they got out of this workshop and what topics they would interested in for the future. J. Gilmore thanked the speakers, L. Mercer, and staff, on behalf of R. Boyles, Jr., for putting together the workshop.

A Draft Proposal to the ISFMP Policy Board for Transition to an Ecosystem-Based Management Approach for the Atlantic States Marine Fisheries Commission

April 2010

Michelle Duval, Carl Hershner, Wilson Laney,

[Note: we can add other authors as necessary, or take them all off if we don't think appropriate; need to contact Carl regarding including his name if we decide to do so; I think it is appropriate if we decide to use the APNEP format, since he was a major contributor.]

[Much of this draft is shamelessly stolen from the Albemarle Pamlico National Estuary Program EBM proposal]

***Ecosystem-Based Management* (EBM)** is a management approach[i] that:

$ Is concerned with the ecological integrity that sustains both human and natural resources systems.

$ Integrates ecological, social, and economic goals and recognizes humans as key components of the ecosystem.

$ Considers ecological, not just political boundaries.

$ Addresses systems and the complexity of natural processes and uses adaptive management to reduce risk related to decisions and actions.

$ Engages multiple stakeholders in a collaborative process to define problems and find solutions providing mutual benefit.

Introduction

Ecosystem-Based Management (EBM) is a paradigm that has gained favor within many government agencies and other organizations worldwide[1] to effectively manage natural resources in their respective jurisdictions. The tenet is that managing natural resources from a systems perspective increases the likelihood of success by forging more effective connections among humans, nature, science, and government.[ii] Yet finding a consensus on the definition of EBM and identifying places as a model where the practice has been fully implemented is elusive. With their broad place-based missions, interagency facilitation role, stakeholder-driven orientation, and adaptive tools such as ecological indicators, the US Environmental Protection Agency (USEPA) sponsored National Estuary Programs (NEPs) are considered promising

candidates for EBM implementation and evaluation. [2] The Albemarle Pamlico National Estuary Program (APNEP) has begun a process of transition to EBM, and its Policy Board has approved a transition proposal. Although the resource mission of the Atlantic States Marine Fisheries Commission (ASMFC) is narrower (i.e., focused on a particular set of commercially and recreationally important fish and crustacean species and the ecosystems which support them) than that of the individual National Estuary Programs, the ecosystem required to sustain the species which ASMFC manages is geographically much broader and in fact encompasses all the US east coast NEPs. This draft proposal is based upon the APNEP proposal, scaled up to fit the ASMFC institutional framework and geographic boundaries.

Acknowledging the potential to demonstrate the net benefits of EBM in the form of moving more rapidly toward positive environmental [or should we say fishery?] outcomes, the Atlantic States Marine Fisheries Commission's Interstate Fisheries Management Program (ISFMP) Policy Board has tasked the Management and Science Committee, Habitat Committee, Multi-Species Technical Committee and Assessment Science Committee to consider processes necessary to integrate and implement EBM concepts and tools within the ASMFC's programs and with its state and federal partners. Both the US Fish and Wildlife Service, and National Marine Fisheries Service are supportive of the EBM approach for use in fishery management, and have implemented strategies in which the ASMFC's partnership is being sought (e.g., the establishment of the North Atlantic and South Atlantic Landscape Conservation Cooperatives by the USFWS).

The ASMFC planning documents presently include the following EBM-related strategies and tasks:

- Increase data collection and research for ecosystem based management strategies (Five-Year Strategic Plan, Goal 2, page 10)
- Task 1.1.8 - Develop Commission policy regarding ecosystem based approach to fisheries management (2010 Action Plan, Goal 1, Strategy 1.1, page 4)
- Task 2.4.3 - Participate as members of the Chesapeake Bay Food Web Quantitative Ecosystem Team, and the Atlantic Menhaden, Atlantic Striped Bass, and American Shad Plan Development Teams to ensure coordination of the Bay plans with the Commission FMPs (2010 Action Plan, Goal 2, Strategy 2.4, page 13)
- Task 2.5.3 - Seek cooperative opportunities with state, federal and university researchers to collaborate using existing data collection platforms to advance ASMFC ecosystem models. E.g., diet studies, surveying spawning habitats. (2010 Action Plan, Goal 2, Strategy 2.5, page 14)
- Strategy 2.6 - Increase data collection and research for ecosystem-based management strategies (2010 Action Plan, Goal 2, page 14)
- Task 2.6.1 - Develop Commission policy regarding ecosystem based approach to fisheries management (see Task 1.1.8)(2010 Action Plan, Goal 2, Strategy 2.6, page 14)
- Task 2.6.2 - Promote interstate programs to improve integrated management of fish, fish habitat, and water quality in regulatory and operational programs (2010 Action Plan, Goal 2, Strategy 2.6, page 14)

- $ Task 2.6.3 - Develop Commission approach to ecosystem science to support ecosystem-based fishery management (2010 Action Plan, Goal 2, Strategy 2.6, page 14)
- $ Goal 4 - Protect, restore and enhance fish habitat and ecosystem health through partnerships, policy development, and education (2010 Action Plan, page 18)
- $ Task 4.3.1 - Serve on the SAFMC habitat and Environmental Protection Advisory Panel and Chesapeake Bay Habitat Suitability Quantitative Ecosystem Team (2010 Action Plan, Goal 4, Strategy 4.3, page 19)
- $ Task 4.4.1 - Facilitate coordination and distribution of information for ecosystem-based management and marine protected (managed) area activities (2010 Action Plan, Goal 4, Strategy 4.4, page 20)

The ASMFC's Habitat Program Five-Year Strategic and Management Plan states that "This plan calls for the Commission to be a change agent in effectively integrating habitat protection, restoration, and enhancement into fisheries management programs, in recognition of ecosystem-based management principles." Major ecosystem related goals of the plan include:

- $ 1. Effectively protect, restore, and enhance Atlantic coastal fish habitat through fisheries management programs and partnerships, such as the Atlantic Coastal Fish Habitat Partnership (ACFHP)
- $ 2. Identify important habitat areas for Commission-managed species
- $ 6. Engage local governments in habitat protection, restoration, and enhancement programs

It is apparent from the inclusion of the above goals, strategies and tasks in Commission planning documents that ASMFC is already moving down the path towards EBM.

This proposal is the result of EBM-oriented discussions and activities over the past six months, including recent discussions with the ISFMP Policy Board on EBM principles at the 2009 annual meeting in November. To continue the momentum from the latter meeting, ASMFC formed an ad-hoc EBM work group in November to propose a course of action whereby ASMFC can most effectively transition from the status quo, largely single-species approach, to a plan and program which is positioned to better support EBM in the ASMFC and member jurisdictions. The team has met several times over the past three months and [has reached consensus on] [or is proposing] the following approach to transition.

ASMFC staff over the course of [the next year?? or some other appropriate time frame] will work with partners to create and begin developing an EBM Transition Plan and implementing steps to build the necessary foundations to fully implement the plan. The transition plan will identify specific actions and timelines that should take place over the next five years (2010-2014) [or, if it has to fit within the existing ASMFC Five-Year Strategic Plan, 2010-2014].

The revised ASMFC 2011 Action Plan targeted for October, 2010, will include both the EBM Transition Plan and any additional items required to meet envisioned programmatic (i.e.,

Interstate Fisheries Management Program, Science Program and Habitat Program) requirements and commitments.

The EBM Transition Plan is envisioned to include and address four essential elements of EBM.[iii] As a preliminary step to give reviewers an idea of what specifically the plan will address, each element is addressed below with the following two sub-elements:

• "*Status*": ASMFC's progress to date in meeting element objectives, and

• "*Future*": Possible ASMFC near and long-term targets for meeting element objectives.

1. A holistic vision and plan that includes a comprehensive description of the ecosystem required by ASMFC species and articulation of multiple management objectives.

Status: Most natural resource and environmental agencies have missions that are targeted to particular aspects of services of the ecosystem such as watershed planning for designated uses or EBM for sustainability of marine fisheries. ASMFC's mission is: to promote the better utilization of the fisheries, marine, shell and anadromous, of the Atlantic seaboard by the development of a joint program for the promotion and protection of such fisheries, and by the prevention of physical waste of the fisheries from any cause. ASMFC's holistic vision is: Healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015.

The ASMFC's mission, vision and plan are articulated within its Five-Year Strategic Plan, 2010 Action Plan, and Habitat Program Five-Year Strategic and Management Plan. These plans, and the individual species Fishery Management Plans, include all the management objectives for the individual species management by the Commission in partnership with its partners (DC, PRFC, NMFS and USFWS).

The Commission's current (2009) Five Year Strategic Plan 2009-2013, 2010 Action Plan, and Habitat Program Five-Year Strategic and Management Plan do not include a provision for developing a comprehensive description of the ecosystem(s) which support ASMFC species. However, the recently-published Diadromous Species Habitat Source Document which details the habitat requirements of those species covers much of the area which other ASMFC species occupy. The recently-approved Amendment 3 to the Shad and River Herring Fishery Management Plan requires that ASMFC member jurisdictions prepare Habitat Plans which will address the requirements of American shad, again covering much of the area occupied by other ASMFC species. Finally, those species which are jointly managed with federal Fishery Management Councils have defined Essential Fish Habitat which comprehensively describes habitats required by those species. Materials from these documents may be compiled to provide a comprehensive description of the ecosystem which supports ASMFC species.

Future: Work will begin in 2011 to prepare an EBM Transition Plan with goals and objectives, including an an initiative for ASMFC partners to work toward consensus on a common content

management system.[3] An appropriate amount of time will be directed to creating a comprehensive description of the ecosystems supporting ASMFC species.

The ASMFC's current multi-species modeling activities will contribute to filling the gap until the EBM Transition Plan is completed, but additional effort will be required through a baseline project. The purposes of the ASMFC baseline project are to: provide a broad ecological and socioeconomic baseline characterization; serve as a frame of reference to support subsequent assessment of EMB implementation performance against EMB goals; and facilitate future adaptive management of ASMFC resources. This baseline characterization will include:

• *Description of the ASMFC regional ecosystem(s)*
Describe ecosystem structure and function, habitats, species assemblages and socioeconomic patterns across the study region.

• *Assessment of ecosystem condition at EBM implementation*
Interpret ecological and/or socioeconomic data and results in the context of historical trend data, physical and other system drivers, and data from other protected or unprotected locations to understand the context of the implementation conditions. We believe that a large part of this work has already been undertaken by the Atlantic Coastal Fish Habitat Partnership, through the habitat assessment conducted by NOAA [insert reference here].

• *Initial data points for long-term tracking of condition and trends in ASMFC ecosystem(s)*
Establish the initial points to begin long-term monitoring of changes in ecological and socioeconomic elements of the system, after new EBM implementation.

2. A community that has effective engagement of policy makers, managers, scientists, and stakeholders.

Status: The ASMFC's current structure supports engagement of policy makers, managers, stakeholders, and scientists through the ASMFC public comment process, Advisory Panels, species Technical Committees and other standing committees, species Management Boards, the ISFMP Policy Board and the full Commission.

Future*:* Increase partner coordination and effectiveness by emphasizing the role of each Commission member [and partner?, inclusion of this wording would be inclusive of PRFC, DC, FWS and NMFS] as a conduit for EBM engagement: receiving information at ASMFC meetings, and taking that information to peers and organizational staffs, who in turn promote policies that lead to changes in management where appropriate. The ASMFC will work to develop a [Memorandum of Agreement] or [Ecosystem Based Fishery Management Plan] among key stakeholders and interested parties to focus implementation of the plan in the form of a cooperative partnership.

3. A process that includes effective adaptive management to address a changing system.

Status: Currently, the link between the coordinated coastwide fishery management (through ASMFC fishery management plans) and other relevant independent management activities (e.g., for habitat conservation, restoration and protection) of ASMFC members and partners (State, Federal, NGOs) and present status and trends in ASMFC managed species within the US east coast region is somewhat ambiguous, especially for some species (e.g., weakfish, river herring). Plans for monitoring ASMFC-managed species are already in place or underway, through the Atlantic Coast Cooperative Statistics Program, and existing federal partner monitoring (MRFSS, MRIP, TIP and other commercial monitoring programs, and USFWS Hunting, Fishing and Outdoor Recreation Survey). Movement toward an EBM approach has already been undertaken by ASMFC, through the development of a Multi-Species VPA model which incorporates prey. As noted above, the ASMFC has been invited to partner with the USFWS and U.S. Geological Survey in the establishment of Landscape Conservation Cooperatives, which will be producing species-habitat models that will enable a more rapid move toward EBM for fish species. The ASMFC is also currently partnering in the Atlantic Coastal Fish Habitat Partnership, an organization which will implement aquatic conservation delivery which will benefit ASMFC species.

Future: The ASMFC has charged the Assessment Science, Multi-Species Technical, Habitat, and Management and Science Committees with developing a process for transition to an ecosystem based approach to management of ASMFC species, which will clarify the relationships between ecosystems, management measures, species response and adaptive management responses. The EBM Work Group envisions that additional ASMFC partnerships, such as with the South Atlantic and North Atlantic LCC's, will add science capacity. The existing partnership with the ACFHP will increase the ASMFC's ability to implement conservation delivery on the ground.

4. A framework that includes appropriate authority, implementation area, management institutions, financial resources, and effective communications.

Status: The program's authority is derived from the ASMFC Charter, Compact and federal legislation including the Atlantic Striped Bass Conservation Act, and Atlantic Coastal Fisheries Cooperative Management Act. The current ASMFC jurisdictional boundaries include the inland waters of all member jurisdictions, all estuaries, and the nearshore Atlantic Ocean to three miles seaward.

The ASMFC is financially supported by a recurring grant under a cooperative agreement between USDOC's NOAA and USDOI's USFWS, and member dues. Annual federal grants are generally on the order of $ [insert appropriate value here]. Member dues provide an additional [insert appropriate value here].

Future: Activities should include: an evaluation of the Compact and Charter that established ASMFC and its organizational structure, an evaluation of ASMFC's intuitional framework to promote efficient and effective administration of EBM, consideration of providing additional authority to ASMFC during reauthorization of enabling federal legislation (i.e., Anadromous

Fish Conservation Act, Atlantic Striped Bass Conservation Act, Atlantic Coastal Fisheries Cooperative Management Act, etc.) and revision of ASMFC's outreach materials to promote EBM principles.

Tracking EBM Implementation (Success and Failure)

The optimistic viewpoint on EBM is that it will: invoke trust that transcends interests and leads to innovation; lead to agreement on science basis and to a feasible and well-founded plan; and through stakeholder involvement lead to reduced challenges.[iv] The pessimistic viewpoint of EBM is that through consensus, the lowest common denominator results, socio-economic interests will dilute precaution, and special interests will impede implementation.[v] The ASMFC EBM Work Group feels that if all key elements are addressed the former viewpoint will prevail, but only through demonstrations such as proposed here will management concepts be advanced.

i http://www.ebmtools.org/about_ebm.html
ii Cortner H. J, M. A. Moote. 1998. The Politics of Ecosystem Management. Island Press. Page 1
iii Hershner C. 2009. Presentation at the July 22 APNEP Science & Technical Advisory Committee. Research Triangle Park, NC.
iv Layzer, J. 2008. Natural Experiments: Ecosystem-based management and the environment. The MIT Press. Cambridge, MA.
v Ibid.

1 Both the Pew Ocean Commission and the U.S. Commission on Ocean Policy called on the United States to adopt EBM.
2 The application of EBM principles and tools were discussed at EPA-Association of National Estuary Programs fall 2008 meeting at EPA Region 2 headquarters in New York, NY.
3 See as an example, Albemarle-Pamlico National Estuary Program, Science and Technical Advisory CommitteeTechnical Issue Paper *Application Products for Tracking Proposed Ecological Indicators* (April 2008; see the APNEP web site).

Mid-Atlantic Fishery Management Council
Forage Panel Workshop
Raleigh, NC
April 11, 2013

Understanding the roles that forage species play within ecosystems has emerged in the scientific literature as a key element in the development of an ecosystem approach to fishery management. Forage species provide an important link between primary productivity and upper trophic levels within marine ecosystems. At the same time, forage species often support economically valuable fisheries through direct harvest. Recent scientific findings suggest that forage stocks may warrant special management consideration, especially with respect to achieving ecosystem level management goals and objectives. In addition, current National Standard 1 (NS1) guidelines recommend that consideration should be given to managing forage stocks for higher biomass than traditional MSY based reference points (B_{msy}) to enhance and protect the marine ecosystem. The purpose of this workshop is to discuss the key issues relevant to forage fish assessment and management under the Magnuson-Stevens Act. A panel of experts will discuss the role of forage species within ecosystems and best practices with respect to the harvest of forage species, taking their role(s) within ecosystems into account. Based on the outcome of the discussion, the Council will begin the development of a forage exploitation policy which will guide Council decision making at the FMP level as part of its ecosystem approach to fisheries management guidance document.

8:30 am Introductions Mr. Richard Robins, Jr.
Dr. John Boreman (Panel Moderator)

8:45 am Presentation 1: Dr. Ellen Pikitch

This presentation will introduce the forage management issue and describe results of the Lenfest task force.

- identify the problem and discuss generic forage definitions
- discuss scientific evidence that forage stocks require special management consideration
- summarize Lenfest and other scientific findings and recommendations with respect to management of forage stocks

9:15 am Presentation 2: Dr. Edward Houde

The primary purpose of this talk is to summarize current scientific consensus on forage species management and then to place the issue within the context of ecosystems under the jurisdiction of the Mid-Atlantic Council.

- summarize current scientific consensus on need to manage forage fish more conservatively to preserve ecosystem structure and function (including resiliency)
- place the issue within the context of Mid-Atlantic (MA) ecosystems
- briefly describe MA ecosystems and species that are likely important forage stocks (managed and unmanaged)

- describe what options the MAFMC has relative to special management of forage species
- discuss approaches to forage fish management taken by other Councils and NS1 guidance on the subject

9:45 am Panel Discussion - Trigger Question Set 1

1. Is a generic definition of forage possible?
2. What are the key considerations when determining appropriate buffers to manage forage species to achieve ecosystem level objectives (i.e., to enhance and protect the marine ecosystem)?
3. What is the range of exploitation rates the Council should consider for forage species?
4. What trade-offs (biological, economic, etc.) would the Council face if it adopts exploitation policies or control rules for forage species to preserve or enhance ecosystem structure and function?
5. How have the benefits of ecological sustainability been valued and assessed in other examples?

10:15 am Break

10:30 am Presentation 3: Dr. Robert Latour

This presentation will explore potential approaches for the assessment and management of forage stocks.

- discuss options including development of new biological reference points (BRPs) that would maintain higher biomass (B) targets ($B_{target} > B_{msy}$) for forage species and/or reductions in exploitation rate through additional yield buffers based on existing MSY based BRPs; do both the approaches achieve the same outcome?
- should the Council consider maintaining current BRPs/ABC control rules and decrease P* (probability of overfishing) by implement policy at the ABC control rule level or maintain current ABC control rules and reduce quotas strictly as an OY consideration (i.e., based strictly on Council policy)?
- describe why assuming a constant natural mortality (M) is insufficient to address ecosystem function
- if predation mortality (M2) is modeled explicitly in a stock assessment for a forage species, is that sufficient to maintain or enhance ecosystem structure and function? would changes to BRPs still be necessary? would incorporation of M2 directly in the assessment automatically readjust BRPs?

11:00 am Presentation 4: Dr. Sarah Gaichas

This talk will describe the current state of ecosystem science in the Northeastern US.

- describe the current state of information, models, etc. available to support an ecosystem approach to management, especially with respect to development or forage management policy in the Mid-Atlantic

- discuss approaches that could be taken to bridge from current single species assessment models to ones that account for species interactions, including analyses to support forage species management
- describe other approaches that could be considered to address the forage issue (i.e., should the Council be developing exploitation policies based functional groups as opposed to current species level approach?)
- describe how the ecosystem has changed in modern history (e.g. species composition changes), and how these changes might relate to Council ecosystem level objectives and its ability to preserve or enhance the system through fisheries management
- describe the information (data, models, etc.) needed to begin to consider forage more directly

11:30 am Panel Discussion - Trigger Question Set 2

1. Why is the assumption of constant natural mortality not sufficient to allow forage stocks to fulfill their role(s) within ecosystems?
2. To address special management of forage species, should the Council increase B_{target} or maintain current MSY based BRPs and add buffers?
3. At what level in the OFL-ABC-OY continuum is special management consideration for forage species best handled - at the stock assessment level or as an OY consideration? Both?
4. If predation mortality (M2) is modeled explicitly in a stock assessment for a forage/LTL species, is that sufficient to maintain or enhance ecosystem structure and function? Would changes to BRPs still be necessary? Would incorporation of M2 directly in the assessment automatically readjust BRPs?
5. How could system level or trophic level OY caps contribute to the management of species interactions within MA fisheries and the Council's ecosystem objectives?

12:00 pm Lunch

1:15 pm Staff Visioning summary relative to ecosystem considerations

The afternoon session will begin with a brief review of stakeholder input on ecosystem issues and forage fish management obtained during the Council's Visioning Project.

1:30 pm The afternoon wrap-up discussion will be an interactive session between the Council and Forage Panel guided by the following trigger questions:

Trigger Question Set 1

1. How should the Council approach addressing the issue of special management of forage species (i.e., should the Council consider revising BRPs or maintain current BRPs and consider additional buffers?)
2. Where and when in the process is this issue most effectively addressed? At the stock assessment (M2), OFL, ABC, OY levels? All of the above?

Trigger Question Set 2

1. Is the current state of knowledge sufficient to provide tactical advice to the Council relative to special management of forage species?
2. What other information/analyses are necessary to provide tactical advice to the Council on forage fish management?

Trigger Question 3

Given the current state of the science related to this issue, what steps can the Council take in the near term to develop an exploitation policy for forage stocks to insure that their role in maintaining or enhancing ecosystem structure and function is preserved?

3:00 pm Adjourn

Information about the workshop can be obtained by visiting the Council website at:
http://mafmc.org/meeting_materials/2013/04-2013/briefing_book_2013_04.htm
Tab 09_Forage Panel Workshop

http://www.mafmc.org/workshop/forage-fish-workshop

Rob Latour's presentation (audio file with powerpoint): Potential Approaches for Assessment and Management of Forage Stocks
http://mafmc.adobeconnect.com/p4e4tg8pgx3/
http://mafmc.adobeconnect.com/p7ntg58t74r/ questions