Atlantic States Marine Fisheries Commission

American Lobster Management Board

October 18, 2021
9:00 a.m. – 12:00 p.m.
Webinar

Draft Agenda

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

1.	Welcome/Call to Order (*D. McKiernan*)	9:00 a.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from August 2021	9:00 a.m.
3.	Public Comment	9:05 a.m.
4.	Review Annual Data Update of American Lobster Abundance Indices *(K. Reardon)*	9:15 a.m.
5.	Discuss Development of Draft Addendum XXVII on Gulf of Maine/Georges Bank Resiliency *(C. Starks)* • Consider PDT Recommendations on Objectives • Provide Feedback to PDT on Proposed Options	9:45 a.m.
6.	Progress Update on Draft Addendum XXIX: Electronic Vessel Tracking Devices in the Federal American Lobster and Jonah Crab Fisheries *(C. Starks)*	10:45 a.m.
7.	Consider Next Steps for Development of a Management Strategy Evaluation of the American Lobster Fisheries *(J. Kipp)* **Possible Action**	11:30 a.m.
8.	Other Business/Adjourn	12:00 p.m.

The meeting will be held via webinar, click here for details.

MEETING OVERVIEW

American Lobster Management Board
October 18, 2021
9:00 a.m. – 12:00 p.m.
Webinar

Chair: Daniel McKiernan (MA) Assumed Chairmanship: 02/20	Technical Committee Chair: Kathleen Reardon (ME)	Law Enforcement Committee Representative: Rob Beal
Vice Chair: Dr. Jason McNamee	Advisory Panel Chair: Grant Moore (MA)	Previous Board Meeting: August 2, 2021
Voting Members: ME, NH, MA, RI, CT, NY, NJ, DE, MD, VA, NMFS, NEFMC (12 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from August 2, 2021

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Review Annual Data Update of American Lobster Abundance Indices (9:15-9:45 a.m.)

Background

- During the 2020 stock assessment the Stock Assessment Subcommittee recommended an annual data update process between American lobster stock assessments to more closely monitor changes in stock abundance. The objective of this process is to present information—including any potentially concerning trends—that could support additional research or consideration of changes to management. Data sets recommended for this process were generally those that indicate exploitable lobster stock abundance conditions expected in subsequent years and include: YOY settlement indicators, trawl survey indicators, including recruit abundance (71-80 mm carapace length lobsters) and survey encounter rate, and ventless trap survey sex-specific model-based abundance indices (53 mm+ carapace length lobsters).
- The Technical Committee updated the annual abundance indices to provide the Board with the most recent information on trends in the Gulf of Maine/Georges Bank (GOM/GBK) and Southern New England (SNE) stocks **(Briefing Materials)**.

Presentations

- Annual Data Update of American Lobster Abundance Indices by K. Reardon

5. Discuss Development of Draft Addendum XXVII on Gulf of Maine/Georges Bank Resiliency (9:45-10:45 a.m.)

Background

- Addendum XXVII was initiated in 2017 to proactively increase resilience of the GOM/GBK stock but stalled due to the prioritization of Atlantic right whale issues. After accepting the 2020 Benchmark Stock Assessment for American lobster, the Board reinitiated work on the draft addendum in February 2021, with a focus on developing a trigger mechanism that would automatically implement management measures to improve the biological resiliency of the GOM/GBK stock if the trigger is reached. Since then the Plan Development Team (PDT) and Technical Committee (TC) have met a number of times to discuss the development of the addendum and analyze potential management options.
- The PDT tasked the TC with recommending appropriate management measures for improving the health of the GOM/GBK stock, and analyzing the impacts of changes to minimum and maximum gauge size for the management areas within the stock. The TC performed these analyses and made recommendations to the PDT in a memo dated September 10, 2021 (**Briefing Materials**).
- In August the PDT received Board guidance on the goals and objectives of the addendum. The Board's guidance included (1) prioritizing options to increase the biological resiliency of the stock over standardization, (2) considering a tiered trigger mechanism with multiple trigger levels that include relatively proactive trigger levels, and (3) not considering trigger levels that may already have been surpassed. Given the conflicting nature between the stated objective of increasing biological resiliency of the stock, some of the Board guidance, and the TC advice, the PDT has struggled to develop appropriate options for Draft Addendum XXVII. The PDT recommends the Board consider revising the objective of the action and provide feedback on the proposed management options **(Supplemental Materials)**.

Presentations

- PDT Recommendations for Draft Addendum XXVII by C. Starks

Board Actions for Consideration at the Meeting

- Consider PDT recommendations on action objective and provide feedback to PDT on proposed options

6. Progress Update on Draft Addendum XXIX: Electronic Vessel Tracking Devices in the Federal American Lobster and Jonah Crab Fisheries (10:45-11:30 a.m.)

Background

- In May 2021, the Board discussed electronic vessel tracking in the federal lobster and Jonah crab fisheries. After reviewing recent work to test additional tracking devices, integrate cell-based tracking with ACCSP's SAFIS eTRIPS mobile trip reporting application, and create trip viewers within SAFIS eTRIPS online, the Board agreed that there is a critical need for high-resolution spatial and temporal data to characterize effort in the federal lobster and Jonah crab fleet. In particular, these data will help to address a number of challenges facing the fisheries, including Atlantic right whale risk reduction efforts, marine spatial planning discussions, and offshore enforcement. The Board formed technical work group including to develop objectives, technological solutions,

and system characteristics for vessel tracking devices in the federal lobster and Jonah crab fisheries, which recommended initiating an addendum to implement tracking requirements in the federal fleet.
- The Board initiated Draft Addendum XXIX in August 2021 to consider electronic tracking requirements in the federal lobster and Jonah crab fisheries. Since August the Plan Development Team has met several times to discuss the development of the addendum.

Presentations
- Progress Update on Draft Addendum XXIX by C. Starks

7. Consider Next Steps for Development of a Management Strategy Evaluation of the American Lobster Fisheries (11:30 a.m.-12:00 p.m.) Possible Action

Background
- In May 2021 the Board reviewed TC recommendations on a Management Strategy Evaluation (MSE) for the lobster fishery. The TC recommended the Board pursue a two-phase MSE focused on the GOM/GBK stock, with the goal of providing short-term management guidance at the stock-wide scale while concurrently building the framework to expand the MSE to provide long-term, spatially-explicit management advice. As next steps, the TC recommended a formal process to develop management goals and objectives for the future of the lobster fishery, and forming a steering committee for additional scoping and work plan development **(Briefing Materials)**.
- At their last two meetings, the Board expressed interest in pursuing an MSE but postponed any action on development of an MSE in order prioritize work on Draft Addendum XXVII and Draft Addendum XXIX.

Presentations
- Review of MSE Options and TC recommendations by J. Kipp

Board Actions for Consideration at the Meeting
- Consider forming a steering committee to develop lobster management goals and objectives and an MSE work plan

8. Other Business/Adjourn

American Lobster and Jonah Crab TC Task List

Activity level: High

Committee Overlap Score: Medium

Committee Task List
Lobster TC • Spring 2021: Provide recommendations on MSE focal areas, timelines, and costs • Spring-summer 2021: Provide analysis for development of Draft Addendum XXVII • Annual state compliance reports are due August 1 • Fall 2021: Annual data update of lobster abundance indices *Jonah Crab TC* • Spring-Summer 2021: Develop recommendations on initiating Jonah crab stock assessment • Annual state compliance reports are due August 1 • Fall/Winter 2021: Begin data submissions for Jonah crab stock assessment

TC Members

American Lobster: Kathleen Reardon (ME, TC Chair), Joshua Carloni (NH), Jeff Kipp (ASMFC), Kim McKown (NY), Conor McManus (RI), Chad Power (NJ), Tracy Pugh (MA), Burton Shank (NOAA), Craig Weedon (MD), Somers Smott (VA), Renee St. Amand (CT)

Jonah Crab: Derek Perry (MA, TC Chair), Joshua Carloni (NH), Chad Power (NJ), Jeff Kipp (ASMFC), Conor McManus (RI), Allison Murphy (NOAA), Kathleen Reardon (ME), Chris Scott (NY), Burton Shank (NOAA), Somers Smott (VA), Corinne Truesdale (RI), Craig Weedon (MD)

Addendum XXVII PDT Members

American Lobster: Kathleen Reardon (ME), Joshua Carloni (NH), Robert Glenn (MA), Corinne Truesdale (RI), Allison Murphy (NOAA)

Addendum XXIX PDT Members

American Lobster: William DeVoe (ME), Renee Zobel (NH), Nicholas Buchan (MA), Richard Balouskus (RI), Kim McKown (NY), Barry Clifford (NOAA), Allison Murphy (NOAA)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

AMERICAN LOBSTER MANAGEMENT BOARD

Webinar
August 2, 2021

These minutes are draft and subject to approval by the American Lobster Management Board.
The Board will review the minutes during its next meeting.

Draft Proceedings of the American Lobster Management Board Webinar
August 2021

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ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Sen. David Miramant, ME (LA)
Cherie Patterson, NH (AA)
Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Dan McKiernan, MA (AA)
Raymond Kane, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Jason McNamee, RI (AA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Colleen Bouffard, CT, proxy for J. Davis (AA)
Bill Hyatt, CT (GA)
Maureen Davidson, NY, proxy for J. Gilmore (AA)
Emerson Hasbrouck, NY (GA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Houghtaling (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Mike Luisi, MD, proxy for B. Anderson (AA)
David Sikorski, MD, proxy for Del. Stein (LA)
Pat Geer, VA, proxy for S. Bowman (LA)
Allison Murphy, NMFS

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

Ex-Officio Members

Kathleen Reardon, Technical Committee Chair
Derek Perry, Jonah Crab TC Chair

Staff

Robert Beal
Toni Kerns
Maya Drzewicki
Tina Berger
Kristen Anstead
Pat Campfield
Lisa Carty
Emilie Franke
Lisa Havel
Chris Jacobs
Jeff Kipp
Dustin Colson Leaning
Kirby Rootes-Murdy
Sarah Murray
Joe Myers
Mike Rinaldi
Julie Defilippi Simpson
Caitlin Starks
Deke Tompkins
Geoff White

Guests

Karen Abrams, NOAA
Jennifer Anderson, NOAA
Bill Anderson, MD (AA)
Nicholas Buchan, MA DMF
Mel Bell, SC DENR
Catherine Becker, FL FWC
Peter Clarke, NJ DEP
Chris Batsavage, NC DENR
Jeff Brust, NJ DEP
Erika Burgess, FL FWC
Colleen Coogan, NOAA
Heather Corbett, NJ DEP
Peter Benoit, Ofc. Sen. King (ME)
David Bethoney, CFR Foundation
Karen Bradbury, Ofc. Sen. Whitehouse (RI)
Alicia Brown, NH FGD
Clare Crowley, FL FWC
Jessica Daher, NJ DEP

Guests (continued)

Justin Davis, CT (AA)
Bill Devoe, ME DMR
Steve Doctor, MD DNR
Laura Engleby, NOAA
Lynn Fegley, MD DNR
Marianne Ferguson, NOAA
Joe Fessenden, Am. Comm. Fishing
Crystal Franco, NOAA
Erica Fuller, Earth Justice
Shaun Gehan, Gehan Law
Melanie Griffin, MA DMF
Jon Hare, NOAA
Hannah Hart, FL FWC
Marin Hawk, MSC
Doug Haymans, GA (AA)
Heidi Henninger, Offshore Lobster
Jay Hermsen, NOAA
Helen Takade-Heumacher, EDF
Haley Kohler, Vineyard Wind
Rob LaFrance, Quinnipiac Univ
Wilson Laney
Lauren Latchford, NOAA
Chip Lynch, NOAA
Shanna Madsen, VMRC
Kim McKown, NYS DEC
Conor McManus, RI DEM
Nichola Meserve, MA DMF
Kennedy Neill, Yorktown, VA
Jeffrey Nichols, ME DMR
Scott Olszewski, RI DRM
Noah Oppenheim, Homarus Strategies
Will Poston, SGA
Jessica Powell, NOAA
Chad Power, NJ DEP
Tracy Pugh, MA DMF
Story Reed, MA DMF
Renee Reilly, NJ DEP
Jason Rock, NC DENR
Samantha Russo, FL FWC
Scott Schaffer, MA DMF
Burton Shank, NOAA
Kara Shervanick, NOAA
Krista Shipley, FL FWC
Melissa Smith, ME DMR
Somers Smott, VMRC
Rene St. Amand CT DEP
David Stormer, DE DFW
Marisa Trego, NOAA
Corinne Truesdale, RI DEM
Jesica Waller, ME DMR
Megan Ware, ME DMR
Anna Webb, MA DMF
Craig Weedon, MD DNR
Kelly Whitmore, MA DMF
Chris Wright, NOAA
Renee Zobel, NH FGD
Barb Zoodsma, NOAA
Chao Zou, NOAA

The American Lobster Management Board of the Atlantic States Marine Fisheries Commission convened via webinar; Monday, August 2, 2021, and was called to order at 1:30 p.m. by Chair Daniel McKiernan.

CALL TO ORDER

CHAIR DANIEL McKIERNAN: Welcome everyone to the August 2, 2021 American Lobster Management Board meeting. My name is Daniel McKiernan; I'm the Administrative Commissioner from Massachusetts.

APPROVAL OF AGENDA

CHAIR McKIERNAN: First on the agenda is approval of the agenda itself. Are there any objections to the agenda, or any additions or modifications anyone wants to make? Raise your hand if you do.

MS. TONI KERNS: I don't see any hands, Dan.

CHAIR McKIERNAN: Right, seeing none, it's approved by unanimous consent.

APPROVAL OF PROCEEDINGS

CHAIR McKIERNAN: Next on the agenda is approval of the proceedings from the May, 2021 Board meeting. Are there any additions or modifications that are requested to the proceedings? Please, raise your hand.

MS. KERNS: I don't see any hands, Dan.

CHAIR McKIERNAN: That's great, thank you, Toni, therefore, I declare it's approved by unanimous consent.

PUBLIC COMMENT

CHAIR McKIERNAN: Next, Public Comment. On the agenda is a ten-minute time period for the public to communicate to the Board on any items that are not on the agenda. Is there anyone who has enlisted in advance to comment, or anyone who has got their hand raised, Toni?

MS. KERNS: I'm not aware of anyone asking in advance, and I currently don't see anybody with their hand up.

PROGRESS REPORT ON DEVELOPMENT OF DRAFT ADDENDUM XXVII ON THE GULF OF MAINE/GEORGES BANK RESILIENCY

CHAIR McKIERNAN: Great, okay we'll move right into Item Number 4, which is the Progress Report on Development of Draft Addendum XXVII on the Gulf of Maine/Georges Bank Resiliency issue. The Board will recall this was first initiated in 2017, to increase the resiliency of this particular stock.

We did back burner this, due to the prioritization of the Large Whale Take Reduction Team rules that have been facing the state and federal governments. The Board reinitiated the draft addendum in February, and the PDT and the TC have been meeting numerous times. Today the PDT is seeking guidance from the Board, with the intention of providing a draft addendum for public comment coming back to the Board in October, at our next meeting. Caitlin Starks has a presentation, so Caitlin, I'll turn it over to you.

MS. KERNS: Caitlin, before you start, if I could just make sure the Board is aware that the way Dan and I are going to do hands raised is, I'll monitor the hands as I see hands go up during questions or comment periods. I'll read off the three hands in a row, about who is going to go, and then the folks that are on deck, just to keep track of the hands. Thanks.

CHAIR McKIERNAN: Thank you, Toni.

MS. CAITLIN STARKS: Thanks, Toni. Thanks, Mr. Chair, for the introduction to this topic. You actually covered my first couple of slides, so that makes things a lot easier for me. Throughout the presentation I'll give some quick background, skipping over some things that Dan already covered, an updated action timeline, some updated technical considerations that have been discussed by the TC and the PDT.

Then I'll go over the draft recommendations for options that the PDT has developed up to this point, regarding the management options for the Addendum. Then I have a few areas where we're looking for Board guidance and next steps for the document. This is a very brief context that Dan essentially already covered.

I can mostly skip it, but the highlights are that this was originally initiated in August, 2017, based on our report from the Gulf of Maine/Georges Bank Subcommittee that emphasized concerns about decreasing trends in Maine's Larval Settlement Survey over recent years that might foreshadow future declines in recruitment in landings. The Board initiated this Addendum to increase resiliency of the Gulf of Maine and Georges Bank stock, by considering standard management measures for the stock.

Then after it was stalled for a few years, and reinitiated in February, the Board motion that was made in February changed the focus of the Addendum a bit, by specifying that the action should focus on a trigger mechanism, such that upon reaching a trigger, measures would be automatically implemented to improve the biological resiliency of the Gulf of Maine and Georges Bank stock.

That is what the PDT and TC have been focused on since February. They've met several times. They met before the May meeting, where they presented the draft structure of options to the Board, and received some additional guidance. That Board guidance at the time was that the action should prioritize increasing resiliency of the stock over standardizing measures.

That it should consider a tiered approach with multiple trigger levels, and that it should include some relatively conservative trigger levels, such that a change to measures would occur before abundance falls significantly from current levels. Since that May meeting, the PDT and TC have continued meeting to work on analyses to inform the draft options for the document.

However, due to some of our Technical Committee members competing workloads on other high priority projects, we did have some challenges with completing the analyses that are needed to fully flush out the proposed management options before this meeting. That leads me to the updated timeline for the action. I just covered the first four rows on the table here, so now we're at the fifth row, looking at the Board receiving a progress update on the Addendum today, and then following today's meeting the plan is for the PDT to finalize the draft addendum document for public comment, with the TC analysis and recommendations that will be completed in the near future. That would set us up for the Board to consider the draft addendum for public comment in October.

Then if that draft addendum is approved for public comment, hearings would be able to take place in November and December, and the Board could meet to consider the Addendum for final approval in February, 2022. Now I'll switch gears, and go over some of the Technical Committee work that is in progress to provide advice to the PDT on the various components of the Addendum, including indices for establishing triggers, trigger levels, and management measures that are expected to increase biological resiliency of the stock.

It should be noted again that some of these analyses are not quite complete, so nothing presented today should be considered final. But on the topic of indices that could be used to establish the trigger mechanism for the Addendum, the Technical Committee has recommended using the abundance indices that till be updated as part of the annual data update process.

These include a combined index for the Maine and New Hampshire Trawl Survey and the Massachusetts Trawl Survey, with separate indices for the spring and the fall survey. Then third, the Ventless Trap Survey Index. The Technical Committee advised that the indices should be constrained to the survey provided strata, and they should focus on the pre-recruit sizes, which are 71 to 80 millimeters, and sexes should be aggregated.

The focus on those sublegal sizes is recommended as a way to estimate future abundance trends for the spawning stock. This approach was also supported by correlation analysis from the stock assessment that shows there is a relationship between the trawl indices and the model abundance from the assessment.

For trigger levels, the TC agreed that the proposed trigger levels should be related to the assessment model output and the abundance reference points that were adopted by the Board. The reference points that have been discussed for relating to triggers are the fishery industry target, which is the 25th percentile of the high abundance regime, the modeled abundance level at the time when the abundance regime shifted from the moderate to high regime, and the abundance limit.

A trigger level approximating the fishery industry target would be the most conservative, where the trigger level that is approximating the abundance limit, which is again the points below which the stock status would be considered depleted, would be the least conservative, and really taking action at that time would be more reactive to poor stock conditions than it would be proactive.

The proposal that the TC has put together for the triggers is that each trigger point could be defined as a certain amount of observed decline in the indices that would approximate a certain change in abundance. For example, management would be triggered if the three-year moving median of the indices were to fall by a certain percentage from the reference value. The Technical Committee recommends using a running median, as opposed to an average, to smooth out annual variation, but also to better identify declining trends, as opposed to the average method. I'll try to better explain this in the next few slides, but just remember that the TC is still working out some of the details on this so the approach is not final yet. This is a visual for the reference points from the stock assessment, to remind you all of where they fall in the Gulf of Maine/Georges Bank model abundance curve.

The highest horizontal dotted line represents the fishery industry target. Below that there is a dashed blue line that represents the point where the abundance regime shift occurs from the moderate abundance regime to the high abundance regime. Below that the dashed red line is the abundance limit, and the solid red line at the bottom is the abundance threshold.

The black dot, again on the upper right, represents the average abundance from 2016 to 2018, which is what was used to make the stock status determination for the assessment. That's what the TC is proposing as the reference level to compare the triggers to. These are the percent declines from our reference abundance value, which is that black dot, or the average abundance from 2016 to 2018 to each of the trigger levels that are being considered at this point.

From that 2016 to 2018 average abundance to the fishery industry target reference point, that would be a 17 percent decline in abundance, to the point where the moderate to high regime shift takes place would be a 32 percent decline. Then to the point the 75th percentile of the moderate abundance regime, that would be a 45 percent decline, and all the way to the abundance limit would be a 51 percent decline.

Those are the trigger levels that are being considered. Remember that these would be based on annual indices, rather than the model of abundance, but the TC does feel that it's appropriate to use a one-to-one comparison for changes in the annual abundance indices, to approximate changes in that model of abundance, based on the correlation analysis that was performed.

Then here is what those trigger levels look like as declines in abundance, just so you can get an idea of how these things are connected here. Over on the top right you're looking at the declining black lines from the black dot. You see the dotted line is

the cumulative decline to the fishery industry target, the dash line is the cumulative decline to the abundance level, where the shift occurred from moderate to high abundance regime.

The dot dash line then is the cumulative decline to the 75th percentile of the moderate abundance regime, and the solid line is the cumulative decline to the abundance limit. The TC has also discussed the types of management measures that would be most appropriate for increasing biological resiliency, and they generally agree that increasing minimum gauge size is expected to have the most positive impact to stock resiliency, by allowing more individuals in the population to reproduce, and that is even if the gauge change is relatively small.

They've noted that increasing the minimum size would likely have a short-term impact of decreasing the number of lobsters landed, but it ultimately is expected to increase the total weight of landings. They've also noted that vent size changes should be made consistent with those changes in minimum gauge size. For maximum gauge size, the TC has said that decreasing it has the potential to increase stock resiliency by making large lobsters unavailable to the fishery. But the effects of that are less certain, due to less data. They noted that also minor changes to maximum gauge size are less likely to have a big impact, compared to changes to minimum gauge size, and that's because inshore where most of the landings are coming from, the size structure of the population is already truncated, so few large individuals are being caught.

The Technical Committee is still working on finalizing some of these analyses to better predict how certain gauge size changes would impact the stock in areas in the fishery, and in particular they are incorporating new data for Area 3 since the last time they did this analysis. One concern or issue that came up during the PDT discussions on trigger levels and potential management measures, is that there was some disagreement among PDT members about the appropriateness of an approach.

It's a tiered approach, where you have multiple triggers that would be established, and a more conservative trigger would result in only slightly more restrictive measures compared to our current measures, and a less conservative trigger would result in relatively more restrictive measures than the current measures.

The argument from some PDT members was that given the existing uncertainties about the stock recruit relationship, that there is not necessarily a strong scientific rationale for an approach like this. But other PDT members felt that it makes sense to have a smaller change to management occur sooner rather than later, and then have a second trigger in place so that further restrictions can be implemented if things were to continue declining.

This is something that might require more discussion among the TC and PDT, but they have highlighted it as something they would like to discuss with the Board. Before I jump into PDT recommendations, we want to go over where we are with current management measures. This table shows the area-specific measures for Gulf of Maine and Georges Bank, and I think the main things to note here are the differences between areas for minimum gauge size and vent sizes, V-notch requirements and definitions, and maximum gauge sizes.

Then also, the difference within the Outer Cape Cod Area for state versus federal waters. Those are things that this Addendum may address. This is a chart that compares those minimum and maximum gauge sizes for the areas within the stock. We have the yellow slots showing where each area currently falls.

As you can see, Area 1 has the smallest minimum gauge size at 3 and ¼ of an inch, and Outer Cape Cod is at 3 and 3/8 of an inch, and Area 3 is at 3 and 17/32 of an inch. Area 1 also has the smallest maximum gauge size at 5 inches, whereas Outer Cape Cod and Area 3 are more similar on their

maximum size at 6 and ¾ of an inch for federal waters, but no limit in state waters of Outer Cape Cod.

Also, on this chart there is an orange horizontal line in the middle, and that is representing the estimated size at 50 percent maturity for the Gulf of Maine and Georges Bank stock, which is 87 millimeters carapace length. There is some variation within different areas of the overall stock unit, but as you can see, minimum gauge size for Area 1 and Outer Cape Cod both fall below that stock-wide size at 50 percent maturity, which suggests that there is growth overfishing occurring, and the Technical Committee has generally agreed that it's better for the stock resiliency to move the minimum size to the at or above that 5 at 50 percent maturity of the area where the fishing is occurring.

As I mentioned, the Technical Committee hasn't provided final analyses on the impacts of gauge size changes, but the PDT does want to get feedback from the Board on whether for each area, are there any gauge sizes that are complete nonstarters that the Board would be unwilling to consider? Just keep that in mind as we go through the other options from the PDT.

Now on to the PDT recommendations. As I mentioned, they are still waiting on Technical Committee analyses to fill in some details. Generally, the PDT has just been focusing on structuring the management options in the Addendum to meet the objectives of the action, and make sure that it's accessible for the public and the Board.

Since the last meeting the PDT has changed the draft structure of options, to group them into four separate issues. The first issue would address the standardization of some measures, such as inconsistencies within LCMAs at final approval of the Addendum. The second issue would address the trigger mechanism, and include trigger level options.

The third issue would address the management measures that would be implemented as a result of hitting the triggers established under Issue 2. Then the fourth issue would be to address a spatial implementation of those measures within Area 3. For Issue 1, these are the proposed options as currently drafted.

Option 1, as always, is status quo, and that is that no changes to measures would occur upon final approval of this addendum. Option 2 is that some standardized measures would be implemented upon final approval of the Addendum, and the additional sub-options would define which measures those would be.

The sub-options to note are not mutually exclusive, so the Board could select more than one. Sub-option 2A is that upon final approval of the Addendum, measures within each LCMA would be standardized to the most conservative measure, where there are inconsistencies in measures for state and federal waters within the stock.

This would result in Outer Cape Cod's maximum gauge being standardized to 6 and ¾ of an inch for both state and federal waters, and the V-notch definition and requirement being standardized to 1/8 of an inch, with or without setal hairs. Option 2B is to implement a standard V-notch requirement across all LCMAs in the stock upon final approval of the Addendum, and that would result in mandatory V-notching for all eggers in LCMA 1, 3, and Outer Cape Cod.

Then Sub-option 2C is to standardize regulations across LCMAs in the stock for issuing trap tags for trap losses upon final approval of the Addendum, and that would result in no issuance of trap tags before trap losses occur. Issue 2 again considers establishing a trigger mechanism to automatically implement measures to improve biological resiliency. As I mentioned before, the PDT has been discussing several options for triggers. The first is status quo, which would be no trigger mechanism at all, so no management triggered by something really just the indices, and then the trigger levels alternative options are ranging from 17 percent

decline in the indices to 51 percent decline in the indices. It should be noted that for this issue, the intent is that the Board could select either one trigger only, or select two triggers and use a tier approach.

Issue 3 is considering what management measures would be put in place when each trigger is hit. This is where the PDT has yet to fill in those exact measures based on the Technical Committee analysis, but this is the general structure that they recommended for these options. The PDT wanted two sets of options, one that would consider LCMA specific measures, and one that would consider standardized measures.

But, given the Board's guidance to prioritize resiliency, any measures considered under either category would have to be projected to increase biological resiliency of the stock. For Option 1, we have sub-options to establish LCMA specific minimum gauge and vent sizes, and maximum gauge sizes for each area to increase resiliency.

Those are the nonstandard options. Then under Option 2, there would be two options for standard minimum sizes across the LCMAs, and those can be tied to either one or two triggers established under Trigger 2, or Issue 2. Then there are a few more options here, so next under Option 3 there would be two additional options for standardizing the maximum gauge sizes across LCMAs, and again those would be tied to either one or two triggers, depending on what's chosen under Issue 2.

Then lastly under this issue, Option 4 is, that in addition to the gauge and vent sizes that would be implemented by each trigger, the Board could also choose to trigger any of the measures that were considered, but not selected under Issue 1. As a reminder, those are things like the standard sizes within LCMAs, V-notch requirements, and trap tag loss regulations.

Then this is our last issue, Issue 4, which is addressing where in Area 3 the management measures triggered by the Addendum would apply. Option 1 is status quo, which means that Area 3 would be treated all as one unit, so the rules would apply throughout Area 3. Option 2 is that the measures would only apply in the part of Area 3 that is considered to be a part of the Gulf of Maine and Georges Bank stock.

Specifically, that means that Area 3 would be split along the 70-degree west longitude line, to create an eastern section and a western section of Area 3, with an overlap of 30 minutes on either side of that line. Under this option the idea is that LCMA 3 harvesters could choose to fish exclusively in either the western or the eastern portion of the area, and they would be allowed to fish annually in the overlap zone without needing to change their area declaration.

Then in that overlap zone they would be held to the management measures of whichever sub area they had declared. That gets us through all of the proposed options to this point, and now I just want to put up a few questions that the PDT has raised for the Board to think about today. First, given that there is some disagreement or concerns with the tiered approach to management triggers and measures, due to uncertainties about the stock recruit relationship. Does the Board want to weigh in further on whether you want to pursue that approach? Second, is there a desire to remove any of the proposed trigger levels from consideration, either because they are too proactive or not precautionary enough? Then third, considering the range of possible minimum and maximum gauge sizes, are there limitations to the options that the Board would be willing to consider? Finally, a question came up about the process for implementing changes to measures when a trigger is hit.

The question is, if a trigger mechanism is implemented through the final approval of the Addendum, would the states be able to write that trigger rule into their rulemaking, or would new rulemaking to implement new measures have to

occur only after that trigger is met? This is just to get a better sense of the expected timelines for evaluating a trigger and then implementing new management measures as a result.

This is my last slide, which is just reviewing the next steps. After this meeting the TC will finalize their analyses to inform the management options. Then in August and September the PDT will be meeting to consider those analyses, and recommend final options for the document.

At this stage I expect to invite those members of the Board who had volunteered in May, to sit in on the PDT meetings and offer some guidance on the document. Then following finalizing the document, we expect it will be presented at the October meeting for the Board to consider it for public comment. That is all I've got, so I'm happy to take any questions, Mr. Chair.

CHAIR McKIERNAN: Thank you, Caitlin. I think you've gone over a lot of pretty nuanced detail here, and I'm wondering if there are any questions about the presentation before we get into any of the substantive discussion. I actually have one myself, and it has to do with the slide, Issue 1 options.

In that slide it mentions under 2A, referring to this would result in Outer Cape Cod maximum gauge being standardize to 6 and ¾ for state and federal waters. Actually, I think it's a little more complicated, because under the federal regulations the most restrictive rule applies. We have dual permitted lobstermen, who are fishing in the Outer Cape that are bound under the federal standards to comply with the more restrictive rule.

In other words, they would have a 6 and ¾ inch minimum size in state waters, because they hold the federal permit. I don't know if you need to change that per se, but I want to make that correction so people can understand the complexity of this dual jurisdiction situation. I would welcome any other Board members if they have any questions to Caitlin on any of these other options, to ask those now.

MS. STARKS: Dan, I just want to clarify that point, to make sure I understand. For Outer Cape Cod, the idea is to just blanket have all harvesters permitted for that area be required to meet the 6 and ¾ inch maximum gauge is correct?

CHAIR McKIERNAN: Well, that's certainly one outcome, but I just want it to be known that given the dual authorities in the state and federal managed fishery, that the status quo in the Outer Cape, in my view, is that those who are dually permitted already are bound by the more conservative rule when in state waters. In other words, the issue I'm taking issue with is instead of saying for state and federal waters say state and federal permit holders, because there is that issue of if you're fishing in state waters but you hold a federal permit, you are bound by those federal rules. I would let, maybe somebody from NMFS sort of reinforce that, but that's my understanding.

MS. STARKS: I think I've got you, Dan, thank you.

CHAIR McKIERNAN: Are there any questions on the presentation? If not, I guess we could get into some of the substance.

MS. KERNS: Right now, I have David Borden.

CHAIR McKIERNAN: Go ahead, David.

MR. DAVID V. BORDEN: Caitlin, while Dan's got this slide up. On 2A, have the technical folks looked at the impacts of that change, in terms of how it would affect the industry itself? What type of lost revenue, for instance, would be expected?

MS. STARKS: The short answer is no. We don't have analysis on that. I think it would be possible to do an analysis to show changes in catch of different sizes based on that change, but I'm not quite sure if we have the data to go as far as value. I can ask the Technical Committee what kind of analysis we can put forward for that change.

MR. BORDEN: Okay, and then a follow up, if I may, Mr. Chairman. A follow up would be, in terms of the gauge changes. Are the technical folks looking at a particular range of increases? In other words, how much of an increment? Are we looking at a 16th, a 32nd? How is that going to be evaluated?

MS. STARKS: Sorry, I want to make sure I understand the question. Are you asking what gauge size increases are being considered?

MR. BORDEN: Yes, not the gauge size, the increment of change. How much of a change are you going to look at? I just point out that in Rhode Island I think when I worked for the Department, I think we went through 8-gauge changes during my tenure. We always did it using a 32nd of an inch, in order to minimize the economic harm to the industry. But they were sequential, in other words one came right after another. Are you going to look at that type of strategy, or are you going to look at say a more aggressive strategy, a 16th of an inch? What is the increment of change?

MS. STARKS: I guess that is something we could add options for. Right now, we were not thinking of a gradual approach being part of the option. I think generally what I have on the slide right now, this chart of maximum and minimum gauge sizes is what the TC has been analyzing. We're looking at these sets of minimum and maximum gauge sizes. If a change were implemented, I think right now we're just looking at it being implemented right away, and not necessarily a gradual increase to get to that size.

MR. BORDEN: Okay, thank you. Mr. Chairman, when you get to the point you're taking statements, I'll have a statement on that if you would like to call on me again. Thank you.

CHAIR McKIERNAN: Sure, thank you, David. Is there anyone else on the Board that wants to comment at this point?

MS. KERNS: No hands, Mr. Chair. Oh, you have Kathleen Reardon, your TC Chair.

CHAIR McKIERNAN: Go ahead, Kathleen.

MS. KATHEEN REARDON: Just to clarify, David. We're looking at 16th of an inch for these increases. It's kind of hard to tell, because of all the different fractions, but just to clarify. Right now, we are looking at 16th.

CHAIR McKIERNAN: Just for my clarification. Is that kind of a recommendation, a kind of recommendation the PDT would be expected to make, because it's a little more sort of socioeconomic, as opposed to the TC? Would that be the role of the PDT, to sort of weigh in on that? I guess that's a question for Caitlin.

MS. STARKS: Yes, Dan. I believe so. The Technical Committee will be able to provide the analysis that says, you know, at this minimum and maximum gauge size this is the expected outcome, in terms of changes for the stock, and changes in catch. But the PDT would definitely be able to recommend something like an incremental increase, or other issues that relate more to the market side or industry side of things.

CHAIR McKIERNAN: Okay, thanks. Any other discussion on this presentation from the Board?

MS. KERNS: No hands, Mr. Chair.

CHAIR McKIERNAN: At this point, Caitlin, this is an update. There is still more work being done on the back end by the two committees, the TC and the PDT. Will you feel cheated if you don't get more substantive discussion by Board members, or are you okay if we wait to see something closer to a final product?

MS. STARKS: I do have these questions up on this slide that we were hoping to get some discussion on today. In particular, I think it would be helpful to hear if there are any gauge sizes that should not be considered as options for this document. I think that is one that the PDT has struggled with.

CHAIR McKIERNAN: It sounded like David Borden wanted to come back and talk about gauge size increments. David, are you ready to bring that up?

MS. KERNS: Mr. Chair, you have a queue of David, Pat and Jason McNamee.

CHAIR McKIERNAN: That would be David Borden, Pat and Jay.

MR. BORDEN: Okay, thank you, Mr. Chairman. My only suggestion, having gone through that in my history numerous times. Every time we get, at least I'll just talk from a Rhode Island perspective. Every time we would be confronted with the need to raise a change for scientific, biological reason or whatever.

The industry would want to know, what is the projected impact, and then there would be a discussion that would follow it, which would relate to, how do we minimize the negative consequences? As I've spoken before at previous Board meetings, this whole concept, I have some concerns about it, which I'm going to voice at some point today.

When you start having a tiered approach that is based on, and I'm just picking a number out of the air, based on a 30 percent reduction in abundance, and then you superimpose on that a 16th of an inch gauge size change. Unless the data, our experience from Rhode Island is completely wrong, then you're going to compound the negative impact on the industry.

I think the Board really needs to think through how they do that. I'm not saying don't do it, I'm saying we have to be careful that we factor in a broader range of considerations, other than just science. If we want to try to minimize the negative consequences to the industry, you're going to want to phase it in, but have a strategy where the industry knows and expects a certain set of regulations to come out of it, and you can use a phase-in strategy to achieve the same end. You might be forced to kind of abandon, if you advocated a much more aggressive strategy up front. I think there needs to be some discussion on at least the analysis. If we're going to look at gauge changes, then I would advocate, fine, we look at a 16th if that is what the technical folks want to look at, but we also look at the consequences of a phase-in strategy like a 32nd, once a year for X number of years.

CHAIR McKIERNAN: Pat Keliher.

MR. PATRICK C. KELIHER: Caitlin has listed four questions that the PDT is asking for the Board for guidance. How do you want to handle these, one at a time or do you want me to address all the points that I have related to these questions?

CHAIR McKIERNAN: Well, this particular item is scheduled for only another ten minutes on the agenda. I don't think we have to keep exactly to the timing. But why don't you take a crack at what the concerns are that you see from the state of Maine, which is the number one lobster producer in the country. I think your input is really valuable.

MR. KELIHER: Well, I appreciate the standing you've given us. I'll just try to quickly hit on all four of these questions then, to give a little bit of thought from the state of Maine around these issues. Question Number 1, is the Board still interested in a tiered approach. I think from Maine's standpoint, we are.

We think we need to push for a tiered approach that allows for action earlier in the process, and is likely the type of action that is going to be more palatable. In other words, we don't have to be so draconian. I think we can take a lesson out of the Southern New England playbook here. If we continue to look for a single action, I think it's going to push us down the road. It's going to be harder to get to that point, and when we come to taking an action, it's going to have to be much more draconian, if we could even get to that point. I think the tiered approach is the right approach.

The second question, does the Board wish to remove any of the proposed trigger levels, because they are either too aggressive, or the trigger may already be met. I guess all I would say to that one is, we wouldn't want to be too aggressive and implement a trigger that has already been met, right? If the PDT is going to look at triggers, let's not have something be established that would have already been met before we even finalized the Addendum.

Number 3, are there limitations to the range of gauge sizes the Board is willing to consider. From our perspective, we need to stay with the biology here. Maybe I don't see a need to consider minimum gauge sizes and then one that are greater than the size at maturity. But other than that, let's stick with the biology. Then Number 4, if a trigger mechanism is implemented through final approval, will states be able to write established triggers into the rulemaking.

I do want to point out the state of Maine's both minimum and maximum sizes are in statute, which creates some complexity. But knowing this is coming, it will be the Department's intent to submit a bill to the Legislature this fall, or this winter, excuse me, to ask either for the authority to establish these, or new gauge sizes, or ask for the gauge sizes to be changed, if they have been addressed through an FMP by the Commission. Those are my quick thoughts around those points, and I hope they were beneficial.

CHAIR McKIERNAN: Thank you, Pat. Jason McNamee.

DR. JASON McNAMEE: I think in general; I'm just going to support everything that Commissioner Keliher just said. I agree. I think the idea here would be triggers was to be kind of proactive, and have a system kind of set up. I appreciated the comments about kind of learning the lesson from Southern New England, and trying to be proactive. I think these triggers seek to implement that, and I appreciate the PDTs concern about the weak stock recruit relationship, but again, I think that type of uncertainty is exactly why we want to have a series of triggers, you know in place, so that you're not kind of waiting for potentially the stock assessment to catch up, or get you to a point where you are kind of beyond the point of being able to recover in a reasonable way.

That for me, gets at Number 2 as well, where I think the suite of triggers that you have in there seem good. I don't have any recommendation to remove any, the comment that Pat made notwithstanding. I think it would be awkward to implement something that potentially we've already triggered.

I'm not going to comment any more on Number 3, and then on Number 4, it seems like we would want to have this in perspective so that again, if the idea is to be nimble, and to be able to make some changes prior to something really bad happening in the population, which is so important to the economies of particular, Maine, but also Massachusetts, also Rhode Island. You know, I would think we would want to have these things kind of in place, so that we could use them rapidly if needed. That's it. I just wanted to weigh in on the questions as well. Thank you, Mr. Chair.

CHAIR McKIERNAN: Caitlin, is one of the fundamental questions in Number 4, how long would each state require to enact amended rules? Are those time periods sufficiently quick? Am I right in sort of summarizing it that way?

MS. STARKS: Yes, I think so, Dan. We're trying to get at, you know figuring out what the timeline is if we have the ability to evaluate whether a trigger has been hit every October, which is the plan for when those data updates would occur. Would the states be able to implement quickly enough measures to implement for the following fishing year, if they don't write these trigger rules into their rulemaking? I think that is the gist of it.

CHAIR McKIERNAN: Yes, I can say on the Massachusetts end, we have done so many quick

rule changes in the Scup, Black Sea Bass and Fluke arena that we have a whole routine of these emergency actions justified as needing to comply with an ASMFC plan, that we could certainly enact a rule within, certainly less than five months, but we could do it in a couple of months. But it sounds like in Maine they need to extract the authority from the statute into another regulatory scheme. Is Maine the only state within the Gulf of Maine that has that challenge? What about New Hampshire and Rhode Island?

MS. KERNS: Dan, you have Cheri with her hand up.

CHAIR McKIERNAN: Okay, go ahead, Cheri.

MS. CHERI PATTERSON: Yes, thank you, Mr. Chair. New Hampshire can react very quickly with our rulemaking, considering this is an ASMFC managed species. Under Number 4, I would prefer to write in the rulemaking the trigger process, as long as there is some, and I know that there cannot be some clear thought process that this is going to last for a long time. I would hate to continually have to change rules or triggers on an annual basis, because ASMFC is changing it.

I would prefer to just keep it set for a long period of time. I also agree with Pat and Jay on Numbers 1, 2, and 3. I think that it's important to keep this tiered approach. I think it allows us to pivot quicker, to react to the management of lobster. I think that I agree with what both Pat and Jay say for Number 2 and I don't see where Number 3, where we need further limitations to the range of gauge sizes that is being considered.

CHAIR McKIERNAN: Okay, Toni, anyone else with their hand up?

MS. KERNS: You have Jason McNamee.

CHAIR McKIERNAN: Great, go ahead, Jason.

DR. McNAMEE: Yes, I was just going to quickly answer the question, Mr. Chair, that you asked. I think that you asked, but in Rhode Island it wouldn't be statutory, it would be regulatory, so we could get things established in a reasonable amount of, you know it's relative, I guess, but a reasonable amount of time. It shouldn't take years, or anything like that.

CHAIR McKIERNAN: Okay thanks, and I know that this is about resiliency of the Gulf of Maine stock, but when we're all done with the next iteration of lobster management, I hope that there will be some attempt to make some of the rules a little bit more compatible, relative to commerce.

Although this isn't one of the objectives that has been laid out, the fact that some of the Area 1 lobsters can't be easily imported, or have to be filtered out before they get to some of the Southern New England states or Mid-Atlantic states, has been a concern of mine, in terms of the effects on commerce. At some point I think we need to ask if it's worth it.

If not, can we achieve some of these conservation measures in a way that is more consistent with ease of commerce? You know, I would hate to see a commerce clause case sort of bubble up. Obviously, it's a conservation measure, but I know that it's been problematic for some dealers to be shipping lobsters to states with a slightly higher minimum size, and that is problematic. Any other comments, Toni?

MS. KERNS: David Borden.

CHAIR McKIERNAN: Go ahead, David.

MR. BORDEN: Just general comment follow-up on what I said before. I support this, so everyone is clear. I support this concept, and I think it's incumbent upon the Board to try to do this is a manner which is clear, and kind of effective and timely. On the issue of timing, I'm a little bit concerned, and I'll express more at the next meeting, about our ability to kind of standardize

some of the regulations, and then develop this tiered approach all in one action.

Hopefully the technical people will prove me wrong, bring forth an analysis that we can all agree with. But I think the tiered, the aspects of the tiered phase really have to be well thought through by the Board. It's going to be very complicated, I think, and there are going to be really dire implications for 10,000 fishermen up and down the coast, of how we do that.

What I would suggest is, at the next Board meeting we really focus on our ability to do this all-in-one action. I could envision a strategy where we break this into two actions, and do the first step of standardizing some of the regulations, and then in the second phase, which would quickly follow the first phase, then focus on the triggers.

You know I'm a bit concerned that some of this analysis hasn't been done, and the fact that it's only a few months away, when it's supposed to be ready to go to public hearing. I don't think that is necessarily a realistic expectation. Then, the other concern I have with it relates to my experience with Southern New England. I've said this before, so I'll be brief, but we went from the peak of landings in Southern New England, to basically a collapsed stock in four to five years. I'm sure Caitlin has got the chart that documents that, and she could put it up for the Board. But that's a really quick period of time to go from one extreme to the other extreme. We have to factor that in to our consideration of this. If we pick triggers that don't get implemented until there is a 50 percent reduction, that is the one exactly, thank you, Caitlin.

If we pick triggers that respond too late in the process, it's just not going to be an effective strategy. I think we've got to think through that really carefully, and try to look at a more gradual but phased-in approach that requires action as the stock goes down, instead of picking, say 50 percent or 30 percent decline. I mean the stock, and Pat Keliher, please correct this if I'm wrong. From peak landings, I think we're already down 30 million pounds. How far down do we really want this to go, before we start taking actions? My recommendation is to take actions sooner. It would be better to take a whole series of small steps sooner than waiting for some major event, where you have to go do something that is so draconian, it's just going to put a whole bunch of fishermen out of business. Thank you very much, sorry to be winded.

CHAIR McKIERNAN: Thank you, David. All right, anyone else?

MS. KERNS: Kathleen Reardon.

CHAIR McKIERNAN: Kathleen.

MS. REARDON: A question for David. You were talking about standardization, and that is something at the previous Board meeting we were given some guidance to focus on resiliency, and so that is what we have been focusing on. But you were still talking about standardization, is that across LCMAs or within LCMAs?

CHAIR McKIERNAN: Go ahead, David.

MR. BORDEN: Kathleen, the last portion of your question was a little bit broken up, could you repeat it, please? I apologize. I'm not sure.

MS. REARDON: It may be my internet, sorry about that. My question is, you were talking about standardization, and at the last Board meeting we were given the guidance to focus on resiliency rather than standardization across LCMAs. That is why, within the PDT process, we have had kind of different options, one being standardization across LCMAs, both Area 3 and Area 1, and then another option, which is area specific. I just wanted some clarification. Are you expecting that things are going to be only standardization, or that things could still be area specific?

MR. BORDEN: My response is I think that that is a decision we have yet to make. I don't think we

necessarily can make it. My assumption is we're going to look at some of these analyses, and then try to make some decisions that get to that very question. My personal view at this stage, without seeing the analyses, I think there are some issues that are kind of glaring examples of how we could standardize regulations, and improve the resiliency of the stock. You know you can view that. One of the things that I kind of struggle with a little bit is, we're kind of focused on the scientific portion of it, but you can add resiliency to the stock by changing a whole host of other measures that currently are not on the table. I'm not sure I've answered your question.

CHAIR McKIERNAN: David, I think if I could weigh in. I think these measures that are being floated are those that can be flipped by a simple regulatory amendment in short order. Some of the other things that we've done in the past, like in Southern New England, where we went to a complicated effort control plan, could not be accomplished in the span of a round of rulemaking. You know it took such a long time to work out the details of those plans. I'm seeing this plan as choosing those routine lobster management measures that the input control types, you know as opposed to the output controls.

MR. BORDEN: If I might, Mr. Chairman, can I follow up on that?

CHAIR McKIERNAN: Sure, go ahead.

MR. BORDEN: I mean, I think we should stay away from gauge changes in the first phase. I think that's too complicated, and it's not that I'm trying to avoid gauge changes, it's just going to become very complicated and very contentious. I think we should focus on issues like potential changes in the V-notch definition, where you have to V-notch or not V-notch. I could see us (David stopped).

CHAIR McKIERNAN: Did we lose David?

MS. KERNS: Looks like we lost him. He's still there, but I don't hear him. David, we lost you. I'll text him to let him know.

CHAIR McKIERNAN: All right, well we do need to move on, on the agenda. Why don't we take, let's give him 30 seconds to get back, hopefully he can come back quickly?

MS. STARKS: While we're waiting for David, Mr. Chair, I think I have something to offer.

CHAIR McKIERNAN: Yes, go ahead, Caitlin.

MS. STARKS: As I mentioned, I think after this meeting we are planning to have more PDT meetings to look through the Technical Committee analysis, and I had mentioned that that would be a good time for Board members. In May we asked if there would be some subcommittee of Board members that would be interested in providing guidance on this document. I think it sounds like we'll need some additional guidance, and maybe we just have those conversations at the PDT meeting.

CHAIR McKIERNAN: I agree with that, that is a great strategy. Someone like David, who has had many, many decades of lobster fishery management experience, is an important voice in this discussion. Why don't we move on, unless there is anybody else who wants to speak to this, because I think David's concerns can be brought up at those meetings with the PDT.

MS. KERNS: I just want to check. Kathleen, is your hand raised from before?

MS. REARDON: Actually, it was just to respond a little bit to David. The conversation of other measures, like V-notches for effort control, like trap reductions. They were discussed within the Technical Committee, and we I think came to consensus that the measure that we have the most certainty on as having an impact to resiliency is gauge changes.

CHAIR McKIERNAN: Okay, that is a good clarification. David, are you back? Okay. All right, if

there are no objections. Caitlin, did you get the feedback you were seeking at this point?

MR. BORDEN: Mr. Chairman, I apologize. I'm not quite sure what is going on. I was completely muted, and I had no control over it. I also missed part of the discussion; I couldn't hear anything. Let me just make this one quick point, in terms of the whole issue of standardizing things.

I think there is a whole range of things that we can take quick action on in the first phase, they are fairly simple, easy to analyze. Depending upon what the technical folks come back to us, the PDT come back to us at the next meeting, we may want to think about separating the first phase from the second phase, because I can see the second phase being far more complicated. But we can make that decision at the next meeting, Mr. Chairman.

CHAIR McKIERNAN: Thanks, David, and I think you will be getting an invitation to attend, as a Board member, the meeting of the PDT and the TC, right, Caitlin?

MS. STARKS: Yes, that is my intention.

CHAIR McKIERNAN: Okay, all right if there are no other comments that we need at this point, let's move on, if there are no objections.

REVIEW OF THE WORK GROUP REPORT ON VESSEL TRACKING DEVICES IN THE FEDERAL LOBSTER AND JONAH CRAB FISHERIES

CHAIR McKIERNAN: Great, okay next is a Review of the Work Group Report on Vessel Tracking Devices in the Federal Lobster and Jonah Crab Fisheries, and Caitlin, another presentation for you.

MS. STARKS: Thank you, give me one second to get this up on the screen.

CHAIR McKIERNAN: I can editorialize in the meantime. I think this is one of the more important issues of our time for this lobster fishery. In my own experience it's really hard to help the lobster fishery sort of be considered for the important role that it plays in the maritime economy, when it's so difficult to identify places and times of fishing.

The lobster fishery at this point is at a real disadvantage relative to its other counterparts, that being groundfish, scallops, herring, surf clams, all those other fisheries that have vessel tracking systems or vessel monitoring systems. That is my comment to begin, so go ahead, Caitlin.

MS. STARKS: All right, thank you, Mr. Chair. Today for some context, at the Lobster Board meeting in May the Board expressed continued support for implementing vessel tracking requirements for federally permitted lobster and Jonah crab vessels. This has been a continuing discussion for the Board over the course of several years, with the Board highlighting the need for high resolution spatial and temporal data from vessel tracking, particularly for federal waters, to address several challenges that the lobster fishery is facing. At that May meeting the Board agreed to form a work group, which included representatives from the Board, federal and state management agencies, and law enforcement, and that group was identifying objectives, technological solutions and just some characteristics for implementing vessel tracking requirements in the federal lobster and Jonah crab fisheries.

That work group, as well as technical staff who have been working with the tracking technology and data systems have met several times over the last few months, and they've put together information on the objectives of requiring harvesters to collect tracking data, and identified some of the essential device characteristics for those trackers.

Based on the Board's previous discussions and intentions for a tracking program, the work group developed this proposed objective statement, which is that the objective of requiring vessel tracking devices for federally permitted vessels, and just to be clear that includes vessels with both

federal and state permits as well, for lobster and Jonah crab, is to collect high resolution spatial and temporal data to characterize effort in the federal American lobster and Jonah crab fisheries for management and enforcement needs.

Noting that these data will improve the stock assessment, inform management decisions related to protected species, and enhance offshore enforcement. To go over a bit more detail again on each of these aspects. First is acknowledge that improved spatial resolution of harvest data will improve the size composition data that is used in the stock assessment models, which will ultimately allow for better estimates of exploitation and reference abundance.

Second, the current model is being used to assess the location of vertical lines in the fishery, and their associated risk to right whales could be significantly improved with high resolution vessel tracking data. The recently published biological opinion includes additional risk reductions for the U.S. lobster fishery, starting in 2025, so there is a pressing need to get these data and models updated with better information before that time, to determine if additional reductions were needed.

Third, there is a need to record the footprint of the U.S. lobster fishery, so that information can be considered as part of ongoing and future spatial allocations discussions that result from new, emerging ocean uses, such as aquaculture, marine protected areas, and offshore energy development.

President Biden's 2021 January Executive Order included a goal of protecting 30 percent of U.S. waters by 2030, and that is just one indication that these types of conversations are definitely on the horizon. Lastly, there is the enforcement challenge of locating broadly dispersed gear in the offshore areas. Vessel tracking should definitely benefit the efficiency and efficacy of enforcement, by providing locations of type gear to enforcement officials.

Out of the work group discussions the recommendation was developed that the Board should initiate an addendum to consider implementing electronic tracking requirements for federally permitted vessels in the lobster and Jonah crab fishery, and this is based on the understanding that this would allow tracking data collection to be implemented under the authority of the Atlantic Coastal Fishery Cooperative Management Act, ACFCMA, which will provide the process and flexibility that we need for collecting information and sharing that data, in order to achieve the objectives that we've identified.

Additionally, operating under ACFCMA would allow the tracking data to be stored directly to ACCSP, and that will make data access easier for state fishery management agencies and law enforcement. The work group also made several recommendations on specifications that should be considered for the tracking devices that would be required if the program were implemented.

First, the trackers should report location data at a rate of one ping per minute for at least 90 percent of the fishing trip, and based on pilot project results, our understanding is that with this rate we would be able to distinguish lobster fishing activity from transiting activity, and also calculate the number of traps per trawl.

Second, the work group noted that cellular tracking devices are the preferred technology over satellite systems, due to lower cost and that they are generally simpler to install and use than satellite-based technology. The working group also emphasized that devices should be required to meet some minimum standards, and those should be defined by ACCSP and its partners, to ensure that data needs are consistently met, while still allowing flexibility for technology to be able to evolve and improve over time.

Some examples of these requirements are that they should have power systems capable of running the

device at the specified ping rate for the entire fishing trip. They should meet minimum precision and accuracy requirements, and they should be capable of making a distinction between a tracker unit and a vessel permit or vessel or permit, so that the data coming from a particular tracker at a particular time can be tied to a vessel or a permit, rather than the tracker itself.

Some additional considerations that the work group brought up were first, that there are several issues where they felt consulting the Law Enforcement Committee would be useful. For example, they would like the LEC to weigh in on when tracking devices would need to remain active. What rate or capabilities they should have for a dockside communication, and what tamper proof feature should be required, such as affixing devices to the vessels.

The work group also noted that the Addendum will need to consider how tracking requirements should be applied to the mobile gear fleet, as opposed to pot trap vessels, since these different gear types could require different recording rates. They also said that technical staff from the states and ACCSP should draft the standards and processes for data reporting, management, and dissemination of vessel tracked data collected under the proposed requirements, and lastly that the Addendum should address a process for how devices would be approved for use in the fishery.

Beyond those considerations the working group members also noted some questions that will need to be answered as this process moves forward, which are listed on this slide. For one, the Board is looking for, in terms of the timeline for implementation, what is the Board looking for in general? How quickly are we looking for this to be implemented, and if the Board were to initiate an action today, the Addendum could be completed by February, 2022 at the earliest. If that is the case, there is a question of how that overlaps with the timeline for the mandatory eVTR for lobster permit holders.

Additionally, we want to figure out how much lead time is needed to develop the data collection and management systems that will be needed for this program, as well as the time and resource requirements for ACCSP for things like program development and data management and program maintenance, and also need to determine the time and resources requirements from the state side, as well as who will provide tech support to harvesters for these tracking devices, and who will pay for them.

With all of that information in mind, the action for consideration today is whether the Board would like to initiate an addendum to consider implementing a requirement for electronic vessel tracking for federally permitted lobster and Jonah crab vessels. That is the end of my presentation, so I can take any questions.

CHAIR McKIERNAN: Thank you, Caitlin, are there any questions for Caitlin?

MS. KERNS: I have Pat Geer and then David Borden.

CHAIR McKIERNAN: Okay, go ahead, Pat.

MR. PAT GEER: Caitlin, I just had a question. How well will a cellular system work versus satellite, especially when you're going offshore?

MS. STARKS: My understanding is that the cellular devices would still be logging the locations in a cache, and as soon as it comes back into cellular range it would be uploading those locations. I believe that their precision accuracy is equivalent, it's just a matter of the lag between when the location is recorded and when it's uploaded.

MR. GEER: Okay, thanks.

CHAIR McKIERNAN: David Borden.

MR. BORDEN: My question is, and I don't know whether this is to Alli or staff. For purposes of the question, just assume that we do a tracking Addendum. It takes a year to do that, it takes another year to implement it, so that is two years.

Then we make a recommendation to NOAA to implement it for permit holders in federal waters, as a trailing action. How long will it take NOAA to do that? I recognize that that is going to be dependent upon what we do in the action originally. But if Alli could provide some guidance on that it would be helpful. Then I might want to follow up with another question.

CHAIR McKIERNAN: Alli, is it you or anyone else from the Service that would respond to those, let us know.

MS. ALLISON MURPHY: Thank you, Mr. Chair, and thank you for the question, David. I think you're totally spot on in regard to that the devil is going to be a little bit in the details, as to what the PDT develops, and how rigorous of a system they develop. I think that's really going to inform the process to implementation.

You know something really built up, like more akin to our VMS program with this type approval. I don't know if vessels are going to need to be inspected and certified for having, you know the system installed, that kind of stuff. That is going to necessitate additional time to be built into the process before any flip, before we could turn this program on.

There is that aspect. I think another really important thing here is, if this Addendum is initiated, I'm hoping that there will be a PDT or a working group developed that will consist of some of the state experts who have worked with these systems, and can potentially front load some of the analyses that we would have to do in a federal rulemaking into that Addendum.

One of the things we've talked about at the working group level is the one-minute ping rate, and potentially Maine has some analyses demonstrating why the one-minute ping rate is necessary for enforcement. That would be another thing that would kind of help facilitate things to move on a little bit more quickly.

As far as rulemaking goes. We definitely don't have the best track record with the lingering eVTR rulemaking not proceeding super-fast. But I have heard loud and clear how important this issue is to everybody at the Board, and I think I could garner some support from some folks at GARFO, and try to move this action through fairly quickly. Does that help answer your question, David?

MR. BORDEN: Yes, thank you, and Mr. Chairman, can I follow up with another question?

CHAIR McKIERNAN: Go ahead, David.

MR. BORDEN: This is a question and also a suggestion, to try to help this situation. I mean the states have a long history of taking action on lobster in advance of federal rules. We've implemented a number of regulations. One of my questions, as everyone knows, I support this action. I've spoken repeatedly on the need to do this. I know that the industry, some members of the industry are not going to like the action.

But it's the only way that I can envision us ever being in a position to actually support the industry, given what's taking place, in terms of wind energy development, right whale rules. You know I've listed the reasons why we need to get on with this. I think one of the outstanding questions, and this doesn't need to be answered today, but I would like it answered by the Board meeting, the next Board meeting, is in consultation with Alli and Chip Lynch, and you, Mr. Chairman, and whoever else.

I would like to know whether or not the states have the ability, after they pass an Addendum, to implement. Make it a compliance requirement of the Plan for dual permit holders, and specify a timeline. Then let the NOAA process just work along behind it as a trailing action. We've done that before; it's been fairly effective. It's a way of putting a regulation in effect on a timely basis. The trick in it is that we need to be in lock step through dialogue with the National Marine Fishery Service on the various elements that Alli just mentioned. There is a coordination function that has to take place. If you would, Mr. Chairman, I would like that

question kind of evaluated between now and the next Board meeting, and get a report from Chip Lynch and others in a knowledgeable position, where they can respond to that.

CHAIR McKIERNAN: David, are you also kind of implying that each of our states needs to check with, like our at-home legal counsels, as to whether there would be sufficient state authority to move forward with this? Is that part of your question?

MR. BORDEN: Yes.

CHAIR McKIERNAN: Okay. I'm not sure Chip Lynch can provide the answer for every state, because different states may come back with a different response.

MR. BORDEN: Yes, that is a good point, and I think that should be factored in to it. We need to get some guidance on this. The big issue with me on trackers is, if I could mandate and implement trackers on all dual permit holders tomorrow, I would do it, as a way of buffering the industry from all of the changes that we see coming.

I am particularly concerned about the implications of the spread of wind energy, given the experience in Southern New England. It's going to spread up into the Gulf of Maine and out on Georges, and we need to know where this fishery takes place. We need to know the spatial and temporal footprint of the fishery, so that we can document it and try to minimize the impacts on the industry.

CHAIR McKIERNAN: Agreed. All right. Does anyone else care to comment, or even make a motion to possibly move forward with a future addendum?

MS. KERNS: You have Eric Reid with his hand up.

CHAIR McKIERNAN: Great. Eric.

MR. ERIC REID: I don't think we need to have any more conversation. The conversation has built the rationale for a motion that I'm happy to make, and Caitlin actually has it, if you would like it.

CHAIR McKIERNAN: Certainly, thank you.

MR. REID: Okay. I move to initiate an addendum to implementing electronic tracking for federally permitted vessels in the lobster and Jonah crab fishery, with the goal of collecting high resolution spatial and temporal effort data. This tracking data shall be collected under the authority of the Atlantic Coastal Fishery Cooperative Management Act. The PDT should use the Work Group report on vessel tracking as guidance when developing options and system characteristics. If I get a second that would be great. I don't have any additional rationale, Mr. Chairman, I don't think it's necessary.

CHAIR McKIERNAN: Is there a second?

MS. KERNS: I have Cheri Patterson.

CHAIR McKIERNAN: Okay, brilliant. Is there anyone who would like to discuss this motion in any detail, or should we just go to a vote?

MS. KERNS: Pat Keliher with his hand up.

CHAIR McKIERNAN: Go ahead, Pat.

MR. KELIHER: Mr. Chairman, I'll just take a second. I do want just to stress the point that you made at the very beginning, as we were getting ready for the meeting, about the importance of this work. There is a lot of opposition within the industry, and I've heard it. But I am going to support this motion. I am supporting this motion, because the fact is we are being asked to stand up and advocate in many cases for this industry, without the data that we need to do it. Right whales are the perfect case in point, so I will be supporting this motion.

I do want to just make sure that the record is clear, that this motion also ensures by using the authority of the Atlantic Coast Fisheries Cooperative Management Act, that this data that will be

collected through trackers will be confidential and protected as such, just as any other data would be. For clarity, I would like that to be reflected in the record. Thank you.

CHAIR McKIERNAN: Thank you, Pat, anyone else?

MS. KERNS: No additional hands, Mr. Chair.

CHAIR McKIERNAN: All right.

MS. KERNS: You have Alli Murphy, I apologize.

CHAIR McKIERNAN: Go ahead, Alli.

MS. MURPHY: Sorry for being slow at getting my hand up. First, I just wanted to express my sincere thanks to Caitlin and Toni for jumping in on this issue, and leading both the policy and the data focused working groups over the summer. I would also like to thank the Directors that participated, as well as your technical staff that contributed to all the progress this summer.

Obviously, we're supportive of this effort going forward. As an Addendum, and should this pass, GARFO is, me and other staff are going to continue to participate on development to be sure to get everything we need, and so that we're ready to hit the ground running, when and if the recommendation comes to us. You know we'll be looking, as said in the working group meetings, to continue to match the requirements with the objectives of the program. I think there is potentially some work on program administration and data flows, but I think if we have all of the right people in the room, we'll be able to get there. Thank you.

CHAIR McKIERNAN: Thanks, Alli, and I want to also refer back to David Borden's comments that states do have a long history of taking actions in advance of NMFS, and it often works. But when we have enacted certain things that have been incompatible with NMFS standards, it's been extremely painful, and it's set us back substantially.

I really appreciate the conversations that we've had in this working group, to try to get the various jurisdictions all on the same page, not only in terms of the objectives, but the technology issues. It's complicated, but it is so worth it, in my view. Is there anyone else with their hand up? Otherwise, we'll go to vote on this.

MS. KERNS: No, Mr. Chairman, I don't have any additional hands. We made a small correction, so do you mind rereading it into the record please?

CHAIR McKIERNAN: Certainly, the motion is to move to initiate an addendum to implement electronic tracking for federally permitted vessels in the lobster and Jonah crab fishery, with the goal of collecting high resolution spatial and temporal effort data. This tracking data shall be collected under the authority of the Atlantic Coast Fisheries Cooperative Management Act.

The PDT should use the Work Group report on vessel tracking as guidance when developing options and system characteristics. Motion by Mr. Reid, second by Ms. Patterson. Let's go to vote. Is there any objection to the motion that is on the board, please raise your hand?

MS. KERNS: I don't see any hands, Mr. Chair.
CHAIR McKIERNAN: Are there any abstentions?

MS. KERNS: No hands.

CHAIR McKIERNAN: **All right then, I'm going to declare it's approved by unanimous consent.** All right, we're only ten minutes behind.

JONAH CRAB PRE-ASSESSMENT REPORT AND CONSIDERATION OF A STOCK ASSESSMENT

CHAIR McKIERNAN: The next item in the agenda is Jonah Crab Pre-Assessment Report and Consideration of a Stock Assessment**.** Caitlin, do you kick it off and hand it over to Derek, or do we go right to Derek?

MS. STARKS: Derek will be the presenter, and Maya, I think you should be showing the slide.

CHAIR McKIERNAN: Maya, take it away. I guess Derek take it away, Maya is in control of the slides. Derek Perry.

MR. DEREK PERRY: My name is Derek Perry; I'm with the Massachusetts Division of Marine Fisheries, currently serving as Chair of the Jonah crab Technical Committee. Today I'll be talking about the Jonah Crab Pre-Assessment Data Workshop and Report. We'll go into a little background about how we got here, the TCs opinion that there is a need for a coastwide stock assessment, evaluation of available data sources, and potential stock assessment approaches, some research recommendations, and a recommendation on stock assessment schedule. The TC met in August, 2017, and again April, 2020, to discuss Jonah crab research and available data. They identified data limitations, but also a need for more in-depth data review, to determine the feasibility of a stock assessment.

The Board tasked the TC in August, 2020 with conducting a pre-assessment workshop, to report out potential stock assessment approaches supported by available data. This report is developed for that task. A virtual workshop was held November, 2020. We had three webinars, one in February and two in June of 2021 were conducted.

A report was developed from workshop and webinar discussions, and was included in meeting materials. There has been an increasing trend in landings for Jonah crabs, it has basically quadrupled in the last 20 or so years, as the price per pound has gone up about 100 percent. You're going to shift away from lobster to Jonah crabs in Southern New England.

It's unknown what the role of abundance has played in this increase in landings. One of the things we hope to get from an assessment is to determine the role that abundance has played in landings, and determine that relationship between landings abundance, to identify sustainable levels. There is a need for science-based management for Jonah crabs, and advice in light of Canadian Jonah crab stock declines.

There are no assessments of U.S. Jonah crab stocks, but there have been some in Canada. It showed in Canada that there has been a decline in stocks, based on a very short time of directed landings. We also wish to promote market development. You may recall that the Jonah crab FMP was put in place in 2015, largely based on the Fisheries Improvement Project that was brought to by a grocery store chain, which was concerned about sustainability of the product, and a lack of management.

There is now management in place, but still concerns about sustainability. Next, we'll go with some data sources for life history, indices of abundance and fisheries removals. The best available life history data we have is for size-at-maturity. After the FMP went in place, we have three new studies looking at size-at-maturity. All of them show that size-at-maturity for males and females from all regions in U.S. waters are below the current minimal legal size.

There is also a fair amount of data for juvenile growth, based on studies from Rhode Island and New Hampshire. For data limitations, one of the biggest ones we have is adult growth. We can get crabs to grow and molt in captivity at juvenile sizes, but not at adult sizes. We don't know how long it takes them to molt, or how much they grow from molt.

We have some tagging's that we looked at, where crabs were at liberty for three years that did not molt. It's unknown how long these crabs live, or what the natural mortality rates are. The TC looked at 31 different surveys that encounter Jonah crabs. There are some issues with some of them limiting utility of surveys for providing indices of abundance.

One of those was spatial coverage. Most of the fishery occurs in federal waters, whereas most of the surveys occurred in state waters. There are also some concerns about the small spatial scale of some of those surveys, some of them are just based on wind farms, they don't really have a large scale of which to determine abundance. There is also concern about time series, a private FMP in 2015, a lot of the surveys did not count Jonah crabs or take Jonah crab information, so all of them started around 2015 or thereafter.

There are also concerns about catchability. Jonah crabs will burrow in sediment, so therefore they are not really successful in trawl gear, as other species may be, below survey catch rates. What we have here is a number of surveys that we looked at. On the far left we have the surveys that we looked at. To the right of that we have a time series, whether or not they collect carapace width measurements.

Next to that column we have whether or not they collect sex information, next to that are those surveys that we don't think will be used for near-term assessment with the Ys. What we are left with is a CFRF Ventless Trap Survey, Maine/New Hampshire Trawl Survey and Mass Net Trawl Survey, New Jersey Ocean Trawl Survey and Northeast Fisheries Science Center Trawl Survey.
On the far right are the reasons why some of those surveys may not be useable for us. SS stands for small spatial domain, TS stands for short or discontinuous time series, CR stands for inadequate catch rates. We're left with five surveys which are good candidates. That last slide was based on post settlement and adults. This next one here is for settlement and end-of-year indices.

But with the eight different surveys, from those we have six surveys that are possible candidates. The Nomandeau Plankton Survey is probably not a good candidate, based on identification issues. They do identify the species for Cancer crabs, and the U. Maine Deepwater Collectors have a fairly short, discontinuous time series.

Looking at fisheries removal's landings, there are three main issues that were discussed, one of which being species identification. There are two close related species, Jonah crabs and rock crabs, Cancer Irroratus and Cancer Borealis. Some parts of the range their search was a lot of crabs of both species.

There was some concern that some fishermen report rock crabs as Jonah crabs, and therefore, landings may be off. This is anticipated to be a minor issue to the scale of Jonah crab landings relative to those of other Cancer crabs. There is also concern about under reporting. This is anticipated to be a minor issue following stricter reporting requirements and increase in harvest value in volume in the mid-2000s.

Part of that period of time, it's thought that there may have been some cash sales at the dock, but we think that is less of an issue now. There is also concern about landing units, these were corrected where encountered. The TC believes that 2006 is likely a reliable start year for landings time period, with seasonal and spatial data available for this time series are available if needed.

Looking at Biosampling, the table down below has year on the far left and quarter or season in the next column, and going across it's steadier at 537, 526 and 525. These represent most of the landings for Jonah crab in the United States, Area 537, which is south of Massachusetts, lands about 70 percent of the Jonah crab landings by year, 526 and 525 represent about 10 percent of landings. The areas that have most of the landings were sampling better, with still some room for improvement.

The time series is still too short for use in population dynamics modeling approaches. The color codes there are red, we basically haven't sampled much at all, yellow is fully covered, and green is well covered, so 537 we also confirm we have the best sampling in that region report and sea

sampling. There is number of trips there, number of samples.

Just looking at possible assessment approaches. This slide here represents the most likely methods we could use right now. Looking at stock indicators, the outputs, annual indicator values relative to time period-based reference values. This is used for American lobsters, spot and croaker.

We also use index-based methods. Outputs: Stock status based on ad-hoc historical time period or sustainable catch levels. This is used for horseshoe crabs. We have the data available, there are numerous options and flexibility, but there will be limited outputs. Other assessment models we could work towards would include biomass dynamics-based data poor models, or biomass dynamics models. We have data available, there are potential assumption violations.

Other models we could work towards in future assessments would be a Collie-Sissenwine Analysis, a Statistical Catch at Length Models. These have potential data limitations, but they have more robust outputs. The TC put together a list of priorities for research recommendations, starting with high, moderate and low.

I'll present here some of the high priority recommendations. The first one here is with genetics, for stock assessment purposes or stock ID purposes, rather. Information should be collected to help delineate stock boundaries, for example genetics. Identification of stock boundaries is an essential step in the stock assessment that will inform many subsequent steps including development of input data, and identification of methods applicable to the stocks.

Some genetic research is currently being conducted by GMGI that may address this recommendation. Female migration pathways, seasonality and larval duration and dispersal need to be researched. Anecdotal information suggests seasonal aggregations in inshore areas, but research would help to understand these mechanisms and inform stock boundaries.

Basically, what we're looking for is to see if there is a connection between inshore areas and offshore areas for stock ID purposes. Inter-molt duration of adult crab is currently unknown, and growth increment data for mature crab is limited. These data will be necessary to transition to a size or age-based assessment method, similar to what is used for lobster.

More high priority research recommendations. We would like to see development of fishery independent surveys, for example ventless trap surveys, to index post settlement Jonah crab abundance from offshore areas, where most of the fishery is executed. We would also like to see an increase of fisheries dependent monitoring of the offshore fleet. Sampling intensity by stat area should be based on landings. We would also like to see reproductive studies pertaining to male/female spawning size ratios, the possibility of successful spawning by physiological mature, but morphometrically immature male crabs, and potential for sperm limitations should be conducted.

This is largely based because it's a male dominated fishery, about 99 percent of the crabs that are landed are males, so if you remove the larger males, what happens to the reproductive potential of the rest of the fishery? The amount of directed commercial effort on Jonah crab or lobster should be quantified on a per-trip basis.

This is a mixed crustacean fishery, so it would be helpful for catch-per-unit effort data if we know what the fishermen are targeting. The stock assessment schedule, the TC recognizes that Jonah crab is a data poor species with limited assessment options, but also a pressing need for a formal assessment, based on the things I discussed earlier.

The NRCC and ASMFC stock assessment schedules currently include a placeholder for a 2023 Jonah

crab assessment. The TC recommends conducting a near-term stock assessment to be completed in 2023. With that I'll take any questions.

CHAIR McKIERNAN: Thank you, Derek, that was highly informative. Are there any questions for Derek from the Board?

MS. KERNS: Right now, I have Jason McNamee.

CHAIR McKIERNAN: Go ahead, Jason.

DR. McNAMEE: Thank you very much for the presentation, that was great. I thought what I would like to offer, in particular the discussion on the assessment types. I'll make a comment first, and just say I think there is nothing wrong, in particular when they are at kind of the advent of a species management, and an assessment process to allow that process to kind of evolve, you know start off with some simpler methods, and evolve as you collect the needed information.

I thought all of your research recommendations were spot on. I think those are critical for getting to that more analytical regime for assessment for this species. But what I wanted to flag for you, and for the Technical Committee is, the data limited tool kit is an option I think you all should investigate a little bit.

It's got, I think it's probably over 50 or 60 different data limited methods kind of built into it. It's in our package, and it has like a management strategy component built into it as well, so it has an ability to simulate. I think that would be a really valuable tool to investigate in the process, with the idea that you're going to have to use data limited approaches, at least in the beginning here. I just wanted to kind of put that on your radar.

MR. PERRY: Thank you, Jason, we'll look into that.

CHAIR McKIERNAN: Thanks, Jason. Anyone else on the Board?

MS. KERNS: I don't see any additional hands.

CHAIR McKIERNAN: Okay, so the deliverable for this Board is to potentially make a motion, take a vote on whether to initiate a stock assessment. Is there anyone on the Board that would like to do that?

MS. KERNS: Mr. Chairman, if there is just an oral consensus to do that, I don't think you need a written-out motion on the table. Just to make it easier for you. Ray Kane has his hand up.

CHAIR McKIERNAN: Oh, Ray, have you got something?

MR. RAYMOND W. KANE: Yes, I realized my hand works, as soon as Eric started making that motion, the previous motion, I raised my hand and wasn't sure if my hand was working**. I move to initiate a stock assessment for Jonah crab to be completed in 2023.**

CHAIR McKIERNAN: Thank you, Ray, is there a second?

MS. KERNS: David Borden.

CHAIR McKIERNAN: Thank you, David, is there any discussion? If not, we'll go right to a vote.

MS. KERNS: I guess, Mr. Chairman, I think I've made this confusing for Maya, because I said you don't need a written-out motion. You know you don't really need this, but go ahead.

CHAIR McKIERNAN: All right, is there any objection to the motion? Hearing none, it is approved by unanimous consent. Thank you, Toni. Well, we're pretty much on schedule. Thank you, Derek, for that great presentation and Jason for the feedback.

CONSIDER DEVELOPMENT OF A MANAGEMENT STRATEGY EVALUATION OF THE AMERICAN LOBSTER FISHERIES

CHAIR McKIERNAN: The second to the last item, Number 7 on the agenda is Development of a Management Strategy Evaluation of the American Lobster Fishery. Jeff Kipp.

MR. JEFF KIPP: I'm Jeff Kipp; I'm the Stock Assessment Scientist working on American Lobster and I'm here to talk about continuing development of a management strategy evaluation for American lobster. Just to recap the last discussion the Board had about this issue. The TC presented some recommendations at the last meeting, the May meeting, on a lobster MSE and the potential development of one.

The first recommendation was on the option the TC recommended, among some options they provided for, some potential pathways for a lobster MSE and that was a two-phased Gulf of Maine/Georges Bank focused MSE. They also provided two recommendations for next steps for developing an MSE.

The first was to form a steering committee to further guide development of an MSE, and develop a comprehensive, fully flushed out work plan for completing an MSE. The TC also provided a recommended next step of convening a management Objectives and Goals Workshop. Following the review of those recommendations, the Board postponed further consideration of MSE development until this meeting, the August, 2021 meeting. The reasoning for postponing and making that a motion was to prioritize work on Draft Addendum XXVII, acknowledging that there would be several folks that would overlap in working both on the Addendum and development of that Addendum, and sort of next steps in moving forward in MSE.
That motion was made in anticipation of Addendum XXVII being reviewed at this meeting for public comment, but as Caitlin showed earlier, we're now anticipating the Addendum being reviewed at the October annual meeting, and so the timeline is a little different than when this motion was made.

But, because the motion was made specifically noting the August, 2021 meeting there is the need to bring this back up and get some Board guidance on how to proceed with a potential MSE for lobster. Now I'll go over just some additional detail, and the TCs recommended next steps, and then put forward a suggested path forward to the Board for consideration.

Again, the first next step that the TC recommended was developing a steering committee. The steering committee would complete additional scoping, including the format of stakeholder outreach opportunities, and processes within the MSE, and also for identifying all the funding sources, and all of the necessary personnel that would be needed for completing an MSE.

The Steering Committee charge would be to develop a comprehensive work plan, to ensure a successful MSE process, but not to direct the content within an MSE process. All of that information and process would develop as the MSE was formally initiated, and started going in to some of the milestones and workshops and stakeholder outreach parts of the MSE.

I just wanted to make that clear, that that was sort of the direction of the Technical Committee in that recommendation. The MSE start date would depend on completion of that management workshop, Management Objectives and Goals Workshop, and the outcome of the Steering Committee finding.

The idea here is that this Steering Committee is sort of a preliminary step. They would provide a comprehensive work plan, so that the Board can understand all of the components of an MSE, and then following that the Board would decide whether the MSE would be formally started, or not. The next step recommended by the TC was a management workshop.

This was recommended because there was recognition that the Technical Committee, and also this Steering Committee if formed, would need Board and stakeholder input to guide the MSE. The idea of this management workshop would be to provide big picture goals, both short and long term, to guide the focus of the two phases of that Gulf of Maine/Georges Bank MSE.

The Technical Committee offered an example to follow that was the Management Objectives Workshop with the Commission, coordinated when developing ecological reference points. It's just noted that this should be conducted parallel to the Steering Committee's work and development of a work plan, so that the final recommendations of the Steering Committee are relevant to the objectives and goals for the future of the lobster fishery. For the next steps, because again the Board postponed further consideration of developing an MSE until this meeting. Staff got together and thought out a plan of where we could go from here, recognizing that Addendum XXVII work does continue. What could potentially be done in progressing an MSE, while not impeding the necessary work for finalizing Addendum XXVII.

The proposed next step here would be to move forward with the development of a steering committee. I think staff generally saw this as something that can be done to further develop an MSE, that isn't going to require considerable work, particularly on folks that are continuing to work on Addendum XXVII work, the Technical Committee members and PDT members.

If this was agreed to by the Board the staff could continue to work with Board and TC members, sort of behind the scenes and, as time allows, to populate the steering committee and get the correct representation on that committee. Then the idea here would be that we could have a steering committee formed, and bring that back to the Board for their review, and consensus once Addendum XXVII is completed.

Just to provide a timeline, noting Addendum XXVII work that is ongoing, and these potential next steps for an MSE. At this meeting, if the Board chooses, staff could begin to work with Board members and TC to populate that MSE Steering Committee. At the annual meeting in October, the Board will be reviewing, and hopefully approving, Draft Addendum XXVII for public comment, and then between annual meeting and the next Commission meeting in February of 2022, the Addendum XXVII draft would go out for public hearings.

Again, staff could continue to work on reaching out to the right folks to populate an MSE Steering Committee. Then we would get to the winter meeting in February, 2022, the Board would be reviewing the final Draft Addendum XXVII, and following that the Board could review the membership of the MSE Steering Committee that was developed over the next several months.

Then following, hopefully approval of Draft Addendum XXVII at the February meeting, work on MSE and development of an MSE could then pick up following that meeting, where the MSE Steering Committee meets, and starts to work on this work plan, and also along with that could be coordinating and developing this Management Goals and Objectives Workshop. Those are the proposed next steps for continuing development of a lobster MSE, and that's all I had to show, and I can stop and see if there are any questions on what I showed.

CHAIR McKIERNAN: Any questions from the Board?

MS. KERNS: You have Pat Keliher.

CHAIR McKIERNAN: Go ahead, Pat.

MR. KELIHER: Jeff, thanks for that update. Jeff, can you just explain to me what you're thinking of for the makeup of the Steering Committee science, either science/technical, policy? The reason I ask is we have now added a second addendum to everybody's work list or work plans. As the maker of the motion the last time to delay, my thinking was we would delay with the understanding where we were going with Addendum XXVII, now we've got a second Addendum that frankly I think

personally, I would have it take precedence over the Resiliency Addendum. But I think that is for some further Board discussion, possibly. But I'm afraid we've made our mess even worse now, when it comes to MSE, and we may need to think about postponing until a date later out in the year, into 2022.

MR. KIPP: Yes, thanks for your question. I may have glossed over one slide I had there that did provide some detail on the TCs recommendation for the membership of the steering committee, so apologies for that. But the TC did recommend representatives from the Board, from the Technical Committee, from ASMFC staff, industry stakeholders, folks from the Commission's Committee on Economics and Social Sciences, and potentially some members from the Commission's Assessment and Science Committee.

That was kind of the background the TC thought would be necessary for the Steering Committee, and the TC did make a note that it would be ideal to have some members amongst those folks with MSE experience to guide this. For a number of Steering Committee members, the TC recommended 12 as a maximum, and potentially fewer than that, but that is sort of the details of the membership that the TC recommended.

MR. KELIHER: Just a follow up comment, Mr. Chairman.

CHAIR McKIERNAN: Yes, go ahead, Pat.

MR. KELIHER: Yes, I just want to reiterate the workload that we have in front of us with the two addendums. I hate to continue to delay work on MSE, I think it does have some merit to do that work. I'm not sure if the pending whale conservation framework might not trump some of this as it progresses, but I certainly don't want to not start the process in some of those important conversations. I just think we need to have a realistic conversation about the timing of initiating any MSE Steering Committee. Thank you.

CHAIR McKIERNAN: Any other Board members like to weigh in? Toni, my screen is just plain blue, so I'm not sure if everyone else is seeing that.

MS. KERNS: Yes, it's not just you.

CHAIR McKIERNAN: Okay, so if you could help me. Are there any other Board members with their hands up?

MS. KERNS: David Borden.

CHAIR McKIERNAN: Great, thank you. David Borden.

MR. BORDEN: Mr. Chairman, I don't know if this is appropriate now, or under other business, but I want to talk about the issue that Pat Keliher brought up on priorities. Do you want to mix it with this agenda item, or do you want to take it up separately?

CHAIR McKIERNAN: This is the final item for the agenda, so if you think that we can blend these, and still get through the agenda, because this is our last item of business, so go ahead.

MR. BORDEN: Okay, and I'll keep this brief. I agree with some of what Pat said, but I would come at it from a slightly different perspective. I think the priorities, I mean we have limits on staff time and technical time. That is what we're all talking about. We've got this kind of a parallel issue of; how do we deal with work priorities.

All of these issues are important, and I don't think anybody would dispute that. But given the limitations on staff time, I think at the next meeting we should have a discussion on priorities. My own view, so everyone knows where I'm going with this. My own view is Resilience Amendment should be split into two parts; the first phase would be some fairly simple, straightforward adjustments to some of the measures.

We would stay away from the more complicated issues of triggers and gauge changes and so forth. Then the second priority would be the tracking action, and then the third priority, I think would be Phase 2 of Resilience. Then the Management Strategy Evaluation would come in with Phase 2. To me, and I'm just offering that. We don't need to debate that. I'm just offering that so people know my thinking on it. I think we have to prioritize some of these actions, and get on with the ones that we think are most important, and really use our staff time wisely.

CHAIR McKIERNAN: Well David, before you go away. I mean from my perspective as the Director at Mass DMF, I'm seeing a different set of staff working on tracking than would be working on those other issues. I don't know how the other states see that, but I wouldn't want to back burner the Tracking Addendum, because of the workload associated with Resiliency. I don't know if Pat or Jason or Cheri want to weigh in about those staff assignments, relative to those different tasks.

MR. BORDEN: My only comment, Mr. Chairman would be that your perspective is probably a function of the number of staff you have.

MS. KERNS: You have Pat Keliher with his hand up.

CHAIR McKIERNAN: Go ahead, Pat.

MS. KERNS: Then Jason McNamee behind.

MR. KELIHER: Your point around staffing. There is a difference, at least around for us. I was thinking kind of more holistically up and down the coast, but for Maine we would have different staff working on the Tracker Addendum versus Resiliency Addendum, so from that standpoint, I do agree. If other states are in the similar situation, then maybe those two do move forward at the same time. David's point around splitting Resiliency, I'm not sure I'm there yet. I would need to think about it and talk more about it. I'm certainly open to the discussion.

CHAIR McKIERNAN: Is that a discussion that can take place at the next meeting, based on whatever progress is made on those two issues?

MR. KELIHER: Yes, I mean we're going to be potentially splitting it and moving portions of it ahead for public hearing, instead of the entire document, so possibly we could take that approach.

CHAIR McKIERNAN: All right, Jason.

DR. McNAMEE: Maybe I'll start off with a general comment. You know, as we kind of came into this meeting, I was looking and you know this group has high activity level, high overlap, and we're asking for a lot of stuff. For me it's hard. I think the MSE is very important, but I'm in line with the comments generally that you've heard so far, where I'm okay if the MSE gets pushed a little bit, as long as it stays on the radar.

But if it gets pushed to clear the decks a little bit here, with some of this other stuff, that I agree is important, and also more pressing, you know currently than it will be to have the MSE completed. I also have a little bit of comfort that I think there is going to be some work going on in the background, you know with some, I don't know if the grants have been awarded or whatever, but I know there is interest out there in kind of getting some of this work started.

My hope is that some of that proceeds and so it won't be like starting from scratch whenever we do get back to the MSE, but long story short, I think, you know thinking about priorities, the Tracking Addendum, which we just approved, lump on top of that the Jonah crab assessment, which I think will have some of that high overlap that is indicated in the meeting materials.

I think it makes sense to kind of postpone working on the MSE for a bit. I'm not sure the exact thing, and maybe that's something we should discuss before we dispense with this. But I just wanted to

get on the record to let folks know that I was comfortable punching on the MSE for a little bit, to get working on some of this other stuff quicker.

CHAIR McKIERNAN: Jeff, would it make sense for you to bring up that last slide that had to do with scheduling, and get your feedback on what you're hearing from Board members, and how you think this could proceed?

MR. KIPP: Yes, I can bring that up.

MS. KERNS: Dan, while he's doing that. Cheri and then David have their hands in the queue.

CHAIR McKIERNAN: Go ahead, Jeff.

MR. KIPP: This is the slide with that timeline, and this is just acknowledging again sort of where we know we're going with Addendum XXVII, and those recommendations on sort of proceeding with MSE development. Notably, the TC recommended next steps. The point was made that this doesn't include the now initiated addendum on Tracking, so that is not captured here. But this would be based on sort of staff's recommended next steps for MSE.

CHAIR McKIERNAN: I apologize, Toni, I didn't write down those names that are in the queue.

MS. KERNS: No worries, I have Cheri and then I think David.

CHAIR McKIERNAN: David Borden again.

MS. KERNS: Yes.
CHAIR McKIERNAN: All right, Cheri.

MS. PATTERSON: I agree with Pat. I think we're going to have a heavy lift with the Tracking. If we can slow down the MSE, I think that that would be better overall, considering we have the Tracking and the Jonah crab stock assessment, which is dealing with a data poor species, that has a tendency to add its own complexity. If there is some suggested timeline at the next meeting, from Jeff, to indicate how it can still be moving forward, but just be at a slower track. I think I would appreciate that. Thanks.

CHAIR McKIERNAN: David Borden.

MR. BORDEN: Just a quick point, Mr. Chairman. As I suggested before, I think once we get more information at the next meeting, we'll be able to have a more informed discussion of this. I think that is a timeline that we should act on it. The only reason I floated those ideas was, I wanted people to think about them in the interim phase. Thank you.

CHAIR McKIERNAN: Jeff, I'm looking at this third line. It looks like the November to December is when, no I'm sorry. The August/October staff begin to work to populate the MSE Steering Committee. Can that be delayed by a quarter or two, and would it effect the ability to pursue the funding, for which you folks I think are going to have to pursue to accomplish this?

MR. KIPP: No, I mean I think this was just to kind of keep the ball rolling. Developing the Steering Committee was seen as something that would require minimal work that could occur in the background, sort of just some leg work that could get done between now and the February meeting, when Addendum XXVII is to be completed.

I think that this could be delayed, and we could still meet the timeline of coming to the February meeting with an MSE Steering Committee formed. It's basically just going to be getting recommendations from technical folks and some of those folks from things like the Committee on Socioeconomics and Science.
You know I think that that can be done on a shorter timeframe, something like, you know if it was the annual meeting and the Board was okay with moving forward with developing that Steering Committee. I don't think that would necessarily delay things too much, relative to how they are laid out here. I don't know if that answers your question, Dan.

CHAIR McKIERNAN: I guess I would ask Pat Keliher to weigh in. It sounds like Jeff is recommending that we still create a steering committee between now and, or maybe between now and the meeting, or maybe at the next meeting, but slow walk it a little bit after that. Is that what I'm hearing? Pat, are you good if we still create a Steering Committee, say at the next Board meeting in October?

MR. KELIHER: We would create the Steering Committee at that meeting?

CHAIR McKIERNAN: I think that is what Jeff is sort of implying. Jeff?

MR. KIPP: No, I think the idea here was that that would be sort of initiated right now, if we went with the suggested timeline here, and then the Board would review the membership at the February meeting, so they would review final draft of Addendum 27, and then the next step would be to review the MSE Steering Committee membership at that February meeting.

It could be something where we just hold off for now, or we revisit this at the annual meeting, and if the Board would change their direction there, and consider going to Steering Committee at that point, I think we could stay on that February timeframe, or we can just consider developing the Steering Committee, which would be the next step from the TC, I think. I think any way we lay it out on a timeline here, that would be the next step. If the Board thinks that it is necessary to delay that further than the February meeting, that could be reflected in a timeline here.
CHAIR McKIERNAN: Go ahead, Pat.

MR. KELIHER: Mr. Chairman, I like the idea of delaying, and having this conversation at the annual meeting, because frankly it may give some of us the opportunity to just have an informal meeting around staff constraints, because if we were trying to do something between now and then, I would say the ability for Maine DMR staff to participate would be severely limited. But if we can all get on to the same page between now and the October meeting, that may be a better use of time.

CHAIR McKIERNAN: Okay, so we're hitting the pause button, and we're going to reconvene on this issue at the October meeting, and just continue the conversation. Maybe individual states can maybe bring forward some potential names at that point, or be thinking about who they would like to nominate. Do I have that right?

MR. KELIHER: I think that would be a good idea, Mr. Chairman, and then a bunch of us could just jump on a call at some point, when the time is right between now and October, just to talk about the complexities and the timing issues.

CHAIR McKIERNAN: Okay, Toni, did you want to speak up?

MS. KERNS: It's all good, Dan.

CHAIR McKIERNAN: All right, so we're good? Any other discussion on this matter?

MS. KERNS: I don't see any other hands.

OTHER BUSINESS/ADJOURN ADJOURNMENT

CHAIR McKIERNAN: Cool. All right, is there any other business to come before the Board? No, Toni?

MS. KERNS: No hands, sorry.

CHAIR McKIERNAN: Well, thank you everyone.

(Whereupon the meeting convened at 3:40 p.m. on Monday, August 2, 2021.)

Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: **American Lobster Management Board**

FROM: **American Lobster Technical Committee**

DATE: **October 1, 2021**

SUBJECT: **2021 American Lobster Data Update**

Background

An annual Data Update process between American lobster stock assessments was recommended during the 2020 stock assessment to more closely monitor changes in stock abundance. The objective of this process is to present information—including any potentially concerning trends—that could support additional research or consideration of changes to management. Data sets recommended for this process were generally those that indicate exploitable lobster stock abundance conditions expected in subsequent years and include:

- YOY settlement indicators
- Trawl survey indicators, including recruit abundance (71-80 mm carapace length lobsters) and survey encounter rate
- Ventless trap survey sex-specific model-based abundance indices (53 mm+ carapace length lobsters)

For this first Data Update, data sets were updated with data since the stock assessment (i.e., 2019 and 2020). Indicator status (negative, neutral, or positive – see table below) was determined relative to the percentiles of the stock assessment time series (i.e., data set start year through 2018).

Indicator	< 25th percentile	Between 25th and 75th percentile	> 75th percentile
YOY settlement (larval or YOY)	Negative	Neutral	Positive
Trawl survey recruit abundance	Negative	Neutral	Positive
Trawl survey encounter rate	Negative	Neutral	Positive
Ventless trap survey abundance	Negative	Neutral	Positive

The five year means provided during the stock assessment (2014-2018) for terminal indicator status determinations were also updated with the new years of data. This treatment of data is consistent with the stock indicators provided during stock assessments (see Section 5 in the stock assessment report for more detail) with two important notes. First, the ventless trap survey abundance indices have not been presented as stock indicators in past assessments due to concerns that the short time series is not representative of the stock's productivity potential. These indices are included in this Data Update, along with the other data sets, specifically to show changes in stock conditions since the 2020 stock assessment. The Technical Committee recommended these indices be presented as indices by NOAA statistical area. Stratification of the ventless trap survey was designed around these statistical areas, unlike the trawl surveys, and these indices provide better spatial resolution to examine abundance

trends within the stock boundary. The ventless trap survey index model developed during the stock assessment was structured to estimate stockwide indices and has not been evaluated for estimating indices by statistical area, so these indices are design-based calculations as opposed to model-based indices originally recommended for the Data Update process. Second, the covid-19 pandemic had substantial impacts on data collection in 2020 and many of the trawl surveys providing these data sets did not sample which impacts the updated five year means provided in the results. Below are the results of the data updates by sub-stock.

Results

Gulf of Maine (GOM)

- YOY conditions showed improvements, but were still not positive (Table 1 and Figure 1).
    - Updated five year means were all neutral, whereas two of five were negative during the stock assessment.
    - All 2019 and 2020 values were neutral except the MA 514 value in 2019 which was negative.
- Trawl survey recruit abundance indicators showed positive conditions similar to conditions during the stock assessment (Table 2 and Figure 2).
    - Five of six indicators were not available for 2020 due to covid-19 sampling restrictions.
    - Updated five year means were all positive, as they were during the stock assessment.
    - The only value available for 2020 (ME/NH Fall) was the first neutral annual value observed since 2015.
    - Fall indicators tended to show declining trends in the last few years of available data that were not apparent in spring indicators.
- Trawl survey encounter rates were similar to conditions during the stock assessment, but did show some deterioration from positive to neutral conditions (Table 3 and Figure 3).
    - Five of six indicators were not available for 2020 due to covid-19 sampling restrictions.
    - Three of six updated five year means were neutral, whereas only one was neutral during the stock assessment. All others were positive.
- Ventless trap survey indices showed abundance declining since the stock assessment (Table 4 and Figure 4).
    - Six of eight updated five year means were neutral, whereas only four of eight were neutral during the stock assessment. All others were positive.
    - The two positive updated five year means were for the two sexes in the northern-most statistical area (511). Despite the positive means, the 2020 values for both sexes showed strong declines to neutral conditions.
    - The female survey value in 2020 and the male value in 2019 and 2020 in the southern-most statistical area (514) were negative, the first negative values observed in the stock since 2014.

Georges Bank (GBK)

- Trawl survey recruit abundance indicators showed deteriorating conditions since the stock assessment (Table 5 and Figure 5).
    - No indicators were available for 2020 due to covid-19 sampling restrictions.
    - Updated means for one of the two indicators changed from neutral to negative. Both were neutral during the stock assessment.

    - These indicators tend to be noisier than some of the other abundance indicators, with high interannual variability and lack of discernible trends.
- Trawl survey encounter rates were positive and similar to conditions during the stock assessment (Table 6 and Figure 6).
    - No indicators were available for 2020 due to covid-19 sampling restrictions.
    - Updated means for both indicators were positive. This is unchanged from the stock assessment.

Southern New England (SNE)

- YOY conditions deteriorated slightly and were negative across the stock (Table 7 and Figure 7).
    - Updated five year means were all negative, whereas one of three was neutral during the stock assessment.
    - All 2019 and 2020 values were negative except the RI value in 2020 which was neutral.
    - No YOY have been caught during the MA survey for the last six years.
- Trawl survey recruit abundance indicators generally showed neutral conditions offshore deteriorating to negative conditions inshore, which were similar to conditions during the stock assessment (Table 8 and Figure 8).
    - Six of eight indicators were not available for 2020 due to covid-19 sampling restrictions.
    - Updated five year means for both offshore indices (NEFSC Spring and Fall) and one inshore index (MA Fall) were neutral while all other inshore indices were negative. These are unchanged from five year means during the stock assessment.
    - Both offshore indices were negative in 2019.
- Trawl survey encounter rates were similar to conditions during the stock assessment (Table 9 and Figure 9).
    - Six of eight indicators were not available for 2020 due to covid-19 sampling restrictions.
    - Updated means for two of eight indicators were neutral (both in the fall) while the remaining six were negative. This is unchanged from the stock assessment.
- Ventless trap survey indices showed conditions similar to conditions during the stock assessment (Table 10 and Figure 10).
    - Updated five year means were all neutral. This included the updated mean for males in statistical area 539 flipping from negative to neutral. However, both the 2019 and 2020 annual values were negative.
    - Female values for 2019 and 2020 in statistical area 539 were also both negative, while all 2019 and 2020 values in statistical area 538 were neutral.
    - It is important to note that the ventless trap survey has only taken place during depleted stock conditions coinciding with an adverse environmental regime, so interannual variability can be misleading without the context of a longer time series encompassing varying stock conditions.

Tables and Figures

Table 1. GOM abundance indicators: YOY indices.

YOUNG-OF-YEAR INDICES					
Survey	*ME*				*MA*
	511	*512*	*513 East*	*513 West*	*514*
1981					
1982					
1983					
1984					
1985					
1986					
1987					
1988					
1989			1.64		
1990			0.77		
1991			1.54		
1992			1.30		
1993			0.45		
1994			1.61		
1995		0.02	0.66		1.01
1996		0.05	0.47		0.00
1997		0.05	0.46		0.10
1998		0.00	0.14		0.03
1999		0.04	0.65		0.43
2000	0.00	0.10	0.13	0.17	0.07
2001	0.24	0.43	2.08	1.17	0.43
2002	0.13	0.29	1.38	0.85	1.00
2003	0.22	0.27	1.75	1.22	0.78
2004	0.18	0.36	1.75	0.67	1.13
2005	1.59	1.36	1.77	0.82	1.11
2006	0.58	1.13	0.84	0.82	0.46
2007	0.84	1.34	2.01	1.27	1.38
2008	0.42	0.83	1.08	0.97	0.33
2009	0.69	0.48	1.25	0.45	0.17
2010	0.28	0.72	0.80	0.47	0.50
2011	0.41	1.10	2.33	0.67	0.64
2012	0.53	0.73	1.06	0.22	0.09
2013	0.10	0.20	0.48	0.12	0.00
2014	0.16	0.43	0.83	0.33	0.11
2015	0.11	0.22	0.43	0.05	0.00
2016	0.13	0.21	0.47	0.12	0.08
2017	0.16	0.36	0.70	0.20	0.08
2018	0.27	0.32	0.71	0.20	0.03
2014-2018 mean	0.17	0.31	0.63	0.18	0.06
2019	0.42	0.61	1.03	0.35	0.06
2020	0.29	0.49	1.17	0.25	0.19
2016-2020 mean	0.25	0.40	0.82	0.23	0.09

25th	0.15	0.18	0.52	0.20	0.08
median	0.24	0.34	0.84	0.47	0.25
75th	0.48	0.72	1.59	0.84	0.67

Figure 1. GOM abundance indicators: YOY indices.

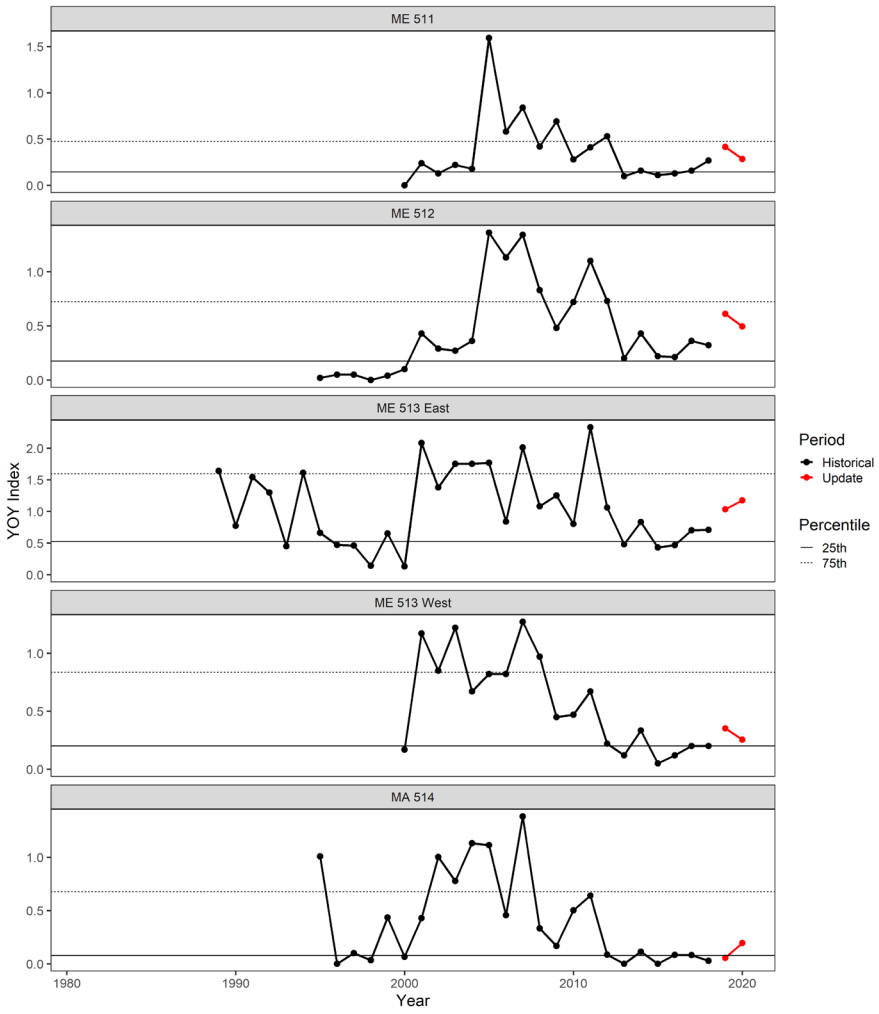


Table 2. GOM abundance indicators: trawl survey recruit abundance.

RECRUIT ABUNDANCE (SURVEY)						
Abundance of lobsters 71 - 80 mm CL (sexes combined)						
Survey	*NEFSC*		*ME/NH*		*MA 514*	
	Spring	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*
1981	0.13	0.06			6.43	4.80
1982	0.29	0.42			2.77	3.89
1983	0.28	0.90			1.77	9.71
1984	0.20	0.31			2.17	6.13
1985	0.14	1.41			4.44	9.50
1986	0.27	1.29			2.99	3.83
1987	0.67	0.57			2.42	1.17
1988	0.67	1.21			2.50	4.14
1989	0.00	1.61			4.45	7.53
1990	0.27	1.76			6.12	15.36
1991	0.55	1.41			2.74	7.55
1992	0.50	1.37			4.32	9.01
1993	0.25	0.86			5.14	3.20
1994	0.15	2.75			7.54	13.87
1995	1.45	1.44			4.55	12.18
1996	0.76	4.59			3.11	11.96
1997	2.02	2.12			4.59	6.48
1998	1.59	2.16			4.52	7.54
1999	1.51	3.01			4.25	8.73
2000	4.64	3.01		24.09	4.25	8.89
2001	1.05	1.51	9.28	17.81	4.31	1.59
2002	1.08	1.91	22.00	22.41	3.41	5.00
2003	1.41	0.36	10.65	18.32	1.96	0.67
2004	0.84	2.26	7.55	12.29	2.47	1.30
2005	0.34	0.87	18.51	25.90	4.40	2.12
2006	2.17	1.27	18.07	18.30	6.09	5.29
2007	1.62	0.64	15.91	16.82	0.77	1.58
2008	0.99	2.41	17.88	31.61	2.54	6.14
2009	4.88	4.90	24.72	32.67	3.20	8.91
2010	2.98	4.53	17.66	37.35	2.20	9.53
2011	10.27	11.83	39.25	46.09	5.24	14.98
2012	11.25	6.74	36.55	37.12	3.03	11.35
2013	10.93	18.12	34.50	37.86	4.82	12.16
2014	11.66	21.54	50.79	41.95	3.35	7.05
2015	14.44	17.89	38.51	67.99	7.09	17.86
2016	13.25	22.54	50.83	60.07	13.58	17.41
2017	15.74		48.42	48.13	7.85	13.63
2018	14.15	15.87	42.77	55.84	5.25	25.62
2014-2018 mean	13.84	19.46	46.27	54.80	7.43	16.31
2019	16.69	7.62	46.37	50.85	10.78	14.61
2020				34.65		
2016-2020 mean	14.95	15.34	47.10	49.91	9.37	17.82
25th	0.30	1.21	17.72	20.36	2.75	4.30
median	1.07	1.76	23.36	32.67	4.28	7.55
75th	4.23	4.53	39.07	44.02	5.06	11.81

Figure 2. GOM abundance indicators: trawl survey recruit abundance.

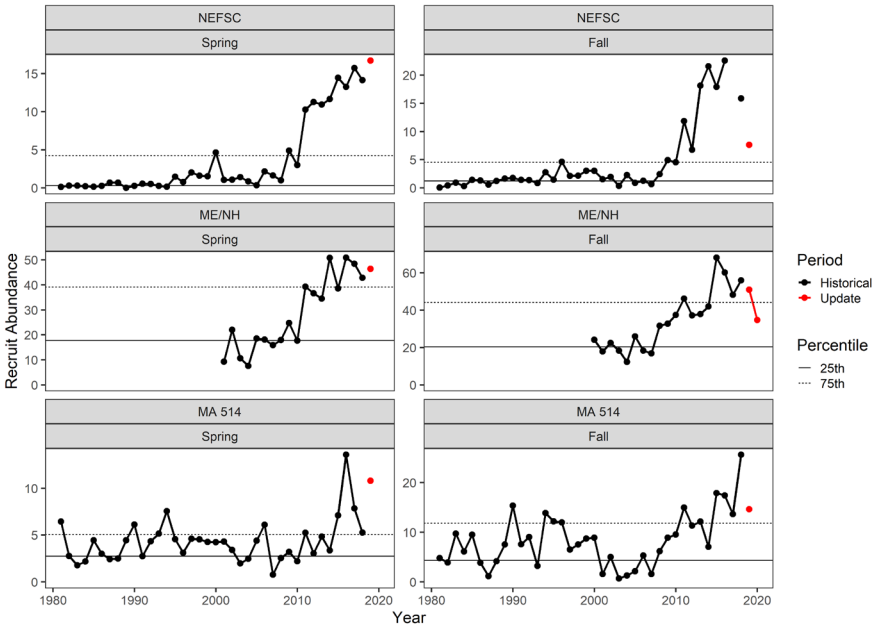


Table 3. GOM abundance indicators: trawl survey encounter rate.

SURVEY LOBSTER ENCOUNTER RATE Proportion of postive tows						
Survey	*NEFSC*		*ME/NH*		*MA 514*	
	Spring	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*
1981	0.44	0.25			0.86	0.73
1982	0.34	0.18			0.50	0.70
1983	0.26	0.33			0.76	0.76
1984	0.28	0.36			0.76	0.76
1985	0.38	0.49			0.71	0.67
1986	0.33	0.47			0.68	0.83
1987	0.43	0.24			0.85	0.54
1988	0.31	0.30			0.76	0.58
1989	0.19	0.35			0.78	0.95
1990	0.41	0.32			0.86	0.95
1991	0.42	0.32			0.87	0.94
1992	0.40	0.24			0.93	0.77
1993	0.41	0.39			0.97	0.82
1994	0.45	0.40			1.00	0.93
1995	0.41	0.37			0.93	0.93
1996	0.54	0.54			0.91	0.96
1997	0.64	0.35			0.93	0.86
1998	0.52	0.40			0.76	0.69
1999	0.51	0.42			0.73	0.91
2000	0.63	0.42		0.94	0.93	0.98
2001	0.57	0.40	0.88	0.86	0.93	0.72
2002	0.75	0.53	0.94	0.95	0.91	0.73
2003	0.69	0.44	0.92	0.85	0.82	0.55
2004	0.87	0.31	0.89	0.86	0.84	0.56
2005	0.77	0.36	0.95	0.91	0.95	0.67
2006	0.72	0.60	0.93	0.93	0.91	0.88
2007	0.72	0.43	0.97	0.85	0.51	0.54
2008	0.84	0.49	0.92	0.86	0.83	0.75
2009	0.82	0.63	0.98	0.92	0.89	0.87
2010	0.85	0.75	0.98	0.96	0.87	0.98
2011	0.83	0.74	0.99	0.96	0.89	0.85
2012	0.86	0.78	0.98	0.98	0.91	0.95
2013	0.87	0.73	1.00	0.93	0.96	0.96
2014	0.90	0.71	1.00	0.99	0.79	0.96
2015	0.93	0.69	1.00	0.96	0.98	0.95
2016	0.94	0.75	1.00	0.96	0.96	0.97
2017	0.86		0.99	0.94	0.84	0.98
2018	0.86	0.71	0.98	0.96	0.84	0.90
2014-2018 mean	0.90	0.72	0.99	0.96	0.88	0.95
2019	0.83	0.71	0.99	0.95	0.85	0.93
2020				0.96		
2016-2020 mean	0.87	0.72	0.99	0.95	0.87	0.94
25th	0.41	0.35	0.93	0.89	0.78	0.72
median	0.60	0.42	0.98	0.94	0.86	0.86
75th	0.84	0.60	0.99	0.96	0.93	0.95

Figure 3. GOM abundance indicators: trawl survey encounter rate.

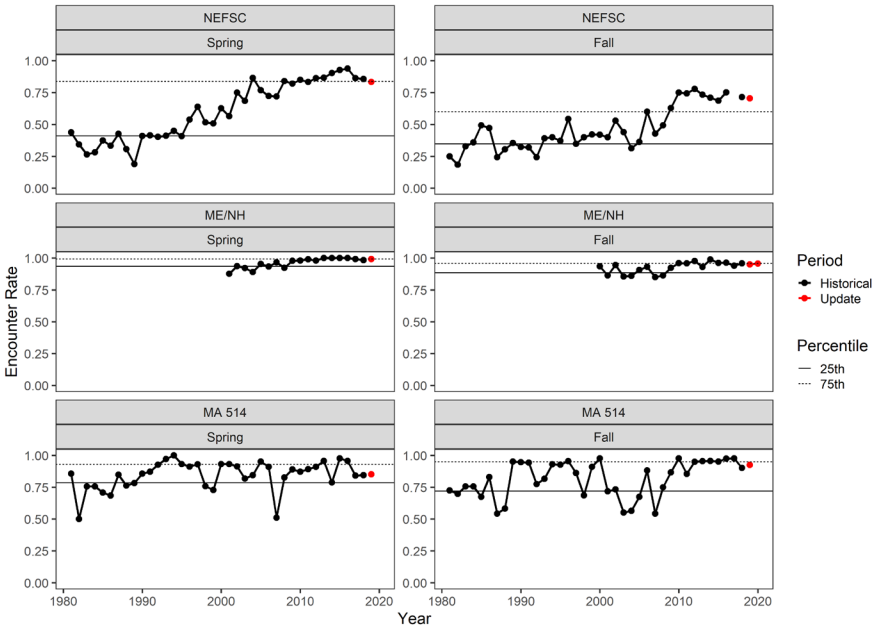


Table 4. GOM abundance indicators: ventless trap survey abundance.

VENTLESS TRAP ABUNDANCE Abundance of lobsters ≥ 53 mm CL								
Survey	*511*		*512*		*513*		*514*	
	Female	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*
1981								
1982								
1983								
1984								
1985								
1986								
1987								
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
2000								
2001								
2002								
2003								
2004								
2005								
2006	7.65	5.34	6.87	5.38	5.73	4.37	3.10	3.40
2007	5.06	3.91	3.95	3.83	5.82	4.35	1.85	1.84
2008	4.94	3.87	5.78	4.95	5.78	4.97	2.77	2.51
2009	3.60	2.65	6.31	5.35	6.89	5.53	2.72	2.66
2010	5.66	3.90	6.95	5.69	6.61	5.27	2.49	2.22
2011	8.70	6.52	11.10	8.48	7.32	5.60	3.47	2.60
2012	10.95	7.64	12.06	9.47	11.40	7.72	5.21	4.52
2013	11.14	7.95	11.87	8.64	9.36	6.49		
2014	10.38	6.63	11.92	8.04	7.74	4.96	3.15	2.35
2015	8.47	4.63	10.39	7.70	8.57	5.50	4.01	3.16
2016	14.59	9.15	14.34	10.75	10.78	7.56	4.79	3.56
2017	11.69	7.07	11.61	8.52	8.46	5.56	3.38	2.45
2018	15.10	9.43	11.26	8.23	9.57	6.37	3.47	2.43
2014-2018 mean	12.05	7.38	11.90	8.65	9.02	5.99	3.76	2.79
2019	12.93	8.27	8.23	5.96	8.59	5.20	2.85	1.93
2020	7.65	5.44	7.95	5.95	9.29	6.61	2.50	1.69
2016-2020 mean	12.39	7.87	10.68	7.88	9.34	6.26	3.40	2.41

25th	5.66	3.91	6.87	5.38	6.61	4.97	2.76	2.41
median	8.70	6.52	11.10	8.04	7.74	5.53	3.27	2.56
75th	11.14	7.64	11.87	8.52	9.36	6.37	3.61	3.22

Figure 4. GOM abundance indicators: ventless trap survey abundance.

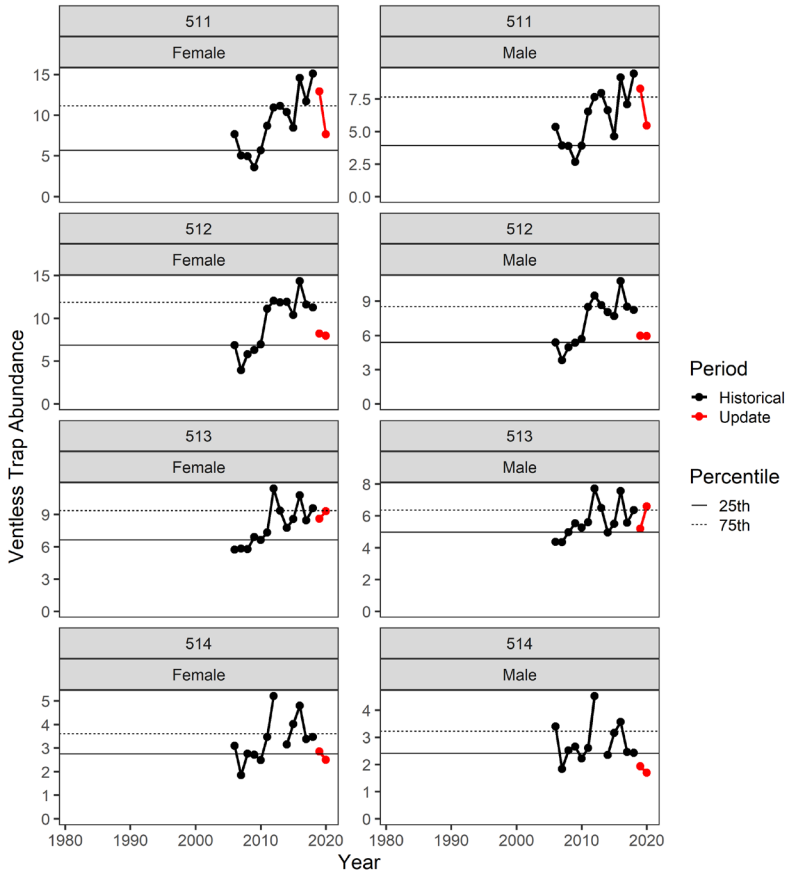


Table 5. GBK abundance indicators: trawl survey recruit abundance.

RECRUIT ABUNDANCE (SURVEY)		
Abundance of lobsters 71 - 80 mm CL (sexes combined)		
Survey	*NEFSC*	
	Spring	*Fall*
1981	0.08	0.28
1982	0.18	0.41
1983	0.16	0.33
1984	0.09	0.40
1985	0.19	0.26
1986	0.57	0.64
1987	0.43	0.54
1988	0.09	0.36
1989	0.04	0.23
1990	0.44	0.47
1991	0.08	0.34
1992	0.13	0.62
1993	0.50	0.22
1994	0.01	0.13
1995	0.03	0.14
1996	0.00	0.35
1997	0.06	0.90
1998	0.01	0.33
1999	0.07	0.29
2000	0.27	0.33
2001	0.47	0.45
2002	0.06	0.56
2003	0.29	0.16
2004	0.04	0.18
2005	0.09	0.13
2006	0.16	0.12
2007	0.03	0.23
2008	0.05	0.17
2009	0.30	0.33
2010	0.30	0.15
2011	0.09	0.35
2012	0.15	0.17
2013	0.14	0.24
2014	0.16	0.21
2015	0.06	0.44
2016	0.15	0.13
2017	0.35	
2018	0.04	0.22
2014-2018 mean	0.15	0.25
2019	0.16	0.13
2020		
2016-2020 mean	0.17	0.16

25th	0.06	0.18
median	0.11	0.29
75th	0.25	0.40

Figure 5. GBK abundance indicators: trawl survey recruit abundance.

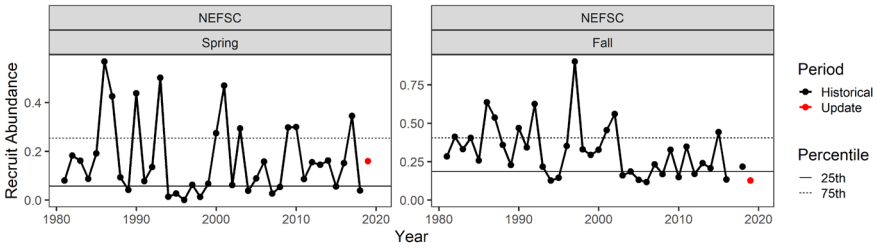


Table 6. GBK abundance indicators: trawl survey encounter rate.

SURVEY LOBSTER ENCOUNTER RATE		
Proportion of postive tows		
Survey	*NEFSC*	
	Spring	*Fall*
1981	0.23	0.52
1982	0.23	0.43
1983	0.18	0.38
1984	0.12	0.34
1985	0.19	0.35
1986	0.27	0.36
1987	0.18	0.35
1988	0.34	0.40
1989	0.14	0.38
1990	0.18	0.44
1991	0.19	0.45
1992	0.26	0.49
1993	0.22	0.36
1994	0.11	0.38
1995	0.14	0.42
1996	0.16	0.40
1997	0.10	0.48
1998	0.10	0.40
1999	0.16	0.58
2000	0.23	0.41
2001	0.23	0.49
2002	0.29	0.55
2003	0.27	0.44
2004	0.18	0.53
2005	0.16	0.58
2006	0.24	0.54
2007	0.26	0.46
2008	0.29	0.55
2009	0.34	0.54
2010	0.38	0.62
2011	0.30	0.69
2012	0.35	0.57
2013	0.33	0.65
2014	0.37	0.61
2015	0.27	0.59
2016	0.45	0.55
2017	0.40	
2018	0.29	0.59
2014-2018 mean	0.36	0.58
2019	0.36	0.57
2020		
2016-2020 mean	0.37	0.57

25th	0.18	0.40
median	0.23	0.48
75th	0.29	0.55

Figure 6. GBK abundance indicators: trawl survey encounter rate.

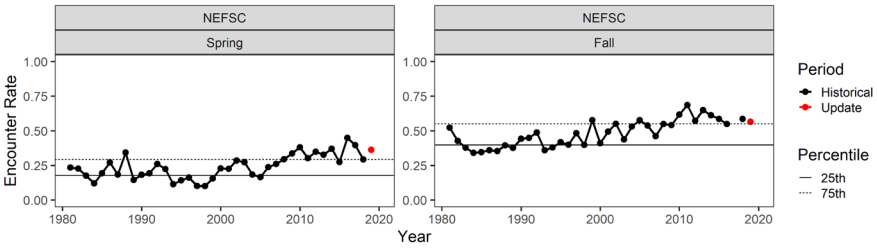


Table 7. SNE abundance indicators: YOY indices.

YOUNG-OF-YEAR INDICES			
Survey	***MA***	***RI***	***CT / ELIS Larvae***
1981			
1982			
1983			
1984			0.43
1985			0.53
1986			0.90
1987			0.78
1988			0.74
1989			0.74
1990		1.18	0.81
1991		1.45	0.55
1992		0.63	1.44
1993		0.51	1.19
1994		1.21	0.98
1995	0.17	0.34	1.46
1996	0.00	0.15	0.31
1997	0.08	0.98	0.21
1998	0.28	0.54	0.55
1999	0.06	0.89	2.83
2000	0.33	0.28	0.78
2001	0.11	0.72	0.32
2002	0.11	0.25	0.64
2003	0.00	0.70	0.25
2004	0.06	0.40	0.45
2005	0.17	0.54	0.49
2006	0.28	0.44	0.71
2007	0.17	0.36	0.37
2008	0.00	0.14	0.37
2009	0.06	0.06	0.19
2010	0.00	0.08	0.35
2011	0.00	0.00	0.26
2012	0.00	0.09	0.12
2013	0.17	0.19	0.16
2014	0.11	0.22	0.06
2015	0.00	0.17	0.19
2016	0.00	0.03	0.45
2017	0.00	0.03	0.10
2018	0.00	0.03	0.17
2014-2018 mean	0.02	0.09	0.19
2019	0.00	0.03	0.21
2020	0.00	0.14	0.10
2016-2020 mean	0.00	0.05	0.20

25th	0.00	0.14	0.26
median	0.06	0.34	0.45
75th	0.17	0.63	0.76

Figure 7. SNE abundance indicators: YOY indices.

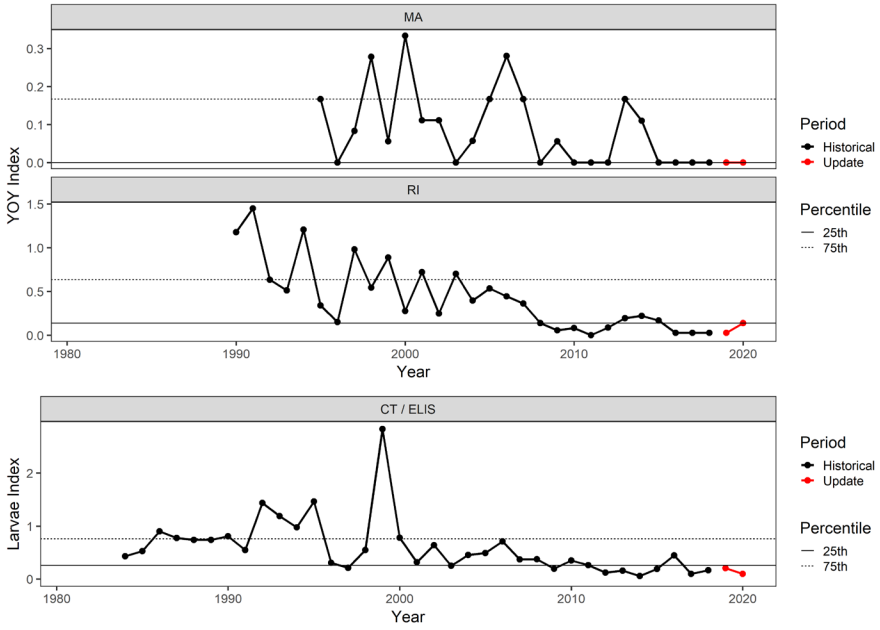


Table 8. SNE abundance indicators: trawl survey recruit abundance.

RECRUIT ABUNDANCE (SURVEY)								
Abundance of lobsters 71 - 80 mm CL (sexes combined)								
Survey	*NEFSC*		*MA*		*RI*		*CT*	
	Spring	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*
1981	0.10	0.89	0.66	0.07	0.89	1.31		
1982	0.74	0.74	0.10	0.04	0.26	0.64		
1983	0.45	0.62	0.10	0.04	0.94	0.43		
1984	0.10	0.81	0.42	0.01	1.03	1.35	10.09	6.80
1985	1.99	1.01	0.33	0.09	0.28	0.97	3.08	3.93
1986	0.18	0.59	0.17	0.19	0.91	1.28	2.77	5.76
1987	1.04	0.45	0.27	0.17	0.79	3.14	2.93	6.86
1988	0.55	0.60	0.24	0.16	0.47	4.05	1.85	4.88
1989	0.09	1.65	0.14	0.42	0.90	3.26	4.86	5.28
1990	0.71	0.83	2.34	0.32	2.17	2.69	6.89	7.74
1991	0.31	0.51	1.23	0.87	4.77	3.10	10.83	10.32
1992	0.19	0.94	0.10	0.55	0.62	1.97	10.31	10.65
1993	0.59	0.42	0.25	0.52	7.81	8.29	7.78	15.18
1994	0.15	0.38	0.95	0.42	1.00	3.88	5.07	11.51
1995	0.01	0.61	1.13	0.03	1.33	4.50	12.13	11.20
1996	0.40	2.39	0.40	0.32	1.60	6.55	11.37	11.08
1997	1.64	1.60	1.44	0.12	2.58	6.10	15.42	24.99
1998	0.78	1.06	1.11	0.11	1.63	3.24	24.06	12.72
1999	2.43	0.66	0.73	0.19	1.71	2.07	24.57	12.96
2000	0.67	1.27	0.55	0.13	1.54	1.83	13.37	8.27
2001	0.39	0.45	0.18	0.03	2.97	2.17	10.77	7.41
2002	1.63	0.39	0.34	0.00	2.68	0.73	8.07	2.75
2003	0.34	0.33	0.07	0.00	0.29	0.93	3.52	4.08
2004	0.27	0.28	0.05	0.00	1.86	1.48	2.38	3.37
2005	0.11	0.24	0.08	0.00	1.07	2.53	2.26	1.54
2006	0.19	0.32	0.09	0.03	3.63	2.24	2.02	1.38
2007	0.19	0.35	0.07	0.00	0.68	2.68	2.65	1.12
2008	0.21	0.29	0.16	0.01	0.64	2.95	2.20	1.27
2009	0.15	0.35	0.16	0.05	1.14	1.36	1.20	1.33
2010	0.21	0.73	0.05	0.19	0.44	1.21	1.26	
2011	0.10	0.64	0.19	0.00	0.42	1.02	0.43	0.18
2012	0.11	0.99	0.06	0.21	0.30	0.18	0.44	0.08
2013	0.23	0.44	0.11	0.04	0.16	0.02	0.23	0.06
2014		0.67	0.04	0.00	0.02	0.14	0.15	0.05
2015	0.03	0.28	0.07	0.30	0.05	0.37	0.15	0.06
2016	0.83	0.69	0.05	0.13	0.57	0.25	0.16	0.00
2017	0.10		0.13	0.16	0.14	0.41	0.03	0.00
2018	0.08	0.38	0.02	0.01	0.18	0.68	0.00	0.01
2014-2018 mean	0.26	0.51	0.06	0.12	0.19	0.37	0.10	0.03
2019	0.06	0.32	0.01	0.02	0.52	0.50	0.03	0.00
2020					0.23	0.32		
2016-2020 mean	0.27	0.47	0.05	0.08	0.33	0.43	0.06	0.00

25th	0.11	0.38	0.08	0.02	0.42	0.78	1.23	1.16
median	0.23	0.61	0.16	0.10	0.91	1.65	2.93	4.48
75th	0.67	0.83	0.42	0.19	1.62	3.07	10.20	9.81

Figure 8. SNE abundance indicators: trawl survey recruit abundance.

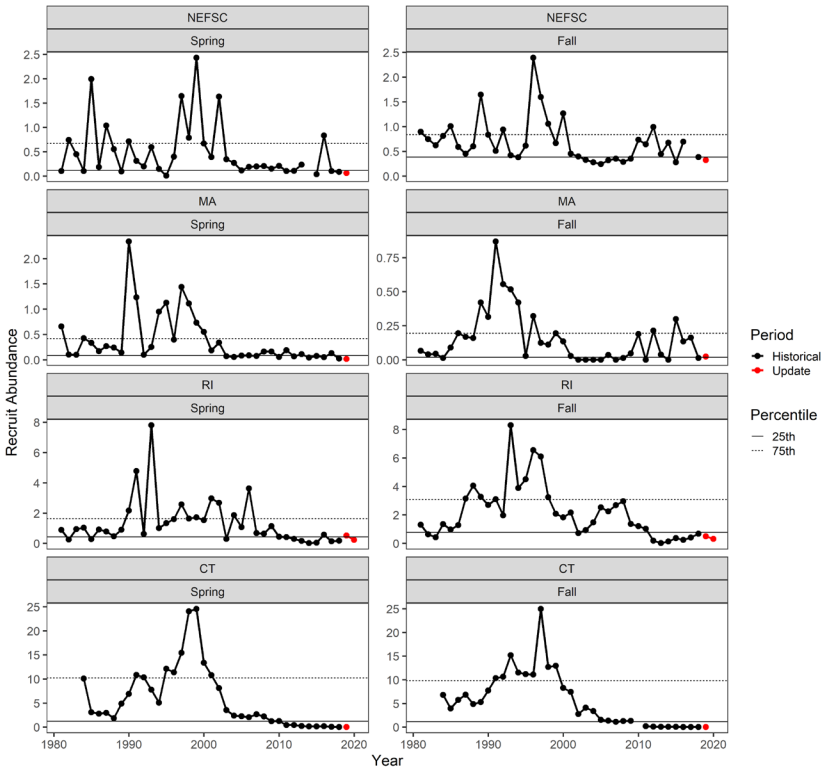


Table 9. SNE abundance indicators: trawl survey encounter rate.

SURVEY LOBSTER ENCOUNTER RATE Proportion of postive tows								
Survey	*NEFSC*		*MA*		*RI*		*CT*	
	Spring	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*
1981	0.18	0.47	0.38	0.15	0.49	0.41		
1982	0.26	0.35	0.28	0.21	0.30	0.43		
1983	0.14	0.26	0.21	0.16	0.46	0.37		
1984	0.08	0.32	0.40	0.18	0.59	0.44	0.63	0.76
1985	0.21	0.34	0.51	0.22	0.31	0.50	0.57	0.69
1986	0.17	0.25	0.39	0.39	0.64	0.46	0.67	0.61
1987	0.13	0.23	0.28	0.18	0.35	0.47	0.63	0.76
1988	0.09	0.28	0.39	0.21	0.49	0.55	0.65	0.66
1989	0.13	0.40	0.50	0.33	0.52	0.57	0.75	0.63
1990	0.14	0.44	0.66	0.44	0.64	0.53	0.73	0.76
1991	0.14	0.33	0.41	0.40	0.77	0.69	0.81	0.77
1992	0.22	0.34	0.51	0.23	0.40	0.57	0.77	0.68
1993	0.12	0.27	0.54	0.27	0.50	0.71	0.73	0.75
1994	0.09	0.25	0.51	0.20	0.58	0.57	0.73	0.74
1995	0.05	0.35	0.44	0.13	0.55	0.67	0.77	0.68
1996	0.10	0.39	0.30	0.16	0.79	0.76	0.66	0.78
1997	0.25	0.28	0.45	0.21	0.75	0.71	0.71	0.81
1998	0.12	0.34	0.54	0.13	0.59	0.55	0.83	0.71
1999	0.22	0.28	0.41	0.21	0.76	0.59	0.78	0.79
2000	0.13	0.31	0.45	0.15	0.68	0.63	0.81	0.73
2001	0.21	0.25	0.28	0.18	0.65	0.60	0.77	0.58
2002	0.19	0.24	0.28	0.03	0.61	0.45	0.73	0.59
2003	0.11	0.26	0.14	0.03	0.51	0.40	0.71	0.64
2004	0.10	0.19	0.28	0.03	0.54	0.50	0.61	0.66
2005	0.08	0.19	0.34	0.15	0.49	0.45	0.63	0.54
2006	0.14	0.23	0.43	0.03	0.79	0.62	0.61	0.51
2007	0.13	0.21	0.34	0.10	0.44	0.54	0.70	0.53
2008	0.10	0.22	0.33	0.10	0.55	0.52	0.63	0.65
2009	0.17	0.32	0.50	0.05	0.57	0.40	0.49	0.55
2010	0.12	0.33	0.23	0.24	0.47	0.45	0.54	
2011	0.13	0.35	0.18	0.05	0.30	0.23	0.46	0.28
2012	0.13	0.34	0.18	0.15	0.27	0.16	0.43	0.20
2013	0.10	0.28	0.18	0.08	0.20	0.09	0.28	0.15
2014		0.26	0.13	0.08	0.07	0.23	0.26	0.10
2015	0.06	0.27	0.10	0.05	0.12	0.16	0.27	0.10
2016	0.15	0.25	0.08	0.11	0.30	0.14	0.25	0.03
2017	0.08		0.08	0.16	0.16	0.23	0.08	0.03
2018	0.08	0.29	0.11	0.06	0.09	0.18	0.09	0.01
2014-2018 mean	0.09	0.27	0.10	0.09	0.15	0.19	0.19	0.05
2019	0.05	0.26	0.05	0.11	0.16	0.11	0.09	0.00
2020					0.16	0.16		
2016-2020 mean	0.09	0.27	0.08	0.11	0.17	0.16	0.13	0.02

25th	0.10	0.25	0.21	0.08	0.32	0.40	0.52	0.52
median	0.13	0.28	0.34	0.16	0.51	0.49	0.65	0.64
75th	0.17	0.34	0.44	0.21	0.60	0.57	0.73	0.74

Figure 9. SNE abundance indicators: trawl survey encounter rate.

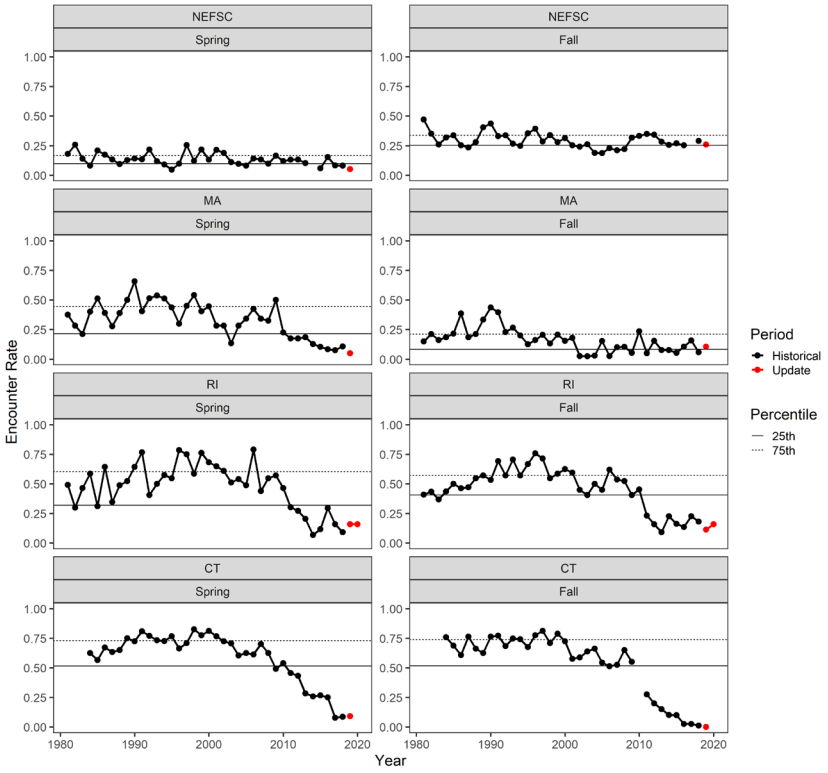
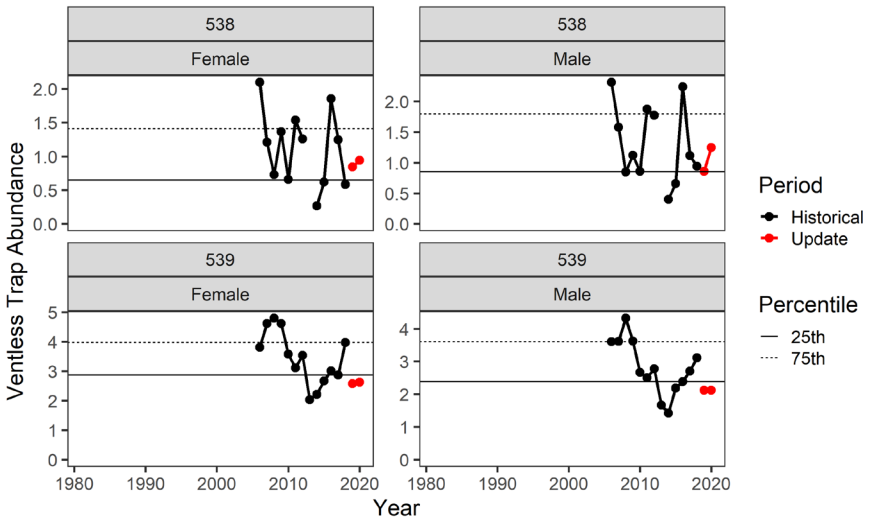


Table 10. SNE abundance indicators: ventless trap survey abundance.

VENTLESS TRAP ABUNDANCE Abundance of lobsters ≥ 53 mm CL				
Survey	*538*		*539*	
	Female	*Male*	*Female*	*Male*
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990				
1991				
1992				
1993				
1994				
1995				
1996				
1997				
1998				
1999				
2000				
2001				
2002				
2003				
2004				
2005				
2006	2.10	2.31	3.81	3.60
2007	1.21	1.58	4.61	3.61
2008	0.73	0.85	4.80	4.32
2009	1.37	1.12	4.61	3.62
2010	0.66	0.86	3.57	2.67
2011	1.54	1.88	3.11	2.50
2012	1.26	1.77	3.53	2.77
2013			2.03	1.67
2014	0.27	0.40	2.22	1.42
2015	0.62	0.66	2.66	2.18
2016	1.85	2.24	3.01	2.38
2017	1.25	1.11	2.86	2.71
2018	0.58	0.94	3.97	3.12
2014-2018 mean	0.91	1.07	2.94	2.36
2019	0.84	0.86	2.57	2.12
2020	0.94	1.25	2.63	2.12
2016-2020 mean	1.09	1.28	3.01	2.49
25th	0.65	0.85	2.86	2.38
median	1.23	1.12	3.53	2.71
75th	1.41	1.80	3.97	3.60

Figure 10. SNE abundance indicators: ventless trap survey abundance.



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MEMORANDUM

TO: **American Lobster Plan Development Team**

FROM: **American Lobster Technical Committee**

DATE: **September 10, 2021**

SUBJECT: **Technical Committee Recommendations for Development of Draft Addendum XXVII on Gulf of Maine/Georges Bank Resiliency**

Background

At the February 2021 meeting, the Board reinitiated work on Draft Addendum XXVII, which aims to proactively address resiliency of the Gulf of Maine/Georges Bank (GOM/GBK) stock given recent declines in young-of-year indicators, despite the stock not experiencing overfishing and abundance being near time-series highs. The Board specified the scope of the action through the following motion:

> *"Move to re-initiate PDT and TC work on the Gulf of Maine resiliency addendum. The addendum should focus on a trigger mechanism such that, upon reaching of the trigger, measures would be automatically implemented to improve the biological resiliency of the GOM/GBK stock."*

To inform the development of the document, the Plan Development Team (PDT) requested the Technical Committee (TC) perform several analyses and make recommendations on the range of options to be considered in the draft addendum. The TC defined resiliency as the ability of the stock to recover from a disturbance, and their recommendations are based on the understanding that the Board is interested in increasing stock resiliency by adding an additional biological buffer to the stock through the protection of spawning stock biomass across LCMAs. This memo outlines these analyses and recommendations for the PDT's consideration.

Summary of Technical Committee Recommendations

Below are the key recommendations arising from the TC analysis and discussion. Specifically, the TC made recommendations on proposed options for Draft Addendum XXVII related to the trigger mechanism for implementing a change to management measures, the trigger levels, and the management measures that should be considered. The subsequent sections of the memo provide additional information on the analyses performed and rationale for each set of recommendations.

- ***Recommendation on trigger mechanism***
    - The TC recommends using an annual trigger index that can be used to establish whether relative abundance has reached a specific trigger level. This index will be calculated as the average of recruit (71-80 mm carapace length) indices from (1) the combined ME/NH and MA DMF spring trawl surveys, (2) the combined ME/NH and MA DMF fall trawl surveys, and (3) the combined Gulf of Maine Ventless Trap Survey. The three-year running average of the trigger index (using the current year being evaluated and two preceding years) would trigger management action when it falls below the selected trigger level(s).

- ***Recommendations on trigger levels***
    - For trigger levels based on annual abundance indices, the TC recommends the document consider the following trigger levels:
        - Management triggered by the three-year running average of the trigger index (using the current year being evaluated and two preceding years) when it declines by 17% from the reference period. This trigger level approximates the Fishery/Industry Target reference point, calculated as the 25th percentile of the model abundance during the high abundance regime.
        - Management triggered by the three-year running average of the trigger index (using the current year being evaluated and two preceding years) when it declines by 32% from the reference period. This trigger level approximates the abundance level where the regime shift occurred from the moderate to high abundance regime, as defined in the 2020 stock assessment.
        - Management triggered by the three-year running average of the trigger index (using the current year being evaluated and two preceding years) when it declines by 45% from the reference period. This trigger level approximates the 75th percentile of the moderate abundance regime.
        - The TC does not recommend the PDT include the option for management to be triggered by a 51% decline in indices from the reference period in this addendum.
    - The TC recommends an option be added to the document for immediate action to increase minimum legal size while the stock conditions are favorable. The purpose of this option is to address the issue of growth overfishing, as demonstrated with the potential increase in catch weight in projections done for this memo, as well as to increase the proportion of females that reach maturity prior to the gauge.
- ***Recommendations on the range of management options for increasing resiliency***
    - The TC analyzed a broad range of changes to the minimum and maximum gauge sizes in the LCMAs within the GOM/GBK stock. The TC recommends the draft document only consider management measures that 1) are projected to increase SSB, and 2) result in the minimum gauge size increasing to or above the size at 50% maturity (L50) for each LCMA (LCMA 1: eastern GOM L50 = 88 mm, western GOM L50 = 83 mm, LCMA 3: Georges Bank L50 = 91 mm). See enclosed report for the projected impacts of gauge size combinations. The gauge sizes analyzed by the TC and the current gauge sizes by area are provided in Table 1.
    - It should be noted that for this addendum, the Board directed the PDT only to consider changes to biological management measures currently in place for the lobster fishery (e.g., gauge and vent sizes, v-notching rules, and seasons). The TC agreed that of these management tools, the measures most likely to provide increases to stock resiliency are the minimum and maximum gauge sizes. Therefore, the TC analysis focuses primarily on changes to the current minimum and maximum gauge sizes in the GOM/GBK stock.

Trigger Mechanism: Analysis and Recommendations

Recruit (71-80 mm carapace length) indices are used as model-free indicators of recruitment to the lobster fishery in the following year. During the 2020 stock assessment, recruit indicators were found to

be correlated with the stock assessment model estimates of reference abundance (78+ mm carapace length), providing a reliable means to track abundance changes and potential need for management response more frequently than through intermittent stock assessments. There are eight GOM/GBK stock recruit indicators updated for each assessment: spring and fall indices for each of the ME/NH, MA DMF, NEFSC GOM, and NEFSC GBK bottom trawl surveys. The NEFSC indicators in the GOM and GBK regions are considered to be indicators of offshore recruitment which differs from the GOM/GBK stock-wide recruitment dynamics. Therefore, the TC recommends using only the inshore surveys (ME/NH and MA DMF) where the bulk of the population and fishery occur, which are assumed to be more representative of stock-wide recruitment. These trawl surveys employ similar methodologies and, along with selectivity and swept area calibration factors, can be combined into two indices, a spring index and a fall index. Additionally, the TC recommends using the standardized index from the Ventless Trap Survey as an indicator of recruitment during the summer.

To calculate a trigger index, each of the three individual indices were scaled to their 2017 reference levels so they are on the same scale. The one year lag expected between recruit indices and reference abundance due to growth results in 2017 recruit indices mapping to the terminal year reference abundance used in the 2020 stock assessment status determination (2018). The TC recommends linking the trigger index to the reference abundance in this way so the trigger index is an indication of proportional changes to the reference abundance since the 2020 stock assessment. Proportional changes in the trigger index are compared directly to proportional changes between the terminal year reference abundance and abundance reference points established in the assessment to provide an early indication of reference abundance falling below the reference points. Scaled indices were then averaged across surveys to generate a single trigger index. The final trigger index value represents proportional change from 2017 recruitment (and, therefore, expected proportional change from the reference abundance one year later in 2018 - the terminal year of the stock assessment). A value of one indicates no change, a value greater than one indicates an increase (e.g., 1.2 indicates a 20% increase), and a value less than one indicates a decrease (e.g., 0.8 indicates a 20% decrease).

During the 2020 stock assessment, the peer review panel supported using a smoothing algorithm, such as the running average used in past assessments, to determine stock status, but also recommended exploring alternatives (e.g., running median) to evaluate the robustness of status determinations. To evaluate performance of different methods for a trigger mechanism, akin to evaluating stock status in a stock assessment, a simulation analysis was conducted using the trigger index annual point value, three-year running average, and three-year running median to identify need for management action. For each method, all three individual indices were scaled to a 2017 reference level calculated with the same method used to calculate the index. That is, the 2017 reference level was the 2017 point value for the annual index trigger method, the 2015-2017 average for the three-year running average trigger method, and the 2015-2017 running median for the three-year running median trigger method. The scaled individual and combined indices are compared to various trigger points that have been discussed by the TC in Figure 1.

One potential trigger point discussed by the TC was 0.68 (i.e., a 32% decline) which represents the proportional change between the terminal year stock assessment reference abundance level and the boundary between the high and moderate abundance regimes. This trigger point was treated as the trigger for action in the simulation analysis. Each individual index was projected from 2018 to 2025 following a steady decline that reflected a 32% decline from the observed 2017 index value in 2021. This projected trend is hypothetical to evaluate the performance of the three calculation methods being considered and does not necessarily reflect the true status or projection of the population. It was

unclear what impacts the method used to calculate the starting point of the projected trend would have on performance of each trigger mechanism, so declines projected from the (1) 2017 point value, (2) 2015-2017 running average, and (3) 2015-2017 running median were evaluated in three separate scenarios. Indices were then sampled from these simulated trends with CVs equal to the average CV over the respective index's time series, assuming a lognormal error structure. These simulations only consider observation error and do not account for process error. Indices were scaled to their reference level as described above, averaged across surveys, and the combined trigger index was evaluated for whether or not it would trigger action ($\leq$0.68) in each year of the projection period. This was repeated 1,000 times for each scenario and action determinations were tallied by year for each of the methods.

Results show similar patterns between the scenarios using a simulated decline from the 2017 point value and from the 2015-2017 average (Table 2; Figures 2-3). The 2015-2017 running median was equal to the 2017 point value for all indices, so the results with a simulated decline from this value were identical to the 2017 point value scenario (Table 2; Figure 4). Incorrect action is triggered very infrequently (< 3% of the time) by the annual and running median methods in the first two years of the projection period and never by the running average method. On average, the annual and running median methods incorrectly triggered action about 9% of the time and about 15 times more frequently than the running average method the year before the decline reached the threshold (2020), but also correctly triggered action ≈38% of the time and roughly twice as frequently as the running average method in the year when the threshold was met (2021). The running average method then tended to perform as well as or better than the other methods from 2022-2025, albeit generally at smaller margins of difference, as all methods tended to perform relatively well in these later years when the decline is exacerbated. The delayed response of the running average method can be seen in Figures 5-7, where the median trigger index value across simulations tends to be slightly higher than the annual and running median methods. The variance in index values, however, is lower for the running average method resulting in more consistency across simulations in terms of guidance for management action, whereas the other methods result in mixed guidance for some of the more extreme simulations in more years than the running average method.

Based on these results, the trigger mechanisms using the annual point value and the running median may be considered precautionary methods that perform better for an immediate trigger, on average, but with more variable guidance than the running average method. The running average method may provide a less responsive trigger mechanism that is less likely to incorrectly trigger premature action, and performs well and more consistently after the initial risk of not triggering action when first needed.

The TC recommends the running average method for calculating the trigger index. The individual surveys display interannual variation that might be related to environmental impacts on catchability (for example), an issue that was identified in the stock assessment and is expected to continue to impact these indices index data sets into the future. This simulation analysis suggests the running average method is more robust to interannual variation than the other methods and therefore can be interpreted with higher confidence.

Trigger Levels: Discussion and Recommendations

At the May 2021 ASMFC meeting, the Lobster Board directed the PDT to include some relatively conservative trigger levels in the draft addendum document, such that a change to measures would occur before abundance falls significantly from current levels. Additional guidance was provided by the

Board at the August 2021 meeting. Board members agreed that they are interested in a tiered approach with multiple trigger levels. They also expressed that while they do want to consider trigger options that are proactive, they did not want to consider trigger levels that may have already been met. Based on this feedback, the TC discussed the risks and rewards associated with the trigger levels that have been suggested by the PDT. TC recommendations related to each option are included below.

Trigger level 1 = 17% decline in indices from reference period: The PDT suggested this trigger level to approximate the Fishery/Industry Target reference point. The fishery/industry target is calculated as the 25th percentile of the abundance during the high abundance regime. This trigger level is the most proactive and would likely result in a change to regulations occurring at a higher stock abundance than the other trigger options. The TC recommends its inclusion in the draft addendum.

Trigger level 2 = 32% decline in indices from reference period: The PDT suggested this trigger level to approximate the abundance level where the regime shift occurred from the moderate to high abundance regime, as defined in the 2020 stock assessment. This trigger level is the second-most conservative of the PDT's suggestions, and would likely trigger management action while stock abundance is relatively high. The TC recommends this option be included in the draft addendum.

Trigger level 3= 45% decline in indices from reference period: The PDT suggested this trigger level to approximate the 75th percentile of the moderate abundance regime. This is slightly less conservative than the previous trigger, but still provides an opportunity for action before reaching the abundance limit. The TC recommends this option be included in the draft addendum for public comment, but this is the least proactive trigger level that the TC recommends for inclusion in the draft addendum.

Trigger level 4 = 51% decline in indices from reference period: The PDT suggested this trigger level to approximate the abundance limit reference point. The abundance limit is calculated as the median abundance during the moderate abundance regime. The TC does not recommend the PDT include this trigger level in this draft addendum because it is inconsistent with the addendum's goal of increasing resiliency. If the stock abundance falls below this point, the stock is considered depleted and the stock's ability to replenish itself is diminished. At this level of abundance, management measures should focus on rebuilding strategies as opposed to increasing stock resiliency.

The TC agreed that in general, taking action to increase the minimum gauge size more immediately while abundance is at its highest levels has the potential to enhance the resiliency of the stock. Conversely, if action to increase the minimum gauge size is taken only after the stock has experienced a decline in abundance, the resulting improvement in resiliency is comparatively less. The negative impacts to lobster catch of implementing an increased gauge size (temporarily reduced catch) coupled with a decreased and declining population available to the fishery would be comparatively more detrimental to industry than if the management measures were implemented while stock abundance is greater. None of the above trigger options would allow for a change in management measures to occur before any decline in stock abundance. Therefore, the TC recommends that the document consider an additional option to change the legal gauge size immediately or within a short time-frame, rather than waiting for the change to be triggered by declines in abundance indices. This will have less of an impact to industry if it were implemented sooner, versus waiting until declining abundance is negatively affecting catch. Impacts to catch specifically resulting from an increase in minimum legal size will be temporary, and will result in increased weight of harvested individuals. This approach could also provide industry with more advance notice of an upcoming change in regulations.

Management Options: Analysis and Recommendations

Based on the stated objective of Draft Addendum XXVII "to increase the biological resiliency of the GOM/GBK stock", and Board guidance to focus on the types of biological management measures currently in place, the TC focused their analysis on evaluating the impacts of alternate minimum and maximum sizes for the LCMAs within the stock. The analysis involved updating existing simulation models with more recent data to estimate the impacts of specific minimum and maximum gauge size combinations on total weight of lobsters landed, number of lobsters landed, spawning stock biomass (SSB) and exploitation. Additionally, an analysis specifically for LCMA 3 was performed due to concerns that the offshore fishery in LCMA 3 is considerably different from the inshore (which tends to drive stock-wide modelling results), and, thus may not be accurately represented due to a misparameterized simulation model. The full report on these analyses is enclosed with this memo.

The TC made recommendations for management measures that could be considered to increase biological resiliency of the stock, but wanted to provide clarity on the premises for these recommendations. First, the TC defined resiliency as the ability of the stock to recover from a disturbance, and second, they based their recommendations on the understanding that the Board's intended approach to increasing stock resiliency is to add an additional biological buffer to the stock through the protection of spawning stock biomass across LCMAs.

Based on these premises and the analyses performed, for area-specific management measures, the TC provided the following recommendations for each LCMA in order to provide an increase to biological resiliency of the overall stock.

LCMA 1

Minimum Gauge Size

- The TC recommends the Addendum only consider options that <u>increase</u> the minimum gauge size in LCMA 1.
- The current minimum size in LCMA 1 is significantly below the stock-wide estimated size at 50% maturity (87 mm). Increasing the minimum legal size would allow more females to reproduce prior to harvest, providing a benefit to the stock.
    - There are spatial differences within LCMA 1 in the size at 50% maturity, ranging from 83 mm to 88 mm, from western to eastern GOM. While the magnitude of impacts of increasing minimum size may vary spatially, some level of resiliency should be provided throughout the region from an increase in minimum size for LCMA 1.
    - At the least, increasing the minimum legal size to 86 mm in LCMA 1 would standardize the minimum legal size for all inshore management areas, but this size would still be below the GOM/GB stock wide L50.
- Growth overfishing is occurring in LCMA 1; most of the catch consists of individuals within one molt of minimum legal size, which results in a much smaller yield per recruit than could be achieved if individuals were allowed to attain larger sizes. Increasing the minimum size in LCMA 1 will lessen the extent to which the stock is growth overfished.
- In general, the greater the increase to the minimum size, the greater the expected benefit to stock resiliency.
    - It should be noted that the effects of increasing SSB on recruitment are difficult to predict and are likely heavily influenced by other factors. The analysis conducted on changes to SSB did not attempt to model recruitment subsidies that may result, thus the

estimated increases in landings, abundance and SSB may be underestimated by not accounting for a positive feedback between spawners and recruits and should be considered a conservatively low bound on expected effect. Conversely, the negative influence of environmental factors (e.g. declining larval food resources) on recruitment processes may have a stronger impact on recruitment success than the number of spawners, thus it is not certain that increases to SSB resulting from gauge changes will result in subsequent increases to recruitment.

Maximum Gauge Size

- Increasing the maximum size in LCMA 1 is not expected to have a benefit to stock resiliency, since it would allow harvest of currently protected individuals. Therefore it is not recommended.
    - There is uncertainty on how changing maximum size in LCMA Area 1 would impact stock resiliency, and how.
    - There is uncertainty in how increases to maximum size inshore will influence population dynamics offshore.
- The TC did not analyze the impacts of decreasing the maximum size for LCMA 1, as it is currently the smallest maximum size across LCMAs in the stock.

LCMA 3

Minimum Gauge Size

- The addendum should not consider decreasing the minimum size in LCMA 3.
- Increasing the minimum size in LCMA 3 is not a high priority for increasing resiliency.
    - While the current gauge size is already close to the size at which 50% of females are mature (91 mm for Georges Bank); increases to the minimum legal size will ensure even more females are able to reproduce prior to becoming susceptible to harvest, providing additional benefits to the stock.
    - It is important to note that at the current minimum size, growth overfishing is occurring; lobsters still have very large scope for additional growth. There could be an industry benefit to increasing minimum legal size, but it is not a significant biological concern given the current stock condition. Currently, exploitation of smaller legal-sized lobsters appears to be relatively low, thus there may be less benefit to increasing the minimum gauge size.

Maximum Gauge Size

- Due to the complexities of growth and reproduction of larger lobsters, there is considerable uncertainty on the quantitative impact of decreasing maximum size in LCMA 3 on stock resiliency, but in general it is thought to have biological benefits. Some considerations are included below:
    - Decreasing the maximum size would have some benefit by putting forever protections on a small portion of the stock, including larger individuals of both sexes. Protecting larger individuals reduces the risk to the long-term sustainability of the population by increasing egg production as well as the diversity of breeders, which leads to more successful egg production under a variety of environmental conditions (DFO 2009). There is also evidence that in addition to fecundity, overall larval survival rates may also be increased as a result of increasing the duration and number of hatching locations (DFO 2009).

- Though there is a well-documented increase in clutch size with increased female size, reproductive dynamics of very large lobsters are not well understood. Unknowns include the frequency at which very large females produce clutches, and whether the currently skewed sex ratio is resulting in sperm limitation that may limit female reproductive output.
- The impact of decreasing the maximum size would depend greatly on the magnitude of the decrease.
- It is expected that a maximum size below 6 inches would result in greater negative impacts to catch (and the impacts will likely differ spatially within LCMA 3) but a larger portion of the population would benefit from forever protections.
    - There is some concern as to whether such a large change in the maximum size would intensify fishing mortality on the smaller or other harvestable size classes in an effort to compensate for the lost catch from a maximum size gauge change. A prospective shift could potentially truncate the size structure and increase the probability of lobsters being harvested from these previously less harvested size classes. This in turn would result in fewer lobsters surviving to subsequent molt stages and/or reproducing.

OCC

<u>The TC recommends that measures within OCC should be standardized for state and federal permit holders.</u>

- While the biological benefits of this will not be large due to the size of the fleet and relative amount of landings, there will be some benefit to standardizing the v-notch definition to ⅛" and to implementing the maximum size for all permit holders. This will apply a consistent conservation strategy within the management area.
- There is a clear benefit to law enforcement's ability to enforce conservation measures at the local dealers.

Minimum Gauge Size

- The TC does not recommend decreasing the minimum size in OCC.
- For increases to minimum size, in general, the greater the increase, the greater the benefit to stock resiliency.
    - OCC is considered a transitional area with most lobsters moving in from other locations. Size at maturity is not estimated for this area because of the mixed origins.

Maximum Gauge Size

- Similar to LCMA 3, there is significant uncertainty on how decreasing maximum size in OCC would impact stock resiliency.
- OCC represents a small component of the stock-wide fishery, therefore decreasing the maximum gauge size is unlikely to have a large positive impact to stock resiliency. However, decreasing maximum gauge size could have a minor benefit by putting forever protections on a small portion of the stock, including larger individuals of both sexes.

Additional Considerations

Though the primary focus of this addendum has shifted from the standardization of biological measures across LCMAs to increasing biological resiliency of the stock, the TC noted that there are some benefits to standardization that warrant consideration. Standardization of measures across areas would simplify

the stock assessment and evaluation of management strategies, particularly since management areas do not align with stock boundaries (see for example the difficulties with predicting impacts to LCMA 3 and OCC in this document). In addition, there are benefits for enforcement and commerce. In particular standardization of v-notching requirements and definitions would provide a consistent conservation strategy and simplify enforcement across areas.

Based on the Board's guidance to focus primarily on current measures such as gauge changes, the TC had only limited discussions around alternatives to biological management measures. However, the TC feels it is important to note that other types of management strategies may also provide increases to stock resiliency and should be given more in depth consideration in the future.

Trap reductions have the potential to provide a means to reduce fishing mortality, however the relationship among trap limits, the number of traps in the water, haul frequency, and catch is complex and difficult to predict. It is highly likely that aggressive trap reductions would be necessary to meaningfully reduce fishing mortality. We believe there is considerable latent effort in the LCMA 1 fishery, in terms of both permits and individual traps, and efforts to address these issues in the short-term may increase the Board's ability to manage effort in the future. Note that LMCA 3 has already undergone considerable reductions in traps (both total and individual allocations), which was intended to remove latent effort. Similar efforts should be considered in LCMA 1.

Quotas are a traditional method to control fishing mortality. However, the Board has shown little interest in pursuing the use of quotas. Defining the appropriate level at which to set a quota would require significantly more work due to the current levels of uncertainty around the magnitude of abundance estimates. The current stock assessment model does well with estimating trends in abundance, but less so with magnitude estimates.

The TC emphasized that it may not be realistic to expect that changes to management measures will result in the maintenance of record high abundance levels. To address the Board's goal of increased resiliency, the TC recommendations are expected to partially address growth overfishing, mitigate some effects of a decline in productivity, and improve the stock's ability to rebound from future declines by increasing the proportion of females that can reproduce prior to harvest. This does not imply nor guarantee that the stock could recover to these record high levels, nor should it imply that this action alone is sufficient to ensure long-term sustainability of the fishery. The TC notes that increasing the minimum gauge size to the point where 50% of the population is mature at the minimum legal size is an improvement. However, given the American lobster's scope for growth, maternal effects (fecundity increases with size) and lifetime reproduction potential, further increasing the minimum gauge size to allow as many individuals as possible to reproduce prior to harvest would be beneficial. Additional measures as discussed above could provide the Board better options for managing fishing mortality if that becomes necessary, and should be considered as options for implementation in the future, especially if the stock abundance declines to lower levels of abundance.

Literature Cited

DFO. 2009. Biological Basis for the Protection of Large Lobsters in Lobster Fishing Areas 33 to 38. DFO Can. Sci. Advis. Sec. Sci. Resp. 2008/017.

Tables and Figures

Table 1. Gauge sizes analyzed by TC and current gauge sizes by LCMA.

Min size	inches	mm		Max size	inches	mm	
3 1/4	3.25	82.5	**LCMA 1 minimum**	**5**	5	127.0	**LCMA 1 Max**
3 5/16	3.31	84.1		**5 1/2**	5.5	139.7	
3 3/8	3.38	85.7	**OCC minimum**	**6**	6	152.4	
3 15/32	3.47	88.1		**6 1/4**	6.25	158.7	
3 17/32	3.53	89.7	**LCMA 3 minimum**	**6 1/2**	6.5	165.1	
3 19/32	3.59	91.3		**6 3/4**	6.75	171.4	**LCMA 3/OCC Max**
				9	9	228.6	

Table 2. Percentage of 1,000 simulated indices that triggered action for three simulated decline starting point scenarios, and the averages of these scenarios. The simulated stock was projected to decline 32% in 2021.

Simulated Decline Starting Point	Index Calculation Method	2018	2019	2020	2021	2022	2023	2024	2025
2017 Point Value	Annual	0%	2%	12%	50%	85%	97%	100%	100%
	Three-Year Running Average	0%	0%	1%	27%	86%	100%	100%	100%
	Three-Year Running Median	0%	2%	12%	44%	84%	98%	100%	100%
2015-2017 Average	Annual	0%	0%	3%	21%	59%	89%	99%	100%
	Three-Year Running Average	0%	0%	0%	3%	46%	95%	100%	100%
	Three-Year Running Median	0%	0%	3%	19%	60%	90%	99%	100%
2015-2017 Running Median	Annual	0%	2%	12%	50%	85%	97%	100%	100%
	Three-Year Running Average	0%	0%	1%	27%	86%	100%	100%	100%
	Three-Year Running Median	0%	2%	12%	44%	84%	98%	100%	100%
Average	**Annual**	**0%**	**2%**	**9%**	**40%**	**76%**	**94%**	**100%**	**100%**
	Three-Year Running Average	**0%**	**0%**	**1%**	**19%**	**73%**	**98%**	**100%**	**100%**
	Three-Year Running Median	**0%**	**1%**	**9%**	**36%**	**76%**	**95%**	**100%**	**100%**

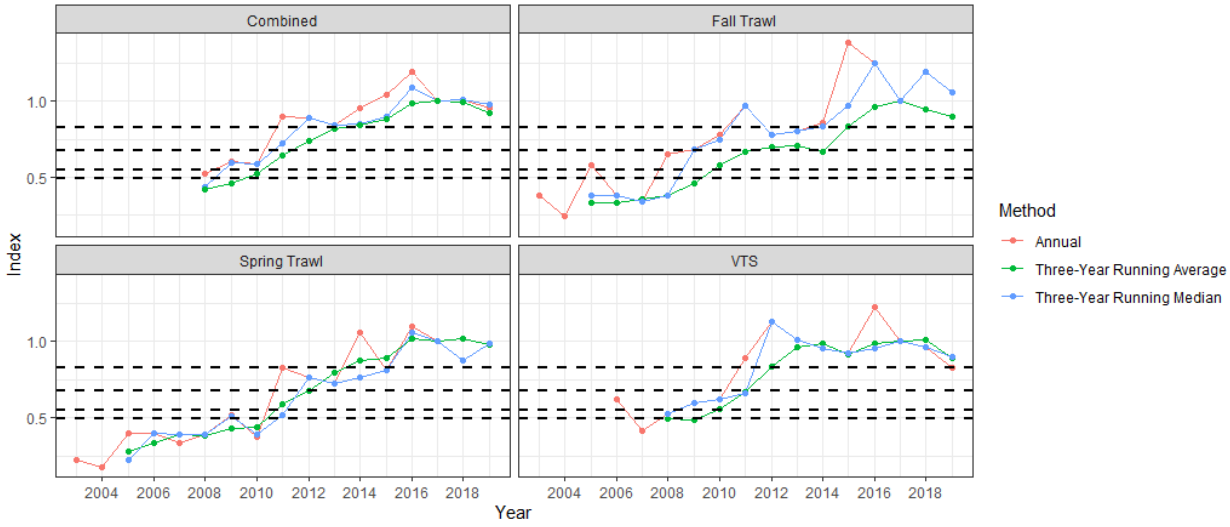

Figure 1. Scaled individual and combined indices using three calculation methods compared to four trigger levels (0.83 – Fishery/Industry Target, 0.68 – Moderate/High Abundance Regime Shift Level, 0.55 – Abundance Limit, 0.49 – Abundance Threshold) identified from potential reference abundance declines (dashed lines).

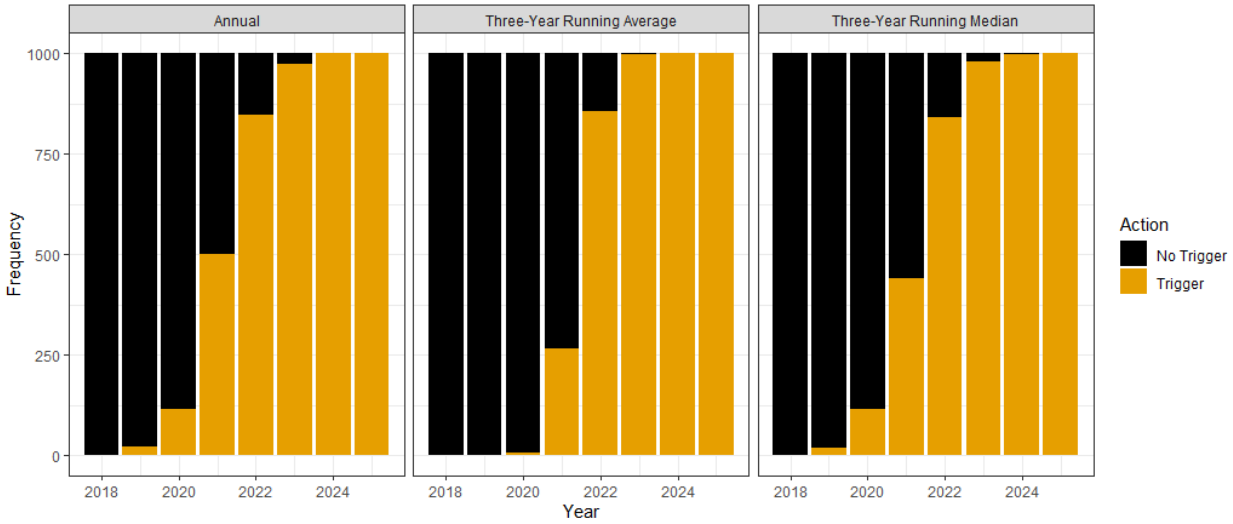

Figure 2. Annual action determinations by method from 1,000 simulated indices with the simulated population declining from the 2017 point value. The simulated stock was projected to decline 32% in 2021.

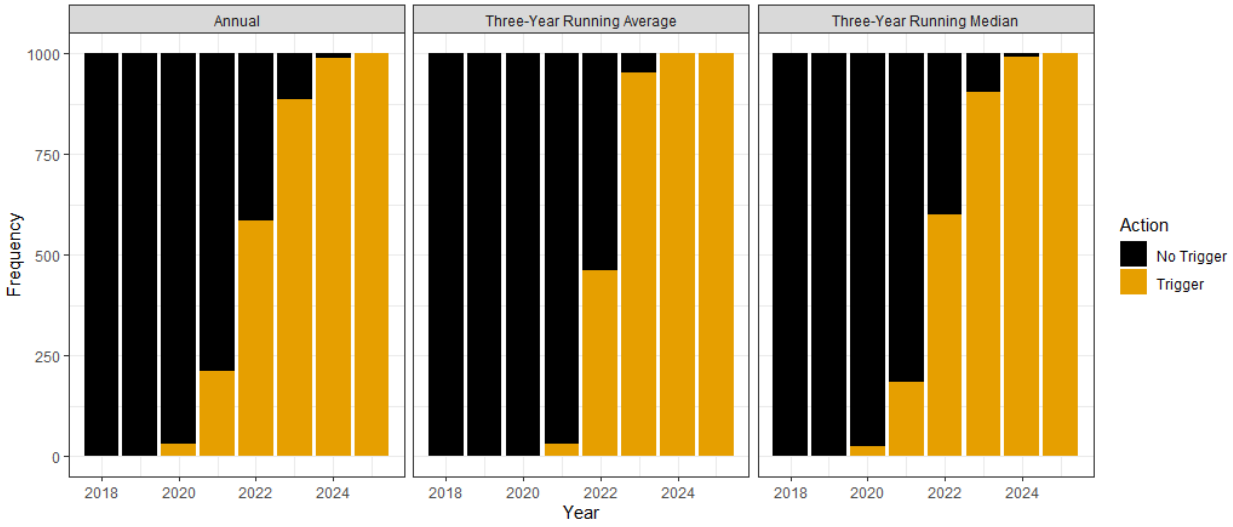

Figure 3. Annual action determinations by method from 1,000 simulated indices with the simulated population declining from the 2015-2017 average. The simulated stock was projected to decline 32% in 2021.

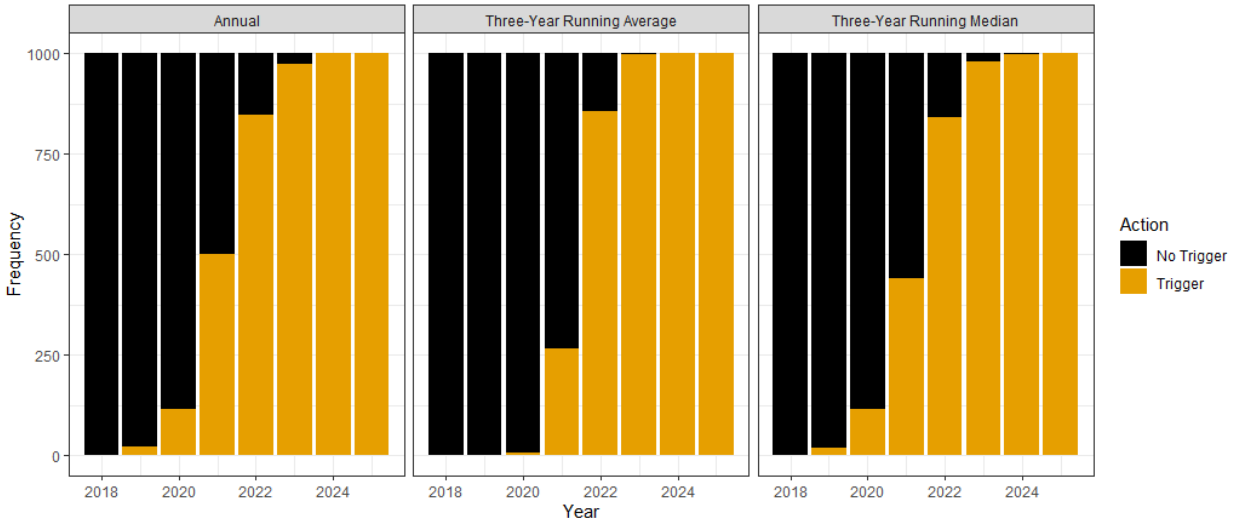

Figure 4. Annual action determinations by method from 1,000 simulated indices with the simulated population declining from the 2015-2017 median. The simulated stock was projected to decline 32% in 2021.

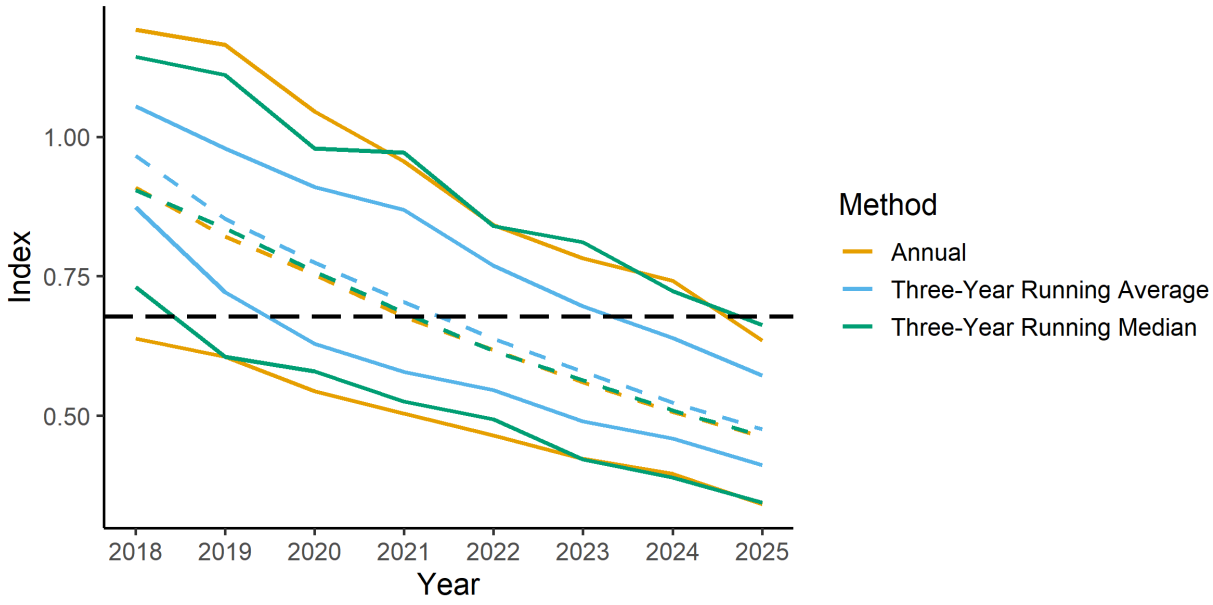

Figure 5. Distribution of index values by method from 1,000 simulations with the simulated population declining from the 2017 point value. The dashed colored lines are the median index values across simulations, the solid color lines are the minimum and maximum index values across simulations, and the dashed black line is the trigger level. The simulated stock was projected to decline 32% in 2021.

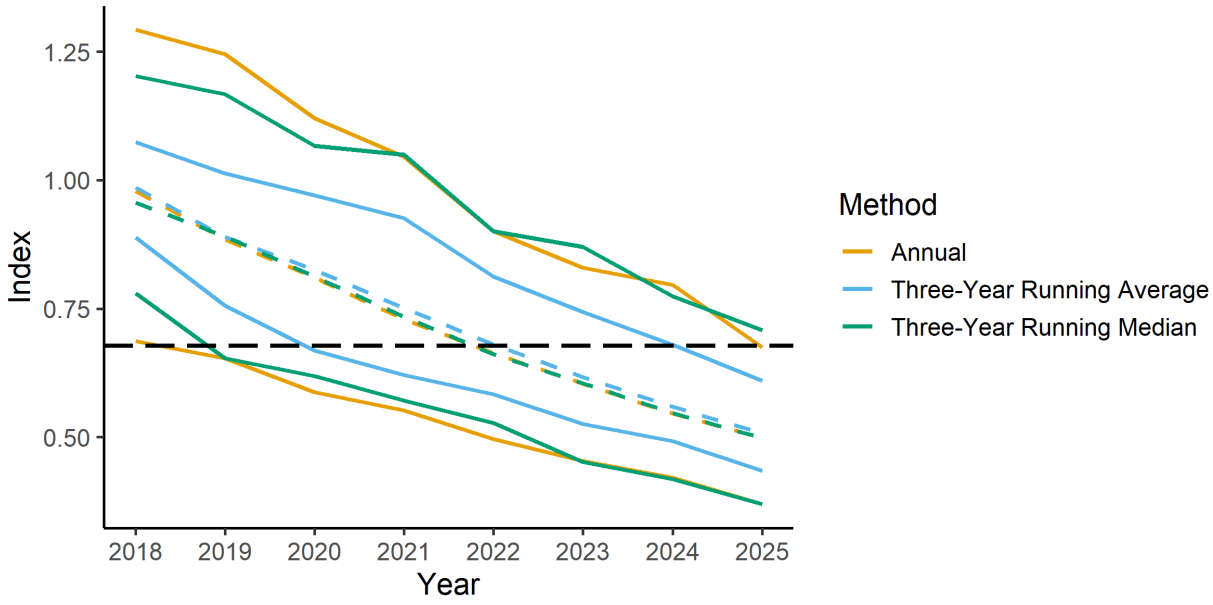

Figure 6. Distribution of index values by method from 1,000 simulations with the simulated population declining from the 2015-2017 running average. The dashed colored lines are the median index values across simulations, the solid color lines are the minimum and maximum index values across simulations, and the dashed black line is the trigger level. The simulated stock was projected to decline 32% in 2021.

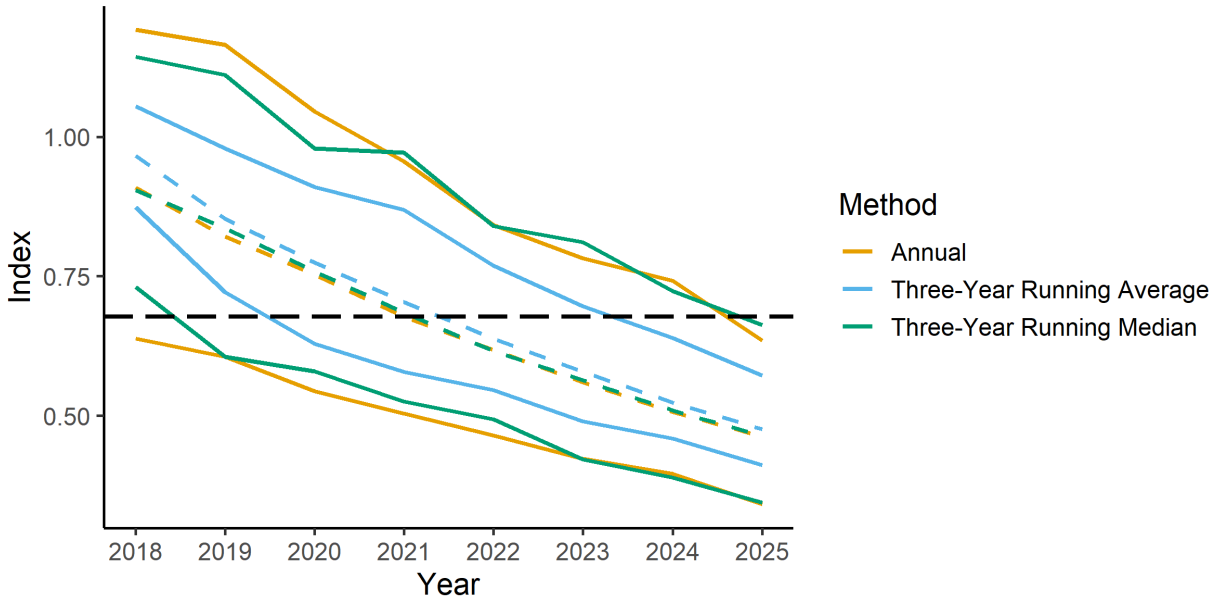

Figure 7. Distribution of index values by method from 1,000 simulations with the simulated population declining from the 2015-2017 running median. The dashed colored lines are the median index values across simulations, the solid color lines are the minimum and maximum index values across simulations, and the dashed black line is the trigger level. The simulated stock was projected to decline 32% in 2021.

Analysis of alternate minimum and maximum sizes as management options for Lobster Management Areas in the Gulf of Maine. Report to the ASFMC Lobster TC and PDT.

Burton Shank and Jeff Kipp

Sept. 9, 2021

The Lobster TC provided analysis to the ASFMC Lobster Board ahead of the Spring 2021 meeting with estimated outcomes to the Gulf of Maine / Georges Bank lobster fishery given the implementation of alternative management measures (min and max gauge size), including changes to total weight of lobsters landed, number of lobsters landed, Spawning Stock Biomass and Exploitation. The analysis included an attempt to examine how fisheries in different LMAs would be affected though the population simulation model was not re-parameterized for each LMA. In discussions, we concluded that the simulations for LMA1 were probably reasonably accurate because:

1. Many of the inputs for the simulations are taken from the 2020 stock assessment. Because the vast majority of the landings come from LMA1, the stock assessment parameters are essentially already tuned to the parameters of the LMA1 fishery.
2. LMA1 is primarily a recruitment-based fishery in inshore or nearshore habitats and, therefore, likely to be representative of the full stock model.

However, there was concern that the offshore fishery in Lobster Management Area 3 was considerably different from the full stock model and, thus, may have inaccurate outcomes due to a mis-parameterized simulation model. The parameters for the Outer Cape Cod fishery are probably somewhere between LMA1 and LMA3 as it consists of both a resident lobster population and a seasonally-migrating population, moving between inshore and offshore habitats.

To address these differences between the LMAs in population simulations, we performed the following:

1. For the LMA1 simulations, we used the stock assessment parameters as the inputs.
2. For LMA3 simulations, we attempted to manually tune the population simulation model to match the catch characteristics of the LMA3 fishery, under the assumption that a simulation model that could reproduce the catch characteristics of the fishery may more accurately project changes in the fishery given changing management measures.
3. For the OCC simulations, we ran two sets of simulations, using the input parameters for both LMA1 and LMA3 under the assumption that this bounds the dynamics we might see in OCC.

For all simulations, populations were initiated with zero abundance and run for 50 years with constant recruitment to allow population abundances and length comps to reach equilibrium. The equilibrium populations were then compared across the various legal selectivity scenarios to determine the effect of these different management alternatives.

For a simple, model-free analysis of the fishery catch composition for LMA1 and LMA3, we calculated the cumulative proportion of catch by weight at length by converting catch-at-size to weight-at-size and weighting for unequal sex ratios and seasonality of landings.

<u>LMA1 Simulations</u>

The input parameters for the LMA1 simulations were primarily drawn from the 2020 stock assessment. This includes the recruitment seasonality, length composition and sex ratio, growth model, gear, legal and conservation selectivities and mean estimated fishing mortality from the terminal years.

LMA1 Results

The cumulative catch weight-by-length curve indicates that the mean size of lobsters landed in the LMA1 fishery is within the smallest legal size bin (83-91mm, Figure 1). Nearly 90% of the catch are below 100mm CL and only about 2% of the catch are over 120mm CL. This supports the perspective that LMA1 landings involve a narrow range of small lobster sizes and is primarily a recruitment-dependent fishery.

Increasing the minimum legal size is projected to decrease the total number of lobsters landed but result in a net increase in yield-per-recruit (YPR) and total weight of catch (Table 1 and 2). However, the magnitude of these changes are small enough that they may not be detectable in the actual fishery given inter-annual variations in recruitment and catch. Changing the maximum legal size is projected to have very little effect on either catch number or weight.

Note that these are purely yield-per-recruit simulations so recruitment subsidies from increased SSB are not assumed in the calculations of catch weight or number so, thus, probably represent a conservative, lower bound. A less conservative upper bound would be the product of change in YPR and the change in SSB.

Increasing the minimum legal size is projected to result in large increases in SSB (Table 3). Minimum legal sizes that approach or exceed the size of maturity produce increasing returns on SSB as this allows a much larger portion of the population to reproduce at least once. Thus, increasing minimum legal size to 88mm is projected to result in a near doubling in SSB. Increasing maximum size can result in a large decrease SSB, particularly as the minimum legal size increases and more of the population survives to reach the current maximum legal size.

Increasing legal size would result in moderate to large decreases in exploitation as more of the stock becomes protected (Table 4) with exploitation decreasing by nearly 30% at a minimum legal size of 88mm. As with catch weight and number, changing maximum legal size has little effect on exploitation rates as these sizes represent a very small portion of the LMA1 population.

LMA3 Simulations

We first analyzed the port and sea sampling data provided for the 2020 benchmark assessment but constrained to LMA3 to estimate fishery characteristics, including catch size composition, catch sex ratio, and conservation selectivity (discarding due to egg-bearing or v-notch status).

We then specified the conservation selectivity from the biosamples and current legal selectivity appropriate for LMA3 in the population simulation model and iteratively tuned the following parameters:

1. Fully-selected fishing mortality, assumed constant across seasons
2. Recruitment sex ratio
3. Recruitment size composition for each sex.

For a given tuning run, the population simulation model was provided an updated set of input parameters and projected forward 25 year to reach equilibrium. The resulting catch composition from the model run was then compared to the average catch composition from the last five years of the biosamples to determine accuracy of the simulation models. Comparisons were conducted both visually for obvious lack-of-fit and by correlating the simulated and observed catch compositions. Correlations were performed on both the catch proportions and logit-transformed catch proportions, the latter to place more emphasis on length compositions that occur in smaller proportions.

Once the model was tuned to perform as well as might be expected, given minor, seasonal lack-of-fit that could not be easily resolved, the simulation model was then run with the tuned parameters for all combinations of proposed minimum and maximum size limits. We then summarized the outputs from the different simulations as values relative to the current minimum and maximum size regulations in place for LMA3.

Results

The cumulative catch weight-by-length curve indicates that 110 mm carapace length is the approximate mean size of lobsters landed in the LMA3 fishery (Figure 1). However, the cumulative curve is nearly linear from 90mm through 130mm, indicating lobsters across this size range are about equally important to the landings of this fishery. Lobsters less than about 92mm constitute the lower 10% quantile of landings while lobsters greater than 136mm constitute the upper 10% quantile with lower and upper quartiles around 98mm and 123mm respectively. This suggests that LMA3 landings include a broad range of lobster sizes, unlike typical inshore lobster fisheries that are primarily recruitment-driven.

The final tuned parameters included a quarterly fishing mortality of 0.1 (0.4 total annual mortality) and a 70:30 female to male recruitment sex ratio. The tuned recruit length compositions are bi-modal for both sexes, indicating recruitment to the fishery comes both from growth of smaller individual within the LMA and immigration from outside the LMA (Figure 2). With these compositions, about 80% of male recruitment and 30% of female recruitment is attributed to growth with the remainder of new individuals coming from immigration from outside the LMA.

Fitting the simulation length comps by manually tuning these parameters resulted in reasonably good fits to the observed length compositions (Figures 3, 4, and 5). Some lack-of-fit is still evident within seasons but this lack-of-fit is generally contrary to the lack-of-fit observed in other seasons, making it difficult to further improve the fit with just the parameters of interest. Correlations between observed and predicted compositions were 0.981 for simple proportions and 0.97 for logit-transformed proportions, suggesting both high and low proportion values for observed length comps are well matched by the simulation and we deemed this adequate to a basis to examine alternative management options.

Decreasing either the minimum or maximum legal size is projected to decrease total weight of catch (Table 5). However, contrary to the previous analysis for the full stock or inshore LMA's, changes to the maximum size have much larger impacts on landings than changes to the minimum size, particularly once the maximum size drops to between 140 and 150mm. Decreasing the maximum size from 171mm to 127mm is projected to decreases landings by about 30% while decreasing the minimum size from 90mm to 83mm is only projected to decrease landings by a couple of percent.

Decreasing the minimum legal size is projected to marginally increase the number of lobsters being landed but decreasing the maximum size marginally to moderately decreases the number of lobsters landed, producing neutral effects for many of the management options explored here (Table 6).

Decreasing maximum legal size from current regulations is projected to increase spawning stock biomass (SSB), possibly significantly, but decreasing minimum sizes would decrease SSB (Table 7). The greatest observed increase would be from holding the minimum size at current values but maximally decreasing maximum sizes, essentially narrowing the length range where lobsters are legal, which is estimated to result in a 64% increase in spawning stock. As above, changes to maximum size have bigger effects on SSB than changes to minimum sizes.

Decreasing maximum sizes would result in a decrease in exploitation but decreasing minimum sizes would increase exploitation (Table 8), countering each other and paralleling patterns observed for SSB. Because the calculation of exploitation is based on numbers of individuals rather than mass, decreasing minimum sizes have larger effects on exploitation than observed above for landings or SSB. Again, changes in exploitation increase rapidly with decreasing maximum sizes once the alternate maximum gauge size reaches a size that includes a significant portion of the catch for the LMA.

OCC Simulations

Due to time and data constraints, we did not attempt to tune a simulation model for OCC. Rather, we assume that population dynamics and fishing mortality rates in OCC are bounded by the conditions observed in the LMA1 and LMA3 fisheries. Thus, we ran simulations for OCC using the OCC legal size range with both the LMA1 and LMA3 parameterizations and present both sets of results with the understanding that results for OCC should fall between these extremes.

In general, outputs (catch weight, number, SSB and exploitation) show different responses for the LMA1 than the LMA3 parameterizations. LMA1 parameterizations tend to produce simulations that are very sensitive to changes in minimum legal size but not maximum legal size, while simulations with LMA3 parameterization only slightly sensitive to changes in minimum legal size but moderately to highly sensitive to changes in maximum legal size.

Total weight of landings is projected to be sensitive to changing minimum legal size with the LMA1 parameterization but be insensitive with the LMA3 parameterization (Table 9 A & B). With the LMA1 parameterization, decreasing minimum size is projected to decrease landings by ~5% while increasing legal size to 88mm would increase landings by 8%. Conversely, landings weight is insensitive to changes in maximum legal size for the LMA1 parameterization but sensitive to changes for the LMA3 parameterization.

Total catch number simulations shows trend similar to catch weight with the LMA1 parameterization being sensitive to changes in minimum size and the LMA3 parameterization sensitive to changes in maximum size (Figure 10 A & B). The pattern otherwise holds that larger minimum legal sizes result in lower catch numbers.

For SSB, the LMA1 parameterization is responsive to both changes in minimum and maximum legal size while the LMA3 parameterization is more sensitive to changes in maximum size (Figure 11 A & B). For example, decreasing minimum legal size to 127mm would increase SSB by between 24% and 65% for the LMA1 and LMA3 parameterizations, respectively. The ranges of minimum size tested in simulations

produce changes in SSB in the rage of -26% to +76% for the LMA1 parameterization and -1% to +6.8% for the LMA3 parameterization.

Decreasing minimum legal size produce increases moderate to small increases in exploitation (16% to 4% for LMA1 and LMA3 parameterizations, respectively, Figure 12 A & B). Either increasing minimum legal size or decreasing maximum legal size decrease serve to decrease exploitation with a maximum decrease of ~39% observed at the largest minimum and smallest maximum size and the LMA3 parameterization.

Discussion

There is a stark difference in cumulative landings by size between LMA1 and LMA3. LMA1 is clearly a recruitment-based fishery that would be highly sensitive to variations in recruitment. The LMA3 fishery, in contrast, is fishing a broad range of lobster sizes, and therefore ages, and is thus somewhat buffered from interannual variation in recruitment dynamics.

The LMA1 fishery is highly sensitive to changes in minimum legal size because of high exploitation rates on newly-recruited lobsters. The range of minimum sizes tested in simulations encompasses size range that represents the majority of landings for the inshore / nearshore fishery. Thus, changes to minimum size would dramatically change the length composition of the catch. Increases in the minimum size will have temporarily but significantly depress landing in the years immediately after are implemented but the benefits to SSB would be similarly immediate. Increasing the minimum legal size can add to the resilience of the fishery by marginally increasing the spread of effort across multiple year classes and significantly increasing SSB and egg production which may buffer the effects in any future change in productivity.

Generally, decreasing maximum gauge sizes have larger effects for LMA3 both relative to decreasing minimum sizes in LMA3 or for changing maximum sizes for the other LMAs. This matches the conclusions based on the cumulative catch curve (Figure 1) that showed that the LMA3 fishery lands a much broader size range of individuals than the inshore LMAs, with the upper portion of length compositions overlapping proposed alternative maximum sizes.

This analysis for LMA3 matches previous analysis conducted for inshore LMAs, finding that larger minimum legal sizes had positive effects across population parameters including higher catch weights, increased SSB and decreased exploitation. However, decreasing maximum legal sizes has mixed effects, decreasing immediate landings but increasing SSB, potentially by a larger margin. Because recruitment subsidies from increasing SSB are not included in this simulation, the net effect of these two opposing changes are uncertain. While decreasing maximum legal sizes would decrease immediate landings and make a larger portion of the population inaccessible to the fishery permanently (i.e. excluded lobsters won't grow into a legal size in the future), this increase in SSB may eventually produce a recruitment subsidy that could offset this loss of catch. The net effect would depend on multiple factors including the connectivity of the added SSB to larval settlement habitat and the migration patterns of these large females into adjacent habitats including inshore Gulf of Maine and international waters.

Finally, it is important to note the importance of large female lobsters that dominate the landings for much of LMA3. This both highlights the partial dependence of this fishery on immigration from adjacent habitats and adds uncertainty to this analysis. The growth and molt cycling of such large females is

poorly understood and are not particularly well informed in the current growth model. Thus, the tuned parameters may be biased by mis-specification of the growth model and results in this analysis may be sensitive to the growth model used in some cases. Interpretation of tuned parameters and confidence in the precise results of this analysis should be taken with some caution. However, the general patterns of changing catch, SSB and exploitation with changes in minimum and maximum legal sizes is consistent across this and previous analyses so may be treated with higher confidence.

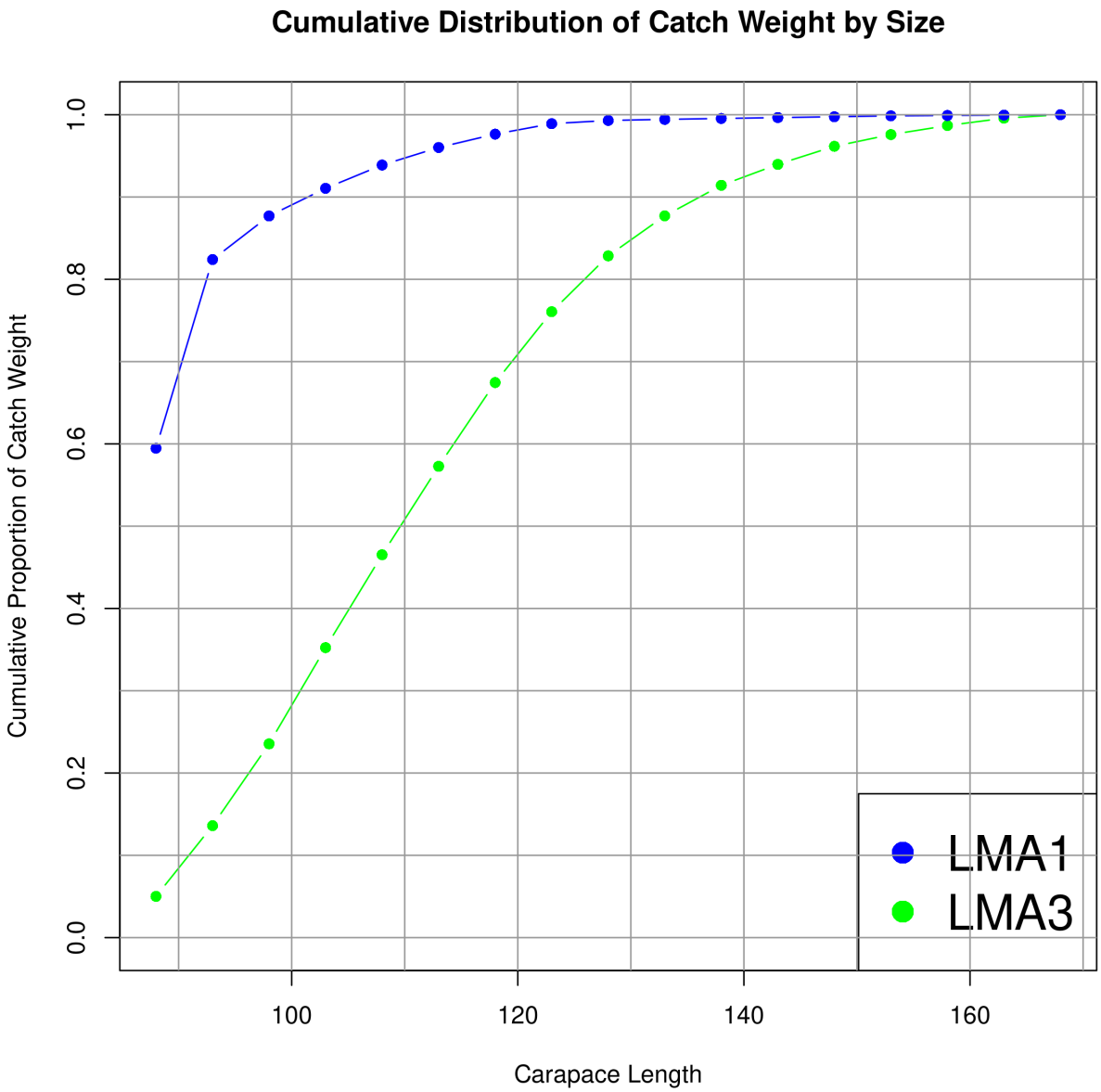

Figure 1. Cumulative proportion of catch weight by carapace length. To interpret, lobsters less than 90mm constitute approximately 8% of landings, while lobsters less than 130mm constitute approximately 85% of landings.

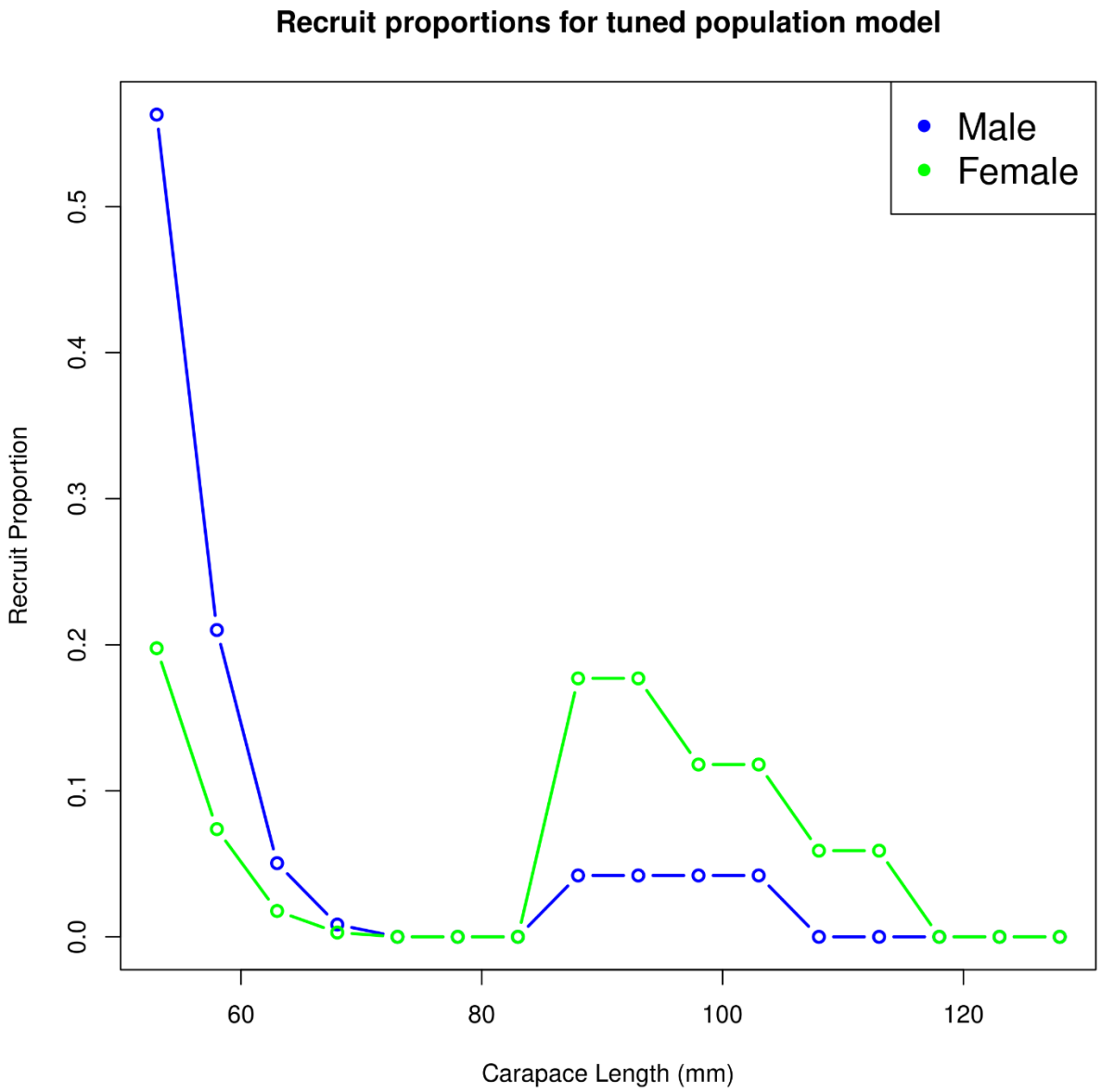

Figure 2. Tuned recruitment length compositions for the fitted model. The bi-modal length distribution suggests a combination of recruitment by growth (individuals <70mm) and migration (individuals >85 mm) with males primarily recruiting by growth and females primarily recruiting by migration as mature adults.

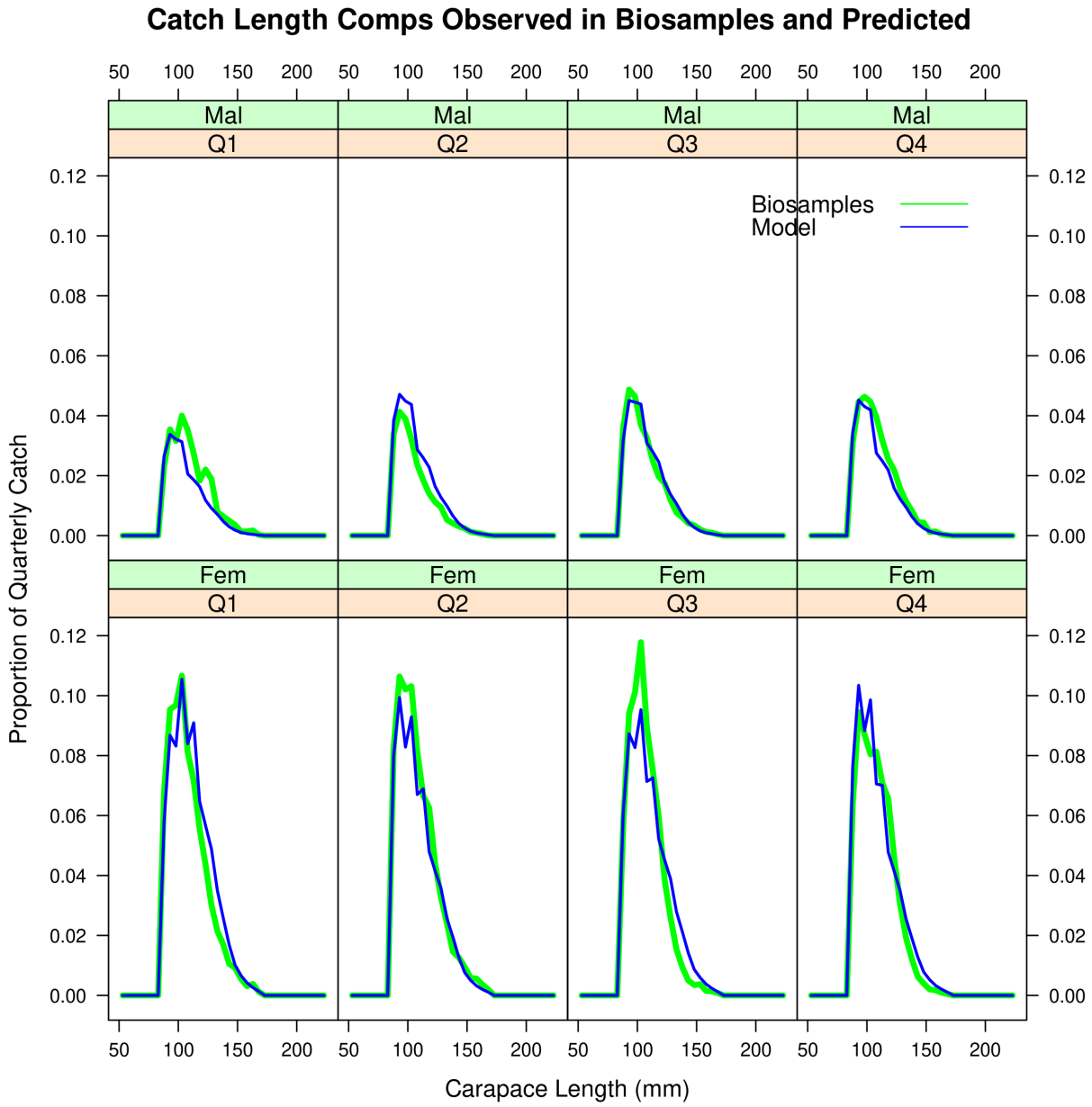

Figure 3. LMA 3 catch length compositions by sex and quarter based on biosampling and from the tuned population model.

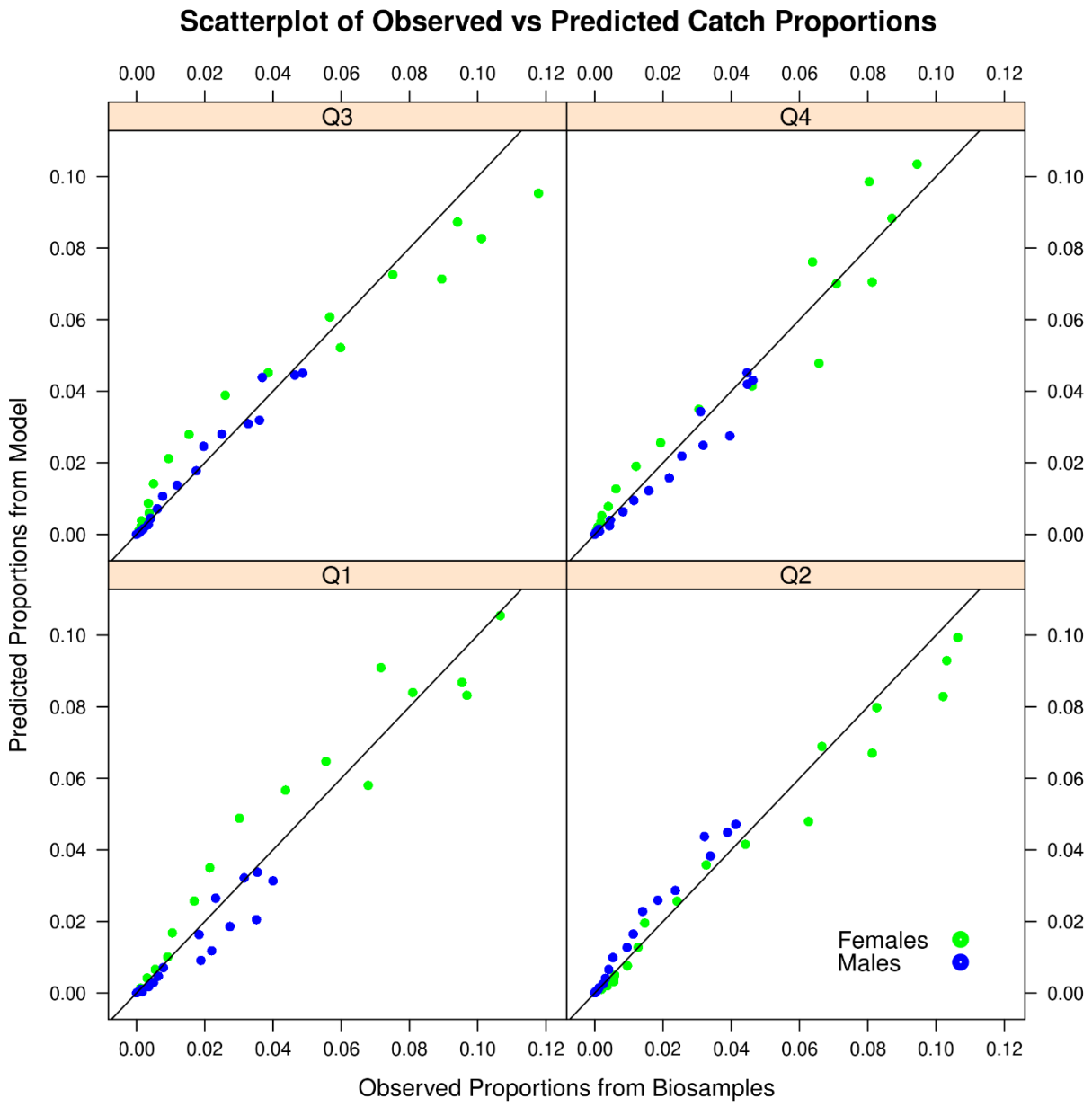

Figure 4. Relationship between length composition proportions observed in biosamples and predicted in the tuned population model by quarter and sex. The diagonal 1:1 line shows an ideal fit between the data sets.

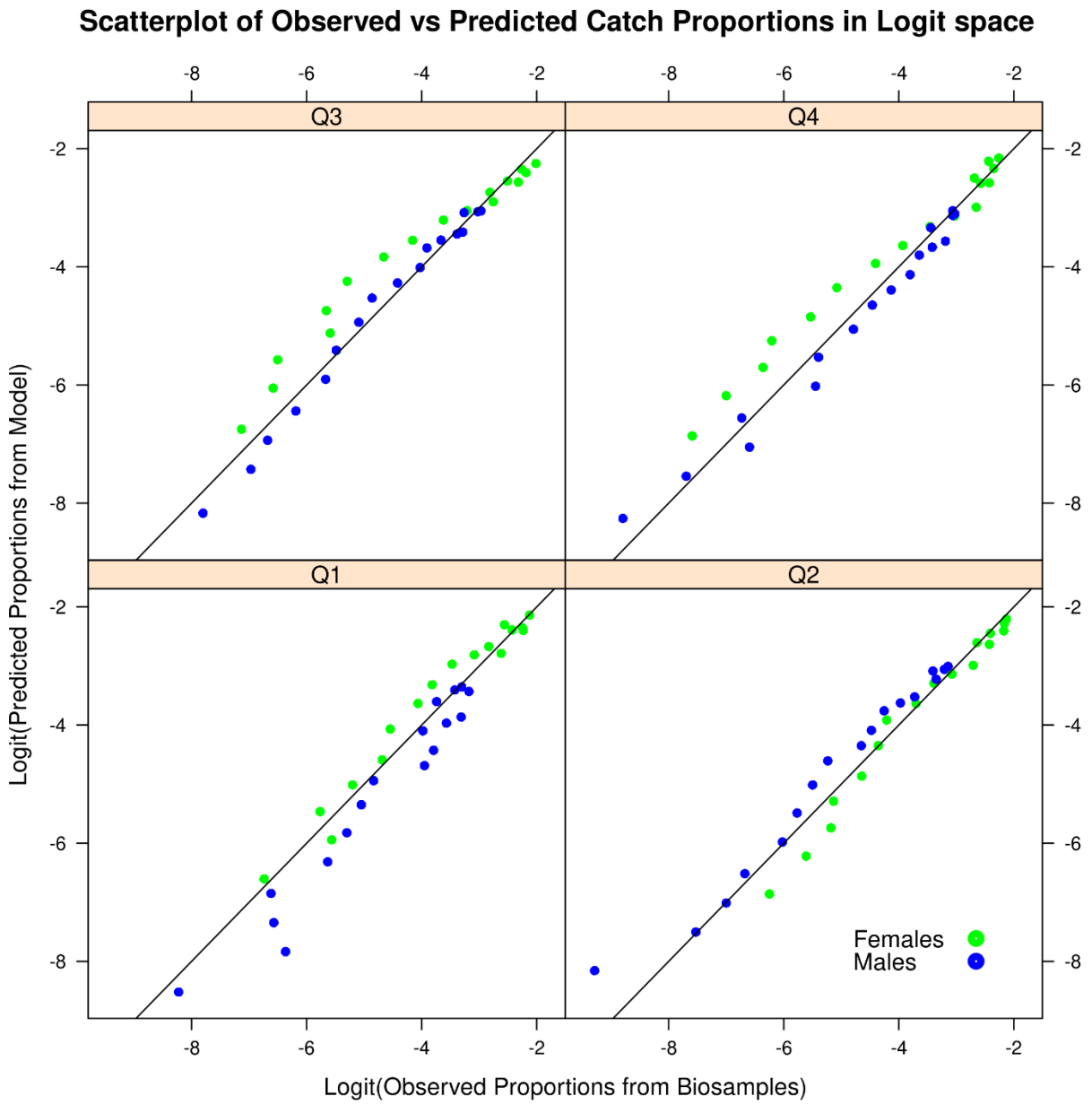

Figure 5. Relationship between length composition proportions observed in biosamples and predicted in the tuned population model by quarter and sex. Data points are logit-transformed to emphasize fit to lengths that occur in low proportions. The diagonal 1:1 line shows an ideal fit between the data sets.

Table 1. LMA1 projected relative changes to Weight of Landings resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	0.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
3.31in / 84mm	3.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
3.38in / 86mm	5.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
3.47in / 88mm	13.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%
3.53in / 90mm	14.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
3.594in / 91mm	16.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%

Table 2. LMA1 projected relative changes to Number of lobsters Landed resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	0.00%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%
3.31in / 84mm	-2.00%	-1.80%	-1.80%	-1.80%	-1.80%	-1.80%	-1.80%
3.38in / 86mm	-3.60%	-3.30%	-3.30%	-3.30%	-3.30%	-3.30%	-3.30%
3.47in / 88mm	-8.50%	-8.10%	-8.00%	-8.00%	-8.00%	-8.00%	-8.00%
3.53in / 90mm	-9.50%	-9.00%	-9.00%	-9.00%	-9.00%	-9.00%	-9.00%
3.594in / 91mm	-11.30%	-10.80%	-10.70%	-10.70%	-10.70%	-10.70%	-10.70%

Table 3. LMA1 projected relative changes to Spawning Stock Biomass resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size	Maximum Gauge Size: 5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	0.00%	-16.50%	-18.30%	-18.50%	-18.50%	-18.60%	-18.60%
3.31in / 84mm	19.00%	-1.40%	-3.60%	-3.80%	-3.90%	-3.90%	-3.90%
3.38in / 86mm	38.00%	13.90%	11.30%	11.00%	10.90%	10.90%	10.90%
3.47in / 88mm	98.00%	61.00%	56.90%	56.60%	56.50%	56.40%	56.40%
3.53in / 90mm	117.00%	75.80%	71.30%	70.90%	70.70%	70.70%	70.70%
3.594in / 91mm	151.00%	101.70%	96.40%	95.90%	95.70%	95.70%	95.60%

Table 4. LMA1 projected relative changes to Exploitation resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size	Maximum Gauge Size: 5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	0.00%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%
3.31in / 84mm	-8.50%	-7.70%	-7.60%	-7.60%	-7.60%	-7.60%	-7.60%
3.38in / 86mm	-14.40%	-13.60%	-13.50%	-13.50%	-13.50%	-13.50%	-13.50%
3.47in / 88mm	-29.40%	-28.40%	-28.30%	-28.30%	-28.30%	-28.30%	-28.30%
3.53in / 90mm	-32.10%	-31.00%	-30.90%	-30.90%	-30.90%	-30.90%	-30.90%
3.594in / 91mm	-36.50%	-35.40%	-35.30%	-35.20%	-35.20%	-35.20%	-35.20%

Table 5. LMA3 projected relative changes to Weight of Landings resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size	Maximum Gauge Size: 5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-31.30%	-14.60%	-6.30%	-4.20%	-2.80%	-2.10%	-0.80%
3.31in / 84mm	-31.20%	-14.30%	-6.00%	-3.80%	-2.40%	-1.60%	-0.40%
3.38in / 86mm	-31.20%	-14.00%	-5.60%	-3.40%	-2.00%	-1.20%	0.00%
3.47in / 88mm	-31.10%	-13.60%	-5.00%	-2.70%	-1.30%	-0.50%	0.80%
3.53in / 90mm	-31.40%	-13.40%	-4.60%	-2.30%	-0.90%	0.00%	1.30%
3.594in / 91mm	-31.70%	-13.20%	-4.10%	-1.70%	-0.30%	0.60%	1.90%

Table 6. LMA3 projected relative changes to Number of lobsters Landed resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size	Maximum Gauge Size: 5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-11.10%	-0.80%	3.20%	4.00%	4.50%	4.70%	5.00%
3.31in / 84mm	-12.20%	-1.70%	2.30%	3.20%	3.70%	3.90%	4.20%
3.38in / 86mm	-13.20%	-2.60%	1.50%	2.30%	2.80%	3.10%	3.40%
3.47in / 88mm	-15.20%	-4.20%	-0.10%	0.80%	1.30%	1.50%	1.80%
3.53in / 90mm	-17.10%	-5.90%	-1.70%	-0.80%	-0.30%	0.00%	0.30%
3.594in / 91mm	-19.50%	-7.90%	-3.60%	-2.60%	-2.10%	-1.90%	-1.50%

Table 7. LMA3 projected relative changes to Spawning Stock Biomass resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size	Maximum Gauge Size: 5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	56.00%	19.00%	3.00%	-1.50%	-3.80%	-5.20%	-6.90%
3.31in / 84mm	57.00%	20.00%	3.00%	-0.80%	-3.10%	-4.50%	-6.20%
3.38in / 86mm	59.00%	21.00%	4.00%	0.00%	-2.40%	-3.70%	-5.50%
3.47in / 88mm	61.00%	23.00%	6.00%	1.50%	-0.90%	-2.30%	-4.10%
3.53in / 90mm	64.00%	25.00%	8.00%	3.80%	1.40%	0.00%	-1.80%
3.594in / 91mm	69.00%	29.00%	11.00%	6.70%	4.20%	2.80%	1.00%

Table 8. LMA3 projected relative changes to Exploitation resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell).

Minimum Gauge Size	Maximum Gauge Size: 5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-20.40%	-0.30%	8.40%	10.30%	11.40%	11.90%	12.50%
3.31in / 84mm	-22.30%	-2.40%	6.30%	8.10%	9.20%	9.70%	10.30%
3.38in / 86mm	-24.10%	-4.40%	4.10%	6.00%	7.00%	7.50%	8.10%
3.47in / 88mm	-27.40%	-8.10%	0.30%	2.20%	3.10%	3.70%	4.30%
3.53in / 90mm	-30.60%	-11.60%	-3.30%	-1.50%	-0.50%	0.00%	0.60%
3.594in / 91mm	-34.20%	-15.60%	-7.50%	-5.70%	-4.80%	-4.20%	-3.70%

Table 9. OCC projected relative changes to Weight of Landings resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell), based on (A) LMA1 or (B) LMA3 paramerizations.

A.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-5.60%	-5.00%	-4.90%	-4.90%	-4.90%	-4.90%	-4.90%
3.31in / 84mm	-2.70%	-2.00%	-1.90%	-1.90%	-1.90%	-1.90%	-1.90%
3.38in / 86mm	-0.90%	-0.10%	0.00%	0.00%	0.00%	0.00%	0.00%
3.47in / 88mm	6.60%	7.80%	8.00%	8.00%	8.00%	8.00%	8.00%
3.53in / 90mm	7.40%	8.80%	8.90%	8.90%	8.90%	8.90%	8.90%
3.594in / 91mm	9.30%	11.00%	11.20%	11.20%	11.20%	11.20%	11.20%

B.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-30.40%	-13.50%	-5.20%	-3.00%	-1.60%	-0.80%	0.00%
3.31in / 84mm	-30.30%	-13.20%	-4.80%	-2.60%	-1.20%	-0.40%	1.00%
3.38in / 86mm	-30.30%	-13.00%	-4.40%	-2.20%	-0.80%	0.00%	1.00%
3.47in / 88mm	-30.30%	-12.50%	-3.80%	-1.50%	-0.10%	0.70%	2.00%
3.53in / 90mm	-30.60%	-12.40%	-3.40%	-1.10%	0.40%	1.20%	3.00%
3.594in / 91mm	-30.90%	-12.10%	-2.90%	-0.50%	1.00%	1.90%	3.00%

Table 10. OCC projected relative changes to Number of lobsters Landed resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell), based on (A) LMA1 or (B) LMA3 paramerizations.

A.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	3.40%	3.60%	3.60%	3.60%	3.60%	3.60%	3.60%
3.31in / 84mm	1.30%	1.60%	1.60%	1.60%	1.60%	1.60%	1.60%
3.38in / 86mm	-0.30%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3.47in / 88mm	-5.40%	-4.90%	-4.90%	-4.90%	-4.90%	-4.90%	-4.90%
3.53in / 90mm	-6.40%	-5.90%	-5.90%	-5.90%	-5.90%	-5.90%	-5.90%
3.594in / 91mm	-8.30%	-7.70%	-7.70%	-7.70%	-7.70%	-7.70%	-7.70%

B.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-13.80%	-3.70%	0.10%	0.90%	1.40%	1.60%	1.90%
3.31in / 84mm	-14.80%	-4.60%	-0.70%	0.10%	0.60%	0.80%	1.10%
3.38in / 86mm	-15.80%	-5.50%	-1.50%	-0.70%	-0.20%	0.00%	0.30%
3.47in / 88mm	-17.70%	-7.10%	-3.10%	-2.20%	-1.70%	-1.50%	-1.20%
3.53in / 90mm	-19.60%	-8.70%	-4.60%	-3.70%	-3.20%	-3.00%	-2.70%
3.594in / 91mm	-21.90%	-10.70%	-6.40%	-5.50%	-5.00%	-4.80%	-4.50%

Table 11. OCC projected relative changes to Spawning Stock Biomass resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell), based on (A) LMA1 or (B) LMA3 paramerizations.

A.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-9.80%	-24.70%	-26.40%	-26.50%	-26.60%	-26.60%	-26.60%
3.31in / 84mm	7.00%	-11.10%	-13.10%	-13.30%	-13.30%	-13.30%	-13.30%
3.38in / 86mm	24.30%	2.70%	0.30%	0.10%	0.00%	0.00%	0.00%
3.47in / 88mm	78.20%	45.10%	41.50%	41.20%	41.10%	41.00%	41.00%
3.53in / 90mm	95.50%	58.50%	54.40%	54.00%	53.90%	53.90%	53.90%
3.594in / 91mm	126.20%	81.80%	77.00%	76.60%	76.50%	76.40%	76.40%

B.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	63.00%	24.00%	7.00%	2.00%	-0.10%	-1.50%	-3.30%
3.31in / 84mm	64.00%	25.00%	7.00%	3.00%	0.60%	-0.70%	-2.60%
3.38in / 86mm	65.00%	26.00%	8.00%	4.00%	1.40%	0.00%	-1.80%
3.47in / 88mm	67.00%	27.00%	10.00%	5.00%	2.90%	1.50%	-0.30%
3.53in / 90mm	71.00%	30.00%	12.00%	8.00%	5.30%	3.90%	2.00%
3.594in / 91mm	75.00%	34.00%	15.00%	11.00%	8.30%	6.80%	4.90%

Table 12. OCC projected relative changes to Exploitation resulting from alternative minimum and maximum options, relative to the current regulations (yellow cell), based on (A) LMA1 or (B) LMA3 paramerizations.

A.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	15.60%	16.50%	16.50%	16.50%	16.50%	16.50%	16.50%
3.31in / 84mm	5.80%	6.70%	6.80%	6.80%	6.80%	6.80%	6.80%
3.38in / 86mm	-1.10%	-0.10%	0.00%	0.00%	0.00%	0.00%	0.00%
3.47in / 88mm	-18.40%	-17.30%	-17.10%	-17.10%	-17.10%	-17.10%	-17.10%
3.53in / 90mm	-21.50%	-20.20%	-20.10%	-20.10%	-20.10%	-20.10%	-20.10%
3.594in / 91mm	-26.70%	-25.30%	-25.20%	-25.20%	-25.20%	-25.20%	-25.20%

B.

Minimum Gauge Size \ Maximum Gauge Size	5in / 127mm	5.5in / 140mm	6in / 152mm	6.25in / 159mm	6.5in / 165mm	6.75in / 171mm	None
3.25in / 83mm	-26.00%	-7.30%	0.80%	2.60%	3.60%	4.10%	4.60%
3.31in / 84mm	-27.70%	-9.20%	-1.20%	0.60%	1.50%	2.00%	2.60%
3.38in / 86mm	-29.40%	-11.10%	-3.20%	-1.40%	-0.50%	0.00%	0.60%
3.47in / 88mm	-32.50%	-14.50%	-6.70%	-5.00%	-4.10%	-3.60%	-3.00%
3.53in / 90mm	-35.40%	-17.70%	-10.00%	-8.40%	-7.50%	-7.00%	-6.50%
3.594in / 91mm	-38.80%	-21.50%	-13.90%	-12.30%	-11.40%	-10.90%	-10.40%

Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: **American Lobster Management Board**

FROM: **American Lobster Technical Committee**

DATE: **April 16, 2021**

SUBJECT: **Lobster Management Strategy Evaluation Options**

The Atlantic States Marine Fisheries Commission's Lobster Technical Committee (TC) was tasked by the American Lobster Management Board (Board) at the Commission's 2021 Winter Meeting to develop a set of prioritized options, timelines, and draft budgets to assist the Board in considering if management strategy evaluation (MSE) could be of use for management of the lobster fisheries. The TC met via webinar two times following the Winter Meeting to develop and prioritize these options. Options are outlined at the end of the memorandum, and include anticipated personnel needs, major budget line items, and timelines with milestones that would incur a substantial cost. However, the TC indicated that due to the highly interdisciplinary nature of MSE, additional perspectives are needed to provide a comprehensive work plan. Therefore, the TC has provided some recommendations for next steps for MSE development in addition to a recommended option to pursue. In addition to the line item cost estimates for each option, it is important to keep in mind that these costs do not include time and, consequently, indirect costs of several participants' time being allocated to participating in the MSE process (e.g., TC members); workloads would have to be prioritized and modified to accommodate the MSE workload. Competing workloads include the next lobster stock assessment (tentatively scheduled for 2025) and a potential Jonah crab stock assessment (tentatively scheduled for 2023), at a minimum. The details of the options provided at the end of the memorandum are considered preliminary and may change dependent on management goals and objectives (e.g., need to include anthropologists to address human dimensions objectives).

TC Recommendations on MSE Focus

The TC recommends the option for a two-phase MSE of the Gulf of Maine/Georges Bank (GOM/GBK) stock. The first phase of this option would provide an intermediate MSE at a coarser spatial resolution (i.e., stock level) that can be used to support a management framework in a relatively short timeframe, while also allowing time to build knowledge and tools to develop a subsequent, spatially-explicit MSE in phase two. This phased approach provides short term management guidance, while concurrently building the framework to expand to a spatially explicit approach in phase two. The extended timeframe may also allow several large-scale changes on the horizon for the lobster fishery to develop that could impact the lobster fishery and management goals, and thus better guide the cost and focus of incorporating spatial considerations explicitly into the MSE.

The TC believes MSE has potential for supporting a management framework for the Southern New England (SNE) stock, but believes a SNE-focused MSE is a lower priority option for several reasons. First, the scale of the fisheries in terms of fleet size and landings make the GOM/GBK stock a higher priority. Second, MSEs are generally focused on proactive management strategies for the future of the fishery, such as strategies intended to promote stock resilience, as opposed to reactive management strategies responding to stock conditions estimated in past stock assessments; the TC believes this further skews cost-benefit considerations of MSE in favor of the GOM/GBK stock. Third, the TC anticipates unique

challenges that would require more complex tools to provide a successful SNE MSE. These challenges include the dominant mixed-crustacean nature of the fishery, and the degree and rate at which the lobster population and fishery have changed in response to climate change. These factors require modeling aspects of both Jonah crab and lobster population dynamics and distributions, as well as spatial dynamics of the fishery in any MSE option. There is also a high likelihood for an MSE to require customized model development and data collection by stock (e.g., socio-economic indicators), making MSE focused on one stock at a time most feasible.

TC Recommendations on Next Steps

The TC recommends two next steps for development of an MSE. First, a formal process is recommended to develop management goals and objectives for the future of the lobster fisheries. A good example is the process used by the Ecosystems Management Objectives Workshop conducted by the Commission to guide development of ecological reference points for Atlantic menhaden. Objectives developed from such a process would be used to further develop an MSE work plan for lobster. The second recommendation is to form a steering committee for additional scoping and development of a comprehensive work plan with a detailed timeline, including: outreach components that are not anticipated to incur a substantial cost but are imperative to the success of an MSE (e.g., outreach at regularly scheduled industry association meetings), identification of funding sources for the MSE costs, and identification of personnel. Representation recommended for the steering committee includes Board members, TC members, Commission staff, members of the Commission's Committee on Economics and Social Sciences, industry stakeholders (preferably those with past experience in MSE), and members of the Commission's Assessment and Science Committee or Management and Science Committee with past experience in MSE. To be effective, the number of people in the steering committee should be limited to approximately a dozen members.

The TC discussed two ongoing developments that will potentially streamline the development of a formal MSE approximately a year from now. First, University of Maine researchers have submitted a proposal to the current round of the Sea Grant's American Lobster Research Program funding; while funding is uncertain, the project is to evaluate population dynamics simulations that will incorporate environmental effects into the biological modeling framework likely to be used in a lobster MSE. Second, work towards the conceptualization of an economics model and economic data gathering is being funded by NOAA Fisheries; this will support development of an economic model within the MSE modeling framework. These developments support the TC recommendation for the formation of a steering committee, with a start date for the MSE to be determined pending the results of the steering committee's findings.

GOM/GBK MSE Option (high priority)

Phase One - Stockwide GOM/GBK MSE

Purpose: Evaluate performance of management strategies at the stock level for the GOM/GBK stock in response to changes in recruitment with biological, fishery, and other socio-economic performance metrics.

Timeline: Three years. One modeler workshop in the first year and one modeler and one stakeholder workshop in years two and three.

Personnel and responsibilities:

- ASMFC Lobster TC – Stakeholder recruitment and engagement, data gathering, guidance on technical aspects of the MSE, report writing, and training for using the MSE tools in future updates

- ASMFC Staff – Project management, data gathering, workshop coordination, and report writing/publishing
- ASMFC Lobster Board Members – Define management goals and provide guidance on the direction of the MSE based on established goals, participate in stakeholder input gathering (webinars and workshops)
- Stakeholders – Identify desired objectives and outcomes of an MSE and provide guidance on the direction of the MSE, participate in stakeholder input gathering (surveys, webinars, and workshops)
- Biological modeler – Couple existing assessment model and operating model in a closed-loop model (six months to program, six months to modify based on workshop feedback and to provide training to TC members)
- Economics modeler – Develop an economics model guided by NOAA Fisheries' economic model conceptualization and data gathering work and couple with the assessment model and operating model in a closed-loop model.
- Professional facilitator - Facilitate stakeholder webinars and workshops, assist with stakeholder input survey development and analysis

Costs:

- Facilitator - $25,000
- Travel - $37,500 for two in-person stakeholder workshops (30 people), $22,500 for three in-person modeler workshops (12 people)
- Biological model development - $85,000 (one year postdoc with ASMFC indirect cost cap)
- Economic model development - $115,000 (one year full time or two six month full time contractors)
- Total - $285,000

Phase Two - Spatially-Explicit GOM/GBK MSE

Purpose: Evaluate performance of spatially-directed management strategies for the GOM/GBK stock triggered by external forces (e.g., whale interactions, wind farm development and operation, climate change).

Costs: Estimates to be developed during phase one.

Spatially-Explicit SNE MSE Option (low priority)

Purpose: Evaluate performance of spatially-directed management strategies for the SNE stock in response to changes in recruitment and diversification of the fishery (targeting lobster and Jonah crab) with biological, fishery, and other socio-economic performance metrics.

Timeline: Five years. One modeler workshop in years one through five. One stakeholder workshop in years two, four, and five.

Personnel and responsibilities:

- ASMFC Lobster TC – Stakeholder recruitment and engagement, data gathering, guidance on technical aspects of the MSE, report writing, and training for using the MSE tools in future updates

- ASMFC Staff – Project management, data gathering, workshop coordination, and report writing/publishing
- ASMFC Lobster Board Members – Define management goals and provide guidance on the direction of the MSE based on those pre-defined goals, participate in stakeholder input gathering (webinars and workshops)
- Stakeholders – Identify desired objectives and outcomes of an MSE and provide guidance on the direction of the MSE, participate in stakeholder input gathering (surveys, webinars, and workshops)
- Biological modeler – Conceptualize modeling of the spatial dynamics necessary to address stakeholder objectives by integrating lobster population distribution models along with Jonah crab population distribution and the resulting fleet dynamics. Identify biological and fleet spatial dynamics and resolution of each that can and cannot be modeled with available data to guide configuration of operating and assessment model. Couple assessment model and operating model in a closed-loop model (eighteen months to program, eighteen months to modify based on workshop feedback and provide training to TC members).
- Economics modeler – Conceptualize modeling of the economic processes driven by lobster landings, and interactions between lobster and Jonah crab effort and landings. Identify processes that can and cannot be modeled with available data to guide configuration of model. Couple economics model with the assessment model and operating model in a closed-loop model.
- Professional facilitator – Facilitate stakeholder webinars and workshops, assist with stakeholder input survey development and analysis
- ***Potentially others dependent on management and stakeholder objectives (e.g., reduce whale interactions would require a whale biologist and protected resource personnel)***

Costs:

- Facilitator - $42,000
- Travel - $56,250 for three in-person stakeholder workshops (30 people), $46,875 for five in-person modeler workshops (15 people)
- Spatially-explicit closed-loop model development: $255,000 (three year postdoc with ASMFC indirect cost cap)
- Economic model development: $345,000 (three year full time or two one and half year full time contractors)
- Total - $745,125 (minimum with potential for additional costs dependent on stakeholder objectives)