Atlantic States Marine Fisheries Commission

American Lobster Management Board

August 2, 2021
1:30 – 4:00 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*)	1:30 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from May 2021	1:30 p.m.
3.	Public Comment	1:35 p.m.
4.	Progress Report on Development of Draft Addendum XXVII on Gulf of Maine/Georges Bank Resiliency *(C. Starks)*	1:45 p.m.
5.	Review Work Group Report on Vessel Tracking Devices in Federal Lobster and Jonah Crab Fisheries *(C. Starks)* **Possible Action**	2:20 p.m.
6.	Review Jonah Crab Pre-assessment Report and Consider Initiation of a Stock Assessment *(D. Perry)* **Possible Action**	2:50 p.m.
7.	Consider Development of a Management Strategy Evaluation of the American Lobster Fisheries *(J. Kipp)* **Possible Action**	3:30 p.m.
8.	Other Business/Adjourn	4:00 p.m.

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

MEETING OVERVIEW

American Lobster Management Board
May 3, 2021
1:30 p.m. – 4:00 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: May 3, 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 May 3, 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. Progress Report on Development of Draft Addendum XXVII on Gulf of Maine/Georges Bank Resiliency (1:45-2:20 p.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 TC was tasked by the PDT to analyze possible changes to minimum and maximum gauge size for the management areas within the GOM/GBK stock. Due to competing TC workloads this analysis was delayed.
- The PDT has provided additional guidance on the structure of the management document, and is seeking additional guidance from the Board, with the intention of providing a draft addendum for consideration for public comment in October 2021. **(Briefing Materials)**.

Presentations

- Update on the Development of Draft Addendum XXVII by C. Starks

Board Actions for Consideration at the Meeting

- Provide guidance to PDT on draft management options

5. Review Workgroup Report on Vessel Tracking Devices in Federal Lobster and Jonah Crab Fisheries (2:20-2:50 p.m.) Possible Action

Background

- In May 2021, the Board discussed electronic vessel tracking in the federal lobster and Jonah crab fisheries. They received presentations from state partners on recent work that has expanded upon the Commission's 2020 pilot project on vessel tracking initiated through Addendum XXVI; these projects have tested additional tracking devices, integrated cell-based tracking with ACCSP's SAFIS eTRIPS mobile trip reporting application, and created trip viewers within SAFIS eTRIPS online.
- As in previous discussions, the Board emphasized the critical need for high-resolution spatial and temporal data to characterize effort in the federal lobster and Jonah crab fleet in order 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 a technical workgroup including representatives from NOAA Fisheries, state and federal law enforcement, and members of the Board to develop objectives, technological solutions, and system characteristics for vessel tracking devices in the federal lobster and Jonah crab fisheries. The workgroup and technical staff from ASMFC, ACCSP and the states have met several times since the May meeting to develop recommendations for implementing tracking requirements in the federal fleet **(Supplemental Materials)**.

Presentations

- Workgroup Report on Electronic Vessel Tracking Requirements by C. Starks

Board Actions for Consideration at the Meeting

- Consider next steps for implementation of electronic vessel tracking for federal lobster and Jonah crab vessels

6. Review Jonah Crab Pre-Assessment Report and Consider Initiation of a Stock Assessment (2:50-3:30 p.m.) Possible Action

Background

- The Board tasked the TC in August 2020 with conducting a pre-assessment workshop for Jonah crab and providing a report on available data and recommended assessment approaches. Webinars were held November 16-18, 2020, February 11, 2021, June 3, 2021, and June 29, 2021 to review and discuss available Jonah crab data sets, potential assessment approaches, and remaining data limitations. From these discussions the TC produced a Jonah Crab Pre-Assessment Data Workshop Report. The report includes descriptions of available data and limitations, assessment approaches, and research recommendations (**Briefing Materials**).

- The TC recommends moving forward with a stock assessment to be completed in 2023, consistent with current Northeast Region Coordinating Council and ASMFC assessment schedules (**Briefing Materials**).

Presentations

- Jonah Crab Pre-Assessment Data Workshop Report by D. Perry

Board Actions for Consideration at the Meeting

- Consider initiating a stock assessment for Jonah Crab

7. Consider Development of a Management Strategy Evaluation of the American Lobster Fisheries (3:30-4:00 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)**.
- The Board expressed interest in pursuing an MSE but postponed any action on development of an MSE until the August meeting in order prioritize work on Draft Addendum XXVII.

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: High

Committee Task List
Lobster TC • Summer-Fall 2021: Provide analysis for development of Draft Addendum XXVII • Annual state compliance reports are due August 1 • Annual index data update *Jonah Crab TC* • Summer 2021: Develop recommendations on initiating Jonah crab stock assessment • Annual state compliance reports are due August 1

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)

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

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

AMERICAN LOBSTER MANAGEMENT BOARD

Webinar
May 3, 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
May 2021

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INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Approval of proceedings from February 2, 2021** by consent (Page 1).

3. **Move to postpone the development of a management strategy evaluation until the August 2021 meeting** (Page 7). Motion by Pat Keliher; second by Joe Cimino. Motion carried (Page 11).

4. **Main Motion**
   Move to initiate an addendum to develop objectives for collecting high resolution spatial data, identify technological solutions, and develop system requirements (Page 42). Motion by Allison Murphy; second by Cheri Patterson.. Motion Withdrawn (Page 50).

   Motion to Substitute
   Move to substitute to recommend to the Policy Board that a letter be written to NOAA Fisheries recommending the prioritization of federal rulemaking to require the use of cellular-based or satellite-based vessel tracking devices in the federal lobster and Jonah crab fishery. Include in the letter the Lobster Board's willingness to establish a technical workgroup to support NOAA's efforts on vessel tracking (Page 44). Motion by Pat Keliher; second by Dave Borden. Motion withdrawn (Page 50).

5. **Move that the Lobster Board create a technical working group that includes NOAA, Law Enforcement representatives and members of the Board to develop objectives, technical solutions, and system characteristics for vessel tracking devices in the federal lobster and Jonah crab fisheries, and report back to this Board at the August meeting** (Page 50). Motion by Pat Keliher; second by Mike Luisi. Motion carried by consent (Page 51).

6. **Move to adjourn** by consent (Page 51).

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)
Rep. Sarah Peake, MA (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)
Jim Gilmore, NY (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)
Russell Dize, MD (GA)
Shanna Madsen, 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
Delayne Brown, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Maya Drzewicki
Kristen Anstead
Lindsey Aubart
Pat Campfield
Emilie Franke
Chris Jacobs
Jeff Kipp
Laura Leach
Dustin Colson Leaning
Savannah Lewis
Kirby Rootes-Murdy
Sarah Murray
Joe Myers
Mike Rinaldi
Julie Defilippi Simpson
Caitlin Starks
Deke Tompkins
Geoff White

Guests

Karen Abrams, NOAA
John Almeida, NOAA
Bill Anderson, MD (AA)
Max Appelman, NOAA
Pat Augustine, Coram, NY
Joe Ballenger, SC DNR
Fred Bever, Maine Public Radio
Jeff Brust, NJ DEP
Joshua Carloni, NH F&G
Barry Clifford, NOAA
Colleen Coogan, NOAA
Heather Corbett, NJ DEP
Jessica Daher, NJ DEP
William DeVoe, ME DMR
Kurt Doherty
Aubrey Ellertson, CFR Foundation
G. Warren Elliott, PA (LA)

Guests (continued)

Catherine Fede, NYS DEC
Lynn Fegley, MD DNR
Jack Fullmer
Angela Giuliano, MD DNR
Pat Geer, VMRC
Amelia Harrington, Univ. ME
Heidi Henninger, Offshore Lobster
Jay Hermsen, NOAA
Asm. Eric Houghtaling, NJ (LA)
Carl Lemire, NOAA
Tom Little, Ofc. Asm. Houghtaling
Charles Lynch, NOAA
John Maniscalco, NYS DEC
Kim McKown, NYS DEC
Conor McManus, RI DEM
Nichola Meserve, MA DMF
Wendy Morrison, NOAA
Brandon Muffley, MAFMC
Jeff Nichols, ME DMR
Scott Olszewski, RI DEM
Derek Orner, NOAA
Penelope Overton, Press Herald
Chad Pfeiffer
Nick Popoff, FL FWS
Jason Rock, NC DENR
Bill Semrau, NOAA
Burton Shank, NOAA
Melissa Smith, ME DMR
Somers Smott, VMRC
David Stormer, DE DMF
Jason Surma, Woods Hole Group
Stephanie Sykes, CapeCodFishermen
Megan Ware, VMRC
Anna Webb, MA DMF
Craig Weedon MD DNR
Meredith Whitten, NC DENR
Chris Wright, NMFS
Renee Zobel, NH F&G

The American Lobster Management Board of the Atlantic States Marine Fisheries Commission convened via webinar; Monday, May 3, 2021, and was called to order at 1:00 p.m. by Chair Daniel McKiernan.

CALL TO ORDER

CHAIR DANIEL McKIERNAN: Good afternoon everyone. This is the American Lobster Management Board, the first meeting of the spring meeting of the Atlantic States Marine Fisheries Commission. My name is Dan McKiernan; I am the Administrative Commissioner from the Commonwealth of Massachusetts.

APPROVAL OF AGENDA

CHAIR McKIERNAN: First on our agenda is to approve the agenda. Is there any objection to the agenda as drafted and submitted to you in the materials? Raise your hand if anyone would like to modify the agenda. Any hands, Toni?

MS. TONI KERNS: No hands, Dan.

CHAIR McKIERNAN: All right, hearing none it is approved by consent.

APPROVAL OF PROCEEDINGS

CHAIR McKIERNAN: Next is approval of the proceedings from the February, 2021 meeting. Are there any objections to the proceedings as drafted, please raise your hand?

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

CHAIR McKIERNAN: I'll assume it is approved by unanimous consent.

PUBLIC COMMENT

CHAIR McKIERNAN: Next is public comment. Toni, usually folks sign up physically with a pen and a clipboard. Has anyone from the public reached out to you or the Commission to speak as a member of the public on any issues that are not on today's agenda?

MS. KERNS: Not that I'm aware of. I'll double-check with Caitlin, and if there is somebody that wants to speak, they can always raise their hand.

CHAIR McKIERNAN: Okay, why don't we give that a few seconds?

MS. KERNS: I am not seeing any hands.

CHAIR McKIERNAN: Sounds good.

CONSIDER TECHNICAL COMMITTEE RECOMMENDATION ON MANAGEMENT STRATEGY EVALUATION OPTIONS FOR GULF OF MAINE/GEORGES BANK RESILIENCY AND SOUTHERN NEW ENGLAND AMERICAN LOBSTER FISHERIES

CHAIR McKIERNAN: All right, next on the agenda we are going to consider Technical Committee recommendation on MSE, Management Strategy Evaluation Options for the Gulf of Maine/Georges Bank and Southern New England American Lobster fisheries. This is a follow up to the February, 2021 meeting, when the Board agreed to proceed with an MSE, or at least in the planning of one.

They tasked the Technical Committee to identify timelines and cost estimates for developing an MSE for both stocks, with several potential focal areas, including recommendations from the Southern New England stock assessment. That's in the briefing materials. I think at this time we have a presentation from Kathleen Reardon, unless Caitlin wants to add anything at this time.

MS. CAITLIN STARKS: No, I think Kathleen can go ahead. She'll probably cover all the background. Thanks.

CHAIR McKIERNAN: Great, okay so Kathleen Reardon.

MS. KATHLEEN REARDON: As you already described, this is an update to the conversation that was started at the winter board meeting. At the winter board meeting, Jeff Kipp presented an introduction to the Management Strategy Evaluation process, after the Management and Science Committee recommended

that the Gulf of Maine/Georges Bank stock was a lobster priority species for this process.

The Board started to discuss the utility of this tool for the Gulf of Maine/Georges Bank stock, but was also asked about Southern New England stock. At this point, the Board tasked the TC to prioritize options, develop timelines, and draft budgets to assist the Board in considering the Management and Science recommendation for use of MSE for lobster management.

As a reminder, this slide gives an overview of the process, including the people involved and the original steps taken in the MSE process. This includes the initiation of an MSE, where stakeholders and managers must identify the objectives, metrics, uncertainties, and potential management to be considered.

Then scientists evaluate the data available, including both biological and economic metrics, then create models and simulations to evaluate those objectives and strategies. Then the stakeholders review those results. The process from objectives to models to review should be an iterative process, but it requires engagement from stakeholder managers to work with the scientists to produce usable options for management that achieve the objectives at the end.

To do this, the Lobster Technical Committee met via two webinars to prioritize and develop the next step for the options for MSE. The Lobster Technical Committee determined that while MSE has the potential for supporting management framework for Southern New England, the Southern New England stock is a lower priority for MSE. This was for several reasons.

The MSE process is meant to be a proactive tool to evaluate potential management to achieve sustainable objectives, and not to produce reactive strategies to current or past stock condition. Additionally, the scale of the Southern New England lobster stock and industry is much smaller, in terms of fleet size and landings, as compared to the Gulf of Maine/Georges Bank stock.

The impact of an MSE would have less power, in terms of investment and management outcomes. The Technical Committee discussed that the approach to Southern New England, we would anticipate unique challenges that would likely require new data collection and modeling tools to address how the fishery has responded to climate change, and to better understand the dynamics of the mixed crustacean fishery. This would require customized model development and data collection on the stock level. On the other hand, the Technical Committee recommended that the Gulf of Maine/Georges Bank stock is the highest priority for a Management Strategy Evaluation. To approach the Gulf of Maine/Georges Bank stock, the TC recommended a two-phased approach.

The first phase would focus on stock levels models to provide an intermediate MSE at a coarser spatial resolution that could be used to support a management framework in a relatively short timeframe, while allowing time to build knowledge and tools to develop a subsequent spatially explicit MSE in Phase 2.

This phased approach could provide short term management guidance, while concurrently providing opportunity to build the framework and expand to a spatially explicit approach over a longer time period. The extended timeframe may also allow several large-scale changes that we see on the horizon for the lobster fishery that could impact the lobster fishery and management goals, to develop and thus better guide the cost and focus of incorporating spatial considerations explicitly into the MSE.

To get into more detail of the Gulf of Maine/Georges Bank option, the purpose of Phase 1 would be to evaluate the performance of management strategies, in response to changes in recruitment with biological fishery and socio-economic performance metrics. We anticipate this would take about three years, and include the Lobster TC, ASMFC staff, Board members, stakeholders, a biological modeler and an economic

modeler, and a professional facilitator. The estimated budget would be $285,000.00.

In thinking about the timing of this process, there are some parallel efforts to consider that would contribute to Phase 1 within the next year. Yong Chen of University of Maine, has submitted a proposal to the National Sea Grant to develop population dynamic simulations, and incorporate environmental effects.

If funded this modeling effort would contribute and provide some of the biological modeling framework within the MSE. Secondly, NOAA Fisheries has initiated and funded a post doc to initiate the conceptualization of an economic model in the economic data collection. This would support development of an economic model within the MSE modeling framework.

In Phase 2, the purpose would be to evaluate the performance of spatially directed management strategies triggered by external forces. The second phase allows for the development and consideration of external drivers like climate change, whale interactions, and offshore wind development. The TC determined that much of the framework and budget, data and modeling requirements would need to be fleshed out and developed during Phase 1.

For more details on the Southern New England option, the Technical Committee recommended the evaluation of performance would need to start with a spatially directed management strategy, in response to changes in the recruitment and diversification of the fishery, with biological fishery and socio-economic performance metrics. At minimum, this effort would take five years and cost around $750,000.00. But this may be a low estimate, as we anticipate there may be additional cost, dependent on stakeholder objectives. It is possible we could learn how to approach these issues within the two-phase Gulf of Maine/Georges Bank MSEs, but the Technical Committee recognizes the dynamics within the biology and socio-economics can be different, quite different between the two fisheries. The TC indicated, due to the highly interdisciplinary nature of an MSE process, additional perspectives are needed to provide a comprehensive work plan for the second phase and spatially directed management strategies.

It is also important to recognize that these options currently assume the availability of ASMFC staff and TC members required to do this work. Stakeholder engagement outside the proposed meetings is likely going to be necessary for a successful MSE. With this in mind, staff time may need to be prioritized or modified to accommodate the MSE workload. Some of the competing issues at hand identified by the TC were stock assessments for Jonah crab and lobster, and also whale interactions.

While the TC recognizes that there are uncertainties in these options, we did make some recommendations for next steps. First, we need to develop a formal process to identify the goals and objectives for a future lobster fishery, with stakeholder and Board member input. An example of this is the Ecosystems Management Objectives Workshop, conducted by the Commission to guide ecological reference points for Atlantic menhaden.

Objectives developed from this process would be used to further develop the work plan for lobster. Secondly, the TC recommends the formation of a Steering Committee to complete additional scoping and development of a comprehensive work plan, including outreach with stakeholders to identify funding, and personnel necessary for the effort. Outreach efforts with organizations and fishing associations are not anticipated to incur a high cost, but are imperative for the success of the MSE.

The Steering Committee would include reps from the Board, industry stakeholders, Technical Committee members, ASMFC staff, Committee on Economics and Social Sciences, and the Assessment and Science Committee. It is important to include some people on the Steering Committee that have had past experience with MSEs, and ideally it would be around a dozen people. The next slide, this is my last one, thank you for your attention, and I am happy to take questions.

CHAIR McKIERNAN: Kathleen, this is Dan. I just have a couple of questions to start. Is the U Maine application for the Sea Grant funds, is that already in the pipeline? Is it necessary for the Commission or the Board to send a letter of support for that proposal?

MS. REARDON: As far as I know, it has already been submitted. I am not sure. I assume that there may have been a letter of support, but Caitlin or Toni might know better on that one.

CHAIR McKIERNAN: Okay.

MS. STARKS: I believe Jeff Kipp is a Co-PI on that project, and therefore ASMFC couldn't submit a letter of report, but yes, the proposal has already been submitted.

CHAIR McKIERNAN: It sounds like Sea Grant would be well aware that this would be an ASMFC endorsed work product, so that sounds good. Then my second question on the funding level for this Gulf of Maine/Georges Bank MSE. Would that be funded by the Commission, or would the Commission be looking for contributions from the states? I guess that's a question for Bob and Toni, maybe.

MS. KERNS: Go ahead, Bob.

EXECUTIVE DIRECTOR ROBERT E. BEAL: Dan, we haven't included that cost in our budget for this year. It's kind of a strange year, and we're not traveling as much as we thought, and we may have some funds available toward the end of the year, so we can. But then there is the decision if there are funds left over because we're not traveling.

Is this MSE the highest priority for those funds, or is something else in the Commission a higher priority? There may be a way to fund it from within the Commission. We just have to go through the process to decide through the Executive Committee if that is the priority, if we have the money available.

CHAIR McKIERNAN: Thanks, Bob. All right, why don't we open it up to questions from members of the Board. Raise your hand if you would like to ask any questions.

MS. KERNS: David Borden, Dan.

CHAIR McKIERNAN: Go ahead, David.

MR. DAVID V. BORDEN: As I said at the last meeting, I'm a supporter of MSE. I think it's a good idea. We should use the latest technology to try to manage one of our most important resources. Having said that, I'm struggling a little bit on the issue of the timing. The way I understand the presentation, it would take three years to develop an MSE.

Then at that point the Commission would if need be, start an addendum to implement components of the MSE. I'm now kind of thinking about what we're going to get into in a subsequent agenda item, relative to the Resiliency Amendment, and then the triggers. Is it envisioned that we would develop triggers as part of the MSE output, or are these two entirely separate? I'm a little confused.

CHAIR McKIERNAN: Caitlin, would you like to take a crack at that with Kathleen assisting?

MS. STARKS: Sure. I guess in my mind I see them as separate. The Addendum from what I understand from the Board discussions, is intended to be a short-term action to have management measures that are ready to go if things change for the worse in the next few years. My understanding was the Board wanted to get this Addendum done quickly.

Whereas, the MSE process is a long one as you mentioned. It would take several years to get to the end of the MSE, and then potentially longer to implement any management actions to address the MSE recommendations. I see that more as a long-term process that is asking, in the long term what are the goals of the fishery, and how do you accomplish those goals, given things like climate change or other components that can be put into the models in the

MSE. I guess I don't see the Addendum as being something that would come afterwards.

CHAIR McKIERNAN: David, are you good with that answer?

MR. BORDEN: I'm still a little confused, Mr. Chairman, it may just be me, so you may want to call on someone else. It almost seems like we should have an effort that is focused on resiliency, and that the trigger should be part of the MSE action that comes out of that. Maybe it's just my poor understanding of it. I suggest you call on someone else.

MS. KERNS: Dan, Pat Keliher had his hand up, and then Jason McNamee.

CHAIR McKiernan: Great, okay Pat Keliher.

MR. PATRICK C. KELIHER: First I want to thank Kathleen for that presentation, and I appreciate the fact that the TC has gone ahead and prioritized Gulf of Maine and Southern New England, and put together a budget. I do think, considering the size of that budget, I would think that the Executive Committee is going to need to spend some time thinking about that type of cost associated with this type of work. We have not done so to date.

I'm also concerned about the time that it's going to take and the potential speed of any decline that we might have. I would hate to be in the middle of an MSE process, spending a tremendous amount of resources, both from a staff perspective and industry perspective going forward, only to find that we're playing catch up constantly.

People around the table lived that with Southern New England. It seems to me we do need to finalize the Resiliency Addendum first, before we really undertake an MSE strategy, in order to develop things going forward. If there is decline in that time, we've got triggers. To David Borden's point, I think we need those triggers now, in case we, well not in case. We're starting to see some soft trends now, based on ventless trap and settlement, and we certainly saw a decline in landings last year. At this point, Mr. Chairman, I think I'm ready to make a motion to postpone. But I'll hold that motion until you take more comments, if that would be better.

CHAIR McKIERNAN: Yes, let's hear from Jason McNamee.

DR. JASON McNAMEE: I think what I'm about to say is in support of what Caitlin offered, and I think also aligns with what Pat just said, and what David was wondering about. I don't see any reason why we couldn't move forward with the Resiliency work, in the sequence about whether it needs to be solidly first, and then move forward with the MSE, or if there could be some overlap.

But there is no reason why that couldn't happen, and then I can't remember who exactly said this, but you know you get the triggers are kind of built under our normal paradigm of just kind of working through some different options, and doing a little math on them, and putting them through the normal management process for approval. Those can then feed into the MSE as options, so we can kind of put them in place. We use our best judgment, thinking that they will be effective in some way, shape or form, and then we can test that in the MSE.

I think they can go together. One doesn't necessarily have to happen before the other. It sounds like people's comfort would be to move forward to get some of these triggers, and work on these triggers of the Resiliency work, get that moving forward. Then I think you can come in underneath with the MSE work.

Now that I think gets to one of the slides in the presentation from Kathleen, and that is, you know we're talking about the same people over and over again generally. It's going to be some preliminary work to sort of map this out a little bit, and to figure out where we might be able to start with some of the MSE stuff that's being done by external folks, while the folks that are already working as part of the ASMFC as their work on the Resiliency Amendment.

Mapping the workload, I think is a challenge. But long story short, I think it could work okay to have the Resiliency Amendment kind of get going, and then those things can be pulled into the MSE to sort of test their effectiveness relative to the different tradeoffs that we're going to look at.

MS. KERNS: Dan, you have Cheri Patterson.

CHAIR McKIERNAN: Great. All right, Cheri.

MS. CHERI PATTERSON: I agree. I think that the MSE needs to start. I think it sounds like there are some external sources that need to start their work, in order to be feeding some of the information into the MSE, and while we are in the interim period of looking at the Resiliency and the triggers that are needed. I think they both, and I understand that there is a heavy lift. I think they both need to be moving forward. One will definitely feed into the other in the longer term.

CHAIR McKIERNAN: Well, we've heard from the four states that have fisheries in the Gulf of Maine/Georges Bank. Is there anyone else on the Board of any other members of those delegations that want to comment or ask questions? No hands?

MS. KERNS: No hands, Dan.

CHAIR McKIERNAN: I actually heard some conflicting things. I thought I heard Pat Keliher suggest the MSE, we might pump the brakes on it. Whereas, I heard Cheri say let's go forward with it, and I heard Jason say let's move forward with. Well, we're going to talk about that next, the Addendum XXVII on Resiliency, because that will fall into place and can be tested in the MSE. I think we need a little more discussion on this. Pat, do you want to weigh in again? I think that so far, I'm not hearing consensus. But maybe I'm misinterpreting some of the comments.

MR. KELIHER: Mr. Chairman, thank you. I heard a little bit of the same, I think in what Cheri was saying that it still is a workload issue from the comments she was making. **I would make a motion to postpone the development of a Management Strategy Evaluation, until the Resiliency Addendum has been completed.** If I get a second, I could speak a little more to it.

CHAIR McKIERNAN: All right, is there a second to Pat's motion?

MS. KERNS: Joe Cimino.

CHAIR McKIERNAN: Okay, thank you Joe. Go ahead, Pat, if you want to speak to your motion.

MR. KELIHER: Yes, I think in postponing, it certainly is not my intent to kick the can down the road forever here. I think it gives us the time to prioritize the work in front of us on the Resiliency Addendum. As I said earlier, I think we need that Addendum in place with trigger mechanisms in place before we even initiate the development of an MSE in that first phase is upwards of three years long.

I'm also concerned, it's been touched on by several others about the work load that we have in front of us with the Addendum. MSE is also going to take a significant amount of time for the industry to participate, and we all know that their focus is definitely elsewhere right now, you know and that work load goes beyond them to other people within our agencies as well. With that I would urge us to prioritize the Resiliency Addendum and postpone until we finalize it.

CHAIR McKIERNAN: Okay Pat, thanks, is there anyone else who would like to speak in favor of the motion?

MS. KERNS: I don't know if it's in favor or not, but Jason has his hand up.

CHAIR McKIERNAN: Jason.

DR. McNAMEE: I don't know if it's in favor of either. Maybe you can hear me out and decide. You know everything that Pat said I think I am in agreement with. The one thing that gives me hesitation with this

motion is, what I was trying to get at before. I think we should start work on the Resiliency Amendment first, so that is consistent with Pat.

But I don't know that there aren't elements of the MSE that can get started. I don't think we need the Amendment to start, get worked on and finished before we start the MSE, because I think in some elements of the MSE there might be external partners that are doing the work. I would love to see. You know I have concerns about work load as well.

I would love to see a map of how this could work in the most, try and optimize this a little bit. Figure out what we can get done for the MSE, while the ASMFC folks are working on the Amendment. I would hate to just delay this to the conclusion of the Amendment if we don't have to. I guess that's my point.

CHAIR McKIERNAN: I have a question, maybe back to Kathleen and the U Maine proposal to Sea Grant. Do you think the funding of that is contingent upon this Board embarking or reaffirming its commitment to do an MSE?

MS. REARDON: I don't think I can answer that question. The National Sea Grant, I believe that Review Panel is probably independent of this process, I would guess.

CHAIR McKIERNAN: I guess this is a chicken and egg challenge here, because next on our agenda we're going to talk about the development of Draft Addendum XXVII, and I'm trying to figure out timing, because if we come back. I don't want to jump the gun here, but if it's a timing issue, and the document is approved by, let's say the August meeting. I kind of doubt we would be able to approve it in time for October, but maybe we're talking February. Then we would be embarking potentially on the MSE. Pat Keliher, is that how you envisioned things developing?

MR. KELIHER: Mr. Chairman, I think it is. I mean my intent here is not to preclude our external partners from doing that work. It's strictly to prioritize our work around the Resiliency Addendum. I'm not trying to put any sort of a gag order on respective staff that has some interaction with those external partners.

I just want to make sure we get the Commission to focus on the Resiliency Addendum in the interim. I feel like it is compatible to what Jason is saying, because I agree with Jason. The intent is not to stop all work on it, it's just to focus the Commission's work, and if we have an opportunity to interact during this period of time with our external partners, we should definitely do so.

CHAIR McKIERNAN: Pat, would you envision that at the meeting when any Draft Addendum XXVII was approved as a final action that the MSE evaluation would also be part of our agenda to then kick-start that?

MR. KELIHER: Yes, I think as soon as we're completed with the Addendum, the next set of work on the prioritization list would be MSE.

CHAIR McKIERNAN: All right, so we're still in discussion about the motion. Is there anyone else who hasn't spoken, or Jason would you like to weigh in?

MS. KERNS: Dan, you have a list of folks, Ali, Cheri, Joe, and David, who are all names. Jason put his hand down, but he did raise it at some point there.

CHAIR McKIERNAN: All right, thank you for that, Toni. Let's go to Ali.

MS. ALLISON MURPHY: I would support this motion. I think you know one of the tradeoffs that I heard mentioned in the discussion of this, either today or last meeting as well is that we might not be able to complete the Jonah crab stock assessment. Correct me if I'm wrong, Mr. Chairman, but I think we are supposed to be getting a report out on some pre-assessment work in August. I think delaying, at least until August, would kind of at least give me a better sense of what that tradeoff is.

CHAIR McKIERNAN: Cheri Patterson.

MS. PATTERSON: I do agree that the Resiliency Addendum should be prioritized, but I really do not like to see that word postpone the development of an MSE, because I think that that needs to continue to be moved forward. I would hate to see any sort of delay in, say this Resiliency Addendum, or even Jonah crab work continue to postpone this MSE.

I wouldn't mind seeing that the Resiliency Addendum be prioritized in this motion, but that the MSE will continue development, whether that be just outlining the steps, determining the outside sources that are going to be producing some information for this and such. But I think it's important to keep this one moving.

CHAIR McKIERNAN: You're opposed to the motion as drafted at this point.

MS. PATTERSON: Correct.

CHAIR McKIERNAN: Joe Cimino.

MR. JOE CIMINO: I guess now, after Jason's comments and the maker's clarifications. I just want to say as seconder on it, I fully agree with what Jason was hoping for, and Pat's acceptance of that this motion does not stop that. I'm still in favor.

CHAIR McKIERNAN: Toni, any other hands?

MS. KERNS: You have David Borden.

CHAIR McKIERNAN: David Borden, go ahead.

MR. BORDEN: I think I'm opposed to this specific language, and having said that I totally support what Pat said when he verbalized it, which was basically that we would prioritize the work on the Resiliency Addendum, and to the extent that we can work on MSE we would allow that process to go forward. I'm supportive of his verbal characterization, but the language here is a little problematic.

CHAIR McKIERNAN: David, do you have any recommended amendments to the language, or would you like to substitute?

MR. BORDEN: No, not at this time, thank you.

CHAIR McKIERNAN: Okay. Toni, anyone else?

MS. KERNS: You now have Pat Keliher and Cheri Patterson.

CHAIR McKIERNAN: Go ahead, Pat.

MR. KELIHER: Yes, Mr. Chairman, I realize the motion belongs to the Board at this point in time, but I think this feels like a little bit of semantics here. What I am trying to do is prioritize. If the seconder agrees to just readjust the language here to say prioritize the Resiliency Addendum over MSE, and just leave it at that. I'm happy to have it go forward that way, and it seems like that might meet everybody's intentions, based on their comments.

CHAIR McKIERNAN: That might be a little too vague, because I think. Help me out, Caitlin. I think the Technical Committee wants us to, or the PDT wants us to develop possibly a Steering Committee, right, coming out of this?

MS. STARKS: Yes, thank you. I think it is a little vague to just say prioritize the Addendum over a Management Strategy Evaluation. I think we would need some more specific guidance as to when you would like the Steering Committee to be formed. Do you want to wait until the Draft Addendum is approved for public comment for us to form a Steering Committee and have that group meet?

Just more detail in what you're envisioning the timeline looking like would be helpful, because I think if you say that we're unclear on what to do, for example between now and the August meeting, in terms of the MSE, because right now the focus is on that Draft Addendum.

CHAIR McKIERNAN: Would it, and I know I'm going to get to Cheri in a minute here. Would it be possible to postpone any vote on this MSE until say the August meeting, when at that time we will likely have a Draft Addendum XXVII, and probably will be able to take the temperature of the Board as to, you know whether the options that are coming out like have Board support.

Then things might fall into place a little better. I think we're all struggling with these two initiatives, and I know those who have been in favor of proceeding are comfortable delineating how they differ. But I still think that there is some sequencing here that is a little confusing. I see Bob Beal put his hands up. Bob, do you want to weigh in as the Executive Director with some guidance?

EXECUTIVE DIRECTOR BEAL: If my hand is up that is not intentional, but since I'm talking, I might as well keep talking. I think maybe postponing until August so you have more information in front of the group is fine. It doesn't delay things very long. You know the MSE is a multi-year project, and waiting a couple months really won't change the course of that very much, and we'll be able to get a lot more information in front of the group.

CHAIR McKIERNAN: Okay, but I still have a live motion up, and I still have some folks who have their hands up. Cheri Patterson.

MS. PATTERSON: I'm for what you just indicated. I'm okay with delaying this particular vote until the August meeting, when we get some more information on how far the Resiliency Addendum has moved forward.

CHAIR McKIERNAN: Is there anyone else, Toni? Do we have Emerson and Adam with their hands up, or no?

MS. KERNS: No, I don't have any of those hands up, I just see Pat's hand up still, but he took it down, so I think that was left over from before. No hands.

CHAIR McKIERNAN: I have a motion. Do we need to vote this motion up or down, given that there is some support building for maybe just a one-meeting postponement, as maybe a friendly amendment?

MS. KERNS: If that is the agreement of the Board to postpone to the August meeting, we might want to write that into the motion if Pat is open to that, and if not then we can bring the motion back, if it's the Board's intent to bring the motion back at the meeting, they can vote it back to the table.

CHAIR McKIERNAN: Do we need a motion to table then, if we're not going to vote on this, or to postpone until August? Is that a separate motion that we need, Toni?

MS. KERNS: No, just to bring it back to the meeting, since there is no time certain here. We would need to vote it back to the table at the August meeting.

CHAIR McKIERNAN: But how do we get this from being a live motion, do we just get consensus from all the Board members?

MS. KERNS: You can vote the motion up or down, and there is just no time certain to when, I mean it's just until the completion of the Resiliency Addendum. If somebody wants to bring it back up at the August meeting then they can bring it then.

CHAIR McKIERNAN: Yes, well the reason I am looking at this motion and I see until completion of the Resiliency Addendum, which Pat and I just mapped out may not be until February of 2022. If we want to continue conversations about the MSE in August or in October, that would prevent it from coming up, right?

MS. KERNS: The Board could discuss it, but Pat has his hand up, and then David and then Ritchie.

CHAIR McKIERNAN: Go ahead, Pat Keliher.

MR. KELIHER: Yes, if my seconder would agree to this small change, we could move to postpone the development of a Management Strategy Evaluation until the August meeting. That pushes it off to the

next meeting, and then we can revisit the issue and figure out which direction we want to go in.

CHAIR McKIERNAN: Okay, thanks. Ritchie, we haven't heard from you yet, Ritchie White.

MS. KERNS: Can we find out if that is okay with Joe?

CHAIR McKIERNAN: Oh, with Joe, okay. Joe, as a seconder, are you good with that?

MR. CIMINO: I do support that, and while I have the microphone, Mr. Chair. At that August meeting, you know Jason McNamee brought up the concept of maybe having this timeline mapped out for how an MSE would proceed. I would hope that perhaps by then we can have something like that.

MS. TINA L. BERGER: Maya, you can make that change to the motion.

MS. KERNS: Dan, just a question to staff on whether or not, you know Jeff or Caitlin. Would that map be able to be created without a Steering Committee, or would you need a Steering Committee to create that map?

MR. JEFF J. KIPP: This is Jeff.

MS. STARKS: This is Caitlin, oh go ahead, Jeff.

MR. KIPP: I can jump and take this one. We did provide a timeline in the memo, and it gives the timeline of our major milestone, being the workshops. That is sort of in there as an initial map. I don't know if folks were interested in seeing more detail, but if they were then yes, we wanted the Steering Committee to be formed to help provide those greater details.

CHAIR McKIERNAN: Okay, but this particular motion simply postpones the development, so there wouldn't be any creation of the Steering Committee if this motion were to pass.

MS. KERNS: That is correct, Dan, I just wanted to make sure that there is an expectation from the Board of what would come in front of them in August.

CHAIR McKIERNAN: Okay. We haven't heard from Ritchie White.

MR. G. RITCHIE WHITE: I was just going to make a motion to change the motion as Pat has already done, thank you.

CHAIR McKIERNAN: All right, so are we comfortable with Pat's motion, which would postpone any new developments, in terms of the creation of a Steering Committee just three months out, and then we would come back with some more discussion, and then at that time we'll ask the creation of a Steering Committee.

MS. KERNS: Mr. Chairman, Joe has his hand up. I don't know if it's a factor from before or not, it was so he no longer has his hand up. I don't see any hands raised.

CHAIR McKIERNAN: Since Jason brought up the issue of mapping out the future. Jason, are you comfortable if we simply pick this up in August, without any developments over the next three months?

DR. McNAMEE: Yes, thank you, Mr. Chair. Yes.

CHAIR McKIERNAN: All right, so why don't we proceed to a vote on this. **Is there any objection to the motion as amended and appearing on the board at this time?**

MS. KERNS: I see no hands, Mr. Chair.

CHAIR McKIERNAN: All right thank you. **Seeing none, it is approved by unanimous consent**.

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

CHAIR McKIERNAN: All right, well we're looking forward to that at the August meeting, because

obviously the next item on the agenda is the one that I think the Board is trying to prioritize and develop on a quicker timeframe, and that is Update Draft Addendum XXVII on the Gulf of Maine/Georges Bank Resiliency. Clearly this is something some of the Board members want quicker than the three to five-year timeline. At this time, there is a presentation by Caitlin, I believe.

MS. STARKS: Yes. All right, just want to make sure everyone can see the slide.

CHAIR McKIERNAN: Yes.

MS. STARKS: Great. All right, this is Caitlin Starks, the FMP Coordinator for Lobster. I'm going to give a presentation on the development of Draft Addendum XXVII, which is on Resiliency of the Gulf of Maine and Georges Bank stock. In the presentation today I'll just be covering some background information on the action, go over the draft timeline for the action's development.

I'll briefly review the new abundance reference points from the 2020 assessment, as they pertain to this discussion, as well as the current management measures. Then I'll summarize some considerations for the Addendum that were raised by the Technical Committee, highlight some areas where the Plan Development Team has requested guidance from the Board.

Then finally I'll go over the Plan Development Team's recommendations for draft management options. Draft Addendum XXVII was originally initiated in August, 2017. The Board at that meeting received a report from the Gulf of Maine and Georges Bank Subcommittee, which was established to discuss future management of the stock, given changing ocean conditions.

The Committee highlighted some concerns about decreasing trends in Maine's larval settlement survey over recent years, and that those trends might be foreshadowing future declines in recruitment and landings. As a result of that report, and the Committee recommendation, the Board initiated Draft Addendum XXVII to increase the resiliency of the Gulf of Maine and Georges Bank stock, by considering uniform management measures across the stock.

However, following the initiation of the Addendum, work on the Atlantic right whale issues became the Board's highest priority, and efforts on the draft addendum were stalled. Then in February, '21, this year, the Board reinitiated work on this addendum after receiving the 2020 stock assessment results.

As I mentioned on that last slide, prior to February, 2021, the focus of the draft addendum was on standardization of management measures across the LCMAs in the Gulf of Maine and Georges Bank stock to resolve differences in measures that would allow some lobsters to be protected in one LCMA, but harvested in another. The five areas that were recommended by the PDT to consider standardizing were the V-notch definition and requirements, minimum gauge and vent size, maximum gauge size, whether tags issue for trap tag losses should be issued before or after the trap loss occurs, and finally whether these regulatory changes would apply throughout LCMA 3 or just to the Gulf of Maine and Georges Bank portion of LCMA 3.

In February the Board made this motion on the screen to reinitiate PDT and TC work on the Gulf of Maine Resiliency Addendum. The Board specified that the Addendum should focus on a trigger mechanism, such that upon reaching the trigger measures would automatically be implemented to improve the biological resiliency of the Gulf of Maine and Georges Bank stock.

That changed the focus a little bit from standardization. This is the proposed timeline for the development of the Draft Addendum, and as I mentioned work was reinitiated in February, and since then the PDT and TC have met several times each to work on developing the draft management options, and think about that trigger mechanism.

At this meeting today the goal is to review the recommendations from those groups, and get input from the Board to guide the development of the document. Then after this meeting over the summer, the PDT and TC will work to prepare the draft addendum document, and the plan is to present that document to the Board at the August meeting for consideration for public comment.

If approved for public comment in August, public hearings could take place in late August or early September, and the Board would then be able to meet to consider the Addendum for final approval in October. Now because these are relevant to the discussion today, I just want to briefly review the abundance reference points that were approved following the 2020 assessment.

The Board adopted three reference points for the Gulf of Maine and Georges Bank stock, based on the assessment and peer review recommendations, and those are fishery/industry target, an abundance limit, and an abundance threshold. As a reminder, these reference points were developed using a new methodology that accounts for a changing environmental regime. The fishery industry target is the highest reference point, and that is calculated as the 25th percentile of the high abundance regime.

Below that level the stock's ability to replenish itself is not considered diminished or jeopardized, but falling below this reference point just represents moving towards the lowest levels of abundance during the current abundance regime. Next is the abundance limit, and that is calculated as the median of the moderate abundance regime, and below this limit is where the stock abundance is considered depleted, and the stock's ability to replenish itself is diminished.

Then lastly, the abundance threshold is the lowest reference point, and that is equal to the average of the three highest years of the low abundance regime, and below this level the stock abundance is considered significantly depleted and in danger of stock collapse. Here is a visual for these three reference points and where they fall on the Gulf of Maine and Georges Bank model abundance curves. The dotted line at the top is the fishery industry target, the dash line is the abundance limit, and the solid line at the bottom is the abundance threshold. The black dot on the right represents the average abundance from 2016 to 2018, which is what was used to make the stock status determination. As you can see, above the fishery/industry target the highest reference point. I'll just also note here that the three gray areas are the different abundance regimes. Since we'll also be talking about some of the measures today, I just wanted to quickly remind everyone of what those are for each area.

I just wanted to put these up on the screen, and most importantly, well these are just the areas within the Gulf of Maine and Georges Bank stock. I think the most important thing is to just make note of the differences in a minimum gauge size and vent sizes across the areas, the differences in the V-notch definitions and requirements, and the differences across areas and maximum gauge size, as well as differences within the outer Cape Cod area for state and federal waters.

Now I'll just go over some of the key takeaways from the Technical Committee discussions on the Addendum and, in particular, the TC thought about and offered their advice to the PDT on indices that could be used to establish triggers for management measures. The levels are conditions that could be used to define those triggers, and the types of management measures that could be used to increase biological resiliency.

On the triggers, the TC discussed the pros and cons of various data streams that could be used to establish those triggers. They ultimately agreed that the abundance indices that will be updated annually during the data update process that was recommended by the Stock Assessment Subcommittee would be the most appropriate to use for index-based triggers.

These include the Maine and New Hampshire Trawl Survey, the Massachusetts Trawl Survey, and the Ventless Trap Survey Indicators. The TC specified that the indices specifically for a pre-recruit abundance would be preferred for both the Trawl and VTS Surveys, because looking at those sublegal sizes can provide a forewarning for future trends in spawning stock biomass.

For the trawl survey, the recommendation would be to combine the Maine and New Hampshire Survey and the Massachusetts Survey data into single indices by season, and constrain those to the survey provided strata, and specifically for sizes from 71 to 80 millimeter and sexes aggregated.

Then for the Ventless Trawl Survey it's noted that while the time series is shorter, and the focus is more on the inshore areas versus offshore, the Technical Committee still agreed that it should be considered as an index for establishing triggers. They also reviewed correlation analysis from the stock assessment, and noted that there is a relationship between those trawl indices and the model abundance, which is supported by using those indices for a trigger mechanism.

The Technical Committee also discussed the idea of you could establish a trigger based on the model abundance from the assessment, but they noted that this approach has a drawback in that it wouldn't allow management responses to be as timely, since the action could only be triggered if there is an assessment. Therefore, they suggested that it might be appropriate to have multiple triggers with one being based on indices, and one being based on model abundance. As for how those trigger levels should be defined. The Technical Committee agreed that they should be related at least to the assessment model outputs and the abundance reference points adopted by the Board. The two relevant reference points that were discussed were the fishery industry target, which is that highest reference point, and a trigger level that is linked to this reference point on a scale of very proactive or conservative to not so active, would be more on the proactive end of the spectrum.

The abundance limit is the point again at which the stock is considered depleted. Having a trigger level associated with that reference point would be a more reactive than proactive management choice. If the trigger mechanism is based on survey indices, the Technical Committee suggested that the trigger point could be defined using a rate of change approach.

For example, this could be something like if the medium rate of change over three years is negative 10 percent that would trigger the management measures. In this approach the TC recommends using a running median to smooth out annual variation, and also to better identify declining trends as opposed to an average.

The TC also discussed possibly basing the rate of decline on the trends that were observed in the Southern New England indices around the time of the stock collapse. But further exploration would be needed to come up with that relationship to define that rate of change. Then lastly, the Technical Committee felt it would be important to incorporate the overall magnitude of decline, as opposed to just saying a certain number of years of decline.

Specifically, they suggested defining a magnitude of decline that would approximate the abundance falling from current levels to one of the reference points. To give you an example of what the TC needs with that last suggestion. If we assume that the current abundance is equal to the three-year average abundance for the terminal years of the assessment, which is that black dot, and the level of abundance we want to approximate with the index-based trigger is the abundance limits.

Then we would take the distance between those two points, and figure out what the percent decline is, and use that magnitude of decline in the index as the trigger for management measures. The TC may need to do some additional analysis to figure out what that relationship is between the model abundance and the indices, but this gives you a general idea of what they

mean. Then lastly, the Technical Committee discussed the types of management measures that are most appropriate for the goal of increasing biological resiliency.

Overall, they agreed that increasing the minimum gauge size is expected to have the biggest impact on stock resiliency, by allowing more individuals in the population to reproduce, even with relatively small changes to the minimum gauge size. They noted that when you increase the minimum gauge size, that is expected to marginally decrease the number of lobsters landed, but that the total weight of landings would likely increase.

They also agreed that vent size changes should be consistent with changes in the minimum gauge size. Then for maximum gauge size, the TC commented that changes do have the potential to provide increased stock resiliency, but that the effects are less certain, especially offshore where there is less data available. They noted that for maximum gauge size, minor changes are also less likely to have a big impact, because inshore where most of the landings are from, the size structure of the population is also truncated such that there aren't many large lobster individuals being caught. During these discussions the Technical Committee reviewed the gauge size analysis that was done previously for this Addendum, before it was held up.

They acknowledged that while the inshore data were fairly comprehensive for that the data available for Area 3 that were used in that analysis were quite limited, so the Technical Committee is planning to update the analysis, include some more recent data that have become available since the 2015 assessment on discards in Area 3.

With those updated analyses they should be able to have a better idea of how gauge size changes would impact the offshore portion of the stock. Before I go into the PDT recommendations and draft management options, I just want to bring some questions to the Board's attention that the PDT and TC have requested feedback on.

Both of these groups have expressed that without the Board providing them some direction on the goals and objectives of the Addendum, they can't really move forward with developing appropriate management options. The questions they would like the Board to think about as we discuss the Addendum today are, what are the Board's objectives with regards to biological resiliency of the stock?

For example, should draft management options aim to maintain the current levels of abundance and productivity, or if not, then what levels of abundance is the Board aiming to maintain, or are there other goals related to biological resiliency that the Board is hoping to achieve, like broadening the size structure of the stock. Second, how proactively does the Board want to react to changes in the stock?

For example, how much decline is the Board willing to tolerate before implementing measures, and how does the Board want to react to changes in stock indices between assessments. Third, what are the Board's priorities with regard to standardization of measures across LCMAs versus stock resiliency? Is one of these more important than the other? Then lastly, if the Board is looking to standardize measures throughout the Gulf of Maine and Georges Bank stock, what are the goals and purposes of standardizing those measures?

Is the Board most interested in standardization for the purpose of increased resiliency or for improving enforcement, or facilitating stock assessment, addressing supply chain issues, et cetera? If there is more than one objective for standardization, how should they be prioritized? Without having full direction on those questions, the PDT has recommendations about how to structure the management options in the Addendum.

They recommended that the management options be presented in a package structure, where each option that goes out for comment would include a predetermined set of management measures that would be implemented when a defined trigger is met.

The rationale behind this structure is that the measures would then be able to be crafted with specific goals in mind, and relative to the trigger level that they are associated with. Secondly, it reduces the burden on the public to think through all the possible outcomes if there is a number of proposed triggers, and a variety of management measures that are being considered separately. In addition to that, the PDT has recommended options that are not all mutually exclusive, and could be combined with one another to accomplish multiple goals, or allow for different management responses to occur at different trigger points.

As you'll see in the next slide, the different options represent alternative goals, or different levels of precaution. Some options focus more on the standardization of measures, while some focus only on resiliency and increasing resiliency, and some are a balance of both. Then likewise, some of the options are more proactive while others are less proactive.

This is an overview of the five options the PDT has drafted, and in the next slide they'll go into detail on each one. But Option 1 is always the status quo. Option 2 is more focused on the issue of standardization and resiliency, so it would aim to standardize some of the more easily resolved inconsistencies and measures within and between LCMAs.

For that Option 2, those measures would be implemented upon final approval of the Addendum, rather than through a trigger mechanism. Then Option 3 is focused only on resiliency, and it would be to implement LCMA specific measures to increase biological resiliency, upon reaching a defined trigger.

Then Options 4 and 5 are aiming to balance standardization with resiliency, and there are envisions of kind of complementary options, where standardized measures would be implemented by reaching one trigger in Option 4, and another change to measures to increase resiliency being implemented at another trigger under Option 5. As I mentioned, that some of these are not mutually exclusive, and could be combined. That is what the color-coded column on the right is showing, so the options with matching colors can be combined with one another.

I also want to note that for most of these options the PDT has not yet defined specific triggers or management measures, because they are looking for that additional direction from the Board on the goals and objectives, in order to determine what is appropriate. As I go through these, I'll try to highlight where the PDT has made some suggestions for the Board to think about and discuss. All right, so I'll go into a bit of more depth on each option.

Option 1 obviously is straightforward, but status quo would maintain the current management measures, and would not establish any trigger mechanisms. It probably goes without saying, but this cannot be combined with any other option. Option 2 is to implement some standardized measures upon final approval of the Addendum, and there are a few sub-options that determine which standardized measures would go into effect.

Sub-option 2A is that standardized measures would only be implemented where there are existing inconsistencies in measures within an LCMA for state and federal waters in the Gulf of Maine and Georges Bank stock, and they would be standardized to the most conservative existing measures. What that translates to is that the maximum gauge size in outer Cape Cod would be standardized to 6-3/4 of an inch for both state and federal waters, and the V-notch definition and requirement would be standardized to 1/8 of an inch, with or without the setal hairs. Sub-option 2B would add on to that by also standardizing the V-notch requirement across all LCMAs in the Gulf of Maine and Georges Bank stock. This would result in mandatory V-notching for all eggers in LCMA 1, 3, and outer Cape Cod. Then Sub-option 2C adds on further with the option of standardizing regulations across LCMAs, such that there would be no issuance of replacement tags for trap losses before a trap loss occurs. Option 3 focuses on increasing resiliency, and not on standardization.

This option establishes a trigger to implement LCMA specific measures to increase resiliency. The first sub-option is to increase the minimum gauge sizes in each LCMA of the Gulf of Maine and Georges Bank stock by an equivalent amount. Again, the PDT has not determined what the proposed measures would be yet, but as an example for discussion, they put forward increasing the Area 1 minimum gauge size to 3 and 5/16 of an inch.

It is currently at 3 and 1/4 of an inch, and then increasing the Area 3 and outer Cape Cod sizes by an equivalent amount, and the goal being to bring the minimum gauge sizes closer to the size at 50 percent maturity. The second sub-option is to implement those increases to minimum gauge sizes, and also decrease maximum gauge sizes by equivalent amount.

Again, the PDT has not defined those measures yet, as they are still waiting to see more analyses from the TC. Then as a final note, this option could be combined with Option 2, but not with the next few options. As I go through Option 4, it is just important to keep in mind that the PDT has kind of intended Options 4 and 5 to work together.

Option 4 is to implement the standardized measures upon reaching a defined trigger, which we're calling Trigger 1, since it hasn't been defined yet. The idea with this option is that Trigger 1 would be set at a relatively proactive level, compared to the trigger in Option 5, and the measures that would be implemented would standardize the minimum and maximum gauge size and vent size for all LCMAs in the Gulf of Maine and Georges Bank stock.

The PDT has suggested that the trigger could be based on an observed decline in the indices that would approximate falling from the current levels to the fishery industry target abundance reference point. Again, measures haven't been defined, but the PDT offered the example of a standard minimum gauge size of 3-5/16 of an inch, which is closer to the size at 50 percent maturity for Area 1, and a maximum gauge size of 6-1/2 inches, which is a middle-ground size that decreases the maximum size in Area 3, and increases it in Area 1.

Those changes would be expected to provide some level of increased resiliency to the stock. Then there is also a second sub-option under this option that adds on the implementation of any of the measures from Option 2 that were not selected by the Board. The idea here is that if there is not a desire to implement some of those Option 2 measures right away when the Addendum is approved, they could be tied to this trigger instead, so that they would be implemented later.

Then last is Option 5, which could be used independently or combined with Option 4, to add another trigger for management measures that would aim to increase resiliency. Under this option, the first sub-option is to implement a change to the minimum gauge size/vent size, and maximum gauge sizes for all LCMAs in the Gulf of Maine and Georges Bank stock, to increase biological resiliency at the point at which Trigger 2 is reached. Again, Trigger 2 is not defined, but the PDT recommended that that trigger should be set at a lower level of abundance or a higher level of stock concern than Trigger 1, so it would be less proactive. They suggested that either a stock status determination that abundance is near or below the abundance limit reference point, and/or an index-based proxy for that abundance limit, could be potential triggers.

For measures, the PDT said they should include an increase to the minimum gauge size, and a decrease to the maximum gauge size implemented under Option 4. The second sub-option here is that in addition to those measures this trigger could also standardize the V-notch definition to 1/16 of an inch across LCMAs in the stock, and that is as a middle ground between zero tolerance and 1/8 of an inch.

Again, the PDT intended Options 4 and 5 to be combined with Option 2 if desired, but they can't be combined with Option 3.

PROVIDE GUIDANCE TO THE PLAN DEVELOPMENT TEAM ON DRAFT MANAGEMENT OPTIONS

MS. STARKS: For next steps today, the Board will discuss the PDTs recommendations on Draft Addendum XXVII, and provide some guidance back to the PDT on the goals, objectives and priorities, and then also provide any feedback on the Draft Management Option.

Then following today's meeting, then Technical Committee plans to provide additional analysis on the impacts of management measures to the PDT, and the PDT will work on developing the Draft Addendum document, which will be provided to the Board for consideration for public comment at the August, 2021 meeting. That is the end of my presentation, but I figured it might be helpful to bring these discussion questions back up before the Board gets into conversations about the Addendum.

CHAIR McKIERNAN: Thanks, Caitlin, great presentation. Do you want to take questions at this time?

MS. STARKS: Happy to, yes.

CHAIR McKIERNAN: Okay. Raise your hands.

MS. KERNS: Dan, your first question is from Colleen.

CHAIR McKIERNAN: All right, Colleen.

MS. COLLEEN BOUFFARD: Caitlin, thanks for that great presentation. The question I had was, did the PDT have any discussion about what they expect having standardized measures would be on the ability to determine what the response was to different management measures, should they be implemented when a trigger is hit?

MS. STARKS: I don't think the PDT had discussions this time around on that. But in previous PDT discussions, before the Addendum was stalled, I believe that the understanding was that if you have standardized measures in place, it is easier to project impacts and see effects of changing those measures, with the way that the stock assessment uses the data. I think it would facilitate that.

MS. BOUFFARD: Okay thanks, that is what I would have thought.

CHAIR McKIERNAN: Toni, anyone else?

MS. KERNS: No other hands at this moment. Now we have one, Jason McNamee.

CHAIR McKIERNAN: Go ahead, Jason.

DR. McNAMEE: We're still in question mode here, so I was wondering, I think this is for Caitlin. You know some of the approaches, you know with the indices or the abundance, you have these kind of time series of information. I was wondering if the PDT, and I apologize. It seems like some of what I'm about to say was kind of implied with some of the things. But I just want to sort of ask explicitly.

One thing you can do with a time series of information is, you can pick a certain number of points to go back, so say you want the last three years. In particular this is important with things like indices that have variability in them. But you can pick those three points, and then basically put a regression line through them. You can kind of get that this proactive/not proactive concept, where if you did that and you allowed the regression.

If it's positive that means the index is going up, which for the ones we looked at is generally good. If the slope of that regression is negative, then you're getting into a bad spot. But to go from positive to negative takes a couple of data points to kind of drive that regression down. Did the PDT look at anything like that for some of the indices in the abundance information, so using a regression to determine whether things are going in a good or a bad direction?

MS. STARKS: Yes, the Technical Committee did talk about that, and kind of what I was bringing up with the rate of change idea for defining a trigger. I can let

Kathleen give some more detail, perhaps, but it was described by the TC, and I think it is something they are still considering. Kathleen.

MS. REARDON: Sure. We did look at that for ventless trap indices, looking at a regression rather than rate of change. But a regression really depends on the number of years you choose. It's very sensitive, like just adding one more year, it's very sensitive to what that slope might be, looking at some of the information from Southern New England after 1997.

Looking at the rate of change in some of those indices was helpful in looking at kind of magnitude. In that having a kind of smoothed median, you're able to smooth the trend, but looking at the rate of change, I think that the Technical Committee had come to a consensus that that may be a better metric than a regression.

DR. McNAMEE: Great, thank you both very much.

CHAIR McKIERNAN: Kathleen, if I could follow up. Are we talking about using three-year moving averages or not in some of these indices?

MS. REARDON: That actually is a question for the Board. Three years is what we looked at, but I think that we were playing with numbers that were smaller than the integral between assessments, so three or four years, those are the numbers that were thrown out.

MS. KERNS: Mr. Chairman, you have Cheri Patterson and then Sarah Peake.

CHAIR McKIERNAN: Great, all right, Cheri.

MS. PATTERSON: Maybe this kind of relates to, I'm not sure, it relates to what Jay just asked. Looking at standardizing some of these measurements, and I'm talking more about the size of the lobster, the gauge. If we're seeing or concerned about population decreases right now, and now we're talking about possibly standardizing gauge measurements. How can that be mitigated through smoothing effectively, to assure that we're not looking at some sort of change due to the gauge changes and not due to the population concerns?

MS. STARKS: I'll take a first stab at answering that. I guess my first answer is changes to the gauge size would not be implemented until these trends in the indices are observed. Those trends would be unrelated to changes in the gauge size. After that point then yes, you may see some changes. The trends may be affected by increased minimum gauge sizes for example, leaving more lobsters in the population. Before you get to any trigger though, those indices are just coming from environmental effects, since we're not changing measures at all.

MS. PATTERSON: Okay, thank you.

CHAIR McKIERNAN: Sarah Peake.

REPRESENATIVE SARAH PEAK: Thank you, I think my question is somewhat related to Cheri's, and it is regarding the proposal of the standardization of gauge and V-notch measures across the LCMAs. I guess the question is, is the driver for this, or are we doing this because the stock status across Gulf of Maine and Georges Bank is in a similar situation, so that we are required as a management measure to look at gauge size, as a way to rebuild or to keep the stock at a healthy level, or is this driven by a convenience of enforcement?

As this proposes kind of a second part of the question is, as this proposal was being drafted, do we have any data yet as to the actual impact out on the water, in terms of the effects on the, well I'll just say it. The outer Cape lobstermen's haul and what percent of their catch would be impacted by it?

I think those would be important things to know. I will just say editorializing, that I think that between reducing vertical lines in the water, dealing with offshore wind projects that are coming down the pipeline, dealing with COVID-19 and the closure of

most restaurants, and trade deals with Asia having disappeared.

I feel like lobstermen up and down the coastline, have been kicked in the teeth, and through much having nothing to do with their own practices or what our rules and regulations are. I would sound a cautionary note that we take a look at these in a very hard and a very careful manner, to make sure that the unintended result isn't irreparable economic hard that we are perhaps starting the ball rolling on here with our actions. Thank you.

CHAIR McKIERNAN: Thank you, Sarah. Toni, anyone else?

MS. KERNS: We have Jason McNamee.

CHAIR McKIERNAN: Go ahead, Jason.

DR. McNAMEE: Back on the notion of how many years to check for, you know whether it's a regression or their technique that Kathleen was talking about. My question. Kathleen, I think it was you who said, you look back at, maybe it was Caitlin, I'm sorry I just can't remember. You said you looked back at Southern New England, and that kind of drove some of the information you were using for these analyses. I think that's great.

My question is, just kind of drilling into that. Was the proposal of three years driven by that? In other words, would three years have picked up, you know the negative signals in Southern New England, picked them up quicker, and so that's why we're suggesting it here, or am I connecting two things that you all didn't connect?

MS. REARDON: I think I may actually defer to Jeff Kipp on this one, because he did the analysis, and he may be a better person to answer the question.

MR. KIPP: I think the idea of looking to Southern New England was not really being too clear on what rate of change in Gulf of Maine might be troubling. We were thinking of looking to Southern New England as sort of a case study to relate back to Gulf of Maine, if we saw a rate of change in Gulf of Maine indices that was as fast or faster than what we saw in Southern New England during the period of stock collapse.

That that might signal a greater concern, whereas if the rate of change was much less there was a more gradual change, that that might signal concern, but not to as great of a degree. I think that was the idea of looking to Southern New England data.

DR. McNAMEE: Oh, okay I got you, Jeff, so it was about the magnitude of the rate, rather than kind of then connecting that to sort of assemblage of years used. I think I got that, thank you.

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

CHAIR McKIERNAN: Okay, so I am going to beg the Board to have some really substantive conversations now, as much as possible to maybe reach some consensus views on some of these issues, because the PDT, but especially the TC, can get very frustrated with us as a Board when we don't give them clear guidance, and then they do a whole bunch of analyses, and we don't really signal to them where it is we wanted them to go.

The first bullet on the board is objectives with regard to the biological resiliency of the stock. Can we have a conversation about that? I assume that that means, maybe start the conversation by saying, I assume it's to maintain a very large amount of spawning stock biomass, so that should there be an environmental effect, affecting young of the year survival, that there are enough spawners in the years when the environment may swing positive, and we can have a stock going forward.

I'm not sure the Southern New England example, I know that is what is haunting us. But I'm not sure it's going to be replicated in the Gulf of Maine. But clearly, we have seen reductions in young of the year values for the settlement indices. It's starting to show up in the ventless trap survey as 5, 6, 7-year-old

lobsters are now showing a negative trajectory. We need to tell the TC and the PDT what it is we want to achieve with this Biological Resiliency Addendum. Can I get some conversation going on what constitutes success?

MS. KERNS: Dan, you have Pat Keliher, Jason McNamee, Mike Luisi, and Cheri Patterson.

CHAIR McKIERNAN: I'm sorry, so it's Pat, it's Mike Luisi and Cheri.

MS. KERNS: Pat, Jason, Mike, Cheri.

CHAIR McKIERNAN: All right, Pat from the great state of Maine, where 90 percent of the lobsters are landed, please weigh in.

MR. KELIHER: There is obviously a lot here with these questions. I've got pages of notes scattered all over my desk that I wish were a little bit more focused, because I think some of my comments lead into many of the four bullets that are up here. First, I just wanted to say that I appreciate the focus of the TC and the PDT to move away from economics.

I've raised the economic issue several times. All you have to do is look at the volatility, and compare 2012 to what we're seeing for boat prices over the last several months to know that the use of economics as a management tool here, I think would be very complicated. I think we need to focus on the biological side of this issue, and kind of drill down into what we need to do here.

As far as stock resiliency, stock health, how large the stock should remain. I was thinking back on Southern New England again, wasn't at the table at the time. But it seems to me that the management board was always trying to play catch up when it came to putting things in place, and we need to avoid that.

I looked back, and thought a little bit more about the paper that was put out from GMRI in regards to resiliency associated climate change, and Area 1A certainly would have benefited from the many conservation measures that we had in place. In order to continue to see some buffering during a down time, we're going to have to have triggers in place that recognize that we will see a down turn, because the triggers are going to be based.

I'm assuming we're going to end up with triggers that are going to be in the out years here, so we will start to see some level of decline. I realize what that level is really what the question is. I think we need to develop some trigger mechanisms that one, take into consideration a rate of change, and I've been thinking around a 20 percent mark over a three-year period. Then beyond that, I think it's about the regime from high to low. You know we may need a second range or a second level of triggers, as we start to move out of the high to moderate abundance regime that we are currently in now.

I've got some details around that for later, but I think from a goal perspective, we have to recognize that we will see some decline. To what level really becomes the question. I think we can get into that with some details, as it pertains to giving some additional guidance to the PDT.

CHAIR McKIERNAN: When you talk about a 20 percent decline, you're talking about a decline in those annual indices that come to us from ventless trap and trawl surveys.

MR. KELIHER: Yes, exactly.

CHAIR McKIERNAN: Thanks for that. Anyone else? We've got Jason, you're next.

DR. McNAMEE: I think my comments will generally align with what Pat just said. You know as far as the objectives, just to sort of put it in really simple terms, it seems like what we're trying to do is develop a system that allows us to react to changes in the stock, before it gets too late, or before the management that we would need to do would become very severe.

Smaller incremental changes, in the hopes that you know we could get a positive reaction, I think is what

we're trying to achieve here with this potential action. That is kind of potentially not very helpful to the PDT, but that is generally my sense of what we're trying to do, is to create a system that allows for smaller incremental changes when we are witnessing bad signals, rather than kind of letting things develop to a point where whatever it would be that we would need to do, would be really severe and damaging to the industry.

You know that is kind of my general thought on the first bullet there. I'm having a little, I was trying to tease out something to get at the second bullet here. I'll offer a couple of general thoughts about how proactive. I think in general we don't want to chase every little blip in an index, you know indices have variability.

They go up and down in any given year, and so we don't want to chase that single year change necessarily. That kind of gets at this notion of use of a regression, or how many years you might use in these types of analyses. It sounds like you've got to at least a lower bound. I think you would need at least three data points to react to, given the types of things that we're looking at here, and that's what the PDT kind of put forward. I think that's a good starting spot.

We might want to bound that with something a little longer, like I don't know, five data points, probably that might be too many, not reactive enough. But at least kind of guide us a little bit, and give us a sense of the tradeoff, because then what we can do, kind of like a retrospective analysis, so we can go back. Using Southern New England or whatever, and kind of look at oh, it would have taken you three years to react or you would have reacted in a year, you know that kind of thing. I'll park it there for now. Hopefully that gives folks something to think about.

CHAIR McKIERNAN: Mike Luisi.

MR. MICHAEL LUISI: I was just thinking about this, because Southern New England was kind of the basis for, not the basis, but our stock has declined, as we have seen. They are concerned that it's going to move into the Gulf of Maine/Georges Bank stock. I'm just trying to figure out if management action, is it management that is going to help correct, or is out of our control?

It may have been mentioned during the presentation, but I know that in our area down here, you know I'm speaking for Southern New England. (We don't) have any harvesters anymore, but the stock is not growing, because of other environmental conditions. I'm just trying to learn a little bit as to what is happening in, or is there something. Do we think that management can actually, or are we just subject to what is happening as an environmental condition across our area? That is something I was thinking about while the presentation was happening.

CHAIR McKIERNAN: Okay thanks, Mike. We've got some rhetorical questions there, but they are good ones. Cheri.

MS. PATTERSON: I'm leaning towards somewhat what Pat and Jay have indicated. I think, as much as I would like to maintain the current levels of abundance in productivity, I'm wondering if we would be reacting quickly if we were moving in that direction. Whereas, if we looked at a rate of change over a period of three years, to kind of smooth out any bumps. I think we would be able to detect if there were changes that were needed in time or being proactive, I should say, as opposed to five years.

I'm not sure a five-year plan would be proactive enough. Definitely a single year change in anything would be detectable. That would be more of a reactive scenario. We wouldn't really be able to detect whether the changes were actually doing what we wanted them to do. Some parts I agree with Pat. I think we need to look at a rate of change over a period of three years, and 20 percent doesn't seem unreasonable to me.

CHAIR McKIERNAN: Yes, you bring up a good point, Cheri, about statistical significance, and I wonder, like the Ventless Trap Survey values have means and 95 percent confidence intervals. I guess we would want

to make sure that the values were statistically significantly different from the baseline, or from the point that we're declining from.

You know because some of these surveys, especially ventless, they are firm. The funding sources are firm, but it's conceivable that funding levels could change, you know reduced effort might create a higher confidence interval, a larger confidence interval around the mean. I guess that is something for us. But I think the TC can work on that for us.

But I think it's important to give them the feedback. It sounds like the group has, or at least a few of you, have talked about a decline over a three-year period that is at least 20 percent, might be enough to trigger one of these management actions, notwithstanding Mike Luisi's open-ended question about whether or not these are environmentally driven, and may not be able to be controlled. Toni or Caitlin, is there anyone else with their hand up?

MS. KERNS: I think Kathleen wanted to respond to that, Dan.

CHAIR McKIERNAN: Great, go ahead, Kathleen.

MS. REARDON: Thank you for the feedback Board members, but also, we're interested in where those abundance levels are where you want to take action. I think that Pat Keliher started getting at this, where he was thinking the transition between the current high productivity regime and the medium, and I am curious if other Board members are interested in that. I mean it's not just the three-year rate of change, it's rate of change to what level. That is feedback that we need to be able to recommend to the PDT.

CHAIR McKIERNAN: Kathleen, would it be helpful to throw the, there you go, throw that chart up. Thanks. Do you want to repeat those concepts with this image?

MS. REARDON: Sure. The question is, so using for example, these reference points that were approved in the last stock assessment. If we were to have, this is something that we considered within the Technical Committee, that rate of change, like you could have three years that dropped 10 percent each. Cumulatively that would be a 30 percent drop.

Where that falls within these reference points is the question, but you may have a drop from where you are one year, and 30 percent the next year, and then 30 percent the next year. This is where we did look at that magnitude, looking at Southern New England and found that the drops, the rate of change were higher in magnitude than what we have seen in the Gulf of Maine indices.

But we are seeing more years that are dropping in the latter part of the time series for the Gulf of Maine, and so that is where there is concern. For the Southern New England, it was pretty much negative rate of change from, I think it was 1998 forward. But those numbers were lower than what we have seen in Gulf of Maine now.

But the proposal or the question for the Board is, at what level do you want to trigger management? We can look at rate of change, but it's also where is that threshold? Is it the dotted line, which is the fishery industry target? Is it something lower than that like maybe the 25th percentile of the median regime?

This is what we need feedback on, because if you are accepting that management may not be able to keep the population in the current regime at very high levels, then you may want to choose something lower. But if your objective is to stay in the current regime, in the current productivity, action may need to be more aggressive. I think that is what question we struggle with without guidance.

CHAIR McKIERNAN: Kathleen, if I could, that's a great way to present it. But am I right that the indices that we might rely on are not this, because this is an abundance estimate that only comes out every five years? Are you suggesting that first we would have to find where we reside in the abundance level, and then use those parameters that do correlate with stock

size, such as the ventless and the trawl survey annual indices to project where we think we are?

MS. REARDON: This is a question that came up during the peer review of the stock assessment, and so work was done to look at correlations between the model results and the annual indices that we came up with as an annual update for the Board. We think that we can rely on the indices to provide thresholds, that there is enough correlation between that and the model results.

CHAIR McKIERNAN: Is your question, is there a place on this graph that we can comfortably fall to without taking any action, and then once we get to that point and start to decline further, we should take action? Is that kind of the nature of your question?

MS. REARDON: Yes.

CHAIR McKIERNAN: Okay, because you're showing us that we're at a near all-time high, and I guess the implied message here is, is a decline to some lower level acceptable. Then, when should these kick in? Like, should it be a two-step process? First, we believe we're at a lower level of overall abundance, and then with the declining rates, do we need to arrest that with the management action?

MS. REARDON: Yes, and I think that is also where the PDT came up with the two different triggers, where you have one that is proactive that does one thing, and then another that would be later, if the population continued to decrease, then it would be more aggressive in the future, if you were to choose the kind of progressive management tools.

CHAIR McKIERNAN: Okay. Board members, anyone with your hand up?

MS. KERNS: Dan, you have Jason, Pat Keliher, Cheri, and Mike Luisi.

CHAIR McKIERNAN: Great thanks, Jason.

DR. McNAMEE: I hope I'm getting at the right thing here. But I would think under the premise that I noted earlier, that is the idea here would be to develop a system that allows for quicker and less draconian changes. I would think we would want that fishery industry target as, you know I think I'm understanding what Kathleen is saying, is how these things kind of interplay.

You have a late 20 percent decline, and you know that you're going to tip below the dotted line in three years, and we would initiate action based on that. We've got sort of the notion of how proactive do you want to be. Do you want to be within three years, and you've got your rate of decline to sort of get you to that threshold point?

Just to answer directly. I would think again, under the notion of we want to take action before we have to take really draconian action. We would want that higher line to be at least the first. It then seems like a pretty long drop; you know to get to some of these other limits. That might be something to think through. But I'll leave it there and hope that I was starting to get at what the PDT was asking.

CHAIR McKIERNAN: Pat Keliher.

MR. KELIHER: I think this chart, Caitlin could you follow your cursor down? I think you were in control of that, down the abundance line, down to where it crosses in from high into medium, right there. To me that looks like kind of the sweet spot, and maybe even a little below there for a second trigger if the first trigger is based on a 20 percent change over three years.

Then you could think of an abundance trigger that would be triggered somewhere in and around that particular area. I mean it's a further decline. It's still you know, I'm going to bring economics into it, but not for the sake of developing the trigger. But it still is at a time of high economic value for the fishery.

To me, I think it fits what Jason is talking about from the stepwise approach. We could have the PDT

explore those options from an upper limit trigger that is based on the three-years, and then a lower limit based on abundance when you cross from both crossing the median regime into the moderate regime.

CHAIR McKIERNAN: That's a good suggestion. Kathleen, is that the kind of feedback that you're hoping to get?

MS. REARDON: Yes, I think that that is kind of a threshold. The three year, I just want to be clear that the three year is not, okay three years from now we're going to do something. It's three years that show a decline. If we were to choose where the point is right now on the figure, to say that the, I don't know what percentage, decline that is from where we are right now, let's say 40 percent decline. It's not that. That we look at an average over three years to look at the percent or rate of change over three years, and if we have hit.

It's kind of like the status of the stock within the stock assessment. We're always looking at three years, a median of, in the stock assessment I think it's an average of three years, and I think here we're proposing a median of three years, and to figure out where our status is. The question is, okay what is the appropriate amount of years that we need to look at, to look at where our status is? But then what is the threshold of triggering action? Does that make sense?

CHAIR McKIERNAN: I think so. Cheri Patterson.

MS. PATTERSON: I would like to be more conservative than looking at the current area, and leading into the moderate abundance regime. I would prefer to see a threshold further up, so that we will be taking faster action if need be, and in hopes that we could be taking slower proactive actions over a period of time.

I think when we start looking at this, we're going to see that things are going to be triggering pretty quickly for some minor actions to possibly be taken, so that we're not hitting that trigger in a quick fashion. I think we're already seeing decreases, declines. When we're going to be probably taking minor actions before we even hit this trigger.

MS. STARKS: Can I follow up, Mr. Chair?

CHAIR McKIERNAN: Certainly.

MS. STARKS: I just wanted to clarify Cheri's point. Cheri, on the screen right now I put two circles around different kind of thresholds of abundance that the Board is thinking would be good to serve as triggers for management. The first, the higher one would be a more conservative level, like you were just describing, that is the fishery industry target.

We would be estimating reaching that fishery industry target abundance by using an index of a proxy. Then the lower one could potentially be a second trigger, in addition to that first one. They wouldn't necessarily have to be one or the other at final action. Is that kind of consistent with what you're looking for?

MS. PATTERSON: Yes, as well as minor actions even before we hit the fishery industry target, potentially.

MS. STARKS: Just to further clarify, I want to go back to the options that I described earlier. This slide, just so we can think about this as they relate to kind of the draft options that the PDT put together. That second option there, standardizing some measures would be, that group would be something that is not necessarily increasing resiliency, but would be implemented to resolve inconsistencies at the end of final approval.

Then Option 3, I guess we'll think about Option 4. That is the one, where standardized measures would be implemented upon reaching Trigger 1. If you're thinking as Trigger 1 as being a higher level. Is what you're saying you want another option that is to do something to standardize measures even sooner than that?

MS. PATTERSON: If we're detecting a rate of change up at 20 percent over a three-year period of time, yes.

MS. STARKS: Okay. I think I understand, and I think my thoughts, and Kathleen, please feel free to jump in, is that that 20 percent right now is a little arbitrary, because we haven't calculated like what the percentage of decline is that the TC. We can calculate this; it just hasn't been done. But what rate of decline would it take to get to that fishery industry target. I think it's probably more than 20 percent, like you're saying. Okay, we can think about having something in there that is a little more reactive as well.

CHAIR McKIERNAN: Okay, Mike Luisi.

MR. LUISI: I think some of the questions that I had have already been answered, so I'm going to pass at this point, and we can move on.

CHAIR McKIERNAN: Yes, so coming back to Kathleen. I guess as I think about how this actually would be executed, I have a little bit of, I guess nervousness, that we're looking at the estimate of abundance, which does come out of the stock assessment. I just want to make sure that the indices are reliably going to forecast the new abundance if we're between stock assessments. In other words, I see that those two circles that Caitlin put on the screen, and they all look really logical.

I just worry that between stock assessments we're going to be relying on a couple of parameters that I'm not sure how well they actually correlate. Not that I want to kick the can down the road, but I want to make sure that when we do get to that, we feel really confident that yes, it's time to pull the trigger.

MS. KERNS: Dan, you have a couple new hands up, Pat, Ritchie White, David Borden, Tom Fote, you had your hand up, you put it down, and then Jason your hand is up. I don't know if it's a new hand or an old hand.

CHAIR McKIERNAN: Okay, go ahead, Ritchie.

MR. WHITE: Could we put the slide up that shows the triggers, the two circles for the new triggers? Okay yes, thank you. I'm trying to understand how this unfolds. Example: let's say that next year, which we know will not happen, but let's just say that it drops to the first trigger that's circled.

Then we would continue two more years on, to see what the average of that, if that continues to stay at that level. Let's just say it stays at that level. Then that would kick in mandatory change in regulations. How fast then, do those regulations take effect? If it props next year, how many years before new regulations are in place?

MS. STARKS: I guess first I want to clarify that the options as drafted are currently set up in a different way. It wouldn't be that we would get to the first one and then wait to see what happens, and then take management action. It would be at the first trigger; one set of management measures would be implemented at that point.

It would maybe be a less aggressive set of management measures, like Jason McNamee brought up that maybe it would be a minor reaction to try to provide some increased resiliency to the stock at that higher level. Then if you drop even lower to the second one, there is another trigger in place with another set of management measures that would be implemented. Then to answer the second part of the question about how long it takes after you get to that point, I think it depends a little bit on the timing of when that happens.

We're planning to have these annual data updates, probably in the fall around the time that we go through the FMP review. I think it depends on how quickly the states can change their regulations, so I don't know if I am the best person to answer that. But I would guess maybe for the next fishing year, maybe it would have to be one year later.

CHAIR McKIERNAN: David Borden.

MR. BORDEN: In terms, this is a question, and then maybe a comment. In terms of the indices that are being talked about, we're talking about a composite of

the Mass, New Hampshire, Maine Survey, the Federal Survey, and the Ventless Trap Survey. Is that what we would be using for indices?

MS. STARKS: The Maine and New Hampshire Trawl Survey, the Massachusetts Survey and the Ventless Trap Survey.

MR. BORDEN: Okay, and the Maine, New Hampshire, Massachusetts Survey has not, that composite survey. It is an existing survey, but has a composite of it ever been developed? There was some phrase in some of the minutes about Burton would need to work with technical people on the development of that. Is that correct?

MS. STARKS: I think Jeff actually did take a stab at combining those indices already, so we have something that the Technical Committee had looked at. Jeff, if you would like to speak to how much additional work may need to be done, that might be helpful.

MR. BORDEN: Okay, and then the follow up question is, will that have to undergo some kind of peer review, or are we going to just use it based on the technical review?

MS. STARKS: I think the idea was to just use it based on the technical review, and not have a peer review process for that.

MR. BORDEN: Okay, so the comment, Mr. Chairman, I mean I support in general this comment, the concept moving forward. I have some concerns about the timing of it. I just harken back to what I said at the last Board meeting, which basically, and I'll keep this short, is that once you start to manage a declining stock, it becomes much more difficult, because the regulations inflict on the industry, and I'll give you a specific example.

If we wanted to do a gauge increase, and that would have a direct impact of removing, say 6 to 9 percent of the landings due to the gauge increase. If the stock is declining at 7 percent a year, and then you impose that regulation on the industry. It almost doubles the negative economic consequences to the industry.

I think one of the lessons from Southern New England was, we didn't get out ahead of this fast enough, and the time to implement regulations is now, as opposed to when the stock declines. Because if you're really concerned about minimizing the impacts on the industry, then you should make changes now, as opposed to when it declines, they just accumulate and accelerate the negative consequences.

I guess my point in all that, I could see kind of us getting some resiliency out of changes in the regulations by standardizing some of the components of the existing regulations, while we work through the two triggers which are still. I don't know how we're going to develop these two trigger points, and all of the specifics between now and August, I guess is my concern.

CHAIR McKIERNAN: Yes, I hear you. Jason McNamee.

DR. McNAMEE: Sorry, Mr. Chair, my hand was up by accident last time, I put it down.

CHAIR McKIERNAN: Okay, Pat Keliher.

MR. KELIHER: A couple things. I want to just follow up on David's point. I don't have any illusions that we're going to have a document necessarily ready to go out to be approved at the next meeting. However, if we could get to that point, I certainly wouldn't mind that. In general, I would like to see us prioritize stock resiliency over standardization of these measures.

However, I think there are things within standardization that we could do, that would be more immediate upon the approval of an addendum. Right, some of the lower hanging fruit to get at what David is talking about. After time with staff, I'm not sure, depending on how far we go. I'm not sure how much of a buffer that gives us from a resiliency standpoint.

That is something to think about, but certainly from a prioritization standpoint, I would prioritize resiliency over standardization. Again though, with the

understanding that some of those standardizations could be put in place sooner rather than later. Mr. Chairman, if it helps, I did send Caitlin three motions, and I don't want to put this motion up with the intent of making it a motion. But I worked with staff to try to pull some thoughts together around triggers.

I think it might get to what Cheri in particular is talking about, because it would be a stepwise approach. A little birdie is telling me we may be, even at 20 percent we may be very close to that fishery industry target now. We may want to consider something a little bit larger, maybe closer to 30.

I'm not sure, or maybe we need to have a couple ranges, a range of options developed by the PDT. Then maybe something a little bit different when it comes to that lower target. But I did have a motion put together, and if helps clarify things to move us along, maybe Caitlin could put that up on the screen.

CHAIR McKIERNAN: Okay Pat, that sounds good. The other thing while she is doing that that comes to mind for me is, it is 3:15 and I know there is no other ASMFC business scheduled after this meeting, so we can continue this conversation. But I just wonder if some of this could be accomplished by a subcommittee, especially those who have taken a really active part in this discussion, and whose support will be critical to implement some of these going forward.

That is another option, because I'm personally getting a much better understanding now, with Caitlin and Kathleen's detailed explanation. But I do have a concern about the triggers, and how they will work, and not be inadvertently triggered, or not be so slow that they're meaningless. Let's take a look at your motion, Pat.

MR. KELIHER: Yes, and again, I'm not sure if we need to make this as a motion, as long as there is agreement from the states that this seems to be like the right approach. But the idea was to get the PDT to do some further exploration on an upper and a lower trigger. The reason I thought it would be valuable to put this up on the screen, is just to show some examples around minimum gauge sizes within LMA 1.

Again, it would be a stepwise approach. The question would be, is it 20 percent, is it 30 percent? Is that line between the high and moderate regimes the right spot? Does that need to be lower? Maybe those are some of the things that the PDT can help us explore, but this was my intent.

CHAIR McKIERNAN: Any comments from the Board?

MS. STARKS: I just have one note that I'm seeing a difference in what was discussed and what I heard from most of the Board members about the lower trigger being where the change is from the high abundance regime to the low abundance regime, rather than the abundance limit. To Pat's point, I think it would be helpful to have discussion about whether you want us to consider a trigger, as low as the abundance limit or not, or if you would rather have it be higher.

MS. KERNS: You have David Borden, Dan.

CHAIR McKIERNAN: Go ahead, David.

MR. BORDEN: Pat, I know you're not making the motion at this point. But on the 20 percent over three years. If we have three indices that are part of this, all three have to go down by 20 percent, or are you talking about just one going down by 20 percent?

MR. KELIHER: I was thinking of it being cumulative, which could be 20 percent over all. But you know I'm certainly open for that. I'm not sure we should be using just one, just because of variabilities from year to year, so cumulative across the three indices would probably be a better approach.

MR. BORDEN: Okay, thank you.

CHAIR McKIERNAN: Pat, in light of the questions I was asking earlier. Isn't the abundance parameter going

to be forecasted through the use of these time series surveys? The currency will still be, where do we lie on that abundance time series as forecasted by the ventless trap and fishery independent trawl surveys.

MR. KELIHER: I think you're right, Dan. As I'm thinking about it, I mean you would hit the first trigger and then you would be looking at what those forecasts would be, and then to make a determination on how that next trigger would be pulled. Is that what you're saying?

CHAIR McKIERNAN: Yes, just a 20 percent drop in ventless trap, because let's remember, there is ventless trap in Mass, New Hampshire, and Maine, and there could be regional variability. I think it all has to go into, it's like an overall bottle to look at the Gulf of Maine stock. It has to be, I think combined, and maybe Jeff or Kathleen can speak to that. Like what is the vision of how these surveys feed into a model that just spits out a number and shows us where we are in the trend graph, the abundance trend graph.

MS. REARDON: I think I can speak to that, Dan, and Jeff can weigh in if I don't get it all. But already in the last stock assessment, we have a single model for ventless traps that combines the whole region for the Gulf of Maine/Georges Bank stock for the ventless trap. Then the proposed.

Well, we had to go a little further than the stock assessment did, is combining the two inshore trawl surveys of the Massachusetts Trawl Survey and the Maine/New Hampshire Trawl Survey, combining those into a single index. Those are the same ones that we would look at as a proxy for the abundance results from the model.

CHAIR McKIERNAN: Okay.

MR. KIPP: This is Jeff, I could just add a comment. If we were to use both the ventless trap survey index and that combined Mass/Maine/New Hampshire Trawl Survey Index, that would still leave us with two different time series that we currently have not combined, outside of the assessment model into one sort of indicator, and one index. That would be something we would have to explore additionally if we wanted to figure out some way to do that, aside from looking at them individually as two different data streams.

CHAIR McKIERNAN: Because if we don't then we're dependent on the stock assessment and peer review to tell us every five years where we lie on the trend, without being able to do anything in the interim, right?

MR. KIPP: Yes, we do not have a mapping of these outside indicators to the reference abundance estimates from the model. There still needs to be some work done to try and come up with that mapping from the individual indices outside of the model, to the reference abundance estimates inside the model that we use to compare to the reference points.

CHAIR McKIERNAN: Jeff, do you and Kathleen and Caitlin feel that we could give you enough guidance in this conversation or soon to end, so that you can develop this, or would you like to have more back and forth with like maybe a subcommittee of those who are really active in this discussion to get a better handle on the mechanics of how this will work? It is one thing to talk about the general ideas, but I just wonder if the mechanics are as important as kind of the goals. What do you think?

MS. STARKS: I do think, you know the discussion questions that the PDT and TC put forward were intended to get that guidance that they needed. I think they have a handle on how to make those things work mechanically, once we have an idea from the Board of kind of what levels of abundance you're hoping to maintain, and how much of a drop you're willing to tolerate before taking action.

Questions like that help the TC be able to better define triggers that would be appropriate, to make sure that we're meeting the goals. Does that make sense? I guess I would suggest, I think if the Board is

in agreement on the issues or the suggestions that have been put forward, then I feel like the TC and PDT can take that information and turn it into appropriate triggers.

But if there is not agreement on like the levels, then maybe we should have another couple of minutes of back and forth. But if everyone kind of on the same page as what has been said already, then we may be at a good point.

MS. KERNS: Dan, you have three hands. I don't know if that is to Caitlin's question or not, because they have been raised. But you have Cheri and Tom. The other hand went down.
CHAIR McKIERNAN: Cheri, go ahead.

MS. PATTERSON: Pat, I almost think I was looking at three tiers, where we're all pretty concerned about what rate of change is happening over the last three years. If the assessment is inclusive of the Maine/New Hampshire/Mass Trawl Surveys, we have at least a spring gap out of those surveys from last spring, right? Massachusetts, did you guys operate in the springtime with your trawl survey?

CHAIR McKIERNAN: Not last year, but we're doing it this year.

MS. PATTERSON: Yes, so we have a gap that I don't know how that is going to be filled without retroactive thoughts in our future. That is where that first tier for me is, is looking at what we're going to be doing probably right off the bat. Then looking at that rate of change, if it hits the, what is it the fishery something, the dotted line.

I forgot what the dotted line was, and then down to your lower trigger, being that abundance level that separates the high to the moderate abundance regime. I'm not sure on this last sentence, where you're saying triggers could be associated with stepwise changes to gauge sizes. How quickly can we determine if gauge sizes are effective? Would that be something that we could determine within three years, or is that something that you kind of see within a year, within two years? I guess I would be a little cautious on that last sentence. But the PDT might not even need that, if they feel that they can go with what our conversation has been up to this point.

CHAIR McKIERNAN: I'm seeing some edits to the consensus statement on the screen.

MS. STARKS: I just wanted to put it on the screen, to make sure I was capturing what Cheri's suggestion is, and have the Board give some feedback on that as well.

MR. KELIHER: Mr. Chairman, could I ask a question to that last point that was made by Cheri? Cheri, what types of actions were you considering? I mean obviously a gauge change is going to be disruptive enough. But if you had three, depending on the rate of decline, three-gauge changes could be incredibly disruptive.

I mean, just the time alone to implement, you know put new gauges out. That alone is going to takes some time. I'm just kind of wondering what you're thinking about. Would it all be around a gauge increase, or would it be other types of management actions?

MS. PATTERSON: Mr. Chair, can I answer?

CHAIR McKIERNAN: Yes, please do.

MS. PATTERSON: I was looking at all of the options available to us. Gauge changes is one of the options, I'm not discounting it. I'm just saying that that shouldn't be the one and only one that we consider.

MR. KELIHER: Yes, okay. That's very helpful, thank you, Cheri, I appreciate that.

MS. PATTERSON: Thank you.

CHAIR McKIERNAN: Tom Fote, did you want to weigh in?

MR. THOMAS P. FOTE: I'm hesitant to weigh in. I've just been listening to this for a long time, and listened

to what Mike Luisi said quite well before. My concern is the survey. Do they take bottom temperature when they are doing the surveys, to see what the difference in temperature is from one time to the other time they are doing the survey?

Because we know that water temperature is what is going to basically do us in on lobster, like it did in the Southern New England stock. I know, and I don't see it is anything but a declining stock until we basically turn that around. I don't see us turning it around in my lifetime. It's just frustration, and I'm listening to conversation. Basically, I'm saying, well we take measures, but do we really do anything to stop this, which is what Mike asked a long time ago.

I mean I saw it with surf clams, and we lost the surf clams in New Jersey, because of water temperature. When we basically are having problems with bluefish, we're having problems with weakfish, problems with winter flounder. Some of it is depending on water temperature. There are other environmental factors going on, and we could only manage fish, and this is a real problem we get into. That's all, I just was listening to it and I had to say something.

CHAIR McKIERNAN: Okay thanks, Tom. All right, so Caitlin, is this a helpful enough set of guidance that the TC and PDT could do some business with, in terms of crafting a draft addendum?

MS. STARKS: I guess I have a few questions. I'm going to pull this slide back up with the overview of the options that the PDT drafted, because I just want to remind folks of what is in those. This option, Option 2, is kind of what Cheri was suggesting with her first tier of immediate management action.

These would be measures implemented upon final approval of the Addendum, and the measures that are being considered under that option by the PDT are these. This second option, standardizing measures upon final approval of the Addendum. What is included in that is implementing standardized measures within LCMAs, so those are at the inconsistencies for outer Cape Cod with maximum gauge size, and the V-notch definition and requirement.

Then also, the option to implement standardized measures for V-notch requirements across LCMAs, and another option to implement standard regulations for the trap tag replacement issue. Those were the only measures that were being considered for implementation at final approval of the Addendum. I guess I want to ask if we should be considering maximum/minimum gauge size changes in this as well.

MS. KERNS: Dan, you have two hands up, Cheri and Roy Miller. Then once they are done, I might have a suggestion for you all.

CHAIR McKIERNAN: Okay, let's go to Roy Miller first. We haven't heard from you, Roy.

MR. ROY W. MILLER: I just wanted to make sure I understood the three bullet points that were at the bottom of the draft motion there. Could we go back to them for just a second? There they are. Number 1, immediate management action, would be what we were just discussing. In other words, what standardization would take place immediately upon approval of the Addendum.

Number 2, the 20 percent trigger would take place once we have a data point three years hence from that last data point that was in Figure 1 or the 2016 to 2018. That is my understanding of it. When it drops 20 percent below that data point over three years, for our composite abundance indices, the three indices, a composite abundance index.

Then a management response would be triggered. Then finally, if the abundance trigger drops to the moderate abundance regime, where the circle crossed in the lower level there of Figure 1. That would trigger yet another management response. Am I understanding what was proposed correctly? I realize I'm out of the area of concern here. But I think

perhaps further definition might help all of us understand what is being proposed.

CHAIR McKIERNAN: That is my understanding. Caitlin, do you want to weigh in?

MS. STARKS: I think that was my understanding as well. I think one question I wanted to clarify was about that 20 percent decline, and make sure that you are thinking a 20 percent overall change from the black dot to wherever we are in three years, if that happens, and that would trigger management, or a 20 percent change every year for three years.

CHAIR McKIERNAN: Toni, you had a recommendation.

MS. KERNS: I guess it might be good to get that question answered for Caitlin. We do have Pat Keliher and David Borden with his hand up. But I will say this, and trying to keep us on some timeframe. I think it would be pertinent to make sure that the TC and PDT have enough direction to start getting moving on some issues.

If it's not the Board's intention or expectation to have a document approved for public comment in August, it might be good to have a group of Board members that we could lean on, as the PDT and TC work on the guidance given them. If they additional clarification or questions, we could bring those Board members into their meetings to provide specific guidance back to them. But that would be if the Board was okay with that plan. Again, you have Pat, David, and Ritchie with their hands up.

CHAIR McKIERNAN: Okay, I like the recommendation, but let's go with Pat first.

MR. KELIHER: I'm just trying to pull together the thinking around this to maybe give some greater clarity. What Cheri brought up I think could potentially combine really nice here, or you could have a Tier 1 trigger, which would be immediately standardizing some of the measures. Then Tier 2 could be a percentage decline over the three years as you move from high to moderate regime, and then Tier 3 would be the abundance limit. You could have different types of management options to go. You know those aren't all, obviously, gauge changes. It may be a good way to kind of bring these two things together, to hopefully give the PDT a little bit more focus. Then I can withhold my other comment, Mr. Chairman, until we get back to the other slide that Caitlin had up.

CHAIR McKIERNAN: Thanks, Pat, David Borden.

MR. BORDEN: My comments are all on the immediate management actions. Do you want to hear those at this point, or wait until later?

CHAIR McKIERNAN: Yes, go ahead, I would like to hear that.

MR. BORDEN: Okay, I think that any consideration of gauge changes should be done in the Step 2 or Step 3, and I think that is what was just said. In terms of events, I think it makes some sense to consider standardizing the vent sizes. That, I would point, I mean one of the things that we found in Southern New England is that with the rebuilding a number of these finfish populations, you're much better off not bringing a lot of lobsters to the surface.

One way to stop that is to have the appropriate vents in them, so standardizing the vent I think would be a good addition to it. On the V-notch requirement, I support the concept of standardizing it, in order to make it effective. All you have to do is look at some of the tagging data that New Hampshire and Maine and AOLA put together.

These lobsters are moving all over the Gulf of Maine in various different directions, depending upon where you tag it. It makes sense to have kind of consistent regulations. In terms of the actual definition, I support the proposal of standardizing it. But I think states ought to have the right to be more restrictive.

I think in the case of Maine, their V-notch definition as I understand it, is more restrictive, and they should be allowed to keep that. That has been a provision that

has been very popular with Maine fishermen. I just can't see us changing it, if they continue to support it. On the maximum size, I think it makes some sense to standardize it. But once again, if an area like Area 3 has a different maximum size that ends up being more restrictive, then I think that they should be allowed to keep it. Those are my comments, Mr. Chairman.

CHAIR McKIERNAN: David, if I could ask a question. You talked about standardizing V-notch rules. It begs the question for me, coming from Massachusetts, because we have an area, Area 1, where V-notching is mandatory, the action of cutting the notch. Then we have a second set of rules about possessing what has been a V-notched lobster. Are you in favor of making the possession rules consistent, or are you in favor of making the requirement to notch consistent?

MR. BORDEN: The possession rule.

CHAIR McKIERNAN: Okay, I think that needs to be clarified, because I think one of these options does talk about mandatory V-notching across LMAs.

MR. BORDEN: Yes, I actually have a question on that. But to answer your question, Mr. Chairman. You've got two different sets of rules in the outer Cape. You've got federal rules and then you've got state rules, as a general comment, they are inconsistent with the rules in most of the other areas. I mean these lobsters move tremendous distances.

If we vulcanize some of these management areas, there were good reasons to vulcanize some of these management areas, but if we're really looking forward, and trying to get a more resilient management program, they should be standardized. Some of this, I would point out, I think should be standardized down in Southern New England, so we have a consistent set of regulations that go all the way down into Southern New England.

CHAIR McKIERNAN: David, before you sign off, what about conservational equivalency? From the way you just spoke, I'm assuming that you, and maybe other Board members, would not want to see some of these rules be allowed to have conservation equivalent measures.

MR. BORDEN: Well, my response is I'm generally in favor of conservation equivalency, but you've got to look at this issue in the context of the way it's being discussed. We want to stop the stock from declining. We need to be more conservative. One of the issues with conservation equivalency, and I'm sure we'll get into this with another species.

How do the rules in one state work, or detract from the rules in some other state? Do the rules all work together? I think if we want to be more conservative, in terms of stock management, then we probably want to put some constraints on conservation equivalency.

CHAIR McKIERNAN: Thanks, David. Ritchie White, are you up next?

MR. WHITE: Yes, thank you, Mr. Chair. The answer to Roy Miller's question. Just clarification, because it sounded like it took three years to reach the 20 percent in the second trigger, if we go to three triggers. I just want to make it clear that if the 20 percent is reached in one year, then the trigger is activated. If at the end of three years it's 17 percent, there is no trigger, but if in the fourth year you go over 20 percent, then it's activated. Am I thinking this correctly or not?

CHAIR McKIERNAN: Jeff and Caitlin, is Ritchie on to that? Is that how you see it?

MR. KIPP: I'm sorry, could you repeat? I didn't quite follow. If Ritchie could repeat that.

MR. WHITE: Sure. If we go over 20 percent in the first year, the trigger is put into effect. If we go three years and the average accumulative is 17 percent, then there is no triggering. Then in the fourth year then, if it goes to 20 percent, then it is immediately triggered. Is that a correct analysis?

MR. KIPP: I think that is why we were looking at it as a median over three years. Instead of looking at even each individual year, we would calculate the rate of change from one year to the next, and then take an average of that rate of change, sorry median. If that median rate of change was 20 percent over those three years, that would trigger it.

MR. WHITE: Follow up, Mr. Chair.

CHAIR McKIERNAN: All right, Ritchie, go ahead.

MR. WHITE: In my example then, the fourth year are we starting from scratch? Then you have to go three years to average 20?

MR. KIPP: No, then in that fourth year you would look back. You wouldn't start from scratch, you would look at the median over your four, three, and two. Does that make sense? In moving forward, we would look at a median over a year, whatever our current year is, and then the two years preceding that. Then when you go another year forward, you would look at the median over that current year, and the two years preceding that, so it's a moving median through three years of time. Does that help?

MR. WHITE: Yes, that helps a lot, thank you.

CHAIR McKIERNAN: I guess Caitlin, we've made a lot of progress on this. I would still like to follow Toni's recommendation that we convene, like a little subcommittee, so that if there are questions as the PDT and TC come up with these specifics, if they could bounce these ideas off of a subcommittee. Toni, can you endorse that?

MS. KERNS: Dan, as long as the Board is okay with that. I mean I think it's an okay way to proceed. I just want to make sure that we can have more timely feedback to the PDT, instead of having to wait until August.

CHAIR McKIERNAN: Right, is there any objections on the Board to the creation of a subcommittee of folks who are keenly interested in some of these specifics to be convened to give feedback to the PDT?

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

CHAIR McKIERNAN: Go ahead, Pat.

MR. KELIHER: Mr. Chairman, I guess while I would like to kind of mole our way through some more of these, I understand the reason for wanting to do this, and so I won't object to it. I would like to have a goal in mind here of what we'll have completed for the August meeting. As I said earlier, I can see where this might delay us beyond August. But I don't want to come back to a Board meeting in August, only to debate these all over again, and put us out to October, or even into a winter meeting.

CHAIR McKIERNAN: That's fair. We would still like to see a draft addendum at the August meeting. Is that what you're suggesting?

MR. KELIHER: I would like that to be the goal, Mr. Chairman, at last give it the old college try here.

CHAIR McKIERNAN: Sure. Yes, I mean I think there were two clear challenges. One is, what are the triggers, in terms of abundance levels, and when do you pull triggers. Then, what are the actions. I think the group that has been involved with this discussion might be able to give recommendations to the PDT, so that when it comes out in a draft addendum, and it goes out to the public that it has a shot at being implemented. It doesn't create a huge amount of acrimony.

MR. KELIHER: Yes, that sounds good.

CHAIR McKIERNAN: In terms of naming the membership of the subcommittee, should we just have folks volunteer to Caitlin, if they would like to volunteer for when we would have a conference call or a Zoom call at some point with the PDT? Is everybody good with that? I know I will volunteer. Pat, I hope you will.

MS. KERNS: Cheri has her hand up, I don't know if that is to speak or volunteer.

MS. PATTERSON: Yes, thank you, Mr. Chair, a couple things. Yes, I would like to be on the little subcommittee, of course. But I also have a question, and Dave Borden, I'm kind of following up with something Dave Borden said. I don't need the clarity today, but I would like to have some clarity on lobsters that are in different habitats.

If we're looking at making all the gauge sizes the same, amongst all the LCMAs, I understand that we're managing for one stock. However, they are stocks that are in different habitats, and therefore it was my thought and understanding that there is variability in growth, variability in reproduction and such.

It's also my understanding that the lobsters that were tagged far offshore, while they moved, they moved more north and south and less east and west, or at least dramatically east and west, so that the ones that are offshore kind of stay offshore, far offshore. The ones that they don't generally, there are those exceptions, come to the inshore waters.

If we're looking at trying to standardize gauge sizes, I would like to have some clarity, and again, it doesn't have to be today, on the variability of gauge sizes that we have now, and the reasons why. It was my understanding it's because there are different habitats and different growth rates and reproductive rates.

CHAIR McKIERNAN: Sure, Cheri, and I'm looking at some of the options in the draft document, and some of these options simply raise the gauge an equivalent amount in each LMA, and it doesn't necessarily make it a uniform gauge. That is an option that we could choose in the end.

MS. PATTERSON: Yes, I understand that and I am appreciative of those options, thanks.

CHAIR McKIERNAN: I think we're done with this issue for now. We've got good information on the screen. We've got a commitment to have some members serve on a subcommittee, to give feedback and review to the Addendum as it's being developed. Are we good moving on from here, any objections to moving on?

MS. KERNS: Dan, I just want to, you know since I made that suggestion, I want to make sure that Caitlin and Kathleen feel that they have enough direction to get moving forward. But if they don't, then I think we need to give them a little more feedback.

CHAIR McKIERNAN: Okay, Caitlin and Kathleen.

MS. STARKS: Yes, I think Kathleen has her hand up, so why don't we let her go first.

CHAIR McKIERNAN: Go ahead, Kathleen.

MS. REARDON: One thing that was kind of conflicting in the comments that I've heard. Some people said, Pat Keliher said he wanted to concentrate on resilience, while Dave Borden and Cheri. Well, I think Dave Borden was really pushing for standardization. Hopefully, the subcommittee can weigh in on that, and that is more for the PDT to decide which options to put forward. But I did not hear agreement on where the Board falls on that question.

CHAIR McKIERNAN: Personally, I think David Borden's suggestions about uniformity had more to do with within an LCMA. I don't know whether he was endorsing across LCMA uniform measures. David, do you want to clarify that?

MR. BORDEN: Yes, that's correct. I'm not trying to wordsmith this after the fact. I mean I think it's important. There are some measures that we have that are just totally out of sync, and I won't pick on any area, but they are totally out of sync, in terms of some of the other measures in an LMA. I think those are kind of the low hanging fruit.

I'm in favor of standardizing some of the measures, and to the extent we can do it, and it's not terribly disruptive to the industry. I think it works, even if we

go outside of the Gulf of Maine. If we have more standard regulations, I'm sure our enforcement partners will be a lot happier enforcing the regulations.

DISCUSS VESSEL TRACKING FOR THE LOBSTER FISHERY

CHAIR McKIERNAN: Okay, so we're moving on, no objections? Next on the agenda is the discussion about tracking. Caitlin, I think you have a presentation on the issue of tracking.

MS. STARKS: Actually, we have a couple presentations, so we'll try to make it fast. We have Bill DeVoe and Anna Webb up first, and then I'll follow up with just a few slides. Maya, could you pull the presentation up, please? Bill, are you on audio?

UPDATE ON TRACKING PROJECTS

MR. WILLIAM DeVOE: I'm all set, thank you, Caitlin. Good afternoon, thank you, Caitlin, thank you, Mr. Chairman. Thanks for the opportunity to present today on some recent updates at DMR regarding vessel tracking testing in the lobster fishery. When I last presented to the Board in October, I gave an update on the various cellular tracking devices that DMR and DMF had tested as part of the ASMFC Electronic Tracking Pilot Project.

At that time our average tracking device cost was $350.00 per device, with about the same amount per device recurring annually for cellular data. As of December, of last year, Dee Larson tested a new cellular tracking device, the Particle TrackerOne, which is offered significantly lower cost, along with increased tracking functionality. Particle was a company I had worked with before for some non-tracking technology, and they introduced a dedicated tracking devise last summer. We are currently integrating the Particle TrackerOne with harvester reporting and other data streams. The TrackerOne is about $160.00 apiece, they use a low-cost rate limited cellular plan.

These plans are based on usage, and since even a one-minute ping rate consumes relatively little data, compared with a typical cell phone, the plan costs are considerably less. One of the primary drivers of this lower cost is the fact that there are over 200,000 Particle devices reporting, versus this typically much lower numbers for many fishery-specific trackers.

This means that our initial device cost is cut in half, compared to the past devices we tested, and the recurring annual cost is one quarter of what it was with the previous tracking systems. In addition to the cost savings number comes an increased track in functionality as well. TrackerOne is run on the open-source software. They can be modified to add functionality beyond tracking.

They have an expanded port that supports many common electrical interfaces, and Particle now offers tutorials, and an active developers' online community. The Trackers are powered by USB or hardwired. Many of the trackers we worked with in the past had to be hardwired to a circuit breaker on the boat. USB is a great option, and Particle Trackers set up quickly.

Harvesters can use a regular cell phone adapter to power the Tracker, versus having a lot of cable down below deck to one of their circuits. The Tracker also has a backup battery that can continue to power the tracker for over a day after power is removed. The devices are waterproof, but they seem to work fine from the wheelhouse. All of our deployments are currently just on the dash of the wheelhouse.

DMR is currently testing 5 TrackerOne's. At the right is a picture of one of these trackers, they are a little bit bigger than your typical wallet. DMR has contracted Bluefin Data to develop a harvester reporting global app that will meet federal reporting requirements for all fisheries.

We are integrating data streams from the TrackerOne with this app. As of Friday afternoon, our TrackerOne deployments are feeding data in real-time to BluefinData. We just had a boat come in around two o'clock,that is successfully offloaded. Their trip location is at a one-minute ping rate.

As harvesters who have TrackerOnes on their boats test the vessel app in the coming months. Their location data will be sent to Bluefin to be submitted to ACCSP, along with their harvester report. Since the TrackerOne is always on when the vessel is powered, there is no need for the harvester to have their phone or other mobile device running for the duration of the trip. Additionally, if they forget their phone at home, or they start their trip report after leaving port, the track is already being recorded. On the right of the slide, you can see the screenshot from the VESL app of the trip report being submitted.

As I mentioned a few slides ago, TrackerOnes run on open-source firmware, so at DMR we made some custom modifications specific to the lobster fishery. The first was out in the Bluetooth interface. The tracker is constantly transmitting its own unique ID, so that the VESL mobile app can detect which tracker a harvester is using, and associate this tracker with their VESL account. This solves the issue of what boat has what tracker, and it also allows the VESL app to use the basic troubleshooting of the tracker status.

For example, if I mailed a fisherman the tracker, and there was no cell service at the dock where they typically tied up their boat, the VESL app would detect that by connecting to the tracker. Additionally, we are testing Bluetooth gear tags. During the ASMFC funded pilot project, we tested out gear tags for our company's Succorfish that were trying to integrate similar functionality for a lower cost.

We set up a TrackerOne to detect the unique idea of these tags, as they transit on and off the vessel. The tags can be used as trap or end line tags, or in mobile gear like auto trawls or scallop dredges. The tags are about $20.00 apiece. Battery life should be at least five years, although it might be as high as ten years.

There remain some questions about how the production of these tags would scale up. The software side is set, we're working on dealer tests in the coming weeks to determine the efficacy. Lastly, privations, DMR we tested out, didn't deploy the option of a button board to allow events on the vessel to be sent back with the tracking data.

It was a more of an option for specific research projects, not suite wide. Additionally, we're investigating the requirements for VMS type approval, to try to help ease the adoption of these trackers. This comes fully recognizing that DMF devices traditionally offer much different functionality than most cellular-based trackers. The type of approval process may be incompatible with these newer tracking systems.

Right is the screenshot for vessel, the current method of capturing fishing location. Future integrations on work, Bluefin has added a map interface to the vessel reporting app, such the harvesters can view their own tracks. Eventually we'll be creating an administrative interface to view all vessels, and to probably do some fishery statistics, heat maps and so forth.

There are many possibilities for integrating environmental data streams from censors in traps around the vessel. An example would be temperature loggers in traps, so that when the other traps are pulled, the bottom data got uploaded. The Tracker could almost be a hub to transmit these data streams back to shore.

We also talked about integrating the TrackerOne with the plotter or computers on the vessel, to show the position of gear, and allow some two-way communication similar to some VMS devices. That is my update from DMR, I think Anna is next, and then Caitlin will do some questions after that. Thank you.

CHAIR McKIERNAN: Who is up next, is it Anna Webb?

MS. ANNA WEBB: Yes, can you hear me?

CHAIR McKIERNAN: I can, yes, go ahead.

MS. WEBB: We're doing a very similar pilot, but through the ACCSP SAFIS applications. Connecting cellular-based special monitoring systems and e/Trips

mobile for real-time linking of track to harvester trip reports. This is just kind of a refresher as to why we're focused on cell-based vessel tracking. They are generally lower in cost, although ours are not quite as low as what Bill just presented, but we're working on that.

They work in and out of cell range, data are stored, transmitted once it's available again. Data plans can be charged as monthly or annual cost. Ping rates are generally adjustable without a changing cost, and they can use direct power, solar power, and they are compatible with most vessels. This market is expanding rapidly.

Like Bill said, the Particle tracker came out last summer. Things have been changing quite rapidly. For our project, we had a couple of objectives. Basically, we were testing the ability of five different devices to collect vessel GPS information, working with the APIs for each device company, to acquire those tracks and link them to the harvester trip report submitted via eTRIPS/mobile.

We're testing the functionality of geofences, both within eTRIPS/mobile, and the different devices that we're testing. Then we quickly realized we needed to add on a few things, mostly a viewing interface in the app for the harvester to see their own tracks, and an admin viewing interface to see all tracks within your jurisdiction.

We settled on these five devices here. The fifth one is the integrated GPS into a tablet itself. Like Bill said, our costs were generally similar to what he has presented, averaged around $350.00 to $400.00, with data plans ranging from anywhere from low end of $100 to a high end of $400.00. Within eTRIPS/mobile, it is currently endorsed for trip report submission by multiple states in the federal jurisdictions. The tracking version uses the device company's APIs to pull in the vessel positions, based on a trip start and end times.

It works on all three platforms, including laptops, tablets and phones. It does work offline, and stores data until a Wi-Fi connection is reestablished, which does not have to be on the vessel itself. Then the new map view option lets the user see their track trips within the app. If you're using the tablet as a tracker, there is potential to use the map view in real time, and see your position in real time.

The app is ready for deployment. We're looking for some fishing industry participation at the moment, and hopefully we'll get some production trips in the next month or two. Here is an example of what a track might look like within the harvester app itself. There is no indication speed or anything, but it does show the track itself.

Testing, we have done a lot of testing in cars, not so much on a lot of active fishing vessels at the moment. But we have had successful tracks pulled from all devices and links to trips appropriately. We're hoping to launch on more volunteer vessels shortly. We have two in Massachusetts, Rhode Island has a few charter participants, and is looking for more commercial participants. We have an FAQ developed, in order to give to potential interested parties. The ongoing work we have right now is primarily focused on geofencing. Our geofencing is basically a virtual perimeter that you could put around whatever you want. We're looking into how we might notify users, both admin or end users in real time, if in cell range, if a vessel is approaching or crosses a fenced area.

There is a lot of different use cases for such things. Bill mentioned the defining ports to decrease port ping rates, or you can flag areas as closed. ACCSP specifically Mike Rinaldi, has developed a VMS track viewer within SAFIS, so that we can as administrators can look at tracks and summarize information, including calculated speed, so you can maybe estimate where some activity might have been happening.

We'll be able to review some of that ping rate data in more real time and identify efforts, after we get it on fishing levels. We're hopeful we'll have final reports by the end of the summer. This is an example of the

track viewer. This is the admin interface. This is a repetition of display speeds on top of the track.

Anywhere where it is red is the slowest, yellow is the next, and then green is the fastest. We've expanded upon the work that Bill presented last year, and can further confirm that cell base trackers are cost effective, as compared to satellite. Installation of devices, which also Bill mentioned a little bit, can be complicated if they are actually wiring it in, and if we were to do a broad scale implementation, we may need to look into hiring installation technicians.

We have successfully connected all devices, and we are not seeing any significant benefit of one type of tracker over another. They all have different pros and cons, particularly in relation to power. Some are solar, and don't work the further north you go. Whereas, frequently the further north you go, others just are more cumbersome. They kind of balance out, in terms of the pros and cons.

We think that this could be available as early as 2022 for eTRIPS users. We're currently in the process of looking into how we might expand this project, particularly in terms of how do we apply for more funds to do so, that is. These are just a few of the ideas we've been tossing around, how do we pay for broad scale implementation? How do we enhance geofencing? Bill also touched on this, but these are being piloted as data collection tools, not as law enforcement tools.

To integrate those into law enforcement is going to take some work. Add more devices, such as the Particle device he just presented, and what other needs do we need to think about in the next two to four years? The funding cycles mean that we won't get money for this next phase until next summer, which would mean implementation if you're on an annual basis for 2024. Then what lobster specific needs? We're not sure what we might want to pursue going forward. That's all I have.

CHAIR McKIERNAN: Thanks, Anna, I have a question. If this is being used on a voluntary basis now, and if through the management system was mandatory. How could it be determined that the vessel is in compliance with a functioning tracker?

MS. WEBB: Well, we would be able to see if, I don't know how you would do it before they reported, but once they start reporting if they're not also having tracks with those reports. We should be able to see, if we know who is getting what device, then we can see whether it is turned on or not. Those are other options.

MR. DeVOE: Dave, this is Bill. I'll just continue what Anna said that the tracker actually offers the opportunity to see if they haven't reported, because we would see that track plot if they went out fishing, but didn't submit a report. That is something we've actually talked about with Bluefin.

Kind of like putting together a matrix of all the different possible scenarios, like a vessel reports but their tracker isn't on. A tracker reports, but there is no trip report. We get a trip report, but might only get half the track or something. There is all these different sort of QA/QC scenarios that could come out of that.

MS. WEBB: Yes, agreed.

MS. KERNS: Dan, Jason McNamee's hand it up.

CHAIR McKIERNAN: Go ahead, Jason.

MS. STARKS: Sorry, if I can interrupt, Dan. I don't know if you wanted to get through all the slides, but there are a few more.

CHAIR McKIERNAN: Oh, okay.

MS. WEBB: Not mine, right.

CHAIR McKIERNAN: Why don't we hold off, Jason, and go ahead, Caitlin.

MS. STARKS: Sorry about that, thought it might be good to get through the end. I just wanted to give a

little bit of context for the discussion as you get into it today, on this topic of vessel tracking in the lobster and Jonah crab fishery. It's come up before the Board a number of times in the past, and the Board has generally noted that vessel tracking and the data, the spatial resolution and temporal resolution of data that would be provided is a critical data need, particularly for the federal water's fishery.

There are more details in the memo that is in supplemental materials, so I'll keep it short to save time. But these data would be extremely beneficial for addressing several challenges that are currently facing the lobster fishery, and those include right whale and protected resources interactions and risk reduction regulations, improving enforcement in the offshore fleet, and informing future discussions and decisions on marine protected areas, and spatial planning at the federal level.

These are just a few examples of how the Commission and states have been supporting efforts to facilitate the development of electronic tracking programs for the fishery. First, the Board approved the electronic vessel tracking program, the pilot program that came out of Addendum XXVI, and that we've heard about in the past. The Commission has previously sent a letter to NOAA Fisheries in April, 2019, recommending development of electronic tracking systems in the federal lobster fishery, and in the Commission's recent comments on the Atlantic Large Whale Take Reduction Plan modifications, in March of this year. It identified the need for improved offshore enforcement, in order for those proposed rules to be effective.

Then lastly, as we just heard from Bill and Anna, there has been ongoing work at the state level to test these trackers and integrate the data with reporting systems. With that in mind, the Board might wish to consider today whether it would like to forward a recommendation to the ISFMP Policy Board to recommend that NOAA Fisheries implement electronic vessel tracking requirements for the federal lobster and Jonah crab fishery, and that's all the slides we have, so we can go back to questions. Sorry for the interruption.

CHAIR McKIERNAN: Okay, Jason, you had a question?

DR. McNAMEE: It is a question. I think it's for Bill and/or Anna. Anna, I think it was you. You made the comment that you know you have a number of technologies. They are all good. They all have different tradeoffs. But what I was wondering is, if all of them can integrate into the, for instance like ACCSP database, so it's like they all work in that way. That is what I was wondering.

MS. WEBB: I will say, we didn't pilot every device that Maine and Massachusetts piloted for the first project. There are five devices, or four external devices, plus an integrated GPS and a tablet that work with ACCSP right now. I personally would love to see the Particle Tracker added. That is dependent on what ACCSP says, in terms of what is in scope and out of scope for maintenance of this application. As we consider applying in this next funding cycle.

MR. DeVOE: My understanding is that we should be able to submit locations from those now. I mean the ACCSP API as APAIS. The only data elements that it accepts is basically time stamp, latitude and longitude.

MS. WEBB: Right, yes. Any tracker we could get data from, but linking it to the trip report will only occur on the four external devices currently. I mean you could look at the time stamp and manually do it. But the automated link is only for five devices right now.

DR. McNAMEE: Excellent, thank you both very much. Just to make a comment. You know I think if there are opportunities to have options, you know I think that is great. Nice work, thank you for that report.

MS. KERNS: Alli Murphy has her hand up.

CHAIR McKIERNAN: Great. Okay, so we have a Board consideration for the discussion. Alli, do you want to start the discussion?

MS. MURPHY: Sure, Mr. Chairman, thank you. I think this is an important issue, and potentially a very valuable data source. The great work done to date has been very successful at demonstrating that there are other possible systems that we can employ, other than the satellite-based VMS systems currently used in GARFO fisheries.

I do understand the urgency here, but I think it's really important that we get this right. I would urge the Board against sending a recommendation to NOAA Fisheries, as outlined in the April 27th memo, and instead develop this program through a Commission Addendum process. If I may, I have a couple additional points, Mr. Chair.

CHAIR McKIERNAN: Yes, please do.

MS. MURPHY: First, much like our discussion on the Gulf of Maine Resiliency Addendum, I think it would be beneficial to define the goals and objectives of this data collection program. It seems like the memo has jumped to a solution, and identified a bunch of ways that we could use the data resulting from that solution.

But I think we need to do a little bit more work to ensure that our solution fits a problem that is based on a management need here. Some questions I have that Anna raised in her presentation are, you know is this a monitoring, compliance and enforcement issue? Can we develop a comprehensive plan to address that, or is this purely to collect higher resolution spatial data than what was included in Addendum XXVI?

I think once we've answered those questions, or we know what that driver is, we can then evaluate what the best technological solution will be at the lowest cost. Then, I think second, the participation of our experts, so that is our management and data folks, as well as our enforcement partners from all of our jurisdictions. It is going to be important to not only establishing those objectives, but they are going to be critical to defining what data we collect, how, and then how well jurisdictions can access and make use of it.

On this point, I think being more proactive in our process here, and having these cross jurisdictional and cross program conversations earlier in the development process, then say we did with Addendum XXVI, when those conversations took place after we passed the Addendum, is going to benefit and speed this whole process. Mr. Chairman, I know we're over time here, and if you would like, I would be prepared to make a motion. But if you would like to open it up for some additional discussion, I can wait as well.

CHAIR McKIERNAN: Well, you know what? Why don't we let you put the motion up, because the discussion can follow the motion?

MS. KERNS: Dan, Pat had his hand up before Ali. I mean, I don't know if you want to go to Pat.

CHAIR McKIERNAN: Sure, okay so hold on a second, Ali. We'll go to Pat and I'll come right back to you.

MR. KELIHER: I have to say that I am very much in firm opposition to many of the points that Ali has just raised. We're in a situation where we have spent a tremendous amount of time looking into these issues around trackers. As you heard from the two presentations today, we have many options.

Those options will be critical for the Agency to have in place moving forward, based on what they've done in the past with VMS, having additional contractors available, so nobody is stuck in a single box, as far as what technology they would be able to use. We have the ability to house this data through ACCSP, which is a critical component.

I would argue that we have the goals and objectives, and Caitlin could back up one slide to the points to consider. Those points are key here. We have a whale issue that is being driven by models that make great assumptions. The data associated with trackers would allow us to fill in the void, the data voids with those particular models.

The offshore enforcement issue again, is critical here. We've talked about through the Law Enforcement Committee, and more broadly at the Board, about the need for having large offshore patrol vessels to work in a more thorough way in Offshore Area 1, and out into Area 3. But we've kind of said right off the bat that after looking into those issues, that a tracker will only make that work more efficient. We now have NOAA OLE looking at the use of remote operated vehicles, submersibles, excuse me, in order to check that gear.

Well, you have to be able to find the gear in order to be able to check it, and trackers would allow that to happen. You know these marine protected areas and spatial planning efforts that are underway, President Biden has his 30-30 Initiative. Again, incredibly important data to be able to fill in the voids there.

I just look at the amount of work that we had to go through on deep water corals in Maine, pulling that information together. Months of interviews with harvesters by multiple members of my staff, in order to pull that together. We could have had that done in a matter of hours, if we had this type of data.

I also don't believe that we are under any obligation by statute, in order to move forward with a letter of recommendation from the Policy Board to the Agency. I've heard about this. I've had conversations with folks within the Agency about wanting to see an Addendum, but we don't have the time. Let's just make it really clear. We don't have the time to go through this process, in order to advance this work that needs to be done.

I think we need to do it jointly. I think we need to do it in partnership between the Agency and the States and the Commission. But time is of the essence, and we need to have something in place, in my mind, by January 1st of 2023, in order for it to be useful for the conversations in particular around whales, based on the Biological Opinion and the timing of the framework that has been put forward. I would have a motion as well; in case we need to.

CHAIR McKIERNAN: Well, yes. I would like to let Ali finish her arguments. Speaking as Chairman and also as somebody who has dealt with NOAA on issues of VMS and access to VTR data, and the very difficult challenges of those ten-minute square conversations, where NOAA goes forward with something, and then we all try to get access to it, it's really challenging. I'm interested to hear from Ali, you know her argument about the advantages of the Addendum. But Ali, why don't you complete your argument, before we go back to Pat.

MS. MURPHY: Thank you, Mr. Chairman, do you want me to make that motion now?

CHAIR McKIERNAN: Yes, but just tell us what you have in mind, but sure, put it up if you would like.

MS. MURPHY: Yes, so I think I would move to initiate an addendum to develop objectives for collecting high resolution spatial data, identify technological solutions, and develop system requirements.

MS. STARKS: Can you repeat what you said after identify, please?

MS. MURPHY: Technological solutions, and develop system requirements.

CHAIR McKIERNAN: Okay, usually we let you speak to the motion once you get a second. Is there anything else that you want to put forward as the rationale for this, before we ask for a second?

MS. MURPHY: If I may, Mr. Chair. You know I think my language here is a little bit vague on purpose, so that the PDT or whoever we're tasking can start at step one and define the need, and then find the solution that fits that need. Yes, I guess I can leave it there. I also, I guess one additional point would be that I think there is absolutely, as Commissioner Keliher said, that the need for us to work in collaboration on this.

I think the Commission process is the way to do that. I think if this is kicked to NOAA, and we do this all internally, there is not a lot of ability for us to check in with our state partners and with the Commission on what we're doing, until we've proposed a rule. I think this will be the most efficient path forward.

CHAIR McKIERNAN: Okay Ali, thanks for that. Can we get a second from the Board on this motion?

MS. KERNS: We have hands that have been up, David, so I'm not sure if these hands are for seconding the motion or not. If someone is seconding it, could they just voice that second?

MS. PATTERSON: This is Cheri. For the sake of conversation and to start the discussion, I'll second.

CHAIR McKIERNAN: Thanks, Cheri. Ali, maybe if you could just elaborate, because I hear Pat's concern that, I think he perceives that having an Addendum is going to slow this process down. You seem to be arguing that having this process might speed it up, because through the Commission we might be able to do things in a more expeditious fashion. Can you speak to that?

MS. MURPHY: Yes, so I guess part of my fear here is, you know if this is kicked to us. As I just said, you know without the ability to check in with all of you on the development of this program until we have a proposed rule. I fear that we're recreating some of the mistakes we made with Addendum XXVI, by doing that hard work of understanding each other's programs, and finding solutions that work for everybody too late in the process, and that will slow things down.

I also think some of the work that this group could do up front will aid in my potential rulemaking process later on. You know having those goals and objectives clearly defined, and having some information on costs and some of that work has already been done, and will also help to help me with the justification that this really is the lowest cost solution for the problem that we're trying to address.

CHAIR McKIERNAN: Okay thanks. Any discussion on the motion?

MS. KERNS: You have Pat Keliher, David Borden, Jason McNamee, Cheri Patterson, and Mike Luisi. At some point, Dan, I would like to ask some questions about potentially about these objectives that Ali has described, but let the Board have some discussion first.

CHAIR McKIERNAN: Okay, so I've got Pat Keliher, Dave Borden, Jason McNamee, Mike Luisi, who else?

MS. KERNS: Cheri Patterson.

CHAIR McKIERNAN: All right, Cheri. Okay, Pat Keliher, go ahead.

MR. KELIHER: I appreciate Ali's points here, but I still have to disagree where we're at. We could go through an entire addendum process, and there is zero guarantee that at the end of the day we will have this work completed by the Agency, and there are examples of that that are in play right now. What I would like to do is make a motion to substitute, and Caitlin has that language.

CHAIR McKIERNAN: Okay.

MS. STARKS: Dan, could you let me know. You sent me a couple things, so I just want to make sure it's the third one.

CHAIR McKIERNAN: I'm sorry, Caitlin, are you asking me to send you something?

MS. STARKS: Sorry, I meant Pat, if I said Dan. Sorry, mixing up names. Pat, are you talking about the?

MR. KELIHER: To recommend that the Policy Board write a letter.

MS. STARKS: Maya, can you pull that motion up, please?

MR. KELIHER: Mr. Chairman, I would move to substitute, to recommend to the Policy Board that a letter be written to NOAA Fisheries recommending the prioritization of federal rulemaking to require the use of cellular-based vessel tracking devices in the federal lobster and Jonah crab fishery. Included in this letter the Lobster Board's willingness to establish a technical workgroup to support NOAA's efforts on vessel tracking.

CHAIR McKIERNAN: Is there a second for Pat's motion? Toni, any hands up?

MS. KERNS: All those same hands are up from before, so if someone could just voice their second. It's hard for me to tell.

MR. BORDEN: Second, David Borden.

CHAIR McKIERNAN: Second by David Borden. Okay, can we have discussion on this motion?

MS. KERNS: You still have the same hands, but Jason McNamee has his hand up.

CHAIR McKIERNAN: Go ahead, Jason.

DR. McNAMEE: Now I'm sort of wondering. I am generally supportive of what Ali offered. You know, I'm thinking it's an opportunity for us to make sure. You know if we just sort of offer a letter, and then NOAA implements it in a way that is not helpful to us. You know, I saw the Addendum as an opportunity for us to make sure the way it gets implemented is going to work for the states. I guess an addendum process doesn't feel like an enormous amount of time, so I was supportive of that.

Now with Pat's substitute, I guess I have the question of, I like that too, because again, it is my view that this technical workgroup would serve that same purpose. In the end, I just want to make sure that NOAA gets guidance from us, from all of the work that we've been doing to make sure that this gets implemented properly. I guess I'm wondering what Ali thinks about this, you know the second part of Pat's new motion here that will put together a technical working group to support NOAA for that informational piece. I'm wondering if that fits the bill or not.

CHAIR McKIERNAN: Ali, do you want to speak to Jason's question?

MS. MURPHY: Yes, I mean I think if that were possible, I think that would be helpful. But unfortunately, there are restrictions on having that kind of guidance and check in with members of the public while we're in rulemaking. Chip may be able to give me a hand here with some of the legal arguments against it, but it sounds like Commissioner Keliher is recommending something like a federal advisory committee, and that would trigger FACA problems for us.

CHAIR McKIERNAN: Okay, thanks. Any other hands up to discuss the substitute motion?

MS. KERNS: We have David Borden, Cheri, and Pat Keliher. I do just want to say, just before they go, Dan. I do actually think we already, through the work that we have done, already have the answers to most of Ali's questions that she would want to go through an addendum process. I just do want to point that out to the Board. I'm not sure.

Those aren't the type of issues that we typically take out for public comment. I think it would be really difficult for the public to comment on some of those things, and most people haven't used these trackers yet, and that the trackers have been developed in conjunction with industry. Those folks that would be providing advice that we would be putting in this letter to NOAA, in addition in this sort of workgroup, which could include industry members, obviously law enforcement would be commenting at that time. I just wanted to point those pieces out.

CHAIR McKIERNAN: Thanks, Toni, David Borden.

MR. BORDEN: I'm in support of Pat's substitute, and I'm opposed to the underlying motion. I just point out, and I'll use myself as the example. I've worked over the past couple of years on issues involving the Monument, corals, wind development in Southern New England, right whales, and soon I think we're going to be confronted with a whole new round of wind proposals, if Congress approves the budget, and allocates 400 billion, that's with a B, dollars for tax credits for alternative energy development in both solar and wind.

I think you'll see a proliferation of wind. Each one of those issues would have been made so much easier if we had specific information on where the fishery is actually taking place, which we don't, with all due respect to NOAA. The use of current reporting system does not lend itself to reporting in a really defined spatial area. With all of those issues we were constantly in the perspective of, well is there a fishery there? How much of a fishery takes place? We need this type of information.

I also point out that the recommendation by Mr. Keliher only applies to federal permit holders. It does not apply to state permit holders. If it is only going to apply to federal permit holders, I'm not sure why we need an addendum in the first place. Then the final point is on this issue that Ali raised, about certain laws and regulations. I think it is incumbent upon the leadership of the Commission if this motion passes, the substitute passes, to work with NOAA to work through those issues, and try to eliminate as much of the confusion that might ensue.

I mean on the confidentiality provisions, most of the state personnel that have led the work on this, and done a lot of fine work on behalf of the state agencies on this issue. All of those individuals can be bound by confidentiality agreements. I think this is something that we can send a letter, but then commit ourselves to partner with NOAA on the details in an appropriate manner.

CHAIR McKIERNAN: Jason McNamee.

DR. McNAMEE: I'm all set, Mr. Chair.

CHAIR McKIERNAN: Okay, Mike Luisi.

MR. LUISI: No, the questions that I had have been answered. I'm good to go, I'll pass.

CHAIR McKIERNAN: Okay, Cheri Patterson.

MS. PATTERSON: Yes, thank you. I'm probably going to be voting yes for Pat's motion to substitute, especially since I heard that an addendum isn't really needed for this. The objectives are already stated, as to why we need the high-resolution spatial data, and I guess I need some sort of confirmation from either Chip or Ali, as to can NOAA in fact move forward with rulemaking, based on a technical workgroup input, or do they really have to shut off all communications with "the public."

I put that in quotes, in order to develop some sort of vessel tracking. I guess I'm concerned about timing here, and I think we've got all the information needed to pull together by something by a timeline of January 1st, 2023, right now. But I guess I need to hear substantively from Chip, as to whether that is correct or not, thanks.

CHAIR McKIERNAN: Thanks, Cheri. Can we get some feedback from NOAA Fisheries, either Chip or Ali?

MS. KERNS: Chip has his hand up Dan, and he should be unmuted. He just needs to unmute himself.

MR. CHIP LYNCH: Hi everybody, and thanks. This is Chip Lynch with NOAA General Counsel. To Cheri's point, and Pat's point, there is not a legal restriction that prohibits NOAA from beginning a rulemaking without an addendum. I think I just put three or four negatives together there, I'm not sure if that's right.

We can begin the rulemaking without a formal addendum. But to Ali's point, once we begin rulemaking, the law concerning ex parte communication would mean that we would not be able to engage in a technical workgroup, the type that

Pat might be referencing. We have all sorts of federal advisory committees.

You know we can hear of it as FACA, with restrictions that prohibit there being a group that makes recommendations, a special blue-ribbon panel that they get special access. I would note, both with Ali's motion and Pat's motion, that there is a certain commonality to it. They are not mutually exclusive. It seems as though both are calling for process, it's just when that process occurs.

Legally, there is the potential to have that process occur before the formal recommendation, and that would allow for a little bit more time for this to bake, but wouldn't necessarily slow down anything, and need to potentially not even have to be an addendum. But it would be the convening of a group before the letter was sent. I'm not suggesting that, I'm just noting that there is potentially a hybrid here between the two motions that is something that the Board might want to consider. Thank you.

CHAIR McKIERNAN: Thanks, Chip. Chip, could you answer a question for me? It has to do with access to the data. Given our experience with VMS, and how difficult it is to get access to VMS, unless you are approved, I guess by NMFS Law Enforcement or some folks at NOAA. Is it possible if this goes the federal route, that the states may have less access to this data than we want?

MR. LYNCH: Sure, so I would think that that would be one of the issues that folks would want to discuss. Is it possible? Oh, absolutely it's possible. It need not be intentional either, it could be an unintended consequence, because some federal bureaucrat, like me, just didn't know enough about the issue and wrote something a certain way, without consideration to the problems at hand, so yes.

This is necessarily getting together with some people, even if it's just for a whole other ASMFC season. You know next meeting, just people get together and sort of troubleshoot some issues. You could end up with people saying, nope everything is fine, we're good to go, or we're not. I think that would be time well spent in something that doesn't necessarily slow things down.

CHAIR McKIERNAN: Thanks. As I understand these two motions, if the substitute passes and that is made final, then the Policy Board would be recommended to write a letter, and the response to that letter could still be, from NOAA Fisheries, telling the Policy Board that we think you should do an addendum. It's sort of a tennis match, right, what's being served, what's being returned, instead of going right to an addendum, which is Ali's motion. Is there anyone else who wants to comment on the substitute motion, because we might as well take a vote soon.

MS. KERNS: You have Eric Reid, David Borden, Jason and Pat Keliher. They've all had their hands up.

CHAIR McKIERNAN: All right, Eric Reid, go ahead.

MR. ERIC REID: I don't know how many boats already have satellite tracking devices, so I'm not really sure why we can't use those objectives to justify anything we do. This cannot happen fast enough. I would support Mr. Keliher's motion. But I have a question, because it says to require the use of cellular-based tracking devices in the federal lobster and Jonah crab fishery. Now, my boats, they have lobster permits, but they've got satellite.

I would assume that it would be okay to have satellite tracking, in which case the motion should read something like, to require the use of approved vessel tracking devices in the federal lobster and Jonah crab fishery, as opposed to having to get a cellular device to meet the qualifications of this motion. It's just a technical point, but that's it. Thank you.

CHAIR McKIERNAN: Pat, do you accept that as a friendly amendment?

MR. KELIHER: Yes, assuming my seconder would I can go along with that, because there are going to be a lot of conversations around the technical side of this,

such as ping rate. I think we would get to that point down the road, and if we had satellite-based systems that pinged at a faster rate to achieve what we need here, then yes, I would say I would be fine with that.

CHAIR McKIERNAN: David Borden, are you good with that amendment?

MR. BORDEN: Yes, sir.

CHAIR McKIERNAN: Okay, Caitlin, do you want to make that minor change?

MS. STARKS: Yes, not me, Maya. Did you get that, and if not just ask for clarification?

MS. MAYA DRZEWICKI: Could you just repeat the amendment?

MS. KERNS: Maya, it would be use of cellular-based or satellite-based vessel tracking devices. But Dan, Bill DeVoe just put his hand up. Do you mind going to him? My guess is that he is going to speak to the expense that would come with satellite-based tracking at the ping rates that we've talked about, but maybe not.

CHAIR McKIERNAN: Sure, go ahead, Bill.

MR. DeVOE: I definitely would suggest that the satellite-based tracking is going to be prohibitively expensive, particularly the same ping rates, which are almost nonexistent. I also would request that you all could think about how these devices would be implemented along with the existing federal VMS requirements.

You know, if we are putting the suggestion in, is this going to get steamrolled, you know into the suggestion that the devices have to be an existing type approved VMS device, for which there are some that are cellular based, but the requirements are quite contradictory. In particular what comes to my mind, is that for the type approval process.

There is the suggestion, that cellular-based devices can be approved, and that they do not need to upload data until they are back in cell service. But the type approval process also dictates that VMS devices are able to use mobile forms, are able to have two-way e-mailing, all of these sorts of functionalities that I at least haven't heard any suggestion that we need, to get this much needed spatial data in the lobster fishery.

CHAIR McKIERNAN: Sure. Is it also clear in this motion that this is the Jonah and lobster trap fishery? It's the vessels fishing traps, right? Because I think to Eric Reid's point, his vessels have federal lobster permits, but they may not be fishing traps. Eric, is that your expectation?

MR. REID: Yes, Mr. Chairman, that would be correct. But there is no sense in having a system where the ping rate may not be as high, which was pointed out already. But to have to go through the expense of getting another system, it seems foolish to me, that's all.

CHAIR McKIERNAN: Who is next, David Borden.

MR. BORDEN: A quick point, but if I might. Chip, would it help if in the last sentence we said something like, include in the letter the Commission's willingness to establish a technical working group of state agency personnel to support NOAAs effort. Would that help in your view? That way, the people that are being brought to bear could be bound by the confidentiality rules.

MR. LYNCH: Mr. Chair.

CHAIR McKIERNAN: Yes, go ahead, Chip.

MR. LYNCH: The FACA issue is less about confidentiality, and more about access. I don't know enough about the issue with tracking to advise, but I am not sure it would be much of a delay. If the technical group could get together, and before the August meeting you might be in the same position of not wanting to do an addendum.

But you would still have that technical group having met. I just don't know how long it would take a group to meet. But it seems as though moving it off to the summer meeting, you would still have that technical group meeting, might be a compromise that achieves the goals of many of the groups here.

MR. KELIHER: Mr. Chairman, to that point.

CHAIR McKIERNAN: Go ahead, Pat.

MR. KELIHER: Chip, my intent was certainly not to trip any issues with FACA that both you and Ali have brought up. The intent is to, I mean I feel like on many occasions we have working groups that work proactively together with the Agency. Would it help in, maybe this is what you were trying to get to, with kind of that middle of the road. Would it help to change the order here to have the Policy Board institute a technical working group, or collaboratively with the Agency.

Then we would revisit the need for, and possibly then just revisit the need for a follow up letter to prioritize it. I mean the whole idea here, Chip, is to prioritize rulemaking, because I don't think based on what I've heard, that GARFO has the bandwidth right now to do this work. I think it is incumbent upon us to work proactively together, in order to complete this task. If there is a way that we can structure this to avoid FACA, but still get to the same end, I'm all ears.

MR. LYNCH: Mr. Chair.

CHAIR McKIERNAN: Go ahead, Chip.

MR. LYNCH: Normally at a Commission meeting if I'm at the microphone, I can look over to see Ali giving me the knife to the throat sign to be quiet. I can't here though.

MR. KELIHER: She's giving it to you, Chip, she's giving it.

CHAIR McKIERNAN: Would you like to take like a three-minute break?

MR. LYNCH: No, I think I'm okay, and I'll just have Ali just thump me after. But I think what I'm saying is that yes, Pat. I don't know if the Agency wants a compromise, but what I'm telling you is that if a tech group, on which the federal government could be a member were discussing this issue generally, you could be back in the same position that you are now in August.

But you will be far more informed, and the three-month time delay is not necessarily a time delay, because it is front-end loading scoping and issues into what could be a potential federal rulemaking, if that is what indeed what the Commission wants to do.

MR. KELIHER: The motion could be that the Policy Board invites NOAA Fisheries to participate in a technical working group on the development of federal rulemaking around approved vessel tracking methods for the federal lobster and Jonah crab fishery.

MR. LYNCH: Mr. Chairman, can I speak?

CHAIR McKIERNAN: Please do.

MR. LYNCH: Not to beat a dead horse, Pat. I can tell you that your intent here is loud and clear, and is recognized by the Agency. Loud and clear before this meeting even was convened. I would not put in the motion that this is recommending federal rulemaking at this point. That would be something that no harm done by keeping it out. If that is where you all want to be in August, you can state it at that point.

CHAIR McKIERNAN: Pat, do you have?

MR. KELIHER: I think I would like my seconder to weigh in here, but I think we're going to get to that point, right? I would be amenable to recommending that the Policy Board write a letter to NOAA, inviting them to participate on a technical working group to further develop vessel tracking devices for the federal lobster and Jonah crab fishery, and just leave out anything around prioritization. Then we could put this

on the agenda for the August meeting, where we could report out the progress.

I want to make sure it's also clear in the record here today, I'm not looking to avoid public participation in this. I think to Toni's point, we've got a lot of information already on the table that would be beneficial for NOAA to understand, and then the public process would come from down the road, if we got to the point of federal rulemaking the public would comment on it at that time.

CHAIR McKIERNAN: Okay, so Pat, can we take like a two-minute break for you to redraft this language?

MR. KELIHER: Sure.

CHAIR McKIERNAN: What is the official time, Toni?

MS. KERNS: The official time is 5:01.

CHAIR McKIERNAN: Okay, let's reconvene at 5:05.

MS. KERNS: Pat, I'm calling you.

CHAIR McKIERNAN: Are we ready to reconvene, it's 5:05.

MS. STARKS: Toni is not picking up; I'm assuming she might still be talking to Pat on the phone.

MR. KELIHER: We got it. Okay, Mr. Chairman, I think we have a solution.

CHAIR McKIERNAN: Go ahead, Pat.

MR. KELIHER: The solution would actually be a Board prerogative, instead of dealing with this with a motion at all. If I can read my hen scratching here, we would create a technical working group that includes NOAA, Law Enforcement representatives, and members of the Board, to develop objectives, technical solutions, and system characteristics for vessel tracking devices in the federal lobster and Jonah crab fisheries, and report back to the Lobster Management Board at the August meeting.

CHAIR McKIERNAN: Okay. You are making a second substitute motion.

MR. KELIHER: I think you could do this if there is Board consensus, Mr. Chairman. I think we could, if you wanted to, eliminate the motions that are on the Board with agreements. I don't know if you can, based on the fact that they are owned by the Board now. But it may be the quickest way forward, and it achieves my intent, and I believe it achieves the intent that Ali and Chip were getting to.

CHAIR McKIERNAN: It sounds like you've come to a good solution, Pat. Can we just see the final language on the screen, if you would give that to staff?

MR. KELIHER: Let me see if I can. I was more handwriting this than anything, so let me just pull this back up.

MS. KERNS: Pat, I can help you, and Maya, it's sort of a combination of these motions, if need be.

MR. KELIHER: It might be easier to just read it to Maya, for her to capture this.

MS. KERNS: Maya, it uses a lot of the words from Ali's motion, and then the second motion.

MS. DRZEWICKI: Okay that's fine, you could start talking whenever.

MR. KELIHER: The Lobster Board would create a Technical Working Group that includes.

MS. DRZEWICKI: Should I start a brand-new paragraph, or should I just jump in somewhere?

MR. KELIHER: I would start right below my motion, brand new. It will make it cleaner.

MS. DRZEWICKI: Okay, I'm ready.

MR. KELIHER: The Lobster Board would create a technical working group that includes NOAA, LE representatives.

CHAIR McKIERNAN: Is that state and federal?

MR. KELIHER: Yes, and members of the Board to develop objectives, technical solutions, and system characteristics for vessel tracking devices in the federal lobster and Jonah crab fisheries, and report back to this Board at the August meeting.

CHAIR McKIERNAN: Okay. Will we see it on the screen shortly?

MS. KERNS: At the bottom, Dan.

CHAIR McKIERNAN: Yes, so this should be a motion for the Lobster Board to create, and we need a second?

MS. KERNS: Dan, if there is consensus you don't need a motion to do this.

CHAIR McKIERNAN: Okay, thanks, Toni, is there any objection to the new concept motion that Pat has brought forward?

MS. KERNS: But Dan, the one thing that we would need to do is get the Board's consent to withdraw the other motions, but those withdraws would have to also be okay with the makers and seconders, because we do have motions on the table.

CHAIR McKIERNAN: All right, so to Mr. Borden and Mr. Keliher, do you agree to withdraw your previous motion?

MR. KELIHER: I would.

MR. BORDEN: Yes.

CHAIR McKIERNAN: To Ms. Murphy and Ms. Patterson, do you agree to withdraw your previous motion?

MS. PATTERSON: Yes.

MS. MURPHY: Thank you, Mr. Chair, yes. I think this is a good middle ground to start some of these discussions, thank you.

CHAIR McKIERNAN: Okay, so now we have a new motion. I understand Bob Beal wants to weigh in before we go forward. Bob.

EXECUTIVE DIRECTOR BEAL: Yes, thanks, Dan. I think technically the maker and the seconder can't withdraw their own motion, now that they are the property of the Board. They've been debated for quite a while now, and you need to have full consensus by the Board that they are comfortable withdrawing both of these motions, rather than just the maker and the seconder.

CHAIR McKIERNAN: Okay. To the full Board, is there any objection to withdrawal of Mr. Keliher's motion seconded by Mr. Borden? Hearing none, to the Board. Is there any objection to withdrawal of the motion previously made by Ms. Murphy, seconded by Ms. Patterson?

MS. KERNS: Dan, I want to make sure Mike Luisi is not objecting. He has his hand up, so I just want to confirm.

CHAIR McKIERNAN: Mike.

MR. LUISI: Oh no, Dan, I'm not objecting, I just had a question. But you are going in the right path. I was just trying to figure out how this worked under Robert's Rules. I think what you're doing right now. That's all I had a question for, so I want to put my hand down. But as long as we can clear the board and then vote on the new motion, I think we're good to go.

CHAIR McKIERNAN: I think so too, thanks to Robert Beal helping us with Robert's Rules. I think we're in a good place. Now we have this new motion. Do we need a second on this motion, Toni?

MS. KERNS: I guess my thought was is you could do this by consensus. It doesn't necessarily have to be a motion. But it can be a motion if you need it to be.

MR. LUISI: I'll second the motion if need be, after the other motions get clear, I'll second the motion for discussion.

CHAIR McKIERNAN: All right, so it's a motion by Pat Keliher, it's been seconded by Mike Luisi, and we can take discussion. Is there any need for discussion? If not, then we can just, is there any objection, assuming not?

MS. KERNS: I don't see, well Pat Keliher has his hand up. I think it might be an artifact of before.

MR. KELIHER: Yes, my apologies. I get confused with these fancy buttons, sorry.

CHAIR McKIERNAN: **All right, so there is no objection to this motion. It's enacted by consent.** Thank you everyone, sorry about that difficult process, but these are very important issues. In my mind there is probably nothing more important than the lobster fishery having an opportunity to establish its footprint on all the issues that were laid out in that memo.

OTHER BUSINESS

APPOINTMENT TO THE PLAN DEVELOPMENT TEAM FOR ADDENDUM XXVII

CHAIR McKIERNAN: All right, I think next is Other Business. Is there any other business to come before the Board? Actually, I have one. I would like to appoint Bob Glenn to the Plan Development Team. Is there any objection on the Board to Bob Glenn joining the PDT? Bob is a former TC Chair, and has done a lot of great work on this, as well as the Large Whale Team, and I think he would be a great contributor to the PDT.

MS. KERNS: Dan, to clarify that is for Addendum XXVII that Max does not have a representative from.

CHAIR McKIERNAN: Thanks, Toni. Hearing no objection, let Bob know he's a part of the PDT for Addendum XXVII.

ADJOURNMENT

CHAIR McKIERNAN: All right, can I get a motion to adjourn?

MR. KELIHER: So, moved.

CHAIR McKIERNAN: Thank you everyone. Meeting adjourned.

(Whereupon the meeting convened at 5:15 p.m. on Monday, May 3, 2021.)

Atlantic States Marine Fisheries Commission

American Lobster Addendum XXVII Plan Development Team
Meeting Summary
Webinar
Wednesday, July 7, 2021

Attendance: Caitlin Starks (Chair, ASMFC), Kathleen Reardon (ME), Corinne Truesdale (RI), Bob Glenn (MA), Alli Murphy (NOAA), Emilie Franke (ASMFC)

The Plan Development Team (PDT) met to continue the development of Draft Addendum XXVII on biological resiliency in the Gulf of Maine/Georges Bank (GOM/GBK) Stock. First the TC Chair gave an update on the status of analyses being performed by the TC to provide advice to the PDT on appropriate management measures to increase the biological resiliency of the stock. The TC has reviewed previous analyses to estimate projected impacts of various gauge size changes on catch (in numbers and weight) and spawning stock biomass (SSB). However, there was concern among TC members that the offshore fishery in Lobster Conservation and Management Area (LCMA) 3 was considerably different from the full stock model and, thus, may have inaccurate results due to a mis-parameterized simulation model. To address this, the TC agreed to perform further analysis for LCMA 3 to 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. Due to TC workloads this analysis has not yet been completed but is expected soon.

Next the PDT discussed two alternatives for how to structure the proposed management options in the addendum. The PDT reviewed the previous options they developed, which included "packages" of management triggers and the measures that would be implemented as a result of reaching that trigger. Concerns were raised that some of the options to standardize measures within or across LCMAs did not meet the goal of increasing resiliency. The group acknowledged that the Board prioritized increasing resiliency over standardization, but the document could consider options that accomplish both objectives; they agreed that the document should be clear as to what objectives each proposed option is intended to accomplish. The PDT preferred the second draft option structure, which arranges the options into 4 issues:

1. Standardizing some measures upon final approval of addendum
2. Establishing management triggers to automatically implement measures to increase biological resiliency
3. Management measures that would be automatically implemented at defined triggers
4. Spatial implementation of management measures in LCMA 3

The PDT provided additional guidance on the options to be considered in the document. First, they agreed that more than two trigger levels should be proposed to give the Board a broader range of options from very conservative (trigger related to Fishery/Industry Target reference

point) to less conservative (trigger related to Abundance Limit reference point). They noted that the document should provide more description and explanation of the biological risks and rewards associated with the trigger options, or else they may be viewed as arbitrary levels. Kathleen noted that the regime shift analysis in the assessment could be used to better explain the trigger levels.

With regard to the management measures that should be included in the document as options, the PDT discussed that the most effective way to impact the stock resiliency seems to be to increase the minimum size in LCMA 1, given that is where the large majority of landings occur, and that the minimum size in LCMA 1 is still several millimeters under the size at 50% maturity. They also noted that increasing minimum size should increase yield in weight, whereas decreasing maximum size would reduce yield. The PDT agreed that for the measures options, minimum and maximum size should be dealt with separately, and that it would be best to put forward a set of Area-specific measures and a set of standardized measures. For the Area-specific measures, the PDT noted that depending on the TC analysis, it may be beneficial to consider an option in which the minimum size in Area 1 is increased while the maximum size in Area 3 is decreased, given differences in catch composition between the area. There was some disagreement among members about whether there is a scientific basis for using a tiered approach where less restrictive measures would be implemented at a more conservative trigger, and more restrictive measures would be implemented at a second less conservative trigger level, given uncertainties about the stock-recruit relationship. Ultimately the group agreed to keep this approach on the table since it was desired by the Board, and will look for additional feedback at the next Board meeting.

The PDT members each provided approximations of how long it would take their states or agencies to implement management measures, both at the time the addendum is approved, and when a management trigger is met. These approximations were based on a tentative timeline of addendum approval in February 2022, followed by evaluation of management triggers in October of each year when the TC provides annual index data to the Board. There may be a need for multiple states to write the trigger mechanism into their regulations so that they can quickly implement management measures when they are triggered. The following timelines were estimated for implementing management measures:

- **Maine**: The minimum and maximum gauge size are regulated in statute; meaning a change to these would have to go through the state legislature. The amount of time required to change the statute depends on whether it is initiated in the first or second session of the legislature, and this could take up to 20 months. It may be necessary to remove the minimum and maximum gauge size from statute to implement a management trigger.
- **New Hampshire**: It will likely take around 2 months to make changes such as gauge or v-notch regulations.
- **Massachusetts**: Once the addendum is approved, it could take 4-6 months to get the regulations through the state's public process.

- **Rhode Island**: From February 2022, it is estimated it would take around 4 months to implement measures.
- **NOAA Fisheries**: It would take about a year to implement new regulations, and the intention would be to write the triggers into federal rulemaking.

The PDT also noted that consideration should be given to how long industry would need to obtain new gauges if the size is changed. For example, if a new minimum size is established that is not currently being used in any of the management areas, a new gauge would have to be manufactured, which could take more time; alternatively, if the minimum size changes to something that is already being used, less time would likely be needed to produce new gauges because it would simply be a matter of increasing supply. Timing will depend on the demand and supply for different gauge sizes and the manufacturers. The PDT also stated that it would make the most sense to implement new measures resulting from a management trigger at the beginning of the season rather than in the middle of the season.

The PDT is seeking additional information and Board guidance regarding the questions below:

- Considering pros and cons of a tiered approach to management triggers and measures, is the Board still interested in using this approach?
- Are there any trigger levels the Board would consider too aggressive (i.e. the trigger may already be met) or not precautionary enough?
- If a trigger mechanism is implemented through final approval of the addendum, will the states be able write the established triggers into their rulemaking? Or would rulemaking to implement new management measured have to occur *after* a trigger is met?
- Are there limitations to the range of gauge sizes the Board is willing to consider?

Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: **American Lobster Management Board**

FROM: **Jonah Crab Technical Committee**

DATE: **July 19, 2021**

SUBJECT: **Jonah crab pre-assessment report and Technical Committee recommendations**

Background

The Atlantic States Marine Fisheries Commission (ASMFC) approved the Jonah crab Fishery Management Plan (FMP) in August of 2015. The impetus of the FMP was a group of industry members that formed a fisheries improvement project (FIP) and requested ASMFC take on the management of Jonah crab. The FIP was concerned that questions over sustainability and lack of management would hinder the market for Jonah crab. While management is now in place, the sustainability of the fishery is still unknown. Jonah crab landings increased rapidly starting in the mid-2000s. Coastwide landings, which averaged 4.8 million pounds from 1997 to 1999, have since quadrupled to an average of 20.1 million pounds from 2017 to 2019. Canadian Jonah crab assessments – where similar landings trajectories were observed – have suggested that non-science-based catch measures used to manage Jonah crab were not sustainable. To date there has been no stock assessment of US Jonah crab, stock status is unknown, and there has been limited science-based advice available to support management of Jonah crab fisheries.

The Jonah Crab Technical Committee (TC) met in August 2017 to review research projects and discuss data limitations. This review identified limitations on understanding of basic life history processes, but also identified several ongoing projects that could help fill some information gaps in coming years. The TC met again in April 2020 to review ongoing research as well as regular agency monitoring efforts. During this meeting, the TC recommended a more in-depth review of available data to better understand limitations and identify stock assessment approaches that could be supported with available data. Subsequently, the American Lobster Management Board (Board) tasked the TC in August 2020 with conducting a pre-assessment workshop for Jonah crab and providing a report on available data and recommended assessment approaches. Webinars were held November 16-18, 2020, February 11, 2021, June 3, 2021, and June 29, 2021 to review and discuss available Jonah crab data sets, potential assessment approaches, and remaining data limitations. From these discussions the TC produced a Jonah Crab Pre-Assessment Data Workshop Report (hereafter, report). This memo outlines a recommendation on near-term Jonah crab stock assessment and potential assessment approaches. More detailed information on available data and assessment approaches can be found in the report included in the meeting materials.

Recommendation on Jonah Crab Stock Assessment Schedule

The TC recommends moving forward with a stock assessment to be completed in 2023, consistent with current Northeast Region Coordinating Council and ASMFC assessment schedules. Given the data available, steady increase in landings as the fishery has developed, the precedent set by Canadian fisheries for risks of managing Jonah crab without science-based guidance, and persistent uncertainty about sustainability and market limitations, the TC believes that conducting a near-term stock

assessment would be worthwhile. A near-term assessment could help answer questions about the status and sustainability of the resource and provide more information with which to manage the fishery in a shorter timeframe. Additionally, it could identify data needs beyond those identified during the pre-assessment data workshop, which if addressed, could help strengthen future assessments.

Potential Stock Assessment Approaches

Jonah crab should be considered a data poor species, which will limit the types of approaches that can be used for assessment. Below are the most likely assessment approaches that could be utilized in a near-term assessment, including outputs and examples of other ASMFC-managed species that have been assessed with the approach. Several additional approaches are discussed in the report, but these approaches are less likely to be useful for a near-term assessment due to potential assumption violations or data limitations.

- ***Stock Indicators***

  Stock indicators are simple, empirical time series analyses that do not require assumptions typical of population dynamics models. These indicators can be used in a framework to provide a categorical characterization of stock conditions to complement stock status estimates from other assessment approaches and/or pre-defined triggers for management responses.

  Outputs: Annual indicator values relative to time period-based reference values

  Examples of other ASMFC-managed species assessed with these approaches: American lobster (categorical characterization of stock conditions to complement stock status estimates from other assessment approaches), spot and Atlantic croaker (pre-defined triggers for management responses)

- ***Index-Based Methods***

  These assessment approaches include a number of methods that utilize indices of abundance to provide stock status based on an ad hoc, historical time period (e.g., ARIMA) or catch-based management advice (e.g., PlanB). Performance of several of these methods when natural mortality is misspecified or annual catch data is incomplete, two areas of uncertainty facing Jonah crab assessment, was recently evaluated through a research track assessment conducted by the NEFSC (Legault et al. 2020). The assessment found two groups of methods tend to perform best dependent on the condition of the stock (i.e., favorable or unfavorable) for groundfish species and could be useful for short-term management advice while working towards advice from models that account for size/age structure of the stock.

  Outputs: Stock status based on an ad hoc, historical time period or sustainable catch levels

  Examples of other ASMFC-managed species assessed with these approaches: Horseshoe crab (stock status based on an ad hoc, historical time period)

Atlantic States Marine Fisheries Commission

Jonah Crab Pre-Assessment Data Workshop Report

August 2021

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

Atlantic States Marine Fisheries Commission

Jonah Crab Pre-Assessment Data Workshop Report

Prepared by the
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1 INTRODUCTION

Cooperative interstate management of Jonah crab (*Cancer borealis*) in U.S. waters was first implemented in 2015 with the adoption of the Atlantic States Marine Fisheries Commission's (ASMFC) Interstate Fishery Management Plan (FMP; ASMFC 2015). However, there has been no stock assessment of U.S. Jonah crab to date, stock status is unknown, and there has been limited science-based advice available to support management of Jonah crab fisheries. The Jonah Crab Technical Committee (TC) met in August 2017 to review research projects and discuss data limitations. This review identified limitations on understanding of basic life history processes, but also identified several projects in progress that could help fill some information gaps in coming years. The TC met again in April 2020 and reviewed ongoing research as well as regular agency monitoring efforts. During this meeting, the TC recommended a more in-depth review of available data to better understand limitations and identify stock assessment approaches that could be supported with available data. Subsequently, the ASMFC American Lobster Management Board (Board) tasked the TC in August 2020 with conducting a pre-assessment workshop for Jonah crab and providing a report on available data and recommended assessment approaches. A series of webinars was held November 16-18, 2020, February 11, 2021, June 3, 2021, and June 29, 2021 to review and discuss available Jonah crab data sets, potential assessment approaches, and remaining data limitations. This report provides the TC's evaluation of the data sets, findings on potential approaches for a near-term stock assessment to provide management advice, and research recommendations to advance future stock assessments.

1.1 Brief Overview and History of the Fisheries

Until recently, Jonah crab were predominantly a bycatch species in the American lobster fishery—annual commercial Jonah crab landings were generally lower than 6 million pounds through 2000 (Figure 1). Since then, as the lobster fishery has declined in southern New England (SNE) and the market for crab has expanded, harvesters have pivoted to target Jonah crab in addition to (or instead of) lobster. A mixed crustacean fishery now exists in which fishers seasonally adjust their fishing strategies to target Jonah crab or lobster. Harvest pressure on Jonah crab has increased substantially over the past two decades, with landings increasing steadily since around 2000 (Figure 1). Total Jonah crab commercial catch in 2019 was 17.7 million pounds, with a total ex-vessel value exceeding $13 million.

The Jonah crab commercial fishery occurs predominantly in SNE. Most of the U.S. Jonah crab commercial catch is landed in Massachusetts (57.4%, 2017-2019 average) and Rhode Island (21.4%), and most harvest occurs offshore in NOAA Fisheries statistical areas (hereafter, statistical area) 537 (71.5%), 526 (10.5%), and 525 (9.9%) - hereafter, the core statistical areas. Most Jonah crab commercial landings are reported as having been caught in traps and pots (92.7%, 2012-2019), and most harvest that is not reported as trap-caught does not have a gear type reported (6.1% of total harvest). Less than 1% of the commercial harvest is reported as coming from trawls (0.2%) or dredges (0.1%).

Coastwide, commercial landings of Jonah crab are highest in the late autumn and winter months (October to February). In an interview study, fishermen indicated that this seasonal shift was driven by the lobster fishery—lobster are less abundant in winter, so harvesters transition to target Jonah crab during these months. Based on interviews with fifteen Jonah crab fishermen from Rhode Island and Massachusetts (Truesdale et al. 2019a), the number of traps set to target Jonah crab over lobster increased by 73% in the winter compared with the summer months. Fishing strategy adjustments made to transition between Jonah crab and lobster include escape vent modifications, bait type, and fishing location changes.

A small Jonah crab claw fishery operates in Delaware, Maryland, and Virginia, wherein the claws of large Jonah crabs are removed and the animal is returned to the ocean alive. Claw harvest comes mostly from lobster vessels fishing in Lobster Conservation Management Area (LCMA) 5 and accounts for less than 1% of the coastwide commercial landings.

There is no regulatory distinction between a lobster trap and a Jonah crab trap, and a vessel's target species can often not be determined from trip reports and dealer data. Because of the issue of identifying target species and because the Jonah crab fishery is recently developed and still evolving, Jonah crab fishing effort is not yet well characterized and there is little literature describing the seasonal dynamics, fishing strategies, and socioeconomic aspects of the fishery. Some anecdotal information has been summarized and may provide a starting point for analyzing and characterizing the fishery (Truesdale et al. 2019a), but quantifying fishing effort for Jonah crab versus lobster remains a data need for future assessments.

1.2 Management Unit Definition

The management unit for Jonah crab includes the U.S. Atlantic states from Maine through Virginia, though the biological range of the species extends from Newfoundland, Canada to Florida.

1.3 Regulatory History

The ASMFC coordinates the interstate management of Jonah crab in state waters (from 0-3 miles offshore). The ASMFC manages Jonah crab through the FMP, which was approved by the Board in August 2015 under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (1993). Management authority in the exclusive economic zone (EEZ), which extends from 3-200 miles offshore, lies with NOAA Fisheries. The FMP was initiated in response to concern about increasing targeted fishing pressure for Jonah crab, which has long been considered a bycatch species in the lobster fishery. The mixed nature of the fishery created a challenge for managing a Jonah crab fishery completely separate from the lobster fishery without impacting the number of vertical lines and traps in state and federal waters. Furthermore, a lack of universal permitting and reporting requirements made it difficult to characterize catch and effort to the full extent in order to manage the fishery.

The goal of the FMP is to promote conservation, reduce the possibility of recruitment failure, and allow for the full utilization of the resource by the industry. The FMP lays out specific management measures in the commercial fishery to limit effort and protect spawning stock biomass in the absence of a range-wide stock assessment. These include a 4.75" minimum size

carapace width (CW) and a prohibition on the retention of egg-bearing females. To prevent the fishery from being open access, the FMP states that participation in the directed trap fishery is limited to lobster permit holders or those who can prove a history of crab-only pot fishing. All others must obtain an incidental permit. In the recreational fishery, the FMP sets a possession limit of 50 whole crabs per person per day and prohibits the retention of egg-bearing females. Due to the lack of data on the Jonah crab fishery, the FMP implements a fishery-dependent data collection program. The FMP also requires harvester and dealer reporting along with port and sea sampling.

Addendum I was approved by the Board in May 2016, and states were required to implement the management measures in Addendum I by January 1, 2017. Addendum I establishes a bycatch limit of 1,000 pounds of crab/trip for non-trap gear (e.g., otter trawls, gillnets) and non-lobster trap gear (e.g., fish, crab, and whelk pots). In doing so, the Addendum caps incidental landings of Jonah crab across all non-directed gear types with a uniform bycatch allowance. While the gear types in Addendum I make minimal contributions to total landings in the fishery, the 1,000 pound limit provides a cap to potential increases in effort and trap proliferation.

Addendum II was approved in January 2017, with associated measures required by January 1, 2018. Addendum II establishes a coastwide standard for claw harvest. Specifically, it permits Jonah crab fishermen to detach and harvest claws at sea, with a required minimum claw length (measured along the bottom of the claw, from the joint to the lower tip of the claw) of 2.75" if the volume of claws landed is greater than five gallons. Claw landings less than five gallons do not have to meet the minimum claw length standard. The Addendum also establishes a definition of bycatch in the Jonah crab fishery, whereby the total pounds of Jonah crab caught as bycatch must weigh less than the total amount of the targeted species at all times during a fishing trip. The intent of this definition is to address concerns regarding the expansion of a small-scale fishery under the bycatch limit.

In response to concerns regarding deficits in existing reporting requirements, the Board approved Addendum III in February 2018, which improves the collection of harvester and biological data in the Jonah crab fishery. Specifically, the Addendum improves the spatial resolution of harvester data collection by requiring fishermen to report via 10 minute squares. It also expands the required harvester reporting data elements to collect greater information on gear configurations and effort. In addition, the Addendum established a deadline that within five years, states are required to implement 100% harvester reporting, with the prioritization of electronic harvester reporting development during that time. Finally, the Addendum improves the biological sampling requirements by establishing a baseline of ten sampling trips/year, and encourages states with more than 10% of coastwide landings to conduct additional sampling trips. The provisions of Addendum III went into effect January 1, 2019, however, implementation of the requirement for commercial harvesters to report their fishing location by 10 minute longitudinal/latitudinal square was delayed until January 1, 2021.

Federal regulations complementing the majority of measures included in the FMP and Addenda I and II became effective on December 12, 2019. Commercial measures included requiring a federal lobster permit, a minimum CW, a prohibition on retaining egg-bearing females, incidental catch limits, and federal dealer permitting and reporting requirements. Recreational

measures included a daily catch limit and a prohibition on retaining egg-bearing females. The Jonah crab claw-only fishery is not directly regulated in federal waters; harvesters must abide by state requirements.

1.4 Assessment History

The only stock assessments conducted for Jonah crab to date have been in Canadian Lobster Fishing Area (LFA) 41 where Jonah crab have been caught as directed catch starting in 1995. In response to the developing fishery, a total allowable catch (TAC) of 720 metric tons that was not based on scientific advice was implemented for the fishery. This TAC was fully or nearly caught in all seasons from the 1996-1997 fishing season through the 2000-2001 fishing season and was followed by a continuous decline in catch through the 2008 fishing season. Assessments were conducted in 2000 and, most recently, in 2009 (Fisheries and Oceans Canada 2009). These assessments provided empirical-based stock indicators developed from existing monitoring programs. Indicators included abundance indicators (fishery-independent indices of abundance, fishery CPUE, and total landings) and fishing pressure indicators (number of traps hauled and median size). Indicators were categorized as positive, neutral, or negative and used to provide qualitative characterizations of stock status. In the most recent assessment, all indicators were negative relative to the previous assessment time period (1995-1999), with the exception of median size. Abundance indicators from surrounding LFAs where directed Jonah crab fisheries had not developed indicated no clear abundance declines over the same time period. Although the assessment notes some uncertainty in the cause(s) of negative stock conditions, the results suggest the TAC was not sustainable and declines are due to fishing down the biomass from the start of the fishery.

2 LIFE HISTORY

2.1 Summary

Jonah crab range from Newfoundland to Florida (see Section 3 for more detail on habitat). Movements of mature Jonah crabs are generally limited (<5 km), particularly compared to the similar species Atlantic rock crab (*Cancer irroratus*; Stehlik et al. 1991), but some may travel over 100 km (Perry et al. 2019).

Maximum reported size is 222 mm CW for males (Pezzack et al. 2011) and 152 mm CW for females (Haefner 1977). Recent work using the gastric mill to age Jonah crab has shown promise, but the gastric mill is shed during ecdysis so it is unknown how an annulus could be formed. Using the gastric mill method, male Jonah crabs are estimated to reach minimum legal size (120.65 mm CW) at 4 to 7 years of age (Huntsberger 2019). Male crabs below 120 mm molted in June in southern New England (Truesdale et al. 2019b). Molt probability of male crabs decreases with increasing CW (Truesdale et al. 2019b). In a tagging study, some crabs had not molted when recaptured nearly three years after their initial capture (MA DMF unpublished data).

Male crabs have been estimated to reach morphometric maturity at 128 mm CW in Canada (Moriyasu et al. 2002), but all studies in U.S. waters (Carpenter 1978, Ordzie and Satchwill 1983,

Perry et al. 2017, Lawrence 2020, Olsen and Stevens 2020) have shown that male and female crabs reach maturity below the current minimum legal size. Estimated size-at-maturity in U.S. waters ranges from 90 to 117 mm CW for male crabs (Table 1) and 40 to 94 mm CW for female crabs (Table 2).

In nearshore waters, Jonah crab prey upon polychaetes, mussels, snails, and other shellfish (Stehlik 1993 Donahue et al. 2009). Jonah crab are consumed by tautog, smooth dogfish, lobsters, cunner, cod, and gulls (Richards 1992, Donahue et al. 2009). Food habits data collected from the NOAA Fisheries Northeast Fisheries Science Center (NEFSC) trawl survey showed cod, longhorn sculpin, smooth dogfish, little skate and barndoor skate had the highest number of sampled stomachs containing Jonah crab (NEFSC unpublished data).

2.2 Recent Jonah Crab Life History Studies

2.2.1 Massachusetts Division of Marine Fisheries Tagging Study

The Massachusetts Division of Marine Fisheries (MA DMF), in collaboration with the Atlantic Offshore Lobstermen's Association (AOLA), New Hampshire Fish and Game (NH F&G), and Maine Department of Marine Resources (ME DMR), completed a Jonah crab tagging study in 2018 in which over 32,000 Jonah crabs were tagged across 12 different statistical areas. Two types of tags were used; a t-bar tag designed to stay with the crab through a molt, and a cinch tag that would be lost after a molt. Other data collected at the time of release included CW, sex, egg status, and cull status. Preliminary data suggests that most Jonah crab do not migrate far. Most of the recaptures (over 900 crabs) occurred within 5 km of where they were released, though six crabs traveled more than 100 km. None of the 25 crabs recaptured after more than 600 days had molted.

2.2.2 University of Maine Growth Study

A growth study including techniques for age determination was completed by Huntsberger (2019) for Jonah crabs from the Gulf of Maine (GOM). Three independent methods of age determination were compared: (1) length frequency analysis of crabs sampled periodically in wild nursery populations including young-of-year (YOY) crabs, (2) building a probabilistic growth model informed with data from a laboratory growth study, and (3) applying the method of direct gastric mill band counts from crabs collected in two contrasting temperature regimes along Maine's coast.

In summary, the length frequency analysis was conducted at a weekly scale with passive collectors in the water column during the late summer, a monthly scale collecting size frequency on 358 crabs with benthic suction sampling at four sites near the mouth of the Damariscotta River estuary, and a yearly scale using existing survey data from the American Lobster Settlement Index (ALSI) and Maine-New Hampshire trawl survey. These three methods provided size-at-age estimates for the first three year classes, clear size ranges for YOY (3.8-6.6 mm CW), and showed correlation between YOY and legal size crabs 4 to 6 years later (Figure 2).

For the laboratory growth study, 464 Jonah crabs from mid-coast between 3.1-143mm CW were monitored in captivity for up to two years. Overall, 172 individuals (40%) molted while in

captivity. The data fields recorded were date and size at capture, weekly size, date of molt and new size, and date of mortality. No molts were observed in the winter and molting peaked in the late spring and early summer. Molt increment decreased with larger crabs, averaging between 12 and 40% of the pre-molt size. The data collected were used to build a probabilistic molt model estimating the growth of an individual male crab until it reached legal size. Modeled growth of 1,000 crabs highlighted variability in growth, as males reached minimum legal size at an estimated four to nine years of age. No growth data for mature females or males over 100 mm were collected.

2.2.3 Rhode Island Growth Study

From 2016 to 2017, a growth study was conducted by a University of Rhode Island (URI) graduate student in collaboration with the Rhode Island Department of Environmental Management Division of Marine Fisheries (RIDEM DMF). Molt increment data were collected from Jonah crabs observed in the laboratory, as well as from Jonah crabs that molted in commercial traps. These crabs were caught in statistical areas 539 and inshore 537. Regression analysis of growth-per-molt was conducted on 119 growth increments from females ranging in post-molt CW from 73 to 113 mm and 91 increments collected from males ranging between 97 and 149 mm (Truesdale et al. 2019b). Molting seasonality was also observed, and molt probabilities were estimated for male crabs via repeated sampling and laboratory observation. These observations indicated a discrete molting period in the summer for male Jonah crabs at the observed sizes, with decreasing molting probabilities as crabs increased in size. Female Jonah crabs were not consistently sampled because they were caught in commercial traps sporadically, so molting seasonality and molt probabilities could not be estimated for females.

2.2.4 Jonah Crab Maturity Studies

There have been three recent Jonah crab size-at-maturity studies conducted since the Jonah crab FMP was approved in 2015. These studies cover a wide area, from the mid-Atlantic to the GOM and expand upon previous research in the mid-Atlantic (Carpenter 1978), SNE (Ordzie and Satchwill 1983) and Nova Scotia (Moriyasu et al. 2002).

From 2015 to 2017, MA DMF, AOLA and the Commercial Fisheries Research Foundation (CFRF) partnered on a Jonah crab maturity study. Over 2,400 male and female crabs from five geographic areas (inshore SNE, offshore SNE, inshore GOM, offshore GOM, and Georges Bank (GB)) were analyzed for morphometric and gonadal maturity. Morphometric data collected included sex, CW, body depth, and chelae dimensions (height, length, and depth). Additionally, width of abdominal (“apron”) segments, egg clutch presence/absence, and presence/absence of a sperm plug in female vulva were recorded for female crabs.

Crabs were collected opportunistically throughout the year. For gonadal analysis, seasons were defined as: January-March (winter), April-June (spring), July-September (summer), and October-December (fall). Male (testes and vas deferens combined) and female (ovaries) gonads were classified based on relative gonad size and color, similar to Haefner (1977) but instead of comparing the size of the gonad to the size of the hepatopancreas, the area of the gonad was compared to the area within the perimeter of the carapace. Male gonad color was classified as

white (indicative of the presence of sperm) or clear/undetectable gonads. Female ovaries were classified as orange, peach, tan, or clear/undetectable gonads.

Male crabs reached morphometric maturity between 103 to 117 mm CW depending on region. The size at 50% morphometric maturity could not be detected in inshore SNE. The size at 50% gonadal maturity also could not be estimated due to the paucity of physiologically immature male crabs in all regions. SNE and GB female crabs reached 50% morphometric maturity at 88 and 94 mm CW, respectively. Morphometric maturity could not be estimated in other regions. The size at which 50% of female crabs reached gonadal maturity varied by region from as little as 86 mm CW (inshore SNE), to as much as 98 mm CW (offshore GOM).

Olsen and Stevens (2020) conducted a maturity study in the Middle Atlantic Bight, collecting samples from 2015 to 2017. Morphometric data was collected on carapace length, CW, spine width, abdomen width, chela length, chela height, and chelae weight. Morphometric size-at-maturity for male crabs (n=562) was determined to be 98.3 mm CW, and 88.2 mm CW for females (n=798). Crabs with claws at the minimum legal size for the claw-only fishery (69.85 mm in claw length) were predicted to be 126 mm CW and 150 mm CW for males and females, respectively.

Lawrence (2020) studied physiological and morphometric maturity in male Jonah crab from SNE. The estimated size at morphometric maturity was 106 mm CW.

3 HABITAT DESCRIPTION

Jonah crabs can be found from Newfoundland to Florida at depths ranging from the intertidal to 800m but are most abundant in the northern latitudes (Pezzack et al. 2011, Haefner 1977, Stehlik et al. 1991). Limited specific information is available for the distribution as depth, season, habitat, and temperature affect the abundance of Jonah crabs (Stehlik et al. 1991, Carpenter 1978, Haefner 1977, Krouse 1980). The highest abundance of Jonah crabs are found in water temperatures of 6-14^{o}C (Stehlik et al. 1991, Haefner 1977, Krouse 1980, Pezzack et al. 2011). Krouse (1980) suggests Jonah crabs have a narrower temperature range tolerance than *Cancer irroratus* and may stay further offshore to attain more stable bottom temperatures. At the southern end of their range, Jonah crab prefer greater depths (Jeffries 1966). In the Mid Atlantic Bight, Haefner (1977) provides evidence for an increase in size as depth increases while Carpenter (1978) suggests relative abundances of distinct size groups can be found at different depths depending on the time of year. Carpenter (1978) found female Jonah crabs are more abundant at depths less than 150m while the males are in deeper water.

Historic offshore trawl surveys and recent interviews with SNE fishermen found the highest abundance of Jonah crabs in silty sand and flat muddy habitats (Haefner 1977, Stehlik et al. 1991, Truesdale et al. 2019a), but studies, mostly in the GOM based on inshore SCUBA work, trapping, and video survey, found Jonah crabs associated with more complex cobble, boulder, and sand substrate (Jeffries 1966, Krouse 1980, Richards 1992, Palma et al. 1999, Reardon 2006). YOY and juvenile Jonah crabs are found in relatively high numbers during the settlement surveys (Section 5.2) in the surveyed cobble habitat. Whether offshore areas provide important settlement or nursery habitat is poorly understood. The discrepancy of observed crab habitat could be due to lower catchability of crabs by trawl surveys and commercial pot gear in

complex habitat, difference of primary substrate type by life stage, or correlation of substrate with depth.

4 FISHERY DEPENDENT DATA SOURCES

4.1 Commercial

4.1.1 Landings Data Collection and Treatment

4.1.1.1 Maine

A Lobster and Crab Fishing License is required to commercially harvest Jonah crab in Maine, and it has historically been a bycatch species of the lobster fishery. A permit endorsement is also available for the drag fishery, which allows a limit of 200 pounds per day and 500 pounds of Jonah crab per trip. Traps are subject to the lobster rules including maximum size, escape vents, and trap tags. There is a recent prohibition of claw harvest, except for a personal use exemption of a 5-gallon bucket maximum. While the market has always dictated a male-only fishery, the recent FMP provided the guidelines for regulations on size of greater than 4.75 inches.

Misidentification of Jonah crab creates challenges in the landings data because both *Cancer irroratus* (Atlantic rock crab) and *Cancer borealis* (Jonah crab) are harvested as bycatch and have an identical common name of “rock crab”. Historically, crab landings were reported on a monthly basis, but were not mandatory until 2004 and were not linked to state harvester identification numbers in the CFDERS database. In 2006, Maine shifted to using the Atlantic Coastal Cooperative Statistics Program’s (ACCSP) Standard Atlantic Fisheries Information System (SAFIS) and Maine’s MARVIN database for monthly mandatory reporting of landings with associated harvester identification numbers that add accountability. In 2008, the mandatory reporting was required on a trip and species level, yet there are still “Crab unclassified” landings in 2020, albeit much reduced as compared to prior to 2008.

Both *Cancer* crab species were considered lower value species compared to lobster and were commonly sold for cash prior to reporting requirements; as such, landings prior to (and potentially after) 2008 should be considered an underestimate. Of the reported landings, ME DMR expects most reported volume and market demand has been for Jonah crab as opposed to Atlantic rock crab, so it is expected that historical and recent landings trends for Jonah crab should include most of the “crab unclassified” and “rock crab” landings. It may be possible to use a price threshold of $0.35 to identify the likely Jonah crab landings, but there is uncertainty on this threshold, especially earlier in the time series.

4.1.1.2 New Hampshire

New Hampshire lobster and crab harvesters have been reporting annual landings from state waters since 1969 to the NH F&G, but only reporting of lobster landings was mandatory prior to 2016. While Jonah crab catch and effort was not mandatory during this period, harvesters were provided the opportunity to report crab bycatch at the monthly level. In 2016, with the adoption of the Jonah crab FMP, New Hampshire implemented mandatory Jonah crab harvest

reporting on both monthly-summary and trip-level reports. Only commercial harvest by state lobster and crab license holders is included.

Historically, the quantity of lobsters and crabs landed in New Hampshire harvested from federal waters was derived from a combination of the NOAA Fisheries weighout and canvas database and federal vessel trip reports (VTRs). Currently, NOAA Fisheries has mandatory reporting of harvest data for the majority of federally permitted vessels that land in New Hampshire through VTRs.

In cooperation with NOAA Fisheries, New Hampshire instituted mandatory lobster dealer reporting in 2005 and began collecting all data required under ACCSP standardized data submission standards. New Hampshire lobster dealers report transaction-level data on a monthly basis through use of paper logbooks or directly through electronic dealer reports (EDR). Dealers report all species harvested and both state and federal dealers have been able to report Jonah crab since implementation. Jonah crab landings in New Hampshire have been reported by dealers since 1994.

Total monthly landings from dealer reports, catch data from federal VTRs, and catch data from state logbooks are available for use for stock assessment purposes. In order to assign areas to the dealer report records and calculate effort estimates, VTRs and state logbooks may be used to identify statistical areas and effort values as dealer reports do not contain area and effort data.

4.1.1.3 Massachusetts

Participation in the Massachusetts Jonah crab fishery has been limited to those that hold a commercial lobster/edible crab permit since 1948. Reporting of landings through Massachusetts trip level reports (MATLR) or NOAA Fisheries VTRs has been mandatory since 2010. On MATLR, fishermen are asked to report location of catch, gear type, amount of gear, soak time, number of trawls, and quantity landed.

Most Jonah crab landed in Massachusetts are caught in federal waters and reported on NOAA Fisheries VTRs. A small number of boats targeting Jonah crab are usually responsible for a large portion of the state Jonah crab landings, but there are numerous fishery participants targeting lobster that land smaller amounts of Jonah crab. Landings are generally in pounds, but occasionally bushels of crabs are reported. In these cases, the number of bushels is multiplied by 65. The landing of anything other than whole crabs is prohibited. There is speculation that landings may have been under-reported prior to 2010, as Jonah crab was considered a low value species and some catch may have been sold for cash at the dock.

4.1.1.4 Rhode Island

Before 2003, commercial landings in Rhode Island are derived using NOAA Fisheries' data collection methods. Beginning in 2003, 100% electronic dealer reporting was implemented in Rhode Island through the Rhode Island Fisheries Information System, the predecessor of the SAFIS. It took a period of about three years to develop consistency in reporting among all dealers with the new trip-level system but from 2006 on, electronic dealer reports are believed to be a fully reliable source of information on Jonah crab landings. It is unknown to what degree

Jonah crab and Atlantic rock crab have been confused in commercial landings for Rhode Island. However, based on discussions with fishers who have landed Jonah crab for a period of decades, this is not expected to be a significant issue for the Rhode Island fishery.

4.1.1.5 Connecticut

Landings are recorded in the NOAA Fisheries weighout and general canvas database as landings at state ports. Connecticut also records landings by licensed commercial fishermen in any port (inside or outside Connecticut) by means of a mandatory logbook system that provides catch and effort information from 1979 to the present. This mandatory monthly logbook system provides detailed daily catch data by species, area, and gear as well as port landed, traps hauled, set over days, and hours trawled (for draggers). The logbook provides a means to look at fundamental changes in the operating characteristics of the lobster fishery within Long Island Sound. Since 1995, the program has required fishermen to report information on the sale and disposition of the catch, including the state or federal permit number of the dealer to whom they sold their catch. Seafood dealers are also required to report all of their individual purchases from commercial fishermen using either the NOAA form Purchases from Fishing Vessels, a Connecticut Seafood Dealer Report, Abbreviated Form for Lobster Transactions Only, or through the ACCSP's SAFIS. A quality assurance program has been established to verify the accuracy of reported statistics through law enforcement coverage and electronic crosschecking of harvester catch reports and seafood dealer reports.

4.1.1.6 New York

The commercial harvesting of Jonah crab requires a New York commercial crab permit. The crab permit has been limited entry since 6/29/1999. The limited entry stipulates that no new permits are issued, but a certain percentage of forfeited permits from the previous year are made available the following year. The limited entry permit resulted in an overall decrease in permits over time. Permit holders have until December 30th and may renew anytime during the calendar year.

New York's commercial fishery harvest data has been collected through state and federal VTRs since 2012 for food fish, lobster, and crab commercial permits. State VTR data is entered by staff into the New York Fishery Information on Sales and Harvest (NYFISH) database or entered directly by fishermen into the ACCSP's eTrips online database. New York landings reported through federal VTRs are entered by federal staff and shared with New York on a weekly basis in order to provide timely and accurate landings estimates. Landings data are reported by statistical area.

4.1.1.7 New Jersey

The commercial harvest of Jonah Crab within state waters of New Jersey does not occur, therefore is not collected. New Jersey reported landings are obtained from NOAA Fisheries.

4.1.1.8 Delaware

The commercial harvest of Jonah Crab requires either a Directed Jonah Crab Landing Permit issued to those who hold a valid Delaware Commercial Lobster Pot License or federal lobster

permit, or an Incidental Jonah Crab Landing Permit issued by the Delaware Department of Natural Resources and Environmental Control. Delaware's commercial landings are collected through state logbooks. State logbook data is entered into a state-owned database and uploaded annually to the ACCSP data warehouse. Logbooks report daily catch and are required to be submitted on a monthly basis.

4.1.1.9 Maryland

Maryland is a *de minimis* state and all Jonah crab landings are caught in federal waters and reported on NOAA Fisheries VTRs and through SAFIS. There is no directed fishery toward Jonah crab and landings are predominately claws. A small fleet of commercial fishing vessels targeting lobster harvest Jonah crab, predominately in LCMA 5, statistical area 626. In addition to the required federal lobster permit, the Maryland Jonah crab permit is required. The Maryland limited entry Jonah crab claw permit was eliminated by Addendum II (2017).

4.1.1.10 Virginia

Virginia data are collected via required monthly reporting by harvesters. The majority of landings are from a single harvester and all landings are confidential.

4.1.2 Biological Sampling Methods

4.1.2.1 NOAA Fisheries

Sea Sampling

The Northeast Fisheries Observer Program (NEFOP) has collected data from vessels engaged in the lobster fishery, including the associated Jonah crab fishery, as funding allows since 1991. Because there is no mandate under the Standardized Bycatch Reporting Methodology (SBRM) to monitor the federal lobster and Jonah crab fishery to support the management of these fisheries, the number of NEFOP sea days are allocated based on the needs to monitor bycatch of species included in SBRM, including groundfish. Thus, sampling intensity is inconsistent and varies across years. In recent years, NEFOP observer coverage peaked at 60 sea days in 2015 but coverage has since dropped to about 4 sea days per year. Data collected by NEFOP observers include CW (mm), sex, presence of eggs, kept and discarded catch weights, bycatch data (including finfish lengths and weights), gear and bait characteristics, haul locations, water depth, trip costs, and incidental takes.

Port Sampling

The NOAA Fisheries Greater Atlantic Regional Fisheries Office initiated a port sampling program for the targeted Jonah crab fishery in 2021. Annual sample requests are stratified by region, stock area, gear type, and calendar quarter and are allocated to focus on the regions where most of the Jonah crab fishery occurs and be complementary to spatial coverage of port and sea sampling by state agencies. Port samplers select vessels for sampling based on current and historical landings data, real-time vessel tracking, and local knowledge of the fisheries. NOAA Fisheries anticipates collecting 74 port samples per year with a standard sample consisting of 40 CW measurements with gender.

4.1.2.2 Commercial Fisheries Research Foundation

Sea Sampling

CFRF has conducted a fishery-dependent Jonah crab data collection project since 2014, and provided 2014-2019 data for the data workshop. As of November 2020, the Research Fleet has sampled over 92,900 Jonah crabs. The CFRF project has involved 25 vessels over the time series and offered coverage of inshore and offshore SNE, GB, and offshore GOM. Typically, three sampling sessions are conducted per month from fishermen's regular commercial catch. A sampling session consists of sampling catch from a trawl starting with the first trap hauled until 20 traps have been sampled or 50 crabs have been sampled, whichever comes first. For sampling the regular catch, fishermen decide which day(s) sampling sessions are conducted, but the trawl(s) sampled on those days is selected at random. Data collected include vessel ID, date, time, location, depth (feet), sex, CW (mm), egg-bearing status, shell hardness, and disposition (kept or discarded). Data are collected on Samsung tablets using CFRF's On Deck Data application and periodically uploaded to a database at CFRF where they are QA/QC'd and provided to ACCSP.

In addition to regular commercial trap (i.e., vented) sampling, each vessel is given three ventless traps to use during the course of this project. To maintain general consistency with most configuration specifications of other ventless trap sampling programs in Rhode Island, Massachusetts, New Hampshire, and Maine, the Lobster and Jonah Crab Research Fleet deploys ventless traps with the following configurations: 40" length x 21" width x 14" height, single parlor, 1" square rubber-coated 12-guage wire, standard mesh netting, cement runners, and a 4" x 6" disabling door. One ventless trap is deployed at a fixed temperature monitoring station, and the others are deployed as the lobstermen see fit. Ventless trap sampling is not associated with commercial trap sampling, and thus is recorded in a different sampling session. CFRF encourages fishing vessels to record at least one ventless Jonah crab sampling session per month at the bottom temperature monitoring site. Only data from the regular catch samples should be used to characterize the commercial catch size and sex composition since ventless trap catch is not representative of the regular commercial catch.

4.1.2.3 Maine

Sea Sampling

ME DMR does not have a formal Jonah crab sea sampling program as it has been considered a low value species as compared to lobster and is not a target species for the Maine fishery. Some research trips were completed in 2003 and 2004 when the ME DMR was exploring experimental Jonah crab traps that would exclude lobsters yet catch Jonah crab. Those trips included subsampled biological data from both the experimental traps and standard commercial lobster traps. Since 2017, the Lobster Sea Sampling program includes an opportunistic protocol to collect Jonah crab data if they are harvested for commercial sale and the sampler has the capacity to do so. If crabs are sampled, the protocol includes collecting biological data including CW, sex, reproductive status, cull status, and shell hardness. In the future, a standardized subsampling protocol will be developed. ME DMR proposes only using data from trips with more than 20 crabs measured.

4.1.2.4 New Hampshire

Sea Sampling

Jonah crabs have been sampled by NH F&G as bycatch on lobster sea sampling trips since 2015. Samples are collected monthly from May through November at two different locations: the Isles of Shoals, and the coast (Portsmouth harbor to Massachusetts Border). Bycatch is sampled on all observed hauls (50% or more of the total hauls for the day). Data collected on Jonah crabs include sex, CW, shell condition, and cull status. Bycatch data are entered into an Access Database along with the coordinates of the trawl, number of set days, bait type, and water depth. Between 2015 and 2019 a total of 529 Jonah crabs have been sampled on 47 sea sampling trips (Table 3). The overall average CW was 97.2 mm.

Port Sampling

NH F&G has conducted Jonah crab port sampling at local dealers on the New Hampshire coast since 2016. Initially, samples were collected from commercial lobster boats harvesting from several different statistical areas throughout the GOM and GB. More recently, due to a lack of fishing effort in some of the statistical areas farther offshore, samples have been obtained from dealers who purchase crabs from vessels fishing in statistical area 513, which includes both state and federal waters. Biological data (CW, sex, molt stage, shell disease, and cull status) are collected on the landed catch, and information is obtained from the dealer to determine total catch and effort where available. Table 4 provides a summary of number of samples collected per year and quarter.

4.1.2.5 Massachusetts

Sea Sampling

MA DMF does not have a formal Jonah crab sea sampling program because roughly 99% of Massachusetts landings come from federal waters, though some samples have been collected opportunistically. Jonah crab sea sampling data were collected during directed lobster trips in Cape Cod Bay (southern statistical area 514) from 2016 to 2018, and during a Jonah crab tagging project in statistical areas 537, 526, 525 from 2016 to 2017. Target species (lobster or Jonah crab) varied during the Jonah crab tagging project trips. Samplers recorded CW (nearest mm), sex, cull status, mortalities, and presence of extruded eggs. Catch was separated by trap. The start of each trawl was recorded using a handheld GPS. The percent cover of shell disease (black spotting) was characterized in 2017 and 2018.

Port Sampling

MA DMF began a Jonah crab port sampling program in the fall of 2013. Sampling intensity was low during 2013 (2 trips) and 2014 (4 trips). A minimum of 10 trips have been conducted annually since 2015. Vessels sampled in 2013 and 2014 were vessels which had previously participated with MA DMF on cooperative research projects. Starting in 2015, vessels and dealers with the most state landings were targeted for sampling. The vast majority of the sampled catch is from statistical areas 537 and 526. Statistical areas 525, 562, and 514 have been sampled with less regularity. A minimum of five crates or the entire catch, whichever is less, is sampled per trip. Data collected include: CW (mm), sex, and cull status. Shell disease and mortalities have been recorded since 2017.

4.1.2.6 Rhode Island

Sea Sampling

Rhode Island does not currently have a sea sampling program for Jonah crab as funds are not available for this purpose. In 2016 and 2017, 12 sea sampling trips did occur which were part of a URI research project. These trips occurred in inshore statistical areas 539 and 537 (Table 5). Data collected include number of traps per trawl, soak time, bait, bottom type, depth, trap location (latitude/longitude), and trap configuration. From each sampled trawl, effort was made to sample all captured Jonah crabs—whenever this was not feasible, a systematic random sampling frame was used to census every second or third trap in a trawl. The following data were recorded for each sampled crab: CW, sex, ovigerous condition, shell disease level, molt condition, and number of claws missing.

Port Sampling

The RIDEM DMF initiated Jonah crab port sampling efforts in 2015; four trips were sampled during the initial year, before staffing and funding limitations placed this program on hold until 2019 (Table 6). Since the resumption of the program in late 2019, RIDEM DMF has strived to conduct ten port sampling trips for Jonah crabs per year. Most port samples have come from fishing trips taking place in offshore statistical areas 525 and 526. Port samplers reach out to captains and owners of offshore fishing vessels and coordinate with these parties to intercept a portion of their catch before it is offloaded to seafood transporters and dealers. At the trip level, samplers collect information from vessel captains on fishing area, bait, soak type, bottom type in fishing area, number of traps set, and average depth. Biological data are collected from a minimum of two totes of Jonah crab per port sample (about 200 crabs). Collected biological variables include CW, sex, shell disease level, molt condition, and cull status (number of claws missing).

4.1.2.7 New York

Sea Sampling

New York State Department of Environmental Conservation (NYDEC) sea sampling data are collected on cooperating commercial vessels in Long Island Sound (statistical area 611) and the Atlantic Ocean side of Long Island (statistical areas 612 and 613). However, Jonah crab were not included in the program until 2017, after the ASMFC Jonah crab FMP was adopted, and no Jonah crab have been sampled during the program. Much of the sea sample effort has been in statistical area 611, where few Jonah crab reside.

Port Sampling

A port sampling program began in 2005. The main objective of the program is to enhance the collection of biological data from lobsters harvested from LCMAs 3, 4 and 5. A communication network was developed with cooperating dealers and fishermen who fish these areas. This network is contacted to identify days and times of vessel landings to provide sampling opportunities. Utilizing this network of contacts allows for the sampling of lobster fishing trips landed in New York from the appropriate LCMAs. Sampling protocol adheres to the standards and procedures established in NOAA Fisheries Fishery Statistics Office Biological Sampling Manual. This program was expanded to collect data from LCMA 6 starting in 2013. Limited

Jonah crab sampling was conducted in 2014 and directed sampling was initiated in 2017. Jonah crab have only been sampled during market sampling.

4.1.2.8 Maryland

Sea Sampling

Maryland is a *de minimis* state and does not currently have a sea sampling program for Jonah crab, as funds are not available and there is no requirement to do so. However, state biologists have conducted sea sampling in previous years aboard federally permitted lobster fishing vessels in Ocean City, Maryland. Sampling occurred during calendar years 2015, 2016, 2018 and 2019 with 315 randomly selected Jonah crab caught in lobster pots from LCMA 5 (statistical area 626) sampled for CW and sex. Biologists will attempt to randomly measure Jonah crab during lobster sea sampling with the goal of 100 crabs per multiday trip.

4.1.3 Trends

4.1.3.1 Commercial Landings

Coastwide Jonah crab landings were queried from the ACCSP Data Warehouse and validated for accuracy with state partners. Landings were low in the early 1980s, increased in the mid-1980s, and became relatively stable through the mid-1990s, averaging 4.5 million pounds per year from 1984-1995 (Table 7, Figure 3). Landings have increased steadily since the mid-1990s, with a maximum of 22.6 million pounds landed in 2018. Massachusetts, Rhode Island, and Maine were the top contributors to landings during this increasing trend, averaging 5.4, 2.3, and 3.6 million pounds per year from 1996-2019, respectively. However, these states have had different trends in landings over this period. Massachusetts and Rhode Island landings have followed an increasing trend similar to the total coastwide landings, while Maine landings increased sharply in the early 2000s and then declined through the early 2010s before increasing in the most recent years. Since 2006, Massachusetts, Rhode Island, and Maine annual landings have averaged 8.0, 3.6, and 2.9 million pounds, respectively. Pots and traps have accounted for the vast majority (>90%) of Jonah crab landings.

In addition to total annual landings, seasonality (quarter) and spatial (statistical area) data were also queried. These data have yet to be validated by state partners and may require the development of a process to gap-fill data by pairing seasonality and spatial data from harvester reports to total landings from dealer reports. These data are important for understanding the temporal and spatial dynamics of the fishery and for improving resolution of characterizing biological attributes (size, sex, egg-bearing status) of the landings with paired biosampling data. Seasonality data are widely available for the bulk of landings since 1990 (Figure 4). Spatial data are well represented for Jonah crab harvest since 2004 (Figure 5).

4.1.3.2 Commercial Biosampling

Commercial biosample data were submitted to the ACCSP Data Warehouse and a coastwide data set was queried. Sea sampling is useful to characterize the biological attributes of the total Jonah crab catch including discarded Jonah crabs. Port or market sampling is useful to characterize the biological attributes of the landed Jonah crab catch. The coastwide data set

included all biosamples except NOAA Fisheries port sampling and NH F&G sea sampling which were not available for upload to the ACCSP Data Warehouse.

Biosampling trips are treated as sampling replicates. Only NOAA Fisheries sea sampling data had unique trip identifiers, so all other biosampling data were assigned a trip identifier based on a unique combination of agency, type (sea vs. port sample), date, port landed, and statistical area.

The number of sampling trips conducted by year and statistical area are in Table 8. The core statistical areas reflect the greatest sampling intensity, in addition to the inshore statistical area 539. Table 9 shows a finer breakdown of sampling in the core statistical areas including the number of trips by type. Sampling intensity, particularly sea sampling, tends to improve through time and shows a gradient in intensity with the highest intensity inshore (statistical area 537) and the lowest intensity offshore (statistical area 525). This gradient of sampling intensity matches the gradient in landings by statistical area.

Sea sampling data indicate larger average sizes of males encountered by the fishery (Figure 6 and Figure 7) and a smaller average size of both sexes caught in the inshore statistical area 539 (Figure 6). There do not appear to be any discernible trends in mean size of the catch in the core statistical areas during the short time series (Figure 7). Port sampling data show larger average sizes of Jonah crabs retained for sale in most cases (Figure 8), indicating selectivity of the fishery even prior to the implementation of a minimum size in the FMP (June 1, 2016).

Available Jonah crab maturity data are in Table 10. There has not been an effort to standardize Jonah crab maturity codes across agencies for use in stock assessment and this is recommended at the beginning of the stock assessment when it occurs.

4.1.4 Commercial Discards/Bycatch

4.1.4.1 NOAA Fisheries

Discard information from 2005-2019 is available from data collected during the NEFOP. Due to confidentiality issues, data were grouped in 5 year increments and by statistical area. Gears were grouped into the following categories:

- TRAPS:
    - POTS + TRAPS,OTHER/NK SPECIES
    - POTS + TRAPS,FISH
    - POTS + TRAPS,CONCH
    - POTS + TRAPS, HAGFISH
    - POTS + TRAPS,SHRIMP
    - POT/TRAP, LOBSTER OFFSH NK
    - POT/TRAP, LOBSTER OFFSH WD/WR
    - POT/TRAP, LOBSTER OFFSH PLASTIC

- POT/TRAP, LOBSTER INSH NK
- POTS + TRAPS,CRAB OTHER

- BOTTOM TRAWL:
  - TRAWL,OTTER,BOTTOM,FISH
  - TRAWL,OTTER,BOTTOM,CRAB
  - TRAWL,OTTER,BOTTOM,SCALLOP
  - TRAWL,OTTER,BOTTOM,TWIN
  - TRAWL,OTTER,BOTTOM,RUHLE
  - TRAWL,OTTER,BOTTOM PAIRED
  - TRAWL,OTTER,BOTTOM,HADDOCK SEPARATOR
  - TRAWL,OTTER,BOTTOM,SHRIMP
- OTHER: all other gears

Figure 9 - Figure 11 summarize the amount of discards (pounds) and the discard rate (discard/$kept_{all}$ for those combined observed trips) by gear category. In general, discards of Jonah crabs have increased over the time series, with clearer trends in trawl and other gear. This is expected, as trap fisheries have not received substantial observer coverage until more recent years.

No overall discard rate could be estimated due to the lack of VTR data in the lobster/crab trap fishery.

4.1.4.2 New Hampshire

Commercial discards of Jonah crab have not been required on New Hampshire state lobster and crab reports, but have been reported as required by harvesters landing catch in NH with a Federal VTR reporting requirement. Discarded pounds of Jonah crab by gear type are included for 2004 to the present from Federal VTRs (Table 11). The overwhelming majority of discards occur in the pot and trap fisheries. Other fisheries represent infrequent and minimal discards.

4.1.4.3 Rhode Island

The RIDEM DMF does not have consistent records of Jonah crab discards in its commercial fisheries. Catch rates of sublegal and culled Jonah crabs may be estimated using the limited sea sampling data available from 2016 and 2017 by isolating measured crabs that fall below the minimum size and crabs missing both claws.

4.2 Recreational

4.2.1 Catch Data Collection and Treatment

4.2.1.1 New Hampshire

Recreational lobster and crab fishing in New Hampshire represents those harvesters that fish with five or fewer traps with no sale of harvested lobsters allowed. Recreational catch and effort data have been collected in the same manner as the commercial harvest for state landings.

Any recreational harvester may elect to use the ACCSP's eTrips electronic reporting program to report trip-level data on a monthly basis. In 2016 with the adoption of a Jonah crab FMP, New Hampshire implemented mandatory Jonah crab harvest reporting on both monthly-summary and trip-level reports. Recreational Jonah crab harvest is included in Table 12.

4.2.1.2 Massachusetts

Massachusetts issues a recreational lobster/edible crab license that allows the permit holder to harvest lobster and edible crabs using 10 traps, SCUBA gear, or a combination of both. There are daily limits of 15 lobsters, 50 *Cancer* crabs (Jonah and Atlantic rock crabs combined count), and 25 blue crabs. While recreational lobster data has been collected during the permit renewal process since 1971, MA DMF has only begun to collect recreational harvest data for Jonah crab in 2018. Harvesters renewing a recreational lobster/edible crab permit are now asked how many Jonah crabs they harvested in the previous year and how many traps they used. Respondents are also asked where most of their harvest effort was located.

The only year for which data is currently available is 2018 when recreational harvesters reported retaining 10,001 Jonah crab.

4.2.1.3 Rhode Island

The recreational Jonah crab fishery in Rhode Island is open year-round with a possession limit of fifty (50) whole Jonah crabs per person per day. While recreational harvest of Jonah crab is not reported in Rhode Island, this is believed to be minimal in comparison with the magnitude of commercial harvest.

5 FISHERY INDEPENDENT DATA SOURCES

Details are provided in this section for surveys that were identified as having potential utility for providing indices of abundance for a near-term stock assessment. Additional surveys considered that were identified as having limited utility are included in Table 13 and Table 14.

5.1 Post-Settlement Surveys

5.1.1 NEFSC Trawl Survey

The NEFSC bottom trawl survey began collecting Jonah crab data in 1979. The spring survey is generally conducted from March to May and the fall survey is generally conducted in September and October.

The NEFSC bottom trawl survey utilizes a stratified random sampling design that provides estimates of sampling error or variance. The study area, which now extends from the Scotian Shelf to Cape Hatteras including the GOM and GB, is stratified by depth. The stratum depth limits are < 9 m, 9-18 m, >18-27 m, >27-55 m, >55-110 m, >110-185 m, and >185-365 m. Stations are randomly selected within strata with the number of stations in the stratum being proportional to stratum area. The total survey area is 2,232,392 km^2. Approximately 320 hauls are made per survey, equivalent to one station roughly every 885 km^2.

Most survey cruises prior to 2008 were conducted using the NOAA ship R/V Albatross IV, a 57 m long stern trawler. However, some cruises were made on the 47 m stern trawler NOAA ship R/V Delaware II. On most spring and fall survey cruises, a standard, roller rigged #36 Yankee otter trawl was used. The standardized #36 Yankee trawls are rigged for hard-bottom with wire foot rope and 0.5 m roller gear. All trawls were lined with a 1.25 cm stretched mesh liner. BMV oval doors were used on all surveys until 1985 when a change to polyvalent doors was made (catch rates are adjusted for this change). Trawl hauls are made for 30 minutes at a vessel speed of 3.5 knots measured relative to the bottom (as opposed to measured through the water).

Beginning in 2009, the spring and fall trawl surveys were conducted from the NOAA ship R/V Henry B. Bigelow; a new, 63 m long research vessel. The standard Bigelow survey bottom trawl is a 3-bridle, 4-seam trawl rigged with a rockhopper sweep. This trawl utilizes 37 m long bridles and 2.2 m^2, 550 kg Poly-Ice Oval trawl doors. The cod-end is lined with a 2.54 cm stretched mesh liner. The rockhopper discs are 40.64 cm diameter in the center section and 35.56 cm in each wing section. Standard trawl hauls are made for 20 minutes on-bottom duration at a vessel speed over ground of 3.0 kts. Paired tow calibration studies were carried out during 2008 to allow for calibration between the R/V Bigelow and R/V Albatross IV and their net types. However, calibrations have not been estimated for Jonah crab. Thus, it is appropriate to treat this survey as separate time series since 2009 until a calibration can be produced.

Regional indices (Figure 12 and Figure 13) were calculated from strata in SNE, GB, GOM, and a region identified as covering the core statistical areas of Jonah crab landings which includes both SNE and GB strata (Core). Spring indices for the SNE and Core regions tend to vary without trend, while GOM and GB indices increase after ≈2000. There is a more consistent increase among regions after ≈2000 in the fall indices.

5.1.2 Maine/New Hampshire Trawl Survey

The ME/NH Inshore Trawl Survey began in 2000 to fill a significant information gap in resource assessment surveys on approximately two-thirds of the inshore portion of the GOM. The survey is conducted in collaboration with NH F&G and its industry partner, Robert Michael, Inc. Conducted biannually, spring and fall, the survey operates on a random stratified sampling design. A goal of 120 survey stations are sampled in 20 strata that are distributed over four depths: 5-20 fathoms, 21-35 fathoms, 36-55 fathoms, and >56 fathoms roughly bounded by the 12-mile limit in five longitudinal regions (Figure 14). The survey samples a portion of 3 statistical areas, 513, 512, and 511. Jonah crab biological data were not fully collected until 2004.

Seasonal indices of abundance both show declines starting in the late 2000s followed by increases to time series highs around 2015 (Table 15; Figure 15 and Figure 16). These increases

were short lived, declining to lower levels in the last few years of the time series. Mean CVs for seasonal indices are 0.41 and 0.33 for the spring and fall, respectively (Table 15).

5.1.3 MA DMF Resource Assessment Program Trawl Survey

Since 1978, the MA DMF Resource Assessment Program has conducted an annual spring (May) and fall (September) bottom trawl survey within state territorial waters. The survey obtains fishery-independent data on the distribution, relative abundance and size composition of finfish and select invertebrates, including Jonah crab. A random stratified sampling design is used to select stations from five bio-geographic regions and six depth zones (Figure 17). Stations are selected before each survey and drawn proportional to the area each stratum occupies within the survey area. A minimum of two stations are drawn per stratum. Stations chosen in un-towable locations are redrawn.

The F/V Frances Elizabeth conducted all surveys through fall 1981. All subsequent surveys have been conducted onboard the NOAA ship R/V Gloria Michelle. A 3/4 size North Atlantic type two seam otter trawl (11.9 m headrope/15.5 m footrope) with a 7.6 cm rubber disc sweep; 19.2 m, 9.5 mm chain bottom legs; 18.3 m, 9.5 mm wire top legs; and 1.8 x 1.0 m, and 147 kg wooden trawl doors have been used for the duration of the survey. A 6.4 mm knotless liner is used in the codend to retain small organisms. Standard tows are 20 minutes but tows of at least 13 minutes are accepted as valid and expanded to the 20 minute standard. Tows are conducted during daylight hours at a tow speed of 2.5 kts. More information on the MA DMF trawl survey can be found by visiting https://www.mass.gov/files/documents/2016/08/tm/tr-38.pdf.

Jonah crabs have been weighed collectively for each tow to the nearest 0.1 kg since 1978, and by sex since 1981. From 1978 through 2009, Jonah crab CW measurements were taken on a wooden measuring board and recorded to the nearest cm on paper logs. Starting during the 2010 spring survey, crabs were measured on electronic length boards and recorded directly in to Fisheries Scientific Computer System (FSCS) data tables. Since the fall 2014 survey, Jonah crab measurements have been recorded with digital calipers to the nearest cm and recorded directly into FSCS. The change to digital calipers was made to improve measurement accuracy, as crab legs sometimes made it difficult to measure crabs on a length board. Female crabs have been inspected for extruded eggs since the fall 2014 survey, but observations of egg bearing crabs are very rare.

Jonah crab are infrequently encountered in SNE strata (Figure 17, regions 1-3), so indices of abundance are only calculated for GOM strata (regions 4-5). Seasonal indices generally show higher relative abundance at the beginning of the time series, lower abundance through the 1990s, and higher abundance since (Table 16-Table 17 and Figure 18-Figure 19). The fall index shows a more consistent increasing trend since the early 2000s, while the spring index is more variable during these years.

5.1.4 NJ DFW Ocean Trawl Survey

The NJ DFW has conducted a groundfish survey along the New Jersey coast since August 1988. The survey area is about 1,800 square miles of coastal waters between Sandy Hook, NJ and Cape Henlopen, DE and from a depth of 18 to 90 ft (5 – 27 m). The area is divided into 15 strata

that are bounded by the 30, 60, and 90 ft (9, 18, and 27 m) isobaths (Figure 20). The survey design is stratified random. Since 1990, cruises have been conducted five times a year; in January, April, June, August, and October. Two 20-minute tows are made in each stratum, plus one more in each of the nine larger strata, for a total of 39 tows per cruise in all months except January, when the additional tows are omitted. The trawl gear is a two seam three-in-one trawl (so named because all the tapers are three to one) with 12 cm mesh in the wings and belly and 7.6 cm in the codend with a 6.4 mm liner. The headrope measures 25 m and the footrope 30.5 m. Rubber cookies measuring 2 3/8 inch (60.3 mm) in diameter are used on the trawl bridles, ground wires, and footrope. Five different vessels have been used to conduct the surveys to date.

Jonah crab have been caught in 7% of tows on average while the index of abundance generally increased through the 2000s and varied highly since (Figure 21). The index of biomass (Figure 22) shows three periods of catch rates without trend, with a period of what appears to be heavier crabs caught in the mid to late 1990s, given the average or relatively low catch rates in numbers during the same period (Figure 21), straddled by an earlier and later period with lower biomass catch rates.

5.2 Settlement/YOY Surveys

5.2.1 ME DMR Settlement Surveys

The ME DMR settlement survey primarily was designed to quantify lobster YOY but has also collected Jonah crab data from the sites throughout the time series. The survey was started in 1989 in a smaller regional area close to Boothbay Harbor within statistical area 513 but was expanded to statistical areas 512 and 511 in 2000. The Maine survey currently monitors 40 sites coastwide within 1-10m in depth. The timing of this survey has shifted over time due to dive staff availability to complete the work, but it has generally occurred between September and December annually. Jonah crab information collected includes CW and location. Notations are made if small crabs carry eggs.

Indices for all statistical area have generally increased through time (Table 18; Figure 23). There were consistent decreases in the indices in 2019.

5.2.2 NH F&G Settlement Survey

NH F&G has participated in the ALSI since 2008, and biological information has been collected on Jonah crabs since 2009. New Hampshire follows the standardized coastwide procedures and monitors three sites along the NH Coast. The index of abundance generally increased through the duration of the time series (Figure 24).

5.2.3 MA DMF Settlement Survey

Massachusetts has conducted a juvenile lobster settlement survey since 1995. The survey begins in mid to early August, and generally runs through late September. The survey started with nine fixed stations in three regions and by 2018, had grown to include 23 fixed stations in seven different regions. The survey extent contracted in 2019 to 14 sites in five regions. The Vineyard Sound region and two of the Buzzards Bay sites were discontinued because juvenile

lobsters are rarely encountered in these areas. The Cape Cod region and some South Shore stations were discontinued due to the increasing presence of white sharks at survey sites during the survey time period.

The survey is conducted at fixed stations by a team of divers. Divers selectively place 0.5 m^2 quadrats over areas of cobble. Twelve quadrats are sampled per station, which are then immediately sorted on the boat.

Jonah crabs have been consistently identified to species in the survey since 2011. Though the survey has not always identified crabs to species, it has consistently identified *Cancer* crabs to genus over the entire time series. Jonah crabs are counted, measured (CW in mm) and sexed when possible. Crabs less than 5 mm are generally too small to sex or identify to species.

Indices of Jonah crab settlement generally varied with no discernible trend until increasing to the highest values of the time series in 2018 or 2019, depending on sampling area (Figure 25).

5.2.4 RIDEM DMF Settlement Survey

The RIDEM DMF conducts a yearly lobster settlement survey at six fixed stations (Figure 26) along Rhode Island's south coast—outside of Narragansett Bay—in late August to early September. At each site, SCUBA divers randomly place twelve quadrats to sample. Once these quadrats are placed, an air lift suction device is used to collect each sample. The survey is intended to measure the abundance of juvenile lobsters, but all other crustaceans, including Jonah crabs, are counted and measured.

The index of Jonah crab settlement shows a period of higher average settlement from the late 1990s through the mid-2000s followed by lower settlement for the remainder of the time series (Figure 27).

6 RECOMMENDATIONS FOR A COASTWIDE STOCK ASSESSMENT

6.1 Need for Coastwide Stock Assessment

Landings of Jonah crab from U.S. waters have increased significantly over the last 20 years, quadrupling from an average of 4.8 million pounds per year during 1997-1999 to an average of 20.1 million pounds per year during 2017-2019. This increase has been driven by several factors including decreased abundance of the SNE lobster stock and increasing prices for Jonah crab landings. There have been no formal analyses to determine if increasing Jonah crab abundance is an additional factor driving the increase in landings. Further, the current minimum legal size established in the FMP (4.75 inch CW) was largely based on market preference for Jonah crabs at the time. The Canada DFO stock assessment (Fisheries and Oceans Canada 2009) provides a precedent for management of Jonah crab without science-based guidance. This stock experienced rapid increases in landings similar to increases seen in the U.S. fishery, before declining to low abundance levels.

From a socioeconomics standpoint, further market development has likely been hindered by the hesitancy of NGO seafood sustainability organizations to fully recognize the sustainability of the U.S. Jonah crab fishery without more rigorous science-based management advice. In 2013,

the Delhaize grocery store chain determined that Jonah crab did not meet its standards of sustainably caught seafood. Rather than remove Jonah crab from their shelves, Delhaize started a Fisheries Improvement Project, which requested that ASMFC develop a Jonah crab FMP and identified a stock assessment as a critical need to inform the FMP (Swenton et al. 2014). In 2015, the Monterey Bay Aquarium Seafood Watch "red-listed" Jonah crab, advising consumers to avoid eating it due to the lack of abundance and life history information (Bradt 2015). The Monterey Bay Aquarium later revised this information and reclassified U.S. Northwest Atlantic Jonah crabs as a "good alternative" in 2016, though this classification is still lower than the most favorable classification of "best choice". The Seafood Watch report cites the lack of a formal stock assessment and reference points (Bradt et al. 2016).

6.2 Evaluation of Available Data Sources

The TC evaluated three data types that serve as the pillars to stock assessment: life history, indices of abundance, and fishery removals.

6.2.1 Life History Data

There is limited life history information available for Jonah crab. The best understood life history parameters are size-at-maturity and growth of immature crabs. Growth data are far more limited for legal-sized crabs and do not support robust growth estimates for the full size range of Jonah crab. This data limitation and unknown longevity of the species also contributes to uncertainty in natural mortality, another crucial, but poorly understood life history parameter. Uncertainty of natural mortality is not unique in stock assessment, but, without additional information for Jonah crab, a broad range of potential natural mortality levels would need to be considered in a stock assessment.

6.2.2 Indices of Abundance

A total of thirty one surveys that encounter Jonah crab were reviewed for their utility to provide indices of abundance that could support assessment approaches (Table 13 and Table 14). There are currently no surveys designed specifically to track Jonah crab abundance. Therefore, surveys designed to track abundance of other species were reviewed. Several issues that could potentially limit the utility of using these surveys to generate reliable indices of Jonah crab abundance are discussed below.

- Spatial coverage: Several surveys reviewed occur in areas that are not primary habitat for the exploitable Jonah crab population (i.e., shallow, inshore). Further, some surveys were designed to address objectives other than tracking population abundance (i.e., wind farm impacts) and have spatial footprints that are too small to capture population-wide trends.
- Time series: Given the low priority of Jonah crab prior to the increase in landings in recent years, several survey sampling protocols limited or completely excluded Jonah crab data collection. This has changed, particularly since about the mid-2010s, and should support an increase in useful abundance trend information in the next five to ten years.

- Catchability: For the surveys identified as likely candidates to provide reliable indices of post-settlement Jonah crab abundance (i.e., trawl surveys), catchability remains the primary issue that needs additional research. Behavioral aspects such as burrowing likely make Jonah crabs even less vulnerable to trawl gears than lobsters. These catchability issues result in relatively low catch rates. Preliminary analyses of length composition data show limited exploitation signals (i.e., changes in mean size) and tracking of cohorts even during periods of higher abundance and fishery landings.

Given the issues identified for interpreting indices from surveys encountering Jonah crab and uncertainty about stock structure, several trawl survey indices were compared to provide information on the utility of these data as abundance indices for stock assessment and to explore for potential spatial heterogeneity that might indicate discrete structuring of the population. Seasonal indices were compared with a Spearman's rank-order correlation analysis. Length compositions were also compared to determine if selectivity varied among the indices. Seasonal length compositions were aggregated across years due to low encounter rates and noisy annual composition data within periods defined by the vessel change in the NEFSC trawl survey ("early" period from 1980-2008 and "late" period from 2009-2019). Proportional stratified length compositions were expanded to length samples by the number of Jonah crab measured. A Kolmogorov-Smirnov test was applied to length data to test for differences in shape and mean of the length distributions.

Regional indices calculated from the NEFSC trawl survey (Figure 12 and Figure 13) were compared to examine degree of spatial corroboration within this survey domain. Despite the vessel change in 2009 and lack of data to calibrate catch rates between vessels, the full time series of indices were analyzed assuming vessel effects impacted indices (and annual index rank values) across regions similarly. There were some years when multiple vessels conducted seasonal surveys and these occurrences were dropped from the data set. Correlation coefficients indicate corroboration among the Core, GB, and SNE indices, slightly less corroboration between GB and GOM indices, and the least corroboration between the Core/SNE and GOM indices (Figure 28 and Figure 29). The Core index was generally more highly correlated with the other regional indices during the fall survey when Jonah crab appear to be more available to the survey (Figure 12). Not surprisingly due to the spatial overlap between SNE and Core indices, length compositions between these regions were similar in all periods (Figure 30 and Figure 31). However, there was limited support for similar selectivity between other regions for most periods including between the overlapping GB and Core indices (Table 19). Similar to the correlation analysis, the fall survey during the later period was most similar among regions with no significant difference detected among SNE, Core, and GOM length compositions.

To examine corroboration of indices among various trawl surveys operating in a similar region, indices calculated from GOM strata covered by the NEFSC, MA DMF, and ME/NH trawl surveys (Figure 32 and Figure 33) were compared. Indices were split into early and late time periods based on the NEFSC vessel change in 2009. Length composition data prior to the ME/NH trawl survey were excluded from the data set. Correlation coefficients indicate relatively weak to no correlation among indices (Figure 34 - Figure 37). Although selectivity between the state trawl

surveys appear similar in most periods (Figure 38 and Figure 39), only the early spring MA DMF and NEFSC and late fall MA DMF and ME/NH surveys were found to have had a shared selectivity pattern (Table 20).

These results highlight the issues identified for potential Jonah crab indices of abundance, though do not isolate any particular factor in interpretation of the signals. The higher correlation of the NEFSC regional indices suggests factors like catchability might be more similar due to the shared vessel characteristics and habitats sampled (deeper, offshore habitat). The weaker correlation between SNE/Core and GOM indices along with similar selectivity patterns indicate some spatial differences that could be driven by stock structure or other spatial processes. The weaker correlation among GOM indices might be driven more by differences in catchability among vessels and spatial differences with state surveys sampling less preferable habitat (shallower, inshore habitat) than the federal survey. Selectivity is likely another factor that explains some lack of correlation, though there is no clear pattern with some comparisons suggesting similar selectivity while others suggest differences in selectivity. Multiple indices with low correlation can be misleading and difficult to objectively choose among for use in stock assessment, and can result in poor stability of population dynamics models when used together (Conn 2010). If differences in trends among indices are reflective of stock structure and not accounted for when being fit in stock assessment models, resultant population and stock status estimates can be biased (Guan et al. 2013). The results of these trawl survey comparisons support the need for additional research on Jonah crab index selection, index treatment in assessment approaches, and stock structure within a stock assessment.

Of the thirty one surveys reviewed, six and five were identify as likely candidates to provide reliable indices of Jonah crab settlement and post-settlement abundance, respectively (Table 13 and Table 14). Details for these surveys are in Section 5.

6.2.3 Fishery Removals

Three primary issues were identified and discussed with regard to total Jonah crab landings: species misidentification, underreporting, and landings units.

As described in Section 4.1.1.1 Jonah crabs and the similar species, Atlantic rock crab, have likely been misidentified as each other, landed using the same common name of “rock crab”, and landed individually or mixed as “crab unclassified”. This was noted as a prevalent issue in Maine, but is believed to be more limited in other states. To evaluate this issue, Atlantic rock crab landings in the ACCSP Data Warehouse were also queried and validated with state partners. Atlantic rock crab landings have been minimal compared to the validated Jonah crab landings (Figure 40), particularly in more recent years as Jonah crab landings have increased. Although species misidentification is an issue that should be further explored in a benchmark stock assessment, the TC anticipates this to be a minor issue given the comparison of landings magnitude of the *Cancer* crab species.

Due to the historical status of Jonah crab as relatively low value bycatch and the lack of/limited reporting requirements in earlier years (≈mid-2000s), there is speculation that some Jonah crab harvest may have been sold off the docks for cash and, therefore, unreported in dealer reports. The TC believes this underreporting may be a minor limitation as it occurred during the period

of lower Jonah crab harvest due to lack of incentive for harvesting Jonah crab (i.e., low market demand, robust lobster fishery with higher prices per pound).

There were some occurrences of erroneous landings units encountered during landings validation. In some cases, landings were in pounds and reported in bushels or vice versa. However, these discrepancies were resolved during the validation process and should not be a limitation of landings data in a stock assessment.

After discussing these issues, particularly in the states that are primary contributors to Jonah crab harvest, the TC believes 2006 is likely a reliable start year for total coastwide landings data. Both seasonal and spatial data are widely available during this period and should allow partitioning of annual coastwide landings if necessary.

Preliminary investigation of biosampling intensity suggests reasonable coverage of core statistical areas starting in 2014. The developing time series and plans to continue biosampling is promising, though the time series is too short for use in population dynamics modeling approaches in a near-term stock assessment. Dedicated funding for Jonah crab biosampling programs would also help shift current sampling by some agencies from an opportunistic effort to more systematic sampling designed to characterize biological attributes of the Jonah crab catch.

6.3 Potential Stock Assessment Approaches

Based on the available Jonah crab data, some potential assessment approaches are outlined below to provide information on the products that could result from a near-term stock assessment to be used for management guidance. The approaches are generally listed in order of data requirements, with the first being the least data-intensive and the last being the most data-intensive.

Stock Indicators

Stock indicators are simple, empirical time series analyses that do not require assumptions typical of population dynamics models. These indicators can be used in a framework to provide a categorical characterization of stock conditions to complement stock status estimates from other assessment approaches and/or pre-defined triggers for management responses.

Data requirements: Variable, but would likely include indices of abundance/biomass, fishery removals, changes in size structure (e.g., median size), and/or relative exploitation

Outputs: Annual indicator values relative to time period-based reference values

Examples of other ASMFC-managed species assessed with these approaches: American lobster (categorical characterization of stock conditions to complement stock status estimates from other assessment approaches), spot and Atlantic croaker (pre-defined triggers for management responses)

Index-Based Methods

These assessment approaches include a number of methods that utilize indices of abundance to provide stock status based on an ad hoc, historical time period (e.g., ARIMA) or catch-based management advice (e.g., PlanB). Performance of several of these methods when natural

mortality is misspecified or annual catch data is incomplete, two areas of uncertainty facing Jonah crab assessment, was recently evaluated through a research track assessment conducted by the NEFSC (Legault et al. 2020). The assessment found two groups of methods tend to perform best dependent on the condition of the stock (i.e., favorable or unfavorable) for groundfish species and could be useful for short-term management advice while working towards advice from models that account for size/age structure of the stock.

Data requirements: Index of abundance, but some methods also require fishery removals and a natural mortality estimate

Outputs: Stock status based on an ad hoc, historical time period or sustainable catch levels

Examples of other ASMFC-managed species assessed with these approaches: Horseshoe crab (stock status based on an ad hoc, historical time period)

Biomass Dynamics-Based Data Poor Models (e.g., Depletion-Based Stock Reduction Analysis, Depletion-Corrected Average Catch)

These assessment approaches apply surplus production theory to observed fishery removal time series to estimate exploitation, total stock biomass, and MSY-based reference points for exploitation, total stock biomass, and catch. These methods were developed to provide catch advice in the interim while necessary data are collected to support more data-rich assessment methods. However, there are concerns changing environmental conditions may violate steady-state assumptions required by these methods that may preclude reliable estimation of catch advice. Some of these methods also require complete time series of fishery removals which may preclude their use for Jonah crab assessment.

Data requirements: Total fishery removals in weight, assumptions about stock depletion levels, and a natural mortality estimate

Outputs: Exploitation and biomass estimates and MSY-based reference points

Examples of other ASMFC-managed species assessed with these approaches: Black drum

Biomass Dynamics Model (e.g., surplus production model)

These assessment approaches are more comprehensive methods than the similar biomass dynamics-based data poor models that can be used if a reliable index of exploitable biomass is available to estimate exploitation, total stock biomass, and MSY-based reference points for exploitation, total stock biomass, and catch. These methods also allow for relaxing some of the assumptions of their data poor counterparts such as depletion levels or early catch histories. However, the same concerns about changing environmental conditions violating steady-state assumptions apply to these models.

Data requirements: Index of exploitable biomass and total fishery removals in weight

Outputs: Exploitation and biomass estimates and MSY-based reference points

Examples of other ASMFC-managed species assessed with these approaches: None

Collie-Sissenwine Analysis

This assessment approach tracks abundance of two stages, recruits entering the fishery in a given year and fully-recruited individuals, through time. This assessment approach has

frequently been applied to crustacean species that lack age composition data. Estimates of fishing mortality and abundance could be compared to complementary per-recruit analyses or, if changing environmental conditions invalidate steady-state assumptions of per-recruit analyses, an ad hoc, historical time period-based reference point to estimate stock status. A limitation that may preclude the use of this approach for Jonah crab assessment is limited data available for converting fishery removals in weight to number of individuals, particularly for earlier years.

Data requirements: Index of recruit and post-recruit abundance, total fishery removals in numbers, and a natural mortality estimate

Outputs: Fishing mortality, abundance, and stock status using complementary per-recruit analyses or an ad hoc time period-based reference point

Examples of other ASMFC-managed species assessed with these approaches: American lobster (historically)

Statistical Catch-at-Length Model (e.g., University of Maine Lobster Model)
These models track stock abundance-at-length through time by explicitly accounting for important processes such as individual growth. As with the Collie-Sissenwine analysis, estimates of fishing mortality and abundance could be compared to complementary per-recruit analyses or, if changing environmental conditions invalidate steady-state assumptions of per-recruit analyses, an ad hoc, historical time period-based reference point to estimate stock status. However, available data likely do not support the use of this assessment method to estimate Jonah crab stock status in the near-term. Future research needs to be done to determine if both fishery-independent and fishery-dependent size composition data sets contain measurable exploitation signals.

Data requirements: Index of abundance and size composition, total fishery removals and size composition, a natural mortality estimate, and growth transition matrices

Outputs: Fishing mortality, abundance, and stock status using complementary per-recruit analyses or an ad hoc time period-based reference point

Examples of other ASMFC-managed species assessed with these approaches: American lobster

6.4 Recommendation on Jonah Crab Stock Assessment Schedule

The TC believes it would be worthwhile to conduct a near-term stock assessment and recommends moving forward with a stock assessment to be completed in 2023, consistent with current Northeast Region Coordinating Council and ASMFC assessment schedules. The Jonah crab FMP is the result of industry concern over a lack of management, and questions regarding the status and sustainability of the Jonah crab resource. Management is now in place, but an assessment could help answer questions about the status and sustainability of the resource, provide more information with which to manage the fishery, as well as identify data needs, in addition to those identified during the pre-assessment data workshop (below), which if addressed, could help strengthen future assessments.

7 RESEARCH RECOMMENDATIONS

High Priority

- Information should be collected to help delineate stock boundaries (e.g. genetics). Identification of stock boundaries is an essential step in stock assessment that will inform many subsequent steps including development of input data and identification of methods applicable to the stock(s). Note: Some genetic research is currently being conducted by the Gloucester Marine Genomics Institute 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.
- Inter-molt duration of adult crabs is currently unknown and growth increment data for mature crabs is limited. These data will be necessary to transition to size- or age-based assessment methods.
- Develop fisheries-independent surveys (e.g. trap survey) to index post-settlement Jonah crab abundance from offshore areas where most of the fishery is executed.
- Increase fisheries-dependent monitoring of the offshore fleet. Sampling intensity by statistical area should be based on landings.
- Reproductive studies pertaining to male-female spawning size ratios, the possibility of successful spawning by physiologically mature but morphometrically immature male crabs, and potential for sperm limitations should be conducted.
- The amount of directed commercial effort on Jonah crabs vs. lobster should be quantified on a per trip basis.

Moderate Priority

- Cohort tracking analyses with existing data should be conducted across and within surveys to better understand if surveys are tracking true abundance signals and provide information on growth, mortality, and other demographic factors.
- Investigate the efficacy of existing lobster ventless trap surveys, including interaction between lobster and Jonah crab, to determine utility for indexing Jonah crab abundance. Research has shown that as lobster trap catch increases; crab catch within the same trap decreases (Miller and Addison 1995, Richards et al. 1983). This suggests abundance trends for Jonah crab will be heavily influenced by lobster density.

Low Priority

- Additional sampling to expand upon the University of Maine Settlement Collector Sampling should be conducted to provide a more comprehensive understanding and tracking of temporal and spatial settlement dynamics.
- The development of aging methods or determination of the mechanism responsible for the suspected annuli formation found in the gastric mill should be explored.

- Food habits data should be analyzed from offshore areas to better understand predation of Jonah crab.

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9 TABLES

Table 1. Morphometric and Gonadal size-at-maturity of male crabs.

Study	Year	Region	Morphometric	Gonadal
Moriyasu et al.	2002	Nova Scotia	128	69
Perry et al.	2017	GOM inshore	103	
Perry et al.	2017	GOM offshore	115	
Perry et al.	2017	Georges Bank	109	
Perry et al.	2017	SNE inshore		
Perry et al.	2017	SNE offshore	117	
Ordzie and Satchwill	1983	SNE inshore		50-60
Lawrence	2020	SNE	106	
Carpenter	1978	Mid Atlantic	90-100	
Olsen and Stevens	2020	Mid Atlantic	98	

Table 2. Morphometric and Gonadal size-at-maturity of female crabs.

Study	Year	Region	Morphometric	Gonadal
Perry et al.	2017	GOM offshore		98
Perry et al.	2017	Georges Bank	94	93
Perry et al.	2017	SNE inshore		86
Perry et al.	2017	SNE offshore	88	89
Ordzie and Satchwill	1983	SNE inshore	40-50	40-50
Carpenter	1978	Mid Atlantic	85	
Olsen and Stevens	2020	Mid Atlantic	88	

Table 3. Summary of Jonah crab sea sampling trips conducted by NH F&G.

Year	Total Number of Sampled Jonah Crabs	Number of Trips with Jonah crab Bycatch	Number of Trips without Jonah crab Bycatch*
2015	198	18	0
2016	192	7	7
2017	50	7	7
2018	22	7	7
2019	67	8	6

*River samples excluded from total number of trips without bycatch since no Jonah crab sampling occurs on these trips.

Table 4. Summary of Jonah crab port sampling trips conducted by NH F&G.

Year	Sample Number	Quarter	Number Sampled	Yearly totals
2016	201601	4	172	172
2017	201701	1	185	642
	201702	2	178	
	201703	3	154	
	201704	4	125	
2018	201801	1	19	675
	201802	2	5	
	201803	2	89	
	201804	3	238	
	201805	3	241	
	201806	4	83	
2019	201901	1	64	222
	201902	2	25	
	201903	3	33	
	201904	4	100	
2020	202001	1	100	400
	202002	2	100	
	202003	3	100	
	202004	4	100	
Total Jonah Crabs Sampled				2,111

Table 5. Summary of Jonah crab sea sampling trips conducted by RIDEM DMF.

Year	Quarter	Statistical Area(s)	Crabs Sampled
2016	2	537	329
2016	1	537	321
2016	3	539	869
2016	3	537	919
2016	3	539	616
2016	4	537	679
2016	4	539	838
2016	4	539	1219
2017	1	539	870
2017	2	539	1204
2017	2	539	467
2017	3	539	322

Table 6. Summary of port sampling trips for Jonah crab conducted by RIDEM DMF.

Year	Quarter	Statistical Area(s)	Crabs Sampled
2015	4	537	514
2016	1	526	228
2016	1	525	82
2016	2	526	142
2019	4	537	208
2019	4	526	137
2020	1	525	194
2020	1	526	229
2020	2	526	253
2020	2	616	155
2020	3	526	212

Table 7. Validated Jonah crab landings by state from the ACCSP Data Warehouse. Asterisks indicate confidential landings data that have been redacted.

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total
1981			99,300	356,900		1,400		15,000	41,300			513,900
1982						7,300	14,200		52,200			73,700
1983			15,600	15,700		400	1,800		15,600	1,900		51,000
1984	2,330,960		3,120,498	114,900		5,800	12,000		35,800	12,400		5,632,358
1985	2,321,353		28	424,000		741	23,400	14,000	15,400	14,900		2,813,822
1986	1,862,525		43	580,900		400	9,500		18,200	38,100		2,509,668
1987	3,303,457		621,200	856,400		3,400	7,300		23,800	47,900		4,863,457
1988	3,120,498		1,065,000	1,192,900		100	5,500		10,000	34,000		5,427,998
1989	3,433,600		1,222,400	1,165,300			3,100		8,400	21,500		5,854,300
1990	3,596,796		1,264,321	882,843		480	18,845		6,573	13,044		5,782,902
1991	2,968,451		979,250	976,744			38,040		7,209	2,046		4,971,740
1992	1,930,396		1,487,991	1,067,826		1,040	37,833		5,448	28		4,530,562
1993	2,124,193		1,312,751	1,028,322		10,459	18,548	2,000	5,725	64		4,502,062
1994	2,012,073	**	1,294,893	1,059,321		249,150	22,431	400	**			4,638,268
1995	**		1,048,824	731,518	10	39,074	22,101		**	25		1,841,552
1996	1,800,214		1,202,790	958,031	9	331,467	26,253		1,028			4,319,792
1997	2,820,385	**	2,693,851	534,319	267	120,069	20,700		**	**		6,189,591
1998	**	**	1,118,194	843,575	535	115,261	76,792		490	**		2,154,847
1999	2,752,114	**	1,739,112	1,396,757	1,022	757	14,037		2,925	**		5,906,724
2000	**	**	1,358,571	225,435	16,806	54,919	16,446		**	**	**	1,672,177
2001	**	**	1,507,268	5,535	6,244	111,845	18,668		33,210		**	1,682,770
2002	9,535,874	**	1,667,683	127,992	688	34,763	18,308		**			11,385,308
2003	6,554,939	**	1,530,595	308,681		62,426	22,698	**	**			8,479,339
2004	6,065,510	**	933,869	906,661	570	35,444	7,209		93			7,949,356
2005	6,005,511		3,663,582	754,594	328	12,641	29,254		**	**		10,465,910
2006	4,489,135		3,614,261	1,096,857	2,460	26,387	**		3,416	**		9,232,516
2007	4,767,353		4,118,472	2,573,573	295	202,898	80,092		8,720	**		11,751,402
2008	3,588,218	**	4,478,547	3,265,159	287	561,386	115,995		12,188	**		12,021,779
2009	3,289,394	**	4,869,605	2,552,779	3,196	509,874	38,482		11,657	**		11,274,987
2010	3,231,202	**	5,689,431	3,720,443	955	968,122	28,400		18,045		**	13,656,598
2011	2,477,058	**	5,379,792	3,213,119	340	172,311	26,286		92,401	**	**	11,361,306
2012	1,725,695	**	7,540,819	3,774,300	2,349	411,657	68,252		**	**		13,523,072
2013	1,383,877	340,751	10,117,542	4,642,196	51,462	375,101	7,803		**	**		16,918,733
2014	1,793,245	404,703	11,904,611	4,435,038	50,070	78,115	33,104		153,714	**	**	18,852,600
2015	1,799,799	**	9,128,900	3,850,894	5,930	208,607	59,156	**	39,750	**		15,093,036
2016	2,085,038	150,341	10,660,653	4,224,092	145	166,197	241,528	**	14,656	3,088		17,545,739
2017	3,369,809	113,354	11,698,342	4,106,481	796	158,089	432,754	**	18,745	**		19,898,370
2018	3,608,046	22,118	13,227,083	4,627,043	320	195,143	868,211	**	14,922	**		22,562,885
2019	2,713,228	70,704	9,697,607	4,078,772	482	106,244	1,046,466	**	14,314		40	17,727,857

Table 8. Number of commercial biosampling trips by year and statistical area. The core statistical areas are bolded and underlined. Colors are scaled to the minimum and maximum number of trips, with green indicating the greatest sampling intensity and red indicating the lowest sampling intensity.

Year	626	627	622	623	616	612	613	611	**537**	**526**	**525**	539	522	562	561	514	515	464	513	465	512	511
2003	0	0	0	0	0	0	0	0	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	9	1
2004	0	0	0	0	0	0	0	0	**0**	**0**	**0**	0	0	0	0	0	0	0	1	0	2	0
2005	0	0	0	0	0	0	0	0	**0**	**1**	**0**	0	0	0	0	1	0	0	0	0	0	0
……																						
2013	0	0	0	0	0	0	0	0	**2**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	3	0	1	0	**26**	**2**	**18**	44	0	9	0	0	0	0	0	0	0	0
2015	1	0	0	0	1	0	3	0	**44**	**24**	**20**	77	0	9	4	3	0	1	0	2	2	0
2016	1	0	0	0	0	1	1	0	**41**	**13**	**23**	91	0	8	13	4	3	9	0	2	4	0
2017	0	0	5	0	0	0	26	0	**19**	**7**	**17**	92	0	4	17	6	2	1	5	1	6	1
2018	2	0	4	0	13	0	0	0	**32**	**25**	**9**	71	0	9	8	13	1	10	12	5	8	6
2019	3	1	3	1	11	0	0	1	**49**	**26**	**4**	72	0	3	23	0	10	6	12	12	13	1

Table 9. Number of commercial biosampling trips and individual Jonah crabs sampled by year, quarter, and trip type in the core statistical areas. Colors are scaled to the minimum and maximum number of trips within each trip type, with green indicating the greatest sampling intensity and red indicating the lowest sampling intensity.

Year	Quarter	537						526						525					
		SEA		PORT		TOTAL		SEA		PORT		TOTAL		SEA		PORT		TOTAL	
		Trips	Samples	Trips	Samples	Trips	Samples	Trips	Samples	Trips	Samples	Trips	Samples	Trips	Samples	Trips	Samples	Trips	Samples
2013	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	4	0	0	2	714	2	714	0	0	0	0	0	0	0	0	0	0	0	0
2014	1	3	459	2	2,600	5	3,059	1	3	0	0	1	3	0	0	0	0	0	0
2014	2	3	273	0	0	3	273	0	0	0	0	0	0	0	0	0	0	0	0
2014	3	13	959	0	0	13	959	0	0	0	0	0	0	7	694	0	0	7	694
2014	4	5	211	0	0	5	211	1	632	0	0	1	632	11	966	0	0	11	966
2015	1	2	543	0	0	2	543	7	4,727	1	754	8	5,481	3	310	0	0	3	310
2015	2	9	842	2	2,561	11	3,403	6	836	2	1,268	8	2,104	9	854	0	0	9	854
2015	3	12	8,085	0	0	12	8,085	3	531	0	0	3	531	4	1,357	0	0	4	1,357
2015	4	14	12,497	5	3,322	19	15,819	4	3,206	1	455	5	3,661	4	1,258	0	0	4	1,258
2016	1	7	1,280	3	2,227	10	3,507	0	0	3	1,608	3	1,608	4	383	1	82	5	465
2016	2	7	2,353	3	1,710	10	4,063	3	3,601	4	2,290	7	5,891	11	1,172	0	0	11	1,172
2016	3	11	1,612	1	760	12	2,372	2	130	1	640	3	770	6	263	0	0	6	263
2016	4	8	792	1	584	9	1,376	0	0	0	0	0	0	1	50	0	0	1	50
2017	1	3	182	0	0	3	182	1	101	0	0	1	101	1	67	0	0	1	67
2017	2	1	52	0	0	1	52	2	69	0	0	2	69	2	368	0	0	2	368
2017	3	9	2,285	0	0	9	2,285	4	306	0	0	4	306	9	388	0	0	9	388
2017	4	6	212	0	0	6	212	0	0	0	0	0	0	5	244	0	0	5	244
2018	1	5	463	0	0	5	463	0	0	0	0	0	0	2	86	0	0	2	86
2018	2	3	280	0	0	3	280	8	550	1	1,608	9	2,158	3	134	0	0	3	134
2018	3	11	563	0	0	11	563	7	449	0	0	7	449	2	101	0	0	2	101
2018	4	12	687	1	641	13	1,328	9	594	0	0	9	594	2	87	0	0	2	87
2019	1	4	545	0	0	4	545	2	337	1	711	3	1,048	2	159	1	626	3	785
2019	2	11	787	1	714	12	1,501	4	296	0	0	4	296	0	0	0	0	0	0
2019	3	13	600	1	14	14	614	10	870	1	570	11	1,440	1	52	0	0	1	52
2019	4	16	861	3	1,034	19	1,895	6	554	2	718	8	1,272	0	0	0	0	0	0

Table 10. ACCSP codes and descriptions for crab maturity data and number of Jonah crab assigned each code by agency.

ACCSP Codes	Description	Maine	Massachusetts	CFRF	NOAA Fisheries
C1	Immature	0	0	0	0
C2	Maturing	0	0	0	0
C3	Yellow-orange	11	0	0	0
C4	Brown	4	0	0	0
C5	Black	0	0	0	0
C6	Spent	0	0	0	0
C7	Inactive	769	0	7371	0
CX	Eggs present	0	0	72064	25
NA	orange	0	3	0	0

Table 11. Commercial discards of Jonah crab reported on Federal VTRs by harvesters with VTR reporting requirements landing in New Hampshire.

Year	Gill Net	Otter Trawl	Lobster or Crab Pot/Trap	Total
2004			118,090	118,090
2005			107,420	107,420
2006	XX		64,107	64,117
2007			54,280	54,280
2008			59,180	59,180
2009			49,440	49,440
2010	XX		80,537	80,538
2011			37,644	37,644
2012			18,512	18,512
2013			39,097	39,097
2014			88,543	88,543
2015			102,165	102,165
2016			97,745	97,745
2017			69,940	69,940
2018			84,151	84,151
2019			108,851	108,851
2020		XX	76,247	76,297

*Confidential values are indicated in red

Table 12. Recreational Jonah crab harvest from New Hampshire.

Year	Recreational Harvest (lbs)
2016	69
2017	70
2018	15
2019	11

Table 13. Summary of surveys encountering settling Jonah crabs and their likely utility for providing an index of abundance for a near-term stock assessment. Reasons identified for surveys unlikely to provide an index of abundance for a near-term assessment were lack of *Cancer* crab species identification (SID) and short and/or discontinuous time series (TS).

Survey	*Time Series*	*Carapace Widths*	*Unlikely to Provide an Index of Abundance for Assessment*	*Reason*
ME DMR Settlement Survey - Statistical Area 511	2001-present	Y		
ME DMR Settlement Survey - Statistical Area 512	2000-present	Y		
ME DMR Settlement Survey - Statistical Area 513	1989-present	Y		
NH F&G Settlement Survey	2009-present	Y		
Normandeau Plankton Survey	1982-present	N	Y	SID
MA DMF Settlement Survey	2011-present	Y		
RIDEM DMF Settlement Survey	1990-present	Y		
UMaine Deepwater Collectors	2007-present	Y	Y	TS

Table 14. Summary of surveys encountering post-settlement Jonah crabs and their likely utility for providing an index of abundance for a near-term stock assessment. Data fields collected after the start year when Jonah crab counts were added to survey protocols are included in parentheses. Reasons identified for surveys unlikely to provide an index of abundance for a near-term assessment were lack of spatial overlap between the survey domain and Jonah crab population and/or small spatial domain (SS), short and/or discontinuous time series (TS), and inadequate catch rates (CR).

Survey	*Time Series*	*Carapace Widths*	*Sex*	*Unlikely to Provide an Index of Abundance for Assessment*	*Reason*
ME Urchin Survey	2004-present	Y	Y	Y	SS
ME VTS	2011-present	Y (2016)	Y (2016)	Y	SS
NH VTS	2009-present	Y (2015)	Y (2015)	Y	SS
Normandeau VTS	1982-present	Y	Y	Y	SS
MA VTS	2007-present	Y	Y (2015)	Y	SS
SMAST VTS	2019	Y	Y	Y	SS, TS
CFRF VTS	2014-present	Y	Y		
CFRF SNE Cooperative VTS	2014-2018	Y	Y	Y	SS, TS
RI VTS	2006-present	Y	Y	Y	SS
NY VTS	2006-2010	N	N	Y	TS
NJ Fixed Gear Survey	2016-present	Y	Y	Y	TS
DE Structure Oriented Survey	2018-present	Y	Y (2020)	Y	TS
CFRF-South Fork Wind Farm Cox's Ledge/RI Sound Trawl	2020-present	Y	Y	Y	SS, TS
Coonamessett Farm Foundation Scallop Dredge	2010-present	N	N	Y	TS
ME/NH Trawl Survey	2001-present	Y	Y (2004)		
MA DMF Trawl Survey	1978-present	Y	Y (1981)		
RI Trawl Survey	2015-present	Y	Y	Y	TS
URI GSO Trawl Survey	2016-present	Y	Y	Y	TS
CT Trawl Survey	1979-present	Y	Y	Y	SS, CR
NY Trawl Survey	2017-present	Y	Y	Y	TS
NJ DFW Ocean Trawl Survey	1989-present	Y	Y (2021)		
NEAMAP Trawl Survey	2007-present	Y	Y	Y	CR
NEFSC Trawl Survey	1969-present	Y	Y		

Table 15. ME/NH seasonal indices of abundance (mean numbers per tow) and coefficients of variation.

Year	Spring		Fall	
	Index	CV	Index	CV
2000			1.83	0.49
2001	4.63	0.87	13.13	0.24
2002	4.41	0.71	6.91	0.68
2003	4.85	0.32	3.80	0.20
2004	6.71	0.51	7.26	0.32
2005	9.51	0.32	4.40	0.33
2006	7.87	0.51	4.03	0.40
2007	5.06	0.31	5.37	0.26
2008	3.93	0.21	6.37	0.20
2009	3.67	0.21	1.86	0.31
2010	2.20	0.39	2.09	0.34
2011	2.21	0.35	1.92	0.30
2012	1.87	0.23	1.68	0.26
2013	1.47	0.40	2.54	0.33
2014	4.98	0.50	1.30	0.33
2015	4.18	0.38	16.73	0.52
2016	12.06	0.44	11.83	0.25
2017	2.95	0.30	5.93	0.23
2018	2.09	0.31	3.93	0.35
2019	1.63	0.51	3.69	0.20

Table 16. MA DMF Spring Trawl Survey index of abundance, coefficients of variation, and percent of catch that is males from Gulf of Maine strata.

Year	Index (N)	CV	% male	Year	Index (N)	CV	% male
1978	2.95	0.63		1999	0.19	0.58	24%
1979	0.11	0.46		2000	0.75	0.31	53%
1980	0.13	0.90		2001	1.63	0.30	47%
1981	1.00	0.64		2002	0.45	0.31	63%
1982	2.25	0.67	40%	2003	0.29	0.32	55%
1983	0.03	1.00	100%	2004	0.43	0.50	29%
1984	0.21	0.45	18%	2005	0.63	0.65	50%
1985	0.31	0.56	82%	2006	0.93	0.30	37%
1986	0.25	0.52	42%	2007	0.35	0.35	62%
1987	0.63	0.65	51%	2008	0.84	0.33	64%
1988	0.03	1.00	100%	2009	0.52	0.26	71%
1989	0.23	0.63	77%	2010	0.12	0.61	41%
1990	0.16	0.61	24%	2011	1.12	0.39	41%
1991	0.05	0.71	96%	2012	0.09	0.50	100%
1992	0.18	0.53	87%	2013	0.31	0.62	56%
1993	0.50	0.60	60%	2014	0.04	0.72	100%
1994	0.39	0.50	48%	2015	2.56	0.31	97%
1995	0.19	0.41	84%	2016	7.75	0.18	71%
1996	0.33	0.39	48%	2017	1.99	0.22	81%
1997	0.18	0.40	60%	2018	1.27	0.32	41%
1998	0.44	0.52	38%	2019	1.15	0.24	56%

Table 17. MA DMF Fall Trawl Survey index of abundance, coefficients of variation, and percent of catch that is males from Gulf of Maine strata.

Year	Index (N)	CV	% male	Year	Index (N)	CV	% male
1978	5.07	0.29		1999	1.75	0.33	65%
1979	2.01	0.37		2000	3.47	0.24	63%
1980	0.98	0.45		2001	0.96	0.31	79%
1981	0.46	0.69		2002	5.13	0.48	45%
1982	1.12	0.39	26%	2003	5.75	0.14	47%
1983	5.4	0.32	28%	2004	2.54	0.27	46%
1984	4.15	0.61	10%	2005	1.31	0.43	45%
1985	3.66	0.32	41%	2006	4.01	0.26	36%
1986	1.98	0.19	25%	2007	3.47	0.17	38%
1987	3.03	0.43	36%	2008	8.77	0.23	30%
1988	1.07	0.18	46%	2009	0.87	0.26	41%
1989	0.32	0.59	80%	2010	3.86	0.21	39%
1990	0.25	0.27	56%	2011	8.09	0.24	30%
1991	1.09	0.38	47%	2012	6.08	0.23	34%
1992	1.36	0.38	35%	2013	1.46	0.19	49%
1993	0.4	0.41	38%	2014	1.58	0.34	55%
1994	0.13	0.69	18%	2015	18.75	0.22	83%
1995	3.81	0.28	42%	2016	8.38	0.21	64%
1996	0.53	0.40	10%	2017	13.61	0.31	13%
1997	0.25	0.47	33%	2018	9.52	0.21	22%
1998	0.74	0.49	33%	2019	1.3	0.39	21%

Table 18. ME DMR Settlement Survey indices of abundance (mean number per square meter) by NOAA statistical area for all sizes encountered and crabs less than 13 mm carapace width with coefficients of variation.

Year	513				512				511			
	All Sizes		<13 mm CW		All Sizes		<13 mm CW		All Sizes		<13 mm CW	
	Index	CV	Index	CV	Index	CV	Index	CV	Index	CV	Index	CV
1989	0.02	1.00	0.00									
1990	0.14	0.50	0.00									
1991	0.09	0.78	0.00									
1992	0.11	0.45	0.00									
1993	0.00		0.00									
1994	0.39	0.46	0.09	0.56								
1995	0.20	0.35	0.00									
1996	0.84	0.45	0.11	1.00								
1997	0.43	0.47	0.00									
1998	0.55	0.35	0.11	0.45								
1999	3.09	0.31	1.54	0.38								
2000	6.75	0.09	1.83	0.24	1.17	0.13	0.04	1.34				
2001	2.87	0.10	0.36	0.53	1.13	0.15	0.22	0.56	0.16	0.44	0.04	1.00
2002	4.73	0.05	0.71	0.23	0.55	0.19	0.00		0.04	1.00	0.00	
2003	2.58	0.10	0.48	0.40	0.76	0.19	0.00		0.03	1.00	0.00	
2004	1.95	0.13	0.37	0.48	0.63	0.22	0.06	1.28	0.00		0.00	
2005	0.98	0.24	0.17	1.27	0.55	0.21	0.00		0.04	1.00	0.00	
2006	2.63	0.11	0.77	0.24	1.42	0.13	0.00		0.16	0.63	0.00	
2007	2.55	0.08	0.82	0.23	0.57	0.25	0.03	2.09	0.16	0.56	0.00	
2008	2.09	0.15	0.40	0.85	0.51	0.31	0.02	2.88	0.16	0.63	0.03	1.00
2009	3.01	0.14	1.23	0.24	0.49	0.21	0.02	1.93	0.06	1.00	0.00	
2010	2.52	0.11	0.83	0.32	0.36	0.40	0.01	2.82	0.07	0.57	0.03	1.00
2011	2.91	0.10	1.22	0.21	0.77	0.18	0.13	0.66	0.00		0.00	
2012	5.60	0.07	3.19	0.14	2.42	0.09	1.57	0.12	2.22	0.21	1.50	0.20
2013	3.64	0.06	0.71	0.25	2.50	0.05	0.18	0.47	1.88	0.17	0.35	0.37
2014	3.75	0.05	0.85	0.16	2.25	0.07	0.30	0.52	1.85	0.25	0.35	0.74
2015	3.34	0.10	1.72	0.16	1.42	0.14	0.33	0.53	0.57	0.39	0.04	1.00
2016	4.20	0.06	2.64	0.09	3.35	0.05	1.53	0.14	1.26	0.34	0.60	0.45
2017	5.49	0.13	2.30	0.18	2.56	0.18	0.45	0.22	1.85	0.09	0.47	0.28
2018	4.98	0.15	3.10	0.21	2.95	0.14	1.15	0.22	2.27	0.44	1.14	0.49
2019	2.27	0.15	0.68	0.20	2.18	0.13	0.37	0.16	0.85	0.18	0.38	0.50

Table 19. Results of Kolmogorov-Smirnov tests comparing shape and location of length compositions between regional NEFSC trawl survey indices by period and season. Significant p-values (<0.05) are bolded and italicized.

Survey X	Survey Y	Period	Season	p-value
GB	SNE	Early	Spring	***0.013***
GB	SNE	Early	Fall	***0.001***
GB	SNE	Late	Spring	***0***
GB	SNE	Late	Fall	***0***
GOM	GB	Early	Spring	***0***
GOM	GB	Early	Fall	***0***
GOM	GB	Late	Spring	***0***
GOM	GB	Late	Fall	***0***
GOM	SNE	Early	Spring	***0***
GOM	SNE	Early	Fall	***0***
GOM	SNE	Late	Spring	***0***
GOM	SNE	Late	Fall	0.196
Core	GOM	Early	Spring	***0***
Core	GOM	Early	Fall	***0***
Core	GOM	Late	Spring	***0***
Core	GOM	Late	Fall	0.149
Core	GB	Early	Spring	***0***
Core	GB	Early	Fall	***0.023***
Core	GB	Late	Spring	***0***
Core	GB	Late	Fall	***0***
Core	SNE	Early	Spring	0.138
Core	SNE	Early	Fall	0.255
Core	SNE	Late	Spring	0.22
Core	SNE	Late	Fall	0.76

Table 20. Results of Kolmogorov-Smirnov tests comparing shape and location of length compositions between Gulf of Maine trawl survey indices by period and season. Significant p-values (<0.05) are bolded and italicized.

Survey X	Survey Y	Period	Season	p-value
MA DMF	NEFSC	Early	Spring	0.148
MA DMF	NEFSC	Early	Fall	***0***
MA DMF	NEFSC	Late	Spring	***0***
MA DMF	NEFSC	Late	Fall	***0***
MA DMF	ME/NH	Early	Spring	***0.001***
MA DMF	ME/NH	Early	Fall	***0***
MA DMF	ME/NH	Late	Spring	***0.025***
MA DMF	ME/NH	Late	Fall	0.054
NEFSC	ME/NH	Early	Spring	***0***
NEFSC	ME/NH	Early	Fall	***0***
NEFSC	ME/NH	Late	Spring	***0***
NEFSC	ME/NH	Late	Fall	***0***

10 FIGURES

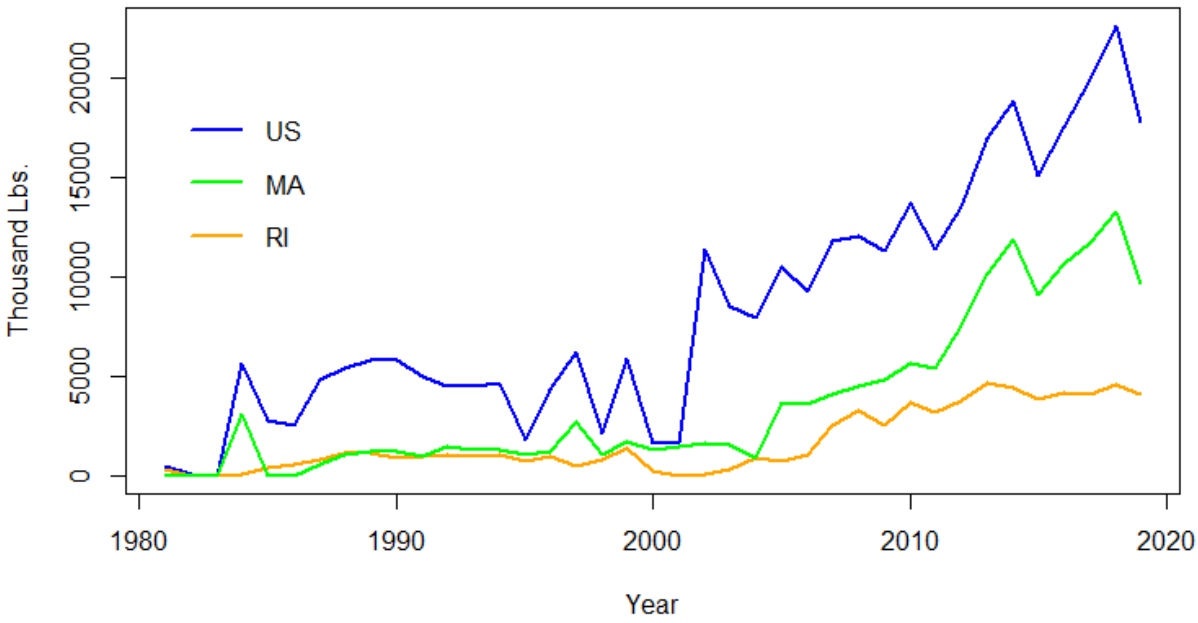


Figure 1. Total Jonah crab landings from U.S. waters and from states that are primary contributors to total landings.

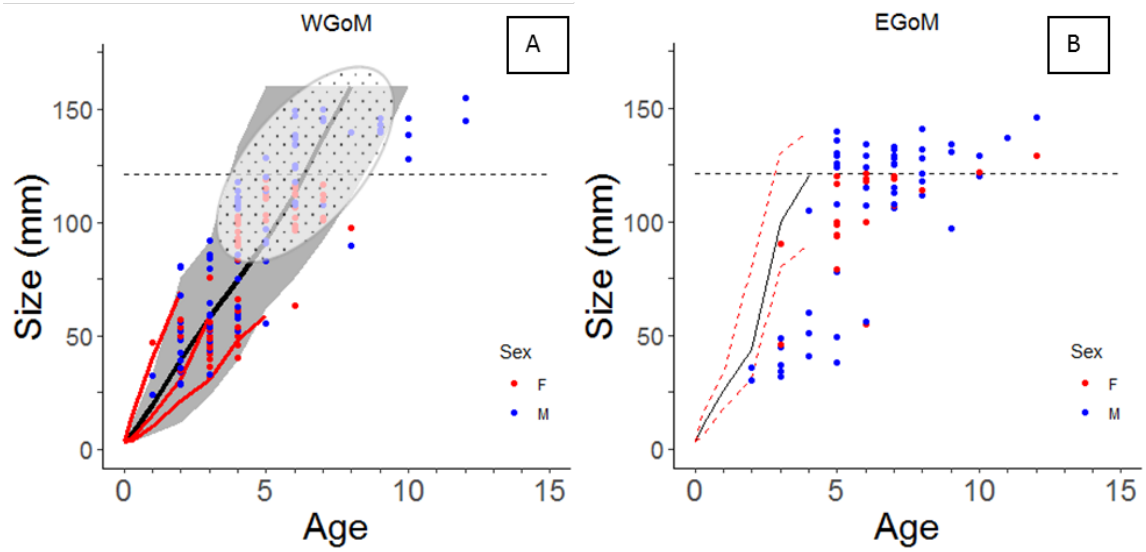


Figure 2. Size at age estimated for all methods for each contrasting thermal regime. A) WGOM, where direct band counts are shown as points, solid black line denotes growth model average with the gray area representing the 95% confidence interval; solid red lines represent the estimated range of age at size from length-frequency analysis. The dotted area represents the areas of increased correlation between settlement and time lagged survey catch at sizes. B) EGOM with the black line representing average size at age for the 2012 cohort in EGOM following the peak of settlement from ALSI through to the ME-NH trawl survey, with the dashed curves representing the range of sizes. The horizontal line denotes legal harvestable size.

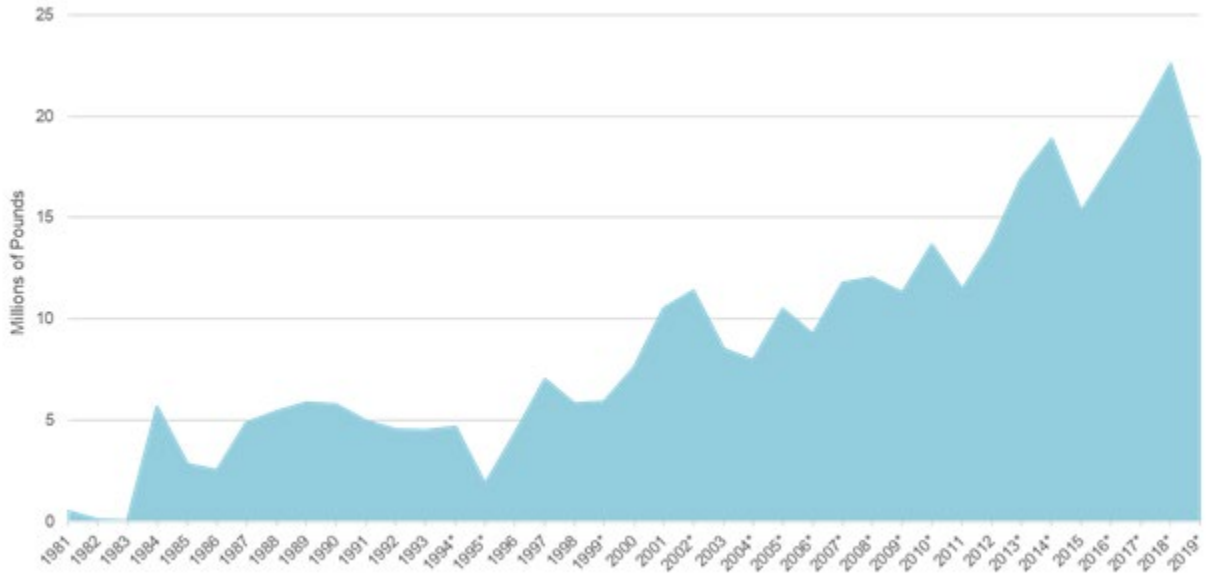


Figure 3. Validated coastwide Jonah crab landings from the ACCSP Data Warehouse. Asterisks indicate confidential landings data have been redacted from the total.

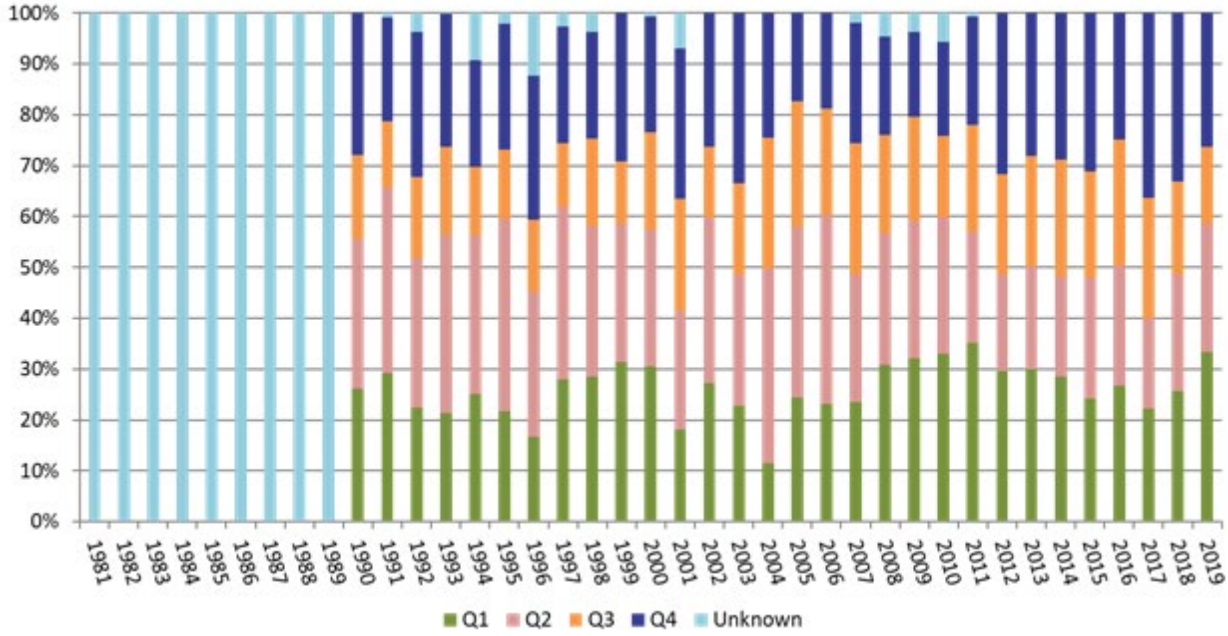


Figure 4. Proportion of coastwide Jonah crab landings by quarter and with unknown quarter. Quarters are three month time periods starting with January-March in quarter one. These seasonality data still need to be validated with state partners.

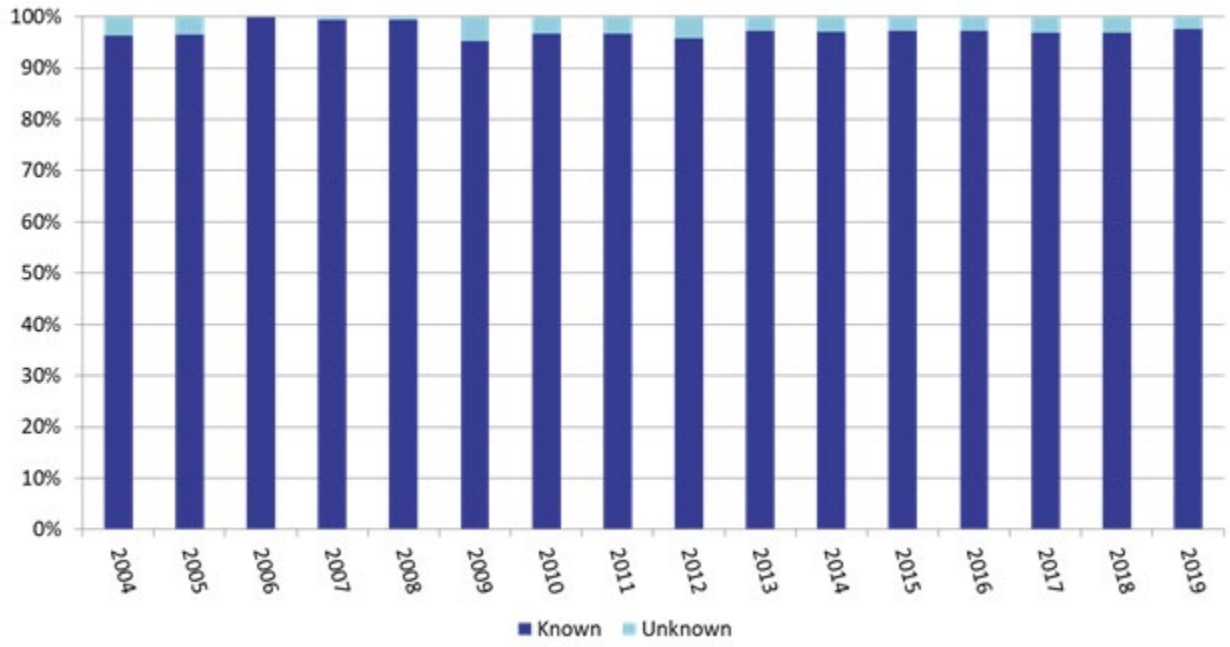


Figure 5. Proportion of Jonah crab landings with known and unknown statistical area from VTRs.

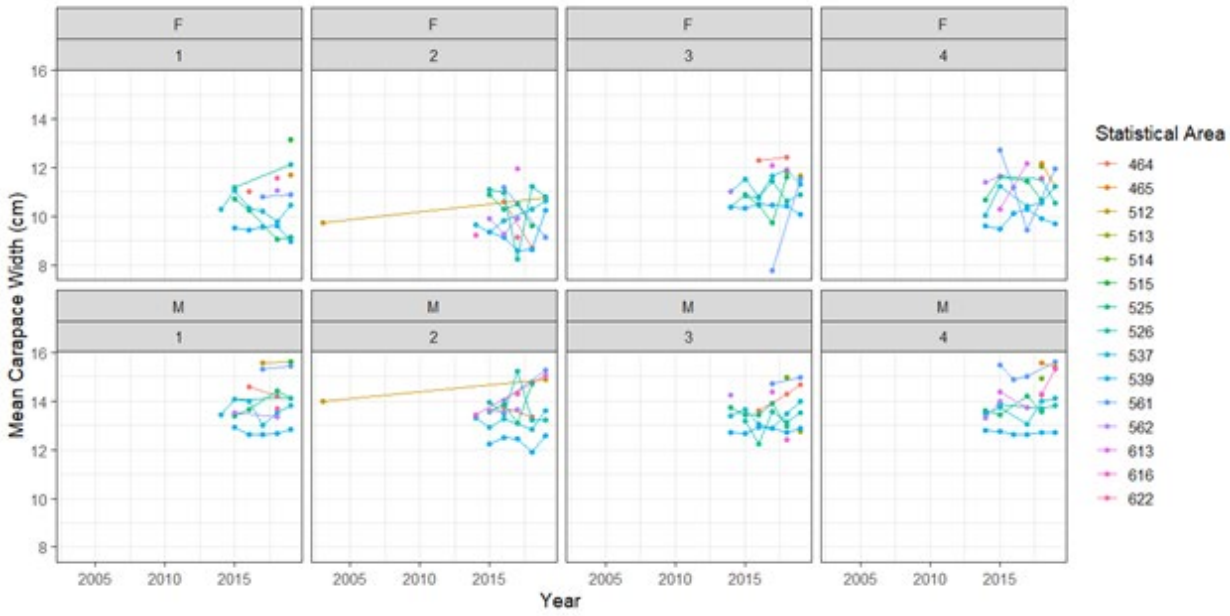


Figure 6. Mean size of Jonah crab sampled during sea sampling trips by sex, (top figure label), quarter (bottom figure label), and statistical area.

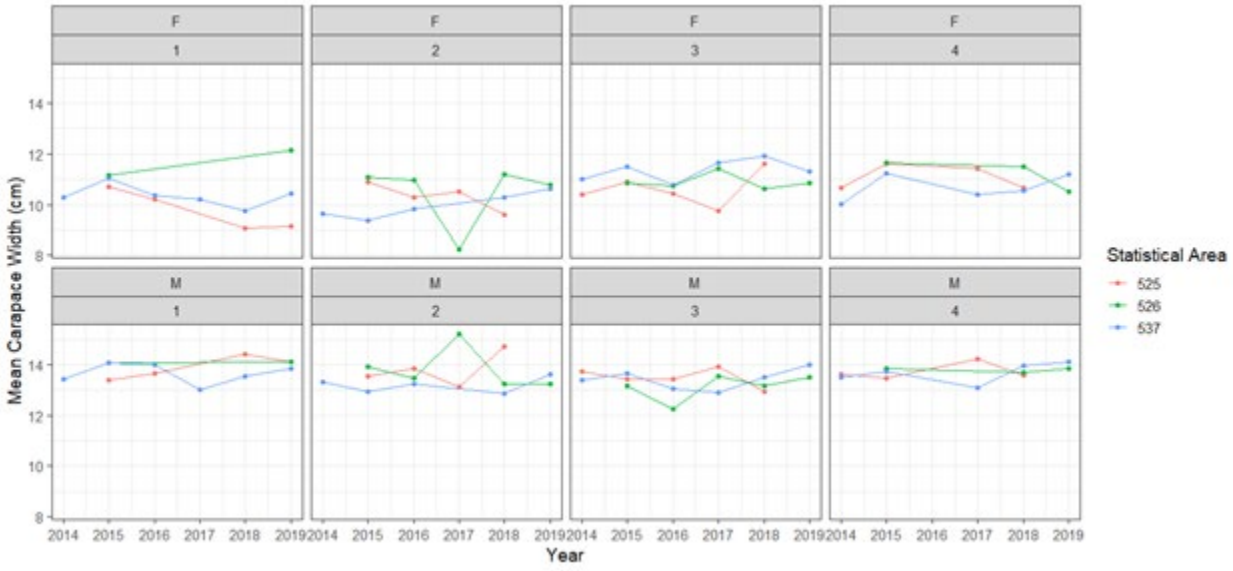


Figure 7. Mean size of Jonah crab sampled during sea sampling trips by sex, (top figure label) and quarter (bottom figure label) in core statistical areas.

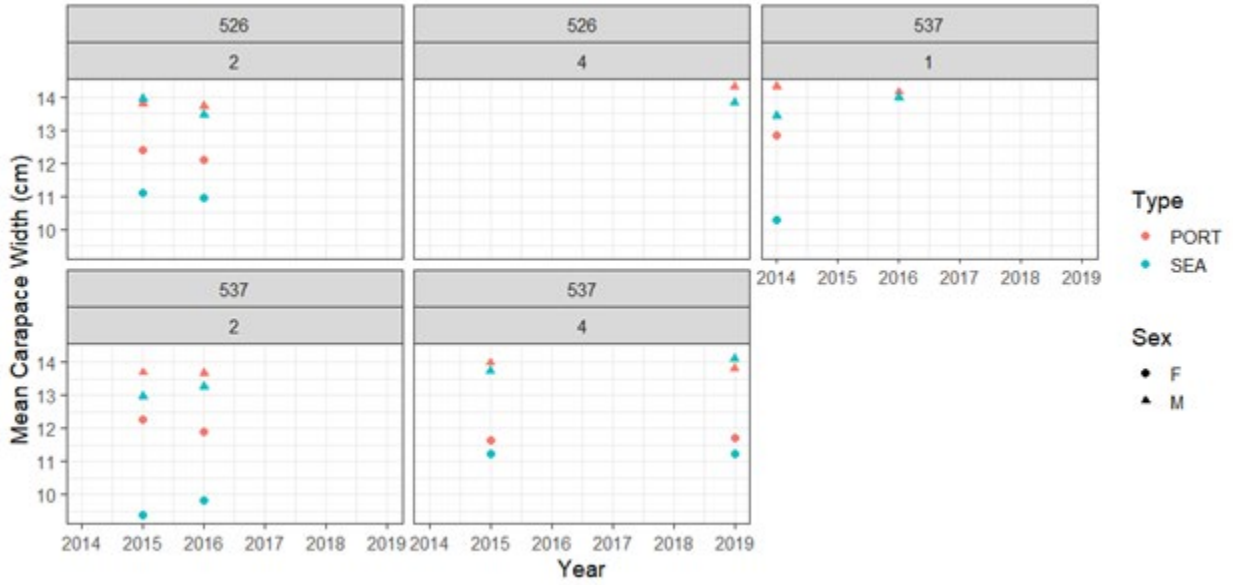
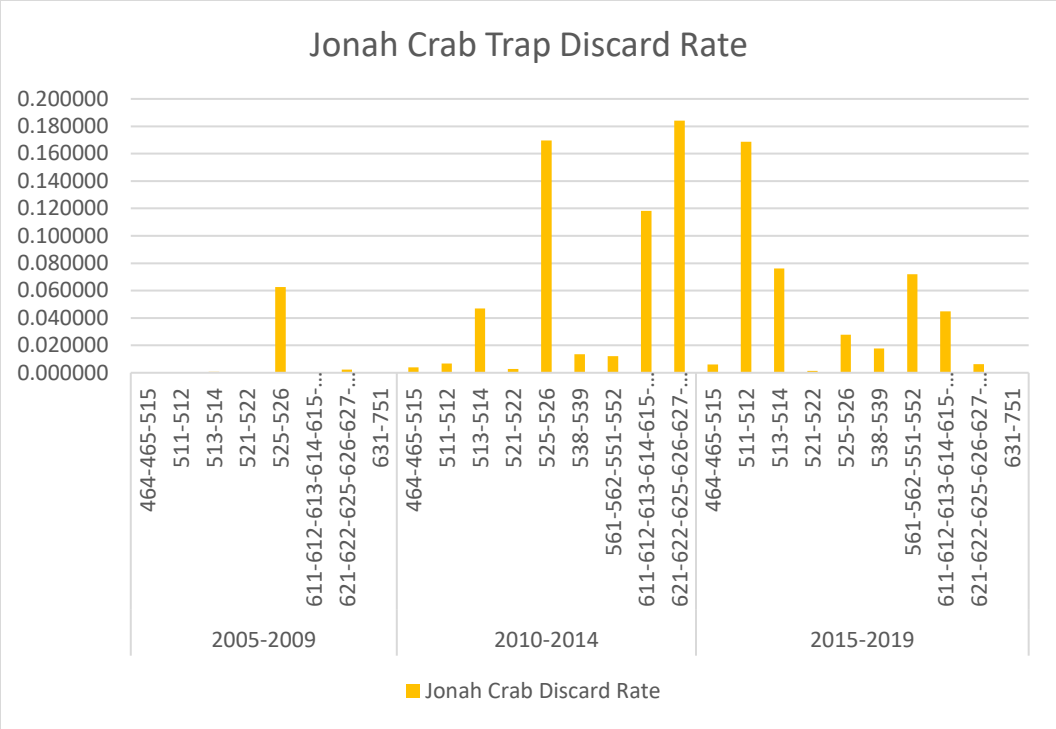


Figure 8. Mean size of Jonah crab sampled during biosampling trips by trip type, sex, statistical area (top figure label), and quarter (bottom figure label) in core statistical areas.



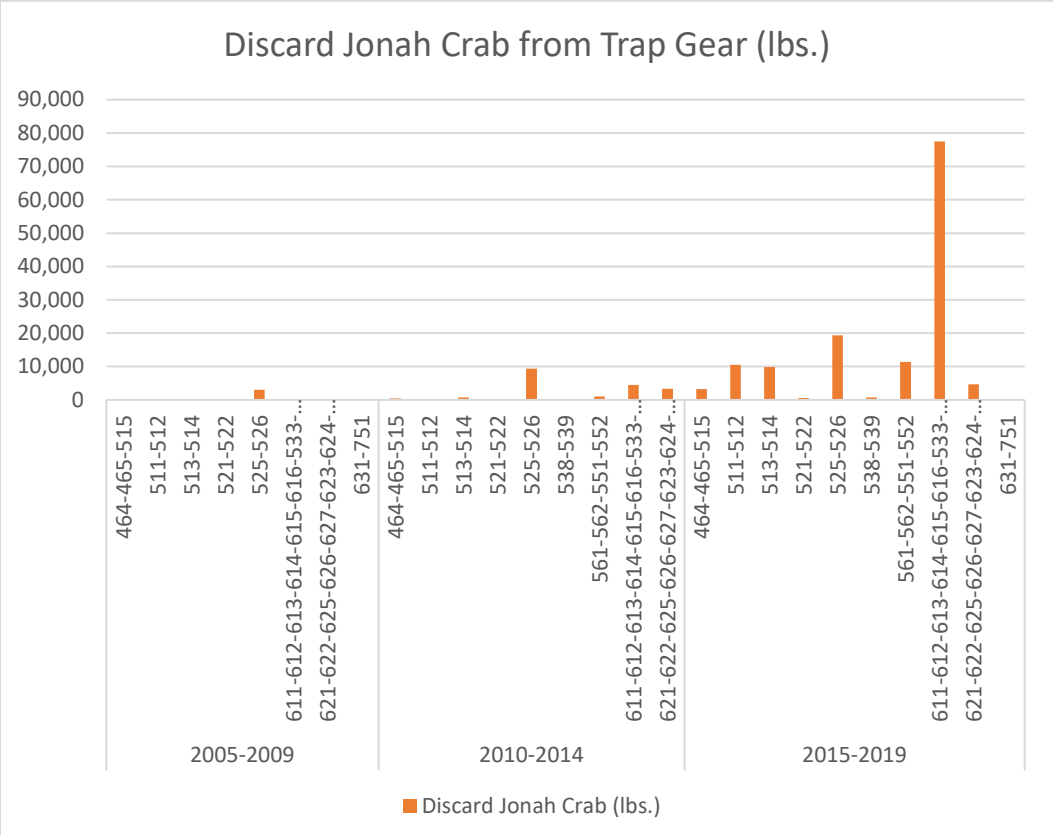
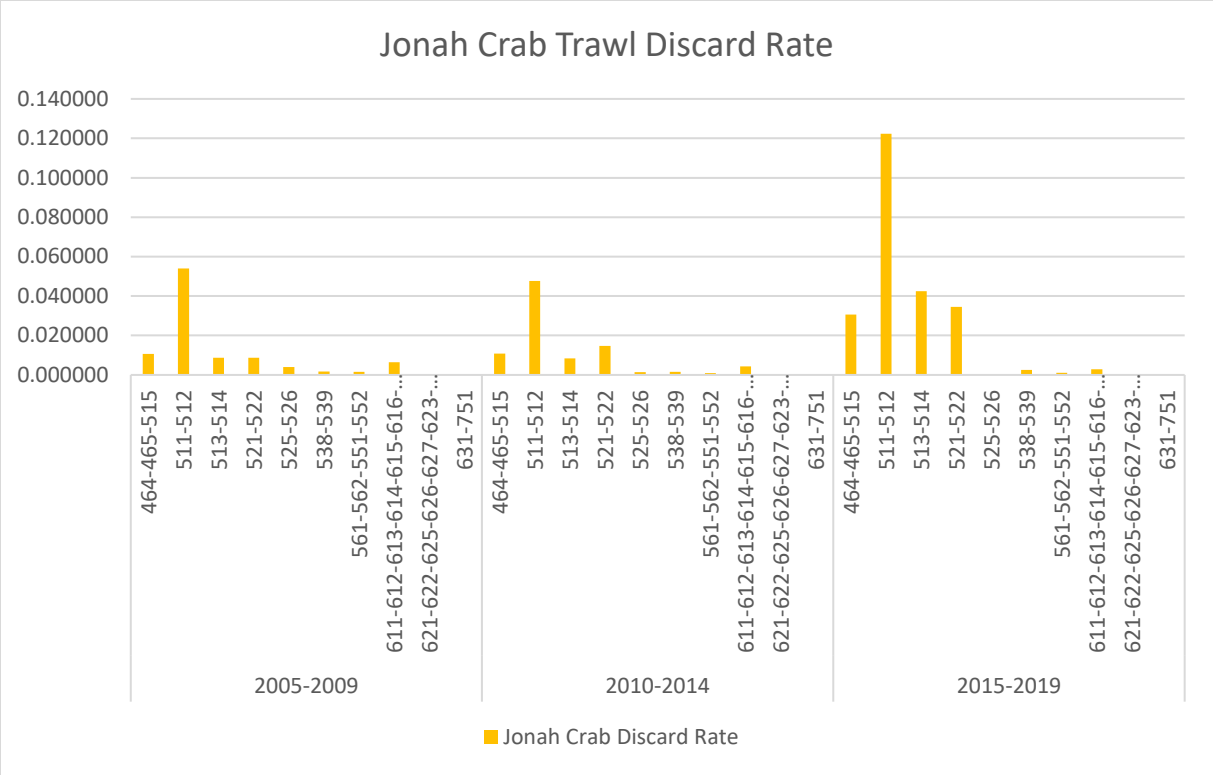


Figure 9. Trap gear discard estimates from data collected during the Northeast Fisheries Science Center's Northeast Fisheries Observer and At-Sea Monitoring programs.



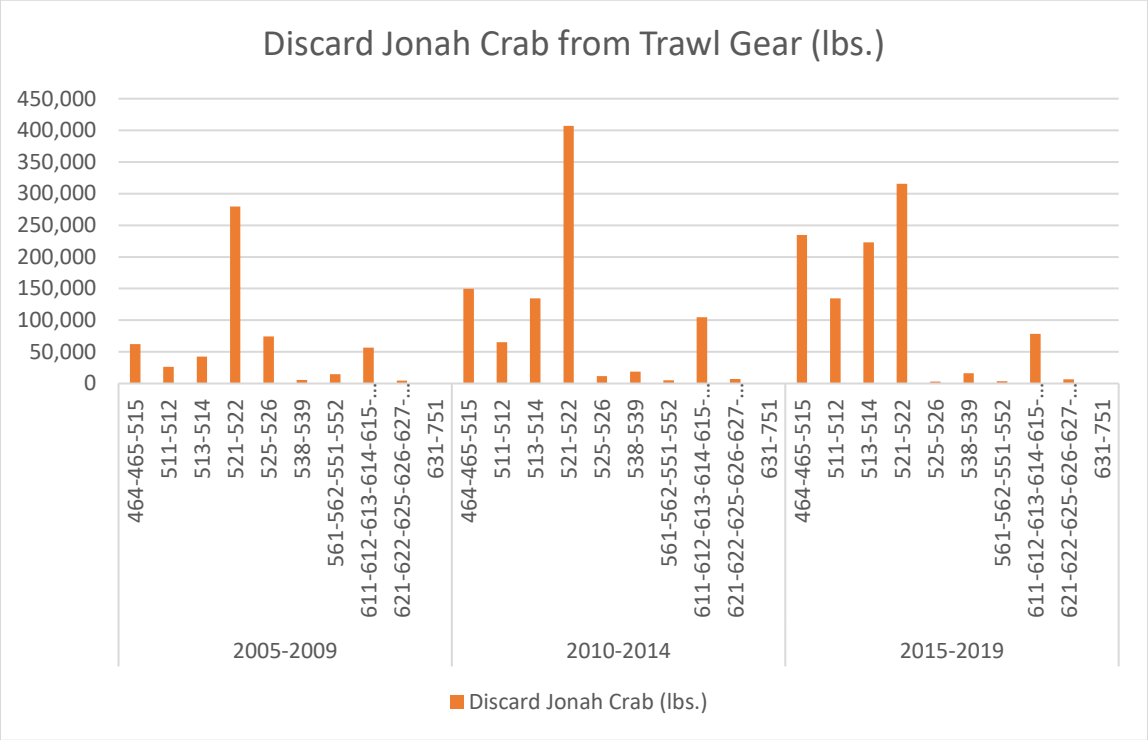
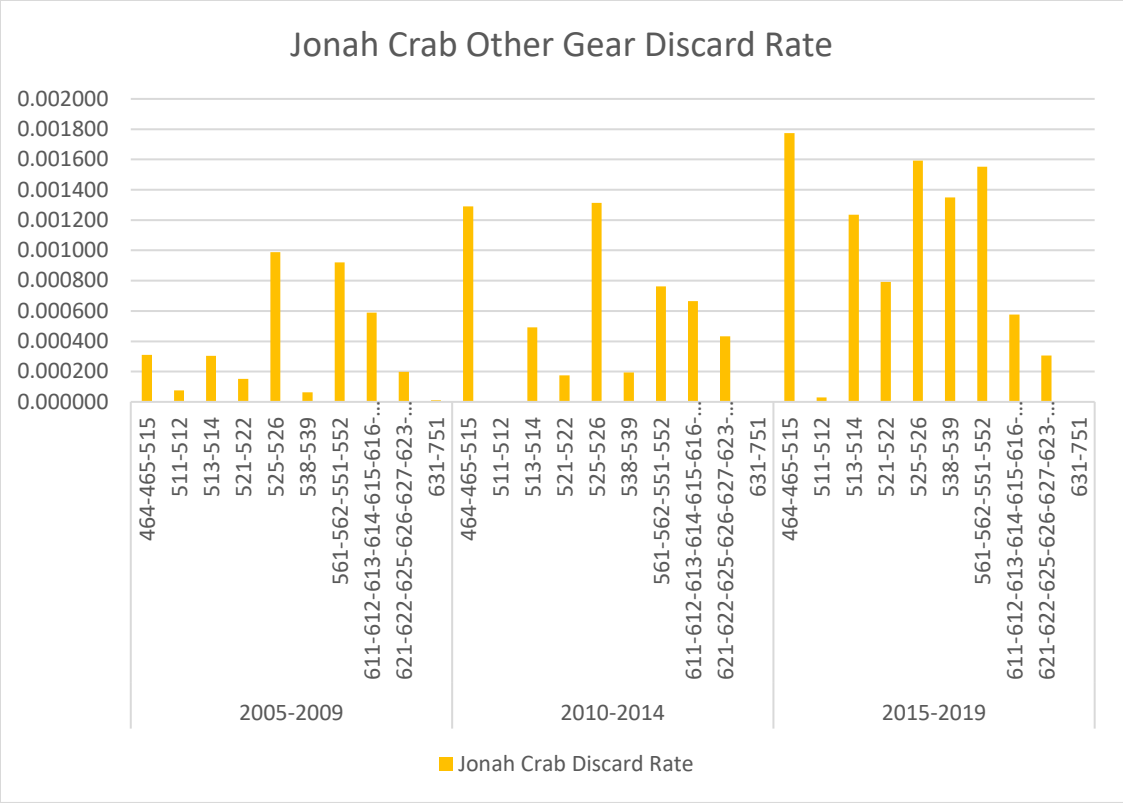


Figure 10. Trawl gear discard estimates from data collected during the Northeast Fisheries Science Center's Northeast Fisheries Observer and At-Sea Monitoring programs.



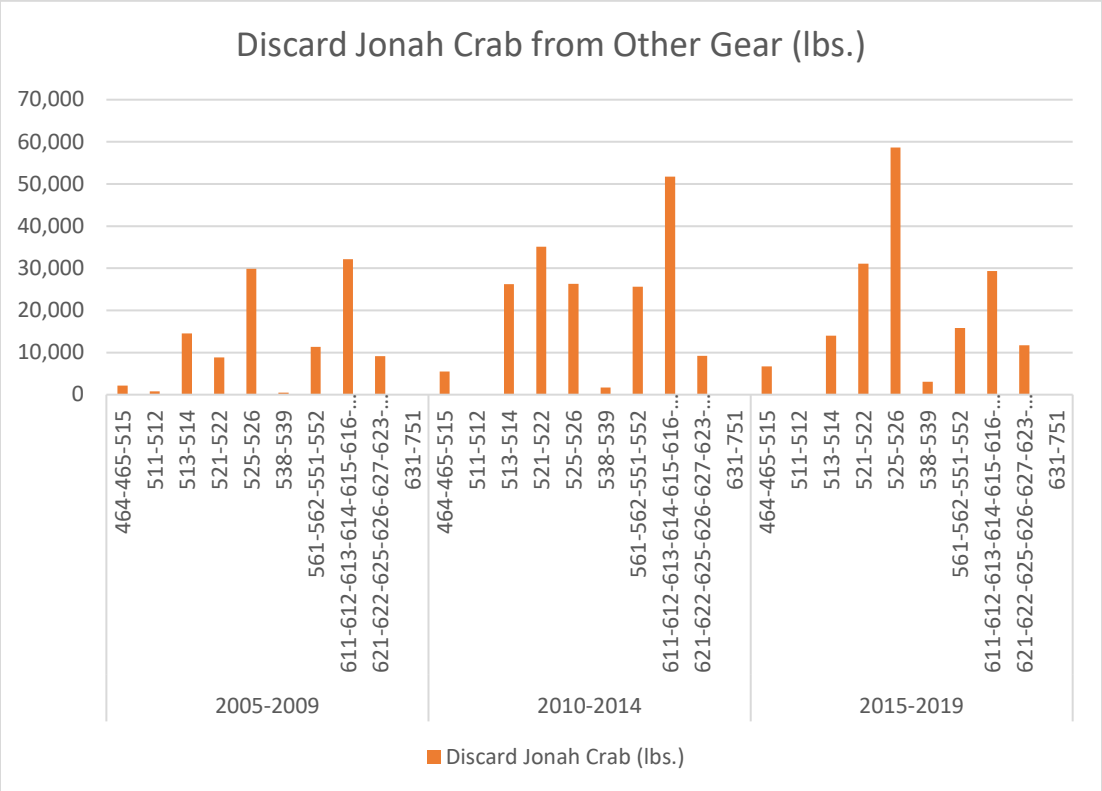


Figure 11. Other gear discard estimates from data collected during the Northeast Fisheries Science Center's Northeast Fisheries Observer and At-Sea Monitoring programs.

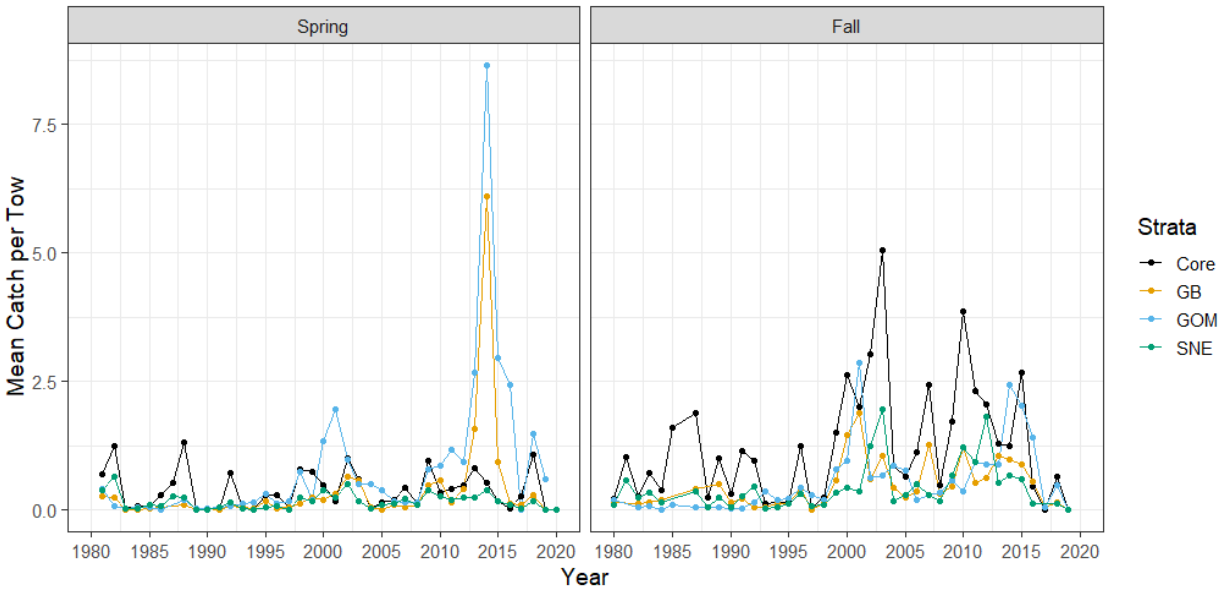


Figure 12. NEFSC trawl survey indices from regions sampled.

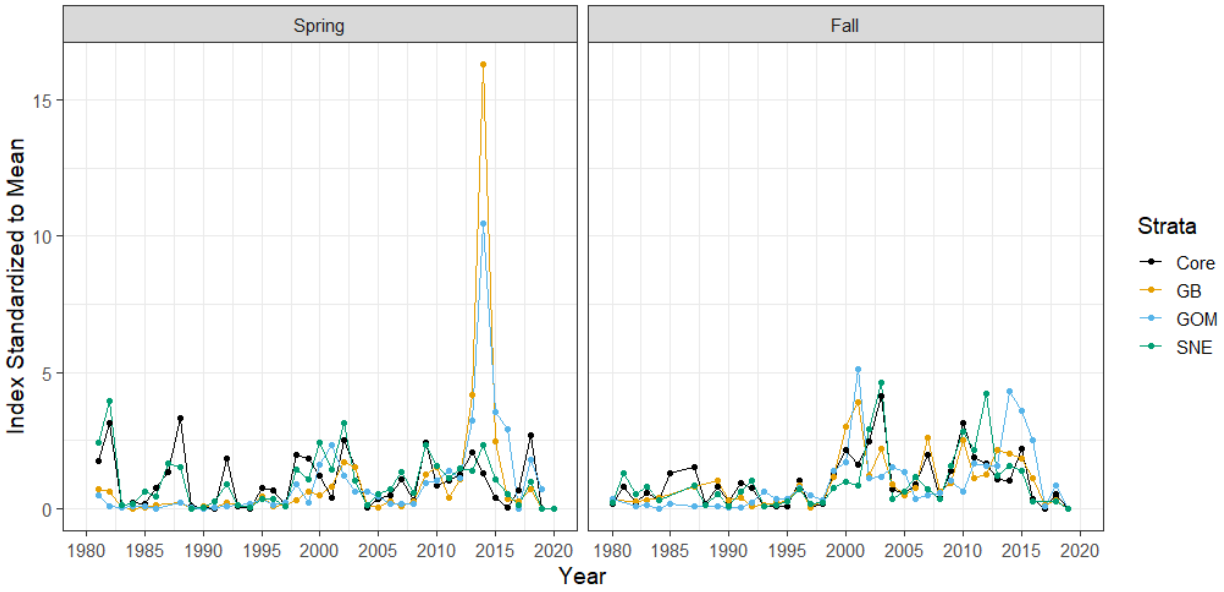


Figure 13. NEFSC trawl survey indices from regions sampled scaled to time series means.

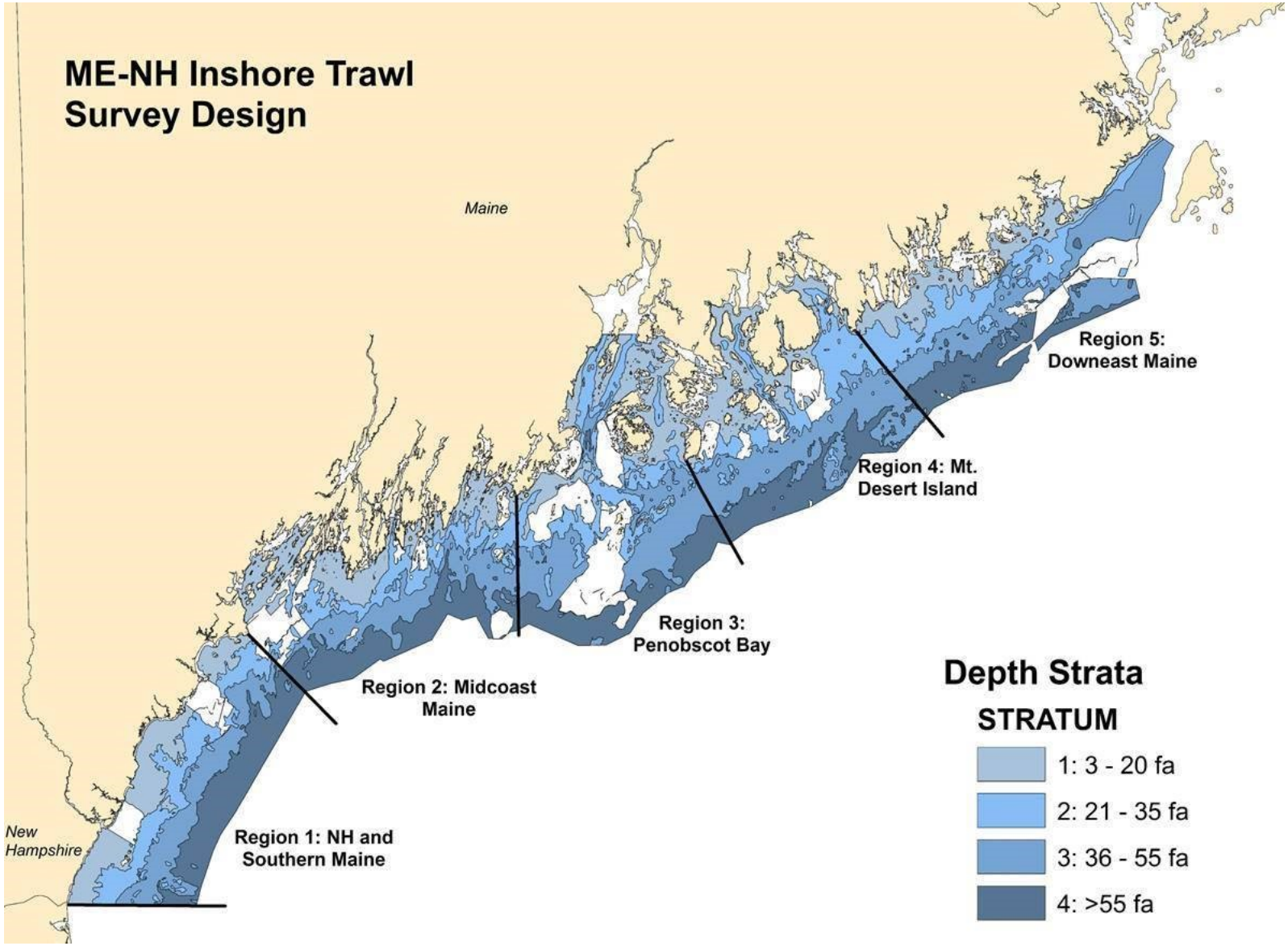


Figure 14. Sampling regions and depth strata for the Maine/New Hampshire trawl survey.

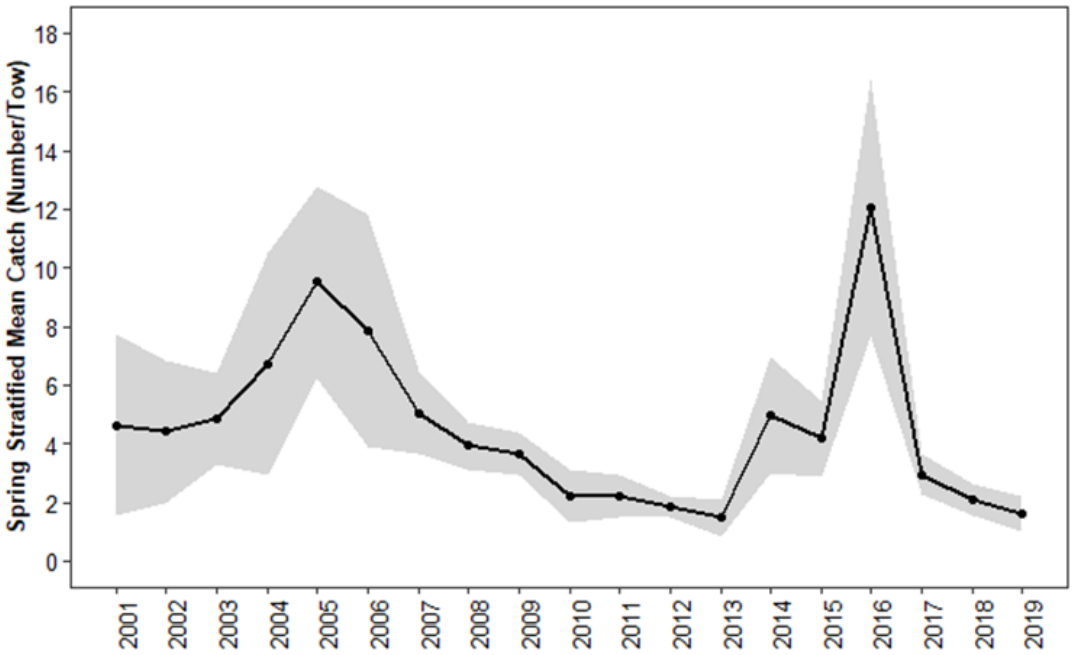


Figure 15. ME/NH spring trawl survey index of abundance (solid line with circles) with 95% confidence interval (shaded region).

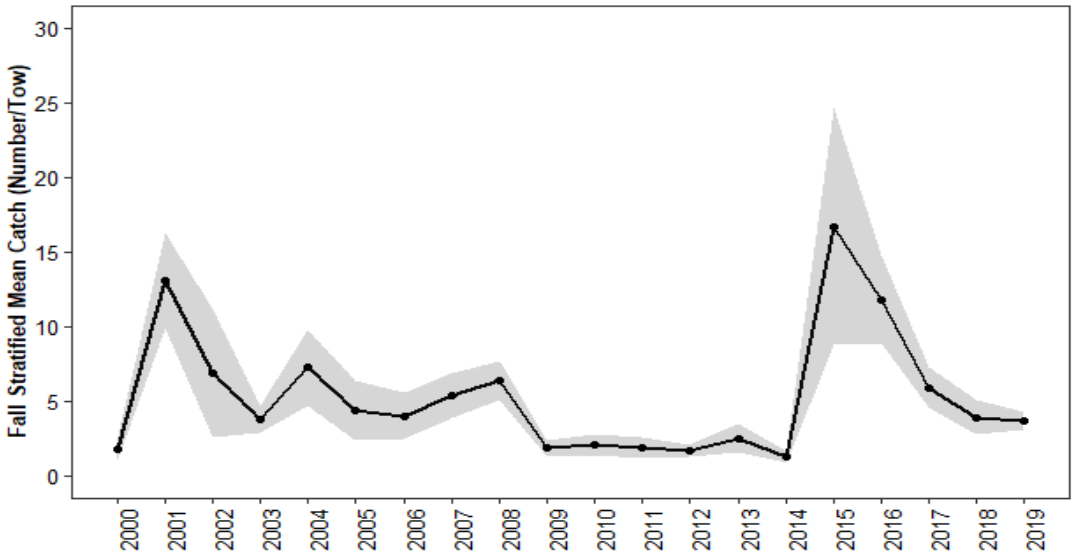


Figure 16. ME/NH fall trawl survey index of abundance (solid line with circles) with 95% confidence interval (shaded region).

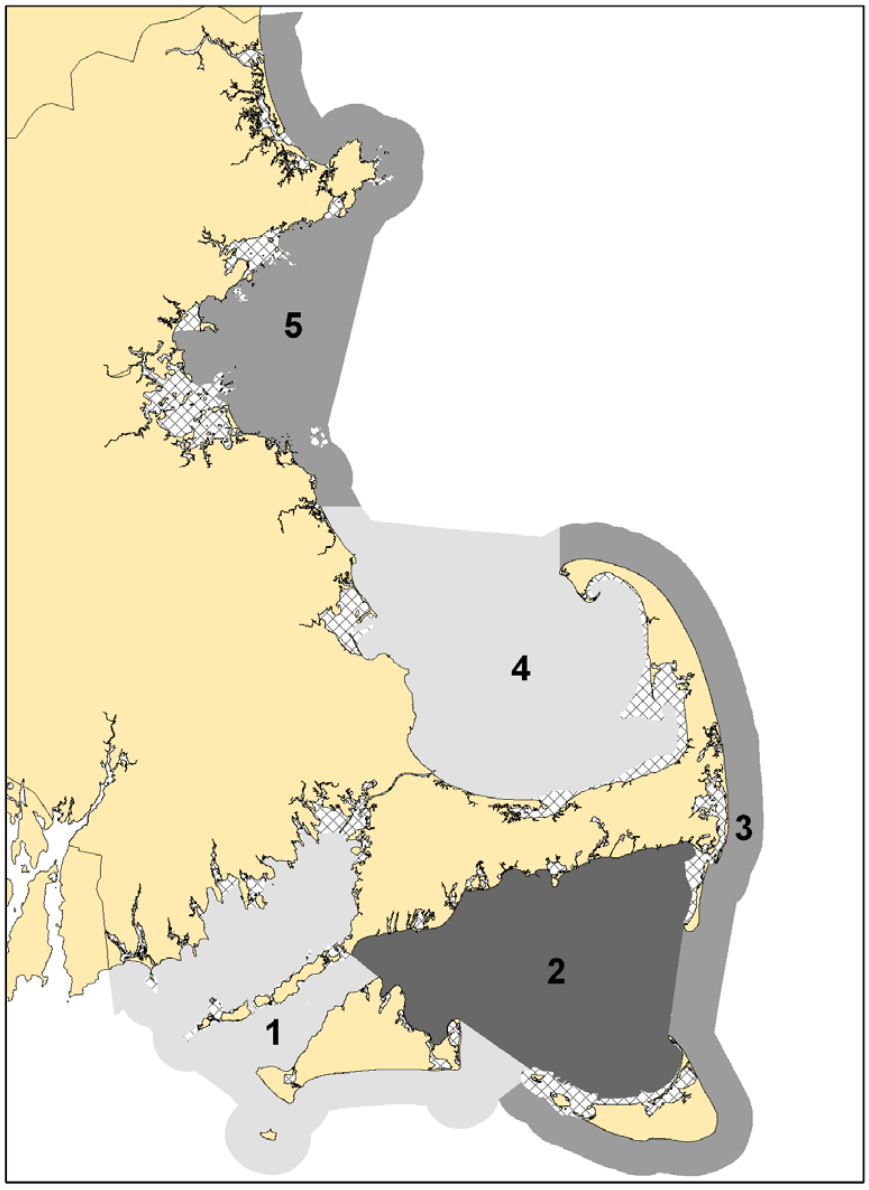


Figure 17. Sampling regions for the MA DMF trawl survey.

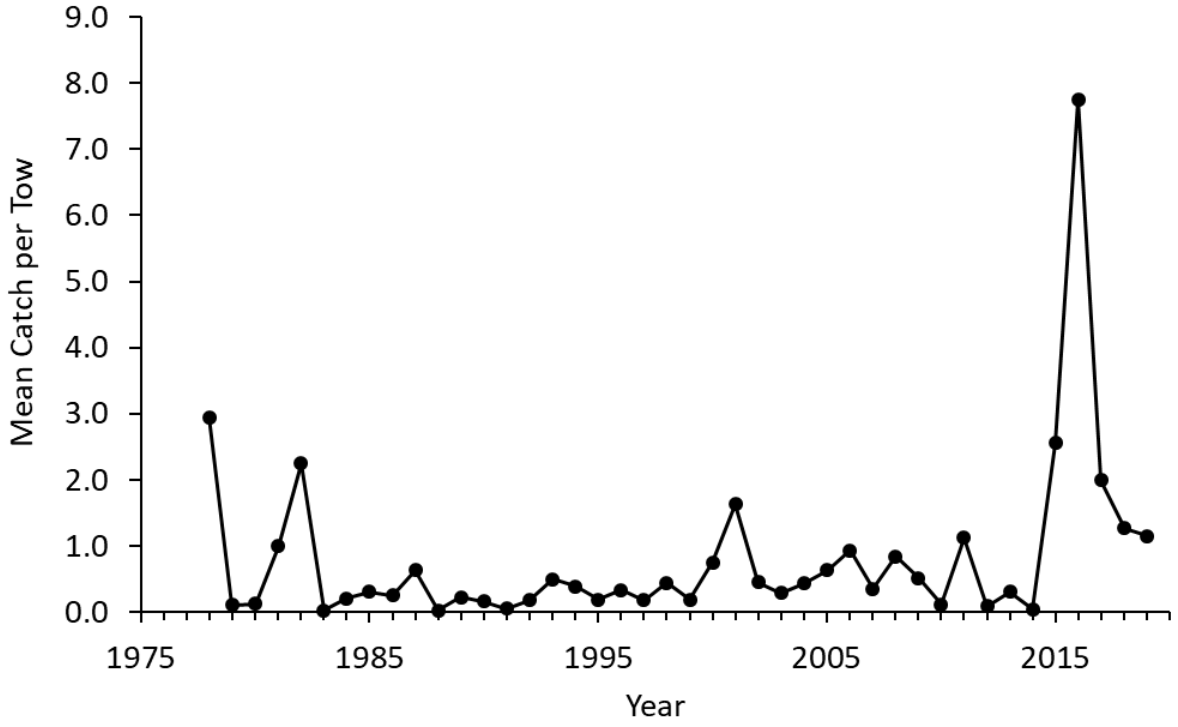


Figure 18. MA DMF Spring Trawl Survey index of abundance for Gulf of Maine strata.

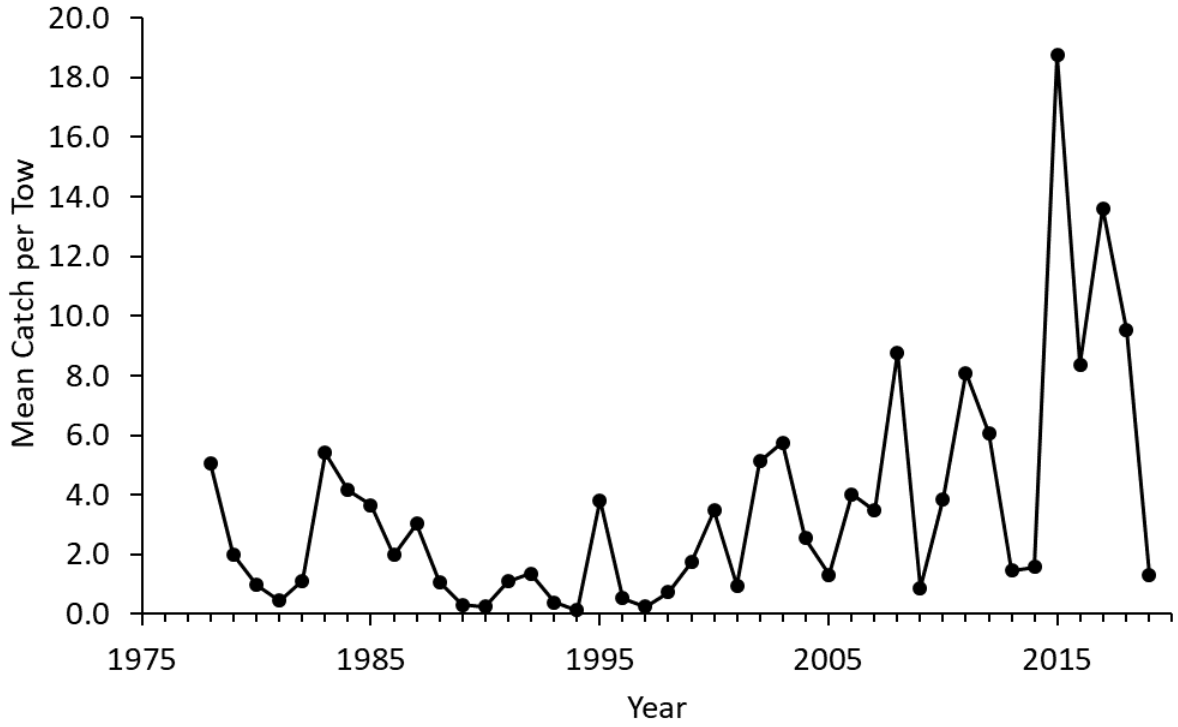


Figure 19. MA DMF Fall Trawl Survey index of abundance for Gulf of Maine strata.

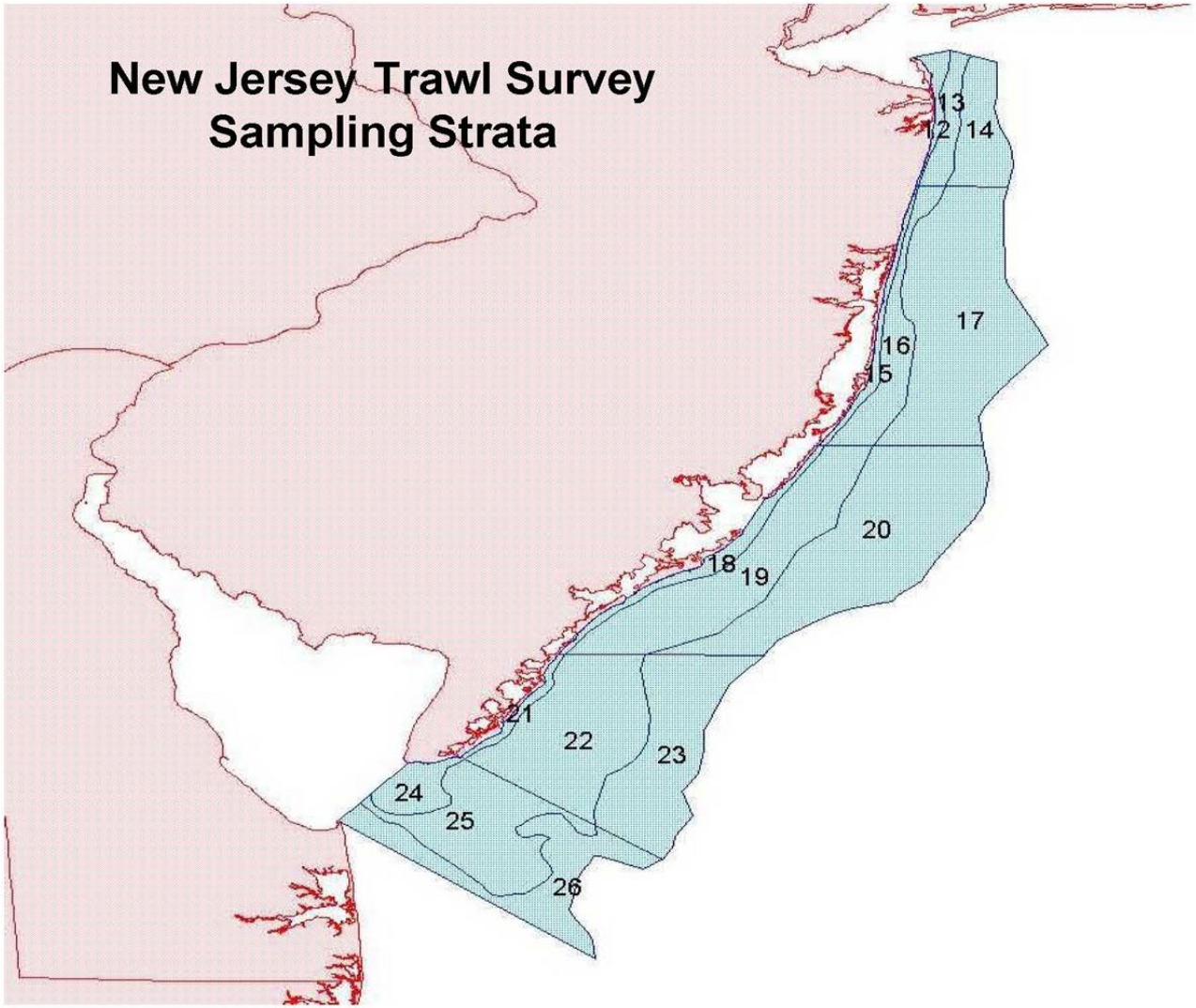


Figure 20. Sampling strata for the New Jersey Ocean Trawl Survey.

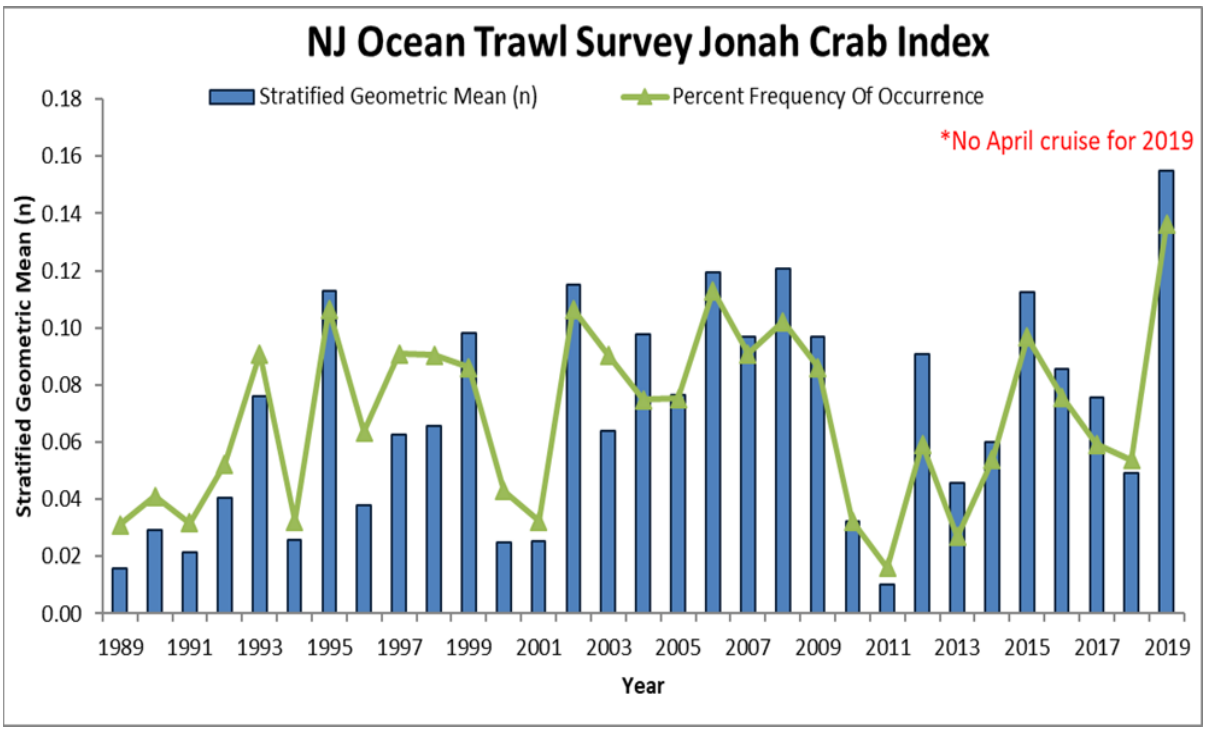


Figure 21. Jonah crab index of abundance and percent frequency occurrence on tows conducted by the New Jersey Ocean Trawl Survey.

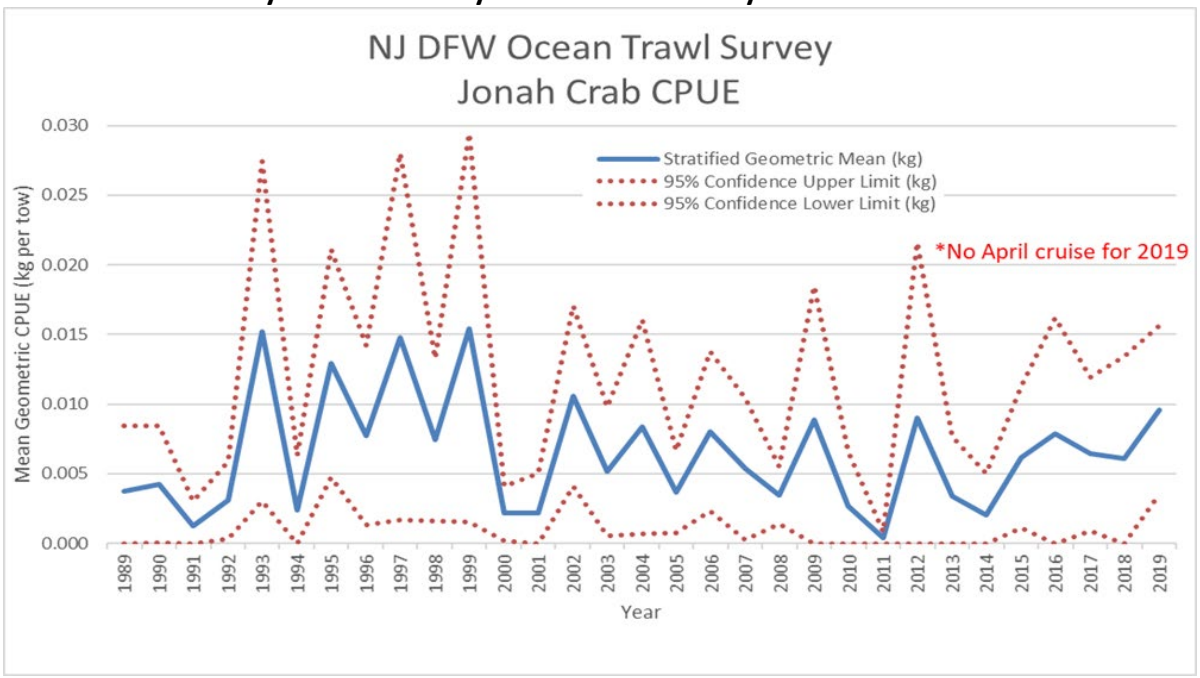


Figure 22. Jonah crab index of biomass for the New Jersey Ocean Trawl Survey.

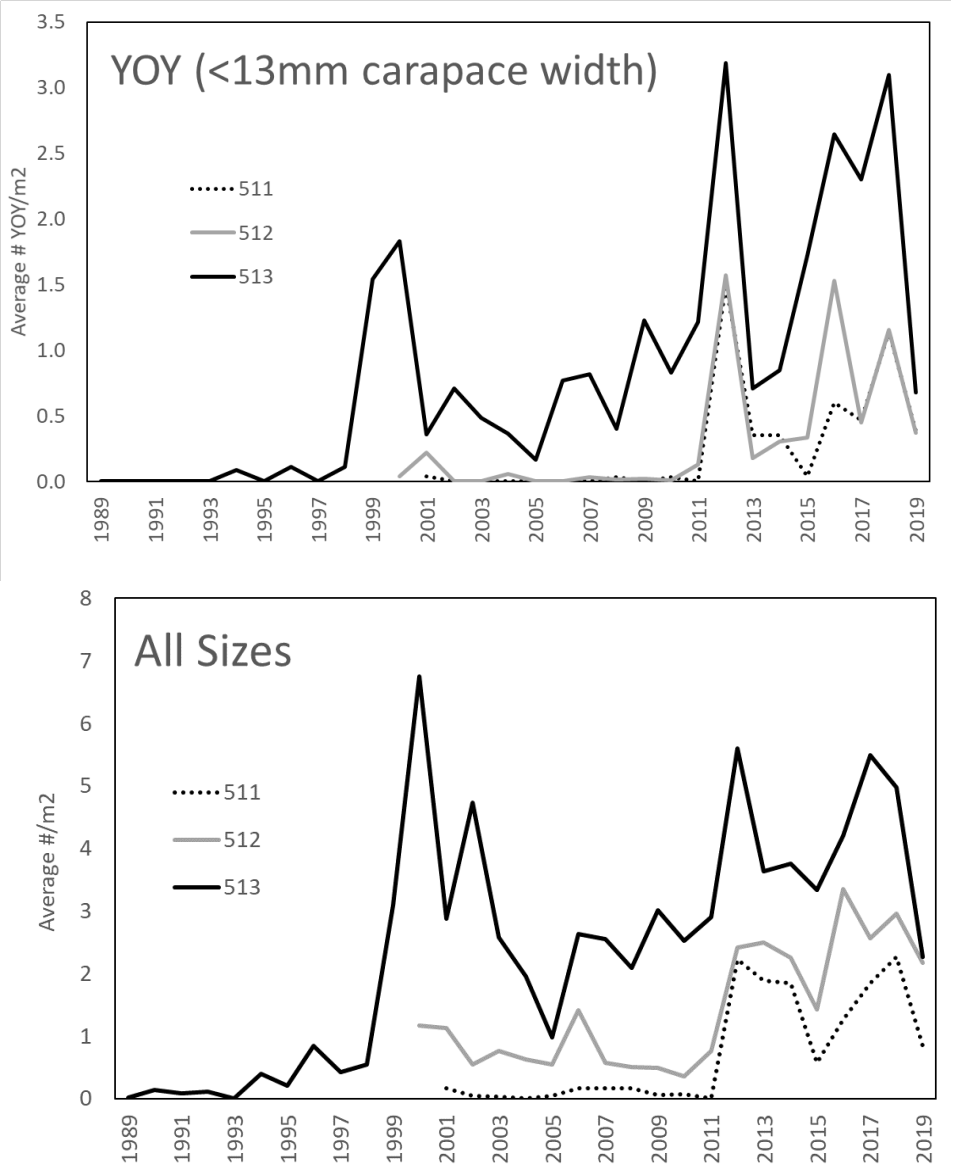


Figure 23. Indices of abundance by NOAA statistical area from the Maine DMR Settlement Survey.

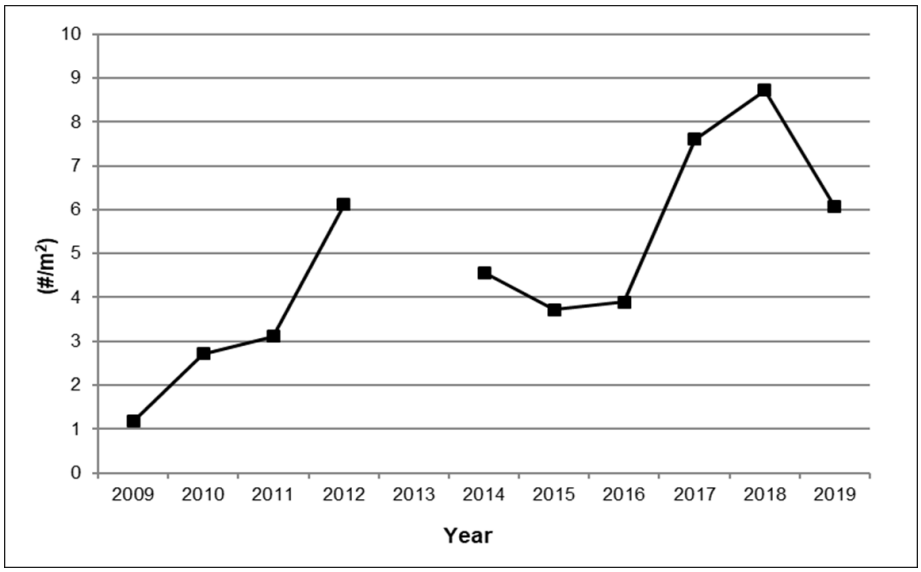


Figure 24. Index of abundance from the NHF&G American Lobster Settlement Survey.

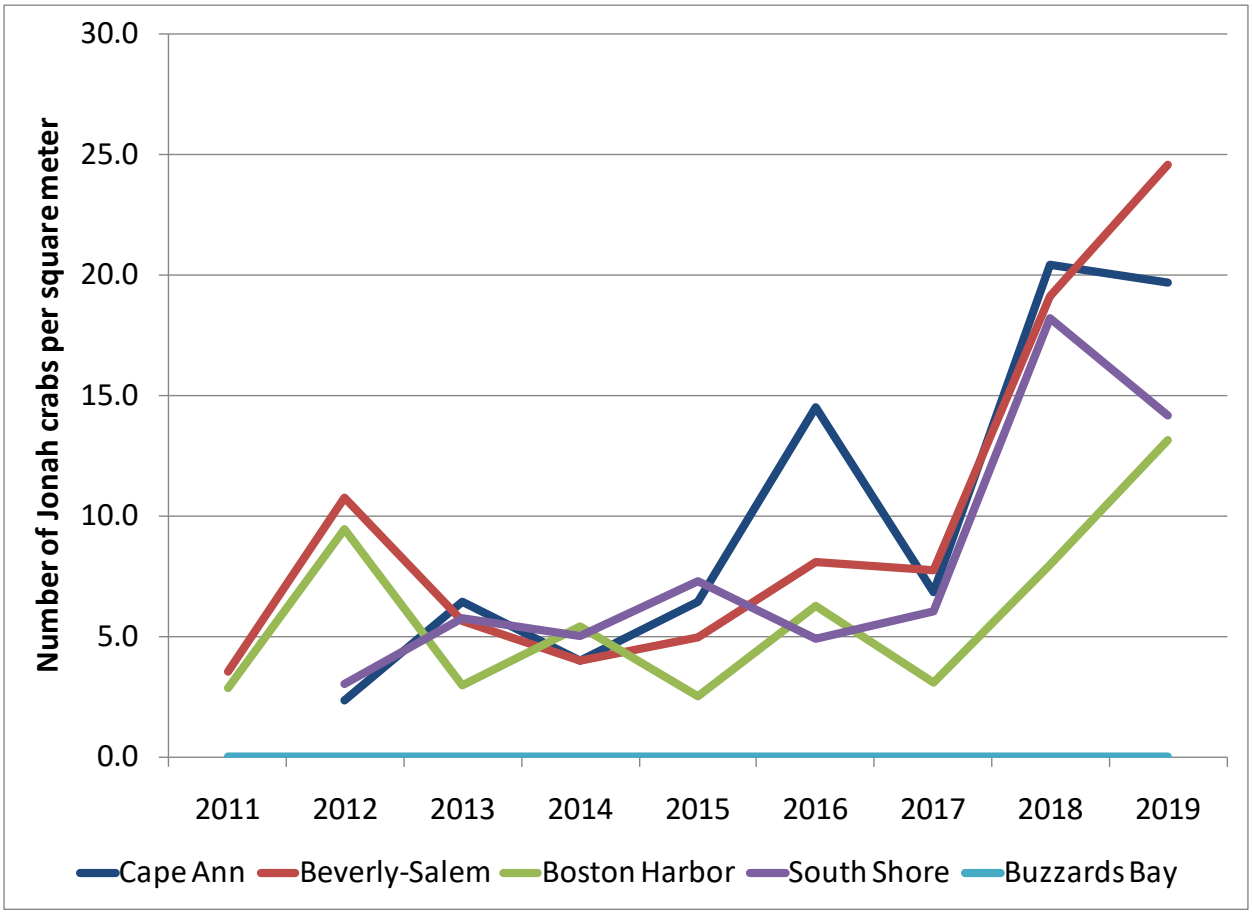


Figure 25. Indices of Jonah crab settlement by sampling area from the MA DMF Settlement Survey.

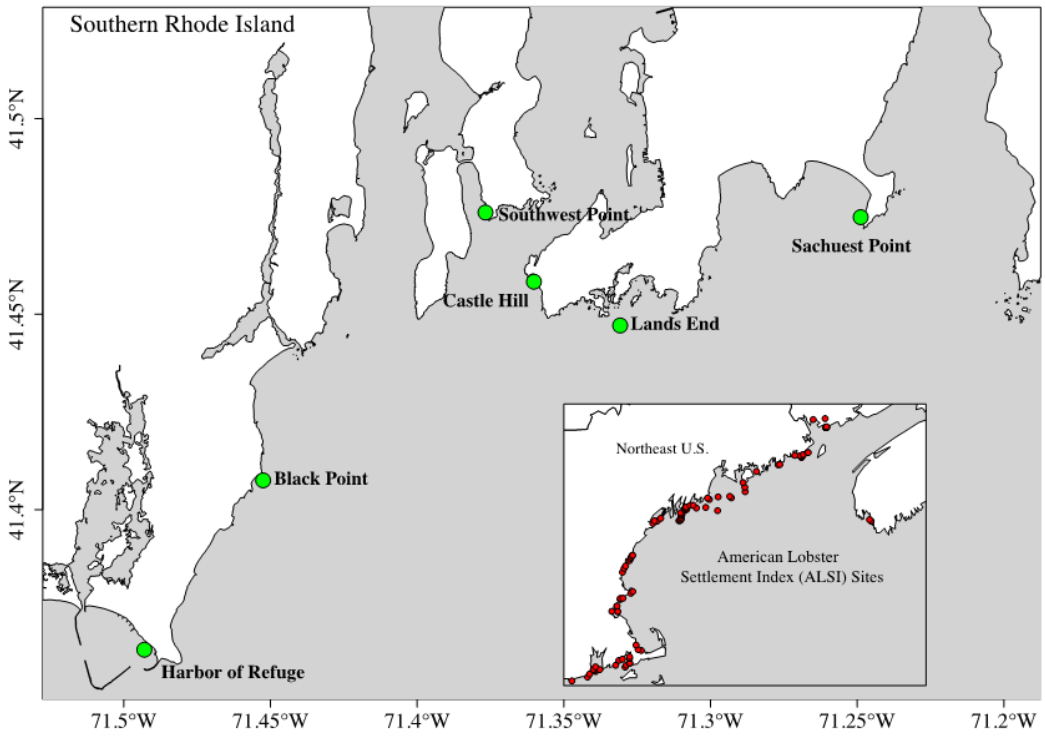


Figure 26. Map of six sites sampled by RIDEM DMF in yearly settlement survey.

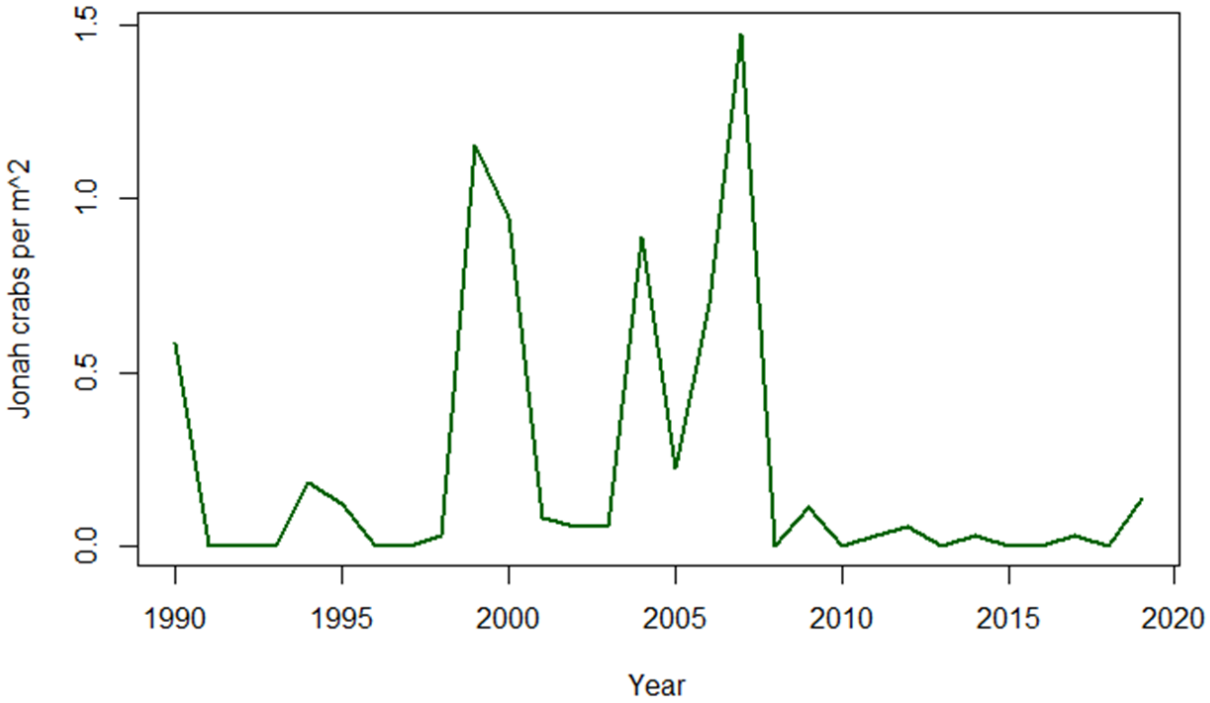


Figure 27. RIDEM DMF settlement survey index of abundance.

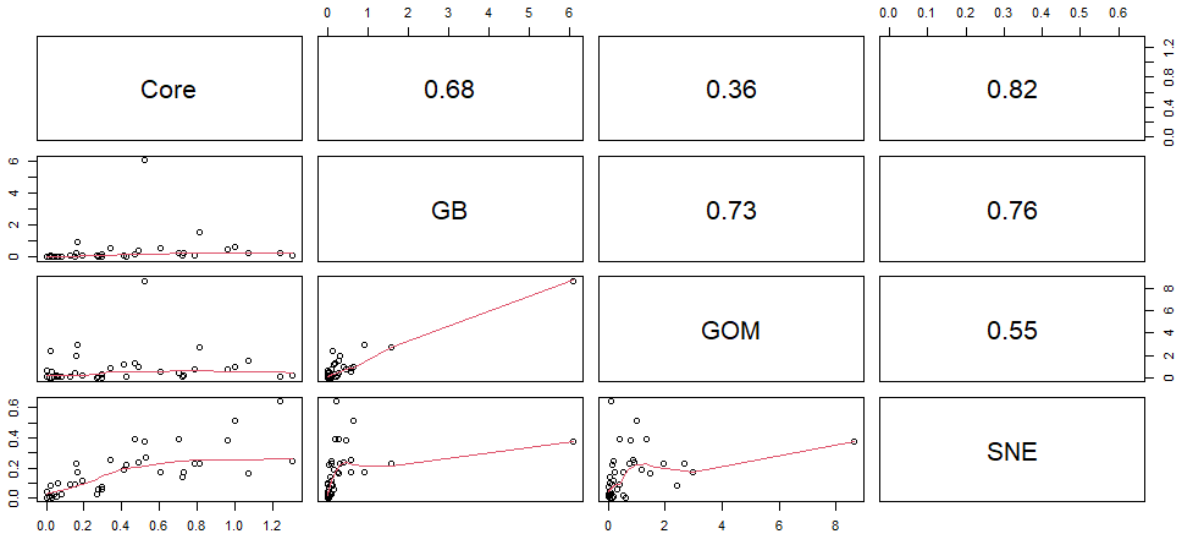


Figure 28. Spearman's rank-order correlation of NEFSC spring trawl survey indices from regions sampled. Plots in the lower panels are pairwise indices (black circles) from regions on the corresponding column and row of the diagonal fit with a LOWESS smoother (red line). Numbers in the upper panel plots are correlation coefficients between indices from regions on the corresponding column and row of the diagonal.

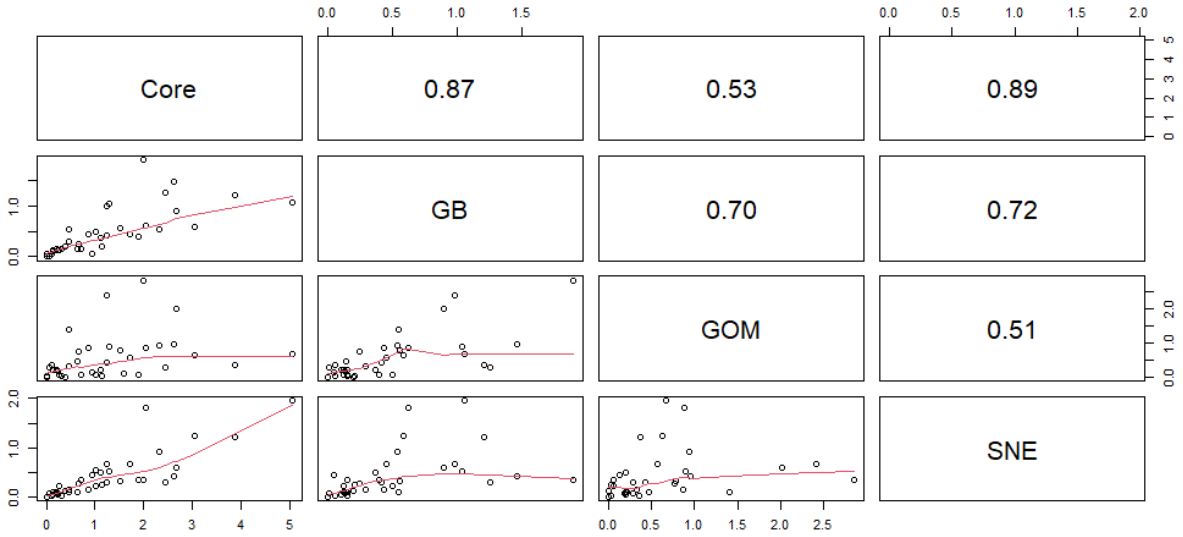


Figure 29. Spearman's rank-order correlation of NEFSC fall trawl survey indices from regions sampled. Plots in the lower panels are pairwise indices (black circles) from regions on the corresponding column and row of the diagonal fit with a LOWESS smoother (red line). Numbers in the upper panel plots are correlation coefficients between indices from regions on the corresponding column and row of the diagonal.

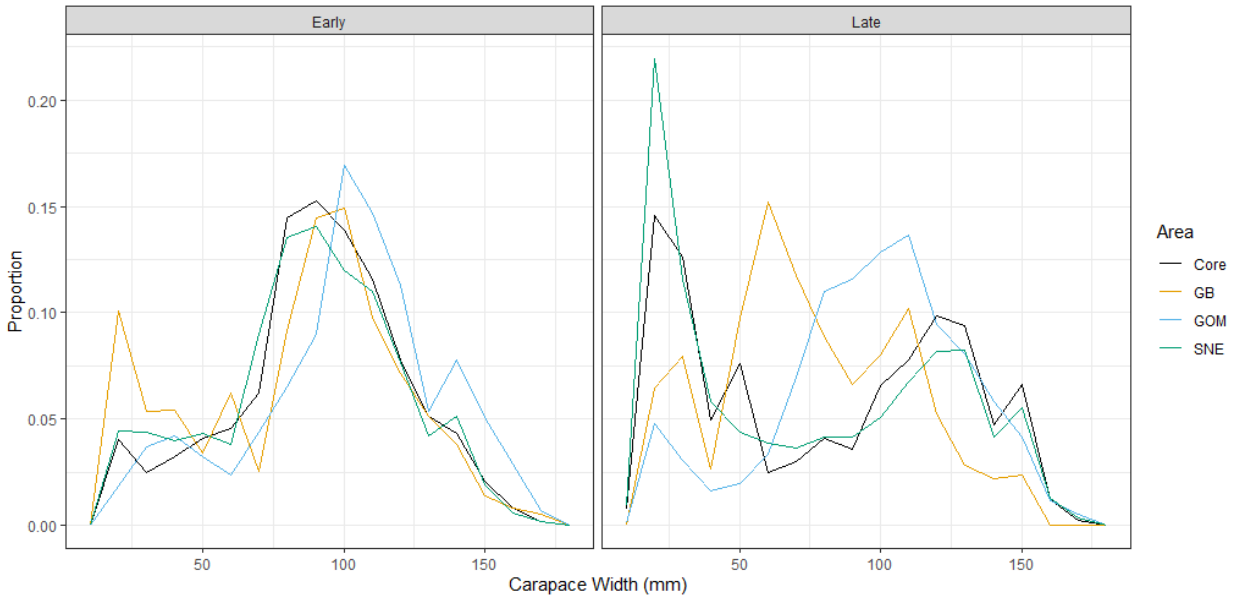


Figure 30. Length compositions of Jonah crab caught by period during the NEFSC spring trawl survey from regions sampled.

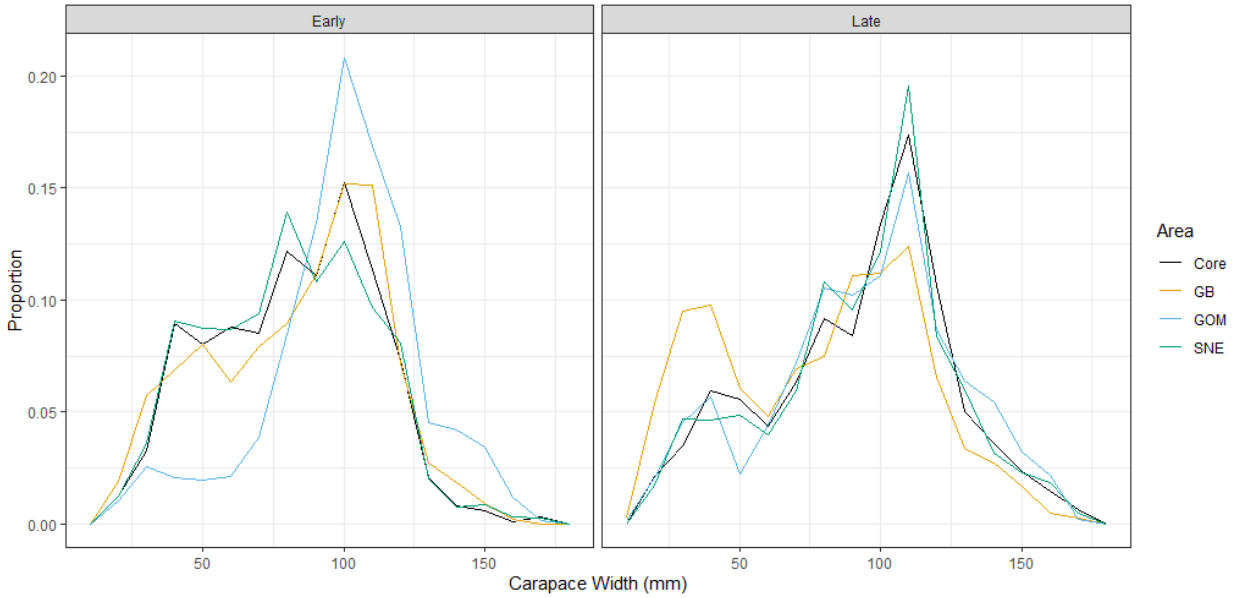


Figure 31. Length compositions of Jonah crab caught by period during the NEFSC fall trawl survey from regions sampled.

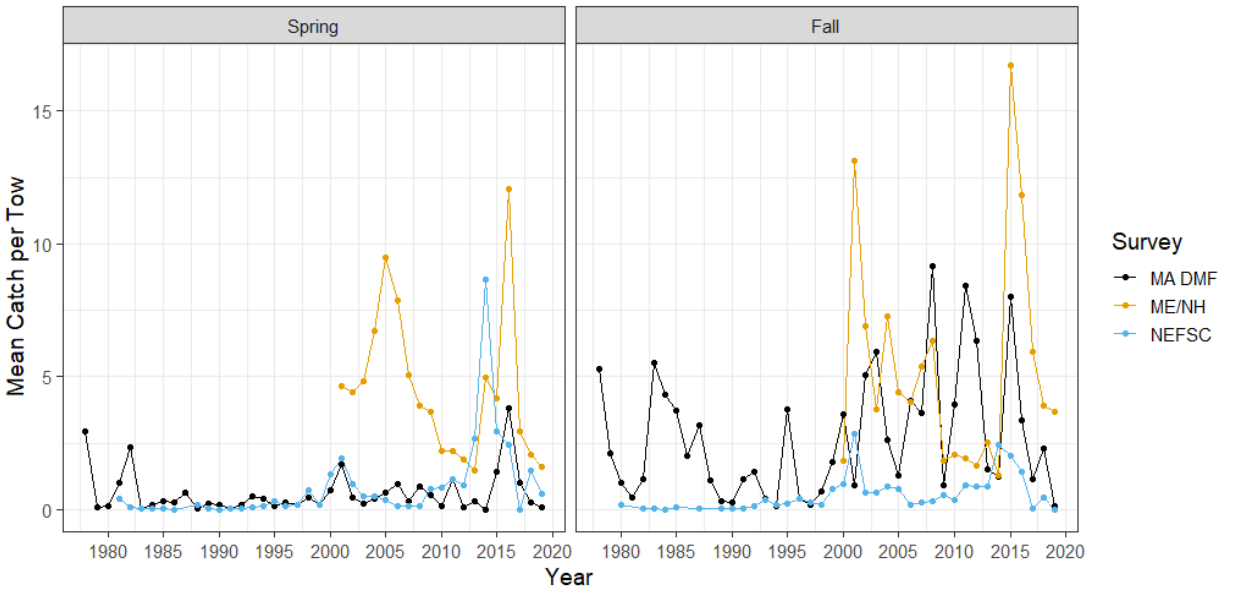


Figure 32. Indices from trawl surveys sampling the Gulf of Maine.

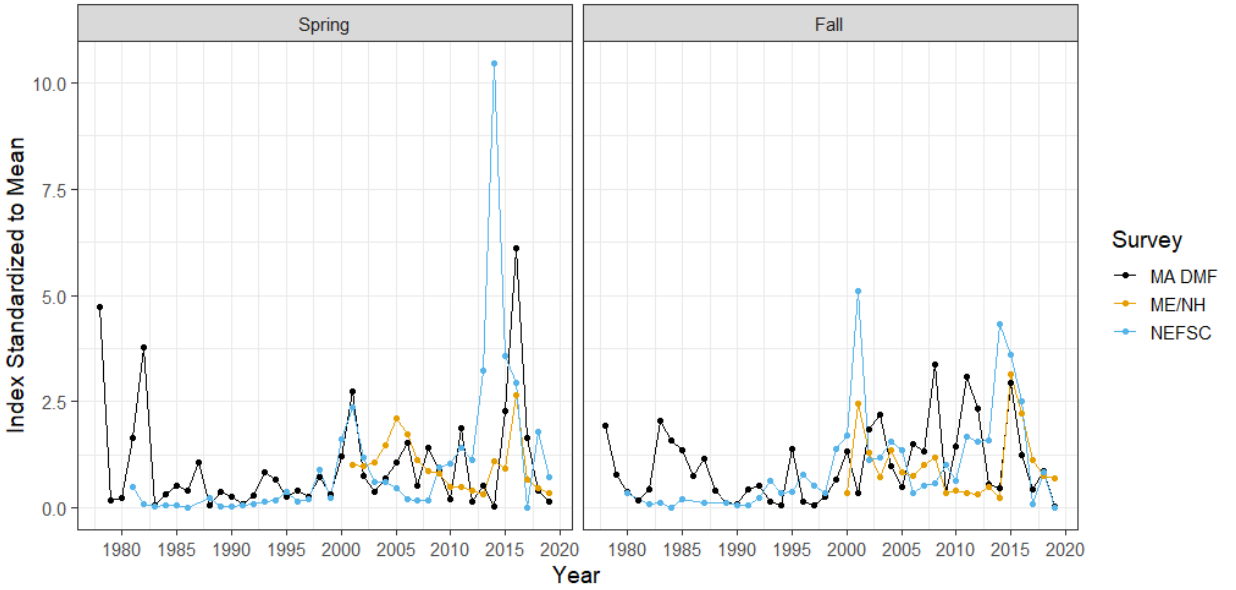


Figure 33. Indices from trawl surveys sampling the Gulf of Maine scaled to time series means.

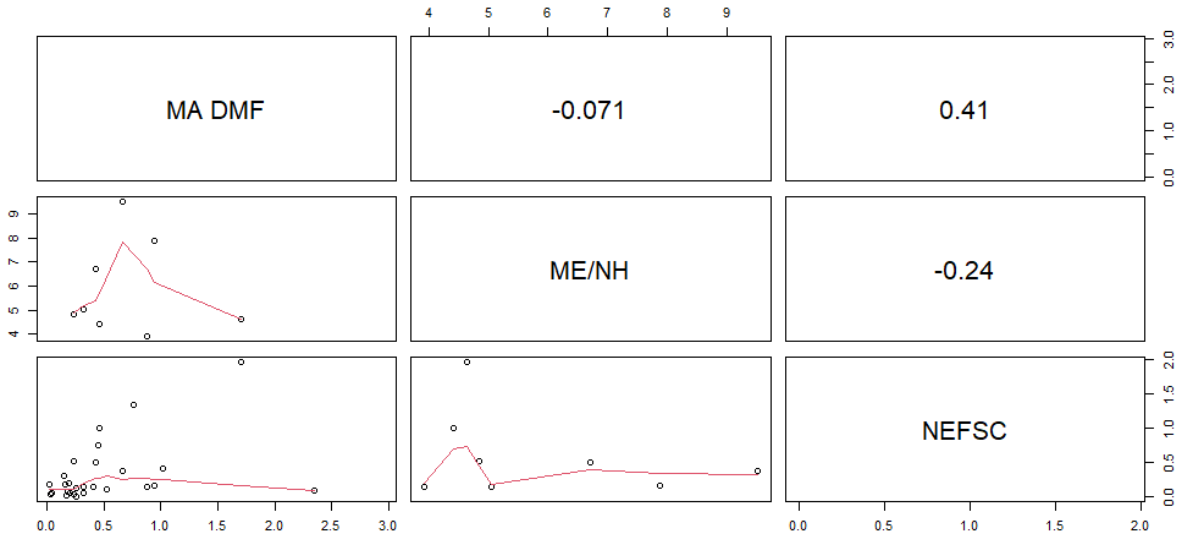


Figure 34. Spearman's rank-order correlation of spring indices from trawl surveys sampling the Gulf of Maine prior to the NEFSC Trawl Survey vessel change in 2009. Plots in the lower panels are pairwise indices (black circles) from surveys on the corresponding column and row of the diagonal fit with a LOWESS smoother (red line). Numbers in the upper panel plots are correlation coefficients between indices from surveys on the corresponding column and row of the diagonal.

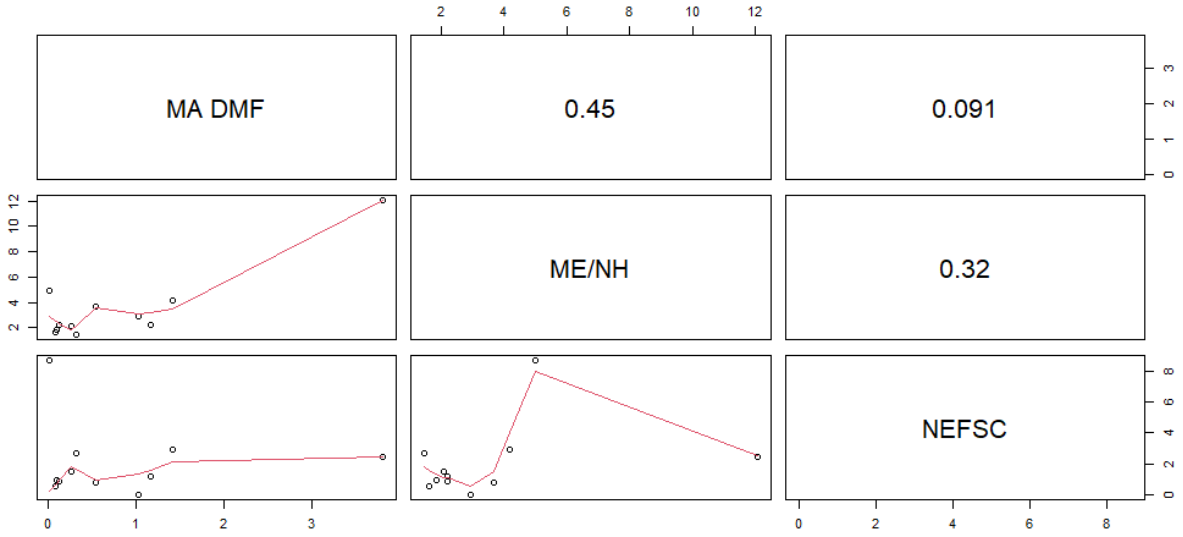


Figure 35. Spearman's rank-order correlation of spring indices from trawl surveys sampling the Gulf of Maine following the NEFSC Trawl Survey vessel change in 2009. Plots in the lower panels are pairwise indices (black circles) from surveys on the corresponding column and row of the diagonal fit with a LOWESS smoother (red line). Numbers in the upper panel plots are correlation coefficients between indices from surveys on the corresponding column and row of the diagonal.

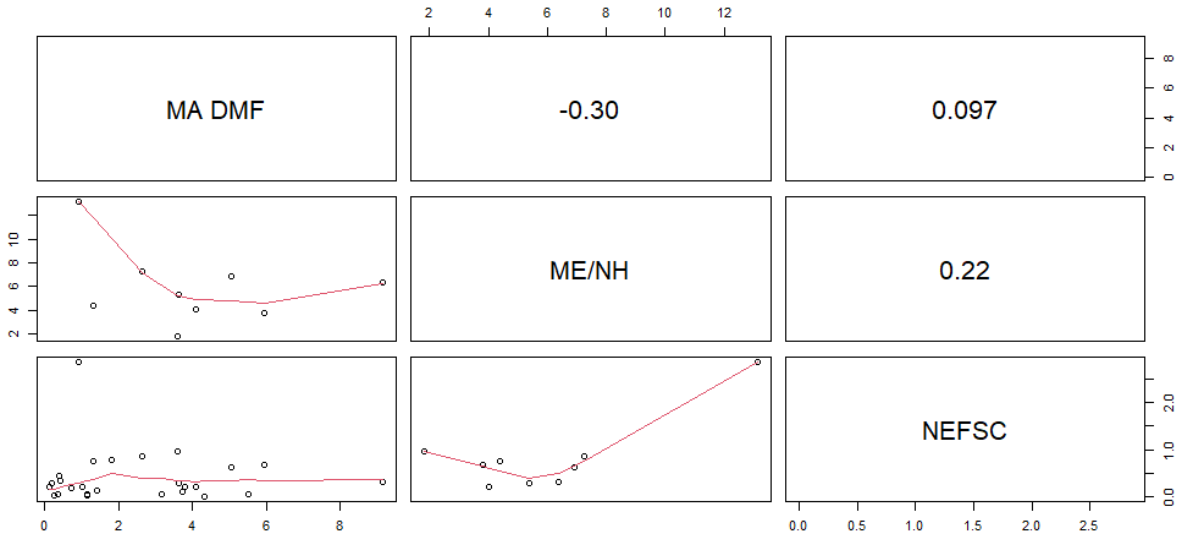


Figure 36. Spearman's rank-order correlation of fall indices from trawl surveys sampling the Gulf of Maine prior to the NEFSC Trawl Survey vessel change in 2009. Plots in the lower panels are pairwise indices (black circles) from surveys on the corresponding column and row of the diagonal fit with a LOWESS smoother (red line). Numbers in the upper panel plots are correlation coefficients between indices from surveys on the corresponding column and row of the diagonal.

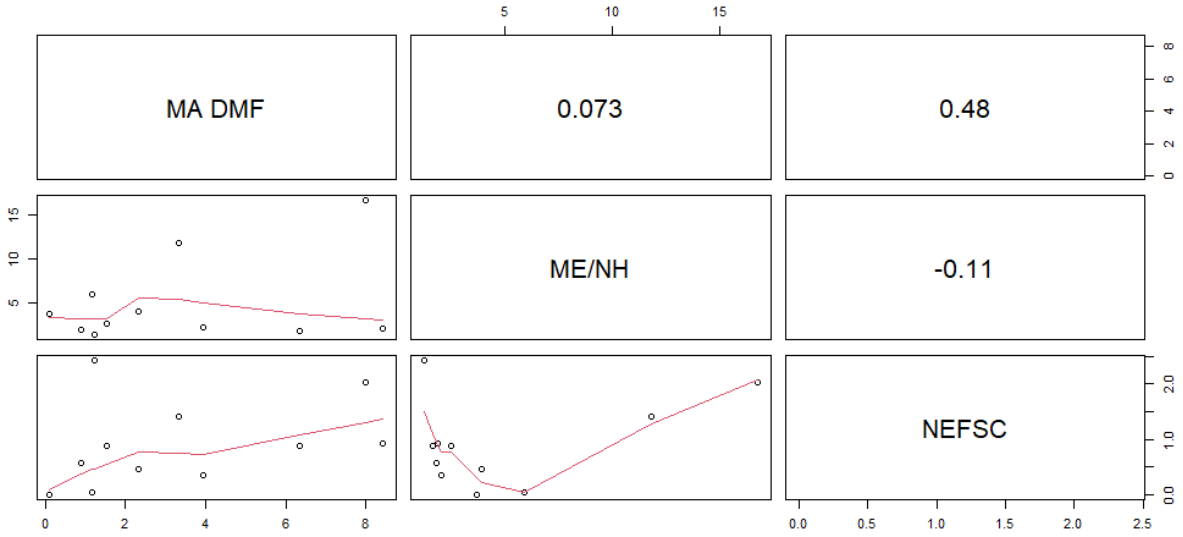


Figure 37. Spearman's rank-order correlation of fall indices from trawl surveys sampling the Gulf of Maine following the NEFSC Trawl Survey vessel change in 2009. Plots in the lower panels are pairwise indices (black circles) from surveys on the corresponding column and row of the diagonal fit with a LOWESS smoother (red line). Numbers in the upper panel plots are correlation coefficients between indices from surveys on the corresponding column and row of the diagonal.

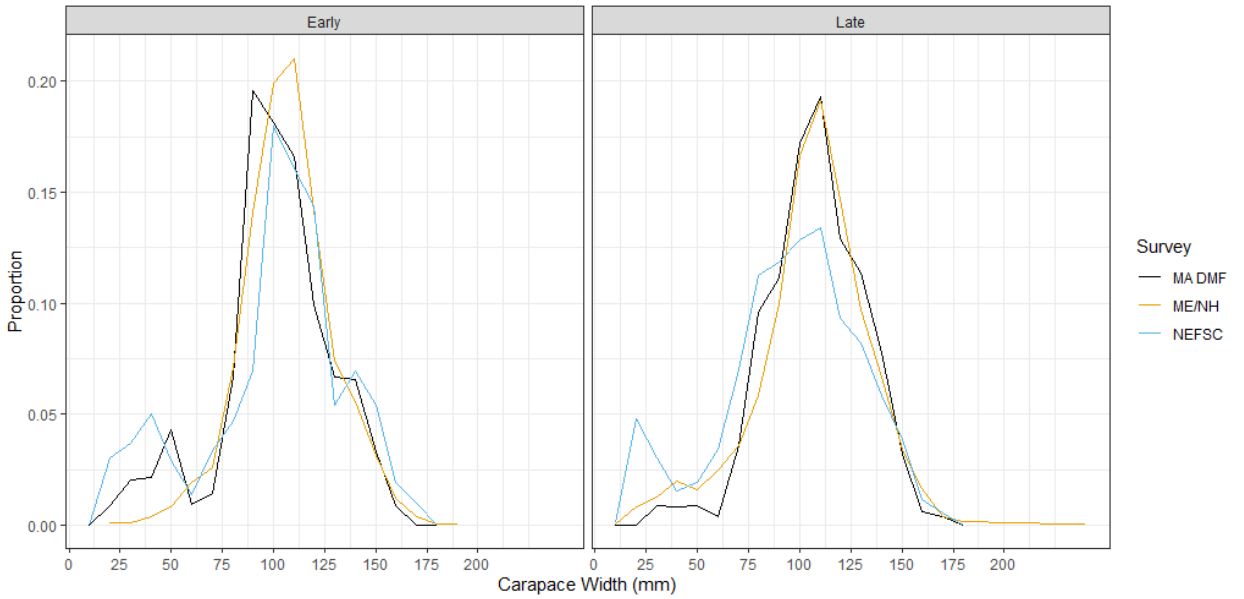


Figure 38. Length compositions of Jonah crab caught by period during spring trawl surveys sampling the Gulf of Maine.

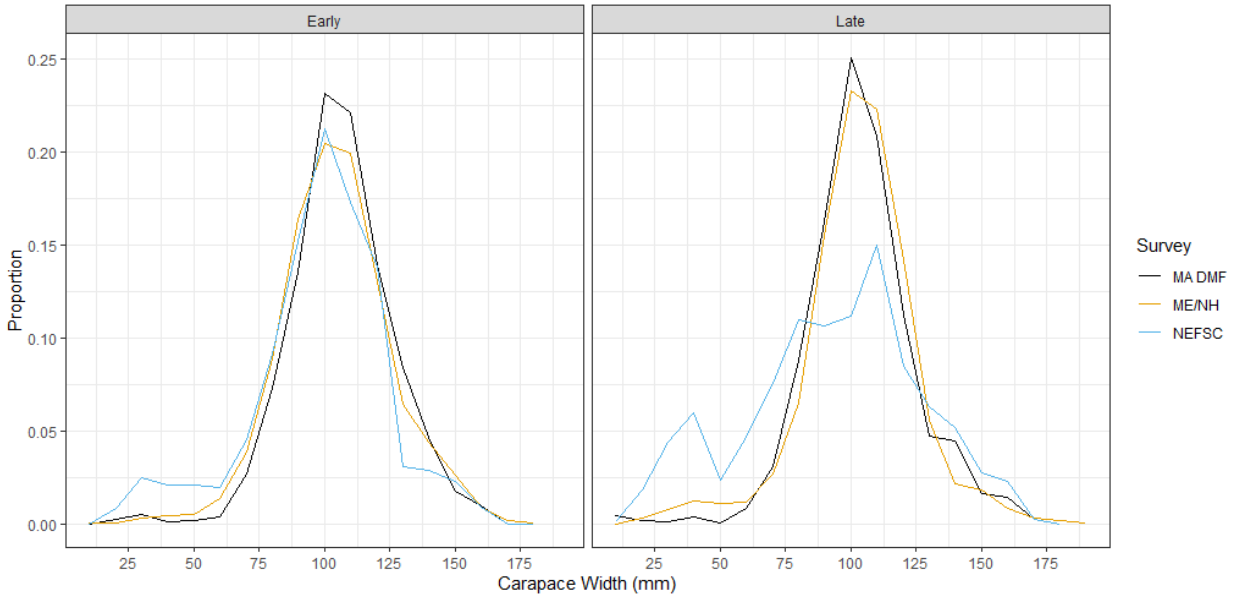


Figure 39. Length compositions of Jonah crab caught by period during fall trawl surveys sampling the Gulf of Maine.

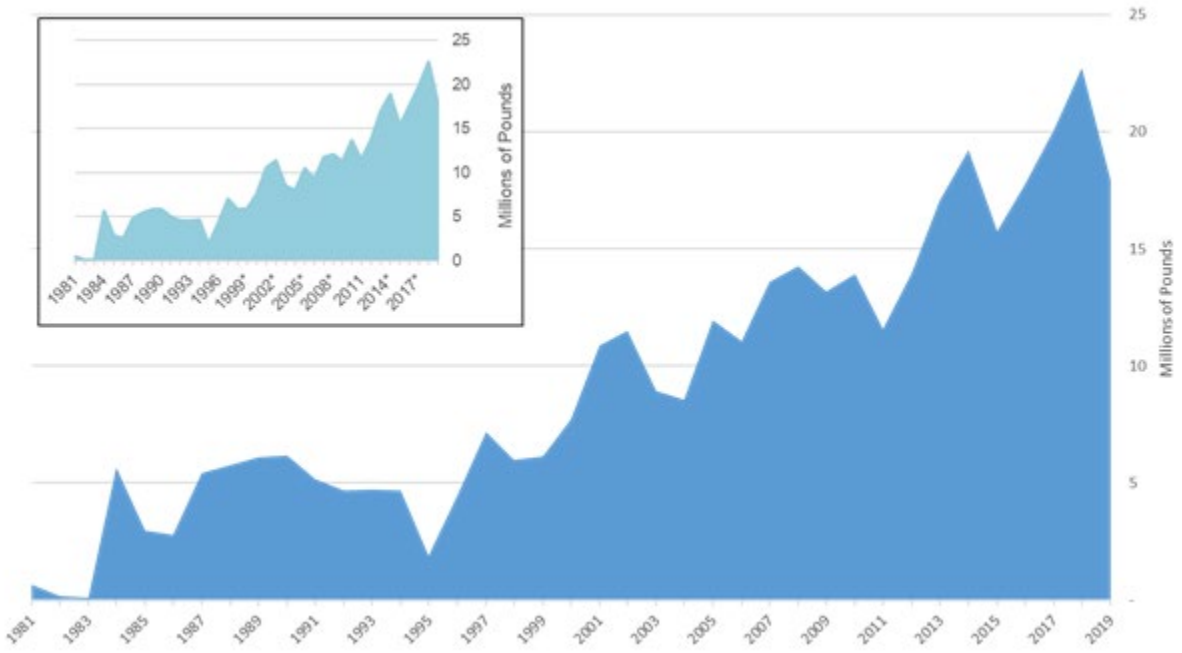


Figure 40. Coastwide Jonah crab landings (small, inset plot) and combined coastwide Jonah crab and Atlantic rock crab landings (large, main plot) from the ACCSP Data Warehouse. Asterisks indicate confidential landings data have been redacted from the total.

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)