Atlantic States Marine Fisheries Commission

American Lobster Management Board

October 19, 2020
1:15 – 4:15 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*)	1:15 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from October 2019	1:15 p.m.
3.	Public Comment	1:20 p.m.
4.	Consider 2020 American Lobster Benchmark Stock Assessment **Final Action** • Presentation of Stock Assessment Report *(K. McKown)* • Presentation of Peer Review Panel Report *(M. Celestino)* • Consider Acceptance of Benchmark Stock Assessment and Peer Review Report for Management Use *(D. McKiernan)* • Consider Management Response to the Assessment and Peer Review *(D. McKiernan)*	1:30 p.m.
5.	Report on Data Collection Requirements for 2021 *(A. Webb)*	3:30 p.m.
6.	Report on Electronic Tracking Pilot Program *(W. DeVoe)*	3:45 p.m.
7.	Consider Fishery Management Plan Reviews and State Compliance **Action** (*C. Starks*) • American Lobster 2019 Fishing Year • Jonah Crab 2018 and 2019 Fishing Years	4:00 p.m.
8.	Other Business/Adjourn	4:15 p.m.

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

MEETING OVERVIEW

American Lobster Management Board Meeting
October 19, 2020
1:15 – 4:15 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: VACANT	Advisory Panel Chair: Grant Moore (MA)	Previous Board Meeting: October 28, 2019
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 October 28, 2019

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. Consider 2020 American Lobster Benchmark Stock Assessment (1:30-3:30 p.m.) Final Action

Background

- The lobster 2020 benchmark stock assessment was completed in July 2020 which evaluated the status of lobster for the Gulf of Maine/Georges Bank and Southern New England stocks. (**Briefing Materials**)
- The assessment was peer-reviewed virtually by a panel of independent experts in August 2020. The Peer Review Report provides the panel's evaluation of the assessment findings. (**Briefing Materials**)
- After reviewing the stock assessment, the Board may consider management response if warranted by the assessment results.

Presentations

- 2020 Benchmark Stock Assessment Overview by K. McKown
- Overview of Peer Review Panel Report by M. Celestino

Board Actions for Consideration at the Meeting

- Accept the Stock Assessment Report and Peer Review Report for management use
- Consider management response, as needed

5. Report on Data Collection Requirements for 2021 (3:30-3:45 p.m.)

Background

- Addenda XXVI (AL) and III (JC) were approved in 2018, and modified harvester reporting and biological data collection requirements for the lobster and Jonah crab fisheries. Specifically, they improve the spatial resolution of data through the reporting of 10 minute squares, as well as require additional data elements including number of traps per trawl and number of buoy lines in order to collect information on gear configurations.
- The new data elements were to be implemented on January 1, 2019, but were delayed in order to incorporate the elements into all reporting platforms. Some elements were implemented in 2020, but the Lobster Data Elements Work Group has been meeting weekly for several months in order to develop definitions for the remaining data elements and determine the implementation timeline for state and federal reporting requirements. The workgroup has also recommended a few additional data elements for a more comprehensive understanding of the fishery.
- It is expected that these data elements will be fully implemented for the 2021 fishing year, and federal reporting will be implemented for either 2022 or 2023.

Presentations

- Report on Data Collection Requirements for 2021 by Anna Webb

6. Report on Electronic Tracking Pilot Program (3:45-4:00 p.m.)

Background

- To improve the spatial resolution of data in the American lobster and Jonah crab fishery, Addendum XXVI established a one year pilot program to test a suite of electronic tracking devices in the Gulf of Maine, Georges Bank, and Southern New England regions. The project was completed during 2019 and 2020.
- The project assessed three devices (Succorfish, Rock7, and Pelagic Data Systems) by placing them on volunteer lobster vessels in Maine and Massachusetts with federal lobster permits. A draft report was submitted to describe the differences in features, performance, and cost between the devices, as well as industry reactions and future work. **(Briefing Materials)**

Presentations

- Report on Electronic Tracking Pilot Program by William DeVoe

7. Consider Fishery Management Plan Reviews and State Compliance (4:00-4:15 p.m.) Action

Background

- State compliance reports for American lobster and Jonah crab were due August 1, 2020.
- The Plan Review Teams reviewed state compliance reports and compiled the annual FMP Reviews for the 2019 Fishing Year. (**Supplemental Materials**)
- Delaware, Maryland, and Virginia have requested and meet the requirements for *de minimis* in the lobster and Jonah crab fisheries.
- The Jonah Crab FMP Review and State Compliance Reports for the 2018 fishing year have not yet been approved due to the Board not meeting since October 2019. (**Briefing Materials**)

Presentations • Overview of Lobster and Jonah Crab FMP Reviews by C. Starks
Board Actions for Consideration at the Meeting • Accept the FMP Reviews and State Compliance Reports for the 2019 fishing year • Accept the Jonah Crab FMP Review and State Compliance Reports for the 2018 fishing year • Approve *de minimis* requests

8. Other Business/Adjourn

American Lobster and Jonah Crab TC Task List

Activity level: Medium

Committee Overlap Score: Low

Committee Task List
Lobster TC • Annual state compliance reports are due August 1 *Jonah Crab TC* • November 2020: Pre-assessment data workshop • Spring 2021: Develop recommendations on initiating stock assessment • Annual state compliance reports are due August 1

TC Members
American Lobster: Kathleen Reardon (ME, TC Chair), Colleen Bouffard (CT), 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)
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)

SAS Members
American Lobster: Kim McKown (NY, SAS Chair), Joshua Carloni (NH), Jeff Kipp (ASMFC), Conor McManus (RI), Tracy Pugh (MA), Kathleen Reardon (ME), Burton Shank (NOAA)
Jonah Crab: None

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

AMERICAN LOBSTER MANAGEMENT BOARD

Wentworth by the Sea
New Castle, New Hampshire
October 28, 2019

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 Meeting
October 2019

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

2. **Approval of proceedings from April 2019** by consent (Page 1).

3. **Move to adjourn** by consent (Page 9).

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Stephen Train, ME (GA)
Sen. David Miramant, ME (LA)
Cherie Patterson, NH, proxy for D. Grout (AA)
Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Raymond Kane, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Jason McNamee, RI (AA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Sen. Craig Miner, CT (LA)
Maureen Davidson, NY, proxy for J. Gilmore (AA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Mike Luisi, MD, proxy for B. Anderson (AA)
Russell Dize, MD (GA)
Phil Langley, MD, proxy for Del. Stein (LA)
Bryan Plumlee, VA (GA)
Pat Geer, VA, proxy for Sen. Mason (LA)
Peter Burns, NMFS
Allison Murphy, NMFS

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

Ex-Officio Members

Rob Beal, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Caitlin Starks
Maya Drzewicki
Katie Drew
Julie Defilippi Simpson

Guests

Sen. Thad Altman, FL (LA)
Erik Anderson, NHCFA
Chris Batsavage, NC DMF
Gabriela Bradt, NH Sea Grant, UNH
Robert T. Brown, MD Watermen Assn.
Kelly Denit, NOAA
Jon Hare, NMFS
Peter Kendall, NEFMC
Nicole Lengyel, RI DEM
Arnold Leo, E. Hampton, NY
Charles Lynch, NOAA
Brandon Muffley, MAFMC
Glenn Normandeau, NH F&G
Michael Pentony, NOAA
Story Reed, MA DMF
John Satterly, USSA
Geoffrey Smith, TNC
Kevin Sullivan, NH F&G
Pam Thames, NOAA
Jack Travelstead, CCA
Lindsey Williams, MIT Sea Grant
Chris Wright, NMFS
Renee Zobel, NH F&G

The American Lobster Management Board of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Monday, October 28, 2019, and was called to order at 9:45 o'clock a.m. by Chairman Stephen Train.

CALL TO ORDER

CHAIRMAN STEPHEN TRAIN: My name is Steve Train. I'm the Governor's Appointee from the state of Maine; and I'm the Chairman of the Lobster Board, and we're going to start the Lobster Board meeting now. It's kind of nice to have the meeting this close, in New Hampshire. It's easy for me to get here, and like most of the things in New Hampshire it's led by two Mainers.

APPROVAL OF AGENDA

CHAIRMAN TRAIN: Everybody got the agenda, I'm certain. Do we have any additions, deletions or corrections on the agenda? I'm sure everyone approves of the agenda.

APPROVAL OF PROCEEDINGS

CHAIRMAN TRAIN: Do we have any additions, deletions, corrections on the previous meeting's minutes? If not I'll consider them both approved by consensus.

PUBLIC COMMENT

CHAIRMAN TRAIN: I'll move forward. Public comment, I don't have anybody on my list for public comment. Is there anybody in the back of the room that would like to comment on anything not on the agenda, which pretty much leaves it wide open? Seeing none, we're on to the next thing.

DISCUSS REPORTING REQUIREMENTS FOR 2020

CHAIRMAN TRAIN: Discuss reporting requirements for 2020. Caitlin.

MS. CAITLIN STARKS: I'll go quickly through this. But for some context, Addendum XXVI for lobster and III for Jonah crab require the collection of a few additional data elements in the Commercial Harvester Reports that had not previously been required, and the original implementation date for those was January 1, 2019, but that date was delayed to January 1, 2020 to allow for those data elements to get added into the reporting platforms.

Most of the elements have been added in at this point, but there are still two, which are bolded on the screen here that have not been added in, and those are location reported via 10-minute square, and the number of buoy lines. Additionally there are a few data elements that are not reported consistently across the management unit, and a few data elements that have been recommended to be added for lobster and Jonah crab reports.

These are the four inconsistently reported data elements, and they include number of traps hauled, traps set, traps per trawl, and number of buoy lines. In different areas these are just reported in different formats. The recommendation is that the Data Workgroup be tasked with determining a consistent method or format for reporting and collecting this information in the Harvester Reports. Reporting data on maximum depth, bait type, bait quantity, and buoy line diameter is not currently required for Addendum XXVI or III. However, the Whale and Bait Related Workgroups discussed these items and thought they would be helpful information to collect for their efforts. It's recommended that these four data elements also get added to the Commercial Harvester Reports and reporting platforms.

Today, the recommended action for the Board is to postpone the implementation of the requirement to collect location via 10-minute square, and number of buoy lines until January 1, 2021, in order to allow more time for these

to get to the reporting platforms. That is all I've got.

CHAIRMAN TRAIN: Cheri.

MS. CHERI PATTERSON: Number of buoy lines. I'm a little concerned with postponing that sort of information. As people well know there is a critical data need for that particular data element, especially as we are moving into a new right whale versus lobster harvester scenarios. We're all trying to come up with some sort of risk reduction.

That is going to have to happen in 2020, some sort of risk reduction. After that there needs to be some sort of way to show that risk reduction does not increase from that particular baseline. In order to determine that you pretty much need to have the number of buoy lines that are out there. I'm a little hesitant to postpone the implementation of the buoy lines.

CHAIRMAN TRAIN: Jason.

DR. JASON McNAMEE: I was curious; I also have some discomfort with the postponement. I was curious about the data recording aspect of this. We could require something, and there might be nowhere to put the data electronically. I'm trying to get a little more information on that. Is it not ready for 2020, because that would influence my vote on this?

CHAIRMAN TRAIN: Toni.

MS. TONI KERNS: For the 10-minute squares, the aspect for collecting that on eTrips is available now, or will be available for 2020. But in the SAFIS computer system it is not available, and it won't be available until about middle of the year, once the SAFIS redesign has been completed. For the number of buoy lines, that aspect could be available for the eTrips, if I am correct, but also would need to be added to the computer version of SAFIS for 2020.

CHAIRMAN TRAIN: Go ahead, Jason.

DR. McNAMEE: It's in eTrips if a state has altered their paper logbook system it could be there. Its paper logbook is there, it's stored on paper, which isn't ideal but it's there, it could be entered later. I don't think I understand. If you put in data into the field in eTrips, where does it go?

MS. JULIE DEFILIPPI SIMPSON: If you choose a 10-minute square it's actually doing sort of a lat/long tag, and that is what's going into our system. The issue with the 10-minute square outside of the eTrips system, specifically the eTrips mobile system, is that the eTrips online system does not have a similar 10-minute square. We would just have a lat/long, which could be translated into a 10-minute square, which is a possibility. For those partners or states that are not collecting a lat/long coordinate, there is no finalized existing grid for how they would name those 10-minute squares, therefore there is no ability for them. Electronically it's easy, we just created a map, they pick one and it's done.

There would need to be maps that accompanied a paper logbook, where people would have to have names for all of the 10-minute squares, and that hasn't been done. Additionally, those who are having this conversation were very concerned about the fact that any particular change in area or gear is how we are currently defining effort.

If you change the area definition from a statistical area to a 10-minute square, you are not just doing it for lobster, you're doing it for every fishery. Every time you change 10-minute squares you would have to start a new effort, and that would be across every fishery, including lobster. We were concerned that that was a very large change to make without making sure everyone was aware of the impact of what that change would be.

CHAIRMAN TRAIN: Pat Keliher.

MR. PATRICK C. KELIHER: I'm trying to in my mind figure out how this is all going to play out, because the state of Maine has been now required to have 100 percent harvester reporting by 2024. That harvester reporting is going to include all of these things that we're postponing. We're in the develop process of starting to develop these tools.

I am hesitant to have a workgroup start working on these things not knowing how that is going to change the work that we're trying to do right now. Is something else going to come up through this process that is going to potentially modify our ongoing efforts at DMR to come into compliance? We had talked about this, and it's all fundraising dependent on how we can or cannot come up with the overall cost of the program to implement.

Requiring Maine to go to 100 percent harvest reporting is probably the most costly motion ever put in place, as far as what the impact to the state is. I'm very concerned about how this particular action could impact the work that we're doing going forward. I want to make sure if we're going to do this we're going to do it once, and we're going to do it right.

CHAIRMAN TRAIN: Toni.

MS. KERNS: For the postponement of the 10-minute squares and the buoy lines, I think that that is pretty straightforward, it's just that there is not the ability to collect it on all platforms, and so therefore we didn't want to make it a requirement for fishermen for states that don't utilize just eTrips Mobile.

There are also some states that had some concerns that they would not be able to fit it on their paper forms, and wanted additional time to work through that. For the items that were recommended by the Workgroup. We had a concern that some states or agencies were collecting that information, or deriving it in different ways, and if you're wanting to use some of that information on an assessment level then it's important that we're collecting it consistently, to be able to utilize it at the assessment level consistently. We wanted to work with the folks from the states that are doing the data collection, to get that information in the most efficient and effective way, in order to be able to translate that to the assessment process cleanly. I believe we should be able to do that within a six-month time period.

CHAIRMAN TRAIN: Anybody else? I do think we do also, if this does get delayed, we do have the Control Date that we put in on 04-19. We might not have all the data, but we have that date saying anything after that may be treated differently. If we see a real escalation of effort before this happens, we do have that Control Date available to us. I don't know if it will work, but we have it. Toni.

MS. KERNS: Just one other thing. Just because we delay this, if a state has the ability to collect this information, we are not preventing them from doing that. I recognize that it is very important to get the number of buoy lines for the whale information. If there is a way for a state to go ahead and collect that this year, then that is fantastic.

CHAIRMAN TRAIN: Now on to Update on the Resiliency in the Gulf of Maine. Sorry about that. Are there any objections to the discussion on the reporting requirements? Okay, now on to the discussion on resiliency. Did you see one? Who is it? Peter Burns, go ahead.

MR. PETER BURNS: I just wanted to note, I'm going to abstain on this because this pertains to state reporting requirements. Thank you.

CHAIRMAN TRAIN: Back to you, Caitlin.

MS. STARKS: I'll go over this quickly as well.

CHAIRMAN TRAIN: Craig Miner.

SENATOR CRAIG A. MINER: I also have a concern about extending this to 2021. Just the optics isn't good. I wonder if there is a way to change that last portion so that it doesn't appear as though it's another whole year of putting it off. It may be that technologically, even if everybody gathers the information it will be sometime after January 1, 2021. But the message I think that sends is not good. But I don't know how to exactly fix it to do what Toni was saying probably we will be able to do.

CHAIRMAN TRAIN: Toni.

MS. KERNS: I understand the concern, Craig, and I don't know what else we can do. Technologically we just don't have the ability to collect all of these data pieces on all platforms. Therefore, it would be very difficult for us to make it a requirement for states to collect that information from the fishermen, if we can't make it available on all the platforms, unless we forced everybody to use eTrips or if you had it on your paper form the state could collect it there.

In terms of compliance and consistency, we discussed having the requirement be made halfway through when it became available, when the SAFIS redesign had been completed, but we were concerned about getting that information out to the fishery, and getting compliance and having inconsistency from the data collection for the entire fishing year. Therefore, as a Workgroup we decided to make that recommendation to start in the next fishing year, when all the data elements would be available on all the platforms.

CHAIRMAN TRAIN: Dan McKiernan.

MR. DANIEL McKIERNAN: Is a motion in order to delay these elements?

CHAIRMAN TRAIN: I was advised no, so I just need a consensus on accepting the report.

MR. McKIERNAN: Well before you do, what I've found in this process is there are us as a Board, and we come up with certain mandates through our votes. Then the TC folks also have their desires and needs, and then it all falls on the data people to figure all this out. What I've learned is that there were some unintended consequences of some of the requirements that even the TC had asked for, specifically trip length.

What we discovered through internal conversations is that trip length was of great interest to the TC when they wanted to look at the offshore fishery, or the fishery that's functionally offshore. But they didn't really care about trip length for an inshore lobsterman who's doing a day trip. Well this is going to have an enormous amount of implications and burden for us as we have our paper reporting lobstermen who give us trip level reports, to be giving us trip length data, which is actually not really of any importance to the TC.

If this is an ongoing initiative, and we're going to hear back from the data folks, maybe at our February meeting about progress, I would also like to see if trip length could be reexamined, because our data folks feel that that may be an unnecessary parameter to be collecting, because our data collection systems is the same for everybody, whether you're digging clams, quahogs, dragging or lobstering. If you're part of the state reporting system it's one form, and we don't feel that trip length is worth it. Could I ask trip length to be examined as well?

MS. KERNS: It's not one of the elements that any of the states said that they had an issue collecting, so it was not brought up in the discussion that the Data Workgroup had, and trip length can be collected in two different ways. It either can be collected through start times and end time on the report, or total trip

time, just you know number of hours. If it's an issue for your state then we can bring it back up to the Workgroup, but it was already a requirement. It's been a requirement all along since Addendum X, I believe.

MR. McKIERNAN: But I would still like to have it discussed by the Data Workgroup if I could.

MS. KERNS: We can do that. It was my understanding that this Board already agreed to the postponement through, we just asked if anybody objected, so if we need to do that again because somebody is objecting then we can. But I thought we just agreed to it, to postpone.

CHAIRMAN TRAIN: Ritchie White.

MR. G. RITCHIE WHITE: A question that just came to me during this discussion. It was said that not all platforms that fishermen use that will work now, but how many platforms would work now, and what percentage of the fishermen are using what percent of platforms? If it's a substantial amount, wouldn't it make sense to go ahead and collect the data on the platforms that do work?

MS. KERNS: It varies by state, Ritchie. In some states they will be able to put it on their paper forms, in other states they will not. It is available on eTrips Mobile, but there is not a large percentage of the fishery that is using eTrips mobile at this time, and it is not available on SAFIS, which is where the larger percentage outside of state paper forms.

CHAIRMAN TRAIN: Okay we've gone back to 4. We've had enough; I hope everyone is satisfied with the answers now. Pat, I guess not.

MR. KELIHER: No, I haven't had enough. I'm having too much fun with this. Bait and the amount of bait, can somebody please tell me how we're going to use that for management decisions? Why are we going to be pulling that type of information?

MS. KERNS: It came out of the Bait Workgroup for wanting to know the different types of bait that are being utilized in the fishery. When the herring bait quota dropped we were trying to figure out what other types of bait are being used, to be able to make sure that there aren't things going into the fishery that could be potentially dangerous to the environment or the species, and so therefore it was something that came out of that Workgroup to ask for. As again, it's not a requirement it was a suggestion. It wouldn't be a requirement unless the Board moved on that.

UPDATE ON RESILIENCY IN THE GULF OF MAINE

CHAIRMAN TRAIN: On to Item Number 5 again, Update on Resiliency in the Gulf of Maine.

MS. STARKS: I have a very brief presentation on Addendum XXVII on Gulf of Maine/Georges Bank resiliency. For some background, in August, 2017, the Board got a report from the Gulf of Maine/Georges Bank Subcommittee that was established to discuss future management of the stock, given changing ocean conditions.

The Committee was concerned about the decreasing trends in Maine's Larval Settlement Survey over recent years, worried that it could foreshadow declines in recruitment and landings for lobster, and the Subcommittee based on that recommended initiating an addendum to increase the resiliency of the Gulf of Maine/Georges Bank stock by considering uniform management measures across the stock.

They felt this would be a proactive response to provide some additional biological buffer through the protection and spawning stock biomass across the LCMAs. The Board did take that recommendation and initiated Draft Addendum XXVII, but following the initiation of

that Addendum as you know, Atlantic right whale issues became prioritized, so efforts on Draft Addendum XXVII were stalled.

The PDT did manage to draft a document, but it was never presented to this Board. Currently the focus of that draft document is on the standardization of management measures across the LCMAs in the Gulf of Maine/Georges Bank stock, since there are currently some differences in management measures in those LCMAs that would allow some lobsters to be protected in one LCA but harvested in another.

Five issues are focused on in that addendum. Issue 1 is focused on v-notching; Issue 2 asks what the minimum gage and vent sizes should be. Issue 3 asks about the maximum gage size for the LCMAs in this stock. Issue 4 asks whether tags issued for trap tag losses should be issued before or after trap tag loss occurs, or trap loss occurs, and Issue 5 asks if the regulatory changes that would result from this Addendum should apply throughout LCMA 3, or just to the Gulf of Maine/Georges Bank portion of LCMA 3.

Today the Board should consider the current priority level of this Addendum, and whether work on it should be continued at this time, and if so what the desired timeline would be for its completion. In addition, it would be worthwhile to discuss whether the management measures being proposed in the Draft Addendum would result in the level of resiliency that this Board is looking for.

Standardizing management measures could add some protection for the stock; however it would not likely result in reduced harvest, so it might be valuable to discuss what levels of resiliency are needed for the Gulf of Maine/Georges Bank stock, and whether the proposed management measures would achieve those. That's all I've got, any questions?

CHAIRMAN TRAIN: Questions for Caitlin. Go ahead, Pat Keliher.

MR. KELIHER: Caitlin thanks for the update on the resiliency addendum. I fully supported delaying the development of the addendum at the time we were dealing with the right whale issue. While the issues around regulatory environment of right whales are not finalized, we certainly are in a place where I think we need a PDT to be working on a resiliency addendum as a high priority.

Just to update the Board. As of the end of September, Maine lobster landings are down significantly, below 50 million pounds to date, and as a reminder we landed 119 million pounds in 2018, so our landings are way off. Now that doesn't mean the sky is falling that means we certainly have a very big delay in the shed.

But that is certainly not the entire reason why we are having significant declines in lobster landings, and as such I think we need to be getting the assessment work done, finalizing the assessment, and then reinitiating efforts at the PDT level on this resiliency addendum, so we can start taking actions on it.

CHAIRMAN TRAIN: Toni.

MS. KERNS: Pat, I have a question based on what you just said. Do you feel that the PDT should be working now as the Stock Assessment Team is finishing up the assessment, or do you want the PDT to wait until the assessment results come out? Then question two is are you still looking for a consistent management measures, or are we looking for something different that as Caitlin said, may reduce harvest or make other changes to the fishery?

CHAIRMAN TRAIN: Go ahead, Pat.

MR. KELIHER: Considering the people are going to be the same from an assessment standpoint

to a PDT standpoint. I mean I would like to start working on it now, but I don't want to delay the assessment. I think we need the assessment to be finalized, and possibly, it's always dangerous when I'm thinking and talking at the same time.

Maybe we need a small workgroup to start looking at the issues around what is currently in the Addendum, and if we need to add any additional items. I'm certainly not prepared to put anything on the table right now. But maybe a small workgroup that could be working through that between now and the winter meeting would be useful.

CHAIRMAN TRAIN: Are you happy with that Toni? Okay, anybody else, questions about resiliency, comments?

PROGRESS UPDATE ON 2020 AMERICAN LOBSTER BENCHMARK STOCK ASSESSMENT

CHAIRMAN TRAIN: Item Number 6 is a Progress Update on 2020 American Lobster Benchmark Stock Assessment**.** Jeff's giving that. I didn't see you over there.

MR. JEFF J. KIPP: I snuck up on you. The last time I've updated this Board on the stock assessment progress, we have had one major milestone. That was a stand-alone Reference Point Workshop. That was two weeks ago. We met, the Stock Assessment Subcommittee in Woods Hole, and talked through some potential alternatives to the reference points that were defined in the last assessment, and we made some good progress towards reference points there.

One of the things we've continued to struggle with that I wanted to bring back to the Board is shifting priorities and competing with those shifting priorities, as Caitlin just mentioned, which has led to some folks on the Stock Assessment Subcommittee having little to almost no time to contribute to assessment work. I just wanted to encourage the Board that if you do have a member on the Stock Assessment Subcommittee to check in with them.

Make sure that they have adequate time to not only sit in on the calls and attend the workshops that we're having, but also to contribute to actual analyses as part of the assessment, and be able to take on tasks as we kind of hit the home stretch of the assessment. The remaining milestones, we do have an assessment workshop, which we are underway planning for the last week of February.

That will be our last in-person workshop for the Stock Assessment Subcommittee to wrap up assessment work. We do have a Peer Review Workshop tentatively scheduled for August, and then the results of this assessment and that peer review would be brought back to this Board at the annual meeting next year, if we remain on track with our proposed assessment timeline. If there are any questions on the assessment progress I can take those now.

CHAIRMAN TRAIN: Go ahead, Jason.

DR. McNAMEE: Thanks for the update, Jeff. Maybe more of a comment than a question, I know that Jeff you're working on one of the models. Conor McManus from my staff is working on one of the others. It is my understanding, so Larry Jacobson retired, that was a big loss to the Assessment Committee. Burton Shank, who worked on the last assessment, it is my understanding, has been kind of pushed off onto a lot of the whale work.

My concern is, Jeff I don't think you worked on the assessment last time. I know Conor didn't. I'm just hoping that there is going to be support for both of you from someone, specifically from NOAA, Burton. I'm hoping that he will have time that this gets prioritized for him at some point, so that you guys can get some support to kind of check what you've been able to do with the model.

I have full confidence in both of you, you're both excellent. But I just you know, this is a team approach right, it's what we do. It is just kind of critically important that at some point some room is made in the schedule of Burton to kind of check in with you guys, and make sure all of the software is running correctly and all that. Just something I wanted to say on the record I'm concerned about, but I understand the limited resources as well.

CHAIRMAN TRAIN: Pat Keliher.

MR. KELIHER: I appreciate Jason's words. I share his concerns, and I don't want to put Dr. Hare on the spot. But I will put Dr. Hare on the spot, since he's in the back of the room. Jon, can you give us any update on when Burton will be able to spend more time focused on lobster issues?

DR. JON HARE: At this time I can't give any further information about when Burton will be able to focus more on lobsters. He and a number of scientists at the Science Center are preparing for Council for Independent Experts Peer Review, the decision support tool that Dr. Shank led to advise the Take Reduction Team, in terms of the right whale/lobster issue. Once we get further along in that peer review, I can give an update back to ASMFC about his ability to help out in the future.

OTHER BUSINESS

CHAIRMAN TRAIN: Are there any other comments or questions? Do we have any other business? Ritchie White.

MR. WHITE: Not on the agenda, but I was curious if Maine could comment on, with the bait shortage for lobster. Have they dealt with any exotic baits coming into the state that they've had to shut down, or is that process that they have in place, which is pretty thorough. Is that working?

CHAIRMAN TRAIN: Pat Keliher.

MR. KELIHER: Dr. Hare probably asked him to put me on the spot, since I put him on the spot. No, I appreciate that question. Obviously with such a drastic reduction in herring, the Maine industry has worked to make that up. We've made it up with approved hard baits that have gone through our system, several species of Pacific groundfish to name a few.

Carp has been looked at, at many different levels, especially from the Illinois River. That has been to date been rejected, but it looks like we are going to move forward with a very small pilot. We did approve one exotic, and the species name is rosefish, I believe from Uruguay, if I remember correctly, which went through our Bait Review Committee, and was given the green light. We've seen very little of that come in yet though. All in all I think the system has worked. Considering that we rely heavily on volunteers, as I've expressed in the past. But with that in mind, I think it's worked. We've said no to a lot of things, and hopefully the process will evolve, and we'll continue to make good decisions to stop bad stuff.

CHAIRMAN TRAIN: Ritchie is shaking his head, you're satisfied? Bill Hyatt, go ahead.

MR. WILLIAM HYATT: Just a follow up to Pat. You said the Asian carp were rejected. I'm just curious as to why, was it a disease related rejection, or having to do more with the mechanics and the amount of fish coming in?

MR. KELIHER: Bill, both really. VHS is one of the reasons we're trying to continue to look at it. We wanted some environmental testing for the areas that they are going to harvest from during cold weather periods, so they are doing that. The state along with U.S. Fish and Wildlife Service will be doing more of that work this fall and early winter.

Then chain of custody became an issue, so we're continuing to look at refining chain of custody, as it pertains to the Illinois River. We

do allow carp from Kentucky to come in. There are no disease issues there, so we still maintain a chain of custody to ensure there is no mixing. But that was approved, actually carp from Kentucky was approved, I believe two years ago. We bring quite a bit of that in.

ADJOURNMENT

CHAIRMAN TRAIN: Anything else? If no, I'll entertain a final motion. Does anyone object to adjourning? We're done.

(Whereupon the meeting adjourned at 10:25 o'clock a.m. on October 28, 2019)

ACCSP Collaborative Electronic Tracking Pilot Program in the American Lobster Fishery – Draft Report

Bill DeVoe, Maine Department of Marine Resources (MEDMR) and
Story Reed, Massachusetts Division of Marine Fisheries (MADMF)
September 4, 2020

Objective

To improve the spatial resolution of data in the American lobster and Jonah crab fishery by conducting a one year pilot program to test a suite of electronic tracking devices in the Gulf of Maine, Georges Bank, and Southern New England regions.

Approach

This project was initiated by the adoption of Addendum XXVI to the American Lobster Fishery Management Plan, which established a one-year pilot electronic tracking program, and by the recommendations of the Atlantic States Marine Fisheries Commission (ASMFC) Lobster Electronic Tracking Subcommittee (Subcommittee) that was formed to help design the tracking program. The Subcommittee was made up of representatives from multiple state agencies, industry, ACCSP, and ASMFC. Through the guidance of the Subcommittee it was determined that multiple devices should be tested in a variety of geographical areas from Southern New England to the Gulf of Maine.

Devices

Tracking devices were acquired by ACCSP from three vendors and placed on volunteer lobster vessels in Maine and Massachusetts. Vessels with federal lobster permits were specifically chosen. The three vendors utilized were Succorfish, Rock7, and Pelagic Data Systems. A fourth vendor (Faria-Beede) had been included in the initial proposal. Due to ongoing issues MEDMR has had with Faria-Beede devices, testing of these devices was dropped in favor of the Rock7 trackers.

This project proposal had initially planned to test tablets running eTrips Mobile. However, this testing did not occur for several reasons. First, a second VMS project being carried out in MA and RI is testing eTrips Mobile on tablets and is working to integrate VMS provider APIs with eTrips. Secondly, as MEDMR is developing a different harvester reporting application, having Maine fishermen test eTrips Mobile would have been confusing and mostly inconsequential.

Deployment

Initial deployment of devices occurred in June 2019 in Maine and November 2019 in Massachusetts. The Rock7 RockFleet devices were the first to be acquired. The Succorfish and Pelagic Data Systems devices were not available for deployment until September and November 2019, respectively.

For devices requiring a direct connection to the vessel's power system (Succorfish and Rock7), installations were completed by the captain or the primary investigators. Several devices in Maine were also outfitted with 12-volt cigarette-lighter style adapters to facilitate easy connections to vessel power systems where these outlets were available.

The COVID-19 shutdown in March 2020 impacted the deployment of some devices in both Maine and Massachusetts. Agency personnel were not able to install some devices due to COVID-19 protocols. Additionally, the seafood industry was severely impacted by the COVID-19 shutdown and many lobster boats fished less than planned during the spring and early summer.

Ping Rate

All devices tested were set to report data at a one-minute ping rate. This rate is necessary to distinguish lobster fishing activity from transiting activity. Faster rates, while possible with these devices, do not generally improve the track resolution as the expected distance between points in the track falls below the horizontal accuracy of the GPS signal.

Results

Device Features & Performance

Rock7

Rock7 is one of the largest distributers of Iridium satellite-based tracking technology. A large portion of their sales seem to come not from VMS devices, but from Iridium modems for use in satellite-connected embedded systems. The company produces VMS devices in both Iridium-only and hybrid Iridium/cellular modes. Rock7 VMS devices are currently required for use in several Australian fisheries; however, it should be noted that a 3rd party vendor handles the installation and data stream management for these units, and that Rock7 is essentially the hardware vendor.

MEDMR tested Iridium-only Rock7 RockFleet devices in 2016; for this project, the dual-band devices were tested. RockFleet devices were set up to report over cellular every minute when in range and every 15 minutes over Iridium when out of cellular range. The RockFleet does not support caching points at a faster rate for later upload; as such, when out of cellular service, the device is limited to only reporting over Iridium. The higher costs per ping associated with Iridium transmissions would limit the offshore ping rate possible with Rock7 units.

MEDMR deployed 4 RockFleets on vessels fishing out of Portland, Stonington, Swans Island, and Steuben. All but one of these devices reported until January 2020, when many vessels ceased fishing for the winter. One device experienced issues periodically "freezing". Rock7 provides a magnet with each device that can be swiped over the unit to reset it in the event of a lock up. This would seem to be prima facie evidence that the devices are prone to this issue. The single RockFleet that froze was only powered when the vessel was running; as such, once the vessel had gone several days without fishing, the internal backup battery was exhausted and the unit reset.

MADMF deployed two RockFleet devices beginning in November 2019; these devices reported successfully until data subscription ended in July 2020.

The Rock7 web interface generally functioned as expected. Multiple vessel positions could be viewed concurrently, and querying vessel positions by date range was straightforward. Options were present for changing the basemap and coloring vessel tracks by speed. Unlike other devices, the web interface allowed for the end user to modify device options like ping rate. The Rock7 website offered no options for distinguishing device vs vessel, which is necessary if devices are reused on multiple vessels or if a vessel needs a replacement unit installed. Ping data was successfully exported both using the web interface and the Rock7 API, which pushes data to endpoints in XML format. Rock7 also provides a pull API that allows for configuring RockFleet options over both cellular and Iridium networks.

Succorfish

Succorfish produces several tracking devices for use in fishing and fleet operations. The company is based out of the United Kingdom, and has previously deployed VMS in fixed and mobile gear fisheries in the UK and Ireland. The Succorfish SC2 is available in cellular-only and dual-band cellular/satellite modes. Both are capable of caching data at a faster ping rate for upload when back in cellular range, making for a cost-effective high-resolution tracking solution.

Succorfish is possibly the only vessel tracking provider to address the issue of distinguishing vessels from tracking devices. Devices are managed separately from assets (vessels) in their data systems, and a dedicated installer mobile app captures detailed metadata about device installations. This metadata may include photos of the vessel/tracker install and forms to obtain captain's consent. The installation app also creates the association between the tracking hardware device and the vessel identifier; a barcode on the SC2 is scanned into the app, creating a verifiable link between each. If a tracking device is installed on a new vessel, or if a vessel receives a new device, newly reported data is associated with the correct vessel.

The Succorfish SC2 contains additional hardware that is of potential interest to lobster vessel tracking. Perhaps most importantly, the Succorfish SC2 has a light on the side clearly indicating that it is receiving external power. The device also has a high-accuracy GPS utilizing several GPS networks (Gaileo, GLONASS, and BeiDou). For communicating with other devices onboard a vessel, the SC2 also has WiFi, Bluetooth, and LoRa capabilities. Additionally, the wiring harness connecting the SC2 to vessel power has additional circuits

for external hardware integration. An anti-tamper loop sends an event with the tracking data if the cable is cut or temporarily disconnected. Normally open/normally closed circuits are also included that trigger ping events; this could facilitate the connection of a hauler sensor to the SC2 with minimal circuitry necessary.

The LoRa (Long Range) capabilities of the SC2 may warrant further investigation. LoRa is a wireless radio system that can reach distances of up 10 kilometers in rural areas. Since cellular data costs remain the largest recurring expense in deploying VMS, if LoRa-to-internet bridges could be placed in the larger lobstering ports, vessels may be able to upload position data when in port without the costs of a cellular connection. This concept is being discussed with engineers at Succorfish.

Succorfish SC2 cellular-only tracking devices were utilized on 6 vessels in Maine and one in Massachusetts. Succorfish has previously provided SC2s for testing to Maine Marine Patrol; 2 of these bonus devices were also installed on lobster vessels. As of August 2020, 4 Succorfish SC2s are still reporting vessel positions in Maine; the other two have been removed. When out of cellular range, the SC2 cached data as expected for future upload.

MEDMR also tested Succorfish's wireless Gear-in-Gear-Out (GIGO) tags with the SC2 devices on both fixed and mobile gear. The tags have a three year battery life and utilize Bluetooth Low Energy; as such, they are detectable by the SC2 when they are anywhere onboard the vessel. The timestamp that each unique tag transits on/off the vessel is transmitted by SC2 with the vessel location data. This technology contrasts with previous Radio Frequency Identification (RFID) technology used on lobster gear, which required a passive RFID tag in the buoy to pass in close proximity to a sensor. Since the tag haul event and set out event are both captured, it is conceivable that this technology could be used to maintain a complete spatial census of all the gear a vessel had in the water at any given time. However, the cost of these tags may be prohibitive to any such effort. Currently, Succorfish offers GIGO beacons for $25 each with a three-year battery life. Additionally, delimiting lobster trawl gear locations using cluster analysis of VMS data has been found to be mostly successful, such that a dedicated hardware device may not be necessary.

MEDMR tested GIGO beacons on one lobster vessel. The captain attached beacons to several of his endlines. Results were inconsistent, possibly due to poor reception due to the position of the SC2. GIGO beacons were also used during the department's scallop surveys. Beacons were attached to both the scientific survey dredge as well as the vessel's normal commercial dredge, allowing each tow to be visualized and survey vs commercial fishing to be easily discerned. These beacons were also invaluable during the Spring 2020 survey when MEDMR staff were unable to work aboard survey vessels due to COVID-19. The GIGO beacon passively captured tow start/tow end times and positions for later analysis.

Compared with other companies involved, Succorfish has taken an active role participating in this project. Representatives traveled to Maine and Massachusetts several times over the last two years to meet with representatives from MEDMR, MADMF, NOAA and the lobster industry. The company has also provided two SC2s, several GIGO beacons and associated data plans free of charge to MEDMR for testing.

Pelagic Data Systems

Pelagic Data Systems offers a lightweight, ruggedized Vessel Tracking System (VTS) device. The VTS device is solar-powered and does not require or allow any power connection from a vessel's electrical system. The simple installation requires screwing the device and bracket to the vessel, in a location that gets direct sunlight for as much of the day as possible. VTS devices receive location information directly from GPS/GLONASS satellites and transmit this information securely, when in range of the cellular network. Data transmission costs are relatively low. The VTS devices were designed for use on fleets and boats of all sizes, including small, open boats with little vessel power and constant exposure to the elements.

The VTS devices record, on average, 600 locations per hour and this ping rate is dependent on vessel speed. They are capable of logging up to one location per second but that is not necessary or practical. The data upload interval can be set individually, depending on cellular network availability, but the default is to upload data every six hours. The default upload rate was sufficient for this project. Pelagic Data Systems staff were available to answer questions on ping rates and showed a willingness to adjust ping rates and upload intervals if needed.

The VTS devices were received in October 2019. Pelagic Data Systems had informed the project that New England was likely on the northern fringe of the optimal range for solar charging, particularly during the winter months. MEDMR tested a VTS during the months of December and January at their office in Boothbay Harbor, ME. The device did not receive enough sunlight to fully charge and become reliably active. MADMF installed the first VTS device on a vessel in late-November 2019. The vessel began recording trips and location data on December 1, 2020. VTS devices were installed on three additional vessels over the course of the winter. During the months of December and January, when sun angles are at the lowest, vessels tied up to docks that were more susceptible to shadows did have some difficulty charging the devices. The vessels on moorings had less issues.

These experiences in the winter months verify that New England is on the northern fringe geographically for successful use of the VTS devices year-round. When the device is operational, it provides a good low-cost option, especially for vessels with limited power. More testing will be done with the device in the Rhode Island/Massachusetts Electronic Tracking and Reporting project.

The Pelagic Data Systems web interface was updated during the project. The updated web interface is simple and functions well. Devices can be assigned to vessels and device battery levels can be monitored. Multiple vessel positions and trips can be displayed.

The Pelagic Data Systems software assigns a unique Trip ID for each trip. Based on changes in speed, the device triggers the start of a trip. The end of a trip is calculated based on multiple parameters, including movement, distance to shore, and distance from known docking locations. Essentially, each device learns where it docks.

Device Cost

Approximate Device Costs – see Appendix I for a more detailed comparison of device features:

	Pelagic Data Systems	Succorfish SC2	Rock Seven
Unit Price	$200	$300	$750
1 Yr Service	$300	$300	$600 (cellular & Iridium)

Industry Involvement and Perception

Comments from lobsterman participating in this project ranged from very positive to indifferent. However, MEDMR specifically targeted captains who have been previously involved with department research, this is expected and likely not an effective indicator of industry perception. Several participants indicated their feelings that VMS is inevitable. VMS is unobtrusive, low-cost and does not require gear modification. Compared with many of the solutions to protected species interactions being currently discussed, VMS may not always generate the visceral response that technologies like ropeless fishing can produce.

Many VMS vendors offer the ability for vessel captains to access their own position data; indeed, some like Succorfish have made it a central part of their marketing strategy. Several captains involved in this project did request access to their VMS device through the various web interfaces. However, this feature may not offer much benefit to the wider industry as many vessels already maintain a track of the vessel's past positions as part of their plotter/navigational system.

The reaction to VMS by the lobster industry will also be influenced by the costs to fishermen, if any, associated with VMS.

MADMF contacted fishermen to gauge their interest in participating in this project and provided outreach to members of the Massachusetts Lobstermen's Association (MAMLA). Members of the MAMLA have begun to change their perception of VMS and see the need for better spatial data in the lobster fishery for a variety of reasons including fisheries management, enforcement, and siting of wind areas. Some also see the value of having access to their own spatial data through a web interface. After attending a February MAMLA delegates meeting, several fishermen expressed interest in participating in the program. Three additional vessels from this interested group were outfitted with devices prior to the COVID-19 shutdown.

Use of VMS by Law Enforcement

Several captains involved in this project were supportive of mandatory VMS in the lobster fishery since they believe it will prevent illegal fishing activity. Although just having a VMS device onboard may be a deterrent to illicit fishing, there will likely be an expectation from the industry that if VMS is mandatory regulators will use it for enforcement purposes.

Several Marine Patrol Officers in Maine were involved in this project and were highly supportive of expansions of VMS in the lobster fleet. Maine officers did not indicate that

real-time data is essential, and supported the lower costs and higher ping rates of the cellular-based devices.

The authors recommend that law enforcement agencies involved in patrolling the lobster fleet be involved in future discussions regarding VMS, particularly regarding the actual necessity of real-time data.

Effort Analysis

MEDMR has experimented with several methods for quantifying fishing effort from VMS data. These methods were developed from past use of VMS in the urchin and scallop fisheries, as well as VMS data from lobster vessels as part of this project. These experiences have identified several methods for identifying fishing activity in different fisheries.

Early experiments with VMS devices on urchin and scallop vessels used vessel speed as a proxy for fishing effort. Since divers and draggers tended to move slowly while fishing, using either the reported speed or calculated speed allowed pings occurring in areas of fishing effort to be identified. An immediate issue with this method was that pings produced while a vessel was sitting at the dock are also identified as effort using both speed filtering and clustering methods for effort detection. This situation is hereafter referred to as 'pings-in-port'.

Pings-in-Port

Given the limited spatial extent in which these VMS devices were required on urchin vessels, known ports/mooring locations were identified and data from within these areas were removed prior to effort detection. However, this method would be impractical for use in the lobster fishery, where hundreds of ports are utilized, and vessels often tie up in different locations throughout the year.

Several methods for removal of pings-in-port for lobster vessels have been tested using VMS data from lobster vessels obtained during this project:

1 – If a harvester report is available, the trip start/trip end times can be used to filter VMS data within the trip timeframe. This removes extraneous pings produced when the vessel was sitting on a dock or mooring. Since a harvester may report times slightly before or after the actual trip start or end time, an effective method may be to further filter these data before effort detection by reducing the temporal range on either end, or by buffering the first few pings of the trip by a set distance and removing pings within this buffer. This may still create artifacts if a vessel stopped for fuel or ice. These artifacts can be identified programmatically by their proximity to shore, but as fishing effort may also occur near shore (hauling singles around ledges) this can be a difficult distinction.

2 - If no harvester report is available, for a given date the home port can be detected by filtering pings within an hour of midnight and proximity to shore. Since much of the lobster fishery is day boat based, this will often provide a reliable estimate of where the vessel was tied up that night, allowing this portion of the track to be removed.

Preprocessing

All VMS devices tested produce at a minimum ping data with the following fields: device identifier, datetime, latitude, and longitude. Additional fields produced may contain data such as device speed, bearing, and GPS accuracy. These extra data are usually unnecessary, as attributes like bearing and speed can be calculated at any time.

Preprocessing of data produced by devices in this project involved adding several track metadata fields necessary to organize ping data into tracks/trips. Generally, ping data is arranged by vessel and timestamp, and track IDs are assigned sequentially by splitting tracks by vessel/day or using the trip start/end times from a harvester report. Fields are also added to each ping containing the time, distance and bearing to the next ping. The track IDs can then be used to create line features for each trip track. Several tools exist for preprocessing of VMS data; NOAA has created a Track Builder Plugin for ArcGIS Desktop, and MEDMR has developed R/C++ based tools internally.

Quantifying Effort

Detection of lobster fishing effort by vessel speed alone has been shown to produce errors; lobster boats often move at slower speeds when the distance between gear sets is small and may also slow down during transiting. The below maps contain the track of a lobster vessel fishing 10-trap trawls (green line), recorded by a Succorfish SC2 at a 1-minute ping rate. The orange dots are haul start locations as recorded by an onboard MEDMR observer. The red polygons in the left map are detected trawl locations using vessel speed. Pings less than a 2.5 m/s speed (roughly 5 knots) were identified by first buffering all pings by 150m (the furthest a vessel going 2.5 m/s could travel between 1-minute pings), then dissolving these buffers together and selecting only polygons with >1 ping. This method has the advantage over just speed filtering in that some basic cluster analysis can be incorporated by varying the minimum number of pings per polygon. The vessel slowed down to eat lunch at the southern end of the track, and this part of the track was incorrectly identified as effort. Fishing effort on the right-hand map was correctly identified using cluster analysis. The centroids of these effort clusters can be used as a haul location, and clusters can be numbered sequentially within a trip.

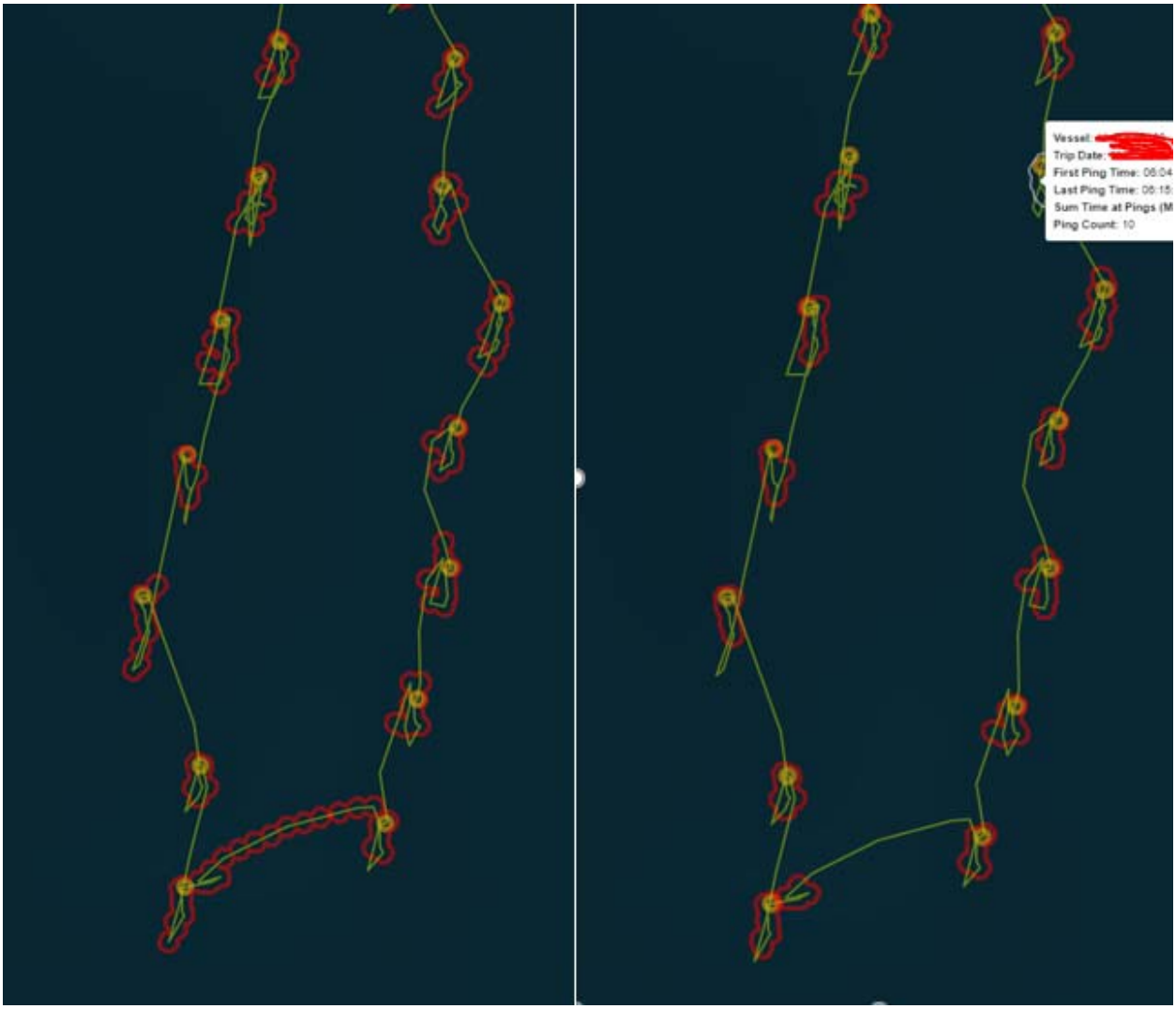

Figure 1: Track of lobster vessel hauling 10-trap trawls. Orange dots are observer recorded haul locations. Red is effort detected based on vessel speed (left) and cluster analysis (right). Note incorrectly identified effort at southern end of track on left map.

The cluster analysis in the map at right used Ward's method as implemented in the base R 'stats' package. A matrix of the geographic distance between all pings in the trip was first calculated (i.e., for a 12-hour trip at 1-minute ping rate, a 720x720 matrix). This distance matrix was then used to create a hierarchal cluster tree using the single linkage method, which could be cut into clusters using two methods:

1. If the number of hauls/trawls occurring within the trip is unknown, the hierarchal tree was cut into clusters based on height. Since the single linkage method was used, this height threshold is the minimum distance between points in adjacent clusters. Clusters that have fewer than 3 points were then filtered out. This method can be thought of as 'speed filtering with clustering.' This method was used in the map above.

2. If the harvester report provides the number of trawls hauled, k-means clustering can be used to cut the tree into the most significant k number of clusters. This is a particularly useful method for trips hauling mostly trawls and providing trawl quantities in a harvester report.

One limitation of this approach is that clusters are only identified spatially and not temporally. If a vessel transits back through the same area during the same trip creating a cluster of points (such as in a channel), these pings can be misidentified as effort. This situation can be remedied by calculating a matrix of time between all points in the trip in addition to the distance matrix described above. The product of the time and distance matrices would then be used to classify clusters.

The above method has also been used with VMS data collected by a Succorfish SC2 on a vessel contracted by MEDMR for the Ventless Trap Survey, which fishes triples. Trawl locations were detectable from these datasets and matched up well with positions taken by MEDMR staff. However, fishing trips where triples were fished in tightly spaced groups of 5 (a common practice in some areas in Maine) were only detectable as single clusters of points. Any attempt to identify gear locations must therefore take into account information from the harvester report, as well as a geospatial model of gear sizes based on regulations and common fishing practices.

While cluster analysis methods may have difficulty identifying smaller inshore trawls, these results indicate that it is possible to programmatically quantify larger trawl locations from VMS data. This is significant as larger offshore trawls are implicated in producing a greater risk to protected species, and the improvement of spatial data related to these gear types is likely of higher management priority than quantification of inshore effort. The methods described also permit storage of haul locations as coordinate values at the effort level, versus existing methods of creating large raster heatmaps of vessel effort over time. Recent efforts by federal and state agencies to model risk to North Atlantic Right Whales have attempted to model the spatiotemporal distribution of actual vertical line numbers versus just fishing effort; this demonstrates that being able to quantify fishing effort as gear types and distributions is important in addition to simply quantifying transit time.

It may be possible with further work to develop better methods of effort quantification using time series classification of observer-verified VMS data; see the further work section for more detail.

Future Work

Expansion of Vessel Monitoring in the Lobster Fleet

MEDMR is currently developing a harvester reporting app (VESL). The app vendor is working to integrate vessel position data from the Succorfish API with harvester reports, such that positional data can be submitted to SAFIS along with harvester reports. Other VMS provider's APIs may be added as needed. Additionally, the MEDMR is discussing an expanded pilot project testing up to 25 SC2s alongside the VESL app.

MADMF continues to work with Rhode Island DEM on the ongoing ACCSP-funded project to integrate vessel monitoring systems and electronic reporting in SAFIS. Field testing will begin soon on multiple hardware options.

Further Industry Involvement

The authors suggest that the original subcommittee involved in this project be reconvened to discuss further steps and provide industry outreach. Further discussions with regional lobster associations is also recommended.

Software Development

The collection of VMS data alongside harvester reports will facilitate the development of better effort detection algorithms. When gear configurations, like total gear in the water and number of trawls is known, these variables can be used to better identify lobster fishing activity in track data.

An additional area of further work is the collection of activity-classified time series of tracking data by captains and/or department staff. If an activity field indicating hauling vs steaming and gear size could be added to the existing ping fields (vessel, timestamp, lat, lon), the resulting classified ping data could be used to train effort detecting machine learning models. An example ArcGIS QuickCapture application developed at MEDMR to record classified vessel tracks is shown to the right; when the app is started, the number of traps per trawl is input by the user and can be changed at any time during the trip. The app records the vessel track along with the selected activity type and trawl size. Separate buttons allow for quickly capturing gear events that may result in anomalies in tracking data.

Hardware Development

Several of the devices tested included additional hardware and peripheral options that may warrant further research. All three device models included some variety of local wireless connectivity (Bluetooth, WiFi, etc). The Succorfish SC2 also includes connections in the wiring harness, that when closed, trigger ping events. These connections could provide a method of incorporating a hauler sensor with the VMS device, if such a sensor is deemed necessary.

In addition to the experiments with gear beacons carried out by MEDMR, the Succorfish SC2 is also capable of communicating wirelessly with a low-cost water temperature sensor. The sensor can be placed on a trap, and when hauled relays temperature readings to the SC2 which are then uploaded with positional data. This offers the possibility of using VMS to drastically expand the resolution of bottom temperature data in the Gulf of Maine,

similar to current projects like Environmental Monitors on Lobster Traps and Large Trawlers (eMOLT). Collection of environmental data via VMS devices could also provide an avenue for regulatory agencies to cover the cost of a vessel's tracking device in exchange for that vessel providing useful scientific data.

Summary

The need for higher spatial resolution data in the lobster fishery has become increasingly apparent. The continued risk of protected species interactions demands better accounting of where lobster fishing occurs than the currently reported zone/distance from shore/10 arc-minute square attributes. Further pressure to develop wind energy resources within the Gulf of Maine is also highlighting the paucity of spatial data for this fishery. It is no longer enough to say that 'lobstering can occur anywhere', and it is inevitable that the lobster industry and state/federal managers will need to delineate areas most critical to the fishery.

Incorporating cloud-connected vessel monitoring devices can also relay valuable secondary data, improving the availability of oceanographic data like sea bottom temperature. In addition to providing necessary data for conversations pertaining to ocean resource use, widespread deployment of VMS devices in the lobster fleet will provide valuable scientific data on the distribution of lobsters throughout the year and across multiple years. This information will be invaluable to managers and scientists as lobster populations continue to adapt to changing ocean conditions.

Testing of multiple devices as part of this project and others has shown that there are clear technological paths to accomplish large-scale vessel monitoring at a fraction of the cost of past efforts. The use of cellular VMS is a cost-effective alternative to satellite based VMS, offering significantly higher ping rates for the slight tradeoff of a several hour delay in data availability when vessels are offshore. Testing of these devices showed that vessel position was almost always successfully reported, provided that the tracking device was receiving power. However, while testing has shown these devices to work as expected, there remain several hurdles to expanding cellular VMS in the lobster fishery:

1. Installation of many VMS devices will require dedicated installation technicians. These technicians will need to travel throughout New England and coordinate times with vessel captains to install VMS devices. If devices requiring vessel power are used, consideration will need to be given as to how the connection is made. Should the VMS device be powered all the time, or only when the vessel engine is running?
2. Significant data integration work remains. At a minimum, vessel positions will need to be linked with harvester reports. Further work will be necessary to convert raw vessel positions into meaningful indicators of lobster fishing activities, such as heat maps of effort/catch and CPUE indices.
3. There remain questions as to who will pay for the upfront hardware costs of VMS devices, including installation, as well as the monthly data subscription cost.

Appendix I: Comparison of VMS Device Characteristics

	Succorfish SC2	Rock7 RockFleet	Pelagic Data Systems
Tested in Project?	**Yes**	**Yes**	**Yes**
Waterproof Rating	IP67	IP68	IP68
Cost			
Device Cost	$300	$750	$200
Data Cost (Yearly)	$300	$600 (cellular & Iridium)	$300
Connectivity			
Cellular	Yes	Optional add-on	Yes
Satellite	Iridium	Iridium	No
Bluetooth	Yes	Yes	No
WiFi	Yes	No	No
LoRa	Yes	No	No
Accelerometer	Yes	Yes	No
Serial/UART	Yes	Optional add-on	No
Magnetometer	No	No	No
Normally Open/Normally Closed Contacts	Yes	No	No
Power			
External	Yes; 5-36V	Yes, 9-30V	No
Internal Battery	Yes; Li-ion 5200mAh	Yes	Yes
Solar	No	No	Yes
Consumption(GSM/Iridium)	160/350mA	500mA max, < 30mA sleep	
Software			
Vessels managed separately from devices	Yes	No	No
User-adjustable ping rate	No	Yes	No
API	Push/Pull Non-Persiste	Push XML	Pull JSON

Draft Document for Board Review

ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

For Jonah Crab
(*Cancer borealis*)

2018 FISHING YEAR

Prepared by the Plan Review Team

April 2020

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

Draft Document for Board Review

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2019 REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION FISHERY MANAGEMENT PLAN FOR JONAH CRAB (*Cancer borealis*)

2018 FISHING YEAR

1.0 Status of the Fishery Management Plan

Year of ASMFC Plan's Adoption:	FMP (2015)
Framework Adjustments:	Addendum I (2016) Addendum II (2017) Addendum III (2018)
Management Unit:	Maine through North Carolina
States with a Declared Interest:	Maine through Virginia (Excluding Pennsylvania and DC)
Active Committees:	American Lobster Management Board, Technical Committee, Plan Review Team, Advisory Panel, Electronic Reporting Subcommittee, Electronic Tracking Subcommittee

2.0 Status of the Fishery

2.1 Commercial Fishery

Historically, Jonah crab was taken as bycatch in the lobster fishery; however, in recent years a directed fishery has emerged causing landings to rapidly increase. Throughout the 1990's, landings fluctuated between approximately 2 and 3 million pounds, and the overall value of the fishery was low. In the early 2000's landings began to increase, with over 7 million pounds landed in 2005. By 2014, landings had almost tripled to 17 million pounds and a value of nearly $13 million dollars. This rapid increase in landings can be attributed to an increase in the price of other crab (such as Dungeness), creating a substitute market for Jonah crab, as well as a decrease in the abundance of lobsters in Southern New England, causing fishermen to redirect effort on Jonah crab.

Today, Jonah crab and lobster are considered a mixed crustacean fishery in which fishermen can target lobster or crab at different times of the year based on slight gear modifications and small shifts in the areas in which the traps are fished. While the majority of Jonah crab is harvested as whole crabs, fishermen from several states, including New York, Maryland and Virginia, land claws. Jonah crab claws are relatively large and can be an inexpensive substitute for stone crab claws. As a result, they can provide an important source of income for fishermen. A historic claw fishery takes place along the Delmarva Peninsula where small boat fishermen harvest Jonah crab claws because they do not have a seawater storage tank on board to store whole crabs.

In 2018, landings along the Atlantic Coast increased to 19.8 million pounds of Jonah crab, representing $17.6 million in ex-vessel value. The states of Massachusetts (67%) and Rhode Island (23%) were the largest contributors to landings in the fishery. Landings in descending order also occurred in Maine, New Jersey, New York, Maryland, New Hampshire, Virginia, Delaware, and Connecticut. 99.9% of coastwide landings in 2018 came from trap gear.

2.2 Recreational Fishery

The magnitude of the Jonah crab recreational fishery is unknown at this time; however, it is believed to be quite small in comparison to the size of the commercial fishery.

3.0 Status of the Stock

Jonah crab are distributed in the waters of the Northwest Atlantic Ocean primarily from Newfoundland, Canada to Florida. The life cycle of Jonah crab is poorly described, and what is known is largely compiled from a patchwork of studies that have both targeted and incidentally documented the species. Female crab (and likely some males) are documented moving inshore during the late spring and summer. Motivations for this migration are unknown, but maturation, spawning, and molting have all been postulated. It is also generally accepted that these migrating crab move back offshore in the fall and winter. Due to the lack of a widespread and well-developed aging method for crustaceans, the age, growth, and maturity of Jonah crab is poorly described.

The status of the Jonah crab resource is relatively unknown and no range wide stock assessment has been conducted. Massachusetts, Rhode Island, Maine, and New Hampshire conduct inshore state water trawl surveys, and NOAA Fisheries conducts a trawl survey in federal waters which collects data on Jonah crab abundance and distribution. In addition, several studies are on-going (Section 7.0) to gather more information on the species.

4.0 Status of Management Measures

Interstate Fishery Management Plan for Jonah Crab (2015)

Jonah crab is managed under the Interstate Fishery Management Plan (FMP) which was approved by the American Lobster Management Board in August 2015. 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. These include a 4.75” minimum size with zero tolerance 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 (2016)
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 crab limit provides a cap to potential increases in effort and trap proliferation.

Addendum II (2017)
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 forearm 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.

Addendum III (2018)
Addendum III 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.

5.0 Fishery Monitoring
The provisions of Addendum III did not impact fishery monitoring programs in 2018. As a result, language in the FMP sets the standard for fishery monitoring. Specifically, the FMP requires that "*at a minimum, state and federal agencies shall conduct port/sea sampling to collect the following types of information on landings, where possible: carapace width, sex, discards, egg-bearing status, cull status, shell hardness, and whether the landings are whole crabs or parts*." The FMP also establishes coastwide mandatory reporting and fishery dependent sampling with 100% dealer and harvester reporting. Jurisdictions which currently require less than 100% harvester reporting in the lobster fishery are require to maintain, at a minimum, their current programs and extend them to Jonah crab. *De minimis* states are not required to conduct fishery-independent sampling or port/sea sampling. These requirements for fishery monitoring will be amended in future years to reflect implementation of Addendum III.

Overviews of the states' port and sea sampling are as follows:

- Maine: Maine conducted 27 sea sampling trips and sampled 2,147 Jonah crab. Sampling occurs through the Lobster Sea Sampling program, which has a sampling protocol for Jonah crab including collecting data on carapace width, sex, reproductive status, cull status, and shell hardness. Maine's lobster port sampling program was suspended in 2011.
- New Hampshire: Staff sampled 36 Jonah crab on 15 sea sampling trips and collected information on sex, the presence of eggs, cull condition, molt stage, and carapace length. NH initiated a quarterly port sampling program in late 2016. Quarterly sampling took place at shellfish dealers, where an interview with the captain occurred and a biological sample was taken. A total of 675 Jonah crab were sampled through this new program, of which a maximum of 250 crabs were sexed, measured for carapace length, and (when feasible) weighed.
- Massachusetts: Massachusetts conducted 13 sea sampling trips and sampled 757 Jonah crab. Data collected include shell width, sex, egg bearing status, cull status, and shell hardness. Massachusetts also conducted 16 port sampling trips and sampled 12,570 Jonah crab.
- Rhode Island: Currently, RI DEM DMF does not have a structured Sea Sampling program due to staffing and budget limitations. The Division plans to develop a Jonah crab sea/port sampling program by 2020.
- Connecticut: No sea sampling or port sampling trips were conducted for Jonah crab.
- New York: Staff conducted 6 market sampling trips, collecting information on 140 Jonah crab. No sea sampling trips were conducted for Jonah crab.
- New Jersey: No sea or port sampling trips were conducted for Jonah crab.
- Delaware: No sea or port sampling trips were conducted for Jonah crab.
- Maryland: Maryland conducted one multi-day sea sampling trip and sampled 100 Jonah crab. Data collected included carapace width, egg bearing status, cull status, shell hardness, sex and whether the landings are whole crabs or parts.
- Virginia: No sea or port sampling trips were conducted for Jonah crab.

6.0 Status of Surveys

The FMP for Jonah crab encourages states to expand current lobster surveys (i.e. trawl surveys, ventless trap surveys, settlement surveys) to collection biological information on Jonah crab. The following outlines the fishery-independent surveys conducted by each state.

Maine

A. Settlement Survey

The Maine settlement survey was primarily designed to quantify lobster young-of-year (YOY), but has also collected Jonah crab data from the sites throughout the survey. Jonah crab information collected includes carapace width, sex (when large enough), ovigerous condition, claw status, shell hardness, and location. The density of Jonah crab has increased over the past

two decades with high values in 2012 and 2016 (Figure 1). Similarly, the density of all Jonah crab noticeably increased in the early 2000's and has remained high since (Figure 1).

B. State Trawl Survey

The ME/NH Inshore Trawl Survey began in 2000 and is conducted biannually (spring and fall) through a random stratified sampling scheme. Jonah crab data has been collected throughout the history of this survey. The 2018 spring survey completed 118 tows and sampled a total of 234 Jonah crab. The spring abundance indices for Jonah crab significantly increased from 2013 to 2016, but declined in 2017 and 2018 (Figure 2). The 2018 fall survey completed 96 tows and sampled 415 Jonah crab. Abundance indices for Jonah crab declined in 2017 and 2018 (Figure 2).

C. Ventless Trap Survey

Maine began its Juvenile Lobster Ventless Trap Survey in 2006. Since the beginning of the survey, Jonah crab counts were recorded by the contracted fishermen, but the confidence in early years of this data is low because of the confusion between the two *Cancer* crabs (Jonah crab vs. rock crab) and similar common names. In 2016, the survey began collecting biological data for Jonah crab including carapace width, sex, ovigerous condition, claw status, shell hardness, and location. Figure 3 shows the catch of Jonah crab per trap in 2018.

D. Sea Urchin Survey

Maine DMR conducts an annual dive survey of the sea urchin stock within state waters. From May through June, divers evaluated approximately 60 1-meter square quadrats at each site. Beginning in 2004, the data collected on crabs was expanded to include carapace width and sex. A total of 139,371 quadrats have been evaluated for Jonah crab through 2018. Counts of Jonah crab in 2018 were slightly lower than 2017 (Figure 4).

New Hampshire

A. Settlement Survey

Since 2009, species information has been collected on Jonah crab in the New Hampshire Fish and Game portion of the American Lobster Settlement Index. Figure 5 depicts the CPUE (#/m^2) of Jonah crab for all NH sites combined, from 2009 through 2018. This time series shows a general upward trend to a time series high in 2018.

B. Ventless Trap Survey

Since 2009, New Hampshire Fish and Game has been conducting the coastwide Random Stratified Ventless Trap Survey in state waters (statistical area 513). A total of six sites were surveyed twice a month from June through September in 2018. Beginning in 2016 all Jonah crab were evaluated for sex and carapace length. A total of 9 Jonah crab over 8 trips were measured during the 2018 sampling season.

Massachusetts

A. Settlement Survey

The Juvenile Lobster Suction Survey has consistently identified Jonah crab since 2011, and has identified the *Cancer* crabs to genus since 1995. Figure 6 shows that Jonah crab are generally absent from the two sampled locations in stat area 538 (Buzzards Bay and Vineyard Sound) but are present at other sampled locations. The number of Jonah crab per square meter increased from 2017 to 2018 at all sites in statistical area 514 (Figure 6).

B. Ventless Trap Survey

CPUE of Jonah crab from the MA DMF Ventless Trap Survey within NMFS statistical areas 538 and 537 has been low but relatively stable between 2010 to 2018 (Figure 7). The 2018 data point is the second lowest in the time series. Though the survey started in 2005, Figure 7 only shows data from 2011 through 2017 due to changes in areas surveyed prior to 2011. Area 514 has been on an overall downward trend, but has been fairly stable since 2009 (Figure 8).

C. Trawl Survey

The MA DMF Trawl Survey is conducted in five geographic regions; data is grouped into two regions, north of Cape Cod and south of Cape Cod. Recent trends in both regions have been positive, but the 2018 fall data south of Cape Cod was below the time series median (Figure 9). All other 2018 data points were above time series medians and trending upward based on a fitted generalized additive model.

Rhode Island

A. Ventless Trap Survey

Since its inception in 2006, the RI Ventless Trap Survey (VTS) has recorded counts of Jonah crab per pot. In 2014, carapace width and sex were also recorded for all individuals. In 2018, the VTS was conducted during June-August and over 18 sampling trips. A total of 106 Jonah crab were sampled. All sampling was conducted in LMA 2, NMFS Statistical Area 539. The stratified mean catch per ventless trap on a six pot (three ventless, three vented) trawl was 0.27 Jonah crab (Figure 10).

B. Trawl Survey

RIDEM has conducted Spring and Fall trawl surveys since 1979, and a monthly trawl survey since 1990. However, the survey did not begin counting Jonah crab specifically until 2015. Given the short time series of Jonah crab data available and few Jonah crab observations by the surveys, the information is not available at this time. As the datasets for Jonah crab from these trawl surveys grow, these data will be provided as abundance indices.

Connecticut

A. Trawl Survey

Jonah crab abundance is monitored through the Long Island Sound Trawl Survey (LISTS) during the spring (April, May, June) and fall (September and October) cruises, all within NMFS statistical area 611. The survey documents the number of individuals caught and total weight per haul by survey site in Long Island Sound. The Long Island Sound Trawl Survey caught one Jonah crab in the fall 2007 survey and two in the fall 2008 survey. Both observations occurred in

October at the same trawl site in eastern Long Island Sound. No Jonah crab have been observed in the survey since 2008.

New York

A. Trawl Survey

New York initiated a stratified random trawl survey in the near shore ocean waters off the south shore of Long Island in 2018 from the Rockaways to Montauk Point and the New York waters of Block Island Sound. Sampling was conducted five times a year during the winter (February), spring (May, June), summer (August), and fall (December). Twenty-five to 30 stations were sampled each trip. Thirty-four Jonah crabs were caught during the 2018 survey. They ranged in size from 18 to 143 mm shell width (SW) and averaged 56 mm SW.

New Jersey

A. Trawl Survey

A fishery-independent Ocean Trawl Survey is conducted from Sandy Hook, NJ to Cape May, NJ each year. The survey stratifies sampling in three depth gradients, inshore (18'-30'), mid-shore (30'-60'), and offshore (60'-90'). The mean CPUE, which is calculated as the sum of the mean weight of Jonah crab collected in each sampling area weighted by the stratum area, has remained low throughout the time series (Figure 11).

7.0 Recent and On-Going Research Projects

A. Maturity Study

MA DMF, in collaboration with AOLA and CFRF, has conducted a Jonah crab maturity study. Results suggest that females mature at a smaller size than males (~88-94mm carapace width vs. ~103-117mm carapace width, depending on region sampled). Importantly, the sizes at maturity for both sexes are below the current minimum legal size for harvest (121 mm).

In addition, a graduate student at the University of Maryland Eastern Shore completed a master's thesis on the size at sexual maturity and reproductive biology of Jonah crabs in the Mid-Atlantic Bight in the spring of 2018. Jonah crabs were collected as bycatch in black sea bass and lobster pots from December 2015 to September 2017 as well as from the 2016 and 2017 Virginia Institute of Marine Science Mid-Atlantic Sea Scallop dredge survey. Measurements included: sex, weight, length, width, chela length and height, abdomen width (females), molt condition, presence/absence of egg clutches, and presence/absence of external sperm plugs. A gonadosomatic index was created for female Jonah crabs.

B. Tagging Study

MA DMF, in collaboration with AOLA, NH F&G, and ME DMR, completed a Jonah crab tagging study in 2018 in which over 32,000 Jonah crabs were tagged across 12 different NMFS statistical areas. Preliminary data suggests that most Jonah crab are not migrating far; Most of the recaptures (over 900 crabs) were recaptured within 5 km of where they were released, though six crabs traveled more than 100 km. None of the seven crabs recaptured after more than 600 days had molted.

C. Declawing Study

New Hampshire Fish and Game and Wells National Estuarine Research Reserve conducted a laboratory study to investigate mortality rates associated with declawing Jonah crabs. Four mortality trials were conducted over three seasons. Mortality rates (% died) by treatment were: Controls=16%, 1-claw removed=51%, and 2-claws removed=70%. Additional research is being conducted to assess how declawing clawing affects mating, feeding and movement.

D. Growth and Fishery Dependent Data

A graduate student at URI is completing a Master's Thesis on Jonah crab, focusing on fishery-dependent data collection and growth. From June 2016 to August 2017, a pilot sea sampling program was implemented to collect information on size distributions, length-weight relationships, sex ratios, molting condition, and shell disease levels. In addition, a laboratory study was conducted in 2016-2017 to describe the growth of Jonah crab in RI Sound. Results include quantification of growth-per-molt in male and female Jonah crab, and a description of molting seasonality and molt probabilities in male Jonah crab. Finally, the Master's Thesis includes fifteen in-person interviews with Jonah crab fishermen to collect their knowledge concerning Jonah crab biology and fishery characteristics. The interviews provided insight into aspects of the species biology and life history that have not been well studied, identified topics requiring more research like stock structure and spawning seasonality, and highlighted some predominant perceptions and concerns related to fishery management.

E. CFRF Research Fleet

The Commercial Fisheries Research Foundation (CFRF) has expanded their lobster commercial research fleet to sample Jonah crab. Biological data collected include carapace width, sex, shell hardness, egg status, and disposition. As of September 2018, 56,301 Jonah crab have been sampled through the program.

8.0 State Compliance

All states except New York have implemented the provisions of the Jonah Crab FMP and associated addenda. The implementation deadline for the Jonah Crab FMP was June 1, 2016; the implementation deadline for Addendum I was January 1, 2017; and the implementation deadline for Addendum II was January 1, 2018.

- New York has not yet implemented the full suite of management measures required under the Jonah Crab FMP or Addendum I and II. New York crab legislation currently prohibits harvest of female crabs with eggs, limits recreational harvest to 50 crabs, establishes a 4.75" minimum carapace width, and establishes a 2.75" minimum claw length for harvest of claws only. Regulations to limit the directed trap fishery to lobster permit holders only and the 1,000 crab bycatch limit have not been implemented. NY will need to revise the crab legislation to require a lobster permit for the directed trap fishery and adopt regulations to allow a 1,000 crab daily bycatch to crab permit holders; it is unclear how long it will take to get the legislation revised.

9.0 De Minimis Requests.

The states of Virginia, Maryland, and Delaware have requested *de minimis* status. According to the Jonah crab FMP, states may qualify for *de minimis* status if, for the preceding three years for which data are available, their average commercial landings (by weight) constitute less than 1% of the average coastwide commercial catch. Delaware, Maryland, and Virginia meet the *de minimis* requirement.

10.0 Research Recommendations

The following research questions were compiled by the Jonah Crab TC and need to be answered in order to complete a coastwide stock assessment.

- ***Growth Rates*** – While there has been some research on Jonah crab growth rates, more studies are needed to determine growth rates along the entire coast. In particular, it is necessary to determine the molt frequency, molt increment, and if there is a terminal molt.
- ***Maturity and Reproduction –*** Studies are needed to determine the size at maturity of crabs in different regions, the size ratio of mating crabs, and sperm limitations.
- ***Migration –*** There are several tagging studies on-going in the Jonah crab fishery. Hopefully these studies will elucidate the migrations of Jonah crab as well as seasonal habitat preferences.
- ***Natural Mortality*** – An estimate of natural mortality must be developed for Jonah crab in order to carry out a stock assessment. In particular, it will be critical to determine the natural mortality of the adult size crabs.

11.0 Plan Review Team Recommendations

The following are recommendations from the Plan Review Team:

- The PRT recommends the Board approve the *de minimis* requests of DE, MD, and VA.
- The PRT raises concerns about the unimplemented Jonah crab regulations in NY, particularly the regulations to limit the directed trap fishery to lobster permit holders only and the 1,000 crab bycatch limit. Similar issues were raised in the 2018 compliance reports and have not been addressed within the last year.
- The PRT recommends that jurisdictions with crab-only fishermen report on the number of these fishermen, their collective number of traps fished, and the rules governing their fishing activity.
- The PRT recommends continued research of the Jonah crab species so that a coastwide stock assessment can be completed in the near future.
- The PRT recommends the LEC review compliance in the Jonah crab fishery, given it is a fairly new fishery management plan and lessons may be learned.

12.0 Tables

Table 1. Landings (in pounds) of Jonah crab by the states of Maine through Virginia. 2010-2017 landings were provided by ACCSP based on state data submissions. 2018 landings were submitted by the states as a part of the compliance reports and should be considered preliminary. *C= confidential data*

	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	Total
2010	1,093,962	C	5,689,431	3,720,440	C	968,122	30,441		18,045	C	11,690,987
2011	1,096,592	C	5,379,792	3,213,119	C	69,440	26,909		92,401	C	9,947,027
2012	556,675	C	7,540,510	3,774,300	2,349	410,349	68,459		C	C	12,560,390
2013	379,073	340,751	10,109,590	4,651,796	51,462	371,675	C		C	C	16,075,597
2014	348,295	404,703	11,904,611	4,435,934	C	83,060	C		153,714	C	17,413,451
2015	312,063	C	9,128,876	4,298,894	C	207,437	68,116	C	39,750	C	14,253,340
2016	604,138	150,341	10,668,039	4,224,092	C	165,427	260,856	C	14,656	C	16,093,104
2017	1,042,782	113,354	11,698,705	4,111,281	C	158,271	433,132	C	23,564	C	17,594,243
2018	1,079,729	22,136	13,333,278	4,629,276	C	196,060	491,122	C	60,628	C	19,816,742

13.0 Figures

Figure 1: The density of Jonah crab measured over time in the Maine Settlement Survey by statistical area. The top graph shows the density of YOY Jonah crab (<13mm carapace width) and the bottom graph shows the density of all Jonah crab.

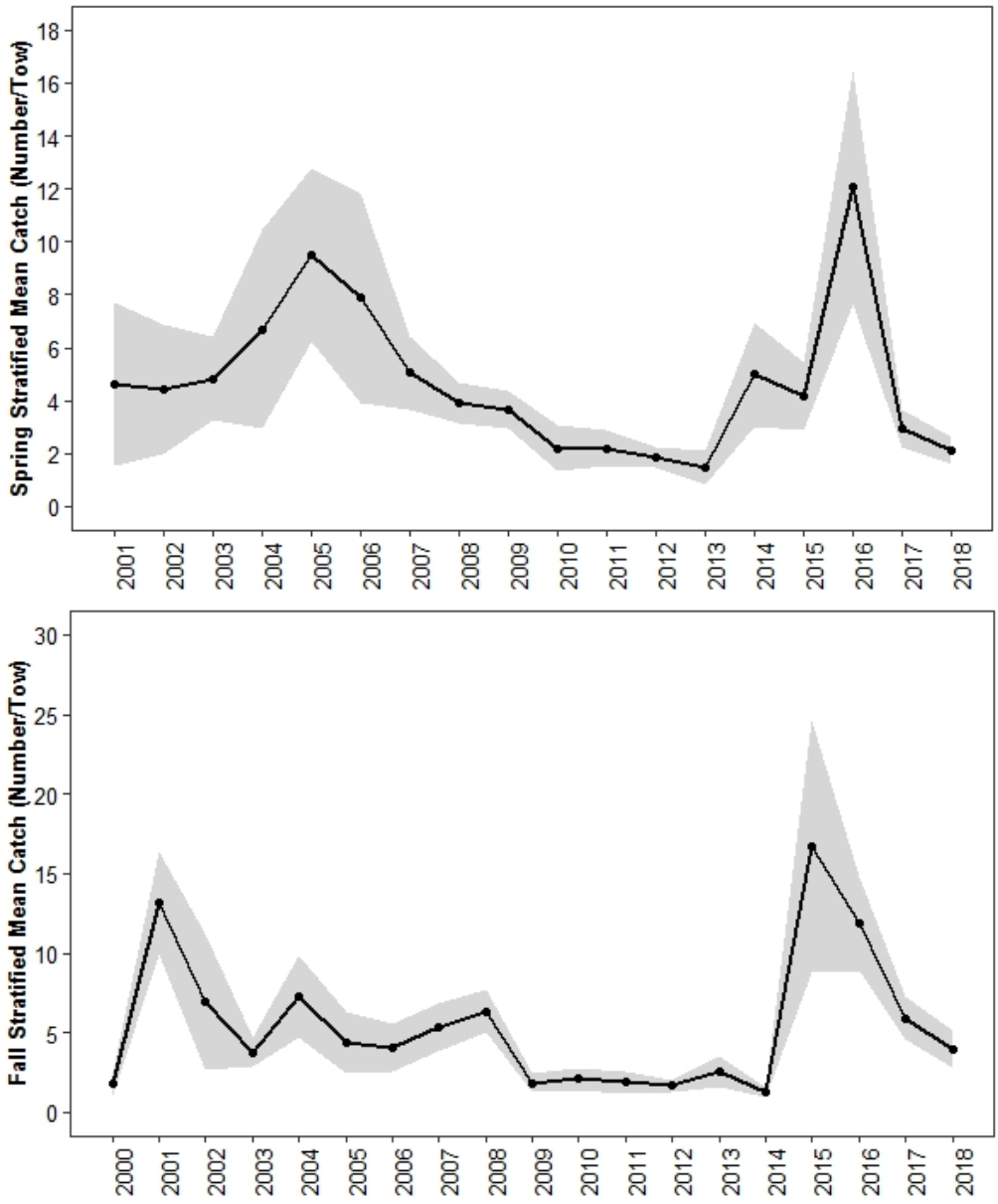

Figure 2: Maine-New Hampshire survey abundance indices for Jonah crab, 2001-2018. Results of the spring survey are on the top and results from the fall survey are on the bottom.

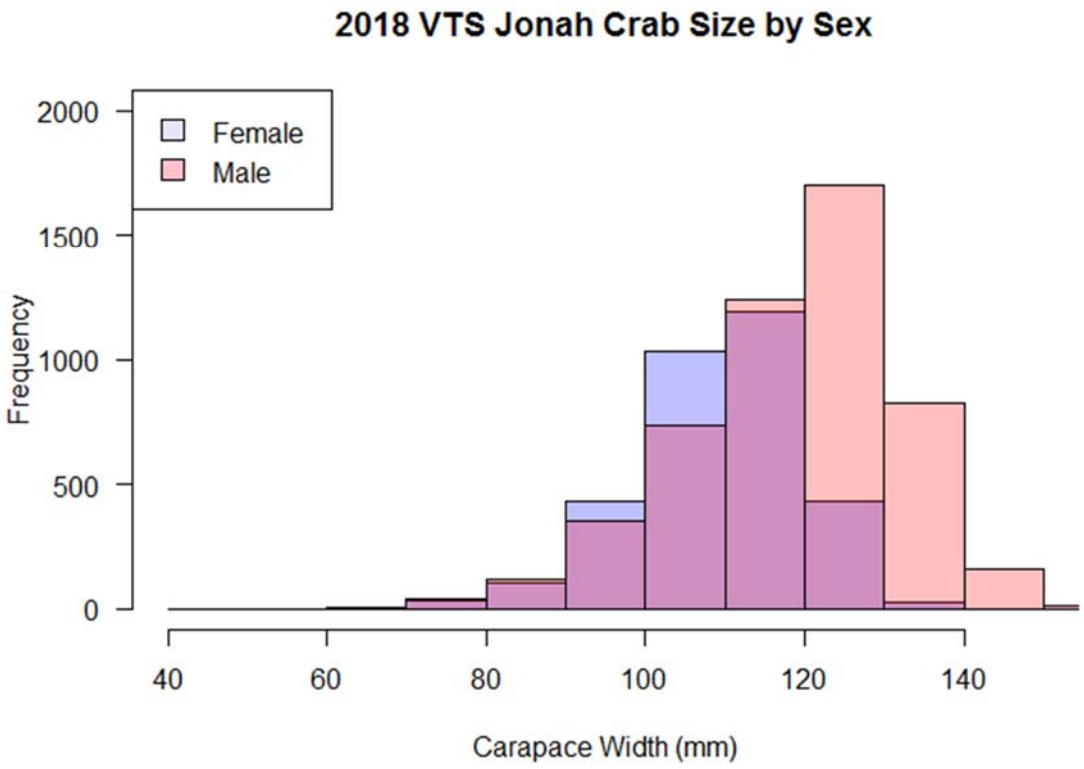

Figure 3: Jonah crab size frequency by sex from the 2018 Maine Ventless Trap Survey.

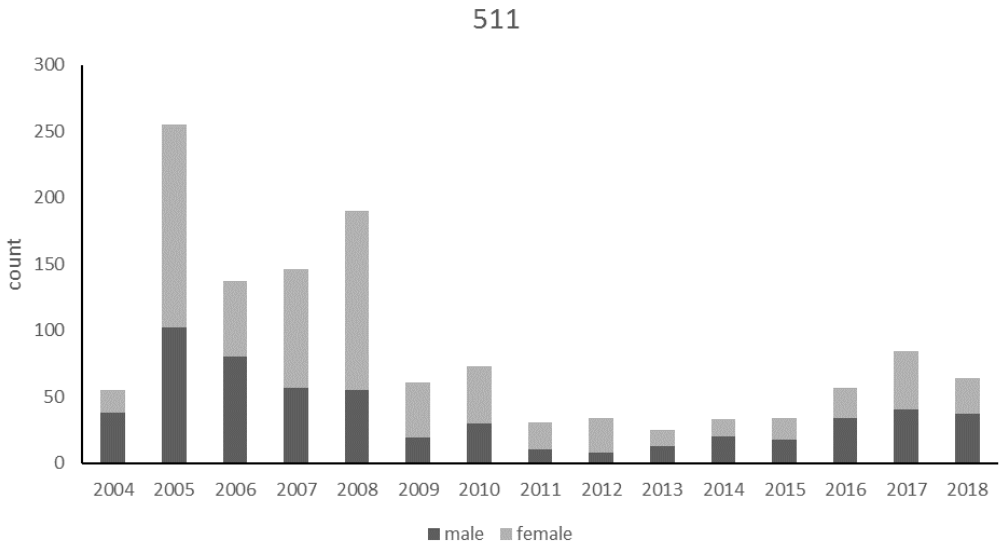

Figure 4: Observed crabs from the Maine Sea Urchin Survey (statistical area 511).

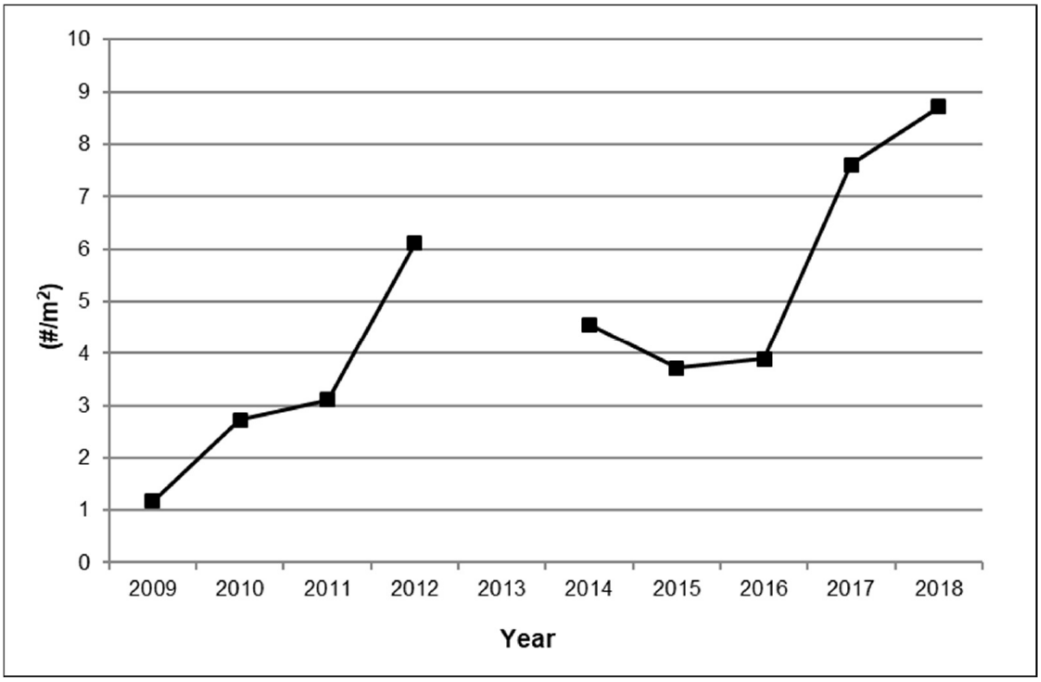

Figure 5: Catch per unit effort (#/m^2) of Jonah crab during the American Lobster Settlement Index Survey, in New Hampshire, from 2009 through 2018.

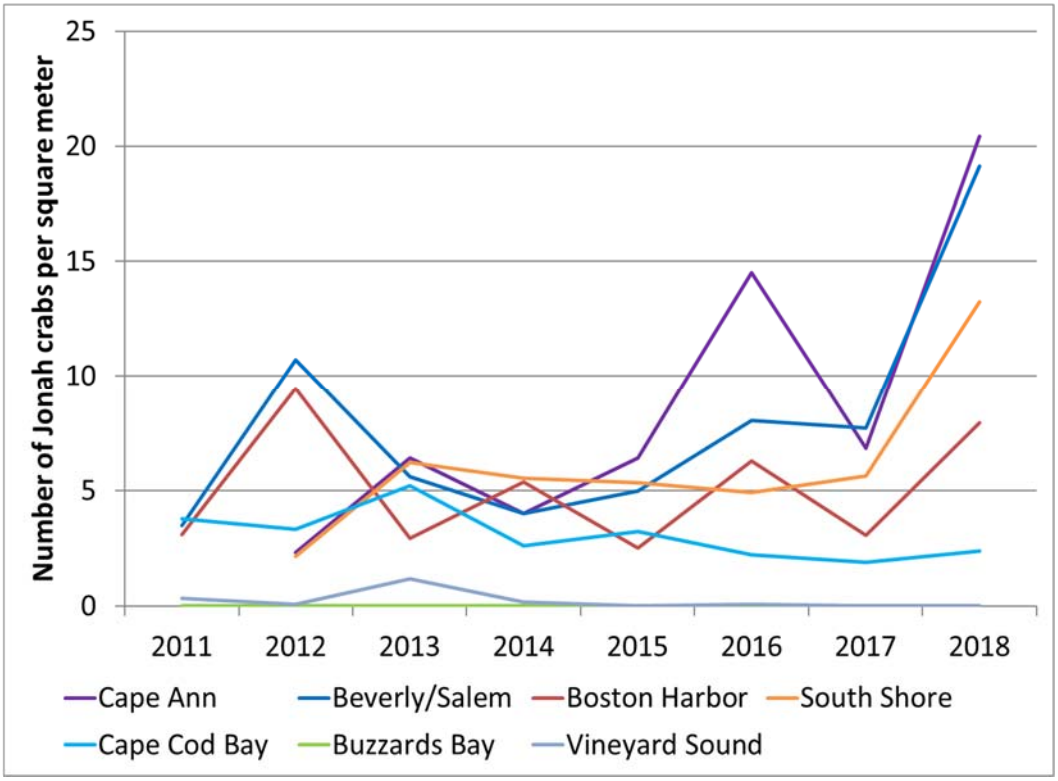

Figure 6: Number of Jonah crab per square meter from the MA DMF juvenile lobster suction survey. Cape Ann, Beverly/Salem, Boston Harbor, South Shore, and Cape Cod Bay are in NMFS statistical area 514; Buzzards Bay and Vineyard Sound are in statistical area 538.

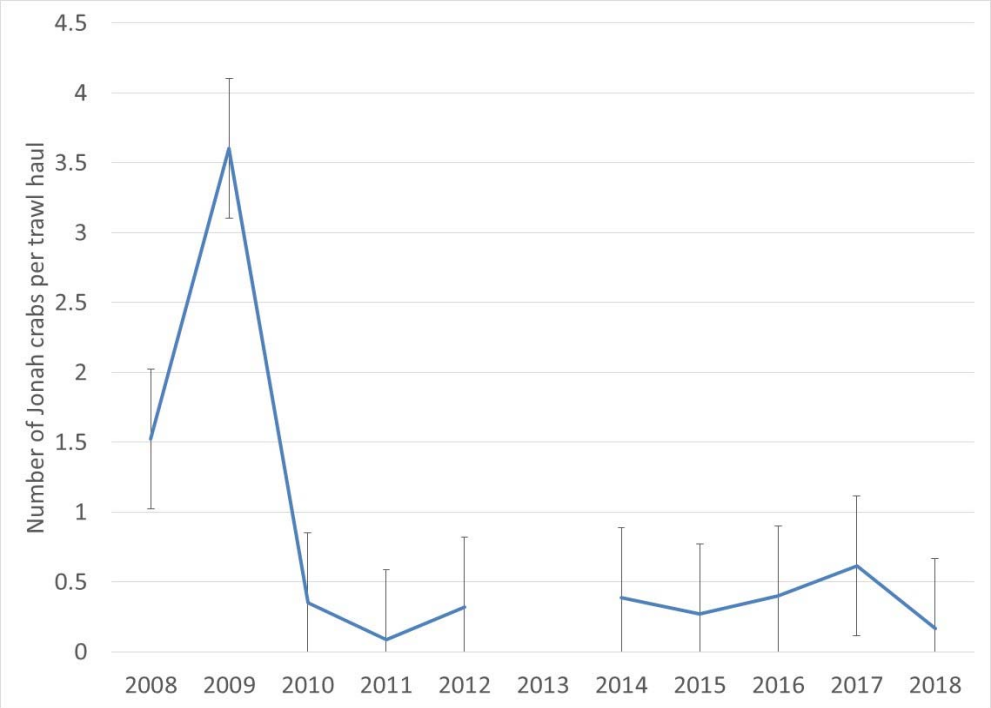

Figure 7. Number of Jonah crab per trawl haul from NMFS stat area 538 from the MA DMF Ventless Trap Survey. CPUE is standardized to a 6 pot trawl with three vented and three ventless traps. Error bars are ± two times the standard error. The survey did not occur in 2013.

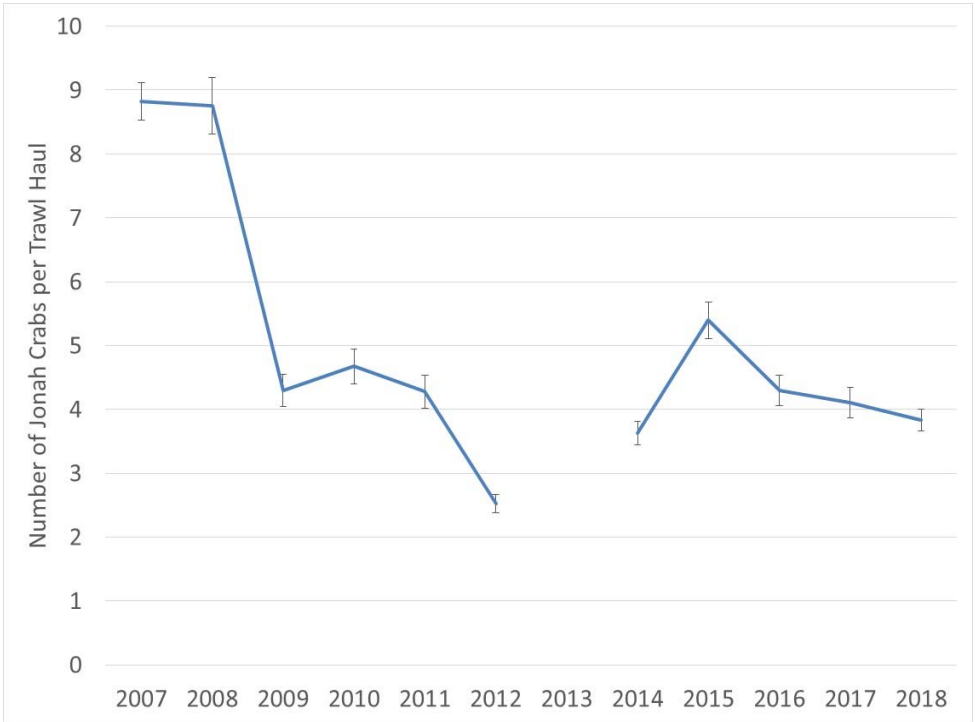

Figure 8. Number of Jonah crab per trawl haul from NMFS stat area 514 from the MA DMF Ventless Trap Survey. CPUE is standardized to a 6 pot trawl with three vented and three ventless traps. Error bars are ± two times the standard error. The survey did not occur in 2013.

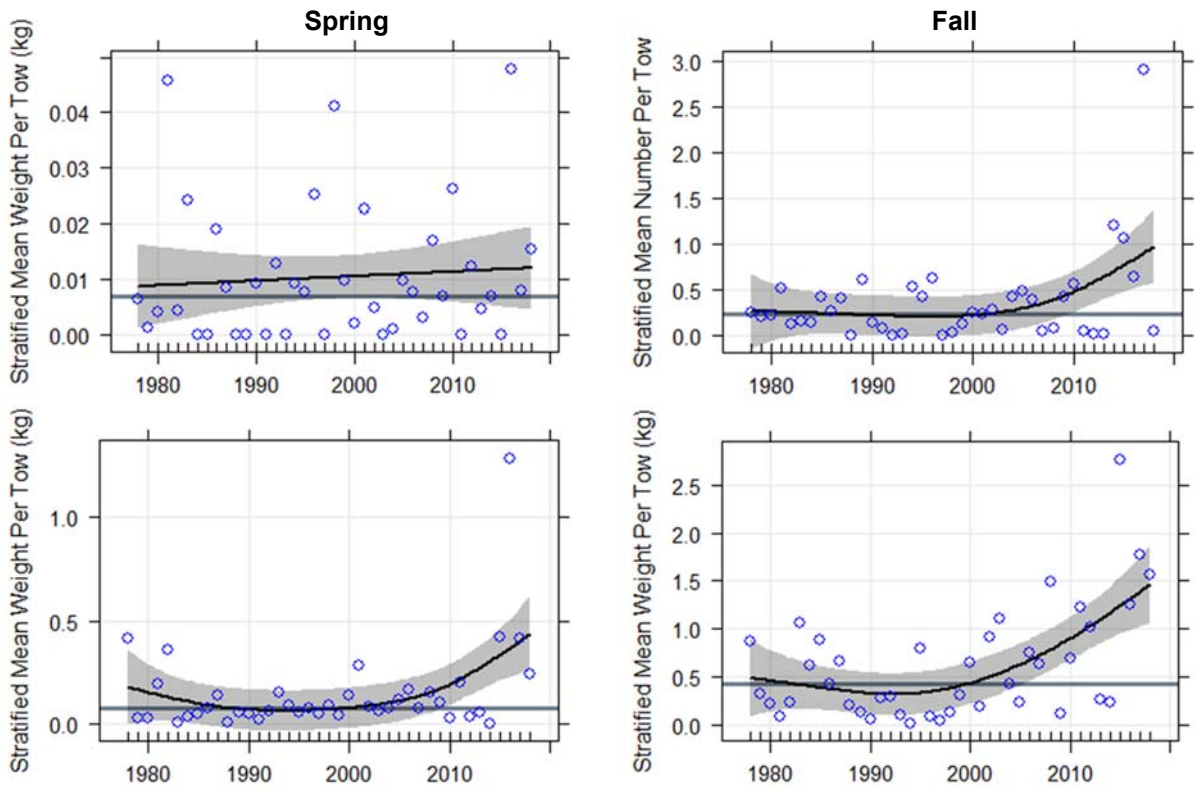

Figure 9. Jonah crab (sexes combined) stratified mean weight per tow from the MA DMF spring (left) and fall (right) trawl survey for regions 1–3 (south and east of Cape Cod, top) and regions 4 and 5 (north of Cape Cod, bottom). Black line is the generalized additive model fit, grey line is the time series median, shaded area is ± two times the standard error of the predicted value.

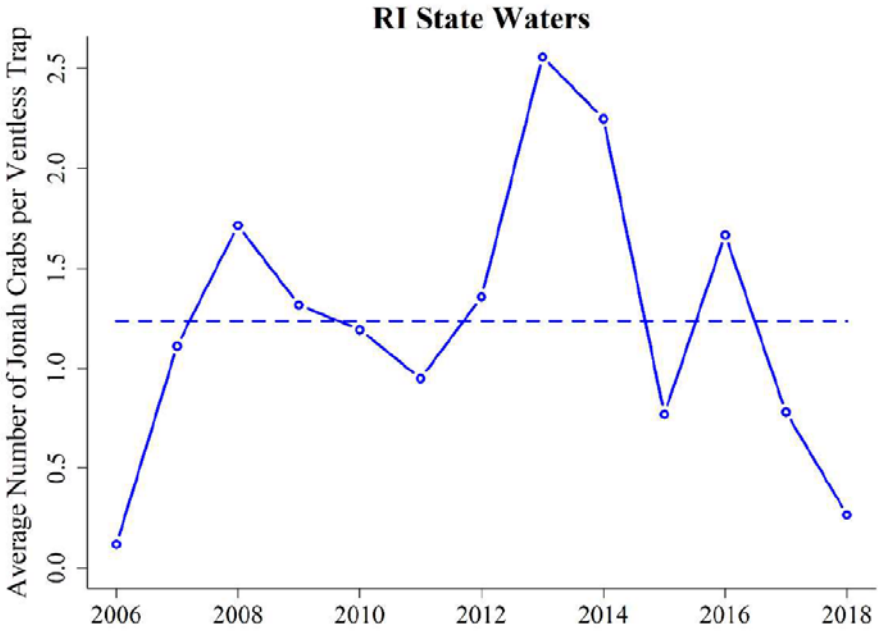

Figure 10: Stratified mean catch (#) per ventless trap in a VTS haul for Jonah crab. Dashed line

indicates time series mean.

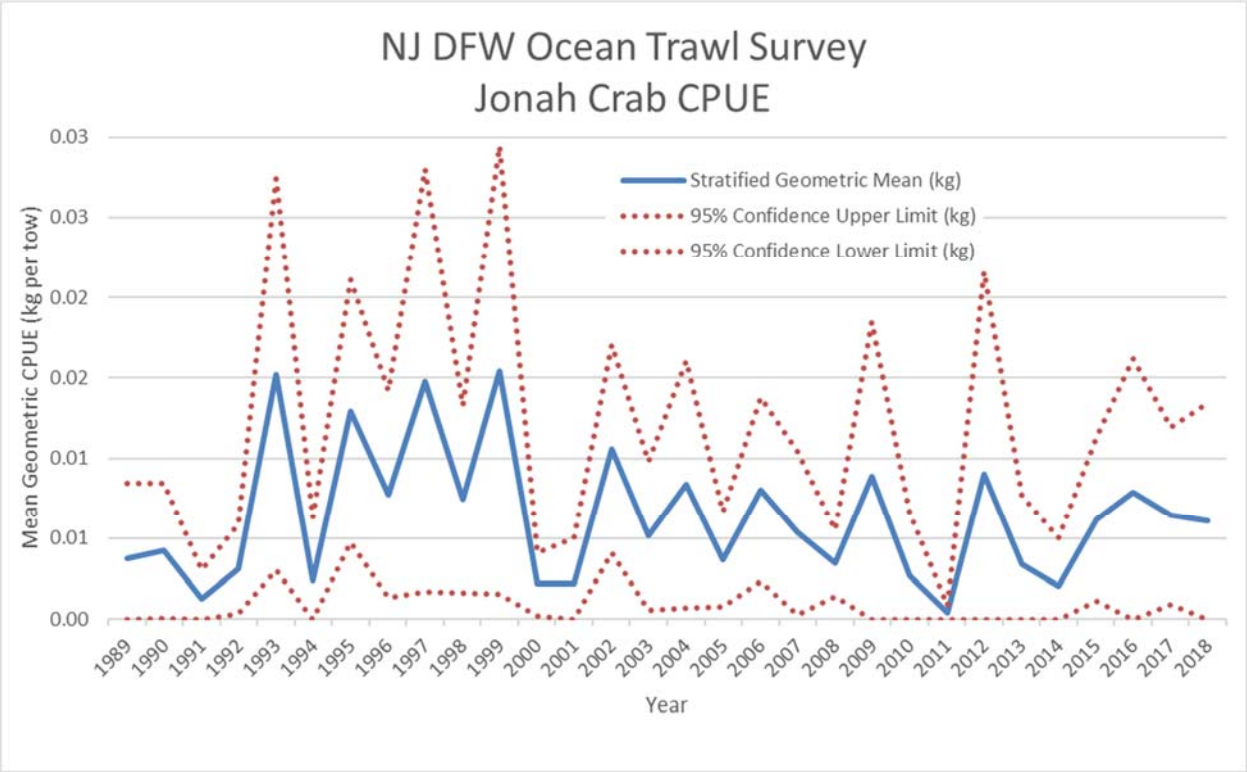

Figure 11: Stratified mean CPUE of all Jonah crab collected aboard the NJDFW Ocean Trawl Survey. The survey stratifies sampling in three depth gradients, inshore (18'-30'), mid-shore (30'-60'), offshore (60'-90'). The mean CPUE was calculated as the sum of the mean weight (in kg) of Jonah crab per size class collected in each sampling area weighted by the stratum area.

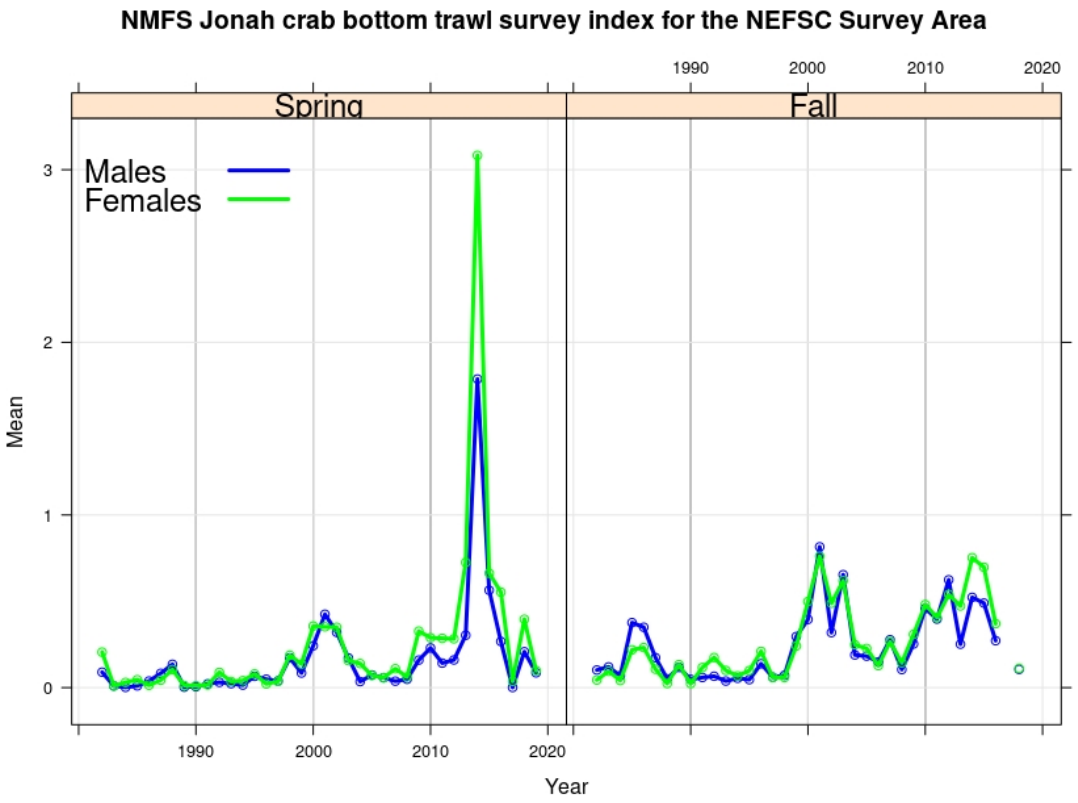

Figure 12: NMFS Jonah Crab index (mean number per tow) from the bottom trawl survey for the NEFSC Survey Area, through 2019.