Atlantic States Marine Fisheries Commission

American Lobster Management Board

August 5, 2014
9:45 a.m. – 12:15 p.m.
Alexandria, Virginia

Draft Agenda

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

1.	Welcome/Call to Order *(D. McKiernan)*	9:45 a.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from October 2013	9:45 a.m.
3.	Public Comment	9:45 a.m.
4.	Consider Draft Addendum XXIII for Final Approval (*K. Taylor)* **Final Action**	10:00 a.m.
5.	Consider Cancer Crab PID for Public Comment *(K. Taylor)* **Action**	10:05 a.m.
6.	Review Southern New England 10% Reduction Evaluation *(B. Glenn)*	10:45 a.m.
7.	Update on upcoming federal actions *(P. Burns)*	11: 10 a.m.
8.	Review of consistency with federal trap transfer regulations *(K. Taylor)* **Possible Action**	11:20 a.m.
9.	Stock Assessment Update *(B. Glenn)*	11:55 a.m.
10.	Elect Vice-Chair *(D. McKiernan)* **Action**	12:10 p.m.
11.	Other Business/Adjourn	12:15 p.m.

The meeting will be held at the Crowne Plaza Hotel, 901 North Fairfax Street, Alexandria, Virginia; 703-683-6000

MEETING OVERVIEW

American Lobster Management Board Meeting
Tuesday, August 5, 2014
9:45 a.m. – 12:15 p.m.
Alexandria, Virginia

Chair: Dan McKiernan (MA) Assumed Chairmanship: 08/14	Technical Committee Chair: Bob Glenn (MA)	Law Enforcement Committee Representative: Joe Fessenden (ME)
Vice Chair: Vacant	Advisory Panel Chair: Vacant	Previous Board Meeting: October 28, 2013
Voting Members: ME, NH, MA, RI, CT, NY, NJ, DE, MD, VA, NC, NMFS (12 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2013

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 Draft Addendum XXIII for Final Approval (10:00 – 10:05 a.m.) Final Action

Background

- A habitat addendum was developed for American Lobster by the Habitat Committee **(Briefing Material).**

Presentations

- Review of Draft Addendum XXIII by K. Taylor

Action for consideration

- Final approval Draft Addendum XXIII

5. Consider Cancer Crab PID for Public Comment (10:05 – 10:45 a.m.) Action

Background

- In May the Policy Board passed a motion for the American Lobster Board to develop a FMP for Cancer Crabs based on the recommendations provided by the Jonah Crab Fishery Improvement Project (FIP). A FIP is a multistakeholder effort to improve a fisheries performance to a level that is consistent with the Marine Stewardship Council's (MSC) sustainable seafood certification.
- As the first step in FMP development, a Public Information Document (PID) was drafted to gather information concerning the Cancer Crab fisheries and to provide an opportunity for the public to identify major issues and alternatives relative to the management of this species **(Supplemental Material)**.

Presentations

- Review of the Cancer Crab PID for Public Comment by K. Taylor

Action for consideration

- Approve the Cancer Crab PID for public comment

6. Review Southern New England 10% Reduction Evaluation (10:45 – 11:10 a.m.)

Background

- Under Addendum XVII all Lobster Conservation Management Areas (LCMAs) within Southern New England (SNE) were required to reduce exploitation by 10% in order to address rebuilding. The Technical Committee (TC) met to evaluate if the LCMA approved measures have met the 10% reduction requirement.

Presentations

- Review Southern New England 10% Reduction Evaluation by TC Chair

Action for consideration

- None

7. Update on federal actions (11:10 – 11:20.m.)

Background

- Review of recent federal regulations t, including Area 2 and Outer Cape Area Limited Access Program and Trap Transfer Program.

Presentations

- Review of recent and upcoming federal action by P. Burns

Action for consideration

- None

8. Review of Consistency with federal trap transfer regulations (11:20 – 11:55.m.)
Possible Action

Background

- Some portions of NOAA Fisheries recently promulgated regulations either differ from the Commissions plan or the Commission's plan does not include provisions for consistent implementation, such as the conservation tax of full business transfers and conservation tax increments **(Supplemental Material).**

Presentations

- Review of federal and Commission plans by K. Taylor

Action for consideration

- Consider direction to the PDT in developing consistent management measures

9. Stock Assessment Update (11:55 – 12:15 p.m.)

Background

- A stock assessment is currently being completed for American lobster and is expected to be peer reviewed in early 2015.

Presentations

- Review of stock assessment progress by SAS Chair

Action for consideration

- None

10. Elect Vice-Chair
11. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

AMERICAN LOBSTER MANAGEMENT BOARD

The King & Prince Beach and Golf Resort
St. Simons Island, Georgia
October 28, 2013

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

TABLE OF CONTENTS

INDEX OF MOTIONS

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Steve Train, ME (GA)
Rep. Walter Kumiega, ME (LA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Doug Grout, NH (AA)
G. Ritchie White, NH (GA)
Jocelyn Cary, MA, proxy for Rep. Peake (LA)
Dan McKiernan, MA, proxy for P. Diodati (AA)
Bill Adler, MA (GA)
Robert Ballou, RI (AA)
David Borden, RI, proxy for B. McElroy (GA)
Rick Bellavance, RI, proxy for Sen. Sosnowski (LA)
David Simpson, CT (AA)
Rep. Craig Miner, CT (LA)
Lance Stewart, CT (GA)
James Gilmore, NY (AA)
Pat Augustine, NY (GA)
Peter Himchak, NJ, proxy for D. Chanda (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Albano (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Russell Dize, DE, proxy for Sen. Colburn (LA)
Roy Miller, DE (GA)
Bernie Pankowski, DE, proxy for Sen.Venables (LA)
Tom O'Connell, MD (AA)
Bill Goldborough, MD (GA)
Rob O'Reilly, VA, proxy for J. Travelstead (AA)
Peter Burns, NMFS

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

Ex-Officio Members

Joe Fessenden, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Kate Taylor
Marin Hawk

Guests

Terry Stockwell, ME DMR
John Bullard, NMFS
David Pierce, MA DMF
Derek Orner, NOAA
Kim McKown, NY DEC
Mike Armstrong, MA DMF
Nichola Meserve, MA DMF
Lauren Latchford, Duke Univ
Linda Mercer, ME DMR
Tim Huss, NY DEC
Mari-Beth DeLucia, The Nature Conservancy
Joseph Gordon, PEW
Charles Lynch, NOAA
Richard Allen, Newington, NH
Arnold Leo, E.Hampton Baymens Assn.
Jay Lugar, MSC
David Spencer, AOLA
Will Bokelaer, Colonial Heights, VA
Raymond Kane, CHOIR
Rick Allyn, Trenton, NJ
Ann Pierce, Maine Elver Fishermen Assn.
Jeffrey Pierce, Maine Elver Fishermen Assn.
Mark Alexander, CT DEEP

The American Lobster Management Board of the Atlantic States Marine Fisheries Commission convened in the Lanier Ballroom of The King and Prince Beach & Golf Resort, St. Simons Island, Georgia, October 28, 2013, and was called to order at 9:35 o'clock a.m. by Chairman Douglas E. Grout.

CALL TO ORDER

CHAIRMAN DOUGLAS E. GROUT: All right, this is a meeting of the ASMFC Lobster Board. My name is Doug Grout; I'm chairman. This is my last meeting; Dan, you're up. The vice-chair will be taking over. We have a few things on the agenda here. Hopefully, they'll go smoothly and quickly.

APPROVAL OF AGENDA

CHAIRMAN GROUT First of all, we have an agenda here. Is there anybody that would like to make a change to the agenda or any modifications? Pete Himchak.

MR. PETER HIMCHAK: Mr. Chairman, I have two small items to bring up under other business. One is a change in the sixth abdominal tail segment that all states should be interested in hearing about. We're going from 1-1/16th to 1-1/8th inches. I'll get into that under other business. The other issue is the potential for shifting the closed season in Areas 4 and 5 under Addendum XVII. That really only pertains to five states and maybe I'll just bring it up and we can discuss it throughout the week. Thank you.

CHAIRMAN GROUT: Dave Borden, you had a change?

MR. DAVID V.D. BORDEN: Mr. Chairman, under other business I would like to just briefly talk about Closed Area 2.

APPROVAL OF PROCEEDINGS

CHAIRMAN GROUT: Are there any other changes? Are there any objections to approving the agenda as modified? Seeing none; we will now move to approval of the proceedings from the August 2013 meeting. Are there any modifications? I actually have one note that I'd like to make. One of the motions had a slight error in the listing of which section of the addendum they were referring to in there.

What I'd like to do is tell Joe that under the change to Motion Number 3 on Page iii, it says right now 3.2.3, ownership caps, when it should be 3.1.2 refers to ownership caps. With that note made, we'll make that change to the minutes. Are there any other changes to the minutes? Okay, seeing none, are there any objections to approving the minutes as modified? I see they are approved.

PUBLIC COMMENT

Item Number 3 is we have the opportunity for public comment, and these are for things that are not on the agenda right now. Is there anybody in the public that would like to provide comments on things that are not on the agenda? Seeing none; we will move to Agenda Item Number 4.

DRAFT ADDENDUM XXII

This is to consider Draft Addendum XXII for final approval. This will be a final action and we'll start off with Kate Taylor providing a review of this draft addendum.

REVIEW OF MANAGEMENT OPTIONS

MS. KATE TAYLOR: In December 2011 the board approved the development of an addendum to respond to the poor condition in the Southern New England stock by scaling the size of the fishery to the size of the resource. The stock is currently overfished but overfishing is not occurring. The board initiated an addendum to address this issue with trap reductions and changes to the transferability programs.

The board split the addendum with trap reductions addressed through Addendum XVIII approved in 2012 and some changes in the transferability programs for Area 2 and 3 addressed through Addendum XXI, which the board reviewed and approved in August. This

draft addendum presents two additional options for management of the Southern New England stock for consideration.

These options, if the board will remember, were previously considered under Draft Addendum XXI. This draft addendum made two corrections to the options that were considered in the previous addendum, and this was to accurately reflect the trap reduction schedule. The addendum for consideration today also adds one additional option under the aggregate ownership cap.

The first option for consideration was a single ownership cap or it is previously called the individual permit cap. Option 1 is the status quo and Option 2 is a single ownership cap. Under the aggregate ownership cap, Option 1 is the status quo. Option 2 is an aggregate ownership cap, and this option was previously considered under Draft Addendum XXI, which is referred here to as a partial exemption.

Under this option, no single company or individual may own traps greater than five times the single ownership cap if they have not already accumulated them prior to the Service publishing a present-day control date. However, should an individual owner be in excess of the cap before the control date is published, that owner will retain their existing cap and the owner may not increase their trap ownership once the control date has been published.

A new option for consideration under Draft Addendum XXII under aggregate ownership cap is a full exemption under the cap. This would be if an entity falls under the grandfather provision, that entity would be allowed to acquire additional trap allocations up to the single ownership cap for each of its grandfathered permits.

Otherwise, an ownership with an accumulation of fewer traps than the cap at the time the control date is published may not exceed the aggregate ownership cap. This table just reflects the trap reduction schedule.

If either Option 2 or Option 3 is considered, then the board would recommend that NOAA Fisheries establish a control date for the number of traps a single company or individual may own or share ownership in Area 3. This table shows the single ownership and the aggregate ownership caps as presented during the trap reduction schedule. That concludes my presentation. Thank you, Mr. Chairman.

CHAIRMAN GROUT: Are there any questions on this right now? Steve Train.

MR. STEPHEN R. TRAIN: I'm trying to understand the purpose of this entire thing is management and effort control and it seems like the new option would actually allow an increase in effort based on the current effort in the fishery. If somebody had three or four permits but was only fishing one to two of them and maybe only had three or four hundred tags on one of them, they could increase the tag allotment in each permit they have up to the individual cap and work all the way up to the five or something. Did I miss this the last time or does change allow an actual increase in effort because there could be latent effort sitting in tags and permits that now under this option could be active and real increased effort.

CHAIRMAN GROUT: You remember there is also an active trap cap limit, which is lower than the actual number of traps that you can own. That is what is really restricting fishing effort. The aggregate trap cap limit provides the opportunity for an owner of a permit to accumulate extra traps in anticipation of potential future reductions that may occur.

But what it is, is they're buying these – and correct me if I'm wrong, but they're obtaining these extra traps that are latent traps and there still is going to be latent effort. They still can't fish it because we have the – at least at this particular point in time because there is still the active trap cap.

MR. TRAIN: I understood the active trap cap, but my question as with most of these fisheries we have a lot of latent effort. The new option, as I see it, would allow that latent effort to be

transferred into a multiple permit holder's hands and increase the active effort on one of the permits or two of the permits that may not have been up to the individual trap cap; and therefore it becomes active effort without changing – it is not like they'd have 1,200 tags and 1,200 in reserve.

One of those permits may have been a 300 or 400 tag permit; and by activating the latent effort from other permits, these multiple permitted vessels or owners would increase the real effort in the fishery. I didn't think that was the point.

MS. TAYLOR: The new option under consideration just deals with – the change is really with the grandfathered permits; so if a permit holder had a grandfathered permit – they had seven permits; they would be allowed to purchase traps up to the single ownership cap for each permit. The original option under consideration; those permit holders would still be allowed to hold more than five permits, but they would still be required to follow the aggregate ownership cap.

MR. PATRICK AUGUSTINE: As we select and approve which options we're going to take; have our partners – the National Marine Fisheries Service – have any major issues with going in this direction? Is it compatible? As I recall, they did review and they made comments about it. Has that position changed?

MR. PETER BURNS: We can look at this. We were unable to provide comments on this particular addendum because the government shutdown prevented us from being able to submit the comments. These issues have been debated by the commission under Addendum XXI in part and also now, so we would take a look at these and we would go through our normal process to evaluate these measures.

MR. BORDEN: I would just like to follow up on Steve's point just very briefly that I think the way to look at this addendum is that it is part of a comprehensive package that the Policy Board has adopted over the years. Basically there is an overall cap that was based on the history of performance in the area.

The commission then cut 25 percent of those traps that were allocated in a separate action. The new action that you promulgated as part of Addendum XXI is going to cut another 25 percent of the traps; and then on top of that there is a 10 percent transfer tax that gets imposed. When you consider all of those factors together, what they do is they basically lower the amount of gear in the water. The first cut was estimated pretty much to remove a large portion of the latency. As these traps transfer, the amount of gear will get consolidated on to fewer and fewer operating units, which basically can maintain their economic viability. That is the whole purpose of doing this.

CHAIRMAN GROUT: Pat, you had a followup?

MR. AUGUSTINE: Yes, the followup was when you get through with the questions, I'm ready for a motion.

CHAIRMAN GROUT: We have one other thing we have to do before motions; and Kate has a report on the public comment that was received on this.

PUBLIC COMMENT SUMMARY

MS. TAYLOR: The public comment period **o**n the addendum ran from September 16th through October 17th. There were two letters that were received. The first one was from ALOA and they supported Option 2 under the single ownership cap and Option 3, the new option for consideration under the ownership cap.

The Little Bay Lobster Group supported Option 3, the new option under the aggregated ownership cap. I would also just like mention that in addition to ALOA and the Little Bay Lobster Group, additional organizations also commented on these measures, the single and aggregate ownership caps, during the public comment period for Draft Addendum XXI. We mentioned at the last board meeting that their options just would be presented to board again,

but please note that Option 3 under the aggregate ownership cap was not included in Draft Addendum XXI.
Under the single ownership cap, Off the Shelf, Cote Fisheries and Rhode Island Lobstermen's Association supported Option 2. Under the aggregate ownership cap, Off the Shelf supported Option 1, the status quo. Cote Fisheries and Rhode Island Lobstermen's Association supported Option 2. Thank you, Mr. Chairman.

CHAIRMAN GROUT: Are there any questions for Kate? Bob Ballou.

MR. ROBERT BALLOU: Kate, you correctly characterized the comments, but in your memo there is a typo and I think you know that, so maybe there is a way to correct for the record that typo that refers to XXII when it should say XXI. Thank you.

CHAIRMAN GROUT: Okay, sounds good. Are there any other questions? Peter.

MR. BURNS: Mr. Chairman, I just had a comment in part of the addendum that pertains to the implementation at the federal level. I think this is probably something that is standard for all the addenda; but when we just took a little closer look at it, we didn't see the need. It recommends that the National Marine Fisheries Service promulgate all necessary regulations to implement the measures contained in Sections 3 and 4.

I just want to point out that there is really nothing in Section 4 which deals with – specifically it deals with the compliance and with the annual review. There is really nothing – there are no regulations that we would promulgate to be consistent with that. We already have that authority already in place; so it would really just be the Section 3 measures.

CHAIRMAN GROUT: Okay, are there any further questions? I guess we're ready for a motion.

MR. DAN McKIERNAN: **I have a motion to adopt the provisions of Addendum XXII, and I forwarded that motion to Kate, if we can get it on the board. I move to adopt the following elements of Addendum XXII and ask the ASMFC Executive Director to forward the addendum to NMFS with a request that they implement the new management provisions as soon as possible: Section 3.1, governing single ownership caps, adopt Option 2; and for Section 3.2, governing aggregated ownership caps, adopt Option 3, full exemption.**

CHAIRMAN GROUT: Second by Ritchie White. Is there discussion on this motion? Dave.

CONSIDER FINAL APPROVAL OF DRAFT ADDENDUM XXII

MR. DAVID SIMPSON: Yes, just a general I guess implementation concern that as we do this cap-and-trade type of thing, I have a concern about knowledge and availability of federal permits and traps in every state. Part of what I think we'll have to do to implement this is that data base and I think logically using that data base so that we can publicly see who owns how many traps, how many permits.

When traps or permits become available, the public in each state can see that. I wondered if either Chip or Peter could comment to how the federal government would respond to this – this would be purely federal permit – to make sure that they're available regardless of what state is offering or interested in getting a permit.

CHAIRMAN GROUT: Peter, were you listening to Dave's query here?

MR. BURNS: Yes, and I believe that his concern is making sure that the general public is aware of traps that may be available for transferability once this program goes online. Right now our program isn't really going to change anything. It would allow anyone with a federal – you'd still have to have a federal permit in order to transfer traps; so it wouldn't be that anybody from the public would come out – this is all about capping federal lobster permits.

In our proposed rule we would allow anyone with a federal permit who didn't qualify to be able to buy into that process. As far as making the public known about what types of traps are available during the trap transfer period, maybe that's something that the commission might want to discuss and have some kind of process in place through the data base or some other way to address that.

MR. SIMPSON: Well, even if you stay within existing permit holders and you're just trading traps, I want to make sure that frankly as a small state that only has a couple of players, that they have an equal opportunity to participate in the federal fishery and that these traps aren't traded exclusively privately by neighbors and friends; that there is a more open process to see that there are traps available and have equal opportunity in this fishery regardless of what state they're from.

MS. TONI KERNS: Right now the data base is not designed to be open to the public, and that is because there are data confidentiality issues. In particular your state has told us that we have to have all users sign the data confidentiality agreement to allow for Connecticut's data to be put into the data base. I don't believe we can make it open to the public that way.

Secondly, we didn't design it to be open to the public right now. It was just for administration. My understanding of how the public would know about the ability to buy and sell is just the same way that the public knows about the ability to buy and sell full businesses where people put up ads in the different trading papers, et cetera, when they're looking to sell traps.

MR. McKIERNAN: Toni makes a good point, but I think there is another challenge here, and that is how each of the states treats its permit records. We have been dealing with the ITT system in the Outer Cape and Area 2; and we have been disclosing to the public the permit holders and their allocations; because typically how this works is someone might cold call someone who has got a permit to find out if they're interested in selling.

I think that is what is in play as well as just a disclosure of who has the allocation. I believe the federal allocations are public record, the Area 3 allocations, so I think this is probably something the individual states have work out to determine if they can all join in to make this stuff transparent.

MR. SIMPSON: I would have to look into what the issue for Connecticut is; but we're not talking about catch. It's allocation of traps in federal waters; and I don't know how we could effectively implement and enforce these caps and limits if it's all secret who has how many traps. I do think we think we need that transparency.

Again, on level they're just private businesses and what they do is their own issue; but as governments, federal or state, we have a responsibility under the law to make sure that protected classes aren't adversely impacted and at the federal level that interstate commerce is open and transparent.

MS. KERNS: I think one thing that potentially we could do, and we would need to check with all our partners before agreeing to do so, but we could have all of the partners send the commission a list of their permit holders and the number of traps they have allocated potentially at the same time that you are sending out the letters to your permit holders and then we could put it in a report and make it available on our webpage. I would want to make sure that information would be allowed to be published prior to agreeing to do that. We could have Kate check with all the partners and then get back to the Lobster Board at the February meeting.

MR. HIMCHAK: Mr. Chairman, I see David's point and at some point there should be, yes, like a clearinghouse on who holds how many traps. Under the federal scheme of things, in surf clam management we're grappling with excessive shares, who has a certain percentage that can control the market. Since the ASMFC essentially has the regulation on lobsters, at some point they may want to address the issue of what constitutes an excessive share in a certain area. I just put it out for thought.

MR. SIMPSON: Dan observed that he thought the federal trap allocation was public information, and I wondered if Peter or Chip could let us know.

CHAIRMAN GROUT: Does either of you want to take bite at this? Peter.

MR. BURNS: Right now we don't divulge that information on actual allocations information, but this is something different. This is really talking about – I think what Mr. Simpson is proposing is establishing a marketplace I guess for transferability, so somebody to be able to go online and say, "I've got so many traps available" and making that available.

I think it's sort of outside the context of how we handle permit allocations and that type of thing. It's not really something in the data base. Maybe I said that, but I was kind of thinking some report or capability in the data base that would make that information available, but I think it might be up to the buyers and sellers to provide that information voluntarily in order to facilitate trap transferability.

MR. SIMPSON: Okay, so the first part it does sound like the federal government won't disclose to the public how many traps somebody has and that they issue a permit for, which seems odd to me and will probably defeat my desire to see some openness in this process. We're issuing permits, we're proposing caps on ownership and consolidation and yet nobody will be able to see that for themselves, so I don't know how it's going to work.

I didn't anticipate the data base being the marketplace but simply I think there is a need to be public in these transactions; that this number of traps are available and where do they go. As a crosscheck as just open government, these are federal and state permits that are being traded, authorization to do a certain activity, and it just seems to me it should be open and transparent.

CHAIRMAN GROUT: Correct me if I'm wrong, but I didn't see that this was going to be a list of people who are offering trap allocations for sale. I saw this as just saying what you were asking – you and Dan were talking about was just a list of who has got what. There is no marketing involved here.

It is the same way if someone asked us if we could provide a name of who are the licensees in our state. We couldn't provide private information but we could – and I guess I see that a little bit different than saying this is a clearinghouse of people that want to offer it up for sale. I don't understand why there would be a problem with just offering the names of people that have the allocations. Dan.

MR. McKIERNAN: This conversation is really interesting and it is going to have to go on especially when Mike Cahall gives his presentation, about the data base, but can I call the question at this time. I think the things we are talking about need further discussion but just not at this point.

CHAIRMAN GROUT: I agree; we kind of got off the track here on how this applied to the motion. Did you want to make one final comment on the motion?

MR. MICHAEL PENTONY: For those who don't know me, I'm Mike Pentony with NMFS Northeast Regional Office. I just had one question and two concerns about the motion. The first question is in Option 3, Section 3.2, there is an assumption that NMFS will publish a control date that will form the framework for this action in determining who is grandfathered in and who is not, but there is no backstop if the agency doesn't publish a control date. I was just wondering if the board wants to entertain a backstop or just assume that we will publish the control date.

CHAIRMAN GROUT: Do you want to answer that question?

MR. McKIERNAN: Yes; I intended to follow up with another motion after this asking NMFS to enact a control date.

MR. PENTONY: My first concern is that because we have not yet published a control date – although obviously if the board requests it, we

will entertain that, but obviously any control date will be published some time in the future. It could be a month, two months, three months, depending on our ability to follow through on that.

Has the board given any consideration to the implications to the market for permits between today when the board would take this action as final action and when we publish the control date that then determines who is grandfathered in and who is not? I do have some concerns about the potential implications to the permit market for the timing of those two actions.

The second concern that I have is with the – I think there is an assumption embedded in this document that we can clearly identify individual firms and entities to then assign ownership of permits and trap allocations, too. I can tell you that in almost all of our fisheries we are struggling significantly with identifying individual entities because of how the ownership of permits and vessels can be very, very convoluted with multiple owners owning multiple pieces of multiple vessels.

We have no information on ownership share; so if two individuals own a vessel and a permit, it might be a 90 percent/10 percent allocation as far as control, but we have none of that information so we could assume a 50/50 percent, which may not be appropriate or fair. When we get into the weeds on implementing this type of action where we are setting up ownership caps across entities, that is when things are going to get very, very complicated as we try to identify who all the actual entities and individuals are and how we would assign those ownership shares to those entities and individuals. I just raise that as a concern to the board that this is a very complicated system that you're proposing.

CHAIRMAN GROUT: I think in addressing the last part, the way the addendum is written, if a person has their name on any corporation or business entity, that would be considered – he would be considered an owner regardless at what percentage he owned of it. Mike.

MR. PENTONY: Yes, I mean, obviously, if a person's name is on the record as being an owner, they're presumed to be an owner. The difficulty is – I hate to get into examples, but maybe it would clarify. Two individuals jointly own a vessel and a permit is associated with that vessel. One of those individuals also jointly owns a vessel and a permit with a third individual. Do we treat those three as a single entity because there is co-ownership among them? Do we treat them as two separate entities based on the vessel and the permit associated with that vessel; but then we have to split up – but then how do we determine the ownership since there is a common owner between the two entities?

We have to determine how allocate ownership rights and caps to that individual or do we treat them as three different individuals and just divvy up the permits and trap allocations among the three? That is just one very simple example. There are layers and layers of ownership and entities among common owners and common interests out there that we have to navigate in order to assign these ownership caps and track the allocations if we are to implement this effectively.

MS. KERNS: I just wanted to go back to Mike's first point about the control date; for what we would do if the control date was a couple of months down the road instead of today. I just want to remind the board that for Area 3 we already have what we call an anti-monopoly clause where if an individual didn't have more than five permits before 2003, then they couldn't carry that forward.

That doesn't mean that the commission put in place. I know that is not necessarily something that NOAA has put in place, but it is rules that we do have in our regulations; and the states that give out there permits for federal waters to their state fishermen have been upholding those rules because I think is in Addendum VI.

MR. BORDEN: A process issue, Mr. Chairman. Dan McKiernan had suggested that the discussion is really appropriate to the presentation that Mike Cahall is going to give

and provide us. My preference would be to postpone further discussion on it until we first hear from Mike, who I'm sure is probably going to enlighten us as to how some of these issues are going to be handled. I'd like to call the question.

CHAIRMAN GROUT: Okay, the question has been called.

MR. AUGUSTINE: Point of order, Mr. Chairman. I'm concerned that we make this motion and pass it without hearing this report; so I would move to temporarily table this motion until that report. Can we do that or not and will it have a direct impact on the outcome of this vote?

CHAIRMAN GROUT: These issues aren't really tied together with the motion that's up on the board.

MR. AUGUSTINE: Well, there are enough questions that have been raised by NOAA that we're concerned as to how to vote on this thing. There are enough wrinkles here that leave one to wonder – the lobster fishery is probably one of the most complicated plans that we have had. This seems to make it more complicated, and it is going to affect us like everybody else.

I would like to hear more debate around the room before we call the question, Mr. Chairman. This is another one of those scary ones where we're doing something that there is just a lot of gray area, and I understand what we're trying to do. I was willing to make the motion early on, so I'll leave to the other board members. Thank you.

CHAIRMAN GROUT: Okay, we're getting into a discussion after the question was called, and then you were talking about tabling this after the question has been called. I don't think that's a point of order that you can make. All right, another point of order, Mr. Abbott.

MR. DENNIS ABBOTT: Well, the point of order is you can't call the question while heated debate is going on and while people are interested in stating their views. To Pat Augustine, he feels that we need more information before we vote, and he is asking that we hear from Mike Cahall, which would be proper.

You vote to limit the debate if you wish, if you don't want to go on and vote, but for just a board member, my friend, David Borden saying let's call the question while other people are still seeking information that will make their vote clearer, then it's not correct to take a vote. I agree with Pat Augustine that it isn't a big deal to table this for a few moments while we obtain additional information which might obviously be helpful in us making a final decision.

CHAIRMAN GROUT: I will turn to Toni, but I believe the point that we're making here is that when he gets this information that Mike is going to provide is not going to be pertinent to this particular motion here. You may believe it is, but it's not going to. Toni, go ahead.

MS. KERNS: The discussion that we'll have with Mike is talking about the use of the data base. The discussion that we were just having that Mike Pentony brought up was about the aggregate caps, and the data base discussion will not get into control dates or the aggregate ownership cap. It is not going to enlighten you for the use of this motion that is on the table. I would recommend that you move forward with your motion.

MR. AUGUSTINE: Very quickly, Mr. Chairman, to that point, that's the issue. There were some raised questions as a result of the response from Mike, and now I'm more concerned that we just go ahead and slam-dunk this thing and approve it knowing full well we're not going to have full disclosure as to who has ownership and so on.

We're going down that road and that was my concern; and what Mr. Borden had said led me to believe that maybe if we would have had this report, it would have been helpful. Obviously not now, so it keeps that big cloud over this action as to whether we're really going in the right direction. We have no control date – I'm sorry, we're past debate; we've called the

question. That was my point, Mr. Chairman, and I thank you for that.

MR. McKIERNAN: Many years ago we adopted an addendum that limited the number of permits that an entity can hold to five in Area 3 with grandfathered in anyone who held more than five prior to that date. I think that has largely been unenforced by NMFS. I don't believe that they have been policing the ownership of those permits consistent with the ASMFC Rule.

We're not actually doing anything that changes that. We're simply changing another ASMFC Rule that at some point we do need NMFS to address this because it is a long-standing rule that entities shouldn't own more than some number.

What we're doing today is we're saying, okay, for anybody who has more than that magic number five, once trap transferability starts, yes, if they have seven permits they can go up to the trap limit of those seven permits. I understand Pat's concerns; I understand all the concerns, but I just don't think that it is direct to this motion. I think it is a little bit off the mark in terms of the concern. Having said all that, we do have to deal with the complications of ownership and corporate entities, and it is very complicated.

To Toni's point, most of our permit holders in states are issued to individuals. The permits are issued to individuals so we could police that; but when it comes to the Area 3 fleet, they're all federal permits, most of them are corporations. We don't necessarily look into another state's corporate records to see who in Rhode Island has Area 3 permits, but at some point the larger regulatory entity, NFMS, might need to do that. I understand Mike's concerns that it is time-consuming and difficult, but we have to get to that, but it's not part of this action.

CHAIRMAN GROUT: Okay, is there further discussion on this? I know you want to call the question, but if you'd like to limit the debate. Is there any further discussion on this? Dave.

MR. SIMPSON: Yes, just quickly to say I think we all knew that this was a lot harder to implement than to talk about. With that understanding, we're striving for this and I'm fine with it.

CHAIRMAN GROUT: Okay, let's vote on this question. I'll give you a minute to caucus and this will be a roll call vote. This is a final action so this will be a roll call vote.

(Whereupon, a caucus was held.)

EXECUTIVE DIRECTOR ROBERT E. BEAL: Mr. Chairman, I think the cleanest thing to do would be to approve all the pieces of the addendum through regular votes and not roll call votes; and then at the end have one final motion that approves the addendum with all the provisions in the previous motions and the vote on that final motion would be a roll call vote. It is probably the cleanest and easiest way.

CHAIRMAN GROUT: Thank you for that clarification; so this will not be a roll call vote. This will be a raise-your-hand vote. All those in favor of this motion raise your hand; all those opposed; abstentions; null votes. **The motion carries nine to zero to one to zero. The motion carries.** You had another motion, Dan, for a control date.

MR. McKIERNAN: **I do; a motion to request NMFS to enact a control date of today, October 28, 2013, or alternatively the earliest date possible after this date to establish a time certain after which a single person, company or entity may no longer be able to purchase additional permits or trap allocation in excess of the limits established in Addendum XXII. This is designed to affect those permit holders who hold Area 3 allocation**.

CHAIRMAN GROUT: Second by Ritchie White. Is there discussion on this motion? Mike, would you like to come up?

MR. PENTONY: I just wanted to advise the board that typically when we publish a control date, the control date is effective as of the date of publication in the Federal Register.

CHAIRMAN GROUT: Thank you, Mike, for reminding us of that, and I think that's incorporated into your motion. Craig Miner.

REPRESENTATIVE CRAIG A. MINER: Just as a clarification; would the purchase of additional permits be different from an individual's purchase of a permit if they were new? The point of my question is, is this fishery in essence closed to new participants or would that still be allowed? It would just be the accumulation of additional permits that would not be allowed after that date if you weren't in the fishery?

CHAIRMAN GROUT: The latter. Yes, you would have to purchase a permit that is already out there. Okay, is there further discussion? Are you ready to vote on this? Do you need time to caucus? I'm not seeing anybody raise their hand. Okay, all those in favor of this motion raise your hand; all those opposed; abstentions; null votes.

The motion carries nine to zero to one to zero. Now we need a motion an implementation date for this. Remember in Addendum XXI we had an implementation date of November 1st and I thought that might be a little bit quick for this. Does any have an implementation date they'd like to suggest for this? Bill.

MR. WILLIAM A. ADLER: Mr. Chairman, I'd like to ask like, for instance, the federal service will work on its own, I assume, so I would just want to think that not rather than throwing a date or when you throw a date out there, that everybody will have to have when they can do it.

MS. KERNS: If folks remember when we did Addendum XX, I think it was, the implementation was tied to the onset of transferability and NMFS being able to enact that rule for transferability, so that the states didn't start reducing traps before traps had been allocated by the federal government and started transferability. We could do something similar here, recognizing that this addendum has all basically recommendations to NOAA Fisheries so that if the states have any regulations listed, then you would want to go ahead and change those in your rule-making process.

Several states just state that your regulations are consistent with those identified in Addendum I through whatever number we're at; and so you don't actually put regulations in place for Area 3 fishermen. It depends on the state. We could just tie it to the implementation of transferability by NOAA Fisheries if we need to.

CHAIRMAN GROUT: Would anybody like to make that motion?

MR. McKIERNAN: **I move that the implementation date of Addendum XXII be tied to the onset of transferability among state and federal permits after the creation of the data base to accommodate all transfers.**

MR. BORDEN: Second.

CHAIRMAN GROUT: There is a second and I just have a question for Toni; and that is if this is the implementation date at the onset of transferability, how does that affect our request of NMFS to implement a control date?

MS. KERNS: I think you can have different provisions of the addendum move forward without having the date be the same. Again, I only made that recommendation in the sense that, for example, in Addendum XX we had these trap reductions that we didn't want to actively start happening until traps had been allocated. Folks were starting to get their rulemaking done and in process, but they didn't actually put it a go until those allocations occurred. That was why I was trying to tie it to the onset of transferability, but that states could go ahead and get it ready to go.

CHAIRMAN GROUT: So this implementation date then would be implementation of state rules, but the addendum is going to be officially approved here, conceivably, at this date.

MS. KERNS: Correct.

CHAIRMAN GROUT: Okay, is there further discussion on this motion? Thank you for that

clarification. Seeing no discussion; are you folks ready to vote on this? Seeing no objection, everybody in favor of this motion raise your hand; all those opposed raise your hand; abstentions; null votes. **The motion carries nine to zero to one**. Now we need a motion to approve Addendum XXII as modified today. Bill Adler.

MR. ADLER**: I'll make that; approve the addendum as modified today**.

CHAIRMAN GROUT: Is there a second; Steve Train. Since we've had nine to zero to one votes, I'm going to ask are there any objections – okay, I will read the motion, but keep in mind what I was going to do was ask for any objections as opposed to going to a roll call; and then if the federal services want to abstain, we'll put that on the record. Okay, move to approve Addendum XXII as modified today. The motion was made by Mr. Adler and seconded by Mr. Train. Is there any motion to this motion? Yes, Peter.

MR. BURNS: I will abstain from the vote, please.

CHAIRMAN GROUT: So seeing no objections except for one abstention by the Service**, this is passed.**

CONSIDER DRAFT ADDENDUM XXIII FOR PUBLIC COMMENT

CHAIRMAN GROUT: All right, the next agenda item is to consider Draft Addendum XXIII for public comment, and Kate Taylor has a presentation on this.

MS. TAYLOR: Draft Addendum XXIII is a habitat addendum. Our Habitat Committee has set priorities to update the habitat sections for our species FMPs. The habitat addendum contains habitat components, which are those elements that play a vital role in the reproduction, growth and sustainability of fisheries by providing shelter and feeding and spawning and nursery grounds for lobsters to survive.

This includes the recommendations for temperature, salinity, dissolved oxygen, pH, and other habitat components that are important to lobsters. For each of these components, a description of the summary of the requirements, tolerances and potential effects n lobsters is described for the early life stages, juveniles and adults.

It also includes impacts to these components and their effects. This includes the anthropogenic and ecological impacts associated with dredging and dumping, transportation projects, pollution and water quality, commercial fishing. It also includes impacts associated with climate change. There are also sections on habitat bottlenecks and habitat enhancements. The addendum makes recommendations for further research on habitat improvements and recommendations for monitoring and managing lobster habitats. Thank you, Mr. Chairman.

MR. ADLER: Mr. Chairman, when I first read this over, I said, okay, so what; what does this do; there are no options. Dan McKiernan did explain to me why. I was just wondering usually there is a section in an addendum that says, well, background, and it says something like statement of a problem. Usually it has something like that in there.

I was just trying to picture somebody at a public hearing going okay, yup, yup, yup, that's great; agree with that, agree with that; and so what! I just didn't know if – I didn't see that in here, a section at the very beginning. It simply says we're trying to update our information on all of these things for our records, I guess. Am I reading this correctly?

MS. TAYLOR: No; this is an addendum that just updates the habitat sections. The board has previously passed habitat addendums for sturgeon and red drum. There are no management options; and for the public comment period we have not had any public hearings held on these addendums. We just state that there no management options under consideration in the addendum; it is just for updating the necessary sections for FMPs.

MR. ADLER: Yes; I understand that. It is just normally – and I think that's good and I'm in favor of it. It is just that usually there a little paragraph that says we're doing this and there are no management options. Usually there is something in there.

MS. TAYLOR: We can add text in to make sure that is very clear to the beginning of the document.

MR. AUGUSTINE: This is an excellent report to add to that. I think what Bill is getting to is basically what I was looking at. At the tail end of it, about Page 22 and 23, actually Page 17 and under – I'm sorry, Page 21, 1.7, recommendations for further habitat research. I wonder if you could eke out two or three key items that might be brought as clear recommendations for the board to take action in the future.

You define what some of the issues are that should be looked at, but I'm just wondering if maybe a couple of bullets that would lead us in that direction as a clear statement. You're saying what we could do as recommendations, and I'm saying what in bullet form so the reader will say, "Gee, whiz, you're right. This is a great document, it updates our habitat, but it doesn't really clearly tell me where we want to go."

MR. ADAM NOWALSKY: Similar to what Bill was mentioning, I didn't see a specified board initiation for this addendum in the document; so would it be useful to include something in here so that the public would understand how this was initiated; if not through specific board action, as a result of something out of the Habitat Committee or from a process perspective so the public would know what the origin of this addendum was. Typically we move to initiate an addendum at a board meeting. I don't believe that was the process with this. I think it would be helpful to offer that information.

MS. KERNS: These habitat addenda are prioritized via the Habitat Committee. Next year we're doing a sciaenid document. The Policy Board approved the ability to do this. We can put it in the beginning where we describe what the document contains and how to do public comment on it, so we can that it was initiated through the Habitat Committee. It is some that we will continue to do for all of our species that we update the habitat sections.

The recommendations that are in here do come from the Habitat Committee, so I don't think we want to limit the number of recommendations that are included in the document. If boards want the Habitat Committee to prioritize those recommendations, we can go back to the Habitat Committee and ask them to do so, but I think it's important that we keep all of the recommendations in the document.

MR. SIMPSON: I just want to say this is a really good report, a lot of good information in it. There were a couple of other potential references to add. I hope I can do those in the next week or two. There was a nice study that Linda Alexander did on food habits of larval lobsters and things like that that would be good to include.

CHAIRMAN GROUT: I think that will be wonderful if you can add those. You can send those to Kate. Is there any other discussion on this? What we need is a motion to approve this for public comment. Pat.

MR. AUGUSTINE: **Mr. Chairman, I move that the Draft Addendum XXIII to the American Lobster Management Plan be approved for public comment.**

CHAIRMAN GROUT: Seconded by Pat Keliher. Is there further discussion? Okay, we'll vote on this. All states and jurisdictions in favor raise your hand. **The motion carries unanimously**.

REVIEW OF LOBSTER TRAP TRANSFERABILITY DATA BASE PROGRESS

CHAIRMAN GROUT: The next item on the agenda is Mike Cahall. He will have a

presentation on progress of the Lobster Trap Transferability Data Base.

MR. MICHAEL CAHALL: Hopefully, I will able to answer some of your questions and hopefully we won't raise anymore than we answer. We did come up with a catchy acronym, which will be Lobstahs for Lobster Trap Allocation History System, LOBSTAHS – sorry, folks, I'm from Maryland. We thought that would get a rise out of you.

We have a working group that is put together composed of representatives of all the folks that are currently involved in transferability; of course, Massachusetts, Rhode Island, Connecticut, NOAA Fisheries and the commission. We have been meeting over the course of the last several months via conference call.

At this point I think we're up to five or six – it's a lot of calls – to try and work through what everyone's expectations of the system is and also what kind of business processes we need to establish as we work through it. One of the issues was that really the concept of transferability was pretty well understood. The mechanism of transferability and the business practices that you have to put in place to make it work were not.

There was a lot of discussion back and forth on how we would go about doing business and the work that needs to be accomplished for everyone to work together. The basic premise of a transfer is relatively straightforward, but then a side issue as how; how do you notify everyone else. If your permit holder holds permits in another jurisdiction; does that person need to be notified, does that jurisdiction need to approve the transfer, those sorts of things.

Then do you get more into the multiple jurisdictions, especially when you're starting to tie them together, the federal permits, and that still isn't a hundred percent determined. As we sort of started talking about it, most of the program partners weren't really ready to put this into a system yet. The interaction between the program partners, as I said before, hadn't been a hundred percent established.

In general most of the regulations weren't ready; so what we did was we decided that we would scale back the initial system. We started to look at what then the basic requirements are. The system will track current and past allocations. It will allow transfers between permit holders; and in its current incarnation it will allow transfers between permit holders in the same jurisdiction.

It will connect federal vessel and state fishermen permits. This is the so-called dual permit. We're going to using the SAFIS data base structures as they already exist. One of the advantages of putting the system into SAFIS is that it will connect to our existing permitting records; and it will also require that the permit records for each jurisdiction be correct, accurate and kept up to date, which has always been an ongoing problem working in the system.

The permitting records are used by the dealers and commercial fishermen as part of their selection criteria and making sure that all of the records line up correctly; especially for any of you who work with this data much has always been an ongoing problem. Having it connect into the existing SAFIS data base will help resolve some of that.

It will also allow us to have a pretty quick read on how effective your management measures have been since almost all of the landings that are associated with these permits come in through SAFIS one way or the other. Just to show you a little bit of what the basic system screens look like, this is an allocation screen. This is our standard transfer screen as it is currently envisioned.

It is just a snapshot of the prototype and it basically shows you the process that you follow on the left side. Down the left alley is basically the process that you follow to initiate the transfers. The way the system is currently designed, it is set up as an administrative system so that there is no ability for the fishing public to log into it.

It is designed to be used by state or federal level administrators who know who is whom and who knows what the rules are. Basically, as you see just down the left alley, you select who your seller is, you select who is receiving it. You process it and confirm the transaction. In addition, what it will do is it will notify any other jurisdiction that has an interest in the particular transaction that a transaction is pending.

In its initial incarnation it will require them to go through all of the folks. In later incarnations, once we have our rules straightened a little bit better, it may just send out an informational message. Basically what happens in this particular case, if this gentleman has a permit in another jurisdiction, the jurisdictional administrator will be notified in that process.

The transaction cannot be completed until it is approved by the other administrator. That way everybody knows what is going on and it prevents surprises. One of the big discussions was making sure everybody was able to see what was going on. At least at the beginning we decided this was the best way to go ahead and move forward with that.

Now, keep in mind this is a prototype screen. This particular version of the system is about to be dissembled because the basic data base designed required some modifications based on our most recent discussions, but this is basically how it's going to look. We'll probably use the same look and feel even when we design it against the new data base. In addition, we've had a round of what do you need out of the system, what kind of reporting does it need to be able to provide.

It will be able to provide you partner-specific allocations, and we'll probably build several reports that do that, that show who has how many allocations or how much allocation is set in each of the lobster management areas. We may be able to do some forecasting so if you cut it X percent, this is what it's going to look like and that sort of thing.

But, number one on everybody's list was I need to know who has what where, and that's essentially what this is. In addition, right now this system will not limit the view. If you log in as Connecticut and you want to see who is doing what in Rhode Island, you're going to be able to. We have worked through some of the confidentiality issues; most specifically with Connecticut, who is not allowed to release their records to the public.

We're going to allow the administrators for the other jurisdictions access to those records. The next piece, it will provide a complete permit and allocation history. This required a little bit of doing because we had to create an entity that is the allocation. Because the allocations can move so much, it is going to be a little bit of wizardry to make sure that we're able to do that; because as I heard several times, this is a very complicated fishery and it is very difficult to automate.

Then finally we'll allow complete allocation views so you could see what a particular individual has across multiple jurisdictions or a particular vessel. Although right now none of the states are permitting the vessels, we will be associating state vessels with the state fishermen permits. This is just a quick look at one of the reports that we've got.

Basically this is a transfer document, and this shows what a transfer looks like. Then at the very bottom it shows that you have a pending transfer that is waiting. This is the transfer history on this particular individual. There will be many, many of these. Again, this built on the current prototype and we're in the midst of overhauling that.

We actually expect to promulgate a new data base design next week, and then we'll be building new objects on top of that. After a good bit of discussion, we've decided that we're going to pilot the system in Massachusetts. Massachusetts is the most ready. They have the regulations in place. The folks in Massachusetts are very familiar with the SAFIS data base, and it should be relatively easy to bring in their permits and their allocations.

After we get Massachusetts data up, they'll begin to do transfers within Massachusetts initially. Connecticut may be providing some data on the first round. They may not be actually executing the transfers, but the data will be available in the system so that folks can see across this jurisdiction.

Currently this is our timeline. As I said before, we'll be promulgating the data base design in the next couple days. Then after that we'll start building the objects, the screens on top of that. Massachusetts is planning to deliver their allocation data by November 15th using a standard transfer format that we have developed.

It is very similar to the one that is used to bring in participants and permits into the SAFIS system now. We expect to have the pilot system available in mid-December. The bug fixes obviously are going to happen as they're needed. We expect it to be buggy; they always are when we first roll it out. We'll do more comprehensive systems' reviews prior to new loads or the season seasons.

So probably mid to late summer in 2014 we'll go through the whole thing and make sure that it's doing what folks want and plan on making modifications as needed. Again, we'll look at where we are in early calendar 2015 so that we know that we're actually taking care of business. Obviously, we'll add additional agencies as they get ready.

I don't have a timeline for that specifically because most of you are not a hundred percent sure when your regulations are going to be published and put into effect. The same is the case for NMFS NERO at this point. I can't build the system based on business rules that don't exist; and so we have to have – and I know the regulations are often tinkered on their way into becoming final. We want to be sure that we correctly automate the rules.

This has always been one of the hangups, well, I need the system; but we need the rules; but I need the system; but we need the rules and so get a chicken and egg kind of thing. Basically we've decided to go ahead and deploy a fairly simple default system and then expand it as we need to, as folks come into the system.

The NOAA Fisheries integration is going to be a little more complicated because we have to be able to correctly link them with the existing state permits; but again our data base design will cover this. We've got a mechanism built into the system to link the state permits with the federal permits.

As I said before, possibly we're going to expand this into other states. I've talked to a few of you already before the meeting and we're looking at bringing in some additional states as we move forward. One thing I need to emphasize to this board; changes in the regulations will impact the system. If you make a significant change in the rules, it will have to be built into the system. A good example is this cap that you're dropping 5 percent every year.

It will require some kind of mechanism built into the system so that a system administrator can process that drop; and right now there isn't one. I mean this particular change isn't actually that complex to implement, but you have to keep in mind that it is already a complicated system and that more layers of complexity will make it more difficult to automate, and that tends to cause more mistakes; and also at times it is difficult to interpret the requirements. Most of you have been working with this for a long time and you sort of know it inside and out and backwards; but coming into it cold was an interesting experience. That is where we are right now. Do you have any questions?

CHAIRMAN GROUT: Are there any questions for Mike? Bob Ballou.

MR. BALLOU: Thank you, Mike, for the presentation. I'm trying to understand the sequence starting out with a pilot in Massachusetts followed by other states being able to opt in as soon as they're ready with their regulations. That's what I heard you say. When would be the earliest that other – I assume the pilot needs to commence and conclude first; or, no; that is going to happen parallel with other states being able to opt in?

MR. CAHALL: Yes; essentially we'll pilot the system. We'll work out the bugs with Massachusetts, but the within-state transfers are identical in between the jurisdictions, so there is no reason we can't bring in additional folks as they get ready. I expect Connecticut will be next. I don't have a date yet from John Lake in Rhode Island; but that's the order of the states, I believe.

MR. BALLOU: Well, it's actually on another topic. Mike, I think I heard you say that with regard to confidentiality Connecticut was the only state that did not allow the information to be released publicly. Did I understand you correctly and is it only Connecticut that's a factor here in terms of trying to make this data base more publicly accessible?

MR. CAHALL: Well, there is more than one factor in making the system public. It is my understanding, and I may be incorrect, but Connecticut has very strict regulations of their permitting records. Most of you, your permit records are a public record, and so we can release those to the public.

At that point there is no public face to this system. It is intended to be use at an administrative level. To kind of go past with the discussions you all had a little bit earlier, there is no mechanism in the system – in its current version and in the design specifications that we have that provides for any kind of public interface. I recognize the desire to be able to somehow display potentially available allocation; but at this point that is beyond the scope of the current system.

REPRESENTATIVE WALTER KUMIEGA, III: How would you respond to a freedom of information request?

MR. CAHALL: By sending it back to the state partners. We'll handle it exactly the same way we always handle those sorts of things. We don't own the data that is in the system. The data that is in the system belongs to the partners.

MR. McKIERNAN: I just want to make comment and thank Mike for a great report. If there is any skepticism on the board about why this has taken so long; once we finally got in this, we realized how difficult it was to make these systems compatible. We always talk about NMFS permits vessels and states permit named individuals; and so be it.

But when you then try to manage the entities and you try to line up these two permits to the entity, it is really, really challenging. One of the reasons Massachusetts is not going to deliver the data for another few weeks is because I'm having staff go in and tease out of the federal system the pieces of the records that need to be in the state system.

So specifically if Bill Adler, for instance, has a state permit with us but he also has a federal permit, I want to get Bill Adler's permit information that's in the federal system into the state system so we truly line them up. We haven't had that in the past; and that is part of the administrative challenge. All of the states permit slightly differently. That is their prerogative; but when you try to do something that creates consistency, and for a data base you need consistent formats and consistent protocols. Part of the exercise is to make sure these two independent records are lining up and identifying the same entity.

MR. BEAL: Mike, on your last slide you mentioned that changes in regulations would require changes in the data base; and you had the 5 percent example that was talked about earlier. Can the data base handle that or accommodate that now if the administrators go in and do that manually? It's obviously more labor-intensive, but there is a way under the current framework to implement some of those rules without a whole lot of programming work on your end; is that correct?

MR. CAHALL: Because of the complexity of the rules, we've designed the data base as simply as we could. The more complex your data base design is, the less flexible it becomes. What we've done is we've designed a very simple system that basically does a dual track. It tracks the fisherman on one track and the vessels on a

separate track; and there is not a lot of interaction built into it.

The truth is, yes, absolutely, the administrators will be able to go in and individually reduce everybody's cap by 5 percent if they choose to. If these kinds of transactions are the sorts of things that happen occasionally, it might be worth it to consider adding it. I would expect that this working group is going to continue to exist for the life of the system, and we're going to have to talk about additional requirements over time.

Another consideration is staff time for ACCSP and the costs of doing implementation and making the changes. We got a slug of money a few years ago to build the system; and once we've got it up and running and deployed, that slug of money is gone. If there are significant changes that are required, the board will have to request the commission to go find funding to pay for the changes to the system.

MR. SIMPSON: And just because it has come up a couple times and just to explain in terms of Connecticut's confidentiality rules; if you remember Area 6, 90-some percent of our fishermen fish in, and that's history based allocation. For many fishermen, their trap allocation was based on landings and reported effort in our logbook system.

That data being confidential, the interpretation to this date has been that the trap allocation derived from those logbook calculations, you know, calculated number of traps fished, is also confidential; but I think it is something that we need to overcome whether by statute or regulatory changes so that we can manage the system and address some of the issues that I brought up earlier in the conversation. But who has a permit is currently clearly available public information. It is just their allocation.

CHAIRMAN GROUT: Okay, thank you, Mike; we appreciate that.

UPDATE ON FEDERAL MANAGEMENT ACTIONS

CHAIRMAN GROUT: The next agenda item is we're going to have an update from NOAA Fisheries, Allie Murphy, on the federal management actions that are going on.

MS. ALLISON MURPHY: Thank you, Mr. Chairman, and thank you to the board for the opportunity to be here today and provide you with this update. My name is Allison Murphy, Allie Murphy, and I'm relatively new to working on the Lobster ISFMP. I have been asked to help out Pete Burns while he was works on the much more complex transferability final rule, to work on rulemaking to implement management measures in the Southern New England stock.

As you're all well aware, in 2009 a study indicated that the Southern New England stock was at a low level of abundance and experiencing recruitment failure, which was preventing the stock from rebuilding. The board approved Addendum XVII in February 2012 with the goal of reducing exploitation on the Southern New England by 10 percent.

Addendum XVII included area-specific measures for Areas 2 through 6, which I've got summarized on the next slide. In August 2012 the board approved Addendum XVIII to rescale the fishery to the size of the Southern New England stock through trap reductions in Areas 2 and 3. So, again, I've summarized the measures in Addenda XVII and XVIII on this slide.

V-notching, minimum size and seasonal closures were all included in Addendum XVII. The mandatory v-notching of legal-sized egg-bearing females was approved for Areas 2, 4, and 5 with the caveat that additional seasonal closures may be implemented if v-notching is determined insufficient to meet the conservation objectives.

Second, a minimum size was approved for Area 3; third, seasonal closures were approved for Areas 4 and 5 that included a two-week grace period for the removal of gear from the water. Finally, in Addendum XVIII the board approved

a 50 percent reduction over six years in Area 2 where in Year One there would be a 25 percent reduction followed by 5 percent reductions in Years two through six.

Then in Area 3 an overall 25 percent reduction was approved with 5 percent reductions in each of Years one through five. This past summer we published an advanced notice of proposed rulemaking, seeking comment on these upcoming measures. In total we received four comments generally supporting the action. We also received a few comments on the transferability program, which highlights the interplay between these two programs.

Most of the management measures in that previous slide are relatively easy and straightforward to implement. However, the timing of the trap reductions with trap transferability is a little bit more tricky. On this slide I've tried to display two scenarios; both where a vessel owner with an allocation of 200 traps is attempting to transfer in 30 additional traps.

The resulting allocation depends on the order of implementing trap reductions and trap transferability. Under the first scenario, which is the NMFS preferred scenario, trap reductions would take place first followed by trap transferability. As you can see in the bold at the bottom of the slide, this results in an additional two traps being allocated to that owner over the second scenario.

We intend to discuss both of these scenarios in the upcoming proposed rule. I am here with you today to seek guidance and comment during our upcoming comment period on which alternative you prefer. As for a timeline going forward, we anticipate publishing a proposed rule implementing these measures later this fall and winter, and that would have a 30-day comment period. We expect a final rule to publish some time the winter of 2014.

We expect the mandatory v-notching and minimum size and area closures to be effective for the start of 2014. The effectiveness of the trap reductions would be implemented concurrent with the trap transferability program to mitigate the effects of the trap cuts. I want to thank you for the opportunity to provide you with this update and see if there are any questions.

CHAIRMAN GROUT: Thank you, Allie. Are there any questions for Allie on this? Bob.

MR. BALLOU: I'm curious as to the process for providing commission feedback on the question that was asked regarding the timing of transferability via trap reductions.

CHAIRMAN GROUT: We were just discussing that. Toni.

MS. KERNS: I'm not sure if the board remembers, but we did discuss timing and the reductions that occur in the areas. In board discussions we had stated that the reductions would occur first and then the transfers could be done. When the agencies sent the letters to the individuals telling them how many traps they had in the upcoming fishing year, that trap reduction would already there for the reductions that occur on an annual basis.

During the transferability timeframe, which as everybody remembers is only about a one-time period, they would be using that letter that the state sends out saying these are the number of traps that you'll have for the upcoming fishing year which are available for transfer. For the Area 2 trap reduction, which has the 25 percent reduction from the get-go, that needs to occur first and then transfers can come off of that. That is what we had said.

I think that's even how we worded the motion for how transferability came online, that it was tied to first the allocations, then the reductions and then the transferability. I'll have to go back and double-check that. In terms of how we can provide comments to the National Marine Fisheries Service on this issue, the board can request to the Policy Board to provide comments that are consistent with the management plan that we have in place on this.

MR. PENTONY: Yes, just to clarify in case there is a little confusion. The reason we wanted

to give the board a preview of what we anticipate being in our proposed rule, particularly raising this issue that we were hoping for some additional clarification. Given the timing of things, we expect the proposed rule to publish and the comment period to close before the next scheduled board meeting.

This was essentially a way to preview to the board what will be in the proposed rule – what we anticipate being in the proposed rule; so that if members of the board wished to provide comment, they have an idea of what and when to expect to see our proposed rule.

CHAIRMAN GROUT: As I understand this, the public comment period is going to open and close before our next board meeting. We entertain any further comments now at this board meeting beyond what is in our management plans on this; but if board members want to provide comment in between, once it's published, you could send it to Kate and then we can incorporate that into the commission's comment letter.

We would also need a motion here to request the Policy Board, as I understand it, to provide comments on the proposed rules once they come out. That is sort of our process right now. If you have any comments right now beyond what is in our management plans, provide them now. If you want to provide comments after the rules come out, provide them to Kate. This process here at some point is going to need – if we're going to comment on this at all, we're going to need a motion to the Policy Board requesting that we make comments on this when it comes out. Toni, do you have more?

MS. KERNS: I think that in several boards, sometimes if we're in concurrence that we want to send a letter, you don't actually have to write a motion up on the screen if you don't want to. You can just have agreement that you want to send a letter to the National Marine Fisheries Service commenting on the proposed rule when it comes out. We will send it to the full board to see prior to sending.

CHAIRMAN GROUT: So we wouldn't need to go to the Policy Board with this letter?

MS. KERNS: You do need to go to the Policy Board, but you don't actually have to have the motion here. You can just bring it to the Policy Board as the chairman of the Lobster Board if you don't want to do a motion.

CHAIRMAN GROUT: Is there consensus that we want to comment on this and do you want me to bring this to the Policy Board that we'd like to have a letter written when the rules are published? Yes, Walter.

REPRESENTATIVE KUMIEGA: I have a clarification question. In this example the person who was selling the 30 traps, they would have been subject to the same 5 percent reduction to their allocation; so I don't see how it matters when the reduction – everybody is going to get cut 5 percent, so I'm not sure that I understand what difference it makes when it comes. There is no transfer tax as part of this proposal?

CHAIRMAN GROUT: Yes, there is. Allie; do you want to respond to that?

MS. MURPHY: I think with this example I was just trying to show that one scenario benefits the buyer and one scenario benefits the seller. The first scenario would benefit the buyer, the person continuing in the fishery. I did not factor in any tax here. I was just trying to show a clean example.

MR. ADLER: On this particular scenario, I thought we were trying to put the transferability in before the trap reductions or at the same time. Wasn't that what we were trying to do?

MS. KERNS: We were trying to get it in as soon as possible; but when we went back and looked at the timeframe of how the proposed rule would come out, we knew that the allocations would come out first. Once we did the allocations, then we needed to do those initial reductions to not have as much latent effort come out with the allocations. If you don't take the reduction first, before allowing

transferability, there is latent effort that can be on the table and you could bring more active effort back in. That's why we said we would do the reductions first and then allow the transferability to occur.

MR. BURNS: Mr. Chairman, just to clarify, the board and the industry has made it clear to us that even though we've got transferability as one action and the trap cuts as something different, the trap cuts make transferability that much more immediate and necessary so that the industry will be able to mitigate the impacts of the trap cuts.

That is why, as Allie's slide points out here, we're trying to time these two rules together. We're trying to do them together as best as we can because both of these things are linked. What we're trying to do here is really be able to put both of these things in together, one in consideration of the other. And so as the commission's addendum – I think it's Addendum XVIII says you can have transferability and the trap cuts in the same year. Having the trap cuts first might make a lot more sense because then that allows somebody to be able to transfer traps to mitigate against the impacts of the cuts.

If you have transferability first, some of these people are already going to be at their cap. They are not even going to be able to buy up, so they're only going to be reduced and then they're going have to wait until the following year, because it's going to be an annual process, to be able to buy back; and they'll have to spend that whole year at a lower trap allocation with potential economic problems that go with that.

Our intent here is to try to line these up the best we can, and so we've got our final rule for the trap transferability and for the allocation and qualification process for Area 2 and the Outer Cape underway, which we hope to get in place by the end of the year. Then we'll start our qualification and allocation process for Area 2 and the Outer Cape; and then we'll be able to start developing the process for trap transferability in consideration of the trap cuts that would likely go in lockstep.

MR. McKIERNAN: I think the answer to the question comes in lining up the various deadlines that fishermen and the agencies have for executing any of this. As I understand it, we have a trap transfer application period; we have a permit year period; and we have a trap tag ordering period; and so we have to line all of these three up.

For example, if the transfers have to be submitted by November 1st and the permitting year starts January 1st, the question is when are we going to allow the trap tags to be ordered; because at the very end of all of this is the practical administration of trap tags. We just have to figure out those details.

For Massachusetts, we've been allowing people to order trap tags with their renewals, which can happen as soon as they get their renewal application, such as Thanksgiving or early December.

They can order their tags for the following year, and this has been a real aid in alleviating the bottleneck at Stoffle.

We just have to figure out which of these days are firm and then change our administrative deadline. It seems like the permitting period is somewhat firm; that's January 1st for most states. The trap transfer application period is firm in the addendum, right, or it could be amended. Then it becomes, okay, when are we going to allow the trap tags to be ordered, because that's administrative. I don't have an answer, but those are the three things you have to line up.

CHAIRMAN GROUT: Is there anything else on this item? As I understand it, I didn't see any objections here and we will bring that issue about asking the Policy Board for permission to write a letter on the comment on the proposed rules when they come out. Again, if you have any comments on it, please send them to Kate. Bill.

MR. ADLER: Mr. Chairman, I don't know if this is where it is. I saw "federal" so I immediately pick up my federal piece of paper

here. Is this the place to mention something about the Omnibus Habitat Amendment or should that be somewhere else?

CHAIRMAN GROUT: It's under other business. Okay, that should be it. Thank you very much; and again the Service, I thank you very much for giving us this heads-up. It is very much appreciated because I know it's outside of the rule-making process. Item 8, we had a letter from the National Marine Fisheries Service requesting that the commission work with the state directors and the large whale take reduction team to try and address some gear-marking differences between the different areas.

We had a conference call in July and Kate is going to give a brief review of what went on at that conference call and we're probably going to want to respond to the council's letter to us on this. It will be another request to the Policy Board.

REVIEW OF LOBSTER GEAR-MARKING REGULATION INCONSISTENCIES

MS. TAYLOR: The council had sent a letter to the commission discussing the inconsistencies and related safety concerns of the offshore lobster gear-marking regulations. The council believes that some of the current gear-marking requirements may be unobservable on the water's surface and in some cases are not followed.

Specifically some of these regulations deal with the single buoys for three or less traps; three-foot stick on only one end of the traps and trawls in Massachusetts waters; the use of sinking ground lines that pull surface markers under water; and no middle surface markings for traps in a trawl less than 6,000 feet long.

As the chairman mentioned, state and federal agencies got together for a call and discussed this over the summer. The highlighted concerns were trawlers getting hung up on the gear that is not marked; some inconsistencies dealing with implementation or inability to deal with responding to the inconsistencies between the states and include that Maine regulations within twelve miles are set in statute.

For New Hampshire, they can address landings of fish in federal waters, but cannot do at-sea enforcement. They have seen increased fishing effort in three-plus miles offshore. They do not have mobile gear in territorial waters. It is fixed-gear only in state waters. In Massachusetts, the requirements for fixed-gear fishers to fish buoy lines in federal waters only in order to reduce impacts to whale habitat.

These regulations were previously out to twelve miles, but they were removed so they can only regulate activities in federal waters only if not in conflict with federal regulations. The federal regulations say that you have to rig your gear consistent with the regulations from the state that you're fishing from.

The working group did discuss some recommendations to maybe improve the inconsistencies between the states and potential ways to better have these regulations be consistent. This includes there might be some benefit to synchronizing gear markings either between three to twelve miles or twelve miles plus offshore.

The working group favored talking with the LEC to get more information on the problems and enforceability in the twelve-plus mile zone. The states also discussed that they will try to distribute their gear-marking regulations to the other states to keep the states informed on the dates of any lobster-related meetings where they can disseminate this information so that new fishermen are aware of the regulations that are in place and ensure that the regulations that are in place are being enforced and followed. The next steps would be if there are any additional recommendations to be discussed by the board and potentially send a letter back to the council

CHAIRMAN GROUT: Are there any questions on this or any comments from the states that participated in this and the agency? As I said, my intent would be to put together a draft letter responding to the council with some of the summary of actions that Kate had up in the

previous slide and write a letter back to the council saying this is what we're going to do. Dan.

MR. McKIERNAN: Based on my recollection of the conference call, Terry Stockwell and I thought this would be a good discussion point for either the LCMT or maybe bring it up to like the Maine Fish Forum to get some of the other lobstering areas that are there to talk about coming up with something.

I do think that there is a need for federal regulations in the three to twelve mile zone that are consistent and that people can live with. We amended our rules a few years ago when a certain well-known whale plaintiff tried to make the case that we were responsible for whale entanglements in federal waters because our regulations required buoy lines to be put on lobster gear. We said, no, that's not the case.

That is how we came to have no rules in the three to twelve mile zone, but I clearly there needs to be some kind of consistency. I would be happy to try to coordinate that and maybe take it up to Maine Fish Forum if that is a convenient way to do it.

CHAIRMAN GROUT: Yes, I think that's one, Maine Fish Forum, any lobster meetings, LCMT meetings we wanted to bring that forward. As you said, as far as New Hampshire state rules, the way we're set up we can't make rules for the three to twelve miles right now. All our rules only apply zero to three miles.

MR. McKIERNAN: To follow up, I'd also bring it to Bill's annual weekend. I didn't mean to sell his short.

MR. ADLER: I'm trying to figure out whether the comment is there is not enough buoy marking or there is too much buoy marking. When the whale comes in, we talk about less buoys and yet when you try to see visual you're talking, well, we need more buoys. I was getting confused as to which way they were thinking here.

CHAIRMAN GROUT: Well, clearly when it came to whales, as you know they're looking for less lines. I think what the council was trying to bring forward to us is the concern of mobile gear fishermen not being able to see buoys out in federal waters. Joe.

COLONEL JOSEPH FESSENDEN: The council has a Law Enforcement Committee and we meet quarterly. This issue has been on our agenda a couple of times. You may want to refer it back to that group. Representatives from New Hampshire, Maine, Massachusetts, Rhode Island and Connecticut all attend this meeting. The feds have regulations outside three for marking gear requirements.

Up in Maine it is a huge issue for us because a lot of these requirements require high flyers and most of our fixed-gear fishermen don't use high flyers because they fish relatively inshore. It is not tied to a twelve-mile limit. Basically there is a provision in the federal regulation that requires a certain distance from shore you have to have high flyers and the orientation of gear, how it is set. I know a lot of the smaller draggers there, especially fishermen from New Hampshire that complain regularly about Maine fishermen not marking their gear. It is a law enforcement issue, I think.

CHAIRMAN GROUT: Unless there is any objection to it, I will bring this as another letter that we're going to ask the Policy Board permission to move forward with; just responding the council's letters.

OTHER BUSINESS

CHAIRMAN GROUT: Seeing no objections; we will move on to other business. First of all, Pete, you had a couple items that you wanted to bring up.

MR. HIMCHAK: I will dispense with the easier one first. The lobstermen in New Jersey, all thirty of them, are having second guesses about the closed season they selected under Addendum XVII. That was the phase one of Southern New England rebuilding; 10 percent reduction in exploitation.

We opted for a closed season of February and March in Areas 4 and 5 with mandatory v-notching that was approved by the technical committee and the board. They're thinking that maybe some other season may be more to their liking I guess in 2014. I guess I have two questions.

First of all, is it possible under Addendum XVII to change a season in 2014 without even – I mean, we haven't even evaluated the effect of the initial closure and mandatory v-notching to see if we reached the 10 percent reduction. I have asked ASMFC staff if this is even a possibility. I'm not sure what the answer is but the technical committee would certainly have to get involved in this; and they are so encumbered by the stock assessment at this point that we may be asking an awful of them.

In addition to that, in order for New Jersey to change the closed season in Area 4 and 5, it would impact the states of New York, Delaware, Maryland and Virginia. I'm bringing this up I guess for initial reaction maybe from the board on changing a closed season while we're still essentially evaluating Addendum XVII.

I can speak with the individual state directors during the week to see if in fact – I mean, you're asking five states now to make a regulatory change before next February; and you'd have to get the LCMTs to meet and come up with a common season. It is a heavy lift; but if other states are hearing from their lobstermen that they're not happy with the February/March closure, I'd like to hear that. The ASMFC staff has already told me what I'm up against with the technical committee; and the other state directors, I'll be looking for their advice during the week. That's Issue Number One.

MS. KERNS: I think I have an easy response for you, Pete. That was a conservation equivalency proposal so you could come back with to us with a new season; and I assume it would still be tied to your v-notching. We could have the technical committee evaluate it and we could come back and the board can consider it in February; or, if the board were to choose to do so, they could consider via an electronic vote. Again, it's likely that your approval would be some time in the January or February time period, which would be a short timeframe for all these other states to make changes to their regulations for this coming fishing year. As you said, all the other jurisdictions would also have to change their regulations in time to make this change happen. The addendum does state it is for the entire area and not for individual states for this particular conservation equivalency.

We would not need technical committee review if you came forward with one of the seasons that you proposed in the previous conservation equivalency plan because several seasons were considered. You could do that. We would have to see if we can get some timeframe to prioritize for the technical committee.

We did say that the technical committee's priority would be to work on the assessment and so that would take away from their assessment timing. This summer the technical committee will have to evaluate of the states' conservation equivalency programs and report back to the board in August on how those programs worked for 2013. We'll do that once we have all of the final landings' data for last year. I think you're really highly dependent on the other agencies' ability to promulgate regulations that quickly.

MR. HIMCHAK: Thank you, Toni, and I will individually meet with the other state regulators to see if they do have any intention to change a season and then it it's administratively possible. And if it's not, then we can't do it. I think I have my answers. Issue Number Two, apparently the importation of lobster parts into New Jersey, that sixth tail segment, just before the telson, has to have a 1-1/16th inch measurement.

We put that into effect at least 25 years ago because, again, it was, well, we don't want people mutilating lobsters and bringing in parts. Our lobstermen have to land whole lobsters. Now, what we have found out – and maybe some other states have also – is that we get an awful lot of inquiries about essentially shipping lobster parts into New Jersey for markets; not just the tails but the claws and even the legs.

We did another study on the carapace length versus the measurement of the sixth abdominal segment and did a regression analysis. At the time the 1-1/16th was put in our carapace length was 3-1/4, which is now in the Gulf of Maine, Area 1. What we have decided to do is actually a legal-sized lobster in New Jersey at 3-3/8th should have a corresponding tail segment length of 1-1/8th, so we are making that change by regulation; so if you want to ship lobster tails into New Jersey, our enforcement guys will have new gauges. They will go out and make sure that they are 1-1/8th inches and not 1-1/16th. That is important for other states to know. We should have this in place by January 1st. Are there any questions?

MR. McKIERNAN: This is an issue that I've been working on for about four years in Massachusetts. Maine has made a lot of strides in the processing of lobster parts, and this is all positive for the markets. Furthermore, we have the Canadians who are catching more lobsters in total than we do as the United States. We have the NAFTA Agreements.

There are a lot of really complicated trade issues here. I think in light of what is going on with the striped bass addendums where we're now tagging fish and we're asking the dealers and even the restaurants in some cases to still be having tags. This is a ripe area for ASMFC to start looking at regarding conservation standards and how they start affecting interstate commerce. In Massachusetts I was up against a single legislator, who is very influential, who allowed a law to go forward that limited tails to three ounces.

It didn't allow us to market claws or sell claws at all despite my pleadings and explanation that some of this stuff that is coming into the state is MSC-certified. If the law enforcement officers in a state aren't being challenged by any significant compliance issues about a product, it probably ought not to be regulated. This is a ripe area for the commission.

We tend to stick to the where, the when and the how and who can harvest; but once it's harvested and starts to gets processed, it is a whole different set of stakeholders that we don't necessarily deal with, but we're making rules or individual members are making rules that can be quite burdensome, and I think that we need to look at that.

I would like maybe law enforcement in the future work with the board to talk about standards for possession on some lobster parts. If I had a position from ASMFC that the following should be allowed – and I understand that if you have a different minimum size, then you need to uphold that minimum size in your state for live lobsters; but if it's processed and it's stamped product of Maine, for instance, and you clearly know where it's coming from and it's MSC-certified; does it really make any sense to prevent from going across state lines?

I hope that we can deal with this in the future. I'm glad Pete is making that progress; but when we looked at that particular regulation, we said to our legislature we don't want a sixth segment tail height. It is burdensome on law enforcement and it really doesn't have any positive conservation benefits.

To remind everybody, I think when New Jersey enacted that rule, it was legal to take a tail off of the lobster and come in with a bucket of parts; but the plan now, since the plan was adopted twenty years ago or eighteen years ago, prohibits the landing of parts by lobstermen. The enforcement needs to happen on the water, at the dock, going into the shop and not when it gets into commerce.

MR. PATRICK C. KELIHER: I think for the state of Maine – and I appreciate Dan's comments – I think "burdensome" is the right term here. It becomes a commerce issue; it becomes access to markets. With the expansion of the fishery here and with the expansion of the fishery in Canada, access to markets and the market as a whole becomes incredibly important; and to have states enact rules that become burdensome to other states when it's not about a management issue, it's about chain of custody. When you can show true chain of custody, it shouldn't be an issue as far as legality. I would New Jersey would be able to

work with he commission and work with member states to identify proper chain of custody to not burden other states.

MR. HIMCHAK: Just as a point of the why, the statement of the problem or the background for doing this is that we were getting inundated with an awful lot of calls about shipping a lot of products into the state. If we only have thirty guys that harvest about 900,000 pounds of lobsters and the markets get glutted and they're not making much money as it is, we're doing it for their best interest primarily. Lobsters can still be shipped into New Jersey; they just have to comply with that 1-1/8th measurement.

MR. KELIHER: Then this becomes a commerce issue for commerce across state lines. There could be some federal interactions as far as ability to ship. This doesn't sound like a conservation issue. It sounds like a market issue.

CHAIRMAN GROUT: Okay, is there further discussion this? We have one other item under other business. Dave Borden.

MR. BORDEN: Mr. Chairman, I'll try to be brief in the interest of time. The point I'd like to discuss is Closed Area 2. I think most of the board knows that the commission previously adopted Addendum XX that dealt with this issue. The concern here is that there has been an area that has been closed by the New England Council for groundfish protection reasons for approximately 20 years.

During that last 20 years there has been a sizable offshore lobster fishery that has developed in the area; and it's a seasonal fishery that occurs in that area. There are also sizable numbers of egg-bearing females that are in the area that migrate through the area. The concern that I just want to flag for the board's attention is that both NMFS and the New England Council have various proposals to reopen the area for the mobile gear sector.

The commission addressed the groundfish portion of the concerns by putting a closed season in the area, which the closed season effectively allows the lobster industry to have access to the area for one-third of the year and then they have to get all their gear out of the area; and then the groundfish industry can access the area.

At the point that the area is open to the mobile gear fleet, the majority of the egg-bearing females have migrated through the area, so it's kind of an ideal situation. We allowed both user groups to access the area in order to harvest the available resources. We need the same type of dialogue and discussion and action to take place with the scallop fleet.

We're kind of in an ideal situation in this regard. We've got three members of the commission that serve in a dual capacity as commission representatives, Terry Stockwell, Dave Pierce, Doug Grout. I spoke to Doug about the issue, and he has scheduled this issue on the executive committee meeting of the New England Council.

Since that also includes the council executive director and the regional director of NMFS, I've basically asked them to explore different ways to either resolve the issue or set up a dialogue that promotes a resolution of the issue so that we avoid a gear conflict and impacts on the lobster resource.

I'm just flagging this. If anyone has concerns, I'd be happy to discuss it, but Doug has already taken the action of scheduling it on the executive committee. I'd ask the other representatives who already have duplicate capacities here, Dave Pierce and Terry Stockwell, to support that action. Thank you.

CHAIRMAN GROUT: Thank you very much for that; and as Dave mentioned, our letter that the commission sent to the council after the last meeting is an item on the executive committee's agenda in November. Bill Adler.

MR. ADLER: First of all, back on what Dave was just talking about, if you remember there was an agreement with the ground fishermen in Area 2; but it took the ASMFC to put that agreement in place for the lobster side of the story, which we did. I would assume that

something along that line would probably have to happen again, which is fine. I mean I think that works.

While we're there, the Omnibus Habitat Amendment, I just wanted to mention a couple of things they had mentioned here about possibly closing area. My question was can the federal people close an area to lobstering in federal waters if in the Omnibus Habitat Amendment an area is being closed to lobster fishing. Can they do it?

Now, there have been two things I have listened to; one where they could and the other one they couldn't. First of all, they went and they put some more rules on the Outer Cape fishermen in federal waters that was not part of any addendum that we ever did, but they did it through their federal process without basically running it to us first to do it.

That was one case where they did it. The other side of the picture was they wanted the ASMFC to do an addendum to enforce the Closed Area 2 on the lobster fleet. In one case they said, well, we can't do that you have to; and then on the other side they put more rules in that wasn't in any of our addendums. It is sort of a question if the Omnibus Habitat Amendment does move through and it has closed a lobster area; can they do that or do they have to do it through us?

CHAIRMAN GROUT: I think I know the answer to this, but, Pete, would you like to speak to that or not?

MR. BURNS: It seems like kind of a convoluted question; I'm not quite sure.

CHAIRMAN GROUT: I think the questions is could the National Marine Fisheries Service, on their own through some management process, either the council or the large whale take reduction team – as I remember that example comes to mind and one of the proposed rules put a closed area to lobster traps, prohibit lobster traps in certain areas in federal waters. It certainly seems like they have at least been proposed in the past. Mike looks like he wants to jump right into this. Thank you, Mike.

MR. PENTONY: I can't give you a definitive answer in part because it depends on the management nexus and what the rationale is. If the council is proposing an area to be closed to all fishing and it had a sufficient justification and a rationale as to why any type of fishing gear, fixed, lobster traps, midwater trawl, any type of fishing gear that would undermine the management objectives, then that would be the rationale and we would certainly entertain that for approval.

I can provide some explanation on some of the differences in the actions you've seen in the past. For example, Closed Area 2 was closed to protect spawning aggregations of groundfish, and the gear restrictions were to any gear capable of catching groundfish. Lobster gear was an exempted gear; so during the development of Closed Area 2 and the history of Closed Area 2, lobster gear was not prohibited from Closed Area 2.

To impose restrictions or parameters on lobster fishing in Closed Area 2, we needed to work with the commission to get that through. But if the closure was enacted for other reasons to protect all habitats from any gear that might touch the habitat, then there would be different rationale at play and different considerations given.

CHAIRMAN GROUT: Thank you, Mike; that does clarify things for me. Dave.

MR. BORDEN: Mr. Chairman, I would like to ask Mike a question, if I might, or any other representative from NMFS. I'm just a little bit uncertain how a council as part of the Omnibus Habitat Amendment plans on addressing the issue of gear conflicts. We're in this awkward situation where the council has regulatory authority over groundfish and scallops and the commission has the lead authority over lobsters. I'm just wondering how we link up these regulatory bodies so that we don't end up with a massive gear conflict that might result from opening areas or even closing areas. How is that process going to be worked out by the council?

CHAIRMAN GROUT: Well, that was what I was going to ask at the executive committee meeting, but, Mike, if you want to give us a heads-up.

MR. PENTONY: Well, personally I can't speak for the council. As you all know, the council has independent thought and ability to work through these things. What I can speak to, although I think it's not going to directly answer the question, is the process that the agency would take and the things that we would look at in reviewing any council proposal under the Magnuson Act.

One of the required elements of an FMP or an FMP amendment is a Fishery Impact Statement. If you look at the statute of the Magnuson Act, a Fishery Impact Statement is supposed to look at the potential effects of the proposed action on other fisheries. That seems like a clear opportunity for the council to look at potential gear conflicts that might develop as a result of the changes that are proposed in Habitat Omnibus Amendment.

Because that's a required element of an FMP amendment, it would be something that the agency would look at in reviewing the amendment for compliance with the Magnuson Act and other laws. If there was insufficient consideration to the impacts of the action on the lobster fishery, for example, that would be something that we would have concern with. Therefore, we would encourage the council to give full consideration of those impacts and address them and mitigate them to the extent possible.

ADJOURNMENT

CHAIRMAN GROUT: Is there anything else? Seeing none, I'll take a motion to adjourn.

(Whereupon, the meeting was adjourned at 11:55 o'clock a.m., October 28, 2013.)

Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM XXIII TO THE AMERICAN LOBSTER MANAGEMENT PLAN FOR PUBLIC COMMENT

Habitat Considerations

ASMFC Vision Statement:
Healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015.

November 2013

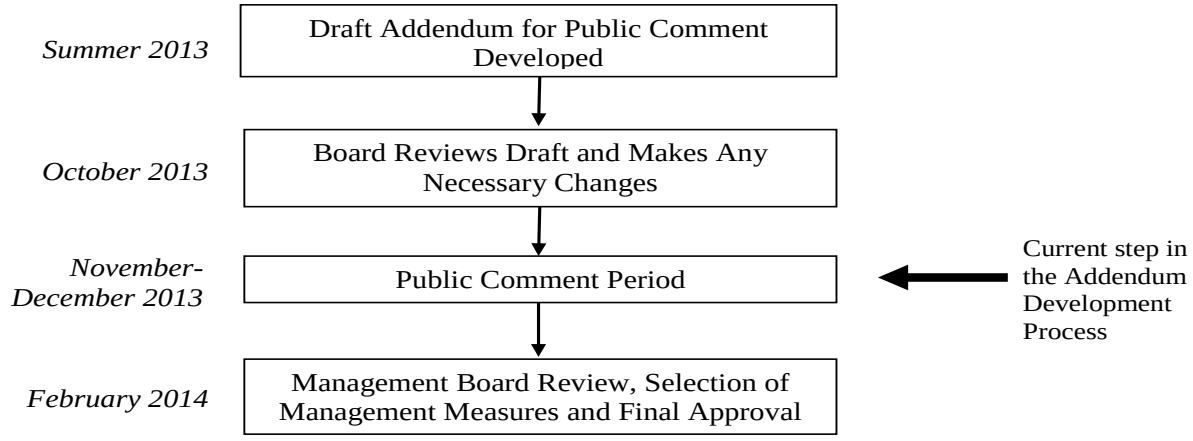
Public Comment Process and Proposed Timeline

This addendum is intended to provide supporting information on American lobster habitat needs and concerns and does not impact current regulatory measures.

The public is encouraged to submit comments regarding this document at any time during the addendum process. The final date comments will be accepted until **5:00 PM (EST) on December 20, 2013.** Comments may be submitted by mail, email, or fax. If you have any questions or would like to submit comment, please use the contact information below.

Mail: Kate Taylor
Atlantic States Marine Fisheries Commission
1050 North Highland Street Suite 200A-N
Arlington, VA 22201

Email: ktaylor@asmfc.org
Phone: (703) 842-0740
Fax:(703)842-0741



1. Habitat Considerations

1.1. Introduction

The Atlantic State Marine Fisheries Commission's (Commission's) involvement in habitat issues has grown with the broadening of fisheries management responsibilities and the evolution of ecosystem-based fishery management. Since 1990, the Fishery Management Plans (FMP) for Commission-managed species have included more specific habitat information and recommendations.

The Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) sets the basis for the regulatory fisheries management program of the Commission, and requires that Commission FMPs include a habitat component. ACFCMA also recognizes habitat impairment as an issue contributing to fisheries declines. In response to this mandate, the Charter developed to guide the Interstate Fisheries Management Program of the Commission directs that "conservation programs and management measures shall be designed to protect fish habitats." The Commission recognizes that habitat protection and conservation are an important component to successful fisheries management.

The mission of the Atlantic States Marine Fisheries Commission's Habitat Program is:

> *To work through the Commission, in cooperation with appropriate agencies and organizations, to enhance and cooperatively manage vital fish habitat for conservation, restoration, and protection, and to support the cooperative management of Commission managed species.*

Although fisheries resources directly depend on habitat, state fisheries agencies generally do not maintain regulatory authority for habitat conservation. However, states can benefit by working on these common habitat problems in a coordinated fashion. One of the primary goals of the Habitat Committee, as identified in its *Habitat Committee Guidance Document (2013)*, is to "identify, enhance, and cooperatively manage vital fish habitat for conservation, restoration, and protection, and supporting the cooperative management of ASMFC and jointly-managed species." Successful conservation of fishery habitat for managed species will depend on the identification, protection, restoration, and promotion of important habitat areas. In order to achieve this goal, the Habitat Committee is responsible for developing and/or updating the habitat sections of Commission's FMPs that will serve as tools for state and federal agencies for protecting fish habitats.

This addendum was initiated by the Habitat Committee in 2012 in order to update the habitat section of the current American Lobster FMP, which was approved in 1997. This addendum is intended to provide supporting information on American lobster habitat needs and concerns and does not impact current regulatory measures.

1.2. Components of Habitat

Habitat components are those elements that play a vital role in the reproduction, growth and sustainability of commercial and recreational fisheries by providing shelter, feeding, spawning, and nursery grounds for lobsters to survive (www.habitat.noaa.gov/index.html). Habitat components include temperature, salinity, dissolved oxygen, pH, light and photoperiod, substrate, oceanographic conditions, and diet (also reviewed in Mercaldo-Allen and Kuropat 1994, ASMFC 1997, 2009). For each component, a description and summary of

habitat requirements, tolerances, and potential effects on lobsters is described for their early-life stages (eggs and larvae), as well as for juveniles and adults. A summary of key biological threshold values is given at the end of this section.

1.2.1. **Temperature**

Temperature is the primary driving force influencing lobster metabolism, activity levels, spawning, development, growth, and possibly life span (Hawkins 1996, ASMFC 1997, 2009). Lobsters of all life-stages are reported to live in areas that range broadly in water temperature from -1ºC to over 25ºC (Aiken and Waddy 1986, ASMFC 1997, 2009). Changes in temperature also have striking effects resulting in at least a two-fold increase in activity (e.g., heart and respiration rates) with each 10°C rise in temperature (i.e., Q_{10} temperature coefficient). Temperature has direct effects on physiological processes such as gas exchange, acid-base regulation, cardiac performance, and protein synthesis among others that can negatively affect these animals under stressful thermal conditions (Whiteley et al. 1997, Table 1).

Degrees Celsius	**-1**	**4**	**10**	**12**	**15**	**20**	**25**
Degrees Fahrenheit	30	39	50	54	59	68	77

Table 1. Temperature range and key values (converted to degrees Fahrenheit) that are relevant to lobster physiology and are provided here as a reference.

Eggs & Larvae

Temperature is the key factor that determines the length of time the eggs are carried and when eggs will hatch (Templeman 1940, Perkins 1972, Aiken and Waddy 1980, Tlusty et al. 2008, Goldstein 2012). Egg hatching typically occurs when surface water temperatures are generally > 12°C (MacKenzie 1988), between June-September but the timing of this event is highly dependent on the region. Closely coupled metabolic rates increase with temperature thereby modulating yolk absorption, growth, and ultimately, the survival of eggs (Pandian 1970, Helluy and Beltz 1991). Although optimal temperatures for lobster egg growth are not fully known, seasonally fluctuating temperatures result in disparate growth patterns and subsequently, differing hatch times (Sibert et al. 2004, Goldstein 2012).

Crustacean egg exposure to either prolonged warm or cold temperatures can have a deleterious effect on the use of their yolk reserves (Garcia-Guerrero et al. 2003, Manush et al. 2006), and it has been suggested that prolonged (more so than average) cold temperatures (< 4°C) negatively affect egg development in *H. americanus* (Waddy and Aiken 1995). However, seasonally changing temperatures, including a refractory period of 'normally' cold (wintertime) seawater temperatures (< 5°C) are important to conserving egg resources for more rapid increases in temperature (> 10°C) that typically occur later in the season and precede hatch (Waddy and Aiken 1995). These kinds of seasonally- fluctuating thermal conditions were simulated in laboratory studies and resulted in egg development that extended well into the spring and early summer (see Table 2 in Perkins 1972, Gendron and Ouellett 2009, Goldstein 2012).

For both lobster eggs and early-stage larvae, lipids are considered a major energy reserve and are also used as structural components of cell membranes that are being formed as they grow (Sasaki et al. 1986). Lipid depletion rates in lobster eggs are directly related to incubation

temperatures. Yolk lipids tend to become catabolized first followed by yolk proteins. These ratios change and can be used to estimate the cost of egg development at differing temperatures (Sasaki et al. 1986). Over prolonged cold temperatures or those conditions in which temperatures are too high for even short periods of time, some crustacean embryos may instead utilize proteins as an energy source if lipids are low due to thermally-induced demands (Conceicao et al. 1998). However, Sasaki et al. (1986) showed that up until Stage IV (post-larval), lobsters depended upon stored capacities of lipids and that these residual lipids may be favorable to settlement processes. Temperature also has a direct influence on the success of egg clutch attachment and even egg retention and loss. Talbot et al. (1984) discovered that elevated winter temperatures prior to spawning have an adverse effect on egg retention. Other laboratory studies implicate elevated temperatures in a significant loss of extruded eggs as well as their attachment to the abdomen, ultimately influencing hatching success (Talbot and Harper 1984). Observations from field data (undocumented to-date) have also seen such a pattern in some areas.

After hatching, young lobsters pass through one pre-larval and four free-swimming larval (zoeal) stages (distinguished by morphological, behavioral, and physiological attributes) before settling to the bottom and molting into juveniles (Hadley 1908, Lawton and Lavalli 1995). All larval stages are normally completed in 25-35 days (Herrick 1895, see Table 1 in Templeman 1940), but their pelagic duration is highly temperature dependent, and it has recently been suggested that it is markedly shorter than previously thought (Annis et al. 2007). MacKenzie (1988) demonstrated via a series of laboratory rearing studies that if larvae hatch at 10°C they can develop successfully through Stages I and II; however, beyond that, warmer water is needed to complete their development to Stage IV and the early benthic juvenile phase, Stage V (4% larval survivorship at 10°C vs. 56% at 12°C larval survivorship, MacKenzie 1988). Similarly, Sastry and Vargo (1977) reported significantly lower survivorship to stage V at 10°C. Harding et al. (1983) also showed that larval hatching usually occurred when water temperatures rose above 12.5°C. This waiting period may optimize development, growth, and survival of larvae. Changes in the thermal environment (e.g., seasonal fluctuations, rates of change) can have significant physiological influence over total time to egg development as well as timing for the postlarval stage to recruit to the fishery (Templeman 1940, Hofmann and Powell 1998, Goldstein 2012).

Juveniles & Adults

Differences in temperature also can influence juvenile growth patterns (e.g., onset of molting in juveniles or the start or spawning in adults) between regions (Little and Watson 2005). Variations among thermal regimes have been documented to influence lobster size at maturity and overall somatic growth (Estrella and McKiernan 1989, Little and Watson 2005, Wahle and Fogarty 2006, Bergeron 2011). There is a strong influence of water temperature on most aspects of lobster reproduction including maturation, spawning, molt cycle, oogenesis and hatching (see Waddy and Aiken 1995 for review). While elevated temperatures accelerate the onset of reproductive maturity, low temperatures tend to delay ovarian maturation (Templeman 1936, Waddy and Aiken 1995).

Adult lobsters respond to small changes in temperature as demonstrated in previous work (e.g., Crossin et al. 1998, Jury and Watson 2000, Childress and Jury 2006), and they respond both behaviorally (e.g., movement) and physiologically (e.g., changes in cardiac cycle) (McLeese and Wilder 1958, Worden et al. 2006). Crossin et al. (1998) showed that lobsters tend to avoid water temperatures below 5°C and above 18°C and exhibit a thermal preference of 15.9°C; this is similar to the value of 16.5°C found by Reynolds and Casterlin (1979).

Recent laboratory work on lobsters in Long Island Sound (LIS) has shown that as water temperature increased beyond a threshold of ~ 20.5°C, the respiration rate of lobsters increased significantly leading to stress (Powers et al. 2004, Dove et al. 2005). Lobsters tend not to be directly stressed by water temperatures below 20ºC as long as oxygen levels are maintained at > 2 mg O_2L^{-1}. Lobsters held at 21ºC and 23ºC had significantly higher respiration rates than those held at 18ºC and 19.5ºC (Powers et al. 2004). McLeese (1956) gave us insight into the survivorship of lobsters subjected to combinations of varying temperatures, dissolved oxygen, and salinity (see Figure 11 in Fogarty et al. 2008), since biological oxygen demand increases as temperatures increase; likewise, oxygen solubility in seawater diminishes. A key point is that lobsters exposed to seawater temperatures below 20ºC are not generally stressed as long as oxygen concentrations remain > 2 mg O_2L^{-1} and, recent work with lobsters in LIS, confirmed that water temperatures > ~ 20.5ºC induced respiratory stress (Powers et al. 2004, Dove et al. 2005). Thus, 20.5ºC appears to be a key physiological threshold value for lobsters in LIS and possibly other areas.

Worden et al. (2006) demonstrated that cardiac performance (heart rate) is strongly modulated by temperature and cardiac output is maximal at 10ºC and decreases significantly > 20ºC. In-tandem with this finding, Camacho et al. (2006) determined that the upper thermal limit for heart function is more than 20°C warmer than body temperature for lobsters acclimated to cold (4°C) temperatures whereas warm (20°C) acclimated lobsters are living within 10°C of their thermal trigger for heart failure at 30°C, suggesting that the threshold for heart failure is affected by acclimation temperature.

Finally, some studies suggest that although a great deal of lobster activity and locomotion is attributed to temperature, not all temperature ranges demonstrate this relationship (Jury et al. 2005, Langley and Watson 2011). McLeese and Wilder (1958) found a positive relationship at temperatures < 10°C, while others found a negative correlation at excessively warmer temperatures, > 20°C (Courchene and Stokesbury 2011).

1.2.2. **Salinity**

Salinity tolerance varies with developmental stage. Charmantier et al. (2001) provides an excellent review of the ecophysiological adaptation by lobsters to salinity throughout the life cycle. In general, the capacity to osmoregulate varies with development when exposed to low salinity. Furthermore, because lobsters can be found inhabiting shallow coastal areas, bays, estuaries and subtidal areas, they are frequently subjected to dramatic fluctuations in salinity (e.g., abnormal spring run-off and large storm events, Jury et al. 1995) where they may be subjected to short-term exposure to wide ranges in salinity.

<u>Eggs & Larvae</u>

The complex morphology of lobster eggs makes them particularly impenetrable to outside fluids (Talbot and Goudeau 1988, Johnson et al. 2011). However, the permeability of lobster eggs increases close to hatch, resulting in an osmotic uptake of water and the rupture of the membrane (Pandian 1970). For the most part, egg membranes act to osmotically buffer the variations of external salinities. Late-stage eggs carried by ovigerous females died within two hours of exposure to 17 ppt but could tolerate 24 ppt for at least 12 hours (Charmantier and Aiken 1987). Larvae seem to be less tolerant of changes in salinity but were found to progress through all Stages of development between 15-17ºC at 17 ppt (Templeman 1936), while Sastry and Vargo (1977) noticed that larval development to Stage V (early juvenile

phase) slowed in salinities above 20 ppt at 15°C and 15 ppt at 20°C. Also, at 20°C, 48 h mortality (LD_{50}) ranged from14-18 ppt in larvae, was maximal at metamorphosis and decreased to approximately 12 ppt in postlarvae; 48 h LD_{50} was ~10 ppt in 1-year-old juveniles (see Table 1 in Charmantier et al. 2001). Therefore 1-year old lobsters appear to tolerate lower salinities better than young-of-year (YOY) animals.

Juveniles & Adults

The energetic demands on juvenile and adult lobsters engaged in osmoregulation influence their distributions and movements, particularly in estuarine habitats (Watson et al. 1999) and their ability to osmoregulate is heavily influenced by temperature (Charmantier et al. 2001). As a result, adult lobsters adopt behavioral strategies to avoid low salinity (Jury et al. 1994a,b, Childress and Jury 2006). For example, adults vacate their shelters at salinities < 12 ppt. Adults prefer higher salinities (20-25 ppt) over lower ones (10-15 ppt) (Jury 1994a). Females appear much more sensitive to reduced salinity and thus males appear to populate certain estuarine waters and bays on a seasonal basis (Jury et al. 1994a,b, Jury and Watson 2012). A detailed examination of the seasonal movements of lobsters into a New Hampshire estuary (Great Bay), showed that movements occurred in the spring when salinities were > 15 ppt (Watson et al. 1999).

1.2.3. **Dissolved Oxygen**

Eggs & Larvae

Studies in brachyuran crabs (*Cancer spp.*) provide direct evidence between active brood care and oxygen provision. For example, it has been shown that oxygen may be a critical factor in some brooding behaviors (egg-fanning, movement) (Baeza and Fernandez 2002, Romero et al. 2010). Because *H. americanus* also exhibits prolonged maternal care of its brood (e.g., ventilation and fanning of eggs), it is probable, but not documented, that ovigerous females require different conditions to successfully maintain egg clutches through to hatch and may select habitats that contain sediments providing a high rate of oxygen exchange (e.g., Dungeness crabs, Stone and O'Clair 2002). For larvae, dissolved oxygen (DO) concentrations < 1.0 mg O_2L^{-1} and pH levels < 5.0 and > 9.0 are lethal (Ennis 1995). Miller et al. (1992) found that larval-stage lobsters appear twice as sensitive as juveniles and adults to reduced DO. However, since larvae are planktonic, spending a good deal of time in the upper portion of the water column, they are apt to encounter continuously sufficient levels of DO.

Juveniles & Adults

Lobsters require more oxygen as water temperature increases and hypoxic waters become more stressful as they warm. The lower lethal oxygen level for juveniles and adults ranged from 0.2 mg O_2L^{-1} at 5°C to 1.2 mg O_2L^{-1} at 25°C in 30 ppt (Harding 1992). A study conducted in Western Long Island Sound (WLIS) showed that in general, the threshold of adult lobsters to critical DO levels is high compared to other marine species (finfish and squid), and these lobsters demonstrated a behavioral avoidance of DO levels < ~2.0 mgL^{-1} (Howell and Simpson 1994). Prior to molting, juveniles and adults become more susceptible and sensitive to low DO as oxygen consumption peaks at molting (Penkoff and Thurberg1982) and molting lobsters have been found to be less resistant to high temperature and low DO and salinity than lobsters during intermolt periods (Waddy et al. 1995).

Other reports document congregations of lobsters in large numbers near the edges of hypoxic zones where DO was > 2 mgL^{-1}. These lobsters moved away from other areas where DO

dropped below 2 mgL^{-1}, thereby concentrating some populations of lobsters in WLIS during a severe hypoxic event in 1999 (see review in Pearce and Balcom 2005). In a series of laboratory-based experiments, Robohm et al. (2005) demonstrated that lobsters exposed to a combination of organics (ammonia, sulfides), normal summer-time temperatures, and low DO became increasingly susceptible to disease (e.g., *Aerococcus viridans*). Similarly, at high water temperatures (24°C) lethal effects on disease-free eastern LIS lobsters were minimal as long as DO was kept high; low DO at 24°C killed 90% of the lobsters in eight days (Draxler et al. 2005).

1.2.4. **pH**

Larvae

Low pH or ocean acidification (OA) resulting from the global increase in atmospheric CO_2 concentration may become an emerging threat to lobsters as has already been documented in the congener *H. gammarus* where Arnold et al. (2009) showed that larvae cultured in acidic seawater exhibited compromised exoskeletons (disruption of the calcification process) and decreased carapace masses. For *H. americanus* Hall and Bowden (2012) investigated the difference in development of newly hatched larvae until 90 days post-hatch when exposed to levels of low pH using morphological analysis, carapace calcification, and molecular expression of immune parameters. Preliminary results indicate that chronic exposure to low pH can have a detrimental impact on larval development. Based on ocean pH levels predicted for 2100, Keppel et al. (2012) studied the effects of reduced seawater pH on the growth (carapace length) and development (time to molt) of *H. americanus* larvae through Stages I-IV and determined that larvae in acidified seawater (pH = 7.7) exhibited a significantly shorter carapace length than those in control (pH = 8.1) seawater at each stage and also took significantly more time to reach each molt than control larvae. Thus, for the few studies we do have data for the effects of OA appear to slow overall development and stunt growth.

Juveniles & Adults

Few studies of OA and its effects on juvenile or adult lobsters have been reported. In European lobster (*Homarus gammarus*) Agnalt et al. (2013) noted deformities in both larvae and juveniles exposed to lower pH at two different temperatures. In *Homarus americanus* juveniles showed increased their calcification by 600% under high CO_2 levels (CO_2 = 2800 µatm) for 60 days but with high mortality rates (Ries et al. 2009). The combination of warmer temperatures and predicted levels of OA, would likely contribute to additional metabolic stress on juvenile lobsters, as seen in the crab *Hyas araneus* (Walther et al. 2010). In longer-term studies the effects of exposure to forecasted levels of OA were examined by Long et al. (2013) on the growth, condition, calcification, and survival of juvenile red king crabs, *Paralithodes camtschaticus*, and Tanner crabs, *Chionoecetes bairdi*. One dramatic result was that 100% mortality of red king crabs was reported after 95 days at a seawater pH of 7.5. Similarly to larval lobsters, there was a noticeable a decrease in survival for both species and may have serious negative impacts in lobsters as well.

1.2.5. **Light & Photoperiod**

Eggs & Larvae

There is evidence to suggest early larval stages are positively phototactic and later stages are capable of vertical migration in the water column (Fogarty 1983). Templeman and Tibbo (1945) noted that Stage III and IV larvae are less sensitive to light levels than early stages. A

minimum light intensity is required to attract larvae to the sea surface but early-stage larvae seek lower depths in bright sunlight (Templeman 1933). Larval survival was found to be higher in low-light environments and larvae cultured in continuous darkness developed faster and were almost twice the weight of larvae grown in a photoperiod of 12:12 light:dark (LD) (Eagles et al. 1986).

Juveniles & Adults

Previous studies have demonstrated that daily rhythms in lobsters are influenced by endogenous circadian clocks, synchronized to natural LD cycles (Lawton and Lavalli 1995). A recent laboratory study by Langley and Watson (2011) found that lobsters are more nocturnal than diurnal and that activity peaks before dawn and after dusk. In addition, the reported presence of a light-sensitive molecule, cryptochrome, in the ventral nerve cord of lobsters suggests that this compound may play a role in lobster orientation and movement (White et al. 2012). For pre-ovigerous adult females, at low temperatures reproduction seems to be regulated by temperature, but at elevated temperatures photoperiod becomes the more overriding factor, especially if winter water temperatures remain elevated (Hedgecock 1983, Aiken and Waddy 1980, 1990). In a field study of LIS lobsters, Weiss (1970) found that light intensity strongly affected burrow occupancy and foraging behavior. Juvenile lobsters usually stayed in their burrows whenever ambient light intensity exceeded 0.04 μWcm^{-2}. Lobsters first emerged from their burrows ~25 min. after sunset at an underwater light intensity of 0.02 μWcm^{-2} from June-November. From December-January, lobsters did not appear until 40 min. after sunset when light intensity was less than that level (Weiss 1970, Lavalli and Lawton 1995).

1.2.6. **Substrate**

Postlarvae

Pre- and postlarval (Stage IV) selection of substrate types are complex processes (Boudreau et al. 1990, Cobb and Wahle 1994, Wahle and Incze 1997). Postlarvae utilize a variety of habitat types (e.g., nearshore rocky areas, offshore canyons, enclosed embayments, estuaries) that differ in their abiotic and biotic features over spatial and temporal scales (Wahle 1993, Wilson 1999, Wahle et al. 2013). Although subtidal cobble beds are largely considered preferred settlement areas (Wahle and Steneck 1991), the plasticity in substrate settlement choice remains broad (Caddy 1986). Howard and Bennett (1979) and Pottle and Elner (1982) found that lobsters tend to choose gravel rather than silt/clay substrates. Cobb et al. (1983) and Able et al. (1988) both found that postlarvae settle rapidly into rock/gravel, macroalgal-covered rock, salt-marsh peat, eelgrass, and seaweed substrates. Barshaw et al. (1985) and Barshaw and Bryant-Rich (1988) observed that postlarval lobster settled quickly into eelgrass, followed by rocks with algae in sand, then mud. In addition, the presence of biologically relevant odor plumes (adult conspecifics and macroalgae) and the existence of a thermocline have been reported to impact postlarval substrate selection especially in shallow habitats (Boudreau et al. 1991, 1993). Wahle et al. (2013) recently documented settled lobsters as deep as 80 m, although most were abundant above the thermocline (typically < 20 m, Boudreau et al. 1992) in summer-stratified regions (e.g., W. Gulf of ME and S. New England); likewise, depth-related differences were diminished in thermally mixed waters. A settlement (time series) index for American lobster has been formally established for lobster nursery habitats in both the northeast US and Atlantic Canada and remains active (see Wahle 2009, Wahle et al. 2013).

Juveniles & Adults

As in larvae, juveniles are distinguished by their ecological ontogeny until functional maturity and adulthood (see Lawton and Lavalli 1995). Lobsters may not leave their burrows until they reach a carapace length (CL) between 20-40 mm (Barshaw and Bryant-Rich 1988). Lobsters in this early benthic phase (5-40 mm CL) were found by Wahle (1988) and Wahle and Steneck (1991) in midcoast Maine to be most abundant in cobble and macroalgal-covered bedrock and rare in featureless mud, sand, or bedrock. Short et al. (2001) found evidence of adolescent lobsters and their preference for eelgrass beds in the lower portion of Great Bay Estuary, NH and reported that in associated mesocosm experiments, lobsters (53-73 mm CL) showed a clear preference for eelgrass over bare mud.

It is difficult to conclude that shelter-providing substrate, cobble in particular, represents a natural demographic bottleneck when juvenile lobsters occur in other substrates (e.g., eelgrass, bedrock, and muds; Addison and Fogarty 1992). However, in the absence of shelter juvenile lobsters require substrate that they can manipulate to form a shelter, especially YOY lobsters (Lawton and Lavalli 1995). The range of habitat types available to juvenile lobsters increases as pressure from predation declines (Lawton and Lavalli 1995) and the need for specific shelter size may be resolved by the lobster's ability to manipulate its environment which can result in the construction of suitable shelter from otherwise uninhabitable substrate. The excavation of shelters under man-made objects is common among juvenile and adult lobsters and may be important on featureless bottom (Cooper and Uzmann 1977).

Finally, Geraldi et al. (2009) determined that lobster movements were influenced by the quality and type of substrates (e.g., rock vs. sand) through which they were moving. Based on tag returns, lobsters that were initially caught and released on sediment moved farther and faster than those initially caught in traps on rocky substrate. Even in some estuarine environments, complex hard-bottom areas between soft-sediment patches (e.g., eelgrass beds) can serve as corridors and passageways for decapod crustaceans engaged in short- or long-term movements (see Micheli and Peterson 1999).

1.2.7. **Oceanography**

Abiotic factors such as tidal fronts, internal wave slicks, turbulence, surface currents, wind and Ekman transport (among many others; reviewed in Shanks 1995) at the time (and site) of hatch set the initial conditions for larval dispersal, and vary depending on the timing of this event (Tlusty et al. 2008, Goldstein 2012). The residence time for lobster larvae in the water column is controlled predominantly by surface water temperatures and, to a lesser extent, by food availability (Phillips and Sastry 1980, Mackenzie 1988, Annis 2005, Annis et al. 2007). These two factors, temperature and food ultimately help to influence their final destination along with intrinsic larval behaviors (e.g., vertical migration and swimming, Harding et al. 1987, Ennis 1995).

In the Gulf of Maine (GoM) there is considerable variation in circulation patterns from year to year. Variations in temperature and volume of water flowing into the GoM (including freshwater input from rivers) along with atmospheric fluctuations (temperature and wind patterns) are all factors that significantly affect the scale and duration of GoM circulation features like water masses (different densities), gyres, and alongshore currents (Mountain and Manning 1994). Various sources and sinks have been suggested for lobster larvae (e.g., wind direction, nutrients, drift; Katz et al. 1994, Incze et al. 2006, Chassé and Miller 2010). Incze and Naime (2000) reported on cross-shelf transport and the ability of larvae to utilize onshore

sea breeze transport towards shore. Recently, Xue et al. (2008) and Incze et al. (2010) identified sources and sinks for 15 coastal areas and modeled larval release and dispersal over a period of four months. The Southern New England (SNE) stock area is characterized by weaker tidal currents than the GoM and Georges Bank, and, as a consequence drift was found to be highly wind dependent, with tidal currents only influencing short term movements. Fogarty (1983) observed peak larval densities following periods of inshore winds in the days preceding sampling in Block Island Sound and identified offshore areas and LIS as larval sources. Lund and Stewart (1970) suggest that relatively high concentrations of larvae in western LIS are a result of surface currents creating a larval retention area.

1.2.8. **Diet**

Larvae

The natural diet of larval and postlarval lobsters includes the wide variety of phytoplankton and zooplankton available to them (Ennis 1995), but, for the most part is relatively unstudied as more diet studies have been conducted in relation to culturing larvae in hatchery-type settings (e.g., Conklin 1995). Unlike the earlier larval stages, Stage IV postlarvae show increased dependence on protein and sequester lipid stores (Ennis 1995).

Juveniles & Adults

Zooplankton has been shown to provide an adequate diet for the growth and survival of shelter restricted juveniles and supplements the diet of emergent phase juveniles (Barshaw 1989, Lavalli 1991). Despite these habitat differences, diet is fairly consistent for emergent and vagile phase juveniles and is dominated by mussels, lobsters, rock crabs (*Cancer spp.*) and gastropods (Weiss 1970). Plants may be actively selected, forming a functional nutritional component of the diet (Weiss 1970, Conklin 1995). Lobsters forage among a wide spectrum of plants and animals that include crustaceans, mollusks, echinoderms, polycheates, and macroalgae. Lobsters are also known to temporally shift their diet depending on season or habitat (Elner and Campbell 1987, Conklin 1995) and are considered keystone predators, capable of driving the trophic dynamics in many benthic communities (Mann and Breen 1972). There is typically peak feeding activity between June and July; feeding activity then remains high in September even as temperatures begin to fall; and females maintain a higher level of feeding activity than males, at least until mid-February (Lawton and Lavalli 1995).

Category	**Life-Stage**	**Threshold Value**	**Reference**
Temperature	Eggs	<5^{o}C winter, 10-12^{o}C hatching	1, 2
	Larvae	10-12^{o}C	2
	Juveniles/Adults	5-18^{o}C, preference ~ 16^{o}C, 20.5^{o}C stressed	3, 4, 5, 6
Salinity	Eggs/Larvae	< 17 ppt	7
	Juveniles/Adults	< 12 ppt	8
Dissolved Oxygen	Larvae	< 1 mgO_2L^{-1}	9
	Juveniles/Adults	< 2 ppm	10
pH	Larvae	< 7.7 (Stages I – IV)	11
	Juveniles/Adults	n/a	

Table 2. A summary of key biological threshold values for *H. americanus.* References: (1) Waddy and Aiken 1995; (2) MacKenzie 1988; (3) Reynolds and Casterlin 1979; (4) Crossin et al. 1998; (5) Dove et al. 2005; (6) Powers et al. 2004; (7) Charmantier et al. 2001; (8) Jury et al. 1994; (9) Ennis 1995; (10) Howell and Simpson 1994; (11) Keppel et al. 2012.

Given the widespread use of baited traps in some areas, it is very likely that these components play a significant role in habitat in some areas. Since many lobsters enter and vacate traps repeatedly (Jury et al. 2001), it is likely that most lobsters feed from traps before they are finally captured. In areas of intense fishing pressure, trap bait may provide a significant energy subsidy, supplementing the natural food resources available on lobster grounds (Lawton and Lavalli 1995, Grabowski et al. 2010).

1.3. Anthropogenic & Ecological Impacts on Lobster Habitat Components

Coastal areas in general attract construction and land and water-based development activities, which in-turn contributes to cumulative impacts on coastal resources, including fisheries. These activities can introduce pollutants (through point and non-point sources), cause changes in water quality (temperature, salinity, dissolved oxygen, suspended solids), modify the physical characteristics of a habitat, or remove/replace the habitat altogether, all of which can result in adverse impacts (particularly near-shore) on American lobsters and their associated resources.

1.3.1. **Dumping & Dredging**

Human activities can have a significant impact on the lobster resource and its environment. Siltation and turbidity from deforestation, poor agricultural practices, urban development, quarrying, dredging, construction, or oil drilling can destroy lobster habitat and adversely affect larval growth, development, and survival (Aiken and Waddy 1986, Harding et al. 1982, Harding 1992).

Ocean dumping has been identified as another major problem for lobster especially when it results in burying gravel beds. "Ocean dumping of silt-clay over gravel may increase spatial competition among juvenile lobsters for shelter in remaining gravel habitat" (Pottle and Elner 1982). Ocean dumping can affect bathymetry, sediment grain size, and trace element concentration disturbing benthic biota and population structure (Aiken and Waddy 1986). The disposal of soft sediments from harbor dredging can directly impact lobster habitat and disrupt food resources; however, the dumping of coarse, uncontaminated material may enhance lobster habitat once it is colonized with prey organisms (Harding 1992). For over 60 years (1924-1986) a marine dump-site off New York in the New York Bight apex (12-mile site) received an annual average of 8 million metric tons of sewage sludge from sewer districts in the New York/New Jersey area (ASMFC 1997). This location, at the head of Hudson Canyon, has been noted for its heavy metal contamination, high fecal coliform counts, “black oozy substrate, and anoxic layer of bottom water”. The area has been largely devoid of fishing practices. An elevated incidence of shell disease in some animals (‘burn spot’, shell disease, or epizootic shell disease, undetermined) and black gill disease was observed in crustaceans collected at this site (Harding 1992).

Since dumping at the 12-mile site ended in 1987, followed by a shift to a deepwater, 106-mile site, studies have shown some improvement in contaminant levels, bacterial counts, and in the low dissolved oxygen readings, which previously characterized the area. However, shortly after dumping began in the 106-mile offshore site, reports by offshore fishermen indicated a high rate of shell disease (or related, see above) in both lobsters and rock crabs in that area and a concurrent decline in landings. As a result, a joint NOAA/EPA Working Group met between 1988 and 1989 to assess if a relationship existed between shell disease prevalence and crustacean population fluctuations, and to determine if shell disease is

pollution-related and if it results in mortality (Sindermann 1996).

The working group concluded that, although mortalities from shell disease have been observed in laboratory or impounded situations, and shell disease may pre-dispose crustaceans to predation or disease-related mortality, there is no conclusive evidence that shell disease causes fluctuations in crustacean populations in the New York Bight apex (ASMFC 1997). Subsequent studies conducted in the 12-mile site have been unable to conclude if improvements in shell disease prevalence have occurred since the sludge dumping was suspended, due to highly variable data.

Dredging and drilling muds also can be toxic at lethal and sublethal concentrations. Pottle and Elner (1982) reported that dredging or smothering of 'nursery areas' occupied by juvenile lobsters could have serious consequences for future recruitment into commercial fishing areas. Potentially lethal components of drilling muds include petroleum hydrocarbons, asphalts, aromatic lignosulphates, heavy metals and calcium-like cations such as barium and strontium. Observed reactions of lobsters to these include, depending on the concentrations, impaired coordination, cessation of feeding, loss of mobility, and death. Inhibition of burrowing behavior of Stage IV and V lobsters has been demonstrated (Mercaldo-Allen and Kuropat 1994). Drilling muds also affect habitat by their tendency to settle in depressions or flow downhill, a particular problem for lobsters whose natural habitat is offshore canyon areas

1.3.2. **Energy & Transportation Projects**

The Federal Energy Policy Act of 2005 allows leases, easements, and rights-of-way for coastal and offshore project activities for "energy-related purposes or for other authorized marine-related purposes," and support for offshore operations and facilities (NMFS 2010). Therefore, there are likely many cases where these present and future activities could impact habitat for lobsters.

Federal offshore areas are also increasingly being used as sites for energy projects, such as wind farms and LNG (liquid-natural gas) terminals (e.g., Neptune and Excelerate offshore LNG facilities, see NMFS 2010) and related infrastructure, such as pipelines. These sites potentially compete with the commercial lobster industry for space and may impact the integrity of certain habitat types for lobster. The implementation of pipeline projects or their related facilities raises concerns about the impact that their placement could have on lobster mobility and lobster habitat. The HubLine natural gas pipeline (29.4 mi long and 24-30" diameter pipe) from Salem/Beverly to Weymouth was constructed by Algonquin Gas Transmission Company in Massachusetts Bay between 2002-2003, and prior to this, Massachusetts Division of Marine Fisheries (MADMF) undertook extensive assessments (commercial lobster sea-sampling, ventless lobster trap monitoring, and early benthic phase lobster suction sampling) to evaluate the impact of these pipeline activities (see Estrella 2009 for details). Results indicated that there was no definitive evidence found that surface-laid pipe or its trench construction blocked the seasonal inshore migration of lobsters.

Wind farm proposals are also becoming more popular and these proposed projects include the establishment of underwater platforms that could potentially influence lobster movement patterns and local current structure thereby influencing larval dispersal patterns, impacting predator-prey interactions, and altering dominant fishing practices. However, additional structures (e.g., submersed platforms) may potentially benefit lobsters with additional

structured habitats. Cape Wind Associates (CWA) proposes to construct a wind farm on Horseshoe Shoal, located between Cape Cod and Nantucket Island in Nantucket Sound, Massachusetts (NMFS 2010). The CWA project would have 130 wind turbines located as close as 4.1 miles off Cape Cod in an area of ~24 mi^2 with the turbines being placed at a minimum of 1/3 of a mile apart. If constructed, theses turbines would preempt other bottom uses in an area similar to oil and natural gas leases. The potential impacts associated with the CWA offshore wind energy project include the construction, operation and removal of turbine platforms and transmission cables; thermal and vibration impacts; and changes to species assemblages within the area from the introduction of vertical structures (NMFS 2010).

1.3.3. **Pollution & Water Quality**

Lobsters are sensitive to chemicals and have been known to vacate areas that have been subjected to pollution. Connor (1972) estimated that larvae are more susceptible than adults. The effects of petroleum products, industrial chemicals, and heavy metals are well published and include reduced survival, molt inhibition, regeneration, malformation, and changes in metabolism, energetics, and behavior (Aiken and Waddy 1986). Other important human activities that may lead to pollution and lobster habitat destruction include landfills, dredging, dumping, industrial wastes, spills and sewage outfalls. Point sources of pollution come from industrial plants, such as pulp and paper mills, fish processing plants, textile mills, metal fabrication and finishing plants, municipal sewage treatment plants, and chemical and electronic factories.

Non-point sources are not as easily located. Rainwater runoff often contains pesticides from agricultural and forested areas along with hydrocarbons, heavy metals and organics from urban areas. It is not unusual for older cities to combine their storm drainage system with the sewer system that results in raw sewage discharges during times of overflow (Lincoln 1998). All of these pollution sources can have a tremendous impact on water quality and habitat preservation. These problems can be multiplied when the contaminants get into the sediments and then are disturbed by dredging. When contaminants are suspended in the water column they become available for uptake by many species (including lobsters) and can accumulate throughout the food chain.

Considerable research has been done on the effects of hydrocarbons and drilling fluids on lobsters (Atema et al. 1982). These studies show that “both the chemical toxicity in the water column and the physical effect of covering the substrate with drilling mud interfere with normal lobster behavior.” For postlarval lobsters, sublethal effects included feeding and molting delays, severe delays in shelter construction, increased walking and swimming difficulties, and lethargy. Atema and others (1982) concluded "perhaps as little as 1 mm (~0.04 inches) covering of drilling mud may cause increased exposure to predators and currents, resulting in the substrate becoming unsuitable for lobster settling and survival."

<u>Pesticides & Heavy Metals</u>

Lobsters are highly sensitive to certain pollutants, particularly pesticides. Organochlorines (e.g., DDT, PCDD, endosulfan, endrin, dieldrin, chlordane), pyrethoid pesticides (e.g., permethrin, cypermethrin, and fenvalerate) and organophosphate pesticides have very low lethal thresholds for lobsters (Mercaldo-Allen and Kuropat 1994). The use of organophosphate pesticides (e.g., emamectin benzoate, azamethiphos) to treat sea lice infestations in aquaculture operations (typically salmonids) have negative impacts on lobsters

as well. Abgrall et al. (2000) investigated the use of azamethiphos in relation to shelter use by juvenile lobsters in the laboratory. Results indicated that lobsters avoided high levels of azamethiphos by vacating their shelters and concluded that although concentrations used in the aquaculture industry (100 μgL^{-1}) are low and would not affect lobster shelter use, mortality would increase due to prolonged exposure time to this pesticide or, indirectly through the susceptibility of leaving a shelter. Waddy et al. (2007) reported that a similar pesticide (emamectin benzoate), added as a prescribed medicated treatment for ectoparasites in salmon feed was capable of disrupting molting in ovigerous lobsters (these animals molted prematurely and lost their eggs), but is not typically consumed at high enough doses (0.6-0.8 $\mu g\ EMBg^{-1}$ was considered high), to elicit such a response. However, the impacts of waste fish feeds and their attractiveness to lobsters in aquaculture operations is something that warrants further research.

Importantly, chemicals used in mosquito control may have volatile effects in some lobster populations. The pesticides malathion, resmethrin, sumithrin, and methoprene elicit negative sub-lethal effects on lobster immune systems and act as endocrine disruptors (from all life-stages). Many of these chemicals were routinely used throughout the New York Metropolitan area to control West Nile Virus and coincided with a mass lobster mortality event in WLIS in 1999 (CTDEP 2000). Subsequent laboratory studies (DeGuise et al. 2005, Zulkosky et al. 2005) have shown that both lobster larvae and adults are sensitive to these compounds however, the concentrations and degree to which these lobsters were exposed is not fully known though modeling research by Landeck-Miller et al. (2005) suggest that concentrations of pesticides in the near bottom waters of LIS during 1999 probably were not high enough to represent stress to lobsters.

Heavy metals such as arsenic, copper, mercury, cadmium, iron, zinc, and lead are toxic at various concentrations and the details of their toxicity throughout all lobster life-stages is given in Mercaldo-Allen and Kuropat Tables 2-29 (1994). Stage I lobster larvae are quite sensitive to heavy metals. Although mortality resulted from test exposures to all three metals, toxicity to mercury was the greatest for first stage larvae followed by copper, then cadmium. Exposure to higher concentrations of copper (56 vs. 30 mgL^{-1}) was necessary for a lethal effect on juveniles and adults. Only sublethal effects were observed in juveniles from significant cadmium contamination while adults were not affected (Mercaldo-Allen and Kuropat 1994). The exposure of lobsters to heavy metals in the laboratory produced sublethal effects including impaired chemoreception and biochemical changes.

Pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), halogenated hydrocarbons, and detergents may not have detrimental effects upon lobsters themselves, but may render them unfit for human consumption. Large quantities of PCBs were discharged by electrical component manufacturers into New Bedford Harbor and the adjacent Acushnet River in Massachusetts over several decades (Weaver 1984). The harbor sediments and biota still contain relatively large concentrations of PCBs that resulted in a significant segment of this estuarine system being closed to commercial lobstering. PCBs and PAHs accumulate quickly in lobster tissues, especially in the hepatopancreas, and can be slow to depurate. Organic chemical exposure interfered with normal behavioral, chemosensory, and physiological processes. Industrial wastes resulted in significant lobster mortality by causing asphyxiation and/or cardiac function (Mercaldo-Allen and Kuropat 1994).

Oil Pollution

Many studies have been conducted on the effects of crude oil on lobsters. Toxicity varies with the level of refinement of oil and the concentration to which the animals are exposed (Mercaldo-Allen and Kuropat 1994). For example, the more highly refined no. 2 fuel oil is more toxic than no. 6 oil. Responses to exposure range from mortality to sublethal effects of chemosensory interference or loss of coordination and equilibrium (Harding 1992). Larval forms are particularly sensitive since oil co-occurs in surface waters with them.

Oil pollution also severely and negatively affects the small food organisms critical to larval lobsters. Larvae which were fed oil contaminated *Artemia* spp. exhibited disruption in energetics (including reduced lipid levels), molting delays, reduced respiration rates, slowed growth rate, and changes in the oxygen/nitrogen ratio (Capuzzo and Lancaster 1981, 1982, Capuzzo et al. 1984, Mercaldo-Allen and Kuropat 1994). Oil pollution also affects lobsters in their adult stages. For example, laboratory studies have indicated that small quantities of crude oil can interfere with specific, perhaps chemosensory, behavior of lobsters. Feeding behavior has been shown in these studies to be affected, with the period between detection and attempted acquisition. Because of changes in feeding and other behaviors, it is possible that crude oil may interfere with the ability of male lobsters to detect sex pheromones released by female lobsters, which could severely interfere with reproductive activity.

Chlorine Toxicity

The effects and impacts of chlorine toxicity are related to the construction (some recent) and operation of chlorinated sewage outfall effluent. A MADMF report (2010) sought to assess if chlorinated sewage treatment plant effluent is having adverse effects on lobster abundance and the hard-bottom habitats utilized by lobster and other marine organisms in Massachusetts Bay and Buzzards Bay. Since 2000, sewage from the Greater Metropolitan Boston area is discharged into Massachusetts Bay through a 9.5-mile outfall pipe terminating in ~100-ft. deep waters. This effluent is discharged through more than 50 diffuser heads spanning the final ~1 mile of the outfall. Prior to 2000, sewage effluent for the Boston Harbor region was released through outfalls within the harbor. In one report (prior to the outfall's completion), Mitchell et al. (1998) concluded, “No impact is expected from residual chlorine in the effluent because after the initial dilution, the concentration of chlorine will be below water quality standards and will likely not be present at detectable levels once discharged”. A second report by Lavalli and Kropp (1998) examined and compared the densities of YOY and shelter-restricted juvenile lobsters at the proposed Mass Bay outfall site prior to the outfall activation. In early September 1998, suction sampling for YOY was conducted at both the vicinity of the outfall and two nearby inshore stations. The data collected showed significantly lower densities of YOY and yearling lobsters as well as larger early-benthic-phase lobsters at the outfall compared to the inshore sites. Lavalli and Kropp's report concluded that, “while the cobble habitat at the vicinity of the outfall is suitable for settlement, it does *not* represent a major settlement site and thus there is no indication that the outfall will have any appreciable impact on these life stages of the American lobster”.

Outfall benthic monitoring reports (dating back to 1992 and consisting of 23 fixed stations) concluded that associated hard-bottom communities have "not changed substantially with activation of the outfall" (Maciolek et al. 2009). MADMF (2010) indicated no short-term lethal effects on lobsters in the immediate environment surrounding the outfall. In addition, the report stated (at the time the assessment was conducted) that although isolated instances of chlorine exposure may adversely affect lobsters, this would likely be a discrete event in both time and space.

In terms of acute toxicity, Capuzzo et al. (1976) studied the effects of chlorine on larval (Stage I) lobsters in the laboratory and documented respiratory stress at levels of 5000 μgL^{-1} of free chlorine and an LD_{50} of 16.3 mgL^{-1} (16,300 μgL^{-1}) of free chlorine (sodium hypochlorite) at 25˚C. Additional LD_{50} tests at 20 and 30˚C found no significant mortality at 20˚C and exposure at 30˚C resulted in an LD_{50} of 2.5 mgL^{-1}. Chloramines (post treatment residuals) and free chlorine was found to be harmful to Stage I larvae depending on the concentration, temperature, exposure duration and form of chlorine.

1.3.4. **Commercial Fishing Practices**

"Habitat alteration by the fishing activities themselves is perhaps the least understood of the important environmental effects of fishing" (NRC 1995). In order to help minimize adverse effects of fishing practices, the Swept Area Seabed Impact (SASI) model (and its parameters) was recently adopted to provide a coherent framework for "enabling managers to better understand the nature of fishing gear impacts (including lobster) on benthic habitats, and the spatial distribution of benthic habitat vulnerability to particular fishing gears" (see Figure 1 in NEFMC 2011). This comparative and integrative approach allows for a thorough assessment of gear types and their impacts and contributes to the objectives of essential fish habitat (EFH) in both New England and throughout the mid-Atlantic (NEFMC 2011).

Claw Loss & Shell Damage

Cull lobsters (those with missing or regenerating claws) are attributed to anthropogenic as well as natural causes. Among potential fishery-induced injuries, claw loss significantly impacts market value. Krouse (1976) calculated that cull lobsters weighed 14-20% less than fully clawed lobsters. Since 1999, an annual average of 10-20% of the total catch sampled from commercial lobster traps in Massachusetts coastal waters were culls (Glenn et al. 2007). However, an overlooked impact of culling is its effect in reducing the growth rate due to the energy partitioning between molt and regeneration (Aiken 1980). This can delay recruitment to minimum commercial size, and, if maturity is more a function of age than size, as it is in the spiny lobster (Davis 1981), then the size at maturity will be lowered. Claw loss can also affect lobster behavior. It is possible that since dominant lobsters "claim" the optimal shelters, animals which are behaviorally subordinate due to claw loss are forced to congregate on less optimal habitat (i.e., open sand or mud areas) which lack structure. Additionally, a number of lobstermen claim that there are areas that they refer to as "hospital grounds" where large numbers of culls can be found, particularly in estuaries (e.g., Moriyasu et al. 1999).

Inter- and intra-specific aggression in lobster traps, as well as handling by fishermen, contribute to claw loss which may also occur in the wild as a result of not only territoriality but through aggressive encounters as well (O'Neill and Cobb 1979). The relative contribution of each potential cause is unknown. Mobile gear fisheries contribute to lobster shell damage and can result in mortality. Observations of fresh shell damage and claw loss were made when investigating the impact of bottom trawling off Duxbury Beach, Massachusetts (Estrella 1989). The occurrence of fresh shell damage in new-shelled lobster was consistent with the results reported by Ganz (1980) in Rhode Island waters and Smith and Howell (1987) in LIS. Although Spurr (1978) did not record molt stage of the lobsters he studied off New Hampshire, he reported that the highest damage incidence occurred in July; when new-shelled lobsters are expected to be more abundant.

Trawling

Some level of delayed mortality occurs to new-shelled lobsters that are damaged by trawling (e.g., otter) and dredging (e.g., scallop). Smith and Howell (1987) observed delayed mortality in 33.3% of the 18 new-shelled lobsters they tested. Similar results were found by Witherell and Howe (1989) who calculated a cumulative mortality of 29.5%. The mortality to undamaged hardshell lobsters was 0.6% (Smith and Howell 1987). The impact of trawling on sandy habitat is negligible and of short-term duration (Estrella 1989, Spurr 1978). Graham (1955) and Gibbs et al. (1980) found no detectable changes in benthic fauna as a result of trawling in their sandy study areas. Smith and Stewart (1985) concluded that no long-lasting impressions or habitat loss resulted from trawl door furrowing in soft mud bottom and only minor sediment disturbance (<1" depth) occurred in the sweep path.

More recently, Simpson and Watling (2006) conducted a study on the impacts of shrimp trawling in the GoM and its effects on mud-bottom fishing grounds. Their results suggest that seasonal shrimp trawling produced short-term changes (<3 months) to the macrofaunal community but did not seem to result in any long-term changes. Furthermore, the impacts to these trawling activities were mitigated, in part, by benthic megafauna (lobsters and fishes) through burrowing and pit digging by these animals; these activities acted to rework sediments thereby minimizing these impacts. It seems logical that lobster vulnerability should not be as great on rough rocky substrate where boulders would prevent the sweep from riding close to the bottom. Nocturnal vs. diurnal behavior may be important factors in lobster catchability from trawling. Smith and Stewart (1985) discussed the potential for greater lobster activity during daytime in dark deep-water environments compared to lighter shoal areas.

Traps

While there have been few studies on the effect of lobster traps on benthic habitats, available information suggests trap gear tends to have limited long-term adverse impacts on benthic habitat, particularly when compared with mobile fishing gears such as trawls and dredges. Because most inshore lobster traps are hauled, re-baited, and then reset on a regular basis, frequent hauling in areas of dense vegetation (e.g., kelp beds and eelgrass) is more likely to result in damage (ASMFC 2003, NMFS 2010). By comparison, the evaluation of lobster traps on attached epibenthic megafauna (sponges, soft corals, tube worms) in a European study showed no negative effect on the abundance of attached megafauna (Eno et al. 2001), however wind-driven effects on trap movements were shown to impact sessile benthic habitat fauna in the spiny lobster fishery (see Lewis et al. 2009). Therefore, variables such as depth, turbulence, and wind events may be factors that contribute to and influence trap-gear impacts. A workshop concerning the effects of fishing gear on marine habitats in the northeastern U.S. concluded that the degree of impact caused by lobster pots and traps to biological and physical structures and to benthic species in mud, sand and gravel habitats was low; impacts were expected to be greater in rocky habitats where emergent epifauna or biogenic structures are present (NEFMC 2002). More detailed work in this area could be useful in assessing *H. americanus* trap impacts to benthic habitat structure.

Ghost Traps & Derelict Gear

'Ghost fishing' can been defined as “the mortality of fish and other species that takes place after all control of fishing gear is lost by a fisherman” (www.fao.org/fishery) and can be detrimental to the lobster resource and its fishery. Ghost traps have been estimated to continue to fish at a rate of 10% the effectiveness of a baited trap with 25% of the ghost trap lobsters dying (Pecci et al. 1978) and represents an ~3-6% loss in annual landings in the U.S.

(Harding 1992). Regulations addressing ghost fishing through a requirement of biodegradable escape panels or hinges are now in place in most states however it is important to note that few studies have been carried out to assess the degradation time for these devices (although they are usually replaced annually, C. Wilson, pers. comm.). Lobsters and other marine animals captured in derelict traps may experience starvation, cannibalism, infection, disease or prolonged exposure to poor water quality (low dissolved oxygen, Guillory 1993). In the Chesapeake Bay blue crab fishery, Havens et al. (2008), used side scan sonar to locate derelict traps and assess their extent and accumulation rate in the York River, Virginia. Trap loss rates were estimated at 30%, resulting in the potential addition of over 100,000 traps annually to the Chesapeake Bay derelict trap population in Virginia.

Gear loss can be expensive (~$100 per trap) and with the advent of inexpensive and readily available technology such as GPS systems, the retrieval of lost gear is possible. In other instances, programs have been carried out to recover, document and dispose of derelict (ghost) lobster traps (Gulf of Maine Lobster Foundation, GOMLF, 2011, see http://www.gomlf.org/index.asp). For example, during the 2010 gear recovery effort, more than 1,000 traps were recovered by 27 fishing vessels from three lobster conservation management zones. In WLIS, the Cornell Cooperative Extension (CCE) conducted a total of 28 research trips during the Fall of 2010 and retrieved 2,298 derelict lobster traps and recycled 25.95 tons (51,900 lbs.) of derelict lobster traps into clean renewable energy (CCE, NFWF 2012). The CCE study also catalogued each trap that was retrieved (e.g., physical condition, escape vent present) and concluded that these abandoned, lost, or discarded lobster traps are a problem in WLIS. Often, many of the LIS lobster traps that were recovered had sunk into the mud above the vent, making them inoperable. Similar efforts have also been underway (in LIS) through the National Fish and Wildlife Foundation's WLIS Marine Debris Assessment and Prevention Program (NFWF 2012).

Between 2010 and 2011, a series of 'abandoned' lobster pot trawls were deployed and monitored (SCUBA assessments) in Cape Cod Bay and Buzzards Bay. A key finding from this study showed that ghost traps continue to fish for longer than previously thought (> 2 years or more; NFWF 2012). Additionally, traps that are set in deeper waters or in proximity to sheltered environments "may continue to catch lobster and bycatch species for an extended period of time due to a lack of oxidation of the metal (hog rings) while in the water and attachment of biofouling organisms over the escape panels"(NFWF 2012).

Whale Entanglements

Although a variety of species are potentially capable of entanglement from lobster trap gear, whales (in-particular North Atlantic right whales, but others as well) are vulnerable due to their propensity to feed below the surface, or feeding while swimming with their mouths open (NMFS 2010). Johnson et al. (2005) noted that any part of the trap gear complex (the buoy line, ground line, float line, and surface system line) creates a risk of entanglement. It is probably the case that the total numbers of entanglement are greater than those actually recorded. For example, a total of three right whale entanglements due to lobster gear were documented in Maine coastal waters between 1997-2005 (NMFS data compiled by the Massachusetts Lobstermens Assoc.), and 48 cases of entanglement from 1997-2005 in Northeastern waters (NMFS compilation for ALWTRT). Additional studies concluded that 60% and 70% of right whales exhibited entanglement scarring, suggesting this is an ongoing issue (Fujiwara and Caswell 2001, Myers et al. 2007). The problem seems to be more significant in offshore waters where vessels tend to fish larger strings of traps. Although Federal regulations seeking to mitigate entanglements by mandating sinking ground line on

all lobster trap gear (effective April-2009), vertical lines that link the bottom-tending trap to the surface line(s) and buoy(s) continue to pose an entanglement risk to protected species (NMFS 2010).

By-catch

The term 'by-catch' refers to the unintentional landing and discarding of animals not specifically targeted by fishing vessels (NMFS 2010). In general, traps used in commercial lobster fisheries are among the more selective types of fishing gear but they are known to capture non-targeted species. Therefore, by-catch is a relevant and indirect component to habitat since there is the potential to alter community structure (e.g., removal of predators). By and large, overall levels of by-catch in lobster traps are low relative to other marine fisheries. Fish and invertebrates landed in lobster traps are likely to be discarded with lower mortality rates than those landed with other gear types such as trawls and dredges (Davis 2002).

Fishes that are caught in lobster traps include tautog, scup, black sea bass, cod, cusk, eels and flounder. C. Wilson (data from Maine DMR) indicated that at least 10 finfish species are routinely documented as discarded by-catch (see Table 1 in Bannister et al. 2013). The most abundant fish by-catch is longhorn sculpin, comprising 0.5% of the lobster catch over a 3-year period. In addition to fish, a variety of invertebrates are found in and attached to lobster traps, including Jonah and rock crabs, red crabs, starfish, urchins, whelks and conchs (ASMFC 1997, Bannister et al. 2013). The discard mortality rates (% of discarded animals that die) associated with animals caught in traps is considered low, particularly when compared against the mortality rates linked with mobile fishing gears such as trawls and dredges (NMFS 2010).

Lobster Trap Bait

Bait used in lobster traps is an important component of the lobster fishery. It has been estimated that 50-60,000 tons of bait (primarily Atlantic herring) are used in the U.S. lobster fishery annually (NMFS 2010). In Maine, herring comprises nearly 90% of the bait used while in SNE, skate (~ 15,000 tons/year since 2001) are frequently substituted as bait. Many lobstermen consider the amount of bait being used in the fishery as providing a positive effect on the lobster population as it is often remarked that 'lobsters are being farmed'. The rationale behind this notion is that sub-legal sized lobsters, in addition to other by-catch (fishes and crabs), move in and out of traps to feed on bait. Thus, this 'bait subsidy' (bait use has increased 4-fold since the 1970s in Maine) is responsible for an increase of lobster abundance in some areas and may be a contributing factor in lobster biomass in some coastal areas (Grabowski et al. 2009, 2010). In one recent study, Grabowski et al. (2009) determined that sublegal lobsters in midcoast Maine grew 15% more per molt in fished areas (with trap bait) compared with closed areas, suggesting an effect of the bait subsidy; however at another site in eastern Maine, lobsters at unfished sites grew faster than those at fished sites. The differences in natural diets between sites confound these results indicating the challenges in controlling these effects in the wild.

In terms of bait utilization, it has been suggested that that about 2/3 of bait in traps is used by lobsters and the remaining 1/3 by crabs and other species (Grabowski, pers. obs.). It is proposed that bait may comprise a large proportion of a lobster's diet (upwards of 34-55 %), which could substantially impact their overall health as well (Myers and Tlusty 2009). A recent survey of bait use by Nova Scotian lobstermen indicated an average of 860 g (1.9 lbs.) of bait (herring or mackerel) was used each time a trap was set, translating to over 5,216 kg

(11,500 lbs.) of bait/year/lobsterman (Harnish and Willison 2009). With such large volumes of bait being used in some areas, the ecological and economic implications of bait subsidies may be a concern to both scientists and industry.

1.4. Climate Change Impacts to Lobster Habitat Components

Climate change has always been an integral part of natural ecosystems and the fisheries that are supported therein. Although many fisheries worldwide can be resilient to environmental changes (Brander 2009), some factors may in fact limit this capacity: 1) the rate of climate change is predicted to accelerate in the near-future; 2) resiliency in species and systems is being compromised by increasing fishing pressures, pollution, habitat degradation, disease, and invasive species; and 3) the effects of lowering of the oceans pH due to rising CO_2 levels remains mostly unknown (Brander 2007, 2010). Additionally, distributional shifts to higher latitudes and deeper waters of commercially important marine species (including lobsters), in response to warming temperatures is leading to changes in community structure, trophic interactions, and the dynamics of fisheries, with increasing vulnerability of many coastal fisheries to climate change (Pinsky and Fogarty 2012, Cheung et al 2013).

Given the highly influential role that temperature has on all life history phases of *H. americanus* (Fogarty 1995), and the sensitivity of lobster growth and reproductive dynamics to variations in temperature regimes (Waddy and Aiken 1995), it is not too hard to prognosticate how climatological changes could affect lobster broodstock fecundity, size at maturity, egg development, and hatch, species range and distribution, population densities, among others. For example, rising seawater temperatures would accelerate egg development and hatching, thereby shortening larval development. In some areas, offshore movements by lobsters seeking to avoid warm water could cause eggs to hatch too far offshore (Goldstein 2012, Pugh and Glenn 2012), setting up sub-optimal dispersal trajectories and possible larval wastage. Other climate-related scenarios are certainly possible as well.

Changes in ocean temperatures will undoubtedly cause alterations to thermal profiles that would have cascading effects on the movement dynamics of ovigerous lobsters, which in turn, would influence egg development rates, timing of hatch, predation and ultimately, larval survivorship and dispersal. Continued and more detailed investigations of the physiological tolerances, thermal thresholds, and behaviors of ovigerous lobsters, their eggs and larvae and would certainly contribute to further enhancing our knowledge-base of the effects of changing ocean temperatures.

1.5. Present Condition of Habitats and Habitat Areas of Particular Concern (HAPCs)

American lobsters utilize and reside in nearly all habitat types throughout their range. This includes estuaries, intertidal zones, coastal nearshore waters, and offshore banks and deep-water canyons (Factor 1995, Lincoln 1998). NMFS (2010) report Table 3.13 describes in-detail these habitats and their characteristics. Habitat Areas of Particular Concern (HAPC) are described as subsets of Essential Fisheries Habitat (EFH) which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Although there are currently no documented HAPCs for American lobster, some areas that are particularly vulnerable to protracted and well-documented hypoxia events (LIS, Pearce and Balcom 2005), sub-optimal water temperatures (Buzzards Bay and other areas of SNE and LIS, Pearce and Balcom 2005, Pugh and Glenn

2012) and the presence of deleterious compounds in sediments, certainly warrant consideration for the survival of some lobster populations.

There are anecdotal reports from fishermen of habitats that, at certain times of the year, are spawning and broodstock habitats for ovigerous females. Lobstermen, usually try to avoid these areas, however large numbers of broodstock lobsters that do get caught may be subjected to rough handling practices. While the identification of these 'brooding areas' is known for some crab species (Dungeness crabs, Stone and O'Clair 2002), it is not documented for ovigerous American lobsters. It is essential that identified broodstock and nursery areas are prioritized habitats for lobsters. Finally, because we know that lobsters do in fact populate estuarine systems with regularity (and are purported to reproduce and possibly settle there (e.g., Wahle 1993, Goldstein and Watson unpub. data), these habitats are of particular concern given their pronounced vulnerability to habitat degradation and climate change (Kennish 2002).

1.5.1. **American Lobster Habitat Bottlenecks**

The ASMFC Habitat Guidance Document (2013, pending approval) defines a habitat bottleneck as "a constraint on a species' ability to survive, reproduce, or recruit to the next life stage that results from reductions in available habitat extent and/or habitat capacity and reduces the effectiveness of traditional fisheries management options to control mortality and spawning stock biomass." Although there is some evidence of preferred habitat types (both physical and biological, see Section 1.4.1 for review), there is no concrete supporting evidence that habitat is currently limiting to populations of American lobster. However, there are scenarios affecting components of lobster habitat (i.e., thermal) that would suggest otherwise. First, the "confluence and succession" of environmental factors that provoked a catastrophic loss in the LIS lobster population in 1999 (see Pearce and Balcom 2005 for summary), creating limited areas where lobsters could find safe refuge (although 90% were unable to do so). These lobsters, already compromised by disease (parasitic amobae), and above average water temperatures, became "physiologically weakened", resulting in significant population losses (CTDEP 2000). Therefore, selected habitat combinations that become stressful to lobsters (temperature, dissolved oxygen) can leave some populations vulnerable to further disease and possibly limit areas where conditions are more favorable to survival.

A second scenario involves the contraction of optimal or useable thermal habitat by lobsters (for basic physiological processes, egg and larval development, and growth) and is exemplified by seasonal changes and conditions in bays and estuaries where temperatures become sub-optimal for lobsters at certain times of the year. Repeated studies in Great Bay Estuary (NH) and Narragansett Bay (RI) have convincingly shown that lobsters will selectively avoid areas of sub-optimal temperature (e.g., excessively warm, in summer; Howell et al. 1999, Jury and Watson 2012, MADMF data). As a result of these differences, estuarine systems can become bottleneck habitats if conditions in these areas continue to deteriorate over time. Historically rich lobster populations such as in Buzzards Bay have now experienced dramatic declines and experience summertime temperatures in excess of 20°C (MADMF data, Pugh and Glenn 2012). As a result, lobsters have been concentrated at the mouth of the Bay. Recent MADMF data suggests that lobsters (including ovigerous females) are moving to deeper, cooler waters, thereby concentrating their populations in a much smaller area. These kinds of 'thermal refuges' may become increasingly common and

create potentially significant bottlenecks with respect to brooding areas, places for lobsters to shelter and even possibly altered larval dispersal due to differences in their movements.

1.5.2. **Habitat Enhancement**

Due to past and present adverse impacts from human activities, restorative projects appear likely to have slightly positive effects at the local level. There have been few documented examples of lobster habitat enhancements in the GoM, but there may be significant potential for more, including the planting of artificial kelp beds (NMFS 2010). Artificial shelters made of PVC pipe and concrete blocks were have also been used with good results (Ojeda and Dearborn 1991). So far, evidence seems to indicate that these methods merely serve as gathering points for lobsters in the surrounding area (i.e., the 'attraction hypothesis'), leading some to believe that overall lobster density is not necessarily increased. However, in at least one study (Barber et al. 2009) it has been shown that early-benthic lobster settlement does in fact occur on some artificial reefs.

A number of studies have suggested that, in some areas, shelter is a limiting factor in the distribution and abundance of nearshore lobsters (Butler and Herrnkind 1997 for spiny lobsters, Whale and Incze 1997 in clawed lobsters). The addition of artificial reefs in areas previously devoid of cover or substrate suitable for burrowing has been shown to increase the abundance of resident lobsters (reviewed in Sheehy 1982). Observations have also indicated that extensive growth of encrusting organisms on artificial substrates serves as a source of food for lobsters. Following the M/V World Prodigy oil spill, NOAA and the University of Rhode Island (URI) designed and established an artificial reef system to increase lobster (www.darrp.noaa.gov.html). A total of six cobblestone reefs (in ~15 ft. of water) in Dutch Island Harbor near Jamestown, Rhode Island, were constructed to provide shelter for lobsters of all sizes. In 1997 more than 2000 tagged hatchery-reared YOY lobsters (Stages V-VI) were released over two successive years. Although the settlement of YOY lobsters was significantly increased, the density of YOY lobsters on enhanced reefs was not different from that on the control reefs; further results indicated possible behavioral differences between hatchery-reared lobsters making them more susceptible to predation (Castro et al. 2002, Castro and Cobb 2005). Therefore, future restocking efforts should focus on the behavioral conditioning of hatchery-raised lobsters in order to provide the best chances for survival.

An alternative approach to artificial reef development was recently developed and utilized to focus on criteria that would presumably make for a successful artificial reef for the settlement and growth of lobsters. Barber et al. (2009) developed a series of seven selection factors ('exclusion mapping, depth and slope verification, substrate assessment, data weighting and the subsequent ranking analysis, visual transect surveys, benthic air-lift sampling, and larval settlement collector deployment') that were used to model the efficacy, design, and implementation of an artificial reef system for lobster as related to the best possible biological and physical attributes, including a natural supply of larvae. Within only a short time post installation did this artificial reef yield densities of invertebrates and YOY lobsters that were similar to nearby natural reefs, suggesting that these structures may have future applications.

1.6. Recommendations for Further Habitat Research

Throughout this section there are already many mentioned areas that warrant further detailed research. Below is a thematic list of research topics pertaining to lobster habitat components where data gaps exists or areas where only limited evidence is currently available.

Environmental variables: How is this habitat component related to depth and temperature? They are often related, but it remains difficult to ascertain if lobsters are moving or choosing an area because of the depth or the habitat. Also, do lobsters aggregate in areas with their 'preferred' temperatures? Although there is already evidence for this (e.g., Crossin et al. 1988), we do not know how widespread this occurs. How would anticipated climate change scenarios (temperature, acidification – pH, sea level rise, and salinity) influence lobster life-history processes? For example, given changes to the Gulf of Maine current regime, how might egg development, larval duration, and larval transport become altered?

Ocean Acidification (OA): This is clearly a specific environmental variable we have very limited information regarding American lobsters. We can draw on only a few examples of other marine decapods (crabs, summarized in previous section) but studies that include all life-stages of lobsters should be considered. Focal questions could address how OA might affect larval development and growth, shell integrity in juveniles and adults, and even possibly behavioral changes.

Traps: There is much to learn with respect to trap dynamics – how effective are traps to the sheltering and/or aggregation effect? Also, the dynamics of bait consumption and by-catch as well on lobsters is also relevant. Related to this are the impacts of bait consumption on lobster physiology and health. Although some recent study efforts have been carried out, we need to get a much better handle on ghost trap dynamics and how to quantify their impact.

Lobster Movements: There are many questions here that can be asked in the context of a changing ocean climate. For example, what environmental trigger(s) motivate lobsters to move offshore? Is it only based on temperature? What advantages are there for lobsters to move offshore and how have these patterns changed in specific regions of the fishery? Does shelter quality (or lack thereof) instigate movements to other areas? Based on previous findings from WLIS and Buzzards Bay, what are the 'threshold factors' that elicit lobsters to move away? What combinations of environmental factors and minimal levels are detrimental? Some recent work has suggested that some lobster movement may involve orientation along specific benthic habitat types suggesting habitat corridors of movement in some cases. This is one area of research that should be expanded upon as well.

Finally, do lobsters move and shift their habitats in anticipation of critical events like molting (finding a safe place to molt)? Furthermore, what about the importance of certain habitat types when lobsters densities become too high? – Will lobsters 'spill over' into poor habitat? One important, but sometimes controversial topic is the efficacy of marine protected areas for lobsters. Identifying habitat areas that are integral for brooding aggregations may be a useful starting point.

Mapping & Settlement: The mapping, characterization, and quantification of lobster habitat types needs to be continued throughout U.S. waters. The identification of habitat important to postlarval settlement and early benthic phase lobster is necessary in order to calculate a density index and evaluate a stock-recruitment relationship. Changes in species composition by area, from a hard-bottom complex to a soft-bottom complex and prey diversity on each bottom type should be determined. This information is an important precursor to recruitment assessments and to mobile gear impact studies.

Because, it was recently shown that postlarval lobsters can in fact settle in deeper waters, how common is this and do lobsters routinely settle offshore?

1.7. Recommendations for Monitoring and Managing Lobster Habitat

Most of the current management measures today (minimum sizes, v-notching, closed season, maximum size, slot limits, trap limits, protection of ovigerous lobster) were either discussed or implemented over 100 years ago. Many if these do not include habitat considerations and as such have had very mixed success. In order to be effective, both in supporting sustainable lobster stocks and viable harvest fisheries over an extended geographic range, new analyses of trends in lobster distribution must include known linkages of lobster survival and growth with threshold environmental conditions. Assessment models should incorporate climatic variables such as sea temperature, dissolved oxygen, and salinity by including these drivers as model covariates. To support these necessary modeling exercises, it is important to develop and maintain consistent techniques that monitor distribution and abundance of lobster independent of the fishery so that lobster populations and their habitat needs can be effectively managed throughout their range.

Of particular importance is the need to continue and expand monitoring of the young-of-year and larval production so that highly productive areas are identified and protected. The last stock assessment peer reviewers emphasized the importance of monitoring recruitment in a fishery that relies heavily on newly-mature animals. The early benthic shelter-seeking phase may be the most habitat-dependent and therefore may form the most critical bottleneck determining ultimate population survival rates.

Some suggestions for monitoring the Southern New England lobster stock are outlined in the October 2011 peer review of the ASMFC Lobster Technical Committee Report entitled *Recruitment Failure in the Southern New England Lobster Stock.* One suggestion is for lobster surveys to be continued, and if possible increased, in the future to "enhance their power to detect changes in larval or young-of-year abundance." New surveys should be developed to give a more spatially comprehensive view of spawning patterns possibly with the deployment of passive postlarval collectors. Such surveys should be used to improve the understanding of the recruitment processes, provide early feedback on the success of management measures aimed at protecting spawning habitat and potential, and to allow forecasts of recruitment for both inshore and offshore areas.

Regionally, in the at the southern end of the current lobster distribution the combination of hypoxia and rising water temperature is narrowing the habitat area which can support a healthy lobster stock; identifying areas meeting minimum requirements (>2 ppm DO and <20° C) on an annual basis may provide guidance for stock rebuilding efforts.

The Southern New England Management Area (SNE) for American lobster is experiencing a general decrease in population abundance, particularly in the northern reaches of the range; Lobster Conservation Management Area (LCMA) 2, 4 and 6, as well as adjacent offshore areas of LCMA 3. Much of what is known about these areas has come through efforts made by the bordering states through ventless trap surveys, larval settlement surveys and continuous environmental data collected through fixed buoy systems for both surface and bottom temperatures. Before 2008, little work was completed in LCMA 4 and 5 when the New Jersey at-sea observer program started. New Jersey has been able to collect valuable fishery characterization data but lacks any serious effort at answering questions regarding juvenile habitat and recruitment areas. In order to complete the coverage of the SNE range, fishery-independent surveys in this area are critical.

The Gulf of Maine is a semi-enclosed marginal sea with several deep basins, strong tidal currents and a generally cyclonic circulation. Scotian Shelf water enters along the south coast of Nova Scotia and exits primarily along the northern edge of Georges Bank and secondarily through the Great South Channel (Brooks 1985). Currents are necessary for larval lobster transport that links inshore (coastal) and offshore (basin) lobster populations. Fogarty (1998) calculated that a modest amount of offshore larval supply could add significantly to resiliency of populations in inshore areas where the fishery is concentrated. Favorable conditions for larvae can greatly increase development rate and when coupled with typical physical forcing factors observed within the Gulf of Maine, as described above, create a delivery mechanism of competent larvae to nearshore nursery grounds (Incze and Naimie 2000). These favorable habitat conditions should be assessed and monitored as climatic variables may alter the success of this mechanism in future years.

Clear communication and cooperation among partners, agencies, councils, etc. that manage other fisheries can be an effective tool in maintaining productive American lobster habitat. An example would be conducting surveys to determine the distribution of critical life stages of lobster prior to the opening of areas closed to particular fisheries which may affect lobster habitat. Data from such surveys would inform managers of critical times and habitats vital to lobster growth and reproduction in the area. Periodic or rolling closures have proved to be very effective management strategies when the requirements of all marine resources are well known and well met.

REFERENCES FOR ASMFC HABITAT SECTION

Abgrall, P., R.W. Rangeley, L.E. Burridge and P. Lawton. 2000. Sublethal effects of azamethiphos on shelter use by juvenile lobsters (*Homarus americanus*). Aquaculture. 181: 1-10.

Able, K.W., K.L. Heck, M.P. Fahay and C.T. Roman. 1988. Use of salt-marsh peat reefs by small juvenile lobsters on Cape Cod, Massachusetts. Estuaries. 11: 83-86.

Addison, J. and M. Fogarty, 1992. Juvenile lobster habitat limitation: What can landings tell us. In: The Lobster Newsletter. 5(2): 10-12.

Agnalt, A-L., E.S. Grefsrud, E. Farestveit, M. Larsen and F. Keulder. 2013. Deformities in larvae and juvenile European lobster (*Homarus gammarus*) exposed to lower pH at two different temperatures. Biogeosciences Discuss. 10: 7579-7615.

Aiken, D.E. 1980. Molting and Growth. In: J.S. Cobb and B.F. Phillips (eds.). The Biology and Management of Lobsters. Vol. 1. Academic Press, New York. Pp. 91-163.

Aiken, D.E. and S.L. Waddy. 1980. Reproductive Biology. In: J.S. Cobb and B.F. Phillips (eds.). The Biology and Management of Lobsters. Vol. 1. Academic Press, New York. Pp. 275-276.

Aiken, D.E. and S.L. Waddy. 1986. Environmental influence on recruitment of the American lobster, (*Homarus americanus*): A perspective. Can. J. Fish. Aquat. Sci. 43: 2258-2270.

Annis, E.R. 2005. Temperature effects on the vertical distribution of lobster postlarvae (*Homarus americanus*). Limnology and Oceanography. 50: 1972-1982.

Annis, E.R., L.S. Incze, N. Wolff, and R.S. Steneck. 2007. Estimates of in-situ larval development time for the lobster, *Homarus americanus*. J. Crustacean Biology. 27: 454-462.

Arnold, K. E., H. S. Findlay, J.I. Spicer, C.L. Daniels and D. Boothroyd. 2009. Effects of CO_2-related acidification on aspects of the larval development of the European lobster, *Homarus gammarus* (L.). Biogeosciences Discuss. 6: 3087-3107.

Atema, J., D.F. Leavitt, D.E. Barshaw and M.C. Cuomo. 1982. Effects of drilling muds on behavior of the American lobster, *Homarus americanus*, in water column and substrate exposures. Can. J. Fish. Aquat. Sci. 39: 675-690.

Atlantic States Marine Fisheries Commission (ASMFC). 1997. Amendment 3 to the Interstate Fisheries Management Plan for American Lobster. Fishery Management Report No. 29 of the ASMFC. 44p.

Atlantic States Marine Fisheries Commission (ASMFC). 2003. Mobile Fishing Gear Effects on Benthic Habitats: A Bibliography. 2nd Ed. B.E. Dieter, D. A. Wion and R.A. McConnaughey (eds.). NOAA Technical Memorandum. NMFS-AFSC-135. 211p.

Atlantic States Marine Fisheries Commission (ASMFC). 2009. American Lobster Stock Assessment Report No. 09-01 (supplement). 316p.

Atlantic States Marine Fisheries Commission (ASMFC). 2010. External Independent Peer Review/Center for Independent Experts: Recruitment Failure in the Southern New England Lobster Stock. 123p.

Baeza, J.A. and M. Fernandez. 2002. Active brood care in *Cancer setosus* (Crustacea: Decapoda): the relationship between female behaviour, embryo oxygen consumption and the cost of brooding. Functional Ecology. 16: 241-251.

Bannister, C., H. Powels, B. McCay and P. Knapman. 2013. MSC Assessment Report for Maine Lobster Trap Fishery. Intertek Moody Marine, Ltd. Ref: 82075. 248p.

Barber, J.S., D.M. Chosid, R.P. Glenn and K.A. Whitmore. 2009. A systematic model for artificial reef site selection. NZ J. Marine and Freshwater Research. 43: 283-297.

Barshaw, D.E. 1989. Growth and survival of post-larval lobsters, *Homarus americanus*, on a diet of plankton. Fish. Bull. 87: 366-370.

Barshaw, D.E., D.R. Bryant and J. Atema. 1985. Eelgrass as a possible habitat for early juvenile lobsters, *Homarus americanus*: Behavior and survival in naturalistic laboratory environments. International Workshop on Lobster Recruitment. June 30-July 5. 15p.

Barshaw, D.E. and D.R. Bryant-Rich. 1988. A long-term study on the behavior and survival of early juvenile American lobster, *Homarus americanus*, in three naturalistic substrates: eelgrass, mud, and rocks. Fish. Bull. 86(4): 789-796.

Bergeron, C.E. 2011. Research on lobster age-size relationships: Developing regionally specified growth models from meta-analysis of existing data. M.S. Thesis. University of Maine.

Boudreau, B., E. Bourget and Y. Simard. 1990. Benthic invertebrate larval response to substrate characteristics at settlement: Shelter preferences of the American lobster *Homarus americanus.* Marine Biology. 106: 191-198.

Boudreau. B., Y. Simard and E. Bourget. 1991. Behavioural responses of the planktonic stages of the American lobster *Homarus americanus* to thermal gradients, and ecological implications. Marine Ecology Progress Series. 76: 13-23.

Boudreau, B., Y. Simard and E. Bourget. 1992. Influence of a thermocline on vertical distribution and settlement of post-larvae of the American lobster *Homarus americanus* Milne-Edwards. J. Experimental Marine Biology and Ecology. 162: 35-49.

Boudreau, B., E. Bourget and Y. Simard. 1993. Behavioral responses of competent lobster postlarvae to odor plumes. Marine Biology. 117: 63-69.

Brander, K. 2007. Global fish production and climate change. Proceedings National Academic of Sciences. 104(50): 19709-19714.

Brander, K. 2009. Impacts of climate change on marine ecosystems and fisheries. J. Mar. Biol. Ass. India. 51(1): 1-13.

Brander, K. 2010. Impacts of climate change on fisheries. J. Marine Systems. 79: 389-402.

Brooks, D.A. 1985. Vernal circulation in the Gulf of Maine. J. Geophys. Res. 90:4687-4705.

Butler, M.J. IV and W.F. Herrnkind. 1997. A test of recruitment limitation and the potential for artificial enhancement of spiny lobster populations in Florida. Can. J. Fish. Aquat. Sci. 54: 452-463.

Caddy, J.F. 1986. Modelling stock-recruitment processes in Crustacea: some practical and theoretical perspectives. Can. J. Fish. Aquat. Sci. 43:2330- 2344.

Camacho, J., S. A. Qadri, H. Wang and M.K. Worden. 2006. Temperature acclimation alters cardiac performance in the lobster *Homarus americanus*. J. Comp. Physiol. A. 192: 1327-1334.

Caputi, N., S. de Lestang, S. Frusher and R.A. Wahle. 2013. The impact of climate change on exploited lobster stocks. In: B.F. Phillips, (ed.). Lobsters: Biology, Management, Aquaculture, and Fisheries, 2nd Ed. John Wiley & Sons, Ltd. Oxford, UK. Pp. 129-168.

Capuzzo, J.M. and B.A. Lancaster. 1981. Physiological effects of South Louisiana crude oil on larvae of the American lobster (*Homarus americanus*). In: F.J. Vernberg, A. Calabrese, F.P. Thurberg and W.B.Vernberg (eds.). Biological Monitoring of Marine Pollutants. Academic Press, New York. Pp. 405-423.

Capuzzo, J.M. and B.A. Lancaster. 1982. Physiological effects of petroleum hydrocarbons on larval lobsters (*Homarus americanus*): Hydrocarbon accumulation and interference with lipid metabolism. In: W.B. Vernberg, A.

Calabrese, F.P. Thurberg and W.B. Vernberg (eds.). Physiological Mechanisms of Marine Pollutant Toxicity. Academic Press, New York. Pp. 477-501.

Capuzzo, J.M., S.A. Lawrence and J.A. Davidson. 1976. Combined toxicity of free chlorine, chloromine and temperature to Stage 1 larvae of the American lobster *Homarus americanus*. Water Research. 10: 1093-1099.

Capuzzo, J.M., B.A. Lancaster and G.C. Sasaki. 1984. The effects of petroleum hydrocarbons on lipid metabolism and energetics of larval development and metamorphosis in the American lobster (*Homarus americanus* Milne Edwards). Mar. Environ. Res. 14: 201-228.

Castro, K.M., J.S. Cobb, R.A. Wahle and J. Catena. 2002. Habitat addition and stock enhancement for American lobsters, *Homarus americanus*. J. Marine and Freshwater Research. 52(8): 1253-1261.

Castro, K.M. and J.S. Cobb. 2005. Behaviour of hatchery-reared and wild-caught 4th and 5th stage American lobsters, *Homarus americanus.* NZ J.Marine and Freshwater Research. 39(4): 963-972.

Charmantier, G. and D.E. Aiken. 1987. Osmotic regulation in late embryos and prelarvae of the American lobster, *Homarus americanus* H. Milne-Edwards, 1837 (Crustacea, Decapoda). J. Exp. Mar. Biol. Ecol. 109: 101-108.

Charmantier. G., C. Haond, J.H. Lignot and M. Charmantier-Daures. 2001. Ecophysiological adaptation to salinity throughout a life cycle: A review in Homarid lobsters. J. Exp. Biol. 204: 967-977.

Chassé, J.L. and R.J. Miller. 2010. Lobster larval transport in the southern Gulf of St.Lawrence. Fisheries Oceanography. 19(5): 319–338.

Cheung, W.W.L., R. Watson, and D. Paulys. 2013. Signature of ocean warming in global fisheries catch. Nature. 497: 365-369.

Childress, M.J. and S.H. Jury. 2006. Behaviour. In: B.F. Phillips (ed.). Lobsters: biology, management, aquaculture and fisheries. Oxford, UK. Blackwell Publishing. Pp. 78–112.

Cobb, J.S., T. Gulbransen, B.F. Phillips, D. Wang and M. Syslo.1983. Behavior and distribution of larval and early juvenile *Homarus americanus*. Can. J. Fish. Aquat. Sci. 40: 2184-2188.

Cobb, J.S. and R.A. Wahle. 1994: Early life history and recruitment processes of clawed lobsters. Crustaceana. 67: 1-25.

Conceicao, L., R. Ozorio, E. Suurd and J. Verrith. 1998. Amino acid profile and amino acid utilization in larval African catfish *Clarias gariepinus*, effects of ontogeny and temperature. Fish Physiology and Biochemistry. 19: 43-57.

Connor, P.M. 1972. Acute toxicity of heavy metals to some marine larvae. Marine Pollution Bulletin. 3: 190-192.

Cooper, R.A. and J.R. Uzmann. 1977. Ecology of juvenile and adult clawed lobsters, *Homarus americanus, Homarus gammarus*, and *Nephrops norvegicus*. Div. Fish Oceanogr. Circ. (Aust. CSIRO) 7: 187-208.

Conklin, D.E. 1995. Digestive physiology and nutrition. In: Biology of the lobster *Homarus americanus* (J.R. Factor, Ed.). Academic Press, San Diego. Pp. 153-175.

Courchene, B. and K.D.E. Stokesbury. 2011. Comparison of vented and ventless trap catches of American lobster with SCUBA transect surveys. J. Shellfish Research. 30(2): 389-401.

Crossin, G.T., S.A. Al-Ayoub, S.H. Jury, W.H. Howell and W.H. Watson, III. 1998. Behavioral thermoregulation in the American lobster *Homarus americanus*. J. Experimental Biology. 201: 365-374.

Connecticut Department of Environmental Protection (CTDEP). 2000. Impact of 1999 lobster mortalities in Long Island Sound. Connecticut Department of Environmental Protection, Marine Fisheries Office, Old Lyme, CT. 46p. + appendices.

Davis, G.E. 1981. Effects of injuries on spiny lobster, *Panulirus argus*, and implications for fishery management. Fishery Bulletin. 78(4): 979-984.

Davis, M.W. 2002. Key Principles for Understanding Fish Bycatch Discard Mortality. Canadian J. Fisheries and Aquatic Sciences. 59: 1834-1843.

DeGuise, S., J. Maratea, E.S. Chang and C. Perkins. 2005. Resmethrin immunotoxicitiy and endocrine disrupting effects in the American lobster (*Homarus americanus*) upon experimental exposure. J. Shellfish Research. 24(3): 781-786.

Dove, A.D.M., B. Allam, J.J. Powers and M.S. Sokolowski. 2005. A prolonged thermal stress experiment on the American lobster, *Homarus americanus*. J. Shellfish Research. 24: 761-765.

Draxler, A.F.J., R.A. Robohm, D. Wieczorek, D. Kapareiko and S. Pitchford. 2005. Effect of habitat biogeochemicals on survival of lobsters (*Homarus americanus*). J. Shellfish Research. 24(3): 821-824.

Eagles, M.D., D.E. Aiken and S.L. Waddy. 1986. Influence of light and food on larval American lobsters, *Homarus americanus*. Can. J. Fish. Aquat. Sci. 43: 2303-2310.

Elner, R.W. and A. Campbell. 1987. Natural diets of lobster *Homarus americanus*from barren ground and macroalgal habitats off southwestern Nova Scotia, Canada. Marine Ecology Progress Series. 37: 131-140.

Ennis, G.P. 1995. Larval and postlarval ecology. In: J.R. Factor (ed.) Biology of the lobster *Homarus americanus*. Academic Press, San Diego. Pp. 23-46.

Eno, N.C, + 7 other authors. 2001. Effects of crustacean traps on benthic fauna. ICES Journal of Marine Science. 58: 11-20.

Estrella, B.T. 1989. The impact of bottom trawling on American lobster (*Homarus americanus*) off Duxbury Beach, Massachusetts. Massachusetts Division of Marine Fisheries (MADMF) Report. 12p.

Estrella, B. 2009. HubLine Impact Assessment, Mitigation, and Restoration. Massachusetts Division of Marine Fisheries (MADMF) Report. 81p.

Estrella, B.T. and D. J. McKieran. 1989. Catch per unit effort and biological parameters from Massachusetts coastal lobster, *Homarus americanus*, resource: escriptions and trends. U.S. Department of Commerce, NOAA Technical Report. NMFS 81: 21p.

Factor, J.S. 1995. Biology of the Lobster *Homarus americanus*. Academic Press Inc. San Diego.

Fogarty, M.J. 1983. Distribution and relative abundance of American lobster, *Homarus americanus*, larvae: A review. In: Distribution and relative abundance of American lobster, *Homarus americanus*, larvae: New England investigations during 1974-79. M.J. Fogarty (ed.). NOAA Technical Report NMFS SSRF-775. 66p.

Fogarty, M.J. 1995. Populations, fisheries and management. In J.R. Factor (ed.) The Biology of the Lobster *Homarus americanus.* Academy Press, New York. Pp. 111-137.

Fogarty, M.J., L. Incze, K. Hayhoe, D. Mountain and J. Manning. 2008. Potential climate change impacts on Atlantic cod (*Gaddus morhua*) off the northeastern United States. Mitigation and adaptation strategies for global change. 13: 453-466.

Fogarty, M.J. and Idoine, J.S. 1988. Application of a yield and egg production model based on size to an offshore American lobster population. Trans. Am. Fish. Soc. 117:350-362.

Fogarty, M.J. 1998. Implications of migration and larval interchange in American lobster (*Homarus americanus*) stocks: spatial structure and resilience. Canadian Special Publications Fisheries and Aquatic Sciences 125:273-283.

Fujiwara, M. and H. Caswell. 2001. Demography of the endangered North Atlantic right whale. Nature. 414: 537-541.

Garcia-Guerrero, M., I. Racotta and H. Villareal. 2003. Effect of temperature on lipids, proteins, and carbohydrates levels during development from egg extrusion to juvenile stage of *Cherax quadricarinatus* (Decapoda: Parastacidae). Comparative Biochemistry and Physiology Part A. 135: 147-154.

Ganz, A. 1980. Otter trawl induced lobster damage evaluation. Final Report to Department of Commerce, NOAA, NMFS, Comm. Fish Res. Dev. Act., R.I. Proj. 3-279-R and 3-320-R. 23p.

Gendron, L. and P. Ouellet. 2009. Egg development trajectories of early and late-spawner lobsters (*Homarus americanus*) in the Magdalen Islands, Quebec. J Crust Biol. 29(3): 356-363.

Geraldi, N.R., R.A. Wahle and M. Dunnington. 2009. Habitat effects on American lobster (*Homarus americanus*) movement and density: insights from georeferenced trap arrays, seabed mapping, and tagging. Canadian J. Fisheries and Aquatic Sciences. 66: 460-470.

Gibbs, P.J., A.J. Collins, and L.C. Collett. 1980. Effect of otter prawn trawling on the macrobenthos of a sandy substratum in a New South Wales estuary. Australian J. Mar. and Freshwater Res. 31: 511-516.

Glenn, R., T. Pugh, J. Barber and D. Chosid. 2007. 2005 Massachusetts Lobster Monitoring and Stock Status Report Massachusetts Division of Marine Fisheries (MADMF). Technical Report TR-29. 37p.

Goldstein, J.S. 2012. The impact of seasonal movements by ovigerous American lobsters (*Homarus americanus*) on egg development and larval release. Ph.D. Dissertation. University of New Hampshire. 332p.

Graham, M. 1955. Effect of trawling on animals of the seabed. Pap. Mar. Biol. Oceanogr. Deep Sea Res. Suppl. 3: 1-6.

Grabowski, J.H., J. Gaudette, E.J. Clesceri and P.O. Yund. 2009. The role of food limitation in lobster population dynamics in coastal Maine, United States, and New Brunswick, Canada. NZ J. Marine and Freshwater Research. 43: 185-193.

Grabowski, J.H., E.J. Clesceri, J. Gaudette, A. Baukus, M. Weber and P.O. Yund. 2010. Use of herring bait to farm lobsters in the Gulf of Maine. PLos One. 5: e10188.

Guillory, V. 1993. Ghost fishing in blue crab traps. North American J. Fisheries Management 13:459-466.

Hadley, P.B. 1908. The behavior of the larvae and adolescent stages of the American Lobster. J. Comparative Neurology and Psychology. 19: 199-302.

Hall, J.J. and T.J. Bowden. 2012. Impact on larval development of chronic exposure to a reduced pH environment in the American lobster (*Homarus americanus*). Abstract presentation at The U.S. – Canada Science Symposium: The American Lobster in a Changing Ecosystem. 27-30 November. Portland, Maine.

Harding, G.C. 1992. American lobster (*Homarus americanus* Milne Edwards): A discussion paper on their environmental requirements and the known anthropogenic effects on their populations. Can. Tech. Rep. Fish. Aquat. Sci. 1887: 16p.

Harding, G.C., W.P. Vass and K.F. Drinkwater. 1982. Aspects of larval American lobster (*Homarus americanus*) ecology in St. Georges Bay, Nova Scotia. Can. J. Fish. Aquat. Sci. 39: 1117- 1129.

Harding, G.C., K.F. Drinkwater and W.P. Vass. 1983. Factors influencing the size of American lobster (*Homarus americanus*) stocks along the Atlantic coast of Nova Scotia, Gulf of St. Lawrence, and Gulf of Maine: A new synthesis. Can. J. Fish. Aquat. Sci. 40: 168-184.

Harding, G.C., J.D. Pringle, W.P. Vass, S. Pearre Jr. and S.J. Smith. 1987. Vertical distribution and daily movements of larval lobsters *Homarus americanus* over Browns Bank, Nova Scotia. Marine Ecology Progress Series. 41: 29-41.

Harnish, L. and J.H. Martin Willison. 2009. Efficiency of bait usage in the Nova Scotia lobster fishery: A first look. J. Clean Production. 17: 345-347.

Havens, K., D.M. Bilkovic, D. Stanhope, K. Angstadt and C. Hershner. 2008. The effects of derelict blue crab traps on marine organisms in the lower York River, Virginia, North American J. Fisheries Management. 28(4): 1194-1200.

Hawkins, A.J.S. 1996. Temperature adaptation and genetic polymorphism in aquatic animals. In: I.A. Johnston and A.F. Bennett (eds.) Animals and temperature: Phenotypic and evolutionary adaptation. Cambridge University Press, Cambridge. Pp. 103-125.

Hedgecock, D. 1983. Maturation and spawning of the American lobster *Homarus americanus.* In: CRC Handbook of Mariculture. J.P. McVey (ed.). CRC Press. Boca Raton, Florida. Pp. 261-270.

Helluy, S. and B.S. Beltz. 1991. Embryonic development of the American lobster *Homarus americanus*: Quantitative staging and characterization of an embryonic molt cycle. Biological Bulletin. 180: 355-371.

Herrick, F.H. 1895. The habits and development of the American lobsters and their bearing upon its artificial propagation. Bulletin of the U.S. Commission of Fish and Fisheries. 13: 75-86.

Hofmann, E.E. and T.M. Powell. 1998. Environmental variability effects on marine fisheries: Four case histories. Ecological Applications. 8: S23-S32.

Howard, A.E. and D.B. Bennett. 1979. The substrate preference and burrowing behavior of juvenile lobsters (*Homarus gammarus* (L)). J. Nat. Hist. 12:433- 438.

Howell, P. and D. Simpson. 1994. Abundance of marine resources in relation to dissolved oxygen in Long Island Sound. Estuaries. 17(2): 394-402.

Howell, W.H., W.H. Watson, III and S.H. Jury. 1999. Skewed sex ratio in an estuarine lobster (*Homarus americanus*) population. J. Shellfish Research. 18: 193-201.

Incze, L.S. and C.E. Naimie. 2000. Modeling the transport of lobster (*Homarus americanus*) larvae and postlarvae in the Gulf of Maine. Fisheries Oceanography. 9: 99-113.

Incze, L.S., + 8 other authors. 2006. Early life history and a modeling framework for lobster (*Homarus americanus*) populations in the Gulf of Maine. J. Crustacean Biology. 26: 555-564.

Incze, L.S., + 9 other authors. 2010. Connectivity of lobster (*Homarus americanus*) populations in the coastal Gulf of Maine: Part II. Coupled biophysical dynamics. Fisheries Oceanography. 19(1): 1-20.

Johnson, A., G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry and P. Clapham. 2005. Fishing gear involved in entanglements of right and humpback whales. Mar. Mamm. Sci. 21(4): 635-645.

Johnson, K.J., J.S. Goldstein and W.H. Watson III. 2011. Two methods for determining the fertility status of early-stage American lobster, *Homarus americanus*, eggs. J. Crustacean Biology. 31: 693-700.

Jury, S.H. and W.H. Watson III. 2000. Thermosensitivity of the lobster, *Homarus americanus*, as determined by cardiac assay. Biological Bulletin. 199: 257-264.

Jury, S.H. and W.H. Watson III. 2012. Seasonal and sexual variation in the thermal preferences of estuarine lobsters. Abstract presentation at The U.S. – Canada Science Symposium: The American Lobster in a Changing Ecosystem. 27-30 November. Portland, Maine.

Jury, S.H., M.T. Kinnison, W.H. Howell and W.H. Watson III. 1994a. The behavior of lobsters in response to reduced salinity. J. Experimental Marine Biology and Ecology. 180: 23-37.

Jury, S.H., M.T. Kinnison, W.H. Howell and W.H. Watson, III. 1994b. The effects of reduced salinity on lobster (*Homarus americanus*) Milne-Edwards) metabolism: implications for estuarine populations. J. Experimental Marine Biology and Ecology. 176: 167-185.

Jury, S.H., W.H. Howell and W.H. Watson III. 1995. Lobster movements in response to a hurricane. Marine Ecology Progress Series. 119: 305-310.

Jury, S.H., W.H. Howell, D.F. O'Grady and W.H. Watson III. 2001. Lobster trap video: in situ video surveillance of the behavior of *Homarus americanus* in and around traps. NZ J. Marine and Freshwater Research. 52: 1125-1132.

Jury, S.H., C.C. Chabot and W.H. Watson III. 2005. Daily and circadian rhythms of locomotor activity in the American lobster, *Homarus americanus.* J. Experimental Marine Biology and Ecology. 318: 61-70.

Katz, C.H., J.S. Cobb and M. Spaulding. 1994. Larval behavior, hydrodynamic transport, and potential offshore-to-inshore recruitment in the American lobster *Homarus americanus*. Marine Ecology Progress Series. 103: 265-273.

Kennish, M.J. 2002. Environmental threats and environmental future of estuaries. Environmental Conservation. 29(1): 78-107.

Keppel, E., R. Scrosati and S. Courtenay. 2012. Effect of ocean acidification on American lobster. Abstract presentation at the U.S. – Canada Science Symposium: The American Lobster in a Changing Ecosystem. 27-30 November. Portland, Maine.

Krouse, J.S. 1976. Incidence of cull lobsters, *Homarus americanus* in commercial and research catches off the Maine coast. Fish. Bull. 74(4): 719-724.

Landeck-Miller, R.E., J.R. Wands, K.N. Chytalo and R.A. D'Amico. 2005. Application of water quality modeling technology to investigate the mortality of lobsters (*Homarus americanus*) in Western Long Island Sound during the summer of 1999. J. Shellfish Research. 24(3): 859-864.

Langley, T.G. and W.H. Watson, III. 2011. Seasonal changes in the daily activity of American lobsters (*Homarus americanus*): The influence of temperature and photoperiod. Abstract presentation at the 9th International Conference and Workshop on Lobster Biology and Management. 19-24 June. Bergen, Norway.

Lavalli, K.L. 1991. Survival and growth of early-juvenile American lobsters *Homarus americanus* through their first season while fed diets of mesoplankton, microplankton, and frozen brine shrimp. Fish. Bull. 89: 61-68.

Lavalli, K.L. and R.K. Kropp. 1998. Abundance of juvenile lobsters at the new outfall site: Comparisons with inshore abundances and discussion of potential impacts on lobster populations. Boston: Massachusetts Water Resources Authority. Report ENQUAD 1998-14. 26p.

Lawton, P. and K.L. Lavalli. 1995. Postlarval, juvenile, adolescent, and adult ecology. In: J.R. Factor (ed.) Biology of the lobster *Homarus americanus*. Academic Press, San Diego. Pp. 47-81.

Lewis, C.F., S.L. Slade and T.R. Matthews. 2009. Lobster trap impact on coral reefs: effects of wind-driven trap movement. NZ J. Marine and Freshwater Research. 43: 271-282.

Lincoln, D. 1998. Lobsters on the edge-essential lobster habitats in New England. Report, Greenlite Consultants, Newton Highland, MA. 77p.

Little, S.A. and W.H. Watson III. 2005. Differences in the size at maturity of female American lobsters, *Homarus americanus*, captured throughout the range of the offshore fishery. J. Crustacean Biology. 25: 585-592.

Long, W.C., K.M. Swiney, C. Harris, H.N. Page and R.J. Foy. 2013. Effects of ocean acidification on juvenile Red King crab (*Paralithodes camtschaticus*) and Tanner crab (*Chionoecetes bairdi*) growth, condition, calcification, and survival. PLoS ONE. 8(4): e60959.

Lund, W.A., Jr. and L.L. Stewart. 1970. Abundance and distribution of larval lobsters, *Homarus americanus*, off the coast of Southern New England. Proc. National Shellfish Association. 60: 40-49.

Maciolek, N.J., D.T. Dahlen, R.J. Diaz and B. Hecker. 2009. Outfall Benthic Monitoring Report: 2008 Results. Boston: Massachusetts Water Resources Authority (MWRA). Report 2009-13. 36p. + appendices.

MacKenzie, B.R. 1988. Assessment of temperature effect on interrelationships between stage durations, mortality, and growth in laboratory-reared *Homarus americanus* Milne Edwards larvae. J. Experimental Marine Biology and Ecology. 116: 87-98.

Mann, K.H. and P.A Breen. 1972. The relation between lobster abundance, sea urchins and kelp beds. J. Fisheries Research Board of Canada. 29: 603-609.

Manush, S.M., K. Pal, T. Das and S. Mukherjee. 2006. The influence of temperatures ranging from 25 to 36 C on developmental rates, morphogenesis and survival of freshwater prawn (*Macrobrachium rosenbergii*) embryos. Aquaculture. 256: 529-536.

Massachusetts Division of Marine Fisheries (MADMF). 2010. Potential impacts to lobsters and lobster habitat from chlorinated sewage outfall effluent in Massachusetts Bay and Buzzards Bay: A review of existing information. 12p.

McLeese, D.W. 1956. Effects of temperature, salinity and oxygen on the survival of the American lobster. J. Fish. Res. Board Can. 13(2): 247-272.

McLeese, D.W. and D.G. Wilder. 1958. The activity and catchability of the lobster (*Homarus americanus*) in relation to temperature. J. Fisheries Research Board of Canada. 15: 1345-1354.

Mercaldo-Allen, R. and C.A. Kuropat. 1994. Review of American lobster (*Homarus americanus*) habitat requirements and responses to contaminant exposures. NOAA Technical Memorandum NMFS-NE-105. 60p.

Micheli, F. and C.H. Peterson. 1999. Estuarine vegetated habitats as corridors for predator movements. Conservation Biology. 13: 869-881.

Miller, D.C., S.L. Poucher and L.L. Coiro. 1992. Development of dissolved oxygen criteria for Long Island Sound: The acute effects database. Long Island Sound Research Conference, Abstract Presentation. October 23-24. Southern Connecticut State University.

Mitchell, D.F., N.J. Maciole, K.M. Hopkins and K.D. Wandland. 1998. Biology of the lobster in Massachusetts Bay, Boston: Massachusetts Water Resources Authority (MWRA). Report ENQUAD 98-13. 83p.

Moriyasu, M., W. Landsburg, E. Wade and D.R. Maynard. 1999. The role of an estuary environment for regeneration of claws in the American lobster, *Homarus americanus* H. Milne Edwards, 1837 (Decapoda). Crustaceana. 72(4): 416-433.

Moutain, D.G. and J.P. Manning. 1994. Seasonal and interannual variability in the properties of the surface waters of the Gulf of Maine. Continental Shelf Research. 14: 1555-1581.

Myers, R.M., + 6 other authors. 2007. Saving endangered whales at no cost. Current Biology. 17(1): R10-R11.

Myers, A. and M.F. Tlusty. 2009. A long-term assessment of the physiological effects of herring (*Clupea harengus*) as a dietary component of the American lobster (*Homarus americanus*). NZ J. Marine and Freshwater Research. 43: 173- 183.

National Marine Fisheries Service (NMFS). 2010. Draft Environmental Impact Statement and Report for Proposed Effort Control Measures For the American Lobster Fishery. 304p.

National Resource Council (NRC). 1995. Understanding marine biodiversity: A research agenda for the Nation. National Academy Press. Washington, DC.

National Fish and Wildlife Foundation (NFWF). 2012. Impacts of Ghost Fishing to the American Lobster Fishery. Marine Debris Program 2009 – Final Report. Grant Project ID: 0306.09.018690 (MADMF). 34p.

New England Fisheries Management Council (NEFMC). 2002. Fishery management plan for deep-sea Red crab (*Chaceon quinquedenus*), including an environmental impact statement, an initial regulatory flexibility analysis, and a regulatory impact review. Vol I. 446p.

New England Fisheries Management Council (NEFMC). 2011. The Swept Area Seabed Impact (SASI) model: a tool for analyzing the effects of fishing on essential fish habitat. 21-January. 303p.

Ojeda, F.P. and J.H. Dearborn. 1991. Feeding ecology of benthic mobile predators: experimental analyses of their influence in rocky subtidal communities of the Gulf of Maine. J. Exp. Mar. Biol. Ecol. 149(1): 13-44.

O'Neill, D.J. and J.S. Cobb. 1979. Some factors influencing the outcome of shelter competition in lobsters (*Homarus americanus*). J. Marine Behavior and Physiology. 6(1): 33-45.

Pandian, T.J. 1970. Ecophysiological studies on the developing eggs and embryos of the European lobster *Homarus gammarus*. Marine Biology. 5: 154-167.

Pearce, J. and N. Balcom. 2005. The 1999 Long Island Sound lobster mortality event: Findings of the comprehensive research initiative. J. Shellfish Research. 24(3): 691-697.

Pecci, K.J., R.A. Cooper, C.D. Newell, R.A. Clifford and R.J. Smolowitz. 1978. Ghost fishing of vented and unvented lobster, *Homarus americanus*, traps. Mar. Fish. Rev. 40(5-6): 9-43.

Penkoff, S.J. and F.P. Thurberg. 1982. Changes in oxygen consumption of the American lobster, *Homarus americanus*, during the molt cycle. Comp. Biochem. Physiol. 72A(4): 621-622.

Perkins, H. 1972. Developmental rates at various temperatures of embryos of the northern lobster (*Homarus americanus* Milne Edwards). Fish. Bull. 70: 95-99.

Phillips, B.F. and A.N. Sastry. 1980. Larval ecology. In J.S. Cobb and B.F. Phillips (eds.). The Biology and Management of the Lobster. Academy Press, New York. Pp. 11-57.

Pinksky, M.L. and M. Fogarty. 2012. Lagged social-ecological responses to climate and range shifts in fisheries. Climatic Change. 115: 883-891.

Pottle, R.A. and R.W. Elner. 1982. Substrate preference behavior of juvenile American lobsters, *Homarus americanus*, in gravel and silt-clay sediments. Can. J. Fish. Aquat. Sci. 39: 928-932.

Powers, J., G. Lopez, R. Cerrato and A. Dove. 2004. Effects of thermal stress on Long Island Sound lobsters, *Homarus americanus*. Presentation during second working meeting of LIS Lobster Research Initiative. 3-4 May. Groton, Connecticut.

Pugh, T.L. and R.P. Glenn. 2012. Move it or lose it: Contraction of thermal habitat in Buzzards Bay, Massachusetts, and implications for the resource. Abstract presentation at The U.S. – Canada Science Symposium: The American Lobster in a Changing Ecosystem. 27-30 November. Portland, Maine.

Reynolds, W.W. and M.E. Casterlin. 1979. Behavioral thermoregulation and activity in *Homarus americanus*. Comparative Biochemistry and Physiology. 64A: 25-28.

Ries, J. B., A.L. Cohen and D.C. McCorkle. 2009. Marine calcifiers exhibit mixed responses to CO_2-induced ocean acidification. Geology. 37: 1131-1134.

Robohm, R.A., A.F.J. Draxler, D. Wieczorek, D. Kapareiko and S. Pitchford. 2005. Effects of environmental stressors on disease susceptibility in American lobsters: A controlled laboratory study. J. Shellfish Research. 24(3): 773-779.

Romero, M.C., F. Tapella, B. Stevens and C.L. Buck. 2010. Effects of reproductive stage and temperature on the rates of oxygen consumption in *Paralithodes platypus* (Decapoda: Anomura). J. Crustacean Biology. 30(3): 393-400.

Sasaki, G.C., J.M. Capuzzo and P. Biesiot. 1986. Nutritional and bioenergetics considerations in the development of the American lobster, *Homarus americanus*. Can. J. Fish. Aquat. Sci. 43: 2311-2319.

Sastry, A.N. and S.L. Vargo. 1977. Variations in the physiological responses of crustacean larvae to temperature. In: F.J. Vernberg (ed.). Physiological Responses of Marine Biota to Pollutants. Academic Press, New York. Pp. 401-424.

Shanks, A.L. 1995. Mechanisms of cross-shelf dispersal of larval invertebrates and fish. In: L. McEdwards (ed.). Ecology of Marine Invertebrate Larvae. CRC Press, Boca Raton, Florida. Pp. 323-367.

Sheehy, D. 1982. The use of designed and prefabricated artificial reefs in the United States. Marine Fisheries Review. 44(6-7): 4-15.

Short, F.T., K. Matso, H.M. Hoven, J. Whitten, D.M. Burdick and C.A. Short. 2001. Lobster use of eelgrass habitat in the Piscataqua River on the New Hampshire/Maine border, USA. Estuaries. 24(2): 277-284.

Sibert, V., P. Ouellet and J-C. Brethes. 2004. Changes in yolk total proteins and lipid components and embryonic growth rates during lobster (*Homarus americanus*) egg development under a simulated seasonal temperature cycle. Marine Biology. 144: 1075-1086.

Simpson, A.W. and L. Watling. 2006. An investigation of the cumulative impacts of shrimp trawling on mud-bottom fishing grounds in the Gulf of Maine: effects on habitat and macrofaunal community structure. ICES J. Marine Science. 63: 1616-1630.

Sindermann, C.J. 1996. Ocean pollution and shellfish diseases. In: C.J. Sindermann (ed.). Ocean Pollution: Effects on Living Resources and Humans. CRC Press. Boca Raton, Florida. Pp. 63–81.

Smith, E.M. and P.T. Howell. 1987. The effects of bottom trawling on American lobster, *Homarus americanus*, in Long Island Sound. Fish. Bull. 85(4): 737- 744.

Smith, E.M. and L.L. Stewart. 1985. A study of lobster fisheries in the Connecticut waters of Long Island Sound with special reference to the effects of trawling on lobsters. Report to the Connecticut Guard Assembly on Special Act 83-29. 56p.

Spurr, E.W. 1978. An assessment of short term effects of otter trawling on large epibenthic invertebrates. Final Report to Dept. of Commerce, NOAA, NMFS. Comm. Fish. Res. Dev. Act, N.H., Proj. 3-248-R. 10p.

Stone, R.P. and C.E. O'Clair. 2002. Behavior of female Dungeness crabs, *Cancer magister*, in a glacial southeast Alaska estuary: Homing, brooding-site fidelity, seasonal movements, and habitat use. J. Crustacean Biology. 22: 481-492.

Talbot, P., C. Thayer and P. Wilson. 1984. Spawning, egg attachment and egg retention in captive lobsters (*Homarus americanus*). Aquaculture. 37: 239-249.

Talbot, P. and R. Harper. 1984. Abnormal egg stalk morphology is correlated with clutch attrition in laboratory-maintained lobsters (*Homarus*). Biological Bulletin. 166: 349-356.

Talbot, P. and M. Goudeau. 1988. A complex cortical reaction leads to formation of the fertilization envelope in the lobster, *Homarus americanus*. Gamete Research. 19: 1-18.

Templeman, W. 1933. The effect of environmental conditions on the survival of lobster larvae. Biol. Ed. Can. Man. Rep. 183: 22p.

Templeman, W. 1936. The influence of temperature, salinity, light and food conditions on the survival and growth of the larvae of the lobster (*Homarus americanus*). J. Biol. Board Can. 2: 485-497.

Templeman, W. 1940. Lobster tagging on the west coast of Newfoundland, 1938, Dept. Nat. Res. Fish. Bull. No. 8. 16p.

Templeman, W. and S.N. Tibbo. 1945. Lobster investigations in Newfoundland 1938 to 1941. Newfoundland Dept. Nat. Resour. Fish. Res. Bull. 16: 98p.

Tlusty, M., A. Metzler, E. Malkin, J. Goldstein and M. Koneval. 2008. Microecological impacts of global warming on crustaceans - temperature induced shifts in the release of larvae from American lobster, *Homarus americanus*, females. J. Shellfish Research. 27(2): 443-448.

Waddy, S.L. and D.E. Aiken.1995. Temperature regulation of reproduction in female American lobsters, *Homarus americanus*. ICES Marine Science Symposium. 199: 54-60.

Waddy, S. L., V. A. Merritt, M.N. Hamilton-Gibson, D.E. Aiken and L.E. Burridge 2007. Relationship between dose of emamectin benzoate and molting response of ovigerous American lobsters (*Homarus americanus*).Excotoxicology and Enivronmental Safety. 67: 95-99.

Wahle, R.A. 1988. Recruitment and body size-dependent habitat selection and predator impact in early benthic phase American lobsters. Amer. Zool. 28(4): 14.

Wahle, R.A. 1993. Recruitment to American lobster populations along an estuarine gradient. Estuaries. 16: 731-738.

Wahle, R.A. and R.S. Steneck. 1991. Recruitment habitats and nursery grounds of the American lobster: a demographic bottleneck? Mar. Ecol. Prog. Ser. 69:231-243.

Wahle, R.A. and L.S. Incze. 1997. Pre- and post-settlement processes in recruitment of the American lobster. J. Experimental Marine Biology and Ecology. 217: 179-207.

Wahle, R.A. and M.J. Fogarty. 2006. Growth and development: Understanding and modeling growth variability in lobsters. In: B.F. Phillips (ed.). Lobsters: Biology, Management, Aquaculture and Fisheries. Blackwell Publishing Ltd. Oxford, UK. Pp. 1-44.

Wahle, R.A. 2009. American Lobster Settlement Index: Looking back/looking ahead. Workshop Proceedings, 19-21 June. Burnt Island, Boothbay Harbor, Maine USA. 24p.

Wahle, R. A. + 9 other authors. 2013. The geography and bathymetry of American lobster benthic recruitment as measured by diver-based suction sampling and passive collectors. Marine Biology Research. 9: 42-58.

Walther, K., K. Anger and H.O. Portner. 2010. Effects of ocean acidification and warming on the larval development of the spider crab *Hyas araneus* from different latitudes (54 degrees vs.79 degrees N). Marine Ecology Progress Series. 417: 159–170.

Watson, W.H. III., A. Vetrovs and W.H. Howell. 1999. Lobster movements in an estuary. Marine Biology. 134: 65-67.

Weaver, G. 1984. PCB contamination in and around New Bedford, Mass. Environ. Sci. Technol. 18(1): 22A-27A.

Weiss, H.M. 1970. The diet and feeding behavior of the lobster,*Homarus americanus*, in Long Island Sound. Storrs, Connecticut. Ph.D Dissertation. University of Connecticut. 80p.

White, C.D., K. Bixby and W.H. Watson III. 2012. Presence of a light-sensitive molecule, cryptochrome, in the ventral nerve cord of lobsters (*Homarus americanus*). Abstract presentation at The U.S. – Canada Science Symposium: The American Lobster in a Changing Ecosystem. 27-30 November. Portland, Maine.

Whiteley, N.M., E.W. Taylor and A.J. El Haj. 1997. Seasonal and latitudinal adaptation to temperature in crustaceans. J. Thermal Biology. 22: 419-427.

Wilson, C.J. 1999. Bathymetric and spatial patterns of settlement in American lobster, *H. americanus*, in the Gulf of Maine: Insights into processes controlling abundance. M.S. Thesis. University of Maine. 37p.

Witherell, D.B. and A.B. Howe 1989. Mortality of new shell American Lobster captured by a research trawl. Massachusetts Division of Marine Fisheries (MADMF) Report. 6p.

Worden, M. K., C.M. Clark, M. Conway and S.A. Qadri. 2006. Temperature dependence of caridac performance in the lobster *Homarus americanus*. J. Exp. Mar. Biol. Ecol. 209: 1024-1034.

Xue, H. L. Incze, D. Xu, N. Wolff and N. Pettigrew. 2008. Connectivity of lobster populations in the coastal Gulf of Maine. Part I: Circulation and larval transport potential. Ecological Modeling. 210: 193-211.

Zulkosky, A.M., J.P. Ruggieri, S.A. Terracciano, B.J. Brownawell and A.E. Mcelroy. 2005. Acute toxicity of Resmethrin, Malathion and Methoprene to larval and juvenile American lobsters (*Homarus americanus*) and analysis of pesticide levels in surface waters after Scourge™, Anvil™, Altosid™ application. J. Shellfish Research. 24(3): 795-804.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

May 29, 2014

To: **American Lobster Technical Committee**
American Lobster Management Board

From: **Kate Taylor, Senior FMP Coordinator**

Re: **American Lobster Addendum XVII Evaluation**

Per Addendum XVII all Lobster Conservation Management Areas (LCMAs) within Southern New England (SNE) were required to reduce exploitation by 10% in order to address rebuilding. The Technical Committee (TC) previously reviewed proposals submitted by the LMCAs to ensure they met the criteria established by the American Lobster Management Board (Board) within Addendum XVII (see enclosed memo dated February 1, 2012). The TC has been tasked to evaluate if the approved measures have met the 10% reduction requirement.

By July 1st each state within the SNE stock (LCMAs 2 – 6) must provide: 1) updated landings information through 2013 and 2) an evaluation of the implemented management measures in meeting the required 10% reduction. The reference base years for evaluating the reduction are 2007 – 2009. The Board will be reviewing this program evaluation at the ASMFC Summer Meeting in August.

The management measures approved by the Board are as follows:

LCMA 2

- Mandatory V-notching and immediately release of legal sized egg-bearing female lobsters effective June 1, 2012
- V notches must be to the right of the center flipper as viewed from the rear of the female lobster when the underside of the lobster is down. The v notch should be made by means of a sharp blade bladed instrument, at least ¼ inch and not greater than a ½ inch in depth and tapering to a sharp point.

LCMA 3

- Minimum gauge increases to 3 17/32 inches effective January 1, 2013

LCMA 4

- Mandatory V-notching and immediately release of egg-bearing female lobsters effective July 1, 2012
- V notches must be to the right of the center flipper as viewed from the rear of the female lobster when the underside of the lobster is down. The v notch should be made by means of a sharp blade bladed instrument, at least ¼ inch and not greater than a ½ inch in depth and tapering to a sharp point.
- A season closure to the landing of lobsters from February 1st through March 31st.

- During the February 1st to March 31st closure, lobster potters will have a two week period to remove lobster pots from the water and may set lobster pots one week prior to the end of the closed season.

LCMA 5

- Mandatory V-notching and immediately release of egg-bearing female lobsters effective January 1, 2013
- V notches must be to the right of the center flipper as viewed from the rear of the female lobster when the underside of the lobster is down. The v notch should be made by means of a sharp blade bladed instrument, at least ¼ inch and not greater than a ½ inch in depth and tapering to a sharp point.
- A season closure to the landing of lobsters from February 1st through March 31st.
- During the February 1st to March 31st closure, lobster potters will have a two week period to remove lobster pots from the water and may set lobster pots one week prior to the end of the closed season.

LCMA 6

- A seasonal closure from September 8th to November 28th
- A two week gear removal and two week gear replacement grace period during the closed season, and no lobster traps can be baited more than 1 week prior to season reopening.

Commonwealth of Massachusetts

Division of Marine Fisheries

251 Causeway Street, Suite 400
Boston, Massachusetts 02114
(617)626-1520
fax (617)626-1509

Paul J. Diodati
Director

Deval Patrick
Governor
Maeve Vallely Bartlett
Secretary
Mary B. Griffin
Commissioner

To: ASMFC American Lobster Technical Committee
Re: Evaluation of LMA 2 management plan

INTRODUCTION

To address the depleted condition of the SNE lobster stock, the ASMFC Lobster Board implemented Addendum XVII to reduce exploitation on this stock by 10% with the purpose of initiating rebuilding. All LMAs within the SNE stock were tasked with submitting plans to achieve a 10% reduction in exploitation. While not a management measure recommended by the PDT, LMA 2 submitted a mandatory v-notching plan, which was approved by the Board as conservation equivalency to the recommended measures of increased minimum legal size, decreased maximum size, or implementation of closed seasons (see Addendum XVII available at: http://www.asmfc.org/uploads/file/amLobsterAddendumXVII_feb2012.pdf). The LMA 2 plan called for mandatory v-notching (notch depth to ¼") and release of all legal-sized ovigerous females. LMA 2 uses the 1/8th" V-notch definition regarding harvest protection for v-notched females.

This document is intended to provide updated landings information for the MA portion of LMA 2, and to evaluate the effectiveness of the LMA 2 management plan at achieving the required 10% reduction.

FISHERY-DEPENDENT DATA

Landings in the MA portion of LMA 2 (primarily NMFS Statistical Areas 538 and 537) have declined 12.7% as of 2013 relative to the reference time period (2007 – 2009), and landings in the last three years have been the lowest values in the time series (Figure 1). Relative exploitation (landings/relative abundance) has declined 77% as of 2013 from the reference time period average, from 1.6 down to 0.36. Exploitation over the past four years has been lower than any time since the early 1990's (Figure 2), indicating that harvest is taking place at a lower rate than in the past. This exploitation value represents inshore LMA 2 only, as the landings and MADMF survey data are from NMFS SA 538; thus this exploitation rate likely does not reflect conditions where the majority of fishing activity is currently taking place (Area 537).

There has been continued attrition in the industry, which has lost another 8% of permit holders since the 2007-2009 time period (Table 1); active permits have declined 53% as of 2012 since the 1997 landings peak. Catch per unit effort (CPUE) has increased over the past 5 years (Figure 3), although this is a result of dramatically reduced effort (trap hauls) related to the continued attrition in the industry (Figure 3 and Table 1).

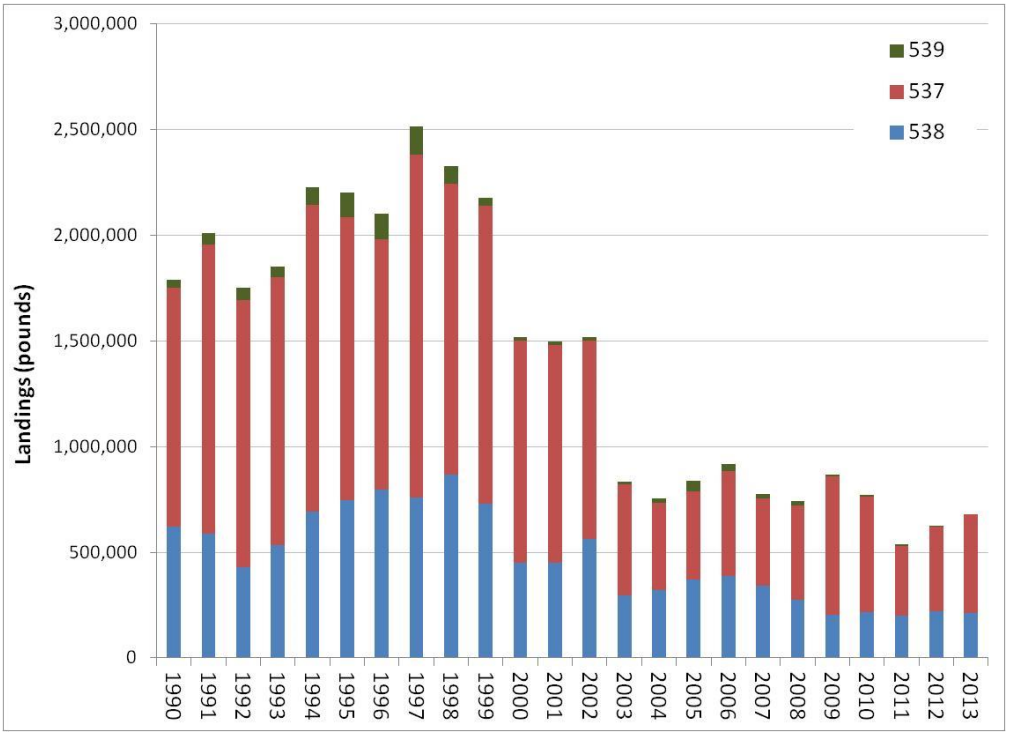


Figure 1. Annual Massachusetts lobster landings (millions of pounds) for NMFS Stat Areas (537, 538, and 539) within LMA 2.

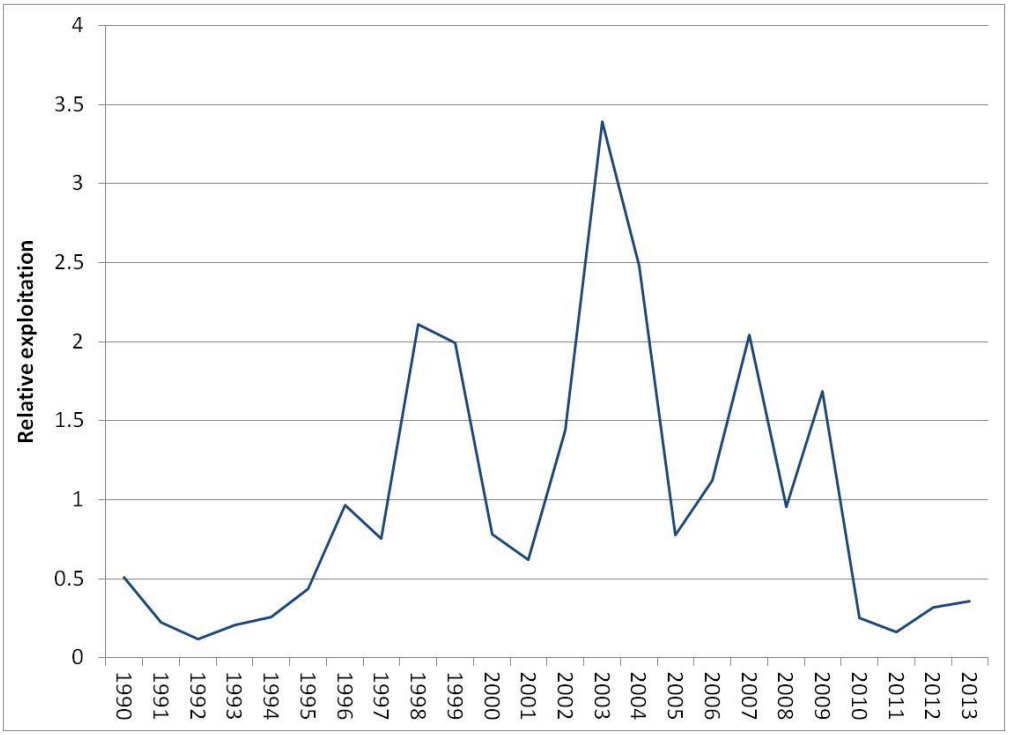


Figure 2. Relative exploitation rate (landings/survey abundance) for NMFS SA 538 (inshore LMA 2).

Table 1. Reference period (2007 – 2009) average number of active permits and traps hauled, 2012 values, and percent change these values.

	2007 - 2009 ave.	2012	% change
Active permits	135	124	-8.15
Traps hauled	1,032,507	634,506	-38.55

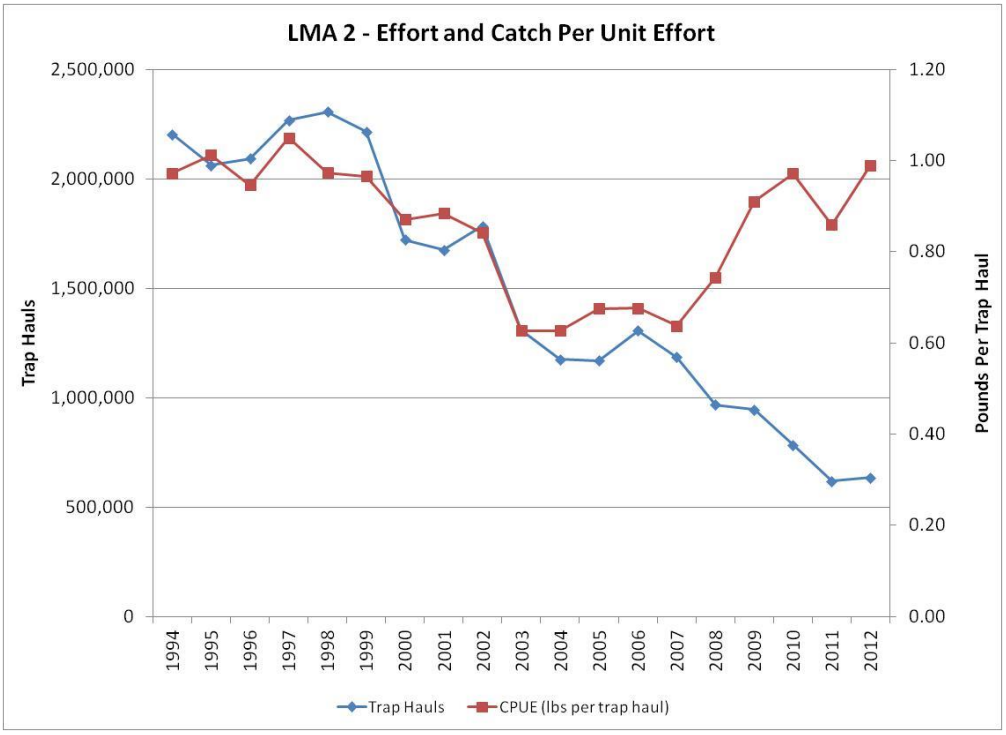


Figure 3. Annual trap hauls (left axis) and catch per trap haul (right axis) for MA LMA 2 permit holders.

Since the implementation of mandatory v-notching in LMA 2, the percentage of v-notched females observed in the MADMF commercial trap sampling program has declined in relation to the reference time period of 2007 – 2009 (Figure 4). During the reference time period an average of 8.9% of legal-sized females were v-notched (the average number sampled was 3,114), while in 2013, one year after mandatory v-notching was instituted, only 6.7% of legal-sized females were v-notched (2,451 females were sampled). There was a minor uptick in the percent of legal-sized females with a v-notch in 2013 relative to 2011 and 2012 (Figure 4). However, this increase was from roughly 3.5% of females to approximately 6.7%, and certainly doesn't suggest a large increase in the v-notching rate. For comparison, note the relatively high prevalence of legal-sized v-notched females from 2004 – 2006, the time period corresponding to the North Cape Oil Spill Mitigation Program (a v-notching program) in MA waters.

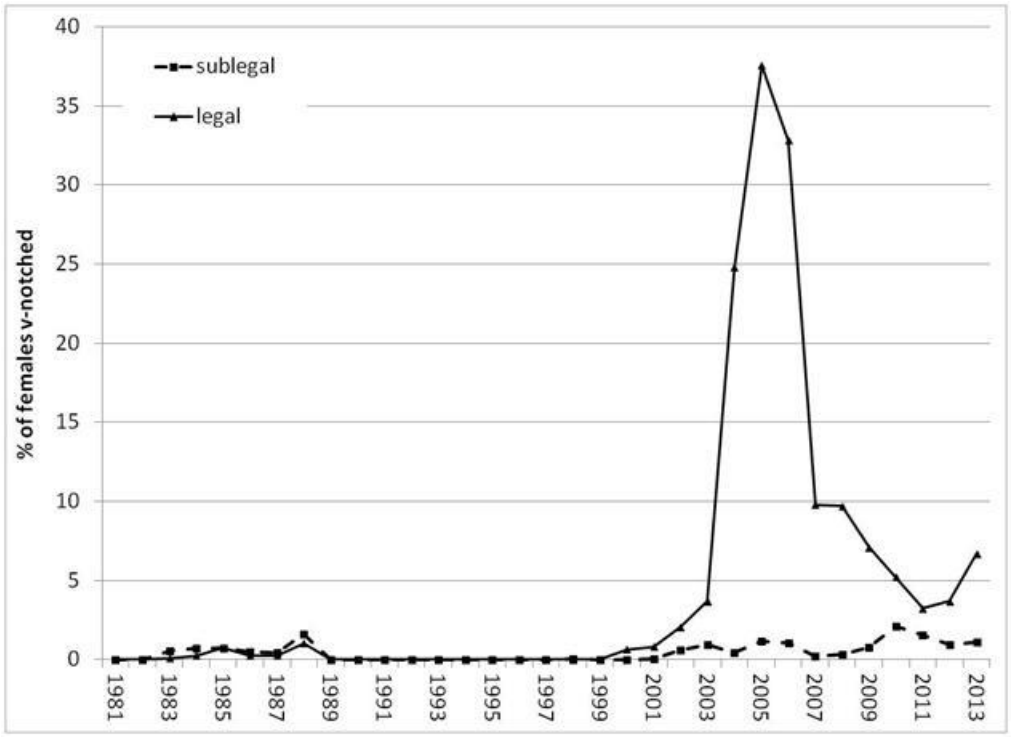


Figure 4. Annual percent of the sublegal and legal-sized female catch from Buzzards Bay (Area 538/537) commercial trap sampling that had a v-notch (1/8" definition).

FISHERY-INDEPENDENT SURVEY DATA

The percentage of legal-sized females with a v-notch did not change from 2011 to 2012 in the original Ventless Trap Survey area (Figure 5). There was a slight uptick in v-notched females from 2011 to 2012 in the expanded survey area, which incorporates a deeper depth stratum and overlaps slightly better with the commercial fleet. However, again compare these v-notching rates to those observed early in the survey time series (2006), and there is little evidence to suggest substantial increases in the proportion of the stock v-notched since the implementation of mandatory v-notching in 2012. Unfortunately there are no survey data from 2013, because there was no funding to conduct the survey. The ventless trap survey was resumed in 2014 and funding appears to be secure moving forward.

Relative abundance of lobsters in the area has remained low, although the last three years have seen modest increases in both recruit-sized and fully recruited lobsters relative to the reference time period (2007 – 2009) (MADMF SNE fall bottom trawl survey, Figure 6). While both the RI and MA YOY survey indices saw slight upticks in 2013, these recruitment indices also remain low, and with such large inter-annual variation throughout the time series it is not wise to assign implications to single data points (Figure 7).

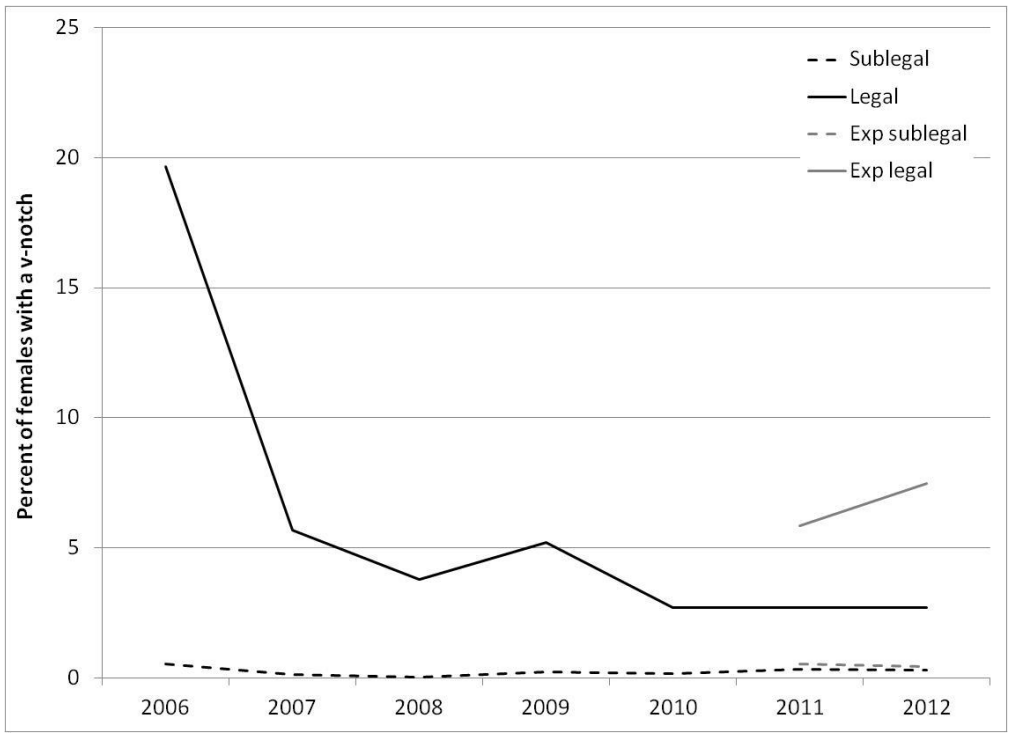


Figure 5. Annual percent of sublegal (dashed line) and legal-sized (solid line) females in Ventless Trap Survey catch with a v-notch (1/8" definition). In 2011 and 2012 the survey was expanded to include an additional, deeper depth stratum. Data from the original survey area only are shown in black (all years), data from the complete expanded survey are in grey (2011 and 2012 only).

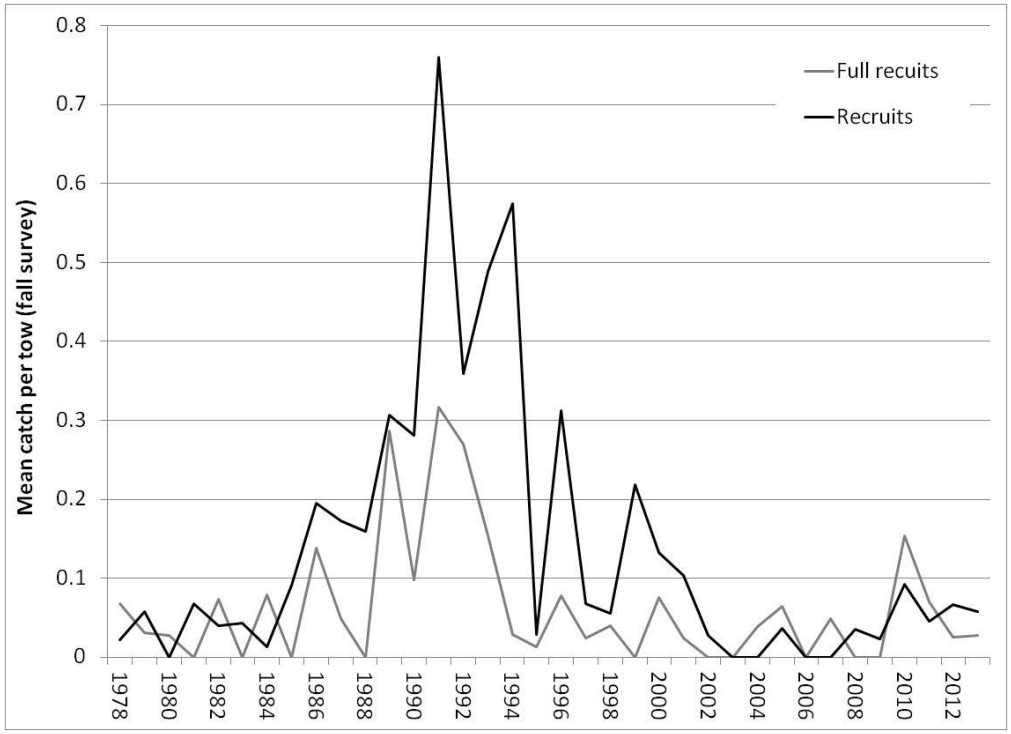


Figure 6. MADMF fall bottom trawl survey mean catch per tow of "full recruits" (legal-sized) and "recruits" (10 mm below minimum legal size). Sexes combined.

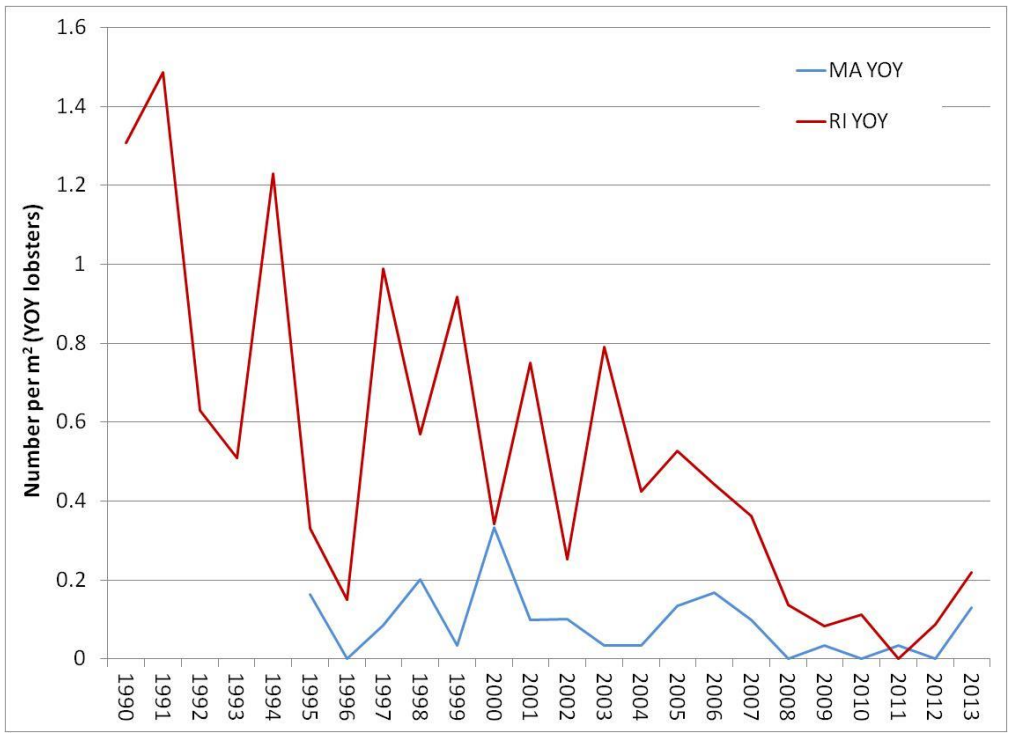


Figure 7. Young-of-the-year lobster density (number/m^2) from MA and RI suction sampling surveys.

CONCLUSION

Landings in the MA portion of LMA 2 have declined by more than 10% since the reference time period. Similarly the relative exploitation rate has declined dramatically. However, neither of these reductions appear to be the result of conservations measures (namely the mandatory v-notching program), but instead are likely indicative of continued very poor resource conditions and a failing fishery. There is no indication from the commercial trap sampling program or the ventless trap survey to suggest that v-notching rates increased substantially after implementation of mandatory v-notching. This is likely due to very low encounter rates of egg-bearing females concomitant with the extraordinarily low levels of fishing effort. For a v-notching program to be successful it is necessary for moderate to high rates of fishing effort to ensure sufficient encounter rates of egg-bearing females.

There is plenty of evidence that abundance has remained low, settlement has remained low, and we should not expect any improvements in stock conditions in the foreseeable future. While CPUE has improved, this is due to the large reduction in trap hauls, and should not be interpreted as improvements in the stock. Landings have been consistently low and declining over the past several years. The increased CPUE may be creating the perception in remaining industry participants that conditions are improving, as they may be observing improved catch rates in their gear. This perception is misleading, and is solely the result of the stock's remnants being divided into fewer pieces among those industry members that have managed to stay operational.

Rhode Island
Department of Environmental Management

DIVISION OF FISH AND WILDLIFE
401 423-1920
FAX 401 423-1925
3 Fort Wetherill Rd
Jamestown, RI 02835

American Lobster Addendum XVII Evaluation for Rhode Island

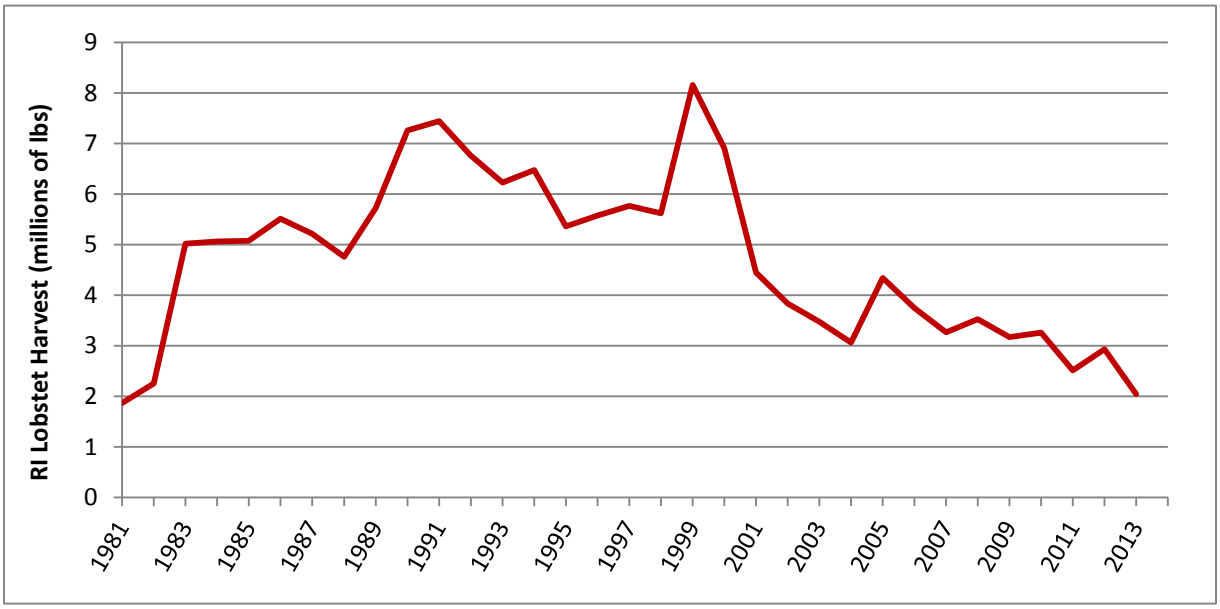
By: Jeff Mercer
RI Department of Environmental Management
Division of Fish and Wildlife

Background:

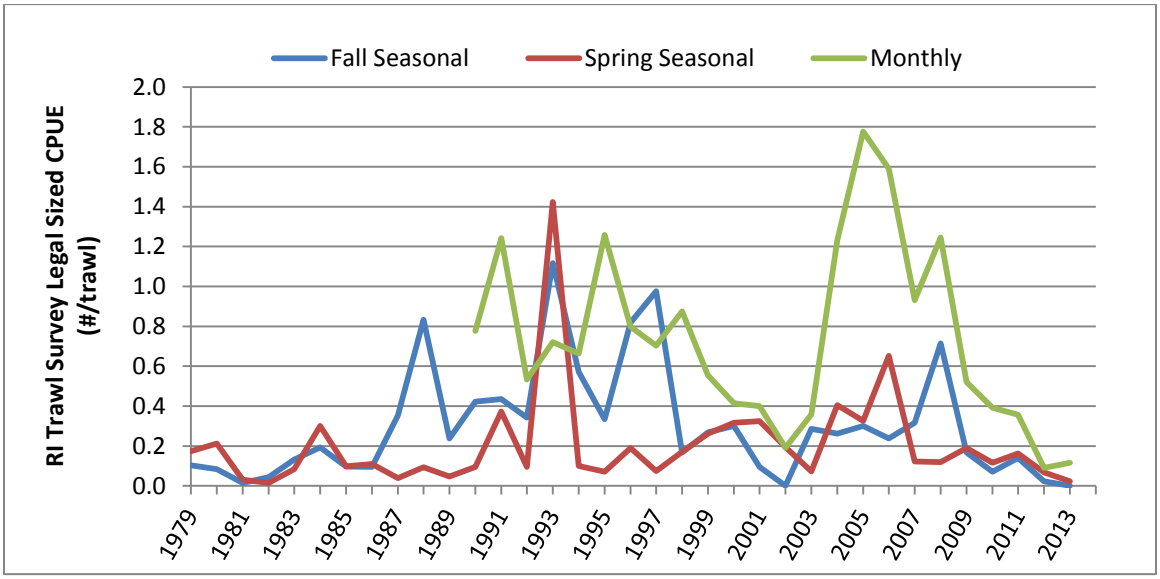
Per Addendum XVII all Lobster Conservation Management Areas (LCMAs) within Southern New England (SNE) were required to reduce exploitation by 10% in order to address rebuilding. State representatives to the Technical Committee (TC) have been tasked tp provide: 1) updated landings information through 2013 and 2) an evaluation of the implemented management measures in meeting the required 10% reduction using 2007-2009 as reference base years for evaluating the reduction. Specific measures include a Mandatory V-notching and immediately release of legal sized egg-bearing female lobsters effective June 1, 2012 in LCMA 2 and a Minimum gauge increases to 3 17/32 inches effective January 1, 2013 LCMA 3.

Landings Update:

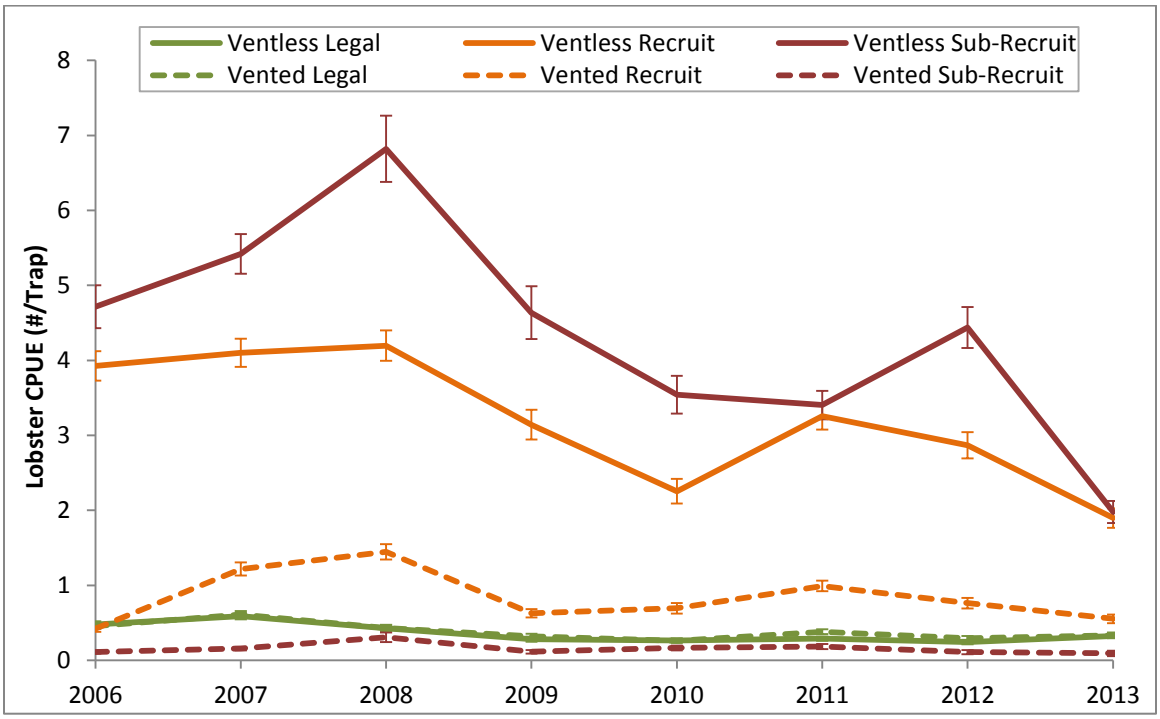
A direct evaluation of exploitation rate is not possible until the bench mark stock assessment is complete and there is an estimate of the total population for the years in question. Catch can be used as proxy for exploitation rate with the assumption that the stock has remained the same over the time period. Lobster landings in millions of pounds in Rhode Island from 1981-2013 have shown a dramatic downward trend since 1999 (Figure 1). The average harvest during the 2007-2009 period was 3.23 million pounds of lobster per year. The average yearly harvest for 2012-2013 was 2.49 million pounds which is a 25.1% reduction from the reference years. There has been a general trend of increasing proportion of landings coming from offshore waters in recent years. In 2012, LCMA 3 accounted for 78.2% of Rhode Island Landings as opposed to an average of 63.9% during 2008-2009. LCMA 2 accounted for all but a miniscule fraction of the remaining landings, 21.6% of the total landings in 2012 versus an average of 36.1% during 2008-2009.



The RI DEM Trawl survey indicates that the legal sized lobster population in Rhode Island waters (LCMA 2) has likely decreased in recent years so the assumption that the stock size has remained the same is likely not true. For the 2012-2013 time period, there was a 97% reduction in the Fall seasonal survey CPUE (legal sized lobsters/trawl) when compared to the reference years, a 68% reduction in the Spring seasonal CPUE and an 88% reduction in the Monthly Trawl survey CPUE (Figure 2). In 2012, LCMA 2 accounted for 21.6% of Rhode Island Landings as opposed to an average of 36.1% during 2008-2009. We have no state specific indices to evaluate trends in abundance form LCMA 3.



The RI DEM Ventless Trap survey indicates similar trends in the lobster population in the Rhode Island portion of LCMA 2 (Figure 3). For the 2012-2013 time period, there was a 32.5% reduction in the CPUE (lobsters/trap) for all trap types for legal sized lobsters. Similar trends for smaller lobsters were observed with a 38.8 % reduction for recrutis (75-85 mm) and 45.5% reduction for sub-recruits (<75 mm) (Table 1).



Ventless Trap Survey Average CPUE

Size Class	Legal		Recruit		Sub-Recruit	
Trap Type	Ventless	Vented	Ventless	Vented	Ventless	Vented
2007-2009	0.43	0.45	3.81	1.10	5.63	0.19
2012-2013	0.28	0.31	2.38	0.66	3.21	0.10
Reduction	34.2%	30.9%	37.5%	40.1%	43.0%	48.1%

Management Measures Evaluation:

RI DEM is able to evaluate the proportion of v-notched lobsters in Rhode Island waters (LCMA 2) through the sea sampling program. From 2000-2006 there was a v-notch program in effect in RI waters funded as part of the North Cape Oil Spill remediation program. Fishermen were paid market price for female eggers that were v-notched and released. With high participation in the program over 1 million female eggers were v-notched. The program resulted in a high proportion of v-notched lobsters in the population in the immediate years (Table 2). The 2007-2009 time period is therefore not a good reference base period with as many as many as 36.7% of the legal female lobsters having a v-notch in 2007 and an average of 19.4% v-notched over the entire time period.

The proportion of legal females sampled with v-notches in 2012 was 3.55%, only slightly up from 2011 at 3.22% when v-notching in LCMA 2 was not mandatory. However, the total number of legal females sampled was much lower in 2012 due to funding cuts in the program with only 1691 individuals sampled, about 40% of what was sampled the previous year. In 2013, funding was not restored until the summer and sampling did not begin again until August. Only 489 legal sized females were sampled during the whole year. The observed v-notch rate was extremely low in 2013 but we attribute this low rate primarily to a new sea sampler who was not diligently checking for v-notches. For all years, the percentage V-notched does not include those individuals that were newly notched as no protection has been afforded to them yet by the V-notch (i.e. they would have been thrown back anyway because they were carrying eggs.)

Female Legal Sized Lobsters

	% V-notched	# Sampled
2000	7.41%	7923
2001	6.85%	6763
2002	12.29%	7097
2003	24.37%	7744
2004	30.23%	7692
2005	50.95%	13037
2006	44.99%	10952
2007	36.74%	3519
2008	8.12%	10423
2009	13.31%	4704
2010	8.92%	4823
2011	3.22%	4157
2012	3.55%	1691
2013	0.20%	489

The impact of the gauge increase in LCMA 3 is difficult for RI DEM to evaluate as the sea sampling program was discontinued prior to the implementation in 2013. With no information of the size distribution of the catch in these waters and the amount of undersized discarded by fishermen it is impossible to evaluate the proportion of the population that is protected by these measures. Inclusion of federal data and industry supported data sources may help determine the effectiveness of the gauge increase.

Conclusions:

There has been a dramatic 25% reduction in catch for the 2012-2013 time period when compared to the reference base years. This reduction is likely due to decreased natural abundance and attrition in the fishery. The v-notch program is likely contributing to a reduced exploitation rate but is not responsible for the 25% reduction as v-notched proportions were higher during the reference base years due to the North Cape remediation funded project.

Memorandum

To: ASMFC Lobster Technical Committee

From: Penny Howell

Date: 7/7/2014

Re: **Effect of the LCMA 6 Harvest Closure on Connecticut Lobster Landings in 2013**

The state of Connecticut enacted a harvest closure for lobster from September 8 through November 28, beginning in 2013 in order to reduce state landings by 10% annually. These dates were based on weekly percentages commercial and recreational landings in LCMA 6 by New York and Connecticut license holders during 2007-2009. Since 2009, Connecticut landings from LCMA 6 have declined by an average of 18% annually; landings in 2012 were already 39% lower than landings in 2009. With the closure in 2013, landings dropped again by nearly half (48%), and were 68% below what they were in 2009.

Seasonally, there was no indication of recoupment following the 2013 closure. Few license holders resumed fishing in December 2013 following the closure; that month contributed a modest 3.6% of total landings for 2013:

	2013 CLOSED SEASON			Total
Year	Before	During	After	pounds
2009	264,109	45,461	59,767	369,337
2010	377,102	24,372	14,370	415,844
2011	156,261	20,444	12,725	189,430
2012	216,919	5,337	3,133	225,389
2013	113,143	-	4,188	117,331

	2013 CLOSED SEASON		
Year	Before	During	After
2009	71.5%	12.3%	16.2%
2010	90.7%	5.9%	3.5%
2011	82.5%	10.8%	6.7%
2012	96.2%	2.4%	1.4%
2013	96.4%	closure	3.6%
2009-2012	85.2%	7.8%	6.9%

Note that these figures represent CT commercial landings originating from LCMA 6 waters for CT license holders only. Recreational landings for 2013 are not available but have totaled less than 3% of commercial landings in previous years.

NEW JERSEY DIVISION OF
Fish and Wildlife
Mail Code 501-03
P.O. Box 420
Trenton, NJ 08625-0400
David Chanda, Director

MEMORANDUM

TO: ASMFC American Lobster Technical Committee

FROM: Peter Clarke, New Jersey Bureau of Marine Fisheries

DATE: July 15, 2014-Revised

SUBJECT: New Jersey American Lobster Addendum XVII Evaluation

As per Atlantic States Marine Fisheries Commissions (ASMFC) Addendum XVII, the New Jersey Division of Fish and Wildlife (NJDFW) implemented management measures to the American lobster fishery in Lobster Conservation Management Area (LCMA) 4 and 5 to comply with a required 10 percent reduction in harvest. In order to achieve this reduction, a closed season from February 1 to March 31 and a mandatory v-notch program for egg-bearing females was implemented on July 1, 2012. The reference base years for evaluating the reduction are 2007-2009 with an average harvest in LCMA 4 of 491,368 pounds and LCMA 5 of 21,991 pounds for NJ (Fig. 1).

New Jersey landings in 2013 were a cumulative 660,066 pounds (Fig. 2) harvested by all gear types in all LCMA's, an overall reduction in harvest of 13.2% (Fig. 1). Based on NJ DFW at-sea observer data, 0.5% of all lobsters observed in 2013 were v-notched females (Fig. 3), substantially lower than the expected 6.4% used to calculate the Addendum XVII management measures for LCMA 4. Although overall State landings have been reduced by 13.2%, when each LCMA harvest is observed, the reduction is carried by LCMA's 3 and 5, 43% and 34% respectively, with LCMA 4 harvest increasing by 3.26%. Effort in LCMA 4 has remained relatively constant over time with roughly 20 full time lobster vessels during both the reference period and 2013. Effort in LCMA's 3 and 5 has decreased over time and is the likely reason for the observed reduction in landings. When monthly landings are observed over the past 4 years, landings during 2013 are very similar to those of 2010 and 2011 with no sharp increase occurring after the closed period of February and March indicating that recoupment did not occur (Fig. 4). The closed

season for New Jersey during the months of February and March are typically a period of little harvest, therefore with v-notching not accounting for the expected percentage (6%) and harvest increasing by 3% overall in LCMA 4, a 10% reduction was not realized for LCMA 4 in 2013. A reduction of 34% was observed in LCMA 5, likely due to a decrease in in effort in the black sea bass pot fishery resulting in lobster by-catch.

Appendix.

Figure 1. New Jersey Percent Reduction Through Mandatory V-Notching and Two Month Closed Season From February 1-March 31.

Year	Average LCMA 3	Average LCMA 4	Average LCMA 5	Total
2007-2009	241,100	491,368	21,991	761,420
2013	138,124	507,376	14,566	660,066
Percent Reduction	-42.71%	3.26%	-33.76%	-13.31%

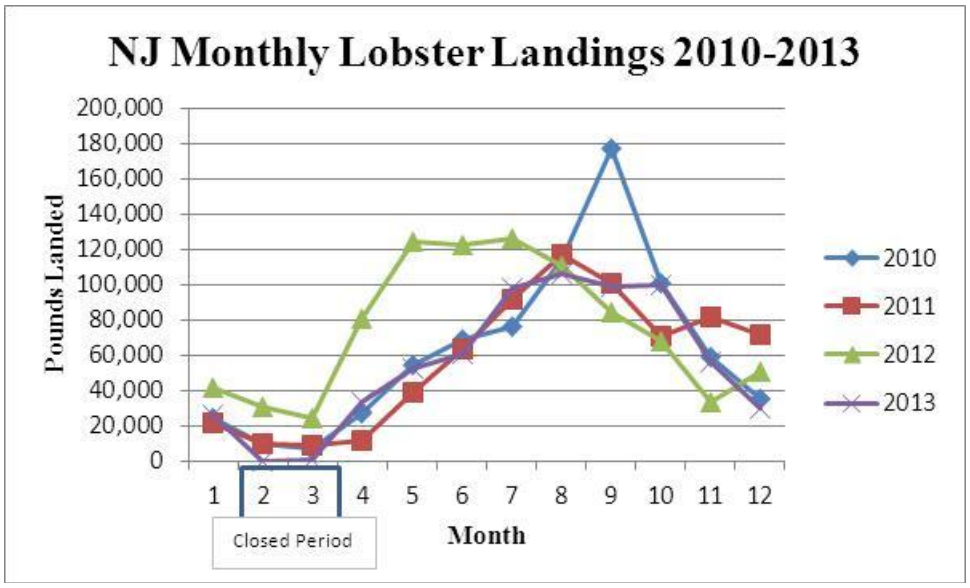
Figure 2. Amercian lobster landings in New Jersey from all gear types. (Data Source: NMFS VTR, ACCSP SAFIS).

Year	LCMA 3	LCMA 4	LCMA 5	Other	Grand Total
1996	2,491	335,669	105,615	8,053	451,828
1997	3,543	362,849	115,688	3,858	485,938
1998	457	479,524	114,126	4,305	598,412
1999	2,007	659,036	114,895	8,928	784,866
2000	815	677,241	152,037	10,703	840,796
2001	78,321	482,779	85,873	6,466	653,439
2002	115,916	355,678	32,527	2,112	506,233
2003	94,625	248,812	36,488	1,928	381,853
2004	111,323	260,104	40,059	1,839	413,325
2005	89,192	271,703	41,296	824	403,015
2006	160,351	372,565	12,968	3,395	549,279
2007	227,558	489,978	20,531	2,742	740,809
2008	258,409	452,925	23,556	10,751	745,641
2009	237,333	531,202	21,885	7,390	797,810
2010	204,877	521,784	21,495	7,622	755,778
2011	215,049	454,282	18,724	325	688,380
2012	119,111	758,233	21,794	2,344	901,482
2013	138,124	507,376	14,566	0	660,066
Grand Total	1,921,378	7,714,364	979,557	83,585	10,698,884

Figure 3. New Jersey At-Sea Observer v-notch data.

Year	Total Lobsters Observed	Total No. Eggers	% Eggers	Total Observed V-Notched	% V-Notched
2012	23,690	823	3.5	29	0.1
2013	9,954	1,088	10.9	39	0.4
Total	**33,644**	**1,911**	**5.7**	**68**	**0.2**

Figure 4. New Jersey American lobster landings by month from 2010 to 2013.



Maryland American Lobster Data for the ASMFC Technical Committee
1 July 2014

Introduction:

The Maryland American Lobster Fishery is a small but economically important fishery centered in Ocean City, Maryland. Although lobster landings reported for Maryland have averaged below 1% of the total coastal landings for recent years, Maryland recognizes that it does not qualify for *de minimus* status, and will not request that status for 2014. The Maryland American Lobster Fishery accounted for 8.3% of the Mid-Atlantic landings in 2013 and 0.05% of the combined Mid-Atlantic and North Atlantic landings in 2013.

Updated Landings Data (Source ACCSP Data Warehouse and MDNR 30 June 2014):

Maryland landed 62,813 pounds of American Lobster in 2013. All landings are from the Southern New England (SNE) Stock, and predominately from Lobster Conservation Management Area (LCMA) 5. There is a difference among the landings data across the three data sources: ACCSP non-confidential dealer reports, ACCSP confidential dealer reports and MDNR fishing reports (Table 1). Since 2010, this difference has reduced, and the most reliable total landings data is from the confidential dealer reports. The MDNR fishing reports are used to obtain data about fishing effort, gear type and location. Lobster traps accounted for 90.2% of the landings in 2013 (Table 2). Fish pots caught the majority (9.77%) of the remaining landings. Fish potters must adhere to non-trap landings limits of 100 lobsters per day with a maximum of 500 lobsters per trip. Overtime since 2007, lobster trap landings have increased while fish pot landings have decreased (Table 2.)

Table 1. Maryland American Lobster Landings (pounds) from Confidential ACCSP Dealer Reports and MDNR Fishing Reports, 2007-2013

Year	Dealer Reports Confidential (lbs) ACCSP	Fishing Reports (lbs) MDDNR
2007	Confidential data	
2008		
2009		
2010		
2011		
2012		
2013		
Total	**246,196**	**268,150**

Table 2. Maryland American Lobster Landings (pounds) by Year and Gear from MDNR Fishing Reports, 2007-2013.

Year	Lobster Trap (lbs)	Fish Pot (lbs)	Conch Pot (lbs)	Gillnet (lbs)	Trawl (lbs)
2007	18,342	8,006	.	185	.
2008	21,749	11,170	.	13	.
2009	23,126	6,795	.	697	.
2010	20,495	8,099	90	.	24
2011	30,830	6,642	.	153	.
2012	50,997	5,715	140	747	72
2013	48,764	5,281	.	18	.
Total	**214,303**	**51,708**	**230**	**1,813**	**96**

Evaluation of the implemented management measures in meeting the required 10% reduction in LCMA 5.

a) Mandatory V-notching and immediately release of egg-bearing female lobsters effective January 1, 2013.

Maryland has implemented regulations to protect American Lobster egg-bearing females from harvest by commercial and recreational fishermen. The practice of marking and releasing egg-bearing females, now formalized by published regulations in Maryland, was most likely performed by commercial fishermen as part of the lobstering tradition. It is difficult to report a direct change in landings due to this regulation at this time. We can report that American Lobster CPUE, defined as pounds/trap/day, has increased steadily in the recent years (Figure 1). The increases in CPUE and landings since 2007 may be due to multiple factors such as climate change and effective management efforts in the Mid-Atlantic and North Atlantic Regions. MDNR fishing reports show that fishing effort has increased since 2007, most likely in response to the profitability of the fishery. However, the fishery has less than ten participants, and effort is not expected to increase significantly. In the near future, Maryland will collect fisheries dependent and independent biological data to describe biological characteristics of the harvest, such as percent females, in order to assess this management measure.

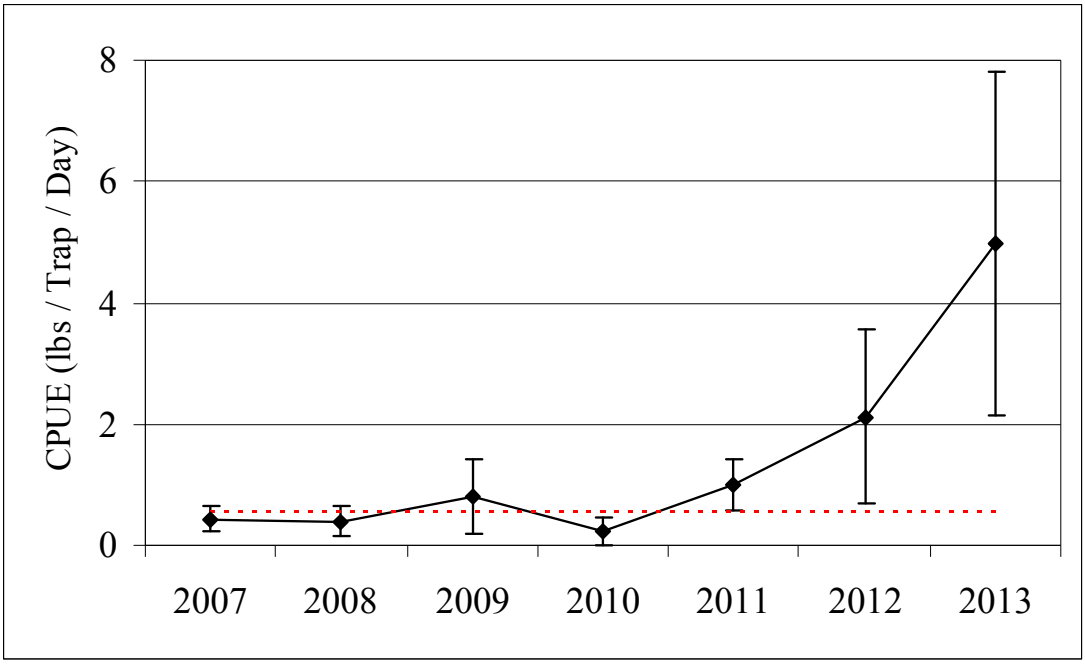


Figure 1. Maryland American Lobster Trap Fishery Catch Per Unit of Effort (CPUE) with 95% confidence intervals, 2007-2013. The red line represents the 3-year average CPUE that occurred during the 2007-2009 baseline reference years.

b) Season closure to the landing of lobsters from February 1st through March 31st.

In December 2013, Maryland adopted regulations that close the season on the harvest of American Lobster from February 1 through March 31. This management measure, while effective in other states with a traditional winter harvest such as New Jersey, had a minimum effect on reducing the landings in Maryland. Maryland does not have a traditional winter fishery in the months of February and March (Figure 2). Since 2007, only 0.9 % of the combined landings occurred during these months. The season closure should reduce landings by approximately 0.9% and prevent additional fishing effort in the winter.

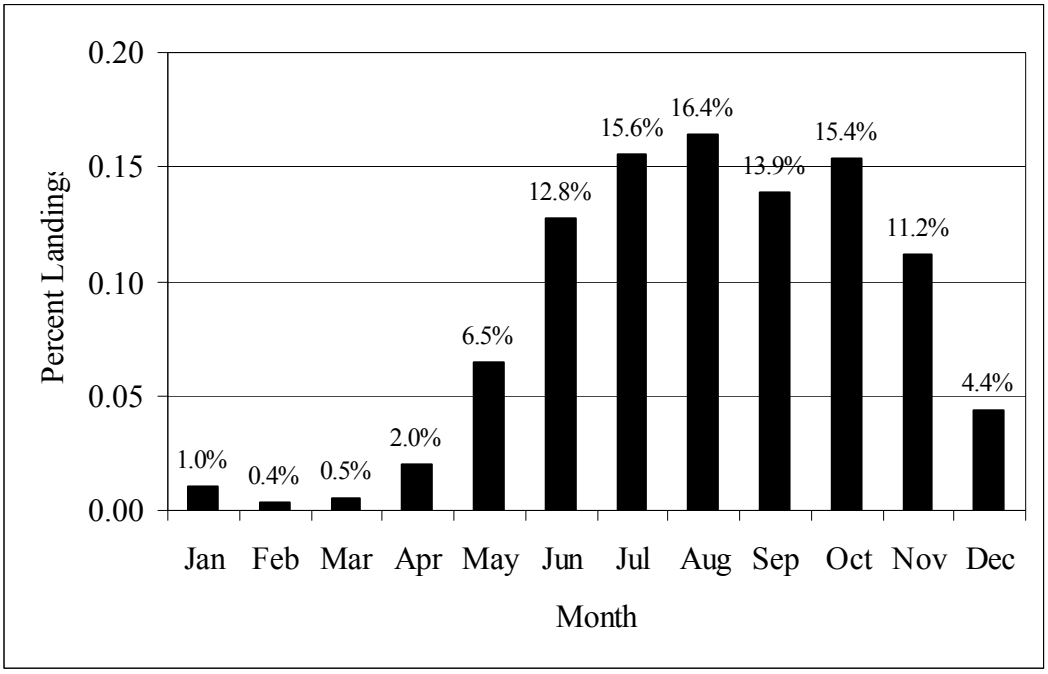


Figure 2. Maryland American Lobster Percent Landing (pounds) by Month, 2007-2013.

Conclusion:

Per Addendum XVII all Lobster Conservation Management Areas (LCMAs) within Southern New England (SNE) were required to reduce exploitation by 10% in order to address rebuilding. Maryland has implemented all required regulations in order to conserve the SNE stock, while under *de minimus* status. The protection of brood stock by mandatory V-notching and immediate release of egg-bearing females cannot be assessed at this time without a monitoring program. Limited biological data will be available next year as we implement a sampling program. The seasonal closure contributed a small portion to the 10% reduction because the winter lobster fishery has very limited participation. However, this winter closure will limit the latent effort from another region when the SNE stock rebuilds off Maryland.