Mid-Atlantic Fishery Management Council
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Richard B. Robins, Jr., Chairman | Lee G. Anderson, Vice Chairman
Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

DATE: May 31, 2016

TO: Council

FROM: Jessica Coakley and José Montañez, Staff

SUBJECT: Atlantic Surfclam and Ocean Quahog Specifications for 2017 and 2018

Atlantic surfclam and ocean quahog specifications expire at the end of 2016. Staff recommend specifications be set for 2 years (2017-2018) to ensure there is no lapse in management measures through 2018. The following materials are enclosed for the Council to consider when setting 2017 and 2018 specifications for Atlantic surfclam and ocean quahog:

1) Report of the May 2016 SSC Meeting (available under Tab 2)
2) Atlantic Surfclam and Ocean Quahog Fishery Performance Report
3) Atlantic Surfclam Staff Recommendation Memo to Chris Moore
4) Ocean Quahog Staff Recommendation Memo to Chris Moore
5) Atlantic Surfclam Fishery Information Document
6) Ocean Quahog Fishery Information Document
7) Report on Estimated Proportion of Undersized Surfclam Landings for 2015

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Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

DATE: 1 June 2016

TO: Richard B. Robins, Jr., MAFMC Chairman

FROM: John Boreman, Ph.D., Chair, MAFMC Scientific and Statistical Committee

SUBJECT: Report of the May 2016 SSC Meeting

The SSC met in Baltimore, MD, on 25-26 May 2016 for the main purpose of developing multi-year ABC recommendations for Surfclams and Ocean Quahogs, and reviewing data updates to determine if the SSC's ABC recommendations for the squids, mackerel, and butterfish should be changed. The SSC also continued discussion of criteria for assigning coefficients of variation for OFLs, and providing input during the Council's re-examination of its risk policy for setting ABCs. The final meeting agenda is attached (Attachment 1).

A total of 12 SSC members were in attendance on May 25th and 10 on May 26th, which constituted a quorum for both days (Attachment 2). Also in attendance were scientists from the NEFSC (NMFS Northeast Fisheries Science Center) by phone, staff from the Council, and representatives from the fishing industry and the general public. Documents cited in this report can be accessed via the MAFMC SSC website (http://www.mafmc.org/ssc-meetings/2016/may-25-26).

Surfclams

Jessica Coakley (MAFMC staff) reviewed the most recent survey and catch data provided by the NEFSC and the fishery performance report prepared by the Advisory Panel, with assistance from Dan Hennen (NEFSC staff). The current ABC specifications for Surfclams expire at the end of the 2016 fishing year, so the SSC is being requested to develop new specifications for the 2017 and 2018 fishing years. A new benchmark assessment is expected later this year.

The SSC's responses to the Council's terms of reference (ToRs, *in italics*) for Surfclams are as follows:

For Surfclam, the SSC will provide a written report that identifies the following for fishing years 2017-2018:

1) The level of uncertainty that the SSC deems most appropriate for the information content of the most recent stock assessment, based on criteria listed in the Omnibus Amendment.

The SSC considered this stock to be characterized by an "SSC-modified OFL probability distribution" in line with its designation in 2013 (old Level 3).

2) If possible, the level of catch (in weight) and the probability of overfishing associated with the overfishing limit (OFL) based on the maximum fishing mortality rate threshold or, if appropriate, an OFL proxy.

Owing to the lack of a new stock assessment, the SSC used the same method that was used in 2013 to estimate the catch in weight for the 2017 and 2018 fishing years. The relevant levels are:

2017	**69,925 mt**	P(overfishing) = 50%
2018	**70,102 mt**	P(overfishing) = 50%

3) The level of catch (in weight) and the probability of overfishing associated with the acceptable biological catch (ABC) for the stock.

The SSC determined the ABC by using the Council's risk policy:

2017	**44,469 mt**	P(overfishing) = 29%
2018	**45,524 mt**	P(overfishing) = 30%

The SSC noted that it is continuing to use an OFL CV = 100% for its projections based on estimates derived from an assessment that employed data only up to and including 2011. Some additional caution that may be necessary because of this extended projection period. However, this is offset by survey evidence of average or above average recruitment in the southern regions, the fact that the quota has not been fully harvested in each year, and generally low exploitation rates.

4) The most significant sources of scientific uncertainty associated with determination of OFL and/or ABC.

The data for the most recent assessment included data up to and including 2011; therefore, the lack of an assessment that uses the most recent data is an important source of uncertainty. The SSC notes that a new assessment is expected to undergo peer review in July 2016 and, if accepted, should provide the basis for specifications when the SSC next reviews this species in May 2017. Additionally, the principal sources of uncertainty from the 2013 determination still apply:

a. The F = M foundation for establishing OFL;
b. Estimates of M used in the assessment;
c. The scales at which regional replenishment occurs and the potential impact of localized depletion;
d. Absolute biomass is not known, and biomasses are currently scaled to presumed abundance in 1999 to develop reference points (because the 1999 biomass is assumed to serve as a proxy for carrying capacity (K) of the stock); and
e. Uncertainty in the fishing mortality rates (F), as identified by the SARC external review panel (Houde, et al. 2013). In particular, the comparison of catch to the scaled abundance (see point c above) introduces unquantified uncertainty in estimates of F. Also, incidental mortality estimates, which are used, in part, to generate fishing mortality rates are poorly described and are not current.

5) Ecosystem considerations accounted for in the stock assessment, and any additional ecosystem

considerations that the SSC took into account in selecting the ABC, including the basis for those additional considerations.

No specific, additional ecosystem considerations were provided to the SSC to include in developing the recommended ABC. The SSC notes that increasing regional temperatures are likely to impact the distribution and abundance of this species. The SSC also notes that ecosystem considerations are included in the terms of reference for the new benchmark assessment: ToR 3 addresses changes in Surfclam habitat quality related to climate change and other factors, and ToR 4 addresses a possible change in depth of Surfclams over time and its impact on vital rates.

6) Prioritized research or monitoring recommendations that would reduce the scientific uncertainty in the ABC recommendation and/or improve the assessment level.

The SSC notes that the ToRs for the upcoming benchmark assessment encapsulate the committee's concerns relative to research and monitoring recommendations.

7) The materials considered in reaching its recommendations.

- 2016 Surfclam and Ocean Quahog AP Fishery Performance Report
- A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf by Hare JA, Morrison WE, Nelson MW, Stachura MM, Teeters EJ, Griffis RB, et al. (2016)
- MAFMC Staff Memo from Jessica Coakley to Chris Moore, dated 6 May 2016
- 2016 Surfclam AP Information Document
- 2016 Surfclam Data Update
- Estimated Proportion of Undersized Surfclam Landings for 2015
- SAW 56 Summary Report
- SAW 56 Assessment Report
- SAW 56 Panelist Report

These documents can be accessed via the SSC's website (http://www.mafmc.org/ssc-meetings/2016/may-25-26).

8) A certification that the recommendations provided by the SSC represent the best scientific information available.

To the best of the SSC's knowledge, these recommendations are based on the best available scientific information.

Ocean Quahogs

As with Surfclams, Jessica Coakley (MAFMC staff) reviewed the most recent survey and catch data provided by the NEFSC and the fishery performance report prepared by the Advisory Panel, with assistance from Dan Hennen (NEFSC staff). The current ABC specifications for Ocean Quahog also expire at the end of the 2016 fishing year, so the SSC is being requested to develop new specifications for the 2017 and 2018 fishing years. A new benchmark assessment is expected in 2017.

The SSC's responses to the Council's terms of reference (ToRs, *in italics*) for Ocean Quahogs are as follows:

For Ocean Quahog, the SSC will provide a written report that identifies the following for fishing years

2017-2018:

1) The level of uncertainty that the SSC deems most appropriate for the information content of the most recent stock assessment, based on criteria listed in the Omnibus Amendment.

Owing to the lack of a more recent assessment, the SSC followed precedent and confirmed its previous evaluation of this stock as one for which "OFL cannot be specified with current state of knowledge."

2) If possible, the level of catch (in weight) and the probability of overfishing associated with the overfishing limit (OFL) based on the maximum fishing mortality rate threshold or, if appropriate, an OFL proxy.

The SSC deemed that it lacked credible information on which to calculate an OFL.

3) The level of catch (in weight) and the probability of overfishing associated with the acceptable biological catch (ABC) for the stock.

The SSC recommends setting an ABC for the 2017 and 2018 fishing years that maintains *status quo*. The recommended ABC in each year is **26,100 mt** – a direct extension of the level of ABC that has been in operation since 2014.

The SSC notes its expectations expressed in 2013 – that catches would remain relatively constant. The SSC also notes that a new assessment is expected in February 2017, the results of which, if accepted, should be available for SSC's May 2017 meeting at which it can reconsider specification of ABC for the 2018 fishing year.

4) The most significant sources of scientific uncertainty associated with determination of OFL and/or ABC.

The SSC reiterates its concerns noted in its 2013 report. The SSC also encourages that information from the SCeMFiS program on levels of recruitment be brought forward for consideration by the SAW/SARC working group and SSC.

Principal concerns in 2013 were:

- The fishing mortality rate reference point was deemed non-credible because species to which Ocean Quahog was compared were not appropriate;
- 40-year forecasts were provided in the previous assessment report and should be continued;
- Mechanisms for low recent recruitments are not known – could be either a result of underlying stock productivity or a consequence of life history of a long lived-species; and
- The nature of historical recruitments is poorly known.

5) Ecosystem considerations accounted for in the stock assessment, and any additional ecosystem considerations that the SSC took into account in selecting the ABC, including the basis for those additional considerations.

No specific, additional considerations are included in the SSC's recommended ABC. The SSC recommends that the upcoming assessment should follow the ecosystem considerations included in the Surfclam assessment and other habitat-related factors that may be relevant.

6) Prioritized research or monitoring recommendations that would reduce the scientific uncertainty in the ABC recommendation and/or improve the assessment level.

The SSC noted these areas in its 2013 report – and they are reiterated here with added notes in brackets:

- Development of credible management reference points remains a high priority. [The recent publication of a management strategy evaluation by Hennen (NAJFM – 2015) is step in this direction.]
- Reliability of estimates of stock biomass should be evaluated.
- Progress on developing age-length keys would be helpful for the assessment and for understanding recruitment patterns. [The SSC notes that the results from the SCeMFiS program may help in this regard.]
- Improved understanding of age-specific reproductive values would be of help in understanding the stock's resilience. For example, are the older and much larger females as important contributors to the spawning potential as they are for some long-lived fishes?
- Quantification of habitat-specific productivity would be important – both in terms providing robust vital rate estimates and also ensuring sustainable patterns of exploitation.
- Impacts of climate variability on long-term productivity and spatial distribution of the stock and of the fishery.

7) The materials considered in reaching its recommendations.

- 2016 Surfclam and Ocean Quahog AP Fishery Performance Report
- A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf by Hare JA, Morrison WE, Nelson MW, Stachura MM, Teeters EJ, Griffis RB, et al. (2016)
- MAFMC Staff Memo from Jessica Coakley to Chris Moore, dated 9 May 2016
- 2016 Ocean Quahog AP Information Document
- 2016 Ocean Quahog Data Update
- Stock Assessment Update for Ocean Quahogs through 2011

These documents can be accessed via the SSC's website (http://www.mafmc.org/ssc-meetings/2016/may-25-26). The SSC also referenced the following journal article:

Hennen, D. R. 2015. How should we harvest an animal that can live for centuries? North American Journal of Fisheries Management 35:512–527, 2015

8) A certification that the recommendations provided by the SSC represent the best scientific information available.

To the best of the SSC knowledge, these recommendations are based on the best available scientific information.

Mackerel, Squids, and Butterfish

For Atlantic Mackerel, Longfin Squid, *Illex* squid, and Butterfish, the SSC was asked to review their ABC recommendations for the 2017 fishing year to determine if they needed to be changed based on new evidence. Atlantic Mackerel are in year three of three-year specifications, and the squids and Butterfish are in year two of three-year specs. Jason Didden (MAFMC staff) and staff from the Northeast Fisheries Science Center (Kiersten Curti for Atlantic Mackerel, Lisa Hendrickson for the squids, and Chuck Adams for Butterfish) walked the SSC through the latest survey and catch data, as

well as the fishery performance reports developed by the MSB Advisory Panel. Documents considered during the SSC deliberations are accessible via the SSC website (http://www.mafmc.org/ssc-meetings/2016/may-25-26) and include the MAFMC staff memo containing ABC recommendations, MAFMC staff's fishery information updates, catch and survey updates from the NEFSC, the combined fishery performance report, the most recent Canadian assessment and TRAC assessments for Atlantic Mackerel, and other informational materials. **For all four species, the SSC determined that the available information did not support changing the ABC recommendations for fishing year 2017.** However, the SSC did note some concerns about the status of Atlantic Mackerel and the squids.

For Atlantic Mackerel, the SSC continues to be concerned about the absence of large fish in the survey area of US and Canadian waters. The SSC appreciated inclusion of the catch-by-area charts in the information provided by the NEFSC, and encouraged development of analogous charts for all species managed by the MAFMC. Since the implementation of annual catch limits in 2011, total catch of Atlantic Mackerel has been less than 40% of the annual ABCs, with the exception of 2015 where catch was approximately 51% of the ABC. Indices-at-age derived from the most recent (spring 2015) bottom trawl survey are predominately fish aged 1 to 3, similar to the age distribution observed in 2009 and 2011; no fish aged six or older were captured in the survey. In the past, these pulses of recruitment did not result in capture of older fish in later years. The SSC was informed that the Canadians are planning to do an assessment of mackerel in the coming year; the SSC encouraged development of a combined US/Canada joint assessment for Atlantic mackerel as part of the TRAC (Trans-Boundary Assessment Committee) process. However, Kiersten Curti informed the committee that recent talks with Canada indicated reluctance by the Canadians to conduct a joint TRAC-type assessment.

The SSC noted that the mean body weight of both squid species captured in the NEFSC bottom trawl survey is still declining. This continues to be a cause for concern that has been attributed to environmental factors, primarily water temperature.[1] The SSC asked if the smaller size of the squids was a limiting factor in the squid fishery; Jeff Kaelin will check and respond.

CV Subgroup Report

Sarah Gaichas walked the SSC through her summary notes of her discussions with NEFSC stock assessment scientists regarding approaches to estimating the coefficient of variation (CV) for the overfishing limit (OFL), a key step in the development of ABC recommendations that invokes the Council's risk policy. The SSC then had a broader discussion of how to proceed regarding OFL CV estimation for both the short term and in the longer term.

The SSC made three general recommendations:

1. Historical forecast error is worth exploring as a short-term solution to establish an OFL CV based on assessments. This information could be requested within the assessment process, and would be available ideally whenever SSC is making recommendations.
    a. The most useful OFL CVs would be developed from separate distributions for forecasts one, two, and three or more years out.

[1] Dawe, E. G., L. C. Hendrickson, E. B. Colburne, K. F. Drinkwater, and M. A. Showell. 2007. Ocean climate effects on the relative abundance of short-finned (*Illex illecebrosus*) and long-finned (*Loligo pealeii*) squid in the Northwest Atlantic Ocean. Fish. Oceanogr. 16 (4): 303–316.

    b. Estimation would be done by looking across previous actual assessment documents, and not just using retrospective patterns within the current assessment. The number of assessments included would generally require going back as far as possible without getting to models and/or data sets that differ radically from the current situation.
    c. Discussion of basic protocols within the subcommittee and with assessment scientists will be necessary; e.g., when are assessments too different to include in the analyses?
2. Move ahead with more formal dialogue with the NEFSC to address the larger issue of estimating uncertainty in the OFL: how to develop criteria for "bins" of OFL CV by life history, data quality, assessment characteristics, and what an assessment able to estimate a satisfactory OFL CV directly actually looks like.
    a. This dialogue could take the form of a 1-2 day workshop, possibly associated with an SSC winter meeting, and possibly convened in Woods Hole.
    b. The Subgroup needs to develop clear objectives and a work plan before scheduling any workshop.
3. Investigate coordination with the NEFMC SSC on risk policy, and how to ensure that requests made of NEFSC assessment scientists were efficiently coordinated between Councils.

The SSC had a related discussion of the MAFMC Risk Policy. The OFL CV Subgroup (Sarah Gaichas, Olaf Jensen, Tom Miller, Brian Rothschild, and Mike Wilberg, with the addition of Paul Rago and David Tomberlin) will assist the Council with analyses of the current risk policy and potential alternative components. Performance of the current risk policy (including selected OFL CV levels) could be addressed alongside alternative configurations of the risk policy that might include changes to P* (probability of overfishing) values, species-specific control rules, or other measures to control interannual variability of ABCs. A management strategy evaluation could address this, but it would be a long-term project and best coordinated with the longer-term collaborative approach to address OFL CV (see point 2 above).

A broader approach to risk policy looking beyond single species approaches to stewardship and management was suggested. This may need the SSC and Monitoring Committee working together, and addressing it would require adding economic and social sciences expertise to the OFL CV Subgroup. Questions to investigate could include:

- When setting ABC for one species, what are ecological and economic outcomes for other species?
- What have been the consequences of our decisions, beyond impacts on the stock? Evaluating this requires better performance measures for economic and social objectives.
- What is being given up throughout the fishery? What other choices will be available given a specific ABC for one species? What are impacts to other fisheries?
- What is the consequence overall of choosing an ABC?
- How might new National Standard 1 and 2 Guidelines influence with the risk policy?

Council's ACL/AM Omnibus Framework

Rich Seagraves updated the SSC on an action recently taken by the Council to initiate a review of its risk policy and ABC control rule framework, which were implemented as a result of the 2007 MSA Reauthorization. MAFMC staff is currently developing a set of alternatives to the risk policy for consideration by the Council, including different control rules based on different life histories or species groups, a potential increase to a maximum P* of 45%, and the shape of the risk tolerance response

curve. The Council is also considering building in inertia to ABC recommendations to minimize inter-annual variability in catch (i.e., restrict inter-annual changes in to ABC to some percentage). In addition, the Council would like to see a more formalized treatment for species with assessments in the data poor category; staff recommends working with the SSC's CV Subgroup and the Council's Executive Committee to accomplish this task. The Council is also considering convening an external panel to provide an independent peer review of the current system. Finally, the Council is interested in determining how the risk policy has performed over the past five years (which could be determined via a management strategy evaluation) and is seeking ways to improve that performance.

During the ensuing discussion, the SSC noted that recent reductions in ABCs were not the result of decisions made about the CV of OFL by the SSC (i.e., they were not due to the selection of CVs input into ABC control rule framework). For example, recent changes in the ABC for summer flounder were the result of changes in stock biomass from the recent assessment update. [The MAFMC SSC is one of the few SSCs actually facing the probability question instead of using *ad hoc* methods.] This is a difficult scientific question and it is probably impossible to get a direct analytical estimate from stock assessments. While the Council welcomed the reduction in the OFL CV from 100% to 60% for some of the species, their concerns relate to the lack of objective criteria to establish the CV about OFL for a given stock assessment. The SSC shares these concerns, which is the basis for establishment of the CV Subgroup.

In terms of maintaining stability of annual catch limits, there is a tension between maximizing yield and maintaining stable catch streams. The Council's desire to place limits on the maximum change in ABC from year to year is largely driven by social and economic considerations. Establishing boundary conditions for acceptable volatility in catch vs risk to populations is not a scientific matter but rather a policy one driven by social and economic considerations. The main objective should be to reduce the volatility in ABCs and avoid chasing assessment noise, while following the rules during standard assessment updates.

In terms of outcomes, the Council and SSC need to consider the consequences of decisions based on the current risk policy and ABC control rule framework. This evaluation should extend beyond the biological impacts on the stock and should include critically important social and economic performance measures as well. On a related issue, the SSC noted that there is an artificial separation between ABC and ACL/TAC considerations - the SSC has never looked at the latter part. The Council should consider ways to address this separation and re-evaluate the SSC's role relative to the role of the Monitoring Committees.

The SSC also noted that the CV Subgroup is currently establishing criteria to bin the CVs for MAFMC stock assessments. The uncertainty associated with the different sources of data that drive the overall OFL CV needs to be more fully explored (see the preceding section of this report). The current risk policy implies a different temporal trajectory of the population in response to the control rule, which does not vary by species. It is critical that an empirical basis is established for specification of the CV for each Mid-Atlantic stock assessment (the stock's life history could be a basis).

Staff will report back to the Council on this discussion and proceed with the plan to engage the SSC through the CV Subgroup in an evaluation of the current system, and consider modifications to the risk policy and ABC framework (with external peer review of any proposed changes).

cc: SSC Members, Lee Anderson, Chris Moore, Rich Seagraves, José Montañez, Jason Didden, Jessica Coakley, Dan Hennen, Kiersten Curti, Lisa Hendrickson, Chuck Adams

Attachment 1

Mid-Atlantic Fishery Management Council
Scientific and Statistical Committee Meeting
25-26 May 2016

Final Agenda

Wednesday May 25, 2016

1:00 pm	Recommend surfclam and ocean quahog ABC specifications (2017-2018)
3:30 pm	CV Subgroup Report
5:00 pm	Adjourn

Thursday May 26, 2016

8:30 am	Review 2017 Atlantic mackerel, long-finned squid, Illex, and butterfish ABC specifications
10:00 am	Other business - Council's ACL/AM Omnibus Framework
11:00 am	Adjourn

Attachment 2

MAFMC Scientific and Statistical Committee
25-26 May 2016 Meeting
Baltimore, MD

Name	Affiliation
SSC Members in Attendance:	
John Boreman (SSC Chairman)	NC State University
Tom Miller (SSC Vice-Chair, 5/25 only)	University of Maryland - CBL
David Tomberlin	NMFS Office of Science and Technology
Doug Lipton	NMFS
Mark Holliday	NMFS (Retired)
Mike Frisk (5/25 only)	Stony Brook University
Sarah Gaichas	NMFS Northeast Fisheries Science Center
Ed Houde	University of Maryland – CBL
Wendy Gabriel	NMFS Northeast Fisheries Science Center
Olaf Jensen	Rutgers University
Paul Rago	NMFS (retired)
Rob Latour	VIMS
Others in attendance:	
Rich Seagraves	MAFMC staff
Jessica Coakley (5/25 only)	MAFMC staff
José Montañez (5/25 only)	MAFMC staff
Jason Didden (5/26 only)	MAFMC staff
Dan Hennen (by phone, 5/25 only)	NMFS Northeast Fisheries Science Center
Lisa Hendrickson (by phone, 5/26 only)	NMFS Northeast Fisheries Science Center
Chuck Adams (by phone, 5/26 only)	NMFS Northeast Fisheries Science Center
Kiersten Curti (by phone, 5/26 only)	NMFS Northeast Fisheries Science Center
Dave Wallace (5/25 only)	Wallace and Associates
Jeff Kaelin	Lund's Seafood and MAFMC member
Tom Alspach	SCOQ Advisory Panel member
Purcie Bennett-Nickerson (5/26 only)	Pew Charitable Trust
Greg DiDomenico (5/26 only)	GSSA

Mid-Atlantic Fishery Management Council (MAFMC; Council)
Surfclam and Ocean Quahog Fishery Performance Report (FPR)
May 2016

The Council's Surfclam and Ocean Quahog Advisory Panel met on May 2, 2016 via webinar and in-person at the Council office to review 2016 data updates to the surfclam and ocean quahog fishery information documents and revise the fishery performance report based on advisor perspectives on these fisheries.

Council Advisors: Thomas Alspach, Thomas Dameron, Peter Himckak, Samuel Martin, Joseph Myers, David Wallace.

Public: Thomas Hoff, Michael LaVecchia, Peter Hughes, Purcie Bennet-Nickerson.

Staff and Scientific and Statistical Committee: John Boreman (SSC), Mark Holliday (SSC), Thomas Miller (SSC), Doug Lipton (SSC), Jessica Coakley (Staff), José Montañez (Staff), Doug Potts (GARFO Staff).

Surfclam and Ocean Quahog

Critical Issues

- The most critical current challenge to the surfclam and ocean quahog fishery is the New England Council's Omnibus Habitat Amendment which has the potential to ban bottom tending mobile gear (including clam dredges) from high energy sand environments where the surfclam and ocean quahogs fishery is the only fishery being prosecuted. This action has the potential impact on the spatial distribution of the fishery, which will result in biological impacts as well as social and economic impacts. It also impacts the Mid-Atlantic Council's ability to manage its jurisdictional fishery for surfclam and ocean quahogs. The industry needs the support of the Council and NMFS in addressing these concerns. As an update to the above, the industry has been engaged in an industry funded effort to examine additional databases (NMFS clam survey data) to examine spatially where industry fishing activity with hydraulic clam gear could occur. The intent is to use this information to identify discrete areas within proposed closures where clam fishing could occur without impacting groundfish habitat.

Market Issues

- For surfclams and ocean quahogs, there are occasional landings in Ocean City, MD. It used to be significant but is no longer. Cape May and Wildwood, NJ are no longer significant. Most of the fleet is fishing out of Pt. Pleasant and Atlantic City, NJ, Oceanview, NY, Hyannis, MA (surfclams only), and New Bedford, MA. Vessels have been moving North and shifting effort. For more details, see the Surfclam and Quahog Information Documents.

- For Maine quahogs, the quahogs have increased to sizes larger than the preferred small size for the market, which explains the decline in the catch rates and prices for Maine quahogs. There is a

suggestion that there is another bed of small clams that has been found, but that is not reflected in the catch.

- A major reason clam plants have been closed over the last 20 years has been wastewater. Two plants recently had permits coming due and closed because of the wastewater requirement and capital investments needed to meet permit limits.

- Another reason for recent consolidation has been the cost of fuel prices and the distance needed to travel to harvest clams - which cascades through the vessel, processors, ports, etc., and has put greater economy on scale and location. Vessel discharge permits will be additional costs, and will affect both vessels and docks. Vessels that have ballast tanks are required to have a vessel discard permit for those vessels greater than 79 ft. Fuel prices have declined giving some relief to industry participants. Commercial Fishing vessels have also been given a 3 year exemption to the Vessel Discharge Permit regulations.

- The cost of complying regulatory function has increased. Prior to 1990, there were already great regulatory costs (e.g., Clean Water Act, Clean Air Act, and other fisheries related regulations). Since the individual transferrable quota (ITQ) went into place to the present, the regulatory function has increased substantially (e.g., coast guard, habitat requirements, bycatch species (marine mammals), etc.) and the cost of staying up to date and following the regulatory requirements (complexity and number) is expanding. The Cost Recovery Amendment is going through rulemaking, and will include recovery of incremental costs for management of the ITQ fisheries. Cost associated with the onboard paralytic shellfish poisoning (PSP) protocol for vessels fishing on Georges Bank includes testing costs, training of personnel, and further testing when clams are brought to shore.

- Vessels built after July 2013 will need to be "classed", and then subsequently kept in that class by inspections, which created significant cost considerations. U.S.C.G. regulations written, under review and soon to go into effect will require training, or demonstration of knowledge and competency, for all individuals in charge of commercial clam vessels operating in federal waters. Current regulations require new commercial fishing vessels, built after July 1, 2013, that are 79 feet or greater in length to be assigned a load line. Regulations require new commercial fishing vessels, built after July 1, 2013, that are at least 79 feet overall in length and will operate in federal waters to meet survey and classification requirements. Commercial fishing vessels built to class requirements before July 1, 2013 must remain in class. Certain commercial fishing vessels that undergo a major conversion will be required to comply with an “alternate safety compliance program” yet to be developed for both load line and construction standards requirements.

- The push to comply with global food safety requirements/initiatives and sustainability certification lead to additional costs. The global food safety ratings are being required by buyers, and if not satisfied could lead to buyers choosing not to use specific suppliers. The Marine Fisheries Advisory Committee (MAFAC) has recommended that NOAA Fisheries use their inspection service to develop sustainability certifications for US seafood similar to the Marine Stewardship Council (MSC) and other independent groups. The surfclam and ocean quahog fisheries are presently under review for MSC certification for Federal surfclam and non-Maine

ocean quahogs; the final report should be available soon with possible certification by the end of the summer.

- The seafood imported into the US needs to be compliant with hazard analysis and critical control points (HACCP) but may not have to meet the third party audits, which makes the domestic seafood more expensive. During a recertification process, it becomes more stringent than the initial certification ("keep raising the bar"); the facility could be found not compliant.

- Increasing foreign imports and foreign competition puts a constraint on price, and the price cannot be increased to absorb all the additional costs and still be competitive in the market place. The limit in demand for clams in the market is driven by many market factors including foreign seafood competition, other products in the marketplace (chicken, etc.), shifting toward healthier market products (e.g., clam sushi, etc. versus a fried or cream based product), and competition with other ingredients, as clams typically are not a center of the plate product. The overall retail market has been steady to a slight decline.

- If just comparing landed value of surfclams and ocean quahogs to landed value of other fish seafood products, you would tend to underestimate the total economic value of that fishery. There is limited information on the multipliers for this industry. There is a large multiplier from the shucking plant to further processing. A study is being conducted to examine these factors in more detail.

Environmental and Ecological Issues

- Many species (including surfclams and ocean quahogs) are moving toward the poles or into deeper waters. This movement is temperature driven. Historically, about half the quota for quahogs used to be taken in the area off the Southern area. The surfclams are increasing in these Southern areas, possibly because of the faster growth rates for surfclams settling when compared to quahogs. Some of the Southern beds that used to be quahog beds now have surfclam recruitments.

- The natural shift in the stocks distribution northwards has driven the movement of the fishery. For more details, see the Surfclam Information Document.

- The issue of bottom tending mobile gear impacts on habitat will continue to be a concern. The environmental community is focused on these issues and there has been a push for increased closures as a tool to reduce habitat impacts. Many of the approaches used are not always based on the best available information to describe impacts and possible approaches. The spatial area for the fishery is small and the gear impacts are considered to be minimal and temporary in nature, due to the high energy sand environments.

- Three positive aspects to support the sustainability of the surfclam and ocean quahog resources include, 1) the opening of Georges Bank has mitigated some of the prior concerns by providing access to more, larger clams and alleviating some of the fishing pressure from the Southern areas, 2) there are ongoing discussions and research projects examining how best to protect small clam areas and increase productivity of the surfclam and quahog stocks (Science Center for Marine Fisheries; SCeMFiS), and 3) compliance with the MSC certification process on an ongoing basis.

Management Issues & Management Induced Effort Shifts

- The Mid-Atlantic Council needs to be more involved in habitat issues (and other issues) that are being proposed through the New England Council process. Many gear or fishery closures are being proposed for species such as groundfish, that will impact surfclam, ocean quahog, and other fisheries (e.g., Georges Bank, Great South Channel, Nantucket Shoals, etc.). The Council now has additional seats on the Habitat Committee to better engage with the New England Council on issues that affect surfclams and ocean quahogs. Advisors urge the Mid-Atlantic Council to appoint members from states that are most engaged and knowledgeable about these fisheries. For industry, keeping up to date and being proactive about what is being proposed is an additional cost. Small fishermen are less able to afford to send people to meetings to stay engaged on the issues.

- Advisors ask the MAFMC to provide the Bureau of Ocean Energy Management (BOEM) all relevant data on surfclam and ocean quahog habitat and highlight the devastating effect a BP like disaster would have on our fishery if oil and gas leases were given out in the waters to the south [in Mid-Atlantic] that are now under consideration.

- The clam industry is concerned about the wind farm leasing process and any mitigation procedures that are undeveloped at this point. The industry wants opportunities to engage on wind array siting relative to the most productive clam fishing beds. BOEM has sold wind energy lease areas off of NJ that correspond with historically important surfclam harvest areas. Industry coordinated the work of Toni Chute (NOAA) and Brian Hooker (BOEM) to produce GIS mapping layers of US Atlantic Coast Surfclam Landings between 1985 - 2014 by 10 minute square and 5 year time periods as a tool to mitigate the wind energy siting consequences to the fishery. This interactive tool can be found at: http://arcg.is/1ONVCyL

G***eneral Fishing Trends***

- Effort is moving northward because the catch rates are higher, resulting in a smaller footprint from dredging activity on habitat. For more details, see the Surfclam and Quahog Information Documents.

- The larger vessels will be accessing Georges Bank, because of the distances traveled and effects of weather. Nantucket Shoals is a smaller boat fishery.

- The larger surfclam vessels going to Georges Bank has taken pressure off some of the nearshore areas, and Southern areas.

- The landings per unit effort (LPUE) may not be indicative of abundance because it only reflects the fishing occurring in a few ten minute squares. The Stock Assessment Review Committee (SARC) panel recommended a more detailed analysis be undertaken on LPUE, and did not make definitive conclusions about the utility of LPUE as an index of abundance. The advisors noted that the LPUE's in the 1970's and 1980's were lower, then increased, and then decreased again. The Advisors were concerned that some of the figures in the CRD13-04 did not include these longer time series showing those initial lower levels. These longer time series figures are in the final assessment report.

- The LPUE has leveled off in recent years. The increases on Georges Bank offset the reduction in LPUE for the areas off NJ for the large clams to use for fried clams.

- 3 vessels are working on Georges Bank for surfclams. When transiting vessels are under time constraints because of product quality, so the 2 smaller vessels (which are slower) stay in the same area while the larger vessels steams further to the east.

- Industry have voluntarily implemented closed areas for small surfclams to maximize use of the resource. The program began about 6 months ago. The Science Center for Marine Fisheries (SCeMFiS) is doing the survey and sampling for the area (annually). Processors and boat owners agreed to close a significant area off Ocean City, MD, and an area off Point Pleasant, NJ (250 square miles). It is being monitored using VMS and associated geo-fencing, and there is an agreed penalty schedule for fishing in the area.

OY

- The industry was comfortable with a maximum OY of 3.4 mil bushels for surfclams in terms of production. For ocean quahogs a maximum OY of 6 million bushels is reasonable in terms of production. Landings for quahogs have been below the OY range because of demand for quahogs.

Other Issues

- The group would like to see *status quo* quotas for the upcoming fishing years; the stability in the quota translates into stability in the fishery and market.

- The clam fishery is the first fishery doing electronic reporting on a per vessel and trip basis ("e-Clams"). It is still being evaluated and tested by NMFS, so both paper and electronic logs are being used and matched. The information should be available in more real time once implemented.

- The new SCeMFiS is industry and National Science Foundation (NSF) supported and has several ongoing and recently completed research projects:

- SCeMFiS, with contributions from NMFS NEFSC, has completed research into data corrections for the breakage of clams in survey mode. This research was taken up because of the additional breakage since switching over to an industry vessel for surveys. If any size clam, large or small, experienced disproportionate breakage the age demographic of the population would not be accurately represented in the assessment. The final report is available on the SCeMFiS website.

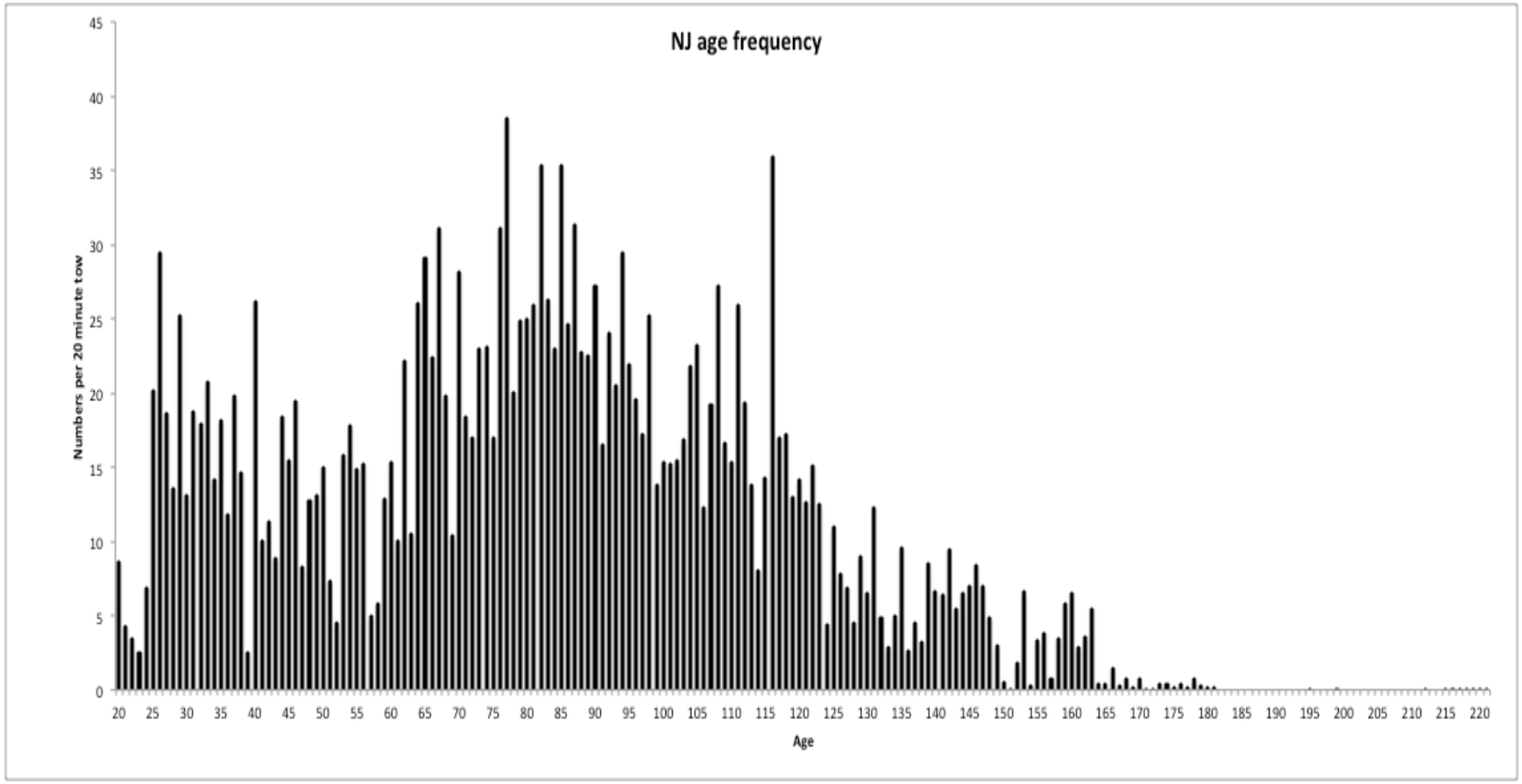
- SCeMFiS has completed the fabrication of a dredge for the collection of juvenile (pre-recruit size) ocean quahog and surfclams. The new Dameron-Kubiak dredge, to be used for selectivity sampling typically conducted during survey operations, has been tested by the NEFSC, NMFS, and found to improve selectivity experiments. The final report is available on the SCeMFiS website.

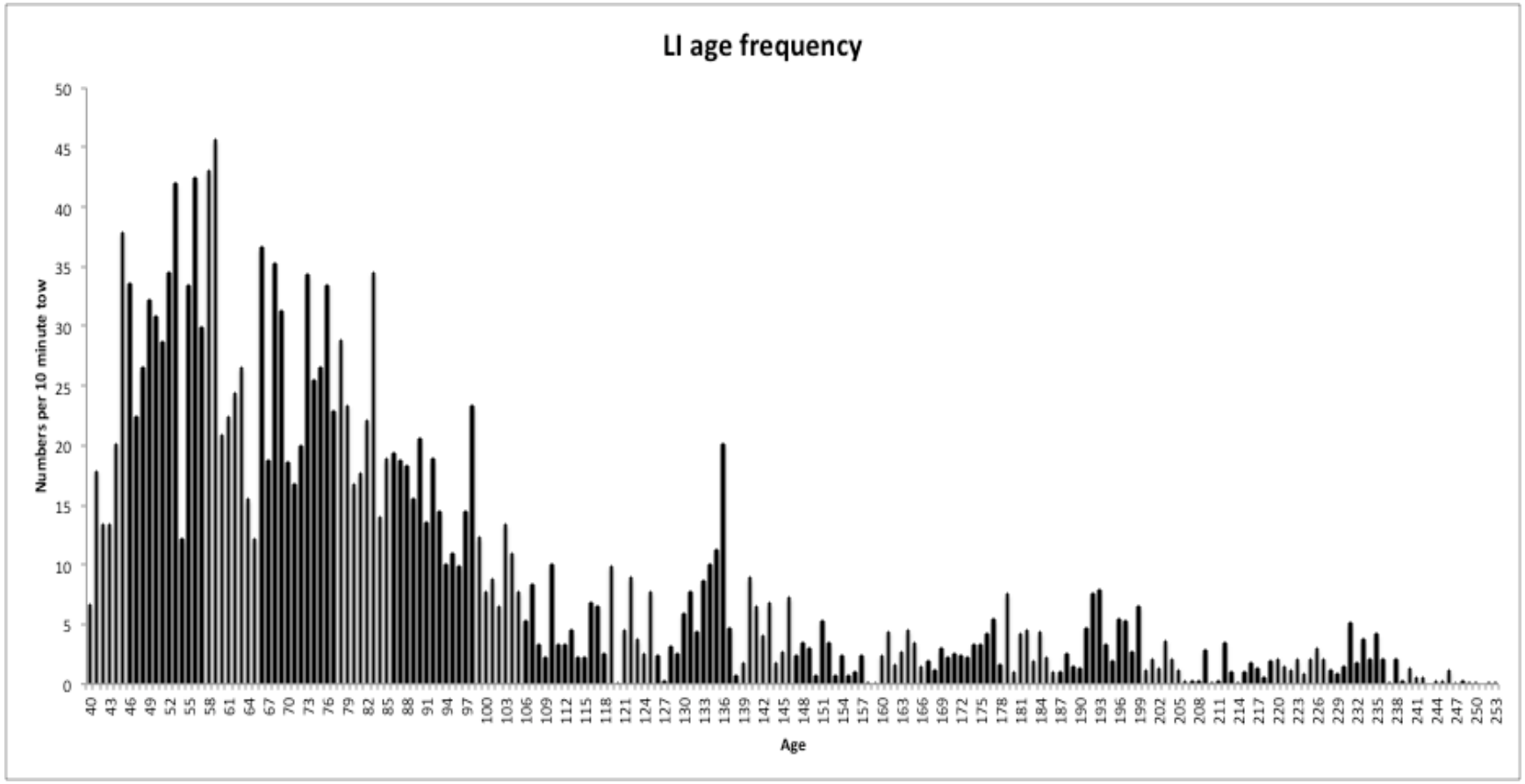
- SCeMFiS has evaluated an area management strategy for the surfclam fishery as one of its projects. The final report is available on the SCeMFiS website.

- SCeMFiS has funded Ocean Quahog recruitment and life history dynamics research. SCeMFiS research does not agree with the long held belief that major quahog recruitment events appear to be separated by decades, that ocean quahogs are relatively unproductive with infrequent recruitment thus vulnerable to overfishing and potential contribution of recruitment to stock biomass and productivity is unknown. The Dameron – Kubiak dredge has shown regular recruitment from the last 60 years down to 10 years of age where the dredge efficiently captures animals. (Recruitment of the ocean quahog (*Arctica islandica*): size and age structure in collections with the Dameron-Kubiak dredge in summer 2014. A final report to Industry Advisory Board (IAB) of the SCeMFiS project number: 2014-02-RM-VIMS now on the SCeMFiS website - www.scemfish.org). Ongoing studies of age structure from 60 – 180 years of age show regular recruitment with lower reports of very old animals probably due to natural mortality. Major recruitment events appear to be more by chance of larval survival and the fact that the stock is near carrying capacity. For more details see Attachment 1, which are preliminary attached age frequency plots from ongoing research to be released towards year-end with Sara Pace's master's thesis.

- SCeMFiS has funded a Surfclam and Ocean Quahog assessment team made up of Drs. Daphne Monroe, Eric Powell and Roger Mann. The team will attend meetings of the Invertebrate Subcommittee, SAW and MAFMC SSC and support the academic commitment to the ocean quahog benchmark assessments. The team will provide new information through the Invertebrate Subcommittee process on historical and recent recruitment to address SSC concerns. The SCeMFiS team will interface with and provide support to the NMFS assessment team during the assessment process with the goal of reducing uncertainty in the assessment process.

Attachment 1. New Jersey, Long Island, Southern New England, and Georges Bank age frequencies.

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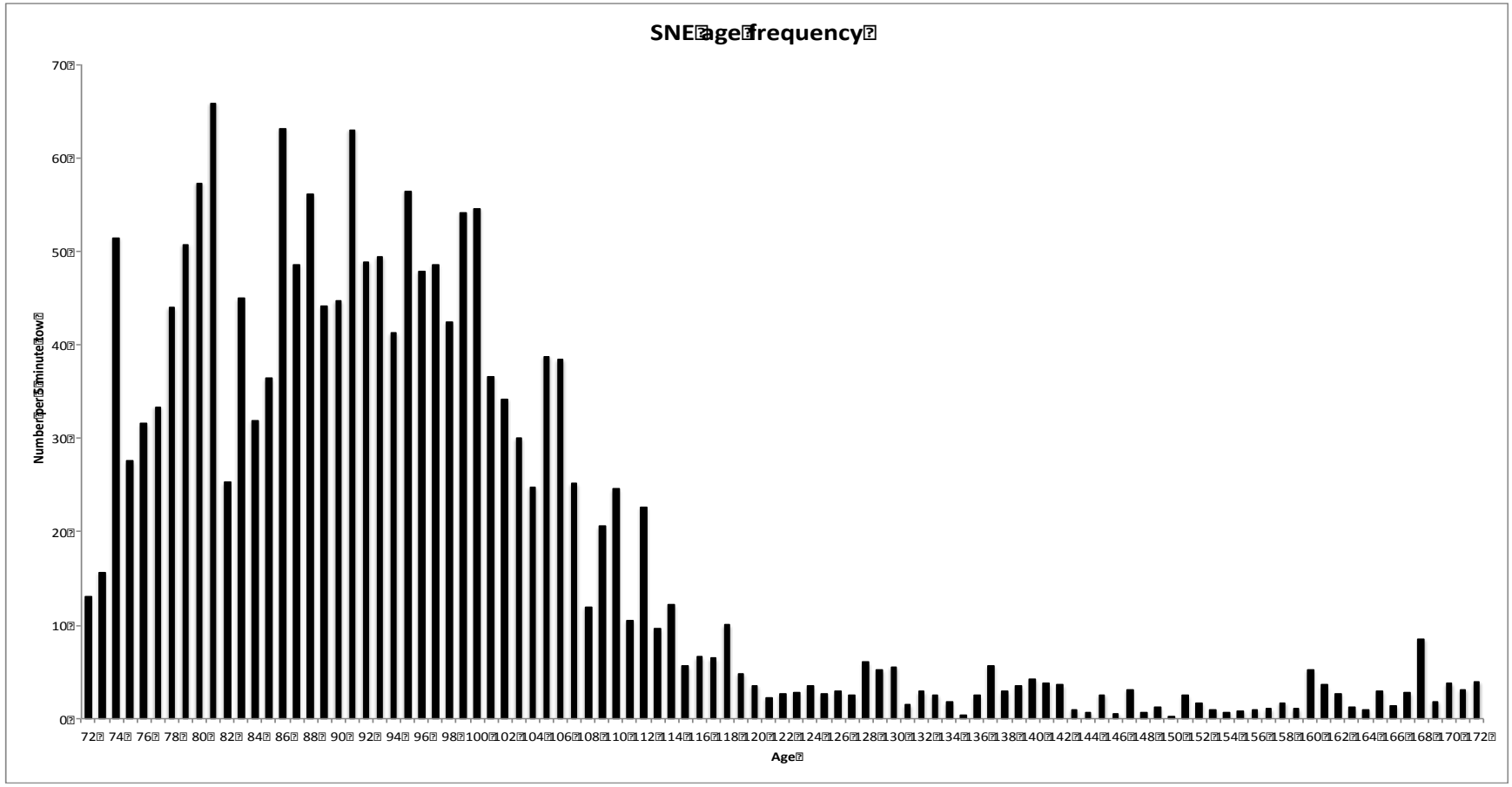
SNE age frequency
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Number per 5 minute tow
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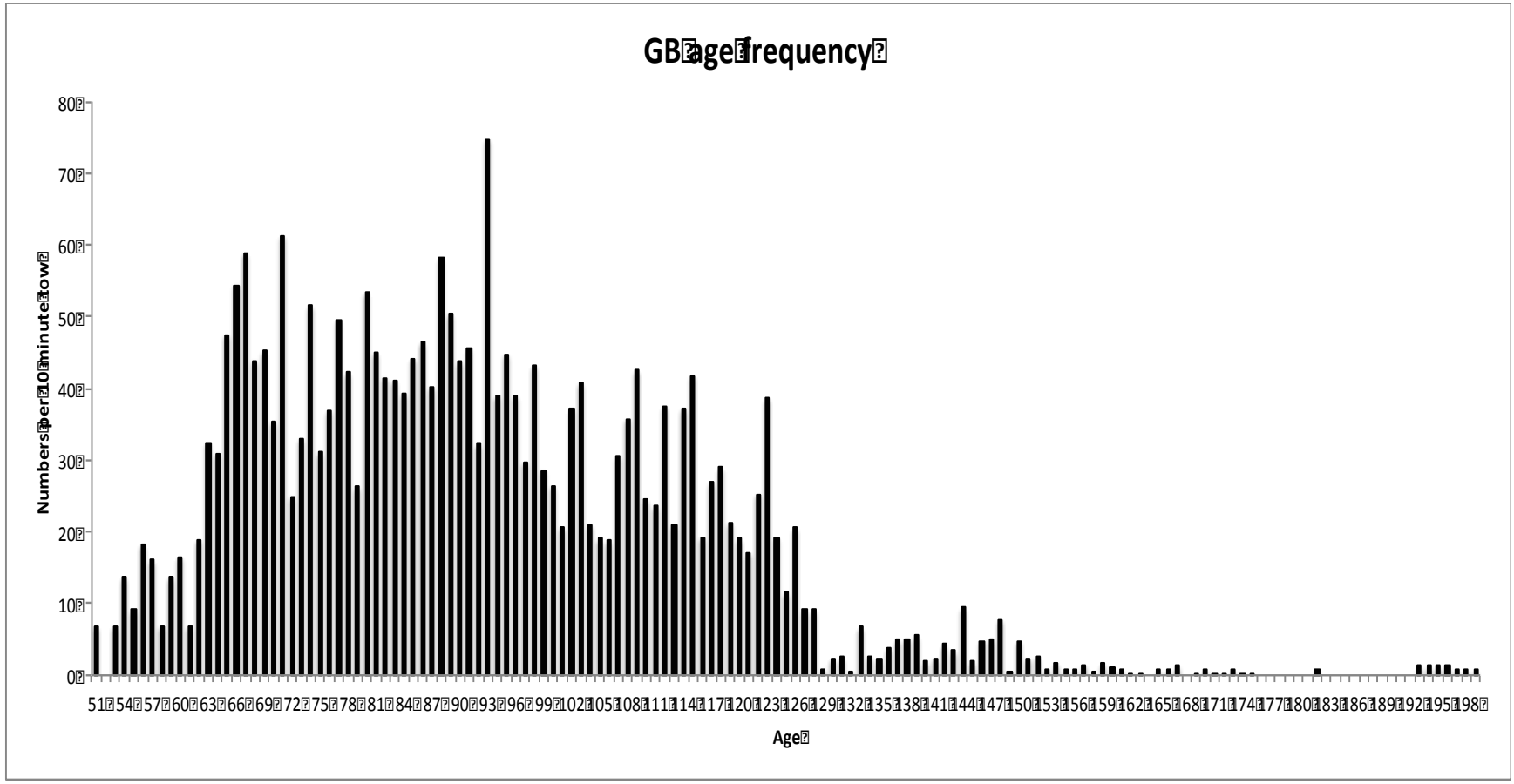
Age


GB age frequency
Numbers per 10 minute slot
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MEMORANDUM

Date: May 6, 2016

To: Chris Moore, Executive Director

From: Jessica Coakley and José Montañez, Staff

Subject: Surfclam Management Measures (2017 and 2018)

Executive Summary

The Atlantic surfclam resource in the US exclusive economic zone (EEZ) is not overfished and overfishing is not occurring in 2011 (NEFSC 2013a). The National Marine Fisheries Service (NMFS) Northeast Fishery Science Center (NEFSC; Dan Hennen Pers. Comm., NEFSC 2016) has provided data updates regarding recent fishery and biological data available at: http://www.mafmc.org/s/DataUpdatefromNEFSC_Surfclam.pdf.

Atlantic surfclam specifications expire at the end of 2016. Staff recommend specifications be set for 2 years (2017-2018) to ensure there is no lapse in management measures through 2018. New stock assessment information will be available in 2017 to possibly change the previously recommended management measures for 2018 as well as set the measures for 2019-2020. The staff recommendation for acceptable biological catches (ABCs) for 2017 and 2018 are 44,469 mt and 45,524 mt, respectively. This is based on surfclam being classified as a typical stock, and the application of the Council risk policy using a Scientific and Statistical Committee (SSC) modified overfishing limit (OFL) probability distribution. The FMP specifies that the annual catch limit (ACL) equals the ABC. Staff recommend an annual catch target (ACT) = 29,364 mt and a commercial quota of 26,218 mt (3.4 million bushels) for 2017 and 2018. This is the same ACT and commercial quota that was implemented for the 2014-2016 fishing years. Staff recommend the surfclam minimum size be suspended in 2017, but recommend that the Council consider the issue of large numbers of small clams appearing in the landings from the Delmarva area. Staff also recommend NMFS undertake detailed analysis of the data relative to the small clam area closure regulations, so the information is available for May/June 2017.

Introduction

The MSA requires each Council's SSC to provide, among other things, ongoing scientific advice for fishery management decisions, including recommendations for ABC, preventing overfishing, and maximum sustainable yield. The Council's catch limit recommendations for the upcoming fishing year(s) cannot exceed the ABC recommendation of the SSC. In this memorandum, information is presented to

assist the development of measures for the Council to consider for the 2017 and 2018 fishery for surfclams. The SSC will recommend an ABC for the surfclam fishery that addresses scientific uncertainty. Based on the SSC recommendations, the Council will make recommendations for ACLs, ACTs, and other implemented measures, and provide those recommendations to the NMFS Northeast Regional Administrator.

Review of SSC Recommendations from May 2013

In May 2013, the SSC met to recommend ABCs for surfclam for fishing years 2014-2016. The SSC recommended that the assessment be considered Level 3 because it provided an acceptable OFL estimate, included estimates of pertinent life history parameters, and explicitly incorporated a substantial amount of available data and also permits uncertainty in input parameters. At that time, the SSC concluded it did not rank higher because the reference points were proxies (not internally estimated) and the uncertainty estimates of the OFL in the assessment could not be used directly to represent all key sources of uncertainty.

The SSC considered surfclam to be a "typical" stock and applied the Council's risk policy to generate ABCs assuming the uncertainty around the OFL is lognormally distributed with a CV=100%.

Year	OFL (mt)	ABC (mt)	P (overfishing)
2014	81,150	60,313	36%
2015	75,178	51,804	33%
2016	71,512	48,197	32%

At that May 2013 meeting, the SSC noted the principle sources of scientific uncertainty are:

a) The F = M foundation for establishing OFL;
b) Estimates of M used in the assessment are uncertain;
c) Uncertainty over the scales at which regional replenishment occurs and the potential impact of localized depletion;
d) Absolute biomass is not known, and biomasses are currently scaled to presumed abundance in 1999 to develop reference points; and,
e) Uncertainty in the fishing mortality rates (F), as identified by the SARC external review panel (Houde, et al. 2013). In particular, the comparison of catch to the scaled abundance (see point c above) introduces unquantified uncertainty in estimates of F. Also, incidental mortality estimates, which are used, in part, to generate fishing mortality rates are poorly described and are not current.

Stock Status and Biological Reference Points

The Atlantic surfclam stock assessment was peer reviewed and approved for management at Stock Assessment Workshop 56 (SAW 56). A statistical catch at age and length model called SS3 was used and incorporates age and length structure, and was conducted as two assessment area pieces and then combined (NEFSC 2013a). More detailed descriptions of stock assessment are available in the SAW 56 documents (i.e., summary, report, SARC panel reviews) at: http://www.nefsc.noaa.gov/saw.

SAW 56 biological reference points were not revised from the prior SAW and include:

- Fishing mortality threshold of $F_{MSYPROXY}$ = M = 0.15,
- $B_{MSYPROXY}$ = B_{TARGET} = 972,000 mt meats, and,
- Minimum stock size threshold, one-half $B_{MSYPROXY}$, as $B_{THRESHOLD}$ = 486,000 mt meats.

The Atlantic surfclam resource in the US EEZ is not overfished and overfishing is not occurring in 2011 (NEFSC 2013a). Estimated biomass of the entire resource during 2011 (approximate 120+ mm shell length, SL) was 1,060,000 mt meats, with a 95% confidence interval of 802,000 - 1,401,000 mt. The 95% confidence interval overlaps the B_{TARGET} = ½ B_{1999} = 972,000 mt meats but is entirely above the $B_{THRESHOLD}$ = 486,000 mt. Estimated annual fishing mortality during 2011 for the entire resource was F = 0.027 (95% confidence interval 0.016 - 0.045), which is entirely below the overfishing threshold $F_{MSYPROXY}$ = 0.15.

Basis for 2017-2018 ABC Recommendation

Staff recommend measures be developed for 2-years. The current specifications expire in December 31, 2016; therefore, management measures (catch and landings limits) must be implemented by January 1, 2017. The results of a July 2016 SAW/SARC review of the surfclam stock assessment will not be available for consideration when setting 2017 measures but will be available for the May 2017 SSC meeting. It is also expected that results from a February/March 2017 SAW/SARC for ocean quahogs will also be available for the May 2017 SSC meeting.

In order to ensure administrative efficiency and that there is no lapse in measures given the timing of the SAW/SARCs for both species, staff is also recommending measures be specified in 2018. These measures can be overwritten with information from the new assessment when it becomes available.

Based on projections from the SAW 56 report (NEFSC 2013b), the annual OFL's provided in the stock assessment based on fishing at $F_{MSYPROXY}$ and the projected stock biomass for each year (2017 and 2018) are:

Year	OFL (mt)	Biomass (mt)
2014	81,150	886,251
2015	75,178	813,077
2016	71,512	792,205
2017	69,925	739,359
2018	70,102	757,738

Staff recommends surfclams be considered a typical stock and that the SSC apply methods that include an SSC-modified OFL probability distribution (the same methods applied in 2013 by the SSC).

Based on the 2017 projected B/B_{MSY} = 76%, the Council risk policy for a typical stock (P* = 0.29), and an assumed lognormal distribution with a CV = 100%, the staff recommend an ABC of 44,469 mt for 2017. For 2018, the staff recommend an ABC of 45,524 mt based on a projected B/B_{MSY} = 78%, the Council risk policy for a typical stock P* = 0.30, and a lognormal distribution CV = 100%.

Year	ABC (mt)	P (overfishing)
2014	60,313	36%
2015	51,804	33%
2016	48,197	32%
2017	44,469	29%
2018	45,524	30%

Other Management Measures

Catch and Landings Limits

In the FMP, the ABC=ACL=TAC and the Council specifies an ACT that accounts for management uncertainty and other relevant factors (Figure 1). Discards are assumed to be zero; however, there is an incidental fishing mortality rate of 12% that applies to landings (commercial quota).

Management uncertainty is comprised of two parts: uncertainty in the ability of managers to control catch and uncertainty in quantifying the true catch (i.e., estimation errors). Because this is an ITQ fishery, and clams cannot be landed without cage tags, the implementation uncertainty is generally considered to be insignificant.

Catch is defined as the sum of landings, a 12% incidental mortality applied to landings, and discards (which are assumed to be 0). The ACL is equal to the ABC as prescribed in the FMP.

Staff recommend the ACT for 2017 and 2018, be set at 29,364 mt, which results in a commercial quota of 26,218 mt (3.40 million bushels). This is the same ACT and commercial quota that was implemented for the 2014-2016 fishing years.

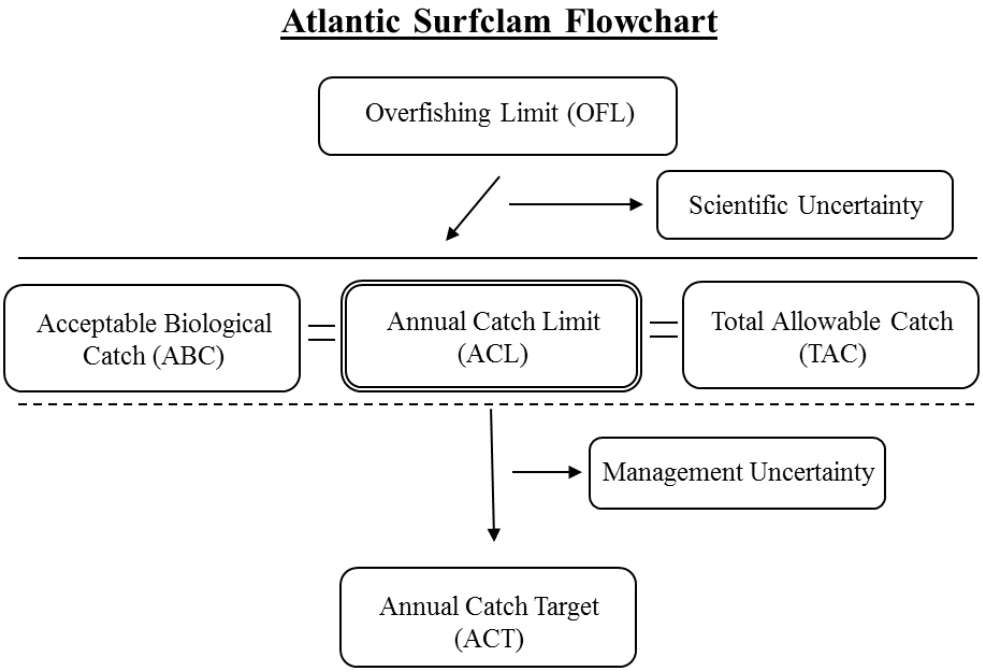

Figure 1. Atlantic surfclam catch limit structure.

Surfclam Minimum Size

In the regulations it states that, "Upon recommendation of the MAFMC, the [NMFS] Regional Administrator [RA] may suspend annually, by publication in the Federal Register, the minimum shell-length standard, unless discard, catch, and survey data indicate that 30 percent of the surfclams are smaller than 4.75 inches (12.065 cm) and the overall reduced shell length is not attributable to beds where the growth of individual surfclams has been reduced because of density dependent factors."

Each year an analysis of the size composition of the landings is developed to inform the Regional administrator regarding minimum size regulations. The report titled, "Estimated Proportion of Undersized Surfclam Landings for 2015" (Hermsen 2015), indicates that:

"The 54 samples used in this analysis contained 1,621 measured surfclams, of which 308 individual surfclams were undersized. Eleven of the 54 samples collected had 30% or more undersized surfclams; one of those samples came from the Georges Bank stock area while the other ten samples with 30% or more undersized surfclams were from the DelMarVa stock area" (Hermsen 2015).

"An estimated 19.2% of the coast wide surfclam landings to date in 2015 were undersized. The lower and upper 95% confidence bounds for this estimate were 18.3% and 20.1%. These estimates are below the 30% maximum that would preclude the Regional Administrator from suspending the minimum shell height standard" (Hermsen 2015).

Staff recommend continued suspension of the minimum shell-length standard for 2017 given that the coastwide 30% threshold for suspension was not triggered. However, the Council should carefully review this information next year and consider issues related to the large numbers of undersized clams that are appearing in the landings in the Delmarva area (up to 70%; Hermsen, 2015) as shown in this report.

Small Surfclam Areas

The regulations state that, the "[NMFS] Regional Administrator [RA] may close an area to surfclams and ocean quahog fishing if he/she determines, based on logbook entries, processors' reports, survey cruises, or other information, that the area contains surfclams of which:
(i) Sixty percent or more are smaller than 4.5 inches (11.43 cm); and
(ii) Not more than 15 percent are larger than 5.5 inches (13.97 cm) in size."

The last time this provision was applied was during the 1980's with three area closures (Atlantic City, NJ, Ocean City, MD, and Chincoteague, VA), with the last of the three areas reopening in 1991.

An analysis of surfclam size distributions for consideration of these regulations was provided to the Council in 2013, when 2014-2016 specifications were developed. The NEFSC fishery-independent clam survey data was used because it has a dredge design which captures smaller surfclams, has randomly selected stations within each survey strata, and provides a sample of the proportions of small (<114 mm, ~4.5 inches), large (> 4.5 inches and <140 mm (~5.5 inches), and extra-large clams (>5.5 inches) in the sampling strata.

In 2013, the Council requested that NEFSC provide these same analyses for the next 3 year specifications cycle. Given the measures proposed for 2017-2018 are interim while awaiting the ongoing surfclam SAW/SARC results, staff recommend NEFSC undertake detailed analysis of the data relative to these regulations so the information is available for the May 2017 SSC meeting and June 2017 Council meeting. The NEFSC may have recommendations for improved analysis and interpretation of the data beyond what was provided in 2013, or other appropriate data with which these could be combined.

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Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

Date: May 9, 2016

To: Chris Moore, Executive Director

From: Jessica Coakley and José Montañez, Staff

Subject: Ocean Quahog Management Measures (2017 and 2018)

Executive Summary

The ocean quahog resource in the US exclusive economic zone (EEZ) is not overfished and overfishing is not occurring in 2011 (Chute et al. 2013). The National Marine Fisheries Service (NMFS) Northeast Fishery Science Center (NEFSC; Dan Hennen Pers. Comm., NEFSC 2016) has provided data updates regarding recent fishery and biological data available at: http://www.mafmc.org/s/DataUpdatefromNEFSC_OceanQuahog.pdf.

Ocean quahog specifications expire at the end of 2016. Staff recommend specifications be set for 2 years (2017-2018) to ensure there is no lapse in management measures through 2018. New stock assessment information will be available in 2017 to possibly change the previously recommended management measures for 2018 as well as set the measures for 2019-2020. Staff recommend acceptable biological catches (ABCs) for 2017 and 2018 be set at 26,100 mt each year. This is the same ABC that the Scientific and Statistical Committee (SSC) recommended for 2014-2016. The Fishery Management Plan (FMP) specifies that the annual catch limit (ACL) equals the ABC. Staff recommend an annual catch target (ACT) for the Maine fishery be set as 524 mt, and the Non-Maine fishery ACT be set at 25,511 mt for 2017 and 2018. This results in a Maine commercial quota of 499 mt (100,000 ME bushels) and a Non-Maine commercial quota of 24,296 mt (5.36 million bushels) for 2017 and 2018. These are the same ACTs and commercial quotas that were implemented for the 2014-2016 fishing years.

Introduction

The Magnuson-Steven Act requires each Council's SSC to provide, among other things, ongoing scientific advice for fishery management decisions, including recommendations for ABC, preventing overfishing, and maximum sustainable yield. The Council's catch limit recommendations for the upcoming fishing year(s) cannot exceed the ABC recommendation of the SSC. In this memorandum, information is presented to assist the development of measures for the Council to consider for the 2017 and 2018 fishery for ocean quahogs. The SSC will recommend ABCs for the ocean quahog fishery that addresses scientific uncertainty. Based on the SSC recommendations, the Council will make recommendations for ACLs, ACTs, and other implemented measures, and provide those recommendations to the NMFS Northeast Regional Administrator.

Review of SSC Recommendations from May 2013

In May 2013, the SSC met to recommend ABCs for ocean quahog for fishing years 2014-2016. The SSC recommended the ocean quahog assessment be considered Level 4 and noted, "that the survey and assessment model provides reliable information on the trends in stock biomass. As a result, given the information on catches, it is possible to develop indices of relative exploitation that likely provide reliable indications of the trend in exploitation. In contrast, the SSC deemed the OFL to be non-credible because few recruitment pulses have been observed in the survey, due to the extreme longevity of quahog, and it appears to be incompatible with the observed stock dynamics. The SSC also notes that the species has an "atypical" life history."

Because the assessment was categorized as Level 4, it was not possible to provide the level of catch associated with the OFL. The SSC also, "deemed that it lacked credible scientific information on which to base a change in ABC."

The SSC recommended setting an ABC equivalent to status quo (26,100 mt) for 2014-2016. It was noted that, "It is the SSC's expectations that catches will remain relatively unchanged during this period. Moreover, the SSC wishes to recommend to the Council, in the strongest possible terms that a benchmark assessment be conducted that focuses on establishing credible biological reference points for a species that is extremely long lived and has a highly uncertain recruitment pattern."

At that May 2013 meeting, the SSC noted that the principle sources of scientific uncertainty are:

a. The fishing mortality rate reference point is deemed to be non-credible, both because of the species to which quahogs were compared were inappropriate and because the details of the calculations of spawning-per-recruit for any particular level were poorly justified.
b. Forecasts over 40-50 years were provided to SSC. Although these forecasts were not used in the ABC determination, the SSC notes that forecasts over this duration should be continued.
c. It is not known whether the low recent recruitments were reflective of a change in underlying stock productivity or a consequence of the life history of a long-lived species with highly uncertain recruitment.
d. The nature of historical recruitments is poorly known.
e. The SSC notes that it identified other substantial sources of uncertainty in its report in 2010.

Stock Status and Biological Reference Points

A forward projecting stock assessment model, based on the Deriso-Schnute delay-difference equation, was applied in a program called (KLAMZ) and was used in the most recent ocean quahog assessment update (Chute et al. 2013). This update utilized the same peer-reviewed and approved methods developed at Stock Assessment Workshop 48 (SAW 48). Based on the June 2013 update, which utilized data through 2011, the stock is not overfished and overfishing is not occurring in 2011, relative to the

biological reference points. Whole stock fishable biomass during 2011 was 2.96 million mt meats and the fishing mortality rate during 2011 for the stock in the exploited region was F= 0.010 y^{-1}.

The SAW 48 biological reference points for ocean quahog include:

- Fishing mortality threshold of $F_{MSYPROXY} = F_{45\%} = 0.022\ y^{-1}$,
- $B_{MSYPROXY} = B_{TARGET}$ = 1.73 million mt meats, and,
- Minimum stock size threshold, one-half $B_{MSYPROXY}$, $B_{THRESHOLD}$ = 1.39 million mt meats.

Basis for 2017 and 2018 ABC Recommendation

Staff recommend measures be developed for 2-years. The current specifications expire in December 31, 2016; therefore, management measures (catch and landings limits) must be implemented by January 1, 2017. The results of a February/March 2017 SAW/SARC review of the ocean quahog stock assessment will not be available for consideration when setting 2017 measures but will be available for the May 2017 SSC meeting. The results of a July 2016 SAW/SARC review of the surfclam stock assessment will also be available for the May 2017 SSC meeting.

In order to ensure administrative efficiency and that there is no lapse in measures given the timing of the SAW/SARCs for both species, staff is also recommending measures be specified in 2018. These measures can be overwritten with information from the new assessment when it becomes available.

Staff recommends ocean quahogs be considered an atypical stock and that the SSC apply methods appropriate when the OFL cannot be specified given current state of knowledge. Based on the prior approaches used, staff recommend an ABC for 2017 and 2018 be set at 26,100 mt each year. This is the same ABC specified by the SSC for 2014-2016.

Other Management Measures

In the FMP, the ABC=ACL=TAC and the Council specifies ACTs that accounts for management uncertainty and other relevant factors (Figure 1). Discards are assumed to be zero; however, there is an incidental fishing mortality rate of 5% that applies to landings (commercial quota). The sum of the Non-Maine and Maine ACTs, may be less than ACL based on achieving the optimum yield (OY), any additional reduction in catch to address management uncertainty, or other factors. Management uncertainty is comprised of two parts: uncertainty in the ability of managers to control catch and uncertainty in quantifying the true catch (i.e., estimation errors). Because this is an ITQ fishery, and ocean quahogs cannot be landed without cage tags, the implementation uncertainty is generally considered to be insignificant.

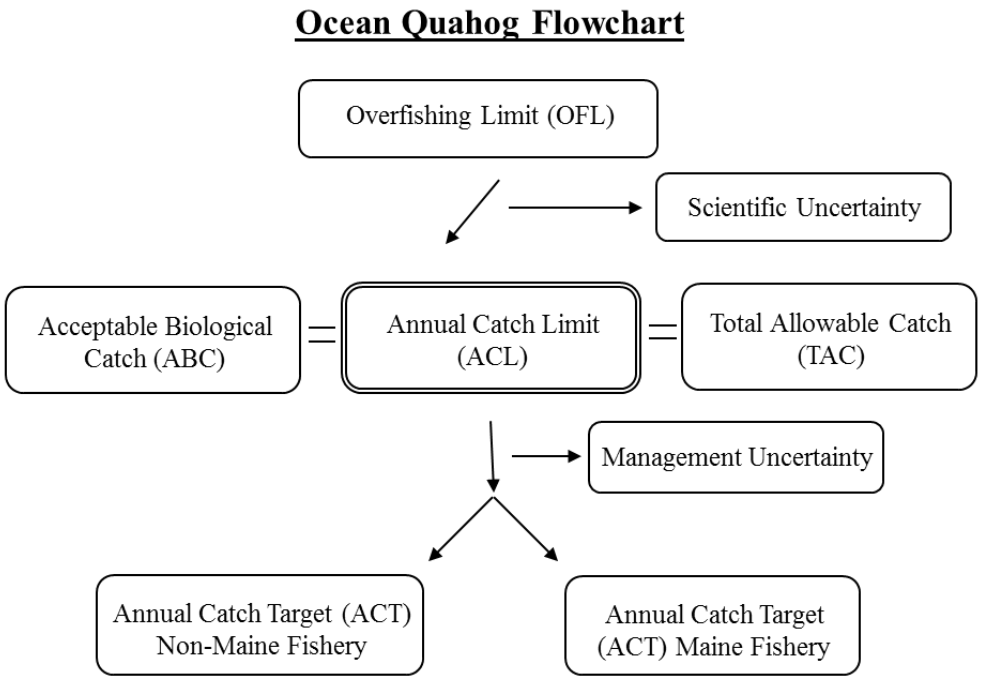

Figure 1. Ocean quahog catch limit structure.

Catch for ocean quahogs is defined as the sum of landings, a 5 percent incidental mortality applied to landings, and discards (which are assumed to be 0). The ACL is equal to the ABC as prescribed in the FMP.

Staff recommended the ACT for the Maine fishery be set as 524 mt, and the Non-Maine fishery ACT be set at 25,511 mt for 2017 and 2018. This results in a Maine commercial quota of 499 mt (100,000 ME bushels) and a Non-Maine commercial quota of 24,296 mt (5.36 million bushels) for 2017 and 2018. This is the same ACT and commercial quota that was implemented for the 2014-2016 fishing years.

References

Chute A, Hennen D, Russell R, Jacobson L. 2013. Stock Assessment Update for Ocean Quahogs (*Arctica islandica*) through 2011. NEFSC Ref Doc 13-17; 156 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

Hennen, Dan. Personal Communication. February 25, 2016. NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

Mid-Atlantic Fishery Management Council
Atlantic Surfclam Information Document - May 2016

Note: The National Marine Fisheries Service (NMFS) Northeast Fishery Science Center (Dan Hennen Pers. Comm., NEFSC 2016) has provided data updates regarding recent fishery and biological data available. The following summarizes some of the information from that data update, but not all; the data update can be referenced for additional details and is available at: http://www.mafmc.org/s/DataUpdatefromNEFSC_Surfclam.pdf.

Management System

The Fishery Management Plan (FMP) for Atlantic surfclam (*Spisula solidissima*) became effective in 1977. The FMP established the management unit as all Atlantic surfclams in the Atlantic Exclusive Economic Zone (EEZ). The FMP is managed by the Mid-Atlantic Fishery Management Council (Council), in conjunction with NMFS as the Federal implementation and enforcement entity. The primary management tool is the specification of an annual quota, which is allocated to the holders of allocation shares (Individual Transferable Quotas - ITQs) at the beginning of each calendar year as specified in Amendment 8 to the FMP (1988). In addition to the Federal waters fishery, there is a small fishery prosecuted in the state waters of New York, New Jersey, and Massachusetts. The FMP, including subsequent Amendments and Frameworks, is available on the Council website at: http://www.mafmc.org.

Basic Biology

Information on Atlantic surfclam biology can be found in the document titled, "Essential Fish Habitat Source Document: Surfclam, *Spisula solidissima*, Life History and Habitat Requirements" (Cargnelli et al. 1999). An electronic version is available at the following website: http://www.nefsc.noaa.gov/nefsc/habitat/efh/. Additional information on this species is available at the following website: http://www.fishwatch.gov/. A summary of the basic biology is provided below.

Atlantic surfclams are distributed along the western North Atlantic Ocean from the southern Gulf of St. Lawrence to Cape Hatteras. Surfclams occur in both the state territorial waters (≤ 3 mi from shore) and within the EEZ (3-200 miles from shore). Commercial concentrations are found primarily off New Jersey, the Delmarva Peninsula, and on Georges Bank. In the Mid-Atlantic region, surfclams are found from the intertidal zone to a depth of about 60 meters, but densities are low at depths greater than 40 meters.

The maximum size of surfclams is about 22.5 cm (8.9 inches) shell length, but surfclams larger than 20 cm (7.9 inches) are rare. The maximum age exceeds 30 years and surfclams of 15-20 years of age are common in many areas. Surfclams are capable of reproduction in their first year of life, although full maturity may not be reached until the second year. Eggs and sperm are shed directly into the water column. Recruitment to the bottom occurs after a planktonic larval period of about three weeks.

Atlantic surfclams are suspension feeders on phytoplankton, and use siphons which are extended above the surface of the substrate to pump in water. Predators of surfclams include certain species of crabs, sea stars, snails, and other crustaceans, as well as fish predators such cod and haddock.

Status of the Stock

The Atlantic surfclam stock assessment was peer reviewed and approved for use by management at Stock Assessment Workshop 56 (SAW 56). A statistical catch at age and length model called SS3 was used and incorporates age and length structure. Reports on "Stock Status," including assessment and reference point updates, SAW reports, and Stock Assessment Review Committee (SARC) panelist reports are available online at the NEFSC website: http://www.nefsc.noaa.gov/saw.

The Atlantic surfclam resource in the US EEZ is not overfished and overfishing is not occurring in 2011 (NEFSC 2013). Estimated biomass of the entire resource during 2011 (approximate 120+ mm shell length, SL) was 1,060 thousand mt (2,337 million lbs), with a 95% confidence interval of 802 - 1,401 thousand mt meats (NEFSC 2013). The 95% confidence interval overlaps the B_{Target} = ½ B_{1999} = 972 thousand mt meats (2,142 million lbs) but is entirely above $B_{Threshold}$ = ½ B_{Target} = 486 thousand mt meats (1,071 million lbs; Figure 1). Estimated annual fishing mortality during 2011 for the entire resource was F = 0.027 (95% confidence interval 0.016 - 0.045), which is entirely below the overfishing threshold F_{MSY} proxy = M = 0.15 (Figure 2).

Estimated biomass on Georges Bank during 2011 (ages 7+, approximately 120+ mm shell length, SL) was 357 thousand mt of meats (787 million lbs) with a 95% confidence interval 252 - 506 mt. Surfclams on Georges Bank were not fished from 1990 to 2008 due to the risk of paralytic shellfish poisoning (PSP).[1] There was light fishing in years 2009-2011 under an exempted fishing permit. Fishing mortality on Georges Bank was close to zero (F_{2011} = 0.009; 95% confidence interval 0.006 - 0.013) during 2011. Estimated biomass of the southern area during 2011 (ages 6+, approximately 120+ mm shell length, SL) was 703 thousand mt (1,549 million lbs), with a 95% confidence interval of 481 - 1,028 thousand mt meats (Figure 3). Estimated fishing mortality during 2011 for the southern area was F = 0.037 (95% confidence interval 0.025 - 0.056) (Figure 4). Recruitment (age 0) has been below average for the whole stock since 1999 (Figure 5).

[1] See Area Closure section on page 15 for additional information.

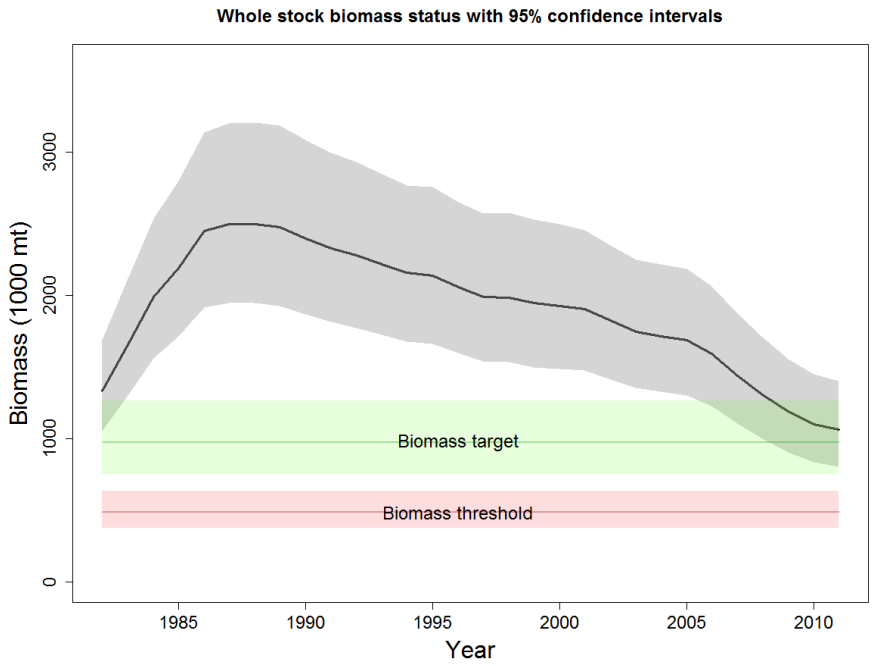

Figure 1. Whole stock biomass status estimates with approximate 95% confidence intervals on the estimates and reference points. Source: Stock Assessment Summary (NEFSC 2013).

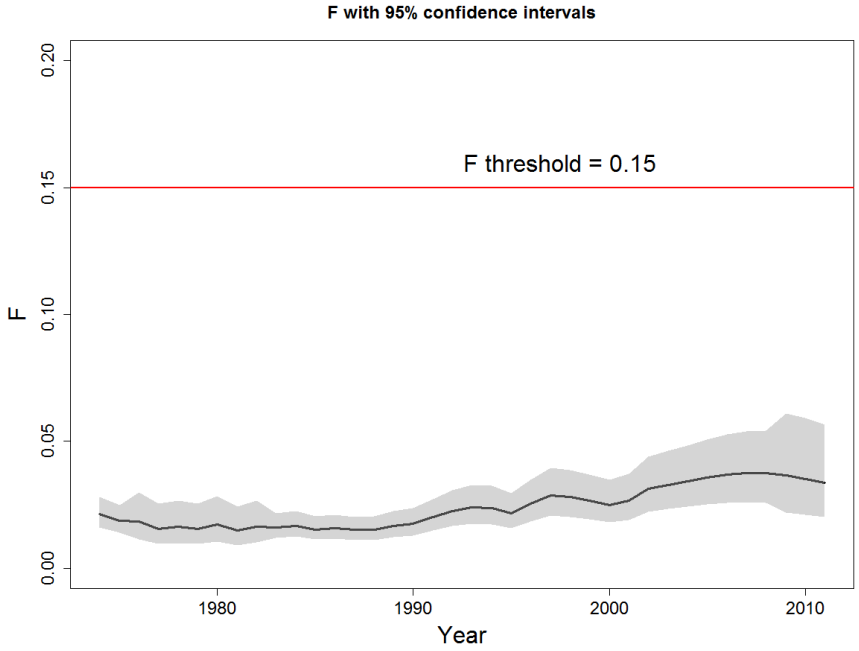

Figure 2. Whole stock fishing mortality estimates with approximate 95% confidence intervals, and the overfishing threshold. Source: Stock Assessment Summary (NEFSC 2013).

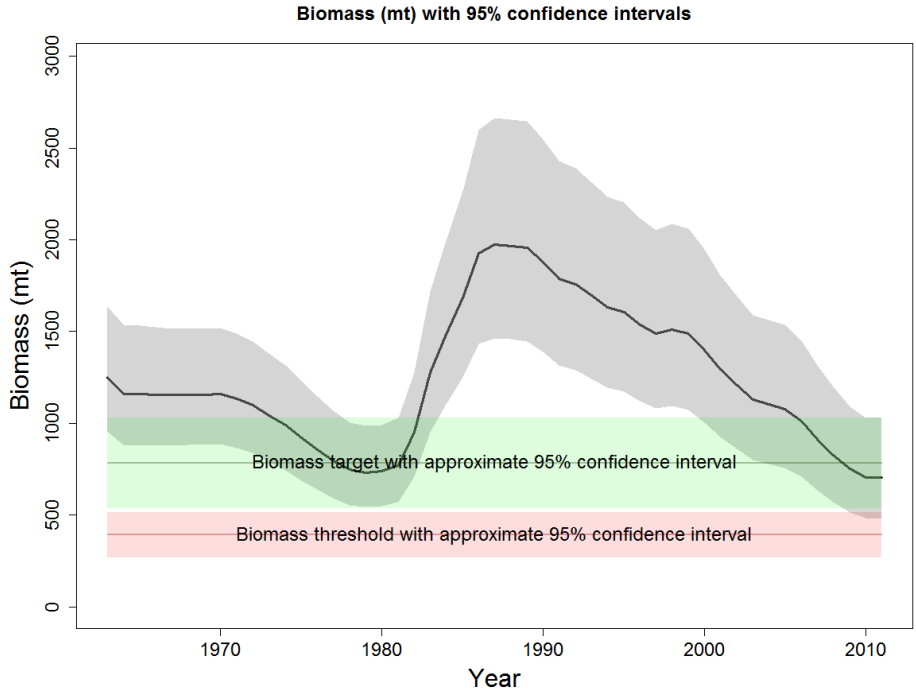

Figure 3. Southern area biomass estimates, and biomass reference points with approximate 95% confidence intervals. Source: Stock Assessment Summary (NEFSC 2013).

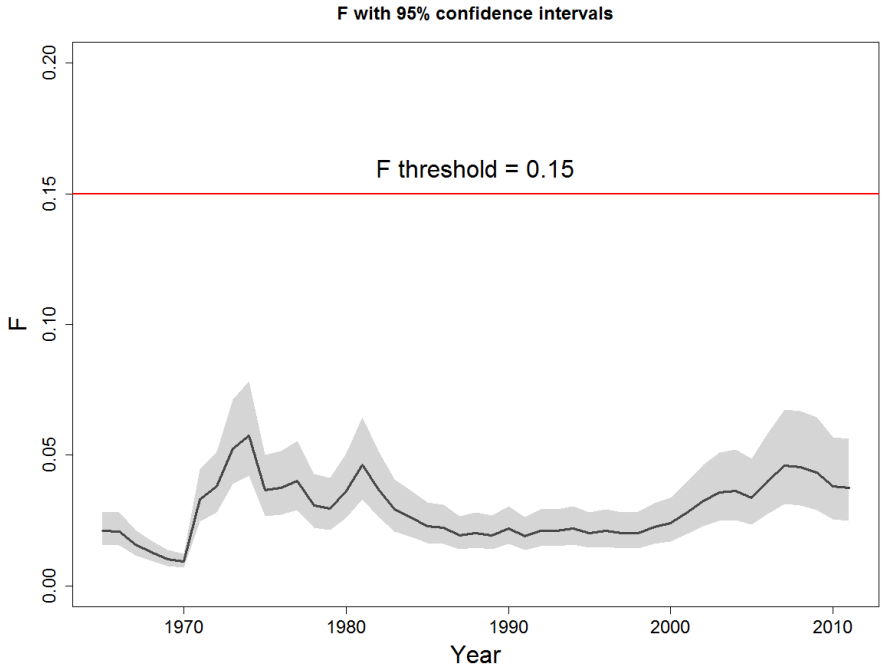

Figure 4. Southern area fishing mortality estimates and with approximate 95% confidence intervals, and the overfishing threshold. Source: Stock Assessment Summary (NEFSC 2013).

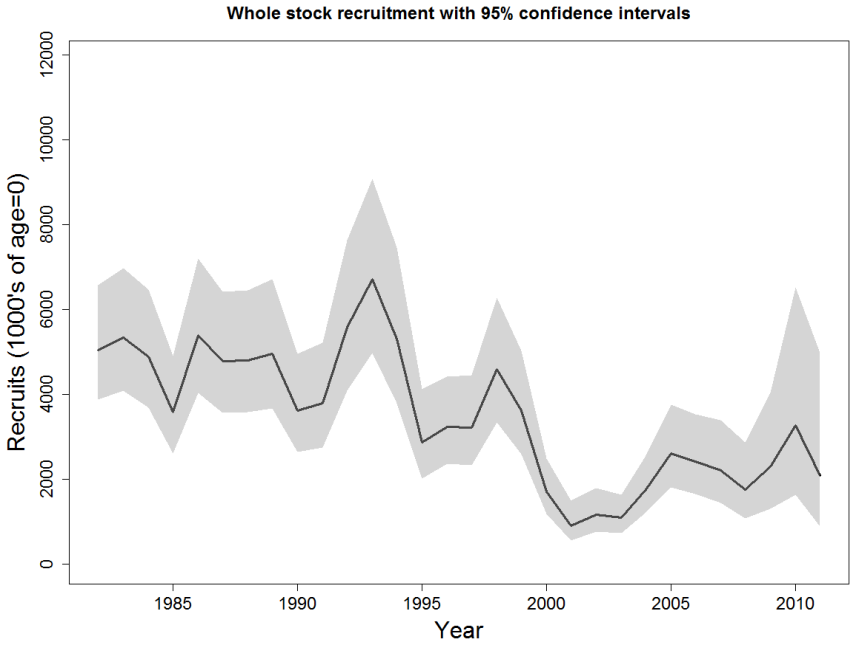

Figure 5. Whole stock recruitment estimates with approximate 95% confidence intervals. Source: Stock Assessment Summary (NEFSC 2013).

Description of the Fishery and Market

The commercial fishery for surfclam in Federal waters is prosecuted with large vessels and hydraulic dredges. Surfclam landings and commercial quotas are given in Table 1 and Figure 6. The distribution of the fishery has changed over time, as shown in Figures 7-11, with a shift to increased landings in Southern New England and Georges Bank areas.

Figures 12-14 provide the distribution of surfclam landings, fishing effort, and landings per unit effort (LPUE) in "important" ten minute squares (TMSQ). Important means that a square ranked in the top 10 TMSQ for total landings during any five-year period (1980-1984, 1985-1989, 1990-1994,1995-1999, 2000-2004, 2005-2009, 2010-2015). Data for 2015 are incomplete and preliminary.

Additional information of the length composition of port sampled surfclams, and their associated sample sizes by area, are available in the data updates (Dan Hennen Pers. Comm., NEFSC 2016) at: http://www.mafmc.org/s/DataUpdatefromNEFSC_Surfclam.pdf.

Port and Community Description

When Amendment 13 to the FMP was developed, the Council hired Dr. Bonnie McCay and her associates at Rutgers University to describe the ports and communities that are associated with the surfclam and ocean quahog fisheries. The researchers did an extensive job characterizing the three main fisheries (non-Maine ocean quahog, Maine ocean quahog, and surfclam). The McCay team characterizations of the ports and communities are based on government census and labor statistics and on observations and interviews carried out during the late 1990s and in the fall of 2001. The description of the fishing gear, areas fished, etc. are fully described in Amendment 13. Communities from Maine to Virginia are involved in the harvesting and processing of surfclams and ocean quahogs. Ports in New Jersey and Massachusetts handle the most volume and value, particularly Atlantic City and Point Pleasant, New Jersey, and New Bedford, Massachusetts. There are also landings in Ocean City, Maryland, and the Jonesport and Beals Island areas of Maine.

Additional information on "Community Profiles for the Northeast US Fisheries" can be found at: http://www.nefsc.noaa.gov/read/socialsci/communityProfiles.html.

Table 1. Federal surfclam quotas and landings: 1998 - 2016.

Year	Total Landings (includes state waters)	EEZ Landings (mt meats)	EEZ Landings[a] ('000 bu)	EEZ Quota ('000 bu)	% Harvested
1998	24,506	18,234	2,365	2,565	92%
1999	26,677	19,577	2,539	2,565	99%
2000	31,093	19,788	2,566	2,565	100%
2001	31,237	22,017	2,855	2,850	100%
2002	32,645	24,006	3,113	3,135	99%
2003	31,526	24,994	3,241	3,250	100%
2004	26,463	24,197	3,138	3,400	92%
2005	22,734	21,163	2,744	3,400	81%
2006	25,779	23,573	3,057	3,400	90%
2007	27,091	24,915	3,231	3,400	95%
2008	25,038	22,510	2,919	3,400	86%
2009	22,283	20,065	2,602	3,400	77%
2010	19,941	17,984	2,332	3,400	69%
2011[b]	19,776	18,839	2,443	3,400	72%
2012[b]	18,378	18,054	2,341	3,400	69%
2013[b]	18,459	18,551	2,406	3,400	71%
2014[c]	18,707	18,227	2,364	3,400	70%
2015[c]	9,117[d]	17,362[d]	2,252[d]	3,400	66%[d]
2016[c]	NA	NA	NA	3,400	NA

[a] 1 surfclam bushel is approximately 17 lb. [b] The Scientific and Statistical Committee (SSC) recommended an overfishing limit (OFL) for 2010, 2011, 2012, and 2013 of 129,300 mt, 114,00 mt, 102,300 mt, and 93,400 mt, respectively, and an acceptable biological catch (ABC) of 96,600 mt (2011-2013). [c] For 2014-2016, the SSC recommended an OFL of 81,150 mt, 75,178 mt, 71,512 mt, respectively, and an acceptable biological catch (ABC) of 60,313 mt, 51,804 mt, and 48,197 mt, respectively. [d] Preliminary, incomplete 2015 data. Source: NMFS clam vessel logbook reports. Dan Hennen Pers. Comm., NEFSC 2016.

Figure 6. Surfclam landings (total and EEZ) during 1965-2014, and preliminary 2015. Source: Dan Hennen Pers. Comm., NEFSC 2016.

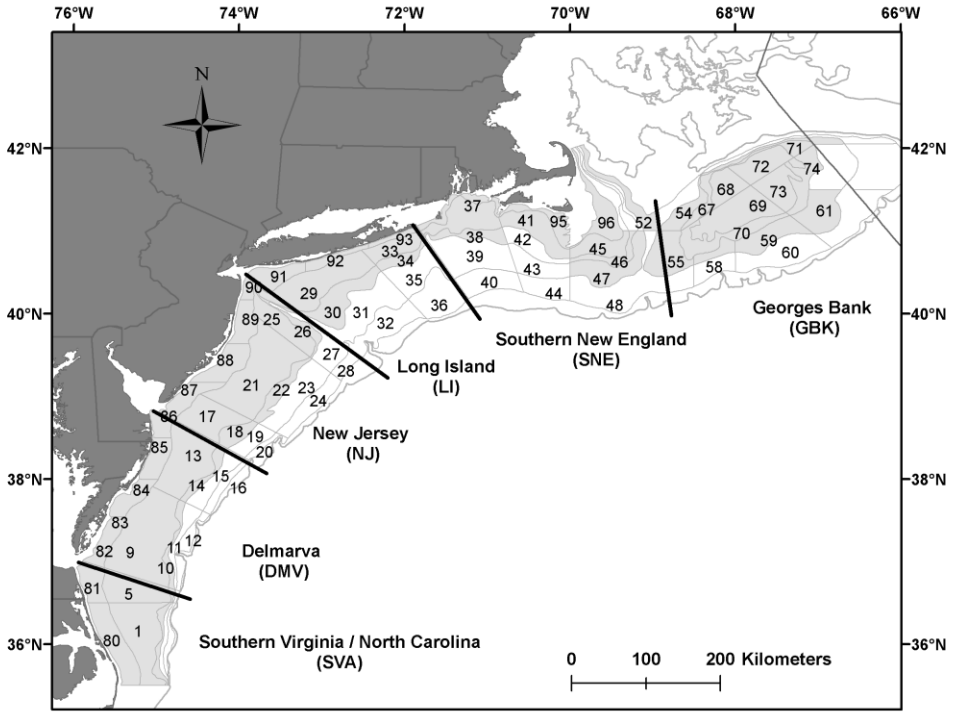

Figure 7. Surfclam stock assessment regions and NEFSC shellfish survey strata. The shaded strata are where surfclams are found. Source: Dan Hennen Pers. Comm., NEFSC 2016.

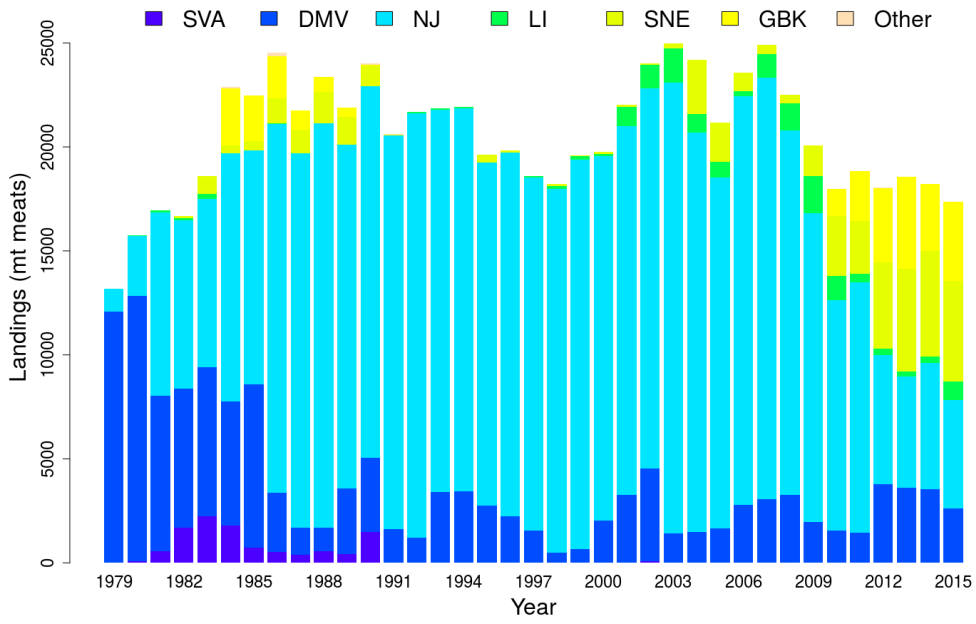

Figure 8. Surfclam landings from the US EEZ during 1979-2014, and preliminary 2015, by stock assessment region. Source: Dan Hennen Pers. Comm., NEFSC 2016.

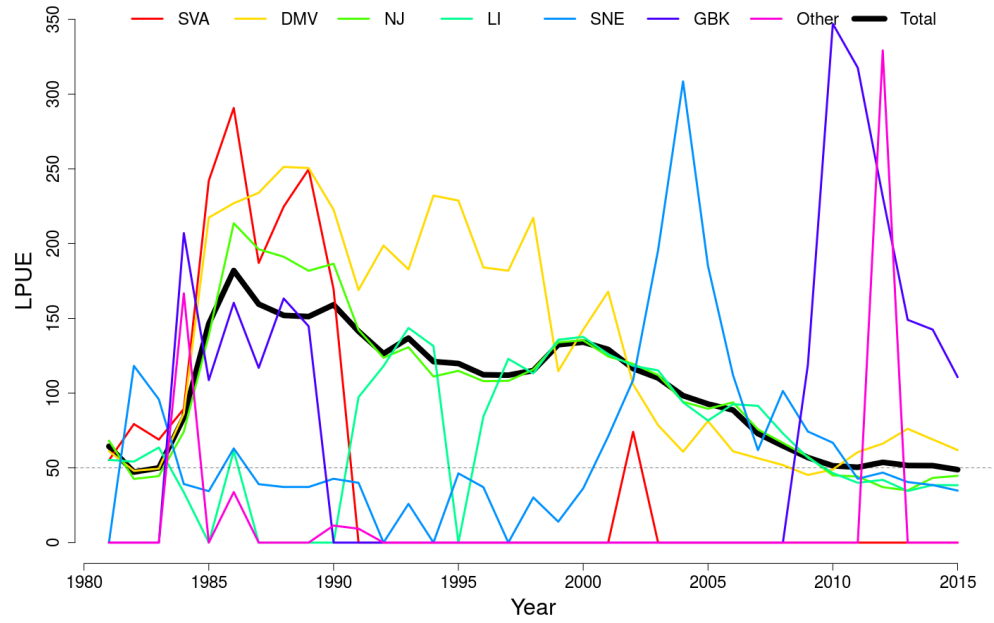

Figure 9. Nominal landings per unit effort (LPUE in bushels landed per hour fished) for surfclam, by region, during 1981-2014, and preliminary 2015. LPUE is total landings in bushels divided by total fishing effort. Source: Dan Hennen Pers. Comm., NEFSC 2016.

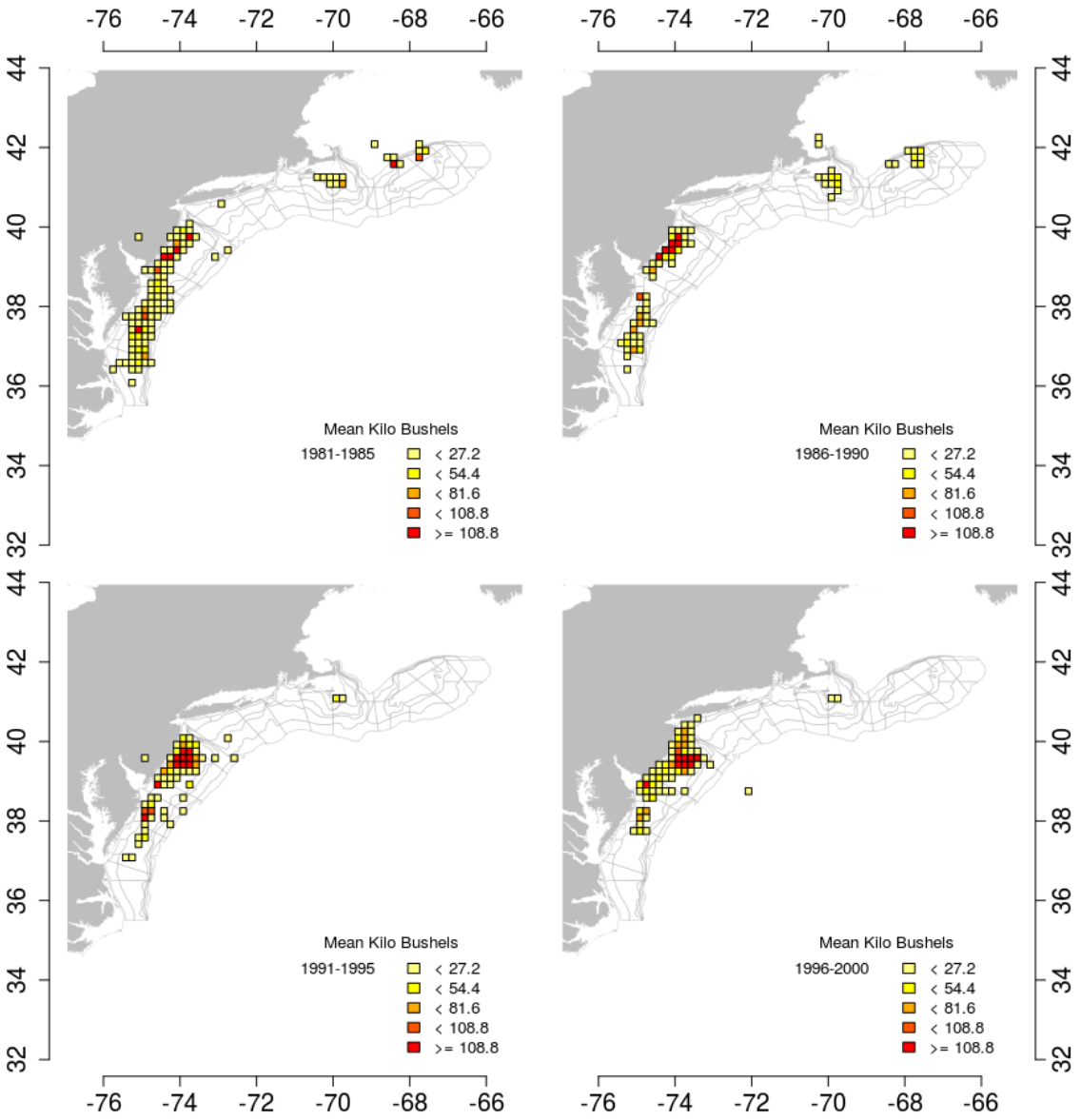

Figure 10. Average surfclam landings by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 1981-2000 (1 kilobushel = 1000 bu y^{-1}). Source: Dan Hennen Pers. Comm., NEFSC 2016.

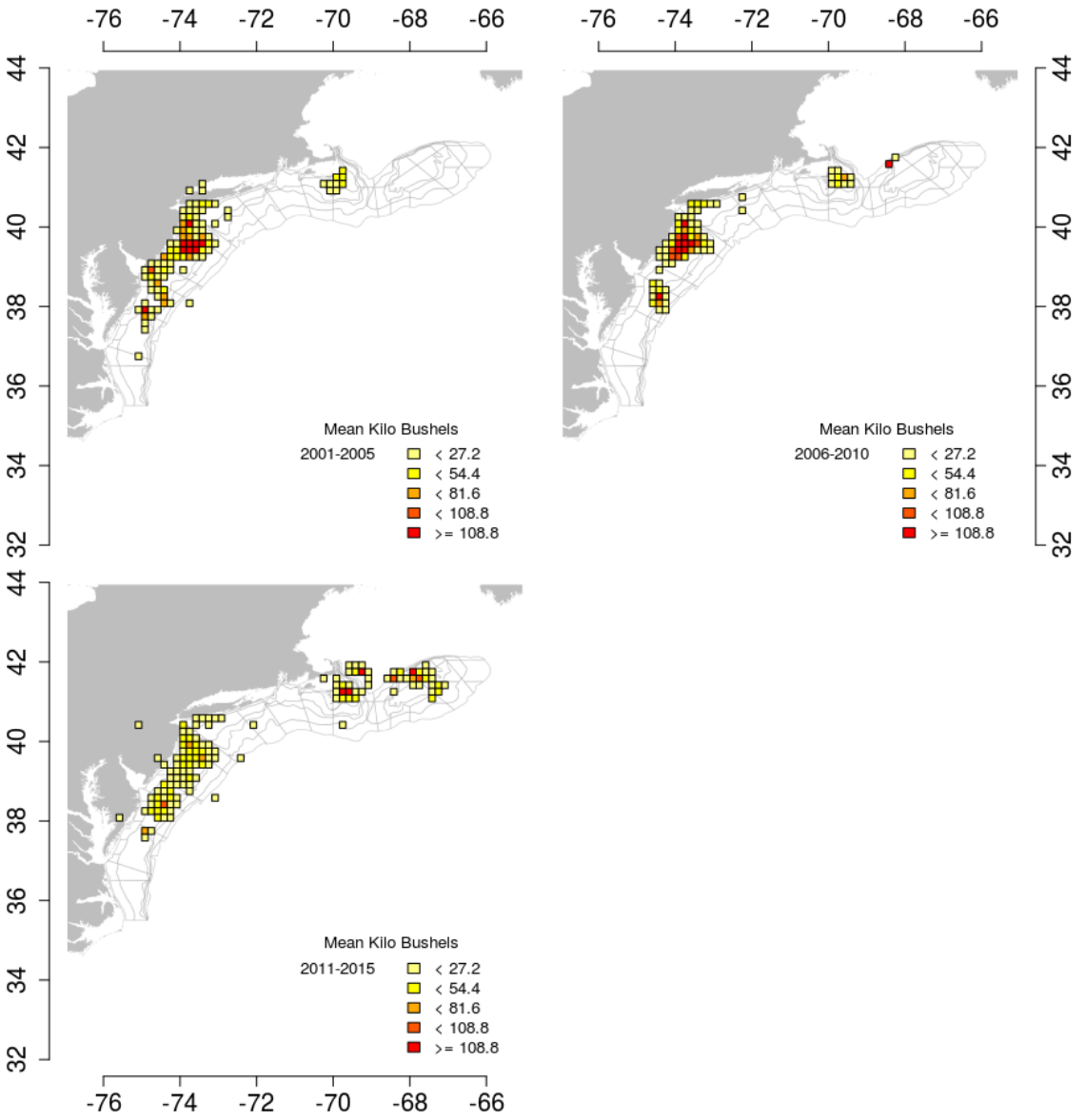

Figure 11. Average surfclam landings by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 2001-2014, and preliminary 2015 (1 kilobushel = 1000 bu y^{-1}). Source: Dan Hennen Pers. Comm., NEFSC 2016.

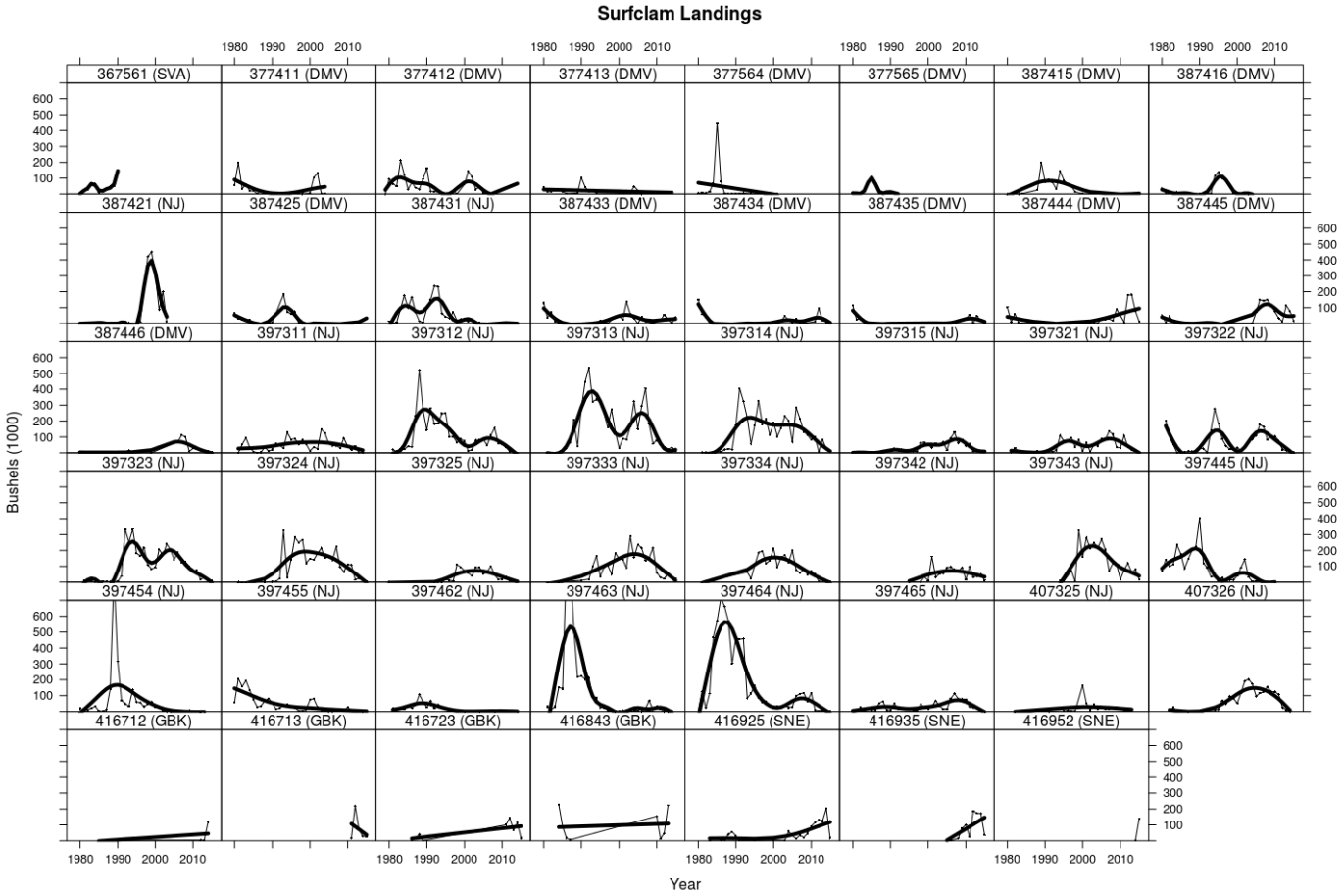

Figure 12. Annual surfclam landings in "important" ten minute squares (TMSQ) during 1980-2015 based on logbook data. Important means that a square ranked in the top 10 TMSQ for total landings during any five-year period (1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2015). Data for 2015 are incomplete and preliminary. To protect the privacy of individual firms, data are not plotted if the number of vessels is less than 2. Instead, a "^" is shown on the x-axis to indicate where data are missing. The solid dark line is a spline intended to show trends. The spline was fit to all available data, including data not plotted. Source: Dan Hennen Pers. Comm., NEFSC 2016.

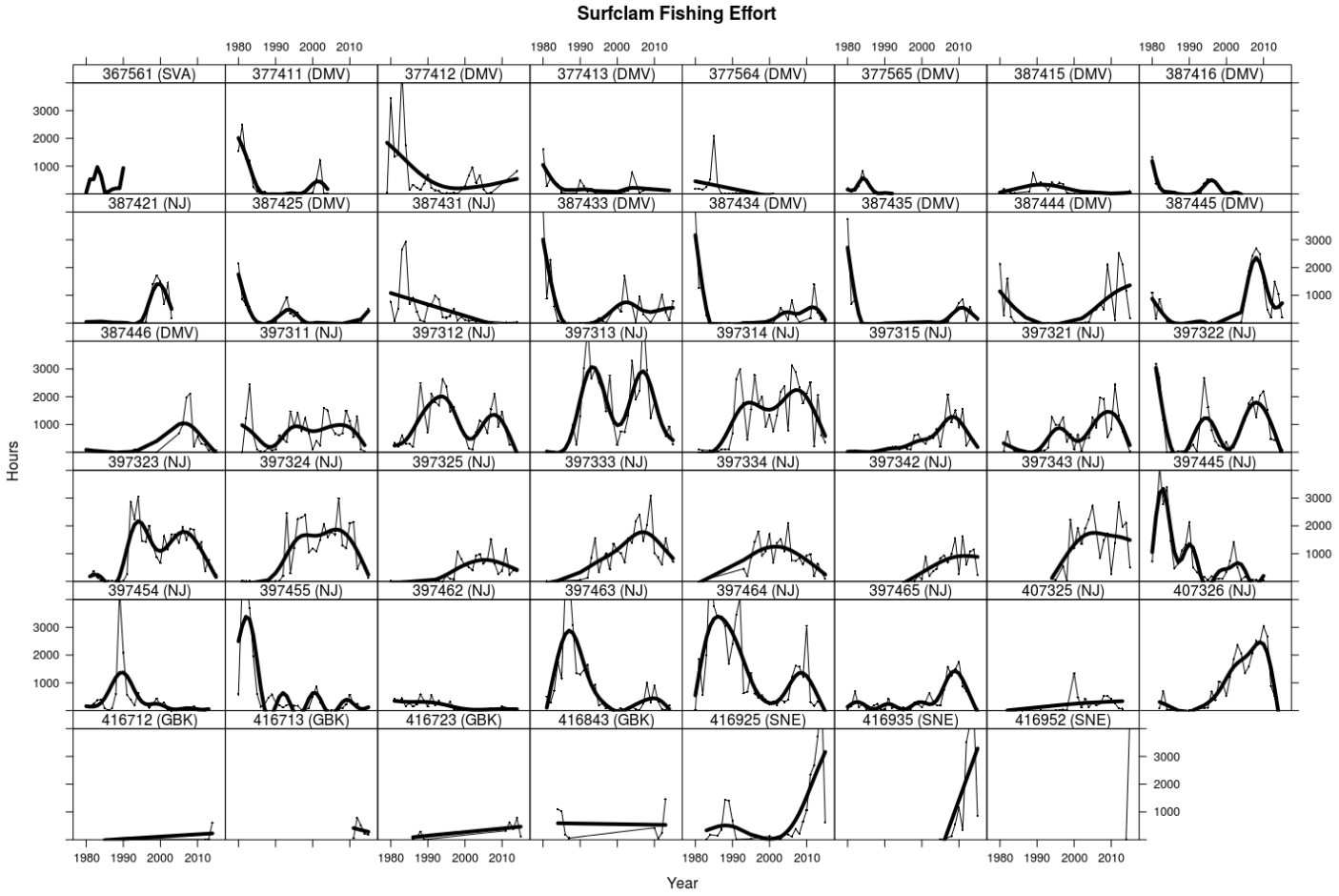

Figure 13. Annual surfclam fishing effort (h y^{-1}) in "important" ten minute squares (TMSQ) during 1980-2015 based on logbook data. Important means that a square ranked in the top 10 TMSQ for total landings during any five-year period (1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2015). Data for 2015 are incomplete and preliminary. To protect the privacy of individual firms, data are not plotted if the number of vessels is less than 2. Instead, a "^" is shown on the x-axis to indicate where data are missing. The solid dark line is a spline intended to show trends. The spline was fit to all available data, including data not plotted. Source: Dan Hennen Pers. Comm., NEFSC 2016.

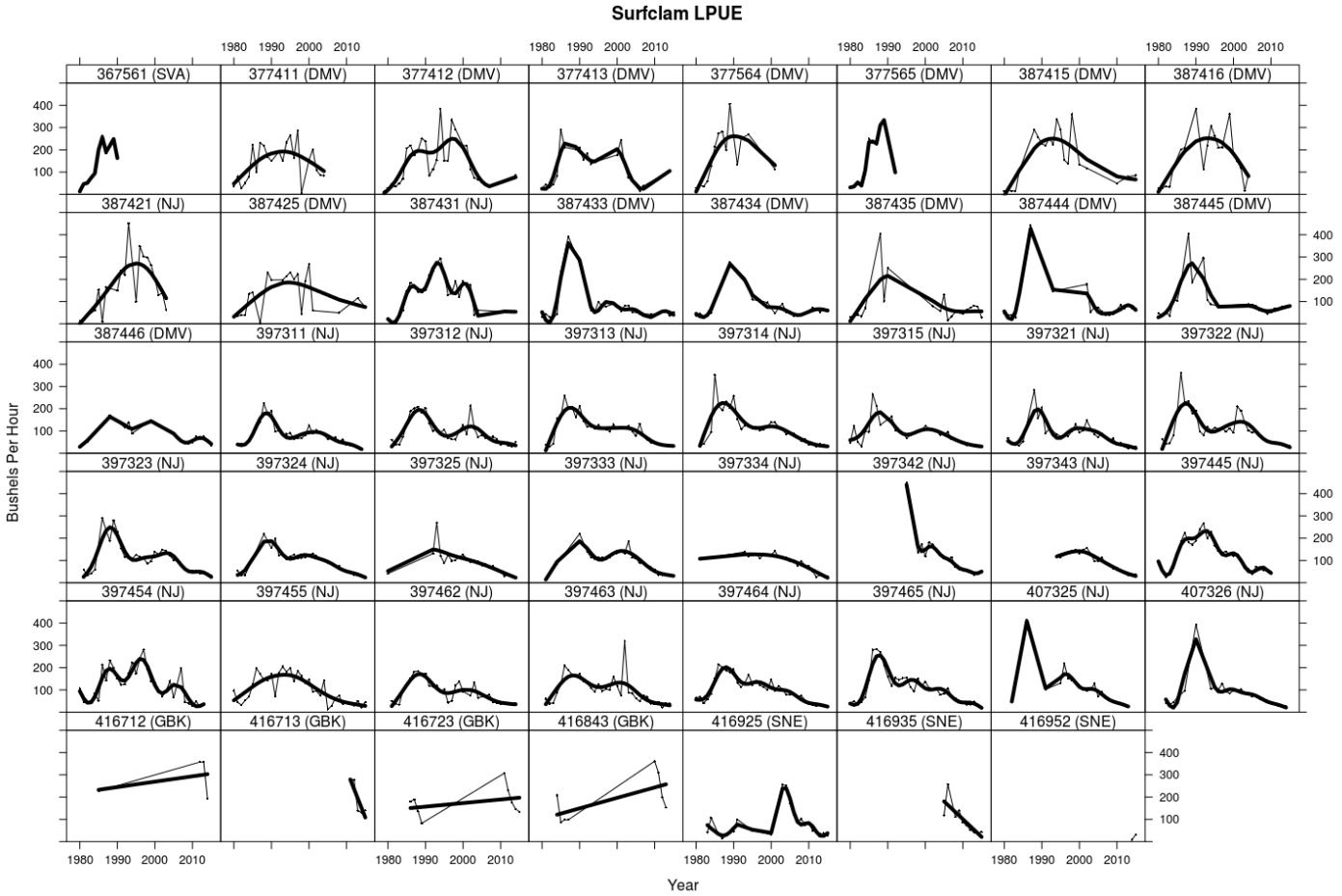

Figure 14. Annual surfclam LPUE (bushels h^{-1}) in "important" ten minute squares (TMSQ) during 1980-2015 based on logbook data. Important means that a square ranked in the top 10 TMSQ for total landings during any five-year period (1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2015). Data for 2015 are incomplete and preliminary. To protect the privacy of individual firms, data are not plotted if the number of vessels is less than 2. Instead, a "^" is shown on the x-axis to indicate where data are missing. The solid dark line is a spline intended to show trends. The spline was fit to all available data, including data not plotted. Source: Dan Hennen Pers. Comm., NEFSC 2016.

Federal Fleet Profile

The total number of vessels participating in the surfclam fishery has remained relatively stable from 2005 through 2015, and has ranged from 29 vessels in 2006 to 42 vessels in 2012 (Table 2). The average ex-vessel price of surflcams reported by processors was $12.61 in 2015, nearly identical to the $12.66 per bushel seen in 2014. The total ex-vessel value of the 2015 federal harvest was approximately $30 million, also nearly identical to 2014. A myriad of factors have contributed to the difficulties in the clam industry. Major users of clam meats have reduced their purchases from industry and stopped advertising products like clam chowder in the media. Industry members reported that imported meat from Canada and Vietnam contributed to an oversupply of clam meats in the marketplace. The costs to vessels harvesting clams has increased due to the rising costs of insurance; industry has also indicated price of diesel fuel in conjunction with distance traveled to fish is a big factor determining trip cost. Trips harvesting surfclams have increased in length as catch rates have declined. The distribution of LPUE in bushels per hour over time is shown below in Figures 9, 15 and 16.

Processing Sector

Even though this document describes the surfclam fishery, the information presented in this section regarding the processing sector is for both surfclams and ocean quahogs as some of these facilities purchase/process both species. In 2015, there were 9 companies reporting purchases of surfclams and/or ocean quahogs from the industrial fisheries outside of Maine. They were distributed by state as indicated in Table 3. Employment data for these specific firms are not available. In 2015, these companies bought approximately $30 million worth of surfclams and $21 million worth of ocean quahogs.

Area Closures

Areas can be closed to surfclam fishing if the abundance of small clams in an area meets certain threshold criteria. This small surfclam closure provision was applied during the 1980's with three area closures (off Atlantic City, NJ, Ocean City, MD, and Chincoteague, VA), with the last of the three areas reopening in 1991.

Fishing areas can also be closed for public health related issues due to environmental degradation or the toxins that cause PSP. PSP is a public health concern for surfclams. PSP is caused by saxitoxins, produced by the alga *Alexandrium fundyense* (red tide). Surfclams on Georges Bank were not fished from 1990 to 2008 due to the risk of PSP. There was light fishing on Georges Bank in years 2009-2011 under an exempted fishing permit and LPUE in that area was substantially higher (5-7 times higher) than in other traditional fishing grounds. The Greater Atlantic Regional Fisheries Office reopened a portion of Georges Bank to the harvest of surfclams and ocean quahogs beginning January 1, 2013 (77 FR 75057, December 19, 2012) under its authority in 50 CFR 648.76. Harvesting vessels have to adhere to the adopted testing protocol from the National Shellfish Sanitation Program.

Industry has indicated that they have recently implemented a large, voluntary closure off Atlantic City, New Jersey because of concerns for the fishery in the area and the prevalence of large numbers of small clams.

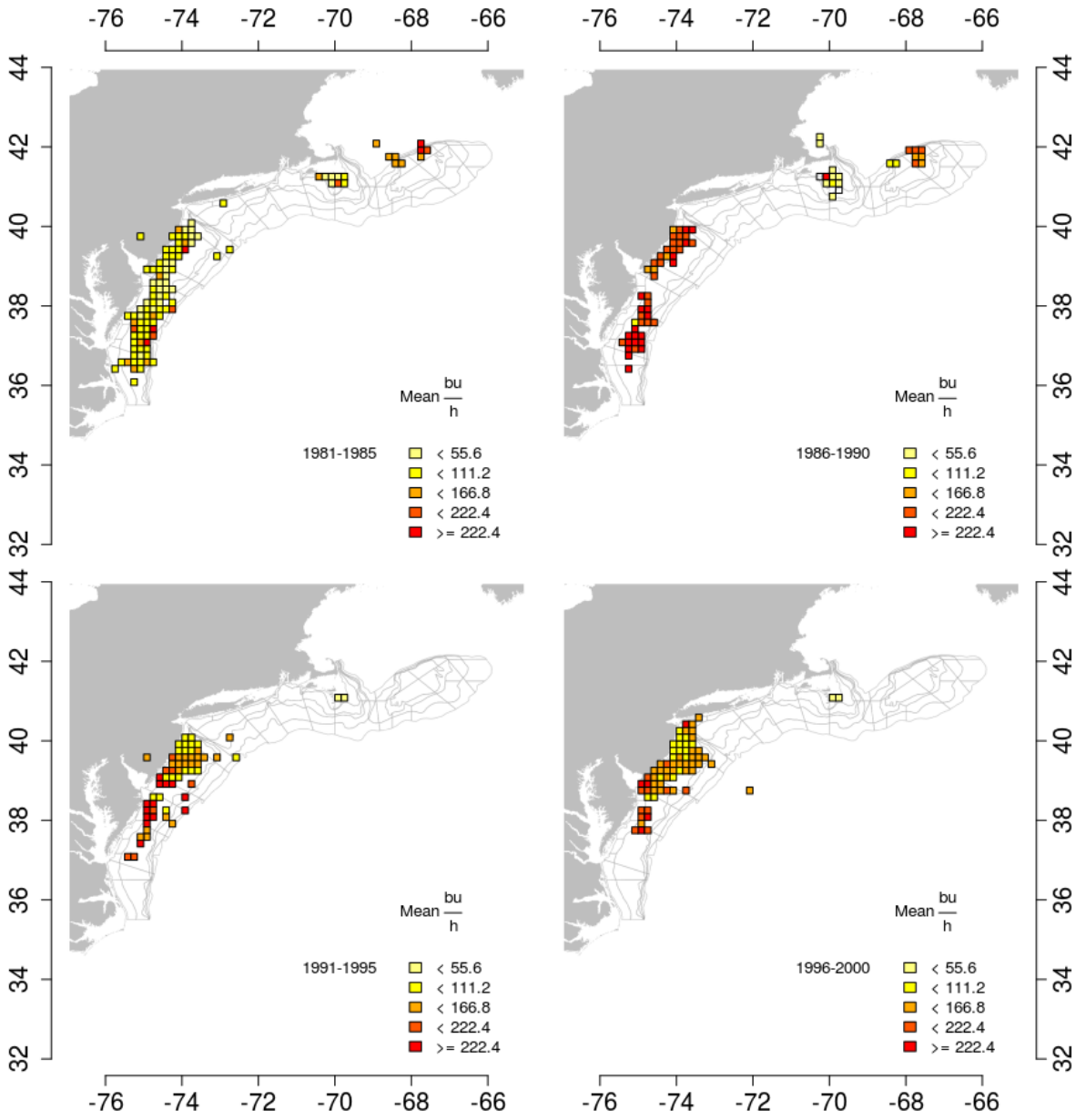

Figure 15. Surfclam landings per unit effort (LPUE in bushels per hour fished) by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 1981-2000. Source: Dan Hennen Pers. Comm., NEFSC 2016.

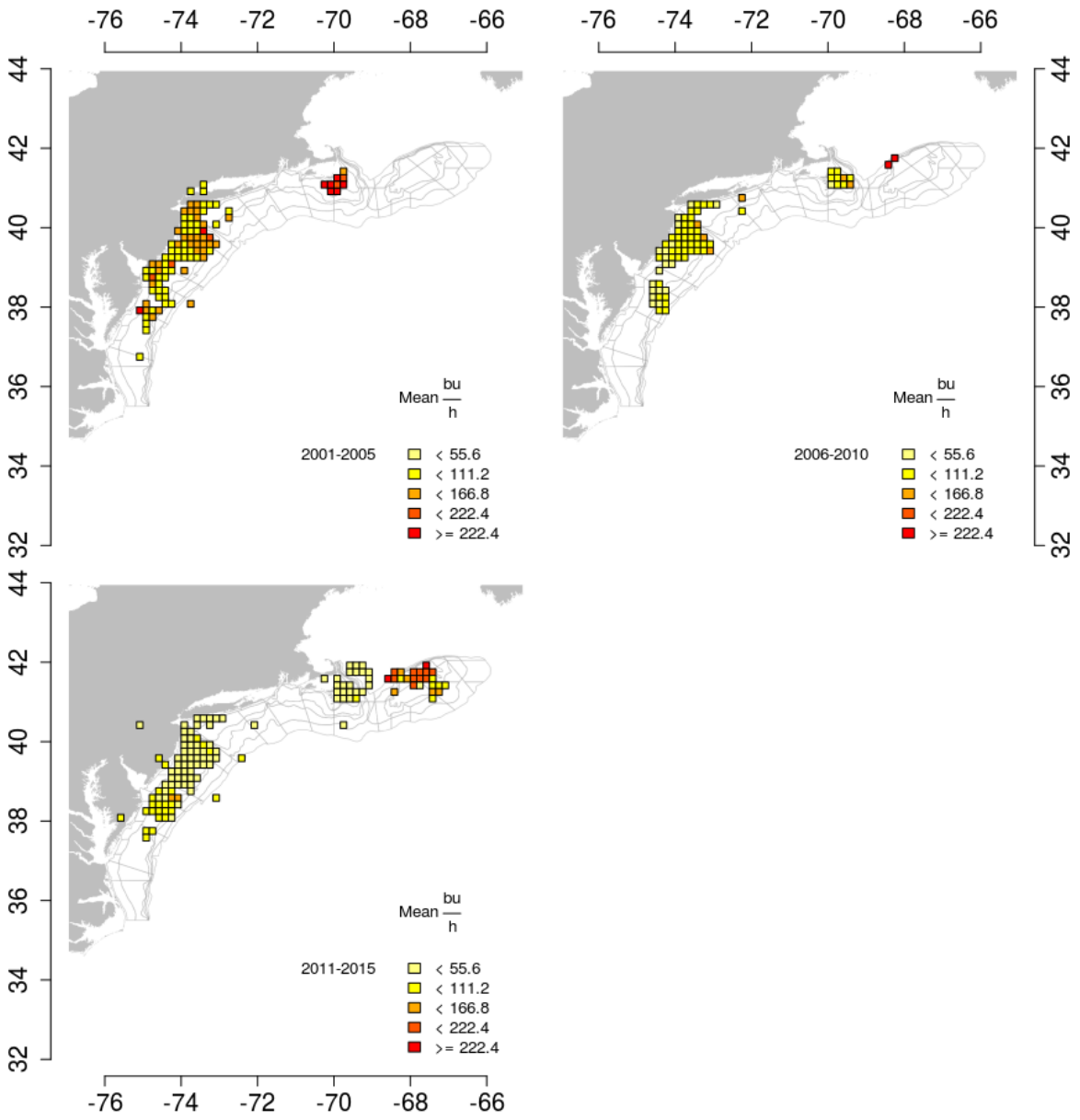

Figure 16. Surfclam landings per unit effort (LPUE in bushels per hour fished) by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 2001-2014, and preliminary 2015. Source: Dan Hennen Pers. Comm., NEFSC 2016.

Table 2. Federal fleet profile, 2006 through 2015.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Harvesting BOTH surfclams & ocean quahogs	9	9	8	8	12	12	13	7	7	6
Harvesting only surfclams	20	24	24	28	22	24	29	33	31	31
Total Vessels	29	33	32	36	34	36	42	40	38	37

Source: NMFS clam vessel logbooks

Table 3. Companies that reported buying surfclams ocean quahogs and by state (from NMFS dealer/processor surfclam/ocean quahog dealer/processor report database) in 2015.

	MA	NJ
Number of Companies	7	2

References

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Northeast Fisheries Science Center. 2013. 56th Northeast Regional Stock Assessment Workshop (56th SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-04; 42 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

Mid-Atlantic Fishery Management Council
Ocean Quahog Information Document - April 2016

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Management System

The Fishery Management Plan (FMP) for ocean quahog (*Arctica islandica)* became effective in 1977. The FMP established the management unit as all ocean quahog in the Atlantic Exclusive Economic Zone (EEZ). The FMP is managed by the Mid-Atlantic Fishery Management Council (Council), in conjunction with NMFS as the Federal implementation and enforcement entity. The primary management tool is the specification of an annual quota, which is allocated to the holders of allocation shares (Individual Transferable Quotas - ITQs) at the beginning of each calendar year as specified in Amendment 8 to the FMP (1988). In addition to the Federal waters fishery, there is a small fishery prosecuted in the state waters of Maine. The FMP, including subsequent Amendments and Frameworks, is available on the Council website at: http://www.mafmc.org.

Basic Biology

Information on ocean quahog biology can be found in the document titled, "Essential Fish Habitat Source Document: Ocean Quahog, *Arctica islandica*, Life History and Habitat Requirements" (Cargnelli et al. 1999). An electronic version is available at the following website: http://www.nefsc.noaa.gov/nefsc/habitat/efh/. Additional information on this species is available at the following website: http://www.fishwatch.gov/. A summary of the basic biology is provided below.

The ocean quahog is a bivalve mollusk distributed in temperate and boreal waters on both sides of the North Atlantic Ocean. In the Northeast Atlantic, quahogs occur from Newfoundland to Cape Hatteras from depths of about 8 to 400 meters. Ocean quahogs further north occur closer to shore. The US stock resource is almost entirely within the EEZ (3-200 miles from shore), outside of state waters, and at depths between 20 and 80 meters. However, in the northern range, ocean quahogs inhabit waters closer to shore, such that the state of Maine has a small commercial fishery which includes beds within the state's territorial sea ($\leq$ 3 miles). Ocean quahogs burrow in a variety of substrates and are often associated with fine sand.

Ocean quahogs are one of the longest-living, slowest growing marine bivalves in the world. Under normal circumstances, they live to more than 100 years old. Ocean quahogs have been aged well in excess of 200 years. Growth tends to slow after age 20, which corresponds to the size currently harvested by the industry (approximately 3 inches). Size and age at sexual maturity are variable and poorly known. Studies in Icelandic waters indicate that 10, 50, and 90 percent of female ocean quahogs were sexually mature at 40, 64 and 88 mm (1.5, 2.5 and 3.5 inches) shell

length or approximately 2, 19 and 61 years of age. Spawning occurs over a protracted interval from summer through autumn. Free-floating larvae may drift far from their spawning location because they develop slowly and are planktonic for more than 30 days before settling. Major recruitment events appear to be separated by periods of decades.

Based on their growth, longevity and recruitment patterns, ocean quahogs are relatively unproductive and able to support only low levels of fishing. The current resource consists of individuals that accumulated over many decades.

Ocean quahogs are suspension feeders on phytoplankton, and use siphons which are extended above the surface of the substrate to pump in water. Predators of ocean quahogs include certain species of crabs, sea stars, and other crustaceans, as well as fish species such as sculpins, ocean pout, cod, and haddock.

Status of the Stock

A forward projecting stock assessment model, based on the Deriso-Schnute delay-difference equation, was applied in a program called (KLAMZ) and was used in the most recent ocean quahog assessment update (Chute et al. 2013). This update utilized the same peer-reviewed and approved methods developed at Stock Assessment Workshop 48 (SAW 48). Detailed reports on "Stock Status," including annual assessment and reference point update reports, SAW reports, and Stock Assessment Review Committee (SARC) panelist reports are available online at the NEFSC website: http://www.nefsc.noaa.gov/.

Based on the June 2013 update, which utilized data through 2011, the stock is not overfished and overfishing is not occurring, relative to the biological reference points (Chute et al. 2013). Whole stock fishable biomass during 2011 was 2.96 million mt meats (Figure 1), which is above the revised B_{target} of 1.73 million mt and the revised $B_{threshold}$ of 1.39 million mt. The fishing mortality rate during 2011 for the stock in the exploited region was F= 0.010 y^{-1} (Figure 2), below the revised $F_{threshold}$ of 0.022 y^{-1}. Fishing mortality for the exploited area of the stock was also below the previous $F_{threshold}$ of 0.08 y^{-1}, and whole stock biomass was above the previous $B_{threshold}$ of 0.89 million mt.

Based on assessment data, the ocean quahog population is an unproductive stock with infrequent recruitment, and thus vulnerable to overfishing (Chute et al. 2013). After three decades of fishing at a low F, the stock as a whole is being fished down. In 2011, fishable stock biomass in the southernmost regions of Southern VA, Delmarva, and NJ was less than half of 1978 pre-fishery levels (recommended target biomass for the stock as a whole is 50% of the pre-fishery biomass). Biomass in the more northern regions of LI increased after 1978 due to a recruitment event and growth, but then began to decrease in the early 1990s when recruitment declined and the fishery gradually began to move north into these regions. Recruitment events appear to be localized and separated by decades, although survey length frequencies show that a low level of recruitment occurs on a continuous basis. The potential contribution of this recruitment to stock biomass and productivity is unknown.

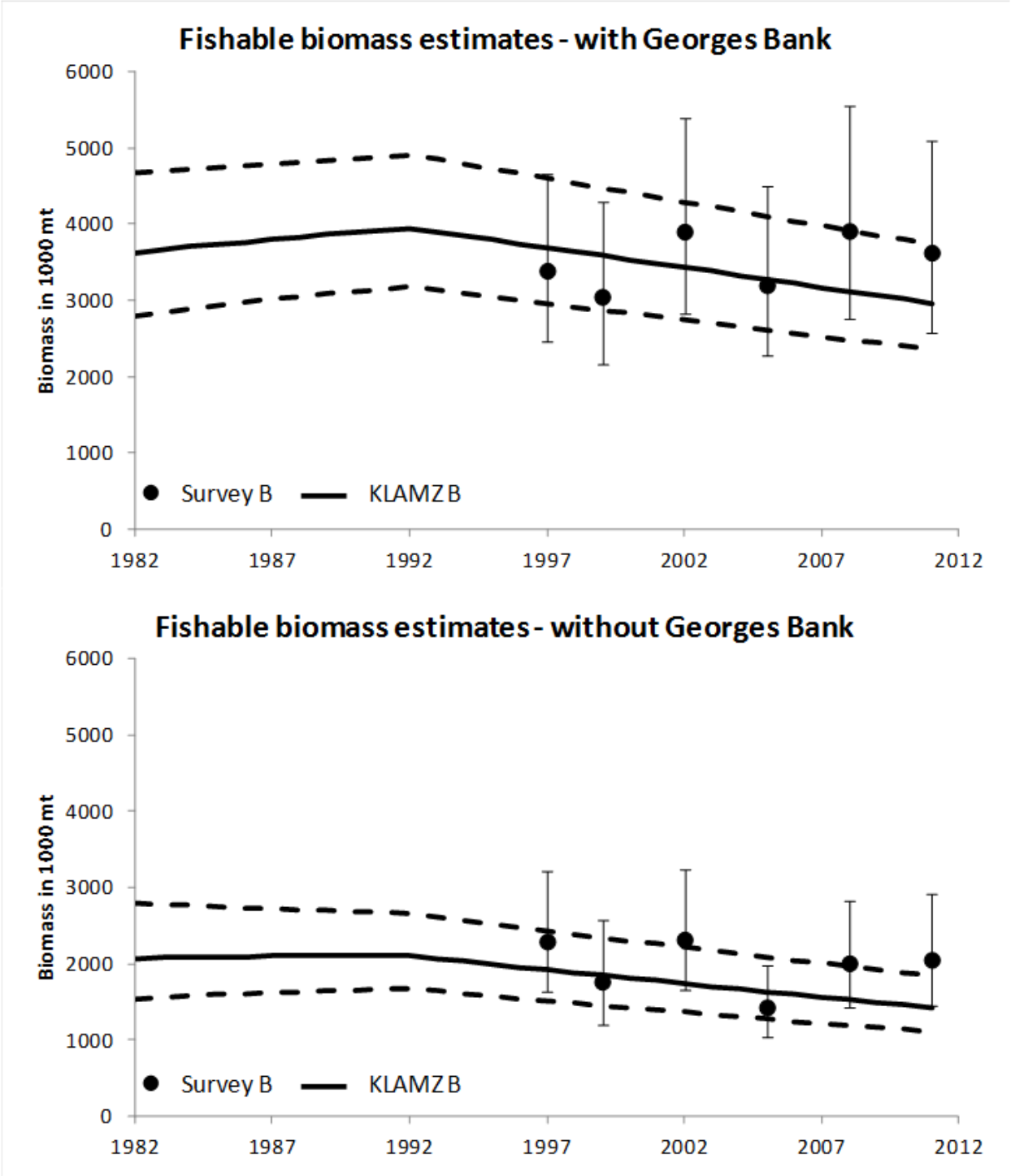


Figure 1. KLAMZ model estimates of fishable biomass for the entire stock (top) and the exploited regions (bottom), 1982-2011. Source: Stock Assessment Update (Chute at al. 2013).

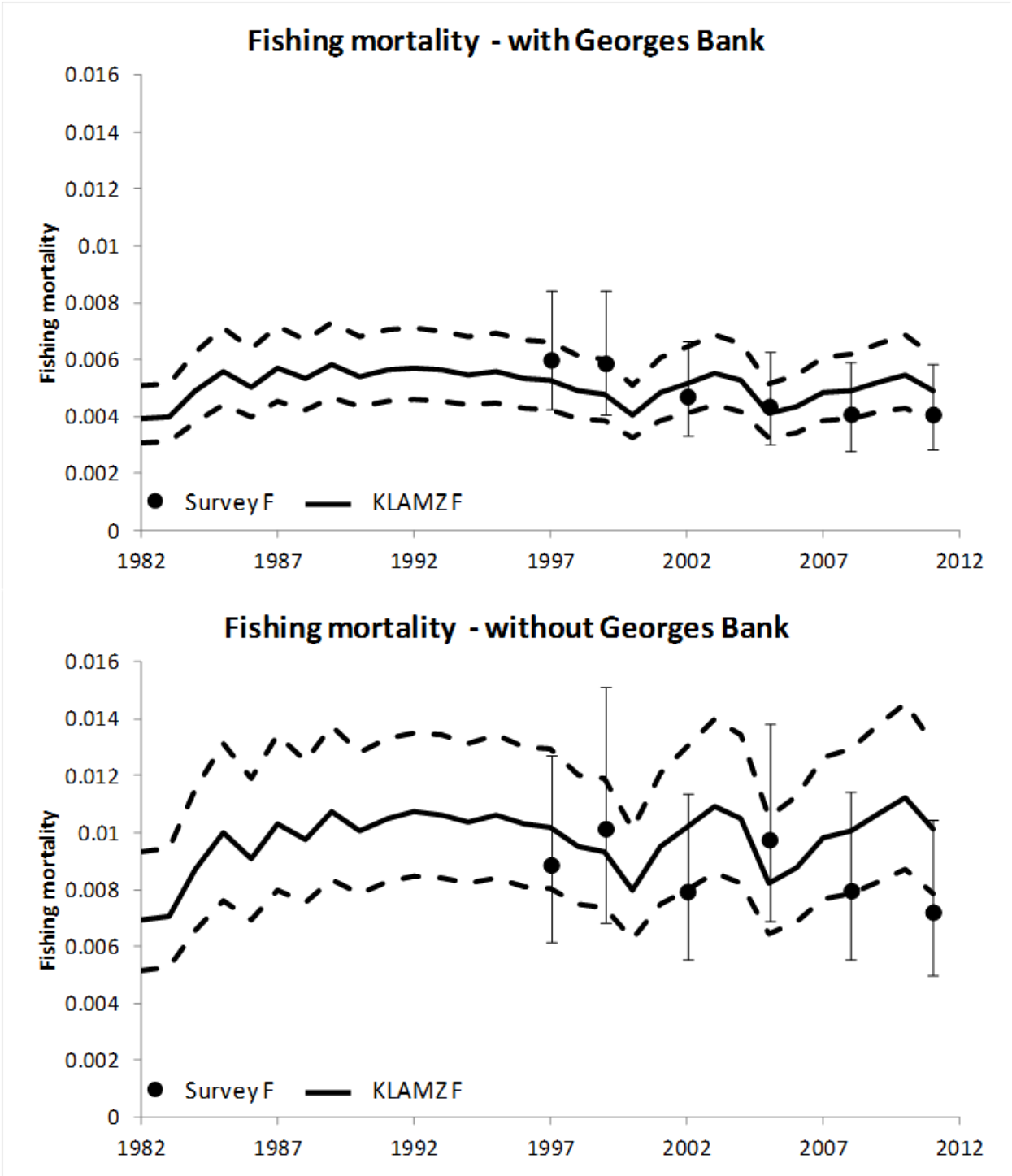


Figure 2. KLAMZ estimates of fishing mortality for the entire stock (top) and the exploited regions (bottom), 1982-2011. Source: Stock Assessment Update (Chute at al. 2013).

Description of the Fishery and Market

The commercial fishery for ocean quahog in Federal waters is prosecuted with large vessels and hydraulic dredges, and is very different from the small Maine fishery prosecuted with small vessels (35-45 ft) targeting quahogs for the local fresh, half shell market. Ocean quahog landings and commercial quotas are given below in Table 1 and Figure 3.

Table 1. Federal Ocean Quahog Quotas and Landings: 1998 - 2016.

Year	EEZ Landings (mt meats)	EEZ Landings[a] ('000 bu)	EEZ Quota ('000 bu)	% Harvested
1998	17,897	3,946	4,000	99%
1999	17,381	3,832	4,500	85%
2000	14,723	3,246	4,500	72%
2001	17,069	3,763	4,500	84%
2002	17,947	3,957	4,500	88%
2003	18,815	4,148	4,500	92%
2004	17,655	3,892	5,000	78%
2005	13,635	3,006	5,333	56%
2006	14,273	3,147	5,333	59%
2007	15,564	3,431	5,333	64%
2008	15,727	3,467	5,333	65%
2009	15,710	3,463	5,333	65%
2010	16,289	3,591	5,333	67%
2011[b]	14,332	3,160	5,333	59%
2012[b]	15,864	3,497	5,333	66%
2013[b]	14,721	3,245	5,333	61%
2014[c]	14,498	3,196	5,333	60%
2015[c]	13,491[d]	2,974[d]	5,333	56% [d]
2016[c]	NA	NA	5,333	NA

[a] 1 ocean quahog bushel is approximately 10 lb. [b] The Scientific and Statistical Committee (SSC) recommended an overfishing limit (OFL) for 2011-2013 = 34,800 mt, and an acceptable biological catch (ABC) = 26,100 mt. [c] For 2014-2016, the SSC did not recommend an OFL. They recommended a constant ABC of 26,100 mt, for 2014-2016. [d] Preliminary 2015 data. Source: NMFS clam vessel logbook reports. Dan Hennen Pers. Comm., NEFSC 2016.

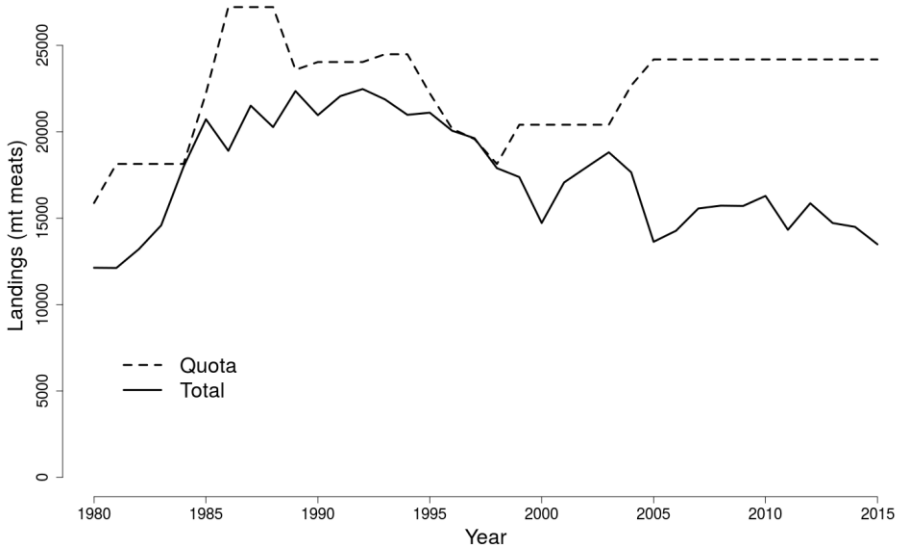


Figure 3. Ocean quahog landings during 1981-2014, and preliminary 2015. Source: Dan Hennen Pers. Comm., NEFSC 2016.

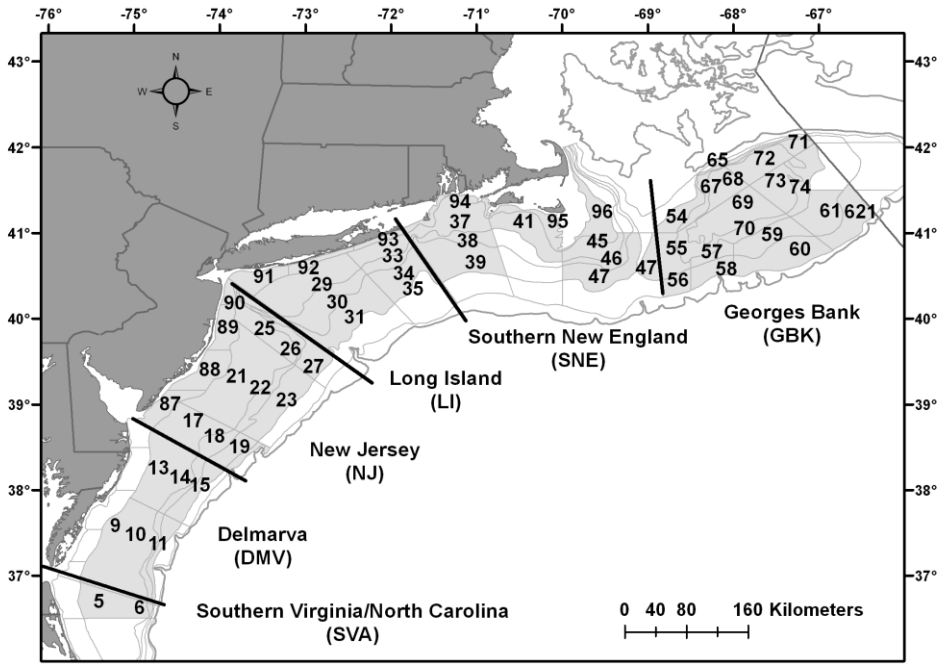


Figure 4. Ocean Quahog stock assessment regions and NEFSC shellfish survey strata. The shaded strata are where ocean quahogs are found. Dan Hennen Pers. Comm., NEFSC 2016.

The distribution of the fishery has changed over time, with the bulk of the fishery from 1980-1990 being prosecuted off the Delmarva, to now being prosecuted in more Northern areas (Figures 4-11). Surfclams on Georges Bank were not fished from 1990 to 2008 due to the risk of paralytic shellfish poisoning (PSP).[1]

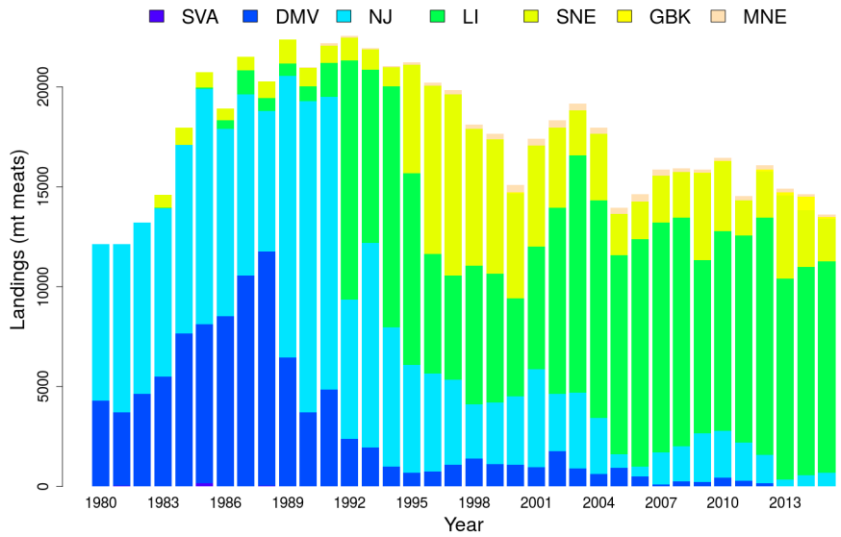


Figure 5. Ocean quahog landings from the US EEZ during 1979-2014, and preliminary 2015, by stock assessment region. Source: Dan Hennen Pers. Comm., NEFSC 2015.

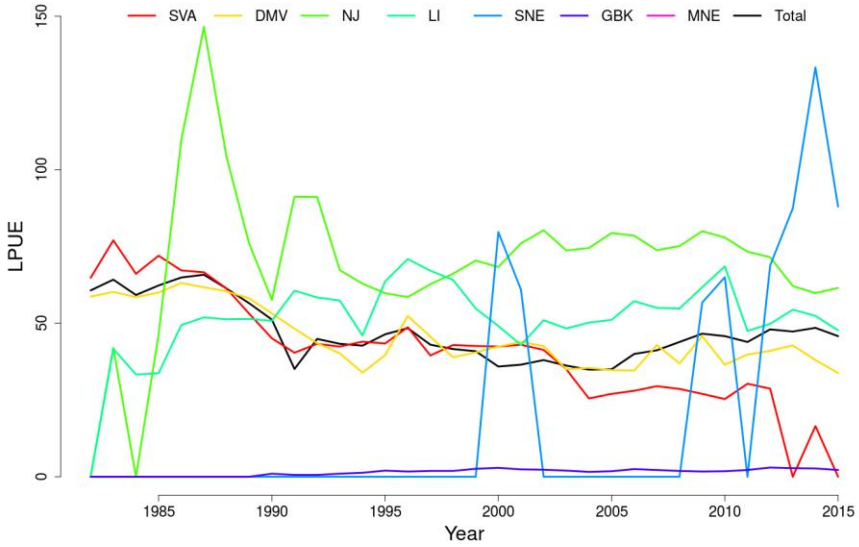


Figure 6. Nominal landings per unit effort (LPUE in bushels landed per hour fished) for ocean quahog, by region, during 1981-2014, and preliminary 2015. LPUE is total landings in bushels divided by total fishing effort. Source: Dan Hennen Pers. Comm., NEFSC 2016.

[1] See Area Closure section on page 17 for additional information.

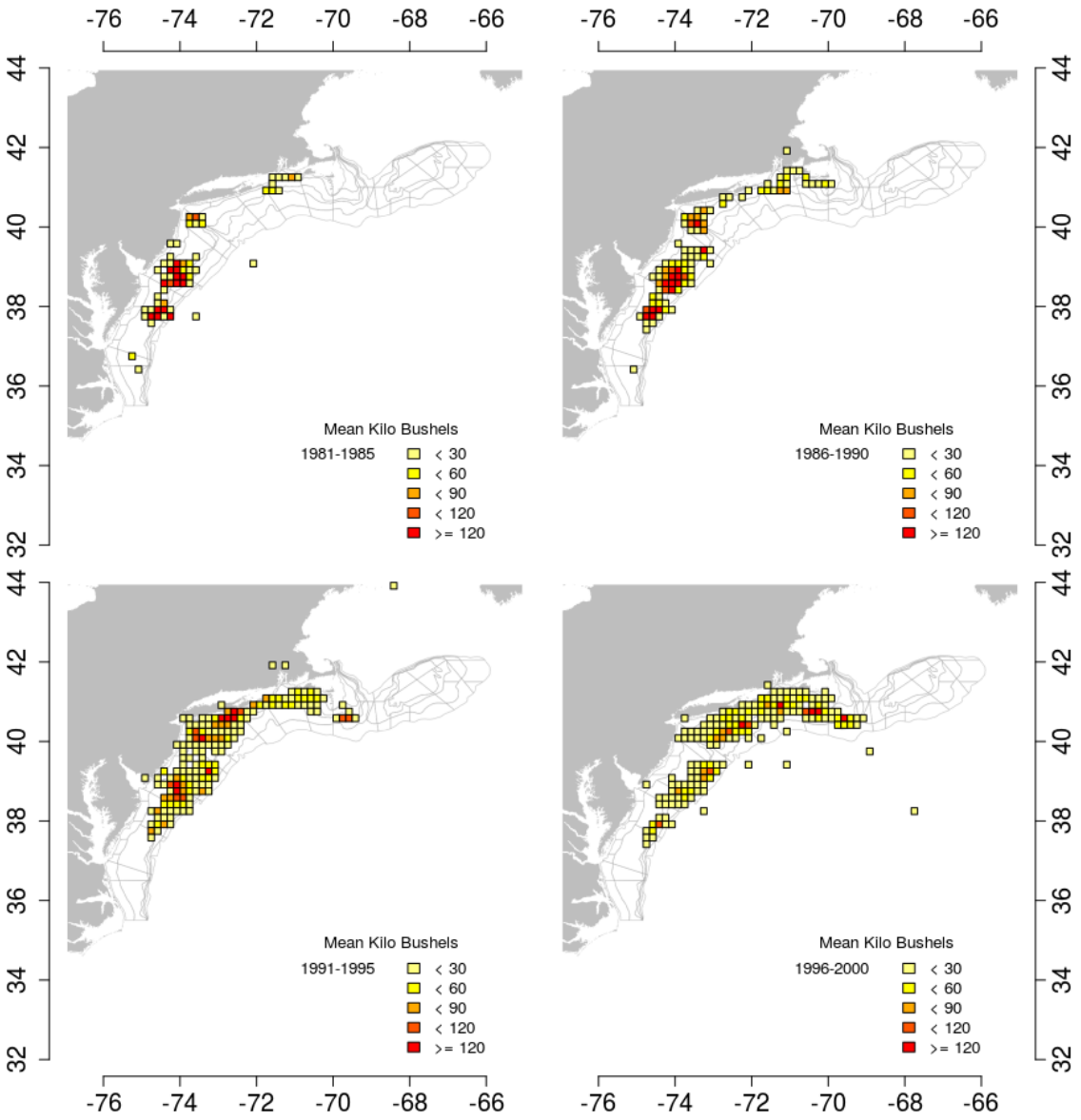


Figure 7. Average ocean quahog landings by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 1981-2000 (1 kilobushel = 1000 bu y^{-1}). Only squares where more than 5 kilo bushels were caught are shown. Source: Dan Hennen Pers. Comm., NEFSC 2016.

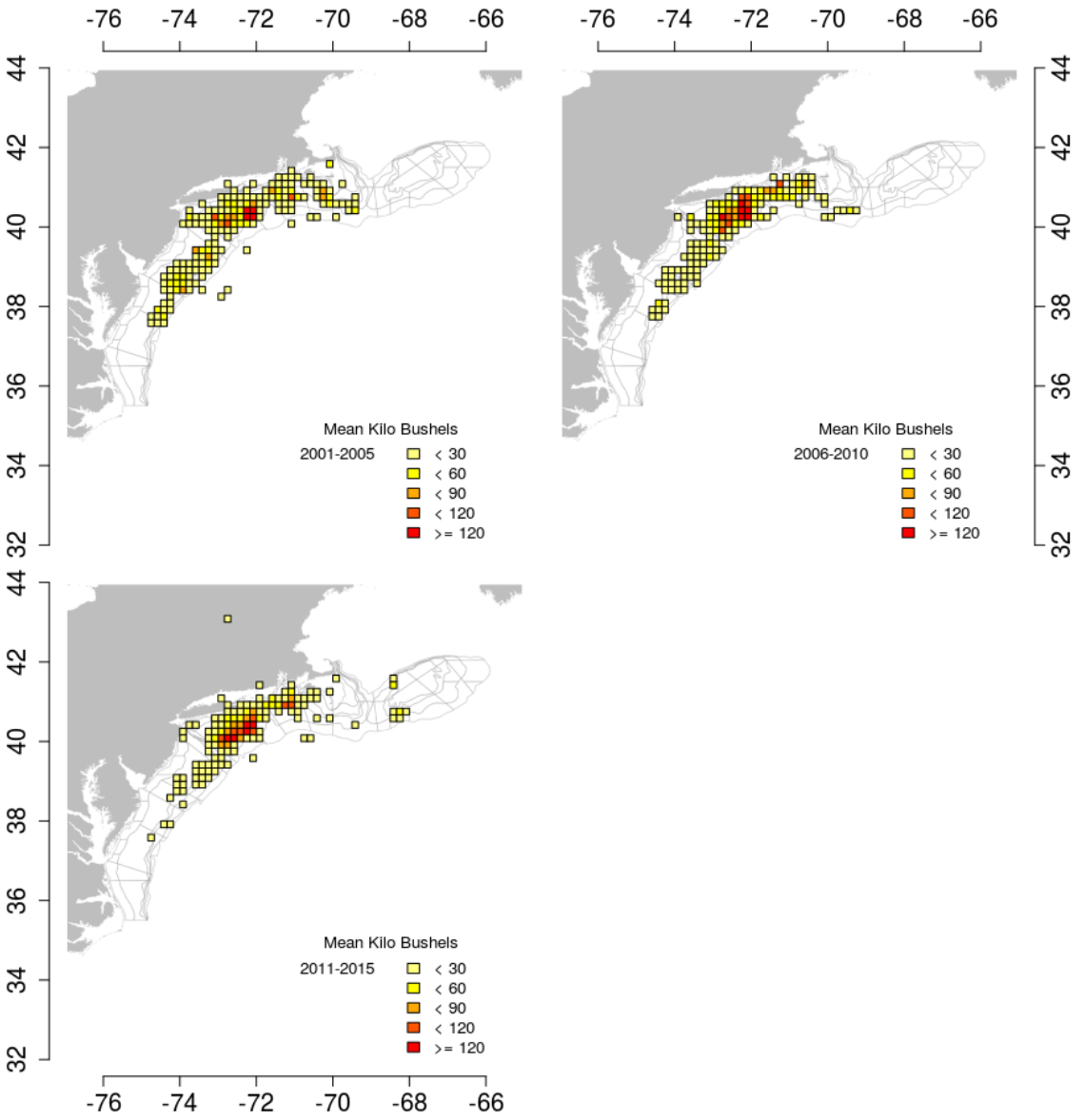


Figure 8. Average ocean quahog landings by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 2001-2014, and preliminary 2015 (1 kilobushel = 1000 bu y^{-1}). Only squares where more than 5 kilo bushels were caught are shown. Source: Dan Hennen Pers. Comm., NEFSC 2016.

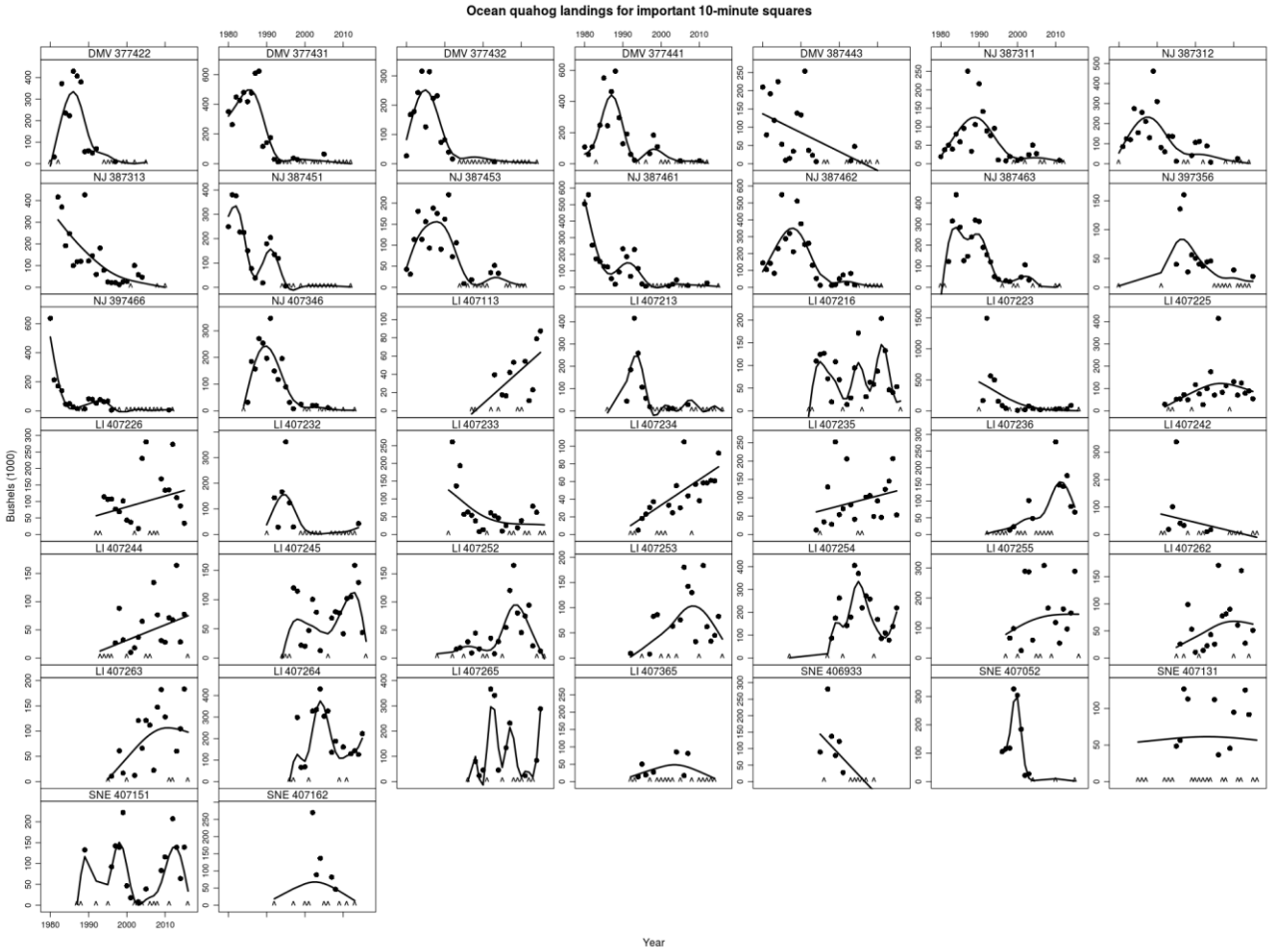


Figure 9. Annual ocean quahog landings in "important" ten minute squares (TMSQ) during 1980-2015 based on logbook data. Important means that a square ranked in the top 10 TMSQ for total landings during any five-year period (1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2015). Data for 2015 are incomplete and preliminary. To protect the privacy of individual firms, data are not plotted if the number of vessels is less than 2. Instead, a "^" is shown on the x-axis to indicate where data are missing. The solid dark line is a spline intended to show trends. The spline was fit to all available data, including data not plotted. Source: Dan Hennen Pers. Comm., NEFSC 2016.

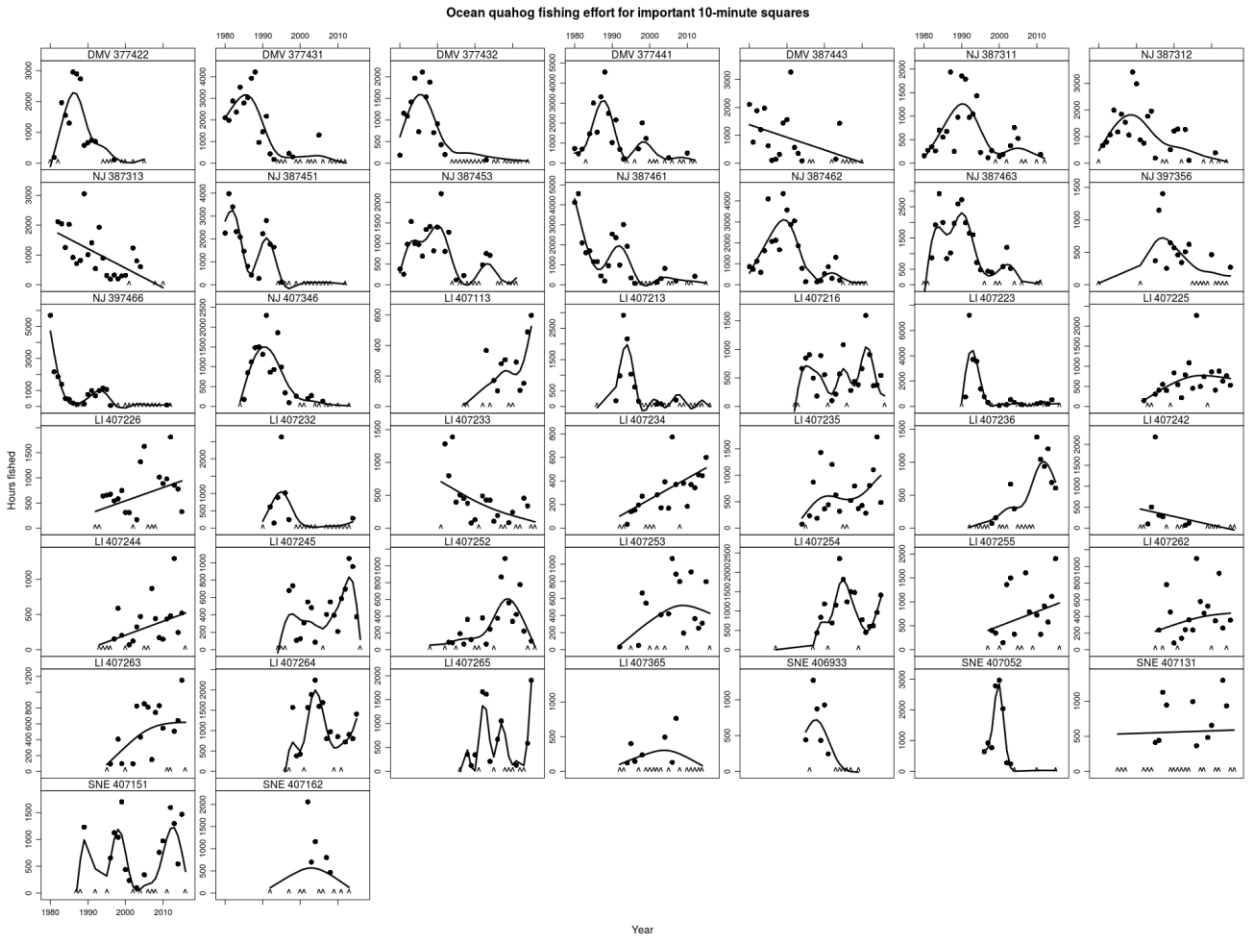


Figure 10. Annual ocean quahog <u>fishing effort</u> (h y^{-1}) in "important" ten minute squares (TMSQ) during 1980-2015 based on logbook data. Important means that a square ranked in the top 10 TMSQ for total landings during any five-year period (1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2015). Data for 2015 are incomplete and preliminary. To protect the privacy of individual firms, data are not plotted if the number of vessels is less than 2. Instead, a "^" is shown on the x-axis to indicate where data are missing. The solid dark line is a spline intended to show trends. The spline was fit to all available data, including data not plotted. Source: Dan Hennen Pers. Comm., NEFSC 2016.

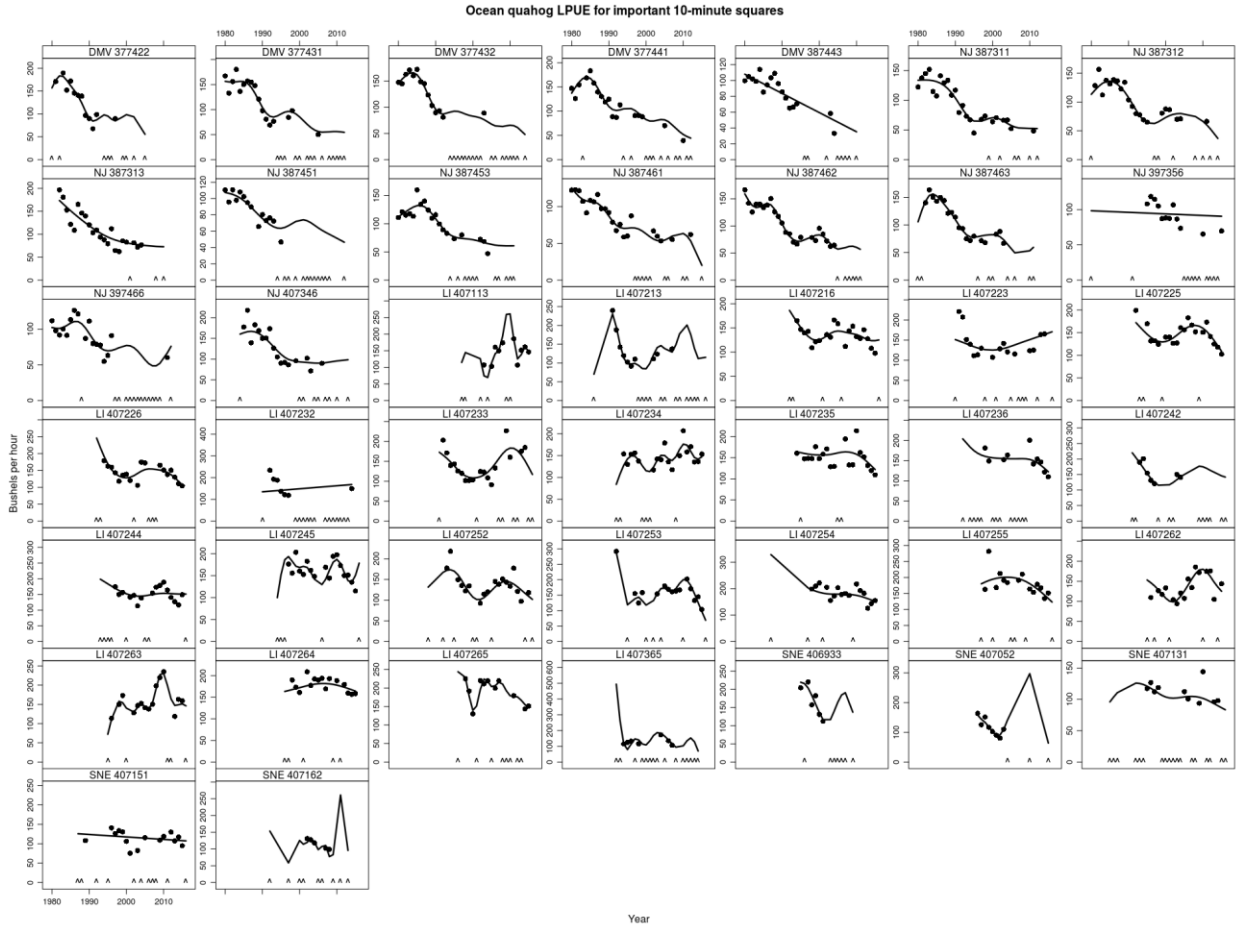


Figure 11. Annual ocean quahog <u>LPUE</u> (bushels h^{-1}) in "important" ten minute squares (TMSQ) during 1980-2015 based on logbook data. Important means that a square ranked in the top 10 TMSQ for total landings during any five-year period (1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2015). Data for 2015 are incomplete and preliminary. To protect the privacy of individual firms, data are not plotted if the number of vessels is less than 2. Instead, a "^" is shown on the x-axis to indicate where data are missing. The solid dark line is a spline intended to show trends. The spline was fit to all available data, including data not plotted. Source: Dan Hennen Pers. Comm., NEFSC 2016.

Additional information of the length composition of port sampled ocean quahogs, and their associated sample sizes by area, are available in the data updates (Dan Hennen Pers. Comm., NEFSC 2016) at: http://www.mafmc.org/s/DataUpdatefromNEFSC_OceanQuahog.pdf.

Port and Community Description

When Amendment 13 to the FMP was developed, the Council hired Dr. Bonnie McCay and her associates at Rutgers University to describe the ports and communities that are associated with the surfclam and ocean quahog fisheries. The researchers did an extensive job characterizing the three main fisheries (non-Maine ocean quahog, Maine ocean quahog, and surfclam). The McCay team characterizations of the ports and communities are based on government census and labor statistics and on observations and interviews carried out during the late 1990s and in the fall of 2001. The description of the fishing gear, areas fished, etc. are fully described in Amendment 13. Communities from Maine to Virginia are involved in the harvesting and processing of surfclams and ocean quahogs. Ports in New Jersey and Massachusetts handle the most volume and value, particularly Atlantic City and Point Pleasant, New Jersey, and New Bedford, Massachusetts. There are also landings in Ocean City, Maryland, and the Jonesport and Beals Island areas of Maine. The small scale Maine fishery is entirely for ocean quahogs, which are sold as shellstock for the half-shell market. The other fisheries are industrialized ones for surfclams and ocean quahogs, which are hand shucked or steam-shucked and processed into fried, canned, and frozen products.

Additional information on "Community Profiles for the Northeast US Fisheries" can be found at: http://www.nefsc.noaa.gov/read/socialsci/communityProfiles.html

Federal Fleet Profile

The total number of vessels participating in the ocean quahog fisheries outside the state of Maine has experienced a downward trend as the fisheries moved beyond a market crisis in 2005 where major users of clam meats reduced their purchases from industry and stopped advertising products like clam chowder in the media. Industry members reported that imported meat from Canada and Vietnam contributed to an oversupply of clam meats in the marketplace. The costs to vessels harvesting clams have increased significantly, with the greatest component being the cost of diesel fuel (in conjunction with distance traveled). Trips harvesting quahogs have also increased in length as catch rates have declined steadily. The 30 or so vessels that reported landings during 2004 and 2005 has consolidated over time into fewer vessels. The Maine ocean quahog fleet numbers started to decline when fuel prices soared in mid-2008, and a decline in the availability of smaller clams consistent with the market demand (i.e., half-shell market), and totaled 8 vessels in 2015 (Table 2).

Table 2. Federal Fleet Profile, 2006 through 2015.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Non-Maine Vessels Harvesting BOTH surfclams & ocean quahogs	9	9	8	8	12	12	13	7	7	6
Non-Maine Vessels Harvesting only ocean quahogs	9	8	10	7	9	7	6	9	9	10
Total Non-Maine Vessels	18	17	18	15	21	19	19	16	16	16
Maine Ocean Quahog Vessels	25	24	22	19	15	13	12	11	9	8

Source: NMFS clam vessel logbooks.

The average ex-vessel price of non-Maine ocean quahogs reported by processors in 2015 was $7.10 per bushel, a few cents higer than the 2014 price ($7.02 per bushel). In 2015, about 3.0 million bushels of non-Maine ocean quahog were landed compared to 3.2 million bushels landed in 2014. The total ex-vessel value of the 2015 federal harvest outside of Maine was approximately $21 million, slightly lower than the $22 million in 2014.

In 2015, the Maine ocean quahog fleet harvested a total of 41,611 Maine bushels, a 66% decrease from the 121,373 bushels harvested in 2006, and an 11% decrease from the prior year (2014; 46,109 bushels). Average prices for Maine ocean quahogs have declined substantially over the past 10 years. In 2003, there were very few trips that sold for less than $37.00 per Maine bushel, and the mean price was $40.66. Prices have since been lower; apparently the result of aggressive price cutting as noted by industry. In 2015, the mean price was $28.27 per Maine bushel. The value of the 2015 harvest reported by the purchasing dealers totaled $1.22 million, a decrease of 10% from the prior year.

The distribution of LPUE in bushels per hour over time is shown below in Figures 6, 12 and 13.

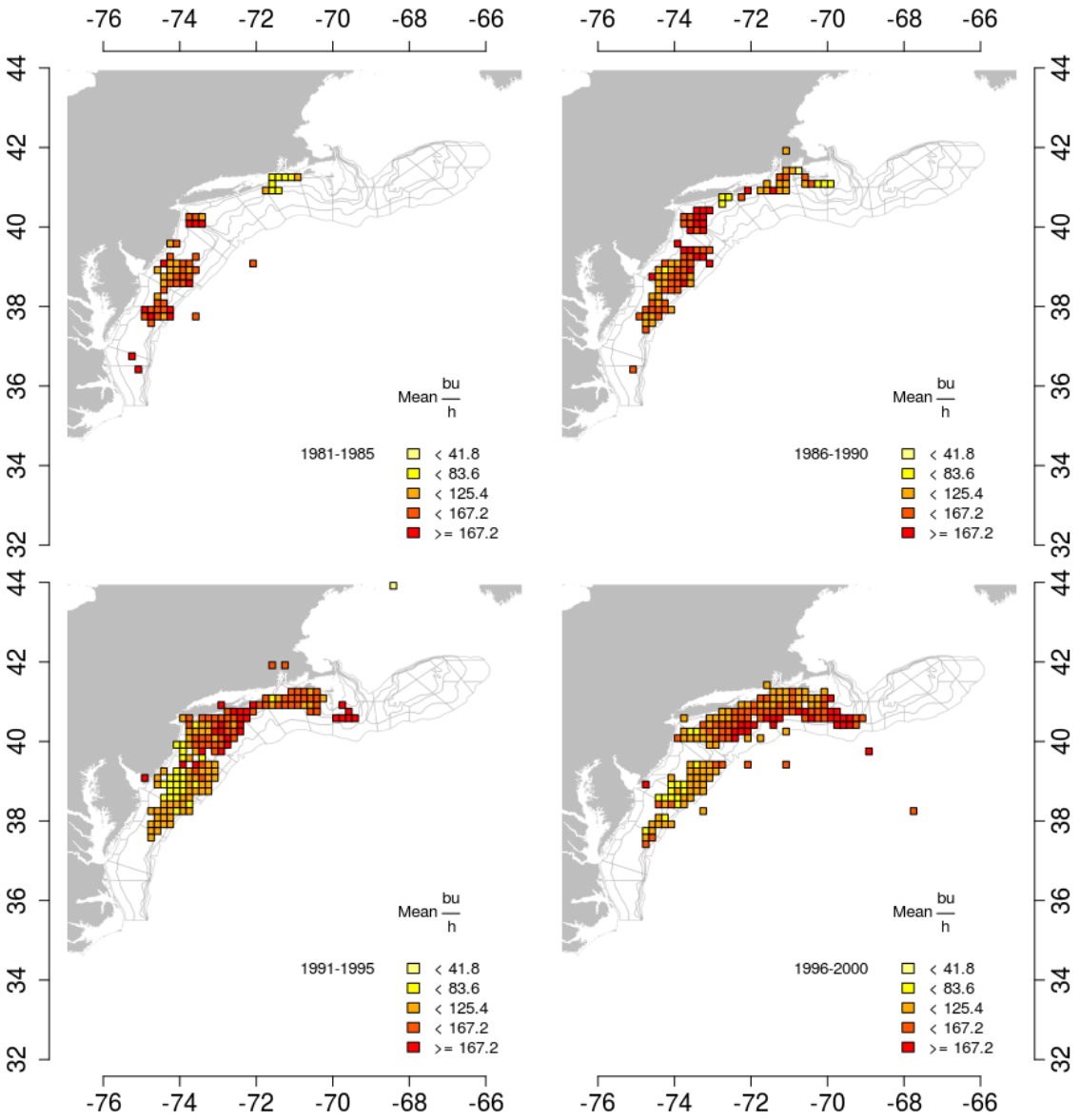


Figure 12. Ocean quahog landings per unit effort (bushels per hour) by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 1981-2000. Only squares where more than 5 kilo bushels were caught are shown. Source: Dan Hennen Pers. Comm., NEFSC 2016.

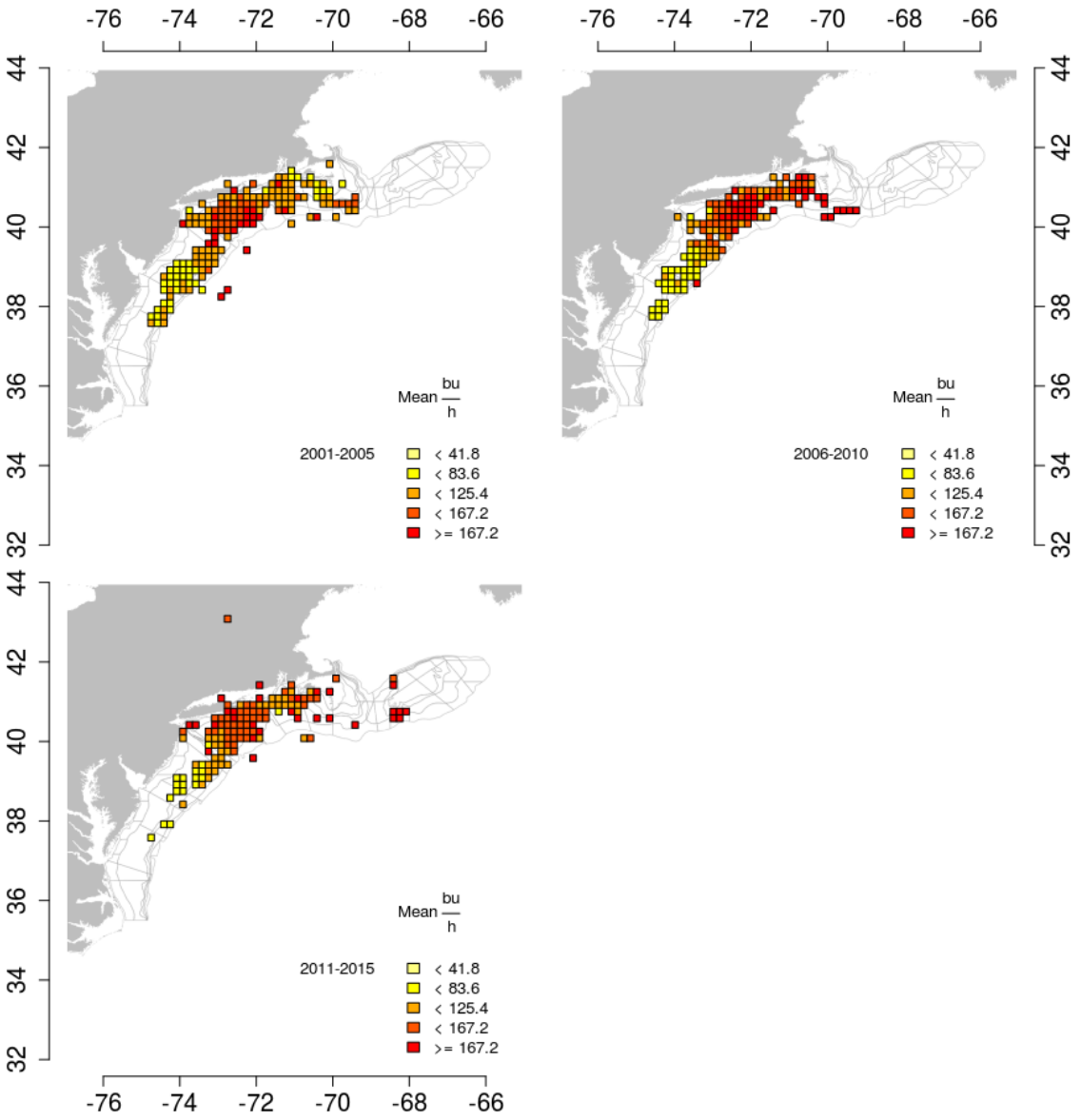


Figure 13. Ocean quahog landings per unit effort (bushels per hour) by ten-minute square (TMSQ), the finest scale location for landings reported in logbooks, for 2001-2014, and preliminary 2015. Only squares where more than 5 kilo bushels were caught are shown. Source: Dan Hennen Pers. Comm., NEFSC 2016.

Processing Sector

Even though this document describes the ocean quahog fisheries, the information presented in this section regarding the processing sector is for both surfclams and ocean quahogs as some of these facilities purchase/process both species. In 2014, there were 9 companies reporting purchases of surfclams and/or ocean quahogs from the industrial fisheries outside of Maine. They were distributed by state as indicated in Table 3. Employment data for these specific firms are not available. In 2015, these companies bought approximately $21 million worth of ocean quahogs and $30 million worth of surfclams.

Area Closures

Fishing areas can also be closed for public health related issues due to environmental degradation or the toxins that cause PSP. PSP is a public health concern for surfclams. PSP is caused by saxitoxins, produced by the alga *Alexandrium fundyense* (red tide). Surfclams on Georges Bank were not fished from 1990 to 2008 due to the risk of PSP. There was light fishing on Georges Bank in years 2009-2011 under an exempted fishing permit. The Greater Atlantic Regional Fisheries Office reopened a portion of Georges Bank to the harvest of surfclams and ocean quahogs beginning January 1, 2013 (77 FR 75057, December 19, 2012) under its authority in 50 CFR 648.76. Harvesting vessels have to adhere to the adopted testing protocol from the National Shellfish Sanitation Program.

Table 3. Companies that reported buying ocean quahogs and surfclams by state (from NMFS dealer/processor surfclam/ocean quahog dealer/processor report database) in 2015.

Number of Companies	MA	NJ
	7	2

References

Cargnelli, L.,S. Griesbach, D. Packer, and E. Weissberger. 1999. Essential Fish Habitat Source Document: Ocean Quahog, *Arctica islandica*, Life History and Habitat Characteristics. NOAA Tech. Memo. NMFS-NE-148.

Chute A., Hennen D., Russell R. and Jacobson L. 2013. Stock assessment update for ocean quahogs (*Arctica islandica*) through 2011. US Dept Commer, Northeast Fish Sci Cent Ref Doc., in review.

Hennen, Dan. Personal Communication. February 25, 2016. NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

Estimated Proportion of Undersized Surfclam Landings for 2015

Jay Hermsen, Ph.D.
Analysis and Program Support Division
Greater Atlantic Regional Fisheries Office
National Marine Fisheries Service
August 25, 2015

Introduction

The Code of Federal Regulations includes a provision for the suspension of minimum landing size regulations for surfclam (*Spisula solidissima*) [CFR 50, §648.75 (b)(3)]:

"upon recommendation of the Mid-Atlantic Fishery Management Council (MAFMC), the Regional Administrator may suspend annually, by publication in the Federal Register, the minimum shell-height standard unless discard, catch, and survey data indicate that 30 percent of the surfclams are smaller than 4.75 inches (12.065 cm) and the overall reduced shell height is not attributable to beds where the growth of individual surfclams has been reduced because of density dependent factors."

Each year an analysis of the size composition of surfclam landings is conducted to inform any recommendation by the Mid-Atlantic Council to the Regional Administrator concerning surfclam minimum size restrictions. The following report summarizes the analysis of mid-Atlantic surfclam landings in 2015.

Data Sources and Procedures

Samples of surfclam landings were collected from the Georges Bank, New Jersey and DelMarVa stock areas. These samples were not evenly distributed and, therefore, had to be weighted by stock area and volume.. The coast-wide distribution of undersized surfclams was then calculated.

The estimate for coast wide undersized surfclams landed was determined by calculating a weighted average proportion of undersized surfclams with equation 1:

$$\hat{P}_c = \left(\sum_{i=1}^{n} W_j \hat{P}_j \right) \qquad (1)$$

where

$\hat{P}_c$ is the estimated coast wide proportion of undersized surfclams landed

W_j is the proportion of landings from stock area *j* in the coast wide reported landings, as calculated with equation 2:

$$W_j = \frac{L_j}{\sum_{1}^{3} L_j} \quad (2)$$

L_j is the volume landed (bushels) from stock area *j*

$\hat{P}_j$ is the estimated proportion of undersized surfclams in stock area *j*, as calculated with equation 3

$$\hat{P}_j = \left(\sum_{i=1}^{n} w_{ij}\, p_{ij} \right) \quad (3)$$

w_{ij} is the proportion of the landings of sample *i* to total landings of all samples from stock area *j*, as calculated with equation 4:

$$w_{ij} = \frac{l_{ij}}{\sum_{i=1}^{n} l_{ij}} \quad (4)$$

l_{ij} is the volume (bushels) for sample *i* from stock area *j*

p_{ij} is the proportion of undersized surfclams in sample *i* from stock area *j*, as calculated with equation 5:

$$p_{ij} = \frac{x_{ij}}{n_{ij}} \quad (5)$$

n_{ij} is the number of surfclams in sample *i* from stock area *j*

x_{ij} is the number of surfclams <121 mm in size from sample *i* of stock area *j*

Once the coast wide weighted average proportion of undersized surfclams was determined, the coast wide variance of the proportional mean was calculated and used to determine the 95% confidence intervals around that estimate.

The variance estimate for the proportion of undersized coast wide landings was calculated using equation 6:

$$\mathrm{var}\left(\hat{P}_c\right) = \sum_{j=1}^{3} W_j^2 \times \mathrm{var}\left(\hat{P}_j\right) \quad (6)$$

where

W_j is the proportion of all landings from stock area *j* to the coast wide landings from all three areas (Georges Bank, New Jersey and DelMarVa), as calculated with equation 2

$\text{var}\left(\hat{P}_j\right)$ is the variance associated with each stock area *j* estimated with equation 7:

$$\text{var}\left(\hat{P}_j\right) = \sum_{i=1}^{n} w_{ij}^2 \times \text{var}\left(\hat{P}_{ij}\right) \quad (7)$$

w_{ij} is the proportion of the landings of sample *i* to total landings of all samples from stock area *j*, as calculated with equation 4

$\text{var}\left(\hat{P}_{ij}\right)$ is the variance of the proportion of sample *i* in stock area *j* estimated with equation 8:

$$\text{var}\left(\hat{P}_{ij}\right) = \frac{\left(p_{ij} \times \left(1 - p_{ij}\right)\right)}{n_{ij}} \quad (8)$$

The 2015 sampling period extended from January 1, 2015 through August 6, 2015. Surfclam samples were collected from vessels fishing in Georges Bank statistical areas 521, 522, and 526; in New Jersey statistical areas 612, 614, and 615; and in DelMarVa statistical area 621 and 622.

Two types of data were used in the analysis: (1) landings information and (2) biological sampling data. Surfclam landings data were collected as part of the Greater Atlantic Regional Fisheries Office mandatory reporting requirements. Vessel and dealer permit holders reported landed volume (bushels), vessel permit number, and fishing location, as well as other information from each vessel trip. This information provided landings data for the principle stock areas. Stakeholder Engagement Division (SED) field staff collected biological samples from selected vessels upon docking. Each sample consisted of shell height measurements from approximately 30 randomly selected individual surfclams. Bushels landed and fishing location of the sampled catch were recorded by SED field staff from information reported by the vessel operators. For length records that lacked area fished information, area fished was determined from the vessel log report for the trip or from the most recent available surfclam log report that included area fished for a particular vessel.

Oracle tables (sfoqpr and sfoqvr in the sfclam schema on the nero oracle server) were used to query and match vessel trip landings by date and permit number. A total of 54

samples from the 2015 sampling period were used for this analysis. There were several instances where a sampled trip lacked volume landed information. The volume of unmatched samples when a vessel could be identified was estimated using the average number of bushels of surfclams landed on all trips by that vessel in fishing year 2015.

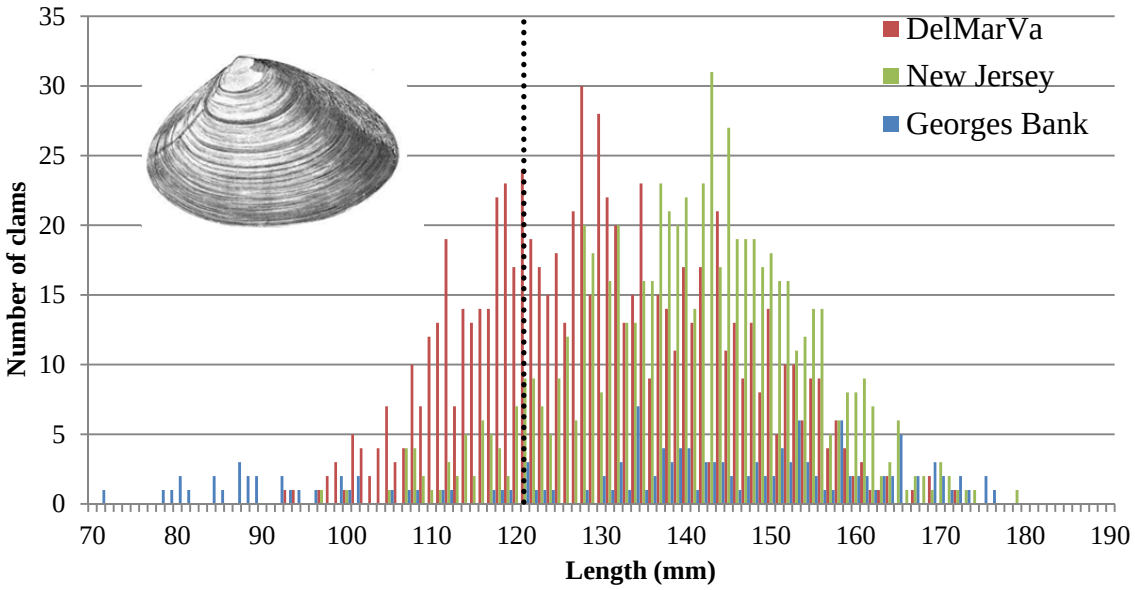
Landings information from the principle stock areas indicated that Georges Bank landings made up approximately 39% of the coast wide catch. The remaining 61% of the catch came from the New Jersey and DelMarVa stock areas (Table 1).

Table 1. FY2015 Landings of surfclams reported by vessels as of August 15, 2015.

Stock area	Reported Landings (bushels) (as of August 15, 2015	Meat weight of reported landings (lbs.)	Percent of reported landings
Georges Bank	480,619	8,170,523	39%
New Jersey	464,333	7,893,666	38%
DelMarVa	281,986	4,793,757	23%
Grand Total	1,226,938	20,857,946	100%

The nominal length distribution of all biological samples obtained from January 1, 2015 through August 5, 2015 indicated that the overwhelming majority of surfclams sampled were larger than or equal to 121 mm. The mean length of the coast wide samples was 136 mm (Figure 1).

Figure 1. Length frequency distribution of surfclams from dockside sampling for FY2015. The dashed vertical line separates surfclams above and below 121 mm.



The 54 samples used in this analysis contained 1,621 measured surfclams, of which 308 individual surfclams were undersized. Eleven of the 54 samples collected had 30% or more undersized surfclams; one of those samples came from the Georges Bank stock area while the other ten samples with 30% or more undersized surfclams were from the DelMarVa stock area (Table 2).

Table 2. Description of the 54 individual surfclam samples collected in 2015, with the proportion of undersized surfclams in each sample.

Sample number	Stock Area	Number of surfclams in sample	Proportion of undersized surfclams	Volume of catch (bushels)
1	DelMarVa	30	0.27	768
2	DelMarVa	30	0.17	768
3	DelMarVa	30	0.13	***592***
4	DelMarVa	30	0.27	1472
5	DelMarVa	30	0.40	864
6	DelMarVa	30	0.27	1440
7	DelMarVa	30	0.03	1760
8	DelMarVa	30	0.13	1440
9	DelMarVa	30	0.00	960
10	DelMarVa	30	0.00	***1124***
11	DelMarVa	30	0.03	832
12	DelMarVa	30	0.00	960

13	DelMarVa	30	0.20	1440
14	DelMarVa	30	0.47	1888
15	DelMarVa	30	0.07	1120
16	DelMarVa	30	0.00	1216
17	DelMarVa	30	0.40	1536
18	DelMarVa	30	0.50	1344
19	DelMarVa	30	0.50	1344
20	DelMarVa	30	0.60	2560
21	DelMarVa	30	0.70	2688
22	DelMarVa	30	0.53	2560
23	DelMarVa	30	0.40	2560
24	DelMarVa	30	0.53	2176
25	DelMarVa	30	0.23	480
26	DelMarVa	30	0.03	3328
27	Georges Bank	30	0.10	***534***
28	Georges Bank	30	0.03	532
29	Georges Bank	30	1.00	***856***
30	Georges Bank	31	0.00	***856***
31	Georges Bank	30	0.00	***1013***
32	New Jersey	30	0.13	***592***
33	New Jersey	30	0.03	***592***
34	New Jersey	30	0.00	1472
35	New Jersey	30	0.17	1376
36	New Jersey	30	0.00	1440
37	New Jersey	30	0.13	1440
38	New Jersey	30	0.00	1440
39	New Jersey	30	0.10	1472
40	New Jersey	30	0.07	1440
41	New Jersey	30	0.00	1440
42	New Jersey	30	0.10	1472
43	New Jersey	30	0.03	1664
44	New Jersey	30	0.10	288
45	New Jersey	30	0.03	160
46	New Jersey	30	0.20	1408
47	New Jersey	30	0.07	800
48	New Jersey	30	0.13	1440
49	New Jersey	30	0.03	1312
50	New Jersey	30	0.00	1184
51	New Jersey	30	0.00	1056
52	New Jersey	30	0.00	640
53	New Jersey	30	0.07	3328

54	New Jersey	30	0.07	1856

*volume of catch in bold italics are estimates, samples with more than 30% undersized surfclams are highlighted.

Estimation Results

An estimated 19.2% of the coast wide surfclam landings to date in 2015 were undersized. The lower and upper 95% confidence bounds for this estimate were 18.3% and 20.1%. These estimates are below the 30% maximum that would preclude the Regional Administrator from suspending the minimum shell height standard (Table 3).

Table 3. Proportional distribution of 2015 undersized surfclams by area and coast-wide.

Area	Estimated percentage of surfclams <121 mm	Lower 95% Confidence Interval	Upper 95% Confidence Interval
Georges Bank	24.46%	24.10%	24.81%
New Jersey	6.54%	6.24%	6.83%
DelMarVa	31.12%	30.95%	31.28%
Coast-wide*	**19.21%**	**18.28%**	**20.13%**

* weighted mean