Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201, Dover, DE 19901
Phone: 302-674-2331 | FAX: 302-674-5399 | www.mafmc.org
Michael P. Luisi, Chairman | G. Warren Elliott, Vice Chairman
Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

Date: July 27, 2020

To: Council

From: Jessica Coakley and José Montañez, Staff

Subject: Atlantic Surfclam and Ocean Quahog Specifications (2021-2026)

The following are included for consideration by the Council on the above subject:

1) July 2020 SSC Report – See Committee Report Tab
2) Surfclam Staff Memo dated July 7, 2020
3) Quahog Staff Memo dated July 7, 2020
4) Atlantic Surfclam and Ocean Quahog Fishery Performance Report
5) Atlantic Surfclam Fishery Information Document
6) Ocean Quahog Fishery Information Document
7) Atlantic Surfclam 2020 Assessment Update Report
8) Ocean Quahog 2020 Assessment Update Report
9) Proportion of Undersized Clams Analysis - Report

More detailed Atlantic Surfclam and Ocean Quahog assessment reports (both present and past) are available at the following website: https://apps-nefsc.fisheries.noaa.gov/saw/reviews_report_options.php

In addition, a short summary (item 10) of the project entitled "Surfclam species diagnostics and population connectivity estimates to inform management" is provided for that project update.

SSC Report is behind

Tab 11

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Michael P. Luisi, Chairman | G. Warren Elliott, Vice Chairman
Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

Date: July 7, 2020

To: Chris Moore, Executive Director

From: Jessica Coakley and José Montañez, Staff

Subject: Surfclam Management Measures (2021-2026)

Executive Summary

The most current assessment of the Atlantic surfclam (*Spisula solidissima*) stock is a management track assessment of the existing 2016 benchmark Stock Synthesis (SS) assessment which indicated the stock is not overfished and overfishing is not occurring in 2019 (Hennen 2020). Based on the previous assessment the stock was also not overfished, and overfishing was not occurring (in 2016; NEFSC 2017). Assessment reports can be found here: https://fish.nefsc.noaa.gov/saw/reviews_report_options.php.

Specifications were last developed for 2018-2020. For this cycle, staff recommend specifications be set for 6 years (2021-2026) to create administrative efficiencies in addressing the National Environmental Policy Act (NEPA) requirements as a result of the new stock assessment process, which is expected to assess surfclam and ocean quahog on a 4 and 6 year cycle, respectively. The staff recommendation for acceptable biological catches (ABCs) for each year for 2021-2026 is around 39,000 - 47,000 mt each year (see box on page 4 for exact values). The fishery management plan specifies that the annual catch limit (ACL) equals the ABC. Staff recommend an annual catch target (ACT) = 29,363 mt and a commercial quota of 26,218 mt (3.40 million bushels) for each year, 2021-2026. This is the same ACT and commercial quota that has been implemented since 2004. Staff recommend the surfclam minimum size be suspended in 2021, but also recommend that the Council encourage the fishing industry to work to avoid landing large numbers of undersized clams.

Introduction

The Magnuson Stevens Act requires each Council's Scientific and Statistical Committee (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 2021-2026 fishery for surfclam. 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.

MID-ATLANTIC
FISHERY MANAGEMENT COUNCIL

Review of SSC Recommendations for Fishing Years 2019-2020

In December 2018, the SSC recommended ABCs for surfclam for fishing years 2019-2020 based on the report on the joint SSC/Northeast Fisheries Science Center (NEFSC) Working Group assigned to develop an estimate of overfishing limit (OFL) for Atlantic Surfclam, which was not previously available. The Working Group concluded that enough information was available to determine an OFL and the best approach is to use the outputs from the benchmark assessment to establish an Atlantic Surfclam OFL for 2019 and 2020. However, the Working Group noted the high level of uncertainty associated with knowledge of the stock and recommended using the point estimate of the OFL from the benchmark assessment and a coefficient of variation (OFL CV) of 150%. The SSC agreed to support the findings and recommendations of the Working Group and used information provided in the Working Group report to recommend new ABCs for 2019 and 2020.

The SSC recommended that the assessment be considered a stock with an SSC-modified OFL probability distribution with a coefficient of variation (OFL CV) of 150%.

Year	OFL (mt)	ABC (mt)
2019	74,281	56,419
2020	74,110	56,289

The SSC's choice of 150% CV for the OFL is for several reasons:

- The uncertainty in biomass estimates derived from the assessment is several-fold higher than seen in assessments for other species.
- The Georges Bank component of the survey declined unexpectedly with use of a higher efficiency gear in the new survey series.
- Fishing mortality is low.
- The Georges Bank component of the survey is highly uncertain due to small sample sizes.
- There are few years in the new survey time series.
- Recruitment is difficult to estimate.

The SSC noted the principle sources of scientific uncertainty associated with determination of OFL and ABC were:

- Absolute estimates of spawning stock biomass (SSB), recruitment (R), and fishing mortality (F) are scale uncertain.
- Uncertainty from combining absolute SSB, F, and R estimates, and projected trends for the northern and southern areas into a "whole stock."
- Ecosystem analyses suggest surfclam habitat is changing – decreasing in Delmarva and increasing in NJ and Long Island. The net effects on total habitat area and carrying capacity are unknown.
- Model assumption of a 12% incidental mortality, which also may have changed.
- Dredge efficiency is a major factor for setting the scale of the model.

- Catchability was estimated differently for the old and new surveys.
- The assumed dome-shaped selectivity patterns for the survey were based on gear selectivity experiments and are not identical to the way selectivity is defined in the model.
- The distribution of size-at-age in the assessment has largest individuals at intermediate ages (probably because the CVs on size at age for the older ages are too small). This may cause a bias in estimates of F.
- There were conflicts between prior distributions of parameters and some other data sets for both models, but especially for the Southern Area. This is a common problem in integrated stock assessments but may be indicative of structural problems that could be explored (e.g., heterogeneity in growth, recruitment, or mortality, which are not modeled in the assessment).
- The recent survey indices based on the new survey on Georges Bank are lower, which is inconsistent with use of a higher efficiency gear.

Stock Status and Biological Reference Points

The most current assessment of the Atlantic surfclam (*Spisula solidissima*) stock is a management track assessment of the existing 2016 benchmark Stock Synthesis (SS) assessment (SAW 61; NEFSC 2017; Hennen 2020). SAW 61 biological reference points were developed and revised from the prior SAW. The reference points are ratios rather than absolute values.

- SSB/SSB_{Target} = 2 is the new biomass target (or $SSB_{MSY\text{-}Proxy}$), where SSB_{Target} is calculated as $SSB_0/2$,
- $SSB/SSB_{Threshold}$ = 1 is the new minimum stock size threshold which defines overfished status, where $SSB_{Threshold}$ is calculated as $SSB_0/4$,
- $F/F_{Threshold}$ = 1 is the new fishing mortality threshold which defines overfishing, where $F_{Threshold}$ is calculated as 4.136 times the mean F during 1982-2015.

Based on the previous 2016 assessment the stock was not overfished, and overfishing was not occurring. In the updated assessment (Hennen 2020), the Atlantic surfclam stock is not overfished and overfishing is not occurring. Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2019 was estimated to be 1,222 ('000 mt) which is 119% of the biomass target (SSB_{MSY} proxy = 1,027 mt). The 2019 fully selected fishing mortality was estimated to be 0.036 which is 25.8% of the overfishing threshold proxy (F_{MSY} proxy = 0.141).

Basis for 2021-2026 ABC Recommendation

<u>Staff recommend specifications be set for 6 years (2021-2026) to create administrative efficiencies in addressing the NEPA requirements as a result of the new stock assessment process, which is expected to assess surfclam and ocean quahog on a 4 and 6 year cycle, respectively.</u>

Projections the management track assessment provided estimates of OFLs for 2021-2026 (Hennen 2020). If the SSC applied their previous methods that include an SSC-modified OFL probability distribution and an assumed lognormal OFL distribution with a CV = 150%, the ABCs would be calculated as given here.

Year	OFL (mt)	ABC (mt)	$SSB/SSB_{Threshold}$ (ratio)[a]	P (overfishing)
2021	51,361	46,919	2.21	0.47
2022	48,202	43,460	2.15	0.46
2023	45,959	41,166	2.12	0.46
2024	44,629	39,888	2.11	0.46
2025	44,048	39,282	2.10	0.46
2026	43,886	39,223	2.11	0.46

[a] The target biomass ratio = 2. See section on BRPs above.

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). 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. The ACL is equal to the ABC as prescribed in the FMP.

The assessment results are robust with respect to stock status and suggest that the current catch levels are reasonable. Staff recommend an ACT = 29,363 mt each year for 2021-2026, which is the commercial quota of 26,218 mt (3.40 million bushels) plus an additional 12% for incidental mortality. Since 2010, the fishery has landed around 70% of the total commercial quota, and the fishery has not landed 100% of the quota since 2003. The industry has indicated this is because they are market limited.

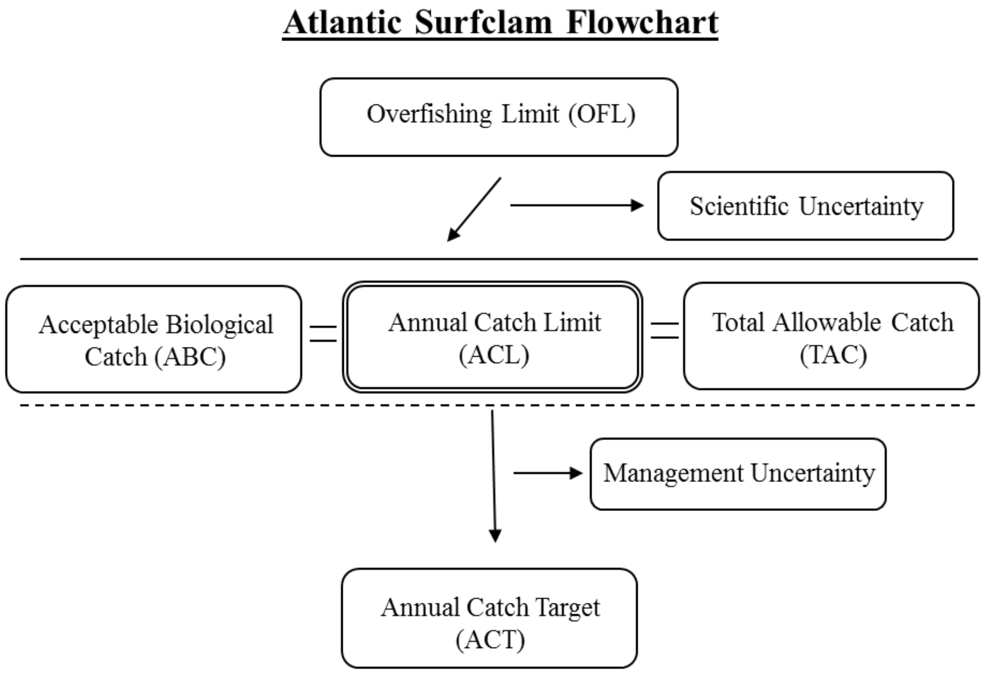

Figure 1. Atlantic surfclam catch limit structure.

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 RA regarding minimum size regulations. The report titled, "Estimated Proportion of Undersized Surfclam Landings for 2019" (Sullivan 2019), indicates that:

An estimated 22.0% of the coast wide surfclam landings to date in 2019 were undersized. The lower and upper 95% confidence intervals (CI) for this estimate were 21.1% and 22.8%. However, it should be noted that there are regional differences. In the Delmarva statistical areas, the estimated percent of undersized clams in the landings is 32.5% (95% CI of 32.2-32.7%), New Jersey is 11.0% (95% CI of 10.9-11.0%), and Georges Bank is 18.2% (95% CI of 18.2-18.3%).

<u>Staff recommend continued suspension of the minimum shell-length standard for 2021 given that the coastwide 30% threshold for suspension was not triggered. However, the Council should encourage the fishing industry to work to avoid landing large numbers of undersized clams, as the overall percentage of undersized clams is getting closer to the 30% coastwide trigger to automatically implement a minimum size</u>.

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 distribution has been provided by the NEFSC (Hennen 2020). Because the commercial fishing gear selects for larger clams and does not sample small clams well, fishery-dependent data would not be representative of the proportions at size in an area. The fishery-independent clam survey conducted by the NEFSC does capture smaller surfclam than the commercial fishery lands, has randomly selected stations within each survey strata, and provides a sample of the proportions of small (<4.5 inches), large (>4.5 inches and <5.5 inches), and extra-large clams (>5.5 inches) in the sampling strata. However, it should be noted that the survey is conducted with a large commercial dredge and likely does not sample small clams well; although it is probably the best information available to address this regulation. Stations within each strata that were candidates for the criteria listed in the regulations (see i and ii above) were mapped (Figures 2 and 3).

This information is presented so the Council can monitor changes in the distribution of surfclam size composition over time and determine if a closure is appropriate. <u>Staff recommend the Council continue to monitor these spatial differences in the fishery</u>.

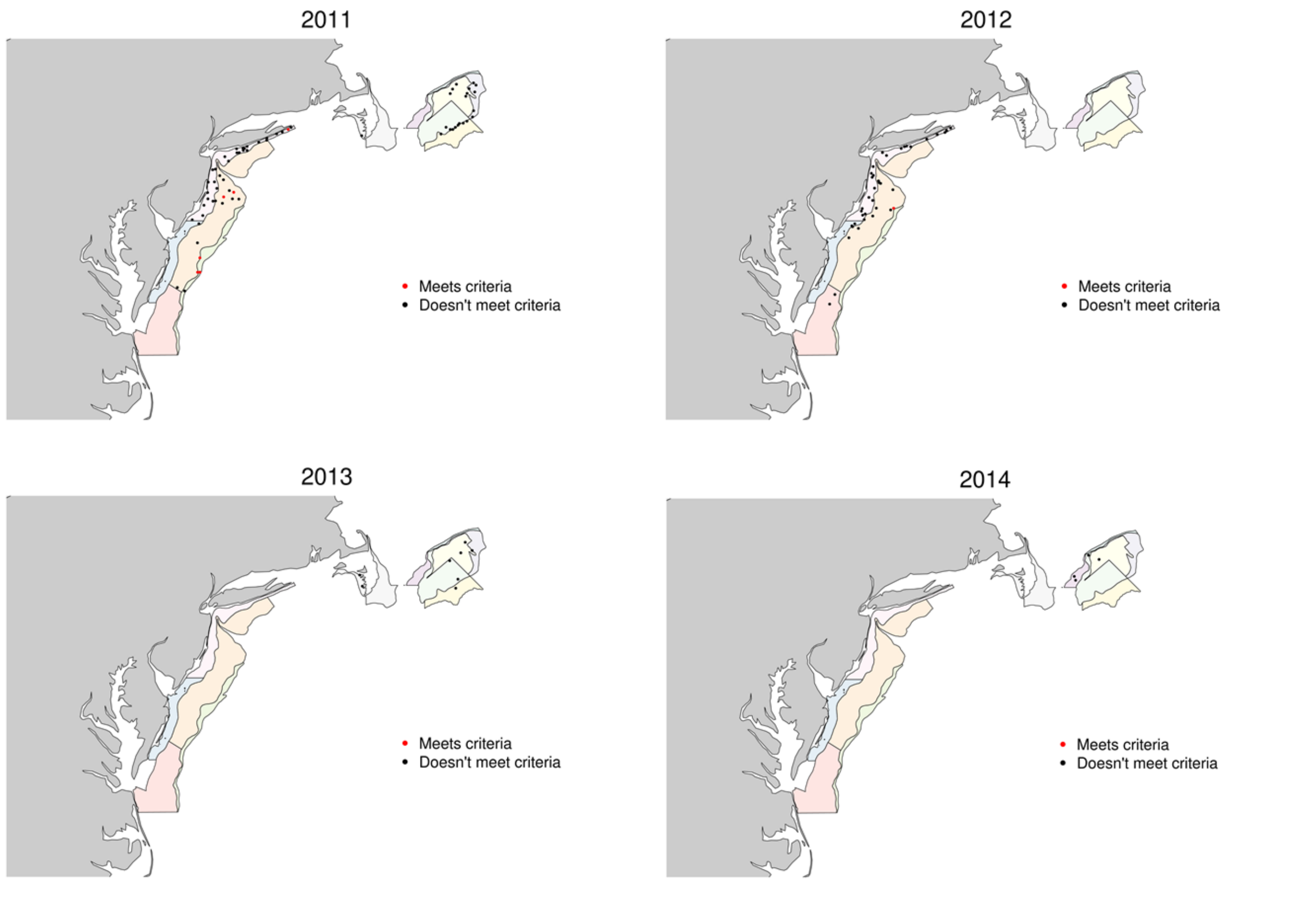

Figure 2. 2011-2014 NEFSC Clam survey stations where surfclams sampled met the small clam area criteria. Source: Hennen 2020.

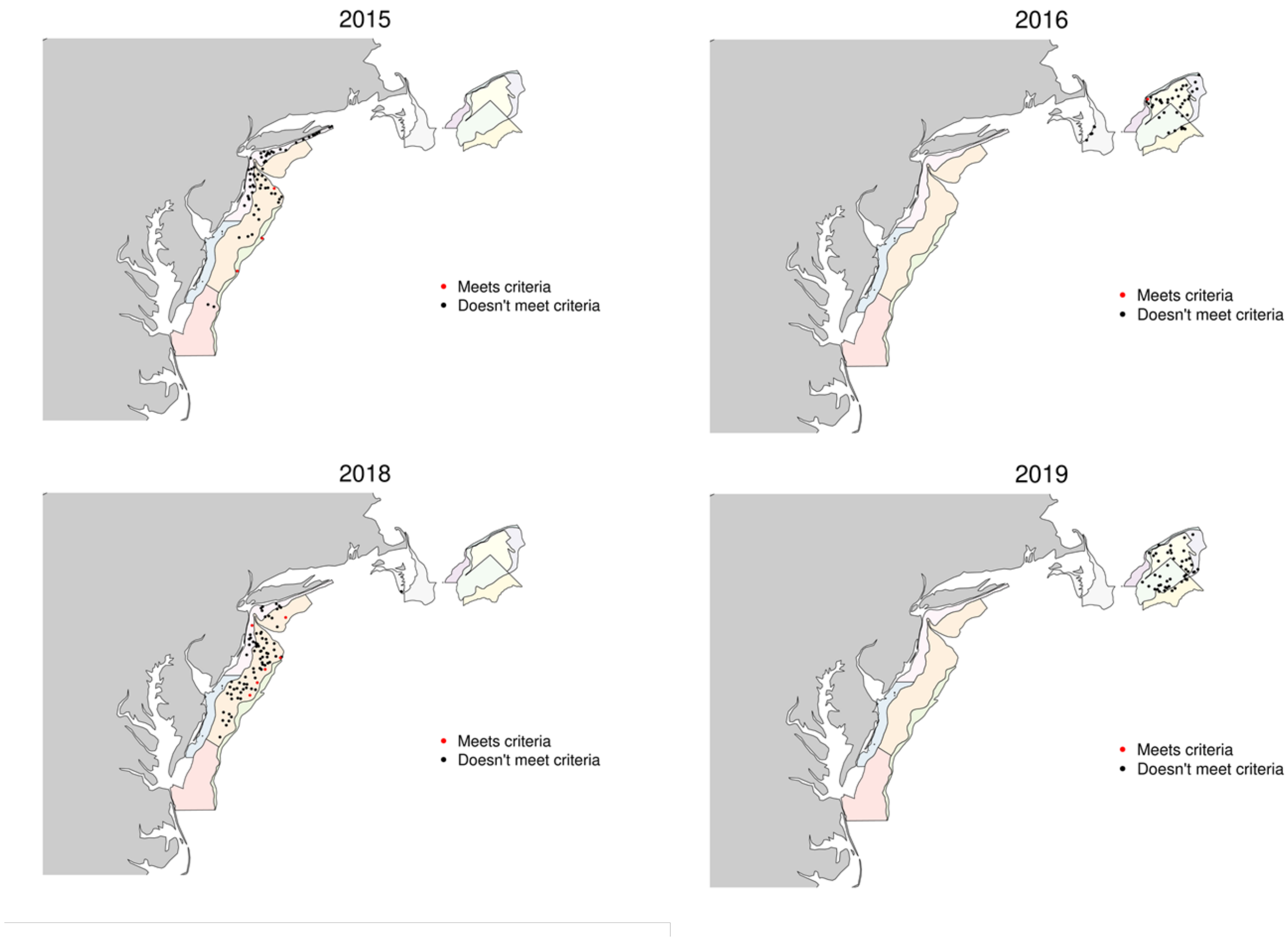

Figure 3. 2015-2019 NEFSC Clam survey stations where surfclams sampled met the small clam area criteria. Source: Hennen 2020.

References

Hennen, Dan. Personal Communication. June 14 and 24, 2020. NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

Northeast Fisheries Science Center. 2017. 61st Northeast Regional Stock Assessment Workshop (61st SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-05; 466 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications.

Sullivan, John. 2019. Estimated Proportion of Undersized Surfclam Landings for 2019. NOAA Fisheries Greater Atlantic Region Fisheries Office report dated November 26, 2019.

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MEMORANDUM

Date: July 7, 2020

To: Chris Moore, Executive Director

From: Jessica Coakley and José Montañez, Staff

Subject: Ocean Quahog Management Measures (2021-2026)

Executive Summary

The most current assessment of the ocean quahog (*Arctica islandica*) stock is a management track assessment of the existing 2017 benchmark Stock Synthesis (SS) assessment which indicated the stock is not overfished and overfishing is not occurring in 2019 (Hennen 2020). Based on the previous assessment the stock was also not overfished, and overfishing was not occurring (in 2016; NEFSC 2017). Assessment reports can be found here: https://fish.nefsc.noaa.gov/saw/reviews_report_options.php.

Specifications were last developed for 2018-2020. For this cycle, staff recommend specifications be set for 6 years (2021-2026) to create administrative efficiencies in addressing the National Environmental Policy Act (NEPA) requirements as a result of the new stock assessment process, which is expected to assess surfclam and ocean quahog on a 4 and 6 year cycle, respectively. The staff recommendation for acceptable biological catches (ABCs) for each year for 2021-2026 is around 44,000 mt each year (see box on page 3 for exact values). The fishery management plan specifies that the annual catch limit (ACL) equals the ABC. Staff recommend a non-Maine fishery ACT (annual catch target) of 25,400 mt with a Maine ACT of 524 mt for each year, 2021-2026; combined these are equal to the ABC=ACL. This results in a commercial quota of 24,190 mt (5.3 million bushels) and a quota for the Maine quahog fishery of 499 mt (100,000 Maine bushels). These are the same quotas that have been implemented since 2005.

Introduction

The Magnuson Stevens Act requires each Council's Scientific and Statistical Committee (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 2021-2026 fishery for ocean quahog. The SSC will recommend an ABC 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 for Fishing Years 2018-2020

In May 2017, the SSC met to recommend ABCs for ocean quahog for fishing years 2018-2020. The SSC determined that the reported OFL estimate, though associated with substantial uncertainty, was deemed credible, and could form the basis of developing management advice. The SSC deemed that, "Ocean Quahog should be considered a stock with an SSC-modified OFL probability distribution." The SSC considered the ocean quahog to be a species with an atypical life history, and applied an SSC modified OFL distribution with a CV=100% for a stock with a spawning stock biomass (SSB) > SSB target.

Year	OFL (mt)	ABC (mt)	$SSB/SSB_{Threshold}$ (ratio)	P (overfishing)
2018	61,600	44,695	2.0	0.35
2019	63,600	46,146		
2020	63,100	45,783		

They also determined the most significant sources of scientific uncertainty associated with determination of OFL and ABC as:

- Absolute estimates of SSB, recruitment (R), and fishing mortality (F) are scale uncertain. Almost all the information on biomass scale was from the priors on survey catchability and at least one model-based depletion estimate of catchability (q) was unlikely given the prior applied in the model.
- Recruitment is difficult to estimate in the ocean quahog assessment because age composition data is not fit in the model and growth is highly variable.
- The assessment considers the stock at large spatial scales and there is a need to improve the understanding of demographic processes (including recruitment and settlement) at smaller spatial scales that are not now captured in the model.

Stock Status and Biological Reference Points

The most current assessment of the ocean quahog (*Arctica islandica*) stock is a management track assessment of the existing 2017 benchmark Stock Synthesis (SS) assessment which indicated the stock is not overfished and overfishing is not occurring in 2019 (Hennen 2020). SAW 63 biological reference points were developed and revised from the prior SAW. The reference points are ratios rather than absolute values.

- $SSB/SSB_{Target} = 1.25$ is the new biomass target (or $SSB_{MSY\text{-}Proxy}$), where SSB_{Target} is calculated as $0.5*SSB_0$,
- $SSB/SSB_{Threshold} = 1$ is the new minimum stock size threshold which defines overfished status, where $SSB_{Threshold}$ is calculated as $0.4*SSB_0$,
- $F/F_{Threshold} = 1$ is the new fishing mortality threshold ($F_{MSY\text{-}Proxy}$) which defines overfishing, where $F_{Threshold}$ is 0.019.

Based on this updated assessment the stock is not overfished and overfishing is not occurring. Retrospective adjustments were not made to the model results. SSB in 2019 was estimated to be 3,651 ('000 mt) which is 172.8% of the biomass target (SSBMSY proxy = 2,113; Figure 1) [These values were corrected from previous versions]. The 2019 fully selected fishing mortality was estimated to be 0.005 which is 25.5% of the overfishing threshold proxy (F_{MSY} proxy = 0.019).

Basis for 2021-2026 ABC Recommendation

Staff recommend specifications be set for 6 years (2021-2026) to create administrative efficiencies in addressing the NEPA requirements as a result of the new stock assessment process, which is expected to assess surfclam and ocean quahog on a 4 and 6 year cycle, respectively.

Projections the management track assessment provided estimates of OFLs for 2021-2026 (Hennen 2020). If the SSC applied their previous methods that include an SSC-modified OFL probability distribution and an assumed lognormal OFL distribution with a CV = 100%, the ABCs would be calculated as given here.

Year	OFL (mt)	ABC (mt)	$SSB/SSB_{Threshhold}$ (ratio)[a]	P (overfishing)
2021	44,960	44,031	2.18	0.49
2022	45,001	44,072	2.18	
2023	45,012	44,082	2.17	
2024	44,994	44,065	2.16	
2025	44,948	44,020	2.15	
2026	44,875	43,948	2.14	

[a] The target biomass ratio = 1.25. See section on BRPs above.

Other Management Measures

In the FMP, the ABC=ACL=TAC and the Council specifies an ACT that accounts for management uncertainty and other relevant factors (Figure 1). There is an incidental fishing mortality rate of 5% 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 ocean quahogs cannot be landed without cage tags, the implementation uncertainty is generally considered to be insignificant.

Catch is defined as the sum of landings, a 5% incidental mortality applied to landings, and discards. The ACL is equal to the ABC as prescribed in the FMP.

Staff recommend a non-Maine fishery ACT of 25,400 mt, and a Maine ACT of 524 mt. This results in a commercial quota of 24,190 mt (5.3 million bushels) and a quota for the Maine quahog fishery of 499 mt (100,000 Maine bushels). These are the same quotas that have been implemented since 2005.

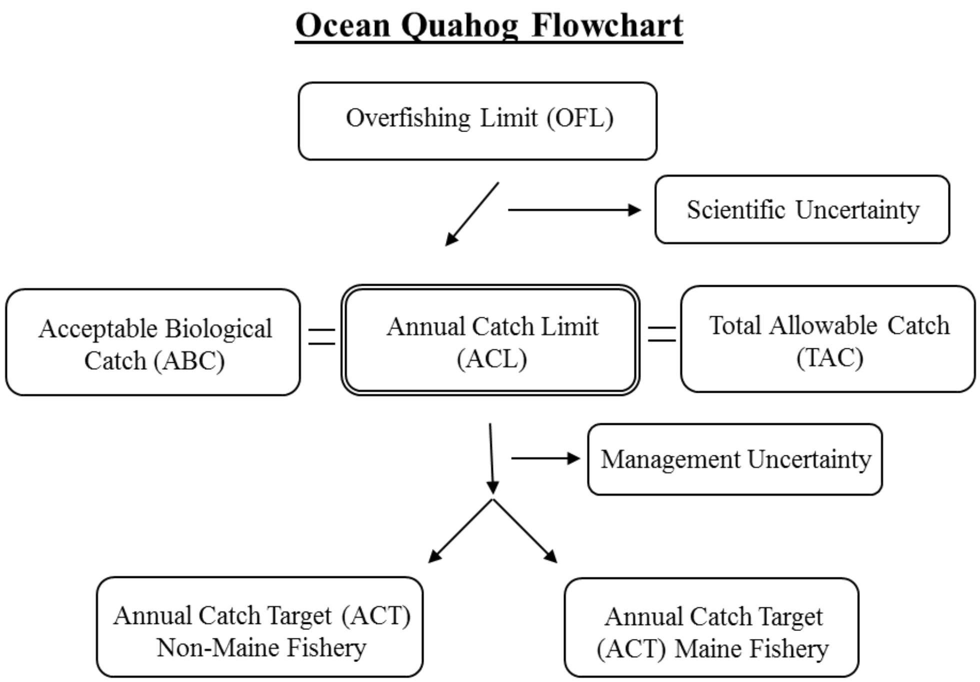

Figure 1. Ocean quahog catch limit structure.

References

Hennen, Dan. Personal Communication. June 14 and 24, 2020. NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

Northeast Fisheries Science Center. 2017. 63rd Northeast Regional Stock Assessment Workshop (63rd SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-09; 28 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications.

Atlantic Surfclam and Ocean Quahog Fishery Performance Report

July 2020

The Mid-Atlantic Fishery Management Council's (Council) Atlantic Surfclam and Ocean Quahog (SCOQ) Advisory Panel (AP) met via webinar on July 8, 2020 to review the Fishery Information Documents and develop the following Fishery Performance Report. The primary purpose of this report is to contextualize catch histories for the Scientific and Statistical Committee (SSC) and Council by providing information about fishing effort, market trends, environmental changes, and other factors. A series of trigger questions listed below were posed to the AP to generate discussion of observations in these fisheries. Please note: Advisor comments described below are not necessarily consensus or majority statements; in those cases, the differences in opinions are noted.

Advisory Panel members present: Thomas Alspach, Thomas Dameron, Michael Ferrigno, Peter Himchak, Samuel Martin, Jeff Pike, and David Wallace. (did not attend: David Belanger, Howard King, and Ken McDermott)

Others present: Jessica Coakley and José Montañez (Council staff), Doug Potts (GARFO), Peter DeFur and Peter Hughes (Council members), Doug Copeland (Atlantic Shores Offshore Wind), and Ron Larsen (Sea Risk Solutions LLC).

Trigger questions:

1. What factors have influenced recent catch (markets/economy, environment, regulations, other factors)?
2. Are the current fishery regulations appropriate? How could they be improved?
3. What would you recommend as research priorities?
4. What else is important for the Council to know?

Critical Issues (not in any priority order)

COVID-19: Sales to restaurants (foodservice) was very low year-on-year for the months of March, April, May, and June; with the expectation that the effects of this may be ongoing and/or longer lasting. Seventy-five (75) percent of all seafood is sold in restaurants in the U.S. Because of the pandemic landings and sales have been reduced. All processors are continuing to operate to protect jobs within their organizations, causing inventories to rise dramatically. Inventory is being built without additional sales. This causes additional storage costs as well as other expenses, which cannot continue in perpetuity without increased demand and sales. If this continues, it may result in lower/reduced landings. When and if retail starts opening back up this will help relieve some of these added expenses.

Research: It is important that the Council continue to support any research projects that would support increasing harvest opportunities within the Great South Channel Habitat Management Area.

Offshore Development: The development of wind energy has become a critical issue for our industry which is further addressed later in this report.

Quotas

The advisors 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 under normal circumstances (which do not include pandemics). There is uncertainty in the market in 2020 under COVID-19. The peer review committee that did the surfclam 2020 assessment agreed that it was well done and surfclams are not overfished and overfishing is not occurring. The industry is of the opinion that the Council's Scientific and Statistical Committee (SSC) will agree with the peer reviewers since two of the members are SSC members. The surfclam assessment will not be reviewed by NEFSC for at least four years. Therefore, the surfclam assessment will be used for the next four years, with an annual review. The ocean quahog population was not assessed because the NEFSC decided that the previous assessment was still relevant for the next six years [Staff: A management track assessment was provided by the NEFSC in 2020].

Market/Economic Conditions

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 and Fairhaven, MA. Trucking costs and the distance needed to travel to harvest clams has put greater economy on scale and location. Fuel prices declined and stabilized in recent years giving some relief to industry participants. Fuel prices continue to be stable.

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 marketplace. Clearwater is operating under a different group of regulations in Canada; they entered into an agreement with indigenous tribes which entitles them to catch 100% of their Canadian fishery Arctic clam quota (30,000 mt). As a result, their excess chopped clam product is being sold in U.S. markets, as a high-quality product at a lower price. This is exerting additional pressure on the marketplace. The limit in demand for clams in the market is driven by many market factors including foreign seafood competition, other products in the marketplace (e.g. 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. There are also some complicating factors related to U.S. relationships with China and the EU in terms of marketing and sales, including trade tariffs.

In terms of positive marketing developments, one processor (LaMonica Fine Foods) has developed a line of canned products for the retail market with a fall 2020 roll out date. All processors are looking into ways to adjust to current market conditions with ready-to-eat product lines as the fresh retail and restaurant sales have declined.

COVID-19 dominates issues related to the market and economic conditions. It is unclear how and when this will impact or change the markets going forward.

Environmental Conditions

Many species (including surfclams and ocean quahogs) are moving northward and into deeper waters. This movement is temperature driven. Historically, about half the quota for quahogs used to be taken in the Southern area. Surfclams are increasing in these Southern areas, possibly because of the faster growth rates for surfclams settling when compared to quahogs. The natural shift in the stock distribution northwards has driven the movement of the fishery. For more details, see the Surfclam Fishery Information Document.

General Fishing Trends

The landings per unit effort (LPUE) is not indicative of stock abundance because it only reflects the fishing occurring in a few ten-minute squares (see Fishery Information Documents). The LPUE has leveled off in recent years. The LPUE continues to be higher on Georges Bank and there are 6 permitted vessels (4 currently fishing) in the open portion of the Georges Banks closed area. Vessels previously fishing in areas that are now closed on Nantucket Shoals (which tend to be smaller vessels) have to travel greater distances to land surfclams resulting in both increased expenses and decreased income.

Fleet Capacity

One new vessel replacement has occurred for a medium size vessel working out of Atlantic City, NJ. Fleet capacity continues to stay static. The overall quotas are not being harvested. The driving factors are from the marketplace and not an inability to catch the quota. The processors are unable to demand the prices at which the products are sold, because the vendors essentially dictate the prices to the processors. This has limited the amount of capitalization that can be done in this fishery. The fleet continues to age, and there have been limited new builds, which has resulted in increased maintenance time spent to refurbish vessels.

Optimum Yield (OY)

The industry was comfortable with a maximum OY of 3.4 million 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.

Offshore Development

The clam advisors are concerned about the BOEM wind farm leasing process and potential impacts to historically important fishing areas. The industry’s opportunities to engage with developers on wind array siting relative to the most productive clam fishing beds has not been productive. This resistance in cooperation lends to the notion that the clam fishery and the ocean wind developers cannot coexist as the developers have made no attempt to give the clam industry any consideration in their layout of their arrays and the spacing between the turbines which will make it unsafe for clam vessels to work within wind farms. Siting is critical in terms of ensuring reasonable fishing access. It has been the experience of the clam industry that any communications by BOEM or wind energy developers is purely perfunctory and true mitigation efforts will not be made.

In the New England and Mid-Atlantic region, offshore wind development is out of control. The industry feels that no matter how hard you try to engage with developers on these issues, you are having no effect or influence. The spatial and operation requirements of the fishery (considering things like weather, tides, safety, etc.) need to be accounted for to ensure access to the wind arrays, but at present that is not happening. These arrays become de-facto Marine Protected Areas and the Councils and industry have nothing to say about how the fishing grounds are managed within the arrays. Unlike finfish, clams do not move, so once the vessels cannot fish in an area those resources are lost to the fishery and the value it brings to the economy. These areas are also likely to be lost to survey data further impacting the biomass estimates of the fishery.

The Council needs to consider the biological impacts on the fishery itself, and other cumulative environmental effects that may occur. These should include things like productivity of the resource, larval displacement, scour and sediment suspension, hydrographic changes, and effects of sounds and other pressures on the zooplankton community (which includes food for clams). In addition, in water structures from offshore wind or other types of closures (e.g. Great South Channel Habitat Management Area) will result in vessels having to travel further and having a larger carbon footprint.

Science and Research Initiatives

Industry continues to do research with the Science Center for Marine Fisheries (SCeMFiS), an industry, university, and National Science Foundation (NSF) supported research center and that has several completed, ongoing and recently funded research projects: http://scemfis.org

There is an ongoing BOEM funded project led by Rutgers University to identify economic impacts of wind energy development on the surfclam industry.

There is an ongoing RODA Knowledge Trust project (funded by NYSERDA) for surfclams and ocean quahogs (as well as some other fisheries) designed to identify economic exposures of lost access for harvesters, processer and shoreside facilities of as a result of future build out of wind energy lease sites.

Research Priorities

The AP feels that MAFMC start to consider how the fisheries independent surveys will take place within wind energy arrays once constructed.

Atlantic Surfclam Fishery Information Document

July 2020

This Fishery Information Document provides a brief overview of the biology, stock condition, management system, and fishery performance for Atlantic surfclam with an emphasis on 2019. Data sources for Fishery Information Documents are generally from unpublished National Marine Fisheries Service (NMFS) survey, dealer, vessel logbook, and permit databases and should be considered preliminary. For more resources, including previous Fishery Information Documents, please visit https://www.mafmc.org/surfclams-quahogs.

Key Facts

- There has been no change to the status of the Atlantic surfclam stock in 2019. The stock is not overfished and overfishing is not occurring.
- The total ex-vessel value of the 2019 federal harvest was approximately $28 million, slightly lower than $30 million in 2018
- In 2019, there were 7 companies reporting purchases of surfclam and/or ocean quahog in 5 states outside of Maine.
- Overall, from 2018 to 2019, there have been no major changes and only slight variation in the fishery landings, prices, and the numbers of vessels and dealers participating in this fishery. However, the surfclam biomass and landings per unit effort continues to decline, and the fishery appears to continue to shift its effort Northward.

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).[1] An electronic version is available at the following website: https://www.fisheries.noaa.gov/new-england-mid-atlantic/habitat-conservation/essential-fish-habitat-efh-northeast. Additional information on this species is available at the following website: https://www.fishwatch.gov/. A summary of the basic biology is provided below.

Atlantic surfclam are distributed along the western North Atlantic Ocean from the southern Gulf of St. Lawrence to Cape Hatteras. Surfclam occur in both the state territorial waters (≤ 3 miles from shore) and within the Exclusive Economic Zone (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, surfclam are found from the intertidal zone to a depth of about 60 meters (197 ft), but densities are low at depths greater than 40 meters (131 ft).

The maximum size of surfclam is about 22.5 cm (8.9 inches) shell length, but surfclam larger than 20 cm (7.9 inches) are rare. The maximum age exceeds 30 years and surfclam of 15-20 years of age are common in many areas. Surfclam 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 surfclam are suspension feeders on phytoplankton, and use siphons which are extended above the surface of the substrate to pump in water. Predators of surfclam 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 most current assessment of the Atlantic surfclam (*Spisula solidissima*) stock is a management track assessment of the existing 2016 benchmark Stock Synthesis (SS) assessment (SAW 61; NEFSC 2017).[2, 3] Based on the previous assessment the stock was not overfished, and overfishing was not occurring. This assessment updates commercial fishery catch data, research survey indices of abundance, commercial length composition, survey length composition and conditional age at length data as well as the analytical SS assessment model and reference points through 2019. Stock projections have been updated through 2026.

Based on this updated assessment, the Atlantic surfclam stock is not overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2019 was estimated to be 1,222 ('000 mt) which is 119% of the biomass target ($SSB_{MSY\ proxy}$ = 1,027; Figure 1). The 2019 fully selected fishing mortality was estimated to be 0.036 which is 25.8% of the overfishing threshold proxy (F_{MSY} proxy = 0.141; Figure 2).

Management System and Fishery Performance

Management

There have been no major changes to the overall management system since the Individual Fishing Quota (ITQ) system was implemented in 1990. The Fishery Management Plan (FMP) for Atlantic surfclam (*Spisula solidissima*) became effective in 1977. The FMP established the management unit as all Atlantic surfclam in the Atlantic EEZ. The FMP is managed by the Mid-Atlantic Fishery Management Council (Council), in conjunction with the 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 (ITQs) at the beginning of each calendar year as specified in Amendment 8 to the FMP (1988). In addition to the Federal water 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: https://www.mafmc.org/.

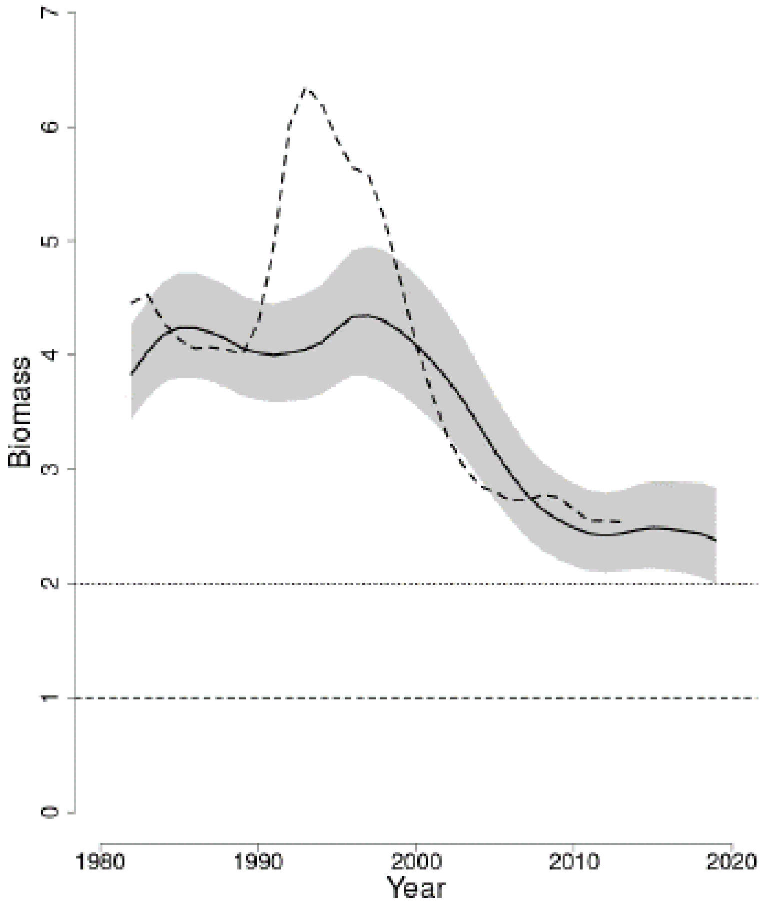

Figure 1. Trends in spawning stock biomass of Atlantic surfclam between 1982 and 2019 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ (½ $SSB_{MSY\ proxy}$; horizontal dashed line) as well as SSB_{Target} ($SSB_{MSY\ proxy}$; horizontal dotted line) based on the 2020 assessment. Units of SSB are the ratio of annual biomass to the biomass threshold ($SSB/SSB_{Threshold}$). The approximate 90% lognormal confidence intervals are shown.[3]

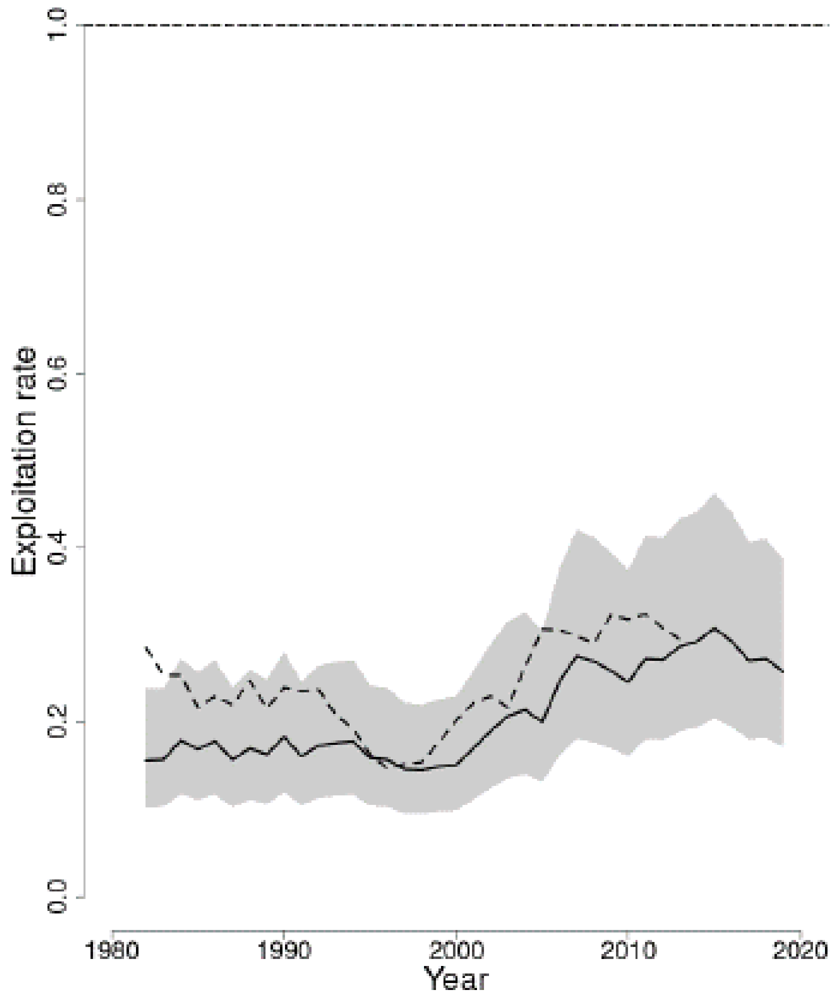

Figure 2. Trends in the fully selected fishing mortality (F_{Full}) of Atlantic surf-clam between 1982 and 2019 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ ($F_{MSY\ proxy}$=0.141; horizontal dashed line), based on the 2020 assessment. Units of fishing mortality are the ratio of annual F to the F threshold ($F/F_{Threshold}$). The approximate 90% lognormal confidence intervals are shown.[3]

Commercial Fishery

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 3. The areas where ocean quahog are found is shown in Figure 4. The distribution of the fishery has changed over time, as shown in Figures 5-8, with a shift to increased landings in Southern New England and Georges Bank areas.

Table 1. Federal surfclam quotas and landings: 1998-2020. Landings for state waters are approximated as total landings - EEZ landings and may not accurately reflect state landings. SSC determined OFLs and ABCs included for years specified.

Year	OFL (mt)	ABC/ ACL (mt)	Total Landings (mt meats; includes state waters)	EEZ Landings (mt meats)	EEZ Landings[a] ('000 bu)	EEZ Quota ('000 bu)	% Harvested
1998	NA	NA	24,506	18,234	2,365	2,565	92%
1999	NA	NA	26,677	19,577	2,539	2,565	99%
2000	NA	NA	31,093	19,788	2,566	2,565	100%
2001	NA	NA	31,237	22,017	2,855	2,850	100%
2002	NA	NA	32,645	24,006	3,113	3,135	99%
2003	NA	NA	31,526	24,994	3,241	3,250	100%
2004	NA	NA	26,463	24,197	3,138	3,400	92%
2005	NA	NA	22,734	21,163	2,744	3,400	81%
2006	NA	NA	25,779	23,573	3,057	3,400	90%
2007	NA	NA	27,091	24,915	3,231	3,400	95%
2008	NA	NA	25,223	22,510	2,919	3,400	86%
2009	NA	NA	22,396	20,065	2,602	3,400	77%
2010	129,300	96,600	19,941	17,984	2,332	3,400	69%
2011	114,000	96,600	20,044	18,839	2,443	3,400	72%
2012	102,300	96,600	18,393	18,054	2,341	3,400	69%
2013	93,400	96,600	18,924	18,551	2,406	3,400	71%
2014	81,150	60,313	18,834	18,227	2,364	3,400	70%
2015	75,178	51,804	18,517	18,154	2,354	3,400	69%
2016	71,512	48,197	18,202	18,039	2,339	3,400	69%
2017	69,925	44,469	17,690	16,902	2,192	3,400	64%
2018	Not specified[b]	29,363[b]	17,114	16,269	2,110	3,400	62%
2019	74,281[c]	56,419[c]	16,502[d]	14,983[d]	1,943[d]	3,400	57%
2020	74,110[c]	56,289[c]	NA	NA	NA	3,400	NA

[a] 1 surfclam bushel is approximately 17 lb. [b] Revised previous 2018 values due to new stock assessment. [c] Revised previous 2019-2020 values due to new analyses. [d] Preliminary, incomplete 2019 data Source: NMFS clam vessel logbook reports.[3]

Figure 9 provides the distribution of surfclam landings 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, 2010-2019). Data for 2019 are incomplete and preliminary, and included in the last time block.

Additional information of the length composition of port sampled surfclam, and their associated sample sizes by area, are available in the stock assessment reports and management track assessment provided.[3]

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 surfclam and ocean quahog. 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 "Snapshots of Human Communities and Fisheries in the Northeast" can be found at: https://fish.nefsc.noaa.gov/read/socialsci/communitySnapshots.php.

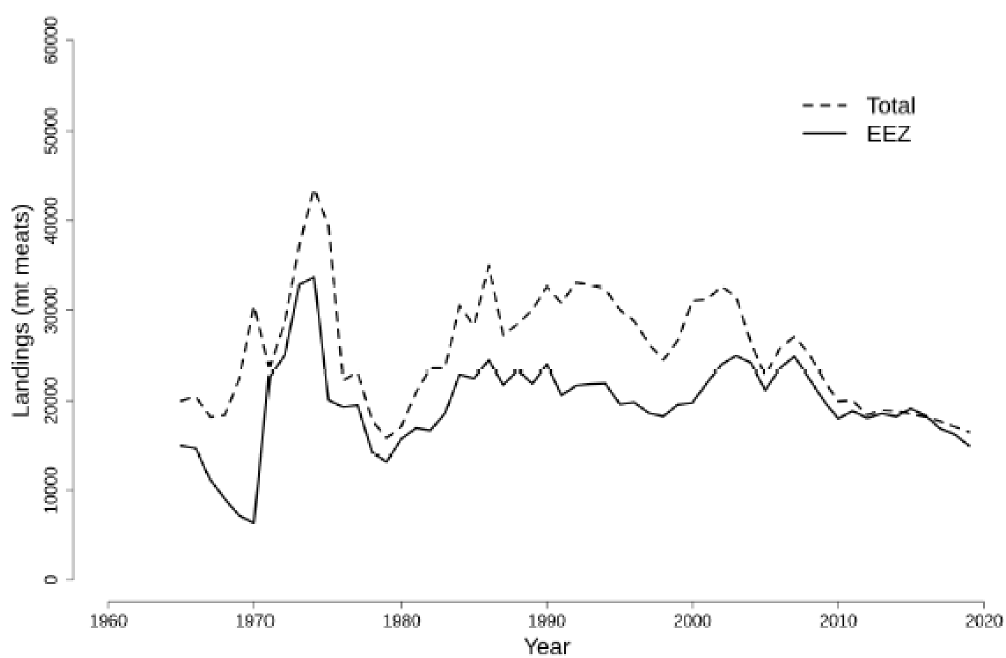

Figure 3. Surfclam landings (total and EEZ) during 1965-2018, and preliminary 2019.[3]

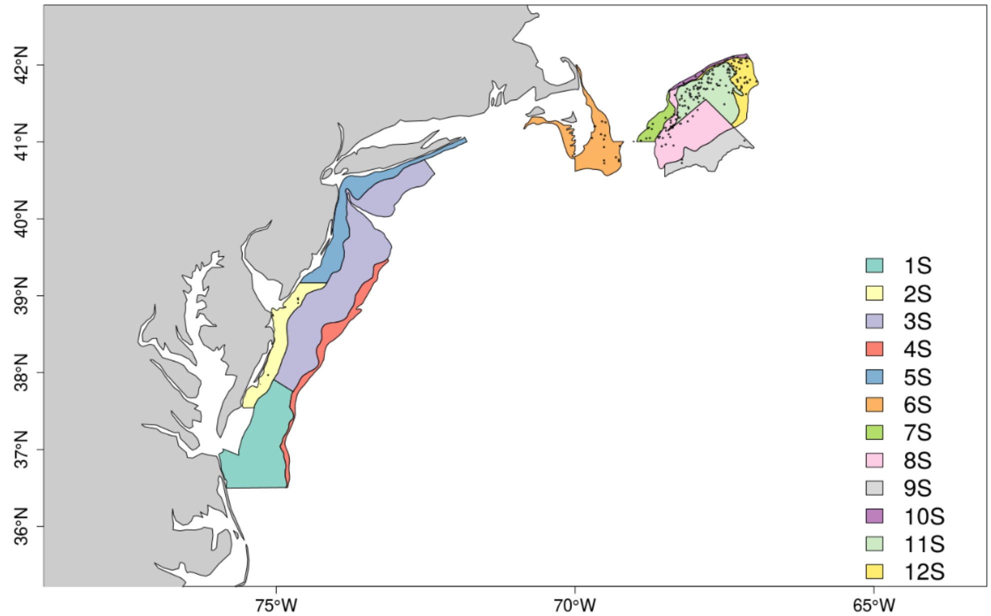

Figure 4. Surfclam stock assessment regions and NEFSC shellfish survey strata. The shaded strata are where surfclam are found.

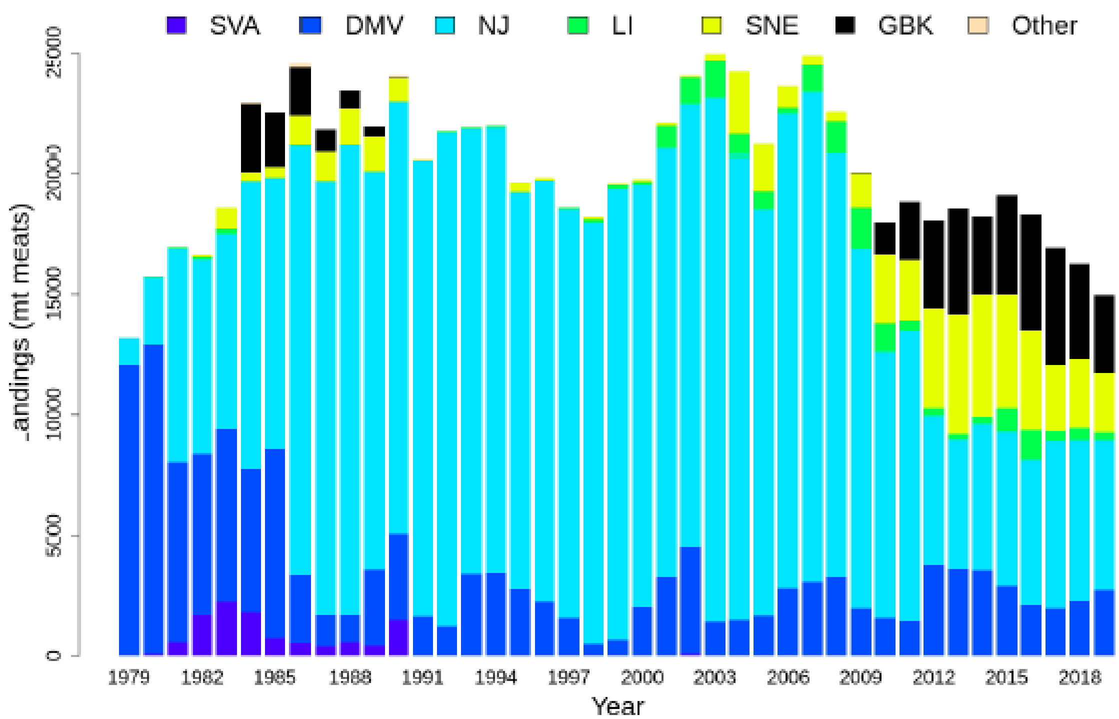

Figure 5. Surfclam landings from the US EEZ during 1979-2018, and preliminary 2019.[3]

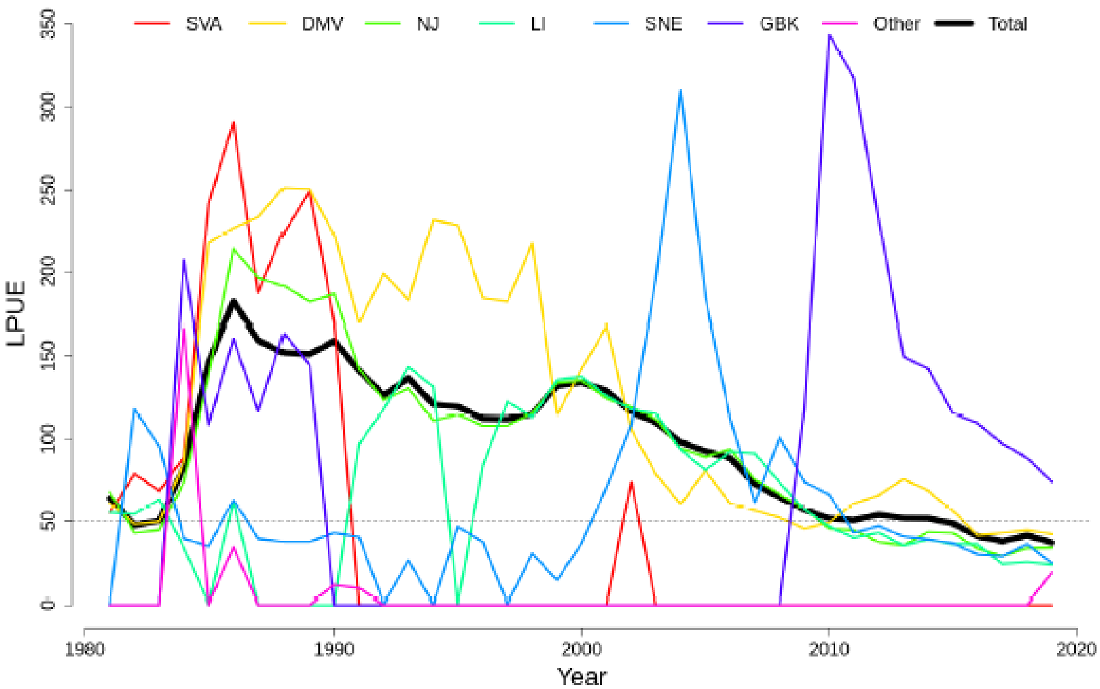

Figure 6. Nominal landings per unit effort (LPUE in bushels landed per hour fished) for surfclam, by region, during 1981-2018, and preliminary 2019. LPUE is total landings in bushels divided by total fishing effort.[3]

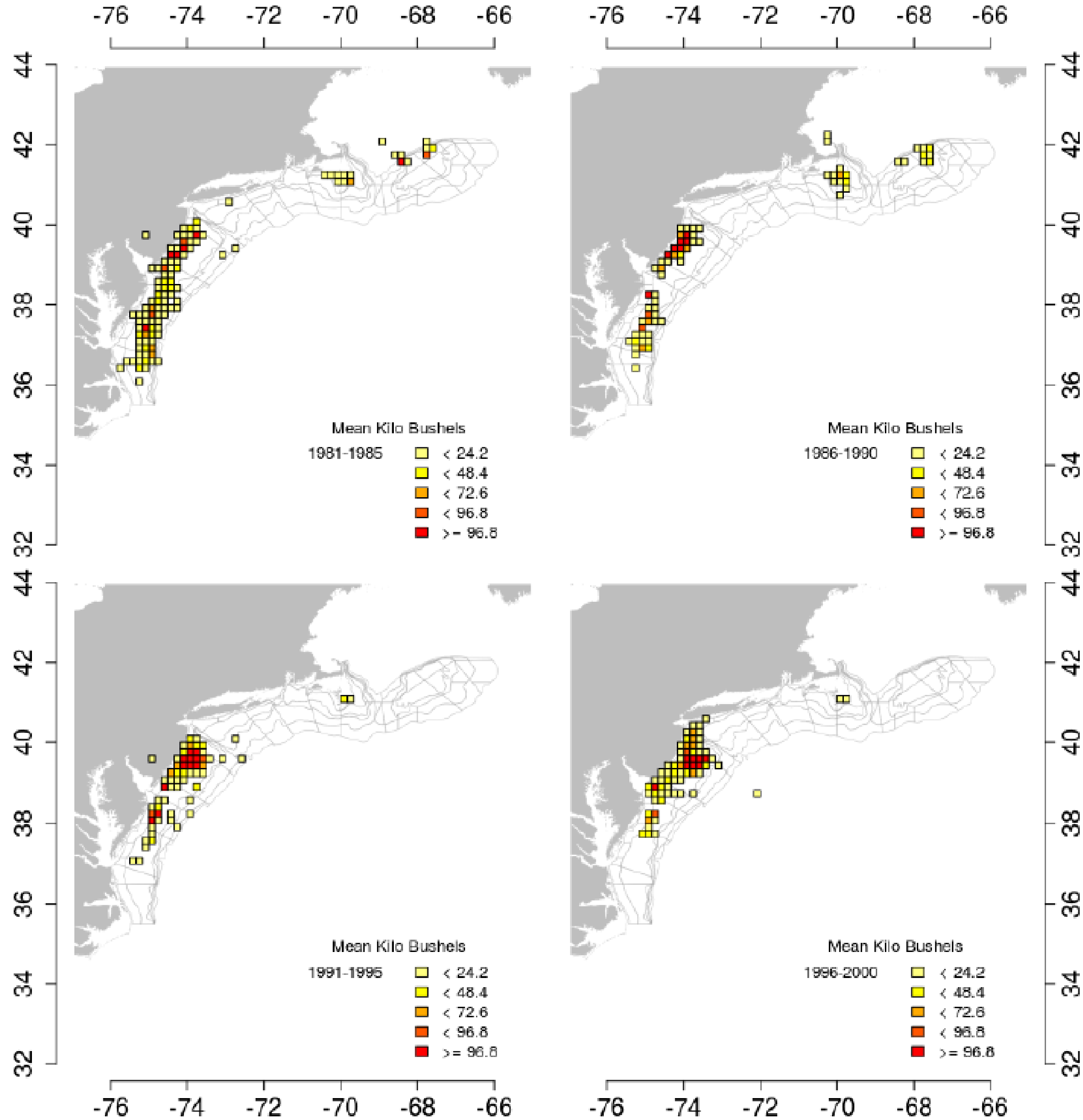

Figure 7. Average surfclam landings by ten-minute squares over time, 1981-2000. Only squares where more the 5 kilo bushels were caught are shown.[3]

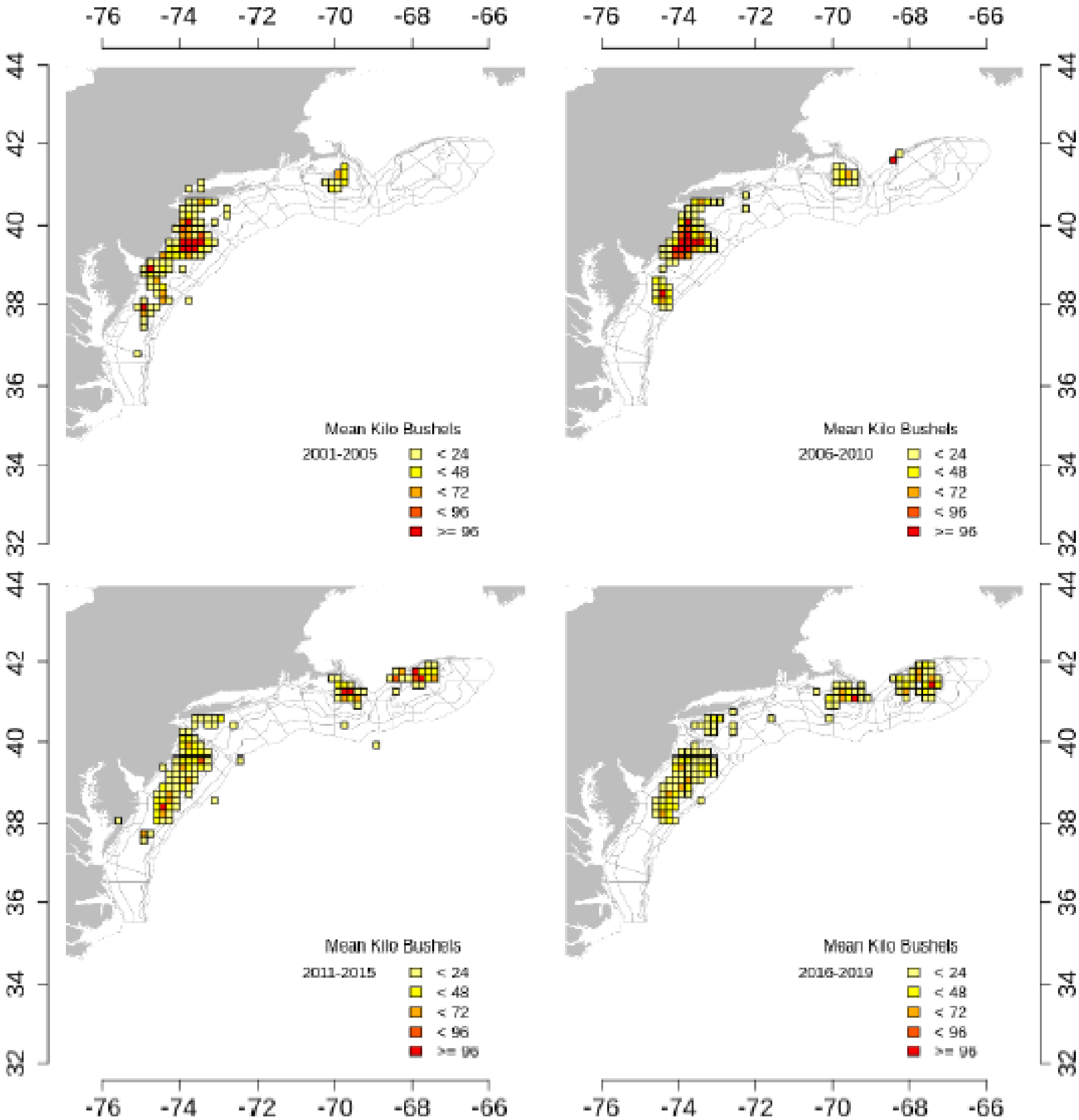

Figure 8. Average surfclam landings by ten-minute squares over time, 2001-2018, and preliminary 2019. Only squares where more the 5 kilo bushels were caught are shown.[3]

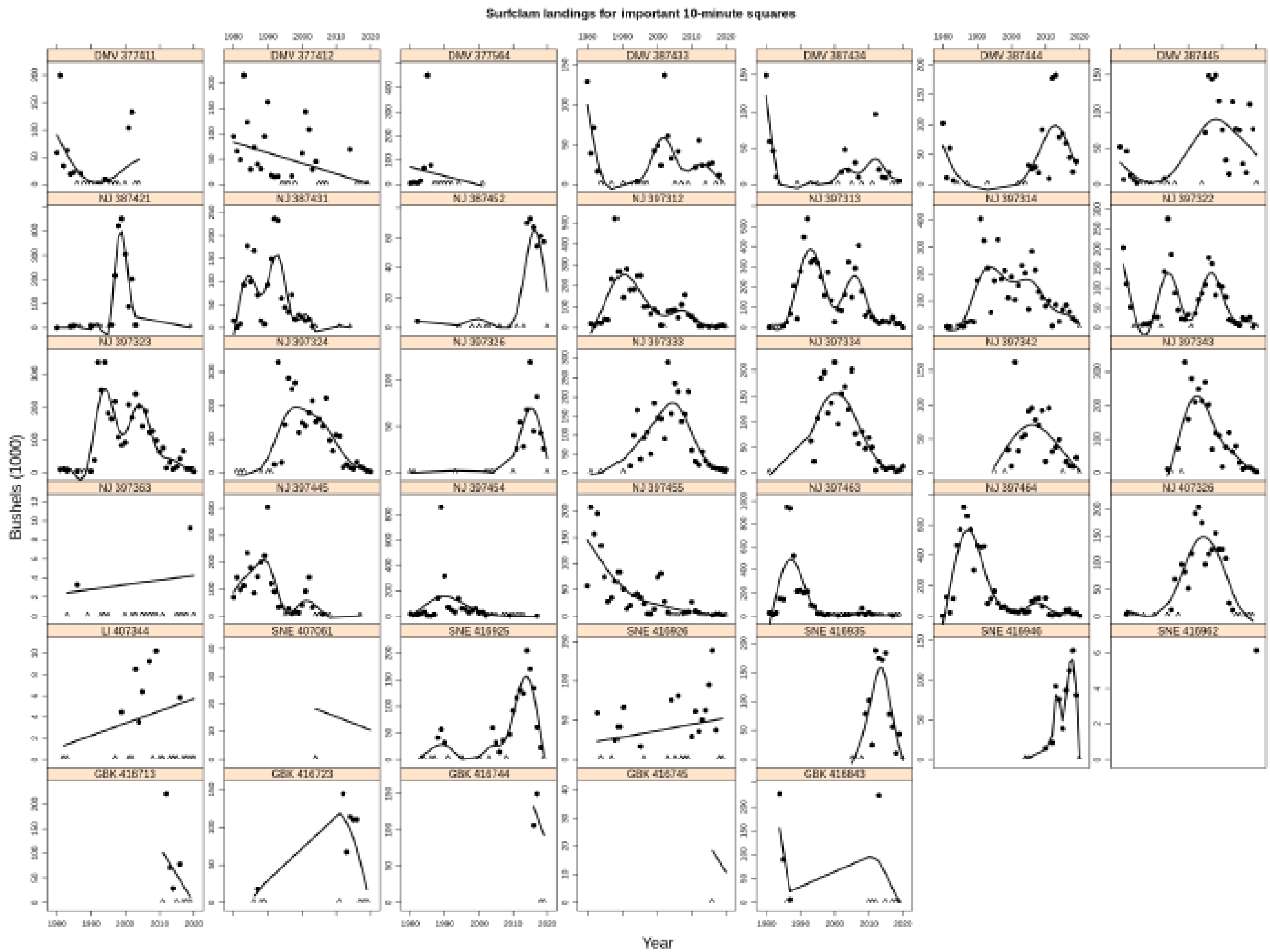

Figure 9. Annual surfclam landings in "important" ten minute squares (TNMS) during 1980-2017 based on logbook data. Important means that a square ranked in the top 10 TNMS for total landings during any five-year period (1980-1984, 1985-1989, ..., 2000-2004, 2005-2009, 2010-2019). Data for 2019 are incomplete 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 too all available data, including data not plotted.[3]

Federal Fleet Profile

The total number of vessels participating in the surfclam fishery has remained relatively stable in the recent decade, with vessels shifting between harvesting surfclam or surfclam and ocean quahog (Table 2). The average ex-vessel price of surflcams reported by processors was $14.37 in 2019, slightly higher than the $14.18 per bushel seen in 2018. The total ex-vessel value of the 2019 federal harvest was approximately $28 million, slightly lower than $30 million in 2018. Industry has described several factors that have affected their industry. Trips harvesting surfclam have increased in length as catch rates have declined. The distribution of LPUE in bushels per hour over time is shown in Figures 7 and 11-12.

Processing Sector

Even though this document describes the surfclam fishery, the information presented in this section regarding the processing sector is for both surfclam and ocean quahog as some of these facilities purchase/process both species.

In 2019, there were 7 companies reporting purchases of surfclam and/or ocean quahog in 5 states outside of Maine. Employment data for these specific firms are not available.

In 2019, these companies bought approximately $28 million worth of surfclam and $19 million worth of ocean quahog.

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 parayltic shellfish poisoning (PSP). PSP is a public health concern for surfclam. PSP is caused by saxitoxins, produced by the alga Alexandrium fundyense (red tide). Surfclam 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 surfclam and ocean quahog beginning January 1, 2013 (77 FR 75057, December 19, 2012) under its authority in 50 CFR 648.76. Harvesting vessels must adhere to the adopted testing protocol from the National Shellfish Sanitation Program.

New England Fishery Management Council's Omnibus Essential Fish Habitat (EFH) Amendment 2 (OHA2) implemented measures that restricted access to the Great South Channel and Georges Shoal Habitat Management Areas. NOAA published a final rule on May 19, 2020 that allows the surfclam fishery to operate hydraulic dredge gear year-round in two small areas (McBlair and Fishing Rip) and seasonally in a third area (Old South) within the Great South Channel Habitat Management Area (HMA). Mussel dredge fishing is also be allowed in these exemption areas. For additional information see: https://www.fisheries.noaa.gov/action/habitat-clam-dredge-exemption-framework.

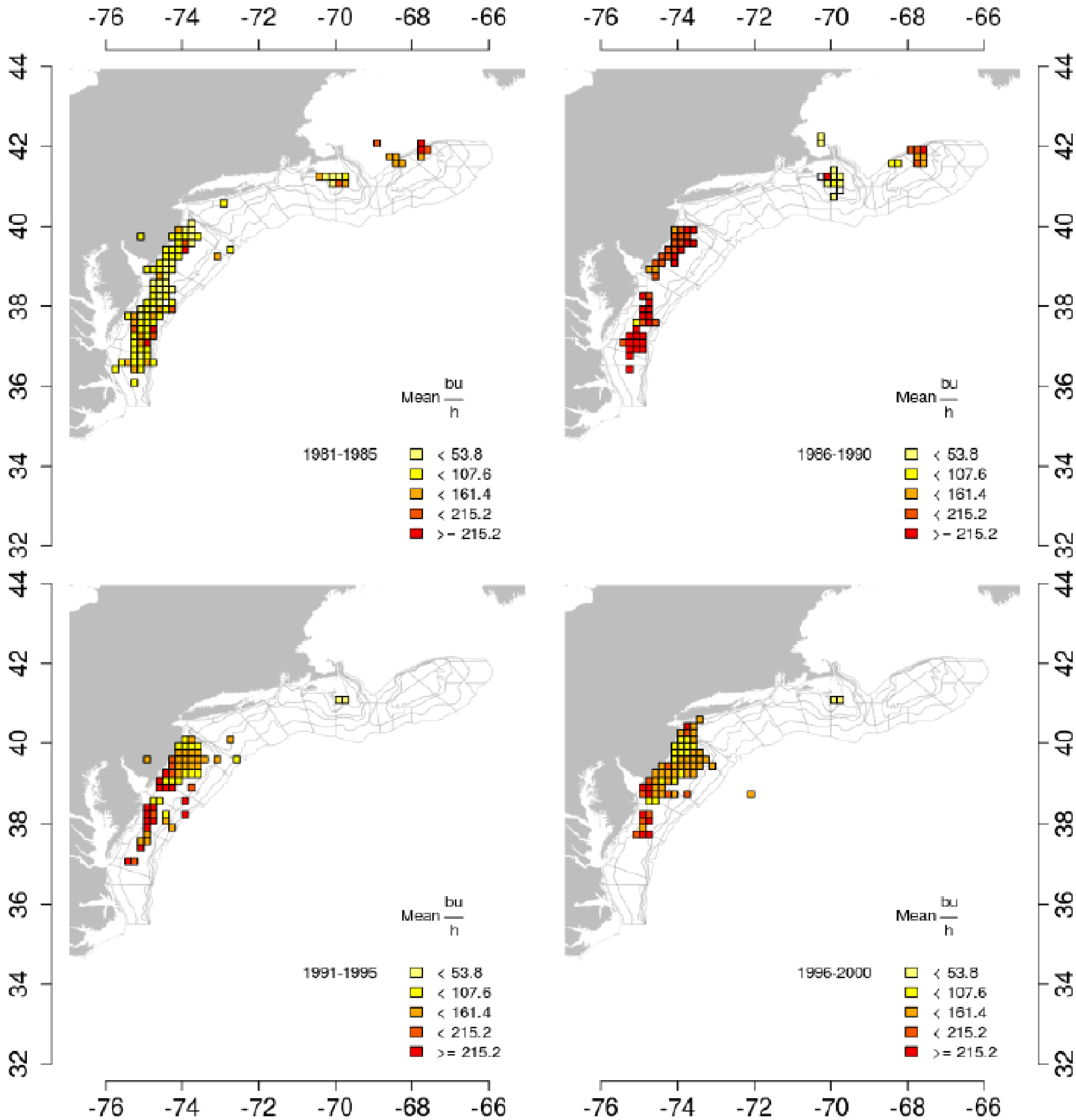

Figure 11. Average surfclam landings per unit effort (LPUE; bu. h^{-1}) by ten-minute squares over time, 1981-2000. Only squares where more the 5 kilo bushels were caught are shown.[3]

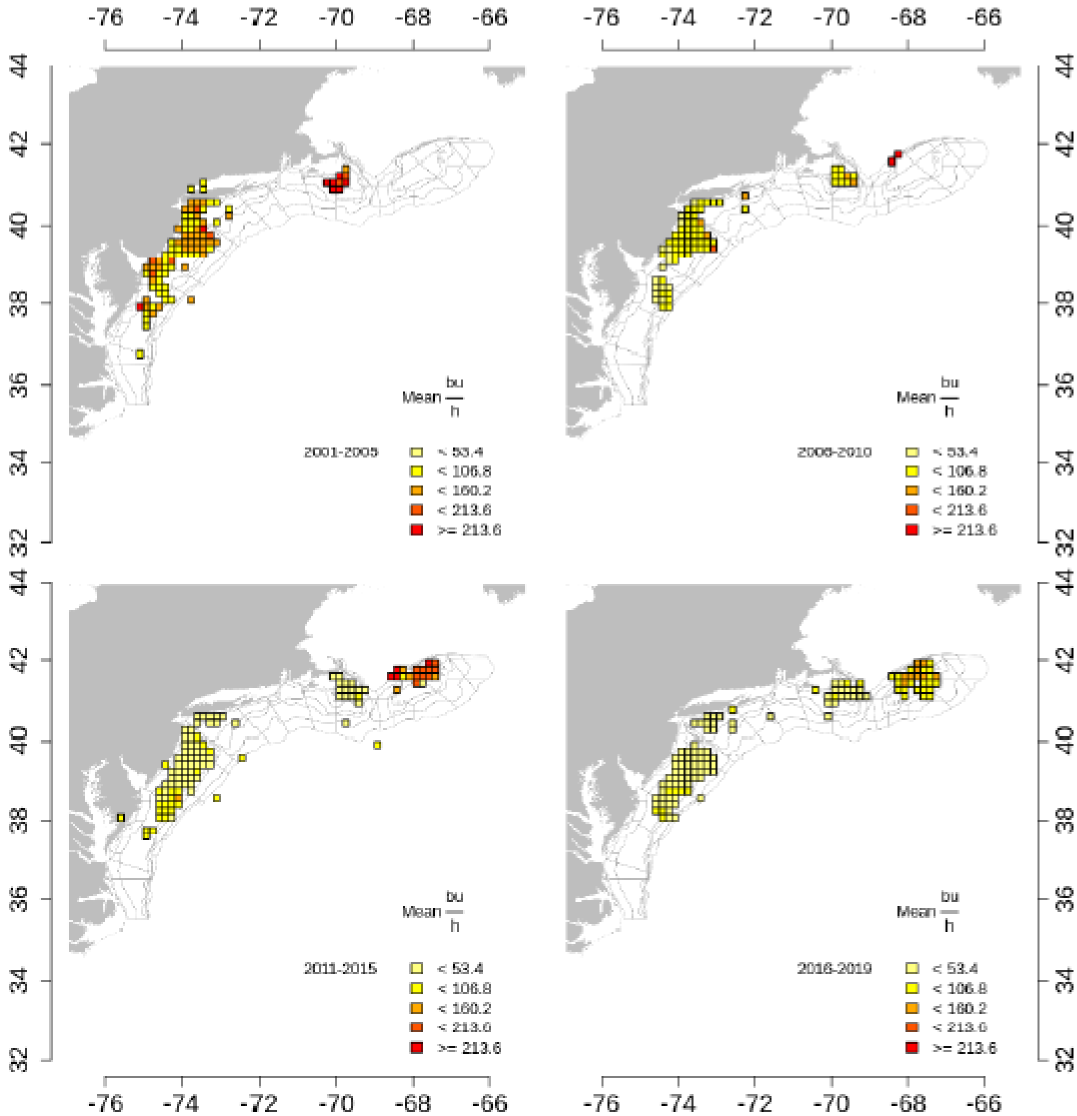

Figure 12. Average surfclam landings per unit effort (LPUE; bu. h-1) by ten-minute squares over time, 2001-2018 and preliminary 2019. Only squares where more the 5 kilo bushels were caught are shown.[3]

Table 2. Federal fleet profile, 2010 through 2019.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Harvesting BOTH surfclam & ocean quahog	12	12	13	7	7	6	8	14	8	7
Harvesting only surfclam	22	24	29	33	31	31	30	26	31	36
Total Vessels	34	36	42	40	38	37	38	40	39	43

Source: NMFS clam vessel logbooks.

References

1. Cargnelli, L., S. Griesbach, D. Packer, and E. Weissberger. 1999. Essential Fish Habitat Source Document: Atlantic Surfclam, *Spisula solidissima*, Life History and Habitat Characteristics. NOAA Tech. Memo. NMFS-NE-142.

2. Northeast Fisheries Science Center. 2016. 61st Northeast Regional Stock Assessment Workshop (61st SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-13; 26 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications.

3. Hennen, Dan. Personal Communication. June 14, 2020. NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

Ocean Quahog Fishery Information Document

July 2020

This Fishery Information Document provides a brief overview of the biology, stock condition, management system, and fishery performance for ocean quahog with an emphasis on 2019. Data sources for Fishery Information Documents are generally from unpublished National Marine Fisheries Service (NMFS) survey, dealer, vessel logbook, and permit databases and should be considered preliminary. For more resources, including previous Fishery Information Documents, please visit http://www.mafmc.org/surfclams-quahogs.

Key Facts

- There has been no change to the status of the ocean quahog stock in 2019. The stock is not overfished and overfishing is not occurring.
- The total ex-vessel value of the 2019 federal harvest was approximately $19 million, lower than the $24 million in 2018.
- In 2019, there were 7 companies reporting purchases of surfclam and/or ocean quahog in 5 states outside of Maine.
- Overall, from 2018 to 2019, there has been a decrease in landings and overall value of the fishery. The numbers of dealers and vessels participating in this surfclam and ocean quahog fisheries has generally remained stable.
- The fishery appears to continue to shift its effort Northward, and has shown increased effort in the Southern New England and Geroges Bank area in recent years.

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).[1] An electronic version is available at the following website: https://www.fisheries.noaa.gov/new-england-mid-atlantic/habitat-conservation/essential-fish-habitat-efh-northeast. Additional information on this species is available at the following website: https://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, quahog occur from Newfoundland to Cape Hatteras from depths of about 8 to 400 meters (26 to 1,312 ft). Ocean quahog further north occur closer to shore. The US stock resource is almost entirely within the Exclusive Economic Zone (EEZ; 3-200 miles from shore), outside of state waters, and at depths between 20 and 80 meters (66 and 262 ft). However, in the northern range, ocean quahog 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 (≤3 miles). Ocean quahog burrow in a variety of substrates and are often associated with fine sand.

Ocean quahog 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 quahog 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 quahog 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 quahog are relatively unproductive and able to support only low levels of fishing. The current resource consists of individuals that accumulated over many decades.

Ocean quahog are suspension feeders on phytoplankton, and use siphons which are extended above the surface of the substrate to pump in water. Predators of ocean quahog 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

The most current assessment of the ocean quahog (*Arctica islandica*) stock is a management track assessment of the existing 2017 benchmark Stock Synthesis (SS) assessment (SAW 63; NEFSC 2017).[2, 3] Based on the previous assessment the stock was not overfished, and overfishing was not occurring. The management track assessment updates commercial fishery catch data, and commercial length composition data, as well as the analytical SS assessment model and reference points through 2019. No new survey data have been collected since the last assessment. Stock projections have been updated through 2026.

Based on this updated assessment, the ocean quahog stock is not overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2019 was estimated to be 3,651 (’000 mt) which is 172.8% of the biomass target ($SSB_{MSY\ proxy}$ = 2,113; Figure 1) [These values were corrected from previous versions]. The 2019 fully selected fishing mortality was estimated to be 0.005 which is 25.5% of the overfishing threshold proxy ($F_{MSY\ proxy}$ = 0.019; Figure 2).

Management System and Fishery Performance

Management

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 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, are available on the Council website at: http://www.mafmc.org.

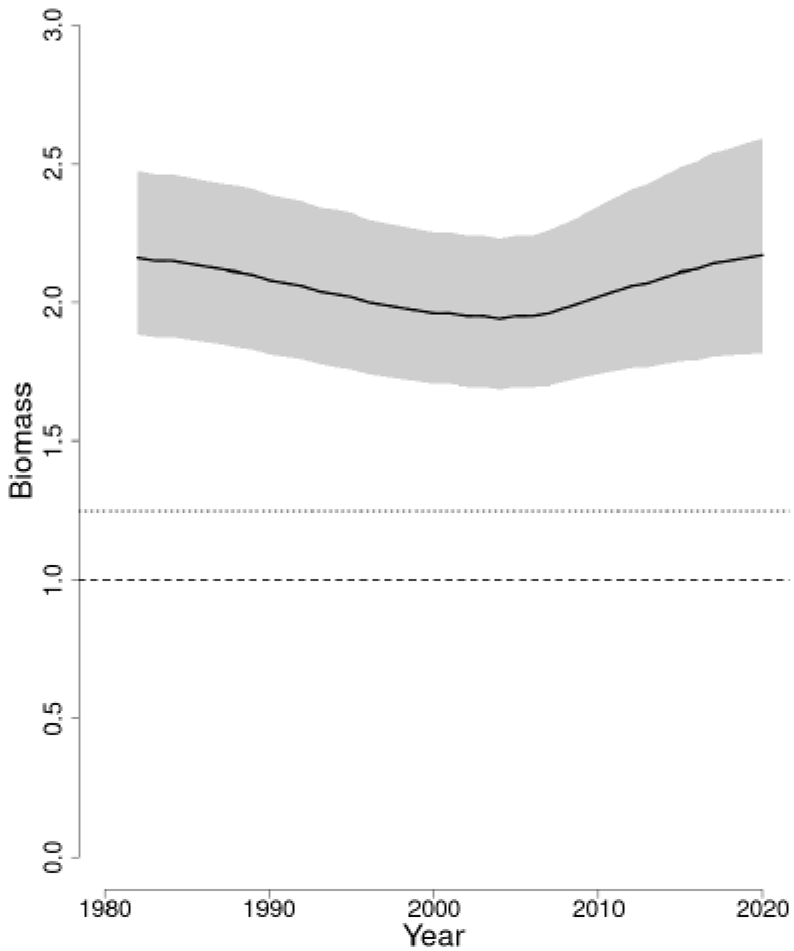

Figure 1. Trends in spawning stock biomass of ocean quahog between 1982 and 2020 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ (horizontal dashed line) as well as SSB_{Target} ($SSB_{MSY\ proxy}$; horizontal dotted line) based on the 2020 assessment. Units of SSB are the ratio of annual biomass to the biomass threshold ($SSB/SSB_{Threshold}$). The approximate 90% lognormal confidence intervals are shown.[3]

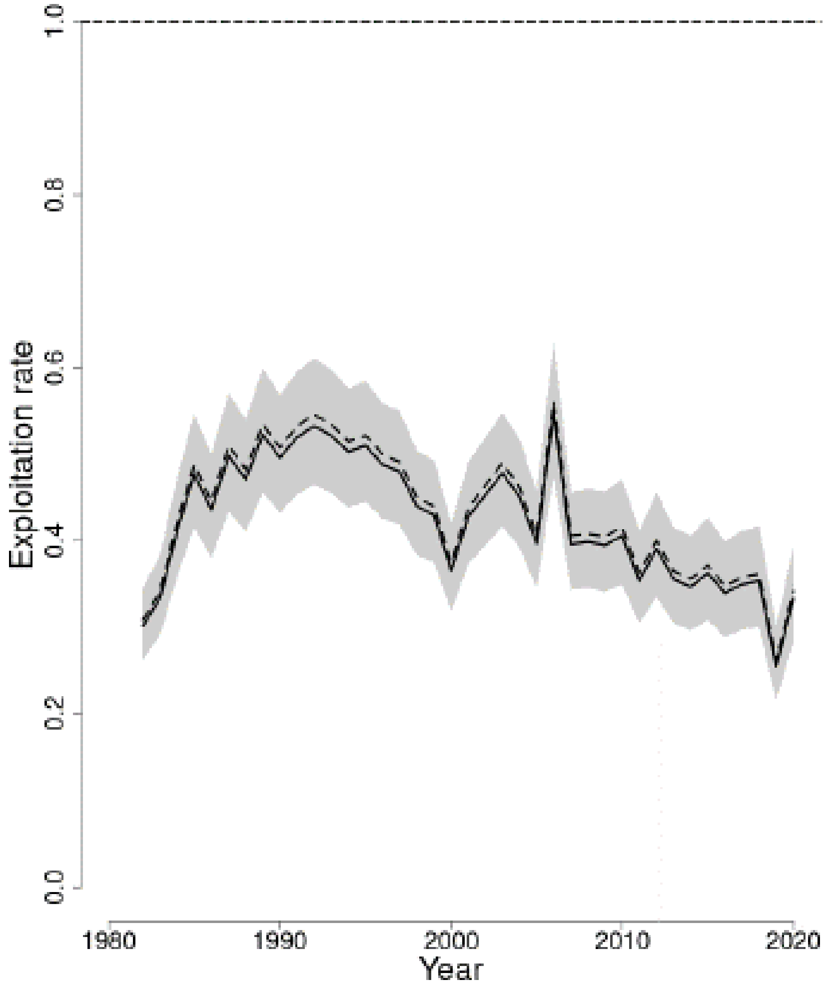

Figure 2. Trends in the fully selected fishing mortality (F_{Full}) of ocean quahog between 1982 and 2020 from the current (solid line) and previous (dashed line)assessment and the corresponding $F_{Threshold}$ ($F_{MSY\ proxy}$=0.019; horizontal dashed line), based on the 2020 assessment. Units of fishing mortality are the ratio of annual F to the F threshold ($F/F_{Threshold}$). The approximate 90% lognormal confidence intervals are shown.[3]

Commercial Fishery

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 quahog for the local fresh, half shell market. Ocean quahog landings and commercial quotas are given below in Table 1 and Figure 3. The areas where ocean quahog are found is shown in Figure 4. The distribution of the fishery has changed over time (Figures 5-8). The bulk of the fishery from 1980-1990 was being prosecuted off the Delmarva but is now being prosecuted in more Northern areas. Surfclam and ocean quahog on Georges Bank were not fished from 1990 to 2008 due to the risk of paralytic shellfish poisoning (PSP). Figure 9 provides the distribution of ocean quahog landings 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, 2010-2019). Data for 2019 are incomplete and preliminary, and included in the last time block. Additional information of the length composition of port sampled ocean quahog, and their associated sample sizes by area, are available in the stock assessment reports and management track assessment provided.[3]

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.

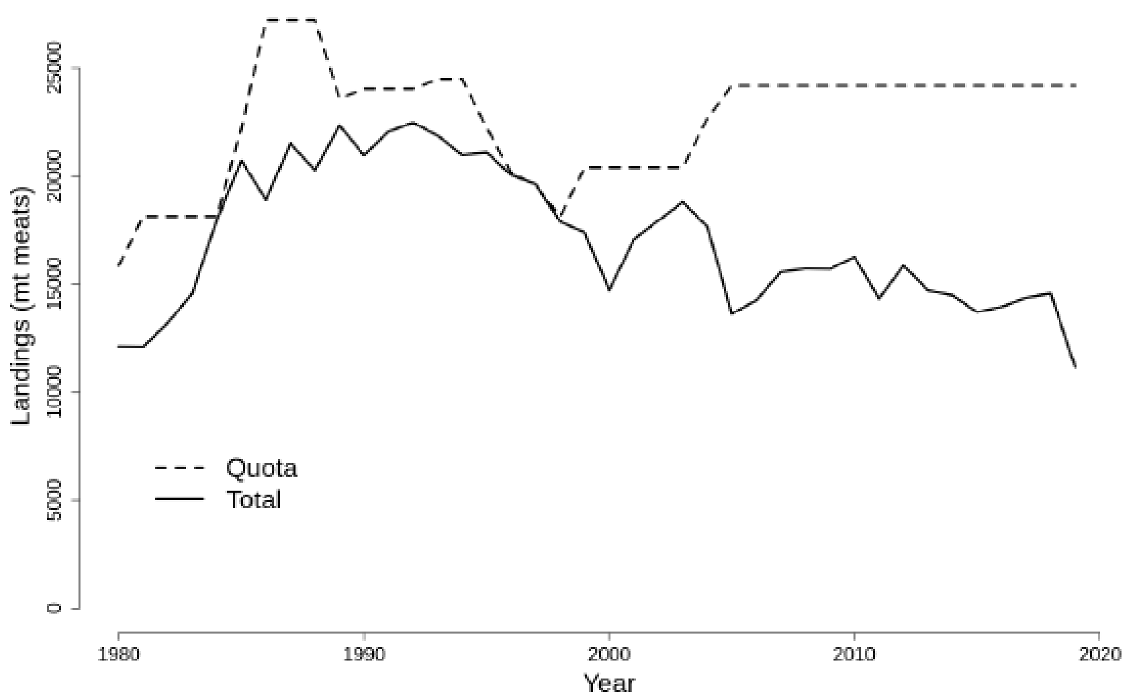

Figure 3. Ocean quahog landings (total and EEZ) during 1965-2018, and preliminary 2019.[3]

Table 1. Federal ocean quahog quotas and landings: 1998-2020. SSC determined OFLs and ABCs included for years specified.

Year	OFL (mt)	ABC/ ACL (mt)	EEZ Landings[a] (mt meats)	EEZ Landings[a,b] ('000 bu)	EEZ Quota ('000 bu; excludes 100,000 ME bu)	% Harvested
1998	NA	NA	17,897	3,946	4,000	99%
1999	NA	NA	17,381	3,832	4,500	85%
2000	NA	NA	14,723	3,246	4,500	72%
2001	NA	NA	17,069	3,763	4,500	84%
2002	NA	NA	17,947	3,957	4,500	88%
2003	NA	NA	18,815	4,148	4,500	92%
2004	NA	NA	17,655	3,892	5,000	78%
2005	NA	NA	13,635	3,006	5,333	56%
2006	NA	NA	14,273	3,147	5,333	59%
2007	NA	NA	15,564	3,431	5,333	64%
2008	NA	NA	15,727	3,467	5,333	65%
2009	NA	NA	15,710	3,463	5,333	65%
2010	NA	NA	16,271	3,587	5,333	67%
2011	34,800	26,100	14,332	3,160	5,333	59%
2012	34,800	26,100	15,864	3,497	5,333	66%
2013	34,800	26,100	14,721	3,245	5,333	61%
2014	Not specified	26,100	14,498	3,196	5,333	60%
2015	Not specified	26,100	13,709	3,022	5,333	56%
2016	Not specified	26,100	13,965	3,079	5,333	58%
2017	Not specified	26,100	14,386	3,172	5,333	59%
2018	61,600	44,695	14,587	3,216	5,333	60%
2019	63,600	46,146	11,160[c]	2,460[c]	5,333	46%
2020	63,100	45,783	NA	NA	5,333	NA

[a] Column excludes Maine Landings which have varied from 70-387 mt per year from 1998-2019 (see assessment for additional details on the Maine fishery). [b] 1 ocean quahog bushel is approximately 10 lb. [c] Preliminary, incomplete 2019 data. Source: NMFS clam vessel logbook reports.

Communities from Maine to Virginia are involved in the harvesting and processing of surfclam and ocean quahog. 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 quahog, which are sold as shellstock for the half-shell market. The other fisheries are industrialized ones for surfclam and ocean quahog, which are hand shucked or steam-shucked and processed into fried, canned, and frozen products.

Additional information on "Snapshots of Human Communities and Fisheries in the Northeast" can be found at: https://www.nefsc.noaa.gov/read/socialsci/communitySnapshots.php.

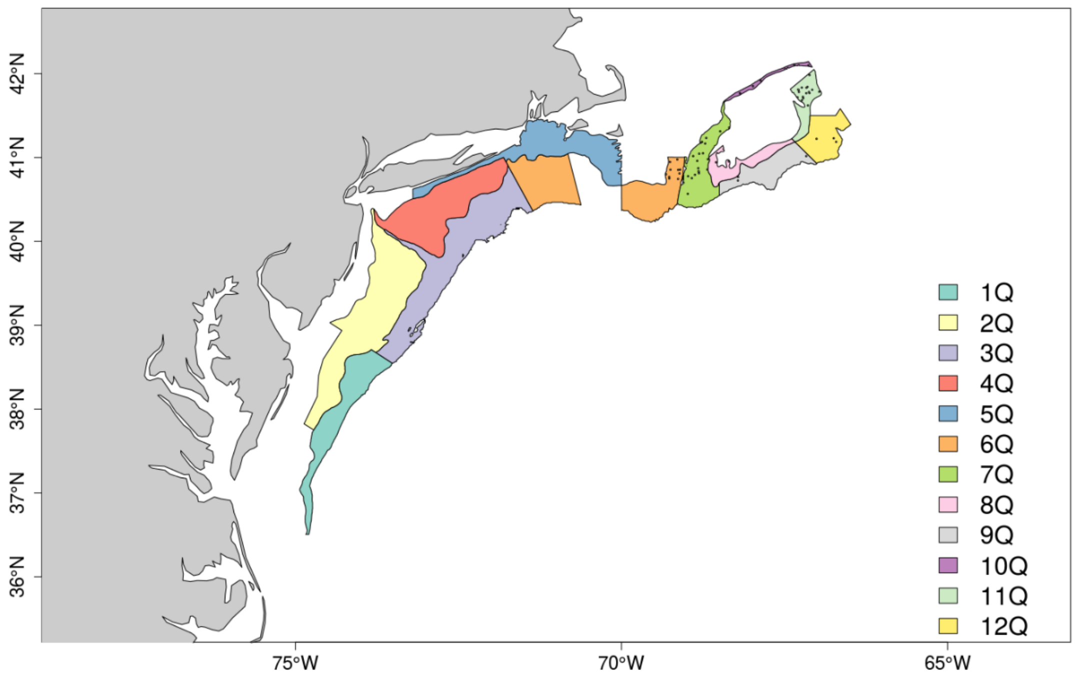

Figure 4. Ocean quahog stock assessment regions and NEFSC shellfish survey strata. The shaded strata are where quahog are found.

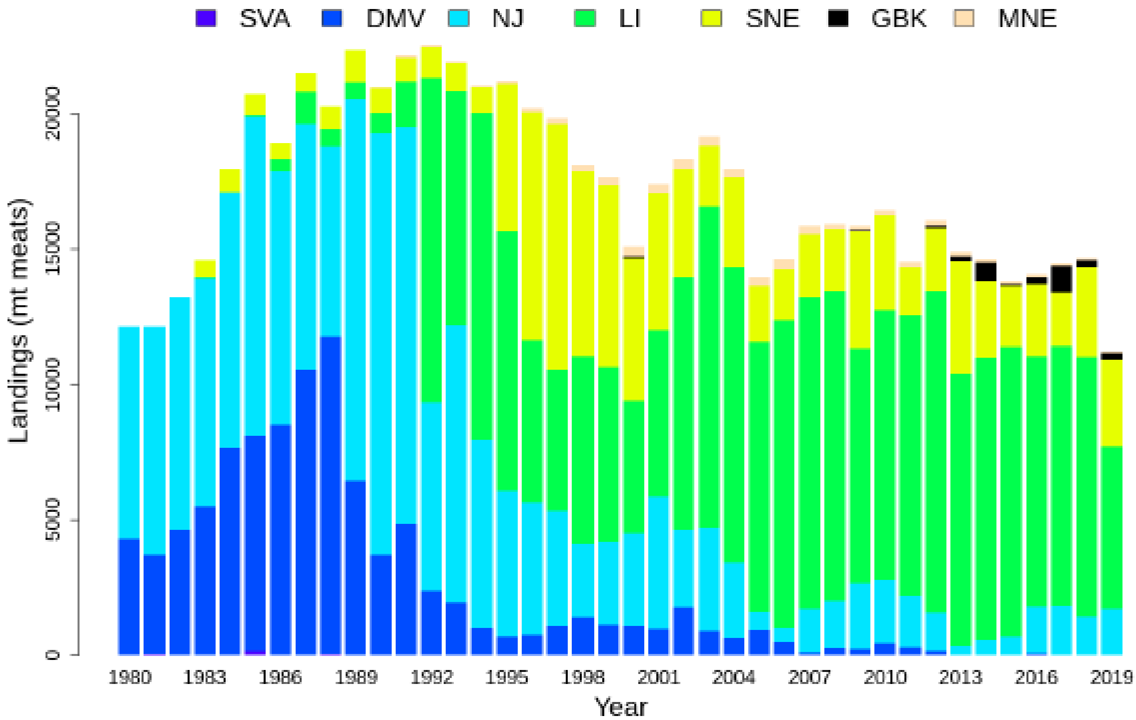

Figure 5. Ocean quahog landings from the US EEZ during 1979-2018, and preliminary 2019.[3]

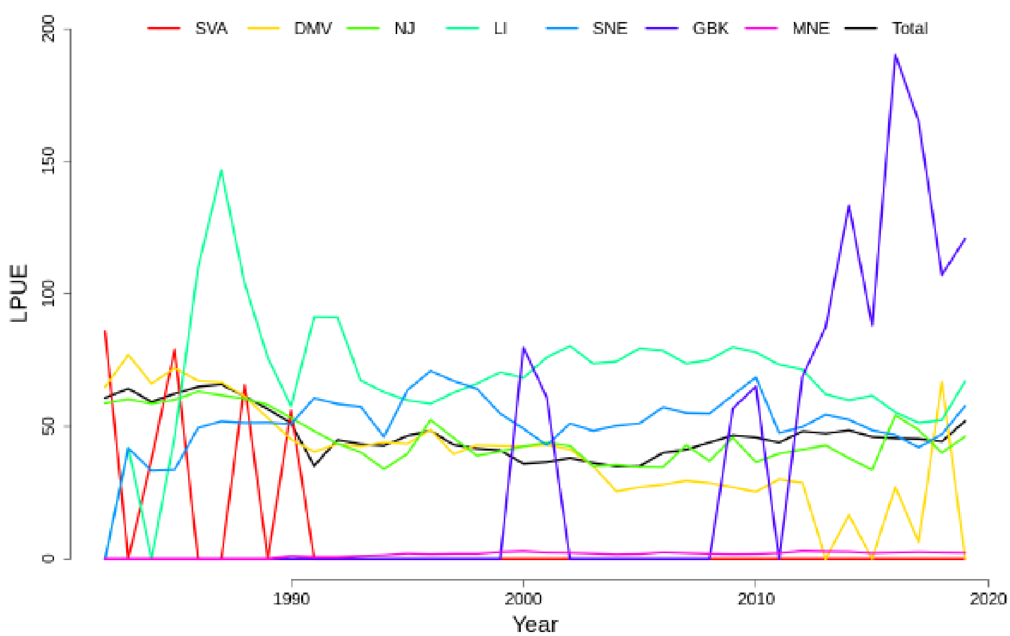

Figure 6. Nominal landings per unit effort (LPUE in bushels landed per hour fished) for ocean quahog, by region, during 1981-2018, and preliminary 2019. LPUE is total landings in bushels divided by total fishing effort.[3]

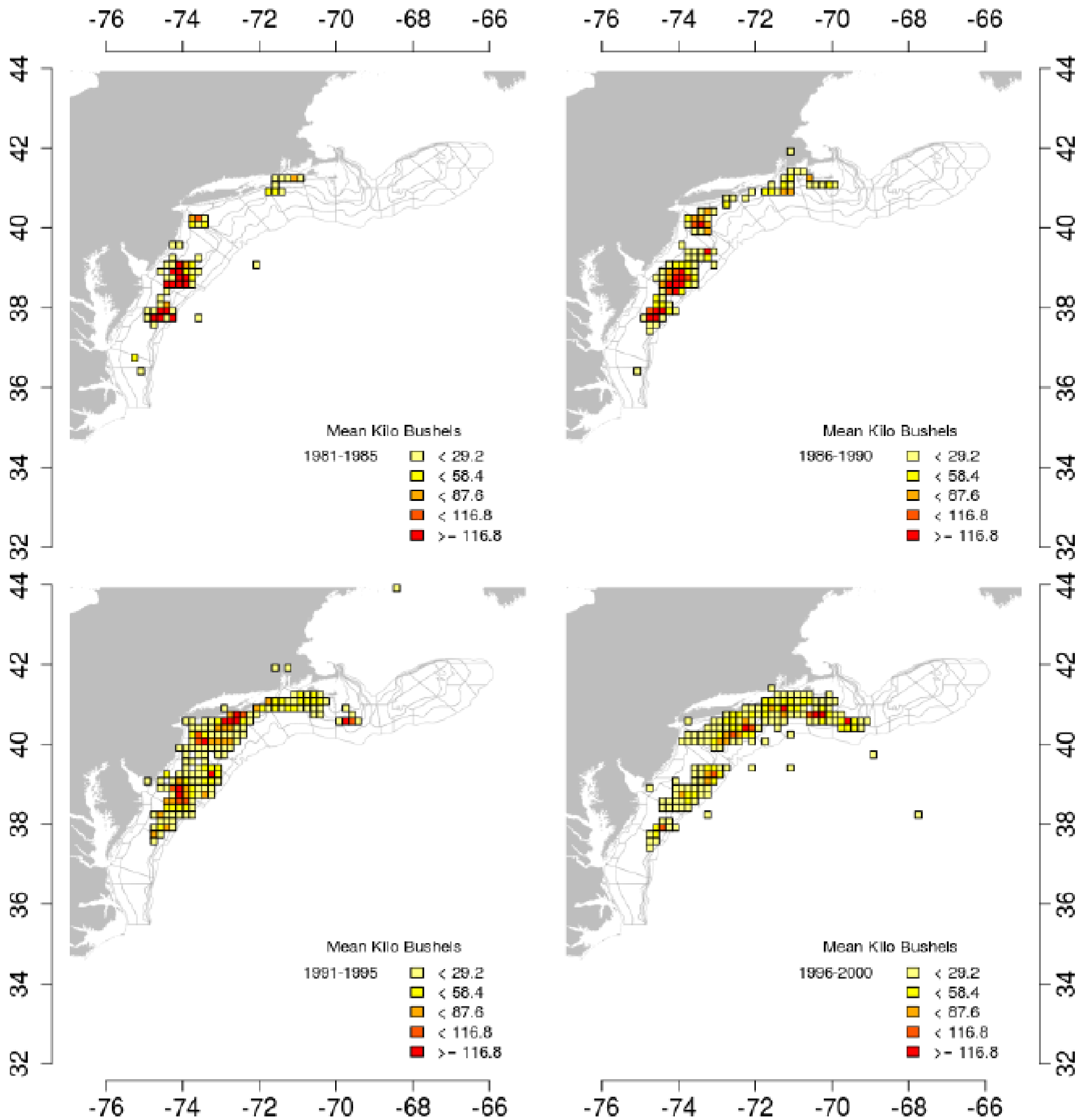

Figure 7. Average ocean quahog landings by ten-minute squares over time, 1981-2000. Only squares where more the 5 kilo bushels were caught are shown.[3]

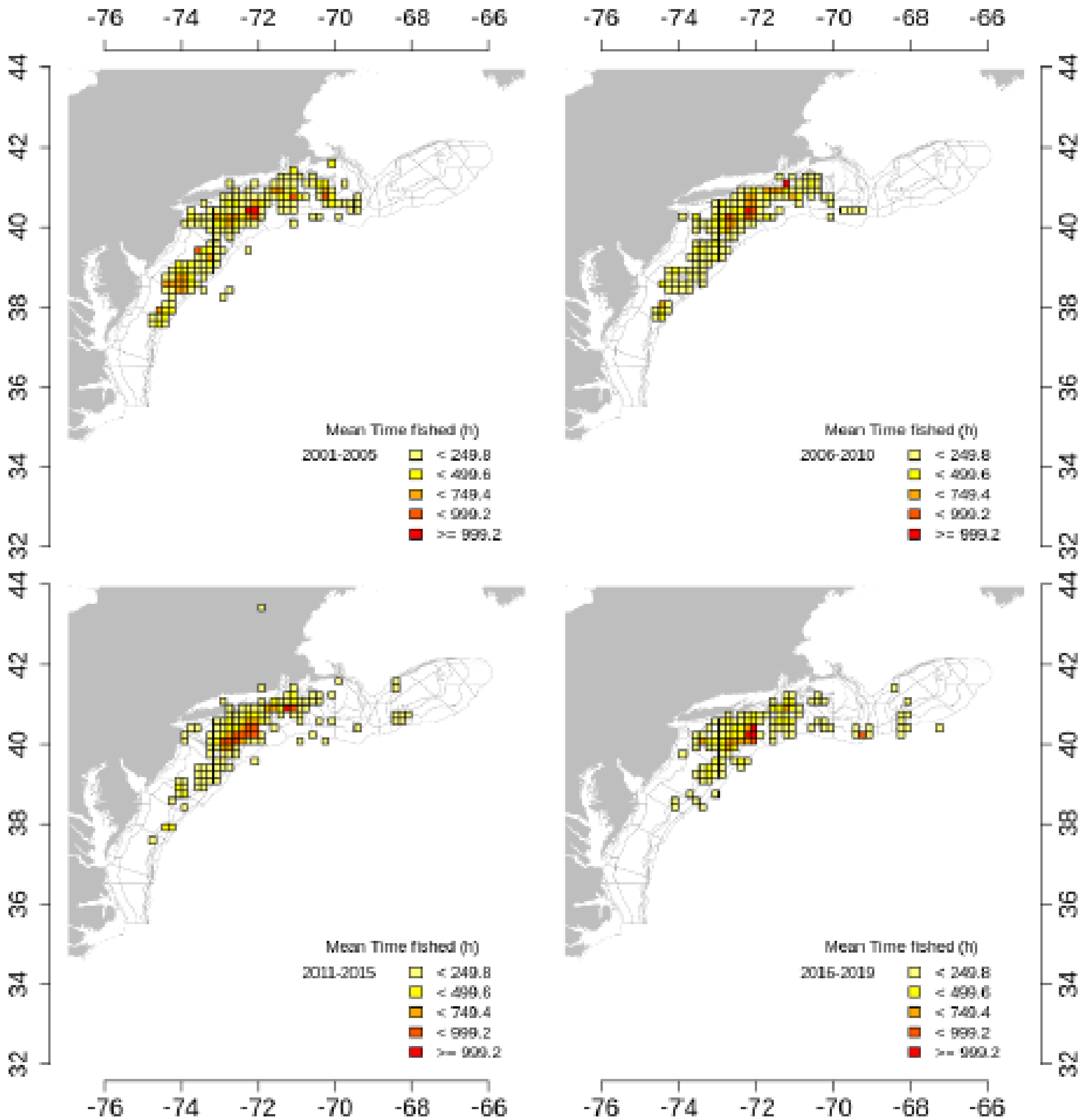

Figure 8. Average ocean quahog landings by ten-minute squares over time, 2001-2017, and preliminary 2018. Only squares where more the 5 kilo bushels were caught are shown.[3]

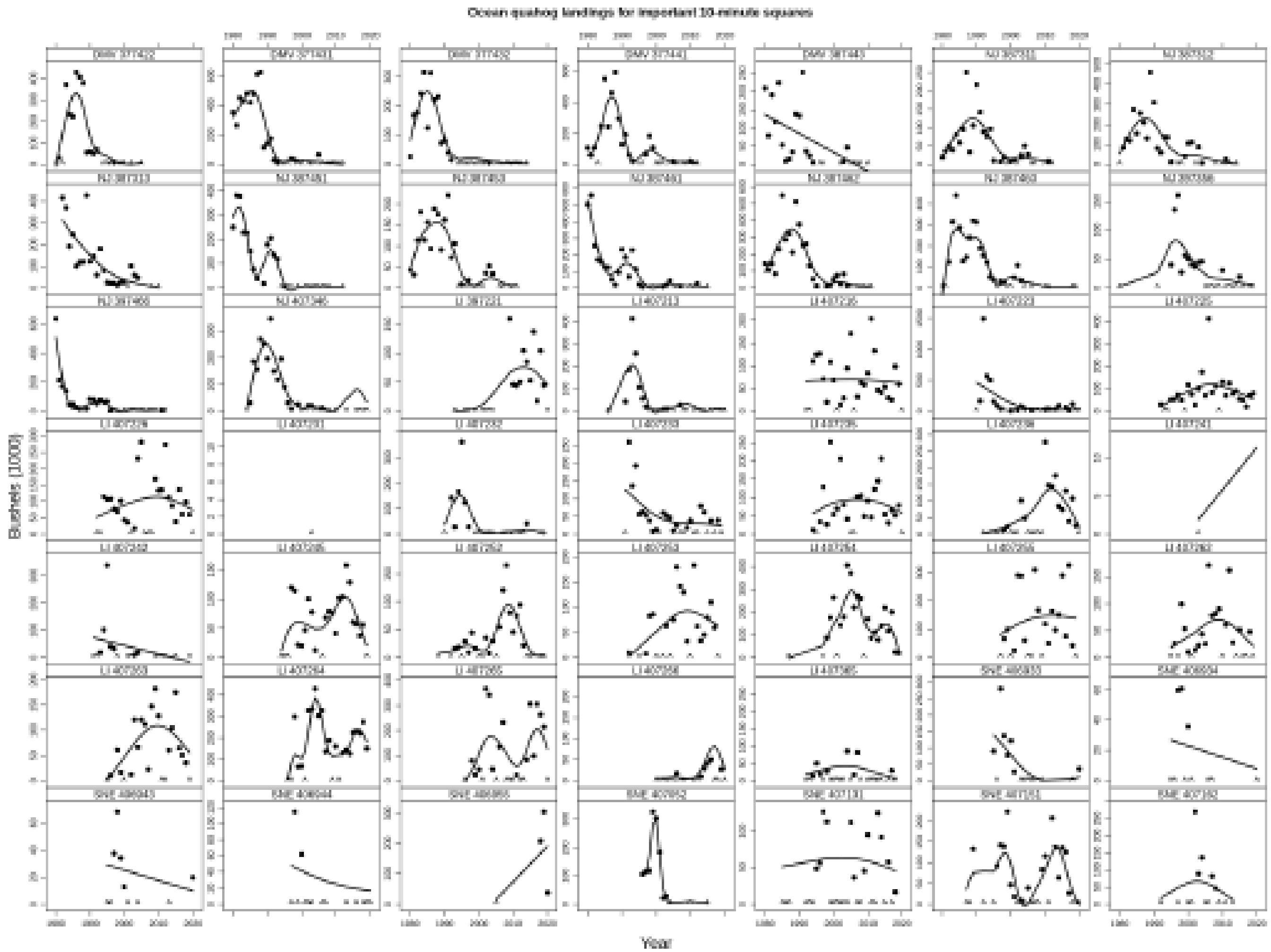

Figure 9. Annual ocean quahog landings in "important" ten minute squares (TNMS) during 1980-2017 based on logbook data. Important means that a square ranked in the top 10 TNMS for total landings during any five-year period (1980-1984, 1985-1989, ..., 2000-2004, 2005-2009, 2010-2018). Data for 2019 are 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 too all available data, including data not plotted.[3]

Federal Fleet Profile

The total number of vessels targeting ocean quahog has remained about the same in recent years; with 21 vessels in 2010 increasing to 22 in 2017, then declining to 15 in 2019 (Table 2). The distribution of LPUE in bushels per hour over time for the non-Maine fishery is shown in Figures 6 and 10-11.

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 6 vessels in 2019 (Table 2). The average ex-vessel price of non-Maine ocean quahog reported by processors in 2019 was $7.86 per bushel, slightly higher than the 2018 price ($7.53 per bushel). In 2019, about 2.5 million bushels of non-Maine ocean quahog were landed, a decline from 3.2 million bushels in 2018. The total ex-vessel value of the 2019 federal harvest outside of Maine was approximately $19 million, lower than the $24 million in 2018. In 2019, the Maine ocean quahog fleet harvested a total of 23,397 Maine bushels, a 81% decrease from the 124,839 bushels harvested in 2006, and a 21% decrease from the prior year (2018; 29,447 bushels). Average prices for Maine ocean quahog had declined substantially over time but have recently show an increasing trend. 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. In 2019, the mean price was $38.24 per Maine bushel. The value of the 2019 harvest reported by the purchasing dealers totaled $0.89 million.

Processing Sector

Even though this document describes the ocean quahog fishery, the information presented in this section regarding the processing sector is for both surfclam and ocean quahog as some of these facilities purchase/process both species.

In 2019, there were 7 companies reporting purchases of surfclam and/or ocean quahog in 5 states outside of Maine. Employment data for these specific firms are not available.

In 2019, these companies bought approximately $28 million worth of surfclam and $19 million worth of ocean quahog.

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 surfclam. PSP is caused by saxitoxins, produced by the alga Alexandrium fundyense (red tide). Surfclam 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 surfclam and ocean quahog beginning January 1, 2013 (77 FR 75057, December 19, 2012) under its authority in 50 CFR 648.76. Harvesting vessels must adhere to the adopted testing protocol from the National Shellfish Sanitation Program.

New England Fishery Management Council's Omnibus Essential Fish Habitat (EFH) Amendment 2 (OHA2) implemented measures that restricted access to the Great South Channel and Georges Shoal Habitat Management Areas. NOAA published a final rule on May 19, 2020 that allows the surfclam fishery to operate hydraulic dredge gear year-round in two small areas (McBlair and Fishing Rip) and seasonally in a third area (Old South) within the Great South Channel Habitat Management Area (HMA). Mussel dredge fishing is also be allowed in these exemption areas. For additional information see: https://www.fisheries.noaa.gov/action/habitat-clam-dredge-exemption-framework.

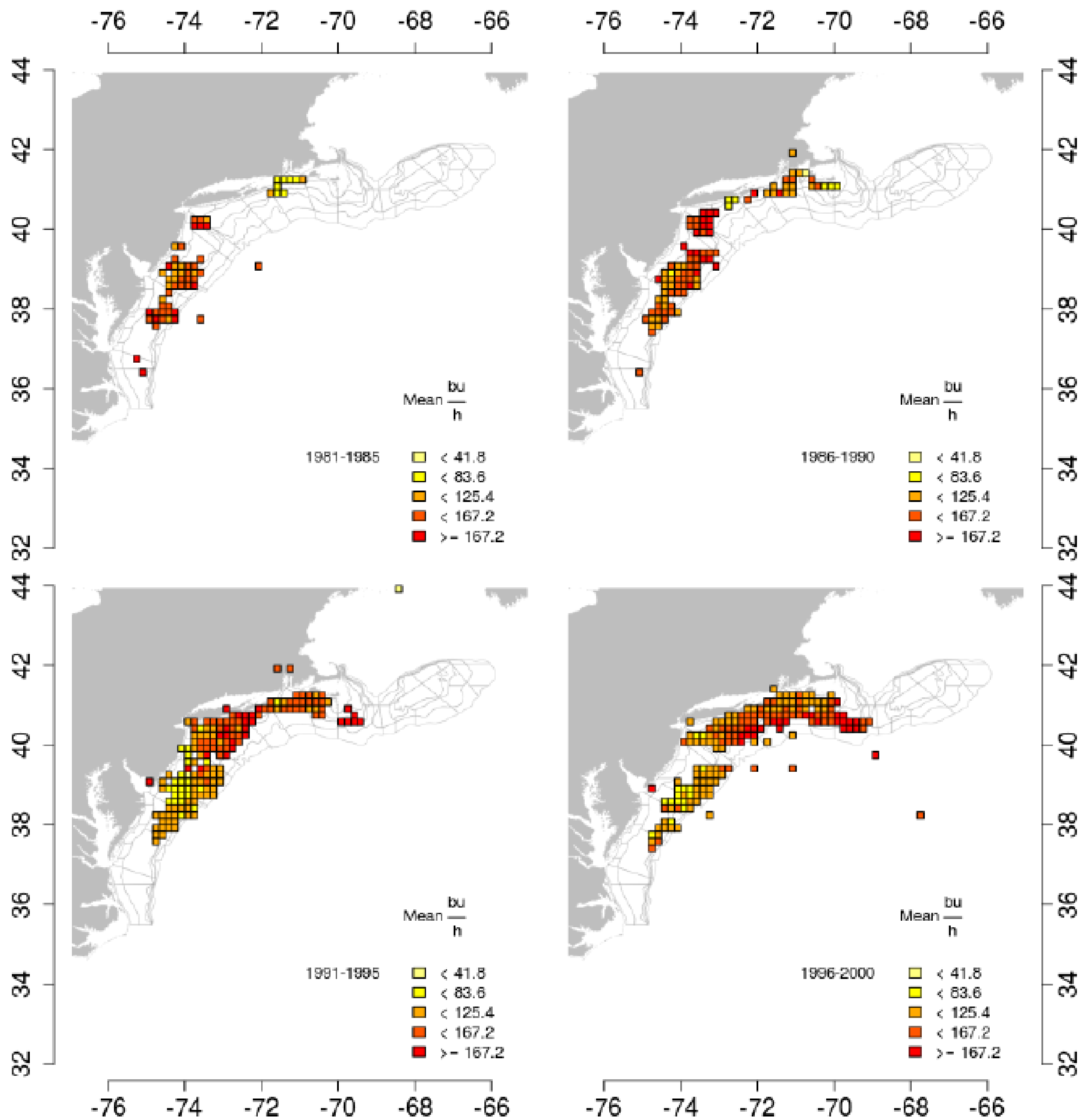

Figure 10. Average ocean quahog landings per unit effort (LPUE; bu. h^{-1}) by ten-minute squares over time, 1981-2000. Only squares where more the 5 kilo bushels were caught are shown.[3]

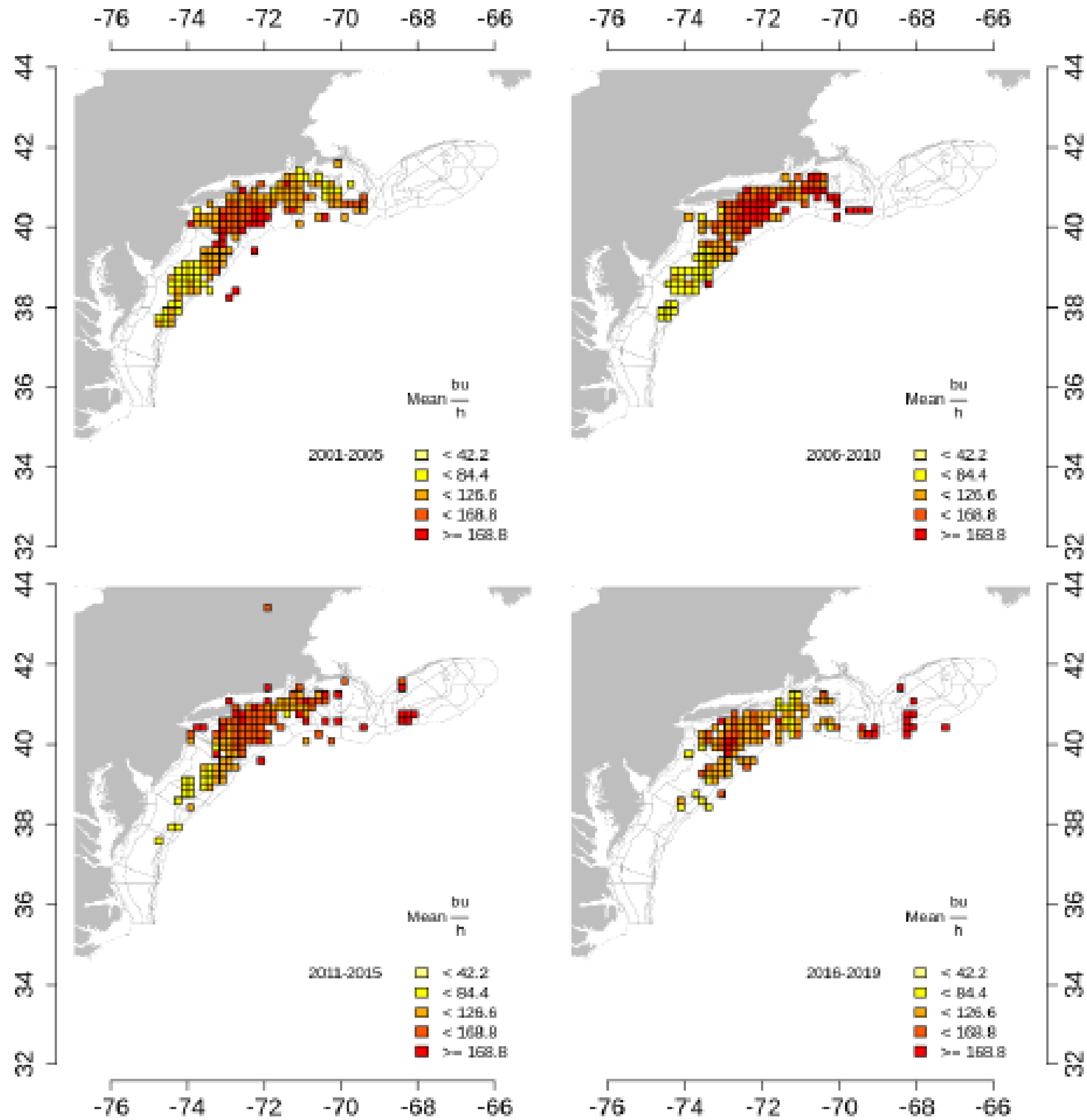

Figure 11. Average ocean quahog landings per unit effort (LPUE; bu. h-1) by ten-minute squares over time, 2001-2018 and preliminary 2019. Only squares where more the 5 kilo bushels were caught are shown.[3]

Table 2. Federal fleet profile, 2010 through 2019.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Non-Maine Vessels Harvesting BOTH surfclam & ocean quahog	12	12	13	7	7	6	8	14	8	7
Non-Maine Vessels Harvesting only ocean quahog	9	7	6	9	9	10	9	8	8	8
Total Non-Maine Vessels	21	19	19	16	16	16	17	22	16	15
Maine Ocean Quahog Vessels	15	13	12	11	9	8	8	8	8	6

Source: NMFS clam vessel logbooks.

References

1. 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.

2. Fisheries Science Center. 2017. 63rd Northeast Regional Stock Assessment Workshop (63rd SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-09; 28 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications.

3. Hennen, Dan. Personal Communication. June 14, 2020. NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

draft working paper for peer review only

Atlantic surfclam

2020 Assessment Update Report

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

Compiled May 2020

This assessment of the Atlantic surfclam (Spissula solidissima) stock is a management track assessment of the existing 2016 benchmark Stock Synthesis (SS) assessment (NEFSC 2017). Based on the previous assessment the stock was not overfished, and overfishing was not occurring. This assessment updates commercial fishery catch data, research survey indices of abundance, commercial length composition, survey length composition and conditional age at length data as well as the analytical SS assessment model and reference points through 2019. Stock projections have been updated through 2026

State of Stock: Based on this updated assessment, the Atlantic surfclam (*Spissula solidissima*) stock is not overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2019 was estimated to be 1,222 ('000 mt) which is 119% of the biomass target (SSB_{MSY} *proxy* = 1,027; Figure 1). The 2019 fully selected fishing mortality was estimated to be 0.036 which is 25.8% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.141; Figure 2).

Table 1: Catch and status table for Atlantic surfclam. All data weights are in (mt) model results are ratios relative to reference points. Model results are from the current SS assessment.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
					Data					
Landings South	16,672	16,452	14,408	14,148	14,992	15,014	13,502	12,083	12,307	11,728
Landings North	1,311	2,387	3,646	4,403	3,236	4,104	4,837	4,819	3,962	3,245
Discards South	9	4	0	3	2	79	42	21	130	0
Discards North	1	1	0	1	0	22	15	8	42	0
Catch for Assessment	17,992	18,844	18,054	18,555	18,230	19,219	18,396	16,932	16,441	14,973
					Model Results					
$\frac{SSB}{SSB_{Threshold}}$	2.49	2.44	2.42	2.44	2.47	2.49	2.48	2.46	2.44	2.38
$\frac{F}{F_{Threshold}}$	0.246	0.273	0.272	0.287	0.293	0.308	0.293	0.271	0.273	0.258
$\frac{R}{R_0}$	1.155	1.217	0.961	0.78	1.105	0.808	0.784	0.583	0.793	0.991

Table 2: Comparison of reference points estimated in an earlier assessment and from the current assessment update. An F_{MSY} proxy was used for the overfishing threshold and was based on a simulation study and scaled to the current assessment.

	2016	2020
F_{MSY} *proxy*	0.019	0.141 (0.087 - 0.222)
SSB_{MSY} ('000 mt)	2688	1027 (583 - 1470)
MSY ('000 mt)	92	252
Overfishing	No	No
Overfished	No	No

Projections: Short term projections of biomass were derived by assumming average recruitment in each forecast year. Growth was assummed to be equal to the growth in the final year of each area. Fishery selectivity for each fleet, and maturity ogive were constant over time for each area. Three projection scenarios were developed for use in management: status quo, which sets annual catch in each forecast year equal to the average catch over the last five years in each area; quota in which the current quota is caught each year and the proportions taken from each area are equal to the average proportions removed from each area over the last five years, and finally, OFL in which the catch is equal to the OFL applied to the terminal biomass in each area. These projections are available in the document entitled 'AtlanticSurfclamUpdateMT2020...pdf' and found on the SASINF

Table 3: Short term projections of total fishery catch and spawning stock biomass for Atlantic surfclam based on a harvest scenario of fishing at F_{MSY} *proxy* between 2020 and 2026.

Year	Catch (mt)	SSB ('000 mt)	$\frac{F}{F_{Threshold}}$
2020	55337	1124	1.02

Year	Catch (mt)	SSB ('000 mt)	$\frac{F}{F_{Threshold}}$
2021	51361	1069	1.02
2022	48202	1039	1.02
2023	45959	1026	1.02
2024	44629	1019	1.02
2025	44048	1018	1.02
2026	43886	1021	1.02

Special Comments:

- What are the most important sources of uncertainty in this stock assessment? Explain, and describe qualitatively how they affect the assessment results (such as estimates of biomass, F, recruitment, and population projections).

  The scale of abundance has been uncertain in all previous Atlantic surfclam assessments. In past assessments scale uncertainty was driven by the combination of an uncertain survey abundance index in the northern area and the fact that the stock is lightly fished. Both factors have been mitigated by recent changes and scale is better defined in this assessment. Improvements to the NEFSC clam survey, additional data and increased fishing pressure have reduced uncertainty in the survey abundance estimates in the northern area.

  Survey indices in the northern area appear to have responded to fishing pressure. Swept area abundance estimates have gone down by approximately the amount removed by the fishery over the saame time period. This represents the first time Atlantic surfclam indices have responded to fishing. Percieved fishing mortality has therefore changed, which influences the overall assessment in several important ways. Scale is difficult to determine in low F fisheries, a problem that has plaugued the Atlantic surfclam assessment for many years. Increased fishing pressure has led to increased precision of both fishing mortality and biomass estimates in north since the last assessment. Uncertainty in scale for the whole stock has therfore decreased. It should be noted however, that the improved NEFSC clam survey has run for only one season in each area. The benefits to the assessment described *here accrue in part because of restratification, which may induce spatial biases as past surveys were not conducted under the current stratification. Additional survey years using the new stratification will be important in bearing out, or reducing confidence in, the current model outputs.*

Estimates of recruitment remain uncertain as the survey and commercial gear does not select for younger animals. Uncertainty in recruitment is relatively unimportant in this stock due to species longevity, and relatively low fishing mortality overall.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}).

  Retrospective adjustments to F are not appropriate for this stock because the reference points are based on trend rather than scale and adjusting the terminal estimate of F would require adjusting the reference point as well. Furthermore a seven year Mohn's ρ cannot be calculated because there are no observations of the MCD survey in the north before 2013. Therefore components of the model relevant to that survey cannot be estimated. Future assessments of Atlantic surfclam could provide a seven year Mohn's ρ calculation, but unless the F reference point is changed to more traditional values, retrospective adjustments do not make sense. Retrospective adjustments to biomass based on a 6 year Mohn's ρ are possible, but not warranted in this case as the retrospective pattern in SSB is minor (see the document entitled 'AtlanticSurfclamUpdateMT2020...pdf' at SASINF for more discussion of retrospective patterns).

- Based on this stock assessment, are population projections well determined or uncertain? If this stock is in a rebuilding plan, how do the projections compare to the rebuilding schedule?

  Population projections for Atlantic surfclam, are reasonably well determined and projected biomass from the last assessment was within the confidence bounds of the biomass estimated in the current assessment. This stock was not in a rebuilding plan.

- Describe any changes that were made to the current stock assessment, beyond incorporating additional years of data and the effect these changes had on the assessment and stock status.

  Several changes were made to the Atlantic surfclam assessment for this update. The most significant of these was the shift from two models with one area each, to one model with two areas. Other important changes were the inclusion of time varying growth in the southern area, and allowing the model to estimate selectivity parameters. Time varying growth was modeled as a trend in the average maximum size as well as a trend in the Von Bertalanffy K parameter. The assessment model estimated most of the selectivity parameters for both commercial and survey fleets in this update, where previously they were fixed. These changes are discussed in more detail the section 'Build a Bridge' in the document entitled 'AtlanticSurfclamUpdateMT2020...pdf' and found at SASINF.

- If the stock status has changed a lot since the previous assessment, explain why this occurred.

  Stock status did not change. Perception of abundance in the northern area, however, has changed. At one time abundance in the northern area was believed to be about equal to abundance in the south. Currently, abundance in the northern area appears low and there is no evidence of strong recruitment in recent years. Early survey data from the northern area is not fit well by the model, but is likely to be of relatively low quality. Therefore the unfished *abundance in the northern area is probably not well described. Abundance in the northern area may never have been very high compared to the abundance in the southern area.*

One consequence of the perception of lower biomass in the north is that fishing mortality there appears to be higher. This in turn affects the F trend for the whole stock and thus the estimate of the F reference point.

- Provide qualitative statements describing the condition of the stock that relate to stock status.

  The Atlantic surfclam stock remains lightly fished and at relatively high abundance in the southern area. The scale of the abundance agrees closely with the swept area abundance estimates for each area (see the section 'Plan B Assessment' in the document entitled 'AtlanticSurfclamUpdateMT2020...pdf' at SASINF.

- Indicate what data or studies are currently lacking and which would be needed most to improve this stock assessment in the future.

  While the overall abundance of Atlantic surfclam remains at or above it's target abundance, the clam industry may be concerned about declining catch rates as the remaining dense aggregations of Atlantic surfclam are fished down. If reduced density makes the Atlantic surfclam fishery economically non-viable, the fishery could contract or even collapse without the stock ever being overfished or experiencing overfishing. Some management on smaller spatial scales, with the objective of maintaining dense aggregations, may be waranted, and should probably be investigated.

- Are there other important issues?

  Atlantic surfclam mature very quickly (<2 years) and are not selected by commercial gear until they are 5 to 7 years old. A traditional F_{MSY} reference point will therefore be nearly infinite. A trend based alternative has been used here, and in the previous assessment, but the methods for deriving it should perhaps be revisited given the changes in growth in the southern area. Previous assumptions regarding growth under warming conditions (faster growth to a smaller maximum size) may not be correct. The model estimated here shows a reduced Von Bertalanffy K parameter, as well as a reduced average maximum size over time in the southern area. This would be consistent with slower growth to a smaller maximum size. There is new research supporting this hypothesis. Pousse et al (in review) studied Atlantic surfclam and ocean acidification and their results indicate that scope for growth is likely to be much lower under OA conditions. In addition, the current low stock size in the northern area may provide a basis for estimating the steepness parameter of the stock recruitment relationship in Atlantic surfclam, which has not previously been possible due to the lack of any observed low stock abundance condition. A new management strategy evaluation of Atlantic surfclam may be warranted.

References:

Northeast Fisheries Science Center. 2016. In: 61^{st} Northeast Regional Stock Assessment Workshop (61^{st} SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-13; 26 p. http://www.nefsc.noaa.gov/publications/

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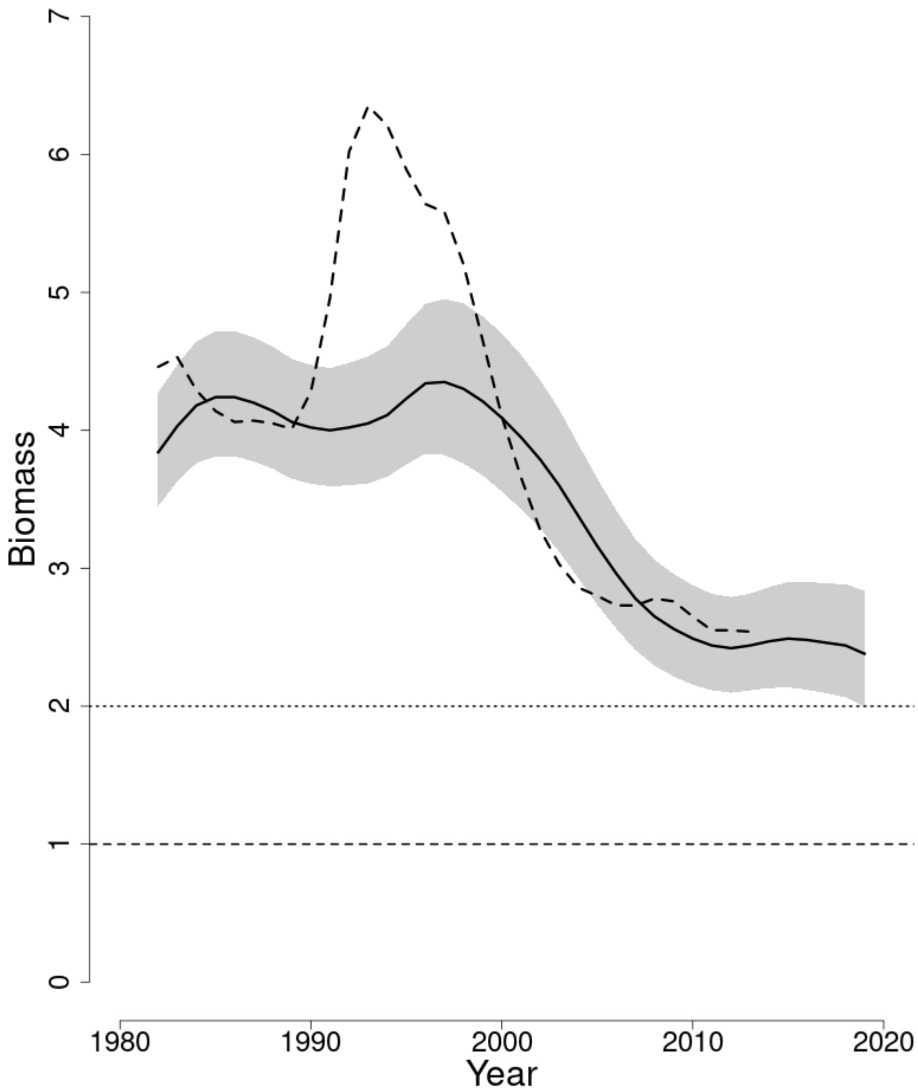

Figure 1: Trends in spawning stock biomass of Atlantic surfclam between 1982 and 2019 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2020 assessment. Units of SSB are the ratio of annual biomass to the biomass threshold ($\frac{SSB}{SSB_{Threshold}}$). The approximate 90% lognormal confidence intervals are shown.

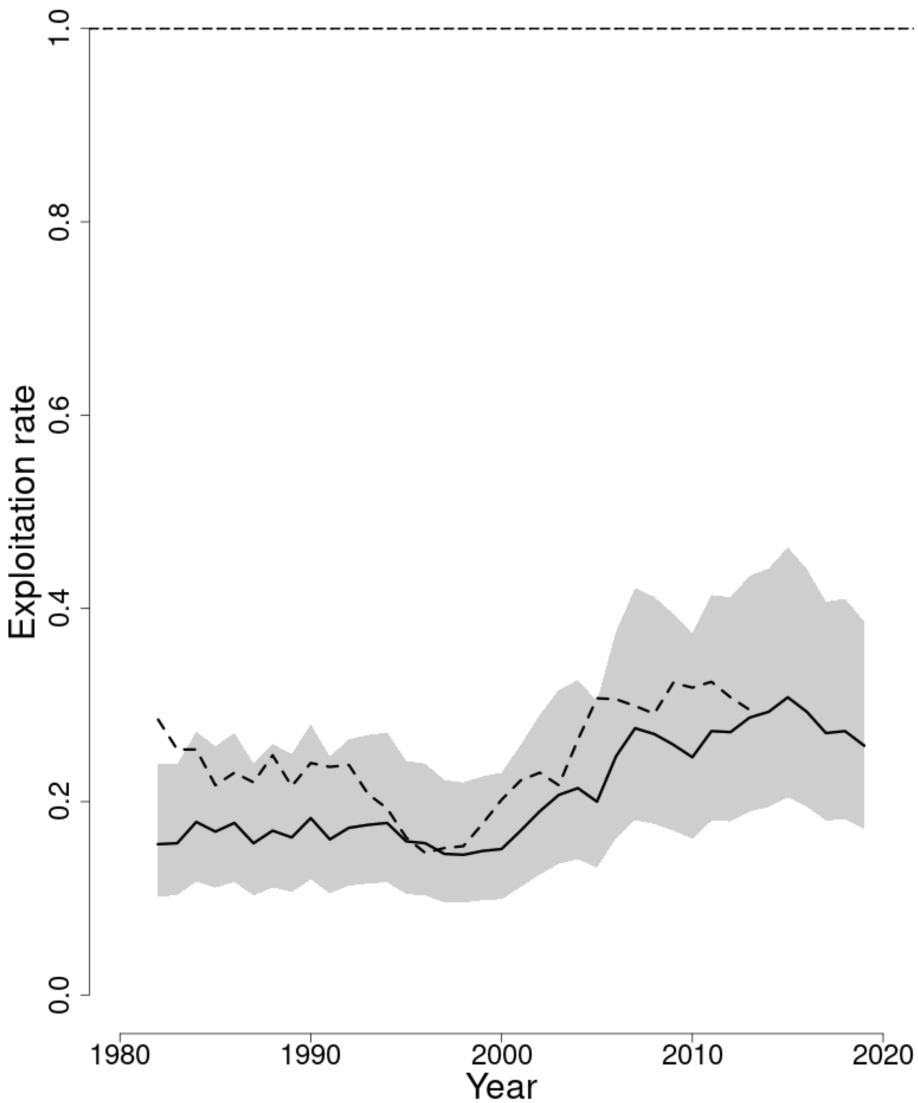

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of Atlantic surfclam between 1982 and 2019 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.141; horizontal dashed line), based on the 2020 assessment. Units of fishing mortality are the ratio of annual F to the F threshold ($\frac{F}{F_{Threshold}}$). The approximate 90% lognormal confidence intervals are shown.

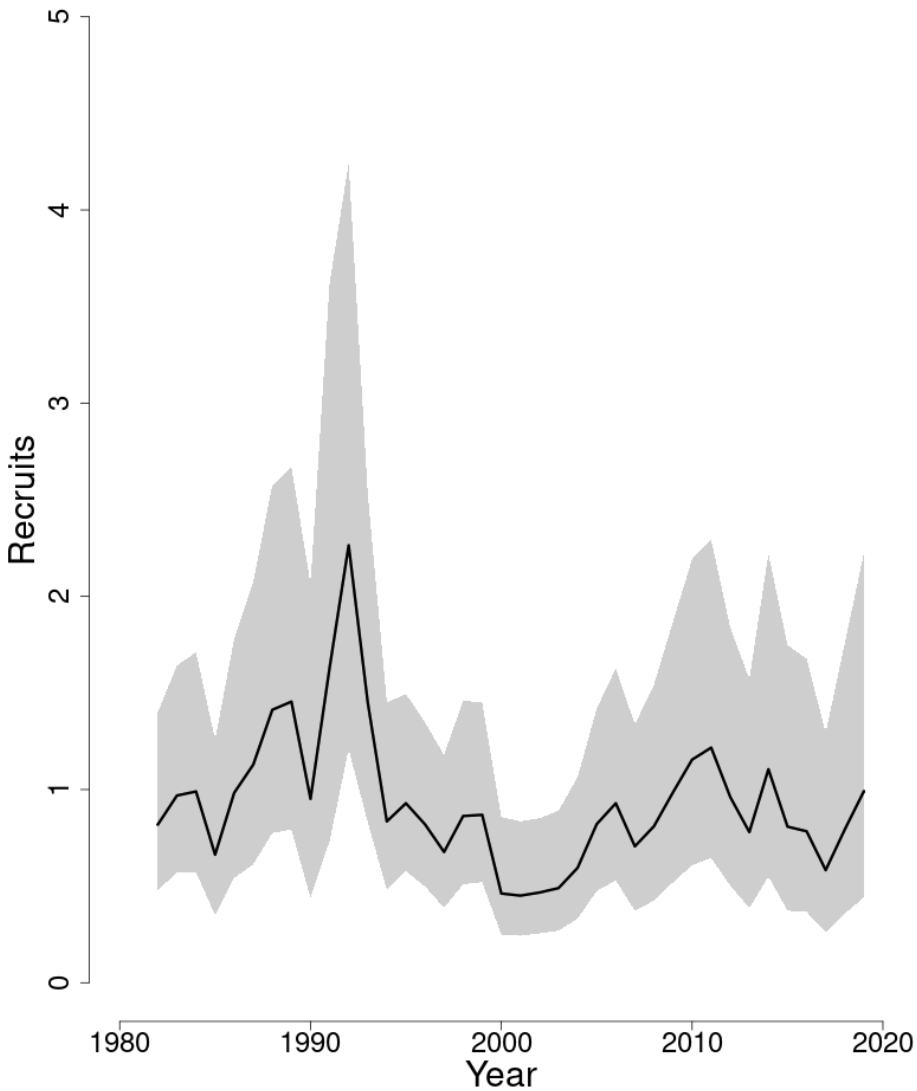

Figure 3: Trends in $\frac{R}{R_0}$ of Atlantic surfclam between 1982 and 2019 from the current (solid line) and previous (dashed line) assessment. Units of recruitment are the ratio of annual R to the unfished R ($\frac{R}{R_0}$). The approximate 90% lognormal confidence intervals are shown.

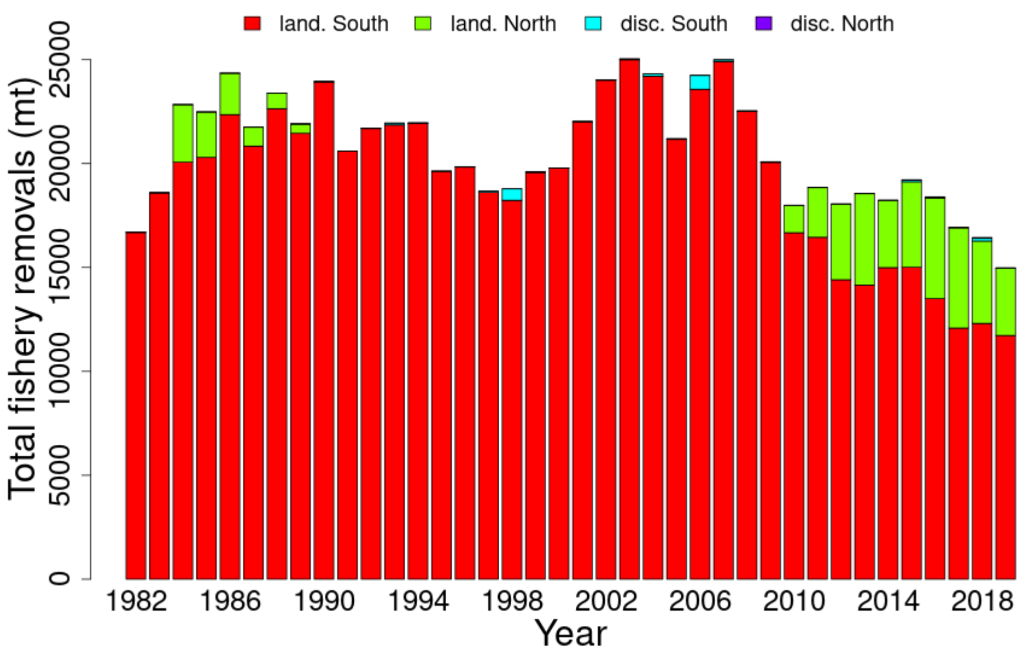

Figure 4: Total catch of Atlantic surfclam between 1982 and 2019 by fleet and disposition (landings and discards).

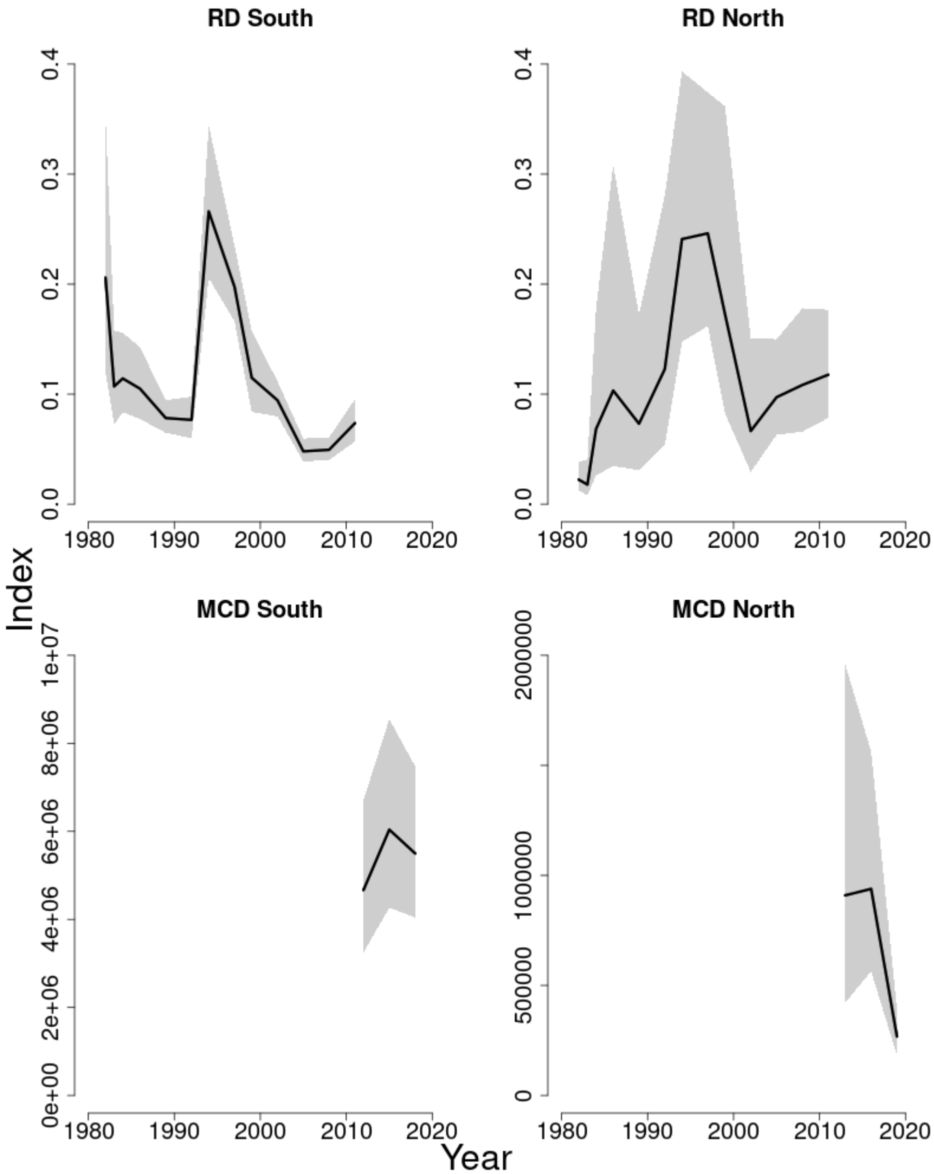

Figure 5: Indices of biomass for the Atlantic surfclam between 1982 and 2019 for the Northeast Fisheries Science Center (NEFSC) clam surveys in the north and south. The RD survey units are weight per tow (kg) and the MCD survey units are swept area numbers (n). The approximate 90% lognormal confidence intervals are shown.

draft working paper for peer review only

Ocean quahog

2020 Assessment Update Report

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

Compiled July 2020

This assessment of the ocean quahog (Arctica islandica) stock is a management track assessment of the existing 2017 benchmark Stock Synthesis (SS) assessment (NEFSC 2017). Based on the previous assessment the stock was not overfished, and overfishing was not occurring. This assessment updates commercial fishery catch data, and commercial length composition data, as well as the analytical SS assessment model and reference points through 2019. No new survey data have been collected since the last assessment. Stock projections have been updated through 2026

State of Stock: Based on this updated assessment the, ocean quahog (*Arctica islandica*) stock is not overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2019 was estimated to be 3,651 ('000 mt) which is 172.8% of the biomass target (SSB_{MSY} *proxy* = 2,113; Figure 1). The 2019 fully selected fishing mortality was estimated to be 0.005 which is 25.5% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.019; Figure 2).

Table 1: Catch and status table for ocean quahog. All data weights are in (mt) model results are ratios relative to reference points. Model results are from the current SS assessment.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
					Data					
Landings South	16,257	14,332	15,757	14,555	13,817	13,629	13,689	13,406	14,328	10,928
Landings North	13	0	106	166	681	81	276	980	258	232
Discards South	5	7	104	5	2	1,682	566	623	795	0
Discards North	0	0	1	0	0	10	11	46	14	0
Catch for Assessment	16,275	14,339	15,968	14,726	14,500	15,402	14,542	15,055	15,396	11,160
					Model Results					
Spawning Stock Biomass	2.02	2.04	2.06	2.07	2.09	2.11	2.12	2.14	2.15	2.16
F_{Full}	0.406	0.354	0.391	0.356	0.347	0.363	0.34	0.35	0.354	0.255
Recruits (age 3)	0.995	0.997	0.997	0.997	0.997	0.998	0.998	0.998	0.998	0.998

Table 2: Comparison of reference points estimated in an earlier assessment and from the current assessment update. An F_{MSY} proxy was used for the overfishing threshold and was based on a simulation study and scaled to the current assessment.

	2017	2020
F_{MSY} *proxy*	0.019	0.019 (0.011 - 0.032)
SSB_{MSY} ('000 mt)	2,014	2,113 (1,754 - 2,473)
MSY ('000 mt)	73	77
Overfishing	No	No
Overfished	No	No

Projections: Short term projections of biomass were derived by assumming average recruitment in each forecast year. Growth, fishery selectivity, and maturity ogive, were constant over time for each area and used in projection. Three projection scenarios were developed for use in management: status quo, which sets annual catch in each forecast year equal to the average catch over the last five years in each area; quota in which the current quota is caught each year and the proportions taken from each area are equal to the average proportions removed from each area over the last five years, and finally, OFL in which the catch is equal to the OFL applied to the terminal biomass in each area. These projections are available in the document entitled 'OceanQuahogUpdateMT2020...pdf' and found on the SASINF

Table 3: Short term projections of total fishery catch and spawning stock biomass for ocean quahog based on a harvest scenario of fishing at F_{MSY} *proxy* between 2020 and 2026.

Year	Catch (mt)	SSB ('000 mt)	F_{Full}
2020	44893	3694	1.02

Year	Catch (mt)	SSB ('000 mt)	F_{Full}
2021	44961	3686	1.02
2022	45001	3675	1.02
2023	45012	3664	1.02
2024	44994	3650	1.02
2025	44948	3636	1.02
2026	44875	3620	1.02

Special Comments:

- What are the most important sources of uncertainty in this stock assessment? Explain, and describe qualitatively how they affect the assessment results (such as estimates of biomass, F, recruitment, and population projections).

  Scale has been uncertain in all previous ocean quahog assessments. Scale uncertainty is driven by the the fact that the stock is lightly fished. Survey indices generally do not respond to contrast in fishing intensity and the model has difficulty deciding on scale once there are enough animals to make fishing an unimportant driver of total mortality. Additionally, the NEFSC clam survey did not survey the northern area very well in the early part of the time series. Evidence for this includes relatively low precision and improbably large changes in abundance for a very long lived species that was not being fished at the time. Recent changes to the NEFSC clam survey have improved performance of the survey and the assessment for Atlantic surfclam. Scale is expected to be better defined in future assessments once new ocean quahog survey data are collected.

  Estimates of recruitment remain uncertain as the survey gear does not select well for younger animals. Uncertainty in recruitment is relatively unimportant in this stock due to their longevity and low fishing mortality.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}).

  No retrospective adjustment of spawning stock biomass or fishing mortality in 2019 was *required. The 7-year Mohn's ρ, relative to SSB, was 0.008 in 2019. The 7-year Mohn's ρ, relative to F, was -0.038 in 2019.*

- Based on this stock assessment, are population projections well determined or uncertain? If this stock is in a rebuilding plan, how do the projections compare to the rebuilding schedule?
  Population projections for ocean quahog, are reasonably well determined and projected biomass from the last assessment was within the confidence bounds of the biomass estimated in the current assessment. This stock was not in a rebuilding plan.

- Describe any changes that were made to the current stock assessment, beyond incorporating additional years of data and the effect these changes had on the assessment and stock status.
  No changes were made to the ocean quahog assessment for this update beyond updating to the latest version of Stock Sythesis. No new survey data was available, but the NEFSC clam survey was re-stratified see the section 'Build a Bridge' in 'OceanQuahogUpdateMT2020...pdf' found on the SASINF.

- If the stock status has changed a lot since the previous assessment, explain why this occurred.
  Stock status did not change. Without any new survey data since the last assessment, there was very little change of any kind.

- Provide qualitative statements describing the condition of the stock that relate to stock status.
  The assessment shows that the ocean quahog stock remains lightly fished and at relatively high abundance. Empirical estimates of abundance and exploitation rate support assessment results - see the section entitled 'Plan B assessment' in 'OceanQuahogUpdateMT2020...pdf' found on the SASINF.

- Indicate what data or studies are currently lacking and which would be needed most to improve this stock assessment in the future.
  There is little age data for ocean quahog available due to the high cost of aging. Therefore growth changes over time are relatively poorly known. Additional work on age and growth would be useful.

- Are there other important issues?
  No.

References:

Northeast Fisheries Science Center. 2017. In: 63^{rd} Northeast Regional Stock Assessment Workshop (63^{rd} SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-10; 409 p. http://www.nefsc.noaa.gov/publications/

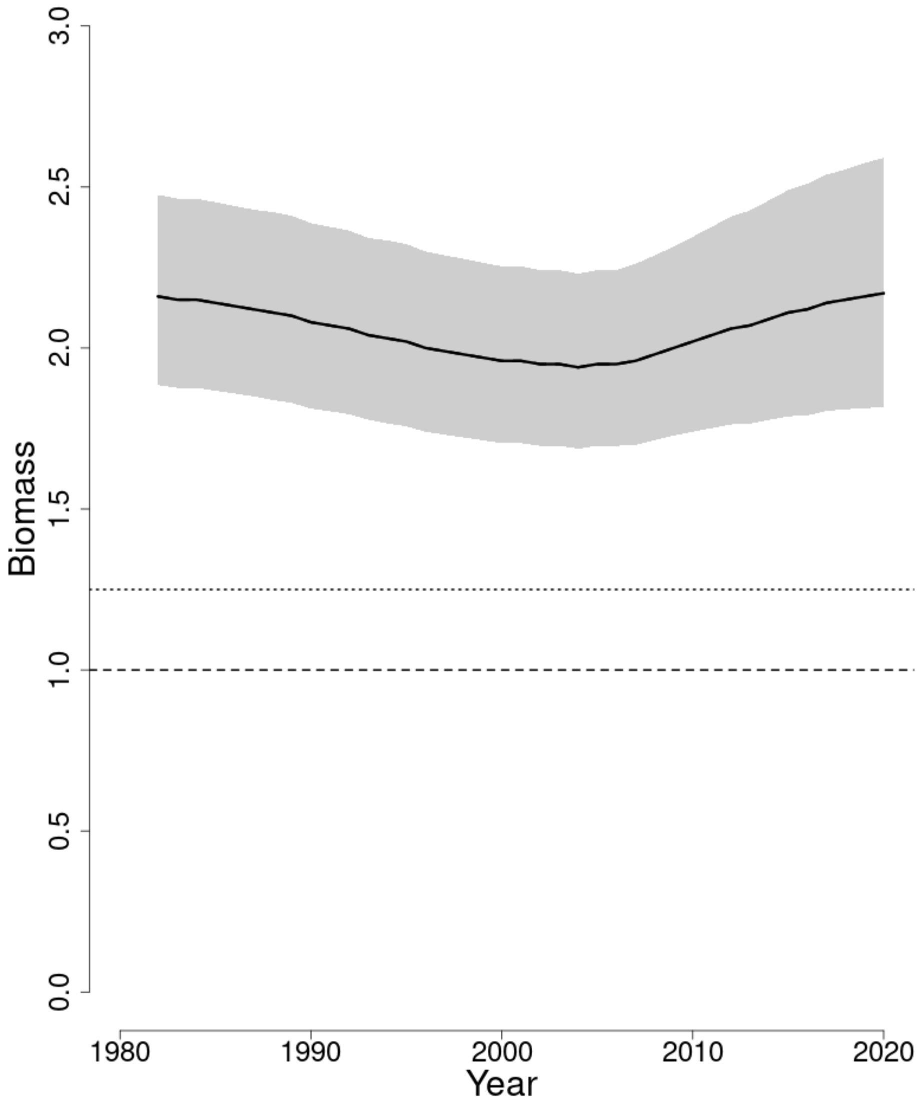

Figure 1: Trends in spawning stock biomass of ocean quahog between 1982 and 2020 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2020 assessment. Units of SSB are the ratio of annual biomass to the biomass threshold ($\frac{SSB}{SSB_{Threshold}}$). The approximate 90% lognormal confidence intervals are shown.

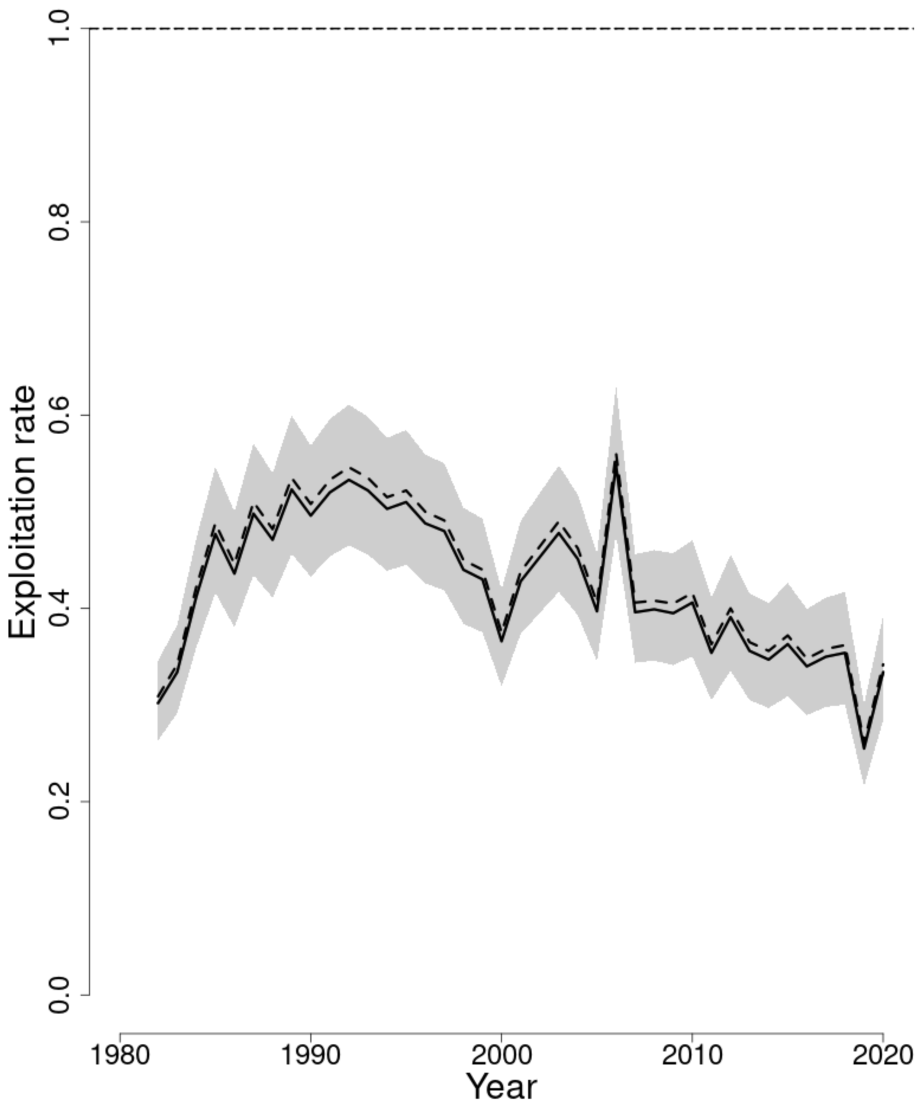

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of ocean quahog between 1982 and 2020 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.019; horizontal dashed line), based on the 2020 assessment. Units of fishing mortality are the ratio of annual F to the F threshold ($\frac{F}{F_{Threshold}}$). The approximate 90% lognormal confidence intervals are shown.

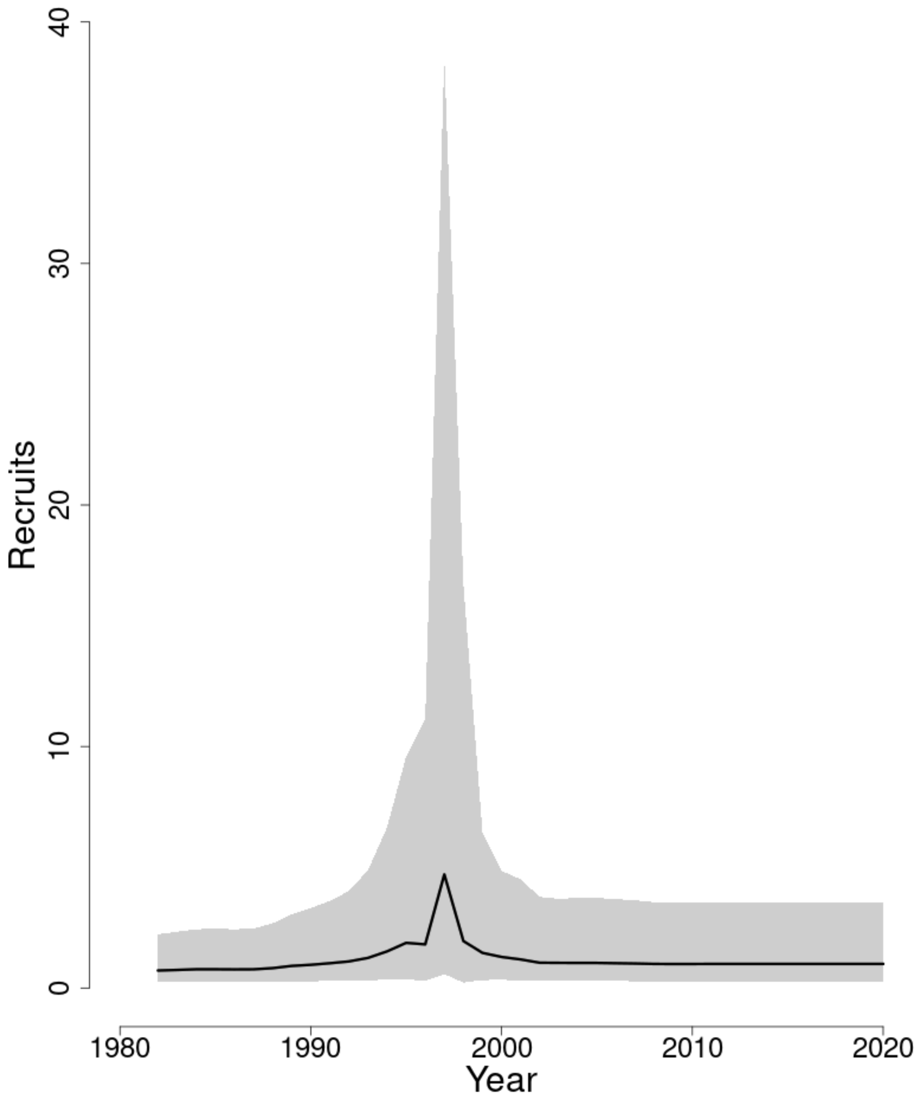

Figure 3: Trends in Recruits (age 3) of ocean quahog between 1982 and 2020 from the current (solid line) and previous (dashed line) assessment. Units of recruitment are the ratio of annual R to the unfished R ($\frac{R}{R_0}$). The approximate 90% lognormal confidence intervals are shown.

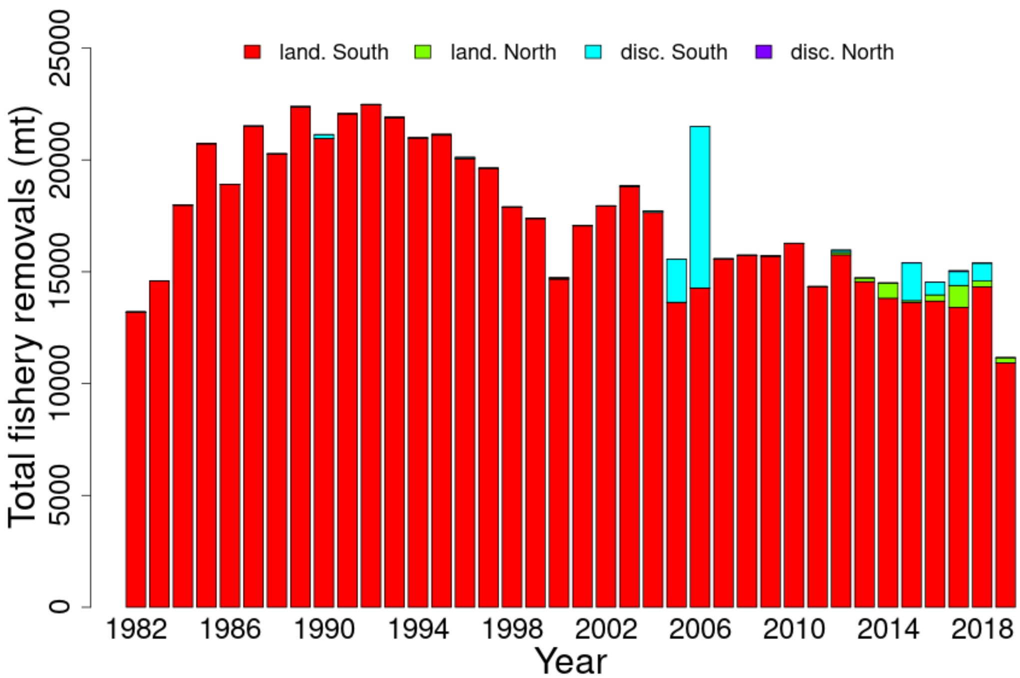

Figure 4: Total catch of ocean quahog between 1982 and 2020 by fleet and disposition (landings and discards).

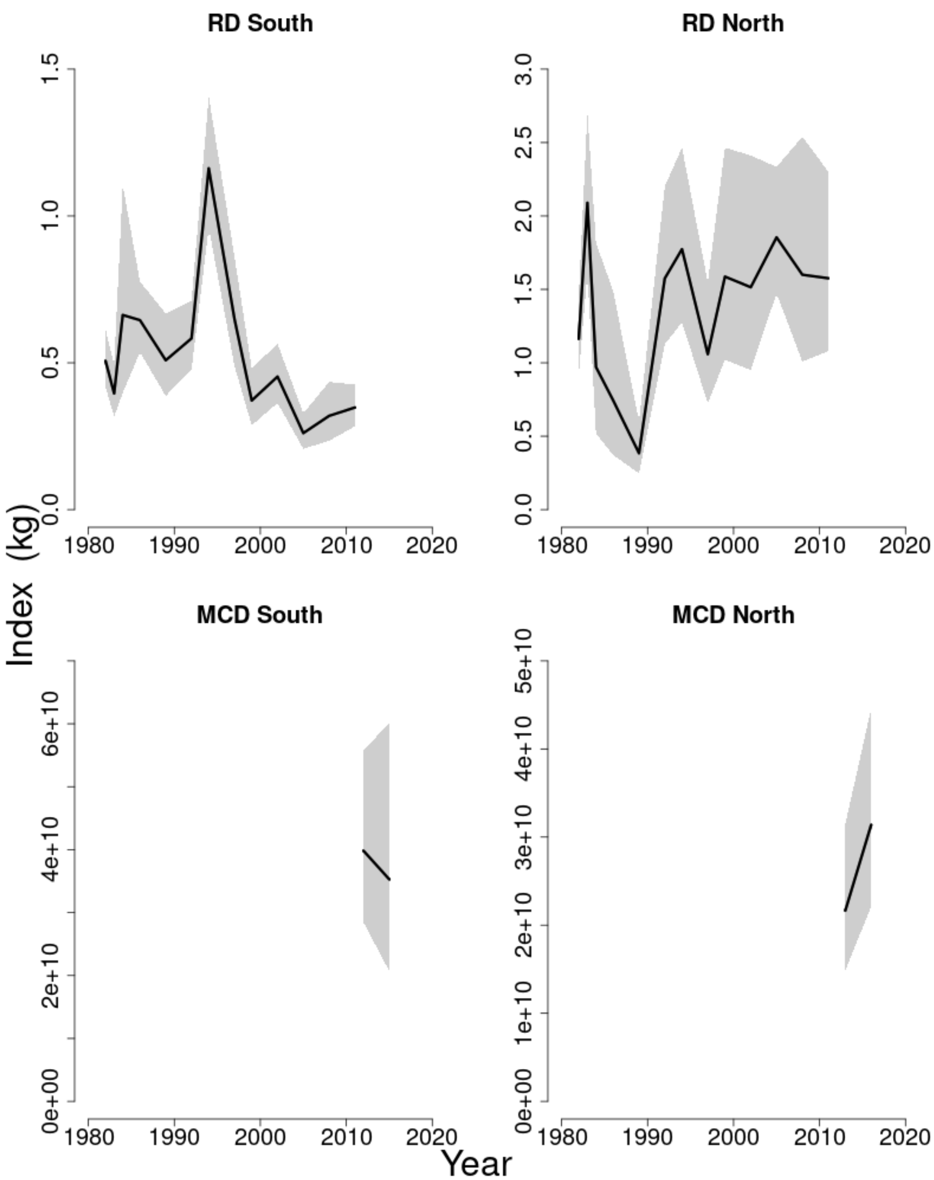

Figure 5: Indices of biomass for the ocean quahog between 1982 and 2016 for the Northeast Fisheries Science Center (NEFSC) clam surveys in the north and south. The RD survey units are weight per tow (kg) and the MCD survey units are swept area numbers (n). The approximate 90% lognormal confidence intervals are shown.

Estimated Proportion of Undersized Surfclam Landings for 2019

John Sullivan.
Analysis and Program Support Division
Greater Atlantic Regional Fisheries Office
National Marine Fisheries Service
November 26, 2019

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 Atlantic surfclam landings in 2019.

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:

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

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:

$$W_j = \frac{L_j}{\sum_{1}^{3} L_j} \tag{2}$$

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

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

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:

$$w_{ij} = \frac{l_{ij}}{\sum_{i=1}^{n} l_{ij}} \tag{4}$$

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:

$$p_{ij} = \frac{x_{ij}}{n_{ij}} \tag{5}$$

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:

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

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

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

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

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

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

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

The 2019 sampling period extended from August 1, 2018 through July 31, 2019. Surfclam samples were collected from vessels fishing in Georges Bank statistical areas 521, 522, 525, and 562; in New Jersey statistical areas 612, 613, 614, and 615; and in DelMarVa statistical area 622. A total of 159 samples from 18 distinct vessels were used for this analysis of the 2019 sampling period.

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. Fishing location of the sampled catch was 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. Volume of the catch from which the sample was derived was pulled from vessel clam log data for the sampled trip. 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. If vessel clam log data could not be matched to a sampled trip, dealer-reported volume information for the sampled trip was used. There were several instances where a sampled trip lacked volume landed information from either the vessel clam logs or dealer reports. The volume of these unmatched samples was estimated using the average number of bushels of surfclams landed on all trips by that vessel in fishing year 2019.

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

Table 1. FY2019 Landings of surfclams reported by vessels August 1, 2018 – July 31, 2019.

Stock area	**Reported Landings (bushels) August, 2018 - July, 2019**	**Meat weight of reported landings (lbs.)**	**Percent of reported landings**
Georges Bank	705,477	11,993,109	37.4%
New Jersey	454,698	7,729,866	24.1%
DelMarVa	726,464	12,349,888	38.5%
Grand Total	1,886639	32,072,863	100.0%

The nominal length distribution of all biological samples obtained from August 1, 2018 – July 31, 2019 indicated that the majority of surfclams sampled were equal to or larger than 121 mm. The mean length of the coast wide samples was 129 mm (Figure 1).

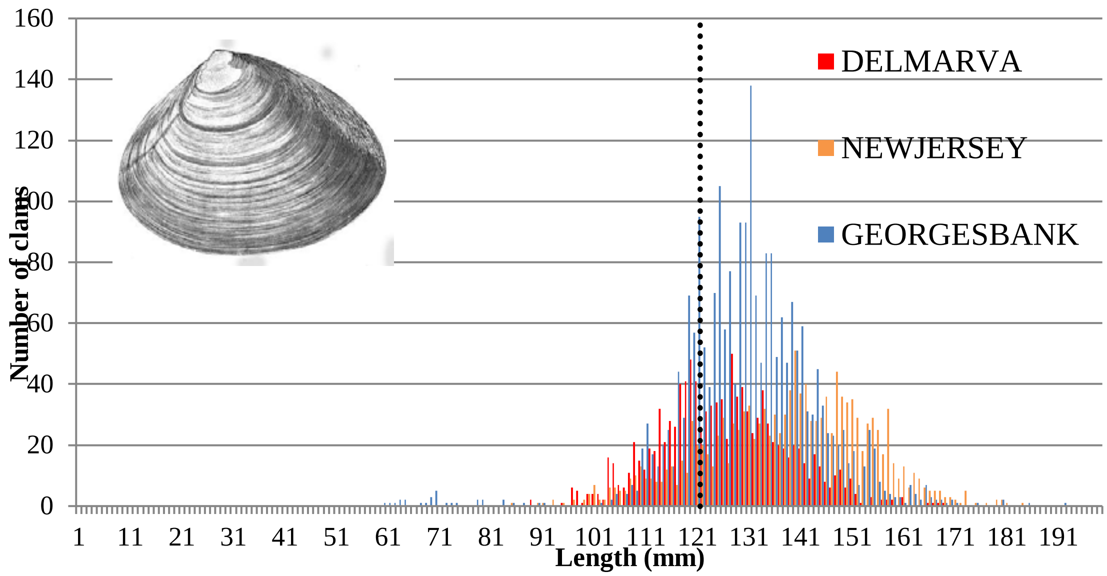

Figure 1. Length frequency distribution of surfclams from dockside sampling for FY2019. The dashed vertical line separates surfclams above and below 121 mm.

The 159 samples used in this analysis contained 4771 measured surfclams, of which 856 individual surfclams were undersized. Fourtyone of the 159 samples collected had 30% or more undersized surfclams; 19 of those samples came from the DelMarVa stock area, 15 came from George's Bank, an the remaining seven samples with 30% or more undersized surfclams came from the New Jersey stock area (Table 2).

Table 2. Description of the 159 individual surfclam samples collected in 2019, 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	0.10	288
2	DelMarVa	30	0.13	960
3	DelMarVa	30	0.27	960
4	DelMarVa	30	0.40	512
5	DelMarVa	30	0.07	480
6	DelMarVa	30	0.20	3040
7	DelMarVa	30	0.50	960
8	DelMarVa	30	0.23	896
9	DelMarVa	30	0.27	768
10	DelMarVa	30	0.07	800
11	DelMarVa	30	0.43	4352
12	DelMarVa	30	0.13	832
13	DelMarVa	30	0.30	64
14	DelMarVa	30	0.27	3584
15	DelMarVa	30	0.70	1088
16	DelMarVa	30	0.37	1664
17	DelMarVa	30	0.47	960
18	DelMarVa	30	0.40	960
19	DelMarVa	30	0.23	960
20	DelMarVa	30	0.40	1664
21	DelMarVa	30	0.20	896
22	DelMarVa	30	0.30	960
23	DelMarVa	30	0.27	96
24	DelMarVa	30	0.13	672
25	DelMarVa	30	0.63	480
26	DelMarVa	30	0.23	1152
27	DelMarVa	30	0.07	544
28	DelMarVa	30	0.33	1024

29	DelMarVa	30	0.23	1344
30	DelMarVa	30	0.43	1440
31	DelMarVa	30	0.10	1440
32	DelMarVa	30	0.30	992
33	DelMarVa	30	0.27	1664
34	DelMarVa	30	0.47	160
35	DelMarVa	30	0.37	1952
36	DelMarVa	30	0.63	1148
37	DelMarVa	30	0.30	960
38	DelMarVa	30	0.67	960
39	Georges Bank	30	0.07	1984
40	Georges Bank	30	0.07	3552
41	Georges Bank	30	0.10	2720
42	Georges Bank	32	0.00	4800
43	Georges Bank	30	0.27	2080
44	Georges Bank	30	0.33	1408
45	Georges Bank	30	0.07	2048
46	Georges Bank	30	0.33	5120
47	Georges Bank	30	0.23	2485
48	Georges Bank	30	1.00	5440
49	Georges Bank	30	0.20	3520
50	Georges Bank	30	0.20	4544
51	Georges Bank	30	0.23	2464
52	Georges Bank	30	0.20	4800
53	Georges Bank	30	0.30	4800
54	Georges Bank	30	0.00	2432
55	Georges Bank	30	0.13	2912
56	Georges Bank	30	0.00	3968
57	Georges Bank	30	0.00	4576
58	Georges Bank	30	0.07	640
59	Georges Bank	30	0.20	3072
60	Georges Bank	30	0.23	4000
61	Georges Bank	30	0.00	2048
62	Georges Bank	30	0.00	4224
63	Georges Bank	30	0.17	3232
64	Georges Bank	30	0.33	4800
65	Georges Bank	30	0.33	3168
66	Georges Bank	30	0.33	4800
67	Georges Bank	30	0.30	4320
68	Georges Bank	30	0.20	1600
69	Georges Bank	30	0.50	4256

70	Georges Bank	30	0.13	3744
71	Georges Bank	30	0.17	3360
72	Georges Bank	30	0.03	4288
73	Georges Bank	30	0.17	4800
74	Georges Bank	30	0.07	3559
75	Georges Bank	30	0.17	4800
76	Georges Bank	30	0.30	4800
77	Georges Bank	30	0.37	4064
78	Georges Bank	30	0.07	4288
79	Georges Bank	30	0.33	2432
80	Georges Bank	30	0.07	4128
81	Georges Bank	30	0.30	3872
82	Georges Bank	30	0.10	4800
83	Georges Bank	30	0.30	4096
84	Georges Bank	30	0.20	704
85	Georges Bank	30	0.30	4864
86	Georges Bank	30	0.10	5440
87	Georges Bank	30	0.07	4288
88	Georges Bank	30	0.07	2752
89	Georges Bank	30	0.00	2624
90	Georges Bank	30	0.03	3392
91	Georges Bank	30	0.13	3584
92	Georges Bank	30	0.10	3584
93	Georges Bank	30	0.07	2400
94	Georges Bank	30	0.23	3520
95	Georges Bank	30	0.07	4288
96	Georges Bank	29	0.10	2080
97	Georges Bank	30	0.03	2720
98	Georges Bank	30	0.03	288
99	Georges Bank	29	0.00	4800
100	Georges Bank	30	0.10	928
101	Georges Bank	30	0.03	5024
102	Georges Bank	30	0.03	896
103	Georges Bank	30	0.00	2432
104	Georges Bank	30	0.00	5440
105	Georges Bank	29	0.10	2752
106	Georges Bank	30	0.00	3840
107	Georges Bank	30	0.00	3232
108	Georges Bank	30	0.00	3520
109	Georges Bank	30	0.07	3040
110	Georges Bank	30	0.00	5440

111	Georges Bank	31	0.03	3392
112	Georges Bank	30	0.10	4288
113	Georges Bank	30	0.00	5440
114	New Jersey	30	0.50	928
115	New Jersey	30	0.03	480
116	New Jersey	30	0.53	996
117	New Jersey	30	0.07	480
118	New Jersey	30	0.20	960
119	New Jersey	30	0.17	512
120	New Jersey	30	0.03	704
121	New Jersey	30	0.43	1024
122	New Jersey	30	0.10	512
123	New Jersey	30	0.37	747
124	New Jersey	30	0.03	480
125	New Jersey	30	0.07	480
126	New Jersey	30	0.13	480
127	New Jersey	30	0.03	480
128	New Jersey	30	0.00	896
129	New Jersey	30	0.00	960
130	New Jersey	30	0.10	480
131	New Jersey	30	0.00	480
132	New Jersey	30	0.00	480
133	New Jersey	30	0.00	2048
134	New Jersey	30	0.00	2048
135	New Jersey	30	0.03	704
136	New Jersey	30	0.00	480
137	New Jersey	30	0.00	1472
138	New Jersey	30	0.00	640
139	New Jersey	30	0.07	832
140	New Jersey	30	0.07	1760
141	New Jersey	30	0.13	480
142	New Jersey	30	0.03	1536
143	New Jersey	30	0.47	1440
144	New Jersey	30	0.03	960
145	New Jersey	30	0.17	960
146	New Jersey	30	0.10	480
147	New Jersey	30	0.03	544
148	New Jersey	30	0.00	960
149	New Jersey	30	0.63	960
150	New Jersey	30	0.00	960
151	New Jersey	30	0.20	864

152	New Jersey	30	0.03	768
153	New Jersey	30	0.00	736
154	New Jersey	30	0.00	672
155	New Jersey	30	0.13	1920
156	New Jersey	31	0.16	1344
157	New Jersey	30	0.30	2688
158	New Jersey	30	0.23	1344
159	New Jersey	30	0.07	1344

*samples with more than 30% undersized surfclams are highlighted.

Estimation Results

An estimated 22.0% of the coast wide surfclam landings to date in 2019 were undersized. The lower and upper 95% confidence bounds for this estimate were 21.1% and 22.8%. 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 2019 undersized surfclams by area and coast-wide.

Area	Estimated percentage of surfclams <121 mm	Lower 95% Confidence Interval	Upper 95% Confidence Interval
Georges Bank	18.2%	18.2%	18.3%
New Jersey	11.0%	10.9%	11.0%
DelMarVa	32.5%	32.2%	32.7%
Coast-wide*	22.0%	21.1%	22.8%

* weighted mean

Surfclam species diagnostics and population connectivity estimates to inform management

PI: Dr. Matthew Hare, Cornell University

Executive Summary:

Recent research has demonstrated that the commercially important surfclam, *Spisula solidissima solidissima*, has an overlapping range with populations of its sister-taxon, *Spisula solidissima similis*. The two ranges overlap nearshore in shallow shelf waters where *S.s. solidissama* grows slower and has a reduced maximum size, making it impossible to distinguish the two taxa in the field. In general, options for management of the surfclam fishery depend on connectivity between centers of abundance such as Georges Bank and the New Jersey shelf. In addition, the abundance, distribution and habitat affinities of the newly discovered *S.s. similis* populations need to be determined to properly interpret survey data and optimize nearshore regulations. Fortunately, the two taxa are easily distinguished using genetic markers and these data have provided preliminary indications of *S.s. similis* range distribution and suggest occasional hybridization with *S.s. solidissima*. The proposed study will develop an efficient, low-cost species diagnostic based on nuclear DNA markers so that large numbers of survey samples can be identified to determine the range and habitat affinities of each taxon. Second, a subset of samples from each taxon, including Georgia samples of *S.s. similis*, will be analyzed with high resolution genomic techniques to quantify the amount of gene flow connectivity occurring among populations of each clam taxon, as well as verify hybridization.