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M E M O R A N D U M

Date: July 31, 2020

To: Michael P. Luisi, Chairman, MAMFC

From: Paul J. Rago, Ph.D., Chair, MAFMC Scientific and Statistical Committee

Subject: Report of the July 22 – 23, 2020 SSC Meeting

The SSC met via webinar on the 22nd and 23rd of July, 2020 to address the following topics: (1) ABC specifications for 2021-26 for Atlantic Surfclam, (2) ABC specifications for 2021-26 for Ocean Quahog, (3) ABC specifications for 2021-22 for Butterfish, (4) ABC specifications for 2021-2023 for Longfin Squid, (5) ABC specifications for 2021 for Atlantic Mackerel, (6) reviewed previously recommended ABC for Bluefish, and updated previously recommended 2021 ABCs with respect to the Councils recent risk policy for (7) Summer Flounder, (8) Scup, and (9) Black Sea Bass. The SSC also received two additional presentations on recent Council decisions related to the allocation amendment for (10) Summer Flounder, Scup, and Black Sea Bass, and the similar amendment for (11) Bluefish. Finally, under (12) Other Business the SSC proposed formation of a working group on role of economic factors in the ABC setting process and expressed concerns about the Council's risk policy for long lived species (Attachment 1).

All 20 of the SSC members participated in the meeting (Attachment 2). The meeting was held entirely via webinar due to concerns regarding the COVID 19 pandemic. The webinar allowed attendees to participate by phone and computer speakers. In the face of some technical problems this caused and despite a packed agenda, the support of Council staff, especially Brandon Muffley, Jason Didden and Mary Sabo, was exemplary.

The meeting opened with a review of the Agenda with a special note that this would be the first time the SSC would be implementing the determination of the OFL CV level during the meeting. This meeting also represented the first time that the NRCC approved stock assessment strategy was implemented which included data updates for 5 species, a Level 1 Management Track Review for one species, a Level 2 Management Track for one species, and Level 3 Management Track reviews for 2 species. The Council's recently approved risk policy for overfishing was applied for the first time as well to not only those stock with updated assessments but also for stocks that had previously approved multiyear ABCs. The newly revised Council risk policy, results in slightly higher ABC determinations over all levels of stock biomass.

In contrast to earlier meetings of the SSC in 2020, there were no special focus sessions that allowed for detailed review and discussion of topics. Instead the focus of this meeting was the setting or revisions of ABC for eight species. For the three stocks which had recent peer reviews, the NEFSC stock assessment leads (Hennen, Adams, Hendrickson) presented the results of the peer reviews. Council staff leads (Jessica Coakley, Jason Didden, Kiley Dancy, Matt Seeley, Karson Coutre, and Julia Beaty) opened the discussions for each species with a review of stock status, Advisory Panel concerns, and initial recommendations for ABCs.

In terms of process, each species summary began with a summary of the assessment product from the NEFSC, a summary of Advisory Panel concerns, and staff recommendations. Before addressing the Terms of Reference, the SSC asked questions about the assessment and recommendations and allowed for the public to participate as well. The SSC then addressed the Terms of Reference and completed the template for determination of the OFL CV where appropriate. The guidelines for filling out the template are provided in Attachment 3. The basic elements of the OFL CV matrix were filled out in advance by the SSC species lead, in collaboration with the MAFMC Chief Scientist and myself as Chair of the SSC. No assignments of OFL CV level were made however. These determinations were made in plenary with full participation of the entire SSC. Public participation and comment was permitted but due to time constraints it was more restricted. The final determination and its basis was justified by a narrative, also reviewed in plenary. In several instances the initial recommendations for OFL CV levels were revised from the initial recommendations. A summary of the matrix elements and the recommendations for each species may be found in Attachments 4 to 6. Collectively, the process seemed to work well and the process should improve with additional iterations.

Summary Table of SSC Decisions

Species	Process	OFL CV (%)	2021 ABC (mt)	P star = P(overfishing)
Surfclam	Level 3 Management Track	100	47,919	0.47
Ocean Quahog	Level 1 Management Track	100	44,031	0.49
Butterfish	Level 2 Management Track	100	11,993 (time varying)	0.35
Longfin Squid	Level 3 Management Track	NA	23,400	NA
Atlantic Mackerel	Data Update	100	29,184	0.386
Bluefish	Data Update	100	7,385	0.183
Summer Flounder	Data Update	60	12,297	0.39
Scup	Data Update	60	15,791	0.49
Black Sea Bass	Data Update	100	7,916	0.49

I wish to thank all of the species leads (Wendy Gabriel, Ed Houde, Rob Latour, Mike Frisk, Dave Secor, Mike Wilberg, John Boreman, and Olav Jensen) for leading the TOR discussions for their respective species. They were assisted by a set of rapporteurs (Mike Wilberg, Olaf Jensen, Sarah Gaichas, Tom Miller, Geret DePiper, Gavin Fay, and Alexei Sharov) who captured the discussions of the SSC. Without their collective efforts it would not have been possible to finish the meeting in two days. I also want to thank Geret DePiper, and Sarah Gaichas for their meeting notes which greatly facilitated preparation of this report. All members of the SSC had the opportunity to review the summaries of the TOR and OFL-CV matrices prior to finalizing this report. Council staff (Jessica Coakley, Jason Didden, Matt Seeley, Kiley Dancy, Karson Coutre, and Julia Beaty) were well prepared as always and briefed the SSC well with excellent presentations. Finally, I thank Brandon Muffley for the teamwork that allowed us to prepare this very long report very quickly after the SSC meeting.

SURFCLAM

Dan Hennen, NEFSC assessment lead, presented the results of the Level 3 Management Track Assessment and Peer Review conducted in June 2020. His results were followed by a presentation by Jessica Coakley, MAFMC staff lead, who summarized recommended ABCs for the period 2021 to 2026.

Hennen provided a major update of the previous benchmark assessment model wherein the historical survey data were re-stratified to achieve greater precision, additional parameters were added and the separate models that had been used for Mid Atlantic and Georges Bank stock areas were combined. This approach is equivalent to that used for Ocean Quahog, thus making the two assessment approaches more consistent. Since 2009 an increasing amount of the total Surfclam catch has come from Georges Bank. Owing to the re-stratification of survey data, improvements in the survey gear, and the signal from fishery removals, the estimates of abundance of Surfclams on Georges Bank declined sharply from earlier assessments. In contrast, survey densities increased in the area between southern Virginia and Southern New England. The new survey boundaries retained the areas where 99% Surfclams have been caught historically but reduced the sampling frame and the number of unproductive low density tows by 46%, In turn, this will allow for a greater number of samples per strata and higher precision.

The model estimates a domed selectivity with 6 parameters, which generated some discussion by the SSC. The flexible selectivity pattern improved the model fit to the length frequency compositions. SSC members noted that the assumptions related to generation of a common pool of recruits from the two stock areas should be validated with modeling studies, as the gyre on Georges Bank is thought to be relatively closed. Modeling studies on the structure of recruitment for sea scallops may be useful. Questions about the basis for the dome-shaped selectivity did not suggest a single basis but the depth of the cutting blades in the dredge gear and the perceived ability of larger clams to burrow deeper may be factors. Finally, dome-shaped selectivity may arise from variability in length at age can also cause the issue. Doming basically means that the number of old age clams coming out of the model is less than what would be expected.

Despite the number of changes, model results overall were similar to previous assessments wherein there is little to no chance of overfishing or being in an overfished condition over any

plausible range of harvest levels or forecast periods. Comparisons of previous abundance estimates with those updated in this assessment are comparable to earlier assessments but are well below the SAW 61 estimates which had large variations in scale. Recruitment appears to be consistently strong in both stock areas.

Comments from the public requested clarification on the basis of the scale changes and expressed concerns about the reduction of the survey area. It was noted that the present survey focuses on areas with much higher overall densities, and that the excluded areas constitute a relatively small fraction of the total biomass. Nonetheless, the presence of Surfclams outside the area of the survey would mean that estimates of fishing mortality rates would be underestimated. Most certainly these areas are not considered economically feasible fishing areas with present technologies. Another concern was the apparent mixing of Surfclams with the Southern Surflam (common name Ravenelli's Surfclam) in inshore areas. A genetic study on the magnitude of this problem is underway.

Jessica Coakley, MAFMC staff lead, followed with a report from the Advisory Panel and recommendations for ABCs. The fleet increased slightly by 4 vessels, to a total of 43 vessels in 2019. Compared to 2018, the 7 processors in 5 states handled about a 7% decrease in ex-vessel value even though average price per bushel increased by about 1%. Industry advisor identified three critical issues: the effects of Covid 19 on retail sales, support for research to increase harvest opportunities in the Great South Channel, and the challenges of offshore wind energy development.

Staff recommendations included setting specifications for 6 years, consistent with NRCC approved schedule of years between assessments. The draft recommendation was to use an OFL CV of 150% and update the quotas with the Council's revised risk policy. Further, the staff recommended the suspension of the 4.75" minimum size restriction on landings given the regulatory capacity to do so when 30% or less of the clams are under the size limit. Current estimates suggest that 22% of the clams are undersized; for economic reasons, undersized clams should be avoided.

The SSC's responses to the terms of reference provided by the MAFMC (in italics) are as follows.

For Atlantic Surfclam, the SSC will provide a written report that identifies the following for the 2021-2026 fishing years:

1) *Based on the criteria identified in the Acceptable Biological Catch (ABC) control rule, assign the stock to one of four types of control rules (analytically derived, modified by the assessment team, modified by the SSC, or OFL cannot be specified) the SSC deems most appropriate for the information content of the most recent stock assessment;*

   The SSC deemed that Atlantic Surfclam should be considered a stock with an SSC-modified OFL probability distribution.

2) *If possible to determine, the level of catch (in weight) associated with the overfishing limit (OFL) for each requested fishing year based on the maximum fishing mortality rate threshold or, if appropriate, an OFL proxy, and the associated coefficient of variation recommended by the SSC and its basis;*

The estimated OFLs are provided below and are based on the staff memo recommendations from the 2020 management track assessment.

Year	OFL (mt)
2021	51,361
2022	48,202
2023	45,959
2024	44,629
2025	44,048
2026	43,886

3) *The level of catch (in weight) and the probability of overfishing (P*) associated with the ABC for each requested fishing year, based on the traditional approach of varying ABCs in each year. If possible, specify interim metrics that can be examined to determine if multi-year specifications need reconsideration prior to their expiration;*

The SSC recommends an OFL CV of 100% be applied to the OFL estimate as appropriate for calculating ABC for Atlantic Surfclam (see Attachment 4, OFL CV table, for additional details). Based on results of the 2020 Level 3 Management Track assessment, surf clams are neither overfished nor is overfishing occurring. Landings in this ITQ fishery and recent discard data are believed to be accurate; recent discard rates are low. Recent restratification of the NEFSC surf clam fishery-independent survey has reduced data gaps, while generally maintaining previously observed trends in abundance. Indices in the northern area (Georges Bank) have shown declines while indices in the south have been relatively stable. Estimates of dredge efficiencies are available for different dredge configurations over time. Updated assessment model structure now includes two areas within a single SS3 model, which includes conditional age at length data, and allows for time-varying growth and estimated selectivity parameters. Because fishing mortality is low compared to natural mortality (particularly for the southern New England/Mid-Atlantic), scale of biomass estimates relies more heavily on survey efficiency. There is little data to directly measure recruitment, but the recruitment assumptions have a small effect on the OFL projections. Total F was based on F by area, weighted by number of fully selected animals in each area. No retrospective pattern requiring adjustment was observed. Biological reference points are evaluated as ratios of $SSB/SSB_{threshold}$ and $F/F_{threshhold}$ to address scale uncertainty, as 2.38 and 0.258, respectively. SSB in 2019 was estimated to be 1,222 thousand mt, 119% of the biomass target ($SSB_{MSY\ proxy}$ = 1,027 thousand mt). F in 2019 was estimated to be 0.036, 25.8% of the overfishing threshold proxy ($F_{MSY\ proxy}$ = 0.141). Proxies were based on previous simulation studies and scaled to the current assessment. Projections are fairly well determined and projected biomass from the last assessment was within the confidence intervals of the relative biomass estimated in the current assessment. Projections of SSB were made under three harvest policies 1.) $F = F_{threshhold} = F_{OFL}$ (F at the OFL); 2.) status quo catch, 19,255 mt; and maximum catch allowed under the Fishery Management Plan "quota level" of 29,364 mt.

The 2020 management track assessment has a substantial shift in scale from the previous benchmark assessment. Under any scenario, biomass will remain above the biomass threshold. Under the second and third scenarios, projected Fs will be lower than the fishing mortality threshold. The status quo catch scenario appears most likely, based on historical landings and fishery conditions. Simulation analyses were conducted in the most recent benchmark assessment to identify the fishing mortality rate threshold.

Using an OFL with a lognormal distribution with a CV = 100%, the SSC recommends the following ABCs:

Year	**ABC (mt)**
2021	47,919
2022	44,522
2023	42,237
2024	40,946
2025	40,345
2026	40,264

4) *The most significant sources of scientific uncertainty associated with determination of OFL and ABC;*

- There was a large change in the estimated abundance from the previous benchmark to the most recent assessment.
- The estimated dome-shaped selectivity patterns for the survey were not completely consistent with gear selectivity experiments.
- 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 may have changed.
- The prior distribution on dredge efficiency has an unknown effect on setting the scale of the model.
- Catchability was estimated differently for the old and new surveys.
- The abundance of southern Surfclam within the Atlantic Surfclam stock area remains unknown.

5) *Ecosystem considerations accounted for in the stock assessment, as appropriate, and any additional ecosystem considerations that the SSC considered in selecting the ABC, including the basis for those additional considerations;*

No additional ecosystem considerations were taken into account in selecting the ABC.

6) *Research or monitoring recommendations that would reduce the scientific uncertainty in the ABC recommendation and/or improve the assessment level;*

- Need for increased understanding in the link/relationship between the OFL and reproductive potential of the Atlantic Surfclam stock.

- Reproductive consequences of fishery operations and relationship of clam density (i.e., high concentration areas versus low density patches); clam density differences in Georges Bank and Southern Region.
- Recovery potential of heavily fished areas.
- Increased understanding of stock dynamics at smaller spatial scales –scale needed is likely finer than current survey gear and survey design. Evidence suggests that patch density in bivalves at small spatial scales can have a substantial impact on reproductive success.
- The prior on survey dredge efficiency has an unknown effect on the scale of the model –more work may be needed.
- Consider methods to estimate natural mortality (M) from the assessments by using data from shells and recently dead individuals.
- Continue to develop the institutional capacity and support for age-length integrated models.
- Include Nantucket Shoals in the surveyed area for Atlantic Surfclam.
- Explore the exchange of recruitment between the two stock areas (in particular whether the southern area contributes recruits to Georges Bank).
- Continue the genetics study to determine the contribution of southern Surfclam in the Atlantic Surfclam stock area.

7) *The materials considered by the SSC in reaching its recommendations;*

- SSC TORs for Atlantic Surfclam
- Staff Memo: 2021-2026 Atlantic Surfclam ABC Recommendations
- Draft 2020 Management Track Assessment Report and NEFSC Data Portal (https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php)
- Draft 2020 Management Track Assessment Peer Review Panel Summary Report
- Draft OFL CV Decision Criteria Summary for Atlantic Surfclam
- 2020 Advisory Panel Atlantic Surfclam and Ocean Quahog Fishery Performance Report
- 2020 Atlantic Surfclam Fishery Information Document
- Background: Proportion of Undersized Clams Analysis
- 61st SAW/SARC Assessment Summary Report (2016)
- 61st SAW/SARC Assessment Report (2016)

8) *A conclusion that the recommendations provided by the SSC are based on scientific information the SSC believes meets the applicable National Standard guidelines for best scientific information available.*

The SSC believes that the recommendations provided are based on scientific information that meets the applicable National Standard guidelines for best scientific information available.

OCEAN QUAHOG

Dan Hennen, NEFSC assessment lead, presented the results of the Level 1 2020 Management Track Assessment. His results were followed by a presentation by Jessica Coakley, MAFMC staff lead, who summarized recommended ABCs for the period 2021 to 2026.

Given that the Ocean Quahog was most recently assessed as a benchmark in 2019 and that no new survey data were available, the primary change in this assessment update was the inclusion of the revised survey data based on the peer-reviewed re-stratification. As with Surfclams, the revised survey domains were much smaller in the northern areas with an overall reduction in stock area of 31% while in the southern areas the reduction was only 7%. Because the reduced survey domains had higher average densities, the changes in total swept area biomass were much less with only an 8% reduction. The biomass estimates in the model updated with the revised survey estimates were essentially equivalent to the earlier model. Similarly, the differences in F and B reference points were less than 0.5% The model results had almost no retrospective pattern. The stock biomass can be expressed in integer multiples of the $B_{threshold}$ levels and the current F to $F_{threshold}$ level is 0.342. Analyses of the uncertainty intervals for the stock assessment results suggest little to no chance of overfishing or becoming overfished in the next 6 years at current harvest levels.

Jessica Coakley, MAFMC staff lead, followed with a report from the Advisory Panel and recommendations for ABCs. Overall ex-vessel value decreased by $5 million from 2018 to $19 million in 2019. Concerns expressed by industry advisors for Surfclams were the same for Ocean Quahogs. Coakley provided the SSC with projected ABCs under an assumed OFL CV of 100%.

SSC discussions generally focused on the concerns about setting quotas for species that live for hundreds of years. The current assessment period of record constitutes a small fraction of the species lifespan. Recruitment is poorly understood but there has been consistent evidence of smaller Ocean Quahogs in study areas. The low rate of harvesting complicates the ability to observe a wider dynamic range desirable in models purporting to show the effects of exploitation. MSE-like simulations were conducted by Hennen (2015) to support the current basis for reference points. One of the model peculiarities highlighted by the SSC was the estimated pulse of recruitment the late 1990's that is almost certainly modeling artifact rather than driven by an observed increase in survey density. Hennen reported that our best understanding of recruitment is steady low values across years. Collectively, these issues led to concerns by the SSC of allowing a harvest rate that would have only a 49% risk of overfishing. Further provisions for "atypical" life histories are summarized under **Other Business**.

The SSC's responses to the terms of reference provided by the MAFMC (*in italics*) are as follows.

For Ocean Quahog, the SSC will provide a written report that identifies the following for the 2021-2026 fishing years:

1) *Based on the criteria identified in the Acceptable Biological Catch (ABC) control rule, assign the stock to one of four types of control rules (analytically derived, modified by the*

assessment team, modified by the SSC, or OFL cannot be specified) the SSC deems most appropriate for the information content of the most recent stock assessment;

The SSC deemed that Ocean Quahog should be considered a stock with an SSC-modified OFL probability distribution. The reported OFL estimate, though associated with substantial uncertainty, was deemed credible, and could form the basis of developing management advice.

2) *If possible to determine, the level of catch (in weight) associated with the overfishing limit (OFL) for each requested fishing year based on the maximum fishing mortality rate threshold or, if appropriate, an OFL proxy, and the associated coefficient of variation recommended by the SSC and its basis;*

The levels in catch associated with the accepted OFL (F=0.019) for the relevant fishing years are:

Year	**OFL(mt)**
2021	44,960
2022	45,001
2023	45,012
2024	44,994
2025	44,948
2026	44,875

3) *The level of catch (in weight) and the probability of overfishing (P*) associated with the ABC for each requested fishing year, based on the traditional approach of varying ABCs in each year. If appropriate, specify interim metrics that can be examined to determine if multi-year specifications need reconsideration prior to their expiration;*

The SSC recommends an OFL CV of 100% be applied to the OFL estimate as appropriate for calculating ABC for Ocean Quahog (see Attachment 5, OFL CV table, for additional details). The Ocean Quahog is a lightly fished stock under limited entry management. Based on the results of the 2020 Level 1 Management Track Assessment update, the stock is neither overfished nor experiencing overfishing. Catches are well documented; they tend to be concentrated in a relatively few ten-minute squares. Fishery-independent surveys conducted since the 1980s indicate little long-term change in stock biomass. Most catches continue to be taken in the southern region of the fishery, with modest landings from the north (Georges Bank). Discards and bycatch mortality (small clams) are at low levels and reasonably well documented. No changes were made in the Ocean Quahog assessment for 2020 beyond updating to the latest version of the Stock Synthesis model. No new survey data were available. However, data from the newly designed and re-stratified NEFSC Clam Survey were used in this updated assessment. Recruitment is poorly defined but no obvious patterns or trends are seen. The poorly defined recruitment may be of minor concern because of individual longevity (>100 years) and low fishing mortality (likely $F < 0.01$). Reference points are ratios rather than absolute values, allowing conclusions about stock status despite considerable scale uncertainty. The low F and prevailing market conditions suggest that stock status will not change rapidly. In this regard, it is notable that SSB/SSB_{thr} is >2.1 and

exploitation level F/F_{thr} is <0.3 in recent years. No internal retrospective adjustment of spawning stock biomass or fishing mortality in 2019 was made in the assessment update because the retrospective analysis was exceptionally stable. Comparison of past estimates of biomass trajectories (2009 to 2020) from KLAMZ and SS modeling indicate quite good agreement. Population projections for Ocean Quahog are reasonably well determined and projected biomass from the 2017 assessment was within the confidence bounds of the biomass estimated in the 2020 assessment. Empirical estimates of biomass (swept area abundance) and exploitation rate are supportive of the SS3 model assessment results, although both the swept area results and the model rely heavily on the same catchability estimate. In a seven-year projection under "status quo," "quota," and "OFL" scenarios, the stock would not be overfished under any of the scenarios and, only under the OFL scenario might overfishing occur. Market conditions suggest that "status quo" landings may prevail, at least in the near future. No particular ecosystem factors were included in the assessment; there is awareness of shifting climate and changing regional temperature that may affect stock productivity and spatial variability. The SS3 assessment model is age- and length-based, but the model is fitted to length composition information rather than age-composition data. More age data are desirable and aging analysis is ongoing, but high cost of aging Ocean Quahogs constrains adoption of age-based assessment modeling.

The SSC applied an SSC modified OFL distribution with a CV=100% and the revised Council risk policy. The calculated ABC values, with associated probabilities of overfishing are:

Year	**ABC (mt)**	**P***
2021	44,031	0.49
2022	44,072	0.49
2023	44,082	0.49
2024	44,065	0.49
2025	44,020	0.49
2026	43,948	0.49

The SSC will evaluate the following interim metrics in considering whether to reconsider or modify the proposed six-year ABC schedule:

1) The value of the relative abundance metric; and
2) The spatial and temporal distribution of catch and effort.

4) *The most significant sources of scientific uncertainty associated with determination of OFL and ABC;*

While the assessment model and empirical survey results are in agreement that the stock is at high biomass and has been relatively lightly exploited, the following remain important sources of uncertainty:

- The apparently low fishing mortality rate and its lack of contrast over the assessment period limit our ability to predict stock dynamics at higher mortality rates.

- Absolute estimates of spawning stock biomass (SSB), recruitment (R), and fishing mortality (F) are scale uncertain. Information on biomass scale is driven primarily by the prior distribution of survey catchability.
- Recruitment is difficult to estimate in the Ocean Quahog assessment because age composition data are 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.

5) *Ecosystem considerations accounted for in the stock assessment, as appropriate, and any additional ecosystem considerations that the SSC considered in selecting the ABC, including the basis for those additional considerations;*

No specific ecosystem considerations were taken into account in selecting the ABC. However, there was consideration by the assessment team and review panel of the potential effects of environmental factors on Ocean Quahog, especially ongoing pending climate change. To date, these effects have been difficult to detect.

6) *Research or monitoring recommendations that would reduce the scientific uncertainty in the ABC recommendation and/or improve the assessment level;*

<u>High Priority</u>

- Priority for outstanding research recommendations should be accorded to biological parameters and further understanding of survey dredge efficiency in relation to Ocean Quahog density and bottom type.
    - Survey performance, age and growth, spatial processes, and recruitment processes are topics that need attention.
    - Additional age and growth studies to determine if extreme longevity (e.g., 400 years) is typical or unusual and to refine estimates of M (see page 47 of the 2017 assessment report).
    - Additional age and growth studies over proper geographic scales to investigate spatial and temporal recruitment patterns.
    - The validated age data show that variable growth was likely. More exploration and validation of growth and growth variability is warranted. Variable growth also could indicate differences in productivity between regions. This possibility should be explored in future assessments, as ageing protocols evolve.

<u>Lower priority</u>

- Development of assessment methods for stocks such as Ocean Quahog that experience low F.
- Development of a method to improve imputation of survey data. Survey data possibly can be modelled purely as an abundance index, standardized for the key factors of region, depth, speed, tow duration, dredge characteristics, etc., without the size-frequency data or a composite metric of area swept based on speed and duration.
- Explore alternative methodologies for direct estimation of abundance or survey catchability

7) *The materials considered by the SSC in reaching its recommendations;*

- SSC TORs for Ocean Quahog
- Staff Memo: 2021-2026 Ocean Quahog ABC recommendations
- Draft 2020 Management Track Assessment Report and NEFSC Data Portal (https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php)
- Draft 2020 Management Track Assessment Peer Review Panel Summary Report
- Draft OFL CV Decision Criteria Summary for Ocean Quahog
- 2020 Advisory Panel Atlantic Surfclam and Ocean Quahog Fishery Performance Report
- 2020 Ocean Quahog Fishery Information Document
- 63rd SAW/SARC Assessment Summary Report (2017)
- 63rd SAW/SARC Assessment Report (2017)
- Hare, J. A., Morrison, W. E., Nelson, M. W., Stachura, M. M., Teeters, E. J., Griffis, R. B., Alexander, M. A., et al. 2016. A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. PLOS ONE, 11: e0146756.
- Hennen, D. R. 2015. How should we harvest an animal that can live for centuries? North American Journal of Fisheries Management 35, 512–527.

8) *A conclusion that the recommendations provided by the SSC are based on scientific information the SSC believes meets the applicable National Standard guidelines for best scientific information available.*

The SSC believes that the recommendations provided are based on scientific information that meets the applicable National Standard guidelines for best scientific information available.

BUTTERFISH

Charles Adams, NEFSC assessment lead, summarized the results of the 2020 Management Track Assessment and Peer Review conducted in June 2020. His results were followed by a presentation by Jason Didden, MAFMC staff lead, on the recommended 2021 ABC based on a 150% OFL CV and the Council's revised risk policy. Both the assessment and the management recommendations were discussed extensively by the SSC.

The most recent benchmark of Butterfish was conducted in 2014 where the stock was declared not overfished and overfishing is not occurring. A notable feature of this assessment was the inclusion of a fixed catchability coefficient based on experimental gear work and consideration of estimates of thermal habitat for Butterfish. By fixing catchability, it became possible to estimate natural mortality for the first time in a model. The model formulation was updated in 2017 and again in 2020 with new data but no changes in model parameterization. Modest adjustments to estimated discards and estimates of relative indices at age from the NEAMAP survey were added. The revised model compared favorably with the earlier assessments in recent years but provided lower estimates for F in the period before 2001. SSB trends since 2000 have been downward irrespective of the model update or data added. Recruitment also has declined

consistently over this period. Despite these trends results of assessment indicate the stock is not overfished nor is overfishing occurring. Analyses of the retrospective pattern suggest no need for adjustment of stock size or fishing mortality estimates. Using catch projections that greatly exceed recently realized catches, the SSB is projected to more than double from 2020 to 2022. The Review Panel questioned the basis for these projections and suggested a truncated time series corresponding to estimated recruitment for 2010 to 2019. These projections for 2021 and 2022 were computed at 100% and 150% CV using either a temporally varying or average ABC consistent with the Council's risk policy.

The peer review panel expressed concerns about the estimates of average weights at age and suggested alternative biological reference points. The SSC noted that the projections are based on restricted set of years, but that the autocorrelation pattern and underlying trend is not addressed in the forecast. Natural mortality is estimated in the model but it does not vary by year. Much of the assessment hinges on the estimate of constant availability as this establishes scale. To allow for temporal variations in availability one must update the oceanographic data and model runs to support computation of the habitat metric. Presently the NEFSC has insufficient resources to update the thermal habitat model estimates.

Jason Didden, MAFMC staff lead, summarized recent activities in the fishery, comments from the industry Advisory Panel, and proposed ABC corresponding to the OFL CV and the Council's revised risk policy. Advisors commented on the impacts of tariffs and closures of fishing habitats in the National Monuments areas. Inflation adjusted prices have declined about 25% between 2010 and 2017 but have increased slightly in 2018 and 2019. The initial staff recommendation was to compute an average ABC for 2021 and 2022 of 13,442 mt using an OFL CV of 150%

The SSC's responses to the terms of reference provided by the MAFMC (*in italics*) are as follows.

For Butterfish, the SSC will provide a written report that identifies the following for the 2021-2022 fishing years:

1) *Based on the criteria identified in the Acceptable Biological Catch (ABC) control rule, assign the stock to one of four types of control rules (analytically derived, modified by the assessment team, modified by the SSC, or OFL cannot be specified) the SSC deems most appropriate for the information content of the most recent stock assessment;*

   The SSC determined that Butterfish should be considered a stock with "an SSC-modified OFL probability distribution." The assessment produced an estimate of the OFL, but the SSC derived the estimate of uncertainty in the OFL using its established OFL CV criteria (see Attachment 6).

2) *If possible to determine, the level of catch (in weight) associated with the overfishing limit (OFL) for each requested fishing year based on the maximum fishing mortality rate threshold or, if appropriate, an OFL proxy, and the associated coefficient of variation recommended by the SSC and its basis;*

The SSC was presented with an update from the benchmark assessment. The F_{MSY} proxy used in the assessment was based on2/3M. The estimate of M in the 2020 assessment was M=1.29, implying the OFL=F_{MSY}=0.86.

The derived OFLs depend on the length of recruitment time series included in projections and the assumption about 2020 removals. The SSC deemed the most recent 10-year recruitment time series (2010-2019) most appropriate, and an assumed 2020 catch of 5,443 (linear regression estimate from 2013-2019).

Assuming that subsequent ABCs are fully harvested, the equivalent OFLs for the two years are (Varying approach):

Year	**OFL**
2021	22,053
2022	24,341

are (Averaged approach):

Year	**OFL**
2021	22,053
2022	23,674

3) *The level of catch (in weight) and the probability of overfishing (P*) associated with the ABC for each requested fishing year, based on: 1) the traditional approach of varying ABCs in each year, and 2) a constant ABC approach derived from the projected ABCs. If possible, specify interim metrics that can be examined to determine if multi-year specifications need reconsideration prior to their expiration;*

The SSC recommends an OFL CV of 100% be applied to the OFL estimate as appropriate for calculating ABC for Butterfish (see Attachment 6, OFL CV table, for additional details). Based on the 2020 updated stock assessment results, the Butterfish stock is not overfished and overfishing is not occurring. SSB in 2019 was estimated to be 29,308 mt, which is 69% of the biomass target ($SSB_{MSY\ Proxy}$ = 42,427 mt). The fully selected fishing mortality rate was estimated to be 0.21, which is 24% of the overfishing threshold ($F_{MSY\ Proxy}$ = 0.86). The PRC accepted the stock assessment model results and affirmed that they can be used to formulate management advice. However, concerns were raised regarding the approach used to estimate mean weights-at-age (some values were not consistent with expected growth), the configuration of the projections (assuming fully realized catches, sampling from the full recruitment time-series), and the general patterns in model outputs (declining trends in estimated biomass and recruitment, increasing trend in estimated fishing mortality). Given that estimated biomass and recruitment both showed decreasing patterns over time, it may be possible to estimate a stock-recruitment (S-R) relationship. Discards have consistently comprised an appreciable fraction of the total catch, yet estimated discards prior to 2010 were highly variable and imprecise (CV range: 0.23 – 1.44). The assumption of 100% daytime Bigelow gear efficiency is strong, necessary for the estimation of M, but conservative in terms of scaling population biomass. The estimated M is high and the PRC

noted that the magnitude of M leaves little expected biomass by age 4 (M = 1.29 implies annual survival = 0.28 and cumulative survival to age 4 = 0.006). The fishing mortality reference point originated from deliberations of the MAMFC SSC when setting an ABC for Butterfish required ad-hoc methods (~2013), and a valid criticism of the estimator used for the $F_{MSY\ Proxy}$ is that it does not functionally relate to SSB, which is important to consider in the context of the potential existence of an S-R relationship. The short-term projections are likely not informative about near-term fishing effects given the aforementioned points raised about how they were configured.

Using an OFL with a lognormal distribution with a CV = 100%, the SSC recommends the following ABCs (Varying approach):

Year	**ABC**
2021	11,993
2022	17,854

(Average approach):

Year	**ABC**
2021	14,924
2022	14,924

The SSC prefers the varying approach due to the observed decline in the estimated biomass and recruits (consistent with recommendations in past years). However, if removals in 2020 are much lower than assumed in the projections (5,443 t), re-evaluation of 2021 ABC may be warranted.

The expected probability of overfishing in these projections is low (average P* <0.35).

As an interim measure, the SSC will evaluate survey CPUEs (NEAMAP and NEFSC Fall survey) as indices of annual recruitment for possible action.

4) *The most significant sources of scientific uncertainty associated with determination of OFL and ABC;*

- The thermal habitat model could not be updated, so changes from the long term average availability which stabilizes q and allows estimation of M cannot be evaluated.
- The foundation for the OFL (Fmsy=2/3M) was ad hoc rather than being derived internally in the model. The application of an assumed q-value to estimate M, while novel and well thought out, contributes to uncertainty.
- The assessment was limited to a period of low stock productivity (due to lack of discard data early in the time series), well after a period of higher exploitation, which reduces the data contrast available to the model.
- Conflicting trends among seasonal surveys were not incorporated in the model.
- There are residual trends in the survey data that might be explained by environmental or biotic (predation) factors that were not incorporated in the model.

- There appears to be a declining trend in annual recruitment. Although most recent recruitment was used in projections, this trend is not projected suggesting projections may be uncertain.

5) *Ecosystem considerations accounted for in the stock assessment, as appropriate, and any additional ecosystem considerations that the SSC considered in selecting the ABC, including the basis for those additional considerations;*

   There were no specific ecosystem considerations in the population dynamics model. However, the OFL was based on a proxy that incorporated consideration of the role of Butterfish as a forage species. Additionally, the calculation of availability of the fish to the survey did incorporate considerations of temperature as a factor influencing fish distributions.

6) *Research or monitoring recommendations that would reduce the scientific uncertainty in the ABC recommendation and/or improve the assessment level;*

   - Evaluate approaches to estimate population scale (e.g., independent estimates of survey availability, natural mortality);
   - Consider alternative approaches/options to produce a streamlined, reproducible, automated thermal habitat index for this assessment;
   - Conduct simulation studies to evaluate the uncertainty in the ad hoc F_{msy} proxy;
   - Consideration of alternative reference points that link to stock biomass;
   - Evaluate approaches to include additional surveys, e.g., from States, in the assessment model;
   - Analyze additional estimation of consumptive demand of predators to identify critical periods of overlap of predators and prey;
   - Reconsider stock structure and degree of exchange with the South Atlantic stock component; and
   - Evaluate alternative methods for estimating weights at age.

7) *The materials considered by the SSC in reaching its recommendations;*

   - SSC TORs for Butterfish
   - Staff Memo: Butterfish, Longfin Squid, and Mackerel ABC recommendations
   - Draft 2020 Butterfish Management Track Assessment Report and NEFSC Data Portal (https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php)
   - Draft 2020 Management Track Assessment Peer Review Panel Summary Report
   - OFL/ABC Butterfish Stock Projections
   - Draft OFL CV Decision Criteria Summary for Butterfish
   - 2020 Advisory Panel Atlantic Mackerel, Longfin Squid, and Butterfish Fishery Performance Report
   - 2020 Butterfish Fishery Information Document
   - 58th SAW/SARC Assessment Summary Report (2014)
   - 58th SAW/SARC Assessment Report (2014)

- Johnson et al 2010 ICES JMS: https://doi.org/10.1093/icesjms/fsu055

8) *A conclusion that the recommendations provided by the SSC are based on scientific information the SSC believes meets the applicable National Standard guidelines for best scientific information available.*

   The SSC believes that the recommendations provided are based on scientific information that meets the applicable National Standard guidelines for best scientific information available.

LONGFIN SQUID

Lisa Hendrickson, NEFSC assessment lead, began with a summary of the findings of the June 2020 Level 3 Management Track peer review and was followed by a summary of recent catches, advisory panel report and initial ABC recommendations by Jason Didden (MAFMC staff lead). Longfin squid is an index-based stock assessment whose stock status is not overfished but overfishing status is unknown. The current assessment approach uses an annualized estimate of relative abundance based on the NEFSC spring and fall bottom trawl surveys. Much of the presentation and the reviewers' comments addressed the potential use of a two-cohort model based on the premise that the juveniles produced during a seasonal survey in one season support the fishery in the subsequent survey period. In other words, the offspring of the Fall BTS become the adults in the following spring BTS and support the landings during that period. Cross-seasonal linkages are important because growth rates are higher in the summer than in winter, suggesting possible differences in the magnitude of fisheries the cohorts can support. Notably, the fall BTS biomass indices average about five times higher than those in the spring.

A case was made for recognizing these differences by redefining the assessment with a more biologically realistic model. The Management Track Review Panel endorsed the concept of such a model but neither the results were not considered sufficient for catch recommendations. Advances in modeling approaches may be sufficient to implement a dynamic model based on these concepts in the future. The SSC noted that modeling decisions about population structure are critical since errors of lumping vs separating cohort dynamics can be equally problematic. Genetic studies of the stock have produced conflicting results. Future management track assessments will continue to develop a revised basis for determining stock status using approaches tailored to Longfin Squid life history.

Jason Didden, MAFMC staff lead, reported that prices for Longfin Squid have been trending upwards generally since 2000 with the highest prices ever observed in 2019. The fishery is regulated by trimester with target allocations of 43%, 17% and 40%, respectively. Recent catches have been below target levels due to lower demands from restaurants (Covid 19). Staff support the concept of sub-annual stock assessment methods for future assessments but not presently. The staff recommendation was an ABC of 23,400 mt for 2021 to 2023. It was noted that peak catches in the early 1970s were between 31,000 and 39,000 mt.

Questions from SSC and the public raised concerns about the evidence for seasonal recruitment (age distributions), variations in seasonal prices, and effects of management regulations in areas under the jurisdiction of the SAFMC plans. No recent aging studies have been conducted. Prices appear to vary only slightly during the season. The existing NEFSC trawl surveys are considered

to be representative of most of the stock since Doryteuthis species don't typically extend below 450 meters and commercial catch rates in fisheries south of Cape Hatteras are lower than in the Mid Atlantic.

The SSC's responses to the terms of reference provided by the MAFMC (*in italics*) are as follows.

For Longfin Squid, the SSC will provide a written report that identifies the following for the 2021-2023 fishing years:

1) *Based on the criteria identified in the Acceptable Biological Catch (ABC) control rule, assign the stock to one of four types of control rules (analytically derived, modified by the assessment team, modified by the SSC, or OFL cannot be specified) the SSC deems most appropriate for the information content of the most recent stock assessment;*

   The SSC determines that the OFL cannot be specified given the available information. Assessment of this stock is based on a catch over biomass index. This does not allow estimation of a maximum fishing mortality rate threshold. This is unchanged from the previous SSC determinations.

2) *If possible to determine, the level of catch (in weight) associated with the overfishing limit (OFL) for each requested fishing year based on the maximum fishing mortality rate threshold or, if appropriate, an OFL proxy, and the associated coefficient of variation recommended by the SSC and its basis;*

   Because an OFL cannot be specified given the current state of knowledge, it is possible neither to specify the level of catch associated with the OFL, nor to define a coefficient of variability associated with OFL on which an ABC could be defined.

3) *The level of catch (in weight) and the probability of overfishing (P*) associated with the ABC for each requested fishing year, based on: 1) the traditional approach of varying ABCs in each year, and 2) a constant ABC approach derived from the projected ABCs. If possible, specify interim metrics that can be examined to determine if multi-year specifications need reconsideration prior to their expiration;*

   Since OFL, its uncertainty and therefore P* cannot be defined, the SSC cannot address the individual elements of this Term of Reference.

   The Longfin Squid population is characterized by two intra-annual cohorts. Previous catch advice has been developed by deriving an annual estimate of the average of productivities of the two intra-annual cohorts. Following precedence, the SSC recommends an ABC for a three-year period (2021-2023) of **23,400 mt**, the same as has been set since 2012 by the SSC. This estimate is based on catch levels that occurred during a period of apparent relatively light exploitation (1976-2009) according to the 2010 Longfin Squid assessment, and based on empirical evidence appears to be sustainable.

The SSC notes that cohort specific reference points presented during the management track assessment bring into question whether the 1976-2009 period was a period of low exploitation.

The SSC will consider the following data sources to evaluate whether to reconsider the three-year ABC specification:

1. Total landings –in particular deviation from average;
2. Substantial changes in the relative abundances of the two intra-annual cohorts.
3. Substantial changes in the exploitation indices of intra-annual cohorts.

4) *The most significant sources of scientific uncertainty associated with determination of OFL and ABC;*

The SSC notes the following sources of uncertainty in ABC

- Apparent differences in productivity of the two intra-annual cohorts is not accounted for as ABC is simply the average of the two cohorts;
- Annual catch advice for intra-annual cohorts likely smooths biotic and abiotic influences on the relative abundance, productivities and catchabilities of each cohort;
- Because of its short life span, the high and variable rate of natural mortality, and the delay in collating survey and catch information, there is an inherent lag in information pertaining to the current state of the stock and the ability to estimate reference points;
- Surveys cover unknown portion of entire range (variable availability) –the range may extend beyond survey coverage;
- The timing of surveys is variable which can complicate interpretation of abundance in a migratory species;
- Using a bottom trawl survey gear for a semi-pelagic species may induce variation in the indices of abundance and obscure the true signal; and
- Highly variable survey trends.

5) *Ecosystem considerations accounted for in the stock assessment, as appropriate, and any additional ecosystem considerations that the SSC considered in selecting the ABC, including the basis for those additional considerations;*

No specific ecosystem considerations were used in the 2020 assessment update, nor taken into account in the SSC's ABC determination.

6) *Research or monitoring recommendations that would reduce the scientific uncertainty in the ABC recommendation and/or improve the assessment level;*

- Continue development of a stock assessment approach that is specifically tailored to the squid life cycle and data availability. One avenue is to consider if assessment or management approaches for other semelparous species might be useful because they offer different approaches to modeling and reference point determination.
- Develop a cohort-specific assessment approach for determining stock status and trends. Given the empirical evidence for differences in productivity between the

cohort, the current annual average approach likely overestimates biological reference points for one cohort and underestimates it for the other.

- If cohort-specific methods cannot be developed, explore the benefits and challenges of alternative weightings of semi-annual surveys other than simple averaging.
- Explore impacts of system productivity and oceanographic correlates with trends in Longfin Squid availability, recruitment, growth, and abundance. This could include:
    - Development of approaches to standardize surveys relative to changes in environmental conditions and survey timing to improve understanding of availability and catchability to the surveys.
    - Evaluation of methods of incorporating ecological relationships, predation, and oceanic events that influence abundance and availability.
- Continue to monitor the performance of the squid fisheries and related fisheries in relation to the full breadth of regulatory measures with a view towards improving the economics of the fisheries.
- Evaluate approaches to real time management including expanding age and growth studies to better estimate average growth patterns and to discern seasonal productivity/catchability patterns.
- Until real-time assessment is feasible, expand cohort analysis to understand dynamics of Longfin Squid to support stock assessments and the incorporation of seasonal indices.
- Refine understanding of stock range and structure. In particular, determination of the extent of population closure would be of utility.
- Research addressing seasonal trends in egg production and maturation.
- Aging of squid within intra-annual cohorts to determine vital rates in support of assessment modeling.
- Develop an operating model with intra-cohort dynamics to support simulation experiments to evaluate key stock assessment assumptions pertaining to separating versus combining intra-annual cohorts.
- Deployment of sonar camera on headrope of survey gear to estimate gear avoidance.

7) *The materials considered by the SSC in reaching its recommendations;*

- SSC TORs for Longfin Squid
- Staff Memo: Butterfish, Longfin Squid, and Mackerel ABC recommendations
- Draft 2020 Longfin Squid Management Track Assessment Report and NEFSC Data Portal (https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php)
- 2020 Management Track Assessment Peer Review Panel Summary Report
- 2020 Advisory Panel Atlantic Mackerel, Longfin Squid, and Butterfish Fishery Performance Report
- 2020 Longfin Squid Fishery Information Document
- 51st SAW/SARC Assessment Summary Report (2010)
- 51st SAW/SARC Assessment Report (2010)

8) *A conclusion that the recommendations provided by the SSC are based on scientific information the SSC believes meets the applicable National Standard guidelines for best scientific information available.*

The SSC believes that the recommendations provided are based on scientific information that meets the applicable National Standard guidelines for best scientific information available.

ATLANTIC MACKEREL

Jason Didden, MAFMC staff lead, began with a update of the fishery and an initial recommendation for ABCs in 2021. It was noted that Mackerel landings are limited by bycatch limits for river herring and shad. The most recent Canadian assessment (held in March 2019) recommended low catches for the northern contingent of the Atlantic Mackerel stock. An advantage of postponing the Management Track assessment for Atlantic Mackerel until June 2021 is that it will synchronize the assessment efforts of both countries and avoid the mismatch that presently occurs.

Questions were raised about the availability of the 2015 year class to the fishery. Their low abundance in recent catches may be due to movements offshore because there is no evidence that a large-scale mortality had occurred. Offshore movements of Mackerel in the spring tend to be abrupt. Further concerns were expressed with missing egg survey and the spring trawl survey in 2020. Catch data and the 2019 egg survey data will however, be available. The SSC optimistically noted that an ICES working group for northwest Atlantic Mackerel had been formed but had not yet met.

The SSC's responses to the terms of reference provided by the MAFMC (*in italics*) are as follows.

For Atlantic Mackerel, the SSC will provide a written statement that identifies the following for the 2021 fishing year and interim 2022 fishing year:

1) *The appropriateness of the staff recommendation to implement status quo ABC specifications for the 2021 fishing season and interim status quo 2022 specifications until revised specifications can be implemented based on the results of a management track stock assessment to be completed in mid-2021. If status quo is inappropriate, specify an alternative ABC for 2021 and interim ABC for 2022 and provide any supporting information used to make this determination;*

   The SSC endorses the staff recommendation of 29,184 MT for the 2021 and 2022 fishing year, equal to ABC specifications for fishing year 2019 and 2020. The SSCs justification includes:

   - Low level of recent recruitments evidenced in the:
     - The 2018 Canadian stock assessment,
     - NEFSC spring survey, and
     - Updated estimates of catch-at-age in the recreational and commercial data.

- Persistent, low levels of spawning stock biomass in the 2018 Canadian assessment.
- High estimates of fishing mortality in the 2018 Canadian assessment.
- The unknown impacts of the 2019 closure of the Mackerel fishery in response to the river herring / shad cap.
- Updated catch at age information, particularly the age 3 index which does not indicate recovery.

2) *Provide any relevant data and/or assessment considerations for the 2021 management track assessment.*

- Published DFO assessment (through 2018)
- Mid-2021 NEFSC assessment will align with the DFO assessment for the Northern Contingent, which should allow for fully updated inputs from the Northern Contingent into the Southern Contingent assessment.
- Recreational landings proportion estimated to be high (38.8% since 2010)
- Lack of egg and NEFSC Spring Trawl survey data from the US in 2020 to inform the management track assessment
- Since 2000, the southern contingent has represented only 6.4% of the combined stock SSB
- DFO SSB trends likely representative of the entire spawning stock
- Atlantic Mackerel NEFSC trawl survey indices continue to be estimated at the high end of historical levels. Swept area biomass estimates might inform interpretation of this phenomenon, and whether it is an artifact of availability and catchability assumptions.
- The estimated size of the most recent year class in the assessment drives assumptions about rebuilding times, OFLs, and ABCs;
- Conversion of egg survey results to the spawning stock biomass estimate;
- The assessment is sensitive to the distribution of Atlantic Mackerel, which has been changing and may continue to change;
- Trawl survey representation of abundance and age structure;
- The assumption of fixed natural mortality rate and data gaps associated with major predators of Mackerel; and
- Missing catch information from bait and recreational fisheries in Canada.

BLUEFISH

Matt Seeley, MAFMC staff lead, provided a summary of recent council actions and noted that 2021 would be the second year of 2-year rebuilding specifications package. Tony Wood, NEFSC assessment lead, provided an update on survey and biological information. Based on the 2019 Management Track assessment, the stock is overfished but overfishing is not occurring.

Catches and survey indices have been trending downward over the past decade. Commercial landings in 2020 were similar to the seasonal patterns in 2019 with no strong effects of reduced demand.

The SSC expressed concerns about the effects of Covid 19 potentially leading to increased recreational catches in 2020, noting that private boat fishing was considered one of the safer

outdoor activities. Any potential overages by the recreational fleet may adversely affect the commercial fishery. Recreational dead discards have been higher than landings since 1996, perhaps reflecting a preference for smaller average sized fish. Some fishermen have reported abundant Bluefish stock offshore out of the range of most harvesters. It was noted that high abundance of sandeels generally bodes well for Bluefish stocks. Linkages of this trend to more broad-based environmental drivers, such as the North Atlantic Oscillation, are unknown.

Questions were raised about the potential utility of a mandatory angler reporting system based on cell phones. Responses suggested that this methodology was still not ready for incorporation into routine monitoring.

Because the stock is in a rebuilding program and application of the Council's revised risk policy has minimal effects Council staff did not recommend any changes from the current ABC of **7,385 mt** for 2021. There was no disagreement by members of the SSC.

SUMMER FLOUNDER

Kiley Dancy, MAFMC staff lead, briefed the SSC on recent trends in the fishery and conclusions of the Advisory Panel. The current status of Summer Flounder is not overfished and overfishing is not occurring based on the 2018 benchmark assessment. Mark Terceiro, NEFSC assessment lead, prepared a data update whose results were incorporated into Kiley's presentation. The 2021 fishing year will be the third year of a constant ABC policy developed in 2019 with catch limit of 11,354 mt. Council staff recommended an 8% increase in the 2021 catch limit to 12,297 mt consistent with the revised Council risk policy that allows 39% probability of overfishing compared to previous level of 34%.

Survey data suggest that the 2018 year class may be above average and this is partially supported by evidence from the fishery and various state surveys. The fall index in 2019 decreased by 36% but the 2019 spring index declined by only 8%. Overall, the survey indices have been varying without trend for the past decade but catches have been trending downward over the same period. Recreational landings in 2019 were about the same as in 2018. Commercial fishermen report recent increases in landings as harvesters compensate for earlier disruptions from Covid 19 related shutdowns.

In recognition of reduced average recruitment in the 2018 benchmark assessment, catch projections use only the recruitment estimates from the most recent 7 years. Trends in average weights at age are decreasing but the differences may be due to the increased survival of males which tend to be smaller as age than females, irrespective of environmental conditions. Historically, males over 10 years old were rare but are now seen as old as 19 years old.

The SSC expressed some concern that the rebuilding of the stock does appear to be rapid. It was noted that rebuilding was predicted to be slow under the harvest policy adopted. Only 86% of the 2019 quota was taken so there may be some effect on rebuilding that is not built into the current 3 year ABC. The 2018 year class will not fully recruit to the fishery for 3 or 4 years. Concerns about increasing discards during this transition were expressed. The Council's MSE project for Summer Flounder will be looking at these potential effects. A member of the public suggested a

total length limit of all landed fish (i. e., sum of all lengths) as a way of reducing discard mortality but there have been no analyses of the efficacy of such measures in the Northeast.

The SSC's responses to the terms of reference provided by the MAFMC (*in italics*) are as follows.

For Summer Flounder, the SSC will provide a written statement that identifies the following for the 2021 fishing year:

1) *Specify a revised ABC for the 2021 fishing season based on the Council's recently approved changes to the risk policy. If revising the 2021 ABC with the new risk policy is inappropriate, specify an alternative ABC for 2021 (e.g., previous recommendation) and provide any supporting information used to make this determination;*

   The SSC received a presentation from Kiley Dancy (MAFMC staff) comprising a data and fishery update and a review of previously recommended 2021 ABC. The SSC initially developed ABC recommendations for the 2021 fishing year during its February 2019 webinar, based on the SAW66 benchmark assessment.

   The data update suggests an above average year class in 2018. These fish will not be fully recruited to the landings in the fishery until 2022. There may be some expected increase in the discards in 2021 from this year class, but this cohort is not included in the projections. This implies some uncertainty over the reliability in the projections from the assessment in assuming the 2019 ABCs given the current information.

   However, the SSC determined this was not a rationale for not applying the new Council risk policy. The SSC recommended that the ABC for the 2021 fishing year should be revised based on December 2019 changes to the MAFMC risk policy and the staff recommendations. The SSC recommends an ABC of **12,297 mt**.

   This represents an 8% increase in the ABC over the previous 2021 ABC recommendation (11,354 mt). The revised ABC is calculated based on a currently implemented 2021 OFL of 14,365 mt, a projected 2021 B/Bmsy of 0.88, a P* value of 0.39 under the revised risk policy, and the currently applied OFL CV of 60%.

2) *Provide any relevant data and/or assessment considerations for the 2021 management track assessment.*

   The SSC endorses the research recommendations provided in the SAW-66 assessment report.

   The SSC notes that many of its recommendations made at the February 2019 meeting are appropriate for a research track assessment and not for the management track assessment scheduled for 2021.

   The 2020 data update received by the SSC at this meeting suggests an above average year class in 2018. These fish will not be fully recruited to the landings in the fishery until 2022.

There may be some expected increase in the discards in 2021 from this year class, but this cohort is not included in the projections. Therefore, for the 2021 management track assessment, the SSC recommends:

1. Verifying the strength of the 2018 year class based on a synthesis of the various surveys included in the assessment. (3 years of data on this year class will be available)
2. Quantify the size, magnitude, and uncertainty of the discards.

SCUP

Karson Coutre, MAFMC staff lead, briefed the SSC with updates of fishery independent and dependent data provided Mark Terceiro, NEFSC assessment lead. Karson also summarized the relevant sections of the Fishery Performance Report prepared by the MAFMC and ASMFC Summer Flounder/Scup/Black Sea Bass Advisory Panels and made initial recommendations on ABC revisions for 2021. Based on the 2019 assessment Scup are presently 63% above B_{msy} (not overfished) and slightly below the F_{msy} threshold (overfishing not occurring). Landings in 2019 have been relatively stable since 2013, typically at or below harvest limits in both the recreational and commercial fisheries. Stock biomass has been declining as forecasted but is thought to be well above the B_{msy} level. Under the Council's revised risk policy, the probability of overfishing limit is set to 0.49 which resulted in a recommended ABC increase of 13% from 13,913 mt to 15,791 mt in 2021.

Based on the 2019 assessment, recruitments for 2016 to 2018 appear to be below average but presence of any trend cannot be verified.

The SSC's responses to the terms of reference provided by the MAFMC (*in italics*) are as follows.

For Scup, the SSC will provide a written statement that identifies the following for the 2021 fishing year:

1) *Specify a revised ABC for the 2021 fishing season based on the Council's recently approved changes to the risk policy. If revising the 2021 ABC with the new risk policy is inappropriate, specify an alternative ABC for 2021 (e.g., previous recommendation) and provide any supporting information used to make this determination;*

   The SSC recommends an ABC of **15,791 mt** for the 2021 fishing season, based on the Council's revised risk policy (P* = 0.49). The SSC notes that, although stock biomass remains well above B_{MSY}, indices of recruitment and stock biomass have declined in recent years. At the same time, total removals in 2019 were below ABC and the removals in 2020 are likely to be below the ABC as well.

2) *Provide any relevant data and/or assessment considerations for the 2021 management track assessment.*

The SSC recommends consideration of the following issues for the 2021 management track assessment, if possible:

- The Scup Statistical Catch at Age assessment model uses multiple selectivity blocks. The final selectivity block (2006-2018) is the longest in the model. The applicability of the most recent selectivity block to the current fishery condition is uncertain. If the fishery selectivity implied in this block changes, estimates of stock number, spawning stock biomass, and fishing mortality become less reliable.
- Improve estimates of discards and discard mortality for commercial and recreational fisheries.
- Recruitment indices for Scup have been declining in recent years. The 2021 management track assessment should consider the implications on stock biomass projections should this trend continue.
- Most of the fishery-independent indices used in the model provide estimates of the abundance of Scup < age 3. One consequence is that much of the information on the dynamics of Scup of older ages arises largely from the fishery catch-at-age and from assumptions of the model, and are not conditioned on fishery-independent observations. As a result, the dynamics of these older fish remain uncertain. Knowledge of the dynamics of these older age classes will become more important as the age structure continues to expand.
- The projection on which the ABC was determined assumes that the quotas would be landed in 2019, 2020, and 2021; however, landings in recent years have been below the quotas and perhaps a more realistic assumption should be used in future projections.
- Uncertainty exists with respect to the estimate of natural mortality used in the assessment.
- Uncertainty exists as to whether the MSY proxies ($SSB_{40\%}$, $F_{40\%}$) selected and their precisions are appropriate for this stock.
- Survey indices are particularly sensitive to Scup availability, which results in high inter-annual variability. Efforts were made to address this question in the Stock Assessment Workshop and Stock Assessment Review Committee (SAW/SARC) in 2017 that should be continued in the 2021 management track assessment.

BLACK SEA BASS

Julia Beaty (MAFMC staff) briefed the SSC on the management history and recent NEFSC data update for Black Sea Bass prepared by Gary Shepherd. The assessment model was not updated for this meeting but data on commercial and recreational landings were provided. Survey data and trends in size composition suggest a broad range of size and age classes in the population.

Julia also summarized the relevant sections of the Fishery Performance Report prepared by the MAFMC and ASMFC Joint Summer Flounder/Scup/Black Sea Bass Advisory Panels. Notably, prices for Black Sea Bass have declined sharply in 2020 from $4-6/lb to $1.50 in response to reduced demand, but the trajectory of seasonal commercial landings in 2020 is comparable to that observed in 2019. Advisers reported that abundance trends in both southern and northern areas appear strong; this observation is consistent with survey trends with the 2015 year class

dominant in both areas. Gary reported that the 2018 year class may also be above average but confirmation must await a model update. Depending on its strength, one might expect increased discarding in fisheries constrained by size limits. New information on mortality rates of discarded fish is available and could be incorporated in the next assessment given the Management Track guidelines.

Julia reviewed the previously approved 2021 and 2020 OFLs and ABCs and recommended an updated ABC value for 2021 consistent with the Council's revised risk policy. Based on the 2019 stock status and the new policy the revised risk of overfishing criterion increases from 42% to 49%. This increased risk policy permits an increased ABC from 6,835 to 7,916 mt for 2021.

Concerns were expressed about the consequences of actual catches exceeding or falling below ABCs during the interim years of a projection period. Generally, it is assumed that the ABC is taken during a multiyear specification period. Ideally the realized catches for a given interim year would be used to update the guidance of future projection years. However, the implications of this purely scientific exercise on management decisions has not been considered by the Council or GARFO.

The SSC's responses to the terms of reference provided by the MAFMC (*in italics*) are as follows.

For Black Sea Bass, the SSC will provide a written statement that identifies the following for the 2021 fishing year:

1) *Specify a revised ABC for the 2021 fishing season based on the Council's recently approved changes to the risk policy. If revising the 2021 ABC with the new risk policy is inappropriate, specify an alternative ABC for 2021 (e.g., previous recommendation) and provide any supporting information used to make this determination;*

The SSC recommends a revised ABC of 7,916 MT for 2021. This ABC is based on the same methods applied by the SSC in 2018 and is adjusted for the updated Council risk policy. This is based upon projections that assume that ABC is taken and not exceeded, as it has been frequently in recent years. Given the small buffer, if the ABC is exceeded, there is a high likelihood of the stock experiencing overfishing.

This is based on the observation that stock indicators in the data update have not changed our perception of the stock:

- 2018 and 2019 catches were stable across recreational and commercial fisheries.
- Incomplete information from 2020 suggests an increase in the survey index. The survey index remained similar between 2018 and 2019.
- Some recruitment signal is apparent in 2019 and incomplete 2020 survey length frequencies.

Council staff noted and the SSC agreed with the need for improved discard projection to prevent ACL and ABC overages as the revised risk policy gets applied, as it reduces the buffer between ABC and OFL to 1%.

2) *Provide any relevant data and/or assessment considerations for the 2021 management track assessment.*

The SSC endorses the list of research recommendations included in the 62nd SARC report. In addition, the SSC recommends:

- Consider basing harvest projections on the actual catch (including overages) in relation to the ABCs. This would be particularly important in later years of the projection.
- Investigate the implications of size structure (progression of strong year classes) on projected discard mortality
- Effort to improve precision of discard estimates, estimate uncertainty in discards
- Update discard mortality rates based on new research (to the extent that these depth-specific mortality estimates can be appropriately matched to recreational catch from similar depths):

    - Zemeckis, D.R., Kneebone, J., Capizzano, C.W., Bochenek, E.A., Hoffman, W.S., Grothues, T., Mandelman, J.W. and Jensen, O.P. 2020. Estimating and reducing the discard mortality of black sea bass (*Centropristis striata*) in a deepwater Mid-Atlantic recreational fishery. Fishery Bulletin. 118:105-119.
    - Rudershausen, P.J., B. J. Runde, and J. A. Buckel. 2020. Effectiveness of venting and descender devices at increasing rates of post-release survival of black sea bass. North American Journal of Fisheries Management. 40:125-132

UPDATE ON COUNCIL AMENDMENTS

Matt Seeley, MAFMC staff lead, made two presentations to the SSC on the recent management actions of the Council with respect to allocations of Summer Flounder, Scup and Black Sea Bass FMP amendment and the Bluefish FMP amendment. The presentations were for information purposes only, although each had important economic implications and may benefit from further analyses by the SSC on alternative quantitative bases. For both FMPs the primary driver for the changes were increases in the magnitude of recreational catches from the revised MRIP estimates. Current allocation patterns are based on historical landing patterns ranging from 1980 to 1992 depending on the species. Revisions to the statistical methodologies and survey methods have revealed substantial underestimation of recreational catches, thereby prompting reconsideration of the bases for allocation. A variety of alternative bases have been proposed by the FMAT and approved by the Council.

The SSC questioned why all of the alternatives based on economic benefits had been removed from consideration. Members of the SSC noted that various econometric methods can allow for economic value to be revealed using surveys of harvesters in both recreational and commercial fisheries. Such approaches may have value as a bottom up strategy for estimating relative values. It was noted that recreational and commercial sectors in Alaska routinely trade quotas

among groups and such procedures might work in the Mid-Atlantic. Several SSC members suggested that earlier inclusion of the SSC could have helped with selection of alternatives. Members expressed anticipation of the final conclusions of the Schnier and Hicks report on Summer Flounder economic model. Collectively the discussions of the FMP amendments provided substantial motivation for the Socio-Economics Working Group outlined under Other Business.

Other Business

Development of a Socio Economics Working Group

The SSC discussed the role of economists and social scientists in the work of the SSC. It was noted that all assessments have economic implications for the affected industries as well as the nation as a whole, as defined in the MSA. Economists participate extensively in the various FMATs of the Council, but specific requests to the SSC from the Council are infrequent. In view of the recently approved increase in the number of social scientists on the SSC a working group was proposed to better define the role of economists in the process of setting ABCs. A workshop, entitled Socioeconomic Aspects in Stock Assessments Workshop (SEASAW), was held in New Orleans in February 2020. Results of that workshop are not yet available but may provide timely input to a working group. The SSC endorsed the concept of a working group and noted that the white paper presented to the Council in August 2019 would also be instructive. The increasing focus on ecosystem considerations, tradeoffs among user groups, evaluation of control rules, communication of socioeconomic risks to Council, and upcoming challenges of offshore energy development were all mentioned as tasks where economic and social sciences could contribute. Given the need to maintain boundaries between science, management and policy decisions, some SSC members expressed concerns that the economic aspects follow after the biological concerns are addressed.

The SSC agreed that a working group would be helpful and a request for its formation would be proposed at the August 2020 Council meeting. A poll will be sent to SSC members to solicit participants with expertise in economics and stock assessment, and to define some terms of reference.

Biological Concerns Regarding Council Risk Policy

At its July 2020 meeting, the SSC developed ABC specifications for Ocean Quahog using the new Council's risk policy. In our deliberations, the SSC accepted the OFL from the most recently updated assessment. The SSC then worked through our nine-step process for estimating the level of scientific uncertainty associated with the OFL. The SSC determined a CV of 100% was appropriate for Quahog. Using this level of scientific uncertainty in the application of the Council's new risk policy resulted in a recommended ABC that represented a 49% probability of exceeding the overfishing level.

The SSC expresses concern that the removal of the "atypical life history" category from the Council's risk policy may have resulted in a recommended ABC associated with a higher level of risk of overfishing than intended for this species. Quahog is believed to live an extraordinarily

long time, with maximum age in excess of 500 years – perhaps 10 times longer than most species with which the Council works. As a result, if we do exceed the true overfishing level, it would take a long time for us to recognize declines in the stock, and the stock may take an extraordinarily long time to recover. Accordingly, the SSC recommends flexibility in the risk policy to account for the unusual characteristics of this species.

Public comments on this topic noted that clams have recovered from catastrophic natural events in recent history.

Miscellaneous

The SSC also considered a proposal to develop a white paper for Council use on the relative merits of time-varying vs constant multiyear harvest policies. Considerations of current stock status and trends would be important aspects of this scientific guidance. There was insufficient time to discuss this concept and further consideration would have to be delayed to the September meeting.

Attachment 1

Mid-Atlantic Fishery Management Council

Scientific and Statistical Committee Meeting

July 22 – 23, 2020 via Webinar

Webinar Information
(Note: same information for both days)
Link: http://mafmc.adobeconnect.com/july2020ssc/
Call-in Number: 1-800-832-0736
Access Code: 5939710#

****REVISED****

AGENDA

** The Wednesday agenda ran long and the Thursday agenda was modified – longfin squid, originally scheduled for Wednesday, was added to Thursday

Wednesday, July 22, 2020

9:00 Welcome/Overview of meeting agenda (Rago)

9:05 Atlantic Surfclam ABC specifications for 2021-2026 fishing years
- Review of 2020 management track assessment and peer review (D. Hennen)
- Review of staff memo and 2021-2026 ABC recommendations (J. Coakley)
- 2021-2026 SSC ABC recommendations (W. Gabriel)

11:15 Ocean Quahog ABC specifications for 2021-2026 fishing years
- Review of 2020 management track assessment and peer review (D. Hennen)
- Review of staff memo and 2021-2026 ABC recommendations (J. Coakley)
- 2021-2026 SSC ABC recommendations (E. Houde)

12:00 Lunch

12:30 Continue Ocean Quahog ABC recommendations

1:30 Butterfish ABC specifications for 2021-2022 fishing years
- Review of 2020 management track assessment and peer review (C. Adams)

- Review of staff memo and 2021-2022 ABC recommendations (J. Didden)
- 2021-2022 SSC ABC recommendations (R. Latour)

5:30 Adjourn

Thursday, July 23, 2020

8:30 Longfin Squid ABC specifications for 2021-2023 fishing years
- Review of 2020 management track assessment and peer review (L. Hendrickson)
- Review of staff memo and 2021-2023 ABC recommendations (J. Didden)
- 2021-2023 SSC ABC recommendations (M. Frisk)

10:30 Atlantic Mackerel ABC specifications for 2021 fishing year
- Review of staff memo and 2021 ABC recommendation (J. Didden)
- 2021 SSC ABC recommendation (D. Secor)

11:30 Bluefish data and fishery update; review of previously recommended 2021 ABC (M. Seeley)

12:30 Lunch

1:00 Summer flounder data and fishery update; review of previously recommended 2021 ABC (K. Dancy)
- Revised 2021 SSC ABC recommendation with new Council risk policy (M. Wilberg)

2:00 Scup data and fishery update; review of previously recommended 2021 ABC (K. Coutre)
- Revised 2021 SSC ABC recommendation with new Council risk policy (J. Boreman)

3:00 Black Sea Bass data and fishery update; review of previously recommended 2021 ABC (J. Beaty)
- Revised 2021 SSC ABC recommendation with new Council risk policy (O. Jensen)

4:00 Update and feedback on Council actions: Summer Flounder, Scup, and Black Sea Bass Commercial/Recreational Allocation Amendment; Bluefish Allocation and Rebuilding Amendment (Council staff)

5:00 Other business

5:30 Adjourn

Note: agenda topic times are approximate and subject to change

Attachment 2

MAFMC Scientific and Statistical Committee
July 22-23, 2020

Meeting Attendance via Webinar

Name	Affiliation
SSC Members in Attendance:	
Paul Rago (SSC Chairman)	NOAA Fisheries (retired)
Tom Miller	University of Maryland – CBL
Ed Houde	University of Maryland – CBL (emeritus)
Dave Secor	University of Maryland – CBL
John Boreman	NOAA Fisheries (retired)
Geret DePiper	NOAA Fisheries NEFSC
Lee Anderson	University of Delaware (emeritus)
Jorge Holzer	University of Maryland
Yan Jiao	Virginia Tech University
Rob Latour	VIMS
Brian Rothschild	Univ. of Massachusetts – Dartmouth (emeritus)
Olaf Jensen	Rutgers University
Sarah Gaichas	NOAA Fisheries NEFSC
Wendy Gabriel	NOAA Fisheries NEFSC
Mike Wilberg (Vice-Chairman)	University of Maryland – CBL
Alexei Sharov	Maryland Dept. of Natural Resources
Mike Frisk	Stony Brook University
Mark Holliday	NOAA Fisheries (retired)
Cynthia Jones	Old Dominion University
Gavin Fay	U. Massachusetts—Dartmouth
Others in attendance (includes presenters and members of public who spoke):	
G. Warren Elliott	MAFMC Vice-Chair
Tony DiLernia (July 23rd only)	MAFMC
Jason Didden	MAFMC staff
Brandon Muffley	MAFMC staff
José Montañez	MAFMC staff
Jessica Coakley (July 22nd only)	MAFMC staff
Mary Sabo	MAFMC staff
Lisa Hendrickson (July 23rd only)	NOAA Fisheries NEFSC
Dan Hennen (July 22nd only)	NOAA Fisheries NEFSC
Charles Adams (July 22nd only)	NOAA Fisheries NEFSC
Karson Coutré	MAFMC staff
Kiley Dancy (July 23rd only)	MAFMC staff
Matt Seeley	MAFMC staff
Julia Beaty	MAFMC staff
Kiersten Curti (July 23rd only)	NOAA Fisheries NEFSC
Mark Terceiro	NOAA Fisheries NEFSC

Tony Wood (July 23rd only)	NOAA Fisheries NEFSC
Gary Shepherd (July 23rd only)	NOAA Fisheries NEFSC
James Fletcher	United National Fisherman's Assoc.
Dave Wallace (July 22nd only)	Wallace and Associates
Greg DiDomenico	Lunds Fisheries
Jeff Kaelin	Lunds Fisheries
Eric Reid	Seafreeze, NEFMC Vice-Chair

Attachment 3

OFL CV Decision Table Criteria (updated June 2020)

Decision Criteria	Default OFL CV=60%	Default OFL CV=100%	Default OFL CV=150%
Data quality	One or more synoptic surveys over stock area for multiple years. High quality monitoring of landings size and age composition. Long term, precise monitoring of discards. Landings estimates highly accurate.	Low precision synoptic surveys or one or more regional surveys which lack coherency in trend. Age and/or length data available with uncertain quality. Lacking or imprecise discard estimates. Moderate accuracy of landings estimates.	No reliable abundance indices. Catch estimates are unreliable. No age and/or length data available or highly uncertain. Natural mortality rates are unknown or suspected to be highly variable. Incomplete or highly uncertain landings estimates.
Model appropriateness and identification process	Multiple differently structured models agree on outputs; many sensitivities explored. Model appropriately captures/considers species life history and spatial/stock structure.	Single model structure with many parameter sensitivities explored. Moderate agreement among different model runs indicating low sensitivities of model results to specific parameterization.	Highly divergent outputs from multiple models or no exploration of alternative model structures or sensitivities.
Retrospective analysis	Minor retrospective patterns.	Moderate retrospective patterns.	No retrospective analysis or severe retrospective patterns.
Comparison with empirical measures or simpler analyses	Assessment biomass and/or fishing mortality estimates compare favorably with empirical estimates.	Moderate agreement between assessment estimates and empirical estimates or simpler analyses.	Estimates of scale are difficult to reconcile and/or no empirical estimates.
Ecosystem factors accounted	Assessment considered habitat and ecosystem effects on stock productivity, distribution, mortality and quantitatively included appropriate factors reducing uncertainty in short term predictions. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are stable. Comparable species in the region have synchronous production characteristics and stable short-term predictions. Climate vulnerability analysis suggests low risk of change in productivity due to changing climate.	Assessment considered habitat/ecosystem factors but did not demonstrate either reduced or inflated short-term prediction uncertainty based on these factors. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are variable, with mixed productivity and uncertainty signals among comparable species in the region. Climate vulnerability analysis suggests moderate risk of change in productivity from changing climate.	Assessment either demonstrated that including appropriate ecosystem/habitat factors increases short-term prediction uncertainty, or did not consider habitat and ecosystem factors. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are variable and degrading. Comparable species in the region have high uncertainty in short term predictions. Climate vulnerability analysis suggests high risk of changing productivity from changing climate.
Trend in recruitment	Consistent recruitment pattern with no trend.	Moderate levels of recruitment variability or modest consistency in pattern or trends. OFL estimates adjusted for recent trends in recruitment. OFL estimate appropriately accounted for recent trends in recruitment.	Recruitment pattern highly inconsistent and variable. Recruitment trend not considered or no recruitment estimate.
Prediction error	Low estimate of recent prediction error.	Moderate estimate of recent prediction error.	High or no estimate of recent prediction error.

Assessment accuracy under different fishing pressures	High degree of contrast in landings and surveys with apparent response in indices to changes in removals. Fishing mortality at levels expected to influence population dynamics in recent years.	Moderate agreement in the surveys to changes in catches. Observed moderate fishing mortality in fishery (i.e., lack of high fishing mortality in recent years).	Relatively little change in surveys or catches over time. Low precision of estimates. Low fishing mortality in recent years. "One-way" trips for production models.
Simulation analysis/MSE	Can be used to evaluate different combinations of uncertainties and indicate the most appropriate OFL CV for a particular stock assessment.		

Attachment 4

SSC-Approved OFL CV Decision Table for Atlantic Surfclam

Decision Criteria	Summary of Decision Criteria Considerations	Assigned OFL CV Bin (60/100/150)
Data quality	**Survey** • Efficiency of survey gear has been estimated through several experiments and is variable between experiments for any gear configuration • Because new strata are larger there are now many fewer gaps in stratum sampling. This reduces the need for data "borrowing." • The Georges Bank components are lower than previous estimates. Sampling intensity there has increased, and the commercial dredge used recently has higher efficiency. • There is one shallow inshore component that is exploited but cannot be surveyed under current protocols. • Restratification led to reduced survey area, and so area swept estimates are lower, reducing the total number in that estimate. • Age and length data were considered adequate. • Large uncertainty envelope may lead to overinterpretation of trends in indices. **Landings and discards** • Landings data are believed to be accurate. • Regular observer coverage of the fishery was implemented recently (2015). • Estimated discards are low.	60%
Model appropriateness and identification process	• Potential concerns about domed selectivity (consequences and mechanisms). May be an artifact of parameter interactions that are not currently understood. • Potential for effects of assumptions about spatial structure. The SS3 model structure in this assessment is a single model with two areas, compared to previous assessments where separate models were generated for each area and results combined. • Uncertainty regarding controls on recruitment • The entire survey time series (stratified number per tow) was used for trend; swept area abundance estimates after 1997 were used for scale. Most recent series (MCD) was used for both scale and trend but only available for three years. • Previous estimates of efficiency were used as an informative prior for q. • A number-weighted F was estimated over the two areas (vs. a total F dominated by high F in Georges Bank, but low stock numbers there). • More parameters were estimated this year (183). • The model incorporated time-varying growth (in southern area), which improved fits to length composition data.	100%

	• Model sensitivities included comparisons of trajectories of earlier assessments with models incorporating changes to new model (SS3), restratification, and addition of discard estimates. • Model sensitivities included comparisons of trajectories of models incorporating area effects, estimating growth in the north, estimating selectivity in both areas, removing apparently erroneous length composition data, allowing time varying growth in the south, and changing the method of estimating overall stock F; sensitivity to R0, the scale-setting parameter; and a variety of other features. • MCMC was used to evaluate uncertainties from maximum likelihood estimates. R0 (unfished recruitment parameter) and recruitment parameters, with roughly similar results as MLE approximate. • There is some sensitivity to initial starting parameter values. • Stock-recruitment relationship appears flat, because of the high steepness parameter: there were no observations of recruitment at low stock sizes to inform this parameter. • Linf declined over time.	
Retrospective analysis	• Historical retrospective showed approximately similar trends although different scales. This model scales biomass lower than previous ones. • Peels based on 6 years indicate only minor internal retrospective patterns: Mohn's rho does not indicate the need for adjustments.	60%
Comparison with empirical measures or simpler analyses	• Swept area biomass estimates and ratios of efficiency-corrected swept area/catch (F proxy) were of similar scale to model results; but both analyses make similar survey catchability assumptions.	60%
Ecosystem factors accounted	• Climate vulnerability indicates a high risk • Effects of southern Surfclam unknown • No ecosystem factors were considered explicitly in the assessment, although the separation into two areas allows responsiveness to potentially different productivities in the two areas, and time-varying growth allows responsiveness to changing but unspecified ecological factors. • If distribution moves deeper as temperatures increase, that shift would be reflected in deeper survey strata that sample Ocean Quahog. • Increasing ocean acidification may affect growth.	150%
Trend in recruitment	• No trend, but not much information on recruitment • Timeseries average recruitment used. OFL projections insensitive to assumptions about recruitment because of six year lag in recruitment to the fishery • Neither survey nor commercial operations select for young Surfclams. • The effect of a single year's recruitment on stock size and stock status is likely small because of the number of ages in the stock.	100%
Prediction error	• Large scale difference between previous benchmark and current management track assessment • Most of the prediction error would seem to be related to uncertainties of scale (bias rather than variance).	150%

	• Performance and precision is compared to earlier assessments (see sensitivity analyses above). • F/Fthreshhold = 0.26, with CV = 0.25; SSB/SSBthreshold = 2.38 with CV = 0.11.	
Assessment accuracy under different fishing pressures	• High signal of fishing on Georges Bank, low signal in southern New England/Mid Atlantic • Fishing mortality appears low relative to natural mortality, which makes scale estimates difficult, reduces the amount of information that can be obtained from fishery dependent data, and increases reliance on estimates of survey efficiency. • Increases in F are emerging in the Georges Bank component, however. This may lead to increased accuracy associated with dynamics in that area.	100%
Simulation analysis/MSE	• Previous benchmark assessment included simulation analyses to choose and test the fishing mortality rate threshold and reference point • A "Plan B" simplified approach was also developed and compared.	100%

Attachment 5

SSC-Approved OFL CV Decision Table for Ocean Quahog

Decision Criteria	Summary of Decision Criteria Considerations	Assigned OFL CV Bin (60/100/150)
Data quality	• Accurate landings data – mandatory logbook reporting • Discards are variable but low compared to landings (generally <5%) • Long-term survey, recently redesigned (restratified), covering stock area to improve survey efficiency and precision • No new survey data since the last assessment, but restratifcation of the survey and its data used in the most recent assessment update • Dredge efficiency and selectivity data and evaluation available to inform models • Comprehensive length-frequency information from landings and survey; little age and growth information is available • Recruitment data sparse, but probably adequate for assessment of this long-lived species • Given the slow life history, the survey data cover a limited number of generations	60%
Model appropriateness and identification process	• SS3 model; two areas (S and N) to provide assessment for whole stock. Other models applied in the past • Model well documented but its efficacy constrained by low F. Trends well described but scale still uncertain • Model generally captures fishery-specific traits for this extremely long-lived species, but performance of reference points for such species is uncertain. Nevertheless, the reference points used have performed well in simulation testing (Hennen, D.R. 2015) • Comparison made among the assessment baseline model and models with different structures • Comprehensive model testing and simulations, including Markov Chain Monte Carlo (MCMC) run to evaluate model performance and uncertainty	100%
Retrospective analysis	• No retrospective adjustment of spawning stock biomass or fishing mortality required because the internal retrospective analysis was exceptionally stable. • Comparisons for several previous assessments and assessment models • Scales differ between early assessments (before 2004) and more recent assessment, but trends are similar • Current assessment (2020) and previous (2017) very similar; SSB a bit higher in 2020.	60%
Comparison with empirical measures or simpler analyses	• Swept area biomasses from surveys are supportive of, and similar to, modeled stock. • Probability distributions for B and F reference points similar to those from SS3 • Because catchability assumptions are identical in both the model and the swept area biomass calculations, these metrics are not independent and provide limited confirmation of the model.	100%

Ecosystem factors accounted	• No stock-relevant ecosystem factors included in the assessment or model • No ecosystem factors outside the stock assessment included in developing reference points. • Awareness of probable ongoing climate change and probable future offshore or northward shifts in distribution, or potential changes in productivity • Vulnerability analysis classified this stock as vulnerable ("very high" vulnerability) to climate/ecosystem change (Hare et al. 2016)	150%
Trend in recruitment	• Recruitment trends or levels not well known or described, but perhaps not critical for model performance in this long-lived species. • Recruitment in this long-lived species is not important for short-term forecasts. • No indication of highly variable recruitment, but aging errors potentially could give rise to a false belief that many age classes are present in the population. • No stock-recruitment relationship. Low power to detect a S-R relationship given limited range of observed SSB • OFL estimates apparently are adjusted by the recruitment proxy generated in the model. The SS3 model has a technical constraint dealing with the low and apparently invariable recruitments. The model accounts for apparent increases in abundance by introducing a single large recruitment near the middle of the time series.	100%
Prediction error	• Prediction errors are considered in the assessment • Model performance and precision are compared to earlier assessments (bridging) • Model performance consistent with earlier modeling. Scale shifts but trends are consistent • Prediction CV for F_{2020}/F_{thr} = 0.342 is 0.295; Prediction CV for SSB_{2020}/SSB_{thr} = 2.17 is 0.108. These CV's are relatively low. • Projected biomass from the last assessment was within the confidence bounds of the biomass estimated in the current assessment	100%
Assessment accuracy under different fishing pressures	• Estimates and projections probably are valid (accurate) but **consistently low F makes it difficult to confirm scales** • The long time series of survey data, catches and trends lend credence to the assessment results despite low F, uncertainty in recruitment, uncertainty in selectivity, and questions about growth patterns • Exploitation is low; F <0.01 and has not varied greatly over the years. Relative F may be declining in the most recent years and F/Fthr <0.3 in the most recent years • While scale is uncertain, relative SSB/SSBthr remains >2, with little change over years or in projected years, probably as expected given the low F and little incentive for fishery to increase effort	150%
Simulation analysis/MSE	• No MSE was conducted for this assessment, but an earlier simulation-based approach to assessment was conducted that informs management strategies and alternatives.	100%

Attachment 6

SSC-Approved OFL CV Decision Table for Butterfish

Decision Criteria	Summary of Decision Criteria Considerations	Assigned OFL CV Bin (60/100/150)
Data quality	• Landings were updated and showed an increasing trend since 2010 but have remained lower than peak values in the mid-1990s (~7500 mt) and late 1990s (~8500 mt). The recent increasing trend in landings is expected given that recent Butterfish ABCs have been increased relative to those for the mid-2000s. • Discards estimation was modified and followed the algorithm typically applied by the NEFSC, so the discards time series changed somewhat when compared to that included in the previous assessment. Discards continue to comprise an importance fraction of total catch, and have remained stable since 2011 (range: ~ 1500-2000 mt). • Total catch (landings + discards) showed harvest of ages 0-3 fish, with the bulk being ages 1-2, particularly since 2015. • Indices of relative abundance were based on the NEFSC fall offshore survey (1989-2019 with 2009-2019 calibrated to Albatross units and 2017 omitted due to insufficient sampling), NEFSC fall inshore survey (1989-2008), and NEAMAP fall survey (2007-2019). • Trends in all survey indices showed slightly decreasing patterns over time, with the NEAMAP index being more variable. • A NEAMAP age-length key was applied as opposed to using the NEFSC age-length key for NEAMAP survey data. This change was supported by the PRC. Age composition of all survey catches reflected high proportions of age-0 fish, far fewer age 1-2 fish, and virtually no age 3+ fish.	100%
Model appropriateness and identification process	• ASAP4, years 1989-2019, ages 0-4+ • Fishery: 1 fleet (landings + discards), 1 commercial selectivity time block, selectivity set to 1.0 (full) for ages 2+, and CVs based on variance estimates of discards. • Surveys: NEFSC fall offshore catchability fixed as product of availability (A = 0.62, mean for 1989-2015, no longer updated) and efficiency (e = 0.2). Selectivity set to 1.0 (full) for age 0, design-based CV estimates were rescaled based on RMSE diagnostics. • Recruitment CV was set to 0.6 and M was estimated. Q has to be assumed in order for model to estimate M • Model diagnostics indicated that the model results were stable and reliable. • The PRC noted some inconsistencies in the input weights-at-age for cohorts, where mean weight appeared to decline for fish transitioning from age 3 to age 4+ or remained stable for fish transition from age 0 to age 1. The PRC recommended revisiting the approach used to calculate mean weights-at-age. • The new estimate of M was slightly higher than the previous estimate (1.29 vs. 1.25), but within the range of expected estimation variability.	100%

	• The assessment model produced a decreasing trend in biomass, and decreasing trend in recruitment, and an increasing trend in fishing mortality. The latter pattern was expected given increased landings in recent years, but the PRC expressed concern regarding the biomass and recruitment patterns.	
Retrospective analysis	• A retrospective analysis was performed and no retrospective adjustments were made to assessment model results but still 30%. • Plots of retro showing mainly one direction even though stats acceptable. Affects initial conditions due to M estimation.	100%
Comparison with empirical measures or simpler analyses	• No simpler analyses were conducted. • Because catchability is assumed known in the assessment, the results should be similar to simple swept area estimates of biomass. Benchmark did a lot of work to reduce this uncertainty but substantial uncertainty remains.	100%
Ecosystem factors accounted	• No formal ecosystem factors were included in the assessment or model, but the benchmark considered thermal habitat effects and predation extensively. Thermal habitat effects are carried over into this assessment by using mean A. However, the inability to update the habitat model is problematic for continuing this approach over the long term. • Natural mortality was freely estimated, and the value was fairly high (M = 1.29) thus allowing the assessment model to produce estimates of biomass and fishing mortality with a high M, which is perhaps expected for a short-lived, pelagic forage species. Seems likely that M is variable over time, high level of uncertainty in M estimate. Predation mortality not directly accounted. M varying without trend not better than constant M (Johnson et al 2010), but trend in M unknown. • Changes in availability to the survey due to changes in habitat were considered previously, but the average availability is used in the assessment.	100%
Trend in recruitment	• The biological reference points were $F_{MSY\ Proxy}$ = 2M/3 (Patterson 1992, MAFMC SSC) and SSB_{MSY} was estimated from long-term projections. Use of the most recent 10 years of recruitment in the OFL calculation accounts for recent lower recruitment (but does not project a trend). • Long-term projections for determining $SSB_{MSY\ Proxy}$ were conducted as follows: i) it was assumed that full catch limits were realized (2020 landings = 23,752, 2021-2070 F = $F_{MSY\ Proxy}$ = 0.86), ii) the full time-series averages for selectivity, maturity, weights-at-age were applied, and iii) projection recruitments came from the full time-series of estimated recruitment values. • Short-term projections were also conducted, again following the aforementioned configuration used to estimate $SSB_{MSY\ Proxy}$. • The Peer Review Committee noted that assuming full realization of catch limits is unlikely to occur so the short-term projections probably overestimate the effects of near-term fishing. Specifically, if the 2020 catch limit was achieved, the projections indicated that the stock would be overfished in 2021. Recent landings have been 5-8 times lower than observed catches. Also, use of the full recruitment time-series may be overly optimistic given that recent recruitment has been low and roughly 1/3 to 1/2 of the long-term average.	100%

Prediction error	• Three model runs were examined (bridging): Run 1 added data for 2017-2019 to the 2017 model; Run 2 used the newly estimated time series of discards; and Run 3 included application of the NEAMAP age-length key. • No substantial differences in model outputs were detected across the three runs. • Assessment model diagnostics were well considered and showed plausible fits and results. • No uncertainty estimates of BRPs were provided (e.g., CVs absent for $F_{2019}/F_{MSY\ Proxy}$ or $SSB_{2019}/ SSB_{MSY\ Proxy}$). • Major sources of uncertainty appear to be: o Discard estimates were highly variable and imprecise. o Commercial catch data were aged with NEFSC age-length keys. o Estimation of M required the assumption that the daytime Bigelow survey efficiency was 100%. o Use of $F_{MSY\ Proxy} = 2M/3$ may be problematic since the estimator is not tied to SSB. • Difficult to assess prediction error based on bridging runs, but consistency with past assessments. This may be due to similar assumptions across assessments with respect to survey catchability.	
Assessment accuracy under different fishing pressures	• Accuracy of assessment results were not characterized in relation to different fishing pressures. • F has been increasing in recent years so should be more informative. • BRPs were recalculated to enable internal consistency with the estimate of M.	100%
Simulation analysis/MSE	• The assessment results and subsequent management advice were not informed by simulation analysis or MSE.	100%