Mid-Atlantic Fishery Management Council
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Michael P. Luisi, Chairman | P. Weston Townsend, Vice Chairman
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M E M O R A N D U M

Date: September 22, 2021

To: Michael P. Luisi, Chairman, MAFMC

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

Subject: Report of the September 2021 SSC Meeting

The SSC met via webinar from 7th-8th September, 2021, addressing the following topics:

- National Standard 1 Technical Memo on ACL's for Data-Limited Stocks
- Chub Mackerel Specifications for 2022
- Proposal for Exempted Fishing Permit for Thread Herring
- Review Spiny Dogfish ABC for 2022
- Atlantic Mackerel Rebuilding ABC Specifications
- Offshore Wind Fishery Impact Studies
- Review Research Set Aside project update by Economics Working Group
- Review progress of Ecosystem Working Group
- Research Track Assessment schedule and Priorities

See Attachment 1 for the meeting's agenda.

Most SSC members were able to participate for all or part of the meeting (Attachment 2). Other participants included Council members, Council staff, NMFS Headquarters, NEFSC and GARFO staff, and representatives of industry, stakeholder groups, and the general public. Council staff provided outstanding technical support throughout the process. Presentations and contributions by stock assessment scientists from NEFSC, Council Staff, and external participants were uniformly high quality. Jason Didden consulted with the NEFSC and SSC on an ongoing basis to improve the information necessary for Atlantic Mackerel discussions. Kiersten Curti, NEFSC, provided timely responses on rebuilding alternatives for Atlantic Mackerel rebuilding projections. Their professionalism greatly facilitated the work of the SSC. A special thanks to Brandon Muffley who guided the SSC's work before, during, and after the meeting.

Within the SSC, David Secor's contributions were substantial both for Atlantic Mackerel and the review of wind energy impact studies. His scholarship is greatly appreciated. Tom Miller served as rapporteur for the challenging discussions on Atlantic mackerel rebuilding. I thank

Sarah Gaichas for her excellent meeting notes and members of the SSC and Council Staff for their comments on an earlier draft of this report

All documents referenced in this report can be accessed via the SSC's meeting website https://www.mafmc.org/ssc-meetings/2021/september-7-8. This report uses many acronyms: a comprehensive guide is listed in Attachment 5.

Overview of SSC Process for ABC Determination

The determination of Acceptable Biological Catches (ABC) is perhaps the most important task of the SSC. The following paragraphs borrow heavily from our report to the Council in August because they explain upcoming challenges of rebuilding for some stocks.

The process for undertaking SSC reviews of stock assessments prepared by the Northeast Fisheries Science Center (NEFSC) is guided by the Terms of Reference (TORs). The TORs are written by Council staff in consultation with Council and SSC leadership. The primary focus of the SSC review is to characterize the full scientific uncertainty of the overfishing limit (OFL) to recommend an ABC. Simulation studies have suggested that the uncertainty of catch estimates is underestimated by the within-model estimates of variation (SSC, 2016) Accordingly, the SSC uses a composite level of uncertainty, or coefficient of variation (CV) derived by following a template described in the SSC's OFL CV Guidance Document (2020). Nine criteria are considered to develop an overall measure of the coefficient of variation. The SSC assigns each criterion one of three specified levels of CV and a composite CV, based on the preponderance of the evidence. The rationale for each criterion is summarized for Atlantic Mackerel in Attachment 4.

The SSC is acutely aware of the importance of its ABC determination. The SSC strives to use a process to derive the OFL CV (Attachment 3) that is open, transparent, and well documented. Prior to the meeting, the SSC's lead for each species collaboratively developed a template of key factors for each criterion. The initial results were provided on the Council's website prior to the SSC meeting. No determinations of CVs are made in this stage. Rather, these initial lists served as template for the broader SSC discussions during which factors were modified, added, or deleted. After a plenary discussion, a consensus determination of CV category was made for each criterion. Finally, an overall determination of the OFL CV was derived based on the overall evidence. No formal weighting of criteria was applied; instead, it was based on the SSC's expert judgement. To date, the overall determination has usually been clear-cut. More difficult decisions could arise in the future as assessment circumstances change. Overall, the process strikes a realistic balance between ensuring transparency and efficiency. The advance preparation also ensures that previous discussions are reviewed for current applicability, that group decisions can be made within a limited period, and that future decisions will have sound documentation.

The same principles apply to the Terms of Reference. Apart from minor editorial changes, the summary of the Terms of Reference herein, and the worksheet for determining the OFV CV (Attachment 4) are exactly as presented in the public meeting.

National Standard 1 Technical Memo: ACLs for Data-Limited Stocks

Data-limited stocks pose a challenge to both scientists and managers across the United States. Compliance with the provisions of the MSA are especially difficult when measures of true status are compromised by lack of data and scientific understanding. The MSA allows for flexibility in the determination of Annual Catch Limits for data-limited stocks; the flexibilities are known as "the (h)(2) flexibilities" pursuant to 50 CFR 600.310(h)(2). Marian Macpherson of the Office of Science and Technology presented an overview of the current draft guidelines for setting ACLs. The "flexibilities" include specification of ACLs in terms of numbers caught rather than total weight and consideration of rate-based ACLs wherein some measure of rate of change in relative status or some metric of exploitation can be estimated. For example, changes in average length may be useful for some stocks as a measure of exploitation level.

Marian Macpherson's presentation was followed by a robust discussion by the SSC. Jason Cope, NMFS, who has been involved with developing technical details of the guidelines assisted in addressing the SSC's concerns. Metrics that rely on attributes of the population (e.g., length composition) also rely heavily on proper sampling designs and proper interpretation of observations. NMFS staff acknowledged these concerns. SSC members also noted the difficulty of maintaining a consistent level of risk across stocks. It was noted that risk is typically highest for those stocks with the least information. Such risks also imply tradeoffs that may extend to other species. This suggests the value of considering ecosystem considerations in the ACL process. The NMFS is reviewing the legal constraints on such approaches.

The NMFS presentation relied on various decision flow charts. It was noted that in many instances the ACL would be based on less than desirable levels of information. One SSC member noted that the scientific literature is far from settled with respect to the utility of many Data Limited Methods. In many instances, simulation testing has revealed poor performance of once promising methods, especially those that rely only on catch.

Chub Mackerel

Chub Mackerel is a data poor stock managed by the MAFMC. Chub Mackerel are thought to be an important component of the diets of tunas and billfish. Walt Golet of the University of Maine led off with a detailed presentation on the diet composition of tunas and billfishes. Fish stomachs were obtained from various recreational fishing tournaments in the Mid-Atlantic and elsewhere. Rarefaction curves were used to estimate the completeness of the dietary sampling in which the number of unique species in the diet levels off as the number of samples increases; this indicates that the existing samples may be sufficient to describe the overall diet. Chub Mackerel were found to be rare diet components in most of the predator species but *Illex* and related squid species dominated their stomach contents. Genetic bar-coding methods proved to be valuable for identifying species that digest rapidly in the stomachs of fishes whose body temperatures can be warmer than ambient. While valuable, such methods can be misleading when they reflect items that may have been ingested initially by the prey. Digestion rates, *per se*, are not well known so full interpretation of diet compositions can be challenging. Another complication is the retention of hard and undigestible parts, such as squid beaks, in the stomachs. Dr. Golet's comprehensive diet study provides useful context for making catch recommendations.

Julia Beaty, MAFMC, provided an overview of the current specifications for Chub Mackerel. The current ABC of 2,300 mt relies heavily on historical landings. Chub Mackerel are rare in MRIP intercepts and the PSEs of recreational catches are high (~60%). Average weights of landed fish are about a pound but no information on discard weights is available. Chub Mackerel were only added to the MAFMC's formal species list in 2017. A commercial industry representative noted that Chub Mackerel swim fast and relatively few vessels have sufficient power to catch them. Moreover, they tend to be a secondary target, especially for vessels fishing for *Illex*.

The SSC noted that much additional data are needed, starting with more intensive monitoring of landings for size and age composition. Presently there is insufficient scientific evidence to increase or decrease the current ABC. However, it was noted that Chub Mackerel is an Atlantic-wide species with productive fisheries in many areas. The SSC encouraged a review of these fisheries and a closely-related Pacific species, *Scomber japonicus*, for their relevance to the Mid-Atlantic region.

The SSC found no reasons to revise the previous ABC recommendation of 2,300 mt. The SSC looks forward to receiving more information on this fishery in 2022.

Review of Thread Herring Exempted Fishing Permit

Lund's Fisheries has applied for an Exempted Fishing Permit (EFP) to harvest 3,000 mt of Thread Herring in 2022. The Council asked the SSC to evaluate the biological implications of the harvest and scientific merits of the proposal. The SSC received a copy of the proposal prior to the meeting. Jeff Kaelin, Lunds Fisheries, provided a broad overview of the proposal and expressed willingness to revise the document as necessary to improve its utility for future science and management. Robert Leaf will serve as an advisor for the collection of fishery and biological information. It is anticipated that about 70 trips would be taken. One of the benefits of this fishery would be the collection of basic biological data prior to the start of any directed fishery in the Mid-Atlantic region. The SSC noted the value of having early biological information on size and age composition which would avoid the lacunae that impede the scientific basis for management Chub Mackerel (see above).

Portside monitoring of Thread Herring landings was considered another strong point as it would allow for monitoring of bycatch of non-target species. However, it is considered unlikely that at-sea observer coverage would be increased to cover more than a nominal number of trips. Lund's Fisheries noted additional willingness to take biological samples at sea at the tow level of resolution. SSC members noted that monitoring of body fat content would be valuable for corroborating trends seen in other forage species. All trips will be responsible for filing electronic VTR reports and other reporting requirements may apply.

Thread Herring is primarily a southern species with evidence of intermittent abundance in Chesapeake Bay in the mid-1990s to 2000. Contemporary data from existing fishery-independent sampling programs are scant. SSC members asked for updates on Thread Herring presence from NEAMAP and other state surveys. The Audubon Society has expressed concerns about capture of forage important to seabirds, but the provided references actually showed very few Thread Herring in seabird diets in the region. It was unclear whether there are concerns

about seabird bycatch, but proposers noted that relatively few sea birds are present in the 30 fathom depth areas where the fishery would be prosecuted. Monitoring for bycatch of birds and marine mammals is encouraged.

Overall, the SSC found no scientific basis for opposing this proposal. The collection of biological and fine-scale fishery performance information at the start of any fishery was viewed as valuable for future scientific management. Moreover, such collections are consistent with the guidelines proposed under NS1 guidelines for Data Limited stocks. Careful consideration should be given to designing a basis for estimation of scientific uncertainty and future management of this resource.

Spiny Dogfish

Jason Didden provided an overview of the fishery in 2020 and reported an update on female Spiny Dogfish spawning stock biomass and recruitment from the 2021 NEFSC spring bottom trawl survey. The current assessment model relies heavily on the spring survey as it is thought to represent a greater fraction of the resource than the fall survey. The fall survey occurs when a substantial fraction of resource is in Canadian waters. The loss of the 2020 survey and missing strata in other recent years increases the uncertainty in the management of this species.

Landing and prices generally declined in 2020 and fishery landings are slow in 2021. These patterns were attributed to COVID-19 and market effects rather than patterns of abundance. Some fleets are transitioning to more profitable fisheries, such as shrimp in Virginia and skates in Massachusetts.

Council staff expressed some concern that survey-based estimates of female spawning stock abundance appeared to down slightly and there was no evidence of a strong year class in 2021. It was noted that the swept area biomass estimate for 2021 would have been higher if the southern strata had been fully sampled. The SSC noted that the age-length relationship for spiny dogfish was based on research efforts nearly 40 years ago. Since then, the best basis for aging has been indeterminate with both spines and vertebrae considered as definitive. However, the most recent data suggest spines may be best. It was suggested that an exchange of samples with DFO Canada would be valuable. Investigators there have validated aging through the presence of radionuclides in samples from the early 1960's. Such samples could be invaluable for current age reading research. Efforts to update the underlying von Bertalanffy growth model were strongly supported by the SSC. A Research Track Assessment is planned for 2022 that potentially could result in an alternative modeling approach.

Atlantic Mackerel Rebuilding

In July, the SSC began an in-depth discussion of the most recent Management Track Assessment and the challenges of rebuilding this depleted stock. Those discussions continued at this September meeting. At this meeting, the SSC received more extensive and specific Terms of Reference related to the rebuilding process and specification of Council goals. One of the most challenging aspects of rebuilding has been reconciliation of longer-term goals of rebuilding with recent trends in recruitment. The B_{msy} estimates are based on a long-term time series of recruitment levels (1975 onward). Recruitments since 2009 have been below the median with

the exception of the 2015-year class. It is not known whether the low recruitments are due to low stock size, poor environmental conditions, or both factors. If current low levels of recruitment persist, then the reductions in recommended landings will be greater and the rebuilding period will be longer. If recruitment is low due to low stock size, then reducing F initially to increase stock size may accelerate population growth over time and lead to progressively higher yields. If low recent recruitment is simply bad luck, then the stock may recover more quickly and catch reductions will be less severe. Hence the trajectory of recovery relies on factors that cannot currently be distinguished.

This session began with an overview of Council decisions in August regarding rebuilding. Jason Didden, MAFMC, reported that the Council had requested emergency action to reduce the ABC in 2021 and 2022 to 15,512 mt. While these levels will result in continued overfishing, they are allowed when a rebuilding program is being revised. The SSC noted that its earlier nonbinding recommendations for ABCs for 2021-22 were not accepted.

The Council specified a rebuilding time period of 10 years and requested evaluation of rebuilding plans which have success probabilities of 50, 60, and 75%. Finally, the Council requested an evaluation of rebuilding using the P* method. The P* method dynamically adjusts catch limits in response to the size of population and acceptable risk of overfishing as set under the Council's risk policy.

Kiersten Curti, NEFSC, provided an overview of projection scenarios consistent with these policy choices. All of the projections begin with the assessment model's terminal year distribution of population sizes. In addition, all projections use the followed series of catch for 2020 to 2022: 18,038 mt, 15,512 mt, 15,512 mt, respectively. Rebuilding policies are assumed to begin in 2023. The major challenge for evaluation of rebuilding strategies is the assumption of future recruitment levels. For short term forecasts consistent with Council quota specifications, the NEFSC generally assumes that recruitment is independent of stock size. Unless conditions suggest otherwise, it is assumed that the entire time series of recruitment estimates is still valid. The SSC discussed the implications of alternative assumptions about recruitment. The three main hypotheses were 1) long-term (1975 onward), 2) short-term (2009 onward) and 3) some form of density dependence. Hypothesis 1 assumes no underlying change in stock dynamics from either stock size or environmental change. Hypothesis 2 assumes a change has occurred but no causal mechanism is identified. Hypothesis 3 assumes that a change has occurred and that low stock size is the primary cause. The SSC discussed these hypotheses in detail as described below.

The SSC acknowledges the exemplary support of Kiersten Curti who not only provided the set of projection scenarios requested but was able to update those scenarios during the meeting in response to SSC requests. Jason Didden and Dave Secor were instrumental in structuring the rebuilding problem and guiding the SSC discussions.

Terms of Reference: Atlantic Mackerel

Following this general discussion, the SSC addressed the Terms of Reference (italics) for Atlantic Mackerel. Responses by the SSC (standard font) to the Terms of Reference provided by the MAFMC are as follows:

For Atlantic Mackerel, the SSC will provide a written statement that identifies the following:

1) *Given the most recent mackerel assessment, provide best science recommendations regardingrecruitment assumption(s) for rebuilding projections and approaches to achieve stock rebuilding in 10 years with 50%, 60%, and 75% probabilities, including what $F_{rebuilds}$ are most consistent with the target rebuilding probabilities;*

Recommendation for $F_{rebuild(s)}$:

Key Considerations:

- The SSC does not find support for the use of unconstrained recruitment estimates drawing from the entire 1975-present time series.
- The SSC recognizes that rebuilding plans are re-evaluated every two years, and the Council will likely require an adaptive approach that responds to survey and biological data.
- The SSC offers two recruitment assumptions as being defensible and supported by the data: a two-phase approach that explicitly incorporates the entire time series (1975 onwards), with the empirical odds of being in different phases and alternatively, the use of the most recent recruitments (2009- onwards). The two-phase approach is associated with faster rebuilding times, while the recent recruitment approach is associated with slower rebuilding.
    - Two-phase approach derived from an analysis conducted intersessionally by SSC Chair Paul Rago, which considers likely recruitment levels above and below the ½ B_{MSY} level.
        - Benefits
            - Recognizes the potential for escaping current low level of recruitment (2009-onwards). The characterization of low recruitment is a "short-term" perspective.
            - Recognizes the potential for positive impacts of biomass accumulation
            - If the stock does not rebuild, the method "locks in" the current recruitment level
            - Implicitly recognizes a stock size influence on recruitment
        - Costs
            - Assumes an explicit threshold for an effect of stock size on recruitment, which is unlikely
            - The threshold can have unexpected effects later on with respect to stock rebuilding
            - The threshold is sensitive to the timing of a pulse of strong recruitment and may not reflect longer-term SSB rebuilding.
            - We are relying on a SSB-based boost to recruitment that has not been observed recently (since 2007).
            - The two-phase approach effectively defines a S-R relationship, which may be arbitrary
            - This approach is novel and potentially precedent building.
    - Recent phase approach depends on recruitment draws from 2009-onwards.
        - Benefits
            - Reflective of empirical evidence that low recruitments have been

observed recently, and thus are assumed to be most likely observed going forward.
    - Recent strong year classes are less strong than has been the case historically.
    - Ensures future catches are scaled appropriately to recent conditions.
    - The approach is the more precautionary of the two recruitment scenarios. If good recruitments do occur at low stock sizes, rebuilding time lines can be adjusted quickly.
  - Costs
    - If we believe recent recruitments are now the norm, we must ask whether current reference points are reliable. This brings into question rebuilding goals.
- The SSC discussed the relative merits of each approach. The SSC noted evidence that across fish stocks globally, rebuilding was generally observed; and that regime shifts and changes in productivity were common. These observations suggest that a model allowing for higher recruitments is warranted. In contrast, the SSC also noted that the recent recruitment assumption is parsimonious and precautionary.

2) *Provide OFL CV and recruitment assumption recommendations so that a standard risk policy P* ABC calculation can be made, as well as advice on how long P* would take to rebuild thestock (if practicable at this time);*

Note for ToR #1 and #2 above: *based on Council input, regarding an emergency action request, and consideration of likely rebuilding implementation timing, assume the initiation of rebuilding (via* $F_{rebuild}$ *or P*) is January 1, 2023 with catches of 15,512 MT for 2021 and 2022.*

Based upon the 2021 Atlantic Mackerel OFL CV Decision Criteria Table, the SSC recommends to use the 150% OFL CV. Key elements for the SSC's rationale for OFL CV of 150% include:

- Uncertainty in natural mortality, which is likely age and time-varying for this pelagic forage species.
- High likelihood that unknown ecosystem factors were affecting phase associations of recruitment, SSB, F, and projection performance.
- High uncertainty in the relationship between recruitment and SSB and what period of recruitment to use in stock rebuilding projections.

Despite the 150% OFL CV assignment, SSC maintains strong confidence in the current stock assessment model and most data inputs.

3) *The most significant sources of scientific uncertainty associated with a determination ofrebuilding ABCs;*

- The appropriate time period of recruitment that forms the basis of projections is highly uncertain as a result of alternative plausible hypotheses regarding the cause of recent

low recruitments, and their influence on likely future recruitment. This drives inferences 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;
- The importance of recreational harvests in mackerel dynamics introduces uncertainty in the assessment over the scale of the population.
- Missing catch information from Canadian bait and recreational fisheries, and commercial discards. From DFO rule publication earlier this year: "It has been estimated by DFO Science that there could be between 2 000 and 5 000 metric tons of unreported catches per year, which includes fishing mortality from various sources, notably recreational and some unreported commercial (including bait) harvests, discards and other mortalities. These unreported catches could potentially undermine the validity of DFO's Atlantic mackerel stock assessment, a concern that has been consistently raised by the Atlantic Mackerel Advisory Committee." https://gazette.gc.ca/rp-pr/p1/2020/2020-10-10/html/reg2-eng.html

4) *Ecosystem considerations accounted for in the stock assessment, as appropriate, and any additional ecosystem considerations that the SSC deems relevant for consideration in determining rebuilding ABCs;*

- The SAW 64 did not explicitly account for predation mortality in the assessment. Ancillary analysis contained as a working document and considered by the working group indicated low incidence in the diets of fishes sampled within the NEFSC bottom trawl survey. Predation by highly migratory species, e.g., sharks, marine mammals, and birds remains unknown.
- Working papers prepared for SAW 64 addressed habitat changes, changing availability, and changes to the fishery. The information contained in the working papers provided useful background for the assessment and contributed to the model identification process, as well as the decision on which portion of the recruitment time series to use.
- The ecosystem criterion was considered and given emphasis in the determination of the OFL CV.

5) *Research recommendations that would reduce the scientific uncertainty in determining rebuilding ABC recommendations and/or could be considered for the 2023 management track assessment, including advice related to identifying whether regime changes have occurred that could warrant calculating reference points with recruitment time series otherthan currently used (1975-terminal year).*

- The SSC supports all of the recommendations from SAW/SARC 64. **In particular, the SSC recommends continuing the U.S. component of the Atlantic Mackerel**

egg survey so that the range-wide egg index can be updated and used in future assessments. This recommendation requires a continuation of the work done to identify and quantify Atlantic Mackerel eggs collected in the survey. Continuing collaboration with both the fishing industry and Canadian scientists to maintain the assessment is also recommended by the SSC.

- An investigation of stock - environment – recruitment interactions that may provide insight into the likely distribution of future recruitments, and possibly biological reference points.
- Evaluation of time and age-variant M and M2 (predation mortality) for this stock
- Further evaluate how error in the egg survey propagates to error in the spawning stock biomass index
- Evaluating US recreational fishery data quality and assessment sensitivity

Offshore Wind Fishery Impact Studies in the Mid-Atlantic

The SSC heard from offshore wind energy fishery scientists on early impact monitoring efforts. Drew Carey (Inspire Environmental) described past BACI work at US's first offshore wind project – Block Island, highlighting lessons learned and guidance for future project monitoring. These included: (1) early engagement of stakeholders to understand their concerns and key views on offshore wind impacts; (2) implementation of good survey design elements such as BACI; (3) limits on the detectability of statistically significant effects when using traditional fishing gears such as otter trawls. Proper design allows application of more rigorous statistical methods to extract comparisons among areas or over time. Daphne Munroe (Rutgers University) presented a regional model forecasting changed patterns of effort and revenue streams to the US surf clam industry. This work generated substantial interest by SSC as an approach that provided multi-scaled outputs (region, port, fleet) on offshore wind impacts and one that could be applied to other stocks. This integrated simulation model mimics the fishing behavior of individual vessels over time and spatial units in response to impacts related to exclusion from and passage through wind energy development areas. Fishing behaviors included search time, distance to port, communication among vessels and processing plant economics Interviews with fishermen were essential for properly parameterizing the model. Greg DeCelles (Orsted) presented perspective on ways to align and standardize monitoring across multiple projects, drawing in part from ROSA's recent monitoring guidance document and emphasizing data sharing. He provided an example of regional assessment opportunities to do multi-scaled biotelemetry research. Elizabeth Methratta (NMFS) provided key considerations in monitoring programs highlighting issues of design, scale, innovation, and hypothesis-driven science.

Some key discussion points among SSC and other attendees included: what can be learned and tested by using historical data on Gulf of Mexico (petro structures) and EU (20+ year offshore wind development); post-construction period for monitoring longer term effects; potential negative interactions between scientific monitoring and fishing activities, including safety issues; and how can we evaluate changed fishing effort patterns given current limitations in VTR and vessel monitoring data.

Julia Beatty, MAFMC, provided an introduction to data available through a NMFS website to evaluate spatial overlap and possible consequences to lost revenue. There was support to

investigate ways of supporting this and other updates on stock-specific offshore wind impacts through NEFSC Annual State of the Ecosystem Report. SSC members noted that future restrictions on gear deployment caused by wind energy sites would likely degrade data quality of surveys used in stock assessment models and increase the coefficient of variation applied to the OFL.

Public comments highlighted some of the externalities of deployment of monitoring gear near monitoring sites that are currently in areas actively fished. Passive outreach to industry would not be sufficient to counteract some of the recent problems encountered. Others noted that it is necessary to take a long-term perspective on such projects including monitoring from construction through decommissioning.

Economic Working Group Activities

Geret DePiper, Economic Working Group chair, provided an overview of activities by the Economics Working Group since July. The key focus of the Working Group has been to assist the Council, GARFO, and NEFSC in laying a new basis for the Research Set Aside (RSA) program. The Research Steering Committee of the Council began a year-long process to envision a new RSA program. Critical aspects of this process include: (1) research priorities, (2) mechanisms for raising funds, and (3) monitoring and enforcement.

Following a successful initial review of research priorities on July 15, 2021, the Econ WG supported a second day-long webinar on August 31 to examine the positive and negative aspects of alternative methods for raising funds for research. The leading alternatives include some form of auction and bilateral arrangements between harvesters and researchers. The auction process has many economic efficiency advantages, but simulation results showed that these advantages are dissipated as additional regulatory complexities are superimposed. Additional presentations by past participants in the RSA program gave a good overview of practical considerations.

A third webinar focusing on monitoring and enforcement issues is planned for October 14. This will be followed by an in-person meeting in early 2022 to summarize results and make final recommendations for consideration by the Council at its April 2022 meeting.

Ecosystem Working Group Activities

Each year the SSC and Council receive a State of the Ecosystem (SOE) report that summarizes multiple trend indices for biological, oceanographic, social and environmental variables. The Ecosystem Working Group was formed by the SSC to translate the important findings of the SOE into operational decisions about catch limits. The Working Group had its first meeting on August 4. Sarah Gaichas, Ecosystem Working Group chair, provided an overview of the meeting and the mission of the Working Group. A primary focus of the group will be distillation of factors affecting the OFL CV determination. The SSC noted that Atlantic Mackerel might be an ideal candidate to examine given the difficulties of identifying causal factors for recent recruitment trends. Simulation analyses and full management strategy evaluations (MSEs) and the like may prove useful for identifying appropriate management advice under such uncertainty. Others noted that an ongoing meta-analysis study of factors affecting the OFL-CV is now

underway; this could be useful for guiding the Working Group. The SSC responded positively to the initial report of the Working Group and looks forward to continued progress in 2022.

Other Business

Research Track Assessment Schedule and Priorities

Brandon Muffley, MAFMC, provided an overview of the planned Research Track Assessments (RTA) through 2026. The SSC noted the RTA related to consideration of ecosystem and climate info in the stock assessment process should be coordinated with the Ecosystem Working Group to avoid duplication of effort. Using only a single stock as a case study might be a good way of focusing efforts.

The 2022 assessment schedule will be crowded as both the *Illex* and Butterfish RTAs have been delayed until March of 2022. Atlantic Mackerel will likely be revisited by the SSC at its March 2022 meeting. The State of the Ecosystem report will also be received in March.

SSC members noted that despite the inefficiencies of Webinar-based meetings, there were some significant advantages related to greater participation and reduced total time for meetings and travel. Members noted the value of the intensive engagement and collaborative teamwork of in-person meetings and recommended at least one such meeting in 2022. The July meeting that deals with specifications for multiple stocks might be the most likely candidate.

Miscellaneous Topics

The National SSC meeting will be held in August 2022 in Sitka, AK with a focus on incorporating ecosystem factors into stock assessments and management. The steering committee is looking for case studies from each region. More details will be forthcoming before the end of the year.

The SSC has emphasized the challenges of developing rebuilding plans and emphasized the need for collaboration among managers, regulators, and scientists. Such collaboration will require a formal meeting to allow for sufficient understanding of perspectives and constraints. The SSC will be working with Council staff to begin this process in the coming months.

Attachment 1

Mid-Atlantic Fishery Management Council

Scientific and Statistical Committee Meeting

September 7 – 8, 2021 via Webinar

Webinar Information
(Note: same information for both days)
Link: September 2021 SSC meeting
Call-in Number: 1-844-621-3956
Access Code: 179 703 0419##

AGENDA

Tuesday, September 7, 2021

9:30 Welcome/Overview of meeting agenda (P. Rago)

9:35 National Standard 1 Technical Guidance Memo – ACL's for Data-Limited Stocks
- Overview and background of Technical Guidance memo (M. Macpherson, NMFS)
- Discussion, feedback, and comments from SSC

10:00 Chub mackerel 2022 ABC review
- Data and fishery update; review of previously recommended 2022 ABC (J. Beaty)
- Review of Chub Mackerel diet study (W. Golet, Univ. of Maine)

11:10 Break

11:20 Thread Herring Exempted Fishing Permit (EFP)
- Overview of Draft EFP proposal (J. Beaty and J. Kaelin/E. Bochenek)
- Discussion, feedback, and comments from SSC

12:30 Lunch

1:30 Spiny Dogfish 2022 ABC review
- Data and fishery update; review of previously recommended 2022 ABC (J. Didden)
- Update on 2022 Research Track assessment

2:15 Atlantic Mackerel Rebuilding ABC Specifications

- Review of Council rebuilding alternatives and request to SSC (J. Didden and K. Curti)
- Considerations for rebuilding projections (D. Secor)
- SSC recommendations (D. Secor)

3:30 Break

3:40 Continue mackerel rebuilding discussion

5:30 Adjourn

Wednesday, September 8, 2021

8:30 Offshore Wind Fishery Impact Studies in the Mid-Atlantic

- Block Island Monitoring Experience: Changes in Fish Densities and Recreational Fishing (D. Carey, Inspire Environmental)
- Understanding Economic Impacts to the Commercial Surfclam Fishing Industry from Offshore Wind Energy Development (D. Monroe, Rutgers University)
- Alignment to Promote a Regional Approach to Fisheries Monitoring (G. DeCelles, Orsted Offshore North America)
- What Does a Good Fishery Resource Monitoring Plan Contain (E. Methratta, Northeast Wind Team, NEFSC)
- Developing potential SSC fishery information products to evaluate changing fishing and offshore wind interactions (J. Beaty)
- Discussion - How do we move from project-scaled impact studies to regional-scale studies?

10:30 Break

10:45 SSC Work Group Updates

- Economic Work Group – Review of RSA Workshop (Funding) and next steps
- Ecosystem Work Group – Overview and approaches from Work Group meeting #1

11:45 Other Business

- Research Track Assessments schedule – potential 2027 priorities
- Planning and potential priorities for 2022

12:30 Adjourn

Note: agenda topic times are approximate and subject to change

Attachment 2

MAFMC Scientific and Statistical Committee
September 7-8, 2021

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)
Lee Anderson	University of Delaware (emeritus)
Jorge Holzer	University of Maryland
Yan Jiao	Virginia Tech University
Rob Latour	Virginia Institute of Marine Science
Brian Rothschild (Sept. 8 only)	Univ. of Massachusetts – Dartmouth (emeritus)
Olaf Jensen	Rutgers University
Sarah Gaichas	NOAA Fisheries NEFSC
Wendy Gabriel	NOAA Fisheries (retired)
Mike Wilberg (Vice-Chairman)	University of Maryland – CBL
Cynthia Jones	Old Dominion University
Gavin Fay	U. Massachusetts—Dartmouth
Alexei Sharov	Maryland Dept. of Natural Resources
Geret DePiper	NOAA Fisheries NEFSC
Others in attendance (only includes presenters and members of public who spoke):	
Kiersten Curti	NEFSC
Jason Didden	MAFMC staff
Brandon Muffley	MAFMC staff
Doug Christel	GARFO
Bonnie Brady	Long Island Commercial Fisheries Assoc
Julia Beaty	MAFMC staff
Jeff Kaelin	Lunds Fisheries
James Fletcher	United National Fisherman's Assoc.
Eleanor Bochenek (Sept 7th only)	Rutgers University (retired)
Robert Leaf (Sept 7th only)	University of Southern Mississippi
Marian Macpherson (Sept 7th only)	NMFS
Jason Cope (Sept 7th only)	NMFS
Drew Carey (Sept 8th only)	Inspire Environmental
Daphne Munroe (Sept 8th only)	Rutgers University
Greg DeCelles (Sept 8th only)	Ørsted
Elizabeth Methratta (Sept 8th only)	NMFS

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 Mackerel – Sept. 2021

Decision Criteria	Summary of Decision Criteria Considerations	Assigned OFL CV Bin (60/100/150)
Data quality	**Surveys** *Synoptic surveys are available but recent low index values contribute imprecision to estimates of SSB. Survey and landings catch-at-age data showed cohort progression of the 2015 year-class.* • The assessment relies heavily on an SSB index derived from egg surveys in both Canadian and US waters. Estimated egg production declined >90% from the 1980s to the 2010s. Since 2010, egg production has remained at historically low levels with a slight increasing trend in recent years. Since 2000, spawning habitats have contracted remarkably in both the US and Canada (DFO 2017; Richardson et al. 2020). During this period, low egg incidence in surveys, and persistently low index values contribute uncertainty to inferences on low magnitude changes. • The assessment considers separate NEFSC spring bottom-trawl time series for the RV Albatross (1975-2008) and the RV Bigelow (2009-2019). Albatross index values exhibited a trend opposite to the SSB index, but analyses suggest that model results are relatively insensitive to the Albatross series. The Bigelow series exhibited abundance and age structure trends consistent with a strong 2015 year-class. • In both vessel series, strong cohorts progressed across years as expected, but cohort progression was occasionally inconsistent for weaker year-classes. **Landings and discards** *Landings data are of moderate certainty. High certainty in US and Canadian commercial landings is offset by unexpected trends in the revised MRIP data and unknown Canadian discards and bait and recreational catches.* • Canadian discards, bait and recreational catches are unknown but likely an important fraction of combined Canada-US catch in recent years. A recent MSE (Van Beveren et al. 2020) concluded that this was a chief source of uncertainty in rebuilding the Northern contingent. • Revised MRIP estimates of recreational catches and discards in the MT assessment resulted in higher estimates especially in recent years; revised estimates increased nearly two-fold for the period 2008-2019. During 2015-2019, recreational catch comprised 34.7% of total US harvests. MRIP estimates and associated error now have a large influence on overall landings data.	**100%**

Model appropriateness and identification process	*A single age-structured model supports the assessment. Diagnostics and sensitivity runs indicate moderate deviations associated with parameter errors.* • ASAP is the primary assessment model in the MT. In SAW 64, two alternative age-based models were considered (SAM, CCAM), which yielded similar stock trajectories. The ASAP model met peer review standards for both the benchmark and MT assessments. • Cohort progressions are apparent in both survey and field data, indicating age determinations are likely accurate in support of the ASAP. • Two contingents with origins in Canada and US waters were combined into a single unit stock, supported by evidence of extensive contingent mixing within US winter and spring fisheries. • In SAW 64, over 150 model configurations of the ASAP model were evaluated in a logical progression for model identification and sensitivity. **Mortality** *Natural mortality is unknown and likely age- and time-variable for this pelagic forage species.* • In the assessment natural mortality is computed based on longevity (life table approach) at M=0.2, invariant with age and over years. • The MT assessment included a likelihood profile analysis that indicated small likelihood differences between M=0.20 and M=0.30, with highest likelihood at M=0.25. The continued use of age-invariant mortality was justified based on a simulation exercise on hypothetical stocks (Deroba and Schueller 2013). • Justification for a time-invariant M was the scarcity of mackerel in the NEFSC Food Habitat Database throughout the series and the lack of predation estimates for the northern contingent, especially given the dominance of the northern contingent to overall stock size. Still, demersal predation as indexed by the NEFSC bottom trawl survey may be rare or uncommon for this pelagic species. Overholtz and Waring (1991) suggested that pilot whales and common dolphins are important predators of adult mackerel. These and other mackerel predators may be have a dominant role in adult mortality.	**60%**
Retrospective analysis	*Moderate retrospective patterns occurred with some anomalous patterns in retrospective peels. Bridge runs showed overall consistency between the benchmark and MT assessments.* • Retrospective patterns in SSB and recruitment were greater in the MT assessment in comparison to the benchmark, with deviating directional bias in 5- year peels for SSB and F. Still, the retrospective-adjusted values for the terminal year fell within the 90% confidence intervals of the unadjusted estimates so a retrospective adjustment in the MT assessment was not warranted. • Bridge runs between the benchmark and MT assessments indicated a negligible change in SSB historical trends and a modest increase F since 2010 owing to the revised MRIP estimates. Bridge runs for the recruitment series continued to support the perception of a strong 2015 year-class.	**100%**

Comparison with empirical measures or simpler analyses	*Simpler analyses or empirical measures were not included in the benchmark or MT assessments, but stock trends are supported by ancillary information.* • Catch curve analysis (MT assessment) showed a 2-3 fold increase in total mortality 2000-2015 in comparison to 1975-1999, consistent with higher Fs (or Ms) in the recent period. Severe age-truncation also supports perception of higher F (or Ms) during since 2010. • Decreases in egg incidence since 2000 (Richardson et al. 2020) is consistent with depletion in SSB observed for that same period.	**100%**
Ecosystem factors accounted	*No ecosystem factors were considered explicitly in the assessment. Atlantic mackerel phase diagram suggests that stock productivity has changed since 2000. The current depleted state of Atlantic mackerel has unknown ecosystem causes. Large shifts in age structure and possible spatial behaviors have also affected stock productivity in unknown ways.* • The contribution of predation mortality to total mortality (M+F) is unknown. M is prone to age- and time-specific variation owing to predation by pelagic predators. Mackerel are scarce in the NEFSC Food Habitat Database throughout the series and the lack of predation estimates for the northern contingent, especially given the dominance of the northern contingent to overall stock size. Still, demersal predation as indexed by the NEFSC bottom trawl survey may be rare or uncommon for this pelagic species. Overholtz and Waring (1991) suggested that pilot whales and common dolphins are important predators of adult mackerel. These and other predators may have a dominant role in adult mackerel mortality. • Although age-9 fish were observed in the 2019 catch, the stock has shown severe age truncation with ages >3 years scarce in catch and survey samples since 2010. Extreme age-truncation is expected to result in depressed recruitment, decreased population resilience, and increased sensitivity to environmental change (Hsieh et al. 2006; Secor et al. 2015). • US harvests are influenced by contingent mixing (contributions by the Northern contingent), which is dynamic over years and decades (Arai et al. 2021). • Lack of an apparent stock-recruitment relationship suggests recruitments are environmentally driven (Plourde et al. 2015). Larval habitat suitability has shown a long-term decline in major regions of the Southern contingent's historical range (McManus et al. 2018). • The NEFSC Climate Vulnerability ranking is "moderate" for Atlantic mackerel, with distributional vulnerability and climate exposure ranked high in part owing to the species' responsiveness to surface oceanographic conditions.	**150%**
Trend in recruitment	*Prior to 1975, when stock size was higher, strong recruitments were likely more frequent. Since then, recruitments have been more episodic and declining, with dominant year-classes occurring every 15-20 years. The implications of low recruitments, if continued, may be profound for future stock levels and management reference points.* • High uncertainty in trends in recruitment centers on whether to use recent or historical time series in stock projections.	**100%**

	• The 2015 year-class estimate from the MT assessment was 15% lower than the estimate from the 2017 benchmark. • In the benchmark assessment, the strong 2015 year-class provided short-term SSB projections that were biased high. Precaution is advised when short-term projections rely heavily on terminal year recruitment. • The lack of an apparent stock recruitment relationship causes uncertainty on whether BRPs should be derived for the entire historical series or for the selected recruitment time series used in stock projections.	
Prediction error	*Prediction error was not estimated in the benchmark or MT assessments, although bridge runs between the two assessments showed relatively good agreement in total catch, SSB and F trajectories despite revised MRIP estimates. The forecast error for rebuilding by 2023, derived from the 2018 benchmark assessment, was high.*	**150%**
Assessment accuracy under different fishing pressures	*Historical high amplitude changes in catch levels follow expectations of stock trajectories, but since 2010 a period of stable low catches and SSB is seemingly unaligned with a period of high and declining F.* • Recent catch has been stable and consistently below quota. • Lack of evidence of a strong and repeatable effect of fishing pressure on stock dynamics. • The Atlantic mackerel stock status phase diagram shows that SSB is largely unrelated to F since 2010. • An alternative view is that SSB has shown significant increases in recent years (MT assessment indicates a 179% increase from 2014 (15,318 mt) to 2019 (42,862 mt), which could drive the strong decline in F following the period of high exploitation prior to 2011.	**150%**
Simulation analysis/MSE	*No formal MSE-type analysis has been conducted for the entire stock. An MSE was conducted for the Northern Contingent (Canada's stock) and indicated high sensitivity of stock trajectories and rebuilding to unreported catch (Van Beveren et al. 2020).*	NA

The SSC consensus was that the Atlantic mackerel stock assessment should be characterized as being associated with a CV of 150%. The SSC holds that despite high quality modeling products, which enable exploration of possible sources of uncertainty, there remains substantial uncertainties over future stock dynamics.

Narrative

The stock phase diagram indicates that SSB has been relatively insensitive to changes in F since 2010. Further, US catches have been stable and below quota for this period. These two elements contribute to uncertainty in the role of F in stock rebuilding and draw attention to the assumption of time- and age-invariant M. It is plausible that Atlantic mackerel are in a depleted state owing to unknown ecosystem causes leading to high uncertainty in the OFL specification. Uncertainty in specifying time stanzas for stock projections and BRPs also point to high uncertainty in ecosystem

processes that have led to the recent period characterized by age-truncation, spawning ground contractions, and changed contingent composition.

The ASAP model and its inclusion of a stock-wide SSB index represented a remarkable advance in Atlantic mackerel assessment. In SAW 64, the ASAP model performance was compared with two alternative age-based models. The model is supported by expected cohort progressions and both the benchmark and MT assessments met peer review standards. In the MT assessment, moderate retrospective patterns occurred with some anomalous patterns in retrospective peels. Bridge runs showed overall consistency between the benchmark and MT assessments, albeit a large revision in MRIP estimates caused an increase in F since 2010.

In recent years, recreational catch comprised 35% of total US harvests, which translates to a greater contribution of error in MRIP estimates to total catch uncertainty. A missing component of catch — Canadian bait, recreational fisheries and discards — likely affects overall assessment accuracy, stock projections, and the effectiveness of stock rebuilding strategies (van Beveren et al. 2020).

A key uncertainty centers on what period of the stock's historical trajectory is relevant to stock projections and BRP determinations. Based upon the benchmark assessment, recent recruitments (inclusive of the strong 2015 year-class) were projected to achieve rebuilding targets by 2023. Projections from the MT assessment indicated much slower stock rebuilding over this period, calling attention to whether expectations for stock trends and/or rebuilding should be drawn from historical (1975-2019 or 1999-2019) or recent (2009-2019) recruitment time series.

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Attachment 5

List of Acronyms used in this report.

Acronym	*Definition*
ABC	Acceptable Biological Catch
AOP	Assessment Oversight Panel
AP	Advisory Panel
ASAP	A Stock Assessment Program
BACI	Before-After Control-Impact
Bmsy	Biomass level at MSY
BRP	Biological Reference Point
CCAM	Censored Catch Assessment Model
CV	Coefficient of Variation
DFO	Department of Fisheries and Oceans
EAFM	Ecosystem Appoach to Fisheries Management
Fmsy	Fishing Mortality rates at MSY
FSV	Fishery Survey Vessel
GARFO	Greater Atlantic Regional Fisheries Office
GRA	Gear Restriction Areas
MAFMC	MidAtlantic Fishery Management Council
MRIP	Marine Recreational Information Program
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
MT	Management Track
MTA	Management Track Assessment
NEFSC	Northeaset Fisheries Science Center
NMFS	National Marine Fisheries Service
NRCC	Northeast Region Coordinating Council
OFL	Overfishing Limit
PRC	Peer Review Committee
PSE	Proportional Standard Error
RHL	Recreational Harvest Limit
ROSA	Responsible Offshore Science Alliance
RSA	Research Set Aside
RTA	Research Track Assessment
RV	Research Vessel
SAM	State Space Assessment Model
SARC	Stock Assessment Review Committee
SAW	Stock Assessment Workshop
SSB	Spawning Stock Biomass
SSC	Scientfic and Statistical Committee
TAL	Total Allowable Landings
TOR	Terms of Reference