

MEMORANDUM

Date: March 28, 2022

To: Michael P. Luisi, Chairman, MAFMC

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

Subject: Report of the March 2022 SSC Meeting

The SSC met via webinar from 15th-16th March 2022, addressing the following topics:

- Review and Potential Change to 2022 *Illex* ABC specifications
- Golden Tilefish update and review of 2023 ABC
- Blueline Tilefish update and review of 2023 ABC
- Atlantic Mackerel 2023-2024 Rebuilding ABC Specifications
- Overview of Council Action: Request for review of Harvest Control Rule
- Ecosystem Science and Application
- Receive update from Economics Working Group on 2021 and future activities

See Attachment 1 for the meeting's agenda.

All SSC members were able to participate for all or part of the meeting (Attachment 2). Other participants included Council members, Council staff, NEFSC and GARFO staff, and representatives of industry, stakeholder groups, and the general public. Council staff provided outstanding technical support throughout the process. The SSC benefited from preparations prior to the meeting; presentations and supporting documents were relevant and high quality. Jason Didden consulted with the NEFSC and SSC on an ongoing basis to improve the information necessary for both the *Illex* squid and Atlantic Mackerel discussions. Kiersten Curti, NEFSC, provided timely responses on rebuilding alternatives for Atlantic Mackerel rebuilding projections. A special thanks to Brandon Muffley who guided the SSC's work before, during, and after the meeting.

Within the SSC, Thomas Miller's guidance on *Illex* discussions and David Secor's contributions for Atlantic Mackerel were both substantial. Their intensity and scholarship are greatly appreciated. I thank Sarah Gaichas and Geret DePiper for their 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/2022/march15-16>. This report uses many acronyms: a comprehensive guide is listed in Attachment 3.

I convened the meeting and made an opening statement regarding my role as a contractor to the Council for the purpose of providing technical support to the Council on *Illex* ABC analyses. Details of my analyses are provided below. To avoid any appearance of conflict of interest, Dr. Michael Wilberg (SSC vice chair) chaired this portion of the meeting and Dr. Thomas Miller led discussions on the Terms of Reference. I also clarified the scope of my contractual support from the Council, noting in particular that my participation in the NRCC's *Illex* Research Track Assessment Working Group was not supported by either the Council or any other entity.

***Illex* Squid**

Rago Presentation

The presentation focused on evaluation of alternative catch limits of 24,000 to 60,000 mt for 2022. The methodology built upon the methods used in 2021 and included some advances developed within the Research Track Assessment. Analyses were based on commercial catch data and NEFSC fall bottom trawl surveys data from 1997 to 2021. Survey data were not available for 2017 and 2020, and catch data for 2021 are considered preliminary. Alternative catch limits were evaluated with respect to their implications for percentage escapement and the ratio of fishing mortality to natural mortality over all years. Percentage escapement is the ratio of fished to the unfished stock size at the end of the fishing season. The numerator is based on the predicted residual stock size given an initial stock size and an alternative catch limit. The denominator is based on same initial stock size but decremented only by natural mortality. In addition to the observed catch and survey values, the computation relies on three parameters: catchability (i.e., probability of capture per tow), availability (i.e., fraction of stock in the sampling domain), and the instantaneous natural mortality rate.

The revised methodology more fully considered the uncertainty in the catchability, availability and natural mortality parameters. Ranges of these parameters were refined by comparisons with values in the scientific literature or via analyses prepared in support of the Research Track Working Group by John Manderson, Brooke Lowman and Anna Mercer. Estimates of availability were improved via spatial analyses of seasonal bottom trawl surveys conducted in the shelf waters of the US and Canada. Notably, these estimates do not consider the availability of unsampled but possibly extensive offshore populations. Estimates of catchability were improved by comparisons with calibration experiments and expert judgement of fishermen. Finally, estimates of a range of natural mortality rates were based on comparisons with values used in the scientific literature.

Effects of uncertainty in the parameters were evaluated by assuming that each parameter had a uniform distribution with lower and upper bounds as described above. The joint effect of these three sources of uncertainty on escapement was evaluated by integrating over the entire

parameter space using a numerically intensive method. Additional details on the parameterization and methodology may be found in the report by Rago (2022) to the Mid-Atlantic Fishery Management Council.

Biological reference points for *Illex* squid have not been developed, but the effects of alternative catch limits were compared to several candidate thresholds that have been applied to manage squid stocks elsewhere and have been suggested for forage species. Target escapement rates of 40% and 50% have been used for other squid species. A ratio of fishing mortality F to natural mortality M equal to 2/3 has been considered for forage species. For the purposes of the analyses considered by the SSC, escapement estimates below 50% and F/M ratios greater than 2/3 were considered as evidence of overfishing. Numerical methods were used to compute the average probability of falling below 50% escapement and above F/M=2/3 for each alternative catch limit. The average was estimated by computing these probabilities for each available year between 1997 and 2021 (n=23).

Based on the actual catches (1997-2021) the estimated probabilities of falling below 50% escapement were below 13%. The maximum historical probability of exceeding F/M=2/3 was less than 21%. Hence the historical catches are unlikely to have resulted in overfishing during this period. Consideration of hypothetical alternative catches reveal similarly low probabilities of creating overfishing over most years. If future years were similar to the poor years 1999, 2001 or 2013, alternative quotas greater than 28,000, 48,000 and 55,000 mt, respectively would have led to escapement levels below 50%. Such exceptions are useful for quota recommendations if the probability of a poor future year is known. Otherwise, analyses based on consideration of all historical years is likely to give a more accurate forecast of risk in an “average” future year. Statistical theory can advise on the consequences of alternative catches but choices related to appropriate risk are matters of policy, not science.

The Council’s Risk Policy can be applied to the evaluation of alternative catch levels if the ratio of current stock sizes to B_{msy} was known. Since this ratio is also not known, any evaluation of risk must be based on assumed values for B/B_{msy}. If the current stock size exceeds B_{msy} (target biomass) then catch limits up to 60,000 mt would not exceed a 28% probability of overfishing. If the population is actually about one half B_{msy} (threshold biomass), then the Council Risk Policy limits the probability of overfishing to 20%. Under this hypothesis, the highest quota consistent with the policy is 47,000 mt. Continuing this logic and considering the F/M threshold of 2/3, the highest acceptable catch limit is 40,000 mt.

Ongoing research efforts to link oceanographic conditions to historic and future stock conditions may improve both forecasting stock size and estimating risk of overfishing.

Following Rago’s presentation, Mike Wilberg noted that the Research Track Assessment (RTA) peer review was completed the week before the SSC meeting. The findings of that meeting and the reports from CIE reviewers have not been summarized, and were not available for consideration by the SSC.

Following the presentation, a number of questions were raised by the SSC.

The catchability q, availability v, and natural mortality M parameters are assumed to be independent but in fact, could be correlated. Covariance among parameters would alter the estimated probabilities but the magnitude and direction of changes are not known. Additional work on the potential consequences of oceanographic processes on the joint distribution of q, v, and M was recommended. The SSC further noted that the estimated range of availability does not account for the fraction of the population offshore. Under this circumstance, the likelihood of overfishing would be lower than reported in the Rago report. Similarly, a 50% escapement policy was chosen for evaluation of alternative quotas. If the more commonly used reference point of 40% escapement level had been used, the risks would have been lower for each of the alternative catch levels. Unfortunately, existing databases of worldwide fishery stock assessment results have few case studies for squid or other comparably short-lived species. Within the Mid-Atlantic region, it was noted that F/M=2/3 has been proposed for Butterfish, but neither the Research Track nor the SSC had endorsed such an approach.

The SSC had several questions about the range of values used for catchability. It was noted that the Bigelow to Albatross conversion (i.e., divide Bigelow catches by 1.4) suggest the Albatross efficiency could not exceed 0.7. Broadscale comparisons of day vs night differences in catch rates further suggested reductions in catchability. Questions regarding the nature of autocorrelation considered in availability analyses were addressed by John Manderson. He provided additional details on the underlying models used by himself and colleagues and noted that Rago had selected more conservative ranges (i.e., those more likely to give higher biomass estimates and therefore give higher estimates of fishing mortality). Another SSC member suggested further refinement of the escapement model parameterization to include alternative statistical distributions (instead of Uniform).

Several SSC members noted the difficulties of having the RTA and SSC meetings in adjacent weeks. Having a longer span would allow for more complete consideration of the RTA findings. For 2022, Council staff advised that this was desirable and that the SSC would be considering the results of a Management Track Assessment for *Illex* at a meeting later in the year. Catch recommendations for 2023 would be considered at that time.

Didden Staff Memo

Jason Didden, Council staff, provided an overview of the 2021 fishery, trends in prices and comments from fishery Advisory Panel. Catches in 2021 were the highest ever during the period of the US-only fishery. Price and demand are the primary drivers of the commercial fishery. The US fishery is small relative to other squid fisheries so prices are largely dependent on international markets. Recent MSC certification of the US *Illex* fishery is viewed as a positive development. Harvesters reported major within-year changes in *Illex* availability to US fishing areas. Such changes are consistent with patterns deduced from mathematical models and investigations of oceanographic processes. Harvesters also commented on the utility of a more extended fishing season to derive a better understanding of the population throughout the year. Harvesters also appreciated participation in discussions about oceanographic factors.

The RTA's conclusions regarding the 2023 fishing year and beyond are not yet known. In view of the dynamic aspects of the fisheries, the Council recommended reconsideration of the SSC's recommendation for 33,000 mt in 2022. In May 2021, the SSC agreed with the staff recommendation of 33,000 mt but expressed concerns that a full range of alternatives had not been evaluated. The report from Rago, commissioned by the Council, was intended to build upon the 2021 analyses. In view of the additional scope for increase suggested by these analyses, the staff recommended an increase of 10% from 2021 to a total of 36,300 mt for 2022. The current risk policy allows for such increases when an OFL does not exist.

The SSC inquired about seasonal patterns of within year fisheries landings and potential influences of COVID 19. In contrast to longfin squid, *Illex* were less affected by restaurant closures. Lisa Hendrickson, NEFSC provided additional context about the spatial pattern of the fishery noting similar patterns in stat area distributions and specific areas within stat areas. As noted earlier, the recommendations from the Research Track Assessment are not yet known nor are the consequences for the MTA later in 2022. The SSC will consider catch recommendations for 2023 at a meeting later in 2022.

Public Comment

Public commenters noted the use of escapement targets in squid fisheries around the world. MSC now recommends the use of escapement targets in their most recent guidance documents. Fisheries operating under such targets have generally been stable. Another commenter requested a 20% increase from the previous ABC to 39,600. He noted the economic and social importance of this fishery particularly during this period when other pelagic fishing opportunities are declining. This proposal was supported by others who further emphasized the small area of fishing relative to the total stock area, the exclusion of *Illex* in offshore areas and the short season length. Others cited observations from research vessels from tows deeper than 2500 m. Finally, it was noted that ex-vessel value alone is an insufficient measure of economic value.

Illex ABC recommendations for 2022

Following these presentations and general discussion, the SSC addressed the Terms of Reference (*italics*) for *Illex* Squid. Responses by the SSC (standard font) to the Terms of Reference provided by the MAFMC are as follows:

Terms of Reference

For *Illex* squid, the SSC will provide a written report that identifies the following for the 2022 fishing year:

- 1) *Review the current 2022 Illex acceptable biological catch (ABC) of 33,000 MT and determine if an ABC adjustment is warranted. If so, please specify an adjusted 2022 Illex ABC and provide any rationale and justification for the adjustment;*

The SSC notes that *Illex* squid continues to be a data poor species.

The SSC received a detailed report from Dr. Paul Rago, who recused himself from discussion of ABC specification. The report included an enhanced, numerical analysis of possible scenarios related to available biomass, the impact of the fishery, and the vulnerability of squid to surveys. This represented extensions to the framework that he had previously presented to the SSC and that provided the basis for the existing ABC determination.

The SSC recognized Rago's presentation included a substantially more comprehensive evaluation of the underlying dynamics of the population and the fishery. The principal conclusions from the Rago presentation accepted by the SSC were:

- Escapement has been relatively high over the last 10 years, suggesting a relatively small impact of the fishery on the component of the stock that is exploited.
- Assumptions regarding parameters that were inputs to the analyses thought were thought to lead to minimum likely estimates.
- Distributions of the joint estimate of F:M suggests that exploitation rate in the fishery is likely low.
- By comparison to empirical escapement reference points used to manage squid fisheries elsewhere globally, the current ABC levels are associated with low risks of exceeding those escapement standards.
- The analyses do not consider any autocorrelation in the dynamics of the squid population that could be caused by stock-recruitment dynamics or by environmental drivers.

The SSC believes that an ABC of 33,000 MT for 2022 is no longer warranted. Instead, the SSC recommends an ABC for 2022 of 40,000 MT based on the following lines of evidence

- It is consistent with discussions of the SSC last year that noted a desire to increase the ABC, but felt it was constrained from so doing because of the lack of a more complete exploration of the implications catch on the squid population. Dr. Rago's enhanced numerical analysis provides such information.
 - It represents an approximately 20% increase in the ABC above the 2021 determination, consistent with the incremental approach the SSC has adopted previously.
 - Based on an evaluation of a prolonged time series, it is consistent with
 - a low chance of falling below the escapement level of 40% that has been used in the management of other squid fisheries (slide 38, p=0.065), and
 - a moderate risk of exceeding a ratio of F:M=2/3 (slide 40, p=0.2)
- Both a 40% escapement level and an F:M=2/3 have been suggested as candidate reference points.
- The SSC believes this level of ABC will lead to a low risk of overfishing.
 - The SSC did not feel comfortable increasing the ABC beyond this level because we continue to lack a clear link between escapement, F:M and the risk of overfishing and thus cannot yet directly apply the Council's risk policy.

2) *The most significant sources of scientific uncertainty associated with determination of the ABC;*

The SSC noted the following ongoing sources of uncertainty for this ABC determination

- The lack of a peer-reviewed OFL introduces substantial uncertainty for the foundation of ABC determination. As an alternative, the SSC is relying on data poor approaches and reference points used to manage other squid fisheries and used to promote sustainability of exploited forage species.

- Continued uncertainty over the fraction, and the interannual variability, of the squid population that is subject to exploitation. This likely leads to estimates that are likely lower bound estimates of the impact of the fishery on the squid population.
- The lack of understanding of stock- recruitment processes in squid complicates development of biological reference points.
- The lack of understanding of the coherence of squid availability on the shelf with environmental drivers of distribution complicate understanding of whether sequences of good or bad years are likely to occur, which would bias understanding of stock status when using data poor approaches.
- Levels of escapement that afford protection against overfishing are poorly understood analytically and empirically.
- Estimates of q , v , and M are uncertain and estimates are assumed to be uncorrelated, whereas there are easily conceived processes that could introduce correlations among these key parameters.

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

The SSC considered:

- A detailed presentation and report, “Evaluation of Alternative Catch Limits for *Illex* in 2022” from Paul Rago.
- ToRs for the research track assessment.
- Maps of the spatial distribution of the squid fisheries for 2019 and 2020 from Lisa Hendrickson
- Fishery advisory performance report for 2022 and fishery information document from Jason Didden
- *Illex* ABC-Staff Recommendation memo from Jason Didden

4) 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 these recommendations meet National Standard guidelines for best available scientific information available.

Golden Tilefish

José Montañez, Council staff, started the discussion on Golden Tilefish ABCs for 2023 began with a review of the fishery performance data for 2021. The stock is not overfished and not experiencing overfishing in 2020 based on the results of a 2021 Management Track Assessment. A data update for 2021 was not provided by the NEFSC but the SSC looks forward to an update in 2023 and the results of a Research Track Assessment in 2024. Harvesters reported an overall increase in CPUE and a broad size distribution, including smaller fish. These improvements are consistent with the changes predicted by the stock assessment. The current quota of 891 mt is part of a 3-year quota for 2022-2024. Actual landings have been slightly below the quotas. Prices were up slightly in 2021 compared to 2020.

In view of the positive signs from the fishery, and the absence of any negative indicators of stock status, the SSC concluded that no adjustments to the quota for 2023 are warranted. The SSC recommends continuation of the previously specified ABC. The SSC also reiterated its ongoing concerns about reductions in biological port sampling for Golden Tilefish.

Blueline Tilefish

Jason Didden reported that commercial landings were down in 2021 but prices were increasing. The trip limit in 2021 dropped from 500 to 300 fish when the stock reached 70% of the quota. The change is designed to reduce targeted trips and the large buffer (30%) reflects the high variability of the catch estimates. Mandatory reporting of recreational private boat harvests has been very low thus far. Blueline tilefish are rare in the MRIP angler intercepts and catches estimates generally have low precision. An operational assessment in collaboration with the Southeast Fisheries Science Center is anticipated in 2024.

Council staff recommended no changes to the existing ABC of 100,520 lb and the SSC concurred with this recommendation.

Atlantic Mackerel

Landings and prices were down in 2021 but similar to recent years. Demand remains strong but US production is a small fraction of worldwide trade.

Following the July 2021 meeting of the SSC and its report, the Council passed a motion in requesting additional guidance from the SSC on rebuilding options for Atlantic Mackerel. Five distinct options were specified to achieve within a 10-year period. The options are distinguished by varying assumptions about recruitment, the desired probability of rebuilding within the 10-year period, and specification of risk for each proposed catch trajectory. The need for reconsideration of rebuilding options arose when the 2021 MTA revealed that rebuilding was lagging behind earlier projections. The Council requested that the options would align with the Council's Risk Policy and the SSC's derivation of a 150% CV for the OFL. Jason Didden, MAFMC presented the options specified by the Council and Kiersten Curti, NEFSC, provided details on each rebuilding option.

Mackerel recruitment has been low in recent years and various assessments have debated the underlying causes. Environmental conditions may be resulting in low recruitment. Alternatively low recruitment may be due to reduced spawning stock biomass. If stock size is low due to long-term environmental conditions, then severe reductions in ABC are required to achieve rebuilding. Alternatively, if stock size is responsible, then increases in recruitment could occur in response to lower rates of fishing. The feedback effect would accelerate recovery beyond that possible if recruitment is assumed to be stationary about a reduced recent average. The stock-dependent recruitment hypothesis was considered in 4 of the 5 rebuilding options (Table 1 below).

The stock recruitment relationship assumes that larger recruitments are more likely when the stock is high than when it is low. The SSB_{msy} for mackerel is estimated as 181,090 mt and F_{msy}=0.22. This hypothesis is formalized as a step function in which the distribution of possible recruitment has a smaller range (2009 onward) and lower average when the stock biomass is below the threshold (0.5 SSB_{msy}). The converse (larger range (1975 onward) and higher mean recruitment) is true when the stock biomass is above the threshold (0.5 SSB_{msy}). The basis for this type of stock recruitment relationship and examples may be found in Brodziak et al. 2001.

Rebuilding scenarios were evaluated using a stochastic projection model based on 2000 bootstrap estimates of the terminal year population sizes from the stock assessment model. Owing to the varying starting conditions and random effects of time varying recruitment, the population trajectories under the rebuilding scenarios result in a broad distribution of values. Measures of central tendency (i.e., median) were used to describe the expected rebuild times, the probability of rebuilding by 2032 and the expected catch trajectories. It was noted that not all of the realizations would successfully rebuild, even under the most aggressive reductions in fishing mortality.

Suggestions from the SSC included alternative ways of capturing the patterns associated with each realization and illustration that rebuilding may fail even with very long rebuilding periods. The distribution of SSB for each year would be useful to characterize because it is expected to be skewed with heavy tail of high rebuild probabilities. The SSC also suggested further investigation into potential environmental drivers for recent low recruitment. It was further noted that rebuilding would be monitored via Management Track Assessments every two years. Adjustments to the rebuilding strategy are expected. The SSC emphasized the deliberative nature of discussions about the stock recruitment relationship and rebuilding strategies. These discussions included extensive consultations among NEFSC and SSC as well as the DFO Canada and other assessment partners.

Following these presentations and 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:

Terms of Reference

For Atlantic Mackerel, the SSC will provide a written statement that identifies the following for the 2023 – 2024 fishing years:

- 1) *Provide acceptable biological catch (ABC) recommendations, in weight, for the Council's rebuilding alternatives. The rebuilding alternatives include either P* based calculations or a target probability of rebuilding (e.g., 50% or 60%) specified by the Council. The alternatives use one of the two recruitment assumptions previously recommended by the SSC – the most recent recruits (2009 onwards) or a two-phase approach that only*

incorporates the longer time series (1975 onwards) once biomass is over half of the rebuilding target. The SSC also previously recommended a 150% CV for the P based calculations.*

This table summarizes the alternatives specified by the Council and gives the calculated 2023, 2024, and total rebuilding plan (2023-2032) ABC estimates. Note that an OFL CV probability of 150% applies to alternatives 2 and 5. The SSC recommends Alternative is 2: Split standard P* (see ToR 2).

Table 1. Atlantic Mackerel Rebuilding Options Summary

Rebuilding Alternative Name	Rebuilding Risk Policy	Recruitment	Probability Rebuild by 2032	F (2023/2024 if multiple)	Rebuilt by (median)	2023 median Catch/ABC (mt)	2024 median Catch/ABC(mt)	Rebuild Plan median catch/ABC 2023-2032 (mt)
1. 2009+ Rebuild	50% chance of rebuilding by 2032	2009+	56.6%	0.01	June 2031	703	865	12,866
2. Split standard P*	Use basic P* as rebuilding plan.	Split at 1/2 Bmsy	51.5%	0.07/0.08	June 2031	4,539	6,207	171,291
3. Split 60% rebuild	60% chance of rebuilding by 2032	Split at 1/2 Bmsy	60.5%	0.12	June 2031	8,094	9,274	144,147
4. Split 50% rebuild	50% chance of	Split at 1/2 Bmsy	53.4%	0.14	June 2032	9,371	10,591	157,821

	rebuilding by 2032							
5. Split 50% rebuild with P* deduction	Use rebuild F from split 50% chance of rebuild and then deduct per P* as if rebuild F was overfishing F	Split at 1/2 Bmsy	62.3%	0.04/ 0.05	June 2029	2,976	4,168	134,022

- 2) *Provide any guidance regarding the relative risks associated with the different rebuilding alternatives and identify the most significant sources of scientific uncertainty associated with rebuilding;*

The SSC reviewed all alternatives and recommends the P* approach with the maximum fishing mortality threshold (MFMT) equal to the Fmsy proxy (Alternative 2). This alternative, (1) fulfills rebuilding plan requirements; (2) is the most responsive to new information on changes in stock status; (3) produces the highest rebuilding plan 10-year catch yield; (4) is fully consistent with the Council's P* risk policy; and (5) would avoid "break points" in catch limit advice, which would reduce year-to-year changes in the ABC.

Risks and scientific uncertainties pertain to the two classes of alternatives: Alternative 1, which considers projections on the basis of only recent recruitment (2009+) and the remainder (Alternatives 2-5) that use the recent recruitment period under the condition of SSB<0.5 SSB_{MSY}, and use the entire recruitment series (1975+) when SSB≥0.5 SSB_{MSY} (Alternatives 2-5).

Alternative 1

Risks:

- ABC/Catch levels are quite low indicating risk of a depleted industry and foregone catch once SSB recovers.
- At low to nil catch levels, fishery-dependent data will become unavailable to support stock assessment.
- High discard potential if recruitment recovers under low catch

Scientific Uncertainties:

- Predictions of which recruitment regime exists is highly uncertain owing to lack of understanding on how recruitment is controlled (i.e., role of SSB, the environment, and the food web).
- Recreational catch/unreported removals may exceed low ABCs under this Alternative; knowledge about catch will need to become more precise at low ABCs.

- Uncertainty accumulates with length of projections.

Alternatives 2-5

Risks:

- Stock may not recover without the low F specified in Alternative 1.
- The SSB trigger implies a sudden change in recruitment state, which is not supported by current understanding of what drives recruitment
- The two recruitment stanza approach applies uses an SSB trigger for which there is limited analytical support (SSC Chairman's September 22, 2021 Report to MAFMC)
- An immediate shift towards a higher recruitment regime is assumed at $SSB \geq 0.5 SSB_{MSY}$, whereas an unknown lag may occur between increased SSB and recruitment.
- Because a stock-recruitment relationship is unknown for this stock, it is uncertain whether SSB changes will be driven by increased recruitment or vice versa. This approach implies a S-R relationship, which may be arbitrary given that it has not been parameterized in the assessment
- The approach of shifting recruitment regimes 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.
- Approaches rely on a SSB-based boost to recruitment that has not been observed recently (since 2007).
- The lack of strong precedence of this approach (but see Brodziak et al. 2001) conveys risk in predicting its performance in rebuilding.

Scientific Uncertainties:

- We do not know the form of the underlying stock-recruitment relationship.
- Knowledge about catch will needs to become more precise at low ABCs.
- The trigger SSB for using one or the other recruitment series is deterministic, without consideration of error.
- Uncertainty in small amplitude changes in SSB
- Uncertainty in long projections

- 3) *Provide any data and/or assessment considerations for the 2023 Atlantic Mackerel management track assessment;*

Management Track Assessment

- The Atlantic mackerel egg surveys and related ichthyoplankton processing and data analysis are fundamental in assessment and projections of rebuilding.
- Phase plots are instructive in evaluating linked changes between recruitment, SSB, and F.
- The US recreational sector is less represented in length data in the assessment than commercial sectors. Should evaluate recreational fishery data quality and assessment sensitivity

Considerations for future assessments

- Shoreside sampling needs to be improved (multispecies issue)
 - Cost per length is now higher so sampling reduced since FY 2020
 - Allocation also based on catch amount—but should have minimum sample size for assessments
- Further evaluate is needed on how error in the egg survey propagates to error in the spawning stock biomass index to better interpret small amplitude <50% changes in SSB.

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

- Staff memo: 2023-2024 Atlantic Mackerel rebuilding recommendations and considerations
- NEFSC rebuilding projection tables:
 - Mackerel 10 Year Rebuilding Projections (Excel)
 - Mackerel P* Projections (Excel)
 - Figure – Mackerel SSB Rebuilding Projections
 - Figure – Mackerel Catch Rebuilding Projections
- 2022 Mackerel, Squid, Butterfish Advisory Panel Fishery Performance Report
- 2022 Atlantic Mackerel Fishery Information Document
- July 2021 SSC Meeting Report
- September 2021 SSC Meeting Report
- Brodziak, JKT, WJ Overholtz, and PJ Rago, 2001. Does spawning stock affect recruitment of New England groundfish? Canadian Journal of Fisheries and Aquatic Science 58:306-318

5) *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.*

Agreed. The SSC believes these recommendations meet National Standard guidelines for best available scientific information available.

Council Action: Harvest Control Rule

Julia Beaty, Council staff, opened this session with a succinct overview of the Harvest Control Rule (HCR) under consideration by the Council. The HCR amendment is a complex set of measures designed to regulate recreational harvest of summer flounder, scup, black sea bass, and bluefish. The overall objective is to prevent overfishing by employing controls that account for stock status and its uncertainty. To the extent possible the measures are to be governed by angler preferences and a desire for stability of measures across jurisdictions and over time.

Five different alternatives have been proposed. All of them rely on regular updates of stock status but the algorithms that trigger changes in regulations differ. The basic features of the alternatives are described below:

- Status Quo—measures designed to prevent harvests from exceeding annual harvest limits.
- Percent Change—compares expected harvest to future harvest limits, and current stock size to target level.
- Fishery Score—attributes of stock and fishery (relative biomass, recruitment, fishing mortality and expected harvest) are scored, weighted, and summed to create an aggregate score. Four score intervals are defined and sets of recreational measures are defined within each bin.
- Biological Reference Point—current stock biomass and fishing mortality rates are used to define eight possible bins related to whether overfishing is occurring or not, and four levels of stock size relative to Bmsy. Within each of these eight bins, measure are further governed by trends in biomass, recruitment and recent harvests compared to their limits. The magnitudes of admissible changes are not defined but are categorized as “liberal”, “default”, “restrictive”, “restrictive and re-evaluate”, and “rebuilding”.
- Biomass Matrix—similar to the Biological Reference Point measure but relies on current stock biomass and trends in biomass to create six possible sets of regulatory measures. Four levels of stock size and three levels of biomass trend (increasing, stable, decreasing) are defined. The six bins can span more than one level of biomass trend.

The HCR amendment is motivated by real and perceived uncertainties in the MRIP estimates of catch and perceptions that recent regulations are inconsistent with true stock size, rendering them ineffective. To address these concerns the HCR is a set of alternative algorithms that define a basis for adjusting regulations in response to changes in stock condition. The specific measures (e.g., bag limits, size limits, or seasons) are not defined. Such measures are to be defined during the specifications process by the appropriate technical groups familiar with the fisheries and jurisdictions.

The Council’s request to the SSC is stated below:

Request that the SSC provide a qualitative evaluation, in time for final action at the June 2022 Council/Policy Board meeting, regarding the potential effect of each of the five primary alternatives in the Harvest Control Rule Addendum/Framework on the SSC’s assessment and application of risk and uncertainty in determining ABCs. The intent is to provide the Council and Policy Board with information to consider the tradeoffs among the different alternatives with respect to the relative risk of overfishing, increasing uncertainty, fishery stability, and the likelihood of reaching/remaining at Bmsy for each approach at different biomass levels (e.g., for $\frac{1}{2}$ Bmsy $< B <$ Bmsy, the relative risk among alternatives is (highest to lowest) E > C > B > A > D).

Julia’s presentation and the motion from Council generated extensive discussion within the SSC. The SSC appreciated the breadth of the options and the efforts to link recreational measures to stock status. The SSC inquired about the processes that led to these alternatives and the selection of various bins and thresholds. Discrete, rather than continuous responses to changes in relative

abundance or fishing mortality, could have important feedback effects for population dynamics. Some members expressed concerns that the implications of these control rules have not been evaluated to date. Several ongoing projects, such as the summer flounder MSE project, may be useful for a more comprehensive evaluation.

It was noted that the current process for setting the RHL relies on results from the most recent stock assessment and their relevant projection models. Hence further adjustments for biomass or fishing mortality within a given regulatory option could be viewed as double counting for such factors. To varying degrees, the recreational fisheries for all of the species in the HCR coexist with commercial fisheries. Concerns were raised that this linkage should be explored within the HCR, particularly because recreational overages may create overfishing for the stock as a whole.

As part of a more general discussion the SSC noted that management measures do not always have their intended effects. In theory the HCR will be more successful in addressing the uncertainty of such measure and responding appropriately as situations warrant. Such responsiveness may conflict with the underlying desirability of stable regulations over time.

Several SSC members expressed concerns that fully worked examples had not been provided. Julia explained that specific measures were excluded because it would detract from discussions about the principles underlying each alternative. Council staff are not anticipating conducting simulation studies to compare the efficacy of each alternative for each species. To facilitate such studies, stock assessments might consider using recreational and commercial “fleets” separately. This would allow for more direct estimation of the force of mortality imposed by anglers and commercial harvesters.

Economic and social concerns include angler responses to alternative measures. Angler discontent with current regulations is high in the Mid-Atlantic; this introduces additional uncertainty into the selection of options. MRIP is designed to capture broad trends at an annual time step over multi-state regions. Partitioning such data into smaller domains decreases the precision of estimates. Low precision and potential bias are likely to continue unless recreational data collection efforts are increased.

Prior to the SSC meeting a request to participate in a working group was sent to the Committee. Six members volunteered to participate (Tom Miller, Cynthia Jones, Alexei Sharov, Lee Anderson, Brian Rothschild, and Paul Rago). Tom Miller will chair the group. Several meetings will be held prior to the May 10-11, 2022 meeting of the SSC. The SSC will craft a formal response at that meeting for delivery to the Council at its June 7-9 meeting.

As part of its charge from the Council, the SSC will address two broad themes. First, it will consider how approaches to slow down the rates of change in RHL will affect the uncertainty measures used by the SSC. What are the possible feedback effects of this uncertainty? Second, each of the five options will be considered to identify those least likely to increase uncertainty. In view of the short time available for the review, consensus, rather than analytical approaches will be used.

Ecosystem Science and Application

State of the Ecosystem and EAFM Risk Assessment

Sarah Gaichas presented the NEFSC's State of the Ecosystem report that included over 60 contributors. The iterative process of presentation, suggestions and refinement continues to be appreciated by the SSC. In recent years the SOE report has focused more directly on information relevant to the Council's decision-making process. Wherever possible, links to the underlying methodology and data are provided. The report for 2022 retains the structure from 2021 with a three-page graphical report card, risk summary and synthesis theme. The remainder of the report reviews performance relative to management objectives and risks. Due to changes in the data processing for commercial catch data, some recent catch data for 2020 have not been included.

Recreational seafood and commercial seafood both show long term declines but these declines are not necessarily due to stock status declines. Only two stocks, Atlantic Mackerel and Bluefish are overfished and only one stock (Atlantic Mackerel) is subject to overfishing. Climate risk of particular concern for Surfclam & Ocean Quahog. Recreational effort increased but fleet diversity decreased. The range in opportunities might be important to consider, as contraction of party/charter and shift towards shoreside angling continues.

In the bottom trawl surveys the expected number of species does not appear to be changing over time. Owing to the discontinuity in survey (FSV Albatross vs. R/V Bigelow) methods, the current time series is insufficient to detect statistical differences.

New indicators were introduced in 2022 for Community & Social Vulnerability. Highly engaged and reliant communities are generally less vulnerable to Environmental Justice impacts. Recreational communities tend to be less vulnerable to Environmental Justice issues.

Climate risks appear to be increasing with notable increases in bottom temperature, the frequency of heat waves from August through fall, and changes in seasonality metrics. The Mid-Atlantic Cold Pool is both warming and becoming smaller. Ocean acidification is expanding and more warm core rings from the Gulf Stream are intruding on slope water. Some progress has been made linking these changes to *Illex* abundance.

Ecosystem changes include dominance of smaller zooplankton species, reductions in the energy contend of herring and reductions in fish condition factor. Predator biomass remains high with continuing increases in gray seals and relatively high levels of abundance for Highly Migratory Species. The number and extent of proposed offshore wind energy areas continues to increase.

The SSC expressed appreciation for the comprehensive and synthetic report, the open processes for further investigation of the underlying data and methodologies, and the responsiveness of the team to suggestions for improvement.

The SSC inquired about the use of trend lines and the possibility that the methodology might not be sensitive to local trends. It was noted that several models were evaluated for each time series to select trends based on an AIC value.

Several members asked for details on the Environmental Justice metrics and the underlying indicators. Lisa Colburn, NEFSC, was lead on this section.

<https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities>

Environmental justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

Environmental Justice also includes measures of the demographic composition of the communities, languages, unemployment, poverty and incarceration rates.

Update on SSC Ecosystem Work Group

Sarah Gaichas reported on the work of the Ecosystem Working Group. Several meetings were held and the following key objectives have been identified:

1. Expanding and clarifying the ecosystem portion of the SSC OFL CV determination process (short term objective)

A flow chart outline has been developed to facilitate consideration of ecosystem drivers in stock assessments. If the ecosystem driver has been incorporated into the assessment model or stock projections there is no need to account for these factors outside the model.

Otherwise the OFL might be adjusted in response to such omissions. The direction of adjustments might be known but the magnitude would likely be a function of expert judgement. Additional work on this is underway using John Wiedenmann's MSE model in collaboration with Mike Wilberg. Summer flounder and Atlantic mackerel are currently the focal species.

2. Developing prototype processes to provide multispecies and system level scientific advice appropriate for Council decision making, in particular where there are multispecies and multi-fleet tradeoffs linking directly to economic and social outcomes (long term objective)

The NEFSC has secured funding for additional analytical support. Results may allow for direct incorporation of uncertainty into the OFL CV criteria rubric used by the SSC. Such modeling has the potential for deriving ecosystem level reference points.

3. Collaborating with SSC species leads, stock assessment leads, and relevant working groups in developing the stock-specific Ecosystem and Socio-economic Profiles (ESP) process to specify stock-specific Ecosystem ToRs that are impactful and can be integrated into assessments (moderate-term objective)

This effort will continue on ongoing engagement of SSC members with stock assessment working groups as part of the RTA. In particular, further work with Bluefish RTA in 2023 is

expected. It was noted that a more structured process, beginning with a conceptual model, will increase the odds of success.

The SSC appreciated the progress of the Ecosystem Working Group. It was noted that the timing of information flows is critical in the stock assessment process owing to the tight interdependencies among data and model components and the incompressible management timelines. The SSC expressed interest in receiving information from the Working Group in advance of the stock assessment results. For example, early information on the results of the Research Track Assessments for *Illex* and Butterfish would be helpful in advance of receiving the results of the Management Track Assessments for these species in July. If the current schedule does not allow for such changes, then an additional meeting of the SSC in 2022 may be warranted.

Economic Work Group

Geret DePiper provided an overview of the Economic Work Group activities in 2021 through early 2022. Activities were primarily focused on assisting the Council's Research Steering Committee (RSC) on the feasibility of re-starting the Research Set Aside (RSA) program in the Mid-Atlantic region. The RSA could allow for targeted research on topics relevant to sound management of MAFMC species. The group met regularly throughout the past year and supported the RSC by contributing substantively to four day-long workshops. These included: 1) identification of research topics, 2) application of economic theory for various funding options, 3) enforcement and tradeoff issues, and 4) development of a decision tree for creating a comprehensive RSA process. Draft goals of the revised RSA include:

- 1) Quality peer-reviewed research that maximizes benefits to public and Council by enhancing understanding of its managed resources.
- 2) Ensure monitoring, accountability and enforcement of RSA quota
- 3) Generate resources to fund projects aligned with Council priorities
- 4) Foster collaboration and trust among science, industry and Council.

Overall, the workshops were viewed as highly successful, a view affirmed by the RSC Chair Michelle Duval and members of the public. The Economics Work Group added value to the RSA process and established a strong partnership with the Council. Future requests for assistance from the Economics Work Group are expected. In the meantime, the work group will continue to support the Summer Flounder MSE project, the EAFM risk assessment and terms of reference for stock assessments and other reviews. The overall capacity of the SSC to address economic issues is ultimately limited. Concerns were expressed that substantive involvement in fewer issues is preferred to the converse.

Other Business

- The Scientific Coordination Subcommittee will be hosting a meeting of the Fishery Management Council's Scientific and Statistical Committees August 15th-17th in Sitka, Alaska. Sarah Gaichas will be presenting a keynote address. Up to three members of the SSC will participate in the meeting. The focus of the meeting will be inclusion of ecosystem information in stock assessments.
- There will be no changes to the species and topic leads for the SSC. See Council webpage for details.
https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/6234d93b8ea446be3d67345/1647630651288/2022+SSC+Species_Topic+Leads+Table.pdf
- For purposes of economic stability and regulatory stability, the Council often prefers multi-year specifications for ABCs. These approaches can be problematic with respect to the Council's risk policy, if the population is trending downward from a high level. A small group will be convened to address approaches for averaging ABCs. The SSC will be seeking clarification from Council regarding objectives for multi-year specifications.
- The May 10-11 meeting of the SSC will be a hybrid meeting in Baltimore.

Attachment 1



**Mid-Atlantic Fishery Management Council
Scientific and Statistical Committee Meeting**

March 15 – 16, 2022 via Webinar

Webinar Information

(Note: same information for both days)

Link: [**March 15-16, 2022 SSC Meeting**](#)

Call-in Number: 1-415-655-0001

Access Code: q59Uk4AE5qA

AGENDA

Tuesday, March 15, 2022

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

9:35 Review and potential change to 2022 *Illex* ABC specifications

- Review updated *Illex* quota work products (P. Rago)
- Review of staff memo 2022 ABC recommendation (J. Didden)

11:00 Break

11:15 Continue review of 2022 *Illex* ABC specifications

- SSC 2022 *Illex* ABC recommendations (T. Miller)

12:30 Lunch

1:30 Golden Tilefish data and fishery update; review of previously recommended 2023 ABC (J. Montañez)

2:15 Blueline Tilefish data and fishery update: review of previously recommended 2023 ABC (J. Didden)

3:00 Break

3:15 Atlantic Mackerel 2023 – 2024 Rebuilding ABC Specifications

- Review of Council rebuilding alternatives and stock projections using SSC guidance (J. Didden and K. Curti)
- SSC 2023 – 2024 ABC recommendations (D. Secor)

5:30 Adjourn

Wednesday, March 16, 2022

- 8:30 Overview of Council Action: Recreational Harvest Control Rule (J. Beaty)
 - Council motion on SSC input and guidance
 - Discussion on process and approach to address Council motion (e.g., formation of work group)

10:15 Break

- 10:30 Ecosystem Science and Application (S. Gaichas)
 - NEFSC 2022 Mid-Atlantic State of the Ecosystem Report
 - 2022 update of Council's EAFM Risk Assessment
 - SSC Ecosystem Work Group – update on work group work plan and progress
 - Ecosystem and socio-economic work for 2022 Bluefish Research Track assessment

12:30 Lunch

- 1:00 Report from SSC Economic Work Group
 - Update on engagement with the Council on the RSA redevelopment project
 - Potential area(s) for future engagement

- 1:45 Other Business
 - 2022 Scientific Coordination Subcommittee meeting
 - Species/topic lead assignments
 - ABC averaging approach

2:30 Adjourn

Note: agenda topic times are approximate and subject to change

Attachment 2

MAFMC Scientific and Statistical Committee March 15-16, 2022 Meeting Attendance via Webinar

<u>Name</u>	<u>Affiliation</u>
<i>SSC Members in Attendance:</i>	
Paul Rago (SSC Chairman)	NOAA Fisheries (retired)
Tom Miller	University of Maryland – CBL
Ed Houde	University of Maryland – CBL (emeritus)
Dave Secor (March 15 th only)	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	Univ. of Massachusetts-Dartmouth (emeritus)
Olaf Jensen	U. of Wisconsin-Madison
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
Mike Frisk	Stony Brook University
Mark Holliday	NOAA Fisheries (retired)
<i>Others in attendance (only includes presenters and members of public who spoke):</i>	
Kiersten Curti (March 15 th only)	NEFSC
Jason Didden	MAFMC staff
Brandon Muffley	MAFMC staff
Julia Beaty	MAFMC staff
Jeff Kaelin	Lund's Fisheries
José Montañez	MAFMC staff
Paul Nitschke (March 15 th only)	NEFSC
Lisa Hendrickson (March 15 th only)	NEFSC
John Manderson (March 15 th only)	Open Ocean Research
Greg DiDomenico	Lund's Fisheries
Meghan Lapp	Seafreeze Ltd.
Eric Reid	Fisheries Consultant
Emerson Hasbrouck (March 16 th only)	Cornell Cooperative Extension
Mike Waine (March 16 th only)	American Sportfishing Association
Michelle Duval	MAFMC
Abby Tyrell (March 16 th only)	NEFSC
Kim Hyde (March 16 th only)	NEFSC

Attachment 3. Glossary

ABC—Acceptable Biological Catch
AIC—Akaike's Information Criterion
Bmsy—Biomass at maximum sustainable yield
CV—Coefficient of Variation
DFO—Department of Fisheries and Oceans, Canada
ESP—Ecosystem and Socio-economic Profiles
EAFM—Ecosystem Approach to Fisheries Management
F—Instantaneous rate of fishing mortality
FSV—Fishery Survey Vessel
GARFO—Greater Atlantic Region Fisheries Office
HCR—Harvest Control Rule
M—Instantaneous rate of natural mortality
MRIP—Marine Recreational Information Program
MTA—Management Track Assessment
MSC—Marine Stewardship Council
MSE—Management Strategy Evaluation
OFL—Overfishing Limit
 P^* —Probability of overfishing
 q —catchability coefficient parameter
RHL—Recreational Harvest Limit
RSA—Research Set Aside
RSC—Research Steering Committee
RTA—Research Track Assessment
R/V—Research Vessel
SSBmsy—Spawning stock biomass at maximum sustainable yield
SSC—Scientific and Statistical Committee
 v —availability parameter