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M E M O R A N D U M

Date: March 23, 2023

To: Michael P. Luisi, Chairman, MAFMC

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

Subject: Report of the March 2023 SSC Meeting

Executive Summary

Mid-Atlantic State of the Ecosystem (SOE) Report
The SOE Report for 2023 included a number of key findings:

- 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.
- Distributional shifts are occurring for many species; this complicates both stock assessments and management decisions.
- Many species show declining trends in condition factor and several reveal long term declines in energy content.
- Commercial fishing revenue is declining but overall biomass estimates are generally stable.
- Wind energy areas may impact commercial fishing revenue, have differential impacts (some positive) by species, and require changes to future biological surveys.

The SSC greatly appreciated the thoroughness of the report, the transparency of data and process, and the responsiveness to annual requests for modifications.

Potential Use of Short-Term Forecasts of Species Distributions for Management
The SSC provided comments on a Dynamic Range Model developed by investigators at Rutgers University. For summer flounder, the model creates forecasts of population densities by area over a geographic range from 34 to 44 degrees latitude. Each "patch" includes an age-based

population model which includes the influence of temperature on key biological processes. The SSC encouraged continued development of the approach and potential utility for management decisions, but recommended additional validation studies including comparisons with simpler methods. Further consideration of survey sampling issues and age-dependent responses to temperatures should be considered in future research.

***Illex* Squid ABC Specifications for 2023-2025**

An interdisciplinary team of scientists and fishermen (aka, the Squid Squad) reported on their joint activities to better understand the biological oceanography and the fishery for *Illex* squid. Weekly meetings since 2019 have allowed for collaboration on a number of projects including various peer-reviewed publications, joint industry/research cruises, and collection of synoptic fine-scale information from biological sampling of catches. The SSC appreciated their collaboration as a model for other meaningful partnerships.

The methodology to estimate the risk of overfishing at various quotas was updated to include sampling uncertainty in the survey-based estimates of abundance in the NEFSC fall bottom trawl survey. This additional uncertainty is considered in conjunction with uncertainty in natural mortality, availability of *Illex* to the fishing areas, and catchability of research trawl gear. Addition of this uncertainty did not significantly alter the risk evaluation process previously used.

The updated assessment approach, software and user manual were delivered to the NEFSC for use in 2023 and future assessments. **Results from the application of the methodology to updated data from 2022 led the SSC to retain their recommendation of a 40,000 mt ABC for 2023. Moreover, the SSC recommended the same ABC for 2024 and 2025.** The SSC noted the high level of uncertainty in our overall understanding of *Illex* population dynamics, and recommended continued collection of high resolution samples from the fishery and further investigations into their reproductive biology.

Review of Pilot Video Monitoring Study for Quantification of Recreational Fishing Effort

The SSC appreciated the logistical challenges of video monitoring of fishing effort for nearly three years and the exemplary work of Jason Didden to lead this project. More detailed analyses are underway; the SSC encouraged development of a structured subsampling program and potential software tools to facilitate interpretation and processing. When analyses are completed this project should serve a valuable basis for evaluating future studies and potential integration with other MRIP effort monitoring tools.

Results of Recreational Summer Flounder Management Strategy Evaluation (MSE) Project

This multi-year MSE project is based on a set of linked simulation models that incorporate an operating model of stock dynamics, an assessment model to estimate stock condition, a decision model to make catch recommendations, and a recreational fishing catch and effort model to simulate harvests. The recreational effort model incorporates expected behavioral responses of

harvesters under varying trip and size regulations. Components of this project will also be used to evaluate the efficacy of alternative regulations in the Summer Flounder, Black Sea Bass, and Scup fisheries for 2023 and beyond. The SSC strongly endorsed the continuation of this research effort and encouraged continued engagement with the many partners who have contributed ideas along the way.

Progress Report from the SSC Ecosystem Work Group

The Ecosystem Work Group reported on a number of ongoing and new initiatives to improve the utility of the State of the Ecosystem report for management. These include a better understanding of the role of temperature induced changes in recruitment on ABC recommendations, new measures of ecosystem overfishing, new methods for indexing system level responses, and approaches for evaluating the efficacy of management measures.

Progress Report from the SSC Economic Work Group

The Economic Work Group will focus on a number of high priority Council projects and continue work as requested on the Research Set Aside program. Anticipated activities include work on the Harvest Control Rule, Essential Fish Habitat, and a comprehensive review of the EAFM risk assessment.

Background

The SSC met via webinar from 7th – 8th March 2023, addressing the following topics:

- State of the Ecosystem Report for Mid-Atlantic Region
- Summary of Ecosystem Work Group activities
- Short-Term Forecasts of Species Distributions
- *Illex* 2023-2025 ABC specifications
- Presentation of pilot study report on a recreation effort monitoring based on video monitoring
- Findings of Management Strategy Evaluation for Summer Flounder
- Report of the Economic Work Group plans for 2023 and beyond
- Other business

See Attachment 1 for the meeting's agenda. An Executive Summary provides a quick summary of the primary conclusions of the SSC.

Most SSC members were able to participate for both days 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. 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 similar expertise from Rob Latour's contributions on Short Term Forecast were both substantial and greatly appreciated. I thank Sarah Gaichas, Brandon Muffley, and staff from the ecosystem team at NEFSC 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/2023/march7-8. This report uses many acronyms: a comprehensive guide is listed in Attachment 3.

Mid-Atlantic State of the Ecosystem Report

Sarah Gaichas presented the 2023 State of the Ecosystem (SOE) for the Mid-Atlantic. Her presentation included an overview of the major trends, highlights of significant changes, and a summary of responses by the team of nearly 70 scientists who contributed to the report. The report begins with a report card on current ecosystem properties, a summary of risks, and a focal point synthesis. The report was well received by the SSC who complimented Sarah and her team for the comprehensive nature of the report, the transparency of methods, accessibility of the underlying data, and their ongoing responsiveness to requests for improvements.

Highlights from the SOE report include:

- 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.
- Distributional shifts are occurring for many species; this complicates both stock assessments and management decisions.
- Many species show declining trends in condition factor and several reveal long term declines in energy content.
- Commercial fishing revenue is declining but overall biomass estimates are generally stable.
- Wind energy areas may impact commercial fishing revenue, have differential impacts (some positive) by species, and require changes to future biological surveys.

Specific questions from the SSC related to the determination of "regime shifts" and whether such determinations could be defined in the Northeast Region. Evidence suggests significant changes in fish recruitment, zooplankton species composition and abundance, and condition factor of fish. Another question expressed concern about the focus on commercially important species rather than other species. It was noted that commercial and recreational landings are a primary source of information, all species observed in the bottom trawl surveys are considered for derivation of ecosystem metrics.

Questions about socio-economic issues focused on the potential inclusion of state-level data to address measures of "satisfaction" in recreational fishing. Members noted that SOE graphs labeled as measures of profit are actually measures of revenue. This was followed by a request to incorporate cost estimates for both commercial and recreational fishing. These data, along with demography of the fishermen and the fleet (size and age of vessels), would help explain the differences in revenue trends among communities and species. Sarah and Geret responded that cost surveys are expensive to conduct and therefore infrequent, and Geret noted that a new survey is in the planning stages for implementation in 2023. Additional questions inquired about fuller integration of environmental justice metrics into the broader management concerns.

Several SSC members noted the potential value of including information on smaller fish commonly caught in nearshore or estuarine studies by various states. Such indices are commonly used in stock assessments as indices of abundance for age 0 and 1 fish, but routine collection of these data is challenging because of the many different survey designs and data formats.

The focus on Mid-Atlantic ecosystem condition is valuable, but inclusion of key findings from the Gulf of Maine, Georges Bank, and possibly the Scotian Shelf would provide additional context for the observed trends.

Comments from the public included kudos for the presentation and report as well as questions about inclusion of menhaden abundance estimates from models in the Southeast Atlantic region.

Another commenter requested inclusion of information from the north---Rhode Island, specifically. Council staff reported that the Council will be receiving a briefing on the 2023 Northeast Commercial Fishing Vessel Cost Survey.

Request Tracking Memo

The NEFSC accumulates recommendations annually from the MAFMC and NEFMC. These requests are prioritized and addressed as available resources allow. The SSC applauded the transparency of this process. Many requests require initiation of long-term research programs. In view of planned wind energy developments, inclusion of more marine mammal, sea bird, and top predator data was recommended as an important priority.

Short-Term Forecasts of Species Distributions

Malin Pinsky and Alexa Fredston of Rutgers University presented a detailed overview of their project to develop dynamic models for predicting species distributions in response to climate change. Their models combine spatial analyses of historical bottom trawl data with age-based models to create simulated populations in multiple geographical areas or patches. Simulated populations within these geographical patches can migrate north and south in response to environmental gradients of temperature and randomly by using principles of particle diffusion. Incorporation of fishing mortality within the spatial units helps isolate the potentially confounding effects of spatially heterogeneous fishing mortality on the detection of migration in response to environmental change. Currently the geographical zones are based on one degree of latitude intervals. Input data include abundance, biomass, age, and length data from the fall NEFSC bottom trawl surveys, as well as temperature data from a variety sources. The Bayesian hierarchical state space model was fit initially to the 1972-2006 data.

The predictive skill of the Bayesian hierarchical state space model has been tested by comparing predictions for the 2007-2016 period with observations from the bottom trawl surveys. Various metrics of prediction for Summer Flounder suggest reasonably good correspondence with observed population trends and spatial patterns. As in all models, the variation of predictions increases with the length of the forecast. Model outputs of one to five years are most relevant to Council decisions regarding catch regulations. SSC decisions about appropriate levels of uncertainty in assessments and risk policies could also be informed by such forecasts. The authors noted that true forecasts will also require forecasts of oceanographic conditions on similar time scales.

Modeling efforts for *Illex* squid, Spiny Dogfish, and Gray Triggerfish are currently underway. These species were chosen to illustrate the range of possible applications.

The presentation generated considerable interest from the SSC. Questions of clarification included how the model handles observation error in the surveys, concerns about small area estimation, and effects of missing data. Members noted that distributions of most species have major seasonal shifts across depth gradients and inquired about how such changes are handled

within the model. Discussions often simultaneously addressed potential applications of the dynamic range models and the need for future work. Conclusions drawn from those discussions are summarized under the Terms of Reference below.

Terms of Reference

For the short-term forecast research project, the SSC will provide a written report that identifies the following:

1) *Comment on potential applicability of short-term forecasts of species distribution for stock assessment, science, and management purposes of Mid-Atlantic species. Consider potential implications for the SSC's OFL CV approach;*

- The SSC recognized the significant potential of the models for short-term forecasts for some species. Potential applications include:
    - Model forecasts could be linked to SOE indicators of vulnerability for coastal communities and various social and economic metrics. Investigations of linkages with other SOE indicators are encouraged. EAFM indicators of distributional shifts could be compared with dynamic range model forecasts.
    - Forecasts of distributional shifts could be useful for evaluating recreational fishing performance under various Harvest Control Rules.
    - Evaluation of the feasibility of catch advice relative to the historical distribution of resources.
    - The model could be used as a tool for allocation decisions, particularly if dynamic harvest allocation becomes a possibility.
    - The dynamic range model forecasts may be helpful for interpreting retrospective patterns observed in some species stock assessments.
    - Forecasts may be helpful for interpreting changes in species distributions within and around offshore wind energy areas.
- The SSC expressed concerns that more validation studies are necessary.
    - Applicability will vary greatly among species depending on the spatial domain of the stock and the type of model being used to assess the stock. Currently there are no spatially explicit stock assessments in the Mid-Atlantic region.
    - The dynamic range models could assist with survey redesign, particularly if animals are leaving the defined stock areas.

2) *Provide any research recommendations and inclusion of relevant data for future model development that could facilitate their consideration of factors influencing determination of ABCs.*

- Accommodate ontogenetic population dynamics and, in particular, ontogeny as it relates to spatial distribution and habitat utilization
- Consider alternative patterns of spatial binning. Currently the bins are defined by North/South boundaries, but for many species, distributions along the East/West (or depth) axis may be more important. Thermal preferences of many species vary by age with cooler temperatures preferred by larger individuals. Such preferences often manifest as changes in depth distributions. Future model formulations may benefit by consideration of spatial units defined by both latitude and depth.

- Surveys occur over protracted time blocks and therefore might be considered as a slow-motion depiction of stock distributions rather than a snapshot. In most years, surveys have been conducted with sampling progressing from south to north. The timing and duration of surveys have also varied over time due to logistical and operational factors. Such changes could confound detectability of trends due to climatic change with those attributable to survey timing.
- General patterns of species distribution forecasts should be confirmed by simpler methods.
- Population patches are currently defined by one-degree latitudinal boundaries with no accounting for depth or temperature gradients within patches. Moreover, the width of the sampleable shelf areas, generally <300 m, varies along north-south direction. Accordingly, the number of samples per patch will also vary, resulting in varying levels of precision within the patches. Adjusting the latitudinal boundaries to achieve more even distribution of samples among patches may be useful.
- Consider potential use of spring bottom trawl surveys along with the fall surveys in the definition of dynamic range models.

Illex Squid

I opened this session by noting 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.

Squid Squad Presentation: Kim Hyde, Sarah Salois, and Anna Mercer

Since 2019 an interdisciplinary group of scientists and fishermen have been meeting weekly to address biology and fishery for squid and the underlying effects of oceanography. The only organizing principle for this group is a common desire to understand this enigmatic species better. Meetings began after an Industry-sponsored summit in 2019 and continued through the Research Track Assessment in 2021. Since then, the group has continued to meet weekly to follow up on research recommendations and refine understandings of oceanography and fisheries. Their collective activities have led to several planned and published peer-reviewed papers, a PhD dissertation, and development of technologies to rapidly acquire synoptic and representative information on the size composition of the landings along the east coast. Such information will be the foundation of any type of real-time management methods.

The net result of this project has been improved collaboration among all parties. An area of particular focus has been warm-core rings. Satellite imagery can be used in near real-time to follow the genesis and fate of rings as they encounter the continental shelf. They are thought to deliver squid to the fishing areas and stimulate primary production. Hypotheses about warm core rings by oceanographers can be confirmed by observations of fishermen. Oceanographers are able to quantify the attributes of the rings which has, in turn, led to improved interpretation of causal factors underlying changes in commercial CPUE.

The Squid Squad has also led to the development of improved proposals to fund both oceanographic and fisheries projects. Ongoing efforts include a joint project between the F/V Dyrsten and the R/V Endeavor to examine salinity intrusions and *Illex* squid catch rates. The strong collaborative spirit of the discussions strengthens the credibility and relevance of the proposed work.

SSC commenters noted that ideally we would quantify offshore abundance of *Illex*. Our current understanding is based primarily upon on-shelf sampling and fishing activity. Indirect evidence of migrations is obtained via estimation methods that infer the amount of biomass necessary to support observed fisheries. Stable isotopic ratios of oxygen may provide confirmatory evidence of offshore populations. Fine-scale spatial and temporal data from study fleets may prove to be particularly helpful. One SSC member asked whether there has been any increase in fleet catch rates in response to improved oceanographic data. To date, it has not been possible to tell.

Overall, the SSC greatly appreciated the presentation by the Squad, noting that it exemplifies true collaborative work to advance both science and management.

Rago Presentation

The risk of overfishing in *Illex* squid is estimated by using an escapement model approach developed by Rago in 2022. The model relies on estimates of relative abundance from the fall bottom trawl survey $\mathbf{I_t}$ and total catches $\mathbf{C_t}$ in the calendar year. The escapement model parameters are natural mortality **M**, availability **v** of *Illex* squid to the fishing areas, and catchability **q** of squid in trawls. Each of these parameters is subject to considerable uncertainty and cannot be estimated within the model. Instead, the uncertainty in each of these parameters is informed by the scientific literature and various studies conducted as part of the 2021 Research Track Assessment. These parameters are assumed to be uniformly distributed. By integrating over the ranges of each parameter it is possible to estimate the sampling distribution of output variables of interest. In particular, the sampling distributions of fishing mortality **F**, initial stock biomass **B.0** and escapement **Esc** can be derived. The sampling distributions can then be compared to various theoretical biological reference points to estimate the risk of overfishing.

In 2022, the SSC recommended that additional uncertainty associated with survey-based biomass estimates could readily be incorporated into the escapement model methodology. In response to this recommendation, the model was updated to add another layer of uncertainty based on the relative precision of the fall survey biomass estimate. Per standard sampling theory, the estimated mean was assumed to be normally distributed with a standard deviation equal to the standard error of the estimate from a stratified random survey.

The escapement model was updated to include this uncertainty in the biomass estimate. Simulations were conducted to compare the result from 2022, which did not consider uncertainty in survey biomass with a revised model that did include such uncertainty. The side-by-side comparison included only data from 1997-2021 to ensure strict comparability with the results presented to the SSC in 2022. While the modification increased the biological realism of the

escapement model, the changes had only minimal effects on the risks of overfishing under alternative quotas. As expected, the differences that did occur were generally restricted to changes in the tails of the distributions.

Inclusion of uncertainty in the surveys did result in an increase in the risk of exceeding the F/M threshold of 0.666 when a 40,000 mt quota was considered. Assuming that the population was at 50% of B_{msy}, the catch level consistent with this assumption declines from 40,000 mt to 37,000 mt. However, it should be noted that the probability of falling below a 50% escapement threshold remains low (<10%). Overall, the inclusion of additional uncertainty in the abundance indices had little effect on the overall risk evaluation and is unlikely to have affected the selection of catch levels had the information been considered in 2022. In other words, it's unlikely that the SSC's previous recommendation of an ABC of 40,000 mt in 2022 and 2023 would have changed.

In 2022, the SSC also recommended that a user manual for the estimation and risk model be prepared to facilitate transfer to the NEFSC. A copy of the manual and R code was given to the NEFSC in February and used by Lisa Hendrickson to update the assessment report with new data through 2022.

Hendrickson Presentation

Lisa Hendrickson, NEFSC, presented the results of a working paper that included 2022 catch and fall bottom trawl survey data. The improved methodology for estimating the uncertainty of relative abundance estimates was also incorporated. Although catches in 2022 were very low, the estimated fishing mortality was also very low. The ranges of estimated escapement were well above any theoretical biological reference points, and F/M ratios were well below any such reference points described in the scientific literature for finfish species. When 2022 results were combined with the modeling results from previous years, there were no major changes to the risk profiles. The Council's risk policy was applied by assuming two levels of stock abundance where B/B_{msy}= 0.5 and 1.0, respectively. Under the lower value the acceptable risk of overfishing is 20%. Under a 50% escapement threshold the highest level of catch admissible under this risk policy is 47,000 mt. Alternatively, an F/M threshold of 0.67 would allow 38,000 mt. Finally, if the biological reference point was defined as the joint probability of falling below a 50% escapement threshold and exceeding a F/M threshold of 0.66, catches up to 60,000 mt would be admissible.

Staff Memo

Jason Didden, Council staff, provided an overview of the 2022 fishery, trends in prices, and comments from fishery Advisory Panel. Catches in 2022 were well below quota but prices were high. Prices however are primarily determined on the world market. High fuel prices and availability of the more valuable longfin squid are thought to have reduced fishing effort for *Illex* squid. Staff recommended continuation of the current ABC of 40,000 mt for 2023

In view of two prior reviews of the methodology by the SSC in 2022 and coherence of the current results with earlier results, few questions and comments were received from the SSC or public. A question was asked about the common warning in fishery science to avoid the use of equilibrium approaches. While the approach used for *Illex* is simple, it does incorporate implicit estimates of the processes required to support the observed fishery. Model results suggest that immigration of individuals into the fishing area during the season must be substantial. Natural mortality ranges include the full range of estimates drawn from the literature, but do include the additional mortality associated with maturation and spawning. Finally, the integration of uncertainty in q, v, M, and survey abundances offsets, in part, the uncertainty that would arise in a more realistic model of stock dynamics.

Another question concerned fluctuations of survey abundance with oscillating patterns of survey abundance and high catch levels—is there any evidence of autocorrelations? Historical analyses revealed weak autocorrelations that could induce modest oscillations. Abundances between years tend to fluctuate up to 5-fold since there is little to no overlap of individuals alive at the end of one fishing year and the start of the next fishing year.

Illex ABC recommendations for 2023

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 2023-2025 fishing years:

1) *A. Review the preliminary 2023 Illex acceptable biological catch (ABC) of 40,000 MT recommended by the SSC in July 2022 and determine if an ABC adjustment is warranted. If so, please specify an adjusted 2023 Illex ABC and provide any rationale and justification for the adjustment;*

   The SSC received a detailed analysis addressing sources of additional uncertainty that were not included in prior analyses presented to the SSC. These analyses did not change the SSC's view that an ABC of 40,000 MT is appropriate for this stock given the current state of knowledge.

   B. Provide an Illex ABC for the 2024-2025 fishing years. If appropriate, provide any new or different rationale that was not addressed in Term of Reference 1A;

   Given the information available, the SSC does not see any reason to deviate from the 2023 ABC for *Illex* of 40,000 MT for 2024 and 2025

An assessment of *Illex* stock is scheduled for 2025, although its format is not yet clear. Prior to the availability of a new assessment, the SSC will review the following information to determine the appropriateness of the current ABC:

a) Updated data on catches and discards
b) if available, within-season weights and catches that are being collected collaboratively by industry and researchers

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

The SSC notes the following sources of uncertainty in reaching its recommended ABC

- The high level of uncertainty in the biomass of the resource
- Productivity of the stock and therefore which reference points are suitable
- The fraction of the Illex stock that occurs outside of the fishing area, and the contribution of that fraction to the reproductive potential of the stock overall
- The catchability of the stock
- The rate of natural mortality experienced by the stock
- The composition and distinctness of cohorts
- The variability in cross shelf transport, and the role of variability in eddy formation at the Gulf Stream front, particularly under a changing climate

3) *Research or monitoring recommendations that would reduce the scientific uncertainty in the ABC recommendation;*

The SSC recommends the following actions:

- Continue to maintain the high temporal resolution of samples from the fishery that track within season changes in the composition and length structure of the squid while on the shelf.
- Continue the coordination of linked collection of biological data from the fishery and oceanographic observations on the shelf.
- Continue the collaboration with industrial stakeholders that has produced valuable insights in our understanding of the biology and dynamics of the stock.
- Investigations into the reproductive biology of squid.
- Develop estimates of stock productivity that would lead to recommendations for suitable reference points.
- Research to examine the distribution, abundance of squid that occur off the shelf and the connectivity of squid during this period to the squid that occur on the shelf and are susceptible to fishing.

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

- Evaluation of Alternative Catch Limits for *Illex* in 2023 (Hendrickson, Rago)
- Effects of Survey Uncertainty on Risk of Violating Escapement and Fishing Mortality (P. Rago)
- User Manual for *Illex* Risk Analysis, v1.0 (Rago)
- Presentation: Update on Squid Squad Research Activities
- Staff Memo: 2023-2025 ABC Recommendations and Considerations

- 2023 *Illex* Advisory Panel Fishery Performance Report

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.*

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

Review of Pilot Video Monitoring Study for Quantification of Recreational Fishing Effort

Jason Didden presented initial findings of a three-year pilot study to monitor recreational fishing effort. The study ran from 2020 to 2022 at Ocean City, MD. The advantage of this port is that nearly all the angler trips pass a fixed point. Unfortunately, many other vessels pass this same point. The objectives were to monitor angler trips remotely via video and explore the possibility of estimating angler effort for a segment of the recreational survey. Technological and logistical difficulties have made the data analyses challenging. These challenges included:

- The volume of boat traffic makes it difficult to identify individual vessels and to positively identify fishing trips.
  - Only outgoing vessels could be monitored accurately
  - Vessel trips could not be linked to subsequent angler intercepts
- Mechanical breakdowns of video equipment led to loss of sampling days
- Downloading of video files had to be done manually rather than via WiFi.
- Post processing of video files was cumbersome and subject to error, especially at night and on foggy days.
- As expected, fishing activity varied by season, day of the week, time of day and weather conditions.
- The personnel hours required to operate such a program exceed current capacity of the MAFMC.

The SSC appreciated the challenges of the overall project and reported their similar experiences with automated video systems. Research on these techniques is evolving rapidly; AI type processing may be possible when such software becomes more available. Current software may assist in identification of potential fishing activity to reduce post processing time. Similarly, a structured subsampling program would reduce post processing time but the variations of season, day of week and time of day will require many strata. Discussions with MRIP and other ground-truthing studies in the Southeast and Gulf are encouraged. The SSC applauded Jason's dedicated work on this project and encouraged more comprehensive evaluation of results as time permits. It should provide a sound basis for future work.

Results of Recreational Summer Flounder Management Strategy Evaluation Project

Gavin Fay, Lou Carr-Harris, and Brandon Muffley presented an overview of results from a multi-year study to improve the recreational fishing experience by using a Management Strategy Evaluation (MSE) approach. The project has engaged over 800 stakeholders over a three-year period of development. Objectives included improved quality of angling experience, angler equity, stock sustainability, and socioeconomic sustainability. Seventeen performance metrics were used to monitor performance of alternative strategies. A total of eight different management procedures were considered. A series of interconnected simulation models were developed to address stock dynamics, simulate the stock assessment process, estimate recreational harvest demand under various policy choices, and simulate the fishery removals. The updated models and data sets are evaluated on an annual time step with no within-year lags between the generation of population model results, assessment evaluation, management decisions, and implementation of regulations. Simulated assessments are conducted every two years.

The MSE approach allows for a full evaluation of system level responses to both scientific uncertainty and alternative management strategies. Angler behavior in response to regulations is informed by various ancillary studies and the scientific literature. Trip and size limits are important in evaluating angler demand and resulting satisfaction. Survivability of discarded fish also plays an important role in evaluating the efficacy of management policies. One of the ancillary benefits of this research effort has been the development of a recreational demand model that can be applied to other species (Scup, Black Sea Bass) in development of regulations for 2023-2024.

The SSC appreciated the thoroughness of the MSE approaches and the comprehensive consideration of multiple objectives and tradeoffs. SSC members cautioned that the investment of a large number of stakeholders cannot be squandered. Follow through in derivation of management measures and actual regulations is important to avoid disenfranchisement of this constituency. Education of individuals and organizations that did not participate in the development of the MSE is essential.

Technical questions from the SSC and public included:

- Was the likelihood of compliance with regulations considered? (Answer: To some extent but not exhaustive.)
- How is fishing effort determined? (Answer: Performance of the demand model was evaluated independently and validated.)
- Is the Summer Flounder fishery considered in isolation to fishing activity on related species that might constitute alternative species or have different demand curves? (Answer: Summer Flounder trips are linked to Black Sea Bass trips, but there is no population model for Black Sea Bass. Hence population status is constant.)

- Can the individuals who participated in the initial development of the project be re-engaged to learn about the results? (Answer: This is a good idea and will be considered.)

Progress of SSC Working Groups

Ecosystem Working Group

The three primary objectives of this WG are to: 1) expand and clarify the ecosystem portion of the SSC's OFL CV determination process; 2) develop prototype processes to provide multispecies and system-level scientific advice, especially when there are multispecies and multi-fleet tradeoffs; and 3) collaborate with SSC and stock assessment leads, and appropriate working groups, to develop stock-specific Ecosystem and Socio-economic profiles. Sarah Gaichas reported on four separate projects that are now underway.

- The first is a project coordinated by Mike Wilberg, John Wiedenmann, and their graduate students to use an MSE model to evaluate alternative harvest policies when recruitment is driven by environmental trends. Summer Flounder and Atlantic Mackerel are the focal species.
- Methods for defining ecosystem overfishing definitions are also being evaluated at NEFSC. Alternative definitions all rely on some form of thermodynamic considerations of energy transfer through the ecosystem. The basis for defining net primary production varies among methods as do the methods for considering trophic level within ecosystems. The underlying concept is to create a "safe operating space" for management. The SSC looks forward to recommendations regarding appropriate measures that can be evaluated historically and monitored going forward.
- John Walden, NEFSC, has applied an approach known as Data Envelopment Analysis (DEA) to develop stock-specific Ecosystem and Socio-economic Profiles (ESP). The methodology integrates separate indicators into a single performance metric. Work includes collaboration with SSC species leads, stock assessment leads, and relevant working groups to facilitate incorporation of such indices into assessments.
- Paul Rago and Brian Rothschild are collaborating to develop various system level performance indicators using the results of stock assessments. Retrospective analyses focus on how well management measures are controlling spawning stock biomass and achieving MSY. Historical estimates of recruitment are used to generate predicted landings and SSB levels under optimal fishing mortality. These projections help isolate the effects of controllable parameters (i.e., fishing mortality) from uncontrollable parameters such as recruitment and changes in average weights at age.

Time constraints did not permit feedback from the SSC on these topics, but the SSC will be updated again at its May 2023 meeting.

Economic Working Group

In 2021-2022 the Economic Work Group collaborated with the Council's Research Steering Committee (RSC) and the Council to consider factors necessary for a restart of the Research Set Aside (RSA) program. This "proof-of-concept" project is now complete and under consideration by the MAFMC for implementation. In 2023 the Work Group's efforts will be governed by the expertise and interests of the group, requests from the Council, and Council priorities. Research topics identified by the Council with important economic facets include:

- Priority #2: Develop recreational measures for Summer Flounder, Scup and Black Sea Bass. This will be a follow up to the SSC's review of Harvest Control Rules (HCR) in 2022.
- Priority #5: Updating of the HCR methodology after the regulations sunset in 2025.
- Priority #40: Work with the RSC to address key concerns with the new RSA program, particularly the economic costs of enforcement.
- Priority #45: Essential Fish Habitat.
- Priority #50: EAFM risk assessment comprehensive review.

Items on Economics Group "watchlist" are:

- Priority #37: regarding separation requirements in the Surfclam and Ocean Quahog fisheries
- Priority #70: Use of ACL carryover in fisheries
- Priority #66: Allocation strategies related to quota transfers to ensure equity.
- The overall capacity of the SSC to address economic issues is ultimately limited. Concerns were expressed that substantive involvement in a few issues is preferable to overcommitment.
- Fishery Performance metrics (Rago and Rothschild) as described under the Ecosystem Work Group above.

Other Business

- Olaf Jensen summarized a study recently published by his graduate student, (Bi, et al. 2022) on the topic of consistency of advice from stock assessments. An important question is "how large should the uncertainty buffer for catch advice be to account for variations in perceived stock status between assessment updates?" The study synthesized data from RAM legacy database and other stock assessments around the world. The mean CV was about 100% whereas values of 60% were uncommon. The 60% CV level is used for a number of MAFMC species. Results do not generally indicate an inter-assessment bias or trend in variation; instead, the inaccuracies tend to vary randomly. Assessments that are updated annually tend to have lower CVs, but this may be an artifact of a concomitant absence of review of model assumptions and applicability. Research Track assessments are more likely to result in major changes because all model assumptions are open to revision. Depending on the relative mix of commercial and

recreational harvests, application conversion factors to historical recreational catch data induces major changes in stock assessments.
    - Consideration of climate change as a factor underlying assessment uncertainty will be the next step in this research project.
    - Questions from the public on this topic asked whether the scientists would be examining management and implementation uncertainty in a similarly rigorous fashion.
- The irreplaceable Lee Anderson previously served as the socio-economic lead for Golden Tilefish and Ocean Quahog. It is anticipated that a new SSC member will assume Lee's responsibilities. See Council webpage for details on other species and topic responsibilities - Draft 2023 Species/Topic Lead.
- 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, especially if the population is trending downward from a high level. Progress on this topic will be reviewed prior to the next meeting of the SSC. Outstanding issues include clarification of Council regarding objectives for multi-year specifications, including the application of risk policy to multi-year ABCs.
- The SSC's OFL CV working group will convene before the next SSC meeting to review current status of the OFL CV guidelines and check for consistency of applications.
- The May 9-10, 2023 meeting of the SSC will be an in-person meeting, with a remote option, in Baltimore, MD.

Attachment 1

Mid-Atlantic Fishery Management Council

Scientific and Statistical Committee Meeting

March 7 – 8, 2023 via Webinar

Webinar Information

(Note: same information for both days)
Link: **March 7-8, 2023 SSC Meeting**
Call-in Number: 1-415-655-0001
Access Code: 2334 904 7321; Password: XbJWmFSp773

AGENDA

Tuesday, March 7, 2023

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

9:05 Ecosystem Science Updates (S. Gaichas)
- 2023 NEFSC Mid-Atlantic State of the Ecosystem Report
- SSC Ecosystem Work Group – update and feedback on work group progress

11:00 Break

11:15 Short-Term Forecasts of Species Distributions for Fisheries Management (A. Fredston and M. Pinsky, Rutgers Univ.)
- Review modeling framework and results
- Provide feedback to Council on potential use and application of models and information in science and management

12:30 Lunch

1:30 *Illex* 2023-2025 ABC specifications
- Update from the Northeast Squid Squad on recent science advancements and findings (K. Hyde, A. Mercer, and S. Salois, NEFSC)
- Review of updated "Indirect Method" analysis for quota considerations (L. Hendrickson, NEFSC and P. Rago)

3:00 Break

3:15 Continue Illex 2023-2025 ABC specifications

- Review staff memo and 2023-2025 *Illex* ABC recommendations (J. Didden)
- SSC 2023-2025 *Illex* ABC recommendations (T. Miller)

5:00 Adjourn

Wednesday, March 8, 2023

8:30 Ocean City, MD Recreational Video Project (J. Didden)

- Overview of project design, results, and potential applications

9:00 Results and Findings from the EAFM Recreational Summer Flounder Management Strategy Evaluation (B. Muffley, G. Fay, and A. Carr-Harris)

10:15 Break

10:30 Report from SSC Economic Work Group (G. DePiper)

- Work group projects and engagement opportunities for 2023

11:00 Other Business

- Species/topic lead assignments
- Stock assessment updates: 2023-2024 schedule and peer review needs
- Plans for other SSC Work Groups: Constant/Average ABC and OFL CV

12:30 Adjourn

Note: agenda topic times are approximate and subject to change

Attachment 2

MAFMC Scientific and Statistical Committee

March 7-8, 2023

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)
Jorge Holzer (March 8th only)	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
Mark Holliday	NOAA Fisheries (retired)
Others in attendance (only includes presenters and members of public who spoke):	
Kim Hyde (March 7th only)	NEFSC
Jason Didden	MAFMC staff
Brandon Muffley	MAFMC staff
Malin Pinsky (March 7th only)	Rutgers University
Julia Beaty	MAFMC staff
Jeff Kaelin	Lund's Fisheries
Alexa Fredston	University of California Santa Cruz
Anna Mercer (March 7th only)	NEFSC
Lisa Hendrickson (March 7th only)	NEFSC
Sarah Salois (March 7th only)	NEFSC
Katie Almeida	Town Dock
Greg DiDomenico	Lund's Fisheries
Andrew Carr-Harris (March 8th only)	NEFSC
Mike Waine (March 16th only)	American Sportfishing Association

Attachment 3. Glossary

ABC—Acceptable Biological Catch
AIC—Akaike's Information Criterion
B_{msy}—Biomass at maximum sustainable yield
CV—Coefficient of Variation
DEA—Data Envelopment Analysis (DEA)
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
SOE—State of the Ecosystem
SSB_{msy}—Spawning stock biomass at maximum sustainable yield
SSC—Scientific and Statistical Committee
v—availability parameter