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

MEMORANDUM

Date: June 3, 2020

To: Michael P. Luisi, Chairman, MAMFC

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

Subject: Report of the May 2020 SSC Meeting

The SSC met via webinar on the 12th and 13th of May, 2020 to address the following topics: (1) election of a new vice Chair of the SSC, (2) review products and presentations from the *Illex* Working Group, (3) review the 2020 *Illex* fishing year specifications and make recommendations for 2021 ABC, (4) review climate habitat vulnerability analyses, (5) revise and update changes to OFL CV document; and under Other Business, (6) address internal details for SSC species/topic leads, and discuss the National SSC meeting (Attachment 1).

All 20 of the SSC members participated in the meeting on May 12th and May 13th (Attachment 2) Due to the Covid 19 pandemic the meeting was held entirely via webinar. Support of Council staff was superb and allowed the meeting to proceed smoothly.

The meeting opened with the election of a new vice Chair to replace Tom Miller who had served as vice Chair for more than a decade. Michael Wilberg was nominated by Lee Anderson. No additional nominations were received from the floor. The SSC unanimously approved Mike as the vice Chair. Mike has been a member of the SSC since 2008 and a leader in the development of quantitative methods used by the SSC. Notably these include the methodologies underlying the application of risk policies for setting ABCs.

Tom Miller was thanked for his exemplary service. Gavin Fay, newly appointed to the SSC but unable to attend the March SSC meeting, was recognized. A large number of participants from the Council, Council staff, NEFSC and GARFO staff, industry, and the general public attended the meeting via webinar. Documents referenced in this report and related presentations can be accessed via the SSC's meeting website (https://www.mafmc.org/ssc-meetings/2020/may-12-13).

I wish to thank Tom Miller, Geret DePiper, and Sarah Gaichas for their meeting notes which greatly facilitated preparation of this report. I also thank Brandon Muffley and Jason Didden for helpful reviews of an earlier draft.

SHORTFIN SQUID

The remainder of the first day of the meeting was devoted entirely to shortfin squid. A total of 21 working papers and related documents were prepared for review by the SSC. All of the working papers were prepared in advance of the meeting and posted on the Council website. In order to efficiently address these working papers and the terms of reference a detailed agenda was followed (Attachment 3). Primary authors of each working paper were allowed between 10 and 15 minutes to highlight the primary conclusions and answer questions from the SSC. Members of the public were also offered the chance to comment and ask questions. Following the individual presentations, a general discussion period occurred prior to SSC discussion of the formal Terms of Reference. I contributed several papers to the Illex Working Group, made presentations and was supported by the Council. I therefore recused myself from the discussions related to determination of the ABC and offered only points of clarification when asked by the SSC. Tom Miller, the SSC lead for Illex, led the review of the working papers and Terms of Reference to the SSC.

Review of Illex Working Papers

The reviews began with an overview of rationale for Working Group and literature/management review. Quotas in 2017 to 2019 limited catches, possibly reflecting a new regime of Illex productivity and motivating a more detailed examination of current catch limits. Short-term goals of the Working Group were to understand the state of the science; medium-term goals include adding environmental drivers into analyses.

From a global perspective, management of squid populations is difficult and/or expensive. Despite substantial investments, assessments have been characterized by high uncertainty owing to the short life span and poorly understood dynamics of squid. The SSC discussed the approaches used for NAFO assessments and the potential applicability of such measures to the US stock area. However, staff concluded that this approach, relying primarily on survey ratios, is unlikely to be useful for the US given the seasonal timing of bottom trawl surveys. Most recent NAFO assessment noted that 2019 biomass levels extremely high, potentially moving to a high productivity state, but quotas have not changed.

Results of the industry-sponsored Illex Summit, (Nov. 25-26, 2019) were presented. The Summit focused as a forum for engaging industry directly in the scientific process and bringing industry, science and policy experts together for constructive dialog. Four members of the SSC participated in the Summit. Industry members were concerned by the inflexibility of management, particularly in the last 3 years and noted that industry perspectives of availability would be useful for guiding science-based management. Uncertainties about the role of oceanographic processes were addressed extensively as was the importance of world squid markets as primary determinants of price, and the utility of cooperative research. Price is a primary driver of fishing effort but processing capacity and vessel type (ice/refrigerated sea water/freezer) are also important factors. Results of the Summit were highly influential for directing efforts of the Illex Working Group.

A review of previous cooperative research efforts since 1995 and initial analyses of LPUE (through 2018) from Vessel Trip Reports (VTR) followed. Biological sampling of landings has increased since 1995 as have cooperative research efforts. A primary challenge for all measures of relative abundance is the distinction between availability and true abundance. Real-time measures of abundance have been proposed as a way of addressing this dilemma, but the presence of an offshore population of unknown size complicates all efforts

Initial LPUE modeling investigations of the VTR data suggest the importance of year, season and vessel as primary determinants of predicted relative abundance/availability. These basic patterns were affirmed in analyses of study fleet data. Seasonal patterns of catch rates fluctuated among years suggesting that interactions among these factors were important. These changes may also reflect changing geographical patterns across years. The congruence of patterns between study fleet-based measures and VTR is promising and suggests the need for more detailed comparisons. The composition of the overall fishing fleet is changing in recent years with the inclusion of more ice boats and conversions of freezer boats to RSW vessels.

Bottom trawl survey data from NEFSC and NEAMAP partners were combined to develop an overall probability of occurrence spatial map for the Northeast shelf using a software package known as VAST (Vector Autoregressive Spatio-Temporal). Comparison of these maps with estimates of the spatial footprint of the fishery (based on VTR data) revealed a low degree of overlap with the survey area irrespective of the cutoff criterion used for the probability of occurrence. Youden's J statistic was suggested as an additional measure of spatial overlap for consideration. Because the surveyed areas represent only a fraction of the known distribution of Illex, the results of these analyses suggest substantial opportunity for escapement of squid to unfished areas.

The size of landed squid varies seasonally and annually. Monitoring of body weight has been conducted since the mid 1990's by both federal port agents and via a cooperative program with industry. In the cooperative program, weekly or near weekly data were collected by industry and transferred to NEFSC for keypunching and analyses. Comparisons of the two data sets reveal substantial differences that may be due to different sampling protocols. Industry-supplied samples were based on individual measurements rather than bulk samples, and were therefore more readily interpretable. Analyses suggested significant differences across years in the rate of change of average weights over weeks. Such changes reflect the combined effects of variable growth, contributions of multiple cohorts, and migrations into and out of the fishing area. In collaboration with industry and the NEFSC, the MAFMC has funded a study to age squid samples that may help disentangle these combined effects.

Following lunch additional papers were summarized related to identification of system state (poor, average, good), estimation of fishing mortality, and in-season detection. Multivariate methods were demonstrated to have value for classifying years including discriminant analyses, tree regressions, and cluster analyses. Variables suggested by industry included average weight of squid, price and vessel capacity appeared to be good predictors. Variations in price within a season were not factored into the analyses but industry had reported that fluctuations within a year were typically small relative to changes between years.

Leslis-Davis depletion models have been used in some assessments worldwide but violations of underlying assumptions suggested that this methodology did not reliably detect the influence of catch on LPUE. Commenters noted that the absence of significant results was an indirect indicator of likely low fishing mortality.

The envelope method, previously utilized by the SSC for analysis of butterfish, reinforced the notion that fishing mortality was likely very low. Survey and catch data were independently used to develop a plausible range of population sizes based on a broad range of assumed fishing and natural mortality rates, gear efficiency and availability. The resulting envelope of population sizes could then be used to derive a range of feasible fishing mortality rates for comparison with reference points. Results suggested that maximum weekly fishing mortality rates of about 0.06 were less than half of proposed reference points based on 40% MSP published in the literature.

Vessel Monitoring System (VMS) data can be filtered by vessel speed and combined with average net widths by permit, to derive swept area estimates of fishing effort spatially. Using data from 2017 to 2019, analyses suggested that fishing activity was highly concentrated in a relatively small number of cells (6.99 nm^2 each), but that the overall area swept by the fishery was small (<960 nm^2 in 2019). Additional sensitivity analyses suggested that the maximum fishing mortality rate over the entire stock area was less than 0.54 over a 24-week fishing season (or about 0.023 per week). The VMS analyses could be useful for incorporating results from other studies of fishermen behavior (e.g. decisions to move to new fishing areas), estimates of density differences between fished and unfished areas, and potentially, the effects of price on fishing behavior.

Two papers on in-season detection of fishing status (good, average, poor) were also presented. The challenge is to find statistically significant differences prior to attainment of the quota. Total catch and average body weight were tested as response variables using a Cusum method. The Cusum method is often used in applications of statistical quality control. Detection of such changes in the fishery, particularly if catch rates and body size suggest a better than average year could be used to trigger a change in quota and prevent an early shutdown of the fishery. These response variables were chosen because they are currently being collected and might be feasible to implement in real time with only modest additional investment. The presenter and commenters noted several important areas of refinement including estimation of variances, validation of detection probabilities, and alternative methods for defining seasonal patterns. A potential extension of the algorithm to multiple indicators was also discussed. In terms of actual application of the method, it would be important to define ahead of time, acceptable error rates for false positives and false negatives, as well as critical timing for decision making (e.g., drop dead dates). Commenters noted the value of doing out of sample predictions for the Cusum approach.

Collectively the papers stimulated much discussion within the SSC. Commenters noted that methods used in the Falklands rely on identification of cohorts coming into the fishery using decomposition of polymodal length frequencies. Such methods are doable but are unlikely to be sufficiently timely for practical management especially since growth rates appear to vary annually with temperature regimes. The concept of computing escapement ratios was proposed and the Envelope method was modified to examine historical survey data with the assumption

that 30,000 mt had been caught in each year. Results of the hypothetical scenario suggested that the mid-range of escapement ratios ranged from 0.4 to 0.8 over the period 1967 to 2019.

Public comment

Reports from the Illex Working Group were well received by public commenters who appreciated the extensive incorporation of industry data in the analyses. Several commenters suggested moving directly to 30,000 mt as a quota given the low overlap between the fishery and the resource, and apparent low fishing mortality. It was noted that exclusion of coral zones and the low rate of fishing in Canada also provide substantial escapement opportunity. Expansion of the study fleet was also suggested as a productive future activity. One commenter noted that there may be utility in having additional fine scale information on catch rates and size compositions from fishermen after the fishery had closed officially.

Concerns were expressed that a phased implementation of quota increase, contingent on real-time information as identified in the staff recommendation, could be problematic. Nonetheless industry representatives unanimously pledged to continue supplying information for real-time management. Commenters recognized that many details regarding sample size, risk tolerance, chain of custody for samples, responsibilities for analyses, and reporting to managers. In particular, a time line for approximately 10 weeks after the start of the fishing season would be essential for implementation of a quota change to be economically feasible for industry.

ABC Determination

Following the extended period of discussion of the working papers and public comments, the SSC addressed the Terms of Reference for Shortfin Squid Responses by the SSC to the Terms of Reference (in *italics*) provided by the MAFMC are as follows:

1. Review the current 2020 *Illex* Acceptable Biological Catch (ABC) of 26,000 MT and determine if an ABC adjustment is warranted. If so, please specify an adjusted 2020 *Illex* ABC and provide any rationale and justification for the adjustment. If appropriate, specify any metrics the GARFO could monitor in 2020 to trigger an in-season ABC modification;

The SSC reviewed the material developed by the MAFMC *Illex* Working Group (WG) and the NEFSC and found clear evidence to support an adjustment of the 2020 ABC (26,000 mt). The WG analyses strengthened SSC contention in its 2017 ABC specification that the stock has been lightly exploited. Analyses conducted by the WG indicated that fishing activity from 2000-2018 occurred in 2-10% of the available shelf habitat occupied by *Illex* squid (Wright et al. 2020 ms). True values of the availability of squid to the fishery are likely lower given the full distributional range of this species. An analysis of VMS data, together with assumptions regarding gear efficiency, potential depletion thresholds, and the relative densities of squid in fished and unfished areas suggested that credible ranges of seasonal fishing mortality rates on squid that vary by about 30-fold, ranging from F~0.01 – 0.3 with a values <F=0.1 being most likely (Rago 2020a; Rago 2020 b). Other methods to estimate F often led to negative estimates, most likely because fishing mortality rates are insufficiently high to provide a clear signal to be reliably estimated in such models (Rago 2020d). A review

of the life history of *Illex* suggested that it is likely highly resilient to low levels of exploitation because of the presence of multiple cohorts, batch spawning and increased fecundity levels resulting from the presence of larger squid in the population than were present when fecundity was estimated originally.

The SSC recommends an ABC for *Illex* squid for 2020 of **30,000 mt**, based on the upper limit of values evaluated in the EA documents currently approved by GARFO. Evidence reviewed by the SSC leads it to believe that harvests in the range of 18,000-30,000 mt are unlikely to result in overfishing of the *Illex* stock. The SSC requested additional analysis from Paul Rago which confirmed that this level of ABC did not materially affect the range of estimates of F in the envelope analysis.

The SSC applauds the continued cooperation among the industry and federal and academic scientists to support exploration of real time management (e.g., Rago 2020e, f). However, the SSC believes that the specifics of the implementation of real time management for *Illex* remain sufficiently poorly identified which prevents implementation in the 2020 fishing year. The SSC strongly supports, as an active, ongoing research recommendation, to continue exploration of options by the *Illex* WG to support real time management of this stock, including factors that would trigger an in-season change in regulations, and the magnitude and direction of such a change.

2) Specify a 2021 *Illex* ABC (in weight) and provide any rationale and justification. If appropriate, specify any metrics the SSC could examine in late 2020 or 2021 to determine if any 2021 ABC modification might be appropriate;

The SSC recommend an ABC for *Illex* squid for 2021 of **30,000 mt**. This value is based the determination that catches in the range of 18,000-30,000 mt are unlikely to result in overfishing.

The SSC recommends that a wide range of catch levels be evaluated for the purposes of NEPA requirements pending results from the *Illex* WG

The SSC has insufficient information to recommend any specific metric that could be used to trigger adjustment of the 2021 ABC. The SSC strongly recommends that the Council continues to support work by the *Illex* WG efforts to identify and evaluate management procedures and control rules that may be used in future years. Such evaluation should seek to identify specific data needs, methods to ensure transparent data custody, and to understand regulatory requirements that would ensure efficient and effective implementation.

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

The SSC notes the following important sources of uncertainty in determining the ABC for *Illex* squid.

1) Lack of an accepted stock assessment model and associated OFL means that data poor approaches are required to establish an ABC.

2) Incomplete understanding of *Illex* squid life history, phenology and distribution limit development of appropriate reference points. This uncertainty includes lack of (i) knowledge of the stock area, (ii) the productivity of the stock within that stock area and (iii) the portion of the stock outside of surveyed areas.
3) Incomplete fishery-independent data covering the distribution of *Illex* in both fished and unfished areas of their distributions.
4) Limited understanding of the factors controlling availability of *Illex* squid to the fishery.
5) Limited understanding of the impact of climate and environmental factors on recruitment, growth and understanding of *Illex* squid dynamics
6) Interplay of *Illex* availability to the fishery with the global supply of alternative squid product affects the distribution and level of fishing effort.
7) Internal within season feedbacks within the fishery that affect the distribution and level of fishing effort.
8) Impacts of fishery closures on our understanding of *Illex* squid growth and distribution.

4) Provide any research, data, and/or assessment considerations for the 2021 *Illex* research track assessment;

Based on its 2020 deliberations, the SSC recommends the following work, several of which re-emphasize research recommendations the SSC made in its May 2017 report to the Council:

- Evaluate stock assessment methodologies with a sub-annual time step, undertaking cooperative research with the fishing industry. Such assessment methodologies should seek to support in season management.
- Collect demographic information on growth, maturation, mortality, and reproduction by sex, season, and cohort to estimate and evaluate the level and changes in stock productivity.
- Evaluate the potential to collect real time spatial and temporal data on catch and biological characteristics of the catch to support in season management.
- Undertake fishery-independent data covering the distribution of *Illex* in both fished and unfished areas of their distributions
- Continue work to evaluate factors controlling the availability of *Illex* squid to the fishery.
- Landings time series show evidence of strong autocorrelation. As a result work should evaluate the impact of climate and environmental factors on recruitment, growth and understanding of *Illex* squid dynamics.
- Evaluate the benefits of a post-season, industry run survey to provide additional information on squid growth, distribution and dynamics.
- Explore the influence of market factors, including price, on fleet activity and its relationship to squid abundance.

Beyond the Research Track Assessment, the SSC recommends the *Illex* WG establish, in parallel:

- Protocols that would be required for RTM in 2020 moving forward. This could include developing management scenarios, coincident with revised NEPA bounds of ABC, evaluating and testing the mechanism for expanding or contracting ABCs above an initial year ABC through the use of triggers, and including evaluation of biological and economic risks and benefits of such management scenarios.
- Simulation evaluations of potential in season management procedures to evaluate their potential performance prior to implementation to support implementation of real time management.
    - Alternative in season triggering approaches, including machine learning algorithms and statistical control theory approaches.

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

- Report to the May 2017 Mid Atlantic Fishery Management Council. Dated 2017-05-25
- 2020 Staff ABC recommendation to the SSC
- 2020 *Illex* AP report
- 2020 Illex AP Summary, Dated 2020-05-11
- Hendrickson, L. (2020a ms). Data requested by the MAFMC's SSC *Illex* Working Group. MAFMC SSC *Illex* WG ms
- Hendrickson, L. (2020b) Characterization of body weight data from the landings of northern shortfin squid (*Illex illecebrosus*) and preliminary annual landings-per-unit-effort for the southern (USA) stock component. MAFMC SSC *Illex* WG ms
- Jones, A. W., B, L. Wright, J. P Manderson, A. M. Mercer (2020). An investigation of fine-scale CPUE for northern shortfin squid (*Illex illecebrosus*) using NEFSC study fleet data. MAFMC SSC *Illex* WG ms.
- Rago, P. J. (2020a). Spatial patterns of fishing effort from VMS and implications for fishing mortality, 2017-2019. MAFMC SSC *Illex* WG ms
- Rago, P. J. (2020b). Application of envelope method to *Illex* squid. MAFMC SSC *Illex* WG ms
- Rago, P. J. (2020c). Identification of indicators of fishery condition and relative abundance for *Illex.* MAFMC SSC *Illex* WG ms
- Rago, P. J. (2020d). On the potential use of Leslie Davis depletion model for estimating population size for Illex squid. MAFMC SSC *Illex* WG ms
- Rago, P. J. (2020e). Part 1. Application of CUSUM method for in-season detection of fishery condition for Illex squid: Landings, 1996-2019. MAFMC SSC *Illex* WG ms
- Rago, P. J. (2020f). Part 2. Application of CUSUM method for in-season detection of fishery condition for Illex squid: mean weight, 1997-2019. MAFMC SSC *Illex* WG ms
- Rago, P. J. (2020 g). Supplement to envelope analysis to evaluate impacts of a 30,000 mt ABC. ms

- Wright, B. L., A. W. Jones, A. M. Mercer, J. P. Manderson (2020). Northern shortfin squid (*Illex illecebrosus*) fishery footpring on the northeast US continental shelf. MAFMC SSC *Illex* WG ms

6) 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.

> To the best of the SSC's knowledge, these recommendations are based on the best available scientific information

Further Comments on the Illex Working Group

On the second day of the meeting the SSC affirmed its broad support for an increase in the ABC to 30,000 mt and desire to further refine and test real-time monitoring. It also acknowledged the progress of the Illex Working Group. While the methodologies developed by the Working Group collectively establish that the current level of exploitation is low, they do not, at present, establish the potential magnitude of quota adjustments that would be admissible under the Council's risk policy. SSC members recognized the dilemma of both creating the assessment architecture and reviewing it. These quantities would necessarily be the result of the Research Track Assessment, scheduled for 2021.

The SSC recognized the liabilities of an unfocused data collection program and suggested further work on the details before implementing. Members noted that many technical details need to be worked out regarding procurement, analyses, specific triggers, and timing of decisions for real time management.

Illex was characterized as a resilient species with high fecundity and multiple cohorts per year although the limits of this resiliency are unknown. The implications of maturation patterns and semelparity have been evaluated in the literature with respect to biological reference points but not with respect to resiliency. Hence it is important to characterize what overfishing might look like (e.g., biological attributes) and how it would be measured.

Analyses of the VMS data suggest several avenues for more refined data, particularly the differences in density of Illex in areas with and without intensive fishing. Another potential input from harvesters would be the criteria used for moving from one fishing area to another over the course of a trip. Consideration should also be given to potential behavioral responses of fishermen to the monitoring of catch and probability of in-season increases.

A management strategy evaluation (MSE) was proposed as integrated approach toward focusing the assessment, the data collection programs and approaches for real-time detection, but no details were provided. Machine learning algorithms may also have some utility for identification of system state, but no work on this for Illex has been conducted. Having an ABC closer to the global maximum would be a more useful starting point for in-season adjustments based on triggers.

Future management regulations should consider a wider range of catch options in the Environmental Analyses to allow for greater range of allowable catches. This might also confer a greater opportunity for accelerated rule making with a quota revision by mid August or early September. Regional Office staff noted that regulatory decisions are more difficult when discretionary authority is given in plan. The short life span exempts them from ACL provisions under the MSA, conferring additional flexibility to future management. Having a hardwired change in quota based on well-defined trigger(s) was viewed as an ideal option for rapid decision making.

HABITAT VULNERABILITY REVIEW

The second day of the meeting began with a presentation by Mark Nelson (NOAA Fisheries HQ) on the methods and draft results of the Habitat Climate Vulnerability Assessment (HCVA)

The approach is similar to that used for Northeast Fish Climate Vulnerability Assessment (NEVA)[1]. It begins with a definition of habitat types (Marine, Estuarine Riverine, etc.) followed by definitions of subclasses within. Each habitat type is assigned a sensitivity level by a range of subject matter experts and the overall score is determined on the basis of sensitivity and exposure. Exposure is based on climate scenarios prepared by the IPCC; for this analysis the RCP 8.5 scenario was used. The regional ocean model from ESRL Boulder was used to overlay exposure projections with the habitat maps from multiple sources.

The modeling of impacts on habitat employed used approaches that may be useful for future analyses by the SSC for the State of the Ecosystem (SOE) including

- A "logic model" for scoring attributes against 4 thresholds: low, moderate, high, and very high.
- Sophisticated visual integration technique to compare habitat distribution with projections.
- Bootstrapping to show uncertainty in rankings.

Discussions focused on the linkages to the SOE report, the EAFM risk assessment, links to fish vulnerability assessments and other products that benefit from integration of spatial information. Following the previous day's emphasis on the pelagic Illex species it was noted that most of the work focuses on the bottom habitat rather than water column which may be considered as dynamic habitat. Presenters noted that this topic had been discussed extensively during the development phase but that all water column habitats had low vulnerability. Commenters noted that the assumed persistence of these traits in the future may be an important consequence of climate change. Although not strictly a consequence of climate change, it was noted that in the shorter term ongoing human activities (dredging, hypoxia, red tides, fishing effort) are likely to exacerbate the effects of climate change.

[1] Hare JA, Morrison WE, Nelson MW, Stachura MM, Teeters EJ, Griffis RB, et al. (2016) A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. PLoS ONE 11(2): e0146756. https://doi.org/10.1371/journal.pone.0146756

Several commenters noted the need to link the habitat vulnerability analyses with species vulnerability. For example, species with very different life histories sometimes have equal scores but the habitat drivers may be entirely different. It was acknowledged that a link with the NEVA process was planned. One member suggested the use of life table approaches as a mechanism for such research. Vulnerability of habitats to invasive species was also raised as a potential effect by commenters. Presenters requested some suggestions on appropriate species for more in-depth analyses.

Finally, it was noted that it may be useful to consider the risk-reward tradeoffs of human activity in the analyses. Presenters commented that this was beyond the current research tasks but could be incorporated in the future. Public comments also included questions on how non-climate factors, such as wind energy development could be incorporated. Habitat sensitivity did include consideration of offshore wind farms, shoreline hardening and so forth; these factors will be included in the narratives when the final report is written.

The session concluded by noting the HCVA approach is a novel extension of the Hare et al. methodology and provides a foundation for future research as well as providing linkages to other issues (wind). Questions remain regarding the ability of the methodology to capture fine scale spatial and temporal events such as ocean fronts and their utility for oceanic species such as Illex. Much depends on the stationarity of such features in the future. Another key area for further development is the interaction with other anthropogenic affects.

REVIEW OF OFL CV GUIDANCE DOCUMENT

The guidance document for the definition and application of the uncertainty of OFL estimates continues to evolve. The SSC discussed a set of changes proposed since the September 2019 SSC meeting. The changes related to technical or interpretive issues were resolved fairly quickly. For example, the implications of retrospective analyses and adjustments for bias for determination of an appropriate CV level were addressed. No clear consensus emerged but numerous individuals supported classification based on Mohn's rho estimates. Incorporation of ecosystem considerations also led to several suggested improvements, including Habitat Vulnerability information reviewed earlier in the day. Minor wording changes were also suggested for consideration of trends in recruitment.

Changes related to philosophical issues generated considerable discussion. The primary topic was the proposed implementation of a small working group to develop a draft decision matrix and narrative for the CV determination. The criteria for filling out the matrix are highly technical and need to be done by individuals with deep knowledge of the overall assessment and underlying technical papers. Summoning such information extemporaneously while in plenary session is both difficult and inefficient. Hence it was recognized that having a working draft for discussion ahead of an SSC meeting was efficient and would ensure greater factual accuracy in the summary. On the other hand, the absence of open discussion during the preparation of this document could be construed as violating transparency principles and a product of subjective biases.

After much discussion it was agreed that the OFL CV matrix and narrative was to be a product of the SSC but noted that it would be valuable to consult with the lead assessment scientists to

ensure accuracy. It was further agreed that no draft determination of the overall CV would be made prior to the plenary meeting of the SSC but that a template of accurate information relevant to the criteria was essential for efficient operation of the meeting. It is anticipated that the timing for development of information prior to the meeting would be difficult under the best of circumstances but that the process should get easier after a few assessment iterations.

A compromise position was reached in which the species lead from the SSC would work with the Council staff lead for the stock and the chief scientist, the chair and vice-chair of the SSC, and consult as necessary with the assessment lead to develop a draft OFL CV matrix and narrative for consideration by the full SSC in open session. Importantly, the factual information in the matrix would not be assigned to bins nor would the narrative arrive at a summary conclusion for the appropriate OFL CV level.

Public commenters noted that the industry appreciated the openness of the process and discussions but would continue to watch the process closely.

At their June meeting the Council will need to approve the recommended changes.

OTHER BUSINESS

National Scientific Coordination Subcommittee (SCS): Every two years the Council Coordination Committee (CCC) organizes a theme-oriented meeting of all the Council's SSCs. The purpose of the meetings is to allow for the exchange of ideas and approaches across council SSCs as well as to address themes of national significance. Concerns about spread of the COVID 19 pandemic led the Steering Committee to recommend postponement of the 2020 meeting that the North Pacific Council had planned to host in Sitka, Alaska, August 4-6, 2020 until the summer of 2021. The SSC noted that the planned theme, application of ecosystem indicators into stock assessments, consideration of interacting species, and the assessment of species exhibiting distributional changes, will be applicable to work of the SSC in 2021.

Species Leads. The SSC assigns members (one biologist and one social scientist) to serve as species leads for each stock managed stock and for special topics such as ecosystem-based fishery management. Species leads are responsible for maintaining an in-depth knowledge of the stock's fishery and assessment, as well as leading discussions when the SSC sets ABCs for the species. Follow circulation of the list of current species leads, several changes were made at the meeting. Alexei Sharov will become the new species lead for golden tilefish, complementing his role as a member of the South Atlantic Fisheries Management Council's SSC. John Boreman will become the species lead for scup. Sarah Gaichas will continue to serve as the ecosystems topic lead but will be assisted by Rob Latour when Sarah is presenting the State of the Ecosystem report. In addition, a new topic lead on Energy development/wind farms was added. Dave Secor will serve as the biological lead (a socio-economic lead has not yet been assigned). The revised list of species and topic leads can be found on the Council's SSC webpage at: https://www.mafmc.org/ssc).

NRCC Meeting and Joint Council-SSC Meeting . The SSC was informed that the NRCC would be meeting on May 14 and considering the postponement of the Atlantic mackerel Management Track Assessment review because of the unavailability of Canadian data for 2019. The NRCC

will also be making recommendations for the 2025 Research Track Assessments. Following a similar meeting in 2019, Council would like a joint meeting with the SSC in October in Riverhead, NY. The SSC will consider and identify potential topics to address during the joint meeting later in the year.

ATTACHMENT 1

Mid-Atlantic Fishery Management Council

Scientific and Statistical Committee Meeting

May 12 – 13, 2020 via Webinar

Webinar Information
(Note: same information for both days)
Link: **http://mafmc.adobeconnect.com/may2020ssc/**
Call-in Number: 1-800-832-0736
Access Code: 5939710#

AGENDA

Tuesday, May 12, 2020

10:00 Welcome/Overview of meeting agenda (P. Rago)

10:05 Election of SSC Vice-Chair

10:10 Review of *Illex* Workgroup products (J. Didden/ P. Rago)

12:00 Lunch

1:00 Continue review of *Illex* Workgroup products

3:00 Review and potential change to 2020 *Illex* ABC specifications and set 2021 *Illex* ABC
- Review of staff memo and 2020 - 2021 ABC recommendations (J. Didden)
- SSC 2020 – 2021 *Illex* ABC recommendations (T. Miller)

5:30 Adjourn

Wednesday, May 13, 2020

9:00 Northeast Climate Habitat Vulnerability Assessment (E. Farr, NMFS)

10:00 Review/follow-up of *Illex* discussion, if necessary

10:30 Review updates and changes to OFL CV Guidance Document

11:30 Other business

- National SSC meeting
- SSC species/topic leads for 2020

12:30 Adjourn

Note: agenda topic times are approximate and subject to change

ATTACHMENT 2

MAFMC Scientific and Statistical Committee
May 11-12, 2020

Meeting Attendance via Webinar

Name	Affiliation
SSC Members in Attendance:	
Paul Rago (SSC Chairman)	NOAA Fisheries (retired)
Tom Miller	University of Maryland – CBL
Ed Houde	University of Maryland – CBL (emeritus)
Dave Secor	University of Maryland – CBL
John Boreman	NOAA Fisheries (retired)
Geret DePiper	NOAA Fisheries NEFSC
Lee Anderson	University of Delaware (emeritus)
Jorge Holzer	University of Maryland
Yan Jiao	Virginia Tech University
Rob Latour	VIMS
Brian Rothschild	Univ. of Massachusetts – Dartmouth (emeritus)
Olaf Jensen	Rutgers University
Sarah Gaichas	NOAA Fisheries NEFSC
Wendy Gabriel	NOAA Fisheries NEFSC
Mike Wilberg (Vice-Chairman)	University of Maryland – CBL
Alexei Sharov	Maryland Dept. of Natural Resources
Mike Frisk	Stony Brook University
Mark Holliday	NOAA Fisheries (retired)
Cynthia Jones	Old Dominion University
Gavin Fay	U. Massachusetts—Dartmouth
Others in attendance (includes presenters and members of public who spoke):	
Jason Didden	MAFMC staff
Brandon Muffley	MAFMC staff
G. Warren Elliott	MAFMC Vice-Chair
Lisa Hendrickson	NOAA Fisheries NEFSC
Brooke Wright	NOAA Fisheries NEFSC
Andrew Jones	NOAA Fisheries NEFSC
John Manderson	Open Ocean Research
Doug Christel	GARFO
Greg DiDomenico	Lunds
Megan Lapp	SeaFreeze
Jeff Kaelin	Lunds
Robert Ruhle	F/V Darana R

Katie Almeida	Town Dock
Eric Reid	Seafreeze, NEFMC Vice-Chair
Emily Farr	NOAA Fisheries
Mark Nelson	NOAA Fisheries
Mike Johnson	NOAA Fisheries

Attachment 3. May 12, 2020 agenda for Illex discussion

Time	*Duration*	*Topic*	*Presenter*	*Working Papers*
10:10 AM	0:10	Opening remarks, description of review process	Miller	
10:20 AM	0:10	Overview, TOR, squid biology, fishery, previous SSC decisions, relation to NAFO	Didden	2, 3, 4, 5, 7
10:30 AM	0:15	Summit review	Manderson	18
10:45 AM	0:10	Data Sources: VTR, Dealer, VMS, Survey, Weight Data, Aging	Didden	6, 15, 17
10:55 AM	0:15	CPUE--VTR	Hendrickson	10
11:10 AM	0:15	CPUE--study fleet	Jones	8
11:25 AM	0:15	Footprint and overlap	Wright	9
11:40 AM	0:05	Break		
11:45 AM	0:15	Body weight data	Hendrickson	10
12:00 PM	0:30	AP Summary and Public Comment	Didden/ Miller	
12:30 PM	0:30	Lunch		
1:00 PM	0:10	Indicators of status	Rago	13
1:10 PM	0:15	Leslie Davis Depletion estimator	Rago	14
1:25 PM	0:10	Envelope Method	Rago	12
1:35 PM	0:15	VMS analyses	Rago	11
1:50 PM	0:15	Cusum: Seasonal Landings	Rago	16a
2:05 PM	0:10	Cusum: Average Weights	Rago	16b
2:15 PM	0:10	Break		
2:25 PM	0:15	Public Comment	Miller	
2:40 PM	0:25	Group Discusson and Follow up	All	
3:05 PM	0:45	Summary of SSC conclusions	Miller	
3:50 PM	0:40	Review of staff memo and 2020 - 2021 ABC recommendations	Didden	1
4:30 PM	1:00	SSC Discussion and Recommendationss	Miller	
5:30 PM		Adjourn		

Mid-Atlantic Fishery Management Council
Scientific and Statistical Committee
OFL CV Guidance Document

Approved by Council June 2019
Revised XX 2020

Introduction

The Mid-Atlantic Fishery Management Council's (MAFMC) Scientific and Statistical Committee (SSC) currently uses a control rule to specify the acceptable biological catch (ABC; catch level that sets an upper bound for the Annual Catch Limit) for stocks that have accepted estimates of the overfishing limit (OFL; the catch that is expected to achieve the fishing mortality threshold (FMT)). The control rule is based on the P* (probability of overfishing) approach, which is used to calculate a catch level that is expected to achieve a pre-specified probability (P*) of exceeding the maximum fishing mortality rate reference point. In addition to the P*, which is specified by the MAFMC, the control rule requires a probability distribution for the OFL to describe uncertainty. Because of the difficulty in accurately quantifying the total uncertainty in the OFL, the SSC currently specifies a distribution for the OFL. The point estimate of the OFL from the stock assessment is used as the median of a lognormal distribution with a coefficient of variation (CV) specified by the SSC.

The true uncertainty in the OFL is needed to achieve the MAFMC's goal of a catch limit that meets a specific probability of overfishing. If the CV of the OFL is underestimated, the probability of overfishing will be higher than desired, and, conversely, if the CV of the OFL is too high, then the probability of overfishing will be lower than specified by the Council. The OFL CV is uncertain and difficult to estimate accurately. Three primary sources of uncertainty affect uncertainty in the OFL: uncertainty in the current stock biomass, uncertainty in the FMT and the OFL that is derived from it, and uncertainty from projecting into the future. Uncertainties in biomass and OFL derive from similar sources. Uncertainty is introduced by sampling variability when data are collected. Additional uncertainty is introduced as a result of assumptions and parameter estimates used in the assessment models. Since assessment models are simplifications of real-world, important uncertainties may be entirely uncharacterized. Therefore, the OFL is subject to substantial uncertainty, and the true uncertainty (instead of assessment model precision) is very difficult to estimate.

Commented [MB1]: Note: the SSC made edits to the Introduction to help streamline, re-organize, and clarify some of the original language. These edits do not modify the process, decision criteria, and approach the SSC will take when determining the OFL CV level; therefore, the Introduction edits were accepted and are incorporated into the revised document.

The SSC believes that no single model or even ensemble of models can fully capture the full assessment uncertainty. Rigorous consideration of key assessment parameters and assumptions and comparison among model simulations can improve one's understanding of the true but essentially knowable uncertainty. This document describes the criteria used for determination of bins of uncertainty levels. The ABC is derived from the OFL by assigning the assessment to an appropriate uncertainty bin. Ultimately, the final determination is dependent on expert judgement and qualitative evaluation of a suite of factors that affect uncertainty of the OFL.

The MAFMC SSC has used a range of values, 60-150%, for the CV of the OFL distribution in determining the ABC. However, the SSC, MAFMC, and stakeholders have questioned the rationale for various values of the OFL CV that have been applied by the SSC as well as the consistency underlying the decisions about OFL CVs among assessed stocks. When the ABC control rule was initially adopted, a default amount of uncertainty was estimated from a meta-analysis of accuracy of estimates from simulation studies of statistical catch-at-age model performance, including the uncertainty in biomass in the last year, uncertainty in the fishing mortality reference point, and their covariance[1]. This analysis indicated that a CV = 100% was a reasonable value for the average CV of the OFL distribution. Since that time, the SSC has chosen CVs for the OFL distribution that differ among stocks (Figure 1).

The SSC's intent for this document is to elevate confidence in ABC recommendations by establishing a replicable process that meets Council risk policy objectives and identifies relevant components of assessment uncertainty to be provided to the SSC. The approach outlined here will not resolve all scientific uncertainties and problems, and exceptions will arise that are not specifically addressed in this document; however, this approach should help alleviate many issues and provide a clear, consistent, and transparent process that documents the SSC deliberations and conclusions.

The SSC's approach to setting OFL CVs is intended to:

- Result in prudent decisions for catch advice that are consistent in meeting the objectives of the Council's Risk Policy;
- Be based on clear decision criteria that are consistently applied across stocks; and
- Be supportable with evidence.

Decision Criteria

The SSC agreed to consider nine decision criteria to help define an appropriate OFL CV when setting new or revised ABC recommendations. All decision criteria will be considered by the SSC; however, the relative importance and "weighting" of each criteria will be different for each species and consistent with the approaches and analyses evaluated within each assessment

[1] For more information, please see the SSC white paper titled "Description and Foundation of the Mid-Atlantic Fishery Management Council's Acceptable Biological Catch Control Rule" found at: http://www.mafmc.org/s/MAFMC-ABC-Control-Rule-White-Paper.pdf.

framework. In addition, while these criteria were specifically developed to help in SSC deliberations, they may also be helpful to stock assessment workgroups as they consider and evaluate data and model appropriateness and uncertainty.

The nine decision criteria are provided below with supporting language that generally describes the considerations and information the SSC may utilize when considering each criterion.

1. **Data quality**
    a. Types and quality of available data are primary determinants of the accuracy of any assessment model;
    b. Important fishery-independent data considerations include survey design, coverage (of the unit stock area), and efficiency of survey gear;
    c. Fishery-dependent considerations include accuracy and precision of landings and discards;
    d. Availability of age and/or length data for fishery-independent and dependent sources; validity of underlying assumptions and any potential data borrowing (i.e., gap filling);
    e. ~~Information on natural mortality and other assumed~~ Data in support of key model parameters.

2. **Model appropriateness and identification during the assessment process**
    a. Model selection process and tests are important for choosing assessment models that are likely to be accurate (e.g., model sensitivities within a given model structure);
    b. Comparison among~~between~~ the assessment baseline model and models with different structures is important to determine the effects of assumptions;
    c. Model appropriateness in capturing species and fishery specific traits, such as biological characteristics,~~fleets,~~ life history patterns, spatial/stock structure, and fleets~~biological characteristics~~;
    d. Amount of model testing with consistent or divergent estimates~~trends~~ (particularly for management relevant quantities like the OFL or stock status) ~~among models~~.

3. **Informed by retrospective analysis**
    a. Retrospective pattern is ~~direct~~ evidence of model misspecification and suggests directionality of change with respect to "true" or at least improved model rather than an unspecified set of alternative models;
    b. Comparison of the adjusted OFL to the uncertainty of the OFL estimated from the baseline model to determine if retrospective pattern is a larger portion of uncertainty.

4. **Informed by comparison with simpler analyses**
    a. Swept area biomass or gear comparisons that suggest appropriate minimum scale of population;

b. Comparison with other empirical or simpler measures; e.g., survey Z, Beverton-Holt length-based Z.

5. **Informed by ecosystem factors or comparisons with other species**
    a. Stock-relevant ecosystem factors directly included in the assessment model, e.g.,:
        - Environmentally dependent growth or other population processes;
        - Factors limiting/enhancing stock productivity (habitat quality, etc.);
        - Predation, disease, or episodic environmental mortality (e.g., red tide);
    b. Ecosystem factors outside the stock assessment affecting short term prediction
        - General measures of ecosystem productivity and habitat stability (e.g., primary production amount and timing, temperature trends, etc.);
        - Comparisons among related species; e.g., recruitment, growth, condition patterns across Mid Atlantic fish species stable, varying synchronously, or varying unpredictably;
        - Climate vulnerability or other risk assessment evaluation of potential for changing~~increasing or decreasing~~ productivity under changing conditions.

6. **Informed by measures of trend in recruitment (primarily affecting the accuracy of forecasts)**
    a. Stanzas of abundance for recruits;
    b. Decreasing R/SSB as SSB decreases (evidence of depensation).

7. **Informed by prediction error**
    a. Comparisons of model performance given prior assessments;
    b. Consistency among repeated assessments should be considered in light of changes in the best available information or understanding of stock and fishery dynamics.

8. **Assessment accuracy under different fishing pressures**
    a. Age-structured assessment approaches are generally more accurate under higher fishing mortality rates relative to natural mortality;
    b. Non-age-structured assessment approaches may require specific patterns in the data to be highly accurate (e.g., high contrast in abundance and fishing pressure for a production model);
    c. Prediction error and dynamic trends (e.g., decadal periods) in fishing selectivity patterns.

9. **Informed by simulation analysis or full MSE**
    a. Simulation analyses can be used to test how robust assessment approaches or management strategies are to specific misspecifications in the models or issues in the data.

General Framework Discussion Table

The framework table is intended to provide qualitative assessment of the nine criteria and is not to be used to tabulate a specific score. Instead, the table will help ~~document~~ the SSC document deliberations, ensure a consistent process is followed for all species and assessments, and help the Council and public understand the rationale for the decision reached by the SSC.

The table currently has OFL CV default values (bins) of 60%, 100%, and 150%, and were derived from a variety of simulation analyses, MSE evaluations, and expert judgement by the SSC. As new information, analyses, and assessment methods become available, the SSC may modify the default OFL CV bins or recommend a different OFL CV for a specific species assessment. If any changes to the current default OFL CV values are warranted, the SSC will provide justification and supporting documentation as to why a different value was recommended.

The framework table below provides general evaluation metrics associated with the nine decision criteria for each OFL CV bin.

Decision Criteria	Default OFL CV=60%	Default OFL CV=100%	Default OFL CV=150%
Data quality	One or more synoptic surveys over stock area for multiple years. High quality monitoring of landings size and age composition. Long term, precise monitoring of discards. Landings estimates highly accurate.	Low precision synoptic surveys or one or more regional surveys which lack coherency in trend. Age and/or length data available with uncertain quality. Lacking or imprecise discard estimates. Moderate accuracy of landings estimates.	No reliable abundance indices. Catch estimates are unreliable. No age and/or length data available or highly uncertain. Natural mortality rates are unknown or suspected to be highly variable. Incomplete or highly uncertain landings estimates.
Model appropriateness and identification process	Multiple differently structured models agree on outputs; many sensitivities explored. Model appropriately captures/considers species life history and spatial/stock structure ~~(e.g., black sea bass)~~.	Single model structure with many parameter sensitivities explored. Moderate agreement among different model runs indicating low sensitivities of model results to specific parameterization.	Highly divergent outputs from multiple models or no exploration of alternative model structures or sensitivities.
Retrospective analysis	~~No retrospective adjustment necessary, or OFL estimate includes retrospective adjustment.~~ Minor retrospective patterns.	~~OFL estimate includes retrospective adjustment only if outside 95% bounds of non-adjusted terminal B and F.~~ Moderate retrospective patterns.	No retrospective analysis or severe retrospective patterns ~~observed~~.
Comparison with empirical measures or simpler analyses	Assessment biomass and/or fishing mortality estimates compare favorably with empirical estimates.	~~Both assessment biomass and/or fishing mortality empirical estimates highly uncertain.~~ Moderate agreement between assessment estimates and empirical estimates or simpler analyses.	Estimates of scale are difficult to reconcile and/or no empirical estimates.

Ecosystem factors accounted	Assessment considered habitat and ecosystem effects on stock productivity, distribution, mortality and quantitatively included appropriate factors reducing uncertainty in short term predictions. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are stable. Comparable species in the region have synchronous production characteristics and stable short-term predictions. Climate vulnerability analysis suggests ~~positive impacts on productivity from changing climate~~ low risk of change in productivity due to changing climate.	Assessment considered habitat/ecosystem factors but did not demonstrate either reduced or inflated short-term prediction uncertainty based on these factors. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are variable, with mixed productivity and uncertainty signals among comparable species in the region. Climate vulnerability analysis suggests moderate risk of change in productivity ~~neutral impacts on productivity~~ from changing climate.	Assessment either demonstrated that including appropriate ecosystem/habitat factors increases short-term prediction uncertainty, or did not consider habitat and ecosystem factors. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are variable and degrading. Comparable species in the region have high uncertainty in short term predictions. Climate vulnerability analysis suggests ~~negative impacts~~ high risk of changing productivity from changing climate.
Trend in recruitment	~~OFL estimates adjusted for recent trends in recruitment.~~ Consistent recruitment pattern with no trend.	~~No recruitment trend or uncertain.~~ Moderate levels of recruitment variability or modest consistency in pattern or trends. OFL estimates adjusted for recent trends in recruitment. ~~Insufficient evidence to adjust~~ OFL estimate appropriately accounted for recent trends in~~based on~~ recruitment ~~information available~~.	Recruitment pattern highly inconsistent and variable. Recruitment trend not considered or no recruitment estimate.
Prediction error	Low estimate of recent prediction error.	Moderate estimate of recent prediction error.	High or no estimate of recent prediction error.
Assessment accuracy under different fishing pressures	High degree of contrast in landings and surveys with apparent response in indices to changes in removals. Fishing mortality at levels expected to influence population dynamics~~Observed high fishing mortality~~ in recent years.	Moderate ~~contrast~~agreement in the surveys ~~and~~ to changes in catches. ~~"One-way" trips for production models.~~ Observed moderate fishing mortality in fishery (i.e., lack of high fishing mortality in recent years).	Relatively little change in surveys or catches over time. Low precision of estimates. Low fishing mortality in recent years. "One-way" trips for production models.
Simulation analysis/MSE	Can be used to evaluate different combinations of uncertainties and indicate the most appropriate OFL CV for a particular stock assessment.		

A worked example evaluation of the nine criteria provided in the table above is provided for Summer Flounder (see page 8).

Process for OFL Determination

The SSC's consideration, evaluation, and discussion of the nine decision criteria in determining the appropriate OFL CV level could potentially become cumbersome and time-consuming to be handled effectively during an SSC meeting, particularly if multiple species-specific ABC recommendations are required. In an effort to add efficiency to the ABC-setting process while

still allowing for extensive SSC input and discussion, the SSC species lead will develop a pre-decisional, non-binding document evaluating the nine decision criteria ahead of the SSC meeting. This document will then be posted as part of the SSC meeting materials and available to SSC members for review ahead of the meeting in which an ABC recommendation is required. The process for developing the pre-decisional document and the SSC's OFL CV determination will follow the steps outlined below:

- Upon completion of a stock assessment, the appropriate SSC species lead, seeking input from the stock assessment lead and Council staff as necessary, ~~will work with the stock assessment lead and Council staff to~~ will evaluate the nine decision criteria and develop a draft summary document that provides an overview of relevant assessment information, key findings, and any additional pertinent information for each decision criteria~~complete a draft framework discussion table~~. The summary document would also include a draft narrative (see example narrative on page 10 below) that identifies the most important decision criteria specific to the species and stock assessment under consideration and highlights any other relevant information. The narrative would not include an OFL CV recommendation.
- The draft summary document~~framework table~~ would then be provided to a sub-group comprising ~~of~~ the SSC chair, vice-chair, and Council staff ~~members (initially comprised of the OFL CV workgroup members)~~ for review and feedback ~~and would likely meet via webinar.~~ This sub-group will review the information and draft narrative to~~will~~ help ensure consistency in the interpretation and evaluation of the decision criteria. ~~The SSC species lead, and the sub-group will then develop a draft narrative summarizing the key findings based on the draft framework table. This narrative will include information on the most critical and important decision criteria specific to the species and stock assessment reviewed and highlight any other areas of extended deliberation by the sub-group. The narrative will also recommend an appropriate OFL CV level for SSC consideration. The framework table, narrative and OFL CV recommendation will all be labeled as draft and are pre-decisional and non-binding.~~
- The draft summary document~~framework table~~ and narrative will be provided to the full SSC and posted as part of the meeting materials in advance of the meeting in which the ABC recommendations will be made.
- During the SSC deliberations to address the ABC Terms of Reference, the SSC species lead will provide an overview of the pertinent information associated with the nine decision criteria ~~evaluation,~~ and draft narrative~~, and OFL CV recommendation~~.
- SSC members present at the meeting will then discuss and deliberate any/all information available in order to make an OFL CV recommendation. The SSC meeting summary report will contain both the completed framework table with an evaluation and rationale of the nine decision criteria and a summary narrative. Providing both the framework table and narrative in the meeting summary will help provide a comprehensive record of the SSC's deliberations and justification for their recommendation for future reference.

Given the additional work and preparation~~meetings~~ necessary prior to a scheduled SSC meeting as outlined above, increased coordination ~~between~~among the SSC, NEFSC, and Council staff will be critical to ensure stock assessment documents and information are available in a timely manner. Ideally, stock assessment documents and any other pertinent information would be available at least three weeks prior to the scheduled SSC meeting. The SSC species lead would provide the draft summary document~~and~~ to the SSC chair, vice chair, assessment lead, and Council staff~~sub-group would meet~~ at least two weeks prior to the scheduled SSC meeting for~~to~~ review and feedback~~the framework table and develop the draft narrative~~. The ~~sub-group~~ draft summary document~~s~~ would then be available to the SSC and posted to the meeting materials at least one week prior to the scheduled SSC meeting. ~~Delays in any part of this process could result in a number of implications ranging from inefficient and extended SSC meetings to potential delays in the making ABC recommendations.~~ In addition, continued SSC involvement in the SAW/SARC process (i.e., chairing SAW/SARC assessment reviews, embedding with the assessment work group) will play a critical and informative role in the process to help ensure the timing and deadlines are achieved.

Worked Example

Below is a worked example for Summer Flounder based on the results of the 2018 benchmark assessment. The worked example includes the SSC OFL recommendation, an evaluation of the nine decision criteria as outlined in the framework table and a short narrative documenting key conclusions.

Based on an evaluation of the nine decision criteria, the SSC recommends a CV of 60% be applied to the OFL estimate as an appropriate ABC for Summer Flounder in fishing years 2019-2021.

Commented [MB2]: Note: the SSC made minor edits to the Worked Example to help streamline, re-organize, and clarify some of the original language. These edits do not modify the process, decision criteria, and approach the SSC will take when determining the OFL CV level; therefore, the Worked Example edits were accepted and are incorporated into the revised document.

Decision Criteria	Default OFL CV=60%	Default OFL CV=100%	Default OFL CV=150%
Data quality	Two synoptic surveys (fall and spring) are available for all years in assessment. Additionally, 13 regional surveys are used in model tuning. Time series for R/V Albatross IV and R/V Bigelow treated separately for spring and fall trawl surveys. Bigelow estimates adjusted for results of cooperative research studies on gear efficiency. Age data available for all years in surveys, and age-length keys from surveys were applied to commercial landings, recreational landings, and commercial discards. Recreational and commercial discards are low and measured with good precision. Sex-specific information available for growth. Newly revised historical MRIP catch estimates were used in assessment.		

Model appropriateness and identification process	Models incorporating age and sex-specific growth and mortality rates were developed, tested, and reviewed. Multiple models by different assessment teams were considered. ASAP was preferred assessment model but SS and other statistical catch-at-age models were considered. These include models with age and sex-dependent rates of natural mortality, growth, and fishery selectivity. However, additional work on the more complicated models is needed to appropriately evaluate to the single sex models.		
Retrospective analysis	Retrospective pattern in current assessment is minor with retrospective errors over the last 7 terminal years averaging -4% for F, +2% for SSB, and +2% for recruitment. These retrospective errors are about one-tenth as large as their magnitude in the previous benchmark assessment. Historical retrospective comparisons show general trends of fishing mortality, stock biomass, and recruitment have been consistent since the 1990s assessments.		
Comparison with empirical measures or simpler analyses	Assessment biomass and/or fishing mortality estimates compare favorably with empirical estimates. Results of cooperative research gear experiments were used to adjust scale of biomass indices used in model tuning.		
Ecosystem factors accounted		Aspects of the ecosystem seem to be changing in recent years. Fall ocean bottom and surface temperatures are increasing, and salinity is at or near the historical high. These physical data series may have shifted around 2012, the warmest year on record for this ecosystem. Spring chlorophyll concentrations, a measure of bottom-up ecosystem production in the Summer Flounder stock area, are variable, but the fall time series has been decreasing, especially during 2013-2017. Spring abundances for key zooplankton prey are variable and may be worth examining alongside recruitment patterns for future research. Both probability of occurrence and modeled habitat area show similar patterns of increases from the 1990s to the present, which suggests, despite reduced abundance in the past five years, the distribution footprint of Summer Flounder has not contracted.	

Trend in recruitment		Average recruitment from 1982 to 2017 is 53 million fish at age 0. Recruitment has been below average since 2011, averaging 36 million fish. Overall recruitment variability is modest and it is not possible to determine if recent decline is statistically significant. Projections do not account for recruitment trend.	
Prediction error	Prior to the 2018 benchmark, comparisons of annual forecasts of stock biomass with realized estimates of stock biomass in subsequent assessments reveal a one-year ahead forecasting error with a CV=14%. For two-year forecasts the CV is 26% and for 3-year forecasts the CV= 26%. The average percentage difference between the projection and the subsequent estimate for 1-, 2-, and 3-yr projections was +12%, +23%, and +24%, respectively. Inclusion of the revised MRIP data increased the population scale, rendering prediction comparisons less useful as a metric of model performance.		
Assessment accuracy under different fishing pressures		Fishing mortality has varied over a 6-fold range over the assessment period with major decline since imposition of effective management measures around 2000. This range of fishing mortalities, subsequent fluctuations in total abundance, and success of management changes suggest a moderate level of confidence in assessment results.	
Simulation analysis/MSE	No formal MSE-type analyses have been conducted for this stock.		

Example OFL CV Recommendation Narrative

This is a data rich stock assessment and one of the most comprehensive in the Northeast US. Two synoptic surveys (fall and spring) are available for all years and multiple regional surveys are used in model tuning. Age data are available for all years in surveys, commercial landings, recreational landings, and commercial discards. Recreational and commercial discards are low and measured with good precision. The newly revised MRIP catch estimates were incorporated into the assessment for the first time. Extensive work on alternative model formulations (including size- and sex-based models) have been conducted by independent assessment teams. Spatial variations in catch rates by sex and fisheries have been examined. Multiple model formulations have been systematically evaluated. More complicated models have not been judged superior to single-sex models. The retrospective pattern for the current assessment is exceptionally low and comparisons of biomass estimates across historical assessments show good agreements with trend. Estimates of prediction error for 1- to 3-year

forecasts are less than 25%. The stock has experienced a wide range of fishing mortality rates and appears to have responded as predicted by theory to aggressive management measures in the early 2000s; this suggests a high level of confidence in the results.

Consideration of ecosystem factors apart from the model suggest some cause for concern as increases in temperature and salinity have occurred, especially since 2012. It is too early to tell if changes in chlorophyll indices and zooplankton abundance are related to recent reductions (about 31% decline) in average recruitment in this same period.

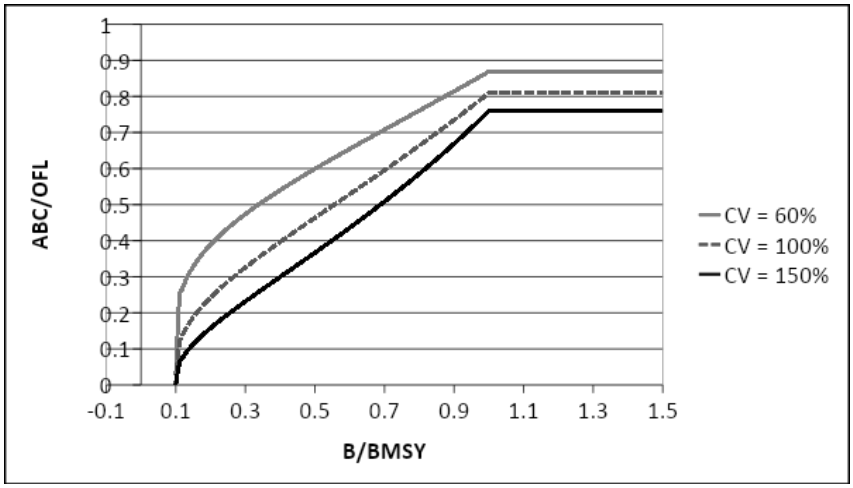

Figure 1. Effect of different CV values currently selected by the MAFMC SSC on the ratio of ABC to OFL for varying levels of biomass relative to the B_{MSY}.

Research Steering Committee Meeting

Potential Re-Development of the Mid-Atlantic Research Set-Aside Program Webinar Meeting Summary

April 2020

The Research Steering Committee (RSC) met via webinar on Tuesday, April 28, 2020 to discuss potential re-development of the research set-aside (RSA) program. The RSC's recommendations will be presented at a subsequent Council Meeting with the goal of hosting an RSA workshop in fall 2020.

RSC members present: Adam Nowalsky (Chair), Steve Heins (Vice-Chair), Chris Batsavage, Peter deFur, Tony DiLernia, Laurie Nolan, Kate Wilke, Ryan Silva (for Mike Pentony), Mike Luisi, Warren Elliott, and Matthew Seeley (MAFMC Staff)

Others present: Bob Beal (ASMFC), Toni Kerns (ASMFC), Brandon Muffley (MAFMC Staff), Cheryl Corbett, Emerson Hasbrouck (Cornell), Kristin Gerbino (Cornell), Scott Curatolo-Wagemann (Cornell), and Tara McClintock.

Summary

The RSC meeting began with a presentation from staff summarizing the goals of the webinar and workshop (proposed), the outcomes of the August 2019 RSC meeting, and the workshop logistics to be discussed on the webinar. The RSC then discussed and refined the proposed goal of the workshop along with the potential locations and scope of attendees. As discussion progressed, the RSC transitioned into developing a range of topics/options for discussion at the workshop. All recommendations for workshop development are as follows with details under each action item:

1. **Identify the need for research via RSA in the Mid-Atlantic**
2. **Confirm the workshop goal**
3. **Identify workshop locations**
4. **Identify the scope of attendees – Invitation list**
5. **Discuss how the program will be administered**
6. **Develop a range of topics/options for discussion at the workshop**
    a. **Discuss/Identify funding mechanisms for further development.**
    b. **Discuss how project results will be reviewed, used in management, and communicated to the Council/stakeholders**
    c. **Identify how the Council will collaborate with the Atlantic States Marine Fisheries Commission**
    d. **Develop a range of topics/options for discussion at the workshop**
7. **Next steps**

Action Items

1. Identify the need for research via RSA in the Mid-Atlantic

The RSC noted that the workshop will help answer the question related to the need RSA fulfills. Depending on the outcomes of the workshop, the RSC and Council will evaluate whether re-development of RSA is warranted. However, the RSC indicated that RSA would allow for additional resources that address Council research needs but noted that the program must be initiated with less administrative burden and be redesigned for success.
To ensure the success of a re-developed program, the RSC discussed the duration of projects that received research funds in the past and noted that funds were often awarded to long term projects as opposed to short term projects. In an effort to better monitor RSA projects and acquire data for management that fills a data need, the RSC recommends focusing on short term projects over long-term projects (i.e. not surveys).

The following discussion points surrounding the need for research in the Mid-Atlantic were proposed by the RSC for the workshop:

- A re-developed program should not fund long term projects.
- RSA funds generated from one species should not be used for research on different species.
- Identify research needs and priorities using:
    - MAFMC 5-year research
    - 2020 Advisory Panel Fishery Performance Reports
    - Research suggestions from the stock assessment reports.
    - Previously completed successful RSA projects (M-A and NE)

2. Confirm the workshop goal

Goal: Develop a final recommendation on how a re-developed MAFMC RSA program would function with justification for the need and design of the program. Identify funding mechanisms and an approach to generate funding.

The RSC noted that the above goal captures everything to justify moving forward with a workshop, as the RSC wants to clarify justification for the need that emphasizes how the program is better and different.

3. Identify workshop locations

As a result of the Covid-19 pandemic, the RSC discussed the timing and location of the workshop and noted the need to consider a venue that may be larger than what has been considered in the past due to social distancing measures. The RSC concluded that this type of workshop would be much better if conducted in person, and thus, recommended hosting the meeting later in the Fall/Winter. The RSC also recommends that remote participation be considered for Council and Committee members even if the workshop is held in-person.

Proposed Locations:

Philadelphia
Baltimore
Webinar – A webinar is being considered due to the uncertainties associated with the Covid-19 pandemic. Webinars have major limitations and it will be difficult when coordinating with individuals that Committee members are not familiar with. We should consider using video conferencing if a webinar is selected as the venue.

To ask when requesting venues:

- Are bookings available for this timeline?
- What are the cancellation policies?
- What are the constraints on the number of people allowed in a room due to social distancing?

Does the RSC recommend going forward with the workshop if it has to be a webinar in 2020?

RSC Recommendation: Host a 1 to 1.5 day in-person workshop in Philadelphia/Baltimore with consideration for Council and Committee member remote participation in Fall 2020.

4. Identify the scope of attendees – Invitation list

Primary Participants:

- Committee Members
- Mid-Atlantic Council Staff
- New England Council Staff
- Atlantic States Marine Fisheries Commission (ASMFC) Staff
- ASMFC Law Enforcement Committee
- NOAA Office of Law Enforcement (OLE)
- Northeast Fisheries Science Center
- Greater Atlantic Regional Fisheries Office (GARFO)
- Scientific and Statistical Committee (e.g. Chair)

Other Invited Participants:

- National Fisheries Institute
- State representatives (e.g. MAFMC and ASMFC Administrative Commissioners)
- MAFMC Advisory Panels
- Previously successful RSA participants
- Science Center for Marine Fisheries
- Other individuals that the RSC deems relevant

The RSC recommends sending out a broad announcement to the "Other Invited Participants" list to gauge initial interest in the workshop (include [Mid and NE] researchers and industry partners that were successful within the RSA program). The RSC deems a successful applicant as one that has previously completed a project and posted a final report.

To assist in developing the attendee list, the RSC recommends requiring pre-registration for members of the public to plan accordingly for the number of participants, with respect for social distancing.

5. Discuss how the program will be administered

- Run as a federal grant program (specific restrictions do exist)
- Do not run as a contractual program
- Noted for discussion at the workshop:
    - Should the RSC recommend the auction be used and at what level?
- Ensure OLE has the opportunity to review the specific type of administration.
    - As discussion of re-development occurs, the RSC will request a list from OLE indicating how individuals "abused the system" in order to avoid these issues in the future.
    - Continue to include a brief summary of the RSA issues.

6. Develop a range of topics/options for discussion at the workshop

a. Discuss/Identify funding mechanisms for further development.

What changes to the previous funding model (auction) are necessary?

- Overhead – Check in with leadership what costs will be covered by the Council.
- Mechanism
    - Auction
    - NE RSA approach
- Include examples of how industry funded research happens around the world (include a few case studies)
- Identify the best model for funding? (this includes revisions to the past model)

b. Discuss how project results will be reviewed, used in management, and communicated to the Council/stakeholders

Reviewed:

This topic may not be appropriate for review at the workshop and should be further discussed with the RSC and Council.

- GARFO staff indicated there is a peer review process that proposals go through prior to funding and during development.
    - Progress and final reports

    - Compile a description of the old review process (see notes from Ryan Silva)
    - RSC review
- Identify a peer review process for once final reports have been submitted.
    - The SSC helps design research priorities, and thus, should review whether projects helped address the research needs.
- Require interim (progress) reports
    - Conducted through GARFO's peer review process

Used in Management:

Set the expectation that approving a project fulfills a management need.

- *Do not need the workshop to answer this question:* As the RSC approves a project, we will have identified what management niche a specific project will fulfill.
- Projects should be tied to a management/assessment need
    - Bring to the workshop as a statement (not for question).
- Projects can inform management without resulting in a specific action.

Communicated to the Council/Stakeholders:

- Present results at joint meetings when species are co-managed
- Dedicate a page to RSA projects on the webpage
    - Post project results on a "presentations" page on the Council's website (possibly with visual recordings)

c. Identify how the Council will collaborate with the Atlantic States Marine Fisheries Commission

For species that are jointly managed, all RSA topics will be covered at joint Council/Board meetings.

d. Other topics

- Discuss program administration.
    - Identify what is run by GARFO/the federal grant program.
    - Identify what should be run by the Council.
- Discuss sufficient revisions to the current funding mechanisms (revised auction system) and propose other funding mechanisms.
    - Discuss methods to ensure funds are generated and used appropriately.
    - Should the program fund long term projects?
    - RSA funds generated from one species should not be used for research on different species.
- Have Law Enforcement provide detail on the intricacies of the RSA program and identify where enforcement issues often arise.
- Indicate that projects should be tied to a management/assessment need.
    - Bring to the workshop as a statement (not for question).
    - Projects can inform management without resulting in a specific action.

- Identify research needs and priorities using:
    - MAFMC 5-year research
    - 2020 Advisory Panel Fishery Performance Reports
    - Research suggestions from the stock assessment reports.
    - Previously completed successful RSA projects (M-A and NE)
- Discuss the peer review process.

7. Next steps

- Host another planning webinar?
- Look for locations in Sept-Nov in the Baltimore/Philadelphia area.
- Begin to develop a detailed workshop agenda with action items to be accomplished at the workshop.
- Look into bringing in a facilitator (possibly Andy Loftus).
- Use the primary list to start. Then convene again via webinar to refine the list.
- Draft a solicitation list and develop a timeline for when it will be sent out.
    - Solicitation will allow for recipients to notify other appropriate interested individuals.
- Note: Staff will summarize the workshop results for refinement by the RSC to make a recommendation the Council.