Center for Independent Experts (CIE) Independent Peer Review Report on the 66th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Benchmark Stock Assessments for Summer Flounder and Striped Bass

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Prepared for

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1. Executive Summary

The 66th Stock Assessment Review Committee (SARC 66) meeting was held from 10am on 27 November 2018 through 4.00 pm on 30 November 2018 at the Northeast Fisheries Science Centre, Wood's Hole, Massachusetts, USA. I was contracted by the Centre for Independent Experts (CIE) to act as a member of the Review panel. The purpose of the meeting was to provide an external peer review of the benchmark stock assessments for summer flounder and striped bass in accordance with the requirements for CIE reviewers contained in the Performance Work Statement (Appendix 2).

A comprehensive set of assessment reports and supporting documentation was made available to the review panel via an *.ftp site in advance of the meeting and provided all the essential elements necessary to undertake the review of both stocks. The review was carried out in open session through a series of presentations on each stock. A small number of additional analyses were requested by the panel, each of which was fully addressed by the assessment teams. The panel reached consensus on which assessments provided a scientifically credible basis for developing fishery management advice.

The Chair of the SARC was unable to participate in the final day of the review meeting and volunteered to draft a SARC summary report for circulation to the panel for comments and amendments as soon as possible after the meeting.

Main findings

Summer flounder

The documentation presented by the SAW 66 in support of their assessments was detailed and thorough and the logistical organization and preparations for the SARC review were excellent. The presentations and responses to Panel questions by the lead assessors (and others) were appropriately detailed and thorough.

Catches from all available sources were well documented and were derived using the most appropriate means. The spatial distribution of catches (landings and discards) and effort were well described, and a northward and eastward movement in the center of gravity of the stock distribution over the recent decades was noted. The mechanisms driving such movements remain unclear. Re-estimation of recreational catches using the calibrated MRIP estimates resulted in a significant increase in the total removals from the population compared to previous MRFSS/MRIP estimates.

Survey data available were presented and whether to include them in the assessment was discussed, as was the utility of commercial CPUE/LPUE indices. Uncertainty associated with the different time series of fishery-dependent and fishery–independent indices was also investigated and characterized. Survey indices were retained for the final assessment but fishery-dependent indices were excluded.

The time series of recruitment indices from surveys indicates that annual recruitment has been below the long-term average since 2011. The results of the assessment are in line with

the survey observations. The mechanisms driving the observed reduced recruitments remain unknown.

An age-structured statistical catch-at-age model (ASAP) was used to estimate population parameters. Such an approach is well established and was used for the previous (2013, SARC 57) summer flounder benchmark assessment. The final model configuration differed from the previous assessment in two main areas:

i) four fleets were included (commercial landings, commercial discards, recreational landings and recreational discards), whereas formerly recreational and commercial landings were combined to create one fleet and commercial and recreational discards were combined to create a second fleet;
ii) The time series of catch data was updated with minor revisions to the commercial catches and major revisions (increases) to the recreational catches by replacing the MRFSS/MRIP estimates with calibrated MRIP estimates.

Biological reference points were revised although the basis for their definition remained the same as for the previous benchmark and are based on $F_{35\%}$ as a proxy for F_{MSY}.

The results of the SAW 66 assessment of summer flounder indicate that in 2017 the stock was not overfished and that overfishing was not taking place.

Projections were undertaken assuming that the ABC for 2018 will be caught. However such projections are illustrative only since the actual catch for 2018 is not yet known. The projections will need to be revised using the final estimate of catch for 2018 to decide on the ABC for 2019 and beyond.

The preferred projections are those that use the 1992-2017 time series of SSB and recruitment as the basis for randomly selecting annual recruitment. If the recently observed (post 2011) lower than average recruitment persists in the short-term, the projected catches for 2019-2023 at $F_{35\%}$ = the F_{MSY} proxy will be overoptimistic.

I consider that the results of the assessments recommended by the SARC 66 provide a credible scientific basis for developing fishery management advice for summer flounder.

Striped bass

The documentation presented by the SAW 66 in support of their assessments was detailed and thorough, and the logistical organization and preparations for the SARC review were excellent. The presentations and responses to Panel questions by the lead assessors (and others) were appropriately detailed and thorough.

An extensive range of fishery-dependent and fishery-independent data were reported in the assessment report and presented to the SARC. The data sources and methodologies to process the data were appropriate. Potential sources of uncertainty and potential strengths and weaknesses of the data were adequately documented and discussed.

Commercial fisheries data on landings discards and catch at age and their derivation were described in appropriate detail as were data on discards and discard mortality. Recreational catches were revised based on the calibrated MRIP estimates.

The spatial distribution of the fisheries and catches was described, and I consider that the derivation of catches and harvest from the commercial and recreational fisheries and the distribution of the fisheries was well described and justified.

A 2-stock SCA assessment model was developed and put forward by the SAW as their preferred model on which to base management advice. While recognizing that the development of the model represents a significant advancement in model development to assess striped bass, the SARC felt that for a variety of reasons relating to various aspects of the model, available data and the input assumptions, it would be premature at present to use the 2SCA model as a basis for management.

A single stock SCA, essentially a similar implementation of the model used for the 2013 benchmark assessment (SARC 57), was recommended by the SARC as the preferred model to use for the development of management advice.

Extensive analyses were undertaken to investigate the plethora of tagging data and information and the details of the data, approach, assumptions and results are meticulously detailed in the 2018 assessment report. The results of the analyses in terms of magnitude and trends in total mortality rate (Z) are informative and are generally in line with the results of the preferred (SCA) assessment model.

Biological reference points were derived from the results of the preferred SCA model using the same definition as used in the previous benchmark assessment (SARC 57), i.e., based on the estimated SSB in 1995, a time when the stock was deemed to have recovered from an overfished state. In 2017, the status of the stock is assessed as overfished and is experiencing overfishing.

Projections for the period 2019-2022 were provided based on the results of the preferred SCA assessment.

Research recommendations from the SARC 57 were partially addressed by the SAW. New research recommendations, mainly relating to further testing and development of the 2-stock model with migration (2SCA) model were suggested.

I consider that the results of the assessments recommended by the SARC 66 provide a credible scientific basis for developing fishery management advice for striped bass.

Acknowledgements

I would like to acknowledge the tremendous efforts of all scientific personnel in preparing the assessment reports. I was thoroughly impressed by the amount and complexity of work undertaken by the analysts in preparing and documenting the data, analyses and findings for both stocks and with their patience and cooperation in the review process. Furthermore, the organization of the meeting by the Chair of the SARC was exemplary as was the welcome and hospitality extended by the staff of the population dynamics team in the NEFSC.

I would also like to thank the other members of the Panel for their assistance and support during the review. All were a pleasure to work with.

Finally, I wish to thank Dr. Manoj Shivlani and Roberto Koeneke from the CIE for doing an excellent job in taking care of the logistical arrangements relating to my participation in this review.

2. Background

Stock assessments undertaken by the NMFS Stock Assessment Workshop (SAW) are reviewed by an independent panel of stock assessment experts; the Stock Assessment Review Committee, or SARC. Independent reviewers are appointed by the Centre for Independent Experts (CIE). CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team and are contracted to deliver an independent peer review report in accordance with the performance work statement (Appendix 1).

The 66th SARC (Stock Assessment Review Committee) met in the Northeast Fisheries Science Center, Woods Hole, MA from 27-30 November 2018 to review benchmark stock assessments for summer flounder (*Paralichthys dentatus*) and striped bass (*Morone saxatilis*). The review committee was composed of Dr. Robert Latour (Virginia Institute of Marine Science, Chair) and three independent stock assessment Experts appointed by the CIE: Dr. John Casey (Independent Consultant), Dr. Robin Cook (Strathclyde University Glasgow UK), Dr. Yan Jiao (Virginia Tech University).

The review was assisted by the NEFSC Stock Assessment Workshop Chair, Dr. James Weinberg, Ms. Toni Chute and Dr. Russel Brown (all NEFSC). The assessment for Summer flounder was presented by Dr. Mark Terceiro (NEFSC) with support from Jessica Coakley (MAFMC, Summer flounder working group chair). The striped bass assessment was presented by Dr. Katie Drew (ASMFC) and Dr Gary Nelson (NEFSC) with support from Mike Celestino and Max Appleman (ASFMC). The list of participants who attended the SARC 66 review and the initial agenda are given in Appendix 3.

The results of the review provide the scientific basis for fishery management in the northeast region and the charge to the SARC is to determine whether the scientific assessments are adequate to serve as a basis for developing such fishery management advice.

3. Review Activities

Draft assessment documents, model input and output files, and extensive background material (previous assessments, previous SARC Panel reports, relevant research reports and publications, etc.) were provided to the SARC in advance of the meeting via a FTP site. A file server was provided in the meeting room to provide common access to all presentation material and additional analyses that were conducted during the course of the SARC meeting. I was able to familiarize myself with the assessment reports and supporting documentation ahead of the review meeting.

The major part of the review (days 1-3, 27-29 November) was carried out in open session through a series of presentations on each stock, each of which was structured to address the terms of reference given to the Stock Assessment Workshop (SAW). Questions on points of clarification were raised by the SARC and responded to by lead assessors and/or supporting personnel. Discussions involved the SARC, lead assessors and audience participants either in person or via a meeting conference call. Rapporteurs were appointed to provide detailed

records of all questions and discussions held in open session. Each CIE reviewer and the Chair, participated freely in the entire review and contributed to the discussions on each of the Terms of Reference. Individual roles for each CIE reviewer were not assigned by the Chair.

Stock assessment summary reports were drafted in open session on days 2 and 3. The SARC met in closed session on 30 November to begin drafting their independent reports. The SARC chair was unable to attend day 4 of the meeting to draft the SARC summary report. Hence, the SARC summary report was not reviewed and finalized by the close of the meeting. The chair volunteered to draft a SARC summary report for circulation to the CIE reviewers for comments and amendments as soon as possible after the meeting.

The SARC summary report was not agreed and finalized by the deadline for submission of this Independent Report to the CIE. Hence, I have been unable to elaborate further on any issues raised in the SARC summary report. However, all reviewers agreed on the main outcomes of the review, and I do not anticipate any major discrepancies between my observations and comments in this report and those in the SARC summary report.

4. Assessment reviews

The following sections provide comments separately for each of the stocks under review, structured according to the terms of reference provided to the SAW.
Section 4.1 relates to summer flounder and Section 4.2 relates to striped bass.

4.1 Summer flounder (Paralichthys dentatus)

1. *Estimate catch from all sources including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data. Compare previous recreational data to re-estimated Marine Recreational Information Program (MRIP) data (if available).*

This ToR was adequately addressed.

The sources of data and the methodology adopted to produce input catch data for the assessment of summer flounder were appropriate and acceptable. Landings and discards were estimated separately for the commercial and recreational fleets.

Commercial landings were derived from official records at state and federal level and are assumed to be reported with minimal error. Commercial discard estimates were obtained from an observer program. Recreational catches (landings and discards) were estimated using estimates from the MRIP-calibrated MRFSS/MRIP surveys. Annual dead discard estimates as used in the assessment were derived from experimentally-derived estimates of release mortality. The information and arguments presented to support a discard mortality rate of 10% were clearly articulated.

The time series (1982-2017) of commercial landings data was revised. The revision resulted in only minor changes to the estimates used in previous assessments. Maximum changes were +/- 8%-9% in two years and for the most recent years estimates varied by less than 1% compared to previous estimates.

For the 2018 assessment, recreational catches were replaced with calibrated MRIP estimates. Such estimates resulted in substantive increases in the estimate of recreational catches throughout the time series but especially for more recent years.Compared to previous estimates, the estimated total catch numbers (landings plus dead discards) increased by 24% and total catch weight increased by 29%.

In summary, I consider that this term of reference was adequately addressed and that the data presented form a credible basis for the assessment approach used.

2. *Present the survey data available, and describe the basis for inclusion or exclusion of those data in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Investigate the utility of commercial or recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data.*

This ToR was fully met.

Survey data were very well documented, and I consider that the way the data were treated was appropriate and form a credible scientific basis for use in the assessment.

The available survey data series are varied and are described in detail in the summer flounder assessment report. They consist of two major types;

i) stock-wide surveys conducted by NMFS, and
ii) a series of State-run surveys which are more localized and cover only a relatively small proportion of the distributional range of the stock.

A source of uncertainty associated with previous assessments has been the change of vessel (Albatross to Bigelow) and sampling protocol (including a change in trawl) in 2009 in the NMFS spring and fall surveys. Until now, length-based calibration factors have been used to convert 2009-2017 spring and fall Bigelow survey catch number and weight indices to Albatross equivalents. In line with previous (SARC 57) observations and suggestions, the 2018 Summer Flounder Working Group (SFWG) explored using the Bigelow indices as separate time series (2009-2016/2017), both to more easily incorporate recent research results on the efficiency of the BIG survey gear and to reduce uncertainty due to the Bigelow-to-Albatross calibration.

The Bigelow time series (2009-2016/17) was also converted to 'absolute' stratified mean numbers and weight per tow indices using estimates of trawl efficiency-at-length derived from 'twin trawl sweep study' experiments conducted during 2015-2017. For input to the assessment model, the 'absolute' mean numbers per tow were converted to Survey swept area numbers (SWAN) to give absolute estimates of the population size from the surveys.

All available survey series were incorporated into the assessment model. I agree that this is appropriate on the grounds that there is no strong, objective, *a-priori* reason to exclude one or more survey series.

Available sources of fishery-dependent CPUE and LPUE were investigated as nominal or model-based indices of abundance. Numerous issues with their utility were identified, and I agree with the conclusions of the SFWG that including fishery-dependent indices of

abundance was not necessary because there were sufficient fishery-independent survey indices with sufficient spatial coverage available for use in the assessment model.

The uncertainty associated with all fishery-dependent and fishery-independent indices of abundance appears to have been thoroughly investigated and described.

3. *Describe life history characteristics and the stock's spatial distribution (for both juveniles and adults), including any changes over time. Describe factors related to productivity of the stock and any ecosystem factors influencing recruitment. If possible, integrate the results into the stock assessment.*

This ToR was fully met.

Life history, and spatial distribution of juveniles and adults over time were extensively analyzed and documented. The metrics described were appropriate. The observed decreasing trends in mean length and weight at age in all seasons and for both sexes from the NEFSC surveys appears real and important, but the reasons for such trends remain unknown. In addition there are indications of slower growth but no indication of a change in condition factor. However, a decreasing proportion of females in age groups 2 and older is apparent.

There are known differences in growth rates for males and females and attempts to take such differences in growth and mortality rates were undertaken (see ToR 4 below) as exploratory/confirmatory assessments.

Survey data also indicate that recruitment has been relatively low in recent years compared to the long-term average although the driver for such a reduction has not been identified. Clearly, it would be desirable to understand what mechanisms are responsible for such changes, so that they can be taken into account in future assessments and projections. The observed reduced recruitment coupled with the other observed changes in life history parameters listed above can influence the estimation of biological reference points, stock status and projections of future catches.

The spatial distribution of summer flounder from NEFSC surveys is described appropriately and in detail. In summary, there appears to have been a shift in the centre of gravity of the distribution of the stock to the north and east. Despite attempts by the SFWG to identify the drivers behind such a change, the causes remain unclear and may be attributable to a variety of mechanisms.

4. *Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty. Include retrospective analyses (both historical and within-model) to allow a comparison with previous assessment results and projections, and to examine model fit. Examine sensitivity of model results to changes in re-estimated recreational data.*

This ToR was fully met and the assessment results provide a credible basis for developing fishery management advice.

An age-structured statistical catch-at-age Model (ASAP) was used to estimate population parameters. Such an approach is well established and was used for the previous (2013, SARC 57) summer flounder benchmark assessment.

The ASAP model allows catch data to be assigned to different 'fleets'. In the previous (2013) benchmark assessment, a two-fleet approach was adopted; i) a landings fleet comprising estimated landings at age from the commercial and recreational fisheries, and ii) a discard fleet comprising estimated discards at age from the commercial and recreational fisheries. In the accepted model formulation for the current (2018) benchmark assessment (referred to as Run F2018_BASE_V2), a four-fleet configuration was adopted; i) commercial landings, ii) commercial discards, iii) recreational landings, and iv) recreational discards.

While such a configuration is acceptable, defining separate fleets for commercial and recreational discards at age is prone to give somewhat artificial selectivity profiles for discards. This is because discarding is both a function of what is caught (selectivity due to fishing) and post-catch selection on board the vessel. I suggest it would be more appropriate to treat the commercial and recreational catches (landings plus discards) as two separate fleets and fit selectivity profiles to those, and then derive partial fishing mortality estimates for discards based on the proportions of the catches discarded by each fleet. Modelled in such a way would most likely be more informative for future management, since the potential effects of different management measures for the commercial and recreational fisheries could be investigated without assuming constant selectivity for discards. Nevertheless, the use of the four-fleet approach adopted is unlikely to have had have any major influence on the resulting estimates of fully selected fishing mortalities compared to a 2-fleet (commercial catch fleet and recreational catch fleet) approach.

The ASAP final configuration included all revisions to input catch at age data including the new 'calibrated MRIP' estimates of recreational catch. The increased catch at age estimates seem only to have a minor influence on the estimates of fully recruited F compared to the most recent (2013) benchmark assessment, but have resulted in significantly higher estimates of stock biomass.

The final ASAP configuration also includes all of the available survey indices. I agree with the SFWG that this is appropriate in that there are no objective criteria to exclude one or more survey series.

In arriving at the preferred model configuration, the SFWG carried out numerous investigations of alternative and comparative model formulations and sensitivity tests. These are all well documented and explained, and the WG is to be commended for the extensive and rigorous work undertaken. Comparisons with the previous (2013) assessment formulations were also carried out using the 'old' MRFSS/MRIP catch estimates and the newly-adopted calibrated MRIP estimates.

The results of the preferred 2018 assessment generally show similar qualitative trends in F throughout the time series as the 2013 (SARC 57) benchmark assessment. The same is true for the trends in SSB, although as a result of the inclusion of the much higher calibrated MRIP catches, the SSB is now assessed to be substantially higher than previous estimates.

Comprehensive diagnostics were presented in the SFWG assessment report and model fits to the catch at age were good, but fits to some survey indices were rather poor although these were given low weight in the likelihood and hence had little influence on the assessment results. Retrospective analyses to investigate the stability of the preferred ASAP model estimates were undertaken back to the year 2010. Historically, the summer flounder stock assessment has shown a retrospective pattern of consistent underestimation of F and overestimation of SSB in the terminal year. However, in the current assessment, no persistent retrospective pattern is evident. This, in part, may be due to the revision of the catch data due to the use of the calibrated MRIP estimates for the recreational catch which increased the

total input catch numbers for the 1982-2017 by 29% compared to the 'old' MRFSS/MRIP estimates.

As in the 2013 benchmark and subsequent update assessments, an assumed value for natural mortality of M=0.25 was used in the preferred 2018 benchmark assessment. While the choice of M=0.25 falls within the range of values derived through various life-history methods and previous population modelling approaches (ADAPT, ASAP, SS2), the results of M-profiling with the current ASAP formulation, suggests that M might be lower than assumed, perhaps in the region of M = 0.1- 0.15 although I do not think this is of major concern for the overall results of the assessment or projections.

5. *State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.*

This ToR was met and the recommended biological reference points are suitable to form the basis of management decisions.

The basis for the biological reference points remain unchanged from the previous 2013 benchmark assessment (SARC 57) and are based on stochastic yield and SSB per recruit and stochastic projection models. The threshold fishing mortality reference point is $F_{35\%}$ and is used as a proxy for F_{MSY}. The target reference point for Biomass is the SSB_{MSY} proxy based on stochastic projections at $F_{35\%}$ stock numbers at age on 1 January 2018 and mean recruitment over the entire time series of data from the assessment (1982-2017). The threshold value for biomass is set at one half of the SSB_{MSY} proxy.

The arguments presented in support of choosing $F_{35\%}$ as a proxy for F_{MSY} remain essentially the same as those accepted by the SARC 57, and I agree that such arguments are reasonable and justify the choice. In any case, changing the basis of management reference points without sufficient justification can alter management decisions and may result in unintended consequences. Nevertheless, F35% is likely to be a rather precautionary value and there may be some merit in revisiting the basis for choosing F35% as a proxy for F_{MSY}.

Whereas the basis for defining the BRPs for summer flounder remain the same as the previous assessment (2013, SARC 57), the absolute values vary. The estimated values for F_{MSY} (F=0.448) and MSY (15,973 mt) proxies have increased compared to the previous (2013) estimates of $F_{MSY} = F_{35\%} = 0.309$ and MSY =12,945 mt. Conversely, the target and threshold reference points for biomass are reduced compared to the 2013 estimates. Such increases in the F and MSY reference point proxies and decreases in the biomass reference point proxies result from changes in mean weights at age and the selectivity profiles derived from the assessment model and used for the stochastic long-term projections.

A final point on reference points; differences in growth by sex of summer flounder complicates the derivation of appropriate management reference points. It would therefore be useful to continue to develop and implement an appropriate separate-sex assessment model.

6. *Make a recommendation[a] about what stock status appears to be, based on the existing model (i.e., model from previous peer reviewed accepted assessment) and with respect to a new modeling approach(-es) developed for this peer review.*

a. Update the existing model with new data and make a stock status recommendation (about overfished and overfishing) with respect to the existing BRP estimates.
b. Then use the newly proposed modeling approach(-es) and make a stock status recommendation with respect to "new" BRPs and their estimates (from TOR-5).
c. Include descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

[a] *NOAA Fisheries has final responsibility for making the stock status determination for this stock based on best available scientific information*

This ToR was met.

Stock status according to the 2013 ASAP assessment (SARC 57). Using the accepted SAW 57 ASAP model with 'Old' MRIP data through 2017, F in 2017 = 0.244 and SSB in 2017 = 34,350 mt. The F_{MSY} proxy = $F_{35\%}$ = 0.309, target biomass SSB_{MSY} proxy = $SSB_{MSY35\%}$ = 62,394 mt and threshold biomass ½ SSB_{MSY} proxy = ½ $SSB_{MSY35\%}$ = 31,197 mt. Hence the 'old' (2013) model indicates that in 2017 the stock was not overfished and overfishing was not occurring.

Stock status according to the 2018 ASAP assessment (SARC 66). Using the accepted 2018 ASAP model with new, calibrated MRIP data through 2017, F in 2017 = 0.334 and SSB in 2017 = 44,552 mt. The F_{MSY} proxy = F35% = 0.448, target biomass SSB_{MSY} proxy = $SSB_{MSY35\%}$ = 57,159 mt and threshold biomass ½ SSB_{MSY} proxy = ½ SSB_{MSY}35% = 28,580 mt. Hence the 'new' (2018) model indicates that in 2017 the stock was not overfished and overfishing was not occurring. This assessment of current stock status appears robust to the proxy reference point for F_{MSY} = $F_{35\%}$ and the threshold reference point for biomass = ½ $SSB_{MSY35\%}$.

The SFWG observed that the age structure in the total catch and in NEFSC trawl surveys has expanded since the late 1990s, which is indicative of low total mortality rates and is consistent with the assessment that overfishing is not occurring. At the same time, annual recruitment appears to have varied about the long-term average, which coupled with low mortality rates, has allowed the SSB to rebuild. However, annual recruitment appears to have remained below average since about 2010, and despite the continued low total mortality the spawning stock biomass has declined.

7. *Develop approaches and apply them to conduct stock projections.*

   a. *Provide numerical annual projections (5 years) and the statistical distribution (i.e., probability density function) of the catch at FMSY or an FMSY proxy (i.e. the overfishing level, OFL) (see Appendix to the SAW TORs). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach in which a range of assumptions about the most important uncertainties in the assessment are considered (e.g., terminal year abundance, variability in recruitment).*

b. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions. Identify reasonable projection parameters (recruitment, weight-at-age, retrospective adjustments, etc.) to use when setting specifications.

c. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

This ToR was met.

Two sets of projections to estimate OFL catches for 2019-2013 were presented by the SFWG both of which are illustrative only, since the total catch for 2018 is not yet known. Furthermore, the ABC for 2018 was set based on projections undertaken assuming the 'old' model configuration that used the MRFSS/MRIP recreational catch estimates. Hence the recreational catch for 2018, which will be based on the calibrated MRIP, is likely to be significantly higher than anticipated when the ABC was set. Both sets of projections assume that recent (2013-2017) patterns of fishery selectivity, discarding, maturity at age and mean weight at age, will remain constant and that 100% of the 2018 ABC (5,999 mt) will be caught.

The first set of projections estimate future recruitment by randomly drawing from the estimated time series of recruitment over 1982-2017 (L-T recruitment). The second set of projections estimate future recruitment by randomly drawing from the recent time series of lower than average recruitment over 2011-2017 (S-T recruitment).

The projections will need to be updated with the 2018 catch estimates and re-run because the final 2018 catch is likely to be higher than the 2018 ABC. If that is the case then the projected catches given in the SFWG assessment report will be overestimates.

The projections for both the L-T and S-T recruitment scenarios, indicate that continued fishing at the F_{MSY} proxy $=F_{35\%}$ = F=0.448, gives zero probability of exceeding the fishing mortality threshold and 0% probability of falling below the biomass threshold during 2019-2023.

While drawing randomly from a time series of stock and recruitment observations without incorporating a stock-recruitment relationship is likely to give realistic estimates of future recruitment in the short term, the reliability of the statements relating to the probability of exceeding reference points requires careful interpretation, since such statements assume that the reference points are fixed and known without error, which is not the case.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports and MAFMC SSC reports. Identify new research recommendations.

This ToR was satisfactorily addressed.

Following the 2013 benchmark assessment eight research recommendations were put forward by the SARC and a further eight put forward by the MAFMC SSC. Three additional recommendations have been put forward by the 2018 SAW66. The 2018 SAW SFWG has made significant progress in addressing some of those recommendations. For some others, and for perfectly good reasons, little progress was made, and the SAW has suggested that in such cases, the research recommendations be removed from the list. I tend to agree.

I also think that there is a need to prioritize and justify research recommendations with an emphasis on those that are likely to result in significantly improved assessments and

management advice rather than a wish-list of things that would be useful to find out or document.

I have no specific research recommendations to add to those already proposed by the SARC 57, MAFMC SSC 2013-2018 and the SAW 66, but would support as a priority those recommendations that would permit development and implementation of separate sex assessments. Such assessments, in principle, would improve the utility of the assessment results, and provide more appropriate BRPs and better advice for management.

4.2 Striped bass (Morone saxatilis)

1. *Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources.*

This ToR was met.

An extensive range of fishery-dependent and fishery-independent data were reported in the assessment report, and the data sources and methodologies to process the data were appropriate. The wealth of information is a reflection of the considerable amount of time and effort expended in assembling and analyzing the available data and information. Potential sources of uncertainty are adequately discussed.

The current assessment deals with coastal migratory striped bass which to date have been assessed and managed as a single stock, although the population is known to be comprised of multiple biologically distinct stocks: predominantly, the Chesapeake Bay stock, the Delaware Bay stock, and the Hudson River stock. For the purposes of the 2018 assessment, two stocks are considered;

i) a Chesapeake Bay stock and
ii) an ocean stock (Delaware bay stock + Hudson River stock).

Results from tagging programs are used in the estimation of natural mortality (M) rates and to derive migration rates to and from Chesapeake Bay. In addition, since 1997, M has increased on fish aged 3 and older that do not migrate out of Chesapeake Bay due to a *Mycobacterium* outbreak in that area. Uncertainty in such estimates remains a concern for the robustness of the assessment results, but I consider that the rates used are the best available at this time.

With the exception of the MRIP CPUE, survey data used for the assessment are localized state-run surveys and are described in detail in the assessment report.

2. *Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries. Review new MRIP estimates of catch, effort and the calibration method, if available.*

This ToR was met.

Commercial fisheries data on landings discards were derived from quota monitoring systems, commercial and recreational sampling programs and relevant methods were employed to derive commercial and recreational catch-at-age for each State.

Discard mortality rates for the commercial fisheries were determined through a combination of literature review, review of values used in previous striped bass stock assessments, and new analyses based on commercial fishing data from the New Jersey anchor and drift gill net fisheries and the Maryland pound net fishery.

Commercial dead discard estimates and associated age compositions were derived separately for the Chesapeake Bay, Delaware Bay and Hudson River fisheries using appropriate estimation methods.

Recreational fishery data on catches and harvest were obtained from the MRIP survey (formerly MRFSS). The recreational catches and harvest have been revised using the calibrated MRIP estimates, which has resulted in an increase in the estimate of coastal striped bass harvest (numbers of fish), which on average is 140% higher than previous uncalibrated estimates and a 160% increase in the estimate of live releases. The re-calibrated time series describe a similar trend over time to the uncalibrated estimates in both catch and harvest.

The spatial distribution of the fisheries and catches was effectively described.

Overall, I consider that the derivation of catches and harvest from the commercial and recreational fisheries and the distribution of the fisheries was well described and justified.

3. *Use an age-based model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component and sex, where possible, and for total stock complex.*

2-stock model with migration (2SCA)

Considerable efforts have been made to develop a new assessment model for striped bass. The model developed and put forward by the SAW as the preferred assessment model is a complex two-stock statistical catch-at-age (2SCA) model to estimate separate population characteristics for each stock that are mixed in a common ("ocean") region but the stock composition in the catches from that region is unknown.

The two 'stocks' are:

i) stock 1; the Chesapeake Bay (CB) stock which has a resident population and a component that migrates between the Bay and the "ocean" and
ii) stock 2; the combined Hudson River and Delaware Bay stocks. Both stocks are present in the "ocean" region in varying proportions. Stock 1 is subject to fishing in Chesapeake Bay and the "ocean", whereas Stock 2 is only subject to fishing in the "ocean" region.

The assessment model uses estimated annual migration rates between CB and the ocean during three time periods (Jan-Feb, Mar-June, July-Dec) to estimate the proportions of Stock 1 caught in the "ocean" region.

For each stock, the 2-stock SCA (2SCA) model estimates annual recruitment; stock-, year-, period- and age-specific abundance and fishing mortality; different selectivity functions for the Chesapeake Bay and Ocean catch data and surveys with age composition data; catchability coefficients for surveys and management reference points. It also allows for different natural mortality rates in each stock, region, year and age.

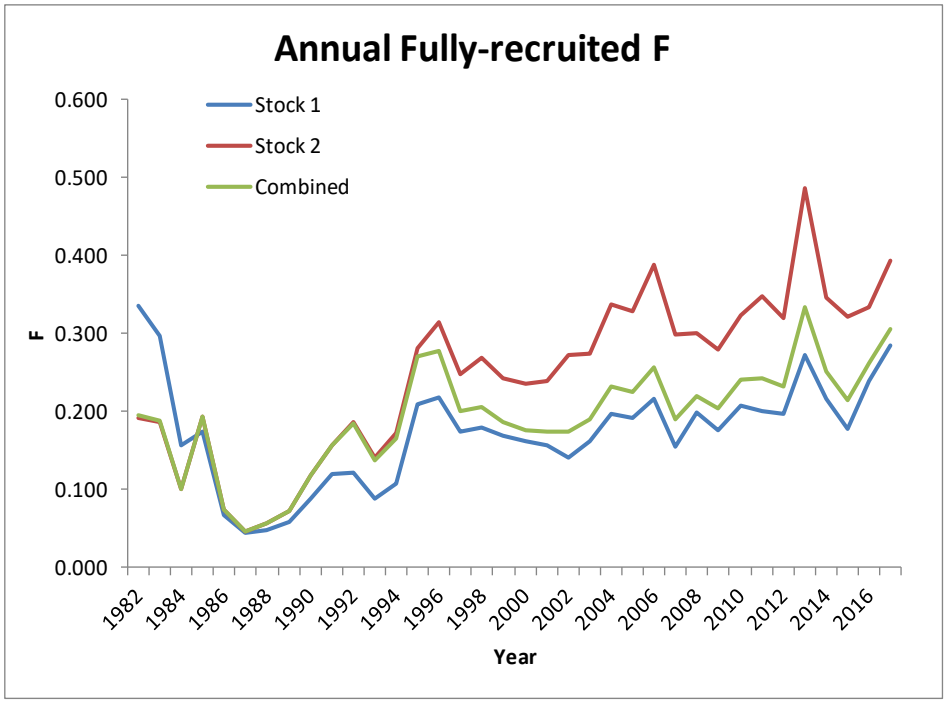
The new model was discussed at length by the SARC. It is a novel and complex approach to assessing the coastal migratory striped bass stock, and the SAW is to be commended for their efforts in developing the model. While conceptually the 2SCA model seems appropriate, I am not convinced that in its current implementation, the results are robust to input assumptions, some of which are rather uncertain.

Sensitivity tests performed to test input assumptions are well documented and explained. However, before the model can be considered a reliable and credible basis for developing management advice, I feel that further testing is required in order to interpret and understand some of the model outputs. For example, I was particularly surprised to see that the results for trends in fully-recruited F for each stock closely mirrored each other (Figure B7.10 of the Assessment report and reproduced below). Similar results were apparent for trends in biomass, which is suspicious given that the two stocks have different life histories and are exploited in different ways.

Other major areas of uncertainty which should be further investigated relate to the following:

i) Estimation of temporal migration rates which are a fundamental characteristic of the model for estimating catches of CB (Stock 1) fish in the "ocean" region and if I am not mistaken, are held constant over time.
ii) A potential bias introduced by assuming that the starting population numbers are determined through natural mortality alone (see equations on page 59 of the assessment report).
iii) The influence of survey indices on model performance and output. Sensitivity tests were undertaken by selectively removing one survey series at a time and examining the influence on model output. However, in fitting the model, high weight was given to the catch data making the test rather redundant. In addition, the commercial catch is assumed to be error free in the model.

Reproduced Figure B7.10 from the assessment report, page 348. Annual fully-recruited F for the Chesapeake Bay (Stock 1) and Hudson River/Delaware bay stocks (Stock 2) of Atlantic striped bass.



The current implementation of the model has implications for estimation of biological reference points (BRPs) and hence for management. This is briefly discussed under ToR 5 below.

Following discussions on the above and other issues, the panel was unanimous in its thinking that although considerable progress has been achieved in developing a 2-stock SCA model for striped bass, at present it would be premature to consider it a credible scientific basis for the development of management advice. Nevertheless, the SAW is to be commended for the novel approach and for the developments achieved to date. The 2SCA approach certainly should be pursued further.

Alternative 2-fleet model

Following the panel's decision not to accept the preferred 2-stock SCA model results as a basis for management advice, the results from the alternative 2-fleet model prepared by the SAW was discussed. This model was based on the 2013 SCA model adopted by the SARC 57, with several changes to model inputs, perhaps the most influential of which was the update of the catch data with calibrated MRIP estimates. The rationale for all such changes is explained and justified in the 2018 assessment report.

In summary, the base model configuration assumed a single stock from which catches could be allocated to two separate fleets; a Chesapeake Bay fleet and a coastal fleet. This differs from the 2013 assessment in that commercial dead releases were included as part of the catches by each fleet, rather than treating them as a separate fleet as was done previously. The time blocks for assessing selectivity for each fleet remained unchanged except for the addition of data for 2017 to the recent time block. All time blocks correspond to management amendments and *a priori*, seem to be appropriate. The number of age-aggregated indices was reduced to six (nine in 2013) and the number of age composition surveys was eight (five in 2013). A new maturity ogive for female maturity was adopted which mainly increased the proportion of mature females in age groups 4 and 5. Finally, the plus-group was set to age group 15+ (13+ in 2013).

A potential source of uncertainty, which was acknowledged by the SAW, is that commercial landings are treated as error free in the model and although the estimates of dead releases are not error free, such error is not accounted for in the model. Sensitivity tests revealed that the model outputs were relatively insensitive to input assumptions. Such a result is not really surprising because the commercial removals are given high weight in the model fit.

Recommended assessment

Following extensive discussion on both assessment approaches, the panel agreed that there was no strong (diagnostic) basis to choose between the two modelling approaches. In principle, a two stock approach should conceptually be better as there is compelling evidence of the existence of two stocks. However, at the present time, there is a need to undertake further testing of the 2-stock model before it can be considered a reliable basis for which to develop management recommendations.

I am in complete agreement with the SARC review panel that the single stock SCA be accepted as the model on which to base management recommendations.

4. *Use tagging data to estimate mortality and abundance, and provide suggestions for further development.*

This ToR was met.

Extensive analyses were undertaken to investigate the plethora of tagging data and information and the details of the data, approach, assumptions and results are meticulously detailed in the 2018 assessment report.

The analyses undertaken were appropriate and the results in terms of magnitude and trends in total mortality rate (Z) are informative and are generally in line with the results of the assessment model although there were variations in the short-term, year–on-year estimates of Z.

I note that partitioning the estimates of Z into F and M is sensitive to the assumed tag reporting rates but that survival rate is not. If the estimated tag reporting rate is higher than the true rate, the way the data are used would result in an overestimation of M and an underestimation of F. Clearly, more confidence in the tag recovery rate estimates is desirable.

5. *Update or redefine biological reference points (BRPs; point estimates or proxies for BMSY, SSBMSY, FMSY, MSY) for each stock component where possible and for the total stock complex. Make a stock status determination based on BRPs by stock component, where possible, and for the total stock complex.*

The analyses undertaken by the SAW on BRPs was in relation to the results of the 2-stock SCA assessment model preferred by the SAW. In the context of evaluating the appropriate assessment modelling approach, panel discussions on the derivation of BRPs from the 2-stock SCA featured heavily.

Of particular concern is the appropriateness and utility of BRPs derived separately for the Chesapeake Bay and “ocean” regions. Such an approach is somewhat artificial as it implies that overfishing can be assigned to a specific fleet (Bay or “ocean”), when in fact, it is a

combination of fishing pressure in both regions that determines the overfishing status of each stock. It would seem more appropriate to define separate BRPs for each stock rather than by fleet. The issue for managers is then how to allocate fishing opportunities in the two regions (Bay or "ocean") so that the desired exploitation rate on each stock can be achieved. To do so really requires that removals from the mixed stock fishery ("ocean") can be allocated to each stock which is not straightforward, and with the current model configuration, allocation relies on the assumptions about immigration rates in the different periods of the year.

Recommended biological reference points

Having agreed that further development and testing of the 2-stock SCA is required before it can be considered a credible basis for the development of management advice, the panel recommended that BRPs be developed based on the alternative single-stock SCA be taken forward. I agree that such reference points form a credible basis for advice and for the development of management decisions.

In the previous 2013 assessment, analyses using parametric approaches applying a variety of stock recruit relationships were attempted, but the analyses produced results that were particularly sensitive to the assumed stock recruit relationships and the SARC57 agreed that the resulting BRPs were not robust enough to be used as a basis for the development of management advice.

It was therefore decided by the SARC 57 that using the estimate of the 1995 SSB as an SSB threshold proxy would be compatible with management objectives. The 1995 SSB estimate was chosen as the most appropriate proxy, because that was a time when the stock was perceived to have recovered after a period of being overfished.

For the present assessment, the panel agreed that the same criteria for defining the SSB threshold should be adopted. Similarly, the SSB target is computed as 125% of the estimate of 1995 female SSB. The F threshold and target are computed as the fishing mortality rates that will maintain the stock at the SSB threshold and target respectively, under long term equilibrium recruitment conditions. While such an approach does not provide direct estimates of F_{MSY} or SSB_{MSY}, I agree it does provide appropriate proxy values, which are adequate for management purposes, and if adhered to, should give high and stable long-term yields.

The resulting estimates for the threshold and target for F reference points from the current assessment (F=0.24 and F= 0.197) are similar in magnitude to those from the 2013 (SARC57) assessment (F=0.22 and F=0.18). However, largely due to the revision of the catch data through incorporation of the calibrated MRIP estimates of recreational catch, the biomass reference points are quite different. The threshold and target values for female SSB from the current assessment are 91,436 mt and 114.295 mt, whereas those from the previous benchmark (2013) were 57,626 mt and 72,032 respectively.

Based on the above assessment, I agree that based on the estimated female spawning stock biomass and fishing mortality in 2017, the stock of Atlantic striped bass is overfished and that overfishing is occurring.

6. *Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.*

This term of reference was successfully addressed and catch projections were based on the single stock SCA assessment outputs.

The projections were carried out appropriately and are relatively insensitive to the assumptions about future recruitment.

It would be informative to managers if future projections could be carried out to investigate the levels of F that would be required to rebuild the stock over differing time-periods.

7. *Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.*

This ToR was met.

The SAW clearly identified those items on the list of research recommendations identified following the SARC 57 where progress had been made. The rather extensive list was categorized into high, moderate and low priority.

In keeping with my opinions relating to research recommendation for summer flounder, I think that thought should to be given to prioritize and justify research recommendations with an emphasis on those that are likely to result in significantly improved assessments and management advice, rather than a wish-list of things that would be useful to find out or document.

With regards to future assessments for striped bass, I would suggest that research effort primarily focus on aiming to further develop and refine the two stock (2SCA) assessment model. The efforts already deployed in developing the model have been extensive and worthwhile, and while at present it would be premature to base management decisions on the model outputs, conceptually it has the potential to provide a credible basis for management decision-making. To this end, there are a number of areas that would benefit from further exploration and refinement.

The pertinent areas for research essentially relate to further testing of the model and input data and assumptions:

1. Fitting the model is sensitive to the estimates of migration between Chesapeake Bay and the "ocean" areas. A better understanding on any temporal variation in the migration rates is highly desirable. If possible further exploration of alternative ways to utilize the available tagging data may prove fruitful in this respect.
2. Further exploration of the appropriateness and derivation of biological reference points for two separate stocks with migration and taking into account exploitation when the stocks are mixed.
3. The results from the existing 2SCA model indicate surprisingly similar trends in population parameters. The reasons for the similarity need to be investigated and if possible clarified.
4. The current implementation of the model assumes that selectivity remains constant across periods within a region & year. The sensitivity of the model to such an assumption should be tested and if possible research undertaken to assess whether it is

likely to be realistic for striped bass. In addition, the utility of the 2-stock (2SCA) model may be enhanced if selectivity patterns could be estimated for different time periods to account for seasonal fisheries that exert different selectivity patterns. Such an enhancement seems not to be a crucial for the assessment of striped bass at present, but the model can potentially be re-configured to be used for assessments of other stocks.

5. A major step forward would be achieved if some reliable means to disaggregate the "ocean" area catches into their respective stock components could be developed. The use of modern genetic techniques might be a feasible approach to investigate, since the costs associated with such techniques have plummeted in recent years and a large number of samples can be processed at relatively little cost. Perhaps such techniques could also be used to investigate historically-collected material, e.g., otoliths and/or scales.

Conclusions

The teams responsible for the 2018 assessment of summer flounder and striped bass have undertaken thorough and extensive analyses and research investigations to prepare age-based analytical assessments. The assessment reports and the presentations during the review have provided an excellent basis to judge the quality and utility of the assessments and results. Data on landings and discards and indices from numerous surveys were appropriately compiled and used. The models put forward as the basis for management generally appear robust to a range of input parameters and assumptions and the diagnostics of the model fits are generally acceptable.

I hope that the points raised in this report and the SARC summary report are received in the spirit that they are intended; that is to offer constructive criticism and encouragement to undertake further investigations with a view to producing even better assessments and advice for management in the future.

Both teams are to be commended on a job well done.

5. Appendix 1: Bibliography of materials provided for review

A – Summer flounder

Deen S, Jauss V, Sullivan PJ. 2018 MS. The effect of ocean environmental conditions on the relative abundance of summer flounder (*Paralichthys dentatus*): spatio-temporal analysis and model comparison using R-INLA. Cornell University, Ithaca NY. SAW/SARC 66 Summer Flounder Working Group Working Paper. 46 p.

Gervelis BJ. 2018 MS. Summer flounder CPUE derived from Cooperative Research Study Fleet self-reported data. NOAA Fisheries NEFSC Cooperative research Branch Narragansett RI. SAW/SARC 66 Summer Flounder Working Group Working Paper. 9 p.

Langan JA, McManus MC, Schonfeld AJ, Truesdale CL, Collie JS. 2018 MS. Evaluating summer flounder (*Paralichthys dentatus*) spatial sex-segregation in a southern New England estuary. University of Rhode Island Graduate School of Oceanography. SAW/SARC 66 Summer Flounder Working Group Working Paper. 20 p.

Maunder MN. 2018a MS. Stock synthesis implementation of a sex-structured virtual population analysis applied to summer flounder. SAW/SARC 66 Summer Flounder Working Group Working Paper. 6 p.

Maunder MN. 2018b MS. Dynamic reference points for summer flounder. SAW/SARC 66 Summer Flounder Working Group Working Paper 12 p.

McNamee J. 2018 MS. Investigating alternative abundance indices for the summer flounder assessment. SAW/SARC 66 Summer Flounder Working Group Working Paper. 45 p.

Miller A, Terceiro M. 2018a MS. Spatial distribution of summer flounder captured in the commercial and recreational fisheries. SAW/SARC 66 Summer Flounder Working Group Working Paper. 18 p.

Miller A, Terceiro M. 2018b MS. Spatial distribution of summer flounder sampled by the NEFSC trawl survey. SAW/SARC 66 Summer Flounder Working Group Working Paper. 87 p.

Miller TJ, Terceiro M. 2018a MS. A state-space, sex-specific, age-structured assessment model for summer flounder. SAW/SARC 66 Summer Flounder Working Group Working Paper. 25 p.

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Sullivan PJ. 2018 MS. A sex-age-length fisheries stock assessment model with analysis and application to summer flounder (*Paralichthys dentatus*). SAW/SARC 66 Summer Flounder Working Group Working Paper. 38 p.

Terceiro M. 2016. Stock Assessment of Summer Flounder for 2016. US Department of Commerce, Northeast Fisheries Science Center Reference Doc. 16-15; 117 p. Available at http://nefsc.noaa.gov/publications

Terceiro M. 2017 MS. The summer flounder ASAP statistical catch at age model by sex. SAW/SARC 66 Summer Flounder Working Group Working Paper. 19 p.

B – Striped bass

ASMFC. 2003. Amendment #6 to the Interstate Fishery Management Plan for Atlantic Striped Bass. Washington (DC): ASMFC. Fisheries Management Report No. 41. 63 p.

Dorazio RM, Hattala KA, McCollough CB, Skjeveland JE. 1994. Tag recovery estimates of migration of striped bass from spawning areas of the Chesapeake Bay. Transactions of the American Fisheries Society 123:950–963.

Jiang H, Pollock KH, Brownie C, Hoenig JM, Latour RJ, Wells BK, Hightower JE. 2007. Tag Return Models Allowing for Harvest and Catch and Release: Evidence of Environmental and Management Impacts on Striped Bass Fishing and Natural Mortality Rates. North American Journal of Fisheries Management 27:387–396.

Kneebone, J., WS Hoffman, MJ Dean, DA Fox and MP. Armstrong. 2014. Movement Patterns and Stock Composition of Adult Striped Bass Tagged in Massachusetts Coastal Waters, Transactions of the American Fisheries Society 143: 1115-1129.

Northeast Fisheries Science Center. 2013a. 57th Northeast Regional Stock Assessment Workshop (57th SAW) Assessment Summary Report. US Department of Commerce, Northeast Fisheries Science Center Reference Doc. 13-14; 39 p.

Northeast Fisheries Science Center. 2013b. 57th Northeast Regional Stock Assessment Workshop (57th SAW) Assessment Report Part B. Striped Bass Stock Assessment for 2013, Updated through 2011. US Department of Commerce, Northeast Fisheries Science Center Reference Doc. 13-16; 290 p.

Northeast Fisheries Science Center. 2013c. 57th Northeast Regional Stock Assessment Workshop (57th SAW) Assessment Report Part B. Appendices. US Department of Commerce, Northeast Fisheries Science Center Reference Doc. 13-16; 186 p.

Northeast Fisheries Science Center. 2013d. Summary Report of the 57th Northeast Regional Stock Assessment Review Committee (SARC 57). 47 p.

Shepherd GR, Nelson GA, Rago PJ, Richards RA, Boreman J, Goodyear CP. 2018. A Chronicle of Striped Bass Population Restoration and Conservation in the Northwest Atlantic, 1979-2016. NOAA Tech Memo NMFS NE-246; 51 p.

SARC Working Papers

Working Group, Stock Assessment Workshop (SAW 66) 2018. Stock Assessment Report for Summer Flounder. Working Paper A1 SAW/SARC 66. November 27-30, 2018, NOAA Fisheries, Northeast Fisheries Science Center. Woods Hole, MA.

Working Group, Stock Assessment Workshop (SAW 66) 2018. Stock Assessment Report for Striped Bass. Working Paper B1. SAW/SARC66. November 27-30, 2018, NOAA Fisheries, Northeast Fisheries Science Center. Woods Hole, MA.

Working Group, Stock Assessment Workshop (SAW 66) 2018. Stock Assessment Summary Report for Summer Flounder. Working Paper A2. SAW/SARC 66, November 27-30, 2018, NOAA Fisheries, Northeast Fisheries Science Center, Woods Hole, MA.

Working Group, Stock Assessment Workshop (SAW 66) 2018. Stock Assessment Summary Report for Striped Bass. Working Paper B2. SAW/SARC 66, November 27-30, 2018, NOAA Fisheries, Northeast Fisheries Science Center, Woods Hole, MA.

Additional Documents

Cover letter for the "Public testimony for the summer flounder independent expert review". Dated: Nov. 15, 2018. From: Save the Summer Flounder Fishery Fund, Greg Hueth, Chairman.

"Public testimony for the summer flounder independent expert review". From: Save the Summer Flounder Fishery Fund. Nov. 2018.

6. Appendix 2 – Performance Work Statement

Performance Work Statement (PWS)

National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Center for Independent Experts (CIE) Program
External Independent Peer Review

66th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC)
Benchmark stock assessment for Summer flounder and Striped bass

Background

The National Marine Fisheries Service (NMFS) is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NMFS science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards[1]. Further information on the Center for Independent Experts (CIE) program may be obtained from www.ciereviews.org.

Scope

The Northeast Regional Stock Assessment Review Committee (SARC) meeting is a formal, multiple-day meeting of stock assessment experts who serve as a panel to peer-review tabled stock assessments and models. The SARC peer review is the cornerstone of the Northeast Stock Assessment Workshop (SAW) process, which includes assessment development, and report preparation (which is done by SAW Working Groups or Atlantic States Marine Fisheries Commission (ASMFC) technical committees), assessment peer review (by the SARC), public presentations, and document publication. This review determines whether or not the scientific assessments are adequate to serve as a basis for developing fishery management advice. Results provide the scientific basis for fisheries within the jurisdiction of NOAA's Greater Atlantic Regional Fisheries Office (GARFO).

[1] http://www.cio.noaa.gov/services_programs/pdfs/OMB_Peer_Review_Bulletin_m05-03.pdf

The purpose of this meeting will be to provide an external peer review of a benchmark stock assessment **Summer flounder and Striped bass**. The requirements for the peer review follow. This Statement of Work (PWS) also includes: **Appendix 1**: TORs for the stock assessment, which are the responsibility of the analysts; **Appendix 2:** a draft meeting agenda; **Appendix 3:** Individual Independent Review Report Requirements; and **Appendix 4:** SARC Summary Report Requirements.

Requirements

NMFS requires three reviewers under this contract (i.e. subject to CIE standards for reviewers) to participate in the panel review. The SARC chair, who is in addition to the three reviewers, will be provided by either the New England or Mid-Atlantic Fishery Management Council's Science and Statistical Committee; although the SARC chair will be participating in this review, the chair's participation (i.e. labor and travel) is not covered by this contract.

Each reviewer will write an individual review report in accordance with the PWS, OMB Guidelines, and the TORs below. All TORs must be addressed in each reviewer's report. No more than one of the reviewers selected for this review is permitted to have served on a SARC panel that reviewed this same species in the past. The reviewers shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Expertise should include forward projecting statistical catch-at-age (SCAA) models. Reviewers should also have experience in evaluating measures of model fit, identification, uncertainty, and forecasting. Reviewers should have experience in development of Biological Reference Points (BRPs) that includes an appreciation for the varying quality and quantity of data available to support estimation of BRPs. For summer flounder, knowledge of flatfish biology and population dynamics would be useful. For striped bass, knowledge of anadromous species and SCAA models with spatial considerations would be useful.

Tasks for Reviewers

- Review the background materials and reports prior to the review meeting
- Attend and participate in the panel review meeting
    - The meeting will consist of presentations by NOAA and other scientists, stock assessment authors and others to facilitate the review, to provide any additional information required by the reviewers, and to answer any questions from reviewers
- Reviewers shall conduct an independent peer review in accordance with the requirements specified in this PWS and TORs, in adherence with the required formatting and content guidelines; reviewers are not required to reach a consensus.
- Each reviewer shall assist the SARC Chair with contributions to the SARC Summary Report
- Deliver individual Independent Review Reports to the Government according to the specified milestone dates
- This report should explain whether each stock assessment Term of Reference of the SAW was or was not completed successfully during the SARC meeting, using the criteria specified below in the "Tasks for SARC panel."
- If any existing Biological Reference Points (BRP) or their proxies are considered inappropriate, the Independent Report should include recommendations and

justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRPs are the best available at this time.

- During the meeting, additional questions that were not in the Terms of Reference but that are directly related to the assessments may be raised. Comments on these questions should be included in a separate section at the end of the Independent Report produced by each reviewer.
- The Independent Report can also be used to provide greater detail than the SARC Summary Report on specific stock assessment Terms of Reference or on additional questions raised during the meeting.

Tasks for SARC panel

- During the SARC meeting, the panel is to determine whether each stock assessment Term of Reference (TOR) of the SAW was or was not completed successfully. To make this determination, panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. If alternative assessment models and model assumptions are presented, evaluate their strengths and weaknesses and then recommend which, if any, scientific approach should be adopted. Where possible, the SARC chair shall identify or facilitate agreement among the reviewers for each stock assessment TOR of the SAW.
- If the panel rejects any of the current BRP or BRP proxies (for B_{MSY} and F_{MSY} and MSY), the panel should explain why those particular BRPs or proxies are not suitable, and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing BRPs or BRP proxies are the best available at this time.
- Each reviewer shall complete the tasks in accordance with the PWS and Schedule of Milestones and Deliverables below.

Tasks for SARC chair and reviewers combined:

Review both the Assessment Report and the draft Assessment Summary Report. The draft Assessment Summary Report is reviewed and edited to assure that it is consistent with the outcome of the peer review, particularly statements about stock status recommendations and descriptions of assessment uncertainty.

The SARC Chair, with the assistance from the reviewers, will write the SARC Summary Report. Each reviewer and the chair will discuss whether they hold similar views on each stock assessment Term of Reference and whether their opinions can be summarized into a single conclusion for all or only for some of the Terms of Reference of the SAW. For terms where a similar view can be reached, the SARC Summary Report will contain a summary of such opinions. In cases where multiple and/or differing views exist on a given Term of Reference, the SARC Summary Report will note that there is no agreement and will specify - in a summary manner – what the different opinions are and the reason(s) for the difference in opinions.

The chair's objective during this SARC Summary Report development process will be to identify or facilitate the finding of an agreement rather than forcing the panel to reach an agreement. The chair will take the lead in editing and completing this report. The chair may

express the chair's opinion on each Term of Reference of the SAW, either as part of the group opinion, or as a separate minority opinion. The SARC Summary Report will not be submitted, reviewed, or approved by the Contractor.

If any existing Biological Reference Points (BRP) or BRP proxies are considered inappropriate, the SARC Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRP proxies are the best available at this time.

Foreign National Security Clearance
When reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, country of birth, country of citizenship, country of permanent residence, country of current residence, dual citizenship (yes, no), passport number, country of passport, travel dates.) to the NEFSC SAW Chair for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/ and http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-national-registration-system.html. The contractor is required to use all appropriate methods to safeguard Personally Identifiable Information (PII).

Place of Performance
The place of performance shall be at the contractor's facilities, and at the Northeast Fisheries Science Center in Woods Hole, Massachusetts.

Period of Performance
The period of performance shall be from the time of award through January 31, 2019. Each reviewer's duties shall not exceed **16** days to complete all required tasks.

Schedule of Milestones and Deliverables: The contractor shall complete the tasks and deliverables in accordance with the following schedule.

No later than Oct. 26, 2018	Contractor selects and confirms reviewers
No later than Nov. 13, 2018	NMFS Project Contact will provide reviewers the pre-review documents
Nov. 27-30, 2018	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
Nov. 30, 2018	SARC Chair and reviewers work at drafting reports during meeting at Woods Hole, MA, USA

Dec. 14, 2018	Reviewers submit draft independent peer review reports to the contractor's technical team for review
Dec. 14, 2018	Draft of SARC Summary Report, reviewed by all reviewers, due to the SARC Chair *
Dec. 21, 2018	SARC Chair sends Final SARC Summary Report, approved by reviewers, to NMFS Project contact (i.e., SAW Chairman)
Jan. 2, 2019	Contractor submits independent peer review reports to Government
Jan. 9, 2019	The COR and/or technical POC distributes the final reports to the NMFS Project Contact

* The SARC Summary Report will not be submitted to, reviewed, or approved by the Contractor.

Applicable Performance Standards

The acceptance of the contract deliverables shall be based on three performance standards: (1) The reports shall be completed in accordance with the required formatting and content (2) The reports shall address each TOR as specified (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Travel

All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (http://www.gsa.gov/portal/content/104790). International travel is authorized for this contract. Travel is not to exceed $12,000.

Restricted or Limited Use of Data

The contractors may be required to sign and adhere to a non-disclosure agreement.

NMFS Project Contact

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Appendix 1. Stock Assessment Terms of Reference for SAW/SARC-66

The SARC Review Panel shall assess whether or not the SAW Working Group has reasonably and satisfactorily completed the following actions.

The stock assessments for SAW/SARC66 require new calibrated catch and effort data from the Marine Recreational Information Program (MRIP). For these assessments to happen, the assessment scientists need the new MRIP data in a form ready for analysis by July 1, 2018.

A. Summer flounder

1. Estimate catch from all sources, including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data. Compare previous recreational data to re-estimated Marine Recreational Information Program (MRIP) data (if available).

2. Present the survey data available, and describe the basis for inclusion or exclusion of those data in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Investigate the utility of commercial or recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data.

3. Describe life history characteristics and the stock's spatial distribution (for both juveniles and adults), including any changes over time. Describe factors related to productivity of the stock and any ecosystem factors influencing recruitment. If possible, integrate the results into the stock assessment.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty. Include retrospective analyses (both historical and within-model) to allow a comparison with previous assessment results and projections, and to examine model fit. Examine sensitivity of model results to changes in re-estimated recreational data.

5. State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

6. Make a recommendation[a] about what stock status appears to be, based on the existing model (i.e., model from previous peer reviewed accepted assessment) and with respect to a new modeling approach(-es) developed for this peer review.
    a. Update the existing model with new data and make a stock status recommendation (about overfished and overfishing) with respect to the existing BRP estimates.

b. Then use the newly proposed modeling approach(-es) and make a stock status recommendation with respect to "new" BRPs and their estimates (from TOR-5).
c. Include descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc).

7. Develop approaches and apply them to conduct stock projections.
    a. Provide numerical annual projections (5 years) and the statistical distribution (i.e., probability density function) of the catch at F_{MSY} or an F_{MSY} proxy (i.e. the overfishing level, OFL) (see Appendix to the SAW TORs). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach in which a range of assumptions about the most important uncertainties in the assessment are considered (e.g., terminal year abundance, variability in recruitment).
    b. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions. Identify reasonable projection parameters (recruitment, weight-at-age, retrospective adjustments, etc.) to use when setting specifications.
    c. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports and MAFMC SSC reports. Identify new research recommendations.

[a]NOAA Fisheries has final responsibility for making the stock status determination for this stock based on best available scientific information.

B. Striped bass

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources.

2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries. Review new MRIP estimates of catch, effort and the calibration method, if available.

3. Use an age-based model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component and sex, where possible, and for total stock complex.

4. Use tagging data to estimate mortality and abundance, and provide suggestions for further development.

5. Update or redefine biological reference points (BRPs; point estimates or proxies for BMSY, SSBMSY, FMSY, MSY) for each stock component where possible and for the total stock complex. Make a stock status determination based on BRPs by stock component, where possible, and for the total stock complex.

6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.

7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

SAW Assessment TORs:

Clarification of Terms
used in the Stock Assessment Terms of Reference

Guidance to SAW Working Group about "Number of Models to include in the Assessment Report":

In general, for any TOR in which one or more models are explored by the Working Group, give a detailed presentation of the "best" model, including inputs, outputs, diagnostics of model adequacy, and sensitivity analyses that evaluate robustness of model results to the assumptions. In less detail, describe other models that were

evaluated by the Working Group and explain their strengths, weaknesses and results in relation to the "best" model. If selection of a "best" model is not possible, present alternative models in detail, and summarize the relative utility each model, including a comparison of results. It should be highlighted whether any models represent a minority opinion.

On "Acceptable Biological Catch" (DOC Nat. Stand. Guidelines. Fed. Reg., v. 74, no. 11, 1-16-2009):

Acceptable biological catch (ABC) is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of Overfishing Limit (OFL) and any other scientific uncertainty…" *(p. 3208) [In other words, OFL ≥ ABC.]*

ABC for overfished stocks. For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. *(p. 3209)*

NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)

ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, Optimal Yield (OY) does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

On "Vulnerability" (DOC Natl. Stand. Guidelines. Fed. Reg., v. 74, no. 11, 1-16-2009):

"Vulnerability. A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce Maximum Sustainable Yield (MSY) and to recover if the population is depleted, and susceptibility is the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality)." (p. 3205)

Participation among members of a Stock Assessment Working Group:

Anyone participating in SAW meetings that will be running or presenting results from an assessment model is expected to supply the source code, a compiled executable, an input file with the proposed configuration, and a detailed model description in advance of the model meeting. Source code for NOAA Toolbox programs is available on request. These measures allow transparency and a fair evaluation of differences that emerge between models.

Appendix 2. Draft Review Meeting Agenda

{Final Meeting agenda to be provided at time of award}

65th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC)
Benchmark stock assessment for A. Summer flounder and B. Striped bass

November 27-30, 2018

Stephen H. Clark Conference Room – Northeast Fisheries Science Center
Woods Hole, Massachusetts

DRAFT AGENDA* (version: June 14, 2018)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Tuesday, Nov. 27

10 – 10:45 AM
Welcome/Description of Review Process — **James Weinberg**, SAW Chair
Introductions/Agenda — **TBD,** SARC Chair
Conduct of Meeting

10:45 – 12:45 PM Assessment Presentation (A. Summer flounder)
Mark Terceiro **TBD**

12:45 – 1:45 PM Lunch

1:45 – 3:45 PM Assesssment Presentation (A. Summer flounder)
Mark Terceiro **TBD**

3:45 – 4 PM Break

4 – 5:45 PM SARC Discussion w/ Presenters (A. Summer flounder)
TBD, SARC Chair **TBD**

5:45 – 6 PM Public Comments

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Wednesday, Nov. 28

8:30 – 10:30 AM Assessment Presentation (B. Striped bass)
Katie Drew **TBD**

10:30 – 10:45 AM Break

10:45 – 12:30 PM Assessment Presentation (B. Striped bass)
Katie Drew **TBD**

12:30 – 1:30 PM Lunch

1:30 – 3:30 PM SARC Discussion w/presenters (B. Striped bass)
TBD, SARC Chair **TBD**

3:30 – 3:45 PM Public Comments

3:45 -4 PM Break

4 – 6 PM Revisit with Presenters (A. Summer flounder)
TBD, SARC Chair **TBD**

7 PM **(**Social Gathering**)**

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Thursday, Nov. 29

8:30 – 10:30	Revisit with Presenters (B. Striped bass)	**TBD,**	**TBD**
10:30 – 10:45	Break		
10:45 – 12:15	Review/Edit Assessment Summary Report (A. Summer flounder)	**TBD,**	**TBD**
12:15 – 1:15 PM	Lunch		
1:15 – 2:45 PM	(cont.) Edit Assessment Summary Report (A. Summer flounder)	**TBD,**	**TBD**
2:45 – 3 PM	Break		
3 – 6 PM	Review/edit Assessment Summary Report (B. Striped bass)	**TBD,**	**TBD**

Friday, Nov. 30

9:00 AM – 5:00 PM	SARC Report writing

*All times are approximate, and may be changed at the discretion of the SARC chair. The meeting is open to the public; however, during the Report Writing sessions we ask that the public refrain from engaging in discussion with the SARC.

Appendix 3. Individual Independent Peer Review Report Requirements

1. The independent peer review report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The report must contain a background section, description of the individual reviewers' roles in the review activities, summary of findings for each TOR in which the weaknesses and strengths are described, and conclusions and recommendations in accordance with the TORs. The independent report shall be an independent peer review, and shall not simply repeat the contents of the SARC Summary Report.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each TOR even if these were consistent with those of other panelists, but especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the SARC Summary Report that they believe might require further clarification.

   d. The report may include recommendations on how to improve future assessments.

3. The report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of this Statement of Work
   Appendix 3: Panel membership or other pertinent information from the panel review meeting.

Appendix 4. SARC Summary Report Requirements

1. The main body of the report shall consist of an introduction prepared by the SARC chair that will include the background and a review of activities and comments on the appropriateness of the process in reaching the goals of the SARC. Following the introduction, for each assessment reviewed, the report should address whether or not each Term of Reference of the SAW Working Group was completed successfully. For each Term of Reference, the SARC Summary Report should state why that Term of Reference was or was not completed successfully.

   To make this determination, the SARC chair and reviewers should consider whether or not the work provides a scientifically credible basis for developing fishery management advice. If the reviewers and SARC chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions.

   The report may include recommendations on how to improve future assessments.

2. If any existing Biological Reference Points (BRPs) or BRP proxies are considered inappropriate, include recommendations and justification for alternatives. If such alternatives cannot be identified, then indicate that the existing BRPs or BRP proxies are the best available at this time.

3. The report shall also include the bibliography of all materials provided during the SAW, and relevant papers cited in the SARC Summary Report, along with a copy of the CIE Statement of Work.

   The report shall also include as a separate appendix the assessment Terms of Reference used for the SAW, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice.

7. Appendix 3: Panel Membership and other attendees.

SARC Panel.

Robert Latour (Chair)	Virginia Institute of Marine Science	latour@vims.edu
Yan Jiao	Virginia Tech University	yjiao@vt.edu
Robin Cook	University of Strathclyde, Glasgow, UK	melford@clara.co.uk
John Casey	Independent Consultant	blindlemoncasey@gmail.com

Other Attendees

Russell Brown	NEFSC	russell.brown@noaa.gov
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Mark Terceiro	NEFSC	mark.terceiro@noaa.gov
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