Report on the 57th North East Regional Stock Assessment Review Committee (SARC)

By

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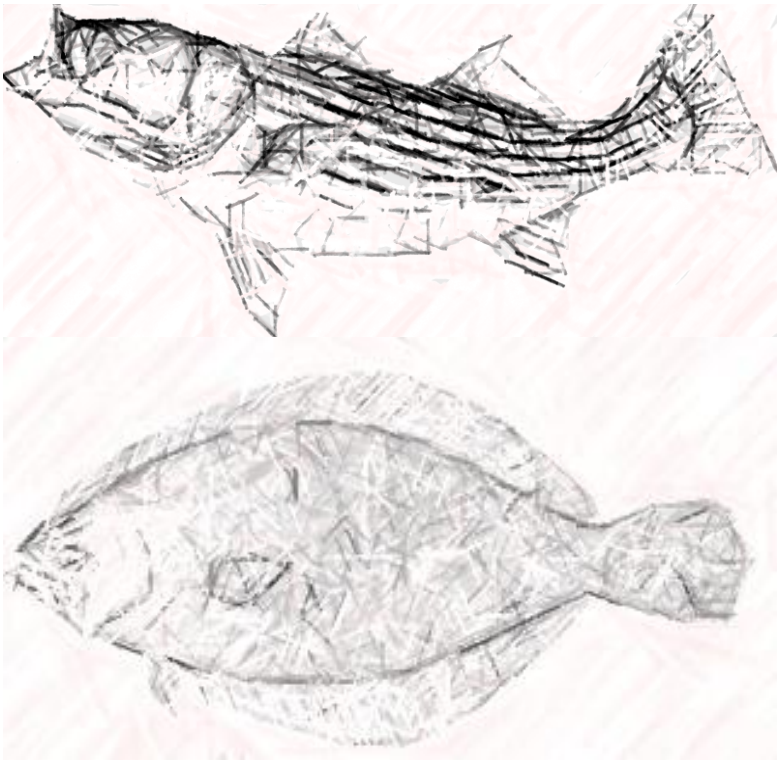
Prepared for
Center for Independent Experts



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Executive Summary

1. Stock assessments of summer flounder and striped bass were reviewed by a panel of three Center for Independent Experts (CIE) reviewers and chaired by Dr. Cynthia Jones in Woods Hole, MA from 23-26 July 2013. Draft stock assessment reports were available approximately one week prior to the review. The panel discussed aspects of the assessment with assessment leaders and indicated changes to the stock summary reports. The Panel prepared a draft SARC57 summary report at the end of the meeting.

Summer Flounder

2. Catch data were available from the commercial and recreational fisheries and included discards. The recreation dead discards are estimated from an uncertain release mortality which adds to uncertainty in the assessment. It might be preferable to include observed live catches of flounder from the recreational fishery as data for the model rather than pre-process them by applying an uncertain mortality.
3. A large number of state and federal surveys are available and an agreed selection protocol applied in choosing the series to use in the assessment. Commercial LPUE indices were investigated but not used in the assessment and this appears to be the correct decision.
4. Sexually dimorphic growth was investigated but it was not possible to apply NEFSC survey data to split catch data by sex due to differences in the proportions of sexes occurring in the survey and the recreational catch. This may lead to some bias in the estimates of age specific mortality rates and on the calculation of MSY reference points.
5. Catch at age analysis was performed using the ASAP model. Comprehensive diagnostics of model fit and uncertainty are provided. The assessment provides a robust summary of stock trends. The split of the catch data into landings and discard "fleets" by the assessment working group was considered artificial and it would be preferable to split catches by true fleet. This issue, however, is unlikely to affect the estimation of total F and SSB.
6. Biological reference points based on F30% and on the current F35% criterion were calculated. Only very small gains in catch can be expected from moving to F30% reference values at the expense of moderate losses to SSB. It was concluded that the F35% reference points should be retained. Based on these proxies, the stock is not overfished and overfishing is not occurring. This is consistent with previous analyses.
7. Projections are provided based on the standard AGEPRO package. Considerable care is necessary in the interpretation of the probability statements that relate to exceeding reference points as they are conditioned on the assumption that reference points are fixed and known without error. The projections are based on close-to-status quo conditions and should be fairly robust and hence provide an adequate basis for management.
8. Progress on research recommendations is provided by the working group and shows more progress on some areas than others. Given the open ended nature of research

recommendations it may be preferable to ask working groups to limit their recommendations to a short list of 5-10 topics in order to focus on areas of greatest priority.

Striped Bass

9. Available survey data comprise surveys of the whole stock area performed by the NEFSC and a number of state surveys that typically cover a limited geographical area. These are listed and described. Few recent surveys cover the whole stock area, which is an important source of uncertainty in the assessment. Some surveys appear to have a large effect on the model results, such as the MRFSS, which is considered to have lower precision.
10. Tagging data were used to estimate natural mortality, which gave higher values than used in previous assessments that were based on life history traits. The analysis appears to be the best available at present and is appropriate for use in the current assessment. It is believed M has been higher in recent years due to disease prevalence in Chesapeake Bay.
11. It is clear from the sex ratios at age that survival rates of males and females differ, which means the current estimates of M are composite values. If possible it would be desirable to try to estimate sex dependent values of M in the future.
12. Catch data were available from the commercial and recreational fishery and included discards. The recreation dead discards are estimated from an uncertain release mortality, which adds to uncertainty in the assessment, and since the recreational catch comprises the larger share of the total, this may be an important source of uncertainty and possible bias. In common with summer flounder, it might be preferable to include observed live catches from the recreational fishery as data for the model rather than pre-process them by applying an uncertain mortality.
13. Catch at age analysis was performed using the SCA model. Comprehensive diagnostics of model fit and uncertainty were provided. The assessment provides a robust summary of stock trends. The split of the catch data into two area fleets and one discard fleet covering the whole area was considered artificial and it would be preferable to split catches by true fleet. This issue, however, is unlikely to affect the estimation of total F and SSB.
14. Tagging data analyses are presented that suggest fishing mortality as estimated from these data are similar to the main assessment. However, the analysis suggests that while the overall estimates of Z are fairly robust, the partitioning of Z between F and M is sensitive to the assumption on tag reporting rates. An obvious further development of the assessment would be to include the tagging data in the SCA model.
15. Biological reference points were calculated but there are important qualifications to the analysis presented. There was confusion about the appropriate use of recruitment models in the various analyses and the use of bias correction when simulating recruitment from statistical distributions. The inconsistencies were investigated during the meeting and largely resolved, but it did emerge that the MSY reference points were highly sensitive to the choice of structural recruitment model. It appeared therefore that it was preferable to retain the existing SSB 1995 reference point and its associated F value.
16. Catch projections were supplied and an extensive range of sensitivity tests support the conclusion that the forecast is robust. However, the projections need to be re-run with the

same model as was used for calculation of the F reference points as this differs from the models used in the projections, leading to potential inconsistency. In striped bass, since fish are fully recruited by the age 4-5, the recruitment model should only have a minor effect on projections.

17. The working group usefully classified research recommendations into three categories of priority. Undoubtedly the recommendations are in themselves quite reasonable and likely to improve assessments in the future if successfully carried out. As with summer flounder it might be useful if working groups limited their recommendations to their top 5 or 10 priorities that are likely to have the greatest impact in improving the assessment.

Recommendations

18. ***Every effort should be made to try to develop whole area abundance indices from the state surveys through better co-ordination, adoption of common sampling protocols and statistical modelling. (The context and more details are provided in paragraph 86 below.)***
19. ***Future assessments should model true fleets (commercial, recreational, etc) and discards should be modeled using a retention ogive acting after fleet selectivity. (paragraphs 46,72, 87)***
20. ***The assessment model should be modified to use the raw recreational release data by changing the observation equation in the model. Release mortality could then be included in the model as a constant, or preferably as a parameter with an informative prior. This would enable a more comprehensive evaluation of the sensitivity of the assessment to release mortality. (paragraphs 33,50, 67,74, 88)***
21. ***Exploratory analyses should be performed for both summer flounder and striped bass, based on current data, to investigate the sensitivity of the assessments to sexually dimorphic growth and survival. This will help evaluate the need to collect additional data and improve the assessment. (paragraphs 42, 64, 75, 80, 89)***
22. ***Further work should be undertaken to model the stock recruitment relationship for striped bass and estimate MSY reference points. As a minimum it should be possible to establish an SSB that produces adequate recruitment. (paragraphs 79,80,90)***
23. ***The projection software should be modified to include the uncertainty in BRPs so that probability statements on exceeding BRPs are more realistic. (paragraphs 56, 91)***
24. ***A protocol should be established to filter research recommendations at the working group level so that only the highest priority topics are listed and that a system is set up to consider research recommendations across stocks to ensure only topics of strategic importance are pursued as a priority. (paragraphs 59,60, 83,84,92)***

Background

25. The SARC57 review of summer flounder and striped bass assessments took place at Wood's Hole, MA, from the 23rd -26th July as part of the SAW process. Background documents (peer reviewed and non-reviewed) were available approximately two weeks before the meeting and the respective stock assessment reports were made available one week before the review. During the two weeks before the meeting the reviewer considered these various materials, which were available electronically. Particular attention was given to the two main assessment reports.
26. Shortly before the opening of the meeting on the 23rd July, the reviewers and the chair of the panel (Dr Cynthia Jones) met with Dr James Weinberg (SAW chair) and Dr Paul Rago (Head of Population Dynamics Branch, NEFSC) to discuss the terms of reference and Statement of Work for the review. Dr Weinberg indicated that the purpose of the review was to establish whether or not the assessments provided an adequate basis for management advice.
27. During the meeting the reviewer discussed the assessments with the lead assessment scientists to seek clarification on a number of scientific and technical issues relating to the data, the stock and the fishery. In the case of striped bass some additional analysis was requested to clarify the interpretation of MSY reference points for this stock.
28. On the final day of the meeting the panel met in closed session and agreed changes to the stock assessment summary documents. The panel also agreed a draft review summary report before the meeting was closed at approximately 15:30.
29. Following the meeting the reviewer continued to correspond with the panel and SARC chair to finalize the review summary report and prepare the individual reviewer's report.

Summer flounder: Findings

ToR 1: Catch

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.

30. I consider that this ToR was broadly met.
31. Data were available from the recreational and commercial fisheries that comprise the main components. The commercial landings are the larger component and are regarded as having minimal error. They are calculated from official landings records at both state and federal level. Recreational catch data are estimated from the MRFSS/MRIP survey. The MRIP survey, available since 2004, is considered an improvement on the MRFSS survey design. However, since the estimates of this component of the catch are from a sample rather than a census they will be subject to much greater estimation error. Comparison of the MFRSS estimates with values estimated from the VTR system differed by a factor of 2-3. This disparity is not explained and may give some insight into the uncertainty in the recreational fishery catch estimates.

32. Discard estimates for the commercial fishery were obtained from an observer program. Various methods were investigated to raise observer samples to fleet level. Raising factors based on the catch of all species by trip was considered to be the most robust approach. This is in line with published studies that show raising discard samples using auxiliary variables is a more robust to the estimation of discarded quantities than simple ratio estimators.
33. Estimates of the recreational fishery discards were made from the MRFSS/MRIP surveys and used an estimate of release mortality to derive dead discards. The release mortality is low but uncertain and small changes in the value used for this mortality can have a large effect on the estimate of dead discards. Some consideration needs to be given as to whether the release data should be pre-processed in this way to estimate "dead discards" since in applying the mortality rate much of the actual observations are simply being "thrown away"; i.e. they are not included in the model. Since the estimate of release mortality is itself rather uncertain, it is possible that deriving dead discards simply adds noise to the assessment. In theory including dead discards in the model should reduce bias, but this may be at the expense of a higher mean squared error in the estimated values from the model.
34. "Uncertainty" as used in the ToR is a somewhat open ended concept and needs to be more clearly defined in order to address it appropriately. The Assessment Report does address some aspects of uncertainty. I would like to have seen an assessment of mis-reporting/recording errors in the commercial landings data and an elaboration of the sample error for the recreational catch. It would be useful to see recreational landings data presented as a mean and confidence interval based on the sample design, to get a minimum estimate of the uncertainty in this component of the data.

ToR 2: Surveys

Present the survey data available for use in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.), and explore standardization of fishery-independent indices*. 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. Describe the spatial distribution of the stock over time.

35. The ToR was fully met.
36. Available survey data comprise surveys of the whole stock area performed by the NEFSC and a number of state surveys that typically cover a small geographical area. These are listed and described. Some of the abundance indices are aggregate measures while others are age structured or sample only the young of the year (YOY). For the NEFSC surveys an additional source of uncertainty arises from a change of vessel and sampling protocol in 2009. In order to preserve the time series the more recent indices have been rescaled based on comparative fishing trials. This is necessary in the short term since the indices for the more recent years are too few to estimate survey catchability reliably in the model. The unfortunate property of this change in design is that it will affect the most recent estimates of abundance and fishing mortality to the greatest extent, which is an important consideration for management given the increased uncertainty. As this time series lengthens in the future it should be treated as a separate survey and the uncertainty should reduce.

37. An agreed and reviewed protocol of the inclusion/exclusion of surveys in the assessment exists and this was applied. This reviewer did not therefore appraise the process further.
38. A number of fishery dependent LPUE indices were investigated as required by the ToR. Standardized indices were estimated by fitting GLMs to vessel trip records to extract a year effect. Overall the working group concluded that these indices were not adequate for inclusion in the assessment. Given the well-known problems with abundance indices based on commercial fishery data, this appears to be an appropriate conclusion, particularly since there are many fishery independent surveys that can be used to inform the assessment model and these should be preferred over indices based on fishery data.
39. Only the NEFSC surveys cover the total stock distribution and this was used to investigate the stock spatial distribution. The center of distribution of the stock appears to be more northerly than in earlier years with larger fish generally found further north. There are many possible explanations for this change including reduced fishing pressure.

ToR 3: Sex specific growth

Review recent information on sex-specific growth and on sex ratios at age. If possible, determine if fish sex, size and age should be used in the assessment*.

40. This ToR was fully met.
41. Differences in growth rate between males and females were identified based on analyses of NEFSC survey data and commercial and recreational fishery data. These show that females are typically larger at age than males. Long term trends in weight at age with lower mean weights in more recent years for the older fish were also demonstrated. The trend coincides with a greater proportion of males at older ages in recent years and may relate to higher survival of fish resulting from lower fishing mortality.
42. No sex determination is made when fish are sampled from the fishery, which means the only source of data to split the catch data by sex is to use the NEFSC survey. However a separate study of the commercial and recreation catches showed that the NEFSC sex compositions were not the same as those in the recreational fishery data and could not be used to split these catches by sex. This prevented a full sex disaggregated assessment. It is likely that differing growth rates are also associated with differences in both natural and fishing mortality between the sexes, and while the assessment group was unable to perform a disaggregated assessment, it remains a potential source of bias in the estimation of population parameters. It may well be that such bias is very small and some consideration needs to be given to the cost effectiveness of collecting sex data in relation to the improvement in assessment bias.

ToR 4: Catch at age analysis

Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-3), and estimate their uncertainty. Explore inclusion of multiple fleets in the model. Include both internal and historical retrospective analyses to allow a comparison with previous assessment results and previous projections.

43. This ToR was fully met and the assessment does provide an adequate basis for management advice.

44. An age structured statistical catch at age model (ASAP) was used to estimate population parameters. This is a likelihood based statistical model which adopts a quasi-Bayesian approach in allowing certain parameters to be constrained by penalty functions. In general terms this is a well-established approach that is widely used and can be considered appropriate for the assessment of the stock.
45. In previous assessments it has been assumed that numbers at age data are independent and lognormally distributed. In the current implementation it was assumed that the proportions at age are described by a multinomial distribution with the total numbers (i.e. numbers summed across ages) being drawn from a separate lognormal distribution. One particular feature of this change is the problem of estimating the "effective sample size" (ESS) for the multinomial distribution and this can have a large effect in the estimated parameters. The assessment group used established methods for estimating ESS but it remains an area for further work. Expert opinion on the use of the multinomial distribution for this class of model is divided but it is a mainstream technique and is likely to give satisfactory results in this assessment.
46. The ASAP model allows catch data to be assigned to different fleets. In this assessment the data were assigned to two "fleets". Landings from the commercial and recreational fishery were combined into a single "fleet" and the same approach was used to create a discard "fleet". This classification to fleets in rather unusual in my experience and does not describe the operation of true fleets since the commercial and recreational data are combined by catch type rather than fishery. It means the estimated selectivity values are not easily interpreted for management purposes. I would have thought it would be more useful to estimate selectivity by true fleet (commercial or recreational) and estimate a separate catch retention ogive for each fishery since this would give a more direct measure of the impact each fishery has on each age group of fish. Modeling the commercial fleet and recreational fleets as true fleets would be a more natural way of partitioning the catch and would give meaningful values of fleet selectivity. While this issue is unlikely to affect the estimates of total fishing mortality by age, it is not particularly helpful if managers wished to investigate the effect of different management measures on the two fisheries by, for example, changing the mesh size of commercial fishing gears.
47. The Working Group should be commended for a very comprehensive and systematic approach to investigate the new model configuration and the updated data. These show the effect of the new configuration when analyzing the same data as the previous assessment and the incremental changes arising by introducing updated data. Overall the new assessment shows the same qualitative historical trends in F and SSB as the old model, but there are differences in scale. This is a particularly important and useful presentation since it shows that estimated stock trends are robust, but greater care is needed when considering the current status of the stock in relation to reference points.
48. Diagnostics from the model do not show major areas of concern. Model fits to the total catch and catch age compositions are generally good. Some state surveys are poorly fit but receive low weight in the likelihood. The retrospective pattern for recent years shows no strong pattern.
49. A likelihood profile was produced over a range of values for natural mortality. The profile indicates that a value between 0.2 and 0.3 receives the highest support, though within this

range there is no clearly preferred choice. This is useful evidence that the choice of M in the assessment is appropriate.

50. Under ToR 1 I discussed the handling of recreational discard data. This deserves further comment. During discussion of the question of release mortality an additional assessment run was performed where the release mortality was double the value used in the final assessment. This showed that the values of total F changed very little and provides reassurance that the assessment is insensitive to the assumption on release mortality. However, it equally raises the question about whether these recreational "dead discards" actually contribute anything to the assessment since leaving them out altogether would presumably also have almost no effect on the estimates of F. Given that there are observations on fish caught and released, and that these should reflect stock abundance, it may well be preferable to include the raw release observations in the model rather than discount them with an uncertain mortality. This would require an observation equation that describes the relationship between stock abundance and live recreational catches. While release mortality may not be estimable within the model, including it as a constant would provide a means of using all the catch data more effectively. The likelihood could be profiled over a range of release mortalities to evaluate the uncertainty on the assessment. It would be even better if a full Bayesian analysis was performed where release mortality was treated as a parameter with an informative prior.

ToR 5: Reference points

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.

51. This ToR was fully met.
52. The established BRPs for summer flounder are based on the MSY proxy of F35%. Other analyses available to the working group examined MSY proxies based on F30%, a less conservative standard that is suggested for flatfish that have a stock-recruitment relationship with a high steepness. The assessment model did not fit a stock recruitment relationship because there is very little information to estimate steepness from the recruitment values since mean recruitment changes little over the range of SSBs observed. Consequently it is unclear if summer flounder has steepness typical of other flatfish. The yield/SSB per recruit analysis suggests that moving from F35% to F30% would result in a small increase in yield (~2%) but a moderate reduction in equilibrium SSB (~20%). For this reason the Working Group proposed that the F35% BRPs should be retained. I tend to agree with this suggestion because there is a risk of changing BRPs without sufficiently strong reasons to do so, and as a result, simply adding variability to management decisions with potentially detrimental consequences.

ToR 6: Stock status

Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model developed for this peer review.

a. When working with the existing model, update it with new data and evaluate stock status (overfished and overfishing) with respect to the existing BRP estimates.
b. Then use the newly proposed model and evaluate stock status with respect to "new" BRPs and their estimates (from TOR-5).

53. The TOR was met.
54. The assessment report documents runs with the old model configuration but using updated data and also provides full analysis of the new model and its outputs. Based on the F35% MSY proxies, the stock is not overfished and overfishing is not occurring, and this is consistent with previous analyses. The assessment of current stock status in relation to these reference points appears to be robust.

ToR 7: Projections

Develop approaches and apply them to conduct stock projections and to compute the statistical distribution (e.g., probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).

a. Provide annual projections (3 years). For given catches, 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.
c. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

55. The ToR was met.
56. Projections are provided based on the standard AGEPRO package. The recruitment assumption is based on random sampling from the estimated recruitment from the most recent 30 year period. In the absence of a reliable stock-recruitment relationship this should give realistic estimates of likely recruitment over a short time horizon. Considerable care is necessary in the interpretation of the probability statements that relate to exceeding reference points. These statements are conditioned on the assumption that reference points are fixed and known without error. In reality they can only be estimated with error so the calculated probabilities do not take into account the uncertainty in the reference points themselves. This may be important in the light of sexually dimorphic growth, which is not explicitly accounted for in the assessment or projections but has a bearing on MSY calculations.
57. Given that the projections are based on close-to-status quo conditions they should be fairly robust and hence provide an adequate basis for management. However, scenarios based on fishing mortality rates that differ substantially from status quo are likely to be much more uncertain because of the effects of different survival rates of males and females and their respective growth schedules.

ToR 8: Research recommendations

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, as well as MAFMC SSC model recommendations from 2012. Identify new research recommendations.

58. The ToR was met.
59. The working group has reported on the status of earlier research recommendations and list new recommendations that have emerged following the most recent assessment. Undoubtedly the recommendations are in themselves quite reasonable and likely to improve assessments in the future if successfully carried out. However, it does seem as if these "shopping lists" are easily compiled without real regard to the resource implications and can expand without limit. It might force some discipline if working groups limited their recommendations to their top 5 or 10 priorities that are likely to have the greatest impact in improving the assessment.
60. There is also a broader issue that, while a research recommendation for this stock may be important, it may compete for resources for research on other stocks that may be of even higher priority. There appears to be no mechanism to develop a more strategic approach to pursuing research recommendations that takes into account the available resources and the wider priorities of managers. Hence there is a danger of pursuing research that is worthwhile but not necessarily of greatest value. Some thought should be given to drawing on the research recommendations across the various stocks and developing a strategic plan that clearly identifies topics of highest priority.

Striped Bass: Findings

ToR 1: Data

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. Evaluate evidence for changes in natural mortality in recent years.

61. The ToR was fully met.
62. Available survey data comprise surveys of the whole stock area performed by the NEFSC and a number of state surveys that typically cover a small geographical area. These are listed and described. Some of the abundance indices are aggregate measures while others are age structured or sample only the young of the year (YOY). For the NEFSC survey only aggregate indices for inshore strata were used and limited to the period 1991-2009. This period avoids the problem of the change in vessel but means for the most recent years the assessment will be more dependent on the state surveys that have only local coverage and the MRFSS survey, which is considered to be of low precision. This may be an important source of uncertainty because the assessment model considers only whole stock population abundance whereas the state survey indices are likely to be affected by local effects that the model will interpret as noise. As can be seen from the model diagnostics, some surveys appear to have a large effect on the model results (such as MRFSS) and this may be due to this problem.

63. Tagging data were used to estimate natural mortality, which gave higher values than used in previous assessments that were based on life history traits. The analysis appears to be the best available at present and is appropriate for use in the current assessment. It is believed M has been higher in recent years due to disease prevalence in Chesapeake Bay. While there are good grounds to believe this may have an effect, it is hard to discern from the analysis if such an increase is really detectable given uncertainties in the data, such as the tag reporting rate.
64. It is clear from the sex ratios at age that survival rates of males and females differ, which means the current estimates of M are composite values. If possible it would be desirable to try to estimate sex dependent values of M in the future.

ToR 2: Catch

Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries.

65. I consider that this ToR was broadly met.
66. Data were available from the recreational and commercial fisheries that comprise the main components. The commercial landings are a smaller component of the total and are regarded as having minimal error. They are calculated from official landings records at both state and federal level. Recreational catch data are estimated from the MRFSS/MRIP survey and dominate the total catch. The MRIP survey, available since 2004, is considered an improvement on the MRFSS survey design. However, since the estimates of this component of the catch are from a sample rather than a census, they will be subject to much greater estimation error, and given that they contribute most to the total catch, this is an important source of uncertainty.
67. Estimates of the recreational fishery discards were made from the MRFSS/MRIP surveys and used an estimate of release mortality to derive dead discards. The release mortality is low but uncertain and small changes in the value used for this mortality can have a large effect on the estimate of dead discards. Some consideration needs to be given as to whether the release data should be pre-processed in this way to estimate "dead discards" since in applying the mortality rate much of the actual observations are simply being "thrown away"; i.e. they are not included in the model. It may be preferable to include all the releases in the model and use a mortality to discount the observations. This would require a modification to the assessment model to allow such observations to be included.
68. In view of the importance of the recreational catch in this fishery I would like to have seen an elaboration of the sampling error for the recreational catch. It would be useful to see recreational landings data presented as a mean and confidence interval based on the sample design, to get a minimum estimate of the uncertainty in this component of the data.

ToR 3: Catch at age analysis

Use the statistical catch-at-age 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, where possible, and for total stock complex.

69. This ToR was fully met and the assessment does provide an adequate basis for management advice.
70. An age structured statistical catch at age model (SCA) was used to estimate population parameters. In general terms this is a well-established approach that is widely used and can be considered appropriate for the assessment of the stock. I welcome the very useful presentation of the model equations in the report, which are often omitted in assessment reports.
71. In the current implementation it was assumed that the proportions at age are described by a multinomial distribution with the total numbers (i.e. numbers summed across ages) being drawn from a separate lognormal distribution. One particular feature of this change is the problem of estimating the "effective sample size" (ESS) for the multinomial distribution and this can have a large effect in the estimated parameters. The assessment group used established methods for estimating ESS but it remains an area for further work. Expert opinion on the use of the multinomial distribution for this class of model is divided but it is a mainstream technique and is likely to give satisfactory results in this assessment.
72. The model allows catch data to be assigned to different fleets. In this assessment the data were assigned to three "fleets", Chesapeake Bay, Coast and Discards. This classification to fleets is rather unusual in my experience and does not describe the operation of true fleets since the commercial and recreational data are combined by area and catch type rather than fishery. It means the estimated selectivity values are not easily interpreted for management purposes. I would have thought it would be more useful to estimate selectivity by true fleet (commercial or recreational) and estimate a separate catch retention ogive for each fishery since this would give a more direct measure of the impact each fishery has on each age group of fish. Modeling the commercial fleet and recreational fleets as true fleets would be a more natural way of partitioning the catch and would give meaningful values of fleet selectivity. While this issue is unlikely to affect the estimates of total fishing mortality by age, it is not particularly helpful if managers wished to investigate the effect of different management measures on the commercial and recreational fisheries.
73. Diagnostics from the model show that two surveys (MRFSS and MDSSN) individually have a large effect on the assessment (see comments under ToR 1) and this illustrates some inconsistency in the signals from the various surveys. While the effect does not change the qualitative trends in stock biomass, it does affect the level of biomass estimated for recent years.
74. Under ToR 2 I discussed the handling of recreational discard data. Given that there are observations on fish caught and released, and that these should reflect stock abundance, it may well be preferable to include the raw release observations in the model rather than discount them with an uncertain mortality. This would require an observation equation that describes the relationship between stock abundance and live recreational catches. While release mortality may not be estimable within the model, including it as a constant over which the likelihood could be profiled would provide a means of using the data more effectively and also facilitate evaluating the uncertainty that release mortality has on the assessment. It would be even better if a full Bayesian analysis was performed where release mortality was treated as a parameter with an informative prior.

75. In calculating the SSB the working group used a time invariant sex ratio ogive to assign female fish to the SSB. The ogive shows the youngest ages as having an approximately equal sex ratio whilst at the oldest ages all the fish are female. Such an ogive can only be explained by differing survival rates of males and females and it is difficult to escape the conclusion that fishing mortality must play a part. If so then the ogive would be expected to change over time as a result of changes in F. It is possible therefore that using a fixed ogive will result in bias in the calculation of SSB in some years, but the magnitude of this bias is unclear.

ToR 4: Tagging analysis

Use the Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) and associated model components applied to the Atlantic striped bass tagging data to estimate F and abundance from coast wide and producer area tag programs along with the uncertainty of those estimates. Provide suggestions for further development of this model.

76. This ToR was fully met. Tagging data analyses are presented that suggest fishing mortality as estimated from these data are similar to the main assessment using the SCA model. However, the analysis suggests that while the overall estimates of Z are fairly robust, the partitioning of Z between F and M is sensitive to the assumption on tag reporting rates.
77. The use of tagging data provides a very useful additional analysis to support the main assessment and adds reassurance to the results since the data are largely independent of the data used in the SCA model. An obvious further development would be to include the tagging data in the SCA model.

ToR 5: Biological reference points

Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY). Define stock status based on BRPs.

78. The ToR was completed but there are important qualifications to the analysis presented.
79. Historically the BRPs for this stock have been based on the 1995 SSB, which was regarded as the biomass achieved when the stock had recovered from a period of being overfished. As well as estimating this quantity from the SCA model, the working group also calculated the MSY values based on various stock recruitment models. In the analysis presented it appeared that if the stock was fished at Fmsy, the implied Bmsy could not be achieved and it was therefore suggested that SSB1995 should be retained as a BRP and that the F associated with this equilibrium SSB should form the relevant F reference point. However, there was confusion about the appropriate use of recruitment models in the various analyses and the use of bias correction when simulating recruitment from statistical distributions. The inconsistencies were investigated during the meeting and largely resolved but it did emerge that the MSY reference points were highly sensitive to the choice of structural recruitment model and that much more work would be required if these were to be proposed for management purposes. It appeared therefore that it was preferable to retain the existing SSB 1995 reference point and its associated F value.

80. It should be noted that the F value calculated to produce an equilibrium SSB equal to the SSB1995 value was based on a stochastic simulation where recruitment was drawn from empirical values for the period 1990 onwards. This is a pragmatic approach, which assumes that mean recruitment is independent of SSB over the range of stock sizes observed. It is probably a sensible approach even though inspection of the stock-recruitment plot suggests possible over-compensation at higher SSBs. This is because the SSBs are calculated from a fixed sex-ratio ogive that may be biased for some years (see comments under ToR 3), making the functional relationship between SSB and recruitment highly uncertain.

ToR 6: Projections

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. Use a sensitivity analysis approach covering a range of assumptions about the most important sources of uncertainty, including potential changes in natural mortality.

81. This ToR was completed and catch projections supplied. An extensive range of sensitivity tests support the conclusion that the forecast is robust. However, following the discussion of the BRPs and the choice of recruitment model, the projections need to be re-run with the same model as was used for calculation of F reference points as this differs from the models used in the projections, leading to potential inconsistency. In practice short term projections would not be expected to be sensitive to the choice of recruitment model unless the fishery is highly dependent on recruiting year classes. In striped bass fish are fully recruited by the age 4-5 so recruitment should only have a minor effect on projections.

ToR 7: Research recommendations

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.

82. The ToR was met.
83. The working group has usefully classified research recommendations into three categories of priority. Undoubtedly the recommendations are in themselves quite reasonable and likely to improve assessments in the future if successfully carried out. However, it does seem as if these "shopping lists" are easily compiled without real regard to the resource implications and can expand without limit. It might force some discipline if working groups limited their recommendations to their top 5 or 10 priorities that are likely to have the greatest impact in improving the assessment.
84. There is also a broader issue that, while a research recommendation for this stock may be important, it may compete for resources for research on other stocks which may be of even higher priority. There appears to be no mechanism to develop a more strategic approach to pursuing research recommendations that takes into account the available resources and the wider priorities of managers. Hence there is a danger of pursuing research that is worthwhile but not necessarily of greatest value. Some thought should be given to drawing on the research

recommendations across the various stocks and developing a strategic plan that clearly identifies topics of highest priority.

Conclusions and Recommendations

85. For both summer flounder and striped bass sufficient data are available to conduct a full age structured stock assessment. The data include landings and discards and fishery independent survey indices. The data were handled appropriately and the assessment models appear to be robust to a range of sensitivity tests and diagnostics. In the case of striped bass, additional tagging data provide a similar picture of fishing mortality and stock biomass. The assessments provide an adequate basis for management advice.
86. Both assessments make use of a number of state surveys, which individually cover a limited geographical range, and because the assessment model is not able to explicitly deal with spatial heterogeneity, these surveys may not be as useful as they could be. It would be highly desirable to co-ordinate the surveys into synoptic coverage of the stock area using similar sampling protocols so that a full age structured index could be derived for the whole area. ***I recommend that every effort should be made to try to develop whole area abundance indices from the state surveys through better co-ordination, adoption of common sampling protocols and statistical modelling.***
87. The choice of fleet components in both assessments was not very realistic since the estimates of fleet selectivity have little meaning and are unlikely to offer any advantages over a model that simply considered one fleet. ***I recommend that future assessments model true fleets (commercial, recreational, etc.) and that discards are modelled using a retention ogive acting after fleet selectivity.*** This is a more conventional way of modelling fleets and leads to more useful values of selectivity.
88. Recreational dead discards were derived from estimates of live releases discounted by a release mortality. As this mortality is small, the calculation of dead discards is sensitive to small changes in the assumed mortality. It also means that much of the real data are effectively removed from the analysis. The problem is likely to be most important for the striped bass assessment. ***I recommend that the assessment model is modified to use the raw recreational release data by changing the observation equation in the model. Release mortality could then be included in the model as a constant, or preferably as a parameter with an informative prior. This would enable a more comprehensive evaluation of the sensitivity of the assessment to release mortality.***
89. Sexually dimorphic growth is a feature of both summer flounder and striped bass. There are implications for both assessments in relation to estimated mortality rates and estimation of MSY reference points. The problem may have significance for the estimation of female SSB in striped bass where a fixed sex ratio ogive is used. ***I recommend that exploratory analyses are performed for both summer flounder and striped bass, based on current data, to investigate the sensitivity of the assessments to sexually dimorphic growth and survival. This will help evaluate the need to collect additional data and improve the assessment.***

90. The BRPs for striped bass are based on the 1995 SSB when the stock was considered to have recovered from an earlier period of depletion. While this is pragmatic, it would be desirable to find a stronger theoretical basis for the reference points. Some work had been done on MSY values but difficulties in modelling recruitment prevented adequate consideration of these BRPs at the review meeting. It appears from the stock-recruitment plot that there is evidence of declining recruitment at lower SSBs, indicating that there may be better ways of identifying minimum biomass for management purposes. ***I recommend that further work is undertaken to model the stock recruitment relationship for striped bass and estimate MSY reference points. As a minimum it should be possible to establish an SSB that produces adequate recruitment.***
91. Statements given in the assessment report on the probability of exceeding reference points in the projection period assume that the reference points are known without error and may give an overly optimistic picture of stock status. Management convention may dictate that this is the preferred approach but it would be more realistic to consider the reference points as subject to estimation error. Projections should more correctly consider the distribution of reference points and include this in the forecast. Clearly this will be of greatest importance where reference points are uncertain and where current F and SSB values are close to the reference point. ***I recommend that the projection software is modified to include the uncertainty in BRPs so that probability statements on exceeding BRPs are more realistic.***
92. Research recommendation made on a stock by stock basis may be important but may compete for resources for research on other stocks which may be of even higher priority. There appears to be no mechanism to develop a more strategic approach to pursuing research recommendations that takes into account the available resources and the wider priorities of managers. Hence there is a danger of pursuing research that is worthwhile but not necessarily of greatest value. ***I recommend that a protocol is established to filter research recommendations at the working group level so that only the highest priority topics are listed and that a system is set up to consider research recommendations across stocks to ensure only topics of strategic importance are pursued as a priority.***

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Appendix 2 Statement of Work

Task Order T37-06, final 28 February 2013

Statement of Work

57th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Benchmark stock assessments for striped bass and summer flounder

Statement of Work (SOW) for CIE Panelists
(including a description of SARC Chairman's duties)

BACKGROUND

The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are independently selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

SCOPE

Project Description: 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 is the cornerstone of the Northeast Stock Assessment Workshop (SAW) process, which includes assessment development (SAW Working Groups or ASMFC technical committees), assessment peer review, public presentations, and document publication. This review determines whether the scientific assessments are adequate to serve as a basis for developing fishery management advice. Results provide the scientific basis for fishery management in the northeast region.

The purpose of this panel review meeting will be to provide an external peer review of stock assessments for striped bass (*Morone saxatilis*) and summer flounder (*Paralichthys dentatus*). Striped bass and summer flounder are commercially and recreationally important species found along the US east coast. This review determines whether the scientific assessments are adequate to serve as a basis for developing fishery management advice.

OBJECTIVES

The SARC review panel will be composed of three appointed reviewers from the Center of Independent Experts (CIE), and an independent chair from the SSC of the New England or MidAtlantic Fishery Management Council. The SARC panel will write the SARC Summary Report and each CIE reviewer will write an individual independent review report.

Duties of reviewers are explained below in the "**Requirements for CIE Reviewers**", in the "**Charge to the SARC Panel**" and in the "**Statement of Tasks**". The stock assessment Terms of Reference (ToRs) are attached in **Annex 2**. The draft agenda of the panel review meeting is attached in **Annex 3**. The SARC Summary Report format is described in **Annex 4.**

Requirements for the reviewers: Three reviewers shall conduct an impartial and independent peer review of the striped bass and summer flounder stock assessments, and this review should be in accordance with this SoW and stock assessment ToRs herein. The reviewers shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Expertise should include statistical catch-at-age, state-space and index methods. 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 that includes an appreciation for the varying quality and quantity of data available to support estimation of Biological Reference Points. For both striped bass and summer flounder, it is desirable to have knowledge of stock assessments involving spatially distributed populations, migratory behavior, and natural mortality rates that vary with time or sex.

PERIOD OF PERFORMANCE

The contractor shall complete the tasks and deliverables as specified in the schedule of milestones within this statement of work. Each reviewer's duties shall not exceed a maximum of 16 days to complete all work tasks of the peer review described herein.

Not covered by the CIE, the SARC chair's duties should not exceed a maximum of 16 days (i.e., several days prior to the meeting for document review; the SARC meeting in Woods Hole; several days following the open meeting for SARC Summary Report preparation).

PLACE OF PERFORMANCE AND TRAVEL

Each reviewer shall conduct an independent peer review during the panel review meeting scheduled in Woods Hole, Massachusetts during July 23-26, 2013.

STATEMENT OF TASKS

Charge to SARC panel: During the SARC meeting, the panel is to determine and write down whether each stock assessment Term of Reference (ToR) of the SAW (see **Annex 2**) 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 Term of Reference 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 following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Tasks prior to the meeting: The contractor shall independently select qualified reviewers that do not have conflicts of interest to conduct an independent scientific peer review in accordance with the tasks and ToRs within the SoW. Upon completion of the independent reviewer selection by the contractor's technical team, the contractor shall provide the reviewer information (full name, title, affiliation, country, address, email, and FAX number) to the COR, who will forward this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The contractor shall be responsible for providing the SoW and stock assessment ToRs to each reviewer. The NMFS Project Contact will be responsible for providing the reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact will also be responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Foreign National Security Clearance: The reviewers shall participate during a panel review meeting at a government facility, and the NMFS Project Contact will be responsible for obtaining the Foreign National Security Clearance approval for the reviewers who are non-US citizens. For this reason, the reviewers shall provide by FAX (or by email if necessary) the requested information (e.g., 1.name [first middle and last], 2.contact information, 3.gender, 4.country of birth, 5.country of citizenship, 6.country of permanent residence, 7.whether there is dual citizenship, 8.country of current residence, 9.birth date [mo, day, year], 10.passport number, 11.country of passport) to the NMFS Project Contact 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/.

Pre-review Background Documents and Working Papers: Approximately two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the SARC chair and CIE reviewers the necessary background information and

reports (i.e., working papers) for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the COR on where to send documents. The reviewers are responsible only for the pre-review documents that are delivered to the contractor in accordance to the SoW scheduled deadlines specified herein. The reviewers shall read all documents deemed as necessary in preparation for the peer review.

Tasks during the panel review meeting: Each reviewer shall conduct the independent peer review in accordance with the SoW and stock assessment ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and contractor.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the stock assessment ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

(SARC chair)
Act as chairperson, where duties include control of the meeting, coordination of presentations and discussions, making sure all stock assessment Terms of Reference of the SAW are reviewed, control of document flow, and facilitation of discussion. For each assessment, 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 that address stock status and assessment uncertainty.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of their analyses. It is permissible to discuss the stock assessment and to request additional information if it is needed to clarify or correct an existing analysis and if the information can be produced rather quickly.

(SARC CIE reviewers)
For each stock assessment, participate as a peer reviewer in panel discussions on assessment validity, results, recommendations, and conclusions. From a reviewer's point of view, determine whether each stock assessment Term of Reference of the SAW was completed successfully. Terms of Reference that are completed successfully are likely to serve as a basis for providing scientific advice to management. If a reviewer considers any existing Biological Reference Point or BRP proxy to be inappropriate, the reviewer should try to recommend an alternative, should one exist. 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 that address stock status and assessment uncertainty.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of their analyses. It is permissible to request additional information if it is needed to clarify or correct an existing analysis and if the information can be produced rather quickly.

Tasks after the panel review meeting:

SARC CIE reviewers:
Each CIE reviewer shall prepare an Independent CIE Report (see **Annex 1**). 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 above in the "Charge to SARC panel" statement.

If any existing Biological Reference Points (BRP) or their proxies are considered inappropriate, the Independent CIE 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 CIE Report produced by each reviewer.

The Independent CIE 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.

SARC chair:
The SARC chair shall prepare a document summarizing the background of the work to be conducted as part of the SARC process and summarizing whether the process was adequate to complete the stock assessment Terms of Reference of the SAW. If appropriate, the chair will include suggestions on how to improve the process. This document will constitute the introduction to the SARC Summary Report (see **Annex 4**).

SARC chair and CIE reviewers:
The SARC Chair, with the assistance from the CIE reviewers, will prepare the SARC Summary Report. Each CIE 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 (please see **Annex 4** for information on contents) should address whether each stock assessment Term of Reference of the SAW was completed successfully. For each Term of Reference, this report should state why that Term of Reference was or was not completed successfully. The Report should also include recommendations that might improve future assessments.

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.

The contents of the draft SARC Summary Report will be approved by the CIE reviewers by the end of the SARC Summary Report development process. The SARC chair will complete all final editorial and formatting changes prior to approval of the contents of the draft SARC Summary Report by the CIE reviewers. The SARC chair will then submit the approved SARC Summary Report to the NEFSC contact (i.e., SAW Chairman).

DELIVERY

Each reviewer shall complete an independent peer review report in accordance with the SoW. Each reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each reviewer shall complete the independent peer review addressing each stock assessment ToR listed in **Annex 2**.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the panel review meeting at the Woods Hole, Massachusetts scheduled during July 23-26, 2013.
3) Conduct an independent peer review in accordance with this SoW and the assessment ToRs (listed in **Annex 2**).
4) No later than August 9, 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and to Dr. David Sampson, CIE Regional Coordinator, via email to david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each assessment ToR in **Annex 2**.

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

June 19, 2013	Contractor sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
July 9, 2013	NMFS Project Contact will attempt to provide reviewers the pre-review documents
July 23-26, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
July 26, 2013	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
August 9, 2013	Reviewers submit draft independent peer review reports to the contractor's technical team for independent review
August 9, 2013	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *
August 16, 2013	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
August 23, 2013	Contractor submits independent peer review reports to the COR who reviews for compliance with the contract requirements
August 30, 2013	The COR distributes the final reports to the NMFS Project Contact and regional Center Director

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

The SAW Chairman will assist the SARC chair prior to, during, and after the meeting in ensuring that documents are distributed in a timely fashion.

NEFSC staff and the SAW Chairman will make the final SARC Summary Report available to the public. Staff and the SAW Chairman will also be responsible for production and publication of the collective Working Group papers, which will serve as a SAW Assessment Report.

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on substitutions. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: The deliverables shall be the final peer review report from each reviewer that satisfies the requirements and terms of reference of this SoW. The contract shall

be successfully completed upon the acceptance of the contract deliverables by the COR based on three performance standards:

(1) each report shall be completed with the format and content in accordance with **Annex 1**,
(2) each report shall address each stock assessment ToR listed in **Annex 2**,
(3) each report shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Upon the acceptance of each independent peer review report by the COR, the reports will be distributed to the NMFS Project Contact and pertinent NMFS science director, at which time the reports will be made publicly available through the government's website.

The contractor shall send the final reports in PDF format to the COR, designated to be William Michaels, via email William.Michaels@noaa.gov

Support Personnel:

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1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
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Key Personnel:

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James.Weinberg@noaa.gov (Phone: 508-495-2352) (FAX: 508-495-2230)

Dr. William Karp, NEFSC Science Director
National Marine Fisheries Service, NOAA
Northeast Fisheries Science Center
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william.karp@noaa.gov Phone: 508-495-2233

Annex 1: Format and Contents of Independent Peer Review Report

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 main body of the report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Findings of whether they accept or reject the work that they reviewed, and an explanation of their decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. For each assessment reviewed, the report should address whether each ToR of the SAW was completed successfully. For each ToR, the Independent Review Report should state why that ToR was or was not completed successfully. To make this determination, the SARC chair and reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice.

   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, and especially where there were divergent views.

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

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not others read the SARC Summary Report. The independent report shall be an independent peer review of each ToR, and shall not simply repeat the contents of the summary report.

3. The reviewer 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.

Annex 2: 57th SAW/SARC Stock Assessment Terms of Reference

(file vers.: 12/18/2012)

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.

2. Present the survey data available for use in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.), and explore standardization of fishery-independent indices*. 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. Describe the spatial distribution of the stock over time.

3. Review recent information on sex-specific growth and on sex ratios at age. If possible, determine if fish sex, size and age should be used in the assessment*.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-3), and estimate their uncertainty. Explore inclusion of multiple fleets in the model. Include both internal and historical retrospective analyses to allow a comparison with previous assessment results and previous 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.

6. Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model developed for this peer review.
    a. When working with the existing model, update it with new data and evaluate stock status (overfished and overfishing) with respect to the existing BRP estimates.
    b. Then use the newly proposed model and evaluate stock status with respect to "new" BRPs and their estimates (from TOR-5).

7. Develop approaches and apply them to conduct stock projections and to compute the statistical distribution (e.g., probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).
    d. Provide annual projections (3 years). For given catches, 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).
    e. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions.
    f. 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, as well as MAFMC SSC model recommendations from 2012. Identify new research recommendations.

(*: Completion of specific sub-task is contingent on analytical support from staff outside of the NEFSC.)

Annex 2 (cont.):

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. Evaluate evidence for changes in natural mortality in recent years.

2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries.

3. Use the statistical catch-at-age 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, where possible, and for total stock complex.

4. Use the Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) and associated model components applied to the Atlantic striped bass tagging data to estimate F and abundance from coast wide and producer area tag programs along with the uncertainty of those estimates. Provide suggestions for further development of this model.

5. Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY). Define stock status based on BRPs.

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. Use a sensitivity analysis approach covering a range of assumptions about the most important sources of uncertainty, including potential changes in natural mortality.

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

(**: These TORs were developed by the ASMFC Striped Bass Stock Assessment Subcommittee and Tagging Subcommittee, with approval from the Technical Committee and Management Board.)

Annex 2 (cont.):

Appendix to the SAW Assessment TORs:

Clarification of Terms
used in the SAW/SARC Terms of Reference

Appendix to the Assessment TORs:

Explanation of "Acceptable Biological Catch" (DOC Natl. Standard Guidelines, Fed. Reg., vol. 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)

Explanation of "Vulnerability" (DOC Natl. Standard Guidelines, Fed. Reg., vol. 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 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)

Rules of Engagement among members of a SAW Assessment Working Group:

> Anyone participating in SAW assessment working group 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.

Annex 3: Draft Agenda

57th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Benchmark stock assessments for summer flounder and striped bass

July 23-26, 2013

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

AGENDA* (version: 28 Feb. 2013)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Tuesday, July 23

10 – 10:30 AM
Welcome — **James Weinberg**, SAW Chair
Introduction — **Cynthia Jones**, SARC Chair
Agenda
Conduct of Meeting

10:30 – 12:30 PM Assessment Presentation (Stock A.)
TBD TBD **TBD**

12:30 – 1:30 PM Lunch

1:30 – 3:30 PM Assesssment Presentation (Stock A.)
TBD TBD **TBD**

3:30 – 3:45 PM Break

3:45 – 4 PM Public Comments

4 - 6 PM SARC Discussion w/ Presenters (Stock A.)
Cynthia Jones, SARC Chair **TBD**

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Wednesday, July 24

9 – 10:45 AM	Assessment Presentation (Stock B.)		
	TBD	TBD	**TBD**
10:45 – 11 AM	Break		
11 – 12:30 PM	(cont.) Assessment Presentation (Stock B.)		
	TBD	TBD	**TBD**
12:30 – 1:45 PM	Lunch		
1:45 – 2 PM	Public Comments		
2 – 3:30 PM	SARC Discussion w/presenters (Stock B.)		
	Cynthia Jones, SARC Chair		**TBD**
3:30 -3:45 PM	Break		
3:45 – 6 PM	Revisit with presenters (Stock A.)		
	Cynthia Jones, SARC Chair		**TBD**
7 PM	**(**Social Gathering **)**		

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Thursday, July 25

8:30 – 10:15	Revisit with presenter (Stock B.)		
	Cynthia Jones, SARC Chair		**TBD**
10:15 – 10:30	Break		
10:30 – 12:45	Review/edit Assessment Summary Report (Stock B.)		
	Cynthia Jones, SARC Chair		**TBD**
12:45 – 2 PM	Lunch		
2 – 2:45 PM	(cont.) edit Assessment Summary Report (Stock B.)		
	Cynthia Jones, SARC Chair		**TBD**
2:45 – 3:00 PM	Break		
3:00 – 6:00 PM	Review/edit Assessment Summary Report (Stock A.)		
	Cynthia Jones, SARC Chair		**TBD**

Friday, July 26

9:00 AM – 5:00 PM	SARC Report writing. (closed meeting)		

*All times are approximate, and may be changed at the discretion of the SARC chair. The meeting is open to the public, except where noted.

The NMFS Project contact will provide the final agenda by May, 2013.

Reviewers must attend the entire meeting.

Annex 4: Contents of SARC Summary Report

1.

The main body of the report shall consist of an introduction prepared by the SARC chair that will include the background, 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 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 CIE reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific 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 the CIE 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 (BRP) 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.

Appendix 3 SARC-57 Panel membership

Cynthia Jones (Chair), Old Dominion University, VA

Robin Cook (CIE), University of Strathclyde, UK

John Simmonds (CIE), ICES-ACOM, Denmark

Henrik Sparholt (CIE), ICES Secretariat, Denmark

In attendance:

Dr Jim Weinberg, SAW chair

Dr Paul Rago, Chief, NEFSC Population Dynamics Branch