Summary Report of the 60th Northeast Regional Stock Assessment Review Committee (SARC 60)

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Prepared by the Stock Assessment Review Committee
Benchmark Assessments for Scup and Bluefish
(SAW/SARC 60)

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SARC 60 Panel Members

Cynthia M. Jones (Chair)
Norman Hall
Sven Kupschus
Kevin Stokes

Table of Contents

1. Introduction 3
1.1 Background 3
1.2 Review of Activities and SARC Process 3
2. Review of Scup 4
2.1 Synopsis of Panel Review 4
2.2 Evaluation of Terms of Reference for Scup 4
A. Scup 4
3. Review of Bluefish 21
3.1 Synopsis of Panel Review 23
3.2 Evaluation of Terms of Reference for Bluefish 23
B. Bluefish 23
4. Bibliography 38
References 38
Working Papers 41
5. Appendices 42

1. Introduction

1.1 Background

The 60th SARC (Stock Assessment Review Committee) met in the Aquarium Conference Room at NOAA's Northeast Fisheries Science Center in Woods Hole, MA during 2-5 June, 2015 to review stock assessments for scup and bluefish. The review committee was composed of three scientists appointed by the Center for Independent Experts: Norman Hall, Sven Kupschus, Kevin Stokes, and Cynthia M. Jones who chaired the review committee as a member of the Mid-Atlantic Fisheries Management Council Scientific and Statistical Committee.

The SARC was assisted by the NEFSC Stock Assessment Workshop (SAW) Chairman, Dr. James Weinberg, Ms. Sheena Steiner, and Dr. Chris Legault. Supporting documentation for the scup assessment was prepared by the scup SAW 60 Working Group, and presentations at the meeting on scup were made by Dr. Mark Terceiro (NEFSC). Materials for the bluefish assessment were prepared by the bluefish Working Group and presentations were led by Dr. Tony Wood, Dr. Katie Drew and J. Manderson. Charles Adams, Larry Alade, Toni Chute, Jon Deroba, Brian Linton, Alicia Miller, and Anne Richards all from the NEFSC acted as rapporteurs. A total of 30 people participated in the SARC 60 meeting.

1.2 Review of Activities and SARC Process

Before the meeting, assessment documents and supporting materials were made available to the SARC Panel via a server on the NEFSC website. On the morning of June 2, 2015, before the meeting, the SARC panel met with Dr. Weinberg to review and discuss the meeting agenda, reporting requirements, and meeting logistics. During the SARC meeting, background and working documents were available electronically and in print. The meeting opened on the morning of Tuesday June 2, with welcoming remarks and comments on the agenda by Drs Weinberg and Jones. Participants and audience members introduced themselves. Following introductions, sessions on June 2 were devoted to presentation and discussion of the scup assessment. The bluefish assessment and discussion sessions were conducted on the morning and afternoon of June 3, followed by continued discussion of the scup assessment in the late afternoon.

Follow-up discussion on the bluefish assessment took place on the morning of 4 June. The morning (scup) and afternoon (bluefish) of June 4 were devoted to drafting the Assessment Summary Reports and hearing results of the follow-up bluefish analyses. The SARC Panel spent the part of June 4 and the final day, June 5, deliberating on whether the SAW WGs had addressed Terms of Reference (ToR) in each of the assessments and drafting elements of this Panel Summary Report.

The SARC Panel and SAW WGs worked collectively during the meeting to reach agreement and consensus on the two assessments. The meeting was collegial.

The Assessment Summary Report for scup and bluefish, with contributions by the NEFSC staff and the SARC Panel, were agreed during the session on Thursday June 4, 2015. The SARC Panel completed drafting this Summary Report by correspondence, evaluating each ToR that had been addressed by the SAW WGs. The SARC Chair compiled and edited the draft Summary Report, which was distributed to the Panel for final review before being submitted to the NEFSC. Additionally, each of the CIE Panelists drafted and submitted an independent reviewer's report to the Center for Independent Experts.

Chris Legault and Katie Drew were very helpful with editing the Assessment Summaries for both species.

The SARC Panel agreed that each of the assessments (scup and bluefish) was effective in delineating stock status, determining biological reference points (*BRP*s) and proxies, and in projecting probable short-term trends in stock biomass, fishing mortality, and catches. Issues and concerns related to each of the stock assessments are discussed below. The SARC process was effective in structuring a critical review of the work of the SAW WGs and in identifying areas of concern and needs for additional work in future assessments.

2. Review of Scup

2.1 Synopsis of Panel Review

The SARC Panel agreed with the SAW 60 WG's conclusion that the scup stock was not overfished and that overfishing was not occurring in 2014.

2.2 Evaluation of Terms of Reference for Scup

A. Scup

1. Estimate catch from all sources including landings and discards. Include recreational discards, as appropriate. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.

The SARC Panel agreed that the SAW met this ToR

Commercial Fisheries Data:

The SARC Panel noted that port sampling of commercial landings was good. Commercial landings data were obtained from Commercial Dealer Reports; VTR from the trawl fishery; and from the Northeast Fishery Observer Program (NEFOP), which has collected data on catch and discards since 1989 but with low sampling intensity of the fishery by observers until 2000. Note that, prior to the late 1980s, commercial landings data provide a minimum estimate of landings because not all states routinely reported catch and effort on Federal Dealer Reports and this is a source of bias in the historical data.

Recent commercial landings have accounted for only ~77% of the commercial quota and, thus, provide an additional buffer to the ACL if this level of landings persists.

Bias in fishery-dependent CPUE data can be introduced because some of the landings data don't have discard information and because some data include only positive trips that catch scup, thereby overestimating the CPUE. To rectify issues pertaining to directed catches in CPUE and LPUE estimation, commercial dealer report data were standardized to trips where >75% of landed fish were scup. The greater focus on the target fishery is questionable due to index hyper-stability risks and it only addresses the problem of identifying trips that could have caught scup but either did not catch them or discarded them, but not the issue of trips that discarded part of the scup catch. In effect it replaces one uncertainty with another so that unless better discard information becomes available in the future a commercial CPUE index is unlikely to be reliable. Additionally, the decision to base the fishery-dependent index of abundance for scup on only those trips in which scup comprises at least 75% of the landings introduces the variability in abundances of those other species, and associated behavioural changes by fishers, as additional sources of uncertainty in the resulting index. The WG is correct that further work is required before a reliable fishery-dependent index is likely to become available. These data were not used in the current assessment.

Recreational Fisheries Data:

Recreational landings were obtained from VTR from the for-hire fishery and from MRFSS/MRIP for angler catch and effort. MRFSS and MRIP are a complemented-survey design with effort estimated from an off-site sampling frame and CPUE from on-site access interviews, with a change in the off-site sampling frame and probability-based sampling for the access sites in the transition from MRFSS to MRIP. The MRFSS estimates have been adjusted to be consistent with the new MRIP methods. Total catch is estimated by multiplying effort by CPUE, also accounting for self-reported discards. Species such as scup that temporally change their spatial distribution typically have added uncertainty in the recreational estimates of CPUE. Because MRFSS/MRIP is designed to provide a broad-scale, multispecies sampling of CPUE, this is inevitable with such a species. Moreover, discard lengths are unobserved in the recreational fishery and discard length frequencies are calculated from the for-hire fishery data and used in conjunction with observed sub-legal landed (observed) lengths to characterize discard

length frequencies. It is a reasonable approach for a difficult issue, but adds to uncertainty.

Discards:
Historical discards in the commercial fleet were high, often approaching or exceeding 50% of the commercial catch. In 2000, Gear Restricted Areas (GRAs) were established and recent discards have decreased to 33% of the catch. There is some evidence from additional analyses that the decrease can be directly linked to the management measure.

In the public-access on-site component of MRFSS/MRIP, recreational reports of discards are self-reported by the angler and cannot be verified. Moreover, the ratio of catch/effort has changed over time, perhaps in response to management regulations.

The SARC Panel was encouraged by the new approaches to handling commercial discard data and thinks that the method for discard estimation has improved. Previously, a Geometric Mean Discards-to-Landings Ratio (GMDL) was used for estimation of commercial discards from 1989 onwards but was based only on trawl gear. This approach is limited to using only trips with both non-zero catches and discards. Use of the Standardized Bycatch Report Method (SBRM) was implemented for the current benchmark assessment, but is still restricted to data from the trawl fishery. The SBRM is a designed sampling method with three stratification alternatives. The SBRM estimates were compared with the GMDL estimate. Note that discard mortality in the trawl fishery is considered to be 100%, which may overestimate removals. Different SBRM estimators were compared to Dealer total landings to investigate the best estimator. This careful consideration of discard estimators has produced more robust estimates and improves the assessment.

2. Present the survey data being used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Characterize the uncertainty and any bias in these sources of data.

The SARC Panel agreed that the SAW met this ToR.

When the 2015 assessment model for scup was developed, the potential indices included: stock abundances calculated from the fishery-independent data collected in the NMFS winter, spring, and fall trawl surveys and in a number of State/academic institution surveys, conducted in waters ranging from Massachusetts to Cape Hatteras. The resultant abundance indices for scup are characterized by considerable inter-annual variability within indices, with such variability being greater for surveys conducted in spring rather than fall. In addition there is considerable variation in the implied stock dynamics between indices.

The SARC Panel noted that data collected during these surveys are representative only of those scup present within the areas that are sampled during the period over which samples are collected. Indices will also be affected by the selectivity and vulnerability of fish of different lengths to the fishing gear employed within the survey. Temporal

variability in the spatial distribution of scup results in varying availability of fish to each survey among different survey years, with smaller surveyed areas being subjected to greater variability than larger areas. Collectively, however, the combination of surveys may be considered as providing data at a number of fixed locations distributed over the geographic range occupied by the scup population. Because the locations at which the individual surveys are conducted are not selected in accordance with a well-defined sampling protocol, and because the surveys differ in their individual designs and sampling methods, bias will inevitably be present in results of analyses that use these survey data. The bias is likely to be reduced if the number of surveys were to be increased and coverage of the area occupied by the scup population broadened. Temporal stratification for the scup surveys is currently constrained to spring and fall.

Several indices and survey age compositions not previously available were considered when developing the 2015 assessment model. These were the NEAMAP spring and fall bottom trawl surveys, RIDFW spring and fall survey age compositions, and the RI Industry Cooperative trap survey. The SARC Panel noted that ageing of scup is based on scales rather than otoliths, and that this may be a source of ageing error. The Panel noted that the use in the 2015 assessment of both true and model ages (true age + 1) introduces confusion and is a potential source of error when specifying input data or interpreting model outputs, and recommends that only true ages should be used.

The spring and fall indices of scup abundance were subjected to GLM and hierarchical analyses to determine the underlying trends and to explore the extent to which the individual indices varied from that trend. The time series of ‘integrated’ indices representing the underlying trend exhibited by the original abundance indices were used subsequently in a sensitivity run of the 2015 assessment model.

The SARC Panel noted that 0 and 1 year old fish typically dominated age compositions from spring trawl surveys while age compositions from fall trawl surveys typically comprised fish from a broader age range. The coherence between expected age compositions of trawl surveys in successive years was less in the case of age data from spring than in such data from fall surveys. Based on examination of age compositions from fall trawl surveys collected over a longer period, such as that from the Connecticut DEEP fall survey, the age range in the mid-1990s decreased with fewer fish of older ages being caught than in earlier years. From the early 2000s, however, the range of ages increased with considerable numbers of older fish again being caught commensurate with a greater abundance of young fish being detected in the late 90s.

3. Describe the thermal habitat and its influence on the distribution and abundance of scup, and attempt to integrate the results into the stock assessment.

The SARC Panel agreed that the SAW met this ToR.

Data Input:

Variables investigated for the development of the habitat model were surface-air, surface and bottom water temperatures, and bottom water salinity. Environmental data were obtained from the NEFSC winter, spring, and fall trawl surveys from 1968-2014.

Statistical Modeling:
The relation between positive scup tows and temperature over time showed slightly increasing trends. Because the NEFSC trawl surveys are designed to estimate multi-species abundance, however, they are not designed to coincide with the movements of scup across the continental shelf. Variability in scup abundance also includes an important component of availability of fish at the time of survey that could not be assessed with generalized linear and additive modeling approaches.

Hydrographic Modeling:
To rectify these data issues, a "parametric thermal niche model using catch and temperature data" was used (input data from the NEFSC and NEAMAP surveys) along with the ROMS model to estimate the proportion of thermal habitat along the U.S. east coast that would be suitable for scup. The results of this modeling showed no systematic trends and little inter-annual variation in the percentage of habitat sampled by the surveys.

Conclusions:
The SARC Panel appreciates this effort to better understand scup's use of habitat. While temperature provides important information on potential species distributions, variables such as prey and predator distributions (among other variables) mapped unto the suitable thermal habitat may better define realized habitat use and improve the value of these environmental-based modeling approaches. Although environmental modeling does not yet provide adequate predictions of habitat use, it is still worthwhile pursuing.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty. Include a historical retrospective analysis to allow a comparison with previous assessment results and previous projections.

The SARC Panel agreed that the SAW met this ToR.

Robustness of scup model to data and settings changes.
The thorough effort by the stock assessment working group was appreciated by the review panel. The resultant final model (S60_BASE_18) presented represents a robust summary of the trends in the dynamics of the scup stock. What is a little less clear from the information presented is the accuracy of the management metrics in absolute terms. The final model is surprisingly stable in terms of the estimates of stock status despite what one would assume to be considerable changes in configuration. The reasons for this stability could not be explored in detail during the review process, but, because the trends in recent SSB are increasing under stable exploitation given increasing catches, the assessment was accepted as suitable for the provision of management advice.

Alternative views of stock dynamics:

Time series length:
Shortening the time series to start in 1989 (S60_BASE_18_1989) did provide some insight into possible reasons for the described stability. Shortening the time series results in a substantial reduction in the contrast in SSB and F over the time series. This alternate view does not change the direction of the trend, but merely alters the rate of change in the management metrics and results in significantly lower values of absolute SSB in conjunction with higher absolute values of F in the terminal year. In contrast, the estimates of recruitment are offset to lower values since 1997 while matching the full time series of recruitment estimates in prior years.

The SARC Panel appreciated the efforts of the WG to include the entire time series of available landings information in the model back to 1963, but there are concerns that, due to a lack of age information, this essentially requires historic recruitment to be restricted to the overall average recruitment in the time series. Given that recruitment has been episodic over the period when age data are available, this assumption has the potential to considerably affect the model parameter estimation in the recent period if, in fact, recruitment levels in the early years differed from the average level. The very low recent levels of F suggest that the model may be coming up against some bounds in the parameter estimation.

Mortality:
A sensitivity analysis to the assumption of M=0.2 was conducted. The results indicate that the model estimates in F are far more sensitive to the assumed value of M in the last decade than at any other period, but that the predicted changes are consistent with the expected changes given the alternative values of M. The SARC Panel concluded that there was no reason to assume that the assumption for M=0.2 was inappropriate. The lack of a model response in F in the period prior to the availability of age information is indicative of the constraint of the model in the historic period as also indicated by the sensitivity to time-series length.

Selectivity pattern:

The accepted assessment model indicates a very steep increase in SSB between 2000 and 2010. Because of the choice of a dome shaped selectivity pattern in all fleets this results in a considerable cryptic biomass in recent years. Although the increase in SSB is supported by almost all the data sources, the evidence for the rate of increase is scarce. The SARC Panel requested a model run with a flat topped selectivity (S60_BASE_18_FLATL) for the catches in all periods. This alternate run indicated that the model could fit the data under this assumption with a more realistic contrast in F (i.e., ‘apical’ F at true age 3, where S = 1) and SSB over the central period of the time series. Terminal year estimates suggested that this would not affect the determination of current stock status or materially alter the short term projections. However, longer term projections of stock status and expected levels of average future yield would be affected

by the alternate assumptions about selectivity. The changes in selectivity had surprisingly little effect on the penalty function and patterning of the residuals. Increase in the sum of the penalty function would most likely be offset by a decrease in the number of parameters estimated by the model. Although AIC values for an exact estimation of the effect were not available, it suggested the flat-topped model may be more parsimonious.

Evidence:
The SARC Panel expected the dramatic decrease in F from very high levels (F=1.53 in 1994) to extremely low levels (F=0.08 in 2002) to have a major impact on the behavior of the fishery. The evidence in plots of the spatial distribution in effort did not in any way support such a dramatic decrease in effort. Suggestions as to the reasoning for this apparent discrepancy, such as retargeting to other fisheries, and the implementation of gear restricted areas (GRAs), could account for some of this effect, although the timing of the GRA implementation and the fact that it was designed to reduce by-catch means that it is unlikely that this would have produced the marked decrease in F that the model estimated. Uncertainty in the effort information is likely to mask small changes in effort, however the estimated change in F is near 20 fold and such a change should be demonstrable from effort data.

Conclusion:

In the view of the SARC Panel, there are some uncertainties in the scup assessment with regards to the parameterization and data usage. All the evidence presented above suggests that the actual decline in F was less dramatic and that the values of recent F were actually higher than estimated. Conversely, the rise in SSB and the estimate of terminal year SSB are likely to be lower than estimated. The analyses undertaken at the Panel's request point to the estimation of historic stock numbers (Ns in year 1) and the need to constrain historic recruitment deviates as having a strong influence on the absolute level of SSB and F in 2014. Because recent trends in these variables suggest that exploitation is currently low, there is little chance that models less restricted in initial stock conditions would estimate stock status to be unsatisfactory or materially affect the projections. The SARC Panel therefore concluded that the model for scup presented by the WG could be used for management in the short term, but if the trends in F or recruitment were to change in the medium term, further investigations would be necessary to ensure that the stock is not over exploited.

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.

The SARC Panel agreed that the SAW met the key elements of this ToR.

Existing status definitions for 'overfished' and 'overfishing' for scup are based on recommendations from the 2008 Data-Poor Stocks Working Group (DPSWG) Peer Review Panel (NEFSC 2009) that $F_{40\%}$ be used as the default threshold fishing mortality reference point and spawning stock biomass at $F_{40\%}$ ($SSB_{40\%}$) be used as the default target stock biomass reference point. The SAW stated the existing definitions and values for $F_{MSYproxy} = F_{40\%}$, $B_{MSYproxy} = SSB_{40\%}$, $B_{THRESHOLD} = ½\ SSB_{40\%}$, and MSY.

Using the accepted new ASAP stock assessment model, the SAW provided new recommended point estimates for the reference points. The $F_{MSYproxy} = F_{40\%} = 0.220$ (where fishing mortality is measured as 'apical' F at true age 3); $B_{MSYproxy} = SSB_{40\%} =$ 87,302 mt; $B_{THRESHOLD} = ½\ SSB_{40\%} =$ 43,651 mt; and the proxy estimate for MSY = $MSY_{40\%}$ = 11,752 mt (comprised of landings of 9,445 mt and discards of 2,307 mt).

The SAW did not provide estimates of the uncertainty of the reference points, nor did it make explicit comment on the adequacy of existing or new reference points, but implicitly accepted the approach of using proxy reference points based on per recruit calculations and projections, as advised by the DPSWG in 2008. It is natural then to update the reference points and MSY estimate using the new, accepted ASAP model. The SARC Panel did not consider it necessary to change reference point definitions and accepted the approach taken and values provided by the SAW.

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).

The SARC Panel agreed that the SAW met this ToR.

The SARC Panel accepted the new ASAP model recommended by the SAW as a basis for providing status determination, though noted a number of concerns (see ToR 4, above, and Special Comments in the Scup Assessment Summary Report for 2015). Having accepted the model (ToR 4) and the biological reference points (ToR 5), the Panel accepted the status determination provided by the SAW.

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) (see Appendix to SAW TORs for definitions).

a. Provide numerical annual projections (3 years). 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.

The SARC Panel agreed that the SAW met the key elements of this ToR.

a) Projections under two 2015 scup catch assumptions were provided by the SAW, with a clear preference for the option reflecting the most recent patterns in the fishery. The ToR calls for the provision of annual probabilities of exceeding threshold reference points (below for SSB and above for F); these are not shown by the SAW but it is clear from the projected estimates of SSB and from the text that the probabilities in each of the years 2016-2018 of falling below the biomass threshold is zero. Similarly, the probability of exceeding the F threshold is very low, if not zero. The SAW recognized the uncertainty in terminal year abundance and variability in recruitment by undertaking 100 stochastic projections using each of the 1000 MCMC estimates of terminal stock size and drawing random samples of future recruitment from the cumulative density function of the estimates of recruitment from 1984 to 2014. The ToR calls for a sensitivity analysis in which a range of assumptions about the most important uncertainties in the assessment are considered. The SAW has stated that biological inputs to the scup assessment are well-founded and has attended to process error and retrospective errors in terminal year estimates of abundance by inflating (doubling) the OFL CV used in the projection. This was deemed sufficient to account for the uncertainty seen in final year abundance/SSB estimates across a wide range of sensitivity tests carried out by the SAW. During the SARC review, a request was made to check if the range of model estimates covered by the inflated CV included the outputs of models with forced flat selectivity and reduced time-series length explored during SARC 60(see ToR 4); the check provided confidence this was so.
b) The SAW has considered projection options to cover two 2015 catch options, noting both are realistic but stating a preference for the option that assumes the ratio of landings to OFL remains constant. This seems reasonable. As noted at (a), the major uncertainties are dealt with via inflation of the CV on the OFL inflated to reflect the range of uncertainty exposed by sensitivity testing.
c) The SAW has attended to this ToR with respect to landings compared to MSY proxies and historical values. This is reasonable, attending to the productivity component of vulnerability. The SAW view is that the stock has low probability of becoming overfished in the short term if fishing is at the OFL. This view is supported by the projections. The SAW has not made any comment on issues of susceptibility (Note that in the SAW ToR, vulnerability is defined in terms of productivity and susceptibility (the potential for the stock to be impacted directly and indirectly by the fishery (e.g. loss of

habitat)). There is no indication that the fishery creates any susceptibility concerns but for completeness the SAW could in future make comment on this issue, even if brief.

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

The SARC Panel agreed that the SAW met this ToR.

Previous Research Recommendations

Note that the contents of the first four columns are text copied from the 2015 Assessment Report, while the two columns at the right contain the Panel's assessment of the contribution that the research item would make to the assessment and its comments on the research item

		Research recommendation to previous SAW	**Action taken by previous SAW**	**Comment by the SARC on how the result might improve assessment**	**Comment by the SARC 60 Review Panel**
DPWG 2008 (NEFSC 2009)	Short term analytical tasks	1) Evaluation of indicators of potential changes in stock status that could provide signs to management of potential reductions of stock productivity in the future would be helpful.	Some progress in SSC work on 'rumble strip' analysis – used in 2013. The 2015 assessment explored the potential use of the Conn (2010) hierarchical method to combine indices across time and space; more developmental work is needed.	This recommendation would provide an external diagnostic as to whether the assessment model requires revision.	Identification of potential indicators should precede evaluation? Is the indicator intended to forecast a potential reduction or detect one that has occurred? A more useful research recommendation might be to modify the model such that it becomes robust to change in stock productivity There is some question as to whether the approach based on CPUE can be used to represent the assessment model where the indices have very different selectivities-at-age.
		2) A management strategy evaluation of alternative approaches to setting quotas would be helpful.	No progress	This research would provide a basis for determination of an appropriate %SPR proxy to match the productivity of the species and its variability	The research recommendation is of a wide scope and it is not clear what was intended here. However, developing this capability would allow addressing of a wide variety of questions regarding the management of scup and other species.
	Long term data and analytical	3) Current research trawl surveys are likely adequate to index the	The RI Industry Cooperative Trap survey was implemented during 2005-	Adding aging information, particularly information that could	It is unfortunate that funding was stopped.

	needs	abundance of scup at ages 0 to 2. However, the implementation of new standardized research surveys that focus on accurately indexing the abundance of older scup (ages 3 and older) would likely improve the accuracy of the stock assessment.	2012. This survey had a higher catch rate for larger and older fish of age 3+ than the bottom trawl surveys. A peer review indicated that some of the design elements should be modified and this advice was followed; however, funding was halted after 2012.	reduce the general uncertainty about the abundance of older ages and specifically the question of the likely selectivity pattern of the fleets would prove very helpful in improving the assessment	
		4) Continuation of at least the current levels of at-sea and port sampling of the commercial and recreational fisheries in which scup are landed and discarded is critical to adequately characterize the quantity, length and age composition of the fishery catches.	Adequate sampling has been maintained (see assessment tables and figures).	This is about maintaining assessment quality.	Given the weaknesses in the assessment at the older ages, maintaining sampling levels is crucial, however further investigations regarding the efficacy (length stratification) could improve the efficiency of the sampling by targeting those ages where length contains less information regarding age (i.e. focusing more on older ages)
		5) Quantification of the biases in the catch and discards, including non-compliance, would help confirm the weightings used in the model. Additional studies would be required to address this issue.	No progress.	The most recent assessment has relaxed the subjective constraints on parameters.	This reduces the reliance on estimates in terms of their variance, however biases would still affect assessment results.

		6) The commercial discard mortality rate was assumed to be 100% in this assessment. Experimental work to better characterize the discard mortality rate of scup captured by different commercial gear types should be conducted to more accurately quantify the magnitude of scup discard mortality.	No progress.	Discarded smaller individuals have historically represented a significant portion of the commercial catches. Such discards have been reduced by the introduction of GRA's. However uncertainty over the fate of discarded individuals is still an issue that needs to be addressed if the accuracy of model inputs is to be improved.	Given the stability of the current assessment with respect to altering mortality patterns the effects on the current model are unlikely to be substantial. However, other model configuration may well be more sensitive to the estimates of discard mortality in the commercial fleet.
MAFMC SSC July 2012		1) Improve estimates of discards and discard mortality for commercial and recreational fisheries	SBRM estimates of commercial fishery discards, which exhibit a less variable time series pattern and improved precision compared to previous estimates, were developed and accepted for this assessment. No progress on discard mortality rates.	The improvements in the use of commercial data are welcomed and will help to stabilize the age structure.	This is very difficult to do for recreational fisheries and improved estimates in terms of their variance serve little purpose if their biases are unknown. In addition the proportion of recreational discards in the assessment is minor compared to other species.
		2) Evaluate indices of stock abundance from new surveys	The RI Cooperative Trap (ended in 2012), NEAMAP spring and fall surveys, indices at age from the RIDFW spring and fall surveys, and indices at age from the NYDEC survey are	The provision of this information has improved the assessment.	

			now included in the assessment documentation.		
		3) Quantify the pattern of predation on scup	The limited NEFSC survey food habits data for scup were reviewed and it is not possible to calculate absolute estimates of consumption of scup by predators due to sample size considerations (~500 identifiable scup in the ~40 year time series).	Better estimates of the temporal variation in natural mortality caused by predation would improve the understanding of stock dynamics. Additionally the information would be highly informative in the estimation of the variability in survey catchability associated with the spatial variability in habitat suitability.	
		4) Conduct biological studies to investigate maturity schedules and factors affecting annual availability of scup to research surveys	The NEFSC maturity schedule for scup was updated. GLM and GAM modeling and GIS investigation of NEFSC bottom trawl survey data on scup distribution, temperature preference, and salinity preference did not reveal strong effects that could be directly linked to a trend in availability. Changes in scup distributions with respect to bottom temperature, body size and abundance within the NEFSC survey were	Noted and now included in the assessment Anything that can help to improve the coherence between different surveys by eliminating spatial effects is considered to be important in the assessment due to inter survey differences in the estimation of trend.	This work was conducted well, however the limited response of the species to the variables included in the model suggested that there was little discernable effect so that the improvements to the model based on the habitat corrected time series were minimal. More informative covariates may provide better results for scup and temperature models may be more informative for other more temperature-dependent species.

			examined to identify potential effects on availability. A thermal habitat model was developed to estimate proportions thermal habitat suitability for scup sampled during fall and spring NEFSC and NEAMAP surveys. These habitat based estimates of availability were used to inform catchability in sensitivity evaluations of the final ASAP model.		
		5) Explore the utility of incorporating ecological relationships, predation, and oceanic events that influence scup population size on the continental shelf and its availability to resource surveys into the stock assessment mode	GLM and GAM modeling and GIS investigation of NEFSC bottom trawl survey data on scup distribution, temperature preference, and salinity preference did not reveal strong effects that could be directly linked to a trend in availability. Changes in scup distributions with respect to bottom temperature, body size and abundance within the NEFSC survey were examined to identify potential effects on availability. A thermal habitat model was developed to estimate proportions thermal habitat suitability for scup sampled during fall and spring NEFSC and	Why would this research be duplicated?	See above

			NEAMAP surveys. These habitat based estimates of availability were used to inform catch ability in sensitivity evaluations of the final ASAP model.		
		6) Evaluate alternate forms of survey selectivity in the assessment to inform indices of abundance at higher ages	The multinomial approach to inclusion of fishery and survey catch at age was used in the assessment model, allowing use of low and variable indices at older ages and, where possible, estimation of selectivity at age.	The ability to allow precise estimates by age is helpful and has now been implemented.	Although this work was completed, final choice of the effective sample size as implemented in the current model for the older ages does tend to reduce the benefits.
New Research Recommendations		1) A standardized fishery dependent CPUE of scup targeted tows, from either NEFOP observer samples or the commercial study fleet, might be considered as an additional index of abundance to complement survey indices in future benchmark assessments		Tuning information on older ages would be useful in this assessment particularly because the index information is variable and not very informative on those ages.	Although highly informative for the assessment, this type of information would have to be corrected for changes in fishery behavior. Also duplicated use of the data (in catch and tuning) does present some weighting issues in the assessment.
		2) Explore additional sources of length/age data from fisheries and surveys in the early parts of the time series to provide additional		The additional data would improve the quality of input data	

		context for model results			
		3) Explore experiments to estimate the catchability of scup in NEFSC and other research trawl surveys (side-by-side, camera, gear mensuration, acoustics, etc.)		Improved understanding of the factors influencing survey catches could be useful	Variation in the availability of scup to the surveys would still be an issue
		4) Refine and update the Manderson et al. availability analysis when/if a new ocean model is available (need additional support). Explore alternative niche model parameterizations including laboratory experiments on thermal preference and tolerance.		Improved understanding of factors influencing scup availability would offer the potential of adjusting survey indices to account for inter-annual variation in availability	The Panel considered that this research had potential
		5) Explore the Study fleet data in general for information that could provide additional context and/or input for the assessment		Better understanding of the characteristics of the survey and fleet data may allow identification of improved methods of processing	This research item does not have a clear focus. It is sound scientific practice to undertake exploratory data analysis to better understand the characteristics of the data that are available for assessment.
		6) A scientifically designed survey to sample larger and older		Improved data on the relative abundance of older fish could improve	The Panel identified the dome shaped selectivity estimated by the model as an issue..

		scup would likely prove useful in improving knowledge of the relative abundance of these large fish.		the assessment	

3. Review of Bluefish

3.1 Synopsis of Panel Review

The SARC Panel agreed with the SAW 60 WG's conclusion that the bluefish stock was not overfished and that overfishing was not occurring in 2014.

3.2 Evaluation of Terms of Reference for Bluefish

B. Bluefish

1. Estimate catch from all sources including landings and discards. Evaluate and if necessary update the discard mortality estimate. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.

   The SARC Panel agreed that the SAW met this ToR[1].

   Commercial Fishery Data:
   Commercial bluefish landings have trended down from a high of 7,162 mt (15.8 million lbs.) in 1983, to a low of 1,974 mt (4.4 million lbs.) in 2013. Commercial landings have an overall declining proportion of total landings. The commercial quota has not been fully caught since being introduced in 2000. Landings have primarily occurred in the mid-Atlantic region. Before SARC 60, data had been obtained from NEFSC Commercial Fisheries Database (CFDBS). To improve on consistency and reproducibility, commercial landings for the 2015 assessment were obtained for 1982 through 2014 from the Atlantic Coastal Cooperative Statistics Program (ACCSP) database maintained by the Atlantic States Fishery Commission. A discrepancy of 1.5% was noted between the ACCSP Virginia commercial reported data and Virginia's Fishery Mandatory Reporting Program Trip (FSMRPT) landings database, and the Potomac River Fishery Commission (PRFC) data that resulted from problems with quality control during data uploading and failure to synchronize data across programs when updating. To deal with this discrepancy, the Working Group (WG) chose to use either the ACCSP or the Virginia historic landings in a given year for whichever one was greater. Although the discrepancy is small, it does introduce uncertainty and potential bias.

   Fishing locations are tracked by VTR, and bluefish were commercially harvested in 36 of 46 statistical areas. While bluefish were historically landed in the southeast

[1] There were inconsistencies in the numbers calculated between the SAW report and the presentations and it was not clear what were landings, and landings + dead discards in the recreational fleet. Also the SAW classify catches = landings + dead discards for the fleet and catches = landings + all discards for the CPUE.

and mid-Atlantic regions, most commercial harvest is now located in the mid-Atlantic region.

Recreational Fishery Data:
Annual recreational harvest has averaged ~14,060 mt (30.9 million lbs) since 1981. It declined from a high value in the early 1980's to a time series low of 3,310 mt (7.3 million lbs) in 1999 and has averaged 6,662 mt (14.7 million lbs) since 2000. Recreational catch (catches = landings+dead discards) has ranged from 66 – 84 % of total harvest from1985-2014 with an increasing proportion as total landings decreased. Data on recreational landings, releases, and biological metrics were obtained for 1981 through 2014 from NMFS MRFSS/MRIP. These surveys have two components: 1) an offsite survey to measure effort, and 2) an on-site access intercept survey to obtain CPUE and biological metrics. Total catch is then estimated by multiplying CPUE by effort. In 2005, results of a review of MRFSS by the National Research Council found bias in the access intercept portion of the survey. This bias was quantified through the MRIP beginning in 2004 and corrections applied to the historical MRFSS landing data. Sampling is stratified by State, mode of fishing, and wave (2 month periods of time). Catch is observed by the survey agent, but releases are self-reported by the angler.

The catch from the charter and for-hire recreational fishery has been surveyed through a separate program, the for-hire survey (FHS), since 2005. This provides a more precise estimate of this sector of the recreational fishery.

Discard Data:
Because of the declining commercial bluefish landings and minimal discards rates for the sector, the WG did not include commercial discard data into the assessment. This introduces a negligible source of bias.

Recreational discard data for the stock assessment relies on self-reporting by anglers during the MRFSS/MRIP survey. This self-reporting adds uncertainty and potential bias to the estimates.

Based on estimates reported in a 1995 paper, and modified by the ASMFC bluefish Technical Committee, recreational discard mortality was estimated at 15% for released fish. Four analyses to estimate recreational discard mortality were presented for the current assessment process suggesting values of 14-17% were appropriate. After considering these results and following a meta-analysis, the WG agreed to use a 15% discard mortality for the 2015 assessment.

In some of the states, technicians record catch and release while on board. Some of the for-hire and charter boat fisheries also report through a logbook program. These programs cover NJ, CT, and RI and sample fishes that migrate there, mostly older and larger bluefish.

2. Present and evaluate data and trends on life history information including, age, growth, natural mortality, food habits, and maturity.

   The SARC Panel agreed that the SAW met this ToR.

   Data relating to aspects of the biological characteristics of bluefish in the waters off the Atlantic coast of the U.S. were extended considerably by recent published studies. Scales were historically used to age bluefish until recently. Ageing of fish using otoliths rather than scales has likely resulted in more accurate estimates of age and eliminated one source of error. It is pleasing to note that improved and standardized aging protocols have been established and that age data for this species from a number of new sources have now been collated.

   The Panel noted that cohorts with high abundance were apparent in the age compositions of recreational catches, and could be tracked through time. There was similar evidence of strong cohorts tracking through age compositions of the MRIP recreational CPUE index; care, however, is needed in interpreting this as confirmatory evidence because of the overlap in data used. Although the age compositions of commercial catches were dominated by younger fish, more abundant cohorts were apparent. The contrast in the latter were less obvious than for the recreational catches. Such structure in age compositions would only be expected if ages are correctly assigned. Thus the ageing errors introduced through use of scales did not appear to be accompanied by a marked decrease in precision.

   The SARC Panel decided that, although it was important to correct scale-based age estimates, the use of scales in the earlier period did not suggest that their use markedly increased the uncertainty in the assessment model. The SARC Panel recommended, however, that correction of scale-based ages be undertaken before the next benchmark assessment.

   A review of the estimates of natural mortality obtained using alternative life history approaches demonstrated that, while estimates were quite variable, the estimate of *M* used in earlier assessments was likely to be appropriate.

   The Panel noted that dietary studies have focused on the prey of bluefish, with little attention is given to its predators. By broadening the focus to include predation of bluefish, insight may be gained into the absolute magnitude of M, and potential temporal variability in this factor.

   The SAW bluefish WG noted a strong bimodal pattern in commercial and recreational landings length compositions, and described a period where the pattern was weaker. No definitive explanation was available though comment was made on the retention of larger fish. The Panel did not see any problems with the bimodality in lengths if the modes could be related to specific cohorts (i.e. a growth effect rather than a selectivity effect).

3. 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.), evaluate the utility of the age-length key for use in stock assessment, and explore standardization of fishery-independent indices. Investigate the utility of recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data, including exploring environmentally driven changes in availability and related changes in size structure. Explore the spatial distribution of the stock over time, and whether there are consistent distributional shifts.

   The SARC Panel agreed that the SAW met this ToR.

   The SARC Panel noted that data from a number of fishery-independent bluefish surveys conducted at locations ranging from Florida to New Hampshire had been used to calculate time series of indices of abundance and, when length data were available, length compositions of the collected fish were determined. Age-length keys, constructed primarily using data for sampled fish from commercial catches, were then employed to construct age compositions from those length compositions.

   The increase in the number of bluefish that have been aged in recent years, and the adoption of a standard ageing protocol has improved the reliability of the age-length keys that are used in the assessment. The SARC Panel noted that these data had also aided resolution of an issue relating to incorrect aging of bluefish from spring samples from North Carolina, which was possibly the result of applying a non-standard birthdate.

   Hierarchical analysis was used to produce a single index representing the underlying trend in juvenile abundance from six beach seine surveys conducted by States ranging from New Hampshire to Virginia. The SARC Panel noted that, while reducing the number of parameters in the assessment model through use of such external analysis, it was necessary to carry the imprecision of the data resulting from that analysis into the assessment model. It was also important to ensure that the assumptions made when conducting the external analysis are consistent with those of the assessment model. The combined YOY index was used in the final assessment.

   A fishery-dependent index and age composition was developed from a GLM analysis of those MRIP intercept data where bluefish were caught or targeted. The factors, which were considered, included year, wave, mode (shore, for-hire, private/rental boat), area fished (inshore, offshore), State, and avidity. The latter factor is known to have a major effect on catch per unit of effort and is essential to take into account.

   Results from the 2015 assessment model were later found to be sensitive to the choice of selectivity assumptions for the MRIP catch and MRIP-CPUE data. The initial choice was one common selectivity function, but results differed significantly from a model estimating selectivity independently. The SARC Panel noted that recreational harvest is calculated as the sum of the A (whole), B1 (bait, filleted, discarded dead) and 15% of B2 (live discarded) estimates of bluefish catches reported in MRIP data, while the recreational CPUE data included A1,B1 and 100% of B2 fish. In addition a size selective

bias exists with a greater proportion of large fish in the B2 estimates due to a preference for the consumption of smaller individuals. Therefore a separate selectivity for both, as used in the assessment is appropriate.

The effect of temperature on the availability of habitat for Bluefish was explored by developing a thermal niche model. Although temperature was a highly significant factor in the niche model, temperature did not appear to sufficiently vary inter-annually to produce a significant effect on survey catchability. The approaches used might assist in exploring the effect on bluefish distribution of other biological factors.

4. Estimate relative fishing mortality, annual fishing mortality, recruitment, total abundance, and stock biomass (both total and spawning stock) for the time series, 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. Explore alternative modeling approaches if feasible.

The SARC Panel agreed that the SAW met this ToR.

The focus of the assessment by the SAW bluefish WG was to remove or at least reduce the constraints on the model generally and specifically the subjective weighting of the different information sources within the model. The WG made very good progress on these primary aims in a structured approach to model development. The basis for the input data was thoroughly reviewed and revised with regards to the ageing information which formed a firm foundation for the analysis. Secondary aims, such as splitting the commercial and recreational fleets and splitting the penalization of the catch and index information into CPUE and multinomial age penalties, were also achieved, addressing criticisms of the previous assessment methodology.

The structured approach to model building provided the necessary background information to understanding the stock dynamics reflected in the model and provided confidence in the model specification. Consequently, the SARC Panel was initially supportive of accepting the final model (B043) as the basis for advice. On close examination of the final model diagnostics, however, it became apparent that there had been a small misspecification of the model (fixing the alpha 50% for the logistic selectivity for the MRIP index at true age 0 rather than as intended at true age 1). Following some further model runs and discussion with the WG the Panel thought the most appropriate way to fix the issue was to determine the alpha 50% within the model. This resulted in the estimation of one additional parameter, but also somewhat reduced the systematic age effects in the age composition residuals of this index in the model. Because the original model specification was not the one intended by the WG, and because the freeing up of the parameter was considered more objective, the Panel in agreement with the WG accepted the new model specification as the final model (B044). Because of the minor differences in model results the existing sensitivity analyses on the basis of model B043 were accepted as representative of the sensitivities of B044. Similarly, the projection results, although different in absolute terms, were also expected

to be only marginally affected in relative terms so the methodology for assessing stock status and determining OFL was accepted on the basis of the presentation based on B043 with values updated using model B044.

One undesirable effect that was observed in the move from model B043 to B044 as the basis of advice was an increase in the magnitude of the retrospective pattern. The pattern was present and persistent in both models, and the change in absolute terms was small, but substantial in relative terms. The size of the retrospective bias in the management metrics of F and SSB for model B044 fell within the confidence limits for these metrics as determined by MCMC analyses of model B044.

Although retrospective patterns are generally undesirable because of their effect on management, their utility as a direct diagnostic for model comparison is debatable. Rather retrospective patterns are generally used to investigate constraints in the model assumptions that might lead to such effects. Investigations of the effects might then indirectly lead to the rejection of a particular model, but a retrospective pattern *per se* is not a justifiable reason to reject one model over another. In this case, the new model specification amplified the existing retrospective pattern but was determined not to be the cause of such a pattern. Because of this, and because the retrospective pattern in absolute terms was small when compared to the assessments of other species, it was deemed appropriate to use B044 as the basis for advice despite the inflated retrospective bias (cf B043).

The accepted assessment model (B044) for bluefish represents the stock dynamics well and is suitable for the provision of advice on stock status and future exploitation. However, the model is strongly driven by one index providing the majority of the information at older ages. This index unfortunately is partially correlated and derived from what is usually considered to be a highly uncertain source of recreational fisheries information (MRFSS/MRIP). The following considerations gave reassurance that everything that could be done had been done to ensure that the violation of the assumption of the independence had minimal impact on the assessment.

1) The MRFSS/MRIP CPUE were corrected for potential avidity (anglers who fish frequently may have different catch rates) bias.
2) The recreational catch and CPUE series differed in that the CPUE series included all the released fish, while the catch series only included 15% of the released catches .
3) Of far greater concern given its importance to model fitting was the fact that the majority of age information for the recreational fleet was re-used in the index calculation. It was not possible to determine the degree of overlap exactly as it varies by age and time.
4) Examination of the estimated catch-at-age for the recreational fleet indicated good cohort coherence particularly in the earlier part where both aging and MRFSS data were thought to be less certain.

The Panel was of the view that any future work in attaining a more independent index of the abundance of older ages should be given priority over other types of data collection to improve the objectivity of the assessment. However, the current assessment diagnostics and the information presented to the panel show little evidence that concerns, other than in principle (esp. 3, above), are warranted. The assessment is considered suitable for the provision of advice.

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.

   The SARC Panel agreed that the SAW met the key elements this ToR

   Existing status definitions for 'overfished' and 'overfishing' for bluefish were determined by SARC 41, based on estimated values of F_{MSY} and B_{MSY}, where B refers to total biomass. The SAW stated the existing definitions and values for F_{MSY}, B_{MSY}, $B_{THRESHOLD} = B_{MSY}$, and MSY.

   The SAW stated that to reliably estimate MSY-based reference points, a stock-recruitment relationship is required, and derivation of one is not feasible for bluefish given the lack of information on recruitment at low stock sizes. As such, the SAW WG proposed to continue using MSY proxy reference points based on per recruit and projection methods. The SARC Panel accepted this approach.

   The SAW WG originally proposed stock status based on total biomass, the standard that was used in the previous bluefish assessment. But, after discussion at SARC 60, it was agreed to use SSB (spawning stock biomass) and SSB-based proxies. Fundamentally the purpose of the biomass reference point is to ensure future recruitment a function to which only the mature portion of the stock contribute. For this reason the panel suggested that new reference points be set on the basis of SSB rather than TSB (total stock biomass), though it was recognized that, given the current estimates of selectivity of immature bluefish and largely stable recruitment there would be little difference on the stock status estimation based on either.

   Using the accepted new ASAP stock assessment model B044, the SAW provided new recommended values for the reference points. The $F_{MSYproxy} = F_{40\%} = 0.170$; $B_{MSYproxy} = SSB_{40\%} = 111{,}228$ mt; $B_{THRESHOLD} = ½\ SSB_{40\%} = 55{,}614$ mt; and the proxy estimate for MSY = $MSY_{40\%} = 13{,}967$ mt. The SAW did not provide estimates of uncertainty of the reference points.

   It was discussed during the SARC that bluefish productivity is high and that 40%SPR is a default level typically associated with less productive demersal species. While considering a lower percentage basis for MSY proxy reference points, it was also noted

that a higher value might be necessary to account for the portion of immature catches taken. The SARC Panel agreed that the 40%SPR basis should be maintained at this time, but that appropriateness of the %SPR levels should be given further consideration in future.

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

   The SARC Panel agreed that the SAW met this ToR (see also ToR 5, above).

   The SARC Panel accepted the new ASAP model recommended by the SAW and as modified during SARC 60 (see ToR 4) as a basis for providing status determination.

   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; 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.

   The SARC Panel agreed that the SAW met the key elements of this ToR.

   a) Projections from the accepted model were made using standard NEFSC software. Projections for a range of constant F scenarios for 2016-2018 and 2015 removals set to the 2015 quota were run, all starting with initial abundance estimates drawn from MCMC runs of the accepted model B044 (run during SARC 60 and finalized immediately following). The projections were done using a single fleet; this required development of a combined selectivity curve, based on the last three years of the model estimates. A small CV was added to the selectivity-at-age estimates, as was also done for

biological parameters drawn from lognormal distributions. The SAW ran a number of sensitivity tests using model B043 to address potential uncertainties using the model as presented to the SARC; based on those tests, conclusions drawn using the accepted model B044 are expected to be robust. The ToR calls for the provision of annual probabilities of exceeding threshold reference points (below for SSB and above for F); these are not shown by the SAW but it is clear from the projected estimates of SSB and from the text provided by the SAW that the probabilities in each of the years 2016-2018 of the SSB falling below the biomass threshold is zero.

b) The SAW considers the projections realistic.
c) The SAW made a number of useful comments related to productivity and susceptibility of bluefish. The SAW has commented that the stock is unlikely to become overfished over the next three years if fishing is at or near the F_{MSY} proxy; the projections support this view.

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 2005 and the research recommendations contained in its 23 September 2013 report to the MAFMC. Identify new research recommendations.

The SARC Panel advised that research recommendations should provide a justification for the proposed research, which clearly identifies how the results will benefit the stock assessment and/or management of bluefish. The recommendations need to be clearly dated, and the source cited, such that the original intent and need is clear. Research items should be specific, rather than open ended. The SARC Panel notes that many of the previously listed research recommendations are unclear and possibly out of date. It is thus difficult to comment on these earlier items. During SARC 60, in light of the concerns (above) expressed by the Panel, the WG revised the text for sections B11.1 and B11.2 of the 2015 Assessment Report (included below). The SARC Panel has reviewed and annotated the new research recommendations in this revised text.

B11.1 Progress made in addressing previous research recommendations.

Commercial Data

- Increase sampling of size and age composition by gear type and statistical area

- Target landings for biological data collection and increase intensity of sampling for biological data.

Addendum I to the Bluefish FMP has resulted in additional commercial biological data (e.g., age, gender, weights) being available (e.g., from NC and NY). Prior to Addendum I, the NC biological collection program targeted commercial landings for biological data (e.g., 2006-2011, age, gender, weight).

Recreational Data

- Increase sampling of size and age composition by gear type and statistical area

- Target landings for biological data collection and increase intensity of sampling for biological data

Addendum I to the Bluefish FMP has resulted in additional recreational biological data (e.g., age, gender, weights) being available from all participating states; in addition, volunteer recreational angler surveys from several states (CT, RI, and NJ) are now providing recreational discard data for use in the bluefish stock assessment.

Ageing Data

- Complete a scale-otolith comparison study

Both independent research and an inter-agency bluefish ageing workshop confirmed that the use of sectioned otoliths is the preferred method by which to age this species (Robillard et al. 2009; ASMFC 2011). Further, each agency follows the standard otolith processing, reading, and age-assignment protocols developed by ODU. Some variations do exist with respect to processing, but these are relatively minor (e.g., baking before or after sectioning, mounting sections using various adhesives, etc.) and allowable as determined by the 2011 Bluefish Ageing Workshop. In response, all organizations that currently are involved with efforts to age bluefish for the purposes of informing the stock assessment for this species do so using sectioned otoliths and the 2011 protocol. The WG determined at the model meeting (WP B6) that historic age scale ages (excluding NC spring scales) were comparable to otolith ages and hence historic scale age data were retained for model runs.

- Conduct study or workshop to address discrepancies between estimated bluefish age from scales and otoliths and the chronological age. Examine issues of inter- and intra-reader variation in interpretation of ages

It was unclear to the WG exactly what this research recommendation was suggesting (especially in light of the previous research recommendation). To the extent that this research recommendation is related to a non-January 1 birthday for early NC spring age data, at the model meeting the WG made adjustments to the NC spring scale and otolith data (WP B6); those corrected spring ages were incorporated into the final assessment.

For the second part of the research recommendation, an ageing workshop was held in 2011 to produce guidelines for future aging work on bluefish. Intra-agency measures of ageing precision are available for nearly all of the organizations currently collecting age data (WP B5). The few organizations that were unable to provide estimates of precision due to staffing limitations (i.e., no second reader), will likely will be able to do so in the future as ageing programs develop further and assuming additional resources become

available. Based on inter-agency measures and the 2011 Workshop, the WG felt comfortable using the expanded sources of age data.

- Examine the feasibility of each state collecting samples of hard parts for ageing, with one or two laboratories interpreting the annuli for consistency

The 2011 workshop resulted in Addendum I to the bluefish fishery management plan, which required all states that capture a substantial portion of bluefish landings to collect and age a minimum of 100 bluefish samples per year. Inter-agency comparability of age data is currently maintained through the adherence to standardized processing and ageing protocols for bluefish, while the digital reference collection developed by the states and maintained by the ASMFC also promotes this consistency by serving as a training tool and reference collection. Formal ageing exchanges meant to quantify inter-agency precision and bias have yet to occur for bluefish. It should be noted, however, that recent exchanges for other species, including black sea bass and summer flounder have shown that standard exchange practices are effort-intensive and often suffer from serious design flaws (ASMFC 2013). The latter issue results in measures of inter-agency precision and bias from the exchange that are not representative of the quality of age data provided by the participating organizations to the assessment process, and are therefore wholly uninformative. Further, discussions regarding the consolidation of all processing and ageing of bluefish under a single agency have determined that the current multi-agency approach is the superior design (WP B5). Gains in consistency that are realized using a single set of processors/readers are offset by increases in bias that arise due to lack of localized knowledge regarding life history and growth.

Fishery-Independent Data

- Continue research on species interactions and predator-prey relationships

No progress made on this item beyond development of working paper summarizing diet information (WP B3) for bluefish derived from NEFSC, NEAMAP, ChesMMAP, and SEAMAP which addressed portions of TOR #2.

- Examine alternative weighting schemes for the available fishery-independent surveys (area, inverse variance, N, etc.)

The Conn (2010) hierarchical approach which implicitly weights surveys by uncertainty was applied to combine multiple noisy state YOY indices that were criticized during the previous review as being unrepresentative of coastwide recruitment due to their individual limited spatial and temporal extent. The WG did not have time to explore model runs using weighting schemes alternative to this.

Finally, the WG adjusted fishery independent survey input CVs in the assessment model to get the RMSEs near 1, and ESS for fishery independent surveys to reflect confidence in age data over different time periods.

- Investigate the feasibility of alternative survey methods that target bluefish across all age classes to create a more representative fishery-independent index of abundance

No specific progress made on this item regarding survey gear types. However, the TC included additional fishery independent surveys (e.g., PSIGNS) that do target a wider age range (0-6+) in the current assessment.

- Initiate sampling of offshore populations in winter months

No progress made on this recommendation.

- Conduct research on influences on recruitment including pathways of larval bluefish

Research has been conducted on recruitment dynamics of bluefish (e.g., multiple cohorts; see paragraph below) however, time constraints prevented the WG from incorporating cohort-specific indices in the model.

Recent research has focused on the factors that influence bluefish survival from the young-of-year stage to age-1. Taylor et al. (2006) concluded that young of year bluefish almost exclusively utilize habitats on the inner continental shelf. Scharf et al. (2006) quantified the inter cohort dynamics of young of year bluefish. Taylor and Able (2006) provide additional information on cohort hatch date and differences in growth between spring and summer cohorts. Morely et al. (2007) explored how energy storage influenced juvenile young of year survival. Taylor et al. (2007) provide further information on fine scale habitat selection of young of year bluefish. Wuenschel et al. (2012) synthesized coastwide data to develop a conceptual model of the processes underlying bluefish recruitment. Morely et al. (2013) documented size selective overwinter mortality of young of year bluefish.

- Initiate coastal surf zone seine study to provide more complete indices of juvenile abundance

Research suggests that the coastal surf zone is important habitat (Able et al. 2013). No progress made on this item.

Models, Inputs, and Outputs

- Explore a tag based assessment and associated costs compared to age based assessments

No progress made on this recommendation. The WG determined that this item is no longer relevant given the potential costs and limited benefits.

- Determine if a tag based assessment could supplement or replace other assessment techniques

No progress made on this recommendation. The WG determined that this item is no longer relevant given the potential costs and limited benefits.

- Continue to examine alternative models including a forward projection catch-at-age model

The intent of this item was not entirely clear to the WG since the previous assessment model was a forward projecting catch at age model. This notwithstanding, the SAW 60 WG explored the application of two models designed to provide catch guidance in data poor situations: Depletion Corrected Average Catch Model (DCAC) and Depletion-Based Stock Reduction Analysis. (See Section B7.3 and Appendices for more details.) Both methods suggest that recent annual harvests were at sustainable levels.

B11.2 New Research Recommendations

High Priority

- Determine whether NC scale data from 1985-1995 are available for age determination; if available, re-age based on protocols outlined in ASMFC (2011); if re-aging results in changes to age assignments, quantify the effects of scale data on the assessment
    - Would allow for validation of the adjustments to the early NC spring age data made by WG at model meeting (WP B6)

      Panel: While useful in ensuring accuracy of input data, the effect on assessment model results is unlikely to be of great magnitude. Move to medium priority.

- Develop additional adult bluefish indices of abundance (e.g., broad spatial scale longline survey or gillnet survey)
    - Given the limited information on older (e.g., age 2+) bluefish collected by existing fishery independent surveys this item addresses the need to adequately characterize dynamics of older fish that are currently not well sampled by fishery independent trawl surveys.

      Panel: This is of high importance. The need for this is discussed under ToR4.

- Expand age structure of SEAMAP index
    - Given patterns of bluefish migration and recruitment (Shepherd et al. 2006, Wuenschel et al. 2012), it is important to monitor bluefish abundance in SAB; currently, the SEAMAP index used in the assessment indexes age 0 abundance only, but recent age data from

SEAMAP suggests collection of age 1 and 2 fish that would help inform the SAB age structure

Panel: This study would address concerns over incomplete mixing of the population at younger ages. If designed correctly, this could be addressed by the survey discussed in the previous research recommendation.

Moderate priority

- Investigate species associations with recreational angler trips targeting bluefish (on a regional and seasonal basis) to potentially modify the MRIP index used in the assessment model
    - Given the importance of the MRIP index in the assessment model, this addresses a need to accurately estimate effort for of the MRIP index (reduce risk of hyperstability)

      Panel: Move this item to high priority. The need for this is discussed under ToR4.

- Explore age- and time-varying natural mortality from, for example, predator prey relationships; quantify effects of age- and time-varying natural mortality in the assessment model
    - This addresses the issue of predation on bluefish by, for example, coastal sharks and/or limited prey resources (top down effects, bottom up effects, and/or environmental effects)

      Panel: High priority in ecosystem context but lower priority for assessment *per se*, as only in the longer term is it likely to inform the estimate of M.

- Continue to evaluate the spatial, temporal, and sector-specific trends in bluefish growth and quantify their effects in the assessment model
    - Addresses appropriateness of WG pooling age data spatially (and temporally) for potential changes regarding the efficiency of the biological collection program

      Panel: This item addresses a concern over incomplete mixing of the population, differential growth and/or possible regional

differences in selectivity, and results are likely to improve the results produced by the assessment model.

- Continue to examine alternative models that take advantage of length-based assessment frameworks. Evaluate the source of bimodal length frequency in the catch (e.g., migration, differential growth rates);

    - This item would address a source of uncertainty in the assessment with age data from different hard parts & provide means to examine the appearance of bimodal length frequency in the catch data.

      Panel: The Panel notes that this item addresses two independent issues that should be considered separately.

      (1) consider the potential benefits and costs of moving to a length-based selectivity model given that (a) the predominant gear is not particularly size-selective and (b) growth is very rapid, and (c) migration patterns appear to be age rather than length dependent.

      Given these considerations, as understood by the Panel, the above item is of low priority.

      (2) determination of the process that leads to bimodality of length compositions.

      The Panel does not understand the concern over bimodality of length compositions as these may well be caused by age modalities. Sufficient data should exist to allow this to be addressed now.

- Modify thermal niche model to incorporate water temperature data more appropriate for bluefish in a timelier manner [e.g., sea surface temperature data & temperature data that cover the full range of bluefish habitat (SAB and estuaries)].

    - This addresses the current limitations of the habitat suitability model for bluefish (limited to hindcast bottom temps, in the MAB).

      Panel: Given how little effect the current habitat model has on bluefish, this research recommendation would appear to be of low priority for this species but may be of higher priority for other species.

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5. Appendices

Appendix 1: 60th SAW/SARC Stock Assessment Terms of Reference (file vers.:)

T08-01 FINAL Version:Dec. 4, 2014

Statement of Work

60th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Benchmark stock assessments for scup and bluefish

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 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 ASMFC technical committees), assessment peer review (by the SARC), 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 fisheries within the jurisdiction of NOAA's Greater Atlantic Regional Fisheries Office (GARFO).

The purpose of this meeting will be to provide an external peer review of benchmark stock assessments for **scup** and **bluefish**.

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 Mid-Atlantic 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 draft stock assessment Terms of Reference (ToRs) which are carried out by the SAW WGs 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 **scup** and **bluefish** 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 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 that includes an appreciation for the varying quality and quantity of data available to support estimation of Biological Reference Points. SARC 59 will address fishery stock assessments of **scup** and **bluefish**. For both species, experience in assessing pelagic stocks and in incorporating environmental factors into assessments would be desirable. For bluefish, experience in the use of recreational fisheries data would also be desirable.

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 June 2-5, 2015.

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, <u>and</u> 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 of stock assessments prepared by SAW WGs or ASMFC Technical Committees 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, FAX number, and CV suitable for public distribution) 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 for review, 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 the following 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 of the stock assessments 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 the tentative dates of June 2-5, 2015.
3) Conduct an independent peer review in accordance with this SoW and the assessment ToRs (listed in **Annex 2**).
4) No later than June 19, 2015, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Dr. Manoj Shivlani, CIE Lead Coordinator, via email to mshivlani@ntvifederal.com, 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.

April 24, 2015	Contractor sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
May 19, 2015	NMFS Project Contact will attempt to provide reviewers the pre-review documents
June 2-5, 2015	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
June 5, 2015	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
June 19, 2015	Reviewers submit draft independent peer review reports to the contractor's technical team for independent review

June 19, 2015	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *
June 26, 2015	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
July 2, 2015	Contractor submits independent peer review reports to the COR who reviews for compliance with the contract requirements
July 10, 2015	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 Allen Shimada, via email allen.shimada@noaa.gov

Support Personnel:

Allen Shimada, COR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
allen.shimada@noaa.gov Phone: 301-427-8174

Manoj Shivlani, CIE Lead Coordinator
NTVI Communications, Inc.
10600 SW 131st Court, Miami, FL 33186
mshivlani@ntvifederal.com Phone: 305-968-7136

Key Personnel:

Dr. James Weinberg, NEFSC SAW Chairman, NMFS Project Contact
Northeast Fisheries Science Center
166 Water Street, Woods Hole, MA 02543
James.Weinberg@noaa.gov (Phone: 508-495-2352) (FAX: 508-495-2230)

Dr. William Karp, NEFSC Science Director
Northeast Fisheries Science Center
166 Water St., Woods Hole, MA 02543
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: 60th SAW/SARC Stock Assessment Terms of Reference (file vers.: 10/162014)

B. Scup

1. Estimate catch from all sources including landings and discards. Include recreational discards, as appropriate. 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 being used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Characterize the uncertainty and any bias in these sources of data.

3. Describe the thermal habitat and its influence on the distribution and abundance of scup, and attempt to 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 a historical retrospective analysis 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) (see Appendix to SAW TORs for definitions).

a. Provide numerical annual projections (3 years). 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.

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

Annex 2: (cont)

C. Bluefish

1. Estimate catch from all sources including landings and discards. Evaluate and if necessary update the discard mortality estimate. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.

2. Present and evaluate data and trends on life history information including, age, growth, natural mortality, food habits, and maturity.

3. 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.), evaluate the utility of the age-length key for use in stock assessment, and explore standardization of fishery-independent indices. Investigate the utility of recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data, including exploring environmentally driven changes in availability and related changes in size structure. Explore the spatial distribution of the stock over time, and whether there are consistent distributional shifts.

4. Estimate relative fishing mortality, annual fishing mortality, recruitment, total abundance, and stock biomass (both total and spawning stock) for the time series, 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. Explore alternative modeling approaches if feasible.

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 review 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; 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.

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 2005 and the research recommendations contained in its 23 September 2013 report to the MAFMC. Identify new research recommendations.

Annex 2: (cont)

Appendix to the SAW Assessment TORs:
Clarification of Terms used in the SAW/SARC Terms of Reference

On "Overfishing Limit" and Acceptable Biological Catch" (DOC Nat. Stand. Guidel. 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 annual catch that is consistent with 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 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)

Interactions 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.

One model or alternative models:

The preferred outcome of the SAW/SARC is to identify a single "best" model and an accompanying set of assessment results and a stock status determination. 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.

Annex 3: Draft Agenda

60th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Benchmark stock assessments for A. scup and **B. bluefish**

June 2-5, 2015

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

DRAFT AGENDA* (version: Dec. 1, 2014)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Tuesday, June 2

10 – 10:30 AM			
Welcome	**James Weinberg**, SAW Chair		
Introduction	**TBD,** SARC Chair		
Agenda			
Conduct of Meeting			
10:30 – 12:30 PM	Assessment Presentation (A. Scup)		
	Mark Terceiro	TBD	**TBD**
12:30 – 1:30 PM	Lunch		
1:30 – 3:30 PM	Assesssment Presentation (A. Scup)		
	Mark Terceiro	TBD	**TBD**
3:30 – 3:45 PM	Break		
3:45 – 5:45 PM	SARC Discussion w/ Presenters (A. Scup)		
	TBD, SARC Chair		**TBD**
5:45 – 6 PM	Public Comments		

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Wednesday, June 3

8:30 – 10:30 AM	Assessment Presentation (B. bluefish)		
	Tony Wood	TBD	**TBD**
10:30 – 10:45 AM	Break		
10:45 – 12:30 PM	(cont.) Assessment Presentation (B. bluefish)		
	Tony Wood	TBD	**TBD**
12:30 – 1:30 PM	Lunch		
1:30 – 3:30 PM	SARC Discussion w/presenters (B. bluefish)		
	TBD, SARC Chair		**TBD**
3:30 – 3:45 PM	Public Comments		
3:45 -4 PM	Break		
4 – 6 PM	Revisit with presenters (A. Scup)		
	TBD, SARC Chair		**TBD**
7 PM	**(**Social Gathering **)**		

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Thursday, June 4

8:30 – 10:30	Revisit with presenters (B. bluefish)	**TBD,** SARC Chair	**TBD**
10:30 – 10:45	Break		
10:45 – 12:15	Review/edit Assessment Summary Report (A. Scup)	**TBD,** SARC Chair	**TBD**
12:15 – 1:15 PM	Lunch		
1:15 – 2:45 PM	(cont.) edit Assessment Summary Report (A. Scup)	**TBD,** SARC Chair	**TBD**
2:45 – 3 PM	Break		
3 – 6 PM	Review/edit Assessment Summary Report (B. bluefish)	**TBD,** SARC Chair	**TBD**

Friday, June 5

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. The public should not engage in discussion with the SARC during SARC report writing, which is scheduled for June 5.

***The NMFS Project contact will provide the final agenda about four weeks before meeting.**
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.