

**Summary Report of the 57th Northeast Regional Stock Assessment Review
Committee (SARC 57)**

**Stock Assessment Review Committee (SARC) Meeting
23-26 July 2013
Northeast Fisheries Science Center
Wood's Hole, Massachusetts**

**Prepared by the Stock Assessment Review Committee
Benchmark Assessments for Summer Flounder and Striped Bass (SAW/SARC 57)**

16 August 2013

SARC 57 Panel Members

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1. Introduction

1.1 Background

The 57th SARC (Stock Assessment Review Committee) met in the Aquarium Conference Room at NOAA's Northeast Fisheries Science Center in Woods Hole, MA from 23-26 July 2013 to review stock assessments for summer flounder (*Paralichthys dentatus*) and striped bass (*Morone saxatilis*). The review committee was composed of Dr. Cynthia M. Jones (MAFMC SSC and Old Dominion University Center for Quantitative Fisheries Ecology, Chair) and three scientists appointed by the Center for Independent Experts: Dr. Robin Cook (Senior Research Fellow, MASTS Population Modelling Group, University of Strathclyde, Glasgow), Dr. Henrik Sparholt (Deputy Head of Advisory Department, ICES Secretariat), and Mr. John Simmonds (Vice Chair of the ICES advisory committee dealing the provision of fisheries advice).

The SARC was assisted by the NEFSC Stock Assessment Workshop (SAW) Chairman, Dr. James Weinberg, Ms. Anne O'Brian, and staff, especially Dr. Paul Rago (NEFSC). Supporting documentation for the summer flounder assessment was prepared by the Southern Demersal Working Group (SDWG), and presentations at the meeting on summer flounder were made by Dr. Mark Terceiro (NEFSC). Materials for the striped bass assessment were prepared by the ASMFC striped bass Technical, Stock Assessment, and Tagging Committee and presentations were made by Dr. Gary Nelson (MA DNR), Heather Corbett (NJ DFW), and Dr. Alexi Sharov (MD DNR). Rapporteurs were provided for each session of the SARC meeting by the NEFSC. A total of 36 people participated in the SARC 57 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 23 July 2013, before the meeting, the SARC panel met with Drs. Weinberg and Rago to review and discuss the meeting agenda (See Appendix, Annex 3), 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 23, July, with welcoming remarks and comments on the agenda by Dr. Weinberg and Dr. Jones. All participants and audience members were introduced at the opening of the SARC meeting and at each of the sessions during the first three days of the meeting. Following introductions, sessions on 23 July were devoted to presentations and discussion of the summer flounder assessment. During this meeting, Dr. Steve Martell, representing the Save the Summer Flounder Fishery Fund (SSFFF), presented comments to the SARC concerning alternative stock assessment approaches

constructed by sex, from a five-page analysis that was made available to the committee (but without time for proper review by the SARC). Striped bass assessment and discussion sessions were conducted on the morning and afternoon of 24 July, followed by continued discussion of the summer flounder assessment in the late afternoon. In that session, the SARC Panel requested additional analysis of the striped bass assessment to re-evaluate the BRPs and projections as consistently empirical or fully parametric.

Follow-up discussion on the striped bass assessment took place in the morning of 25 July. The afternoon of 25 July was spent reviewing and editing the Summer flounder and Striped bass Assessment Summary Reports and hearing results of the follow-up striped bass analyses. The SARC Panel spent the final day, 26 July, 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 summer flounder and striped bass assessments. The meeting was collegial. Considerable time was devoted to facilitate dialog among SARC Panel members, working group scientists, NEFSC assessment scientists, MAFMC staff, and industry representatives.

The completion of the Assessment Summary Report for summer flounder and striped bass, with contributions by the NEFSC staff and the SARC Panel, was accomplished by correspondence on 9 August 2013. 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 NEFSC.

The SARC Panel agreed that each of the assessments (Atlantic summer flounder and striped bass) was effective in delineating stock status, determining BRPs 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 Summer Flounder

The summer flounder, *Paralichthys dentatus* (Linnaeus, 1766), is an important part of the US east coast fisheries. Its range extends from Nova Scotia in the north to Florida in

the south, but it is most abundant in the region extending from Cape Cod to Cape Hatteras in North Carolina, i.e. the Mid-Atlantic Bight (MAB) (Wilk *et al.*, 1980; Packer *et al.*, 1999). Summer flounder is a migratory species that moves every year from the estuaries to the continental shelf on a seasonal basis (Wilk *et al.*, 1980; Sackett *et al.*, 2007). As reviewed by Packer *et al.* (1999), it moves into the warmer waters of estuaries and the shallow continental shelf during spring until fall, whereupon it moves back out into the deeper waters of the continental shelf to weather the winter. Adult summer flounder reproduce off New Jersey, along the Virginia-North Carolina waters, and just south of Cape Hatteras during fall-winter (Smith, 1973). The larval period may be quite protracted, extending between September and May, and the larvae drift into the coastal or estuarine systems that comprise their nursery habitats at about this time (Smith, 1973; Able *et al.*, 1990; Szedlmayer *et al.*, 1992; Kraus and Musick, 2001). Once larvae metamorphose into juveniles, flounder grow rapidly in the estuaries before migrating offshore in the fall, joining the adult population (Szedlmayer *et al.*, 1992; Szedlmayer and Able, 1993; Walsh *et al.*, 1999). The median age of maturity occurs before age-1 and virtually all males and females are mature by age-3. Recent research funded by the Partnership for mid-Atlantic Fisheries Science (PMAFS) has shown dimorphic growth, with females growing larger than males. Recent NMFS surveys have evidenced a decreasing mean length and weight at age in all seasons and for sexes combined. One explanation for this is the recent inclusion of more older males that have lower weight-at-age than females.

Summer flounder have been managed by the Mid-Atlantic Fisheries Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC) as a unit stock from the southern border of North Carolina to the US-Canada border. The National Marine Fisheries Service (NMFS) serves as the federal implementation and enforcement entity. Cooperative management was developed because significant catch is taken from both state (0-3 miles offshore) and federal waters (3-200 miles offshore). The population is modeled with ASAP, a forward projecting age-structured model. It is divided into two "fleets", one for landings from the combined commercial and recreational fisheries, and one for discards from the combined fisheries.

Combined commercial and recreational landings peaked in 1983 at 26,100 mt and decreased through the 1980s and reached a low of 6,500 mt in 1990. Landings have risen since to 8,900 mt in 2012. There is recent evidence for a northern shift in commercial landings with the largest landings now south of Rhode Island and more large catches on Georges Bank. Commercial landings are assumed to be reported with minimal error. Discard rates in the commercial fishery are obtained from observers and from vessel trip reports. Recreational fishing (party and charter boats, and private individual anglers) was estimated historically by the NMFS Marine Recreational Fishery Statistics Survey (MRFSS; 1982-2003), and recently by the Marine Recreational Information Program (MRIP; 2004-present), which are statistically based sampling programs. Landings can be observed by survey agents, but discards are self-reported by anglers (non-party boat anglers).

2.1 Synopsis of Panel Review

The SARC Panel agreed with the SDWG's conclusion that the summer flounder stock from the southern border of North Carolina to the US-Canada border is not overfished and overfishing is not occurring in 2012. Fishing mortality has decreased since 1997, is estimated to be 0.285 and was below the new F_{MSY} proxy of $F_{35\%}=0.309$. SSB in 2012 was estimated to be 51,238 mt, 82% of the new proxy reference point of $SSB_{35\%} = 62,394$ mt.

Annual projections have been provided for 3 years. This was carried out with AGEPRO, with no retrospective adjustment using a CV=100 for the OFL. Note this CV level is the MAFMC SSC assumption for the OFL of level 3 stocks, based on evidence from the literature for a range of stocks; the MCMC-based CV for the summer flounder 2014 OFL is 15%. A sensitivity analysis including stochastic recruitment was based on resampling the 1982-2012 recruitment distribution. Annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass are provided for the options.

A variety of fishery-independent and fishery-dependent studies are available to characterize the stock. Among fishery-independent studies, the NEFSC trawl survey is based on a large scale stratified random design and has historically provided an index of summer flounder abundance in federal waters. There are also nine state survey indices available and additionally a survey of Chesapeake Bay (ChesMMAP) and the North East Area Monitoring and Assessment Program (NEAMAP) which sample juvenile and adult fishes. The SARC Panel discussed the value of these surveys to the assessment and if these surveys could be coordinated in space and time to better match summer flounder habitat use temporally.

Fishery-dependent sampling approaches differ by sector. Landings for the commercial sector are obtained from dealer and Vessel Trip Reports (VTR) and discards are obtained from Observer reports. Several studies have shown a discard mortality of round 80% for this sector. Landings for the recreational sector come from for-hire party and charter boat VTR, while private anglers are intercepted at fishing access points through the MRFSS/MRIP sampling. For private anglers, discards are self-reported. The party/charter VTR reports estimate lower landings and the MRFSS higher landings for this sector. Studies of recreational discard mortality are taken as 10% in the assessment. The SARC Panel commented on the potential uncertainty in the assessment that might result if the discard mortality were actually higher. The working group provided a sensitivity analysis to this aspect of the assessment.

Studies undertaken by NMFS NEFSC and PMAFS have shown that there is sex-specific difference in growth with females living longer and growing larger at age. Recent NEFSC surveys have evidenced a trend of overall slower growth in length and weight and the

increased proportion of older males. Sexually dimorphic growth and survival would argue for developing sex-specific components of the model; the value of such an approach relies on the availability of obtaining sex ratios of the landings, which is not currently feasible for the recreational landings. Moreover, the sex-at-age and sex-at-length keys that were developed for the ocean trawl survey were found to be inappropriate in describing the sex ratios of the recreational landings.

The present assessment uses a statistical catch-at-age model, ASAP, which assumes a multinomial distribution for proportions at age. The results of this new model configuration compared well to the previous ASAP model which assumed independent lognormal distributions for numbers at age in the catch. Moreover, the previous assessments showed retrospective patterns in F and SSB that are not present in the current assessment. In the stock assessment, the stock is modeled as two “fleets”: landings and discards, thus combining both commercial and recreational sectors into these components. Although the validity of the assessment results are not affected by this, the SARC Panel commented that the results were difficult to interpret into factors from each fishing sector, and suggest that future assessments use approaches that make this more interpretable.

Special Comments:

Some progress has already been made developing an assessment model that accounts for sexually dimorphic growth distribution and exploitation rates. Currently it has not been possible to split recreational landings or catch by sexes. The review group would like to encourage further development in this area, with the aim of allowing sexually split assessment to better model summer flounder population.

2.2 Evaluation of Terms of Reference for Summer Flounder

Note : * indicates that completion of specific sub-task is contingent on analytical support from staff outside of the NEFSC.

A. Summer flounder

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

This ToR was met.

Data were available from the two main fisheries, recreational and commercial. The commercial landings are the larger component and data are sourced from official landings records at both state and federal level. These data are regarded as having minimal error. Recreational catch data are estimated from the

MRFSS/MRIP survey. The MRIP methods for catch estimation which have been applied to the original MRFSS data, available since 2004, is an improvement in statistical design on the MRFSS survey design, however, the estimates of this component of the catch is not regarded as particularly precise. Comparison of the MRFSS/MRIP party-charter vessel estimates with those estimated from the VTR system for the party-charter mode differed by a factor of 2-3 during 1995-2011. This disparity is not explained and may give some insight into the uncertainty in the recreational fishery catch estimates.

Discard estimates for the commercial fishery were obtained from an observer program. A number of different methods were investigated to raise observer samples to fleet level. Raising factors based on the catch of all species by trip was considered to be the most robust approach.

Estimates of the recreational fishery discards were made from the MRFSS/MRIP surveys and used an estimate of release mortality to derive dead discards. The release mortality is low but uncertain and small changes in the value used for this mortality can have a large effect on the estimate of dead discards.

The spatial and temporal distribution of catch and effort was investigated using vessel trip records.

No formal estimates of the variances of the catch components are given in the report but the sources of uncertainty are discussed and carefully considered.

2. Present the survey data available for use in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.), and explore standardization of fishery-independent indices*. Investigate the utility of commercial or recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data. Describe the spatial distribution of the stock over time.

This Tor was met

The available surveys are listed and described. They comprise a survey of the whole stock area performed by the NEFSC and a number of state surveys that typically cover a small geographical area. Some of the abundance indices are aggregate measures, while others are age structured or sample only the young of the year (YOY). For the NEFSC surveys the most recent indices were corrected for a change in vessel and sampling protocol in 2009, which is an additional source of uncertainty.

An agreed and reviewed protocol of the inclusion/exclusion of surveys in the assessment exists and this was applied by the SDWG.

A number of fishery dependent LPUE/CPUE indices were investigated. Attempts were made to derive standardized indices by fitting GLMs to vessel trip records. Overall the working group concluded that these indices were not adequate for inclusion in the assessment. Given the availability of fishery independent surveys and the well-known problems with abundance indices based on commercial fishery data this appears to be an appropriate conclusion.

The spatial distribution of the stock was investigated using data from the NEFSC surveys that cover the stock distribution. This shows that the center of distribution of the stock is now more northerly than in earlier years. Larger fish are generally found further north.

There are advantages to standardizing statewide surveys to better address the temporal and spatial availability of this stock so that they give a combined index at the management unit level and consider spatial and temporal patterns of availability.

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

This ToR was met

Analyses of both NEFSC, commercial and recreational fishery data were performed. The PMAFS funded working papers were also helpful in evaluating this ToR. These show that growth differs by sex, with females typically larger at age than males. There are also long-term trends in weight at age with lower mean weights in more recent years for the older fish. This trend coincides with a greater proportion of males at older ages in recent years and may relate to higher survival of fish resulting from lower fishing mortality.

When fish are sampled from the fishery no sex determination is made which means the only source of data to split the catch data by sex is to use survey data. However a study of the commercial and recreation catches showed that the NEFSC sex compositions were not the same as those in the recreational fishery data and could not be used to split these catches by sex. This prevented a full sex disaggregated assessment.

It appeared that the commercial catch could be split by sex. If possible, we encourage further evaluation of methods to measure sex in the recreational fishery.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-3), and

estimate their uncertainty. Explore inclusion of multiple fleets in the model. Include both internal and historical retrospective analyses to allow a comparison with previous assessment results and previous projections.

This ToR was met.

An age structured statistical catch-at-age model (ASAP) was used to estimate population parameters. The catch data were assigned to two “fleets”. Landings from the commercial and recreational fishery were combined into a single “fleet” and the same approach was used to create a discard “fleet”. The Panel felt that this classification to fleets was somewhat artificial since it does not describe the operation of true fleets and the estimated selectivity values are not easily interpreted for management purposes. Modeling the commercial fleet and recreational fleets as true fleets would be a more natural way of partitioning the catch and would give meaningful values of fleet selectivity. However the panel did not believe this issue would be important for the estimation of total fishing mortality.

A new statistical assumption was made in the model which assumes that the proportions at age are described by a multinomial distribution, whereas in the previous assessment model numbers at age were assumed to be independent and drawn from a lognormal distribution.

A structured approach was used to investigate the new model configuration and the updated data. This shows the effect of the new configuration when analyzing the same data as the previous assessment and the incremental changes arising by introducing updated data. Qualitatively the new assessment shows the same historical trends in F and SSB as the old model but there are differences in scale.

Comprehensive diagnostics of model fit are given for all the surveys and the catch at age data. In addition, a retrospective analysis was performed and a likelihood profile produced over a range of values for natural mortality. Fits to the total catch and catch age compositions are generally good. Some state surveys are poorly fit but receive low weight in the likelihood. The retrospective pattern for recent years shows no strong pattern. The profile over M indicates that a value between 0.2 and 0.3 receives the highest support.

Overall the panel agreed that the assessment provided satisfactory estimates of fishing mortality, recruitment and spawning stock biomass.

5. State the existing stock status definitions for “overfished” and “overfishing”. Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY} , $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending

alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the “new” (i.e., updated, redefined, or alternative) BRPs.

This ToR was met.

Current BRPs are based on the $F_{35\%}$ MSY proxy. The Working Group considered a number of analyses which have addressed the basis for BRPs for this stock and which have suggested a less conservative approach, such as $F_{30\%}$. Applying a non-parametric approach where mean recruitment is applied to the yield/SSB per recruit calculation suggests that moving from $F_{35\%}$ to $F_{30\%}$ would result in a very small increase (2%) in yield but a moderate reduction (14%) in equilibrium SSB and 22% increase in fishing mortality (ie. 0.378/0.309). For this reason the Working Group proposed that the $F_{35\%}$ BRPs should be retained. The panel discussed this issue at some length and noted that simulations run with a Beverton-Holt stock recruitment model gave sustainable SSBs and higher yields when run at $F_{30\%}$. However, the Working Group felt that the fit of the stock recruitment curve did not reliably estimate steepness and undermined the quality of the analysis. As a result there was no consensus that $F_{30\%}$ should be preferred over $F_{35\%}$ as a basis for 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).

This ToR was met.

We agreed with the SDWG evaluation of stock status. Using both the old and new reference points and with both old and new assessment models, the stock is not overfished and overfishing is not occurring.

6a. The old model used BRPs established by the 2008 SAW 47 review based on a model wherein age-dependent indices were independent and lognormally distributed. When updated with data through 2011, model results showed that the stock was not overfished and overfishing was not occurring.

6b. The new model used BRPs established by the 2013 SDWG and a model based on multinomial distributed proportions at age. Graphs and tables were presented that showed consistent results with the old and new models and similar values for stock status.

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

This ToR was met.

7a. The working group provided a three-year projection, 2014-2016 using the program AGEPRO, with no retrospective adjustment and a CV=100 for the OFL as applied for stocks of this tier by the MAFMC SSC. They provided a sensitivity analysis by including stochastic recruitment based on resampling the 1982-2012 recruitment distribution. They did not partition the catch into commercial and recreational fishery sectors, but into landings and discard "fleets". A partition into commercial and recreational components is provided by the MAFMC subsequently. The WG projections showed no chance that $F > F_{MSY}$ and $SSB < \frac{1}{2} * SSB_{MSY}$. No retrospective problems were noted as seen in previous assessments.

7b. The SARC panel expressed concern that the effect of differential survival and spatial mixing adds uncertainty to the projections. Summer flounder show sexually-dimorphic growth (females larger) that varies in time and space which has been confirmed by NEFSC research surveys and PMAFS fishery sampling. The stock assessment does not fully account for these dynamics and does not partition the model by sex based on the difficulty in evaluating the landings by sex. It is difficult to discern whether there will be significant effects on the projections of R, F, and SSB due to the uncertainty in dimorphic growth and survival.

Landings are assumed reported without error and this implies a lower-bound estimate if under-reporting occurs.

7c. The AGEPRO 2014-2016 projection results showed that at the MSY proxy of $F_{35\%}$ there was no chance of $F > F_{MSY}$ or $SSB < \frac{1}{2} * SSB_{MSY}$ and less than a 13% chance of exceeding the ABC. The panel agrees that this stock does not appear to be vulnerable to

overfishing based on the projections, and notes that projections were provided with sensitivity analysis where release mortality was halved and doubled to show that F was not very sensitive to changes in the recreational discard mortality.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports, as well as MAFMC SSC model recommendations from 2012. Identify new research recommendations.

This ToR was met

There were 15 old and 13 new research recommendations that were addressed. The WG provided the status of progress on the old research recommendations, but not the new. NMFS and PMAFS have made progress, for example on otolith collections, confirmation of sexually dimorphic growth, reporting accuracy in the recreational fishery, sex ratios in the landings, and otolith chemistry to evaluate spatial structure. The WG sees as a priority the development sex-specific sampling of surveys and landings to provide improved model input, sampling of discards and changing the model to include sex-specific parameterization. The SARC panel agrees that these are priorities and may improve the assessment.

3. Review of Striped Bass

The striped bass (*Morone saxatilis*) is an anadromous, schooling species ranging from the Canadian Maritime Provinces to the Gulf of Mexico, though it is absent from certain parts of Florida. The subpopulation of striped bass between the St. Lawrence River and Albemarle Sound in North Carolina is mainly migratory, moving annually from the ocean into the rivers to spawn and returning to the ocean where they also move latitudinally according to the season (Boreman and Lewis, 1987); the subpopulations south of the Albemarle Sound and in the Gulf of Mexico are considered nonmigratory (e.g. (McIlwain, 1980; Richkus, 1990). The migratory northern striped bass spawn principally (but not exclusively) either in the Chesapeake Bay (and its tributaries), the Delaware River or the Hudson River (e.g. (Kernehhan *et al.*, 1981; Setzler-Hamilton and Hall Jr, 1991; Wirgin *et al.*, 1993; Richards and Rago, 1999). The timing of spawning usually ranges between mid-April and mid-June across the main spawning areas (e.g. (Dovel, 1971; Kernehhan *et al.*, 1981; Boreman and Klauda, 1988). Eggs drift downstream and the larvae develop into juveniles in the river delta at the nearby estuary (Rulifson, 1992; Rulifson *et al.*, 1992). Juveniles usually move downstream into the estuaries during summer-fall, joining the adult population (Shepherd, 2006).

The coastal migratory striped bass stocks have been managed by the Atlantic States Marine Fisheries Commission (ASMFC) under the regulatory authorization of the Striped Bass Conservation Act and Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped bass approved in 2003. Regulations are enforced by the states for inshore waters. Fishing in the EEZ has been banned for both commercial and recreational fisheries since 1990 and is enforced by NMFS and the US Coast Guard.

Commercial fisheries operate in eight of the 14 jurisdictions regulated by ASMFC and recreational fisheries in all jurisdictions. Fisheries are seasonal because of fish migration and regulations. Commercial fisheries are limited by size and quotas, while recreational fisheries are limited by size and daily bag limits. Historically, commercial landings peaked in 1973 at 6,804 mt, declined to 63 mt by 1986 and have fluctuated around 3,162 mt since 2005. Commercial harvests are primarily on age 4-10, while harvest in Chesapeake Bay is on ages 3-6. There is little reliable data on discards of striped bass in state waters and discard ratios rely on ratio estimates from the recreational survey.

Recreational harvest and release statistics were obtained from the MRFSS from 1982-2003 and subsequently from MRIP methods for catch estimation applied to the original MRFSS data. Due to the nature of angler surveys, harvests and discards (releases) are originally reported as numbers and converted to weights. Harvests increased from 1,010 mt in 1990 to 14,082 mt in 2006 and have declined to 8,740 mt in 2012. The recreational harvest currently accounts for over 70% of the total. Moreover discards (releases) have

averaged 85-90% of the catch in most years. Most of the studies of discard mortality in the recreational fishery have been done in freshwater, which is thought to be higher than in saline waters. Estimates of discard mortality had ranged from 9-27%. Based on the effects of temperature and salinity, a discards mortality of 9% was judged to be more appropriate for estuarine and marine waters.

3.1 Synopsis of Panel Review

The SARC Panel agreed with the Striped Bass Technical Committee's (SBTC) conclusion that the stock is not overfished and overfishing is not occurring in 2012. Fishing mortality, is estimated to be 0.188 and was above the new F_{MSY} proxy of $F_{target}=0.175$, but below the new proxy of $F_{threshold}=0.213$. Female SSB in 2012 was estimated to be 61,500 mt, 85% of the new proxy target reference point of $125\%SSB_{1995}=72,380$ mt and above the new proxy $SSB_{threshold}=SSB_{1995}=57,904$ mt. When compared with the BRPs used in the 2011 assessment (Female $SSB_{target}=46,101$ mt, Female $SSB_{threshold}=36,000$ mt, $F_{target}=0.30$, $F_{threshold}=0.34$), the stock is not overfished and overfishing is not occurring.

Annual projections were provided for 3 years. Several modeling approaches were used based on corrected and uncorrected Beverton-Holt and Ricker recruitment functions and on an empirical simulation using nonparametric estimates of the recruitment/SSB distributions. Sensitivity analyses were provided. The SARC Panel requested additional simulations based on the empirical simulations.

A variety of fishery-independent and fishery-dependent studies were available to characterize the stock. Nine fishery-independent indices were included in the model to evaluate trends in relative striped bass abundance. A formal review of these indices was done by ASFMC in 2004. Recently the Virginia Pound Net Study was re-instated as an index. The MRFSS/MRIP Total Catch Rate Index (fishery-dependent) was also included as an index of relative abundance. The SARC did not review the inclusion of these indices, but noted that coordination of fishery-independent surveys to better match the temporal and spatial use of habitats would permit better evaluations of relative abundances of striped bass. Fishery-dependent sampling is through state and federal dealer and fisherman reporting systems for the commercial landings and through survey sampling of the recreational fishery through MRFSS/MRIP surveys.

The Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) provided estimates of F from 0.10-0.15. The F from the IRCR has averaged 0.13 since 1995, varying without trend. The F estimates obtained for the Chesapeake Bay however, provided low values that were not consistent with the level of estimated harvest.

The present assessment uses a statistical catch-at-age (SCA) model that was programmed in ADMB to estimate F , recruitment, total abundance and stock biomass.

Similar to the summer flounder SCA model, they also portioned components into Bay, Coast and Commercial discard “fleets”. Commercial and recreational catches are combined in the first two fleets. There is a sexually-based difference in habitat use with largely males comprising the Bay fleet and females the Coast fleet, each with a different mortality. There was a slight retrospective pattern that may result in an overestimate of F and an underestimate of SSB. The SARC noted that such aggregation of commercial and recreational catches make the results difficult to attribute and also that F derived from the SCA is a composite of sexes.

In view of the large differences in growth between males and females the SARC Panel encourages work to develop a fully sex-disaggregated model that accounts for differences in survivorship and growth. Not only should this improve estimates of population parameters, it should assist in obtaining better estimates of female biomass and enable less biased calculation of MSY reference points.

Special Comments:

Management of striped bass has a long history and ad hoc reference points, such as SSB_{1995} , have been written into regulations and affect the choice of BRP and the approach in population projects to simulate the effect of F. Although this information was included among the reports, the ramifications were not clearly stated such that reviewers, unfamiliar with this long history, could readily discern the appropriateness of subsequent empirical and parametric approaches for population projections. The SARC Panel agreed that clearer exposition of these restraints would increase clarity in future presentations of the striped bass stock assessment.

3.2 Evaluation of Terms of Reference for Striped Bass

Note: ** indicates that completion of specific sub-task is contingent on analytical support from staff outside of the NEFSC.

B. Striped bass**

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources. Evaluate evidence for changes in natural mortality in recent years.

This ToR was met.

The report provided an extensive set of indices of both abundances at age and aggregate abundance. As it was stated that these had been reviewed elsewhere, the preparation of the indices was not included in this review. The very large quantity of

data available implies that a substantial amount of work was involved in preparing these data sets. The available data was considered to be assembled well, though from the SAW report it was unclear initially exactly which data sets were used in the model. This was clarified in the meeting. A change in the sampling program from MRFSS to MRIP adjustments was noted and considered not to be a problem. Both MRFSS/MRIP adjustments and the raw intercept data was used in this assessment. Overall the review group concluded that the data sets provided were suitable for the assessment.

In the longer run there would be clear advantages in assembling a composite survey that could be expected to represent the whole area, rather than the current collection of small state-wide surveys that are currently brought into the assessment as individual indices. Such local surveys may accurately measure movement between areas that are then obscured in the main assessment model. This process variability (stock movement) is effectively treated as observation error by the model; this is acceptable but not ideal.

The use of age aggregated SDNSS index is based on flat selection from 3 year and older. This index fits particularly poorly in the assessment (see below). Given the non-uniform spatial distribution of the stock by age it may be useful to try to obtain a better model of selection for this index or to truncate the age range.

The working group presented the information on natural mortality derived from tag data and concluded that the value to be used in the assessment should be replaced with new values with higher M at younger ages. The SARC reviewers agreed with this conclusion. There were some minor concerns that M at 2-4 ages were rather high, this was discussed and the differences in longevity between males and females were thought to be important in this respect. Overall it was concluded that the revised values represented the best available estimates at the moment. It was noted that it may be possible to combine tag data on mortality in the assessment model directly (see below).

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

This ToR was met.

The review concluded that the assembled catch data represented the best current estimates of catch (landings and dead discards) and they are suitable for the assessment. It was recognized that the estimate of both recreational and commercial dead discards is sensitive to the assumed values of post-release mortality and because a rather high proportion are considered to survive for most gears this may result in a high error on these estimates.

Overall the catch is assembled into three fleets; bay landings, coastal landings and commercial dead discards. By combining the data in this way it is not possible to use the

assessment to evaluate the impact of different 'fisheries' as combined landings and discards. With this formulation estimated F_s on landings can change separately from F on discards in the same fishery, which may not be appropriate. Organizing the data by 'Fishing Fleet' may be a more useful approach. Although it is suggested that this model formulation be examined, it is not thought that the current method affects the main conclusions on the state of stock.

It is noted that the catches are not currently sampled for sex ratio. As there is clear evidence of sexual dimorphism, and sex dependence in the catch rates, there may be advantages in considering splitting the assessment into sex components. If this were to be done it implies estimating a sex split in the catch. Some very reasonable practical restrictions on this were noted. If traditional market sampling methods are not practical to determine sex ratios, it may be possible to develop cooperative approaches with recreational anglers and fish buyers or to use state surveys to collect sex ratio data in a different way.

No formal estimates of the variances of the catch components are given in the report but the sources of uncertainty are discussed and carefully considered.

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

This ToR was met.

The review concludes that this ToR was completed and the current assessment is acceptable and suitable for estimating the state of the stock.

It is noted that the assessment was particularly sensitive to two surveys (MDSSN and MRFSS). The pattern of residuals for both these two surveys are of some concern and the sensitivity analysis shows that the assessed SSB and F would be different over at least the last 8 years if either of these surveys was omitted from the assessment data set. While including these in the assessment was considered acceptable (and removing both would probably give only minor changes) it is of concern that data with such diverse signals are included and individually they can have substantial influence. Further detailed evaluation of these two data sources and their utility in the assessment would be helpful.

The assessment model is based on three 'fleets' that don't correspond to real fisheries (see above). Reformulating the assessment into two or more fleets each with landings and discard components may give added value to the assessment results, as it would

allow the commercial and recreational fisheries to be considered separately in a more useful way.

The assessment is carried out using data combined across sexes. The female biomass is then estimated using temporally invariant age dependent factors. There is some concern that this split factor would depend on F and thus the constant values may be biased in some periods. It is considered that splitting the assessment by sex may be possible and given the implications on mortality and the estimation of reference points it should be considered in the future.

The estimation of F in 1982 is considered particularly uncertain. This is illustrated by the poor fit to the selection for the catch data in that year. The SARC review group endorsed the decision to delete this from the results.

The Working Group presented an extensive range of sensitivity tests that, when taken as a whole, support the conclusion that the assessment can be used for management. With the exception of the sensitivity of the two surveys mentioned above, the assessment was robust to a number of different formulations. The comparison with previous assessments confirmed the relative stability of the modeling approach.

The model formulation in terms of the use effective of sample size for multinomial data and indices fitted with residuals and scaled CVs is complex and hard to understand. The methods to estimate effective sample size appear to be somewhat *ad hoc*, based on initial values equal for each survey and then modified subsequently by inspection. Sensitivity to some aspects of this were explored, however, it is unclear how important this is. Manual iterative reweighting has been used via amendment of CVs for each survey data set. If this approach is the preferred method for the assessment model it should be implemented as an automated process to ensure correct and complete implementation.

It was noted that there was aging bias caused by the use of scales to age individuals. It was shown that this could affect the estimate of SSB and F. However, while this results in different values for both assessment and reference points the perception of the state of the stock is unaltered. Although the perception of stock status may be unchanged, it is the extent to which F is affected that matters for the forecast which may, in turn, be sensitive to this bias. Further exploration should be considered.

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

This ToR was met.

A study was carried out and presented. This study concluded that tag based total mortality was similar to the total mortality in the assessment, though there are some differences in short term trends within the time-series. Estimates of F and M are sensitive to tag reporting rate, so although Z may be well estimated it is more difficult to estimate F. It is suggested that inclusion of tag estimated mortality in the assessment may be helpful. It may for example be possible to use this to estimate or confirm the discard survival rates that are important for estimating catch.

It was noted that there were a few thousand tags recovered from re-releases. This data had not been specifically analyzed. It may be interesting to compare re-releases of tagged fish as these may be more typical of fishery releases than those released by tagging program.

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

This ToR was only partly completed but it was not clear how BRPs had been estimated because there appeared to be inconsistencies in SSB reference values presented. Additional analyses were requested by the panel and performed during the meeting to clarify these problems.

Attempts were made to estimate F_{msy} from analyses using parametric approaches with a variety of stock recruit relationships. These analyses produced disparate results and were particularly sensitive to the recruitment relationships assumed. This was mostly because different functions implied different mean recruitment in the future, though the basis for these differences was weak. Following additional analysis it was concluded that the use of the estimated 1995 SSB as an SSB threshold would be compatible with current management objectives. Once this was defined, a set of internally consistent F and SSB thresholds and targets were defined based on a non-parametric assumption that future recruitment will be similar to past recruitment (1990 to present). The distribution of SSB implied by the target and threshold Fs were examined and it was concluded that the proposed values would give high long term yield and be consistent in terms of F and SSB. Overall this approach does not estimate F_{MSY} or SSB_{MSY} explicitly but gives management reference points that give high and stable long term yield.

6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach covering a range of assumptions about the most important sources of uncertainty, including potential changes in natural mortality.

This ToR was met.

An extensive range of sensitivity tests support the conclusion that the forecast is robust. However, following the discussion of the BRPs and the choice of recruitment model, (see above) there is a potential for inconsistency between projections and BRPs. In the future the projections need to be run with the same recruitment model which is used for calculation of BRP reference points, as the current BRP model differs from the models used in the projections. In practice, short term projections would not be expected to be sensitive to the choice of recruitment model unless the fishery is highly dependent on recruiting year classes. In striped bass fish are fully recruited by the age 4-5 so recruitment should only have a minor effect on projections.

The three fleet approach, which combines discards from both fisheries, makes it difficult to estimate mortality separately for the two main fisheries. As noted above reformulation of the model into recreational and commercial fleets including dead discard components may be of assistance in providing appropriate separate fleetwise catch options.

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

This TOR was met.

The Working Group provided an extensive list of research recommendations and they have clearly identified three levels of importance: high, moderate and low. The Group also identified research priorities as being met or in progress. Section B11.2 identifies the need for a coastal population index as of moderate priority. We consider that if this could be linked to state surveys to obtain a population wide survey this would be of high priority. We also propose that issues surrounding sexually differentiated migration be examined. The assessment group presented information on different migration patterns for males and females. There was a perception that females tend to migrate out of the rivers into the coastal region while males remain in the inshore areas. There were reports of catches being composed of 90% or 95% males within Chesapeake Bay and selection on females was high in the coastal fisheries. The separate exploitation of these different groups could potentially affect the exploitation and certainly influence the evaluation of F_{MSY} . Management targets based on only female SSB may need to be considered carefully if very heavy exploitation of males is occurring but not included in the management targets. It is suggested that simulation of the problem through a two area model could be used to evaluate the consequences for management of sex and space on MSY reference points, the need for precautionary exploitation to protect males or females, and the data needed to manage under these circumstances. In this context it may be useful to evaluate if a two area spatial assessment model could be

parameterized in order to better model the spatially diverse Chesapeake Bay and coastal fisheries.

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5. Appendices

Task Order T37-06, final 28 February 2013

Statement of Work

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

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

BACKGROUND

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

SCOPE

Project Description: The Northeast Regional Stock Assessment Review Committee (SARC) meeting is a formal, multiple-day meeting of stock assessment experts who serve as a panel to peer-review tabled stock assessments and models. The SARC is the cornerstone of the Northeast Stock Assessment Workshop (SAW) process, which includes assessment development (SAW Working Groups or ASMFC technical committees), assessment peer review, public presentations, and document publication. This review determines whether the scientific assessments are adequate to serve as a basis for developing fishery management advice. Results provide the scientific basis for fishery management in the northeast region.

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

OBJECTIVES

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

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

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

PERIOD OF PERFORMANCE

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

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

PLACE OF PERFORMANCE AND TRAVEL

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

STATEMENT OF TASKS

Charge to SARC panel: During the SARC meeting, the panel is to determine and write down whether each stock assessment Term of Reference (ToR) of the SAW (see **Annex 2**) was or was not completed successfully. To make this determination, panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. **If alternative assessment models and model assumptions are presented, evaluate their strengths and weaknesses and then recommend which, if any, scientific approach should be adopted.** Where possible, the SARC chair shall identify or facilitate agreement among the reviewers for each stock assessment Term of Reference of the SAW.

If the panel rejects any of the current BRP or BRP proxies (for B_{MSY} and F_{MSY} and MSY), the panel should explain why those particular BRPs or proxies are not suitable, and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing BRPs or BRP proxies are the best available at this time.

Each reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

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

Foreign National Security Clearance: The reviewers shall participate during a panel review meeting at a government facility, and the NMFS Project Contact will be

responsible for obtaining the Foreign National Security Clearance approval for the reviewers who are non-US citizens. For this reason, the reviewers shall provide by FAX (or by email if necessary) the requested information (e.g., 1.name [first middle and last], 2.contact information, 3.gender, 4.country of birth, 5.country of citizenship, 6.country of permanent residence, 7.whether there is dual citizenship, 8.country of current residence, 9.birth date [mo, day, year], 10.passport number, 11.country of passport) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: <http://deemedexports.noaa.gov/>.

Pre-review Background Documents and Working Papers: Approximately two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the SARC chair and CIE reviewers the necessary background information and reports (i.e., working papers) for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the COR on where to send documents. The reviewers are responsible only for the pre-review documents that are delivered to the contractor in accordance to the SoW scheduled deadlines specified herein. The reviewers shall read all documents deemed as necessary in preparation for the peer review.

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

(SARC chair)

Act as chairperson, where duties include control of the meeting, coordination of presentations and discussions, making sure all stock assessment Terms of Reference of the SAW are reviewed, control of document flow, and facilitation of discussion. For each assessment, review both the Assessment Report and the draft Assessment Summary Report. The draft Assessment Summary Report is reviewed and edited to assure that it is consistent with the outcome of the peer review, particularly statements that address stock status and assessment uncertainty.

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

(SARC CIE reviewers)

For each stock assessment, participate as a peer reviewer in panel discussions on assessment validity, results, recommendations, and conclusions. From a reviewer's point of view, determine whether each stock assessment Term of Reference of the SAW was completed successfully. Terms of Reference that are completed successfully are likely to serve as a basis for providing scientific advice to management. If a reviewer considers any existing Biological Reference Point or BRP proxy to be inappropriate, the reviewer should try to recommend an alternative, should one exist. Review both the Assessment Report and the draft Assessment Summary Report. The draft Assessment Summary Report is reviewed and edited to assure that it is consistent with the outcome of the peer review, particularly statements that address stock status and assessment uncertainty.

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

Tasks after the panel review meeting:

SARC CIE reviewers:

Each CIE reviewer shall prepare an Independent CIE Report (see **Annex 1**). This report should explain whether each stock assessment Term of Reference of the SAW was or was not completed successfully during the SARC meeting, using the criteria specified above in the "Charge to SARC panel" statement.

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

During the meeting, additional questions that were not in the Terms of Reference but that are directly related to the assessments may be raised. Comments on these questions should be included in a separate section at the end of the Independent CIE Report produced by each reviewer.

The Independent CIE Report can also be used to provide greater detail than the SARC Summary Report on specific stock assessment Terms of Reference or on additional questions raised during the meeting.

SARC chair:

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

SARC chair and CIE reviewers:

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

The chair's objective during this SARC Summary Report development process will be to identify or facilitate the finding of an agreement rather than forcing the panel to reach an agreement. The chair will take the lead in editing and completing this report. The chair may express the chair's opinion on each Term of Reference of the SAW, either as part of the group opinion, or as a separate minority opinion.

The SARC Summary Report (please see **Annex 4** for information on contents) should address whether each stock assessment Term of Reference of the SAW was completed successfully. For each Term of Reference, this report should state why that Term of Reference was or was not completed successfully. The Report should also include recommendations that might improve future assessments.

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

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

DELIVERY

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

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

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

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

June 19, 2013	Contractor sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
July 9, 2013	NMFS Project Contact will attempt to provide reviewers the pre-review documents
July 23-26, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
July 26, 2013	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
August 9, 2013	Reviewers submit draft independent peer review reports to the contractor’s technical team for independent review
August 9, 2013	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *

August 16, 2013	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
August 23, 2013	Contractor submits independent peer review reports to the COR who reviews for compliance with the contract requirements
August 30, 2013	The COR distributes the final reports to the NMFS Project Contact and regional Center Director

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

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

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

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

Acceptance of Deliverables: The deliverables shall be the final peer review report from each reviewer that satisfies the requirements and terms of reference of this SoW. The contract shall be successfully completed upon the acceptance of the contract deliverables by the COR based on three performance standards:

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

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

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

Support Personnel:

William Michaels, Program Manager, COR
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Key Personnel:

Dr. James Weinberg, NEFSC SAW Chairman, NMFS Project Contact
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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
National Marine Fisheries Service, NOAA
Northeast Fisheries Science Center
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Annex 1: Format and Contents of Independent Peer Review Report

1. The independent peer review report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).
2. The main body of the report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Findings of whether they accept or reject the work that they reviewed, and an explanation of their decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. For each assessment reviewed, the report should address whether each ToR of the SAW was completed successfully. For each ToR, the Independent Review Report should state why that ToR was or was not completed successfully. To make this determination, the SARC chair and reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice.
 - a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), conclusions, and recommendations.
 - b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.
 - c. Reviewers should elaborate on any points raised in the SARC Summary Report that they feel might require further clarification.
 - d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
 - e. The independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not others read the SARC Summary Report. The independent report shall be an independent peer review of each ToR, and shall not simply repeat the contents of the summary report.
3. The reviewer report shall include the following appendices:
 - Appendix 1: Bibliography of materials provided for review
 - Appendix 2: A copy of this Statement of Work
 - Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

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

(file vers.: 12/18/2012)

A. Summer flounder

1. Estimate catch from all sources including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.
2. Present the survey data available for use in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.), and explore standardization of fishery-independent indices*. Investigate the utility of commercial or recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data. Describe the spatial distribution of the stock over time.
3. Review recent information on sex-specific growth and on sex ratios at age. If possible, determine if fish sex, size and age should be used in the assessment*.
4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-3), and estimate their uncertainty. Explore inclusion of multiple fleets in the model. Include both internal and historical retrospective analyses to allow a comparison with previous assessment results and previous projections.
5. State the existing stock status definitions for “overfished” and “overfishing”. Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY} , $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the “new” (i.e., updated, redefined, or alternative) BRPs.
6. Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model developed for this peer review.
 - a. When working with the existing model, update it with new data and evaluate stock status (overfished and overfishing) with respect to the existing BRP estimates.
 - b. Then use the newly proposed model and evaluate stock status with respect to “new” BRPs and their estimates (from TOR-5).
7. Develop approaches and apply them to conduct stock projections and to compute the statistical distribution (e.g., probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).
 - 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 2012. Identify new research recommendations.

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

Annex 2 (cont.):

B. Striped bass**

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources. Evaluate evidence for changes in natural mortality in recent years.
2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries.
3. Use the statistical catch-at-age model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component, where possible, and for total stock complex.
4. Use the Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) and associated model components applied to the Atlantic striped bass tagging data to estimate F and abundance from coast wide and producer area tag programs along with the uncertainty of those estimates. Provide suggestions for further development of this model.
5. Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY} , SSB_{MSY} , F_{MSY} , MSY). Define stock status based on BRPs.
6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach covering a range of assumptions about the most important sources of uncertainty, including potential changes in natural mortality.
7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

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

Annex 2 (cont.):

Appendix to the SAW Assessment TORs:

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

Explanation of “Acceptable Biological Catch” (DOC Natl. Standard Guidelines, Fed. Reg., vol. 74, no. 11, 1/16/2009):

Acceptable biological catch (ABC) is a level of a stock or stock complex’s annual catch that accounts for the scientific uncertainty in the estimate of [overfishing limit] OFL and any other scientific uncertainty...” (p. 3208) [In other words, $OFL \geq ABC$.]

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

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

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

Explanation of “Vulnerability” (DOC Natl. Standard Guidelines, Fed. Reg., vol. 74, no. 11, 1/16/2009):

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

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

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

Annex 3: Draft Agenda

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

July 23-26, 2013

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

AGENDA* (version: 28 Feb. 2013)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR
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Tuesday, July 23

10 – 10:30 AM

Welcome

James Weinberg, SAW Chair

Introduction

Cynthia Jones, SARC Chair

Agenda

Conduct of Meeting

10:30 – 12:30 PM

Assessment Presentation (Stock A.)

TBD TBD TBD

12:30 – 1:30 PM

Lunch

1:30 – 3:30 PM

Assessment Presentation (Stock A.)

TBD TBD TBD

3:30 – 3:45 PM

Break

3:45 – 4 PM

Public Comments

4 - 6 PM

SARC Discussion w/ Presenters (Stock A.)

Cynthia Jones, SARC Chair

TBD

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR
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Wednesday, July 24

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

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR
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Thursday, July 25

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

Friday, July 26

9:00 AM – 5:00 PM	SARC Report writing. (closed meeting)		
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*All times are approximate, and may be changed at the discretion of the SARC chair.
The meeting is open to the public, except where noted.

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

Reviewers must attend the entire meeting.

Annex 4: Contents of SARC Summary Report

1.

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

To make this determination, the SARC chair and CIE reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. If the CIE reviewers and SARC chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions.

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

2.

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

3.

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

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