CIE Reviewer's Independent Report on

54th Northeast Regional Stock Assessment Workshop

(SAW 54)

Prepared by

Neil Klaer

Prepared for

Center for Independent Experts (CIE)

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2.1.10 TOR-10 Develop approaches and apply them to conduct stock projections and to compute the pdf (probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).

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.

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2.2.2 TOR-2 Present the survey data being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, age-length data, etc.). Investigate the utility of commercial or recreational LPUE as a measure of relative abundance, and characterize the uncertainty and any bias in these sources of data.

2.2.3 TOR-3 Evaluate the validity of the current stock definition, and determine whether it should be changed. Take into account what is known about migration among stock areas.

2.2.4 TOR-4 Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-5), and estimate their uncertainty. Include a historical retrospective analysis to allow a comparison with previous assessment results and previous projections.

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2.2.6 TOR-6 State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for BMSY, BTHRESHOLD, FMSY 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.

2.2.7 TOR-7 Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model, should one be developed for this peer review. In both cases, evaluate whether the stock is rebuilt (if in a rebuilding plan).

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-6).

2.2.8 TOR-8 Develop approaches and apply them to conduct stock projections and to compute the pdf (probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).

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, and recruitment as a function of stock size).

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.

2.2.9 TOR-9 Review, evaluate and report on the status of research recommendations listed in most recent peer reviewed assessment and review panel reports. Identify new research recommendations.

3 Critique of the review process

4 References

Appendix 1: Bibliography of materials provided for review

Appendix 2: A copy of the CIE Statement of Work

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Executive Summary

The Stock Assessment Review Committee (SARC) of the 54th Stock Assessment Workshop (SAW 54) met at the Northeast Fisheries Science Center (NEFSC), Woods Hole, MA during 5th – 9th June 2012 to review Northeast regional benchmark stock assessments of Atlantic Herring *(Clupea harengus)* and Southern New England / Mid-Atlantic Bight Yellowtail Flounder (*Limanda ferruginea*). The SARC review panel (herein called the "Panel") consisted of Chair Robert O'Boyle (Beta Scientific Consulting, Canada) and three scientists representing the Center for Independent Experts (CIE): Chris Francis, Norm Hall and Neil Klaer.

The meeting format included presentations mixed with questions and open discussion. The Panel participated in the review of each term of reference. The meeting was open to the public and public comments were also accepted.

Findings by term of reference

2.1 Atlantic Herring

2.1.1 TOR-1 Successfully completed.

- The WG has made a good compilation of landings and discard data by fixed and mobile gear types from all sources, that extensive length and age sampling data of apparent good quality were available.

- It would be possible to develop alternative catch series that take some account of the uncertainty in the stock boundary.

2.1.2 TOR-2 Successfully completed.

- Reasonable justification was given to use the NMFS spring, fall, and shrimp bottom trawl surveys, and not the winter, larval, and state-run surveys as abundance indices for the stock assessment.

- Commercial LPUE was discounted as a usable index of abundance because of the effect of fishing regulations on locations fished, hyperstability, and the difficulty of identifying "herring trips" because of target switching within trips.

2.1.3 TOR-3 Successfully completed.

- The NEFSC fall acoustic survey was not used as it was seen to cover a limited spatial area that was not representative of the entire stock.

2.1.4 TOR-4 Successfully completed.

- Given the requirement for an assessment of the stock, one major sub-stock confined within the Gulf of Maine/Georges Bank region and uncertainty in the level of mixing of the other two sub-stocks, the Panel agreed with the WG decision to maintain the current stock definition for management purposes.

2.1.5 TOR-5 Successfully completed.

- The base case assessment model with a 50% increase in *M* since 1996 was accepted as the most plausible model for management purposes.

- Key reasons for acceptance of this model with an *M* increase were independent information about a likely increase in Atlantic Herring consumption by predators since about 1996, and the resolution of a retrospective pattern that has caused major concern for the previous Atlantic Herring assessment.

- More work could be done to rule out other possible causes of the retrospective pattern.

2.1.6 TOR-6 Successfully completed.

- The *M* change was justified because of the wealth of available annual information from stomach contents for a wide range of herring predators (fish, mammals, other), and annual abundance estimates of those predators.

- Uncertainty in the level of increase in *M* was examined but others such as the start year for the *M* change, the shape of the *M* adjustment other than a step function, and development of alternative plausible *M* scenarios based on uncertainty in consumption were not.

2.1.7 TOR-7 Successfully completed.

- The Panel concluded that the BRPs calculated using the base model were appropriate for the immediate future (3 to 5 years).

2.1.8 TOR-8 Successfully completed.

- Status was determined using the new model and updated data under a range of *M* (both age- and time–specific and post-1995) and BH steepness options and, except for the unlikely case where steepness was assumed to be 0.35, the current status was estimated to be not overfished and overfishing was not occurring.

2.1.9 TOR-9 Not completed, but some initial work underway.

- Alternative operating model scenarios could be developed that make various assumptions about the mixing and stock boundary effects of sub-stocks and the magnitude and variability of an *M* change.

- Specification of the management objectives and performance measures requires considerable input from management and stakeholders.

2.1.10 TOR-10 Successfully completed.

- Projection methods were sound, and were applied to a wide range of scenarios that successfully spanned the plausible range of uncertainty. Key sources of this stock's vulnerability to becoming overfished were identified and well described.

2.1.11 TOR-11 Successfully completed.

- The Panel commented on the priority of research items listed by the WG, and also made additional research recommendations.

2.2 Yellowtail Flounder

2.2.1 TOR-1 Successfully completed.

- The procedure used by the WG to produce best annual estimates of total landings and discards for the stock was well justified.

- Alternative plausible catch histories should be developed so that this source of uncertainty can be carried into future stock assessments.

- A summary table of available age, length and weight samples by year should be prepared as part of the assessment documentation.

2.2.2 TOR-2 Successfully completed.

- The Panel endorsed the use of the NMFS spring, fall, and winter surveys, and the larval survey, and, because of poor sampling, the exclusion of the southern strata when calculating abundance indices for the winter survey.

- Uncertainty in survey calibration factors was not carried through into the stock assessment.

- Commercial LPUE is unlikely to provide a useful index of abundance due to changes in management regulations, changes in reporting methodology, and the change of the fishery from directed to mostly bycatch.

2.2.3 TOR-3 Successfully completed.

- Available evidence makes a strong case for the southern New England (mid-Atlantic Bight) SNEMA region being a single stock for management purposes.

2.2.4 TOR-4 Successfully completed.

- The base case is an adequate basis for management decisions.

- The statistical catch at age ASAP model is appropriate given the data available.

- There were some concerns that the data weightings were somewhat ad-hoc, and the Panel provided some recommendations on weighting procedures.

- Major uncertainties in the assessment were well characterised by the MCMC analyses and alternate model runs. However there were some uncertainties that were not explored as part of the assessment including survey calibrations, catch history (particularly discards), and base natural mortality rate.

2.2.5 TOR-5 Successfully completed.

- One hypothesis for the recruitment pattern shown by the stock assessment is that the low recruitment levels since 1990 were influenced by a shift in environmental conditions.

- A number of sources of information were shown at the SARC that documented long-term trends or highly variable oceanographic conditions that could influence

Yellowtail Flounder productivity. None, however, showed a pattern that indicated a major shift since about 1990.

2.2.6 TOR-6 Successfully completed.

- In calculating BRPs, the WG considered two alternative scenarios: 'two-stanza' which links the drop in recent recruitment to a decrease in SSB and a 'recent' scenario in which the drop was due to a productivity shift caused by unknown environmental changes.

- The Panel used a weight of evidence approach to conclude that the evidence was 60:40 in favor of the 'recent' scenario, although both scenarios were included in advice to management.

- Values of MSY and B_{MSY} calculated under the two-stanza scenario were surprisingly different from those calculated (during the review meeting) using a modelling approach (with a BH stock-recruit relationship) that is more conventional in other fora. This difference needs further investigation.

2.2.7 TOR-7 Successfully completed.

- When evaluated against the BRPs derived from the two-stanza recruitment scenario, the stock is found to be overfished but when evaluated using the BRPs derived from the recent recruitment scenario, the stock is not overfished and the stock is rebuilt.

- While the Panel considers that the drop in recent recruitment is more likely than not due to a productivity change (see TOR-6), the alternate hypothesis cannot be ruled out.

- Additional scientific advice that could be provided to management in the current situation of dual plausible stock situations is an analysis of the risk to the stock or catches of making an incorrect decision.

2.2.8 TOR-8 Successfully completed.

- The projection methods used in the assessment were sound, and were applied to two alternative scenarios: 'recent' and 'two-stanza'.

2.2.9 TOR-9 Successfully completed.

- The Panel commented on the priority of research items listed by the WG, and also made additional research recommendations.

- I also suggest that an analysis of the consequences of acceptance of the wrong scenario can be undertaken as part of future research.

1.1 Background

The Stock Assessment Review Committee (SARC) of the 54th Stock Assessment Workshop (SAW 54) met at the Northeast Fisheries Science Center (NEFSC), Woods Hole, MA during 5th – 9th June 2012 to review Northeast regional benchmark stock assessments of Atlantic Herring *(Clupea harengus)* and Southern New England / Mid-Atlantic Bight Yellowtail Flounder (*Limanda ferruginea*), guided by the SAW 54 Terms of Reference (Annex 2 of the SAW 54 Statement of Work provided below).

The SARC review panel consisted of Chair Robert O'Boyle (Beta Scientific Consulting, Canada) and three scientists representing the Center for Independent Experts (CIE): Chris Francis, Norm Hall and Neil Klaer.

The SARC was assisted by the NEFSC SAW Chairman, James Weinberg, Anne O'Brien, and Paul Rago (NEFSC). Documentation for the herring assessment was prepared by the NEFSC Herring Working Group (HWG), and the presentations at the meeting were made by Jon Deroba (NEFSC). Documentation for the yellowtail assessment was prepared by the NEFSC Southern Demersal Working Group (SDWG), and the presentation at the meeting was made by Larry Alade (NEFSC). The rapporteurs who recorded the discussion to assist the Panel in its deliberations were Toni Chute (Atlantic Herring) and Jessica Blaylock (Yellowtail Flounder).

1.2 Review of Activities

The SARC met at Woods Hole from Tuesday 5th to Saturday 9th June 2012, the agenda of which is summarized in Table 1 (see full agenda in annex 3 of the SAW Statement of Work below).

Table 1. Summary of SARC/SAW 54 Agenda during 5th – 9th June 2012

	5th June	6th June	7th June	8th June	9th June
	Tuesday	**Wednesday**	**Thursday**	**Friday**	**Saturday**
Morning	Panel meeting (10:30)	Herring assessment	Assessment revisits	Summary Report Review	Panel Report Discussion (closed meeting)
Afternoon	Herring Assessment	SNE Yellowtail assesment	Assessment revisits	Summary Report Review	
			Summary Report Review	Panel Report Discussion (closed meeting)	

Each reviewer on the Panel was assigned to individual Terms of Reference (TORs) for each species to compile summary points and to help in the

preparation of the summary report. I was assigned to TOR-1 landings and effort, TOR-4 stock definition and TOR-11 research recommendations for Atlantic Herring, and TOR-1 landings and effort, TOR-3 stock definition and TOR-9 research recommendations for Yellowtail Flounder.

The Panel devoted Friday afternoon and Saturday morning to distilling and combining summary points for each stock's Terms of Reference as well as observations on the SARC process. It was agreed that each panelist would use these points to draft a section of the summary report, which was then to be compiled and edited by the SARC Chair. There were no disagreements among the reviewers on the contents of the summary report, so my own report here reflects the contents of that report, and provides some additional information.

ATLANTIC HERRING

2.1 Findings by term of reference

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

The Panel concluded that this term of reference had been successfully completed and I agree with the points made in the summary report.

The Working Group (WG) has made a good compilation of landings and discard data by fixed and mobile gear types from all sources, extensive length and age sampling data of apparent good quality were available, and observer coverage of the commercial fishery has been sufficient particularly recently to give confidence in discard estimates.

Some account of uncertainty in catch and discarding was made in the stock assessment through a coefficient of variation (CV) on the catch, and tuning of effective sample sizes on proportions of catch at age. However, greater uncertainty of catches from the stock may be due to the decision on placement of the stock boundary. In particular, the influence of catches in the Scotian Shelf region on the stock is unknown. It would be possible to develop alternative catch series that take some account of the uncertainty in the stock boundary.

Alternative catch series may be developed that attempt to bracket the best estimate, so providing possible low and high alternatives. In the case here, perhaps the most important alternative series would be a high catch one that includes some plausible proportion of catches from the Scotian Shelf.

2.1.2 TOR-2 Present the survey data being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, larval surveys, age-length data, predator consumption rates, etc.). Investigate the utility of commercial LPUE as a measure of relative abundance, and characterize the uncertainty and any bias in these sources of data.

The Panel concluded that this term of reference had been successfully completed and I agree with the points made in the summary report.

The WG provided reasonable justification to use the NMFS spring, fall, and shrimp bottom trawl surveys, and not the winter, larval, and state-run surveys as abundance indices for the stock assessment. The use of commercial LPUE as an index of abundance was discounted because of the effect of fishing regulations on locations fished, hyperstability, and the difficulty of identifying “herring trips” because of target switching within trips. The Panel agreed that LPUE would not provide a useful index of abundance.

It is a general disappointment when long-term survey series are broken due to fishing gear changes. For Atlantic Herring those included changes to the nets, trawl door and vessels within key series. Calculation of calibration factors to allow some series continuity is a particular issue and problem for the assessment of Atlantic Herring.

2.1.3 TOR-3 Evaluate the utility of the NEFSC fall acoustic survey to the stock assessment of herring. Consider degree of spatial and temporal overlap between the survey and the stock. Compare acoustic survey results with measures derived from bottom trawl surveys.

The Panel concluded that this term of reference had been successfully completed and I agree with the points made in the summary report.

The Panel concurred with the decision not to use the NEFSC fall acoustic survey as it was seen to cover a limited spatial area that was not representative of the entire stock.

2.1.4 TOR-4 Evaluate the validity of the current stock definition, and determine whether it should be changed. Take into account what is known about migration among stock areas.

The Panel concluded that this term of reference had been successfully completed and I agree with the points made in the summary report.

There are at least three major sub-stocks of herring within the defined boundaries of the management region encompassing the Gulf of Maine/Georges Bank stock complex, with known mixing at the northern and southern boundaries. Given the requirement for an assessment of the stock, one major sub-stock confined within the Gulf of Maine/Georges Bank region and uncertainty in the level of mixing of the other two sub-stocks, the Panel agrees with the WG decision to maintain the current stock definition for management purposes.

Although the WG has stated that separation of catches and catch composition information by sub-stocks is not possible at present, the Panel believes that such data separation is one of the major barriers to improving the stock assessment, and agrees with the WG that future research should be directed towards data separation by sub-stock. For example, movement rates from tagging studies may be used to create generalized sub-stock mixing rates which could then be used in a multi-substock assessment, or used directly to separate assessment input data by sub-stock.

Sub-stock mixing at the southern and particularly northern stock boundaries introduces one of the major uncertainties into the stock assessment. Scenarios should be developed that account for this uncertainty that can be carried through to the stock assessment. One such approach is to develop alternative catch scenarios as discussed under TOR-1.

2.1.5 TOR-5 Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-6), and estimate their uncertainty. Include a historical retrospective analysis to allow a comparison with previous assessment results and previous projections.

The Panel concluded that this term of reference had been successfully completed and I agree with the points made in the summary report.

The base case assessment model with a 50% increase in *M* since 1996 was accepted as the most plausible model for management purposes.

Key reasons for acceptance of this model with an *M* increase were independent information about a likely increase in Atlantic Herring consumption by predators during that time, and the resolution of a retrospective pattern that caused major concern for the previous Atlantic Herring assessment. The case made for the increased *M* due to increased consumption was convincing (see TOR-6) and led the Panel to accept that scenario as likely.

However, although the increased *M* resolved the retrospective pattern, I believe that more work could be done on this aspect to provide additional confidence in the increased *M* scenario.

The existing retrospective pattern was characterized by an apparent overestimation of recent abundance. To resolve the pattern, a mechanism to reduce the number of fish in the recent population was required. A change in *M* was selected as a likely mechanism due to evidence from consumption information. Other causes or contributors to the retrospective pattern are possible including underestimated fishing mortality or change in survey *q* values (e.g. see Mohn 1999). These other possible causes should be investigated and ruled out if possible. A simple investigation could be made using the assessment model alone to determining what level of change in these other elements would resolve the retrospective pattern, and then to provide a judgment of whether such a scenario is plausible. An improved evaluation would be through development of alternative plausible scenarios as modifications to the operating model in a management strategy evaluation (MSE) (see TOR-9).

A common means for examining major uncertainties in stock assessments that has become routine in recent years is sensitivity analysis – a systematic examination of changes to all major assumptions from the base case (e.g. base *M* and *h* values, and relative likelihood weighting given to different abundance indices and age/length composition). For Atlantic herring, an additional specific assumption requiring examination was the level of *M* increase. These individual changes are normally carried through to the management advice that follows (e.g. resulting F_{msy} and projected catch values). I would also add a table of likelihood components for each sensitivity run so that changes to the model fit can also be examined. Many of these sensitivities were examined during the

SARC Review, allowing the Panel to agree that these uncertainties had been examined under this TOR, but those examinations might best be carried out by the WG as a routine component of the stock assessment.

2.1.6 TOR-6 Consider the implications of consumption of herring, at various life stages, for use in estimating herring natural mortality rate (*M*) and to inform the herring stock-recruitment relationship. Characterize the uncertainty of the consumption estimates. If possible integrate the results into the stock assessment.

The Panel concluded that this term of reference had been successfully completed and I agree with the points made in the summary report.

Estimates of consumption of Atlantic herring were used to inform the decision to increase post-1995 natural mortality in the base assessment model. It is unusual to consider annual consumption as a mechanism for adjustment of natural mortality in a stock assessment, but it was justified in this case because of the wealth of available annual information from stomach contents for a wide range of herring predators (fish, mammals, other), and annual abundance estimates of those predators. Most of the signal in the annual consumption of herring derived from stomach contents rather than predator abundance.

Despite high uncertainty in the resulting estimates of annual herring consumption, the data provided good evidence that consumption of herring had increased since 1996. The Panel noted, however, that (1) the later peak in the time series of annual consumption estimates was driven by the very high abundances of two individual predator species, but similar high levels of abundance for those species were not present in adjacent years; (2) abundance estimates of some predator species were calculated from swept area calculations, rather than assessment models; (3) the consumption estimates used in this assessment were likely to be underestimates of total consumption; and (4) estimates of consumption were included in an exploratory run of the assessment model but did not improve model fit.

Uncertainty in the level of increase in *M* was examined during the SARC meeting, primarily to determine whether there was good justification for using 50%. Other uncertainties, such as the start year for the *M* change, the shape of the *M* adjustment other than a step function, and development of alternative plausible *M* scenarios based on uncertainty in consumption were not examined and are noted for future research.

2.1.7 TOR-7 State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for BMSY, BTHRESHOLD, FMSY 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 Panel concluded that this term of reference had been successfully completed and I agree with the points made in the summary report.

The Panel concluded that the BRPs calculated using the base model, i.e., with a base level of *M* = 0.3 and a post-1995 increase in *M* of 50% due to consumption by predators, was appropriate for the immediate future (3 to 5 years). The Panel recommended, however, that monitoring of predation be continued due to large uncertainty in the assumption that consumption of Atlantic herring by predators would remain at current levels in the longer-term.

2.1.8 TOR-8 Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model, should one be developed for this peer review. In both cases, evaluate whether the stock is rebuilt (if in a rebuilding plan).

- **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.**
- **Then use the newly proposed model and evaluate stock status with respect to "new" BRPs and their estimates (from TOR-7).**

The Panel concluded that this term of reference was successfully completed and I agree with the points made in the summary report.

Status was determined using the new model and updated data under a range of *M* (both age and time – specific and post-1995) and BH steepness options and, except for the unlikely case where steepness was assumed to be 0.35, the current status was estimated to be not overfished and overfishing was not occurring.

2.1.9 TOR-9 Using simulation/estimation methods, evaluate consequences of alternative harvest policies in light of uncertainties in model formulation, presence of retrospective patterns, and incomplete information on magnitude and variability in *M*

The Panel concluded that this term of reference was not completed, but that some initial work was underway. I agree with the points made in the summary report.

Alternative operating model scenarios could be developed for Atlantic herring that make various assumptions about the mixing and stock boundary effects of sub-stocks. Those could encompass the effects of fishing outside the management boundary, and also uncertainty and representativeness of data collections within the boundary. The magnitude and variability of an *M* change is another major component to explore.

While a range of alternative plausible "states of nature" can be hypothesised and implemented as operating model scenarios, I agree with the Panel that the specification of the management objectives and performance measures requires considerable input from management and stakeholders.

2.1.10 TOR-10 Develop approaches and apply them to conduct stock projections and to compute the pdf (probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).

- **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).**
- **Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions.**
- **Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.**

The Panel concluded that this term of reference was successfully completed.

The projection methods were sound, and were applied to a wide range of scenarios that successfully spanned the plausible range of uncertainty. Key sources of this stock's vulnerability to becoming overfished (e.g., contributions from other herring stocks, uncertainty about the strength of the 2008 year class and the persistence of high natural mortality) were identified and well described.

2.1.11 TOR-11 For any research recommendations listed in recent peer reviewed assessment and review panel reports, review, evaluate and report on the status of those research recommendations. Identify new research recommendation

The Panel concluded that this term of reference had been successfully completed. I agree on the comments made in the summary report about the priority of research items listed by the WG, and also agree with the additional research recommendations made by the Panel.

I have added some detail here to Panel recommendation (t):

> t. Using simulation/estimation methods, evaluate consequences of alternative harvest policies in light of uncertainties in model formulation, presence of retrospective patterns, and incomplete information on the magnitude and variability in *M* (TOR-9). Uncertainties to be examined for *M* could include the start year for the *M* change, the shape of the *M* adjustment other than a step function, and alternative plausible *M* scenarios based on consumption data.

YELLOWTAIL FLOUNDER

2.2 Findings by Terms of Reference

2.2.1 TOR-1 Estimate landings and discards by gear type and where possible by fleet, from all sources. Describe the spatial distribution of fishing effort. Characterize uncertainty in these sources of data.

The Panel concluded that this term of reference had been successfully completed and I agree with the comments made in the summary report.

The procedure used by the WG to produce best annual estimates of total landings and discards for the stock was well justified.

Total catch estimation errors were due to apportionment of landings by stock and species, misreporting on VTRs, discard estimates by gear and area and also the discard mortality rate (although 90% is already high). Such uncertainty in total catch can be accounted for by the construction of alternative catch histories that vary these assumptions. It is recommended that alternative plausible catch histories be developed so that this source of uncertainty can be carried into future stock assessments.

A summary table of available age, length and weight samples by year should be prepared as part of the assessment documentation.

2.2.2 TOR-2 Present the survey data being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, age-length data, etc.). Investigate the utility of commercial or recreational LPUE as a measure of relative abundance, and characterize the uncertainty and any bias in these sources of data.

The Panel concluded that this term of reference had been successfully completed and I agree with the comments made in the summary report.

The treatment of surveys was adequate. The NMFS spring, fall, winter and larval surveys were considered by the WG for use in the assessment. The Panel endorsed the use of the NMFS spring, fall, and winter surveys, and the larval survey, and, because of poor sampling, the exclusion of the southern strata when calculating abundance indices for the winter survey. Uncertainty in survey calibration factors was not carried through into the stock assessment.

The Panel acknowledged that commercial LPUE was unlikely to provide a useful index of abundance due to changes in management regulations, changes in reporting methodology, and the change of the fishery from directed to mostly bycatch.

2.2.3 TOR-3 Evaluate the validity of the current stock definition, and determine whether it should be changed. Take into account what is known about migration among stock areas.

The Panel concluded that this term of reference had been successfully completed and I agree with the comments made in the summary report.

Fishing patterns, survey resource distributions, spawning and icthyoplankton distribution, genetics and spatial differences in growth rate combine to make a strong case for the southern New England (mid-Atlantic Bight) SNEMA region being a single stock for management purposes.

There is some tagging evidence for interchange of the SNEMA stock with fish further north. An early larval study (Yveseyenko and Nevinskiy 1981) suggested that there may be some larval leakage from Georges Bank to SNE. This uncertainty could be used in construction of alternative catch histories (see TOR-1), or possibly alternative stock-recruitment relationships (e.g. larval leakage could suggest a stock-recruitment relationship that does not pass through the origin).

2.2.4 TOR-4 Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-5), and estimate their uncertainty. Include a historical retrospective analysis to allow a comparison with previous assessment results and previous projections.

The Panel concluded that this term of reference was successfully completed and I agree with the comments made in the summary report.

The Panel considered the base case (run 26) as an adequate basis for management decisions. The bridging analyses with the VPA of NMFS (2008) was very informative and well done. The statistical catch at age ASAP model is appropriate given the data available. There were concerns that the data weightings (e.g. doubling larval CVs, adding 0.1 to survey CVs) were somewhat ad-hoc, and the Panel provided some recommendations on weighting procedures.

Major uncertainties in the assessment were well characterised by the MCMC analyses and alternate model runs. However there were some uncertainties that were not explored as part of the assessment including survey calibrations (e.g., Bigelow to Albatross), catch history (particularly discards), and base natural mortality rate. As for Atlantic herring, sensitivity analysis of these major uncertainties could be provided as a routine component of the stock assessment.

2.2.5 TOR-5 Investigate causes of annual recruitment variability, particularly the effect of temperature. If possible, integrate the results into the stock assessment (TOR-4).

The Panel concluded that this term of reference was successfully completed and I agree with the comments made in the summary report.

One hypothesis for the recruitment pattern shown by the stock assessment is that the low recruitment levels since 1990 were influenced by a shift in environmental conditions. As yellowtail flounder is at the southern edge of its distributional range, recruitment may well be sensitive to oceanographic conditions. A number of sources of information were shown at the SARC that documented long-term trends, or highly variable oceanographic conditions that could influence yellowtail flounder productivity. None, however, showed a pattern that indicated a major shift since about 1990.

2.2.6 TOR-6 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 Panel concluded that this term of reference was successfully completed and I agree with the comments made in the summary report.

In calculating BRPs, the WG considered two alternative scenarios to explain the step-like drop in yellowtail recruitment that occurred about 1990:

- the 'two-stanza' scenario, which links the drop to a decrease in SSB, positing that expected recruitment falls when SSB is less than about 4300 t
- the 'recent' scenario, in which the drop was deemed to be unrelated to SSB, but was a productivity shift caused by unknown environmental changes.

Since neither scenario could be ruled out by the available evidence, the Panel endorsed the WG's decision to present BRPs (based on the $F_{40\%}$ proxy) for both. Values of MSY and B_{MSY} for the two scenarios were quite different, but $F_{40\%}$ was the same for both.

The Panel advocated that a weight of evidence approach be used to decide whether a species has undergone a productivity shift. Such an approach allows qualitative rating and assessment of the aggregation of different forms of scientific evidence in relationship to a causal hypothesis (Krimsky, 2005). An advantage is that it provides the appearance of a rational and objective process for what would otherwise be a subjective decision, and a disadvantage it that the actual mechanism used to assign weightings to components and arrive at a decision may not be transparent.

Separate criteria used by the Panel to form a judgment on whether there had been a productivity shift in the population were:

1. A long period of observed above or below average recruitment;
2. A long period of above or below average recruitment residuals should be observed that cannot be corrected by simple re-specification of the stock-recruitment relationship;
3. Error in estimated model inputs such as total catch, abundance indices or catch age/size composition can be ruled out as a cause; and
4. A plausible mechanism has been found that is based on environmental or ecological conditions.

My own preference was to provide an indication of what level of acceptance the Panel gave to each of these criteria. It was pointed out that there was less likelihood of agreement among all panel members at this level of detail, so that was not pursued during the SARC. After discussion of these criteria however, the Panel concluded that the evidence was 60:40 in favor of the 'recent' scenario.

While I agree with the Panel view of 60:40, I would like to elaborate on my own consideration of each of the criteria. Item (1) is certainly met. Item (2) is met if residuals are from the overall average in the absence of a stock-recruitment relationship. However, in the case where the BH curve was used, the residual pattern was apparent, but less convincing. Item (3) was not explicitly examined. The base model does not have a serious retrospective problem, so non-stationarity in model assumptions about *M*, total catches or changes in survey *q* values are not indicated from that viewpoint, but still cannot be discounted entirely. Item (4) was not met because environmental effects on recruitment strength for yellowtail flounder are still poorly understood, and even an environmental series that matches the recruitment residuals pattern remains to be found. Ecological/multispecies effects on recruitment are also poorly understood.

The Panel noted that the values of MSY and B_{MSY} calculated under the two-stanza scenario were surprisingly different from those calculated (during the review meeting) using a modelling approach (with a BH stock-recruit relationship) that is more conventional in other fora. This difference needs further investigation (see TOR-9).

2.2.7 TOR-7 Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model, should one be developed for this peer review. In both cases, evaluate whether the stock is rebuilt (if in a rebuilding plan).

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-6).

The Panel concluded that this term of reference was successfully completed and I agree with the comments made in the summary report.

Current status was determined in relation to the two-stanza and recent recruitment scenario reference points (see TOR- 6). When evaluated against the BRPs derived from the two-stanza recruitment scenario, the stock is found to be overfished, but when evaluated using the BRPs derived from the recent recruitment scenario, the stock is not overfished and the stock is rebuilt. Under both scenarios, overfishing is not occurring. During the review, a model was run which included a BH stock-recruitment relationship, which is a parametric alternative to the two-stanza non-parametric scenario. Despite a large difference in the B_{MSY} estimate (with that of the BH model being about 50% of the two-stanza model), current status was determined to be the same under both formulations. The large difference in B_{MSY} estimates from the two models requires further exploration.

The main uncertainty in the assessment is whether or not the step-like drop in recruitment since 1990 is due to a change in stock productivity not associated with spawning biomass and is rather caused by some as yet unidentified oceanographic process. This is influential on determination of current stock status. While the Panel considers that the drop in recent recruitment is more likely than not due to a productivity change (see TOR-6), the alternate hypothesis cannot be ruled out.

Additional scientific advice that could be provided to management in the current situation of dual plausible stock situations is an analysis of the risk to the stock or catches of making an incorrect decision. Jackass Morwong, an Australian groundfish species caught by trawl, was in a very similar circumstance regarding the acceptance or not of a productivity shift, and a MSE was used to perform the risk analysis (Wayte, in review) (see research recommendations).

2.2.8 TOR-8 Develop approaches and apply them to conduct stock projections and to compute the pdf (probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).

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, and recruitment as a function of stock size).**
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 Panel concluded that this term of reference was successfully completed and I agree with the comments made in the summary report.

The projection methods used in the assessment were sound, and were applied to two alternative scenarios: 'recent' and 'two-stanza' (see TOR-6). Under the former, the stock has already rebuilt; under the latter, it cannot rebuild by 2014, even with no fishing. The Panel reiterates its conclusion that the evidence is 60:40 in favour of the 'recent' scenario (see TOR-6). It would have been an improvement if other sources of uncertainty (e.g., the base value of *M*) could have been carried through to the projections, but the existing projections do cover the main source of uncertainty.

2.2.9 TOR-9 Review, evaluate and report on the status of research recommendations listed in most recent peer reviewed assessment and review panel reports. Identify new research recommendations.

The Panel concluded that this term of reference had been successfully completed and I agree with the assessment and recommendations in the summary report that details a number of recommendations by the Panel.

I would like to make an additional recommendation about risk assessment. Given the difference in stock status of the 'recent' and 'two-stanza' scenarios and the associated differences in management implications, an analysis of the consequences of acceptance of the wrong scenario can be undertaken. The consequences can be evaluated in terms of risk to the stock, and making best use of future catch. An example is provided by Wayte, in review.

3 Critique of the review process

The Panel reached summary on all Terms of Reference for each stock. It acknowledges the significant work that the two assessment working groups had undertaken to prepare for the SARC review. It also appreciates the professionalism and cooperation of NEFSC staff at the SARC meeting, which significantly assisted the peer review. Notwithstanding this, during the course of the review, issues came to the attention of the Panel that were not specific to the assessment of either species, resolution of which would assist future SARC reviews. These relate to both the terms of reference of reviews and the presentation of assessment results.

The terms of reference of the herring and yellowtail assessments required a review of their stock definitions. These were conducted during the data meetings of each species, the results of which were brought forward to the assessment meeting. Changes in stock definition have consequences throughout the management system and should not be undertaken without significant consideration of all sources of information. One could expect that there would be considerable reluctance to change stock definition without substantial evidence to the contrary. The Panel considers that reviews of stock definition would more productively be undertaken outside of the normal assessment process and on a schedule that would allow significant changes if these were felt warranted. The review of stock definition needs to highlight the uncertainties in the interactions amongst populations that might influence the interpretation of data during an assessment. This review also needs to determine the catch and indices appropriate for the stock(s) in question.

The term of reference for each stock included review of the data (e.g. catch, indices) to be used in the assessments. Consideration should be given to formally separating the data review from that of the assessment, similar to the SEDAR process conducted by the NMFS Southeast Fisheries Science Center. This would allow the peer review of the assessment to fully devote its attention to determination of stock status, reference points and projections. The data reviews could be undertaken on groups of species (e.g. groundfish, pelagics) to obtain data perspectives across stocks. These reviews would indicate the relative reliability of various datasets (e.g., survey indices) and clearly specify which data and their uncertainties should be brought forward to the assessment review.

While it was evident that the HWG and SDWG had spent considerable time preparing the documents and presentations for the SARC 54, there was unevenness in the relative content of each. In one stock, information was summarized in the working papers that were not summarized in the presentations at the SARC review, while in the other stock, the reverse was the case. Greater detail was sometimes available in the presentation than was in the working papers. It would assist future peer reviews if the evidence supporting the

conclusions of a working group were both presented in the assessment report and the presentation such that panel reviewers may assess whether or not the conclusions are justified.

On some of the figures describing current stock status, both the posterior distribution of the relevant indicator (e.g., spawning stock biomass), as determined through an MCMC process, and point estimates were displayed. Where MCMC was used to provide distributions of current stock status, these should be used to provide metrics and their uncertainty required by the management system. In this case, coefficients of variations based on the Hessian matrix are not required to be reported.

In both assessments, historical trends in spawning stock biomass and fishing mortality were illustrated along with current estimates of the biological reference points (BRPs). However, as highlighted by both assessments, temporal changes in population processes can dramatically change the BRPs. Changes in growth and fishery selectivity can also change the BRPs. There are a number of ways temporal changes in BRPs can be displayed (annually, smoothed over a number of years, by decade, etc.). It would be useful for the NEFSC to develop a policy for the estimation and presentation of temporal changes in BRPs to both avoid future confusion and promote transparent communication with stakeholders and managers on long-term productivity and fisheries changes.

4 References

Krimsky, S. 2005. The Weight of Scientific Evidence in Policy and Law. American Journal of Public Health, Suppl. 1, 95:S1.

Mohn, R. 1999. The retrospective problem in sequential population analysis: An investigation using cod fishery and simulated data. ICES Journal of Marine Science, 56: 473–488.

Wayte, S.E. in review. Management implications of including a climate-induced recruitment shift in the stock assessment for jackass morwong (*Nemadactylus macropterus*) in south-eastern Australia. Fisheries Research, special issue on Stock Synthesis.

Appendix 1. Bibliography

Yellowtail Flounder

Background Papers

19 Anonymous. 2003. Southern New England - Mid Atlantic Yellowtail Flounder. 36th SARC Consensus Summary.

Working Papers

1 Southern Demersal Working Group, Stock Assessment Workshop (SAW 54). 2012. Southern New England Mid-Atlantic (*Limanda ferruginea*) stock assessment updated through 2011. A report of the Southern Demersal Working Group for SARC 54 June 5th – 9th, 2012. Northeast Fisheries Science Center. Woods Hole, MA. SAW/SARC 54.

2 Anonymous. 2012. Southern New England Yellowtail Flounder Assessment Summary for 2012. SAW/SARC 54.

Atlantic Herring

Background Papers

1 Shepherd, G., Cieri, M., Power, M., & Overholtz, W. 2009. Transboundary Resources Assessment Committee Gulf of Maine/Georges Bank Atlantic Herring Stock Assessment Update. TRAC Reference Document 2009/04.

2 Transboundary Resources Assessment Committee. 2009. Gulf Of Maine-Georges Bank Herring Stock Complex. Status Report 2009/04.

3 Transboundary Resource Assessment Committee. 2006. Gulf of Maine-Georges Bank Herring Stock Complex. Status Report 2006/01.

4 Gavaris, S. 2003. Transboundary Resource Assessment Committee (TRAC). Report of Meeting held 10-14 February 2003. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2003/014.

5 O'Boyle, R., & Overholtz, W. 2006. Proceedings of the Transboundary Resources Assessment Committee (TRAC). Benchmark Review of Stock Assessment Models for Gulf of Maine and Georges Bank Herring 2 – 5 May 2006 Woods Hole, Massachusetts.

6 O'Brien, L., & T. Worcester, T. 2008. Proceedings of the Transboundary Resources Assessment Committee (TRAC). Gulf of Maine/Georges Bank Herring, Eastern Georges Bank Cod and Haddock, Georges Bank Yellowtail Flounder. Report of Meeting held 8 - 11 June 2009 St. Andrews Biological Station, St. Andrews, New Brunswick, Canada.

Previous Assessments

7 Jech, J. M. & Stroman, F. 2012. Aggregative patterns of pre-spawning Atlantic herring on Georges Bank from 1999-2010. *Aquat. Living Resour.*, **25**: 1–14.

8 Makris, N. C., Ratilal, P., Symonds, D. T., Jagannathan, S., Lee, S., & Nero, R. W. Fish population and behavior revealed by instantaneous continental shelf–scale imaging. *Science*, **311**: 660-663.

9 Makris, N. C., Ratilal, P., Jagannathan, S., Gong, Z., Andrews, M., Bertsatos, I., Godo, O. R., Nero, R. W., & Jech, J. M. 2009. Supporting online

1 Wood, A. D., Cadrin, S. X., Alade, L. A., Martins, D., Moser, J., & Westwood, A. D. 2012. Mortality and movement of yellowtail flounder, *Limanda ferruginea*, tagged off New England.

2 McBride, R., Press, Y., & Wuenschel, M. 2012. Classifying female yellowtail flounder maturity: comparing at-sea, macroscopic maturity classifications with results from a gonad histology method.

3 McElroy, W. D., Towle, E. K., Press, Y. K., McBride, R. S., & Wuenschel, M. J. 2012. Comparison of fecundity among stocks of female yellowtail flounder, *Limanda ferruginea*.

4 McElroy, W. D., Press, Y. K., & Wuenschel, M. J. 2012. Reproductive effort as a predictor of the natural mortality rate for southern New England yellowtail flounder: the Gunderson method.

5 Alade, L., & Cadrin, S. 2012. A review of yellowtail flounder stock structure off New England.

6 Alade, L., Hart, D., & Legault, C. 2012. Influence of spatial stratification on discard estimation for the Southern New England Mid-Atlantic yellowtail flounder.

7 Alade, L. 2012. Southern New England-Mid Atlantic yellowtail length-weight relationship.

8 Barkley, A., & Cadrin, S. 2012. Results of the application of reflex action mortality predictors onboard commercial fishing vessels.

9 Gervelis, B., Burchard, K., & Hoey, J. 2011. A comparison of discard estimates of yellowtail flounder using study fleet self-reported data and NEFOP observer data.

10 Alade, L. A. 2012. Southern New England Mid-Atlantic yellowtail flounder commercial landings.

11 Hare, J., Richardson, D., & Mountain, D. 2012. Indices of the Mid-Atlantic cold pool and relationship to Southern New England/ Mid-Atlantic yellowtail flounder recruitment.

12 Richardson, D. E., Walsh, H., & Hare, J. 2012. Southern New England yellowtail flounder larval data.

13 Anonymous. 2012. Revised Spatial Stratification for estimating discards for SNEMA yellowtail flounder.

14 GARM. 2002. Southern New England yellowtail flounder.

15 GARM. 2005. Southern New England-Mid Atlantic yellowtail flounder.

16 GARM. 2008. Southern New England/Mid Atlantic yellowtail flounder.

17 Anonymous. 2003. Yellowtail Flounder Stock Structure. 36th SAW Advisory.

18 Northeast Fisheries Science Center. 2003. Report of the 36th Northeast Regional Stock Assessment Workshop (36th SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. Northeast Fish. Sci. Cent. Ref. Doc. 03-06; 453 p. Available from: National Marine Fisheries

Bertsatos, I., Godø, O. R., Nero, R. W., & Jech, J. M. 2009. Supporting online material for "Critical population density triggers rapid formation of vast oceanic fish shoals". *Science*, **323**: 1734.

10 Link. J. S., & Almeida, F. P. 2000. An Overview and History of the Food Web Dynamics Program of the Northeast Fisheries Science Center, Woods Hole, Massachusetts. NOAA Technical Memorandum NMFS-NE-159. 60 pp.

11 Kanwit, J. K., & Libby, D. A. 2009. Seasonal movements of Atlantic herring (*Clupea harengus*): results from a four year tagging study conducted in the Gulf of Maine and Southern New England. *J. Northw. Atl. Fish. Sci.*, **40**: 29–39.

12 Guan, W., Cao, J., Chen, Y., & Matthew Cieri, M. 2012. A simulation study to evaluate impacts of spatial structure of Atlantic herring fishery on retrospective errors in stock assessment.

13 Reid, R. N., Cargnelli, L. M., Griesbach, S. J., Packer, D. B., Johnson, D. L., Zetlin, C. A., Morse, W. W. & Berrien, P. L. 1999. Essential Fish Habitat Source Document: Atlantic Herring, *Clupea harengus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-126. 48 pp.

14 Lorenzen, K. 1996. The relationship between body weight and natural mortality in juvenile and adult fish: a comparison of natural ecosystems and aquaculture. Journal of Fish Biology. 49: 627–647.

15 Miller, T. J., Richardson, D. E., & Hare, J. A. In prep. Maximum likelihood estimation of larval production indices from length frequency and growth information collected on ichthyoplankton surveys.

16 Cao, J., Guan, W., Chen, Y., & Cieri, M. In prep. Evaluating factors influencing retrospective errors in estimating stock biomass for Atlantic herring *Clupea harengus*.

Working Papers

1 Anonymous. 2012. Stock Assessment of Atlantic Herring- Gulf of Maine/Georges Bank. SAW/SARC 54. June 5-9 2012, NOAA Fisheries, Northeast Fisheries Science Center. Woods Hole, MA.

1 Appendices 3-6

Anonymous. 2012. Stock Assessment of Atlantic Herring- Gulf of Maine/Georges Bank. Appendices 3-6. SAW/SARC 54. June 5-9 2012, NOAA Fisheries, Northeast Fisheries Science Center. Woods Hole, MA.

2 Anonymous. 2012. Atlantic Herring Assessment Summary for 2012.

Appendix 2. Statement of Work for Dr. Neil Klaer

External Independent Peer Review by the Center for Independent Experts
54th Stock Assessment Workshop/Stock Assessment Review Committee
(SAW/SARC): Southern New England yellowtail flounder and Atlantic herring.

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

Scope of Work and CIE Process: 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 Technical Representative (COTR), 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 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.

Project Description: The purpose of this meeting will be to provide an external peer review of stock assessments for Southern New England yellowtail flounder (*Pleuronectes ferrugineus*) and Atlantic herring (*Clupea harengus*). Yellowtail flounder is a demersal flatfish distributed from Labrador to Chesapeake Bay generally at depths between 40 and 70 m (20 to 40 fathoms). Off the U.S. coast, three stocks are considered for management purposes: Cape Cod/Gulf of Maine, Georges Bank, and Southern New England/ Mid-Atlantic. The principal fishing gear used to catch yellowtail flounder is the otter trawl. The last peer reviewed assessment of Southern New England yellowtail flounder was in 2008 as part of the GARM III. Atlantic herring is a pelagic fish that is widely distributed in continental shelf waters of the Northeast Atlantic, from Labrador to Cape Hatteras. Important commercial fisheries for juvenile herring (ages 1 to 3) exist along the coasts of Maine and New Brunswick. Development of large-scale fisheries for adult herring is comparatively recent, primarily occurring in the western Gulf of Maine, on Georges Bank, and on the Scotian Shelf. The last peer reviewed assessment of Atlantic herring was in 2009 as part of the TRAC. Yellowtail flounder and Altantic herring are managed by the New England Fishery Management Council. Results of the 2012 peer review will form the scientific basis for fishery management in the northeast region.

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), which are carried out by the SAW Working Groups, are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**. The SARC Summary Report format is described in **Annex 4.**

The SARC 54 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.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review of the stock assessments that are provided, and this review should be in accordance with this SoW and stock assessment ToRs herein. CIE reviewers shall have working knowledge and recent experience in fish stock assessments. For yellowtail, familiarity with forward projecting models and estimation is desirable. For herring, familiarity with pelagic fish and acoustic surveys is desirable. For both stocks, experience with time- and sex-specific natural mortality rate is desirable.

In general, CIE reviewers for SARCs shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Expertise shall include statistical catch-at-age, state-space and index methods. Reviewers shall also have experience in evaluating measures of model fit, identification, uncertainty, and forecasting. Reviewers shall 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 BRPs.

Each CIE reviewer's duties shall not exceed a maximum of 15 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 15 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).

Location and Date of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Woods Hole, Massachusetts during June 5-9, 2012 (Tuesday through Saturday).

Charge to SARC panel: During the SARC meeting, the panel is to determine and write down whether each stock assessment Term of Reference 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. 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 Biological Reference Points (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.

Statement of Tasks:

1. Prior to the meeting

(SARC chair and CIE reviewers)
Review the reports produced by the Working Groups and read background reports.

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

Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email, and FAX number) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and stock assessment ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also 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 COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide by FAX the requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) 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/.
http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-national-registration-system.html

Pre-review Background Documents: 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 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 CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance with the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

2. During the Open meeting

Panel Review Meeting: Each CIE 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 COTR and CIE Lead Coordinator.** 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 discussion, 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.

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.

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.

3. After the Open 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).

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each CIE 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 during June 5-9, 2012 (Tuesday through Saturday).

3) Conduct an independent peer review in accordance with this SoW and the assessment ToRs (listed in **Annex 2**).
4) No later than June 25, 2012, 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 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: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

30 April 2012	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
22 May 2012	NMFS Project Contact will attempt to provide CIE Reviewers the pre-review documents by this date
5-9 June 2012	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
9 June 2012	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
25 June 2012	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
26 June 2012	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *
29 June 2012	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
9 July 2012	CIE submits CIE independent peer review reports to the COTR
16 July 2012	The COTR distributes the final CIE 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 COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR 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 CIE 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: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall be completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each stock assessment ToR listed in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

William Michaels, Program Manager, COTR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-713-2363 ext 136

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPerretti@ntvifederal.com Phone: 571-223-7717

Key Personnel:

NMFS Project Contact:

Dr. James Weinberg, NEFSC SAW Chairman
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, Acting NEFSC Science Director
National Marine Fisheries Service, NOAA
Northeast Fisheries Science Center
166 Water St., Woods Hole, MA 02543
Bill.Karp@noaa.gov Phone: 508-495-2233

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent 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 reviewer 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 Term of Reference of the SAW was completed successfully. For each Term of Reference, the Independent Review 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.

   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 CIE 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 CIE independent report shall be an independent peer review of each ToRs, 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 the CIE Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Stock Assessment Terms of Reference for SAW/SARC54 (June 5-9, 2012) (to be carried out by SAW Working Groups) (file vers.: 10/21/11)

A. Atlantic herring

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

2. Present the survey data being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, larval surveys, age-length data, predator consumption rates, etc.). Investigate the utility of commercial LPUE as a measure of relative abundance, and characterize the uncertainty and any bias in these sources of data.

3. Evaluate the utility of the NEFSC fall acoustic survey to the stock assessment of herring. Consider degree of spatial and temporal overlap between the survey and the stock. Compare acoustic survey results with measures derived from bottom trawl surveys.

4. Evaluate the validity of the current stock definition, and determine whether it should be changed. Take into account what is known about migration among stock areas.

5. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-6), and estimate their uncertainty. Include a historical retrospective analysis to allow a comparison with previous assessment results and previous projections.

6. Consider the implications of consumption of herring, at various life stages, for use in estimating herring natural mortality rate (M) and to inform the herring stock-recruitment relationship. Characterize the uncertainty of the consumption estimates. If possible integrate the results into the stock assessment.

7. 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.

8. Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model, should one be developed for this peer review. In both cases, evaluate whether the stock is rebuilt (if in a rebuilding plan).
    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-7).

9. Using simulation/estimation methods, evaluate consequences of alternative harvest policies in light of uncertainties in model formulation, presence of retrospective patterns, and incomplete information on magnitude and variability in M.

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

11. For any research recommendations listed in recent peer reviewed assessment and review panel reports, review, evaluate and report on the status of those research recommendations. Identify new research recommendations.

B. SNE/Mid-Atlantic Yellowtail Flounder

1. Estimate landings and discards by gear type and where possible by fleet, from all sources. Describe the spatial distribution of fishing effort. Characterize uncertainty in these sources of data.

2. Present the survey data being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, age-length data, etc.). Investigate the utility of commercial or recreational LPUE as a measure of relative abundance, and characterize the uncertainty and any bias in these sources of data.

3. Evaluate the validity of the current stock definition, and determine whether it should be changed. Take into account what is known about migration among stock areas.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-5), and estimate their uncertainty. Include a historical retrospective analysis to allow a comparison with previous assessment results and previous projections.

5. Investigate causes of annual recruitment variability, particularly the effect of temperature. If possible, integrate the results into the stock assessment (TOR-4).

6. 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.

7. Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model, should one be developed for this peer review. In both cases, evaluate whether the stock is rebuilt (if in a rebuilding plan).
    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-6).

8. Develop approaches and apply them to conduct stock projections and to compute the pdf (probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).
    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, and recruitment as a function of stock size).
    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.

9. Review, evaluate and report on the status of research recommendations listed in most recent peer reviewed assessment and review panel reports. Identify new research recommendations.

Appendix to the SAW Assessment TORs:

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

On "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 the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. *(p. 3209)*
>
> NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)
>
> ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, [optimal yield] OY does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

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

> *"Vulnerability.* A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce 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.

(END OF ANNEX 2)

Annex 3: Draft Agenda

54th Northeast Regional Stock Assessment Workshop (SAW 54)
Stock Assessment Review Committee (SARC) Meeting

June 5-9, 2012

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

Draft AGENDA* (version: 14 March 2012)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR
Tuesday, June 5			
1 – 1:30 PM Welcome Introduction Agenda Conduct of Meeting	**James Weinberg**, SAW Chair **Robert O'Boyle**, SARC Chair		
1:30 – 3:30	Assessment Presentation (A. Herring) **Jon Deroba, others**	**TBD**	**TBD**
3:30 – 3:45	Break		
3:45 – 6	Assessment Presentation (A. Herring) **Jon Deroba, others**	**TBD**	**TBD**
Wednesday, June 6			
9 – 11:45	SARC Discussion w/ presenters (A. Herring) **Robert O'Boyle**, SARC Chair		**TBD**
11:45 – 1	Lunch		
1:00 – 3:15	Assessment Presentation (B. SNE YT) **Larry Alade**	**TBD**	**TBD**
3:15 – 3:30	Break		
3:30 – 5:30	SARC Discussion w/ presenters (B. SNE YT) **Robert O'Boyle**, SARC Chair		**TBD**

Thursday, June 7

9 - 11	Revisit w/ presenters (A. herring) **Robert O'Boyle**, SARC Chair	**TBD**
11 – 11:15	Break	
11:15 – 12:30	Revisit w/ presenters (B. SNE YT) **Robert O'Boyle**, SARC Chair	**TBD**
12:30 – 1:45	Lunch	
1:45 – 2:15	(cont.) Revisit w/ presenters (B. SNE YT) **Robert O'Boyle**, SARC Chair	**TBD**
2:15 -2:30	Break	
2:30 – 5:30	Review/edit Assessment Summary Report (A. herring) **Robert O'Boyle**, SARC Chair	**TBD**

Friday, June 8

9 - 12	Review/edit Assessment Summary Report (B. SNE YT) **Robert O'Boyle**, SARC Chair	**TBD**
12 – 1:15	**Lunch**	
1:15 – 5	SARC Report writing. (closed meeting)	

Saturday, June 9

9:00 - 3 PM (cont.) SARC Report writing. (closed meeting)

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

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 any papers cited in the SARC Summary Report, along with a copy of the CIE Statement of Work.

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

Appendix 3. List of participants

The SARC review panel consisted of Chair Robert O'Boyle (Beta Scientific Consulting, Canada) and three scientists representing the Center for Independent Experts (CIE): Chris Francis, Norm Hall and Neil Klaer. The SARC was assisted by the NEFSC SAW Chairman, James Weinberg, Anne O'Brien, and Paul Rago (NEFSC). Documentation for the herring assessment was prepared by the NEFSC Herring Working Group (HWG), and the presentations at the meeting were made by Jon Deroba (NEFSC). Documentation for the yellowtail assessment was prepared by the NEFSC Southern Demersal Working Group (SDWG), and the presentation at the meeting was made by Larry Alade (NEFSC). The rapporteurs who recorded the discussion to assist the Panel in its deliberations were Toni Chute (Atlantic Herring) and Jessica Blaylock (Yellowtail Flounder).