53rd Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Black sea bass and Gulf of Maine cod.

External Independent Peer Review

by

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for

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1. Executive Summary

1.1 Black Sea Bass

The black sea bass assessment was rejected. Although substantial additional research, sampling and data collection had been carried out in order to develop an age-structured assessment, this could not be accepted for two reasons. Firstly, neither the aggregate catch-at-age information nor the survey information show consistent cohort trends, hence there is very little inter-cohort contrast in the data set, and no confirmation can be established that survey abundances do reflect the abundances of the fished populations. Secondly, examination of residual patterns showed pathological patterns of residuals (observed survey data versus predicted values) that appeared to show that the assumption of linear catchability was violated. This is likely to have introduced strong biases in the model fit. However, the move to age-based assessment should be further developed, possibly using a spatially-structured population model.

1.2 Gulf of Maine Cod

The cod assessment is accepted. The methodology used for Gulf of Maine cod was appropriate and well documented; and the link to the previous assessment methodology was also well executed and well documented. The biological reference points based on $F_{35\%SPR}$ as initially proposed are rejected; the $F_{40\%SPR}$ basis for the reference point should be retained. The medium-term projections, as revised during the review meeting to include an assumption of low recruitment at low stock size, are accepted. The Gulf of Maine cod is overfished and is undergoing overfishing.

Examination of residual and retrospective patterns showed an acceptable fit of the assessment model. Sensitivity runs showed that the assessment of the state of the stock was robust to plausible alternative model formulations within a range of 0.9 to 1.5 in fishing mortality. The new assessment indicates a much lower 2005 year-class strength than in the previous assessments, which was attributable to large catches of this cohort in very few trawl hauls in two successive years.

The proposal to change the F_{msy} reference proxy from $F_{40\%SPR}$ was not accepted as the proposed new stock-recruit model fit did not appear to fit the observations well, and no other basis for changing from $F_{40\% SPR}$ to $F_{35\%SPR}$ was found.

1.3. Process and procedure

The meeting was well chaired and managed in good order. However, the ownership of the task of the drafting of the Assessment Summary Report was unclear. Contributions to drafting were taken from the floor of the meeting and it appeared that some contributions from the review panel were not acceptable for administrative reasons. This caused confusion.

2. Background

The review was held at the Northeast Fisheries Science Center, Steven H. Clark conference room, 166 Water St., Woods Hole, MA 02540 from 09h00-18h00 daily. The meeting opened at 09h00 on 29 November and closed at 15h45 on 2 December. Apart from a closed session on the last day, the meetings were open to the public and also made available via webex and via a conference call. The public attendance comprised a significant audience of NEFSC staff, and several representatives of the fisheries sectors, NGOs and of regional fisheries management authorities.

3. Description of the Individual Reviewer's Role in Review Activities

1 November 2011: Agenda and meeting arrangements distributed by SAW chair.

10th. November 2011: Background information distributed by SAW chair (Appendix 1).

10-14 November: Reading background documents (part time).

14 November: The Gulf of Maine cod and the black sea bass assessments were provided.

15 November: NEFSC input datafiles for cod were provided by NEFSC.

15-27 November (part time): Reviewing assessment documentation, data screening, trial assessment runs and software exploration. NEFSC staff assisted by email.

23 November: I requested additional information concerning the cod assessments as below:

> a) QQ plots for the fits of the proportions of the catches at age (ASAP assessment)
> b) Observed versus expected plots for the surveys, separately for each age (ASAP and ADAPT run 10 assessments).
>
> Only the plots in item b) concerning the ASAP assessment were provided, by presentation during the meeting and by email on 14 December.

28 November: Travel to Falmouth. Review panel held a dinner pre-meeting at 20h00 on 28 November for a preliminary exchange of views about the assessments and the conduct of the meeting.

29 November: A pre-meeting was held from 08h10 to 08h40 with J. Weinberg and P. Rago (NEFSC) to discuss meeting logistics. At this stage it was indicated that additional material had been submitted to the SARC review but outside the formal process for such contributions (*i.e.* after closure of the stock assessment workshop). It was decided not to make this paper available to the review panel. It was also decided to change the agenda such that the black sea bass discussion would take place on 30th. November, as the panel was informed that an error had been made in the bass report and that the final results would be presented during the meeting.

29 November – 2 December: Panel meetings, held in Steven H. Clark conference room, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02540 from 09h00-18h00 daily. Meeting opened at 09h00 on 29 November and closed at 15h45 on 2 December. During the meeting I contributed to the discussions, carried out some *ad-hoc* data screening exercises, posed questions to the assessors and provided my opinions as to the adequacy with which each ToR had been addressed (these are further detailed below).

In the closed meeting of 2 December panellists provided their views to the chair on the various items in the statement of work. The chair undertook to draft the report according to these points and to distribute a draft report by 10 December.

3-4 December: Return travel to Belgium.

6 December: NEFSC staff provided revised medium-term projections for cod based on the panel's recommendations. It was agreed to incorporate these in the report.

10 December: chair distributes draft consensus report.

12 December: My comments were provided on the draft consensus report.

15 December: Submission of my draft individual reviewer report.

19 December: Submission of my final individual reviewer report.

4. Findings for each Term of Reference

4.1 Black Sea Bass

4.1.1. Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data. Evaluate available information on discard mortality and, if appropriate, update mortality rates applied to discard components of the catch. Describe the spatial and temporal distribution of fishing effort.

This term of reference was addressed adequately for the purposes of the assessment. However, some shortcomings could be identified and some improvements could be suggested.

The system for reporting commercial catches is not referenced. Reliance is placed on national (NMFS) catch reporting systems (e.g. MRFSS). The uncertainty in discard and in recreational catch figures was considered, but uncertainty in commercial landings information was not examined. However, no concerns were expressed at the meeting about uncertainty in commercial catch reports. While catch reporting is a control issue, obtaining estimates of out-take is a prerequisite for assessment purposes.

The aggregate method of calculating discards is likely to have overestimated the numbers of older fish caught. It would have been better to estimate discards separately by length.

A better description of the rationale for changing from an estimate of 25% discard mortality in the recreational fishery to 15% would have been helpful.

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

This term of reference was addressed adequately for the purposes of the assessment.

The tagging information is informative about seasonal migrations, and appears to show that the stock undergoes seasonal migrations to and from inshore spawning areas, with considerable site fidelity. However, at the aggregate level there are only very weak cohort signals in the survey data. This could be due to ageing errors, to a strong density-dependence mechanism regulating cohort strength, or to blurring of cohort signals across a range of local substocks. Evidence was presented on a local analysis of survey information that lends support to the third of these hypotheses.

As for many stocks in this area, the conversion of survey data from the RV Henry B. Bigelow to Albatross IV equivalents is an important source of uncertainty. As soon as practicable, methods relying on such survey intercalibration estimates should cease to be used.

4.1.3. Consider known aspects of seasonal migration and availability of black sea bass, and investigate ways to incorporate these into the stock assessment. Based on the known aspects, evaluate whether more than one management unit should be used for black sea bass from Cape Hatteras north and, if so, propose unit delineations that could be considered by the Mid-Atlantic Fishery Management Council and for use in future stock assessments.

This term of reference was addressed adequately for the purposes of the assessment.

Existing information was well presented and reviewed, contributing to a picture of a clinal trend in population structure from north to south as well as seasonal inshore-offshore and NW-SE migrations. The existence of such population structure does not preclude the management of the stock and the fishery as a single unit. Several other important commercial stocks are managed in this way (e.g. North Sea Herring, Cod in NAFO 2J3KL).

The conclusion was drawn that the data currently available are inadequate to support an area-specific approach and that an aggregate assessment is the only feasible option, while management should consider local differences. This conclusion appears entirely appropriate.

4.1.4. Investigate estimates of natural mortality rate, M, and if possible incorporate the results into TOR-5. Consider including sex- and age-specific rate estimates, if they can be supported by the data.

This term of reference was addressed adequately for the purposes of the assessment.

A thorough consideration of M estimation was carried out at the GARM-III review, and little additional information is available since then. The decision to use Lorenzen-based Ms averaged to F=0.4 is appropriate given the present state of knowledge. The sensitivity analysis is an important element also.

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

The term of reference is not reliably addressed.

The establishment of an age-based time series is a major step forward in the assessment of this stock. While a better understanding of issues concerning stock dynamics has been achieved, a sufficiently appropriate and reliable model fit has not yet been determined.

The lack of contrast in recruitment data and in the catch-at-age data make it difficult to estimate catchabilities and, consequently, to estimate recent stock sizes and fishing mortalities, and also make it difficult to validate the principle that the surveyed stock and the exploited stock belong to the same populations. On examination of scatterplots of observed on expected survey observations, a deviation from a proportionate relationship could be detected at low stock sizes. In addition, there appeared to be a general tendency for the model to under-estimate the non-zero survey observations. This can be seen in Figures 4.1.5.1 and 4.1.5.2, where many points lie above a notional 45° line through the origin. For these two reasons (as well as other problem issues raised by the other reviewers), the assessment should not be accepted for management purposes.

4.1.6 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 appropriateness of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

In the absence of an accepted assessment model, this ToR could not be accepted as completed.

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

- **a. When working with the existing model, update it with new data and evaluate stock status (overfished and overfishing) with respect to the existing BRP estimates.**
- **b. Then use the newly proposed model and evaluate stock status with respect to "new" BRPs (from black sea bass TOR 6).**

As the assessment model was not accepted, this ToR could not be accepted as completed.

When fitting the previously-accepted SCALE model to the updated information, the results imply that the stock is not overfished and overfishing is not occurring. The quality and robustness of this conclusion is not known.

4.1.8. Develop and apply analytical approaches to conduct single and multi-year stock projections 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 (3-5 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 definition of BRPs for black sea bass).**
- **b. Comment on which projections seem most realistic. Consider major uncertainties in the assessment as well as the 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.**

As the assessment model was not accepted, this ToR could not be accepted as completed.

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

After considering the SARC research recommendations and further issues raised and discussed at the meeting the following priorities are proposed:

Continue age-based assessment modelling with a view to finding a model structure without pathological residual patterns, but consider methods that can work in the absence of strong contrast in cohorts (e.g. catch curves, separable models where F is smoothed over time).

Continue and expand the tagging programme and consider including tag return data in an age-based assessment model.

Develop a specific survey targeted at bass across its area of distribution.

Attempt to construct a simple area-specific model.

Consider further research on the consequences of a protogynous life-history on the response of the stock to exploitation.

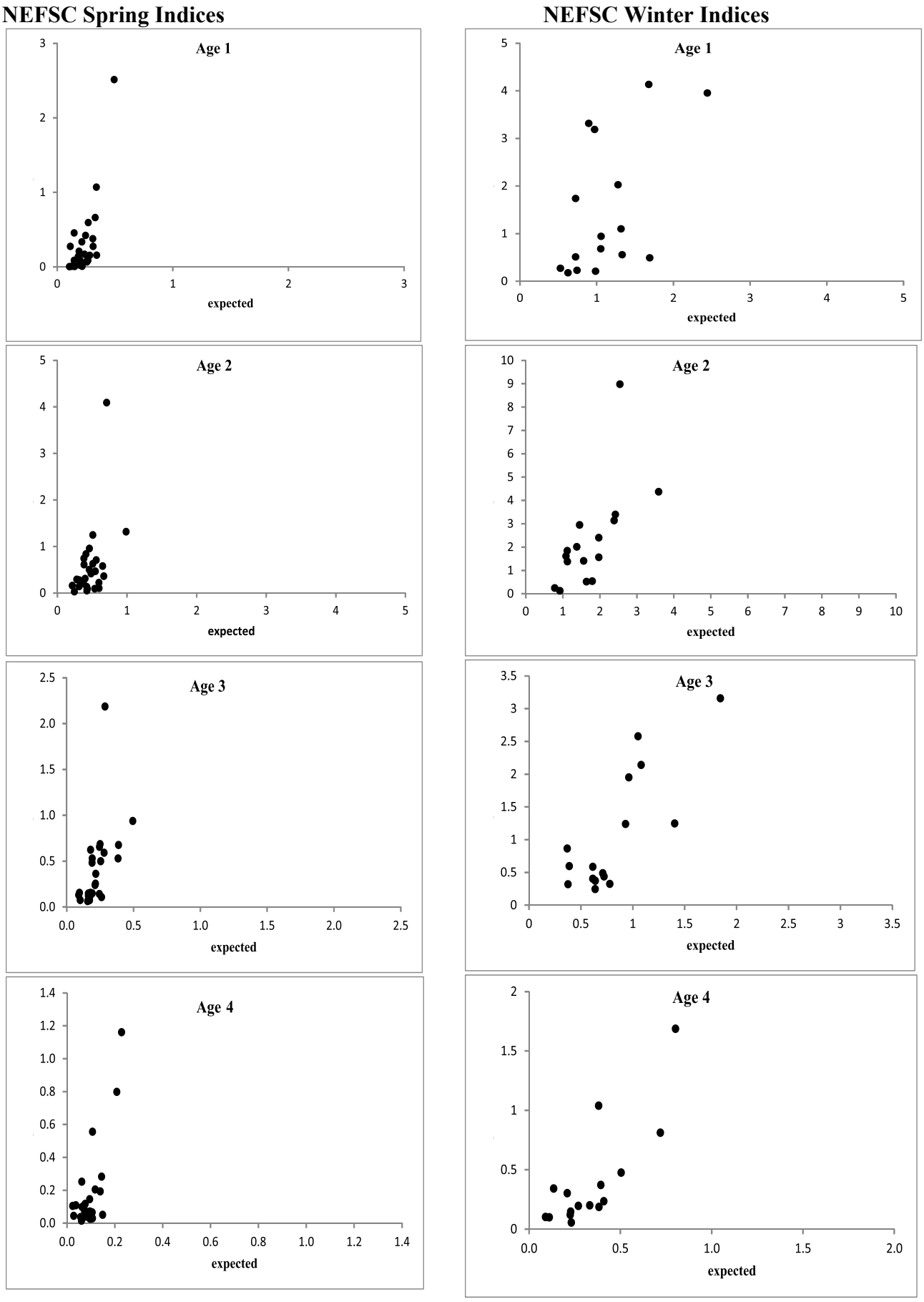

Figure 4.1.5.1 Observed and expected survey indices, ages 1 to 4, for NEFSC spring surveys (left) and winter surveys (right). Redrawn from data supplied by NEFSC.

NEFSC Spring Indices **NEFSC Winter Indices**

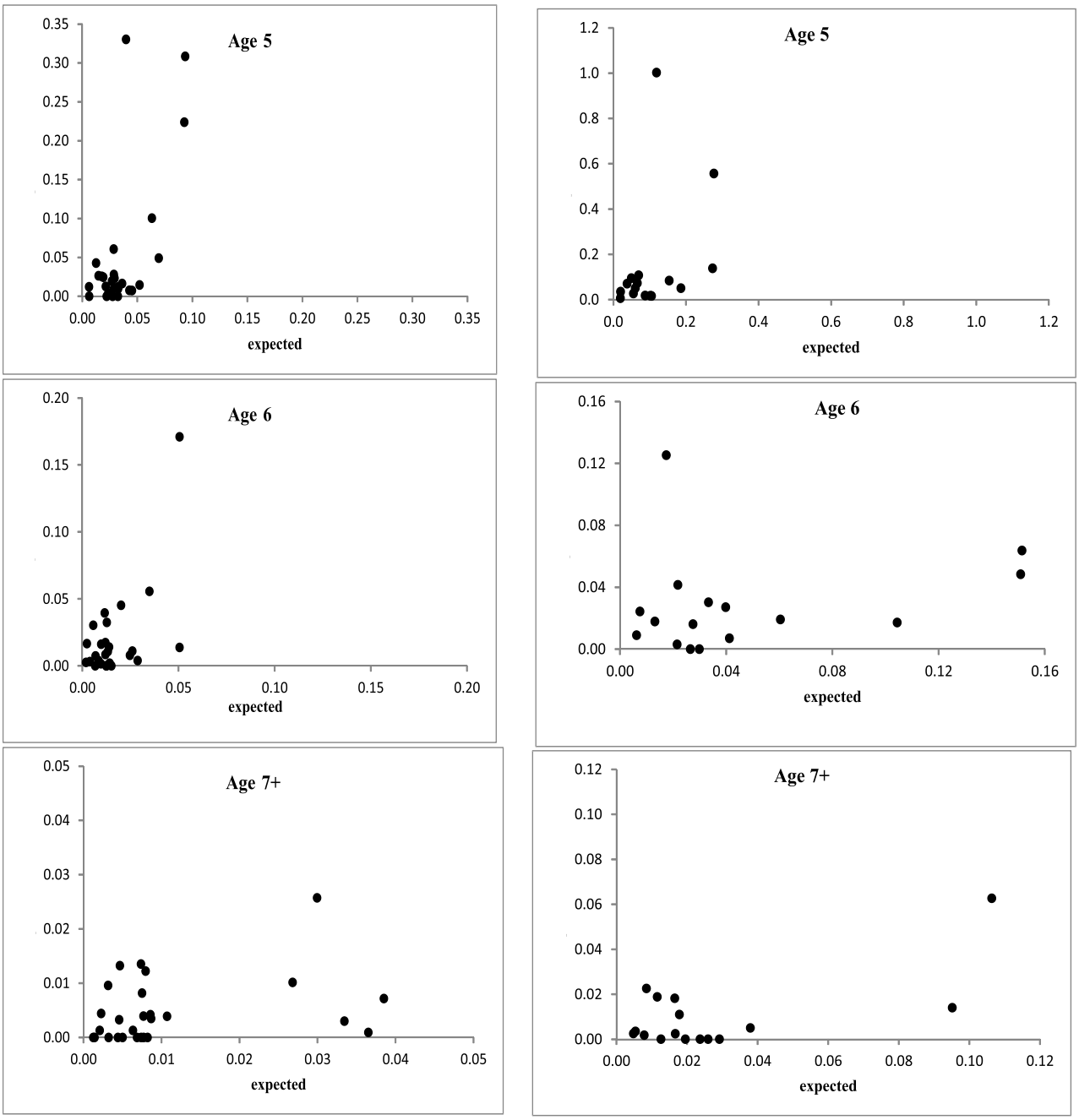

Figure 4.1.5.2. Observed and expected survey indices, ages 5 to 7, for NEFSC spring surveys (left) and winter surveys (right). Redrawn from data supplied by NEFSC.

4.2. Gulf of Maine Cod

4.2.1. Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data. Evaluate available information on discard mortality and, if appropriate, update mortality rates applied to discard components of the catch.

This term of reference was addressed adequately for the purposes of the assessment. However, some shortcomings could be identified and some improvements could be suggested.

As for sea bass, reliance is placed on national (NMFS) catch reporting systems (e.g. MRFSS and VTR-based systems). The uncertainty in discard and in recreational catch figures was considered, but uncertainty in commercial landings information was not examined. Concern was raised about possibly anomalously high MRFSS catch reports during 2010 wave 2, but the sensitivity of the assessment conclusions to this catch report was evaluated and found to be low. As the assessment is strongly driven by survey results it is unlikely that errors in catch reporting would greatly change the perception of the recent state of the stock.

The possibility that the introduction of sectoral ACLs may have incentivised fishers to over-report their catches was discussed, but no data were available on this issue. While catch reporting is a control issue, obtaining estimates of out-take is a prerequisite for assessment purposes.

The new method of estimating discards, taking account of the different size-distributions of fish discarded and landed, is a very necessary improvement to the methodology.

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

This term of reference was addressed adequately for the purposes of the assessment. However, two principal concerns arose with respect to the survey data, but these do not invalidate the use of the assessment for management purposes.

Firstly, high estimates of abundance of the 2005 year-class were detected in two successive NEFSC surveys. This led to a very high recruitment estimate being calculated for management purposes. The latest examination showed that these estimates were driven by a very few trawl hauls with very high catches. The uncertainty associated with the annual estimates was very high. This had not been detected at the time of the GARM III assessment.

There are two approaches to preventing a recurrence of such a problem. The first is that scientists with a good operational knowledge of the surveys should have had an input to the assessment process. It seems very likely that the chief scientists on the surveys would have been aware of the extreme observations, but such knowledge was not communicated into the assessment process. The second would be a statistical approach whereby bootstrap internal variance estimates could be used to derive internal statistical weights for assessment purposes.

The second problem concerns the intercalibration of Albatross IV and Henry Bigelow survey efficiency. The precision of such intercalibration exercises is low, yet the consequences of miss-specification are inevitably high. Recalibrated survey estimates show a step-change in mortality at the time of the recalibration. The perception of the stock status is therefore dependent on the recalibration whose precision, as noted above, is low. Despite this effect, a brief examination of survey results within the Bigelow time series appears to confirm the perception of the stock as

subject to high mortality rates.

The use of commercial LPUE as an index of abundance is clearly inappropriate as only a short and outdated time series of comparable values can be calculated due to changes in fishery regulations.

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

This term of reference was addressed very thoroughly.

The ADAPT assessment model used previously was updated with new information in a stepwise fashion, documenting thoroughly each step in the process. However, the step from the ADAPT to ASAP assessment models was not documented in as much detail. This issue was addressed during presentations at the meeting, and a satisfactory description of the model transition process was provided verbally and graphically. As a consequence, the transition from ADAPT to ASAP was shown not to represent significant uncertainty in conclusions regarding the state of the stock.

Elucidating the precise model fit used took a certain amount of time prior to and during the meeting. A full description of the model equations and inputs would have been helpful (see recommendations). Even where a familiar assessment programme is used, it is helpful to lay out formally the model that is being fitted in each case.

It is also necessary to document fully the input data, such that all the inputs to the assessment model can be found in the report of the assessment workshop.

The SAW process has not identified any particular protocol for the introduction of new assessment models. In other parts of the world it has been found useful to set a rather high bar to model change, such that the new model has to be shown to perform better than the old model in a simulation test that represents the known and suspected characteristics of the stock and the data obtained from it. This hurdle has to be passed before a new model is accepted for assessing a particular stock.

The software is a sophisticated, advanced and user-friendly tool which used provides a good range of diagnostic plots. However, there is no facility to provide:

1. observed/expected scatterplots, which are very useful to evaluate data contrast and conformity with the structural model;

2. QQ plots on individual observations, which are useful for identifying outlying and potentially influential data points.

Observed/expected scatterplots (Figures 4.2.3.1 - 4.2.3.3) show a reasonably good conformity of the data to the assumptions made within the model that the survey index data are in linear proportion to the abundance of the stock.

Concern was raised from the floor that model estimates of stock size were incompatible with swept-area estimates. NEFSC staff examined this issue in detail and could show that, due to assumptions about the area-coverage of surveys, there was not necessarily a contradiction. In any event, model estimates of abundance do scale according to estimates of natural mortality and selection pattern which are in many cases very weakly supported by data. However, the conclusions drawn with reference to stock status and biological reference points are normally robust to such scaling effects.

Considerable concern was also shown from the floor that the fishing mortality could not be as high as evinced by the model fit because of the management measures that had been put in place. Such an apparent contradiction can appear if recent decommissioning caused an increase in average efficiency as inefficient vessels and operators are withdrawn, if an increased economic incentive is created to target cod when days at sea become limiting, or if non-linear relationships develop between commercial fleet catchability and abundance, if (as has been seen in surveys) the stock concentrates in a smaller area and becomes more vulnerable.

I undertook a number of sensitivity runs using alternative software (extended survivors analysis, XSA) and suggested a number of additional runs be calculated with various subsets of the survey data, including single-survey assessments. These were designed to test:

a) sensitivity to use of the oldest ages in the surveys;

b) influence of historic data prior to 2000 on the perception of current stock size;

c) sensitivity to using one or another survey time-series for assessment purposes.

These tests showed a range in structural uncertainties from 0.9 to 1.5 in average fishing mortality on ages 5 to 7. This is probably a better representation of the uncertainty in the assessment than the variance estimates calculated on the basis of the final assessment.

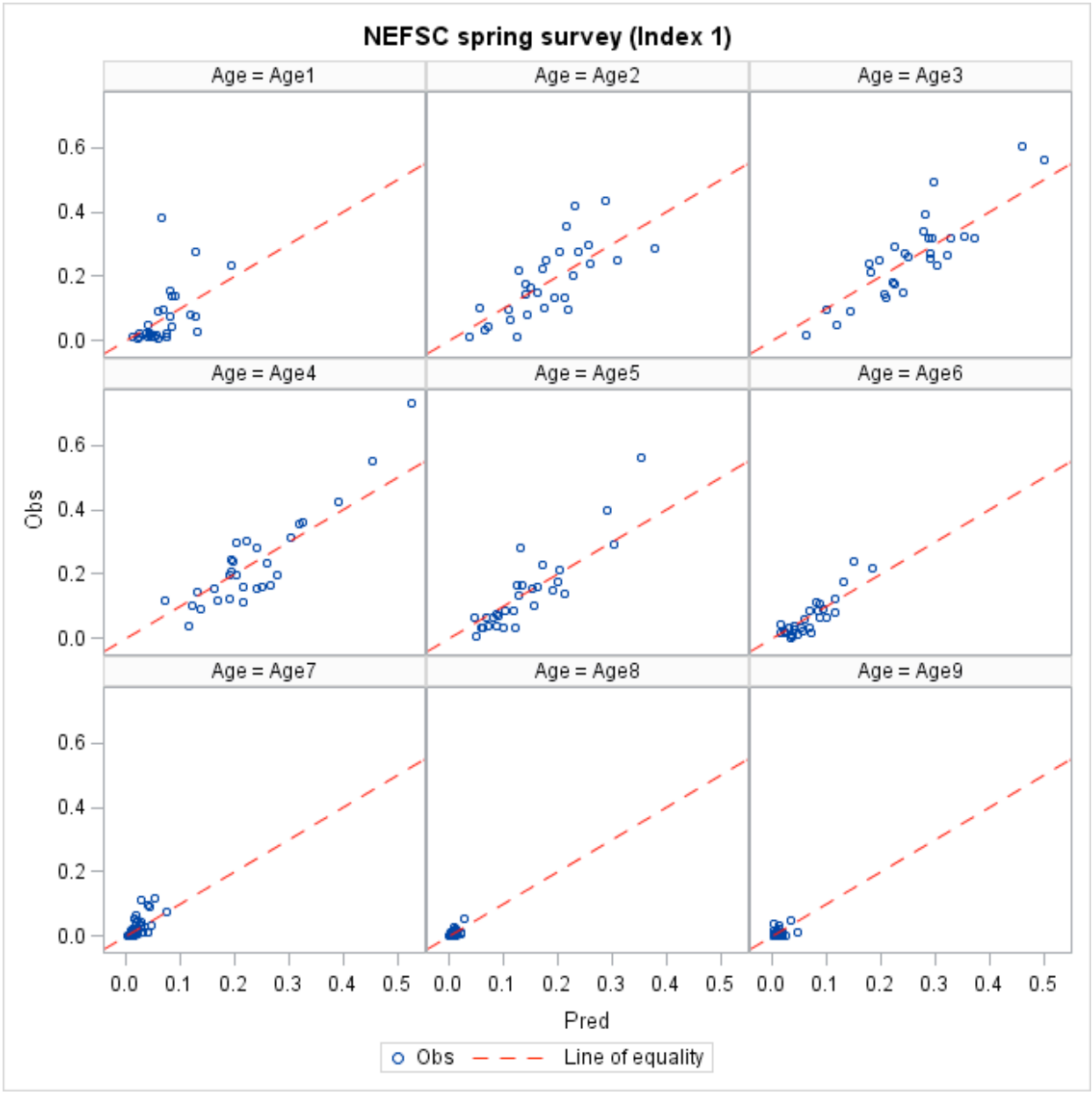

Figure 4.2.3.1. Observed and expected NEFSC spring survey indices. Graph supplied by NEFSC.

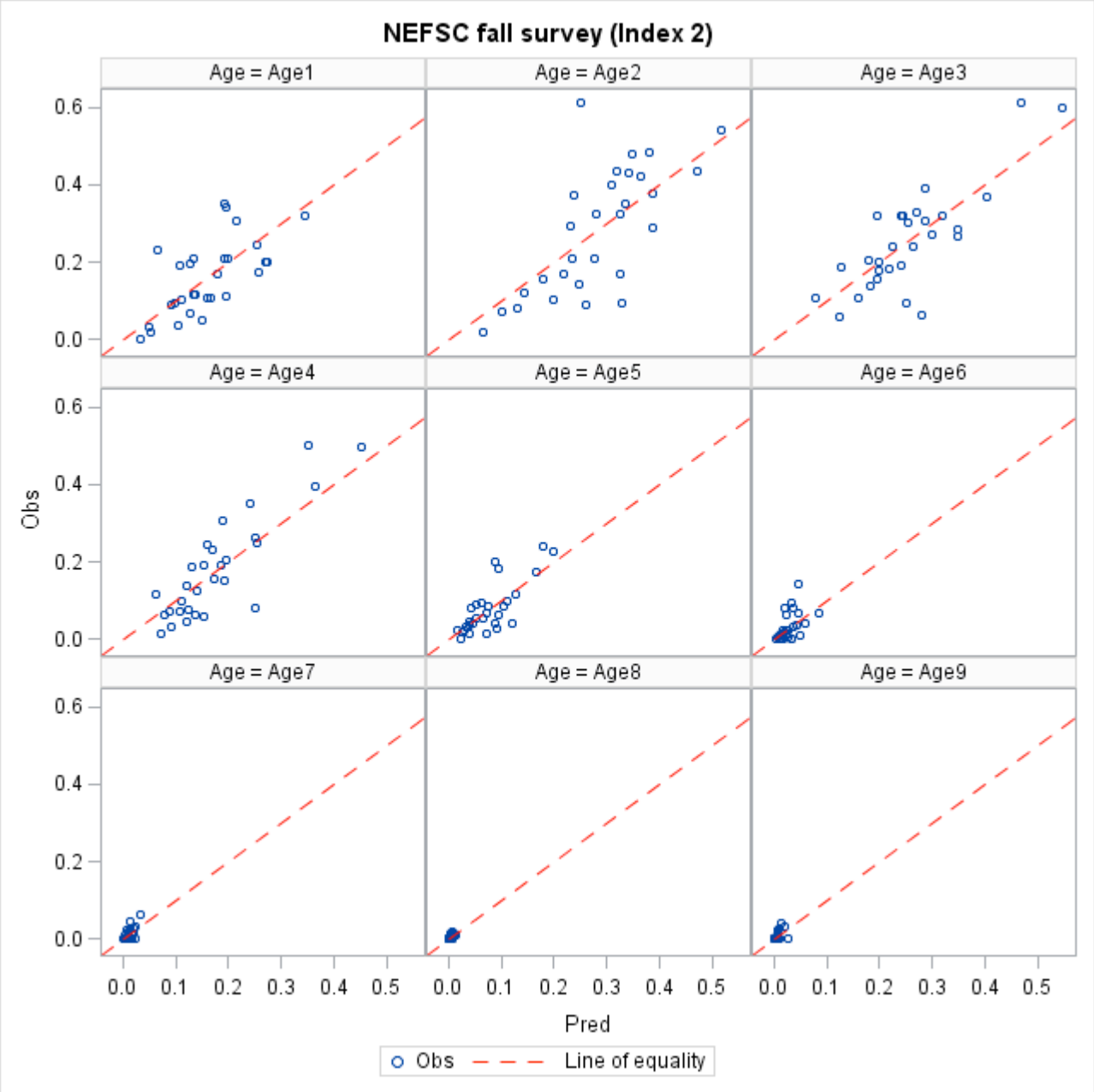

Figure 4.2.3.2. Observed and expected NEFSC Fall survey indices. Graph supplied by NEFSC.

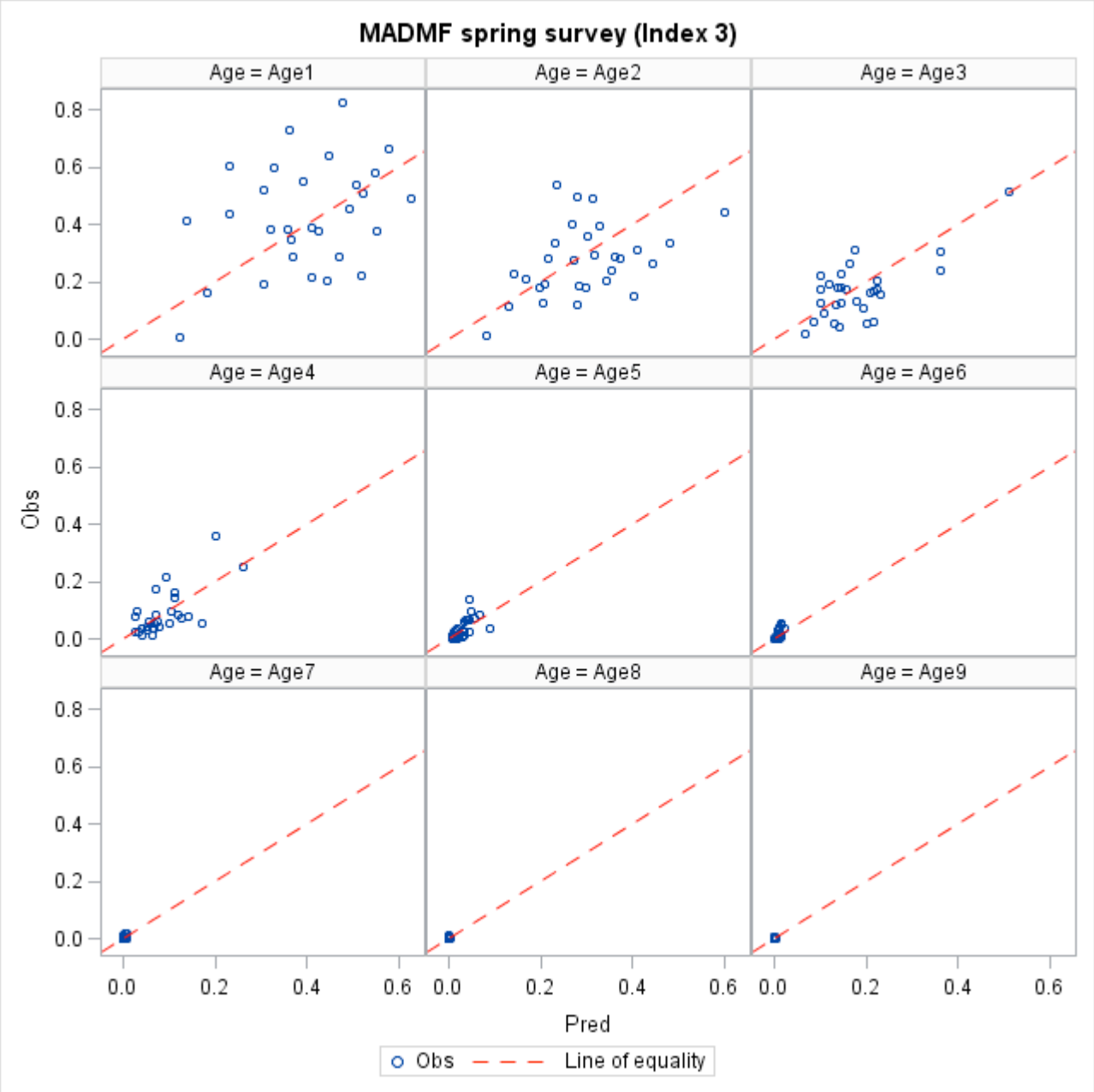

Figure 4.2.3.3. Observed and expected MADMF survey indices. Graph supplied by NEFSC.

4.2.4. Perform a sensitivity analysis which examines the impact of allocation of catch to stock areas on model performance (TOR-3).

This ToR was met. The sensitivity of the assessment to allocation of catches either side of the "Hague Line" was of the order of 5% in biomass.

4.2.5. If time permits, consider the small-scale distribution of cod (e.g., spawning sites, resource distribution, fishing effort) in the Gulf of Maine and advise on its management implications.

This ToR was partially met. Discussions were held on this topic in the assessment workshop but no clear conclusion on management implications of small-scale distributions emerged in the time available. However, the large-scale distribution pattern has changed, with a marked concentration of fish in the western part of the Gulf of Maine in recent years.

4.2.6. 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 appropriateness of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

The ToR was met. The stock is overfished and is undergoing overfishing. While it had been proposed to change the Fmsy proxy from $F_{40\%SPR}$ to $F_{35\%SPR}$, the logic for doing so was not convincing and was based in part on a stock-recruit model that did not fit at all well to the data (Figure A 154 of assessment report). The F_{msy} proxy should be kept at $F_{40\%SPR}$ until a sound reason for changing it can be identified. The B_{msy} proxies should be adjusted accordingly. NEFSC staff accepted to recalculate the values of the reference points and the medium-term projections on this basis, and to edit the final draft of the report accordingly.

4**.2.7. Evaluate stock status with respect to the existing model (from the most recent accepted peer reviewed assessment) and with respect to a new model developed for this peer review. In both cases, evaluate whether the stock is rebuilt.**

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 (from Cod TOR-6).

The ToR was met. Whether based on the old or the new assessment model, the new data lead to the conclusion that the stock is overfished and is undergoing overfishing.

4.2.8. Develop and apply analytical approaches to conduct single and multi-year stock projections 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 (3-5 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.

ToR a. was partially met. Stochastic projections were provided based on the final accepted model fit and the new reference points updated as according to ToR 4.2.6. However, the consequences of a range of structural assumptions for the projections were not examined.

ToR b. was not fully met as only a qualitative description of structural uncertainties was provided.

ToR c. was partially met as some vulnerability issues were discussed but an assessment according to the SAW ToR Appendix was not addressed in full. This reviewer's opinion is that the combination of high fishing rates, low stock productivity due to low recent recruitment, and contraction of the distribution area of the stock combine to make this stock highly vulnerable.

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

The research recommendations in the SAW 53 Working Group report reflect mainly on the use of additional survey data (Maine-New Hampshire inshore trawl surveys, cod catches in the lobster fishery, and use of commercial LPUE index. Of these, the last has been discarded for sound reasons. While the others may yield additional useful information, it seems unlikely that they would very significantly improve the precision with which the stock status can be assessed as these data sources cover only a small part of the distribution of the stock. The NEFSC surveys should, by virtue of their design and coverage, be more efficient at catching cod. Therefore, only mitigated support can be given to these research recommendations.

The mismatch in perception between the view of the stock based on the assessment and perceptions based on perceptions of fleet activity seem widely at variance, however. More research should be directed at finding why this should be so. Particular work areas could include:

- fine-scale studies of cod distribution in relation to the distribution of fishing effort;
- studies of vessel efficiency and performance, with a view to estimating current and historic commercial catchability;
- studies of fishers' behaviours in relation to cod distribution and in relation to management actions.

The assessment would be considerably strengthened if it could be shown by means of simulation tests on generated pseudo-data that the assessment model can produce unbiased estimates of fishing mortality and population size under plausible assumptions about error distributions.

5. Conclusions

5.1 Assessments

The assessment of Gulf of Maine cod appears fundamentally sound and robust, and carried out to a high standard of modern fisheries science. The conclusion that the stock is overfished and is undergoing overfishing appears very robust to alternative interpretations of the data. While it is not impossible that a spuriously high estimate of fishing mortality has been calculated due to an inexact

conversion from "Albatross IV" to "Henry Bigelow" survey abundance estimates, this seems very unlikely given the weight of evidence. The cod stock also appears vulnerable in that its spatial range appears to have been contracting to the inner Gulf of Maine, and recent recruitments have been low.

The assessment of black sea bass benefits from improved knowledge due to a comprehensive effort to build an age-structured data set. However, further work is needed to build a stock assessment model that can represent the populations appropriately using these data.

5.2. Process

It is striking that the new assessment of cod shows a strong difference from previous perceptions, based in large part on the revision of the 2005 year-class strength. The data on which this new perception is based have been available since mid-2009. It seems anomalous that such information was not transmitted for management purposes at an earlier date. For a valuable and charismatic stock like the Gulf of Maine cod, the added value of annual assessments would be very significant and could be carried out at low cost if a "monitoring" approach is taken, i.e. updating an assessment model with new data, with thorough re-examination at longer intervals. This would be especially important for an overfished stock that is increasingly depending on younger age-classes to maintain the stock.

The review process mostly went smoothly and the very good cooperation of NEFSC staff was appreciated. The volume of information presented for review was manageable and reasonable; and consensus could easily be achieved between reviewers and between the review panel and the stock assessment staff concerned.

Some closer standardisation of the presentation of assessment results would be helpful in making assessment results more easily understandable and accessible, and a more standard procedure for assessment model testing and model choice would be helpful.

Difficulties arose in the drafting of the stock assessment summary. It became unclear during the process what was the exact role of the review panel in this drafting as many comments about the summary drafting were taken from the floor of the meeting.

6. Recommendations

6.1 Black sea bass

<u>Catches</u>

Assess reliability of official catch statistics for assessment purposes.

Improve the calculation of discards by estimating discards separately by length.

<u>Surveys</u>

Attempt more spatially-disaggregated analyses of cohort tracking on a local basis.

Continue and intensify tagging programmes.

Develop a bass-targeted survey design using gear designed to catch this species (pots/traps)

The log-transformation used for calculating survey estimates of abundance appears less appropriate

than the arithmetic mean estimator more usually applied.

Natural Mortality

Use of tagging information as a structural and loglikelihood component in the assessment model is recommended in order to investigate further the information content of these data with respect to M.

Consider further research on the consequences of a protogynous life-history on the response of the stock to exploitation.

Assessment

Further analysis of age-structured information is appropriate to address the issues with the residual patterns. This may include modelling at a local scale, though this may not be productive unless data collection targeted on this stock is intensified.

Continue age-based assessment modelling with a view to finding a model structure without pathological residual patterns, but consider methods that can work in the absence of strong contrast in cohorts (e.g., catch curves, separable models where F is smoothed over time).

6.2 Gulf of Maine Cod

Catches

Assess reliability of official catch statistics for assessment purposes.

Surveys

Inputs of qualitative knowledge from the surveys to the assessment process should be facilitated.

Consideration should be given to calculating routine internal annual survey variance estimates for input as prior statistical weights in an assessment model.

As soon as practicable, Bigelow survey data should be treated as an independent time-series in order to make the assessment independent of intercalibration estimates.

Internal screening of survey results to validate cohort tracking and the consistency of internal mortality estimates should be a routine part of the assessment process.

6.3. Software

The assessment programme should provide for QQ plots on individual data points, observed/expected scatter plots by age, as well the current residual/time plots.

The assessment programme should provide for the use of the latest survey information in the assessment, even if catch data are not available for the latest year (this can be done by adding a constraint such that $F_{y+1}=F_y$).

6.4. Process

Assess high-value stocks with annual “monitoring” assessments to allow earlier detection of problems.

Define more precisely the format and content of the “stock assessment summary”. Specify clearly the drafting responsibility for this report.

A full description of model structural equations, error-models, input data, and constraints should be documented in the SAW report for the final assessments of each stock.

Develop a simulation- based testing protocol for the case-specific testing of new assessment models on particular stocks.

Appendix 1 : Bibliography of Reviewed Material

The following material was provided to the Review Panel to assist it in meeting its terms of reference.

Gulf of Maine Cod

1. Anonymous. 2008. GARM III Executive Summary. 30p. In R. O'Boyle et al (Eds.) GARM III. Document Summary

2. Mayo, R., G. Shepherd, L. O'Brien, L. Col and M. Traver. 2008. Appendix F. Gulf of Maine cod Assessment. Pages 228 -582 In R. O' Boyle et al (Eds). GARM III. Document Summary.

3. Northern Demersal Working Group. 2011. Stock Assessment Workshop (SAW 53) A. Gulf of Maine Atlantic cod (*Gadus morhua*) stock assessment updated through 2010. NEFSC. 296p.

4. O'Boyle, R., V. Crecco, L. Van-Eeckhaute, D. Kahn, C. Needle, B. Rothschild, S. Smith, and J. H. Volstad. 2008. Report of the Groundfish Assessment Review Meeting (GARM III). Part 1. Data Methods. DOCUMENT SUMMARY 64 p.

5. O'Boyle, R. , J. De Oliveira, S. Gavaris, J. Ianelli, Y. Jioa, C. M. Jones and P. Medley. 2008. Report of the Groundfish Assessment Review Meeting (GARM III). Part 2. Assessment Methodology (Models). DOCUMENT SUMMARY. 70p.

6. O'Boyle, R. M. Bell, S. Gavaris, V. Haist, S. Reeves and G. Thompson. 2008. Report of the Groundfish Assessment Review Meeting (GARM III). Part 3 Biological Reference Points. DOCUMENT SUMMARY. 88p.

7. Working Group in Re-Evaluation of Biological Reference Points for New England Groundfish. 2002. Re-Evaluation of Biological Reference Points for New England Groundfish. NOAA Northeast Fisheries Science Center Reference Document 02-04. 107p.

Black Sea Bass

8. Cook. R. 2006. Report by the Chair of the 43rd North East Regional Stock Assessment Review Committee (SARC). 73 p.

9. McCartney, M. and M. L. Burton. 2011. Population genetic structure of black sea bass (Centropristis striata) on the eastern U. S. coast, with an analysis of mixing between stocks north and south of Cape Hatteras, North Carolina. Manuscript from the Southeast Data Analysis and Review Process.

10. Miller, T. J., R. Muller, R. O'Boyle and A. A. Rosenberg. 2009. Report by the Peer Review Panel for the Northeast Data Poor Stocks Working Group. NOAA NEFSC Reference Document 09-XX

11. Moser, J. and G. R. Shepherd. 2009. Seasonal distribution and movement of black sea bass (*Centropristis striata*) in the Northwest Atlantic as determined from a mark-recapture experiment. J. Northwest Atl. Fish. Sci. 40: 17-28

12. Northeast Data Poor Stocks Working Group Report. 2008. Part A. Skate species complex, Deep sea red crab, Atlantic wolfish, scup and black sea bass. NOAA NEFSC Reference Document

09-02A. 86 p.

13. Shepherd, G. R. and M. Terceiro. 1994. The summer flounder, scup and black sea bass fisheries of the Mid-Atlantic Bight and Southern New England Waters. NOAA Technical Report NMFS 122. 18p

14. Southern Demersal Working Group. 2011. Stock Assessment Workshop (SAW 53). B. Black Sea Bass. Corrected BSB Assessment (Dated 11/29/11). NEFSC. 148p.

Annex 2: Statement of Work

External Independent Peer Review by the Center for Independent Experts

53rd Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Black sea bass and Gulf of Maine cod.

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 black sea bass (*Centropristis striata*) and Gulf of Maine Atlantic cod (*Gadus morhua*). Black sea bass occupy reefs, wrecks and shell bed habitats. They may attain lengths up to 60 cm with maximum age of 10-12 years. Black sea bass change sex from female to male between ages 2 to 5. Black sea bass are jointly managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fishery Management Council. The last peer reviewed assessment of black sea bass was in 2008 as part of the Data Poor Stocks Working Group, with annual updates since then. The Atlantic cod is a demersal gadoid species found on both sides of the North Atlantic. Cod may attain lengths up to 130 cm with maximum age in excess of 20 years. Commercial and recreational fisheries for cod are managed by the New England Fishery Management Council. The last peer reviewed assessment of Gulf of Maine cod was in 2008 as part of the GARM III. Results of the 2011 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 53 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 sea bass, knowledge of complex life histories and their implications for Biological Reference Points is desirable. For GOM cod, familiarity with forward projecting models and estimation 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 of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Woods Hole, Massachusetts during November 29 – December 2, 2011.

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 BMSY and FMSY 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/.

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 to 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 November 29 – December 2, 2011.
3) Conduct an independent peer review in accordance with this SoW and the assessment ToRs (listed in **Annex 2**).
4) No later than December 16, 2011, 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.

24 October 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
15 November 2011	NMFS Project Contact will attempt to provide CIE Reviewers the pre-review documents by this date
Nov. 29 – Dec. 2 2011	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
1-2 December 2011	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
16 December 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
19 December 2011	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *
23 December 2011	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
30 December 2011	CIE submits CIE independent peer review reports to the COTR
6 January 2012	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.

COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director
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:

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Key Personnel:

NMFS Project Contact:

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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/SARC53 (to be carried out by SAW Working Groups) (file vers.: 5/20/11)

A. Black sea bass

1. Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data. Evaluate available information on discard mortality and, if appropriate, update mortality rates applied to discard components of the catch. Describe the spatial and temporal distribution of fishing effort.

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

3. Consider known aspects of seasonal migration and availability of black sea bass, and investigate ways to incorporate these into the stock assessment. Based on the known aspects, evaluate whether more than one management unit should be used for black sea bass from Cape Hatteras north and, if so, propose unit delineations that could be considered by the Mid-Atlantic Fishery Management Council and for use in future stock assessments.

4. Investigate estimates of natural mortality rate, M, and if possible incorporate the results into TOR-5. Consider including sex- and age-specific rate estimates, if they can be supported by the data.

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

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 appropriateness of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

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

8. Develop and apply analytical approaches to conduct single and multi-year stock projections to compute the pdf (probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).
    d. Provide numerical annual projections (3-5 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 definition of BRPs for black sea bass).
    e. Comment on which projections seem most realistic. Consider major uncertainties in the assessment as well as the sensitivity of the projections to various assumptions.
    f. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

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

B. Cod (Gulf of Maine Stock)

1. Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data. Evaluate available information on discard mortality and, if appropriate, update mortality rates applied to discard components of the catch.

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

abundance. Characterize the uncertainty and any bias in these sources of data.

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

4. Perform a sensitivity analysis which examines the impact of allocation of catch to stock areas on model performance (TOR-3).

5. If time permits, consider the small-scale distribution of cod (e.g., spawning sites, resource distribution, fishing effort) in the Gulf of Maine and advise on its management implications.

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 appropriateness of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

7. Evaluate stock status with respect to the existing model (from the most recent accepted peer reviewed assessment) and with respect to a new model developed for this peer review. In both cases, evaluate whether the stock is rebuilt.
    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 (from Cod TOR-6).

8. Develop and apply analytical approaches to conduct single and multi-year stock projections to compute the pdf (probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).
    d. Provide numerical annual projections (3-5 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).
    e. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions.
    f. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

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

Annex 2 (cont)
Appendix to the Assessment TORs:

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

> *Acceptable biological catch (ABC)* is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of [overfishing limit] OFL and any other scientific uncertainty…" *(p. 3208) [In other words, OFL ≥ ABC.]*
>
> *ABC for overfished stocks.* For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. *(p. 3209)*
>
> NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)
>
> ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, [optimal yield] OY does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

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

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

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

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

Annex 3: Agenda

53rd Northeast Regional Stock Assessment Workshop (SAW 53)
Stock Assessment Review Committee (SARC) Meeting

Nov. 29 - Dec. 2, 2011

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

AGENDA (version: 25 Nov. 2011)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Tuesday, Nov. 29

9:00 – 9:30 AM
Welcome — **James Weinberg**, SAW Chair
Introduction — **Thomas Miller**, SARC Chair
Agenda
Conduct of Meeting

9:30 – 11:45	Assessment Presentation (A. GOM Cod)		
	Mike Palmer	**TBD**	**Tony Wood**
11:45 – 1	Lunch		
1 – 3	SARC Discussion w/ presenters (A. GOM Cod)		
	Thomas Miller, SARC Chair		**Tony Wood**
3 - 3:15	Break		
3:15 - 5:30	Assessment Presentation (B. Black sea bass)		
	Gary Shepherd	**TBD**	**Toni Chute/ Jessica Blaylock**

Wednesday, Nov. 30

9:30 – 11:30	SARC Discussion w/ presenters (B. Black sea bass) **Thomas Miller**, SARC Chair	**Toni Chute/ Jessica Blaylock**
11:30 - 12:45	Lunch	
12:45 – 3:15	Revisit w/ presenters (A. GOM Cod) **Thomas Miller**, SARC Chair	**Tony Wood**
3:15 – 3:30	Break	
3:30 – 5:00	Revisit w/ presenters (B. Black sea bass) **Thomas Miller**, SARC Chair	**Toni Chute/ Jessica Blaylock**

(Evening Social/Dinner – Probably at BBC, Falmouth)

Thursday, Dec. 1

8:45 – 9:45	(cont.) Revisit w/ presenters (B. Black sea bass) **Thomas Miller**, SARC Chair	
9:45 - 10	Break	
10 – 12:30	Review/edit Assessment Summary Report (B. Black sea bass.) **Thomas Miller**, SARC Chair	**Toni Chute/ Jessica Blaylock**
12:30 – 1:45	Lunch	
1:45 – 4:30	Review/edit Assessment Summary Report (A. GOM cod.) **Thomas Miller**, SARC Chair	**Tony Wood**
4:45 – 5:30	SARC Report writing. (closed meeting)	

Friday, Dec. 2

9:00 - 4 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: Panel Membership

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The following NEFSC staff assisted the panel throughout the meeting:

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