CIE Independent Report

52st Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Winter flounder (Southern New England Stock), Winter flounder (Georges Bank Stock), Winter flounder (Gulf of Maine Stock)

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Executive Summary

The Southern New England stock was overfished but overfishing was not occurring. Spawning stock biomass in 2010 was 7,076 mt, 16% of direct MSY-based values for Btarget and 32% of Bthreshold. F (ages 4-5) in 2010 was 0.051, 18% of Fthreshold. These conclusions may be sensitive to the recent levels of M used in the assessment model and also the values of M used when computing reference points.

The Georges Bank stock was not overfished and overfishing was not occurring. Spawning stock biomass in 2010 was 9,703 mt, which was well above the direct MSY-based values of Bthreshold and at 96.1% of the Btarget. F (ages 4-6) in 2010 was 0.15 and was well below the Fthreshold of 0.42. The stock-recruitment relationship was poorly defined for this stock; hence, MSY-based biological reference points are poorly defined, and the conclusion on the "overfished" status does not reflect the uncertainty in the value of Bmsy.

The Gulf of Maine stock was not overfished but it was not determined if overfishing was occurring. The exploitation rate in 2010 was estimated at 0.03, well below the threshold exploitation rate of 0.25 based on F40% from a length-based yield per recruit analysis. There is substantial uncertainty in the GOM winter flounder assessment because of conflict between catches and survey data. The population, as indicated by surveys, has not shown much response to substantial declines in catches.

Background

The purpose of SAW/SARC 52 was to provide an external peer review of assessments for three stocks of winter flounder (*Pseudopleuronectes americanus*): Southern New England, Georges Bank, and Gulf of Maine. Winter flounder is a demersal flatfish distributed in the Northwest Atlantic from Labrador to Georgia. U.S. commercial and recreational fisheries exist from the Gulf of Maine to the Mid-Atlantic Bight. Winter flounder stocks are managed in federal waters under the New England Fishery Management Council's Northeast Multispecies Fishery Management Plan (FMP), and in state waters under Atlantic States Marine Fisheries Commission's Fishery Management Plan for Inshore Stocks of Winter Flounder.

The last assessments for these stocks were carried out at the Groundfish Assessment Review Meeting (GARM-III) in 2008.

The CIE (Center for Independent Experts) reviewer was tasked with conducting an impartial and independent peer review in accordance with the Statement of Work (SoW) and Review Workshop (RW) Terms of Reference (ToRs; Appendix 2) for SAW/SARC 52 to determine if the best available science is utilized for fisheries management decisions, and to present the review in writing. The

Review Panel (RP) was composed of a Chair and three CIE reviewers. The CIE reviewers were independent, meaning that they did not contribute to the assessment under review and did not have a role in any management actions that may stem from the assessment.

The assessment process started with a meeting focused on the compilation of assessment data, and another meeting focused on formulating assessment models to assist in the determination of stocks status. Working papers for each stock based on these meetings were provided before the review meeting.

Role of reviewer

I attended SAW/SARC 52 in Woods Hole, Massachusetts during June 6-10, 2011. I reviewed presentations and reports and participated in the discussion of these documents, in accordance with the SoW and ToRs (see Appendix 2). This report is structured according to my interpretation of the required format and content described in Annex 1 of Appendix 2.

I reviewed background documents, including: (1) draft assessment working papers and summaries for each stock; (2) working papers and presentations from the 2011 SAW working group; (3) previous assessment reports and review panel reports from GARM III; (4) other reference documents including some relevant published papers and other reports. These are listed in Appendix 1.

After the meeting I participated in email discussions dealing with the review panel report and CIE reports.

Summary of findings

The CIE Statement of Work for SAW/SARC52 required that in my CIE report: “Reviewers should elaborate on any points raised in the SARC Summary Report that they feel might require further clarification”. However, the SARC summary report was not available when I compiled my report. The review panel agreed on summary bullets at the workshop and these are provided here under “*Panel conclusions*” for each ToR. I then provide my independent views on whether the specific ToR was successfully met. I also elaborate on some points in the *Panel conclusions*.

ToR 1: Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data.

Panel conclusions

All stocks

- The methodology used to derive the catch information appeared appropriate, although the panel did not have time to conduct an extensive examination of these datasets.
- One might consider the uncertainty in the mortality associated with discards and how that might have affected total landings.
- There is a potential bias in the calculation of spawning stock biomass as the weights at age used are from the landing data and thus are conflated with size selectivity at age especially for the SNE/MA stock.
- Some of the variation in observed weights at age is probably related to variation in sampling rather than actual biological changes in the population. For example, in 1986-1987 for the SNE/MA assessment the weight at age 5 was lower than the cohort weight at age 6. One might consider modeling the weights at age to get more consistent estimators of this component of the population.
- One might consider how much and what component of the overall variation is represented in the PSE. For commercial catch, this typically represented error in the allocation process, whereas the PSE determined in the calculation of the discard information from the observer data reflected variation in sampling. If the PSEs were constructed in such a way to better reflect overall uncertainty their use in weighting the data going into the statistical catch at age model might be usefully employed.
- There are several other sources of uncertainty that could be included or accounted for (for example, errors in catch accounting) that are not discussed further here.

Southern New England

No additional comments.

Georges Bank

- We note that prior to 1982 all fish below the minimum landing size were assumed to be discarded. It is not clear whether this is appropriate or not, but one might double check that assumption.
- The issue of identification of maturity at age at sea came up during the meeting and although the at sea methods seemed challenging, post landing association to appropriate maturity categories might be conducted using some kind of ratio estimator based on laboratory analyses.

Gulf of Maine

- Additional examination of recreational catch data in the early part of the time series is need. The estimated catch and CPUE for 1982 were high and variable.
- Should a length-based yield per recruit analysis be conducted to help determine biological reference points, updated information on growth should be considered.

Additional reviewer views

I can not conclude that this ToR was successfully completed for any of the three stocks. There was no discussion of the possible sources of catches and discards that were not included in the three assessments. Mainly I refer to illegal and unreported catches. These are considered to be substantial in some jurisdictions and for some years (e.g. Canada, Europe). The potential magnitude of such catches was not considered at the review meeting. If they are a small fraction of reported catch then they can be safely ignored. If they are a constant proportion of reported catches then management advice is still possible assuming the proportion does not change in the future. However, if the unreported catch is roughly fixed (i.e. personal use, some black market) in size then this can lead to a biased assessment particularly if the proportion of unreported catch increases as reported catches decline. In this case, if M in the assessment model is considered to cover all unreported deaths in the stock, then if the unreported catch increases to a substantial proportion of the reported catch then the effect of this is an increase in M. The nature of the increase depends on the relationship between reported and unreported catch.

It is obviously difficult to quantify unreported catch, although tagging studies have been used to shed some light on the potential magnitude in the Northern cod fishery in Canada (2J3KL cod). However, it is not sufficient to simply ignore this issue in stock assessment.

I do not conclude that the total uncertainty was characterized properly in all sources of data. The percent standard errors (PSE's) were often small, and it was not clear what uncertainty the PSE's reflected.

The magnitude of deaths due to discards (number discarded times mortality rate) is more difficult to quantify than kept catches. This is usually estimated from observer data which are not always available, or sparse. The discard mortality rates are obviously difficult to estimate and will be a function of the method of capture, time of year, tow depth, etc. The amount of discards was at times a substantial fraction of landings for the Georges Bank stock, suggesting potentially more uncertainty in the estimated catch for this stock. Also, the age and length sampling was poor at times, especially prior to 2000. However, the assessment model used for this stock (i.e. VPA) assumed no error in catch, and

this assumption does not seem appropriate. This was considered at the review meeting and it was not felt that using a statistical catch at age model would lead to different conclusions about stock status. However, this should be verified.

ToR 2: Present survey data being considered and/or used in the assessment (e.g., regional indices of abundance, recruitment, state and other surveys, age-length data, etc.). Characterize uncertainty in these sources of data.

Panel conclusions

All stocks

- Survey data were generally well documented, although some consideration might be given to evaluating whether all surveys provide the same level of information. Some might be considered for elimination, while others might be down weighted relative to others given information content and variability.
- Also, one should provide information on what area of the stock distribution the particular survey covers. How might, or should surveys be combined or kept separated and dealt with in the model? We appreciated that NEFSC scientists were trying to deal with this problem and that discussions will continue in the U.S. and elsewhere on this issue.
- All indices used in the assessment should be tabulated and provided graphically as time series. For example, there should be standard tables of indices at age from the survey with row totals. These tables should be in a standardized format so that comparisons between tables are straightforward.
- One might consider average survey catch per strata over time (kg/tow or #/tow) to provide an indication of the distribution of the resource. Sometimes this was given by bubble plots on maps, but not always. Appendix C1, Table C3, Page 157 of the GOM WP1 document gives another example of this but only for one year and the strata are aggregated.
- Also an assessment of the uncertainty associated with these indices would be helpful for evaluation and also might be considered for inclusion as weights in the assessment.
- Age aggregated indices might be plotted with associated confidence intervals as was done in the GOM document, although it would be good to identify if these are 95% confidence intervals, one standard error, or something else.
- In general, it would be nice to have the data presented as clearly as possible. Some prefer graphical displays and others might prefer tables and, of course, one might need to display the same data in a variety of ways to characterized trends and uncertainty of the data. There were many characteristics of both the data and the model output that were difficult to track simply because the data were not presented appropriately. For reviewers, it is nice to have standardized methods for presenting information, however some creative ways have to be considered to present information that is unique to a particular species or stock or stock assessment problem.

- Consideration should be given to presenting survey Zs (total mortalities) for each survey to examine trends independent of the model itself.
- While the length-based calibrations between vessels were interesting, this method might be considered for peer review itself, either through publication or through a general peer review process. If this method continues to be used, then the inclusion of the uncertainty in the estimates into the assessment should be encouraged. We note that right now the application of this procedure effectively chops off either end of the length series. Later, if it is used to expand the Albatross to Bigelow lengths, the expansion would be quite variable and challenging to use.

Southern New England

No additional comments.

Georges Bank

No additional comments.

Gulf of Maine

Tables of indices at age (and totals) were unavailable.

Additional reviewer views

The survey data used in the assessment were presented in various forms (tables or figures) for all stocks. The uncertainty was partially characterized.

- For the Southern New England stock, CV's were provided in tables for the NEFSC winter, spring and fall surveys, the VIMS NEAMAP spring and fall surveys, but not the state surveys (i.e. MADM Spring, RIDFW Spring, CTDEP Spring, NYDEC, NJDFW Ocean, NJDFW Rivers) or URIGSO.
- For the Georges Bank stock, CV's were provided for the NEFSC spring and fall surveys, but not the Canadian survey. The CV's were provided in tables.
- For the Gulf of Maine stock, CV's were provided for the NEFSC spring, NEFSC fall, MA spring, and MA fall survey indices, but only in figures as confidence intervals.

It would be preferable to have standard tables and figures to display survey data. This could include tables of survey numbers at age with age-aggregated totals and the CVs for the totals. These totals should also be plotted with 95% confidence intervals, although probably not as plus/minus two standard errors.

The age-composition information should be provided in standard plots as well. SPAY bubbles plots are good for showing how well a survey can track cohorts, in conjunction with simple time-series plots of the age-based survey indices. It is important that both be examined together (e.g. see Appendix 4). SPAY plots are

provided by the FLEDA component of the FLR (Fisheries Library in R) package for the R statistical software. FLEDA provides exploratory analysis of stock assessment data. Other tables or plots to illustrate particular features in the data are encouraged. Graphs of Z's for each survey should be provided.

Note that SPAY plots are useful for examining the age composition of catch information as well.

The length-based comparative fishing results for all stocks indicated substantial changes in catchability between the new vessel/survey protocols compared to the old protocols. For small and large lengths where few fish were caught, the regression spline approach indicated large changes in catchability over small changes in length. This was associated with high uncertainty, and will affect the interpretation of small and large fish caught in the survey. This was highlighted in the assessment working paper for the Gulf of Maine stock. The survey calibration approach should be peer reviewed specifically (there was not time to do this at the review meeting) and its efficacy should be simulation tested.

Another approach to account for the change in surveys is to estimate an age-based relative conversion factor for each year of the Albatross time series, to make it comparable to the new time series. In effect, $Q_{a,y}^{\text{Albatross}} = Q_a^{Bigelow} \times \rho_{a,y}$. The conversion factor, $\rho_{a,y}$, is year specific to account for potential changes in growth rates over time. It is based on the length-based relationship applied to annual age-length keys. In an assessment model, a log(ρ) offset could be added to the log Q model for the Albatross survey years. A constant Q at age would still be estimated for the entire survey time series, but this estimate would be multiplied by $\rho_{a,y}$ for the Albatross portion of the time series. It is fairly straight-forward to include the uncertainty about ρ in this approach.

There was speculation that survey catchability (Q) for the Gulf of Maine stock may have increased since the 1980's, because of a reduction in a stock component in estuaries outside of the survey during the 1980's. This could be tested for to see if such a change in Q results in a better assessment.

ToR 3: 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 area-swept biomass estimates. Investigate if implied survey gear or catchability estimates are reasonable. Include a historical retrospective analysis to allow a comparison with previous assessment results.

Panel conclusions

All stocks

- Estimates for each item in this ToR were provided for the SNE and GBK assessments. Because the GOM model was rejected, only estimates of stock biomass and exploitation rates in 2009 and 2010 were available.
- The reviewers take this term of reference to extend to an examination of the quality of the assessment models in general, as model quality is not really addressed in any other ToR provided here.
- In general, the SCA and VPA models used for SNE and GBK were scientifically credible approaches and provided a reasonable basis for fisheries management advice. The GOM SCA model proved to be inadequate, however the fall back analysis of the area swept method provides a reasonable gauge of overfishing status and with time trends in biomass.
- It would be useful, if possible, to have a summary table included in the assessment report describing the details of the model configuration for the preferred model being put forward. For these assessments, certain assumptions were made clear (e.g. assumed value for M), while other assumptions were less clear (e.g. selectivity, was it flat topped or domed shape, was it fixed or allowed to vary, were their breaks in the series). Ultimately, one would like to have documented all the relevant information needed to replicate the assessment.

Southern New England

- The survey age-aggregated indices are declining faster than the preferred model would predict in the last decade for this stock, which may point to a time varying M. In this assessment, this was explored with various time representations of M. While it makes sense that M should be higher than the 0.2 value used in previous assessments, it is not clear whether M should be set at a constant 0.3 level, or go from 0.3 to 0.6, or go from 0.3 to 0.6 back to 0.3, or whether the model might be improved by including instead some other time varying component (catchability, catch reporting, selectivity, etc.). Closer examination of total mortality rates from the surveys should shed some light on this issue.

Georges Bank

- A statistical catch at age model should be considered for the GBK stock as there may be more uncertainty here associated with catch and discards than would be appropriate for the assumption of true known catches made in a VPA type of analysis. The challenge in using a SCA over a VPA for this stock is in tracking the changes in selectivity that likely have occurred as a result of changes in management and in the fishery. While a SCA should be explored, this review found no issues that would necessarily indicate we would get different results than were found in the VPA analysis.

Gulf of Maine

- Several SCA models were explored for this stock. Because of the conflict in the information provided by the survey relative to the age information in the catch and the scale of the total catch, none of the models adequately accounted for trends in both indices. The SCA model looked promising as a way of synthesizing all the information available and if the application was found to be appropriate would provide useful biological reference points, but work still need to be done in this area.

- The GOM assessment is now based on an area swept method. Because this was a fall back assessment, we did not get to explore it fully, however it is a simpler method. We simply note that the survey catchability used in this analysis is more of an assumption than a finely estimated parameter. Nevertheless, the F reference point, and the finding that overfishing is not taking place, is robust to reasonable choices of the survey catchability q.

Additional reviewer views

As indicated in the Panel conclusions above, estimates of annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series were only provided for the Southern New England and Georges Bank stocks. Survey exploitable biomass and exploitation rates were estimated for 2009 and 2010 for the Gulf of Maine stock.

Estimates of uncertainty were not provided for the Southern New England and Georges Bank entire time series estimates of annual fishing mortality, recruitment and stock biomass, but uncertainty was partially addressed through retrospective analyses and comparisons from different model formulations. For the Southern New England stock, uncertainty was characterized probabilistically for total fishing mortality and SSB in 2010 using MCMC methods. For the Georges Bank stock, uncertainty was characterized probabilistically for total fishing mortality and SSB in 2010 using bootstrap methods. These seemed adequate.

The ToR would be better addressed by providing a time series of probabilities that the stock exceeded biomass and F reference points.

Historical retrospective patterns were provided for all stocks, which adequately addressed this part of the ToR.

When assessment models are tuned with swept area survey indices of abundance, the resulting estimates of survey catchability (q) indicate the fraction of the stock that is available, on average, to the surveys.

The Southern New England assessment model was tuned with survey swept area abundance indices at age for the NEFSC Spring, Fall, and Winter surveys, but not for the state surveys. The age-aggregated q's seemed low for the spring and winter surveys. The plausibility of these estimates was not considered by review group. Age patterns in q for some of the indices were presented (i.e. NEFSC Fall and Spring, RI Spring, CT Spring) but were not discussed much at the review workshop. They tended to have a slight dome pattern at older ages which could indicate less availability of older fish to the survey, or M s specified too low.

The survey q's from the Georges Bank assessment model were realistic, both in terms of their age pattern (i.e. no dome) and their scale (i.e. Canadian q < NEFSC Spring q < NEFSC Fall q). Difference in q's between the NEFSC spring and fall surveys may not be statistically significant.

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

Panel conclusions

All stocks

The sensitivity of the assessment results to choices in the allocation of catch appeared to be thoroughly examined. Results did not seem to be overly sensitive to alternative reasonable allocation choices.

Additional reviewer views

None.

ToR 5: Examine the effects of incorporating environmental factors in models of population dynamics (e.g., spring water temperatures in an environmentally-explicit stock recruitment function).

Panel conclusions

All stocks

An analysis of the effects of temperature on departures from mean recruitment levels was provided in a working document by Jon Hare of the NEFSC. Sometimes sea surface or coastal air indicators may not be the most indicative of what will eventually affect recruitment, however, the analysis was conducted in a scientifically sound manner and is shedding some light on the physical drivers for this species. While there appeared to be higher recruitment rates at lower temperatures, predicting how temperature might change and thus how future recruitments and associated biomasses might vary in projections is not straightforward. In the end, the effect of environmental factors was not included in either the assessments or the spawner-recruit models used for reference point estimates or projections.

Additional reviewer views

Another factor that was considered when deciding to not include the environmental factors in spawner-recruit models used for reference point estimates or projections was that there did not seem to be a trend in temperatures that one could project with any confidence.

The temperature effects in the stock-recruitment relationships were fairly convincing, and there seems to be potential to use this information to improve estimates of recruitment in the last couple of assessment years. These recruitments tend to be highly variable but very important in short to medium term projections of stock status. For example, if recent survey indices indicate poor recruitment and warm temperatures (correlated with poor recruitment) then we would have more confidence in the survey results than if temperatures were cool.

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, and FMSY) 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.

Panel conclusions

Previously adopted stock status definitions for "overfished" and "overfishing" were provided for all stocks. These were updated and redefined for the SNE and GBK stocks as new assessment models were adopted and new methods for determining MSY-based BRPs were employed. The GOM assessment, using a

swept area method, was able to provide a proxy estimate of the “overfishing” level, but could not provide an estimate of “overfished” status.

FMSY, SSBMSY, and MSY were estimated from a stock-recruitment model using a range of values for steepness (slope of the stock recruitment curve near the origin) which was consistent with the stock and recruitment data. We anticipate that steepness should be similar between the three stocks. These are three neighboring populations of the same species that share common reproductive strategies. Fecundities at size are similar, although larval survivorship and recruitment to the fishery may vary between areas. Because the data available for any one stock may not be sufficient to fully parameterize a spawner-recruit relationship, some method of bringing additional information to bear on the estimates would be useful. Initially estimates of steepness from the work of Myers et al. (1999) were used as a prior for estimating the spawner-recruit relationship, but because the Myers et al. data include only more distantly related Pleuronectids it was felt that some way of using information available in the adjacent stocks would be more appropriate.

Values of steepness were chosen to be as similar as possible between stocks within the constraints of model fit. A strategy was outlined that allowed the steepness parameters to be chosen among a range of reasonable values that provided good fits to the stock-recruit data for each individual stock, but were also reasonably close in the parameter space to each other. A profile of ΔAIC’s are shown from the spawner-recruit model fits from each of the two stocks in Figure XX. Values of steepness that are with 2 units of the minimum AIC for each stock are considered to be realistic values (Burnham and Anderson, 2002). For the SNE stock this means steepness was set at the largest value such that ΔAIC = 2. For the GBK stock this means steepness was set at the smallest value such that ΔAIC = 2. The model estimates were shrunk towards each other, thus making steepness as similar as possible without losing the stock specific characteristics of the recruitment process.

This method was developed during the SARC52 review meeting for the three winter flounder stocks. Given the information available to the SARC, the review panel believes this method is the most appropriate means available at the meeting for determining the spawner-recruit relationship and for specifying the biological reference points.

The BRP estimates derived for the three winter flounder stocks in this way are direct MSY-based estimates and the panel thinks that they are appropriate to be used to inform management decisions.

Burnham, K. P., and Anderson, D.R. 2002. Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach, 2nd ed. Springer-Verlag.

Myers, R. A., Bowen, K. G., Barrowman, N. J. 1999. Maximum reproductive rate of fish at low population sizes. Can. J. Fish. Aquat. Sci. 56: 2404-2419.

Additional reviewer views

Estimates of uncertainty were not provided for BRP's. Uncertainty about BRP's can be large and this should be taken into account when calculating the probabilities that the stock is over-fished or that over-fishing is occurring. It is generally accepted that it is preferable to estimate Prob(Fcurrent/Fmsy > 1), Prob(Bcurrent/Bmsy < 1), and Prob(Bcurrent/Bthreshold < 1).

For the Gulf of Maine stock, deriving the uncertainty in the F reference point , F40% based on length-based YPR analyses, should be fairly straight-forward to do in principal. For example, a bootstrap resampling method could be used to resample Von Bertalanffy growth curves for the YPR analysis.

I am not sure how to estimate uncertainty for the "shrinkage" procedure used to specify steepness for the Southern New England and Georges Bank stocks stock-recruit models. A similar procedure is a hierarchical random effects model in which stock recruitment curves are estimated jointly, with a stock specific Rmax parameter, a common steepness parameter, plus a stock specific random effect in steepness. With this type of model, the estimate of steepness for a stock is the common term plus the predicted random effect. This prediction will be small in absolute value unless there is "good" evidence in the data that steepness differs between stocks. Common methods (likelihood profile, bootstrap, etc) could be used to derive uncertainties in the stock-specific steepness estimates and Rmax's, and this could be propagated into uncertainty about BRP's.

The Magnuson_Policy_Background.doc I was provided indicated that "MSY is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions and fishery technological characteristics". Some subjective judgement is required when deciding what are prevailing conditions; however, there seems to be an inconsistency in how "prevailing" is interpreted for the Southern New England and Georges Bank stocks.

For the Georges Bank stock, Fmsy was "derived using the most recent five-year average of fishery selectivity and weights-at-age and the maturity-at-age time series average". This was based on recommendations from GARM III. The procedure used to infer prevailing fishery selectivity, weights-at-age and maturity-at-age was not described in the Southern New England assessment report, but I assume they used the same averages as with the Georges Bank stock. However, for both stocks the entire stock-recruit time series was used to infer the recruit per spawner relationship for MSY reference points. Particularly for the Southern New England, I conclude that the prevailing recruit per spawner

relationship was not used for MSY reference point calculations. Prevailing conditions (over the last 10 years) indicate the stock is less productive than for the entire time series. To a lesser extent this also seems to be the case for the Georges Bank stock. Stochastic recruitment could be forecasted using the estimated stock-recruit models but with residuals resampled from only the last 5-10 years. This approach would be more consistent with how prevailing conditions was interpreted for the selectivity, weights, and maturity aspects of stock productivity. It would be useful to have some policy on what is best practise for this issue.

ToR 7: Evaluate stock status (overfished and overfishing) with respect to the "new" BRPs (from TOR 6), and with respect to the existing BRPs (from a previous accepted peer review) whose values have been updated.

Panel conclusions

All stocks

The stock status values were examined by the SAW working group and reviewed at the SARC review meeting. The review panel is satisfied that the evaluations were performed correctly. As always, one should keep in mind the uncertainty associated with determining the reference points as well as the estimates of stock biomass and exploitation rates.

We recommend that future Terms of Reference might include an evaluation of the probability of being overfished or overfishing taking place rather than simply using a point estimate based on the model.

Additional reviewer views

None.

ToR 8: Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs) under a set of alternative harvest scenarios. If the stock needs to be rebuilt, take that into account in these projections.

> ***a. Provide numerical short-term projections (3-5 yrs, or through the end of the rebuilding period, as appropriate). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions about the most important uncertainties in the assessment (e.g., terminal year abundance, variability in recruitment).***
>
> ***b. Take into consideration uncertainties in the assessment and the species biology to describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming or remaining overfished, and how this could affect the choice of ABC.***
>
> ***c. Develop plausible hypotheses (e.g., mixing among the three stocks) which might explain any conflicting trends in the data and undertake scenario analyses to evaluate the consequences of these alternate hypotheses on ABC determination..***

<u>*Panel conclusions*</u>

All stocks

It appeared that the SAW working group used standard methods that were reasonable for conducting projections. The SNE/MA assessment used an MCMC approach to generate its initial values for the projections. The GBK assessment used a bootstrap approach to incorporate the assessment uncertainty into the initial values the projections. The written documentation is unclear about how the SNE/MA projections deal with the uncertainty associated with the recruitment estimates. In the GBK projections variability in recruitment was included based on the spawner-recruit relationship and a resampling of the associated residuals. The GOM assessment provided no projections.

Uncertainty in M is not included in the projections.

Information on stock vulnerability (as may be characterized through indices of productivity and/or susceptibility) was presented in each of the working papers. The text in these sections explores sensitivity analyses, residual plots and retrospectives in this regard. However, it is unclear whether vulnerability issues that are not detectable through standard statistical diagnostics were explored. For example, life history issues such as longevity of the species, fecundity and overall productivity, resilience to impact, and whether the species or stock is overly susceptible to fishing or environmental conditions (such as ocean

warming) were discussed at various points during the review, but no evidence of this appeared to be provided in the documentation.

Boiler plate covers statistical analysis but doesn't address life history traits often viewed as intangibles that may influence stock "vulnerability"… give some examples. Are there additional components of this vulnerability that are not included or accounted for in the projections?

Additional reviewer views

For the SNL stock, projections at F = 0.000 in 2012-2014 indicate less than a 1% chance that the stock would rebuild to SSBMSY = 43,661 mt by 2014.

However, "Amendment 16 revised the overfishing definitions as recommended by the GARM3 (NEFSC 2008), established a target rebuilding date of 2014 under a target fishing mortality rate of F = 0.0, established an expected rebuilding date of 2017 given likely Fs". Hence, although there is a very low probability of rebuilding with F=0, for completeness projections to 2017 should be conducted under status quo F. These projections were conducted for the Georges Bank stock; however, I could not find these results in the summary document prepared at the review meeting.

ToR 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.

Panel conclusions

The research recommendations provided by the SAW working group seemed interesting, constructive and reasonable to try to achieve. We recommend they go forward with these. The working group also reported on previous research recommendations (GARM III and earlier) and they appear to have made good progress in addressing those that were doable. The group should be applauded in this regard.

In addition, we would like to suggest the following:

Calibration of the macroscopic identification of maturity relative to the microscopic ids might be considered through perhaps a ratio estimator to appropriately adjust the maturity at age/length.

Does sexual dimorphism exist for this species? If so, does that create a problem for the assessments? For management?

Georges Bank is a unique area, and a retention index showing the influence on larval drift might be a valuable metric to have.

Stock size indices from the NEFSC Winter, Spring and Autumn surveys were revised to create a consistent set of strata for the whole time series. This means that the survey area was reduced to that which was consistently sampled. This may be ok, but if portions of the population shift into and out of the zones that are no longer sampled (a high possibility for this inshore species) this may adversely affect the indices. So, is this a problem? If so, how might it be best dealt with? We recommend that the number of sets in the excluded strata, the percent biomass in the excluded strata, the percent number of fish per survey strata should be tabulated to see what is missing and see if it is a potential source of bias in the index.

Text on the changes that have occurred in management regulations seems to have been well documented in the assessment documents. What would be nice to have in addition would be a conceptual model outlining what affects these changes may have on the assessment so that the assessment can be examined with regard to these hypothesized effects in a straightforward manner (rather than having to pour through all the text in the document).

Some clear idea of how to respond in a scientific and managerial way to changes in productivity would be useful. For example, if recruitment rates or growth are lower in the last decade, should reference points or projections be based on the last decade, the full time series or some marriage of the two. Another example relevant to these stocks is the situation where M may have increased. Should reference points be based on the most recent M or projections of what will happen with M? We do not have a specific recommendation for how to do this, but this will clearly continue to be a problem for this and other species, so some plan should be developed for how to deal with this. Whatever approach is used, it should be justified and clearly documented.

Additional reviewer views

The assessment working group pursued methods to combine surveys for the Gulf of Maine stock. The goal is to create a more comprehensive survey of the stock as a whole. I suggest these efforts be continued and thought be given to expanding the approach to the Southern New England stock. I recently learned that this is a ToR in the new ICES Working Group “Improving use of Survey Data for Assessment and Advice (WGISDAA)”, which indicates that ICES regards such research as important. Indices based on small parts of the stock range can be misleading when there are changes in stock distribution over time. It has never been clear to me that assessment models can figure this out. The models do not get the information about the spatial coverage of the indices.

Summary of conclusions and recommendations

The stock assessments presented at the SAW/SARC 52 Review Workshop provided the Review Panel with outputs and results from two assessment models (ASAP – Southern New England stock; ADAPT-VPA Georges Bank stock) and as assessment based on survey swept-area biomass estimates (Gulf of Maine). Important sensitivity analyses of assessment models were also presented. Based on the assessments provided, the Review Panel concludes that

- The Southern New England stock was overfished but overfishing was not occurring. Spawning stock biomass in 2010 was 7,076 mt, 16% of direct MSY-based values for Btarget and 32% of Bthreshold. F (ages 4-5) in 2010 was 0.051, 18% of Fthreshold. Important sources of uncertainty are the recent levels of M, what values of M to use for reference points, and the recent levels of recruit per spawner, which have been lower than indicated by a Beverton-Holt stock-recruitment model fit to the entire time series.
- The Georges Bank stock was not overfished and overfishing was not occurring. Spawning stock biomass in 2010 was 9,703 mt, which was well above the direct MSY-based values of Bthreshold and at 96.1% of the Btarget. F (ages 4-6) in 2010 was 0.15 and was well below the Fthreshold of 0.42. An important source of uncertainty is the behaviour of the stock-recruitment relationship outside the range of estimated SSBs. Extrapolations based on fits to the data did not seem reliable for reference point calculations. Hence, the review workshop proposed a method in which steepness was chosen to be similar to the Southern New England stock while at the same time providing a good fit to the Georges Bank stock-recruit data.
- The Gulf of Maine stock was not overfished but it was not determined if overfishing was occurring. The exploitation rate in 2010 based on survey swept-area biomass was estimated at 0.03, well below the threshold exploitation rate of 0.25 based on F40% from a length-based yield per recruit analysis. There is substantial uncertainty in the Gulf of Maine winter flounder assessment because of conflict between catches and survey data. The population, as indicated by surveys, has not shown much response to substantial declines in catches.

In addition to recommendations of the review panel, I recommend for the three winter flounder stocks that,

- more detailed analyses of surveys (year class strength and Z's) be conducted prior to combining information in the main stock assessment model. This is an essential step for building good stock assessment models, and this should be demonstrated to review panels;
- provide time series of probabilities that the stock exceeds biomass and F reference points; that is, provide Prob(F/Fmsy > 1), Prob(B/Bmsy < 1), and Prob(B/Bthreshold < 1);

- Consider using a hierarchical random effects model approach to fitting stock-recruit models to similar stocks;
- Consistently interpret ‘prevailing conditions’ for all aspects of productivity (i.e. recruit per spawner, weights, maturities, etc.) relevant to calculation of MSY reference points. However, I feel that prevailing conditions will often be less relevant than long-term conditions when evaluating MSY reference points;
- the potential magnitude of mis-reported catches, including changes over time, should be considered. If the magnitude is large then this could be addressed through sensitivity analyses for all three stocks;
- research should continue into approaches to combine surveys of portions of stock areas.

For the Southern New England stock, I recommend a review of the plausibility of domed age-patterns in survey catchability versus using too low a value for M.

Critique of the NMFS review process

The CIE Statement of Work for SAW/SARC52 required that in my CIE report: “Reviewers should elaborate on any points raised in the SARC Summary Report that they feel might require further clarification”. This made sense to me.

However, the SARC summary report was not yet available by the time my CIE review report was due. This should be considered when formulating the “Schedule of Milestones and Deliverables that CIE reports”. There should be reasonable time after the SARC (or more generally the Review) Summary Report is due for CIE reviewers to write their independent review reports. We are required to discuss our independent views, especially if they were divergent with other panelists. This is difficult to do without having the final Summary Report.

However, I was assured by the chairperson of the review panel that the Summary Report would deviate little from the summary bullets above, so I expect that my review will adequately address the Statement of Work.

Appendix 1: Bibliography of materials provided for review

SARC 52 - Bibliography – List of References

Working Papers for Review

SDWG. 2011. Southern New England/Mid-Atlantic (SNE/MA) Winter Flounder: Stock Assessment for 2011

SDWG. 2011. Southern New England / Mid-Atlantic (SNE/MA) Winter Flounder Assessment Summary

SDWG. 2011. Georges Bank Winter Flounder Stock Assessment for 2011

SDWG. 2011. Georges Bank Winter Flounder Assessment Summary For 2011

SDWG. 2011. Gulf of Maine (GOM) Winter Flounder Stock Assessment for 2011

SDWG. 2011. Gulf of Maine (GOM) Winter Flounder Assessment Summary for 2011

Background Papers

Southern Demersal Working Group Papers

1. DeCelles, G, Cadrin, SX. ICES CM 2007/L:18, An Interdisciplinary Assessment of Winter Flounder (Pseudopleuronectes americanus) Stock Structure

2. Terceiro, M. Impacts of reduced inshore strata sampling on NEFSC trawl survey indices for SNE/MA winter flounder

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4. Southern Demersal Working Group. 2011. Response to 2008 GARM3 Research Recommendations for winter flounder

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12. McElroy, WD, Rowinski, YK, Towle, McBride RS, Wuenschel MJ. Reproductive potential of female winter flounder, *Pseudopleuronectes americanus*: Comparison of fecundity and skipped spawning among three stocks

13. Hare, J. ToR 5. Examine the effects of incorporating environmental factors in models of population dynamics (e.g., spring water temperatures in an environmentally-explicit stock recruitment function). Development of environmentally-explicit stock-recruitment models for three stocks of winter flounder (*Pseudopleuronectes americanus*) along the northeast coast of the United States

14. Wigley, SE, Blaylock, J, Palmer, M. 2011. Measures of Uncertainty in the Trip-based Allocated Landings. A Working Paper in support of SARC 52 Winter Flounder TOR 4 "Perform a sensitivity analysis which examines the impact of allocation of catch to stock areas on model performance (in TOR 5)."

15. Southern Demersal Working Group. Anthony Woods. 2011. Winter flounder natural mortality derived from data in Howe and Coates (1975) using instantaneous rates tagging models. Working Paper: Re-analysis of Howe and Coates (1975)

16. Southern Demersal Working Group. 2011. Consensus Statement on Biological Reference Points (Term of Reference 6) and Vulnerability (Term of Reference 8b) for Winter Flounder Stocks (also called "16_D")

Garm III Background Papers

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2. Terceiro, M. GARM III Report. NEFSC 2008. J. Southern New England/Mid-Atlantic winter flounder
3. Hendrickson, L. GARM III Report. NEFSC 2008. K. George's Bank winter flounder
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5. O'Boyle R, Bell, Crecco V, Van-Eeckhaute L, Kahn D, Needle C, Rothschild, B, Smith S, Helge Volstad, J . GARM III Report. NEFSC 2008. Report of the Groundfish Review Assessment Meeting (GARM III). Part I. Data Methods.
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Misc. Background Papers

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Appendix 2: A copy of the CIE Statement of Work

Attachment A: Statement of Work for Dr. Noel Cadigan

External Independent Peer Review by the Center for Independent Experts

52st Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Winter flounder (Southern New England Stock), Winter flounder (Georges Bank Stock), Winter flounder (Gulf of Maine Stock).

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 three stocks of winter flounder (*Pseudopleuronectes americanus*): Southern New England, Georges Bank, and Gulf of Maine. Winter flounder, also known as blackback or lemon sole, is a demersal flatfish distributed in the Northwest Atlantic from Labrador to Georgia. U.S. commercial and recreational fisheries exist from the Gulf of Maine to the Mid-Atlantic Bight. Winter flounder stocks are managed in federal waters under the New England Fishery Management Council's Northeast Multispecies Fishery Management Plan (FMP), and in state waters under Atlantic States Marine Fisheries Commission's Fishery Management Plan for Inshore Stocks of Winter Flounder. The last assessment of these three winter flounder stocks was carried out at the Groundfish Assessment Review Meeting (GARM-III) in 2008. Results of the 2011 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 Terms of Reference (ToRs) for the assessment scientists are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**. The SARC Summary Report format is attached as **Annex 4.**

The SARC 52 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 in accordance with the SoW and ToRs herein. CIE reviewers shall have working knowledge and recent experience in fish stock assessments. Reviewers should be familiar with winter flounder (or comparable species) life history and population dynamics.

In general, CIE reviewers for SARCs shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Expertise should include statistical catch-at-age, state-space and index methods. Reviewers should also have experience in evaluating measures of model fit, identification, uncertainty, and forecasting. Reviewers should have experience in development of biological reference points that includes an appreciation for the varying quality and quantity of data available to support estimation of biological reference points.

Each CIE reviewer's duties shall not exceed a maximum of 16 days to complete all work tasks of the peer review described herein.

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

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Woods Hole, Massachusetts during 6-10 June, 2011.

Charge to SARC panel: The panel is to determine and write down whether each Term of Reference of the SAW (see **Annex 2**) was or was not completed successfully during the SARC meeting. 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 chair shall identify or facilitate agreement among the reviewers for each Term of Reference of the SAW.

If the panel rejects any of the current Biological Reference Point (BRP) proxies for B_{MSY} and F_{MSY}, the panel should explain why those particular proxies are not suitable <u>and</u> the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing BRPs 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 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/sponsor.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 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 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 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 Terms of Reference of the SAW are reviewed, control of document flow, and facilitation of discussion. For the 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 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 proxy to be inappropriate, the reviewer should try to recommend an alternative, should one exist.

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 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 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 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 and CIE reviewers will prepare the SARC Summary Report. Each CIE reviewer and the chair will discuss whether they hold similar views on each 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 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 Point (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 ToR as described 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 6-10, 2011.
3) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than June 24, 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 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.

25 April 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
23 May 2011	NMFS Project Contact will attempt to provide CIE Reviewers the pre-review documents by this date
6-10 June 2011	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
9-10 June 2011	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
24 June 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator

27 June 2011	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *
1 July 2011	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
8 July 2011	CIE submits CIE independent peer review reports to the COTR
15 July 2011	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 ToR as specified 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

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Roger W. Peretti, Executive Vice President
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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)

Mr. Frank Almeida, Acting NEFSC Science Director
National Marine Fisheries Service, NOAA
Northeast Fisheries Science Center
166 Water St., Woods Hole, MA 02543
frank.almeida@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: Assessment Terms of Reference for SAW/SARC52

A. Winter flounder (Southern New England Stock)

1. Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data.

2. Present survey data being considered and/or used in the assessment (e.g., regional indices of abundance, recruitment, state and other surveys, age-length data, etc.). Characterize uncertainty in these sources of data.

3. 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 area-swept biomass estimates. Investigate if implied survey gear or catchability estimates are reasonable. Include a historical retrospective analysis to allow a comparison with previous assessment results.

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

5. Examine the effects of incorporating environmental factors in models of population dynamics (e.g., spring water temperatures in an environmentally-explicit stock recruitment function).

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}, $B_{THRESHOLD}$, and F_{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 (overfished and overfishing) with respect to the "new" BRPs (from TOR 6), and with respect to the existing BRPs (from a previous accepted peer review) whose values have been updated.

8. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs) under a set of alternative harvest scenarios. If the stock needs to be rebuilt, take that into account in these projections.
    a. Provide numerical short-term projections (3-5 yrs, or through the end of the rebuilding period, as appropriate). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions about the most important uncertainties in the assessment (e.g., terminal year abundance, variability in recruitment).
    b. Take into consideration uncertainties in the assessment and the species biology to describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming or remaining overfished, and how this could affect the choice of ABC.

c. Develop plausible hypotheses (e.g., mixing among the three stocks) which might explain any conflicting trends in the data and undertake scenario analyses to evaluate the consequences of these alternate hypotheses on ABC determination.

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. Winter flounder (Georges Bank Stock)

1. Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data.

2. Present survey data being considered and/or used in the assessment (e.g., regional indices of abundance, recruitment, state and other surveys, age-length data, etc.). Characterize uncertainty in these sources of data.

3. 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 area-swept biomass estimates. Investigate if implied survey gear or catchability estimates are reasonable. Include a historical retrospective analysis to allow a comparison with previous assessment results.

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

5. Examine the effects of incorporating environmental factors in models of population dynamics (e.g., spring water temperatures in an environmentally-explicit stock recruitment function).

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}, $B_{THRESHOLD}$, and F_{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 (overfished and overfishing) with respect to the "new" BRPs (from TOR 6), and with respect to the existing BRPs (from a previous accepted peer review) whose values have been updated.

8. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs) under a set of alternative harvest scenarios. If the stock needs to be rebuilt, take that into account in these projections.
    a. Provide numerical short-term projections (3-5 yrs, or through the end of the rebuilding period, as appropriate). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions about the most important uncertainties in the assessment (e.g., terminal year abundance, variability in recruitment).
    b. Take into consideration uncertainties in the assessment and the species biology to describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming or remaining overfished, and how this could affect the choice of ABC.
    c. Develop plausible hypotheses (e.g., mixing among the three stocks) which might explain any conflicting trends in the data and undertake scenario analyses to evaluate the consequences of these alternate hypotheses on ABC determination.

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.

C. Winter flounder (Gulf of Maine Stock)

1. Estimate catch from all sources including landings and discards. Characterize the uncertainty in these sources of data.

2. Present survey data being considered and/or used in the assessment (e.g., regional indices of abundance, recruitment, state and other surveys, age-length data, etc.). Characterize uncertainty in these sources of data.

3. 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 area-swept biomass estimates. Investigate if implied survey gear or catchability estimates are reasonable. Include a historical retrospective analysis to allow a comparison with previous assessment results.

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

5. Examine the effects of incorporating environmental factors in models of population dynamics (e.g., spring water temperatures in an environmentally-explicit stock recruitment function).

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}, $B_{THRESHOLD}$, and F_{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 (overfished and overfishing) with respect to the "new" BRPs (from TOR 6), and with respect to the existing BRPs (from a previous accepted peer review) whose values have been updated.

8. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs) under a set of alternative harvest scenarios. If the stock needs to be rebuilt, take that into account in these projections.

    a. Provide numerical short-term projections (3-5 yrs, or through the end of the rebuilding period, as appropriate). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions about the most important uncertainties in the assessment (e.g., terminal year abundance, variability in recruitment).

    b. Take into consideration uncertainties in the assessment and the species biology to describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming or remaining overfished, and how this could affect the choice of ABC.

    c. Develop plausible hypotheses (e.g., mixing among the three stocks) which might explain any conflicting trends in the data and undertake scenario analyses to evaluate the consequences of these alternate hypotheses on ABC determination.

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.

Appendix to the SAW TORs:

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

(The text below is from DOC National Standard Guidelines, Federal Register, vol. 74, no. 11, January 16, 2009)

On "Acceptable Biological Catch":

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":

"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)

Annex 3: Draft Agenda

52nd Northeast Regional Stock Assessment Workshop (SAW 52)
Stock Assessment Review Committee (SARC) Meeting

June 6-10, 2011

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

DRAFT AGENDA (version: 20 April 2011)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR
Monday, June 6			
1 – 1:15 PM			
Welcome	**James Weinberg**, SAW Chair		
Introduction	**Patrick Sullivan**, SARC Chair		
Agenda			
Conduct of Meeting			
1:15 – 3:15	Assessment Presentation (A. SNE Winter flounder)		
	Mark Terceiro	**TBD**	**TBD**
3:15 – 3:30	Break		
3:30 – 5:30	SARC Discussion w/ presenters (A. SNE Winter flounder)		
	Pat Sullivan, SARC Chair		**TBD**
Tuesday, June 7			
8:30-10:30 AM	Assessment Presentation (B. GBK Winter flounder)		
	Lisa Hendrikson	**TBD**	**TBD**
10:30-10-45	Break		
10:45 – 12:30	SARC Discussion w/ presenters (B. GBK Winter flounder)		
	Pat Sullivan, SARC Chair		**TBD**
12:30 - 1:45	Lunch		
1:45 – 3:45	Assessment Presentation (C. GOM Winter flounder)		
	Paul Nitschke	**TBD**	**TBD**
3:45 – 4:00	Break		
4:00 – 5:45	SARC Discussion w/ presenters (C. GOM Winter flounder)		
	Pat Sullivan, SARC Chair		**TBD**

(Evening Social/Dinner at **TBD**, 7pm)

Wednesday, June 8

8:45 – 11	Revisit w/ presenters (A.)	**Pat Sullivan**, SARC Chair	**TBD**
11 - 11:15	Break		
11:15 – 12:30	Revisit w/ presenters (B.)	**Pat Sullivan**, SARC Chair	**TBD**
12:30 – 1:45	Lunch		
1:45 – 2:45	cont. Revisit w/ presenters (B.)	**Pat Sullivan**, SARC Chair	**TBD**
2:45 - 3	Break		
3 – 5:15	Revisit w/ presenters (C.)	**Pat Sullivan**, SARC Chair	**TBD**

Thursday, June 9

8:45 – 11	Review/edit Assessment Summary Report (A.)	**Pat Sullivan**, SARC Chair	**TBD**
11 - 11:15	Break		
11:15 – 12:30	Review/edit Assessment Summary Report (B.)	**Pat Sullivan**, SARC Chair	**TBD**
12:30 – 1:45	Lunch		
1:45 – 2:45	cont. Review/edit Assessment Summary Report (B.)	**Pat Sullivan**, SARC Chair	**TBD**
2:45 - 3	Break		
3 – 5:15	Review/edit Assessment Summary Report (C.)	**Pat Sullivan**, SARC Chair	**TBD**

Friday, June 10

9:00 - 5:30 PM SARC Report writing. (closed meeting)

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

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 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 Point (BRP) proxies are considered inappropriate, include recommendations and justification for alternative proxies. If such alternatives cannot be identified, then indicate that the existing BRPs 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 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 or other pertinent information from the panel review meeting

Panel Membership

Pat Sullivan, SARC Chair
Noel Cadigan, CIE reviewer
John Casey, CIE reviewer
Cynthia Jones, CIE reviewer

Appendix 4: SPAY plots illustrated with some Southern New England survey indices.

The survey proportion at age is

$$p_{a|y} = \frac{I_{ay}}{\sum_a I_{ay}},$$

where I_{ay} is the survey index value for age *a* in year *y*. The standardized proportions at age (SPAY) are computed as

$$p_{a|y}^{std} = \frac{p_{a|y} - \overline{p}_{a|y}}{Y^{-1}\sum_y \left(p_{a|y} - \overline{p}_{a|y}\right)^2}, \; \overline{p}_{a|y} = \frac{\sum_y p_{a|y}}{Y}.$$

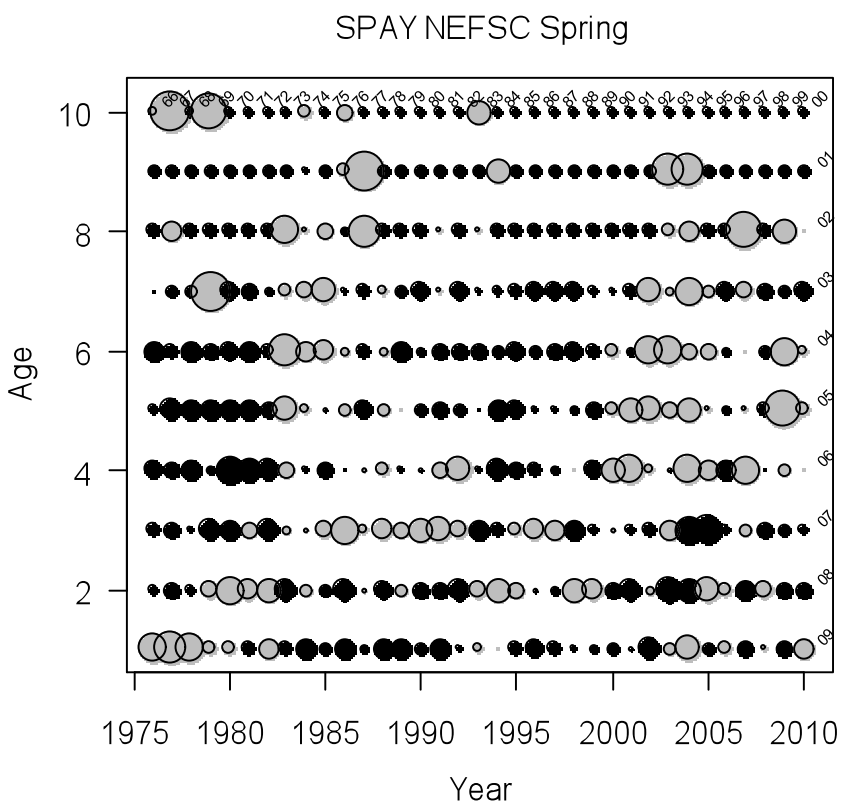

Figure 1. Standardized proportion at age (*SPAY*) for the NEFSC spring survey for the Southern New England winter flounder stock. Black denotes negative values and grey denotes positive values. Bubble areas are proportional to absolute values. A small bubble means the proportion is near average in size for that age in the time series. Cohorts are listed along the margins. Strong cohorts should appear as grey circles that track through time.

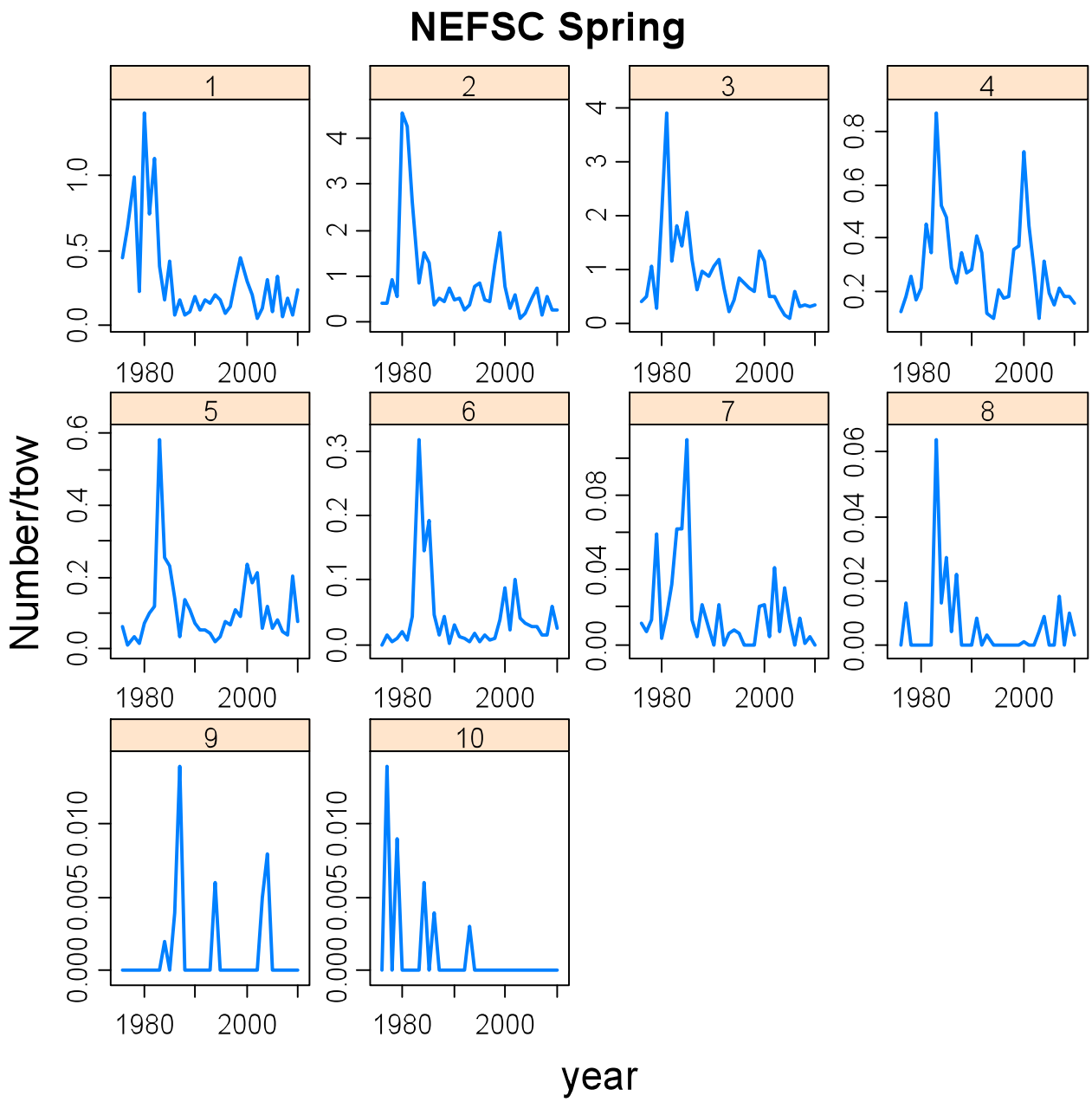

Figure 2. Age-based mean numbers per tow from the NEFSC spring survey for the Southern New England winter flounder stock.