SAW/SARC-52 Winter Flounder

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EXECUTIVE SUMMARY

The Stock Assessment Review of winter flounder stocks (SAW/SARC 52) was held at the NEFSC in Woods Hole, MA from June 6-10, 2011. The chair of the review panel was Patrick Sullivan. Three CIE reviewers (Noel Cadigan, John Casey, and Cynthia M. Jones) comprised the panel. In addition, scientists from the NEFSC and academia participated actively in the discussion in addition to presenting their research. Prior to their departure, the panel produced a draft report of their findings.

There were nine terms of reference (ToR) to be considered for evaluating stock assessment modeling approaches of three stocks of winter flounder (*Pseudopleuronectes americanus*) from Southern New England to the Gulf of Maine. The stocks are structured as southern New England/ mid-Atlantic (SNE/MA), Georges Bank (GBK), and Gulf of Maine (GOM). The terms of references covered generally: 1) the landings and discard estimate, sources and uncertainty, 2) survey data sources and estimates of abundance, along with fish characteristics such as length, weight, maturity, age, as well as the uncertainty in these data, 3) estimation of fishing mortality, recruitment, and stock biomass as well as data uncertainty, 4) sensitivity analyses, 5) environmental effects on stocks, 6&7) stock status and biological reference points, 8) allowable biological catch estimates and associated projections and uncertainty including components such as stock vulnerability, and 9) completion of research recommendations suggested by previous panels. The panel concluded that these terms of reference were met.

These stocks were last reviewed in 2008 at GARM III along with 16 other stocks. At that time, all three stocks were evaluated as overfished and overfishing was occurring. The current status of these stocks was based on new age-structured model output based on larger M (M=0.3) for the SNE/MA and GBK stocks. Model output shows that the SNE/MA stock is overfished but there is no overfishing. This stock is not projected to be rebuilt by 2012-2014. Based on the new stock assessment, the GBK stock is not overfished and overfishing is not occurring. Projections indicate that this stock will be rebuilt by 2012. Because the GOM age-structured assessment was not accepted, an area-swept assessment was used to determine that overfishing was not occurring. No judgment could be made about its biomass status.

In addition to the fundamental issues addressed by the ToRs, the review panel had extensive discussion on: 1) the potential changes in natural mortality and how this affected the stocks, and 2) the appropriate value of steepness, *h*, that should be used in establishing biological reference points. In particular for SNE/MA and GBK stocks the model fitting indicated that M should be higher than the M=0.2 used in previous assessments. Various levels of M were chosen with a range of 0.2 to 0.6, with consensus at M=0.3 as the best current estimate of natural mortality for these stocks. The increase of M could be the result of many factors that were also explored during the meeting with no clear evidence for a specific factor causing this change.

The review panel addressed the use of an arbitrary *h* prior in the S-R relationship. The best data available for *h* from outside sources was a review of reproduction published by Myers et al. (2001) that gave values for flatfish, but did not have any populations of winter flounder in their analyses. The panel felt that because these were adjacent populations of the same species, there should be some common relationship between the steepness of the S-R relations among these stocks. Thus we requested an additional analysis for the SNE/MA and GBK stocks that provided AIC profiles for a range of *h* values for each stock that were also appropriate to the model fits. The ΔAIC cutoff point was chosen as 2 based on guidelines in Burnham and Anderson (1998). The results of this exercise gave closer, but not the same *h*. The range of *h* meeting the ΔAIC criterion was 0.79-0.95 for GBK and 0.5-0.61 for SNE/MA, yielding the closest values of 0.61 for SNE/MA and 0.79 for GBK. The panel recommended fitting the models with these new *h* values rather than taking values from Myers et al. (2001) that didn't even include this species in their analyses. This approach is innovative and should be developed further and should subjected to peer-review. The reproductive biology of these stocks deserves further evaluation and data collection to see whether the underlying reasons for differing S-R relations can be accounted for.

Background

Winter Flounder (*Pseudopleuronectes americanus*) are managed as three stocks (Southern New England SNE/MA; Georges Bank GB; Gulf of Maine GOM) by the New England Fisheries Management Council and underwent their last stock assessments in 2007-2008, in the GARM III meetings. At that time the three stocks were evaluated as overfished and overfishing. GARM III also reported that their status had deteriorated since GARM II. I participated as a CIE reviewer in the meeting on Assessment Methodology (Feb 25-29, 2008).

Some of the challenges stated in my GARM III report remain today. The challenges to obtaining reliable assessment of the status of these stocks are the issue of: changing survey gears and different survey vessels, changing regulations, and problems with survey methodology. Despite these challenges, care was taken to address these issues by the NEFSC.

In SAW/SARC 52, the panel reviewed only the three stocks of winter flounder and was able to evaluate the models in greater depth.

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

My role as a CIE reviewer at SAW-52 modeling meeting was to participate in the review meeting at the NEFSC in Woods Hole, MA, during June 6-10, 2011 (see Appendix 3, Annex 3 for meeting agenda) and to assist in writing and editing the Panel Summary Report. Background documents were available at: http://www.nefsc.noaa.gov/SARC/SARC-52-pdfs/. To prepare, I read and became familiar with the relevant documents provided by the NEFSC scientists to the panel (Appendix 1). Additionally, because the issue of steepness and uncertainty in the biological references points (BRP) in the SNE/MA stock had been the subject of a recently published paper by Rothschild and Jiao (2011), I shared this paper with the panel along with other fundamental papers referenced in Rothschild and Jiao upon which their argument was based.

I attended the review meeting from 9:00 6 June until 17:00 10 June. NMFS scientists presented the results of simulations, exploration of various models, and results of the three assessments as PowerPoint or PDF presentations. During these presentations, the Review Panel members asked questions about the interpretations and received clarifications. We asked for additional work on the assessments in regard to evaluating whether a common value for steepness (h) would better characterize the models for SNE/MA and GBK stocks. We worked together on each TOR and the Panel Summary Report. Formal presentations were finished by Wednesday, presentations on our additional requests were made on Thursday, and the Review Panel met to write the Draft Panel Summary Report from then until the meeting end at 5 PM on Friday afternoon.

The Review Panel reached an agreeable consensus on the draft Panel Summary Report. At the time I write this report to the CIE, we do not have available other than a rough draft of the Panel Summary Report (Appendix 3). The Panel Summary Report will include: findings of whether to accept or reject the work that the panel reviewed, and an explanation of our decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. In this report to CIE, I add additional comments on areas of additional importance to me.

Summary of Findings

Because each of the three stocks has the same exact Terms of Reference (TORs), I am structuring the findings section by the TOR (1-9) and placing my comments relevant to each stock underneath the TOR, as we did in our Review Panel Summary draft.

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

The panel concurred that this TOR had been met and that the NMFS analysts had estimated catch and landings from all sources and had characterized uncertainty. The panel raised several issues for consideration for each stock. These stocks have been subject to both commercial and recreational harvest. We reviewed data on landings and discards and reviewed discard mortality for each fishery. Commercial landings and discard predominated over recreational catches and discards but recreational catch and discard estimates were much more variable.
During the discussion of landings, an issue that was raised by NMFS analysts was the difficulty in obtaining accurate estimates of maturity stage by samplers and by observers who are less experienced in evaluating gross visual examination of gonads in the field which are subsequently confirmed by histological analysis. This is a common concern among agencies. For example, my laboratory is compiling a photographic manual illustrating the gross appearance alongside the microscopic-histological appearance to address just this issue. The NEFSC personnel stated that this was also their goal. I encourage them to follow through with producing these training materials and making then widely available to their samplers and observers. The problems with misidentification of gonadal maturity stage was a problem for the GBK stock when evaluating catch, and SNE/MA stock when the Massachusetts and NMFS survey data were compared, as I discuss briefly under TOR 2 below.

The panel also raised the issue of how the source of weight data could influence stock assessment model results. This issue is a problem when gears select partially recruited young fish that are heavier at age than the rest of their uncaught cohort, as in the commercial catch. Obtaining accurate weights is also a problem when samplers try to weigh recreational catches at access sites. Often these scales are insufficiently precise or improperly calibrated. Typically, I have not relied on angler's self-reported weights, or scale-based measures when using portable scales at access sites. We have found that fish that are returned to the lab and weighed provide more accurate metrics.

A. SNE/MA – Commercial landings and discard data were larger and less variable than recreational data, which was not surprising and was well characterized. The panel noted that Figure A20 showed discrepancies in weight-at-age from that normally seen. In some years, fish of a given cohort are lighter than in the subsequent year. This was quite notable in the mid 1980s and in the past two years. This could be due to sampling issues, inaccurate weights, or inaccurate ageing. I expect this type of figure to reflect a consistent weight-at-age curve for the species. Even though weight-at-age curves can change over time due to density-dependent and environmental changes, the curves should be changing smoothly under those effects and that is not what I saw in this figure. Because these are important data in the

stock assessment model, it is worthy of serious re-evaluation. Because the weights from the surveys were more variable, NMFS analysts used the weights of landings instead. Hence, the issue with Figure A20.

B. GBK – The catch data for this stock had some missing data for length at age among the larger fish categories. I would suggest that NMFS consider using a statistically valid imputation technique (where samples size is properly corrected for the imputation) in developing input data. In the plus group especially, these sizes reflect a running average over the plus group cohorts in which length-at-age would not normally change dramatically.

   The other issue that arose was the problem in obtaining accurate evaluation of maturity stage with gross examination of gonads. The full assessment document indicated that it was previously thought that GBK winter flounder matured at age 2 compared to age three elsewhere. McBride undertook a histological examination of gonads to confirm this. In the GBK, oocyte development was show to begin at age 2, and slow to develop overwinter but at this age fish were not mature fully. Thus, gonads of young fish, which were maturing, had been misclassified as resting stage when they had not fully matured yet. This misclassification would result in estimating the spawning stock biomass as being larger than true. The extent of this overestimation will depend on the abundance of the recruiting cohorts. Because NMFS has compared gonad evaluation in the field with a follow-up evaluation of the same gonad histologically and has limited but matched observations, I suggest that NMFS consider using a statistical approach to correct previous miss-assignments, such as with a ratio estimator if there is sufficient sample size or with a modified logistic-type regression.

C. GOM – The GOM stock is the smallest of the three. Catch and landings data have been characterized recently through the observer program for commercial fisheries. Landings data for the category of large fish was variable. In our discussion, the most problematic data were from the recreational fishery. Early in the time series of MRFSS data, catches were very high and variable. This has led to problems in model fitting and which data to include has been an ad hoc approach to improving subsequent model fit. These data are problematic. In MRFSS, the on site access-point intercepts are used with telephone-survey effort estimates to expand data to catch estimates. The problems contributing to obtaining reliable total catch estimates are the infrequency of intercepting winter flounder anglers and in the weightings given to the access sites. One interview of a successful angler at a usually low effort site will greatly impact the expansion and its variance. I suggest that NMFS analysts look at the intercept data from these early creel survey years to determine if this type of scenario occurred. If so, the expansion can be down-weighted in a variety of ways (geometric means, lower weights for the early data, etc.). Such an approach would provide a less

arbitrary way of dealing with these problematic data.

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.

I concur with the Panel Summary draft that states that this TOR was met for all winter flounder stocks. Several NMFS and state surveys are done for each stock to obtain an index of biomass and biomass at age. With the commissioning of the Bigelow, NMFS surveys cannot reach as far inshore and biomass estimates inshore now rely more heavily on state surveys. In many instances the state surveys had greater mean weights per tow, indicating that they were more efficient for sampling biomass.

Several points were raised during the discussion that applies to all three stocks. The review panel suggested that survey data be presented more clearly and consistently between the stocks (see specifics in the Panel Summary Report draft). There is real value in doing this. Not only will it make the review of these data more complete, but the analysts themselves will be better able to compare and contrast changes in this species biomass and distribution. It was stated that the analysts had already gained insights in working in evaluating the three stocks together. Consistently presented tables and graphs depicting seasonal migrations and densities, weights, ages, and maturity between the three stocks may help in the evaluation of potential climate-change impacts across the metapopulation.

Although these stocks are sufficiently separated to have different vital rates, they are nonetheless part of the species metapopulation complex. Typically reproductive behaviors (size at first maturity but not age, reproductive strategy, breadth but not timing of the spawning season) are conservative among adjacent stocks and will provide further insights into the impacts of fishing and climate change. There are disparities in the stock-recruitment relationships that complicated the evaluation of steepness and deserve to be explored more fully. While growth rates will lead to differences in productivity, it is odd to have such differences in the shape of the S-R curves within adjacent populations of a metapopulation. The work that has been initiated to examine gonadal histology could be expanded to measure spawning frequency, rates of atresia, and oocyte batch sizes in an effort to better characterize these three stocks.

I also concur with the Review Panel report that the calibration between the Albatross and Bigelow needs a thorough peer-review. Compared to the Albatross, the Bigelow gear is catching more small and large fish. This impacts the estimation of recruitment very strongly because of the Bigelow's great capacity at catching smaller fish. Because of the U-shaped nature of the calibration curve, slight changes in its shape can impact the converted number of

recruits (estimated for Albatross gear catchability). In time this will be rectified as the Bigelow-based time series grows. In the meantime, it is a concern depending on the abundance of new recruits.

A. SNE/MA-A recent paper by Rothschild and Jiao (2011) questions various assumptions in stock assessments and used SNE/MA winter flounder as its case study. Among two of the issues that it addresses are stock structure and reproductive productivity. I have commented on these issues in part above. For stock structure, the issue they allude to is that each estuary contains its own "population" of winter flounder that are subject to local adaptation. While local conditions will potentially cause differential survival, for these adaptations to persist to affect the stock overall, there must be reproductive isolation. Otherwise, there will be no maintenance of any local adaptation that occurs. Unless there is strong reproductive isolation of spawning adults within an estuary – for which we have no evidence in this species- or reproductive isolation caused by differential timing of the spawning, there is no mechanism that has been identified to date to validate estuarine-specific philopatry (see Jones 2006 for review of this topic in marine fishes). There is an apparent degree of isolation between the stocks as demonstrated in their different growth rates, size-at-age and maximum ages, but not at a finer scale. This is a topic that is worthy of further investigation, but could not be addressed in the assessment.

   The issue of reproductive productivity is more substantial, as I have discussed above. I found it notable that the S-R curves were so different in shape. I had anticipated that they would be different, but not so fundamentally. Data do not exist to resolve this issue and it does affect the estimation of steepness. The panel addressed this issue by requesting an analytic evaluation of *h* between the SNE/MA and GBK stocks, which used an ad hoc *h* in their assessments. Instead of setting *h* arbitrarily, the panel perceived that there should be communality between the reproductive productivity between these two spatially adjacent stocks. While we had little time to pursue this approach, I suggest that thorough evaluation of reproduction in this metapopulation is justified.

B. GBK – The change from the Albatross to the Bigelow affects the calibration curve in similar ways for this stock as for the others. However, GBK does not suffer from the issue of inaccessibility of shallow inshore water by the Bigelow and may see less of the impact of differences in catch at smaller sizes because of the faster growth rates in this stock.

C. GOM- The GOM is more impacted by the change of NMFS survey vessel than the other areas for several reasons. There is conflicting information from the state inshore trawls and the Bigelow survey. There is also the potential of habitat shift from shallower to deeper water that is confounded by different vessels and survey methods. If it is sufficiently important, then the states or

NMFS can develop targeted surveys using the same gears, whenever possible, to assess habitat change, or institute a tagging study using either applied tags or natural tags that could be used to assess habitat use.

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.

I concur with the Panel Summary Report that this TOR has been met for all stocks of winter flounder. NMFS analysts applied age-based models to each of the stocks. Previous models used a natural mortality value of M=0.2. Current data for the stocks (SNE/MA; GBK) indicate that M has increased. Hence, for these assessments a variety of greater M values were used with the modeling results indicating that M=0.3 gave the most acceptable model results. One of the criticisms of the Rothschild and Jiao paper (2011) was that the M=0.2 was too low, and this has been addressed now by NMFS prior or concurrently with publication of the paper. Age-based stock assessment models were accepted for SNE/MA and GBK. For the GOM an area-swept assessment was used, which can only provide an estimate of relative exploitation.

A. SNE/MA- The workshop addresses various issues about potential changes in q and M that would impact F, recruitment, and stock biomass estimates. The analysts did a thorough job of testing the impacts of changes in M and q and I was satisfied that they had addressed these issues carefully. M is now set at 0.3 and this seems reasonable given their results in the comparison of outcomes at higher M.

B. GBK- I agree that raising M to 0.3 is reasonable given the data that were presented at the workshop.

C. GOM- The analysis included a thorough estimation of potential M for use in the assessment model. However, because of difficulty in adequately fitting the catch data, the assessment model was not accepted by the review panel. Instead an area-swept analysis was used and it appears to be sufficiently robust to provide an adequate estimate of exploitation.

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

I concur with the Review Panel report that this TOR has been adequately met for all three stocks and I have no other specific comments. We did not spend a great deal of time on this TOR for any of the stocks. This was of concern to a previous review panel and the analysts have addressed this concern.

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).

I concur with the Review Panel report that this TOR was adequately met. There has been much work done recently to study the potential impacts of environmental changes, especially in regards to climate change, on survival and recruitment beyond the impact of fishing mortality. Nonetheless, there is large scope for continued research in this area. I would expect to see this species respond to climate change in the future, especially at the southern edge of the range. A study by Manderson (2008) demonstrated that recruitment success was better at lower temperatures and this could prove problematic for SNE/MA if the region experienced warming temperatures. However, no long-term change has been shown in air temperatures used as proxies for ocean temperatures. We did not have data or time to discuss the potential impact of the timing of spring warming –earlier warming- on recruitment success. Other studies in Europe have shown that earlier warm temperatures in the spring have had an impact on species survival and differential temperature in terrestrial systems. Less work has been done on the timing of spring warming in coastal oceans and I suggest that this could be a productive area for future study. There have been productive approaches that related recruitment success in other species to the NAO, Labrador Current and other environmental forcing factors. We discussed a working model by Jon Hare that uses environmental drivers. We reviewed a working paper by Jon Hare that tested several environmental variables against recruitment success. Apparently, retention in productive waters is an important consideration. However, for winter flounder stocks, no clear relation between these factors and recruitment was seen. Thus, the models used to assess winter flounder did not include environmental drivers.

TOR 6. State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, 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.

I concur with the Review Panel draft report that this TOR was met. The results of the stock assessment models for the SNE/MA and GBK stocks provided estimates of current F and SSB. Because the GOM stock was assessed with an area-swept model the status of the SSB was not available, but the exploitation rate could be calculated by comparing catch to estimated area-swept biomass.

The review panel addressed the use of arbitrary *h* in the S-R relationship by requesting that the analysts for the SNE/MA and GBK stocks provide AIC profiles for a range of *h* values for each stock that were appropriate to the model fits. The panel felt that because these were adjacent populations of the same species that there should be some common relationship between the steepness of the S-R relations. The ΔAIC cutoff point was chosen as 2 based on guidelines in Burnham and Anderson (1998). The results of this exercise gave closer, but not the same *h*. The range of *h* meeting the ΔAIC criterion was 0.79-0.95 for GBK and 0.5-0.61 for SNE/MA, yielding the closest values of 0.61 for SNE/MA and 0.79 for GBK. The panel recommended fitting the models with these new *h* values rather than taking values from Myers et al. (2001) that didn't even include this species in their analyses. This approach is innovative and should be developed further and subjected to peer-review. The reproductive biology of these stocks deserves further evaluation and data collection to see whether the underlying reasons for differing S-R relations can be accounted for. With the faster growth rate of GBK, one would anticipate either earlier age at maturity or greater fecundity at age with a potential for steeper *h* as is shown. Depending on how recruitment is defined (it is defined very differently depending on which paper one reads), *h* is close in definition to *r* in Euler's equation for population growth. What remains unexplained is the difference in shape of the curves.

The use of proxies for BRPs was the subject of criticism by Rothschild and Jiao (2011) for the SNE/MA stock. As I discussed previously, they disagree with the values of M used in previous stock assessments and also argue with what they state is an arbitrary choice of percent maximum spawning potential. In their analysis M should be higher and the maximum spawning potential is lower, hence SSB_{msy} should be lower. This paper does not give a thorough review of the development of SPR proxies and I feel that such a review is warranted. As part of my background reading, I reread some of the fundamental papers on the topic. There has been a lot of published work on this topic, but the choice of parameters is very inconsistent. For example, the definition of R ranges widely from age of recruitment to the area,

to the gear, and even in one place to the number surviving who are then themselves reproducing – in essence a measure of fitness. Such choices alter *h* and the proxies that result.

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.

I concur with the conclusions of the Review Panel draft report that this TOR was met for all stocks. We reviewed the status of the stocks using the new model output based on larger M for the SNE/MA and GBK stocks. Model output shows that the SNE/MA stock is overfished but there is no overfishing. This stock will not be rebuilt by 2012-2014. Based on the new stock assessment, the GBK stock is not overfished and overfishing is not occurring. Projections indicate that this stock will be rebuilt by 2012. Because the GOM age-structured assessment was not accepted, an area-swept assessment was used to determine that overfishing was not occurring. No judgment could be made about its biomass status.

SNE/MA- Both the Cat10 and the step model gave the same management advice which indicated that these assessment were robust. Values of M were increased or changed increasingly in a stepwise fashion and the management advice was the same. The advice has proven to be robust to change in these parameters. Among the criticisms level by Rothschild and Jiao (2011) was this issue that M should be increased. The model simulations should address this issue and demonstrate the robustness of the NMFS advice.

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.*

I concur with the Review Panel draft report that this TOR was addressed for all three stocks using standard methods. For the SNE/MA and GBK stocks, the age-structured assessments were accepted and the analysts were able to provide a series of projections of stock biomass recovery. The methods to do this were using MCMC for the SNE/MA stock and bootstrapping for GBK. Because the assessment model was not accepted for the GOM, no projections were available.

This TOR requests that the vulnerability of these stocks be evaluated in terms of important life-history traits. Other TORs addressed these same issues obliquely by evaluating reproductive potential, S-R relationships, and impacts of environmental change on recruitment. I believe that more research is needed. We are seeing changes in reproductive success in other species that occur in this area and use estuaries as nursery grounds. However, there has been no strong evidence that habitat changes are driving apparent changes in stock productivity as was shown in TOR 5. It would be worthwhile evaluating whether these apparent changes are due to changes in size at age, spawning pattern, or fecundity. For example, the GOM stock uses von Bertalanffy growth parameters that date to 1993 and I anticipate that growth rates may have changed in the intervening 18 years.

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.

Review Panels often provide a plethora of research recommendations. This has been true for these winter flounder stocks. I concur with the Review Panel draft report that this TOR has been met. NMFS has made good progress on many of the previous recommendations, such as investigating alternate stock assessment models, evaluating potential environmental effects on stock productivity, among others. I hesitate to add more to the list of research and so I offer these as suggestions.

The research that has been done by McBride to evaluate sexual maturity by comparing gross examination of gonads with subsequent histology is valuable and should be expanded. McBride has shown that young fish that are in the maturing stage have been incorrectly classified to resting stage in gross examination. These results are based on a limited sample size that restricts NMFS ability to apply a correction factor, such as a ratio estimation. The data correction might be approached through use of a logit-based correction which would make efficient use of the available data. Beyond this, a broader study of fecundity at age and

reproductive pattern for all three stocks could be valuable in determining the causes of declining recruitment and productivity.

Scientists in the region (both NMFS and academia) have recently been attending more to evaluating fish life history to understand vulnerability. I encourage this approach, especially for stocks that have limited data, or where there are data conflicts that preclude good model fitting. NMFS analysts noted during the meeting that they had benefitted by working on the three stocks together. Such comparisons can provide valuable insights. In part, the Review Panel used this type of comparative approach when evaluating *h* between SNE/MA and GBK stocks while seeking a more common value for this parameter.

I was surprised that the GOM assessment used VBGF parameters from 1993. The stock growth may have changed over time and the VBGF needs to be updated, if this has not already been done.

There has been a lot of sentiment for re-evaluating stock structure for this species. Recently scientists have been assessing estuarine habitat use and migration patterns. The original work on this species is decades old and with the potential of climate change effects apparent in the distribution of other marine and estuarine species, it would be worthwhile to reassess stock boundaries and quantify connectivity. Newer methods, such as archival tags and otolith chemistry, should prove efficient in providing these metrics.

References

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Manderson, J.P. 2008. The spatial scale of phase synchrony in winter flounder (Pseudopleuronectes americanus) production increased among southern New England nurseries in 1990s. Canadian Journal of Fisheries and Aquatic Science, 60: 340-351.

Myers, R.A., 2001. Stock and recruitment: generalizations about maximum reproductive rate, density dependence, and variability using meta-analytic approaches. ICES Journal of Marine Science, 58: 937–951.

Appendix 1. SARC 52 – Bibliography of Materials Provided

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

3. Southern Demersal Working Group. 2011. Maturity

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

5. Southern Demersal Working Group. 2011. SNE/MA Winter Flounder TOR 4

6. Southern Demersal Working Group. 2011. Management Regulations

7.

   7a. Miller, T. 2011. Winter Flounder Length-based Survey Calibration

   7b. Southern Demersal Working Group. 2011. Winter Flounder Calibration: WP 7

8. McBride, R, Wuenschel, M, McElroy, D, Rowinski, Y, Thornton, G., Nitschke, P. 2011. Classifying female winter flounder maturity during NEFSC resource surveys: comparing at-sea, macroscopic maturity classifications with results from a gonad histology method. A Working Paper for SARC 52

9.

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Appendix 2. CIE Statement of Work

Attachment A: Statement of Work for Dr. Cynthia Jones

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 and 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
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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. SARC/SAW 52 Review Panel Membership

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.
    d. 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).
    e. 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.
    f. 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. SARC/SAW 52 Review Panel Membership

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