Northeast Regional Stock Assessment Review (SARC)

of Atlantic Sea Scallop and Northern Shrimp

Woods Hole, Massachusetts

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Representing the Center of Independent Experts,
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Background

This Center of Independent Experts (CIE, University of Miami) review report should be read in conjunction with the Summary Report of the 45th Northeast Regional Stock Assessment Review Committee (SARC 45) that was prepared by the SARC Panel consisting of Michael Prager (chair), Nick Caputi, J. J. Maguire and Jake Rice.

The Summary Report provides all the details of the background, review activities, and the panel's findings on each of the Terms of Reference (TOR) for northern shrimp (*Pandalus borealis*) and Atlantic sea scallop (*Placopecten magellanicus*).

This review was conducted at the National Marine Fisheries Service facilities at Woods Hole, MA, during 4-8 June 2007 and the format of the review is outlined in Appendix 1.

This independent report provides some additional comments on each of the TOR to complement the Summary Report that may assist the Stock Assessment Workshop (SAW) and does not repeat the information contained in the Summary Report.

Review of northern shrimp assessment terms of reference

The SARC considered the assessment in light of the terms of reference (TOR) provided to the SAW. The findings of the review have been presented according to each of the terms of reference:

1. *Characterize the Gulf of Maine northern shrimp commercial catch, effort, and CPUE, including descriptions of landings and discards of that species.*

Catch and effort data were based on dealer reports (catch) and dockside interviews (CPUE) until 1994. Vessel trip reports (VTR) commenced in 1994 which provided additional information on CPUE. These data have been used to provide the time series of estimates of catch and effort that has improved in the more recent years. The fishery is characterized by large fluctuations in catch and effort as a result of abundance, market prices and status of other fisheries (e.g., lobsters). While these data may not have been comprehensive in different periods they should reflect the key trends in the fishery. Therefore, this TOR has been successfully completed.

The port sampling program has also provided information on catch at length since the early 1980s, which enables an assessment of the relative abundance of the different age classes and development stages. The pattern of fishing in the winter-trawl fishery (and the smaller but growing trap fishery) is dominated by the movement of mature females (ages 3 and older years) inshore in mid-winter to spawn and then movement out again. There is some monitoring of the catch and effort by depth in the port sampling but these depth data may warrant further analysis.

There appears to have been some significant improvements in fishing power over the years and while fishing effort is not used in the current stock assessment it would still be advantageous to document the key changes in fishing power in the fishery to help interpret the model estimates of fishing mortality. Variations in the aggregations of shrimp between years can also affect their catchability and hence catch rates.

Observers onboard commercial trawlers provide an indication of shrimp discards. These have been assumed to be low and ignored in the analysis.

There are periods, such as December, March and April, when a large number of small shrimp may be caught. Given that the target size is for larger shrimp and these are likely to achieve a higher price, assessment of ways that the mean size of shrimp may be increased and discards reduced should be considered. This can include an assessment of the spatial distribution of size and abundance by month, and an assessment of mesh sizes to ensure that an optimum size is retained.

2. *Estimate fishing mortality and exploitable stock biomass in 2006 and characterize the uncertainty of those estimates. Also include estimates for earlier years.*

Estimates of fishing mortality and exploitable stock biomass were provided with estimates of uncertainty and hence the TOR was completed. The autumn and summer surveys provide valuable information on the abundance of different year classes of shrimp. As in all surveys, environmental factors can affect catchability, which will affect the use of the catch rates as reliable indices of abundance. Factors influencing the catchability of shrimp (e.g., environmental conditions, spatial distribution of abundance relative to the survey) in the summer survey should be evaluated so that an appropriate interpretation is made of the survey data.

The relationship between the abundance in life history stages could be examined statistically to identify outliers that may reflect catchability changes or provide an indication of mortality variation in different years. For example, the summer survey can be used to relate the abundance of 1.5 year olds with that of 2.5 and 3.5 year olds between all of the years. The relationship could be of a form $N_{t+1,a+1} = c\ N_{t,a}^{b}$ and fitted using linear regression with a logarithmic transformation where $N_{t,a}$ represents the abundance of age a in year t and the b parameter would indicate if there is any density-dependent mortality ($b<1$) occurring between the two year-classes.

A relationship between catch and survey abundance of different year classes (e.g., 1.5 year olds lagged 2 years) and effort may also provide an indication of the level of density-dependent mortality between the two periods, fishing efficiency, and possible biases in the survey data. These analyses would be valuable in the annual management review of the shrimp assessments.

The mean length of the year-class abundances can also be used to analyze the apparent variability in growth between the years.

The CSA model provides estimates of catchability and abundance that are used to estimate F. Estimates of F were noted to reflect the pattern of nominal fishing effort. A statistical comparison of F and nominal effort can be used to assess if there are effects of fishing efficiency increases.

On page 29 of the Assessment report the observed effort ‘(E=CPUE/C)’ should read ‘(E=C/CPUE)’.

3. Comment on the scientific adequacy of existing biological reference points (BRPs).

The biological reference points are based on the overall biomass of the stock and fishing mortality and they provide a good overview of the status of the stock. Therefore, this TOR was successfully completed.

Historically, there is reasonable evidence that recruitment overfishing has occurred in the early to mid 1970s when fishing mortality was above the current BRPs. Therefore, an assessment of the stock-recruitment relationship (SRR) taking into account environmental factors should be an essential component of the stock assessment. The SARC36 Advisory Report presented a SRR that provided a reasonable assessment (Fig. C5 in SARC36) that the recruitment index of 1.5 year old animals was affected by the spawning stock biomass.

The northern shrimp in the Gulf of Maine is near the end of its spatial distribution range. This makes the species vulnerable to overfishing and sensitive to changes in the environmental conditions. This further emphasizes the need to assess the SRR and the effects of the environment.

If the updated SRR assessment confirms the relationship presented in SARC36 then BRPs based on spawning biomass or egg production should be developed to complement and/or replace the total stock biomass BRP currently being used.

Richards et al. (1996) also showed the relative influence of water temperature and spawning stock on recruitment. An update of this analysis was provided as a verbal presentation during SARC45, which indicates that the stock-recruitment analysis is still relevant. It also appears that it may provide an explanation for the strong 2004 year class. This research should be updated to include the more recent stock, recruitment and environmental data. An understanding of the environmental factors influencing the high recruitment biomass in 2006 and 2007 should be a key area of research for the stock assessment team. An understanding of the effects of these year classes, which are an order of magnitude greater than recent recruitments, is critical for the next few years. This change in biomass may alter the parameters being used in the assessment, which were estimated under different regimes of recruitment. For example, there could be an increase in density-dependent effects as a result of the increased abundance.

The key environmental factors that affect recruitment should also be examined within the long-term trends of those time series to help understand the historic climate trends as well as future trends.

4. Evaluate current stock status with respect to the existing BRPs.

Both the CSA and ASPIC models indicate that the stock is not overfished and that there is no overfishing occurring. Therefore, this TOR was successfully completed. In fact, fishing appears to be well below the appropriate level as a result of poor market conditions.

5. *Perform sensitivity analyses to determine the impact of uncertainty in the data on the assessment results.*

Sensitivity analyses were undertaken to assess some aspects of uncertainty in the models used. A key assessment was that of the natural mortality parameter where there is an indication that the assumption of an M of 0.25 is too low. A higher value of M (0.6) has been examined and further work is being undertaken to assess the appropriate level to use. Therefore, this TOR has been completed.

6. *Analyze food habits data and existing estimates of finfish stock biomass to estimate annual biomass of northern shrimp consumed by cod and other major predators. Compare consumption estimates with removals implied by currently assumed measures of natural mortality for shrimp.*

This TOR was successfully completed as an indication of the level of consumption of shrimp by its key predators was provided. This provided an indication of the likely estimate of M. While there are a number of assumptions involved in the estimation of consumption, the information presented should provide an indication of the annual variation in consumption. This information can be used to assess whether there may be trends in the estimate of M over time as the abundance of predators has changed significantly over the last 20 years. This trend in M can be used to provide a more reliable model assessment.

7. *Review, evaluate and report on the status of the 2002 SARC/Working Group Research Recommendations.*

A number of research recommendations were successfully completed; however, there were other recommendations that were not addressed. It would have been useful to provide further explanation as to the reason why some recommendations were not addressed.

Research Recommendations: Northern Shrimp

Some aspects of future research that should be considered include:

- Conduct an assessment of the spatial distribution of size and abundance by month, and an assessment of mesh sizes to ensure that an optimum shrimp size is retained.
- Assess factors influencing the catchability of shrimp (e.g., environmental conditions, spatial distribution of abundance relative to the survey area) in the summer survey so that an appropriate interpretation is made of the survey data.
- The well-defined length frequency structure provides the basis for a more-detailed model structure. The first step in undertaking this model development could be a statistical assessment of the relationship between catch and the abundance in different life history stages (e.g., 1.5, 2.5 and 3.5 year olds) to identify outliers that may reflect catchability changes or indication of mortality variation in different years.
- The northern shrimp in the Gulf of Maine is near the end of its spatial distribution range. This makes the species vulnerable to overfishing and

sensitive to changes in the environmental conditions. This emphasizes the need to assess the stock-recruitment relationship and the effects of the environment.

- The SRR assessment should lead to the development of the BRP that is based on spawning biomass or egg production.

Review of Atlantic sea scallop assessment terms of reference

The SARC considered the assessment in light of the terms of reference (TOR) provided to the SAW. The findings of the review have been presented according to each of the terms of reference:

1. *Characterize the commercial catch, effort and CPUE, including descriptions of landings and discards of that species.*

Estimates of catch and effort were based on port interviews prior to 1994. In 1994 the vessel trip report (VTR) logbook and dealer reports (DR) by market category were introduced. There was no overlap in data collection to enable calibration of the two time series. Examination of catch rate data showed no break in catch rate (LPUE) time series. CASA modeling also showed a good fit to the landings data based on the survey data with no break in the time series that would indicate a significant bias in either of the two catch and effort time series. Therefore, this TOR was successfully completed.

There have been a number of changes in management and fishing practices that have contributed to changes in efficiency of the fleet. These include (a) limits of 400 lbs per day for open access fleet; (b) minimum average meat weight during 1982-1994; (c) crew limits since 1994; (d) rock chains getting heavier in recent years; and (e) other vessel changes such as engine horsepower. It would be useful to document the effects of these changes in the fishery and undertake a qualitative assessment of these changes based on input from experienced fishers and researchers.

There is a similarity in LPUE from the two main areas, Mid-Atlantic (MA) and Georges Bank (GB). It is suggested that this may be artificial due to the mobility of the fleet. The LPUE in a good recruitment year will be reduced by high effort; however, it is difficult to see how it would be high in a poor recruitment year.

Discards are an important aspect of the assessment and management of the fishery as discards have been estimated to be up to 15%. Between 1982 and 1994 there was an average meat weight requirement that would have contributed to discards. Crew limits, trip limits and processing time for small scallops would also have contributed to discarding. There appears to be a significant reduction in discards since 2005 due to the introduction of 4” rings. Discards are estimated by the observer program; however, it is not clear whether fisher behaviour is affected by the presence of an observer. There is evidence to indicate that there should be good survival of discards if they are handled well (Murawski and Serchuk 1989). There may be value in developing a code of conduct in the handling of discards to maximize survival.

Linking the VMS data with logbook data has provided valuable information on the spatial distribution of effort. Obtaining the spatial catch distribution and relating it to the survey data would provide valuable information on the effectiveness of area closures.

2. *Estimate fishing mortality, spawning stock biomass, and total stock biomass for the current year and characterize the uncertainty of those estimates. If possible, also include estimates for earlier years.*

There has been considerable progress in the stock assessment data and methods since SARC36 and therefore this TOR was successfully completed. These improvements include: (a) GLM to estimate missing values in the NEFSC survey; (b) adjustment of survey abundance on hard bottom due to changes in rock chains on the gear; (c) SMAST video survey to reassess selectivity of the dredge survey for scallops greater than 40+ mm shell height (SH); (d) abundance and size frequency of SMAST video survey; (e) development of a new growth curve; (f) influence of depth in the meat weight and shell height relationship; (g) seasonal variation in the meat weight and shell height relationship; (h) development of a length-structured CASA model using all available data; (i) use of CASA as a basis for estimating F, biomass and BRP; and (j) simulation testing of the CASA model. The assessment has provided improved estimates of F and biomass and provided a measure of their uncertainty. Sensitivity analysis also indicates that biomass estimates were robust to uncertainties and model assumptions.

The dredge survey is a critical part of the stock assessment and management and it is important that it continues. It is a key component of the CASA model for stock assessment and the basis for determining spatial closures that have been the key component in the improvement in the yield of the fishery since the late 1990s.

Environmental effects are likely to affect the survey abundance and hence the stock assessment model. It would be useful to assess the impact of these factors qualitatively or quantitatively. Key environmental indicators (e.g., water temperature, wind strength and direction, swell) at the time of the survey should be recorded and annual variation in these indicators should be noted. If quantitative relationships of environment and catchability are developed using GLM techniques, for example, then annual abundance indices should be standardized using a least square means assessment.

A post-stratification approach is used to assess the closed and open areas. This requires rules for dealing with survey data along open/closed boundaries. This may lead to inadequate sampling occurring within some important closed areas in some years. Given the key importance of the open/closed areas in the stock assessment and management of the fishery, consideration should be given to alternative stratification approaches to ensure the closed areas are sampled adequately in each survey. Simulations may be used to assess whether pre- or post-stratification provide the best sampling approach.

Since the late 1990s, there has been an increase in biomass by a factor of 6 that has changed the characteristics of this fishery. This has been primarily due to the area closures but also due to reduced fishing mortality, changes in selectivity and strong

recruitment. The effect of the area closures and reduced fishing on the biomass of a cohort is relatively easy to assess as it is monitored on an annual basis and assessed using yield per recruit. There has been an increase in meat weight from 14 to 25 g in the last 10 years. However, understanding the contribution of these closures on recruitment is difficult to assess but may assist in further enhancement of this stock.

Understanding the role of increased spawning biomass as a result of the area closures on the strong recruitment may provide some insights into which areas should be targeted for increased protection. Scallop recruitments are well known for their large variability with environmental conditions having a dominant role. There are some similar patterns of recruitment between the MA and GB stocks, which indicates the effect of some common large-scale environmental factor (e.g., water temperature). There are also some contrasting patterns that may indicate localized effects (e.g., water current). Oceanographic modeling of the advection of larvae may provide some insights into source-sink relationships. The oceanographic environment of the GB (eddy structure - more likely to retain larvae) and MA (boundary current – more likely to receive larvae from areas further north) areas are significantly different and may provide an interesting contrast to understand the effects of spawning spatial distribution and the subsequent recruitment spatial distribution. An assessment of the annual variation of this oceanographic pattern during the larval phase may also provide some insights into the annual spatial distribution of recruitment.

The verbal presentation of the stock recruitment assessment showed little evidence of a significant stock recruitment relationship. It also demonstrated that the BRP developed on the basis of YPR provided adequate protection to the spawning stock. Given the very high abundance of the spawning stock that is currently being experienced, it provides good contrast and therefore an opportunity to assess whether this has any effect on recruitment. There appears to be some indication that a Ricker curve may provide a better representation of the SRR than the Beverton-Holt curve. However, given the significant contribution of the environmental conditions to the recruitment variation, any underlying effect of spawning stock will not be determined without first understanding the environmental effect.

The fishing effort is focused on the months when the meat weight is optimum relative to the annual cycle. However, there is some fishing (sometimes as bycatch) at times of the year when meat condition may not be optimum. An assessment of the current seasonal distribution of catch and effort and whether this could be improved to obtain a better yield and economic return should be undertaken. A value per recruit assessment in addition to the YPR assessment may aid in the evaluation.

3. Either update or redefine biological reference points (BRPs; proxies for BMSY and FMSY), as appropriate. Comment on the scientific adequacy of existing and redefined BRPs.

The development of the length-structured CASA model that uses all available data and has a more reliable growth assessment provides a reliable basis for estimating fishing mortality and biomass and the setting of the BRP. Therefore, this TOR was successfully completed.

Although the SRR was not explicitly considered in the assessment, a presentation was made on this issue at the request of the SARC panel. This presentation demonstrated that the existing BRP provided adequate protection to the spawning stock.

The seasonal cycle in meat weight shows a drop in meat weight in Aug-Oct with spawning occurring in Sep-Oct. The monthly distribution of catches should be assessed to see if the yield and economic return can be improved by concentrating fishing during April to August.

4. Evaluate current stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 3).

The stock status indicators for F and biomass are above the old and new BRP and have a relative high degree of certainty. Thus, there was no evidence of overfishing or that the stocks were overfished.

The historical estimates of F and biomass (since the early 1980s) relative to the BRP were presented in the Stock Assessment Summary Report. The Report highlighted that the fishery moved above its current biomass target in about 2000 and below its F threshold in about 2006. This highlights the importance of the management changes in the 1990s to reduce fishing effort and the introduction of the area closures and its positive effect on biomass, landings and economic performance of the fishery.

The assessment team also examined the status of MA and GB stocks separately with respect to F and biomass. Given that there are some differences in the recruitment patterns between the MA and GB stocks, the assessment team should continue to undertake the assessment separately for the two stocks before combining them for an assessment of the overall stock.

5. Recommend modeling approaches and data to use for conducting single and multiyear stock projections, and for computing TACs or TALs.

6. If possible,

a. provide numerical examples of short term projections (2-3 years) of biomass and fishing mortality rate, and characterize their uncertainty, under various TAC/F strategies and

b. compare projected stock status to existing rebuilding or recovery schedules, as appropriate.

These two TOR are considered together in the following comments and both are considered to have been successfully completed. The development of the spatial management forecasting model is a valuable tool to assess the impact of management strategies with respect to the open and closed areas and fishing effort on catch forecasting and biomass. Fishing effort was not assumed constant in all the open areas but assumed to be proportional to fishable biomass, which provides a more realistic scenario and hence an improved forecasting tool. A comparison of the proposed effort distribution with the actual distribution may provide some valuable insights as the distribution of effort may be affected by distance from port.

Changes may occur to which areas are open and closed each year as a result of annual surveys that may identify new patches of recruitment.

The short-term projections indicate that the fishing mortality is at the BRP levels (i.e., approximately the current levels), on average; thus, the current high landings should be maintained and the biomass is expected to stay above the target levels.

If the projected biomass levels are increased well above the 'target' levels then consideration needs to be given as to whether fishing levels should increase above the current threshold levels. The stock assessment team could determine the level of F that is required to maintain the biomass above the target with an appropriate level of certainty (say 50% and 80%).

These projections have been undertaken using F of 0.20 and 0.24. If the new BRP of F of 0.29 is accepted then these calculations should also be undertaken at this F level.

7. Review, evaluate and report on the status of the SARC/Working Group Research Recommendations offered in recent SARC reviewed assessments.

Significant progress has been made in undertaking nearly all of 11 recommendations made in SARC36 as well as other research areas highlighted under TOR 2. Therefore, this TOR was successfully completed. The assessment team also provided an indication of key areas of future research based on their experience in the current stock assessment. These identify some of the key issues that need to be addressed to improve the stock assessment.

Research Recommendations: Atlantic scallop

Some aspects of future research that should be considered include:

- Assess the influence of environmental effects that are likely to affect the survey abundance and hence the stock assessment model.
- There are some similar patterns of recruitment between the MA and GB stocks that indicate the effect of some common large-scale environmental factor (e.g., water temperature). There are also some contrasting patterns that may indicate localized effects (e.g., water current). Oceanographic modeling of the advection of larvae may provide some insights into source-sink relationships.
- The high abundance of spawning stock currently being experienced provides a good contrast and therefore an opportunity to assess whether this has any effect on recruitment. There appears to be some indication that a Ricker curve may provide an appropriate representation of the SRR. Environmental effects are known to contribute to the large variation in scallop recruitment and hence should be considered in the SRR.
- An assessment should be undertaken of the current seasonal distribution of catch and effort and whether this could be improved to obtain a better economic return. A value per recruit assessment in addition to the YPR assessment may aid in this evaluation.
- Given that there are some differences in the recruitment patterns between the MA and GB stocks, the assessment team should continue to undertake the assessment separately for the two stocks before combining them for an assessment of the overall stock.

References

Murawski, S.A and F.M. Serchuk. 1989. Environmental effects of offshore dredge fisheries for bivalves. ICES C.M. 1989/K:27

Richards, A., M. Fogarty, S. Clark, D. Schick, P. Diodati, and A. O'Gorman. 1996. Relative influence of reproductive capacity and temperature on recruitment of *Pandalus borealis* in the Gulf of Maine. ICES C.M. K:13.

Appendix 1: Background material

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Hart, D. R. 2006. Sea Scallop Stock Assessment Update for 2005. Woods Hole, MA: NEFSC/NMFS/NOAA/DOC.

Hart, D. R. 2003. Yield- and biomass-per-recruit analysis for rotational fisheries, with an application to the Atlantic sea scallop (*Placopecten magellanicus*). *Fisheries Bulletin* 101: 44-57.

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McInnes, D. 1986. Interstate Fishery Management Plan for the Northern Shrimp (*Pandalus borealis kroyer*) fishery in the western Gulf of Maine.

Northern Shrimp Assessment Summary Report for 2007.

SARC 36 Northern Shrimp Advisory Report.

SARC 36 Northern Shrimp Consensus Summary.

SAW Invertebrate Subcommittee. 2007. Stock Assessment for Atlantic Sea Scallops (*Placopecten magellanicus*): Consensus Assessment Report, SARC 45 draft.

SAW Invertebrate Subcommittee. 2004. Stock Assessment for Atlantic Sea Scallops (*Placopecten magellanicus*): Consensus Assessment Report, SARC 39. Woods Hole, MA: NEFSC/NMFS/NOAA/DOC.

Stokesbury, K. D. E., Harris, B. P., Marino, M. C., and J. I. Nogueira. 2004. Estimation of sea scallop abundance using a video survey in off-shore US waters. *Journal of Shellfish Research* 23 (1): 33-40.

Appendix 2

Consulting Agreement between the University of Miami and Dr. Nick Caputi

Statement of Work

May 2, 2007

General

The Northeast Regional Stock Assessment Review Committee (SARC) meeting is a formal, multiple-day meeting of stock assessment experts who serve as a panel to peer-review tabled stock assessments and models. The SARC is the cornerstone of the Northeast Stock Assessment Workshop (SAW) process, which includes assessment development (SAW Working Groups or ASMFC technical committees), assessment peer review, public presentations, and document publication.

The SARC 45 review panel will be composed of three appointed reviewers from the Center of Independent Experts (CIE), and a chair from the Scientific and Statistical Committee (SSC) of the regional Fishery Management Councils. The panel will convene at the Woods Hole Laboratory of the Northeast Fisheries Science Center (NEFSC) in Woods Hole, Massachusetts, from June 4-9, 2007 to review two assessments (Atlantic sea scallop, *Placopecten magellanicus*; Northern shrimp, *Pandalus borealis*). In the days following the review of the assessments, the panel will write the SARC Summary Report and each CIE reviewer will write an individual independent review report.

Specific Activities and Responsibilities

The CIE's deliverables shall be provided according to the schedule of milestones listed on Page 5. The CIE reviewers, along with input from the SARC Chairman, will write the SARC Summary Report. In addition, each CIE reviewer will write an individual independent review report. These reports will provide peer-review information for a presentation to be made by NOAA Fisheries at meetings of the New England and Mid-Atlantic Fishery Management Councils in 2007. The SARC Summary Report shall be an accurate and fair representation of the SARC panel viewpoint on how well each SAW Term of Reference was completed (please refer to Annex 1 for the SAW Terms of Reference).

The three SARC CIE reviewers' duties shall occupy a maximum of 14 days per person (i.e., several days prior to the meeting for document review; the SARC meeting in Woods Hole; and several days following the open meeting to contribute to the SARC Summary Report and to produce the Independent CIE Reports).

The SARC chair's duties shall occupy a maximum of 17 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.)

Charge to SARC panel

The panel is to determine and write down whether each Term of Reference of the SAW (see Annex 1) 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.

Roles and responsibilities

(1) Prior to the meeting

(SARC chair and CIE reviewers)

Review the reports produced by the Working Groups and read background reports.

(2) During the Open meeting

(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 each assessment, review both the Assessment Report and the 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 reviewer shall prepare an Independent CIE Report (see Annex 2). 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 Point (BRP) 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.

If a reviewer feels that his/her comments are adequately expressed in the SARC Summary Report, it will not be necessary to repeat the same comments in the Independent CIE Report. In that case, the Independent CIE Report can be used to provide greater detail on specific Terms of Reference or 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.

(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 or a consensual 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 Summary Report development process will be to identify or facilitate the finding of an agreement rather than forcing the panel to reach an agreement if it cannot reach one. 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 3 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.

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).

Schedule

The milestones and schedule are summarized in the table below. No later than June 22, 2007, the CIE reviewers should submit their Independent CIE Reports to the CIE for review[1]. The Independent Reports shall be addressed to "University of Miami Independent System for Peer Review," and sent to Dr. David Sampson, via e-mail to David.Sampson@oregonstate.edu and to Mr. Manoj Shivlani via e-mail to mshivlani@rsmas.miami.edu

[1] All reports will undergo an internal CIE review before they are considered final.

Milestone	Date
Open workshop at Northeast Fisheries Science Center (NEFSC) (begin writing reports, as soon as open Workshop ends)	June 4-7, 2007
SARC Chair and CIE reviewers work at the NEFSC drafting reports	June 7- 9
Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair **	June 22
CIE reviewers submit Independent CIE Reports to CIE for approval	June 22
SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)	June 29
CIE provides reviewed Independent CIE Reports to NMFS COTR for approval	July 6
COTR notifies CIE of approval of reviewed Independent CIE Reports	July 13 *
COTR provides final Independent CIE Reports to NEFSC contact	July 13

* Assuming no revisions are required of the reports.

** 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.

NEFSC Contact person and SAW Chairman:
Dr. James R. Weinberg, NEFSC, Woods Hole, MA. 508-495-2352,
James.Weinberg@noaa.gov

Submission and Acceptance of CIE Reports

The CIE shall provide via e-mail the final Independent CIE Reports in pdf format to Dr. Lisa Desfosse (Lisa.Desfosse@noaa.gov) for review by NOAA Fisheries and approval by the COTR, Dr. Stephen K. Brown, by July 6, 2007. The COTR shall notify the CIE via e-mail regarding acceptance of the reports by July 13, 2007. The COTR will transmit the Independent CIE Reports to the NEFSC contact no later than July 13, 2007.

ANNEX 1:
Terms of Reference for the 45th Northeast Regional Stock Assessment Workshop

(Revised March 7, 2007)

A. Sea Scallops

1. Characterize the commercial catch, effort and CPUE, including descriptions of landings and discards of that species.

2. Estimate fishing mortality, spawning stock biomass, and total stock biomass for the current year and characterize the uncertainty of those estimates. If possible, also include estimates for earlier years.

3. Either update or redefine biological reference points (BRPs; proxies for B_{MSY} and F_{MSY}), as appropriate. Comment on the scientific adequacy of existing and redefined BRPs.

4. Evaluate current stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 3).

5. Recommend what modeling approaches and data should be used for conducting single and multi-year stock projections, and for computing TACs or TALs.

6. If possible,

    a. provide numerical examples of short term projections (2-3 years) of biomass and fishing mortality rate, and characterize their uncertainty, under various TAC/F strategies and

    b. compare projected stock status to existing rebuilding or recovery schedules, as appropriate.

7. Review, evaluate and report on the status of the SARC/Working Group Research Recommendations offered in recent SARC reviewed assessments.

B. Northern Shrimp

1. Characterize the Gulf of Maine northern shrimp commercial catch, effort, and CPUE, including descriptions of landings and discards of that species.

2. Estimate fishing mortality and exploitable stock biomass in 2006 and characterize the uncertainty of those estimates. Also include estimates for earlier years.

3. Comment on the scientific adequacy of existing biological reference points (BRPs).

4. Evaluate current stock status with respect to the existing BRPs.

5. Perform sensitivity analyses to determine the impact of uncertainty in the data on the assessment results.

6. Analyze food habits data and existing estimates of finfish stock biomass to estimate annual biomass of northern shrimp consumed by cod and other major predators. Compare consumption estimates with removals implied by currently assumed measures of natural mortality for shrimp.

7. Review, evaluate and report on the status of the 2002 SARC/Working Group Research Recommendations.

ANNEX 2: Contents of SARC CIE Independent Reports

1. For each assessment reviewed, the report should address whether each Term of Reference of the SAW was completed successfully. For each Term of Reference, state why that Term of Reference was or was not completed successfully. To make this determination, 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 a reviewer feels that his/her comments are adequately expressed in the SARC Summary Report, it will not be necessary to repeat the same comments in the Independent CIE Report. In that case, the Independent CIE Report can be used to provide greater detail on specific Terms of Reference or additional questions raised during the meeting.

2. If any existing Biological Reference Point (BRPs) 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. Any independent analyses conducted by the CIE reviewers as part of their responsibilities under this agreement should be incorporated into their Independent CIE Reports. It would also be helpful if the details of those analyses (e.g, computer programs, spreadsheets etc.) were made available to the respective assessment scientists.

4. Additional questions that were not in the Terms of Reference but that are directly related to the assessments. This section should only be included if additional questions were raised during the SARC meeting.

ANNEX 3: 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.

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 SAW 45, 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 SAW 45, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice.