

**Report on the SARC 45 on Gulf of Maine Northern  
Shrimp and Atlantic Sea Scallops, Woods Hole,  
Massachusetts , June 4-6, 2007**

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**Prepared for the Center for Independent Expert  
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**June 22, 2007**

I agree with the Summary Report of the 45th Northeast Regional Stock Assessment Review Committee (SARC 45) prepared by the Panel. Not all the points raised in the Summary are commented on here.

## 1. Were the terms of reference completed?

### A. Northern shrimp

The size and status of northern shrimp is assessed every year by the Northern Shrimp Technical Committee of the Interstate Fisheries Management Program of the Atlantic States Marine Fisheries Commission. A first management plan was approved in 1986, and Amendment 1, adopted in 2004, entirely replaced the original plan and established biological reference points. The essence of the assessment reviewed during SARC 45 had been prepared in the autumn of 2006 and used to provide advice and decide on management measures for the fishing season starting in December 2006. Varying the length of the fishing season is the main management tool, although advice on catch limits has been provided since 2005 and the management plan allows for the setting of Total Allowable Catches (TAC). The review provided by SARC 45 will be used to improve the assessment that will be conducted during the autumn of 2007.

Comments on each term of reference for Gulf of Maine northern shrimp are provided below.

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

This term of reference was successfully completed.

Landings by State, by State and month, and by gear and month were provided. The number of trawl trips by State and month as well as the number of trips by gear type and month provide information on the nominal fishing effort. Nominal catch per unit of effort (CPUE) was presented both in tonnes per trip and kg per trawl hour. No statistical standardization of the CPUE to account for changes in gear, vessels, season, introduction of the Nordmore grate, or environmental variables etc. was presented.

Sampling intensity was documented and length frequencies by maturity and gender were presented by month, state, and gear for all vessel types (day boats and larger boats). Each sample used to calculate the length frequency was given the same weight, regardless of the size of the landings from which it came.

Discards in the shrimp, herring and whiting (silver hake) fisheries were estimated from the reports of observers at sea, but observer coverage was low and the assessment does

not include discards. Additional sampling (SARC summary recommendation page 12) could probably be achieved through at sea samples by fishermen.

The main stock size index is the Northern Shrimp Technical Committee State/Federal summer survey with data since 1984. The autumn (1968-2006) NEFSC and Maine (1968-1981) surveys are also used. The analysis of the shrimp survey results could be improved by using depth and environmental covariates (cyclical or not) to calculate abundance (see [http://www.dfo-mpo.gc.ca/csas/Csas/publications/ResDocs-DocRech/1999/1999\\_112\\_e.htm](http://www.dfo-mpo.gc.ca/csas/Csas/publications/ResDocs-DocRech/1999/1999_112_e.htm) consulted on June 8, 2007). Normally, around 40 stations are sampled each year, but in some years (e.g., 2006) as few as 29 stations were sampled because of the difficulty in finding suitable trawlable grounds. With 23 years of survey information, it would be worthwhile to identify grounds where it has been consistently possible to fish successfully and use that information to select fishing stations. An alternative would be to randomly select, either once<sup>1</sup> or every year, from stations that have successfully been sampled. There could be benefits in sacrificing statistical rigor for more certainty in achieving a larger number of successful sampling stations.

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

This term of reference was successfully completed.

Two stock assessment methods were used. The Collie-Sissenwine Analysis (CSA) calibrated with the results of the Northern Shrimp Technical Committee State/Federal summer survey was presented as the preferred assessment method while ASPIC calibrated with the same survey, the NEFSC Autumn survey and the Maine survey was presented as confirmatory analysis. The results from both methods are in agreement, particularly for fishing mortality, but as expected, the 2006 and 2007 biomass estimates from ASPIC are lower than those from CSA. The 2007 biomass estimate from CSA of about 70 000t is more than four times higher than the previous maximum in the CSA series. However, it can be considered of the same order as the 1968 biomass estimate of about 50 000t from ASPIC. This suggests that the biomass estimated for 2007 by CSA is not unrealistically high.

Figure A.6.7 of the assessment document shows that all size classes seem to have increased in 2005 compared with 2004, and in 2006 compared with 2005, which suggests that the increased biomasses in 2005 and 2006 could be due at least in part to increased availability to the survey and not only to increased abundance.

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<sup>1</sup> The stations in the English groundfish survey were selected once, the first year of the survey, according to a stratified random designed and the same stations have been kept since then.

The uncertainties were characterized by bootstrapping, doing retrospective analyses, investigating using a substantially higher value for M, and through various sensitivity runs assuming different landings either through the time series or for the last few years. If shrimp were in fact more available to the survey in 2006 than is normally the case, the low estimate of the 2005 year class could be indicative of a very small year class. A recent survey in Massachusetts Bay, during which normally only a handful of shrimp are caught, did catch several baskets of shrimp, confirming that shrimp continue to be abundant or highly available.

The process to separate recruits from recruited and to exclude pre-recruits for the CSA involves the use of selectivity and growth curves. According to figure A.6.4, page 83 of the assessment document, this results in a fully recruited population whose size ranges from about 14 mm dorsal carapace length to slightly above 30 mm, a recruit population whose size range extends from about 13mm to 29mm and a pre-recruit population that extends from 12mm to 27 mm. I would call this process horizontal slicing of the length frequency. I was expecting vertical slicing instead, e.g. shrimp less than 14 are pre-recruits, shrimp between 15 and 18 are recruits, and shrimp from 19mm and above are fully recruited. The approach used seems to mix year classes while my understanding was that the intent of the CSA method was to keep them separate.

The size-structured forward projecting assessment model (CASA) used in the Atlantic sea scallop assessment reviewed during SARC 45 could probably be used on shrimp.

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

This term of reference was met.

The assessment report describes existing reference points and their basis. The implications of analyses suggesting that natural mortality is likely higher than currently assumed in the assessment are recognized.

The assessment document (page 32) draws attention to dual use of  $F = 0.22$  as both a target and a threshold. Therefore, when the target is exceeded, overfishing is said to be occurring. This could make the management of the fishery very sensitive to variability in the assessment, particularly when the fishing mortality exerted is close to the target. The stock status would then alternate between overfishing occurring and not occurring simply due to variability in the assessment and without major concern for the productive capacity of the shrimp stock. The introduction of an F threshold between  $F_{target}$  and  $F_{limit}$  would resolve that problem. The  $F_{target}$  is said to be based on  $F_{50\%}$  spawning per recruit and the  $F_{limit}$  on  $F_{20\%}$  spawning per recruit; however, the choice of  $F_{limit}$  apparently also had to do with the average fishing mortality that is considered to have previously led to stock collapse ( $F = 0.60$ ), and that of  $F_{target}$  had to do with average fishing mortality ( $F = 0.22$ ) during the mid 1980s to mid 1990s when catches and biomass were relatively stable.

The assessment report, as well as its presentation to SARC 45, gave the impression that environmental conditions (long term cyclical or otherwise) were more important than spawning stock size in determining recruitment. But in fact, the stock and recruitment data from the Northern Shrimp Technical Committee State/Federal summer survey or from the NEFSC Autumn survey do show a stronger influence of spawning biomass than for most fish stocks. Reference points, using stock and recruitment as well as environmental information, could therefore be reviewed, once appropriate value(s) for M has been identified. Once the appropriate environmental signal(s) are identified they should be incorporated in production modeling.

The reference points will need to be changed when a higher and more appropriate rate of natural mortality is identified and justified. As indicated above, examination of stock and recruitment scatter plots from the NSTC summer survey and the NEFSC autumn survey both show reasonable relationships between spawning stock and subsequent recruitment. These relationships could be used to identify biomass reference points that could be related to the existing assessment model. A stock recruitment relationship, including environmental variables or not, should be used to calculate fishing mortality reference points.

**ToR 4. Evaluate current stock status with respect to the existing BRP<sub>s</sub>.**

This term of reference was successfully completed.

The current stock biomass is estimated to be far above the Blimit and the fishing mortality is estimated to be considerably smaller than Ftarget/threshold and Flimit.

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

This term of reference was successfully completed.

The stock assessment team investigated the effects of three groups of factors on assessment results: 1) estimate of the mean weight of landed shrimp, 2) sensitivity to under-reporting of landings in the last two years, and 3) sensitivity of CSA to different values of the natural mortality rate, M.

The finding that with M=0.25, the catchability of the survey is greater than 1, while with M=0.60, the catchability is about 0.30, suggests that M=0.25 is unlikely. The estimated M=0.25 was calculated when the fishery was closed and recruitment was low, with probably little density dependent effects taking place. Natural mortality may have been that low at the time, but currently, a higher value seems appropriate.

Although M is likely to be higher than M=0.25, it would not be appropriate to change M at this point until more analyses indicate a more appropriate value(s). The assessment team's idea to use predation estimates to scale yearly values of M is certainly worth pursuing. Examination of goodness of fit plots suggests a better fit with M=0.60 than with M=0.25. M is therefore unlikely to be as low as 0.25; but even 0.60, although a considerably more likely value is not necessarily the definite value.

**ToR 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 term of reference was met.

Yearly estimates of shrimp consumption were derived from the stomach contents of 18 potential shrimp predators collected during the spring and autumn surveys during 1985 to 2006. The estimated consumption of *Pandalus borealis* by all predators combined varied between about 5 000 and 70 000t, with recent values ranging between 30 000 and 50 000t. Predator abundance was estimated from the surveys even though for some of the predators potentially more reliable estimates could have been obtained from analytical assessments. Consistently using survey estimates for predator abundance, however, provides a more stable basis for analysis, and also means that all predators are treated similarly.

Generally, there appears to be an inverse relationship between the biomass of predators and shrimp biomass (kg/tow) from the survey (Figure A.10.9b from the assessment document). However, the interpretation is complicated by the lack of information on the abundance of individual predators and on the abundance of other preys.

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

This term of reference was met.

The assessment document reports on the status of the 2002 research recommendations.

The report, however, understates the achievements on important recommendations such as that on natural mortality and on the two stages control rule. In other cases, the report fails to state clearly that the objective of the recommendation has been achieved (e.g. alternative estimators of F).

Research recommendations for the future include continuing the work on the relationship between spawning stock, environmental conditions and recruitment. Although the

assessment document mentions the strong expected influence of the environment for a species at the southern extreme of its range, the influence of spawning biomass, based on estimated recruitment and biomass from surveys, as presented to the Panel by Anne Richards, seems clearer than for many other marine fish species. Spatially explicit statistical methods could be used to improve the survey estimates using covariates such as depth and temperature.

The management system allows for setting TAC's but management has chosen not to do so. This may have been a wise decision because the imposition of hard TACs could have resulted in the deterioration of the quality of catch and effort information, unless monitoring, control and surveillance at sea and in all the landing ports were very good.

### ***B. Sea scallops***

Sea scallop assessments have recently been reviewed in the SAW/SARC process in January 2001, January 2004 and in June 2007. The assessment is done by the Invertebrate Subcommittee with the lead scientist from the North East Fisheries Science Center. The Atlantic Sea Scallop Fishery Management Plan was first implemented in 1982. There have been 10 Amendments since then and 18 Framework Adjustments. The fishery is mostly for the scallop muscle, because of Paralytic Shellfish Disease (PSD) on Georges Bank, but a few scallops are landed whole. Observer coverage has been higher than for other fisheries in recent years, and the program brings in credible and useful data.

The first part of the presentation on sea scallop focused on recent results on growth and how it is used in the assessment.

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

This term of reference was successfully completed.

Landings by gear and area from 1984 to 2006 were provided, and discards were estimated by area for 1992 to 2006 for the directed scallop fisheries. Discards were estimated to have been low except in 1999 and 2000, possibly because of high recruitment. For other fisheries, scallop landings and discards were estimated by fisheries for 1994 to 2006. Landings per unit of effort were provided, but considerable changes in management complicate their interpretation. Stock size information was derived from a dedicated NEFSC dredge survey, a NEFSC winter survey with a flatfish net, and two SMAST photographic surveys.

Observer coverage has increased considerably since 2003 and most of the vessels with limited access permits for scallops are equipped with VMS. This could provide an opportunity to make greater use of the catch and effort information from the commercial fishery, either to calculate CPUE or to estimate the biomass of specific scallop beds.

**ToR 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.**

This term of reference was successfully completed.

Fishing mortality and stock sizes were estimated both with the old method (re-scaled F based on absolute biomass estimates from the survey) and a new statistical catch at length model (CASA) developed specifically for this scallop resource. An interesting feature is that incidental mortality is applied in the assessment model, not to the input data. The model had been introduced in the previous assessment, further developed in the mean time, and used as the main assessment tool in this assessment while still doing the analyses with the previous method for comparison purposes. The assessment team followed the appropriate process to introduce its new assessment method and thoroughly investigated the differences between the two.

The assessment method should be further tested and documented with the purpose of including it in the NFT toolbox.

The assessment is conducted separately for Georges Bank and for the Mid-Atlantic and the results are combined to depict the whole stock.

Uncertainty in the assessment was evaluated by analyzing the likelihood profiles from the fit, by doing retrospective as well as sensitivity analyses. The retrospective patterns appeared relatively small on the graph, but this may have been due to the scale used – fishing mortality in some years, particularly for Georges Bank were quite high. The patterns were opposite in each geographical areas, which means that when combined, the retrospective pattern was almost not visible on the graphs. The sensitivity analyses showed ((Fig. B5-20 and table B5-12 of the assessment document) that the model results were relatively insensitive to the alternative configurations tested.

An additional sensitivity was requested by the Panel - dropping the dredge survey, because there is a possibility that the survey may not be conducted every year, or at all, in the future. The results were consistent, but did not give a full appreciation of the potential effects because other surveys were kept in the model. Apparently, there is also a possibility that the winter survey could no longer be conducted. Presumably, if that survey had also been excluded from the model, the results would have suggested greater uncertainties. However, the model is constrained to fitting the total landings almost exactly, which does stabilize the results.

Figure B4.4 of the assessment document shows that the landings per unit of effort for the two areas follow each other very closely. This is attributed in the assessment document mostly to the behavior of the fleet, but it could also be an indication that the two subunits form in fact a single biological unit.

**ToR 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.**

This term of reference was met.

The Panel asked the assessment team to include in the assessment report the discussions that took place on stock and recruitment relationships during the assessment meetings. The assessment team produced graphs of egg production (in trillion of eggs) versus recruits separately for the two areas. The target biomass of 109 000 tonnes for the area combined is said to correspond to 120 000 trillion eggs which should be divided 50:50 between Georges Bank and the Middle Atlantic, i.e. corresponding to target egg productions of 60 000 trillion eggs in each area. The egg production and recruits scatter plot for the Mid Atlantic indicates that of the four year classes produced when the egg production was higher than about 60 000 trillion eggs, two were above median recruitment. Of the remaining 26 year classes, produced at egg productions less than 60 000 trillion eggs, the proportion of smaller than median year classes appears higher than 50% when the egg production is less than about 15 000 trillions. For Georges Bank, the egg production versus recruitment appears to be of the Ricker type, that is with peak recruitment at some intermediate egg production. Of the four year classes produced at egg productions higher than 60 000 trillion eggs, three were less than the median. There are only 7 observations at egg productions higher than about 30 000 trillion eggs, and of those only two are above the median. As for the Mid-Atlantic, at egg productions less than about 15 000 trillion eggs, the proportion of smaller year classes seems to increase. For both areas, recruitment does not seem to be impaired at egg productions of about 15-20 000 trillion eggs. This suggests that the risk of recruitment overfishing increases at egg productions considerably lower than that corresponding to the current target biomass. It is only recently that egg production has increased, and more observations will be needed before it will be possible to conclude that the target biomass could be lowered.

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

This term of reference was successfully completed. Scallops are not overfished and overfishing is not occurring.

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

This term of reference was successfully completed.

The assessment team has developed the Scallop Area Management Simulator (SAMS), a size based model that takes into account area management and relevant differences in parameters between areas. Two regions and a total of 15 areas, 9 on Georges Bank and 6 in the Mid Atlantic, are modeled. Biomass estimates in the most recent year from the survey are scaled to the assessment results. Using the survey this way makes it possible to use recruitment estimates by area. Temporal and spatial auto-correlation should be estimated and possibly used in projections.

**ToR 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

This term of reference was successfully completed. Short term spatially-based projections were done under two fishing mortality scenarios.

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

This term of reference is not relevant as scallops are not under a recovery or rebuilding schedule.

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

This term of reference was successfully completed.

The presentation to the SARC and the assessment document reported on progress made on the recommendations from the previous SARC review in 2004. Considerable progress was made on most recommendations.

## **2. Are the reference points appropriate?**

### **A. Northern shrimp**

For northern shrimp, the reference points will need to be recalculated once the best way to deal with suspected higher natural mortality rates is resolved. If this is done through treating predators as an additional fleet, either in ASPIC or somehow in CSA, the mortality reference point could be expressed in terms of total mortality ( $Z$ ) rather than  $F$ . This could complicate management, if  $Z$  increases because of increases in predation rather than increases in fishing mortality.

Existing reference points are appropriate for making management decisions at this time of high shrimp biomass and low fishing mortality.

### ***B. Sea scallops***

The current reference points for sea scallops are based on per-recruit analyses. Fishing at or slightly lower than  $F_{MAX}$  avoids growth overfishing. In cases where  $F_{MAX}$  is less than  $F_{MSY}$ , as could very well be the case for sea scallops, there is a high probability that measures designed to avoid growth overfishing will also prevent recruitment overfishing. Recruitment overfishing is considerably more serious than growth overfishing. The primary objective of fishery management should be to avoid recruitment overfishing, because it leads to stock collapses. The discussion above under ToR 3 for sea scallops, suggests that recruitment may not become impaired at egg productions considerably lower than those corresponding to the current biomass target. Recruitment overfishing, potentially leading to stock collapse is therefore unlikely to occur with the current definition of overfishing which aims at avoiding growth overfishing. If additional stock and recruitment observations support the hypothesis that recruitment is not impaired at lower biomass, or that recruitment is lower at higher egg production as the few available observations suggests for Georges Bank, biomass reference point should be re-evaluated and fishing mortality adjusted to correspond to the new biomass reference points.

Understanding the dynamics of recruitment, including spatial dynamics, is particularly important for sea scallops where management is spatially based because:

- Exceeding  $F_{MAX}$  in the open areas does not necessarily entail negative consequences from a conservation perspective if there is sufficient spawning potential outside of the open area and if the open area regularly receives recruits from outside.
- Without such understanding, it is not possible to know how to calculate a fishing mortality average that could meaningfully be compared with the real fishing mortality that is considered to have an unacceptable probability of leading to recruitment overfishing.
- There have been suggestions that the biomass in areas that are unlikely to ever be open should not be included in the assessment because they will never contribute to the catch directly. They will contribute to recruitment, however, and not including them in the assessment could lead to the awkward situation where the productive capacity of the resource would in no way be threatened, yet considerable unnecessary restrictions would be imposed on the fishery.

Existing reference points have a high probability of avoiding recruitment overfishing.

### **3. Independent analyses**

#### **A. Northern shrimp**

I did not do any significant analyses as a CIE reviewer that are worth incorporating in this report. I am grateful to the assessment team who made their input data and results available electronically.

#### **B. Sea scallops**

Same as above for shrimp.

### **4. Additional questions not in the terms of reference**

As indicated in the Summary Report of the 45th Northeast Regional Stock Assessment Review Committee (SARC 45) prepared by the Panel, our review of the assessment summary documents was relatively lengthy even though the drafts supplied were well written. The solution to this problem is not obvious – not all staff of the Center can take part in all the sessions of all the assessment meetings. It is therefore to be expected, and appropriate, that local participants who have not been involved in the preparation of the assessment summary documents make suggestions at this stage of the process. It would not be appropriate, other than for factual error or stylistic reasons, that local participants make such changes at a later stage, after the public review has been held.

**Appendix 1: Background material**

ASFMC Northern Shrimp Technical Committee. 2004. Amendment 1 to Interstate Fishery Management Plan for Northern Shrimp.

ASFMC Northern Shrimp Technical Committee, Spear, B., and J. Link. 2007. Assessment Report for Gulf of Maine Northern Shrimp.

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.

Hart, D. R. 2001. Individual-based yield-per-recruit analysis, with an application to the Atlantic sea scallop, *Placopecten magellanicus*. *Canadian Journal of Fisheries and Aquatic Sciences* 58: 2351-2358.

Hart, D. R., and P. J. Rago. 2006. Long-Term Dynamics of U.S. Atlantic Sea Scallop *Placopecten magellanicus* Populations. *North American Journal of Fisheries Management* 26: 490-501.

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: Statement of Work

### Consulting Agreement between the University of Miami and Dr. Jean-Jacques Maguire

#### 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<sup>2</sup>. 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](mailto:David.Sampson@oregonstate.edu) and to Mr. Manoj Shivlani via e-mail to [mshivlani@rsmas.miami.edu](mailto:mshivlani@rsmas.miami.edu)

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<sup>2</sup> 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](mailto: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](mailto: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,
  - c. 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
  - d. 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.