CIE SARC-41 Review of stock assessments of summer flounder, bluefish and tilefish

Olav Rune Godø
Nordåsbrotet 116
N-5235 Rådal
Norway

Executive Summary

The SARC-41 meeting was arranged in Woods Hole, Massachusetts, on June 6-10, 2005. The assessments of the stocks of summer flounder, bluefish, and tilefish were presented and discussed during the meeting, and this report presents a review of the available material, including conclusions and recommendations.

The assessment of summer flounder is based on age-based data from the commercial and recreational fisheries, as well as from fisheries-independent data from several surveys. The assessment builds on adequate models and the sound evaluation of the available data. The SAW has adequately responded to the Terms of Reference, and the assessment is suitable as scientific advice for fisheries management. In the short term, it is recommended that new approaches to combining the survey indices should be investigated, and that the sensitivity of the assessment to changes in management regimes in recent decades should be analysed. In the long-term, it is recommended that efforts should be dedicated to improved ageing and studies of biological characteristics of importance to the assessment.

The bluefish assessment was rejected in 2004. Improvements in the models and analysis have been made but it has not been possible for the SAW to follow up many of the recommendations from the 2004 SARC meeting. There is still some uncertainty related to modelling, particularly regarding the input data. My conclusion is that the assessment presented is useful as scientific advice to management but that its conclusions need to be treated with great caution. Although improvements on the technical side of the assessment are possible, it is stressed that it will be difficult to establish a high-quality assessment with the available data. Several recommendations are made regarding action needed to improve data quality in the future, as well as for an analysis of the historic data that would improve the current assessment. In particular, there is a need to establish a measure of the uncertainty of the input data to enhance realism of the assessment.

The assessment of tilefish was made on the basis of fisheries data only. The most important time series besides the landings is the CPUE from the long line fleet. Even though the available data are limited, the SAW has done a thorough job in establishing models that extract the necessary information for giving an overall understanding of the development of the stock. The assessment is adequate and is suitable as scientific advice to management. It is recommended that additional analysis of the CPUE time series should be carried out, along with other measures of

effort. There is also a potential to improve the data quality through cooperation/partnership with the industry. The management should pay attention to the fact that the landings are presently based on one rich year class (1999) and the future of the fishery will depend on the strength of recruiting year classes.

Background

Summer flounder, bluefish and tilefish are harvested species that are assessed annually by stock assessment working groups (SAW) for the purpose of giving management advice. Different proportions of the catches of the three stocks are shared between commercial and recreational fisheries. Complexity is added to the assessment as several types of fishing gear are used. The challenges of designing adequate sampling protocols and establishing relevant models for the available data differ among the stocks. Tilefish were reviewed by SARC in 1992 and an assessment based on a surplus production model (ASPIC) was accepted. A summer flounder stock assessment was reviewed and accepted in 2000 and 2002. In contrast, for various reasons, the 2004 SARC-39 meeting rejected the bluefish assessment that had employed an ASPIC biomass dynamic model. The arguments included incorrect and/or inappropriate handling of the catch and recreational release data, inappropriate use of the biomass index from NEFSC, autocorrelation in the commercial catch rates indicating model misspecification and finally concerns about the sensitivity of the model. Several other concerns were on the agenda and were under evaluation by the 2005 SAW 41 (Northeast Stock Assessment Workshop) and the relevance of the actions taken has been an important review task for the SARC-41 meeting.

The SARC group had the material referenced in APPENDIX I available for review and was asked to evaluate the adequacy of the SAW's responses to the specified Terms of Reference (ToR) (see APPENDIX IV). Moreover, the external reviewers were asked to respond *especially with respect to the adequacy of the assessments reviewed in serving as a basis for providing scientific advice to management.*

Description of review activities

This review was divided into three tasks. *The preparatory part* consisted of studying the documentation supplied before the scheduled review meeting, which took about three full working days. This second task, *participating in the SARC-41 meeting*, took place at the Northeast Fisheries Science Center, Woods Hole, Massachusetts, from June 6 - 10, 2005. During this meeting the responsible persons for the various assessments presented the assessment reports, which were followed by a discussion, according to the programme shown below:

Monday
Opening/Welcome – James Weinberg SAW Chairman
Introduction Cynthia Jones, SARC Chair

Presentations:
Summer flounder – Mark Terceiro
Discussion organized by Cynthia Jones

Tuesday
Bluefish – Jessica Coakley

Discussion organized by Cynthia Jones

Golden Tilefish – Paul Nitschke
Discussion organized by Cynthia Jones

Wednesday
Revisit pending issues
Discussion organized by Cynthia Jones

Discussions were ended at lunchtime.

The third task, *organizing and writing the report* was completed in Bergen, Norway by the given deadline (June 24) (in total, about six working days).

Summary of findings

A summary of findings is organised by stock. Potential action points are marked in italics and will be further dealt with in the Conclusions and Recommendations sections. Recommendations are organised into those for immediate action and those for more long-tem concern. Priority is indicated by the order in which they appear. Attention is also paid to the existing list of research recommendations.

Summer flounder

The assessment report is clear and to the point, and it presents the necessary information. Graphics that present geographical patterns in the distribution of survey densities, catches and sampling would have guided an external reader into the details of the report.

Biology

Summer flounder grow fast and spawn early, and are distributed and exploited over the US continental shelf from Cape Hatteras to Maine. Challenges for monitoring are related to migration, stock structure and variations in growth and maturation. As the stock rebuilds, a change in distribution of old fish may make future assessments less certain. A constant maturation ogive is used for the whole time series. A stock going through large changes in size (Figure 2-2 of SARC-41 A1) as well as associated variation in weight at age (Figure 3-3 SARC-41 A1) is expected to show responses in maturation (see e.g. Trippel *et al.(* 1997)). A change in growth over time will also affect catchability in the surveys, which are size-dependent rather than age-dependent (see e.g. Godø and Sunnanå (1992)). This item is partly dealt with in Research recommendation #9 of the SAW report.
Gaps/needs: Pay particular attention to the distribution of older fish in future field activity during rebuilding of the stock. Information on the maturation ogive, including the reproductive capacity of the stock, should be updated. Growth-dependent factors in the assessment, like maturation and survey catchability, need attention.

Input data

The summer flounder stock is assessed using age-based models with catch input data from the commercial and recreational fisheries. Fisheries-independent data are available from 11 surveys, of which three are run by the Northeast Fisheries Science Center (NEFSC). Several issues related to the input data need further attention:

1. Landings and sampling. The working group document (A1) specifically focuses on the uncertainty of the landing statistics. This worldwide general problem needs attention simply because a change in fishermen's behaviour over time will damage the relationship between surveys and VPA and thus corrupt the assessment of the stock situation in recent years. Further, there are concerns about the effect of the change in management regime in the early 1990s in the direction of state-based management. The effect is not known but could be tested by time-series analysis with intervention.

   Gaps/needs: I suggest that it might be worthwhile pursuing an analysis of the survey/VPA time series with the aim of testing trends in this relationship that can be related to a potential change in the recording practices of commercial and recreational landings or to changes in the management regime.

   Furthermore, the fact that no age sampling exists from the recreational landings might affect the age frequency distribution of half of the total landings. Improved sampling of the recreational fishery is needed, at least to evaluate current practice.

   Gaps/needs: The validity of the use of age data from the recreational landings surveys needs to be tested.

   As reflected in the SAW report's list of research recommendations, there is a need for better data on discard mortalities from both fisheries. Such key factors in the assessment should not be assumed but should build on information from scientific studies.

   Gaps/needs: Carry out research to clarify discard mortalities in the commercial and recreational fisheries.

2. Fisheries independent data. The input to the assessment consists of 13 surveys of which only the three trawl surveys run by the NEFSC cover a substantial part of the population. The other surveys are state-based efforts covering fragments of the stock and thus reflect only local situations. The survey indices are currently used as independent measures of the state of the stock. This encompasses two fundamental problems: a) random variability of the indices (inconsistency) among surveys and years due to the inherent variability in survey trawl catches, and b) index variability, caused by fragmentary coverage of the population by the various surveys. Apparently, some initial analysis has been done to permit a more coherent analysis of the survey data, but this has not yet reached the stage of being applied in the stock assessment. I think this is an urgent issue. There are few reasons to believe that the various surveys produce a coherent signal of stock change over time, but rather that they reflect temporal and geographical variability in distribution of the stock. To improve the utilisation of the survey information, which may have a substantial impact on the assessment of stock size in recent years, I suggest two new approaches that might improve the situation. The first and probably easiest approach is to integrate the triplicate stock coverage per year by the NEFSC surveys into one single input to the assessment. To do this better than at present there might be a need to test methods of integration that involve both statistical and knowledge-based approaches (and combinations of these) to

take into consideration, for example, the ability of different surveys to reflect recruitment. Inclusion of the effects of environmental factors might improve the outcome. The second challenge is to extract information from state survey cruises. As these indices probably partly reflect the temporal and spatial variability of the stock they should thus not be used as independent indices. However, assuming that they reflect the stock situation in a given year in the location concerned, they could all go into a combined coastal index. The idea must be to create a robust signal of abundance change over the whole range of distribution of the stock. If my understanding is correct, this index would be most appropriate for tracking variation in recruitment. In combination with the index developed for the offshore surveys, the fisheries-independent input to the stock assessment could be substantially improved. It should be stressed that I am suggesting just one overall combination approach, although others might be just as valid.
Gaps/needs: To improve the efficiency of the survey data in the assessment there is an urgent need for a novel look at various methodologies for combining the available survey indices.

Aging. When a stock is rebuilding and more old fish appear in it, a sharper focus is needed on obtaining precise age information from this part of the stock.
Gaps/needs: Therefore scales vs. otoliths for aging the fish needs consideration.

Assessment and reference points

The assessment has been updated using the same models as used in earlier assessments (ADAPT VPA and AGEPRO). The approach chosen seems to have a sound basis and has been run with a thorough knowledge of the strengths and weaknesses of the model and the available data. Some concerns have been raised in the assessment report (A-3) about trends of persistent underestimation of F/overestimation of biomass found in the retrospective analysis. Although this is not necessarily a matter for concern, it has been reported from several other stock assessments and is worth attention (see e.g. Nakken (1998)).

Gaps/needs: A second look at the problem should include a search in the literature for alternative methods of tackling the problem.

The re-evaluation of the reference points by standard and alternative methodologies as well as updated data offered new insight and input of importance to management (Table 3.3, 3.4 in A-1). The recommendation to adopt the new reference points from the empirical non-parametric approach in the Fisheries Management Plan seems well founded. The positive development of the stock as reflected in the biomass assessment (Fig. 2-2) is also underlined by the growing proportion of older fish in the stock (Fig. 2-3).

Bluefish

The SAW 41 document on bluefish gives a thorough presentation of the analysis, and together with the presentation at the SARC meeting the action taken in relation to the ToR during the 41 Northeast Stock Assessment Workshop was clarified. Particular

attention was paid to the fact that the SARC 39 rejected the previous bluefish assessment in 2004.

Biology
Bluefish is a pelagic species living in the surface layers. This is a schooling fish and is highly migratory, with seasonal migrations north and south along the coast. It is found in estuaries as well as offshore. Although its general pattern of migration is known, accurate knowledge of its migration behaviour is scarce. A programme of employing archival tags for recording environmental conditions during migration could give us a substantially better data base for understanding distribution patterns. This could become an important input to a distribution and migration model for this species. The goal should be to establish a tool for improving survey and sampling regimes for this species.

Gaps/needs: Start a tagging program with archival tags with the goal of establishing quantitative understanding of bluefish migration and distribution.

Data
Bluefish are assessed using age-based models with catch input data from commercial and recreational fisheries. Fisheries-independent data are available from 13 surveys, some of which are carried out several times a year. Catches come from commercial as well as recreational fishermen and recreational fisheries are responsible for the largest landings.

1. Landings and sampling: As the recreational fishery dominates and as the sampling of recreational catches is most liable to error, there is a strong need for further attention to this aspect, as suggested in the recommendation of SAW 41. Otolith sampling is very limited. Sampling is from commercial catches (gill-nets presumably) and is applied across gears and years. Some evidence, but far from convincing, has been presented in support of this practice. Furthermore, the assumption that the size distributions of the releases are equal to the fish kept needs further attention, as the amount of releases increases. The whole sampling regime and the assumptions associated with it need to be revised.

Gaps/needs: Intensify otolith sampling in both fisheries and analyse the validity of the current practice of combining age samples over years and gears (underlines existing recommendation).

2. Fisheries-independent data: Fisheries-independent data need attention in relation to: a) the present approaches to survey index analysis, and b) evaluation of the adequacy of the methodologies employed.
   a. Development of alternative approaches to index analysis: This is already included as one of the recommendations in document B-1 from SAW 41. I would stress the thoughts expressed in the summer flounder section. Due to the biology of this species one would expect even more fragmented information from surveys covering limited areas. Individual surveys that lack coherent and similar signals, should therefore not necessarily be discarded. A joint signal from a combination of surveys could prove useful (see Summer Flounder above).

Gaps/needs: Continue the analysis of survey data with the aim of establishing combined indices.

b. Evaluation of the adequacy of survey methodologies: The available fisheries-independent information was not designed for bluefish. Catch per unit effort statistics from mobile gear such as trawls very seldom work efficiently for pelagic species like bluefish. The dynamic change in the temporal and spatial distribution patterns of these species implies that catches normally reflect local distribution conditions rather than the fish density in the area, particularly for adults. It is to be hoped that this issue will be resolved as proposed under a). Although my knowledge about this species is limited I consider it likely that new analysis will indicate that the available fisheries independent information is inadequate for the stock assessment of bluefish. However, there exist several other ways of collecting fisheries-independent data from pelagic species, and these should be evaluated.

- Lidar is a laser-based technique, normally airborne, that can record marine organisms down to depths of 40-50 m under reasonably good conditions. A survey over the area can thus be done quickly but would need validation from simultaneous vessel effort (Churnside *et al.* 2003; Churnside and Okumura 2001). Such a survey could probably be useful for other pelagic species and should not be evaluated as an effort on bluefish alone.
- Organise a standardised catch per unit effort survey involving recreational fishermen; e.g. as a recreational fishing festival. This could give a good coverage of the coast at a specific time. Simultaneous biological sampling of catches could provide valuable information for use in the assessment.
- The use of tagging for assessment purposes has already been proposed in the SAW 41 paper. New technology opens up new opportunities that need further exploration before decisions on the type of tag and tagging strategies are taken. By using the fish available under the previous item the programme could provide new information about size compositions of releases and more realistic release mortality in the recreational fishery.
- Sonar technology that searches the surface layers for pelagic fish could be run during standard scientific assessment surveys. Sonar techniques are becoming common in assessments of pelagic species (see e.g. Misund and Coetzee 2000) and will very soon support calibrated instrumentation for assessment purposes.

Gaps/needs: Evaluate alternative fisheries independent assessment methodologies and their potential in relation to blue fish stock assessment. If a workshop on analysis of survey indices is organised, this item could be added to the agenda.

3. Ageing: Both scales and otoliths have been used for ageing. Rebuilding the stock would leave relatively more fish in the 6+ group. The assessment requires resolved age information about this group of fish to follow the development of individual year classes.

Gaps/needs: Establish reliable ageing methodology with otoliths so that assessments over time can include older fish.

Assessment and reference points

The SARC 39 meeting rejected the 2004 assessment both due to inappropriate handling of the data and inherent problems with the applied models. New development and tests of models have since been carried out. The ADAPT and ASAP models have been focused on, while a set of other models has been rejected. The SAW 41 concluded that the ASAP model is the most appropriate. The quality of the assessment derived from these models is still unclear. The uncertainty of the data, particularly the recreational catch information, has been considered but is still not adequately elucidated. My particular concern is the validity of the assessments in recent years. The report states, for example, that the survey indices have been excluded from the ADAPT model without any substantial consequences for the outcome of the assessment. This is not surprising given the quality of the survey data. Moreover, splitting survey indices by length with the same age-length key as used in the catch matrix is an inappropriate double use of data that are assumed to be independent. Nevertheless, it is positive that the two models give comparable results. Thus, in essence, management must here rely on an assessment that is totally dependent on the shaky data from commercial and recreational landings and discards. The assessment offers an optimistic view of the stock, with a positive development since the mid 1990s, with increased stock abundance and reduced fishing mortality. An expected effect on the stock would be an accumulation of larger fish in the catch. This is apparently not occurring. The actual reason for this, whether poor data quality or inadequate modelling, remains uncertain.

Gaps/needs: There is still a need to continue the development of appropriate models for this stock. This development ought to be seen in relation to the improvement in the data available for the assessment and must include better quality assessment data.

The bluefish assessment builds on and is driven by the assumptions associated with the catch statistics, the release and survival figures and the exploitation pattern as discussed above. In such cases the results will depend more on the adequacy of the assumptions than on the actual choice of model. In the case of bluefish there also seem to be problems with the consistency of the results; for example, it appears to be difficult to track strong and/or weak year classes over years (B1 Table 9). Nevertheless, it seems reasonable to conclude that the exploitation is under control. Although the conclusion that the stock is not overfished nor is it experiencing overfishing is technically correct according to the model output, there is every reason to show caution until a better basis for the assessment has been developed.

Tilefish

Tilefish differ from the other species under review in that their distribution pattern (deep water), exploitation (mainly by a few commercial long-liners) and the lack of age sampling do not permit the use of an age-structured assessment model. This represents different challenges for modelling than are presented by the two other species.

Biology
The biology of this species is largely unknown. Its exploitation history is long (beginning of 20th century) but features of its biology of importance to assessment and management are still not documented. For example, data on sex ratios, maturation ogives and fecundity are fragmented, while behavioural characteristics of importance to its availability to fishing gears are scarce. Just as important, we know little of the behavioural characteristics that are utilised by the fishermen, e.g. segregation by size or age that makes year-class targeting possible for the long liners. As the assessment depends on a CPUE index, there is a great need to improve our understanding of the response of the index to year-class strength, changes in fishermen's strategies, etc. Of specific concern are sex differences in growth and maturation that might cause an unbalanced exploitation by sex.

Gaps/needs: *A long-term goal should be to build up our knowledge of the general biology of this species by means of periods of more intense sampling of catches, e.g. as proposed in the Research Recommendation of SAW 41(#4-5).*

Data
The assessment is based on landings and length sampling. An effort time series from the commercial fisheries and the associated CPUE series also is essential for better understanding of trends in stock abundance. Catch sampling has improved in recent years, but the errors and difficulties associated with the effort measure in the CPUE index remains unchanged. Long line is a passive gear and CPUE measures need particular attention due to nonlinearity in most common measures of effort. Simple factors such as gear saturation (Somerton and Kikkawa 1995), territorial or bait defence (Godø *et al.* 1997) are just two examples of factors that may corrupt the index when substantial changes in stock occur.

Gaps/needs: Improve knowledge of the linearity of the catch and effort relationship. Should be included as a topic under the proposed Research Recommendation of SAW 41(#4-5)

It is also a well-known fact that changes in technology and fishermen's behaviour patterns tend to weaken the effects of reduced catch rates. Thus, using days at sea as a measure of effort might result in biased CPUE data. Trying other measures such as the number of hooks or amount of bait might be useful. However, there is a need to collect qualitative and quantitative data on technological and behavioural changes in the fleet. As this is a very small fleet, an interview project could provide very valuable data using limited resources.

Gaps/needs: Collect better information on effort through more detailed information about technology and behavioural changes in the fleet. An interview programme involving companies/vessels that have been engaged in the fishery for a long time could probably provide the information required.

No fisheries-independent data exist, so the quality of the CPUE index is of the utmost importance. This fishery represents an ideal situation with few vessels involved and one dominant gear used. Under these conditions it is clear that a detailed knowledge of the actual effort used in the fishery could be provided through partnership/cooperation with the fleet. This could facilitate the production of a CPUE

time series with a much better effort assessment in the future than the one used in the present assessment.

Assessment and reference points
The latest review of the tilefish assessment was in 1998 by the MAFMC Science and Statistical Committee. Since then, a surplus production model has been the basis for the tilefish management plan and runs with AIM and LRSG have been evaluated. The assessment seems to be sound and relevant, given the available data. The ASPIC assessment is supported by similar results from the two new models. However, the models will be vulnerable to systematic temporal trends in the data that may bias the CPUE information (see above). Such effects should be further evaluated. The fishery seems to be dominated at present by one strong year class (1999) that is responsible for the improved CPUE as well as for larger landings in recent years. This will have to be taken into consideration when a management plan for the stock is drawn up.

Gaps/needs: Test effects on the assessment caused by potential trends in the effort data.

Conclusions and Recommendations

Summer flounder

Adequacy for ToR: The SAW has responded adequately to all ToRs, although not all research recommendations have been completed (described in section 4 of the SAW report.

Conclusion: The assessment is adequate and is suitable as scientific advice to management.

Recommendations

Immediate

1. To improve utilisation of the survey data in the assessment, there is an urgent need to take a new look at various methodologies for combining the available survey indices.
2. I suggest that it might be worthwhile to pursue an analysis of the survey/VPA time series with the aim of testing trends in this relationship that can be related to a potential change in recording practice of commercial or recreational landings or from changes in management regime that took place in the 1990s.
3. The validity behind the use of age data from the surveys in the recreational landings needs to be tested.
4. Further research should be carried out on discard mortality rates in commercial and recreational fisheries. This is an uncompleted item on the SAW report list of research recommendations.
5. A second look at the retrospective pattern in the assessment should include a search in the literature for alternatives for tackling the problem.

Long-term

1. The use of scales vs. otoliths for aging the fish needs further consideration – immediate action is needed but accessibility of applicable results may take time.
2. Pay particular attention to the distribution of older fish in future field activity during rebuilding of the stock. Information on the maturation ogive, including the reproductive capacity of the stock should be updated. Growth-dependent factors in the assessment, e.g. maturation and survey catchability, need attention.

Bluefish

Adequacy in relation to ToR. All given ToR items have been taken into account in the working group. Progress has been made in all of them but there is still a strong need to intensify work on establishing adequate modelling tools. In particular, there is a strong need to improve data quality and to establish measures of this quality.

Conclusion: The assessment of this stock is based on data of very variable quality. Furthermore, several questions were raised on how these data have been used in the assessment. In accepting the proposed reference points and the updated assessment, the SAW concluded that the bluefish stock would not be considered overfished nor was it experiencing overfishing. Although this is technically correct, the overall data underlying the assessment appear weak and call for caution. The assessment could be improved as suggested above, but this would hardly improve the reliability of the results. My conclusion is therefore that, under the current situation the available assessment supplies adequate information for the management of this stock, but the results need to be treated with caution. Immediate action is needed to improve the quality of the catch and survey data and the most influential assumptions all need validation.

Recommendations

Immediate

1. Intensify otolith sampling in both the commercial and recreational fisheries and analyse the validity of the current practice of combining age samples across years and gears (underlines existing recommendation).
2. Intensify the analysis of survey data with the aim of establishing combined indices. The analysis should include a variety of combinations of indices as suggested above. As the recommendations are similar for summer flounder, a workshop involving both stocks could be useful.
3. Evaluate alternative fisheries-independent assessment methodologies (lidar, tagging, standardized recreational CPUE, sonar) and their realistic use in relation to blue fish stock assessment. If a workshop on the analysis of survey indices is organised, this item could be added to the agenda.
4. There is still a need to develop appropriate models for this stock. This should include assessment of uncertainty and sensitivity based on the available input data. This study must continue to test the quality of the new and improved data that might become available for the assessment.

Long-term

1. At the top of last year's recommendations was one to collect information on release mortalities in recreational fisheries. Although immediate action is needed here, which should be coordinated with the tagging recommendation #3 below, it might take time to make results available for an assessment.
2. Develop a standardized CPUE survey index based on recreational fishermen catch and effort.
3. Start a tagging program with archival tags with the goal of establishing quantitative understanding of bluefish migration and distribution.
4. Establish reliable aging methodology using otoliths, so that assessment over time can include older fish.

Tilefish

Adequacy in relation to ToR: The tilefish assessment reflects responsiveness to the given ToRs. The decision not to produce a long-term projection (ToR 5) is correct, given the available data and models. ToR 6, concerning the research recommendation is adequate, but an update according to the recommendation below might be appropriate.

Conclusion: The tilefish assessment is based on a limited data source but its results have been reached through realistic models and sound evaluation of the data. The assessment is adequate and is suitable as scientific advice to management. Particular attention should be paid to the fact that the catches are now dominated by one strong year class (1999), and the stock development in the near future will depend on the strength of recruiting year classes.

Recommendations

Immediate

1. Improve knowledge of the linearity in the catch and effort relationship. This could be included as a topic under the existing Research Recommendation of SAW 41(#4-5), which will need vessel effort.
2. Test effects on the assessment of trends in the effort data.

Long-term

1. A long-term goal should be to build up our knowledge of the general biology of this species through periods of more intense sampling of catches, as proposed in the Research Recommendation of SAW 41(#4-5).
2. Gather better information on effort through more detailed information about technology and behavioural changes in the fleet. An interview programme involving the companies/vessels that have been in the fishery for a long time could probably provide the information required.
3. Establish a long-term cooperation/partnership with the fleet or individual skippers with the aim of replacing the existing effort measures with individual vessel effort, based on detailed information available from the most active fishing vessels.

References

Churnside, J.H., Demer, D.A., and Mahmoudi, B. 2003. A Comparison of Lidar and Echosounder Measurements of Fish Schools in the Gulf of Mexico. Ices Journal of Marine Science, 60: 147-154.

Churnside, J. H. and Okumura, K. S. 2001. A comparison of airborne LIDAR and echo sounder performance in fisheries. J.Marine Acoust.Soc.Jpn. 28(3): 49-61.

Godø, O. R., Huse, I., and Michalsen, K. 1997.Bait defence behaviour of wolffish and its impact on long-line catch rates. ICES Journal of Marine Science, 54: 273-275.

Godø, O. R. and Sunnanå, K. 1992.Size selection during trawl sampling of cod and haddock and its effect on abundance indices at age. Fisheries Research, 13: 293-310.

Misund, O. A. and Coetzee, J. 2000. Recording fish schools by multi-beam sonar: potential for validating and supplementing echo integration recordings of schooling fish. Fisheries Research, 47(2-3): 149-159.

Nakken, O. 1998. Past, present and future exploition and management of marine resources in the Barents Sea and adjacent areas. Fisheries Research, 37: 23-35.

Somerton, D. A. and Kikkawa, B. S. 1995. A stock survey technique using the time to capture individual fish on longlines. Canadian Journal of Fisheries and Aquatic Sciences, 52: 1-11.

Trippel, E. A., Morgan, M. J., Frechet, A., Rollet, C., Sinclair, A., Annand, C., and Brown, L. 1997. Changes in age and length at sexual maturity of northwest Atlantic cod, haddock and pollock stocks, 1972 - 1995. Canadian Technical Report of Fisheries and Aquatic Sciences No.2157: 1-120.

APPENDIX I. Documents Reviewed for SAW/SARC-41, June 6-10, 2005, Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, MA

General Documents

Revisions to the Northeast Regional Stock Assessment Workshop –'Old' versus "new"

Terms of Reference for the 41st Northeast Stock Assessment Workshop, (approved March 18, 2005), SAW/SARC 41, June 6-10, 2005, NEFSC, Woods Hole, MA

Summer Flounder

A-1 Summer flounder: Stock assessment update and biological reference point estimation by SAW Southern Demersal Working Group, Mark Terceiro, NMFS/NEFSC

A-2 Summer Flounder Appendix A: Data Tables & Figures

A-3 Summer Flounder Appendices B: 1) ADAPT VPA Output, 2) AGEPRO Projection Output

A-4 SSC Committee Overfishing Definition (2001)

A-5 A; Summer Flounder, SAW/SARC-35 Report (2002), NEFSC Reference Document 02-14

A-6 Stock Assessment of Summer Flounder for 2003 by Mark Terceiro, August 2003, NEFSC Reference Document 03-09

A-7 SAW Southern Demersal Working Group 2004 Summer Flounder Assessment Summary, June 21, 2004

A-8 Re-evaluation of biological reference points for New England groundfish by Working Group on Re-Evaluation of biological reference points for New England groundfish, March 2002, NEFSC Reference Document 02-04

SARC/SAW-41 2 Powerpoint presentations by Mark Terceiro, June 6, 2005

SARC/SAW-41 Summer Flounder Rapporteur Report by Kathy Sosebee

Bluefish

B-1 B: Working paper for blue stock assessment 41st Northeast Stock Assessment Workshop working document for Stock Assessment Review Committee, June 6-10, 2005

B-2 Corrections to paper B1: Corrections to Paper B1: Bluefish SAW-41 Working Group Stock Assessment Report (May 24, 2005)

B-4 C: Bluefish SARC Report SAW/SARC-23 (1996)

B-5 Report on the 39th Northeast Regional Stock Assessment Workshop (SAW-39) Stock Assessment Review Committee (SARC) Meeting by Andrew I.L. Payne, SARC-39 Chair

SARC/SAW-41 Powerpoint presentation by Jessica Coakley, June 7, 2005

SARC/SAW-41 Bluefish Rapporteur Report by Gary Shepherd

Tilefish

C-1 Assessment of golden tilefish, *Lopholatilus chamaeleonticeps*, in Middle Atlantic-Southern New England Region, SAW 41 SARC Working Paper C1, a report of the Southern Demersal Working Group, NMFS/NEFSC

C-2 Golden Tilefish Summary Report, SARC 41

C-3 Assessment of tilefish in the Middle Atlantic-Southern New England Region by Paul Nitschke, Gary Shepherd, and Mark Terceiro (1998) for S&S Committee Review

C-4 G. Tilefish (Background SAW/SARC 16)

SARC/SAW-41 Powerpoint presentation by Paul Nitschke, June 7, 2005

SARC/SAW-41 Powerpoint presentation by John Brodziak, June 7, 2005

SARC/SAW-41 Tilefish Rapporteur Report by Laurel Col

APPENDIX II. Material references but not available at the SARC-41 meeting

Churnside, J.H., Demer, D.A., and Mahmoudi, B. 2003. A Comparison of Lidar and Echosounder Measurements of Fish Schools in the Gulf of Mexico. ICES Journal of Marine Science, 60: 147-154.

Churnside, J. H. and Okumura, K. S. 2001. A comparison of airborne LIDAR and echo sounder performance in fisheries. J.Marine Acoust.Soc.Jpn. 28(3): 49-61.

Godø, O. R., Huse, I., and Michalsen, K. 1997.Bait defence behaviour of wolffish and its impact on long-line catch rates. ICES Journal of Marine Science, 54: 273-275.

Godø, O. R. and Sunnanå, K. 1992.Size selection during trawl sampling of cod and haddock and its effect on abundance indices at age. Fisheries Research, 13: 293-310.

Misund, O. A. and Coetzee, J. 2000. Recording fish schools by multi-beam sonar: potential for validating and supplementing echo integration recordings of schooling fish. Fisheries Research, 47(2-3): 149-159.

Nakken, O. 1998. Past, present and future exploition and management of marine resources in the Barents Sea and adjacent areas. Fisheries Research, 37: 23-35.

Somerton, D. A. and Kikkawa, B. S. 1995. A stock survey technique using the time to capture individual fish on longlines. Canadian Journal of Fisheries and Aquatic Sciences, 52: 1-11.

Trippel, E. A., Morgan, M. J., Frechet, A., Rollet, C., Sinclair, A., Annand, C., and Brown, L. 1997. Changes in age and length at sexual maturity of northwest Atlantic cod, haddock and pollock stocks, 1972 - 1995. Canadian Technical Report of Fisheries and Aquatic Sciences No.2157: 1-120.

APPENDIX III.

Statement of Work
Consulting Agreement between the University of Miami and Dr. Olav Godø

May 5th, 2005

General

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

The Center for Independent Experts (CIE) shall provide a panel chair and three panelists for the 41st Stock Assessment Review Committee panel. The panel will convene at the Woods Hole Laboratory of the Northeast Fisheries Science Center in Woods Hole, Massachusetts, the week of 6 June 2005 (June 6-10) to review assessments for bluefish (*Pomatomus saltatrix*), tilefish (*Lopholatilus chamaeleonticeps*) and summer flounder (*Paralichthys dentatus*).

Specific Activities and Responsibilities

The CIE's deliverables shall be provided according to the schedule of milestones in the table below. The final reports from the CIE will provide key information for a presentation to be made by NOAA Fisheries at meetings of the New England and Mid-Atlantic Fishery Management Councils in August and September 2006. The chair's duties shall occupy a maximum of 19 days (i.e., several days prior to the meeting for document review; the SARC meeting in Woods Hole; and several days following the meeting to review the individual panelist's Review Reports and produce the Summary Report). This report shall be a summary of the individual Review Reports, accurately and fairly representing all viewpoints. There shall be no attempt by the Chair to develop a consensus report.

Each panelist's duties shall occupy a maximum of 14 workdays (i.e., a few days prior to the meeting for document review; the SARC meeting; and a few days following the meeting to prepare a Review Report). The SARC Review Reports will be provided to the SARC Chair, who will produce the Summary Report based on the individual Review Reports.

Roles and responsibilities:

(1) (Chair and Panelists) Prior to the meeting: review the reports produced by the Working Groups.
(2) (Panelists) During the meeting: participate, as a peer, in panel discussions on assessment validity, results, recommendations, and conclusions especially

with respect to the adequacy of the assessments reviewed in serving as a basis for providing scientific advice to management.

(3) (Panelists) After the meeting: prepare individual Review Reports, each of which provides an executive summary, a review of activities and, for each stock assessment reviewed, a summary of findings and recommendations that emerge from the findings, all in the context of responsiveness to the Terms of Reference for each assessment. Advice on additional questions that are directly related to the assessments and are raised during the meeting should be included in the report text. These additional topics/issues should be listed along with the original Terms of Reference in a separate appendix attached to the report. See Annex 1 for further details on report contents and milestone table below for details on schedule. No later than June 24, 2005, these reports shall be submitted to the CIE for review[1] and to the Chair for summarization. The CIE 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.

NEFSC staff and the SAW Chairman will be responsible for the production of the final SARC report, which will include the Chair's Summary Report and the individual panelist's Review Reports. 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 SAW41 Chairman:
Dr. James R. Weinberg, NEFSC, Woods Hole, MA. 508-495-2352, James.Weinberg@noaa.gov

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

ANNEX 1: Contents of Panelist Report

1. The report shall be prefaced with an executive summary of findings and/or recommendations.

2. The main body of the report shall consist of a background, description of review activities, summary of findings, conclusions/recommendations, and references.

3. The report shall also include as separate appendices the bibliography of all materials provided during SAW 41 and any papers cited in the Panelist's Report, along with a copy of the statement of work.

4. The report shall also include as a separate appendix the Terms of Reference used for SAW 41, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panelist advice.

APPENDIX IV. Terms of Reference (ToR)
Terms of reference for the assessment WG of various stocks were as follows:
Summer flounder

1. Update the summer flounder assessment models (i.e. ADAPT VPA and AGEPRO projection) using the same configurations as those used in the 2004 SAW Southern Demersal Working Group (WG) assessment update.
2. Estimate biological reference points derived by yield and SSB per recruit analysis and by stock-recruitment modeling, following the procedures adopted by the 2002 Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish.
3. Consider the recommendations of the MAFMC Science and Statistical Committee (SSC) 2001 peer review of the summer flounder Overfishing Definition in developing the analyses described in ToR 2. The major recommendations were to explore other proxies (besides Fmax) to FMSY, to continue stock-recruitment model development as additional stock-recruit estimates become available, and to monitor and utilize new data on the population dynamics of summer flounder (e.g., age, growth, and maturity) as they become available.
4. Review, evaluate and report on the status of the SARC/Working Group research recommendations offered in previous SARC and WG reviewed assessments.

Bluefish

1. Evaluate adequacy, appropriateness, and uncertainty of fishery-dependent and fishery independent data used in the assessment.
2. Evaluate adequacy and appropriateness of models used to assess the stock and to estimate population benchmarks.
3. Evaluate and/or update biological reference points as appropriate.
4. Estimate and evaluate stock status (biomass) and fishery status (fishing mortality rates).
    a. Is the stock overfished?
    b. Is overfishing occurring?
5. Develop recommendations for improving data collection and for future research.

Tilefish

1. Characterize the commercial catch including landings and discards. Characterize recreational landings.
2. Estimate fishing mortality and total stock biomass for the current year and characterize the uncertainty of those estimates.
3. Evaluate and either update or re-estimate biological reference points as appropriate.
4. Where appropriate, estimate a constant TAC and/or TAL based on stock status for years following the terminal assessment year.
5. If projections are possible,
    a. provide seven year projections of stock status under various TAC strategies and
    b. evaluate current and projected stock status against existing rebuilding or recovery schedules, as appropriate.