Report on the Assessments of Goosefish and Weakfish
40th SARC, November 29 – December 2, 2004
NEFSC, Woods Hole

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EXECUTIVE SUMMARY

This report provides an independent scientific review of the 2004 assessments of goosefish and weakfish stocks off the US East Coast, at the request of the Center for Independent Experts (CIE). The author was provided with draft stock assessment reports and web access to relevant files and documents (Appendix 4), and participated in the 40th Stock Assessment Review Committee (SARC 40) Meeting, November 29 – December 2, 2004, NEFSC, Woods Hole, MA. The remit of the CIE panelists was summarized by Terry Smith, SAW Chairman, as being simply to "judge the adequacy of the presented assessments in providing scientific advice useful for management".

Goosefish

The Terms of Reference for the goosefish assessment were adequately addressed. The absence of historic catch-at-age data precludes the use of a number of standard assessment approaches. An age-aggregated Bayesian production model is under development, but is not yet at a stage where it can be used for providing scientific advice on the status of this stock. The current assessment is relatively rich in terms of fishery-independent age-disaggregated indices. Although there is some concern regarding the low incidence of goosefish in these research trawl sets, the data are worthy of more intensive analysis than has been undertaken. The assessment concluded, based on a simple analysis of the NEFSC autumn trawl survey index series that neither the northern or southern component of the stock is currently overfished. This conclusion is supported, however it should be pointed out that there is a 44% probability that the southern component is below Bthreshold. The assessment concluded that it could not determine whether or not overfishing was taking place because of uncertainty in the estimates of fishing mortality. There is indirect evidence to indicate that overfishing may be taking place, particularly in the northern area.

The following recommendations are made with respect to future assessments:
- Development of catch-at-age data from observer samples should be given priority.
- Age-disaggregated survey indices should be used to a greater degree to derive relative estimates of stock size and absolute estimates of fishing mortality.
- Research should continue on the development of the Bayesian production model.
- Consideration should be given to carrying out a single assessment of the combined stock and the incorporation of Canadian survey and catch data on monkfish from the northern portion of the area covered by the NEFSC bottom trawl survey.

Weakfish

The Terms of Reference for the weakfish assessment were not adequately addressed. The assessment was incomplete and could not be reviewed by SARC in a conventional manner. An attempt was made to provide some useful comments based on previous assessments and the work carried out thus far on the 2004 assessment. An assessment carried out in 1999 (SAW 30) based on an ADAPT analysis found that weakfish were at

a high level of abundance and subject to low fishing mortality. An update in 2002 extended the ADAPT analysis to 2001 and came to similar conclusions. In both assessments concerns were expressed regarding strong retrospective bias in estimates. Nevertheless, it was considered that the stock was well above the proposed Bthreshold. A review of the inputs to ADAPT showed that they are very noisy and that previous ADAPT treatments are likely unreliable. Changes to the FMP appear to have had a significant impact on the selectivity of the fishery and in the relationship between a recreational fishery catch rate index and stock size which has not been resolved. A more selective treatment of the input data after careful scrutiny may improve the ADAPT formulation and lead to more acceptable diagnostics, however the uncertainty in the catches and the changes in the fishery that have resulted from Amendment 3 suggest that a statistical catch-at-age approach may be more appropriate for the assessment of this stock.

The following recommendations are made with respect to future assessments:
- ➢ An intensive analysis of the coherency among age disaggregated inputs should be carried out and used as a basis for formulating future analytical assessments.
- ➢ An attempt should be made to resolve the discrepancy between catch-independent survey indices and indices derived from recreational fishery catch rate statistics.
- ➢ The suitability of statistical catch-at-age approaches should be explored in which uncertainty in the catches and changes in the selectivity of the fishery can be taken into account.

1. BACKGROUND

This report reviews the 2004 assessments of goosefish and weakfish stocks off the US East Coast, at the request of the Center for Independent Experts (CIE), operated from the Cooperative Institute for Marine and Atmospheric Science (CIMAS) at the University of Miami (see Appendix 5). The author was provided with draft stock assessment reports and web access to relevant files and documents (Appendix 4), and participated in the 40th Stock Assessment Review Committee (SARC 40) Meeting, November 29 – December 2, 2004, NEFSC, Woods Hole, MA. The remit of the CIE panelists was summarized by Terry Smith, SAW Chairman, as being simply to "judge the adequacy of the presented assessments in providing scientific advice useful for management".

Terry Smith, Northeast Regional Stock Assessment Workshop Chairman, provided excellent support to the CIE reviewers throughout the meeting. CIE staff at the University of Miami provided professional expertise in administering the review.

2. REVIEW ACTIVITIES

The SARC 40 meeting was held at the Aquarium Conference Room - Northeast Fisheries Science Center, Woods Hole, Massachusetts from 29 November to 2 December 2004. The Panel membership is listed in Appendix 1. The agenda for the meeting is given in Appendix 3. The meeting was open. Attendees included the SAW Chairman, SARC Chairman, three panelists, the assessment presenters and the rapporteurs. There were few observers and none from the fishing industry. The draft assessment for the goosefish was presented to the Panel and other attendees, and the input data, models, parameter estimates and biological reference points were evaluated through open discussion. The Chair and panelists discussed the strengths and weaknesses of the assessments with the presenters. The goosefish assessment was complete. The scup assessment was withdrawn. The weakfish assessment was incomplete and could therefore no conclusive evaluation was possible. Review was provided on the work carried out to date as presented in numerous documents (Appendix 4). The Terms of Reference for each stock (Appendix 2) were reviewed to ensure they had been fully addressed, and recommendations were made with regard to future assessments.

3. FINDINGS

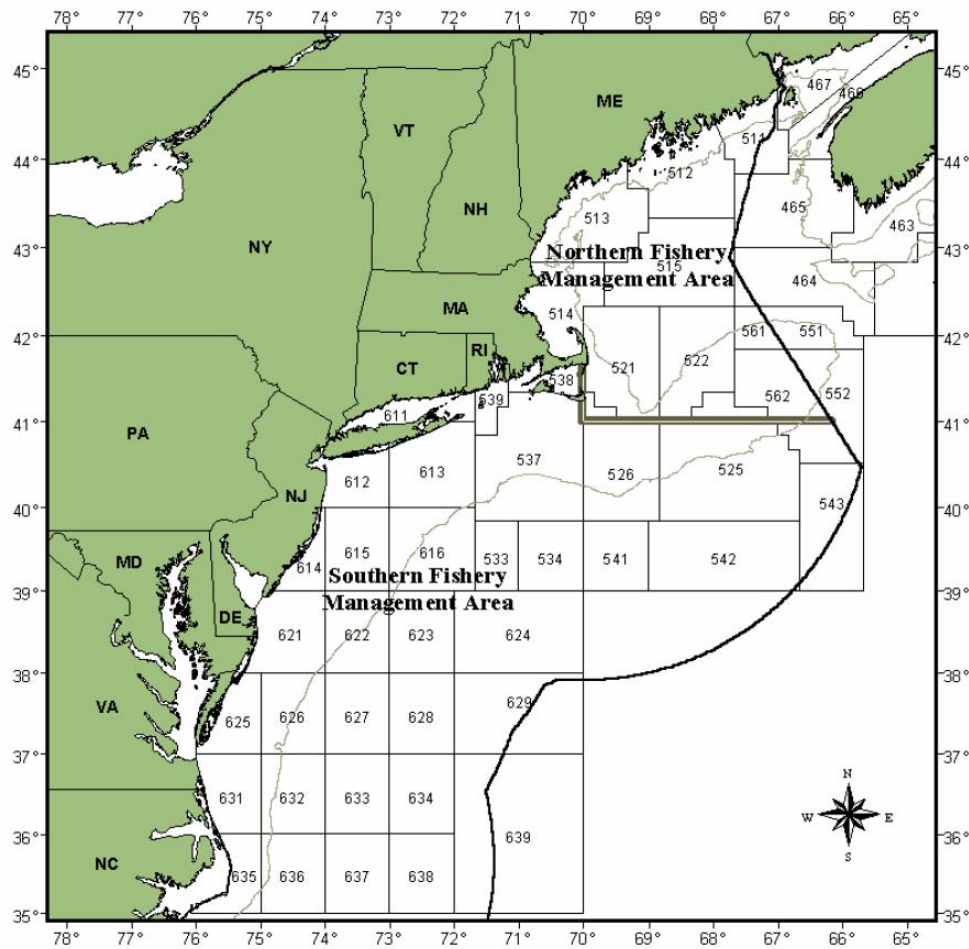### 3.1 Goosefish

3.1.1 Summary

Goosefish are currently under a 10 year rebuilding plan which commenced in 1999 and which specified fishing mortality reductions through setting of TACs and trip limits.

Overfishing: The current Fthreshold is set at Fmax=0.2 for both north and south components. Fthreshold is defined as the rate of fishing that does not exceed the rate associated with the MSY control rule (the harvest strategy which would be expected to result in a long-term average catch approximating MSY). Overfishing is occurring when F exceeds F threshold. Reliable estimates of F were not obtained in the current assessment so the Working Group considered that it was not possible to determine whether or not overfishing is taking place. Landings have increased steadily in the north since 1998 and reached a historic high value in 2003. In the south there was a substantial decrease in landings between 1998 and 2002, and 2003 landings are about half the peak value. Total landings (north and south combined) are close to the historic highest value and when discards are added (current ratio of caught to discarded is 1:0.239), catches are at the highest level over the period 1996 to 2003, the period for which discard data are available in the assessment document. Fishing mortality estimates from the current assessment are certainly very variable, however estimates from both Heinke's method and for exploitation rate from the cooperative survey point to the <u>possibility</u> that overfishing could be occurring. The decline in the maximum length of fish in the surveys may also be of concern in the context of overfishing. The increased trend in landings in the northern area is of particular concern and more overfishing in the north compared to the south is supported by the ratio of exploitation rates in the two areas (2:1) estimated from the 2004 cooperative survey data   The possibility of overfishing is further supported by the observation that rebuilding has tailed off in both stock areas at a level which is below the Bmsy proxy implying that F>Fmsy. Support for the notion that overfishing is occurring in the northern area can also be found in the preliminary results from the Bayesian surplus production model. Because of the uncertainty in the data it is not possible to show directly that overfishing is not taking place. There is indirect evidence to indicate that it may be taking place. It would therefore be prudent to assume that overfishing <u>is</u> taking place until data and analyses can be provided to show, with sufficient probability, it is not.

In addition to the separate assessments of the north and south components, it would be useful to have a combined assessment of the stock as a whole. This could be extended further by including the Canadian data and assessing the stock as a transboundary stock under the US-Canada TRAC process. Note that the 2000 assessment by DFO of the Canadian component expressed concern over the decline in abundance of fish over 60cm and noted low survivorship from the late 1980s onwards. It is possible that a GLM approach applied to the combined data might provide more reliable estimates of fishing

mortality rate than that which is obtained using current approaches on separate components.

Overfished: Btarget is based on median of a 3-yr moving average of the NEFSC autumn bottom trawl surveys over the period 1965-1981. For the northern area this is 2.49 kg/tow and for the southern area it is 1.84 kg/tow. This is a proxy value for "the biomass level that is capable of producing MSY". Bthreshold is based on NEFSC autumn trawl survey indices and is the 33rd percentile of all weight per tow values over the period 1963-1994. For the northern area this is 1.46 kg/tow and for the southern area 0.75 kg/tow. Note this appears to be inconsistent with the NMFS guidelines which specifies Bthreshold = 1/2Btarget. Current smoothed weight per tow was found by the Southern Demersal Working Group to be at 2.06, above Bthreshold with a probability of 0.98 for the northern area and at 0.85, above Bthreshold with a probability of 0.56 for the southern area. Thus neither area is considered to be overfished. There is however a 0.44 probability that the southern area is overfished. Under a precautionary approach in which a low risk of serious harm is desired, this probability might be interpreted as being too high. Clearly both stocks have some way to go before they have rebuilt to Btarget and it is of concern that the recent increase now appears to have tailed off.

Map showing the separation of the northern and southern components of the goosefish stock with NEFSC survey strata overlaid. The US-Canada boundary is also shown.

3.1.2 Input data

The goosefish resource of the US NE coast is roughly divided into a northern and southern component by a line that bisects the Georges Bank. Input data are presented separately for these two components. There does not appear to be any distinction made between the northern component within the US zone and goosefish in the Canadian portion of Georges Bank and on the Scotian Shelf. The NEFSC assessment of northern component includes survey data on a substantial portion of a stock that is assessed by DFO Canada as the Canadian 4VWX5Zc Monkfish Stock (Beanlands et al. 2000). Canadian landings from the Canadian portion of the stock area as reflected in the NEFSC surveys, does not appear to be fully included under Table A2.

There is not historic catch or landings-at-age or length data for goosefish. Mostly only the tails are landed. This hampers analytical assessment of the status of the stock.

Aside from the Canadian surveys which were not used in this assessment, there were 7 survey abundance time series available to the assessment:
1. NEFSC autumn research trawl survey, 1963-2003
2. NEFSC spring research trawl survey, 1968-2004
3. NEFSC winter flatfish survey, southern area only, 1992-2004
4. NEFSC summer scallop survey, southern area only, 1984-2004
5. Cooperative surveys, 2001 and 2004
6. ME-NH autumn trawl survey, 1999-2003
7. ME-NH spring trawl survey, 1999-2003

Surveys 6 and 7 are not considered as abundance indices within an estimation model at the present time because the series are considered to be too short. They do however provide information on spatial distribution and length frequency.

Surveys age age-disaggregated survey data are available from about the mid-1990s onwards.

In addition to RV surveys and landings data, there are data for this stock on discards from fishery observer and VTR databases, catch rates from the VTR database, length-weight and age-length, sex ratio, length-frequency, and mortality from survey estimates

3.1.3 Methods of assessment

Analysis of mortality rates

Mortality estimates were made from NEFSC survey abundance at age data. Two approaches were applied – cohort based catch curves and Heinke's method. Exploitation rates were also calculated from the cooperative surveys. These estimates were based on comparing landings with exploitable biomass and landings+discards with total biomass. Calculations were carried out under assumptions of 100% and intermediate net efficiency. Estimates with tow distances derived from nominal distances and inclinometer based measurements were compared. Calculations were also carried out using fishing year (May to April.

In SARC 34 a length based method from Beverton and Holt (1956) was applied to NEFSC survey data. It was concluded in the SARC 34 report that this approach provided a useful index of trends in total mortality. These calculations were not reported on in the 2004 goosefish assessment document.

The NEFSC data would appear to be potentially the most useful basis for estimating mortality rate. Although I am not familiar with the Beverton and Holt length-based approach, it would appear to be more applicable to situations where age determination is unreliable or where the sample data is considered inadequate for determining age composition from length frequency data. If this is not the case then it seems that an age-based approach would be preferable. The Southern Demersal Working Group concluded

that the estimates of mortality from the application of catch curve analysis were unreliable, probably because of inter-annual variations in catchability and overall low catch rates. Alternative treatments of the data could have been explored. The spring and autumn NEFSC data could have been submitted to a combined analysis by introducing a survey effect in a GLM. Total mortality from the ratios, i.e. $Z_{y,a} = \ln\left(\dfrac{I_{y+a,a+1}}{I_{y,a}}\right)$, could have been analyzed in a GLM including survey, age, and year effects in a GLM and the year effect could have been plotted to look for trends in Z. Even smoothed age by year plots of $Z_{y,a}$ might be informative. It seems a pity to throw out all this data as uninformative, even if goosefish are not as well represented in the survey sets as might be desirable.

Bayesian surplus production model

A Bayesian surplus production model was updated from SARC 31 and 34. The model is considered by the Southern Demersal Working Group to be a potentially valuable approach, but there are data limitations and the results are considered to be preliminary and are not used in the evaluation of the status of the stock with respect to reference points. The model and results were presented in summary form with little detail. Results from the combined area model applied in SARC 34 were not presented. The combined area model accounts for the possibility that biomass dynamics are better approximated by a single population approach. Inputs to the model include the autumn NEFSC research trawl survey and summer scallop survey (southern area only), as well as data from the 2001 and 2004 cooperative surveys.

Three year moving average of NEFSC autumn survey index

In the absence of an acceptable analytical assessment of any form, the Southern Demersal Working Group has adopted a very simple procedure for evaluating stock status based on a three year moving average of the autumn NEFSC survey weight per tow index relative to a target index which is defined as the median of the three year moving average of the index over the period 1965 to 1981. Overfished is defined as ½ target index. Re-sampling of the error distribution of the indices used in calculating the target index and the error distribution of the indices used in calculating current status are used to compute a probability that the current index is below the target index, and hence whether or not the stock is overfished. No method was found acceptable for determining whether or not overfishing was taking place.

This approach is fairly *ad hoc* and does not take into account variation between the index and the stock size. It may perform reasonably under some conditions and poorly under others. It may be possible to evaluate the procedure by applying it to simulated data generated by an operating model representing the true system. The Bayesian production model, while possibly not at the stage of development where it can be used to provide scientific advice, might nevertheless provide a useful tool in the form of an operating model for evaluating the moving average procedure. Including uncertainty in both the

reference point and the current state of the stock is not a universal approach for determining the probability that the stock is below the threshold and should be given further consideration.

Cooperative surveys

The cooperative surveys have a mixed design – stratified random station allocation by NEFSC and fixed stations selected by industry. The data are nevertheless analyzed as if all the sets were allocated according to a stratified random design. If the industry fixed stations are "hot spots" with respect to goosefish distribution, then the current treatment of the data could give biased estimates. An alternative treatment of the data could be to use a spatial smoothing approach. One example is the kernel smoother described in Evans et al. (2000) and references therein.

3.1.4 Results of assessment

Analysis of mortality rates

The Southern Demersal Working Group found that the annual estimates from cohort based catch curves and Heinke's method were highly variable and in the case of Heinke's method, gave unreasonable results in some cases. They concluded that this was caused by inter-annual variability in survey catchability and the overall low catch rates in the NEFSC surveys. The summary plot (Fig. A55) has no legend and the symbols have to be interpreted based on Table A30. The results do look quite variable, as claimed in the assessment document. However, cohort mortality might be difficult to interpret if the FMP introduced in November 1999 had a significant impact on exploitation of goosefish. The annual ratios, either by age or modeled using a GLM to get a year effect, having accounted for survey effect and age effect (or age and pre/post FMP interaction term), might have been informative.

Annual ratios from Heinke's method are variable, however the means across years for both the northern and southern areas indicate fishing mortality rates of 0.3 to 0.6 on 4+ fish. These estimates are somewhat higher than the mean F from the catch curve analysis for more recent cohorts.

Exploitation rates estimated from the 2004 cooperative survey data together with landings and discards data were found to be about twice as high in the north (near 0.29) than in the south (around 0.12) under intermediate survey efficiency. In the 2001 survey exploitation rates were found to be more similar in the north and south (around 0.2) under intermediate efficiency (SARC 34).

Although the estimates of fishing mortality or exploitation rate are very variable, there is some evidence that F in the north exceeds 0.2 and that overfishing may be taking place (under the assumption that Fmsy=M) on this component. The observation that stock

growth appears to have recently tailed off at a level below Bmsy is indirect evidence that Fcurrent>Fmsy.

Bayesian surplus production model

Results from the model are given in Table A34 of the assessment document. WinBugs code and input file for the model are provided in Appendix 1 of the assessment document. No plots were provided to the SARC. Table A34 gives only a partial summary of the posterior distributions. Information for observation error variances (tau2) and q for the scallop survey are not provided in the table. For both north and south runs the precision of the 2004 cooperative survey is assumed to be an order of magnitude worse than the 2001 survey. The number of sets in the 2004 survey was less than in the 2001 survey and the 2004 survey did not go as deep. The general impression given to the SARC was that the quality of the data was not as good as that obtained from the 2001 survey. SARC expressed some concern over the need to "tie down" the parameter r (intrinsic rate of natural increase) by means of mean of 0.5 and a small CV (20%) in order to get sensible results. It was also noted that the 2001 cooperative survey was important for "anchoring" model estimates.

The SARC review of the production model was superficial and not sufficient to fully determine the strengths and weaknesses of the approach. It is not clear at what point in the future the model might become useful for providing scientific advice. It was also not clear whether or not other approaches might be more appropriate. Nevertheless, the adoption of an appropriate modeling approach for interpreting the available data, whether it be the Bayesian surplus production model or some other form of integrated analysis is a priority considering that this stock is relatively data-rich in terms of age-disaggregated indices. It is also of significant economic value, and given that overfishing may currently be taking place, it is important to improve estimates of current status.

Three year moving average of NEFSC autumn survey index

Northern area: A plot of the smoothed weight per tow index is given in Fig. A12. It suggests that this component reached a low point in 1997, recovered somewhat between 1998 and 2002 and may now have stabilized at a level just under 2kg per tow. This is less than the Bmsy proxy of 2.496kg per tow but above Bthreshold proxy of 1.460kg per tow. Estimates of the swept area biomass from the 2001 and 2004 cooperative surveys appears to support the recent trend (i.e. no decrease), and the spring survey suggests a continuing increase to a level that is close to the maximum. The estimate of the probability that the northern component is above Bthreshold based on uncertainty in the proxy and the current state of the stock from the fall NEFSC data is 0.98.

Southern area: A plot of the smoothed weight per tow index is given in Fig. A21. The index indicates an increase after 1999 which may have now ceased. The Bmsy proxy for the southern component is 1.848kg per tow and Bthreshold proxy is 0.750kg per tow. The current smoothed index is 0.85, slightly above Bthreshold. The cooperative survey data supports an increase between 2001 and 2004. The spring survey is quite variable

and even the smoothed trend indicates a fair amount of variation. The data do not support a major increase in the recent period. The winter flatfish survey suggests an increasing trend after 1998 which is supported by the summer scallop survey. The estimate of the probability that the southern component is above Bthreshold based on uncertainty in the proxy and the current state of the stock from the fall NEFSC data is 0.56.

Based on existing Bthreshold of ½ the median 3 year running mean of the fall NEFSC weight per tow index between 1965 and 1981, the resource is not overfished in either stock management area (north or south). In the case of the southern area the probability of being above the threshold is only 56% compared to 98% for the northern area.

3.1.5 Recommendations for future assessments

The inability to obtain direct estimates of current fishing mortality relative to the Fthreshold is clearly a concern. There is uncertainty whether or not overfishing is taking place despite the considerable amount of data available for this stock. One approach is a more integrated evaluation of the available age disaggregated survey data beyond that currently applied through catch curve analysis, Heinke's method and estimation of relative exploitation rate from catch and index data. This could take the form of a general linear modeling approach with survey age and year effects in an analysis of Z where $Z_{y,a} = \ln\left(\frac{I_{y+a,a+1}}{I_{y,a}}\right)$. Alternatively a more fully specified population model based on survey-at-data such as the RCRV1A model of Cook (1997) and recent developments described under SURBA may be applicable. This approach assumes a separable model of fishing mortality, and generates relative estimates for population abundance (and absolute estimates of fishing mortality) by minimizing the sum-of-squares differences between observed and fitted survey-derived abundance. In addition, the development of an age-aggregated assessment model along the lines of exploratory Bayesian production model presented in the current assessment should continue to be pursued. This assessment is relatively data-rich and the stock is of considerable economic value. It would seem appropriate to develop a more comprehensive assessment of the status, including the ability to determine when overfishing is taking place.

Continued analysis of the stock as separate northern and southern components is questionable. The spatial nature of the fishery should not be seen as an overriding factor in the approach to the estimation of stock status. There is only weak support in the data for separate analyses. The current assessment did not provide a combined analysis for review. Further, consideration should be given to a more complete treatment of the Canadian portion of this stock, with possibly some interaction with the team doing the assessment of monkfish in NAFO Divisions 4VWX5Zc, possibly through the TRAC process.

3.1.6 Status of SAW 34 SARC/Working Group recommendations

SARC 34 Recommendations and Actions Taken

1) Research should be continued to define stock structure, including genetic studies, reproductive behavior analyses, morphometric studies, parasite studies, elemental analyses, and studies of egg and larvae transport.

WG Response: An elemental analysis project is underway by Jonathan Grabowski at the University of Maine. This work is expected to be completed by 2006. A study on reproductive behavior has been completed by Chris Chambers of NEFSC Sandy Hook Lab.

Review: Elemental analysis can be informative regarding the water bodies in which individual fish were located at various times but needs to be supplemented by genetic, spawning, and egg and larval transport studies to form a comprehensive view regarding stock structure. Consideration should be given to the application of a single assessment unit approach until such time as the population data indicate a more complex stock structure should be applied in assessments.

2) The SARC recommends changing the overfishing definitions for goosefish. Research on yield per recruit for goosefish should examine the effect and possible causes of differential natural mortality rates by sex, methods to estimate gear selectivity, and the incorporation of discards.

WG Response: The recommendations of SARC 34 were implemented in Framework 2 of the FMP in May 2003. The WG plans to update the estimation of selectivity patterns and the yield per recruit analysis for the next assessment review, tentatively scheduled for 2007. The WG will also explore the feasibility of the estimation of discards by trawl fishery strata (multispecies bycatch, directed monkfish).

Review:

Overfishing definitions - The current Fthreshold is set at Fmax=0.2 for both north and south components consistent with the recommendation from SARC 34. Fthreshold is defined as the rate of fishing that does not exceed the rate associated with the MSY control rule (the harvest strategy which would be expected to result in a long-term average catch approximating MSY). Overfishing is occurring when F exceeds F threshold. Reliable estimates of F were not obtained in the SAW 40 so the Working Group considered that it was not possible to determine whether or not overfishing is taking place. The inability to obtain direct estimates of current fishing mortality relative to the Fthreshold despite the considerable amount of data available for this stock is a serious concern. General linear modeling approaches, the RCRV1A model of Cook (1997) and recent developments described under SURBA may be applicable and should be explored.

Selectivity and yield per recruit analysis -   The instantaneous natural mortality rate for monkfish is assumed to be 0.2, based on an expected maximum age of 15-20 years. This was not updated by SAW 40. Biological data show that growth rates are similar in the northern and southern areas, and between males and females but that most fish larger than 70 cm and age 7 are females.   This would suggest sex differences in survival which may need to be considered in determining the value for Fthreshold through yield per recruit analysis. It has been suggested that a tagging study be implemented to gather data on movements and longevity, and that fishermen be paid to bring in goosefish over 120 cm for biological sampling. These approaches are worth considering further. No new information on selectivity was provided for review by SARC 40. Plans are underway to complete new analyses for the 2007 assessment of goosefish.

3) Surplus production modeling should continue with special emphasis placed on uncertainty in under-reported catches and population size prior to 1980.

WG Response: The Bayesian surplus production model for goosefish was updated for this assessment by including 2001-2003 fishery catch, trawl survey indices, and the 2004 cooperative survey biomass estimates. As noted above concerning the current uncertainty of the 2004 cooperative survey biomass estimates and potential for subsequent revision, the Southern Demersal WG considers the surplus production to be preliminary and not yet sufficient for evaluation of the status of the stock with respect to reference points. The WG plans to continue development of the model in the next assessment, since it appears to have the potential to serve as a valuable tool for integration of the estimation of population biomass and mortality rates and reference points.

Review: Little time was spent by SARC 40 on the review of this model and the updates completed since SARC 34. Research should continue on the development of the Bayesian production model and a complete review should be carried out at the next SARC review of goosefish.

4) Size selectivity studies should be conducted in the trawl fishery to investigate the potential effectiveness of minimum mesh size and shape regulations to reduce discards of undersize monkfish. Additionally, comparative studies of the size selectivity and catchability of trawls and gill nets should be undertaken in order to understand the differences in the numbers of large fish captured in the two gear types.

WG Response: A cooperative research project is underway to investigate fishery selectivity patterns in the trawl fishery the Gulf of Maine (6.5 inch vs. 10 inch square mesh; M. Raymond of Associate Fisheries of Maine and C. Glass of Manomet CCS).

Review: No new results were presented for review by SARC 40.

5) Another cooperative survey for monkfish should be conducted in 2004.

WG Response: 2004 cooperative survey completed, analytical results not complete.

Review: There is concern that the quality of this potentially important survey may deteriorate if it is not used more formally in the provision of scientific advice.

6) Improved sampling rates (as observed in 2000-2001) for commercial landings should be maintained, which should eventually lead to an age-based assessment approach for this species.

WG Response: The overall commercial fishery landings sampling intensity (samples per mt) was 171 mt per length sample in 2000 and 149 mt per sample in 2001. Sampling intensity improved to 121 mt per sample in both 2002 and 2003.

Review – the increased samling rate is commendable, but no catch-at-age data were presented for review. Catch at age would be very useful in the assessment of this stock.

7) Tagging studies should be considered as a basis to evaluate adult movement and rates of growth.

WG Response: A limited number goosefish (46 individuals) were tagged as part of the Rutgers/SMART/MADMF gillnets fishery project. No returns have yet been reported from this project.

Review: The low number of fish tagged and the lack of returns does not bode well. Calculations should be made of the number of goosefish that would need to be tagged to provide reliable estimates of tag loss rate (through double tagging), tagging mortality rate, reporting rate etc., so that sufficiently precise estimates of migration rate, mortality rate etc. can be carried out.

8) Spatial distribution of mature and immature fish and the potential effects of size limits on fishing behavior should be evaluated as a basis for advising on strategies to minimize catch and discard of immature fish.

WG Reponse: Elimination of minimum size regulations were considered, but not adopted, in the development of Amendment 2 to the FMP as a means to reduce discards. Instead, the minimum size regulation was reduced in the southern area to be consistent with the northern area.

Review: Information on spatial distribution by size was provided from the NMFS Winter survey for the period 1999 to 2004. Patterns are apparent but for most of the range there are insufficient data. Observer length frequency distribution data for commercial catches would be very useful in this regard.

9) Indices of abundance should be developed from industry "study fleets, including coverage from outside the depth and spatial range of the NEFSC research surveys.

WG Reponse: The Study fleet, a NMFS cooperative research project, has been implemented in several New England ports. Information of patterns of monkfish landings and cpue should become available in the future.

Review: No new information was provided for review by SARC 40.

3.2 Weakfish

3.2.1 Summary

The management unit is a single stock that covers the Atlantic coast from Florida up to the southern Gulf of Maine. Preliminary 2004 assessment results for weakfish from the Atlantic States Marine Fisheries Commission's Weakfish Stock Assessment Subcommittee were reviewed. The assessment was not complete. It is difficult to provide review on an assessment that is still in progress. SARC attempted to point out the strengths and weaknesses in the current analysis thus far, and in previous assessments. Part of the meeting was spent informally providing advice on alternative treatments of the input data.

The current management plan manages weakfish by minimum size limits, bag limits, minimum mesh sizes, bycatch allowance in other directed fisheries, bycatch reduction devices and gear specific area closures. Minimum size and bag limit are implemented in such a way that a larger minimum size allows a larger bag limit. Ftarget = 0.31 (supposedly equivalent to F30% SPR) and F threshold = 0.50 (supposedly to F20% SPR) The SSBthreshold = 14,400 t (equivalent to 20%SSBo). Changes in growth rates and stock-recruitment relationships are thought to have shifted the quantities associated with the reference points so that current F reference points represent lower %SPR, i.e. risk-prone, while the biomass corresponding to 20%SSBo is lower, i.e. the current value is risk-averse. M is assumed to equal 0.25 based on a maximum age of 12 (M = 3/max age).

Amendment 3 (1996) of the ASMFC FMP aimed at utilizing interstate management so that weakfish can recover to healthy levels by putting in place specific rebuilding objectives. This is thought to have had a significant impact on the fishery. The 30th SAW/SARC (1999) confirmed that the amendment was having a positive effect with regard to increasing SSB, decreased F and expanded age structure.

The 1999 assessment based on an ADAPT analysis found that weakfish were at a high level of abundance and subject to low fishing mortality rates and SSB in 1998 was estimated to be 55%SSBo. Biomass was estimated to have increased rapidly from a low point reached in the early 1990s and recruitment was estimated to have been above average since 1993. Fishing mortality in 1998 was estimated to be 0.21, below Ftarget, slightly above F0.1(0.18) and below Fmax (0.27) and Fmsy (0.6), producing about 40% of MSP.

An update assessment of weakfish to 2000, including estimates of stock size on January 1 2001, was carried out in 2002 (B6, Appendix 4) and an advisory document was prepared (B5, Appendix 4). This assessment found that weakfish were at a high level of abundance and fishing mortality appeared to be low. However, a strong retrospective bias in the ADAPT VPA output suggested that the results be interpreted with considerable caution. Nevertheless, it was considered that, even if the retrospective bias was accounted for, the stock was well above the proposed Bthreshold of 14,400 t.

The Advisory Report from the 2002 update (B5, Appendix 4) indicated that the Stock Assessment Subcommittee was currently attempting to deal with inadequacies in the data and the assessment model by utilizing alternative methods that do not assume that the catch-at-age matrix is estimated without error. This direction is endorsed. However it is also imperative that the individual tuning indices be scrutinized and their information content evaluated. For some indices data for certain ages may be considered uninformative, and in some cases it may be desirable to apply an index as an age-aggregated measure of stock size representative of a portion of the total stock (e.g. sum of ages 1 to 3). Although the direction for the assessment of this stock was set in the 2002 Advisory Report, the current SARC could not evaluate the progress in this regard. It could only confirm that the previous treatment of the data within the ADAPT formulation was inadequate. This does not preclude alternative ADAPT formulations which may be more acceptable. However, in general, because of changes in the FMP and uncertainty in the catches, a catch-at-age analysis approach is endorsed.

3.2.2 Input data

Catch at age estimates are obtained from the individual states and from NMFS. These are estimated by each state with independent length frequency and age-length keys because of differences in the minimum size regulations adopted by states under Amendment 3. Recreational landings and discards data are obtained from NMFS by region together with length frequency data. Because of the nature of this fishery, this is a complex undertaking. Although the derivation of the catch at age data was not presented in sufficient detail to evaluate the uncertainty, the nature of the fishery suggests that an assessment that deals with error in catch at age would be appropriate.

Four fishery-independent age-structured trawl survey indices are available:
1. New Jersey coastal survey
2. Delaware survey in Delaware Bay
3. NMFS fall survey (restricted to strata where weakfish had been regularly caught)
4. Fall SEAMAP costal survey (N. Carolina waters only).

Additional recruit indices for fish age 1 and/or 2 were available from the Delaware DFW surveys, North Carolina DMF surveys, VIMS surveys and Maryland DNR surveys.

In addition to the fishery independent surveys, an index was obtained from the NMFS Marine Recreational Fisheries Statistics Survey (MRFSS). An age aggregated recreational fishery index was also applied in some analyses (REC1:6).

### 3.2.3 Methods of assessment

The weakfish stock is assessed using ADAPT available within the NMFS Fishery Assessment Compilation Toolbox (FACT). Major assumptions are that catch at age is measured without error and that natural mortality is known. Past assessments have explored various alternative approaches including extended survivors analysis and CAGEAN. In the weakfish ADAPT, ages 1 to 5 and 6+ are estimated. ADAPT usually requires a constraint on F on the oldest age. For weakfish fishing mortality on age 6+ in the ADAPT runs presented to the current SARC was variously constrained as F6+=F5 and F6+=F4. ADAPT estimates are prone to retrospective error for a variety of reasons. Retrospective analysis forms an important part of most ADAPT assessments and such an analysis was carried out in the 2002 assessment (B6, Appendix 4). This showed very large retrospective error with F being estimated as much higher and population size much lower in subsequent assessments over the period 1996 to 2000. The 2002 assessment also applied the non-parametric bootstrap approach to determine the uncertainty in the estimates of fully recruited F in 2000. The estimate had wide confidence intervals (80% CI = 0.1 to 0.6 with a mean of 0.12). SSB was estimated to be 51,598 MT in 2000 with bootstrapped 80% CI extending from 41,813 to 56,68 t. Recruitment of age 1 weakfish was estimated to be 58,993 thousand with wide 80% CI of 39,507 to 86,332 thousand. Ignoring the very large retrospective problem and the wide confidence intervals, the results from the 2002 assessment suggest a steady increase in SSB from 1994 to 2001, exceeding SSBthreshold from 1994 onwards. Similarly, F has fallen below Fthreshold since 1995 and Ftarget since 1997. The ADAPT estimates are not consistent with catch rates determined from private recreational boats which indicate a declining trend from about 1996 onwards (B9, Appendix 4).

3.2.4 Results of assessment

The 2002 assessment of weakfish included a number of useful analyses in addition to the ADAPT run. B8 (Appendix 4) examined varying time periods of separability using ICA and compared the results with those obtained from ADAPT. The ADAPT run indicated that the weakfish population was larger and incurred less fishing mortality than those estimated by the separable ICA approach. In the ICA runs, the shorter period of constant selectivity (3-years) produced more conservative estimates than one that used a 5-year separability period. B9 (Appendix 4) estimated relative exploitation rates from landings and relative indices and fishing mortality (scaled relative exploitation rates using the ADAPT F estimates) and compared trends with those obtained from ADAPT and ICA. In addition to indicating inconsistency between information from private recreational boats and the fishery-independent indices, this study also pointed to the need to examine the information content of the individual indices. B9 notes that tuning indices that display high frequency fluctuations in relative abundance (large year effect) are likely prone to excessive measurement error, poor reliability and low information content about

stock variability. This is a very important point in the context of the 2004 weakfish assessment.

Prior to applying the indices to calibrate and ADAPT, ICA or other model, it would be useful to apply a simpler form of analysis such as the Pope-Shepherd-Nicholson approach (an analysis of variance method testing for year, age and yearclass effects). Yearclass effects reflect relative strength of recruitment averaged across ages. Age effects reflect age specific availability/selectivity/catchability and average cumulative mortality to age. Year effects represent changes that effect all ages or cohorts in a similar way, such as a faulty survey (error), age-independent shift in distribution relative to the survey or, in the case of catch-at-age, changes in fishing effort. Weak or non-existent cohort effects (having first accounted for index-specific age effects) may indicate little information in the age-disaggregated data and suggest possibly using the data in an age-aggregated form or not at all. Relative cohort effects that differ among indices or between indices and catch may indicate inconsistencies or lack of coherence in the information. As an initial graphical exercise of this kind, the various age-disaggregated survey indices and catch-at-age data were subject to simple analysis of cohort effect having removed age effect. Data were log-transformed (after multiplying by 100 to avoid negative means of the log values by age which leads to a change in the direction of trends) and were arranged so that rows represented cohorts and columns represented ages.   Within each index (or catch) the mean of the log values for each age was determined and each log value for that age was divided by the age-specific mean to standardize for the age effect. The standardized data were then plotted against yearclass to graphically examine yearclass effects.

Weakfish catch at age
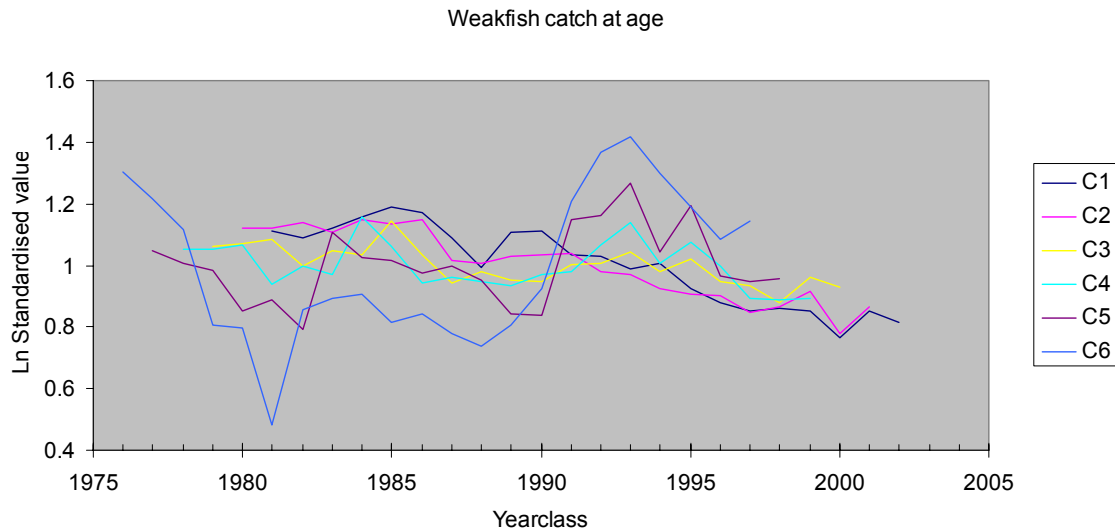
The catch at age data for weakfish shows relatively weak yearclass effects. There is some indication of less strong yearclasses in the late 1980s and somewhat stronger representation in the early 1990s. There is a trend of decreasing yearclass strength in yearclasses arising in the late 1990s, but this may reflect a decrease in the fishing effort as a result of Amendment 3 of the FMP rather than abundance.

Weakfish NMFS Fall Index at age
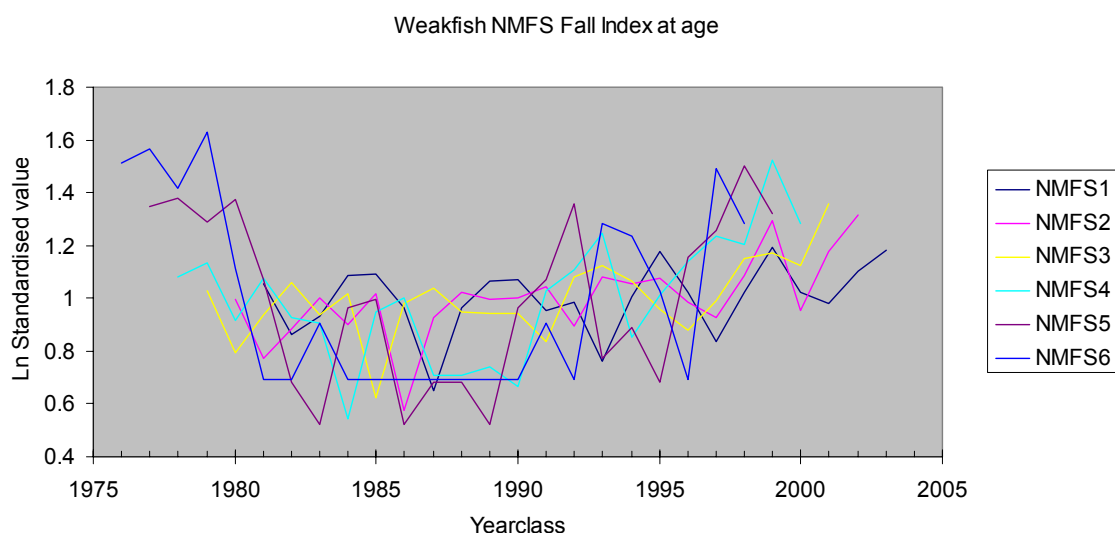
The age disaggregated data for the NMFS fall survey are noisy in terms of year to year information on relative yearclass strength. Ages 1 to 3 show the most coherence, but year effects are still very evident. All ages show a similar increasing trend in yearclass strength since the early 1990s yearclasses.

Weakfish DEDFW Index at age
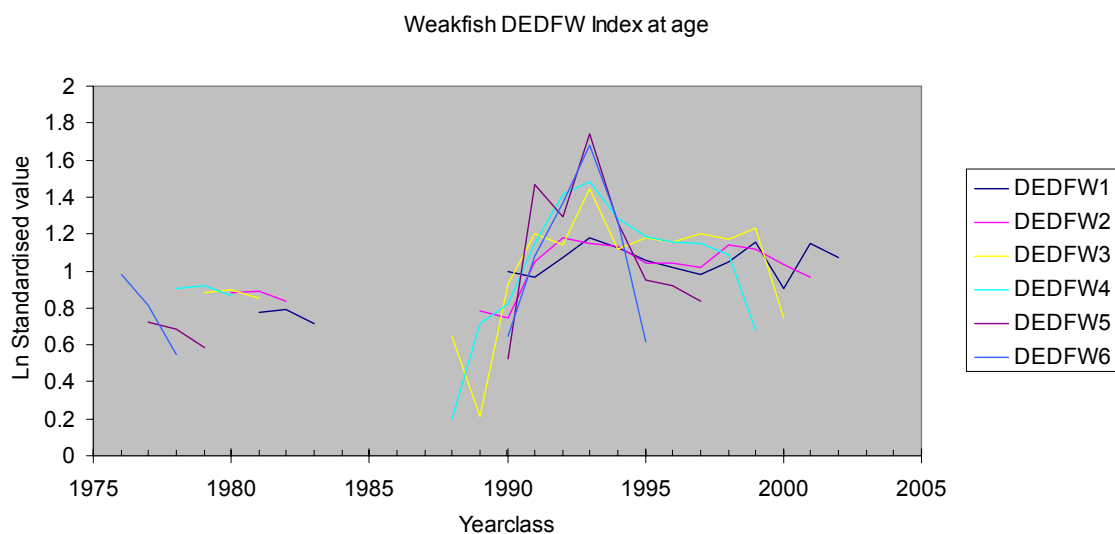
There is some coherence among the ages in the DEDFW data with respect to the relative strengths of yearclasses, which arose in the early 1990s, particularly among the older ages. Information for the younger ages is less clear. After the mid-1990s there appears to be less signal in the data.

Weakfish NJDEP Index at age
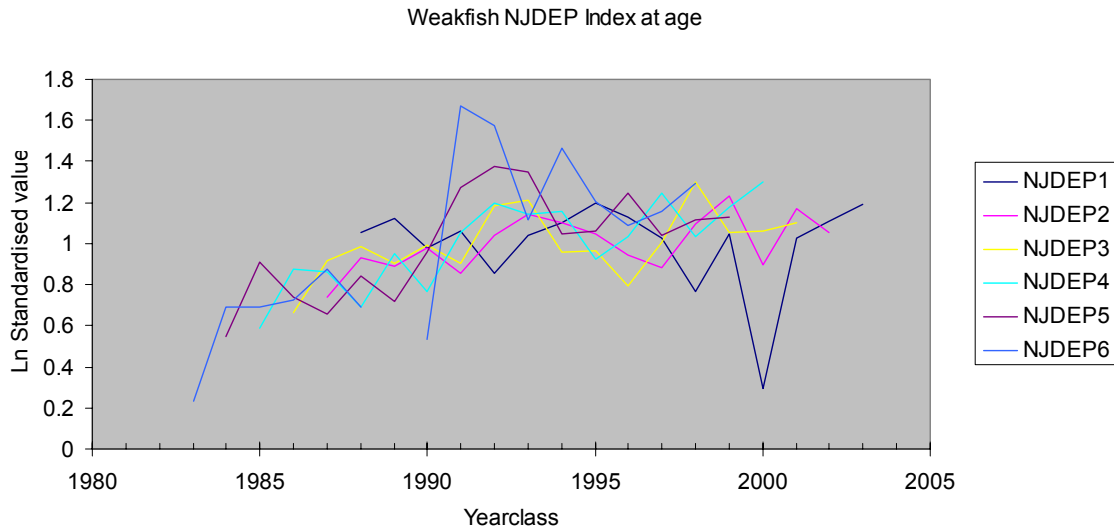
The NJDEP index does not show a lot of consistency in the information on relative cohort strength across individual ages either through survey error (year effects) or ageing error. There is however an overall increasing trend for yearclasses in the 1980s through the early 1990s. The data may be more useful as an age-aggregated tuning index.

Weakfish SEAMAP Index at age
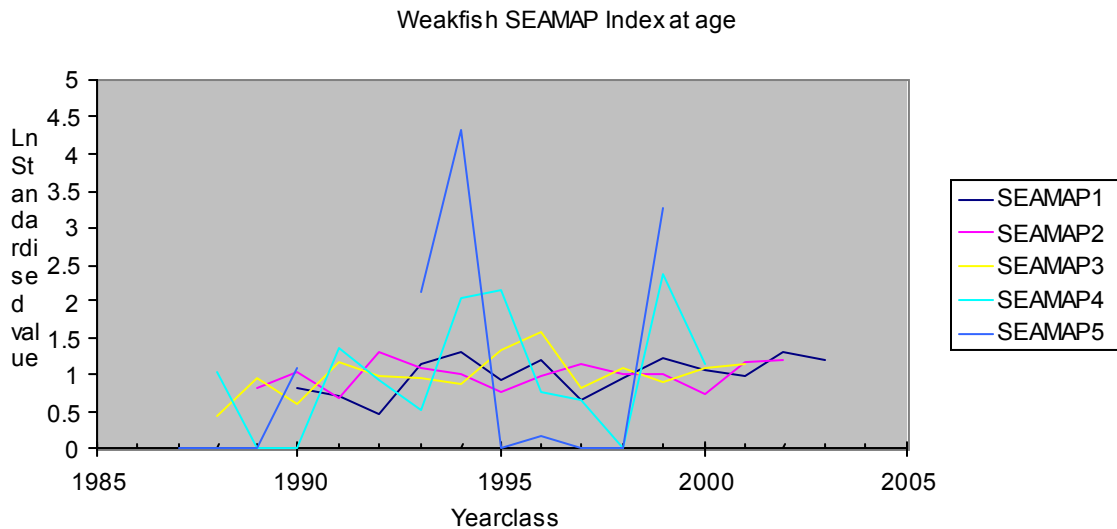
The SEAMAP index shows a lot of noise. There is some coherence in the information for ages 2 to 4 but it is quite weak relative to the noise. There is little overall trend in the data.

Weakfish MRFSS Index at age
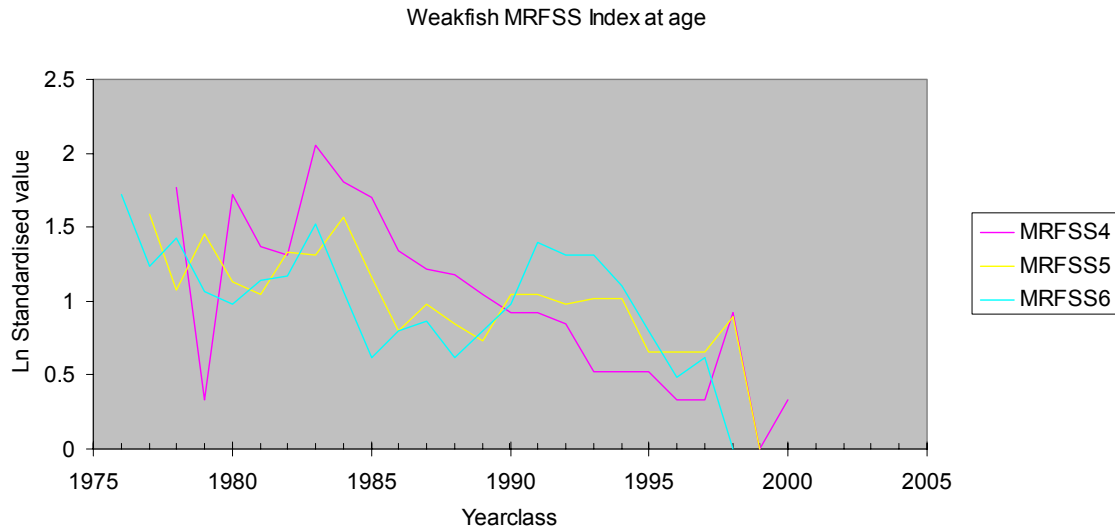
The MRFSS index is of interest. It would show good coherence were it not for evidence of a fairly strong year effect across ages 5 and 6. Information from age 4 is less consistent. It shows a general decreasing trend in yearclass strength. This index is influenced to an unknown extent by Amendment 3 to the FMP.

Recruitment indicators
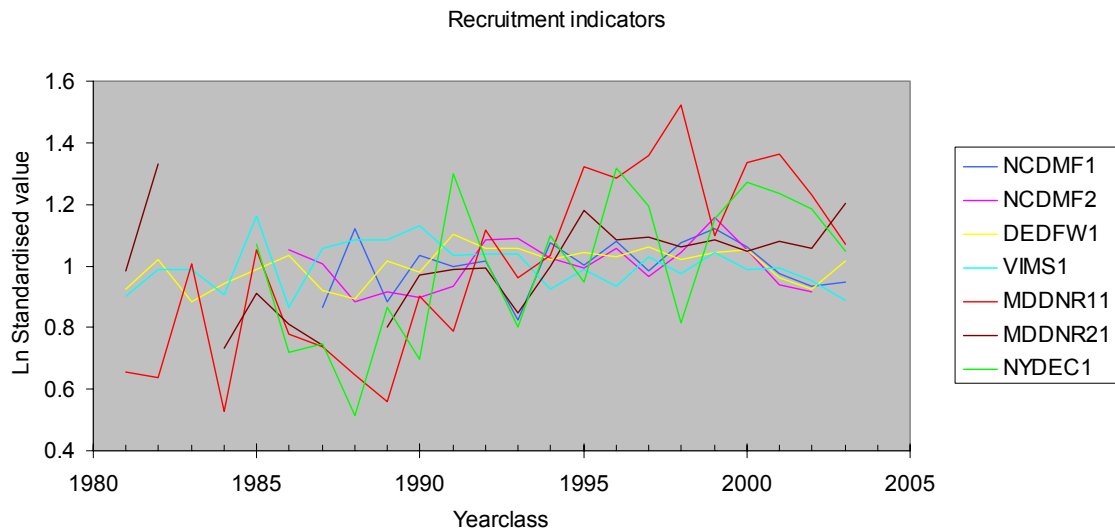
The recruitment indicators (ages 1 and 2) show a lot of variation at an individual yearclass level, but show some indication of a trend of improving yearclass strength for those that arose in the early and mid 1990s.

Weakfish indices mean yearclass strength
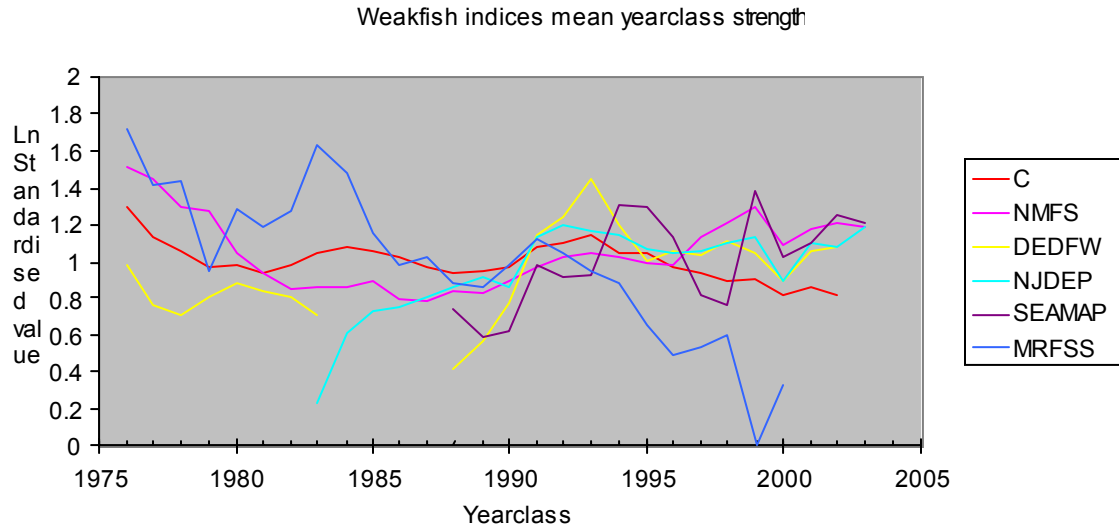
The mean yearclass strength across ages by index and catch indicate a strong divergence between the catch at age data, the NMFS survey and the MRFSS data. The catch data and the NMFS survey show a similar pattern of yearclass strength up until yearclasses that arose in the mid 1990s, where after the NMFS survey shows yearclass strength continuing to improve while the catch data indicate a gradual decline (which could be associated with the effects of Amendment 3 of the FMP) and the MRFSS index shows a strong decline after the 1990 yearclass (again possibly partly a result of the change to the FMP). The other catch-independent indices support the general trends and some of the year-to-year changes in relative yearclass strength seen in the NMFS data for the recent period, and, although muted (presumably because of decreased effort) these year-to-year changes are seen in the catch data as well.

In general the yearclass strength signals derived from the input data are weak and not consistent across indices, indicative of large amounts of error in the data. Any age-based assessment method is going to have a lot of residual unexplained variance. Nevertheless, there are trends within the age-disaggregated data which are not completely incoherent within or across indices and which may be smoothed to give information on changes in stock size through the use of an appropriate model. Simply putting all the indices into an ADAPT estimation does not appear to be a good solution. A major issue is the divergence between the MRFSS and other indices. This needs to be resolved. Putting two inconsistent indices into the model and "asking" the model to decide does not make sense. Given some degree of agreement between the other indices, the MRFSS appears to be the "odd one out" and further investigation is warranted.

The SARC were presented with 3 preliminary ADAPT runs undertaken as part of the incomplete 2004 assessment:

Run 8: No commercial discard data included. Tuning indices included recreational harvest per trip by age for 3-6+ added, along with total recreational catch per trip (including discards), as well as trawl surveys.

Run 10: tuned ages 1 and 2 to surveys and ages 3-6+ to recreational fishery CPUE indices.

Run 13: Commercial discards included. Tuned with trawl surveys only, as in 30th SARC and 2002 update.

Over and above the tuning indices used, the runs differ in that Runs 8 and 10 have an F constraint where F6=F5 while in Run 13 F6=F4.

For diagnostic purposes it would be useful to produce residual plots and plots of catchability at age for each index. Rather than including many indices in one run, it would be useful to look at tuning with one index at a time, while looking at residual patterns.

Weakfish standardized residuals at age
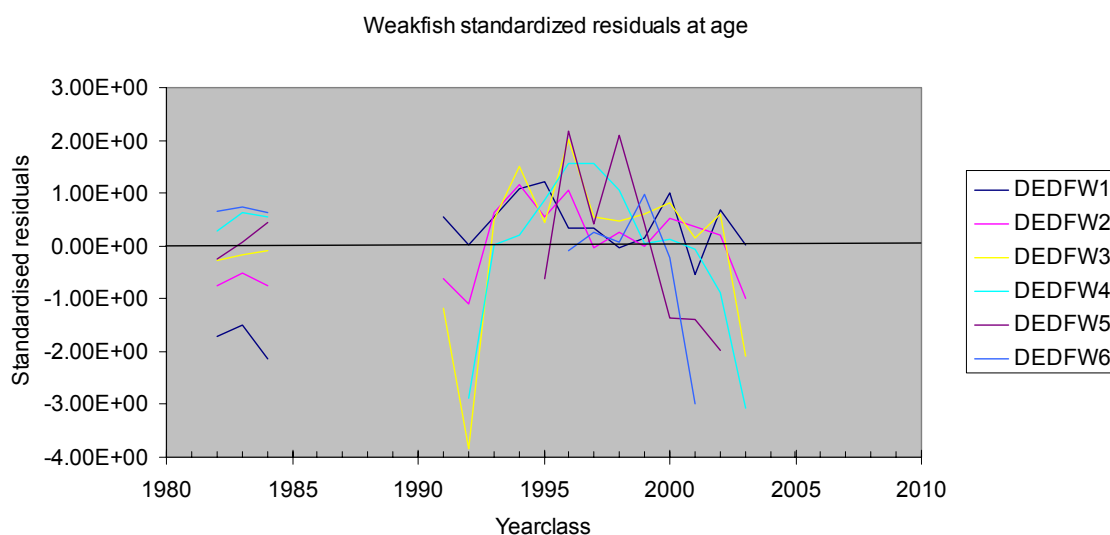
For example, Run 13, which is apparently similar to SARC 30 and the 2002 update, shows a strong temporal pattern in the residuals for DEDFW which would generally be considered to be unacceptable.

Catchability for NJDEP in Run 13
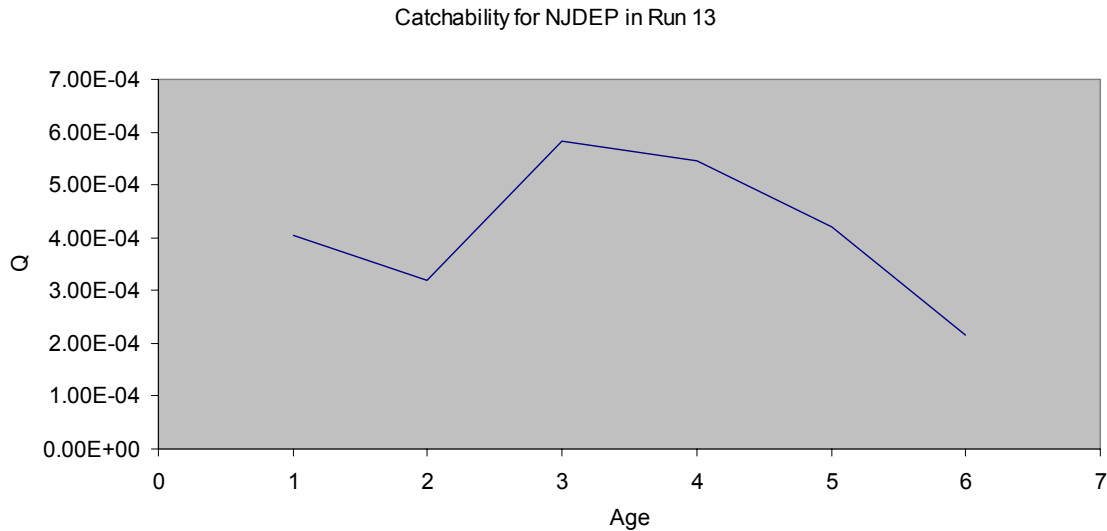
Plotting of catchability at age can also be a useful diagnostic. For example, the plot for NJDEP from Run 13 would need to be interpreted.

As discussed in B8 changes introduced into the fishery as a result of Amendment 3 of the FMP, together with uncertainty in the catch at age data, need to be given consideration in future analytical assessments for this stock. In this context some form of catch-at-age analysis approach with separability may be more appropriate than ADAPT.

3.2.5 Recommendations for future assessments

There is considerable concern regarding the large retrospective error and uncertainty associated with the current estimates of stock size and fishing mortality from ADAPT. It is of primary importance to carefully evaluate the input data in terms of the information content regarding relative year-class strength. This evaluation could take the form of more statistically based GLM approach along the lines of the graphical analysis (i.e. Pope-Shepherd-Nicholson analysis of yearclass, age and year effects). Alternatively the survey analysis approach suggested by Cook (1997) and subsequent developments under SURBA could have merit in this regard. A more selective treatment of the input data after careful scrutiny may improve the ADAPT formulation and lead to more acceptable diagnostics, however the uncertainty in the catches and the changes in the fishery that have resulted from Amendment 3 suggest that a statistical catch-at-age approach may be more appropriate for the assessment of this stock. Thus the intent expressed in the 2002 Advisory Report is endorsed.

It seems unlikely, however, that statistical modeling will be able to reconcile the very different perspective on year-class strength between the fishery independent surveys and the index obtained from the NMFS Marine Recreational Fisheries Statistics Survey. This should be given urgent attention through a focused research project that considers alternative hypotheses for the divergence. SARC were informed about a possible ecological explanation that requires review. Other explanations related to the survey

indices and the recreational fishery statistics under the amended FMP also need to be given careful consideration.

3.2.6 Comments on four questions asked by the ASMFC Working Group

1) Currently, catch-at-age modeling has been done with ADAPT. Given the results to date described below, would the committee suggest other catch-at-age modeling approaches?

Response: There is considerable concern regarding the large retrospective error and uncertainty associated with the current estimates of stock size and fishing mortality from ADAPT.   A GLM analysis of yearclass, age and year effects or application of the survey analysis approach suggested by Cook (1997) and subsequent developments under SURBA may have merit. A more selective treatment of the input data after careful scrutiny may improve the ADAPT formulation and lead to more acceptable diagnostics, however the uncertainty in the catches and the changes in the fishery that have resulted from Amendment 3 suggest that a statistical catch-at-age approach may be more appropriate for the assessment of this stock. It seems unlikely that statistical modeling will be able to reconcile the very different perspective on year-class strength between the fishery independent surveys and the index obtained from the NMFS Marine Recreational Fisheries Statistics Survey. This should be given urgent attention through a focused research project that considers alternative hypotheses for the divergence.

2) Currently, biomass dynamic modeling has used the logistic form presented in a separate report (B11). Length frequency analysis (B12) and growth modeling (B3) indicate significant growth decline, suggesting a decline in productivity. Possibly, parameters such as r and K have changed over the period in question. Does the committee have suggestion for alternative approaches?

Response: The growth analysis reported in B3 is missing the graphs. B12 reports on a derived standardized index of size structure. Mean weight at age for the commercial harvest by state indicates a decline from north to south. A thorough evaluation of changes in growth rate should include a description of the sample design, temporal, spatial and gear type origins of samples and some fairly basic analyses of length frequency at age and weight at age by area over time. Growth curve modeling and derived quantities such as standardized index of size structure could be included thereafter. It was difficult to form an opinion on whether or not the apparent decline in growth was real or an artifact. The use of age-aggregated production models might have some merit. Although the year-class signal is generally weak in the age-disaggregated data, there are some trends within which are not completely incoherent within or across indices. This information would be lost in an age-aggregated production model analysis. The basic inconsistency between the catch rate data and the survey indices is even more stark in the age-aggregated indices and attempting to fit a production model to these data before determining the root cause for the difference does not seem to be advisable.

3) We have employed both fishery independent and fishery dependent indices in both ADAPT and biomass dynamic models. These have different trends and affect model results differently. The latter often produce negative residuals for recent years. Would the committee have any recommendations on selection among these indices?

Response: A thorough evaluation of the alternative causes for the differences needs to be undertaken. Temporal and spatial aspects, selectivity changes and effects of changes in the management plan should be considered. In the absence of a rational explanation for the differences it is difficult to make progress in the assessment.

4) Currently, an active hypothesis is that species interactions have influenced stock dynamics, including striped bass competition or predation and possibly decline in important prey species. Modeling approaches in progress are exploring these possibilities, but this work is not completed. Does the committee have suggestions for exploring this hypothesis?

Response: The two major issues are an apparent decline in growth rate and the discrepancy between the catch rate index and the fishery-independent indices. A possible increase in M is also hinted at. Complexities include the spatial spread of the fishery-independent indices, longshore variability in growth rate, the impact of the changes to the management plan and spatial differences in implementation. While it is attractive to attempt to relate these changes to changes in forage species and predators, simpler single-species hypotheses should be thoroughly evaluated first.

4. REFERENCES

Beanlands, D., Branton, B. and Mohn, B. 2000. The status of monkfish in 4VWX5Zc. Can. Stock. Assess. Sec. Res. Doc. 2000/143, 67p.

Cook, R. M. 1997. Stock trends in six North Sea stocks as revealed by an analysis of research vessel surveys. ICES Journal of Marine Science 54, 924–933.

Evans, G.T., Parsons, D.G., Veitch, P.J., and Orr, D.C. 2000. A local-influence method for estimating biomass from trawl surveys, with Monte Carlo confidence intervals.

APPENDIX 1

Panelists

Dr. Robin Cook, FRS Marine Laboratory, Aberdeen, UK (Chair)

Dr. John Casey, CEFAS, Lowestoft, UK

Dr. Norm Hall, Centre for Fish and Fisheries Research, Murdoch University, Murdoch, Australia

Dr. Peter Shelton, DFO, St John's Canada

APPENDIX 2

Terms of Reference - 40th Northeast Stock Assessment Workshop

SARC, November 29 - December 2, 2004
NEFSC, Woods Hole

Goosefish/Monkfish - SAW Southern Demersal Working Group

1. Review results of the 2004 Cooperative Monkfish Survey; make comparison to the results of the 2001 survey.
2. Characterize the commercial catch including landings and discards.
3. Update other monkfish survey indices *(i.e.,* NEFSC and MADMF indices) and analyses based on those indices.
4. Evaluate the current status of the stock assessment units relative to existing reference points.
5. *Review, evaluate, and report on the status of the SARC/Working Group Research Recommendations offered in the previous SARC-reviewed assessment (i.e., SAW 34 in November 2001).*

Weakfish - ASMFC Technical Committee/Assessment Subcommittee

1. Characterize commercial and recreational catch including landings and discards.
2. Evaluate adequacy and uncertainty of fishery-independent and dependent indices of relative abundance.
3. Estimate fishing mortality, spawning stock biomass, and total stock biomass for 1981-2003, and characterize the uncertainty of these estimates.
4. Evaluate and update or re-estimate biological reference points, as appropriate.
5. Perform stock projections if possible.
6. Make research recommendations for improving data collection and the assessment.
7. *Review, evaluate, and report on the status of the SARC/Working Group Research Recommendations offered in the previous SARC-reviewed assessment (i.e., SAW 30 in December 1999).*

Scup - DeAlteris and Associates Inc. – Assessment withdrawn

1. Characterize the commercial and recreational catch for scup including landings and discards.
2. Estimate fishing mortality, spawning stock biomass, and total stock biomass for the current year, and characterize the uncertainty of these estimates.
3. Evaluate and update or re-estimate biological reference points, as appropriate.
4. Evaluate rebuilding schedules, *i.e.,* provide projections of stock status under various Total Allowable Catch (TAC) and fishing mortality (F) strategies.

APPENDIX 3

40th Northeast Regional Stock Assessment Workshop (SAW 40)
Stock Assessment Review Committee (SARC) Meeting

Aquarium Conference Room - Northeast Fisheries Science Center
Woods Hole, Massachusetts

November 29 – December 2, 2004

AGENDA

TOPIC	PRESENTER	SARC LEADER	RAPPORTEUR
MONDAY, 29 November (1:00 - 5:00 PM)...			
Opening			
Welcome	**Terry Smith**, SAW Chairman		
Introduction	**Robin Cook,** SARC Chairman		
Agenda			
Conduct of meeting			
Goosefish/Monkfish (A)	**Anne Richards**	**TBA**	**Kathy Sosebee**
SARC Discussion	**Robin Cook**		
TUESDAY, 30 November (8:30 - 5:00 PM)..			
Weakfish (B)	**Des Kahn / Jim Uphoff**	**TBA**	**Des Kahn / Jim Uphoff**
SARC Discussion	**Robin Cook**		
WEDNESDAY, 1 December (8:30 - 5:00 PM)			
Weakfish (B) (if necessary)	**Des Kahn Jim Uphoff**	**TBA**	**TBA**
SARC Discussion	**Robin Cook**		
THURSDAY, 2 December (8:30 - 5:00 PM)			
SARC Report writing (closed)			

APPENDIX 4

Bibliography

Goosefish documents and materials

Report of the Southern Demersal Group (WG) meeting – Goosefish

SARC 40: Goosefish (Monkfish) Assessment Summary, WG Draft 11/10/04

Weakfish documents and materials

Documents provided before the meeting:

B1: Weakfish stock assessment summary. Memo from Jim Uphoff

B2: Assessment of Atlantic Coast Weakfish (Cynoscion regalis), 1999
Report to the Stock Assessment Review Committee (SARC)
February 2000. ASMFC Weakfish Stock Assessment Subcommittee

B3: Weakfish growth analysis, based on 2000 samples from pound net and long haul
seine in the Chesapeake Bay and Pamlico Sound. A Report to the ASMFC Weakfish
Technical Committee. Desmond Kahn

B4: Fishing mortality based reference points for weakfish in 2000 based on two growth
models.

B5: Advisory Report. 2002 Weakfish Stock Assessment

B6: Stock Assessment Of Weakfish Through 2000, Including Estimates Of Stock Size
On January 1, 2001. Desmond M. Kahn,

B7: Risk Assessment of Virtual Population Analysis Estimates of Atlantic Coast
Weakfish Fishing Mortality and Spawner Biomass during 1982-2000. Jim Uphoff

B8: An evaluation of Separable Virtual Population Analysis as a tool for assessing the
stock status of weakfish on the Atlantic Coast of the United States. Janaka A. de Silva

B9: Trends in Weakfish Fishing Mortality and Stock Biomass based on Relative
Exploitation from Recreational CPUE and Abundance Indices from Fisheries
Independent Trawl Surveys. Victor Crecco.

B10: Powerpoint presentation: Board presentation

B11: Powerpoint presentation: Biomass

B12: Powerpoint presentation: Weakfish proportional densities

B13: Report to the 40th Stock Assessment Review Committee on preliminary assessment results for weakfish, Cynoscion regalis (Sciaenidae). Desmond M. Kahn

B14: Weakfish ADAPT output data file

B15: Weakfish ADAPT output plots

B16: Weakfish ADAPT diagnostics

B17: Weakfish ADAPT run 8 output

B18: Weakfish ADAPT run 10 output

Additional documents provided:

Weakfish catch-at-age data

ADAPT run descriptions

Powerpoint presentations:
1. Data and ADAPT runs
2. Biomass dynamic modelling
3. Weakfish proportional densities
4. Trophic interactions

APPENDIX 5

STATEMENT OF WORK

Consulting Agreement between the University of Miami and Dr. Peter Shelton

September 24, 2004

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 40th 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 29 November 2004 (November 29 – December 2) to review assessments for monkfish (*Lophius americanus*), scup (*Stenotomus chrysops*), and weakfish (*Cynoscion regalis*).

Specific Activities and Responsibilities

Each panelist's duties shall occupy a maximum of 14 workdays; 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 Report will be provided to the SARC Chair, who will produce the Summary Report based on the individual Review Reports.

Roles and responsibilities:

(1)   Prior to the meeting: review the reports produced by the Working Groups.

(2)   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)   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. See Annex 1 for further details on report contents and milestone table below for details on schedule. No later than December 16, 2004, these reports shall be submitted to the CIE for review

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.

No consensus opinion among the CIE reviewers is sought, and all SARC reports will be the product of the individual CIE reviewer or chairperson.

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.

Contact person:

Dr. Terrence P. Smith, NEFSC, Woods Hole, SAW Chairman, 508-495-2230, Terry.Smith@noaa.gov.