Groundfish Peer Review

February 3-8, 2003
New England Center, Durham, New Hampshire

Report By

Dr. Ewen Bell

Executive Summary

Trawl warp issue.

- There appears to be no systematic change in trawl survey performance in the period covered by the offset trawl warps.
- For those few stocks where significant differences were found, conversion coefficients should be determined.
- Consistency in catchability through time is the most important factor in a survey. Low catchability is not necessarily a problem.

Biological reference points.

- Accurate determination of BMSY requires observations at high stock sizes, a situation which is rare in the stocks under review. The legal framework of managing to BMSY may force scientists to produce values for which there is little scientific basis.
- An alternate approach to biomass reference point determination should be adopted when there are insufficient data for reliable estimation of BMSY.

Description of Review Activities.

Prior to the meeting a large number of documents pertaining to the topics under review were made available to the members of the panel.

The meeting was held February 3-5, 2003 at the New England Centre, Durham, New Hampshire, and was moderated by Don Perkins of the New Hampshire Aquarium. A wide range of the stakeholders was present including scientists, industry representatives, sport fishermen, and representatives from Non-Governmental Organisations (NGOs). The tone of the meeting was generally cordial. A different topic was considered each day, with the first day devoted to the Trawl Warp issues, the second day to biological reference point estimation, and the final day to stock forecasting and rebuilding issues.

The format of the meeting was to take presentations, generally from scientists, but all stakeholders were invited to present data. Following the presentations, the reviewing panel posed questions before opening the discussion to the floor. Due to time limitations, some discussions were cut short, but the majority of views were aired.

All present at the meeting were invited to send their questions and comments to the moderator to ensure an accurate account of proceedings, however this option was not widely used. Transcripts of the discussions were made on the second and third days, which proved useful to compiling of the report.

Following the open meeting, the panel members met in an executive session for a further three days (February 6-8, 2003) to begin preparation of their independent reports, continue reading the documentation, and to request additional material when they required further clarification.

Trawl survey issues and influence on management advice

Considering the results of the Groundfish Assessment Review Meeting (GARM), subsequent results from experimental trawl comparisons, and other appropriate information, provide an evaluation of the significance of potential differences in trawl survey catchability resulting from recently-discovered survey gear problems on management advice for groundfish stocks managed under the Northeast Multispecies Fishery Management Plan.

The trawl warps on the RV Albatross have been found to have incorrect and different length markings for the period of 2000-2002, during which time eight surveys were conducted. The suitability of these eight surveys for inclusion in the survey time series has therefore been called into question.

This topic has been covered in several previous reviews, although this was the first review at which data from the "trawl warp experiment" were available. It was evident from the discussions between scientists and other stakeholders that, despite the previous reviews and the new analyses presented here, there is a wide divergence of opinion over the validity of the survey series. The discussions concerning the utility of scientific surveys very much mirrors discussions within the European arena; the issues appear to be international.

There were several comments made that the surveys were not suitable for fish stock assessment due to low catchability rates. Despite discussions stressing that it is the *consistency* of catchability in surveys that is paramount, many still viewed low catchability as an important issue. No single gear type will have a high catchability for all species, and thus a compromise must be reached. The Yankee #36 trawl used by the surveys is, despite its age, a valid gear for the groundfish it was originally designed to target. Problems may arise when the survey series is used for stocks of low abundance, and where catchability is therefore exceptionally low. In these instances, low catchability may produce data where the statistical noise confounds population signals and data may be influenced by integer artefacts and/or large numbers of zeros. Survey driven assessment of such stocks would increase in accuracy with gear designed more specifically, but the consistency of survey catchability remains paramount.

A. Are conclusions regarding use of 2000-2002 trawl survey data adequately supported by analyses reported by the GARM? Were analyses sufficient to detect differences in survey catches arising from unequal warps and other survey problems? Did the sensitivity analyses presented in the GARM report adequately bound the range of potential effects inferred from analyses of historical and comparative data? Did the GARM adequately characterise the uncertainties in estimated stock sizes and rebuilding mortality rates potentially arising from unequal warp offsets?

Analyses of trawl survey data were undertaken to locate anomalies in the 2000-2002 period possibly induced by the trawl warp offset. These analyses showed no significant step in a large number of parameters including catch at length, catch at depth, and catch variance. Although it is known that unequal warps were introduced in 2000, no data regarding warp length measurement exists prior to this. The lack of stepped change in the survey series could therefore indicate a longer-term issue with offset trawl warps just as equally as it indicates no effect of a change in trawl warps. Whichever scenario is correct, the conclusion is that there appears to have been no systematic change in trawl performance between the periods analysed. The analyses presented to support this are extensive and well thought out.

The sensitivity analyses performed did cover an adequate range of reduced catchability for the species examined. The subsequent trawl experiment has demonstrated that reductions in catchability in the region of 100% are highly unlikely, while changes in catchability of 10-25% are in the region of survey variability.

The concept of increased catchability in the poorly rigged trawl appears to have been overlooked. The general escape response of haddock is to swim upwards, therefore if the poorly rigged net is more likely to lift off the bottom, then haddock catchability might be expected to increase. Resulting simulations of increased haddock catchability were therefore desirable. This omission is largely irrelevant given the lack of significant increase in haddock catches in the "optimal" vs. "worst case" trawl experiment.

The potential for changes in survey catchability on stock status was tested for all 20 species with two species showing changes in stock status from "overfished" to "not overfished," with only a 10% decrease in catchability. Gulf of Maine Haddock was one such species. As mentioned above, it might be expected that haddock catchability might increase with the poorly rigged net. Although the catches were higher in the poorly rigged net the difference is not significant. The potential for the haddock stock to be incorrectly classified due to a 10% *decrease* in catchability is therefore unlikely. The fact that most stocks do not change status, even with a 100% change in survey catchability for the trawl warp years, indicates the poor state of the fisheries.

B. Was the design and analysis of data from experimental trawl comparisons adequate to estimate the magnitude of differences resulting from the use of unequal trawl warps and other experimental treatments? Were estimates of the power of these experiments to detect statistical differences in fish catches between treatment and control survey configurations adequately described?

From the design of the RV Albatross / FV Sea Breeze paired experiments it is impossible to tell if differences observed between "optimal" and "worst case" survey gear were caused by the warp offset or any of the other introduced "problems". If the intention of the experimental fishery was to determine the potential magnitude of differences introduced by differential trawl warp lengths, then this should have been the sole experimental treatment. Additionally, given that only the period of the trawl warp offset is known, and not the frequency of the other problems, it would have made more sense to

focus on the single issue of warp offset. However, given that there is no consistent differences between the "optimal" and "worst case" trawls (i.e. some positive, some negative), there are no grounds for modifying the survey results except for those where significant changes were detected. In these instances, conversion coefficients should be determined.

C. Advise on the significance of differences in species composition and relative catch rates resulting from side-by-side tows performed by commercial and government vessels in the recent trawl experiment with respect to model- and index-based estimates of stock size and fishing mortality rates.

The comparisons of RV and FV species composition are of little or no relevance to the determination of stock sizes. Even after accounting for the difference in the door spread, there are still major differences in mesh size, towing speed and bottom tending characteristics, and a difference in species composition is to be expected. Again, it is the consistency of catchability through time in the surveys which is important

D. Comment on the precision of model-based calculations of stock size and fishing mortality rates in relation to variability in trawl survey catches and other sources of information included in assessments. Are the methods used for incorporating uncertainty into management advice sufficient? How should other sources of uncertainty (e.g., model selection, estimates of total removals) be incorporated?

VPA based assessments take the majority of their information from the catch at age data, thus variability in the survey data is of less importance than to assessment methods solely reliant upon surveys. Due to their generally small sample size, surveys will always be "noisy", but provided that there is no bias in the survey (i.e. low and high abundances are equally captured), the long-term survey assessments will be correct on average. There will inevitably be years when stock sizes are under estimated, but there will equally be years when stock size is over-estimated. The option of not using scientific surveys for assessment purposes is not a valid one. While there have been problems identified with the deployment of the survey gear in the recent past, there has been no drive to improve catch rates such as would be found on a commercial vessel. Use of commercial catch rate data without accounting for changes to vessels, gear and fishing location could seriously over-inflate estimates of stock size and increase the risk of stock collapse.

Attempts to minimize the influence of survey variability in survey-only assessments have been made through the use of three-year running averages. This technique trades reduced survey variability against the ability to detect rapid change. The risk of inducing stock collapse through over predicting stock size is much greater at low stock sizes than at high stock sizes, which fact is not currently taken into account. A precautionary approach to management might look to use estimates of survey CV to produce a more risk-averse strategy.

Concluding remarks.

It was stated that the skipper responsible for deployment of the survey trawl does not have commercial experience, but has been performing the job for 20 years. While the current skipper will have learned techniques for gear deployment over time, it would be preferable if, when a replacement is required, someone with commercial fishing experience could be utilized.

Biological reference points

The biological reference points FMSY and BMSY were recently re-evaluated (Report of the Working Group on Re-Estimation of Biological Reference Points for New England Groundfish Stocks), and some BMSY values were revised upwards quite substantially. These revisions have a particular impact given the Magnuson-Stevens Act (Sustainable Fisheries Act) that requires stocks to be rebuilt to BMSY within 10 years.

Review the fishing mortality and biomass targets and thresholds established for the 20 groundfish stocks included in the Northeast Multispecies FMP. Consider the adequacy of technical analyses supporting estimates of F_{MSY}, B_{MSY} or their proxies, as provided in the *Report of the Working Group on Re-Estimation of Biological Reference Points for New England Groundfish Stocks* (the "Report"). Comment on issues related to the simultaneous achievement of B_{MSY} values for the groundfish complex.

Comments on the general approach.

The Magnuson-Stevens Act (Sustainable Fisheries Act) requires that fish stocks be managed to MSY. Fishing at MSY is a plausible management approach that aims to maximize resource utilization while simultaneously providing a high degree of protection against stock collapse. There are additional legal requirements within the Mangusson-Stevens act that stocks should be rebuilt to BMSY within 10 years or, where that is not possible, an additional generation time is permitted. There is no room in this legislation for cases where BMSY cannot be sufficiently defined so as to be useful. While FMSY can be calculated with a reasonable degree of precision given estimates of selection, growth and natural mortality or through use of a proxy (i.e. $F_{40\%}$), definition of BMSY requires a stock-recruit function.

Most stock-recruit functions use SSB as a proxy for stock reproductive potential. There is increasing evidence that use of this proxy can overestimate a stock's resilience to fishing pressure. For example, large female cod that have spawned at least once are reported to produce larger, more viable eggs with better hatching and survival properties than first time spawners. Thus, with high fishing pressure resulting in a truncated age structure, the spawning potential at low biomasses may be well below that predicted by a stock-recruit curve resulting in longer than anticipated rebuilding times.

Traditional stock-recruit functions are often poorly defined with a limited range of spawning biomasses present in the observed time series. In addition to the short time series available to scientists, the stocks were often exploited for many decades before reliable data became available, thus the maximum stock sizes in the observed data are likely to be well below virgin or even BMSY levels. The restricted data range can create genuine problems for scientists obliged to determine the mandatory BMSY reference points. The different stock-recruit functions may result in vastly differing values of BMSY, and the choice of model may therefore appear almost arbitrary. The function

resulting in the lowest BMSY will result in the least short-term "pain" for industry, although it may actually lead to underutilization of the resource and increased risk to the stock. The function resulting in the highest BMSY while minimizing risk to the stock may in fact be unrealistic, resulting in ever more stringent management action, as the target is actually unattainable. One advantage of using the higher BMSY is that the true BMSY is likely to be found en-route although this could be viewed as the implementation of "precautionary science" rather than "precautionary management".

Ideally, scientists should not be compelled to estimate reference points when the data are not available to do so. In the majority of cases, where stocks are well below the maximum observed stock size and clearly need rebuilding, the problem remains what biomass target to set. Where stock-recruit functional form is ill defined at high biomasses, there is an obvious need to raise the biomass to beyond the highest observed value. Stock projections to the highest observed stock size should be possible as there are observed recruit levels at these sizes. Thus, it will be possible to estimate rebuilding times to this level and slightly beyond. Managers and scientists would have to reach agreement on how far above maximum observed stock size to initially aim.

Many of these comments are echoed in section 4.4 of the Re-Evaluation of Biological Reference Points for New England Groundfish (March 2002).

A. Comment on the technical basis for the estimation of F_{MSY} and B_{MSY}, and choices regarding the use of parametric (Beverton-Holt, Ricker, other candidate models, etc.) and non-parametric stock-recruitment relationships applied to yield per recruit estimates, surplus production models, or proxies for biomass and fishing mortality rate targets and thresholds.

A detailed and rigorous statistical exercise was performed on the available datasets in order to formalize and rationalize the choice of stock-recruit function. Given the constraint that scientists are required by law to develop estimates of BMSY, this would appear to be a logical approach. However, the exercise does seem to have been performed as a straight statistical exercise at the expense of biological understanding.

The working group on re-evaluation of biological reference points for New England groundfish report (NEFC 2002) explored two basic parametric stock-recruit forms: Beverton-Holt (asymptotic) and Ricker (over-compensatory). There is a plausible biological reasoning to both of these models, but they are not exclusive, and many more biologically reasoned recruitment models could be constructed. Unless there is reason to believe that the population dynamics are truly following one of these two models, then the selected model represent an approximation to a functional form. Both models have recruitment increasing with SSB, the rate of increase slowing to an asymptote for the Beverton Holt, while the rate of increase slows and then reverses with increasing SSB for the Ricker. It is the properties of the models at high SSB that really distinguish the models, rather than the exact nature of increase at low SSB.

There may be *a priori* biological reasons for assuming an over-compensatory stock-recruit function (cannibalism, spatial interference between adults and progeny, etc.), and this is acknowledged in the report although this is not taken through to implementation. Cod are known to be cannibalistic for a number of stocks, and it is a reasonable assumption that the same occurs in the Gulf of Maine and Georges Bank stocks. The acceptance of the Beverton-Holt type relationships for these stocks therefore appears to be choosing the wrong model albeit for the right statistical reasons. The problem lies in the range of data available for model fitting in that there is no evidence of either a plateau or a decline in recruitment with increasing SSB and successful discrimination between asymptotic or over-compensatory models requires such data.

These stocks represent good examples of where BMSY reference points are demanded from data that are unable to provide reliable estimates using conventional tools.

B. Comment on the justification for changing the overfishing threshold to $F_{40\%}$ (the proposed proxy for most groundfish stocks) from $F_{20\%}$ that generally defined overfishing before Amendment 9, or from the F_{MSY} estimates in Amendment 9? Are the proposed proxies for F_{MSY} (e.g., $F_{40\%\ MSP}$ for Georges Bank haddock, $F_{50\%\ MSP}$ for Acadian redfish, etc.) more appropriate to achieve MSY, given the groundfish stock dynamics? Are the proposed proxy reference points overly conservative or too liberal for a fishing mortality threshold that complies with the Magnuson-Stevens Act?

If the intention of fishery management is to achieve a long term, sustainable MSY, then fishing at FMSY is the way to achieve that. Fishing at a value of F that is higher than FMSY will not allow the stock to build to a level capable of supporting MSY. From the literature cited, the use of the proposed FMSY proxies appears to be appropriate.

C. Evaluate evidence for density-dependent regulation of population size (e.g., simultaneous occurrence of various stocks at higher population sizes, predator-prey, and growth rate information) for the groundfish complex. Are potential non-stationary stock dynamic processes (i.e., environmental variations in recruitment survival) and/or trophic limitations adequately accounted for in estimates of B_{MSY}? Is there evidence that B_{MSY} values estimated for the 20 groundfish stocks cannot be simultaneously achieved?

From the evidence presented during the meeting there do not appear to be any strong feeding linkages within the fish species assemblage described for the Georges Bank/ Gulf of Maine. As a result, it is unlikely that any one species will dominate a complex where all stocks are rebuilt to BMSY.

Competition is likely to be a more potent force at high stock sizes. There is evidence that large year classes of haddock grow more slowly and mature later (*North Sea*), and will have knock-on consequences for reference points.

Environmental variation is indirectly accounted for when using fitted stock-recruit relationships in that they represent "average" conditions. Longer-term (i.e., decadal) changes in environmental conditions have not been addressed but could impact upon BMSY. Detecting such "regime shifts" is difficult and it could take several years to distinguish a shift from a short-term fluctuation, while advance prediction of such events is beyond current capabilities. Management strategies, which offer some buffer against the possibility of regime shift, are likely to be even more conservative.

The observed data series do not extend back far enough (i.e. close to pre-exploitation) to definitively demonstrate the ability of the system to simultaneously support all stocks at BMSY. Given the uncertainty in some values of BMSY, the ability of the system to support all stocks to this level is also uncertain. There is, however, evidence of much higher biomasses being supported than are currently seen and there is good reason to expect these levels to be achievable as a minimum.

Butterworth Model

Any stock assessment model is just that – a model of the system and the results are conditioned on the assumptions made by the model. It is therefore useful to have more than one stock assessment model, and to identify points of difference, their origin and their consequences. The large range of results for stock size and subsequent reference points obtained from ASPM is of concern in that the model appears to be very sensitive to the assumptions made. There was not the available time within this review process to perform an in-depth analysis of why the model should appear so flexible and I would therefore recommend that investigations are made into the ADAPT and ASPM model differences.

Stock rebuilding and related projections

The Sustainable Fisheries Act requires that various resources be rebuilt to B_{MSY} in no more that 10 years, unless life history attributes of individual stocks dictate a longer rebuilding period (e.g., Georges Bank cod, Acadian redfish, etc.). Considering the uncertainty in stock dynamics and the ability to achieve target rebuilding fishing mortality rates for all stocks in the complex simultaneously, comment on stock projection methodology used to advise on management strategies intended to achieve stock rebuilding goals.

A. Evaluate the adequacy of projection methods used to guide the attainment of B_{MSY}, specifically focusing on estimates of uncertainty in starting stock sizes, recruitment, and implementation uncertainty in the attainment of target fishing mortality rates. Comment on potential biases and precision of stock projection methodologies.

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The AGEPRO software used to forecast rebuilding strategies allows for uncertainty in the estimates of initial population size, natural mortality and future recruitment, while accounting for the additional potential for autocorrelation in recruitment. While this method covers a large portion of uncertainty in projections, there is likely to be further uncertainty from variations in weight, maturity and fishing mortality, all of which will further widen the confidence limits. Provided that there is no bias to the missing uncertainties, the mean trajectory will remain unaffected, but the confidence of rebuilding success to be overestimated.

Of more concern is the inability for the software to cope with trends in parameters. Systematic changes in parameters such as weight- and maturity- at age can cause significant bias in stock projections. For example, a trend of declining weight at age, if unaccounted for, will result in SSB being overestimated and giving an overoptimistic probability of recovery. No information regarding historical age based parameters is given in the GARM report, so the likely impact of these factors is impossible to assess.

B. Are stock projection methodologies sufficient to distinguish the relative merits of various management scenarios?

A wide variety of management scenarios are available in the current AGEPRO software, although the options are not exhaustive. Among other management scenarios that may be considered include the limiting of maximum interannual change in total catch. This would enable a more structured transition within the industry.

C. The Magnuson Stevens Act requires that overfished stocks be rebuilt to a biomass level consistent with producing the maximum sustainable yield from the fishery. Is there a scientific basis for arguing that an intermediate biomass target meets that requirement?

I have addressed the specific question on a scientific basis for intermediate rebuilding targets in the previous section.

General comments.

The volume of documentation accrued prior to, and during, the meeting was too much for each reviewer to read and fully understand on each topic. A division of labour between the reviewers in their statement of work would have allowed each topic to be understood in more detail.

The documentation provided in PDF format would have greatly benefited from consistent book marking. The GARM report had some bookmarks, but others were devoid of any.

APPENDIX 1

STATEMENT OF WORK

Consulting Agreement between the University of Miami and Dr E. D. Bell

January 7, 2003

Introduction

This document presents terms of reference for peer review of the stock assessment and population dynamics science supporting the New England Fishery Management Council's (NEFMC's) Northeast Multispecies Fishery Management Plan (FMP). Specifically, the review will focus on three major terms of reference:

- Effects on the accuracy and present usefulness of trawl survey data due to uneven trawl warps and other recently-discovered gear-related trawl survey problems. These evaluations will be based on gear testing cruises and related workshops conducted during autumn 2002 as well as any other information available to the reviewers.
- Estimates of stock biomass and fishing mortality targets and thresholds for the complex of stocks comprising the groundfish resource, and,
- The adequacy of projections of stock rebuilding to achieve the biomass targets, consistent with time frames as mandated under the Sustainable Fisheries Act.

These three focus areas were originally proposed by the staff of the NEFMC. Specific comments appropriate to three terms of reference provide guidance to the review committee recognizing that reviewers are likely to be unfamiliar with the specifics of the Northeast Multispecies FMP and, the provisions of the Sustainable Fisheries Act. Overall, the terms of reference generally concentrate on the adequacy of the science currently available to support fishery management plan development.

For each subject area, a brief objective statement is provided to give an overall context for the terms of reference to the reviewers. Within these subject areas, specific questions are provided with the intent of providing a minimum set of questions to consider in formulating the group's responses. It is envisioned that the reviewers' responses will take the form of detailed reviews of the information and conclusions reached in the various supporting documents and verbal presentations made to the group, along with their own summaries and opinions regarding the adequacy of existing science in supporting fishery management decisions. The reviewers are encouraged to pay particular attention to alternative methods presented by independent experts, if any, in concluding whether the conclusions of the Report, or other approaches, represent the best science available.

2. Trawl survey issues and influence on management advice

Considering the results of the Groundfish Assessment Review Meeting (GARM), subsequent results from experimental trawl comparisons, and other appropriate information, provide an evaluation of the significance of potential differences in trawl survey catchability resulting from recently-discovered survey gear problems on management advice for groundfish stocks managed under the Northeast Multispecies Fishery Management Plan.

In responding, reviewers should consider the following:

A. Are conclusions regarding use of 2000-2002 trawl survey data adequately supported by analyses reported by the GARM? Were analyses sufficient to detect differences in survey catches arising from unequal warps and other survey problems? Did the sensitivity analyses presented in the GARM report adequately bound the range of potential effects inferred from analyses of historical and comparative data? Did the GARM adequately characterize the uncertainties in estimated stock sizes and rebuilding mortality rates potentially arising from unequal warp offsets?

B. Was the design and analysis of data from experimental trawl comparisons adequate to estimate the magnitude of differences resulting from the use of unequal trawl warps and other experimental treatments? Were estimates of the power of these experiments to detect statistical differences in fish catches between treatment and control survey configurations adequately described?

C. Advise on the significance of differences in species composition and relative catch rates resulting from side-by-side tows performed by commercial and government vessels in the recent trawl experiment with respect to model- and index-based estimates of stock size and fishing mortality rates.

D. Comment on the precision of model-based calculations of stock size and fishing mortality rates in relation to variability in trawl survey catches and other sources of information included in assessments. Are the methods used for incorporating uncertainty into management advice sufficient? How should other sources of uncertainty (e.g., model selection, estimates of total removals) be incorporated?

3. Biological reference points

Review the fishing mortality and biomass targets and thresholds established for the 20 groundfish stocks included in the Northeast Multispecies FMP. Consider the adequacy of technical analyses supporting estimates of F_{MSY}, B_{MSY} or their proxies, as provided in the *Report of the Working Group on Re-Estimation of Biological Reference Points for New England Groundfish Stocks* (the "Report"). Comment on

issues related to the simultaneous achievement of B_{MSY} values for the groundfish complex.

In responding, reviewers should consider the following. Of particular note, the NEFMC's Science and Statistical Committee recommended that additional work was needed "…specifically to explore the implications of the uncertainty in the stock recruitment relationship." For this reason, more specific questions are included in order to add clarity to the issues to be addressed by the reviewers.

A. Comment on the technical basis for the estimation of F_{MSY} and B_{MSY}, and choices regarding the use of parametric (Beverton-Holt, Ricker, other candidate models, etc.) and non-parametric stock-recruitment relationships applied to yield per recruit estimates, surplus production models, or proxies for biomass and fishing mortality rate targets and thresholds.

   - Are the Working Group assumptions (growth, maturity ogive, natural mortality, partial recruitment) appropriate for estimating a B_{MSY} proxy, which establishes a minimum biomass threshold and a rebuilding target?

   - Comment with reference to specific species on whether the use of Beverton-Holt type stock-recruitment curves, as opposed to the use of dome-shaped (Ricker type) curves, represent reasonable scientific judgment employing sound methodology and appropriate data sources. Is there a theoretical or practical basis to detect overcompensation (Ricker curve) from the stock-recruitment curve for each groundfish species based on the magnitude of the intrinsic rate of population increase (r) and the carrying capacity (K) parameter estimates from ASPIC production models?

   - Could alternative non-equilibrium production models for groundfish species be examined for estimating F_{MSY} and B_{MSY} thresholds?

B. Comment on the justification for changing the overfishing threshold to $F_{40\%}$ (the proposed proxy for most groundfish stocks) from $F_{20\%}$ that generally defined overfishing before Amendment 9, or from the F_{MSY} estimates in Amendment 9? Are the proposed proxies for F_{MSY} (e.g., $F_{40\%\ MSP}$ for Georges Bank haddock, $F_{50\%\ MSP}$ for Acadian redfish, etc.) more appropriate to achieve MSY, given the groundfish stock dynamics? Are the proposed proxy reference points overly conservative or too liberal for a fishing mortality threshold that complies with the Magnuson-Stevens Act?

   - Reconstruction of the theoretical S-R curve can be done indirectly for each groundfish species by merging results (YPR, SSB/R) from the Thompson-Bell yield-per-recruit model and expected equilibrium yield (mt) from various stock production models. Are the resulting F_{MSY} values similar to the $F_{40\%}$ values (e.g. for haddock) from the Y/R curve? Is $F_{40\%}$ a suitable proxy for F_{MSY} under these conditions?

C. Evaluate evidence for density-dependent regulation of population size (e.g., simultaneous occurrence of various stocks at higher population sizes, predator-prey, and growth rate information) for the groundfish complex. Are potential non-stationary stock dynamic processes (i.e. environmental variations in recruitment

survival) and/or trophic limitations adequately accounted for in estimates of B_{MSY}? Is there evidence that B_{MSY} values estimated for the 20 groundfish stocks cannot be simultaneously achieved?

4. Stock rebuilding and related projections

The Sustainable Fisheries Act requires that various resources be rebuilt to B_{MSY} in no more that 10 years, unless life history attributes of individual stocks dictate a longer rebuilding period (e.g. Georges Bank cod, Acadian redfish). Considering the uncertainty in stock dynamics and the ability to achieve target rebuilding fishing mortality rates for all stocks in the complex simultaneously, comment on stock projection methodology used to advise on management strategies intended to achieve stock rebuilding goals.

In responding, reviewers should consider the following:

A. Evaluate the adequacy of projection methods used to guide the attainment of B_{MSY}, specifically focusing on estimates of uncertainty in starting stock sizes, recruitment, and implementation uncertainty in the attainment of target fishing mortality rates. Comment on potential biases and precision of stock projection methodologies.

B. Are stock projection methodologies sufficient to distinguish the relative merits of various management scenarios?

C. The Magnuson-Stevens Act requires that overfished stocks be rebuilt to a biomass level consistent with producing the maximum sustainable yield from the fishery. Is there a scientific basis for arguing that an intermediate biomass target meets that requirement?

Schedule

The independent peer review is to be completed by March 1, 2003. In order to meet that deadline, the following review format and timeline is proposed.

3-5 February: Public workshop **(including participation of independent reviewers**) on the GARM Report and report of biological reference points during this week.
6-8 February: Independent reviewers meet in executive session to discuss results from the two workshops and supporting documentation.
10-14 February: Independent reviewers prepare their individual reports and submit them to the summarizer.
17-21 February: Summarizer prepares his/her report summarizing findings of individual reports prepared by panel members, which will be made available to the public.

The February 3–5, 2003 public workshop will begin with an introduction followed by a series of presentations summarizing the various documents presented to the panel. Open comment periods will allow for additional scientific input from various members of the public regarding additional analyses and comments. Peer reviewers will interact with agency and independent scientists and members of the public to ask appropriate questions and discuss results.

Specific

The consultant shall be provided with all background material required to prepare for the review, and the consultant shall attend the February 3 – 5, 2003 workshop, the February 6 – 8, 2003 executive session, and to develop an individual, non-consensus report that shall be submitted for final summarization. The report shall also be submitted to the Center for Independent Experts as a review report.

The consultant's duties shall not exceed a maximum total of 14 days: Several days prior to the workshop for document review; the three-day workshop; the three-day executive session; and several days following the meeting to complete the workshop and executive session report. The reports are to be based on the consultant's findings, and no consensus reports shall be accepted.

The consultant's duties include:

1. Reading all background material provided;

2. Participating in the February 3 – 5, 2003 workshop on the Groundfish Assessment and Review Meeting (GARM) Report and report of biological reference points;

3. Participating in the February 6 – 8, 2003 executive session to discuss results from the two workshops and supporting documentation;

4. No later than February 14, 2003, submitting a written, nonconsensus report that is based on the results of the workshops and supporting documentation, the executive session discussions, and on the terms of reference described in the statement of work. The report should be submitted to the workshop summarizer and to the CIE[1]; the CIE report should be addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David Sampson, via email to david.sampson@oregonstate.edu, and to Mr. Manoj Shivlani, via email to mshivlani@rsmas.miami.edu.

[1] The written report will undergo an internal CIE review before it is considered final. After completion, the CIE will create a PDF version of the written report that will be submitted to NMFS and the consultant.

APPENDIX 2

TERMS OF REFERENCE FOR THE GROUNDFISH SCIENCE REVIEW, FEBRUARY 3-8, 2003

Introduction

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- Effects on the accuracy and present usefulness of trawl survey data due to uneven trawl warps and other recently discovered gear-related trawl survey problems. These evaluations will be based on gear-testing cruises and related workshops conducted during autumn 2002 as well as any other information available to the reviewers.
- Estimates of stock biomass and fishing mortality targets and thresholds for the complex of stocks constituting the groundfish resource, and,
- The adequacy of projections of stock rebuilding to achieve the biomass targets, consistent with time frames mandated under the Sustainable Fisheries Act.

These three focus areas were originally proposed by the staff of the NEFMC. Specific comments appropriate to the three terms of reference provide guidance to the review committee, recognizing that the independent reviewers are likely to be unfamiliar with the specifics of the Northeast Multispecies FMP and the provisions of the Sustainable Fisheries Act. Overall, the terms of reference generally concentrate on the adequacy of the science currently available to support FMP development.

For each subject area, a brief objective statement is provided to give an overall context for the terms of reference to the reviewers. Within these subject areas, specific questions are provided with the intent of providing a minimum set of questions to consider in formulating the group's responses. It is envisioned that the reviewers' responses will take the form of detailed reviews of the information and conclusions reached in the various supporting documents and verbal presentations made to the group, along with their own summaries and opinions regarding the adequacy of existing science in supporting fishery management decisions. The reviewers are encouraged to pay particular attention to alternative methods presented by the independent experts, if any, in concluding whether the conclusions of the Report, or other approaches, represent the best science available.

TERMS OF REFERENCE

1. TRAWL SURVEY ISSUES AND INFLUENCE ON MANAGEMENT ADVICE

Considering the results of the Groundfish Assessment Review Meeting (GARM), subsequent results from experimental trawl comparisons, and other appropriate

information, provide an evaluation of the significance of potential differences in trawl survey catchability resulting from recently discovered survey gear problems on management advice for groundfish stocks managed under the Northeast Multispecies Fishery Management Plan.

In responding, reviewers should consider the following:

A. Are conclusions regarding the use of 2000-2002 trawl survey data adequately supported by analyses reported by the GARM? Were those analyses sufficient to detect differences in survey catches arising from unequal warps and other survey problems? Did the sensitivity analyses presented in the GARM report adequately bound the range of potential effects inferred from analyses of historical and comparative data? Did the GARM adequately characterize the uncertainties in estimated stock sizes and rebuilding mortality rates potentially arising from unequal warp offsets?

B. Was the design and analysis of data from experimental trawl comparisons adequate to estimate the magnitude of differences resulting from the use of unequal trawl warps and other experimental treatments? Were estimates of the power of these experiments to detect statistical differences in fish catches between treatment and control survey configurations adequately described?

C. Advise on the significance of differences in species composition and relative catch rates resulting from side-by-side tows performed by commercial and government vessels in the recent trawl experiment with respect to model- and index-based estimates of stock size and fishing mortality rates.

D. Comment on the precision of model-based calculations of stock size and fishing mortality rates in relation to variability in trawl survey catches and other sources of information included in assessments. Are the methods used for incorporating uncertainty into management advice sufficient? How should other sources of uncertainty (e.g. model selection, estimates of total removals) be incorporated?

2. BIOLOGICAL REFERENCE POINTS

Review the fishing mortality and biomass targets and thresholds established for the 20 groundfish stocks included in the Northeast Multispecies FMP. Consider the adequacy of technical analyses supporting estimates of F_{MSY}, B_{MSY} or their proxies, as provided in the *Report of the Working Group on Re-Estimation of Biological Reference Points for New England Groundfish Stocks* (the "Report"). Comment on issues related to the simultaneous achievement of B_{MSY} values for the groundfish complex.

In responding, reviewers should consider the following. Of particular note, the NEFMC's Science and Statistical Committee recommended that additional work was needed "…specifically to explore the implications of the uncertainty in the stock recruitment relationship." For this reason, more specific questions are included in order to add clarity to the issues to be addressed by the reviewers.

A. Comment on the technical basis for the estimation of F_{MSY} and B_{MSY}, and choices regarding the use of parametric (Beverton-Holt, Ricker, other candidate models, etc.) and non-parametric stock-recruitment relationships applied to yield per recruit estimates, surplus production models, or proxies for biomass and fishing mortality rate targets and thresholds.

- Are the Working Group assumptions (growth, maturity ogive, natural mortality, partial recruitment) appropriate for estimating a B_{MSY} proxy that establishes a minimum biomass threshold and a rebuilding target?

- Comment with reference to specific species on whether the use of Beverton-Holt type stock-recruitment curves, as opposed to the use of dome-shaped (Ricker type) curves, represent reasonable scientific judgment employing sound methodology and appropriate data sources. Is there a theoretical or practical basis to detect overcompensation (Ricker curve) from the stock-recruitment curve for each groundfish species based on the magnitude of the intrinsic rate of population increase (r) and the carrying capacity (K) parameter estimates from ASPIC production models?

- Could alternative non-equilibrium production models for groundfish species be examined for estimating F_{MSY} and B_{MSY} thresholds?

B. Comment on the justification for changing the overfishing threshold to $F_{40\%}$ (the proposed proxy for most groundfish stocks) from the $F_{20\%}$ that generally defined overfishing before Amendment 9, or from the F_{MSY} estimates in Amendment 9? Are the proposed proxies for F_{MSY} (e.g. $F_{40\%\ MSP}$ for Georges Bank haddock, $F_{50\%\ MSP}$ for Acadian redfish) more appropriate to achieve MSY, given the groundfish stock dynamics? Are the proposed proxy reference points overly conservative or too liberal for a fishing mortality threshold that complies with the Magnuson-Stevens Act?

- Reconstruction of the theoretical S-R curve can be done indirectly for each groundfish species by merging results (YPR, SSB/R) from the Thompson-Bell yield-per-recruit model and expected equilibrium yield (mt) from various stock production models. Are the resulting F_{MSY} values similar to the $F_{40\%}$ values (e.g. for haddock) from the Y/R curve? Is $F_{40\%}$ a suitable proxy for F_{MSY} under these conditions?

C. Evaluate evidence for density-dependent regulation of population size (e.g. simultaneous occurrence of various stocks at higher population sizes, predator-prey, and growth rate information) for the groundfish complex. Are potential non-stationary stock dynamic processes (i.e. environmental variations in recruitment survival) and/or trophic limitations adequately accounted for in estimates of B_{MSY}? Is there evidence that B_{MSY} values estimated for the 20 groundfish stocks cannot be simultaneously achieved?

3. STOCK REBUILDING AND RELATED PROJECTIONS

The Sustainable Fisheries Act requires that various resources be rebuilt to B_{MSY} in no more than 10 years, unless life history attributes of individual stocks dictate a longer rebuilding period (e.g. Georges Bank cod, Acadian redfish). Considering the uncertainty in stock dynamics and the ability to achieve target rebuilding fishing mortality rates for all stocks in the complex simultaneously, comment on the stock projection methodology used to advise on management strategies intended to achieve stock rebuilding goals.

In responding, reviewers should consider the following:

A. Evaluate the adequacy of projection methods used to guide the attainment of B_{MSY}, specifically focusing on estimates of uncertainty in starting stock sizes, recruitment, and implementation uncertainty in the attainment of target fishing mortality rates. Comment on potential biases and precision of stock projection methodologies.

B. Are stock projection methodologies sufficient to distinguish the relative merits of various management scenarios?

C. The Magnuson-Stevens Act requires that overfished stocks be rebuilt to a biomass level consistent with producing the maximum sustainable yield from the fishery. Is there a scientific basis for arguing that an intermediate biomass target meets that requirement?

APPENDIX 3

REVIEWERS AND AGENDA
GROUNDFISH PEER REVIEW (GPR)

Public Meeting – 3-5 February 2003, New England Center, University of New Hampshire, Durham, New Hampshire
http://www.necc.unh.edu/

Independent Peer Reviewers (contracted through the Center for Independent Experts (CIE: University of Miami)

Dr Ewen Bell, Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, England

Dr Robin Cook, FRS Marine Laboratory, Aberdeen, Scotland

Dr Murdoch McAllister, Imperial College, London, England

Dr Robert Mohn, Department of Fisheries and Oceans, Halifax, NS, Canada

Dr Andrew Payne (Chair/summarizer), Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, England

Public Session Moderator

Mr Don Perkins, Gulf of Maine Aquarium

AGENDA - modified during meeting to accommodate participants' availability

Monday, 3 February

0900-1700 Public Session – Topic: **Trawl Survey Issues**

Background Documents:

-Report of the Workshop on Trawl Warp Effects on Gear Performance
http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0215/

- Report of the Groundfish Assessment Review Meeting
http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0216/

- Report of the Trawl Survey Experiment Workshop
available online

- Other contributed documents

Order of the Day:

Introduction of peer reviewers, presentation of terms of reference, and discussion of ground rules (Moderator)

Formal Presentations:

- *An overview of trawl survey issues* – **Russell Brown** (30 minutes)
- *Intervention analyses to detect trawl warp offset problems, sensitivity analyses, scale of potential offset factors*- **Paul Rago** (1 hour)
- *Trawl warp and related experiments*- **Michael Fogarty** (1 hour)
- *An evaluation of Paul Starr's analysis of the fishing gear experiment*- **Doug Butterworth** (20 minutes)
- *Comparison of length composition data from trawl experiments*- **Tom Nies** (30 minutes)

Facilitated discussion regarding presented materials in relation to terms of reference (all)

Tuesday, 4 February

0800-1700 Public Session – Topic: **Biological Reference Points**

Background Documents:

- Report of the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish

http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0204/

- Report of the Overfishing Definition Review Panel:
http://www.nefmc.org/documents/overfishing/

- Report of SAW 36

- Report of the Groundfish Assessment Review Meeting:
http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0216/

- NEFMC Council Meeting Report for July 2002, summarizing Scientific and Statistical Committee review of re-estimated reference points
http://www.nefmc.org
(Go to "News and Motions," then click on "Council Reports")

- Other contributed documents

Order of the Day:

Formal Presentations:

- *Re-Evaluation of biological reference points: goals and objectives*- **Steven Murawski** (1 hour)
- *A Strategy to evaluate alternative stock-recruitment models*- **Christopher Legault** (30 minutes)
- *Evidence for density-dependence in species and ecosystem responses*- **Ralph Mayo** (30 minutes**)**
- *An age-structured production model based assessment and reference point evaluation for the Gulf of Maine cod stock*- **Doug Butterworth** (1 hour)
- *Decision analyses using biological reference points in evaluating groundfish stock status*- **Yong Chen** (30 minutes)
- *Overfishing thresholds (F_{MSY}, B_{MSY}) for New England groundfish from empirically based stock recruitment models*- **Victor Crecco** (30 minutes)
- *A general biological reference point working group model*- **Andy Applegate** (20 minutes)

Facilitated discussion regarding presented materials in relation to terms of reference (all)

Wednesday, 5 February

0800-1700 Public Session – Topic: **Projections of Stock Rebuilding**

Background Documents:

-National Standard Guidelines for Overfishing Definitions: Final Rule
http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=1998_register&docid=fr01my98-23.pdf

- AgePro Users manual:

- GARM Report Revised Projections
http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0216/

- Other Contributed Documents

Order of the Day:

Formal Presentations:

- *NMFS National Standard Guidelines and Stock Rebuilding*- **Pamela Mace** (40 minutes)
- *Projection Methodologies used to evaluate medium-term impacts*- **Jon Brodziak** (40 minutes)
- *A phased rebuidling strategy, using the cod stocks from Gulf of Maine and Georges Bank as examples*- **Doug Butterworth** (30 minutes)
- *Rebuilding strategies for three key stocks*- **Dave Lincoln** (30 minutes)

Facilitated discussion regarding presented materials in relation to terms of reference (all)

Thursday, 5 February – Saturday, 8 February

Executive Session – Invited Peer Reviewers and support staff person (Karena Jolles, New Hampshire Fish and Game Department)

Discuss issues raised at public workshop and in supporting documents. Develop strategy for completing individual reports and how summarizer will convert them to a final document.

Commence the report drafting process individually and through debate.

Consult other participants for clarity purposes.

APPENDIX 4

BIBLIOGRAPHY CONSULTED/MADE AVAILABLE

1. Formal Documentation (received before or at the meeting)

Almeida, F. and L. Jacobson. Working Paper: Species Compositions from the NMFS/Industry Survey Trawl Study Conducted by the R/V *Albatross IV* and F/V *Sea Breeze* 28 October-6 November, 2002. 24 pp.

Almeida, F., and L. Jacobson. Species Size Compositions from the NMFS/Industry Survey Trawl Study Conducted by the R/V *Albatross IV* and F/V *Sea Breeze*, 28 October - 6 November 2002.

Almeida, Frank. Working Paper: Comparison of R/V *Albatross IV* and F/V *Sea Breeze* Catch during the NMFS/Industry Survey Trawl Study. Presence vs. Absence by Species. 9 pp.

Almeida, Frank. Working Paper: Composition of the R/V *Albatross IV* 'Other Catch' Component during the NMFS/Industry Survey Trawl Study Conducted 28 October-6 November, 2002. 5 pp.

Almeida, Frank. Working Paper: Cruise Report of the NMFS/Industry Survey Trawl Study Conducted by the R/V *Albatross IV* and F/V *Sea Breeze*, 28 October-6 November, 2002. 6 pp.

Brodziak, J. K. T. and P. J. Rago. AGEPRO Version 2.02 User's Guide. July 23, 2002. 107 pp.

Brodziak, Jon. Comparison of Average Catch Rates of 20 Species for Optimal and Worst-Case Scenario Net Configurations by Area. January 14-15, 2003.

Butterworth, D S, R A Rademeyer and E´ E Planganyi. An Age-Structured Production Model Based Assessment and Reference Point Evaluation for the Gulf of Maine Cod Stock. 41 pp. (3 pp. Addendum added)

Butterworth, D S, R A Rademeyer, É E Plaganyi. Results for Georges Bank Cod of Age-Structured Production Model Based Assessments Similar to those Conducted for the Gulf of Maine Cod Stock. 22 pp.

Crecco, Victor. Overfishing Thresholds (F_{MSY}, B_{MSY}) for New England Groundfish from Empirically-Based Stock-Recruitment Models. January 26, 2003. 21 pp.

Fogarty, Michael J. Analysis of R/V Albatross IV - F/V *Sea Breeze* Trawl Configuration Experiment. 9 pp.

Lovgren, Jim. Observations from the *Albatross IV* correctional cruise. February 5 2003. 4 pp.

National Oceanic and Atmospheric Administration. 50 CFR Part 600 Magnuson Stevens Act Provisions; National Standard Guidelines; Final Rule. May 1, 1998. Federal Register 63(84): 24212-24237.

New England Fishery Management Council. Council Report. July 2002. 6 pp.

New England Fishery Management Council. Correspondence received by Council regarding the trawl gear survey information.

New England Fishery Management Council. Report of the Groundfish Overfishing Definition Committee. November 27, 2000. 12 pp.

Nies, Tom. Working Paper: Analysis of Catch-at-Length Data from the NMFS Industry Survey trawl Study Conducted by the R/V *Albatross IV* and F/V *Sea Breeze*. October 28 - November 6, 2002. 18 pp.

Northeast Fisheries Science Center Reference (NEFSC) Document 02-15. Report of the Workshop on Trawl Warp Effects on Fishing Gear Performance. October 2-3, 2002. 80 pp.

Northeast Fisheries Science Center (NEFSC) Document 02-16. Assessment of 20 Northeast Groundfish Stocks through 2001. A Report of the Groundfish Assessment Review Meeting (GARM) October 8-11, 2002. 511 pp.

Northeast Fisheries Science Center (NEFSC)/Industry Cooperative Survey Gear Study 28 October-6 November, 2002. Source Document: Specifications for Construction of NEFSC Standard #36 Bottom Trawl.

Northeast Fisheries Science Center (NEFSC), National Marine Fisheries Service. Final report of the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish. March 19, 2002. 232 pp. + 163 pp. of Appendix 7.0.

Northeast Regional Stock Assessment Review Committee (36th SARC). Draft Advisory Report on Stock Status. January 2003. 50 pp.

Overfishing Definition Review Panel. Final report: Evaluation of Existing Overfishing Definitions and Recommendations for New Overfishing Definitions to Comply with the Sustainable Fisheries Act. June 17, 1998. 179 pp.

Restrepo, V.R. et al. Technical guidance on the Use of Precautionary Approaches to implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. 1998. NOAA Technical Memorandum NMFS-F/SPO-31.

Starr, Paul. Memorandum: Analysis of NMFS Trawl Survey Data: R/V *Albatross IV* and F/V *Sea Breeze*. January 10, 2003. 16 pp.

Stauffer, Gary. NOAA Protocols for Groundfish Bottom Trawl Surveys of the Nation's Fishery Resources. December 16, 2002. 81 pp.

2. Presentation or illustrative material (received at the meeting)

Applegate, Andy. Handout: General Biological Reference Point Working Group Model.

Brodziak, Jon. Presentation: (Age-Structured) Projection Methodologies Used to Evaluate Medium-Term Impacts. February 5, 2003.

Brown, Russell W. Presentation: Issues with NOAA Fisheries Bottom Trawl Surveys Conducted.

Butterworth, Doug. Summary of Paul Starr's Analysis Presented to the trawl Experiment Workshop, January 14, 2003.

Butterworth, Rademeyer and Plaganyi. Updated Projections covering phased rebuilding.

Chen, Yong. Presentation: Decision analyses using biological reference points in evaluating groundfish stock status. February 2, 2003.

Correspondence Received by Council Regarding the Trawl Gear Survey Information

Fogarty, Mike. Presentation: Effects of Trawl Warp Offsets and Gear Configuration on Survey Catches.

Goudey, Clifford A. Letter to Paul Howard (NEFMC). Comments on the significance of the warp offset issue and on the utility of the recent R/V *Albatross IV* and F/V *Sea Breeze* comparison cruise in determining the possible sampling errors in recent trawl surveys. January 28, 2003.

Industry Stakeholder Concerns raised by those who participated in the September 25-27 experimental cruise, including a list of questions from fishermen. Handout.

Legault, Christopher M. Presentation: A Strategy to Evaluate Alternative Stock-Recruitment Models.

Lincoln, Dave. Presentation: Rebuilding Strategies vs. Catch.

Mace, Pamela M. Presentation: The implementation of National Standard 1 since the SFA. February 2003.

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O'Malley, James. From Science to Illusion: Mathematics in Fishery Management. In *Pacem in Maribus* XXVI, Halifax, November 29-December 3, 1998.

O'Malley, James D. Letter to Mr Ricks Savage. East Coast Fisheries Federation, Inc. May 16, 2002.

Rago, Paul. Presentation: Intervention Analyses to Detect trawl Warp Offset Problems for NMFS R/V Survey Indices from 2000-2002. February 3, 2003.

Stevenson, Barbara. Handout: Trawl Data for R/V *Albatross IV* and F/V *Sea Breeze*.

APPENDIX 5

CLOSING QUESTIONS POSED AND COMMENTS MADE TO THE PANEL BY PARTICIPANTS

Doug Butterworth

1. Have ADAPT assessments explored a sufficient set of sensitivities, for example in respect of alternative values of M, and what are the implications for reference point estimates?

2. Comment on the appropriateness of MSY-based management targets given the imprecision of the estimates and difficulties associated in particular with changes over time resulting from new data and changed methodologies.

3. Given the ASPM-based reference points for two cod stocks, albeit based on initial analysis, are appreciably different from those based on ADAPT methodology, how important is it that further ASPM-based results be developed to be taken into account in the next set of management decisions for these stocks?

4. Given that assessment method, with current data, appear unable to estimate parameters such as stock-recruitment steepness (and hence B_{MSY}) with great precision, what is the potential role of adaptive management towards improving such precision? (Note the relevance of this question in respect of scientific aspects of the TOR 3C.)

5. Is it important for the Albatross to survey efficiently (as well as comparably over time) to be able to use associated swept-area estimates of absolute abundance to "ground-truth" estimates provided by population model assessment methods?

Geoffrey Smith

1. Given the fact that B_{MSY} values are generally set at one half of the carrying capacity of the stock, is it unreasonable to assume that all 19 stocks of groundfish can be rebuilt to B_{MSY} simultaneously?

2. Do rebuilding strategies that allow continued over fishing in the near term pose a greater biological risk than those that reduce fishing mortality rates to levels at or below F_{MSY}?

3. Is the question of the National Standard Guidelines requirement to rebuild overfished stocks to B_{MSY} in 10 years or less a scientific question or a legal and/or public policy question?

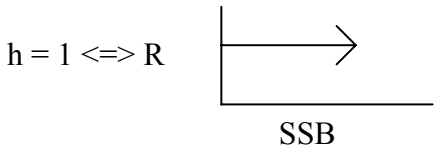
Priscilla Brooks

1. Fisheries management in the United States is governed by the Sustainable Fisheries Act and National Standards that dictate narrowly the parameters with in which management plans are developed. Pamela Mace's presentation gave you a

fairly thorough overview of the law and guidelines. I believe that you must keep in mind the legal reality in which we work and in which your report will be incorporated B_{MSY} and F_{MSY} must be estimated and stocks must be rebuilt within 10 years, except in circumstances in which the natural history of the stock dictates more time. Given these realities, is the NMFS science related to the biological reference points, that is the GARM report, sound?

Jon Brodziak

1. Are the steepness parameters (h) values implied/estimated in the Butterworth production models for GOM cod credible, in the context of Myers et al. (1999. Maximum reproductive rate...CJFAS)?



Ron Smolowitz

1. What is the sensitivity of the trawl survey to towing speed changes over time?

Eric Smith

1. Perhaps a useful follow-on question is to ask "Is there justification, given scientific uncertainty in biological reference points and projection methodology, for setting a lower intermediate 10-year rebuilding target that can be adjusted upwards as the stock builds and our estimate of that value becomes more certain?" This better captures the essence of the Council's question/concern from a management standpoint. TOR 3C

2. Is a Ricker-type S-R curve more (or equally) justified relative to a B-H type curve for cod and haddock? TOR 2A, bullet #2

Phil Ruhle

Please look over NMFS protocol for groundfish surveys, recently developed.

1. The speed issue is of great concern but the gear used is also a problem. In all other surveys gear is well addressed but NEFSC survey net design and age is 40 years. The design has not been used by industry in 20 years.

2. Bottom contact on this gear is very lax as is all aspects of handling of this gear; this is shown in NEFSC protocol as compared to other science centers.

Pamela Mace

Note about the Precautionary Approach:

1. See page 11 of Technical Guidance for a statement about how the precautionary approach is appropriate to management decisions, but not to scientific estimation of assessment-related parameters and variables.

Andy Applegate

1. Which other analytical methods can be used to validate the reference point estimates and rebuilding projections given the heavy reliance on less robust and variable recruitment estimates? How do managers use the scientific advice while this effort is made?

2. Are there better methods within the context of the current National Standards to evaluate the performance of the plan and monitor rebuilding of a set of multispecies fisheries?

Tom Nies

Question on Trawl Experiment

1. Was the design of the experiment adequate to determine if errors in the trawl warp cable affected resent survey results?

   Points to consider:
   -The control net differed from the design of the survey net used for the past two years (ignoring the issue of warp length). Some differences: different doors, use of swivels on doors, different backstraps, different ground cable rigging.
   -Experimental tows were all conducted either into or with the current. Survey tows are towed in the direction of the next station, without regard to current. The experiment never towed cross-current, and a poorly rigged net may tow differently in a cross-current.
   -If, as suggested by Paul Rago based on Pennington's work, the effective sample size for frequency distributions is closely related to number of tows (as opposed to fish caught), were there enough tows to draw conclusions on catch at length/age?
   -Is the assumption of a covariate relationship between the commercial vessel and Albatross catches justified by the analysis? (I have not seen the final paper by Dr. Fogarty).
   -For the covariate analysis, how does the insertion of values for missing Sea Breeze catches affect the results?

Jim O'Malley

1. Is there evidence of any application of the precautionary principle in the assessments or rebuilding targets?

2. Is such an application legitimate in science?

David Frulla

1. If one manages towards B_{MSY} for every species in a mixed stock fishery at the same time, can this result in under utilisation of certain species? TOR 3

2. Can differing F reduction strategies accommodate considerations relating to a mixed stock fishery, economic consideration, and uncertainties related to significantly higher new reference points, while achieving the appropriate biomass target over the relevant rebuilding period? TOR 3

1.