Mid-Atlantic Council Scientific and Statistical Committee Meeting
May 19, 2009
Baltimore, MD
Summary Notes

The meeting was called to order by SSC Chairman Brian Rothschild at 0830. Other SSC members in attendance included John Boreman, Cynthia Jones, Ed Houde, Scott Crosson, Wendy Gabriel, Bonnie McCay, Mike Wilberg and Yan Jiao. Also attending were Fred Serchuk (NEFSC) and public attendees included Greg DiDomenico, Rick Marks, Brad Sewell, Kate Semmens, Ken Hinman, and Ken Stump.

J. Didden presented an overview of biology and fisheries for Atlantic butterfish, as well as staff recommendations for 2010 quota and management recommendations for butterfish for 2010.

Butterfish discussion leader R. Latour summarized his concerns about the stock assessment and ABC recommendations for butterfish as follows:

1. Butterfish is a schooling pelagic species whose abundance is not well characterized by bottom trawl gear.
2. Discard losses are estimated to be twice landings.
3. There is great uncertainty with respect to discard mortality
4. More rigorous treatment of trawl survey data using GLM techniques may have been warranted.
5. The biomass dynamics model used in the assessment assumed variable and has a high M
6. Recent recruitment has been low and landings have declined.
7. There has been a slight increase in survey abundance index recently.
8. The stock assessment is five years old and is based on seven-year-old data.
9. This is a short-lived species with recent poor recruitment , which is a cause for concern given there appears to be no population response (based on recent survey indices) in spite of reductions in harvest (implies discards are not being controlled adequately).
10. There appears to be no basis to determine if stock is currently overfished or if overfishing is occurring given at least a complete generation of butterfish have moved through the fishery since the last stock assessment.

The SSC noted the lack of congruence between spring and fall indices and suggested that an investigation into causal factors of this infidelity would be useful. There appears to be a slight increase in abundance based on the spring survey; the overwintering dynamics of the stock, especially young of the year survival, might be changing.

The SSC discussed behavior of state survey indices; inconclusive because state surveys appear flat and/or trends among surveys appear incongruent (i.e., CT survey is variable and increasing while VA survey is decreasing).

The SSC noted the wide confidence intervals about F and biomass model estimates; however, trends in those parameter estimates are important (i.e., F increasing and biomass decreasing through the time series). It was noted that age structure continues to be truncated even after quotas were restricted to low levels; suggests F from discards remains high given the life history dynamics (i.e., low age at maturity and short life span would suggest a quick biomass response to low F) or a shift in productivity (or both).

The issue of adequacy of observer coverage of the *Loligo* fishery (the source of the majority of butterfish discards) was discussed. The MAFMC has requested increased observer coverage of small mesh fisheries in SNE and MA to improve precision of bycatch estimates in the Loligo fishery for 2009-2010. F. Serchuk noted that it would be desirable to have the SSC review and comment on the annual SBRM report. Funding is currently limiting at-sea observer coverage of the Mid-Atlantic fisheries.

The SSC also noted that it is important that basic information deficiencies for this stock and others be made clear to the Council and NMFS. In addition, no description of the sampling theoretic is presented to assess the quality of the information that was used in the assessment. It is important that the information deficiencies that exist for this and most of the other managed stocks be addressed through the design and implementation of an appropriate sampling program.

The SSC agreed by consensus with the staff quota and management recommendations for butterfish for 2010.

J. Didden presented an overview of biology and fisheries for Atlantic mackerel, as well as staff recommendations for 2010 quota and management recommendations for mackerel for 2010.

He was asked by the SSC about the accuracy of the foreign landings. This is an important issue because the performance of the foreign fishery in the earlier time period of the data set is what is driving the results of the surplus production model (100% observer coverage was required but the foreign catch numbers are considered to be an underestimate of the true foreign catch).

Mackerel discussion leader J. Boreman outlined the following concerns relative to mackerel:

1. The last full assessment for mackerel was undertaken in 2004, and projections in the assessment were not updated between then and now. This means that the information upon which to base specifications is now at least five years old.

2. The projected landings for 2008 are almost 10X what the landings actually were. Why? Is it because the US does not yet have the capacity to take the fish, has stock abundance dropped (it was expected to drop when the 1999 year class played out, but not 10-fold), or some combination of these and other factors?

3. The SSC is given no sense of uncertainty, which it is now required by law to take into account when providing advice to the council. The TOR for the 2004 assessment states: "Estimate fishing mortality, spawning stock biomass, and total stock biomass for the current year and characterize the uncertainty of those estimates." In the assessment itself, the only characterization was of the ASAP model output, stating that the model results "indicate that estimates for both SSB and F are moderately precise." That statement is of little help to the SSC, and doesn't address the uncertainty in the underlying data (fishery-independent surveys, port sampling, at-sea observing, aging, maturity, growth rates, etc.). As a general observation, the SSC needs to be specific in defining the term "characterize" for future assessments if we are to obtain useful information.

4. The stock is at a very high level and recruitment does not seem to be faltering, but the SSC needs a clear sense of the rate at which the industry (especially processors) are gearing up (which may be occurring at a rapid pace). The SSC also need a sense of what level would constitute overcapacity, so we can recommend a braking mechanism, if necessary.

Staff noted that the Council is currently developing a limited access program for mackerel in Amendment 11 to the FMP. Analyses in that amendment include technical capacity estimates of the current mackerel fleet in the range of 100-140 k mt. Failure of the US to catch the quota may be due to poor availability and/or lower stock abundance than the current stock assessment indicates.

There was considerable discussion about the lack of a formal resource sharing agreement between the US and Canada for Atlantic mackerel. Some progress has been made in the area of resource assessment as the next assessment is being conducted jointly with Canada, so we will have a common agreement on the status of the stock. Bottom line is the Canadian catch is currently treated like domestic discards -- they are simply taken off the top to derive the US ABC.

The SSC discussed the implications of the change in the model used from VPA to ASAP, which resulted in a downward revision in the biological reference points. Additional discussion ensued about the age of the assessment and the need to update stock assessments at a minimum of every three years. In addition, the deterministic projections provided do not allow for the quantification of uncertainty as required under MSRA when setting ABC.

The SSC agreed by consensus with the staff quota and management recommendations for Atlantic mackerel for 2010.

The SSC discussed some simple general approaches that could be used to determine stock status lacking a formal stock status evaluation by using basic indicators such as recent recruitment levels. For example, if recruitment is stable or increasing, stock conditions would be considered "good". Other metrics that could be considered as early warning signs include changes or declines in CPUE and changes in distribution, average fish size, or socio-economic indicators.

J. Didden presented an overview of biology and fisheries for *Loligo* and *Illex* squid, as well as staff recommendations for 2010 quota and management recommendations for both species.

The SSC noted that little information exists relative to abundance of *Illex* aside from fishery performance data and that the *Loligo* assessment is dated. None-the-less, **the SSC agreed by consensus with staff recommendations for *Loligo* and *Illex* squid for 2010**. For *Illex*, concern was noted that the advice given allows for the ABC and OFL to be specified at the same level in spite of the fact that, of all four species examined at this meeting, the uncertainty about current *Illex* stock size was the greatest.

J. Coakley gave an overview of the Omnibus Scoping Document. The SSC noted that it would be informative to examine how other Councils and regions are handling this problem. **The SSC made a strong recommendation to convene a second National Workshop to discuss incorporating scientific uncertainty in ABC specifications.**

A general discussion ensued about the use of the tiered model currently utilized in the North Pacific. The SSC noted that the tier structure should include a description of how much bias exists in the assessment. A more complicated modeling approach does not necessarily imply a more accurate one. The SSC also noted that it is important that the terms risk and uncertainty be defined explicitly as they are different (the MAFMC should develop a working definition of uncertainty).

M. Wilberg presented a report of the SSC's SUN Subcommittee. The group is populated by Wilberg, Miller, Latour, and Prager. The group has met once in person and several times via conference call to discuss sources of scientific uncertainty and incorporation in ABC specifications. The group identified a number of desirable characteristics to any approach chosen: 1) must use assessment results available; 2) should not penalize improvements in data and assessment techniques; and 3) doesn't predetermine the outcome such that assessment innovation is impeded. The group identified four major areas or types of uncertainty: 1) data quality; 2) model/process error; 3) stock status and reference point determination; and 4) forecasting (see attached SUN Subcommittee report for more complete description). In addition, the group identified a number of approaches to deal with scientific uncertainty, including a probabilistic approach, quasi-probabilistic approaches, a percent reduction in target relative to the OFL, %MSP, and other approaches such as the 40/10 rule used for Pacific groundfish.

The SSC discussed the need for a probabilistic approach based on Rick Methot's negative comments relative to the MSRA compliance of the North Pacific tiered approach. Development of ABC control rules for MAFMC species will require an evaluation of current and candidate ABC control rules, which represents a significant amount of work. This necessitates an iterative process which will involve the sequential evaluation and modification of existing and/or novel candidate ABC control rules. **The SSC agreed by consensus that the process should maintain the maximum flexibility possible under**

the law to allow for an adaptive approach to ABC control rule development and implementation.

M. Wilberg agreed to ask the SUN Subcommittee to begin this iterative evaluation. Staff noted that funding is available to the Council for the development and implementation of ACLs and AMs. The SSC agreed to work with Staff to develop a work plan to conduct simulation and evaluation of various ABC control rule approaches. The issue of timing was discussed -- the development and completion of ABC control rule evaluation will take considerable time and the Council is under statutory time constraints to complete the Omnibus Amendment. The SSC decided to begin the process by evaluating the performance of various ABC control rule approaches for summer flounder, which is the MAFMC's most data rich species. M. Wilberg noted that the SSC needs to discuss what the basis for the limit fishing mortality will be -- Fmsy or other appropriate proxies. **The SSC agreed by consensus to direct the SUN Subcommittee, in consultation with Council staff, to develop a 1-3 page proposal outlining a scope of work to conduct an evaluation of candidate ABC control rule approaches. The goal of this work will be to develop and test an ABC control rule framework which can be included in the Omnibus Amendment.**

The last agenda item discussed was the request by the Council for SSC comments on three letters received from NGOs concerning implementation of the MSRA. The first letter discussed was received from the Pew Charitable Trust, which basically requested that the Council meet its MSRA statutory requirements and deadlines with respect to ACLs and AMs. The SSC noted that the Council is currently developing the Omnibus Amendment, which is intended to ensure MSRA compliance with the deadlines outlined by Congress in the MSRA and, in general, agreed with the sense of the Pew letter.

Next, the SSC discussed a letter from the NCMC requesting that the Council give special consideration to species managed under the Atlantic Mackerel, Squid, and Butterfish FMP. The letter argues that, because these species are important forage for other managed predator species, they should be managed more conservatively than required under MSRA (i.e., forage species should be maintained at a level above Bmsy to ensure adequate prey abundance to allow rebuilding of predator stocks). The letter also requested that these ecological considerations be addressed in the specification of biological reference points in the Omnibus Amendment. The SSC noted that the request presupposes that the current ABC control rule (yield specified at 75% Fmsy) is inadequate. It was also noted that setting aside a certain portion of the exploitable biomass for predator species beyond the level assumed in the natural mortality assumption is likely to have cascading effects throughout the ecosystem. Atlantic mackerel are not considered "typical" prey species because they are also predators. The current state of knowledge about the ecosystem dynamics is probably insufficient to accurately quantify the full effects of such a strategy. In addition, an ecosystem-based management strategy involves a series of policy decisions about what the ecosystem will actually look like, which is a policy call and well beyond the purview of the SSC. The current management system objective is to obtain optimal fishery performance on a

single-species basis versus optimal ecosystem performance. Optimal ecosystem performance remains to be defined and is inherently a policy decision.

The last letter, from Oceana, maintained that the Council should move beyond single species management and move toward a more comprehensive ecosystem approach. The letter recommended that a good first start would be to develop a matrix of fishery interactions that identifies species impacted by management decisions made within a particular FMP. The SSC agreed with this suggestion and recommended that such a matrix should be developed and would be a useful tool for Council members and the public to help evaluate the potential for collateral effects of management decisions on non-target species not included in the FMP.

The SSC adjourned at 4:00 pm.

Draft Framework Document for Developing Acceptable Biological Catch Recommendations

Scientific Uncertainty Subcommittee
Mid-Atlantic Fishery Management Council Scientific and Statistical Committee

May 6, 2009

Problem Statement

In the revised National Standard 1, the Statistical and Scientific Committee (SSC) of each of the eight regional management Councils have been tasked with recommending Acceptable Biological Catch (ABC) levels. The goal of an ABC is to avoid overfishing by incorporating scientific uncertainty into catch level recommendations. Importantly, the ABCs will constrain the annual catch limit that must be set by the Council as the Councils cannot set a catch level above the ABC recommended by its SSC.

Our goal is to develop a framework for forming ABC recommendations for MAFMC based on information and results from stock assessments and potentially other outside sources. These recommendations should therefore identify the types of estimates the will be generated by future stock assessments as well as how these data and estimates will be used in the development of ABCs.

Good characteristics of methods for developing ABCs will include that they are relatively simple, can be developed from multiple assessment models, and that they do not penalize improvement of information by the stock assessment. In other words, the methods should be relatively easy to apply given the results of the assessment, and we want to attempt to avoid the situation of requiring one specific type of assessment model to the exclusion of others.

The objective of this document is to provide a list of major sources of scientific uncertainty and potential methods of using this uncertainty to develop ABC recommendations. We note that it is important to discuss the alternative approaches in the abstract initially. We believe it would be imprudent base comparisons among different approaches on which methods are the "most" or "least" cautious in terms of their effects on catch levels for specific species over the short term. Such a discussion of the impact of the approach should come once we have determined the reliability and efficacy of each approach. Thus, we recommend testing of any methods that are adopted by the SSC to determine their broader performance in the first year or two after adoption.

Many factors affect our understanding of past population dynamics of a stock, its current status, and how it will respond to fishing in the future. These uncertainties can be separated into four categories: data quality, model uncertainty, stock status and reference point uncertainty, and forecasting uncertainty. Data quality includes factors such as the sampling design and the amount of contrast in the data (Hilborn and Walters 1992). Many sampling designs do not lend themselves well to the estimation of uncertainty. For example, if total catch is estimated through log books of fishers and these log books are

not verified or validated, quantifying uncertainty would be challenging. Common methods of estimating uncertainty would not be helpful because the measurements themselves are never verified – the uncertainty cannot be estimated without auxiliary data. Sources of data uncertainty may include

- Location in space and time of collection relative to stock's range,
- Methods of collection (appropriate for organism, any validation?),
- Vital rate (natural mortality, growth, maturation, etc.) estimation (data collection and validation),
- Development and standardization of indices of abundance,
- Survey design (statistical properties, sample size, statistical design, potential catchability changes due to changes in survey), and
- Amount of contrast in data (relates to how informative data are about population processes).

The second category of uncertainty arises from the use of assessment models themselves. Models, by definition, are simplifications of reality. The simplifications often used in stock assessment and forecasting models contain considerable uncertainty in causes of recruitment dynamics, effects of mortality sources, etc. Predictions and estimates from these models also contain estimation uncertainty (i.e., uncertainty caused by not having taken a census of the population, not directly measuring the process of interest, or not incorporating all of the causes of variation in the models). Sources of model uncertainty include

- Assessment methods differ in their quality (accuracy) of estimates in ways that are not well understood. Qualitatively, this uncertainty is indicated by a lack of fit to data sources (i.e., patterns in residuals) and retrospective patterns,
- Estimation uncertainty,
- Model uncertainty (including assumed parameter values). Fitting different assessment models to the same data set can often produce more variability in estimates than indicated by the precision of estimates from a single model,and
- Method for estimating uncertainty. The methods for estimating uncertainty rely on suites of assumptions. The degree to which these assumptions are met is often suspect.

The data and models are used to estimate the current status of the stock, which is then compared against reference points that are often calculated external to the assessment model. The reliability of both measures influence the degree of overall scientific uncertainty that must be incorporated into the calculation of ABC levels. For example, the reference point values are point estimates or proxies of an underlying random variable. In both cases we can expect there to be a variance associated with these estimates that should be incorporated into ABC estimation. Examples of such sources of uncertainty include

- Use of proxies. F_{MSY} is not estimated directly for most MAFMC species, and
- Stationarity of reference points over time

Ultimately managers and stakeholders are interested in how policies influence the sustainability of the fisheries and the stocks on which they rely. Ideally, this requires developing forecasts of the future stock status under alternative management actions. Forecasts have associated uncertainties that include

- Stationarity of processes. This may not be a big issue for short-term forecasts,
- How to handle uncertainty that is not included in the assessment, and
- Process error in population dynamics.

Other considerations have also been suggested as important enough to warrant inclusion in ABC recommendations, such as productivity of the stock. This may be a concern if it is not already included in reference point estimation. This procedure has been called productivity sustainability analysis with the idea that management should be more precautionary for species with low productivity.

Potential methods for including uncertainty

This section includes potential methods for including scientific uncertainty in ABC recommendations. They range from the most formal treatment of uncertainty in the pure probabilistic approach to entirely ad hoc methods.

Probabilistic approach (Shertzer et al. 2008)
This method relies on estimating the overfishing level (OFL) reference point, its uncertainty (distribution), and uncertainty in future population size (distribution) and uses the joint distribution and a pre-specified level of tolerance, P*, for exceeding the reference point to determine ABC. Implementation of the algorithm involves estimating the distribution of F_{MSY} and the distribution of forecasted population size. One would then choose the level of catch that will achieve a certain probability of avoiding the limit reference point. This method assumes all important sources of uncertainty are captured in joint distribution of the OFL reference point and forecasted population size and that level of acceptable risk is specified (Shertzer et al. 2008). The original formulation of the Shertzer et al. (2008) approach included management uncertainty, but this could easily be left out of the analysis.

Quasi-probabilistic approaches
This class of methods includes potential ways to adjust the probabilistic method by a qualitative analysis of uncertainty that is not explicitly incorporated in the stock assessment. These methods are similar and somewhat related to one another.

I. Probability of exceeding OFL adjustment (SAFMC) – Estimate joint PDF as in pure probabilistic approach. Adjust P* based on qualitative assessment of risks that were not included in the assessment and reference point calculations. Methods based on these ideas are being considered by the SAFMC SSC.

II. Uncertainty adjustment – Estimate uncertainty and add additional uncertainty based on qualitative indicators. The variance or coefficient of variation of the estimate could be inflated by additional amounts of uncertainty for qualitative factors.

Ad hoc approaches
Many ad hoc approaches have been developed for converting assessment results into targets and limits for management (Deroba and Bence 2008). These methods may at first not seem to satisfy the revised National Standard 1 because they do not explicitly consider uncertainty in setting of allowable catch. However, the SUN committee believes that such methods could be tested in a simulation framework to see if their properties comply with the current rules. Three examples of ad hoc approaches are:

1) Methot method – Estimate uncertainty in the reference point. Based on a worst case scenario amount of precaution (buffer), partition potential buffer among potential sources of uncertainty. Modify the maximum potential buffer to allow for uncertainty based on semi-quantitative characteristics of the stock assessment and available data.

2) Percentage reduction in target F relative to OFL. This method is similar to the Methot method.

3) Control rules based on spawning potential ratio (SPR), such as 40-10 rule (e.g., Punt 2003).

Such approaches could be tested using a management strategy evaluation approach to determine if their properties were acceptable, but many of the decisions that go into these rules would be difficult to simulate.

Qualitative approaches
Tiered approach such as used in the north Pacific. Different methods are used depending on the amount of available information. This could apply various forms of the above approaches to stocks with different levels of data availability.

Across each of these methods there are a number of other questions that will need to be addressed to develop a complete ABC control rule. One such question is whether the amount of precaution should be a function of stock size, under the idea that more precaution may be desired when stocks are low.

References

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