Report of the Review Panel of the

Data Poor Working Group: Monkfish

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National Marine Fisheries Service
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Executive summary

The independent panel (Review Panel) to review the monkfish (*Lophius americanus*) stock assessment for the northern and southern management units met in Woods Hole from Monday, July 9 through Friday, July 13, 2007. The members of the Review Panel were the chair, John Annala of the Gulf of Maine Research Institute, Robert Mohn of the Bedford Institute of Oceanography, and Rafael Duarte of the Portuguese National Research Institute for Agriculture and Fisheries (IPIMAR).

The Panel received presentations from the Working Group members on the assessment, thoroughly and constructively discussed the results and their implications, and requested and received additional information, including additional model outputs. Steve Cadrin coordinated the presentations and additional presentations were given by Anne Richards (lead scientist), Paul Rago, Paul Nitschke, Liz Brooks, and Chris Legault. There was an attempt to reach consensus between the Panel and Working Group members.

The Review Panel concluded that the Assessment Team met six of the nine terms of reference successfully and partially met the other three terms of reference.

The Review Panel agreed with the following major conclusions from the stock assessment:

- The SCALE model is the preferred model at this stage for use in stock status determination, short-term projections, and management plan evaluation.

- The age-based yield per recruit model is the preferred model to estimate fishing mortality based BRPs; and the SCALE model is the preferred model to estimate biomass-based BRPs.

- Overfishing is not occurring and the resource is not overfished in either the northern or southern management areas.

- Biomass in both management units is expected to increase through 2009 at the TALs as proposed in Framework 4 of the Monkfish Plan (5000 mt in the northern management unit and 5100 mt in the southern management unit).

- Using the revised BRPs and estimates of stock status, monkfish in the two management units are not overfished and rebuilding is not required.

1 Introduction

1.1 Background

The Review Panel met in Woods Hole from Monday, July 9 through Friday, July 13, 2007, to review assessments of the northern and southern monkfish management units.

Both the Working Group meeting and the Review Panel meeting were coordinated by Dr Jim Weinberg, NEFSC.

The members of the Review Panel were the chair, John Annala of the Gulf of Maine Research Institute, Robert Mohn of the Bedford Institute of Oceanography, and Rafael Duarte of the Portuguese National Research Institute for Agriculture and Fisheries (IPIMAR).

1.2 Review of Activities

The conduct of this Review departed somewhat from the process normally followed. The Monkfish Working Group had met in June 2007 to produce their report for review by the Panel. However, the Working Group did not complete its work during that period, nor did it reach a consensus on the preferred metrics to put forward to address Terms of Reference 4 through 8 (see below). Therefore, the Review Panel met jointly with the Working Group during the first four days of the Review process to aid in the finalization of the Working Group report.

During these four days, the Panel received presentations from the Working Group members on the assessment, thoroughly and constructively discussed the results and their implications, and requested and received additional information, including additional model outputs. Steve Cadrin coordinated the presentations and additional presentations were given by Anne Richards (lead scientist), Paul Rago, Paul Nitschke, Liz Brooks, and Chris Legault. There was an attempt to reach consensus between the Panel and Working Group members.

The Review Panel did not find the process followed for monkfish entirely satisfactory. The stock assessment was not completed by the end of the Working Group meeting in June and a considerable amount of time was spent during the week of 9 July reviewing technical details rather than reviewing the stock assessment. Indeed, the Working Group report was not available in final form even at the end of the Review Panel meeting. The positive aspect of this process was that the Review Panel was able to get a better grasp of the technical details and a better understanding of the assessment approach used. However, because of the combined Working Group/Review Panel meeting approach, the chair and the other two members of the Review Panel found that their roles were not unambiguously defined.

2 Review of the monkfish assessment

2.1 Terms of Reference (TOR)

The Terms of Reference of both the Working Group and the Review Panel were as follows:

1. Characterize the commercial landings, effort, LPUE, and discards for monkfish in the northern and southern management areas.

2. Evaluate the fishery-independent and fishery-dependent measures of relative abundance with respect to their accuracy and precision.
3. Incorporate recommendations of the March 2006 External Peer review of the 2001 and 2004 Cooperative Monkfish Surveys. Incorporate these industry based assessments as appropriate into the stock assessment. Recommend whether additional cooperative surveys should be conducted.
4. Estimate fishing mortality, spawning stock biomass, and total stock biomass or suitable proxies for as many years as possible for existing time series. Characterize the uncertainty of those estimates.
5. If appropriate, update or redefine biological reference points (BRPs) that could be used annually for stock status determination, taking into account that survey vessels will change in 2008, and that BRPs must be objective and measurable.
6. Evaluate the current status of the stock assessment units relative to both the existing BRPs and the updated or redefined BRPs (see TOR 5).
7. Compute TALs and measures of uncertainty for Fishing Years 2007 and 2008 (and if possible, future years) under various levels of fishing mortality. If fishing mortality can not be estimated, consider alternative or proxy methodologies for computing TALs.
8. Evaluate the efficacy of management measures and control rules that have been used to rebuild monkfish to target levels. Specifically address whether the stocks can be rebuilt by 2010 under the existing rebuilding program, and indicate what the fishing mortality rates or catch limits would have to be. Consider alternative approaches with respect to the probability of attaining target levels and the relevance of time lags in availability of information for formulation of management decisions.
9. Review research conducted to date that addresses research recommendations in the previous SARC-reviewed assessments. Incorporate any validated results into the current assessment. Update and prioritize Research Recommendations.

2.2 Review Panel findings by term of reference

There are a number of life history parameters that cut across and impact many of the following nine Terms of Reference. The Working Group and Review Panel discussed and reviewed these parameters and the following is a summary of the Panel's conclusions:

1. The panel expressed concerns over the lack of fit of the von Bertalanffy growth function to the age – length data that required Linf to be fixed. This was caused by the apparent linear relationship between length and age over the range of the observations. The panel observed that this linear relation may be caused by aging problems using the current vertebral ageing technique. Similar linear growth increments are also observed for the Iberian *Lophius piscatorius* stock (aged with illicia). For this region, additional growth information including catch length distributions of strong year classes and results from tagging experiments indicate that the actual ageing method might underestimate growth in younger ages (ICES, 2007).

2. The panel recommended that the development of a separate sex model be considered in order to better account for the different growth rates between sexes.

2.2.1 Characterize the commercial landings, effort, LPUE, and discards for monkfish in the northern and southern management areas.

The Review Panel concluded that the assessment team met this term of reference successfully. The data on commercial landings, discard estimates, size and age composition of the U.S. catch, and commercial effort and CPUE were compiled and characterized well.

With regard to discard estimates, the Panel expressed concern at the small number of samples in some years that were available to estimate discard ratios and the resulting relatively high c.v.'s. The Panel concluded that the sample sizes that generated the length frequency distributions of both the commercial catch from observers and the landings from port samplers were relatively large and therefore well sampled and characterized.

2.2.2 Evaluate the fishery-independent and fishery-dependent measures of relative abundance with respect to their accuracy and precision.

The Review Panel concluded that the Assessment Team met this term of reference successfully.

The Panel agreed the following:

Fishery-independent – The accuracy and precision of the five survey time series (fall, spring, and winter trawl; shrimp; and scallop) are sufficient for these indices to be used as model inputs.

Fishery-dependent – Because of the difficulties with the commercial CPUE data described in the Working Group report, these data are not suitable as model inputs.

2.2.3 Incorporate recommendations of the March 2006 External Peer review of the 2001 and 2004 Cooperative Monkfish Surveys. Incorporate these industry based assessments as appropriate into the stock assessment. Recommend whether additional cooperative surveys should be conducted.

The Review Panel concluded that the assessment team partially met this term of reference. The age-length data from the Cooperative Monkfish Surveys were used in the development of the age at length data that were used as inputs for the SCALE model and the biomass estimates used as a reality check against the SCALE model biomass estimates using an assumed range of catchability coefficients. However, the Working Group made no recommendation as to whether additional cooperative surveys should be conducted.

2.3.4 Estimate fishing mortality, spawning stock biomass, and total stock biomass or suitable proxies for as many years as possible for existing time series. Characterize the uncertainty of those estimates.

The Review Panel concluded that the assessment team met all parts of this term of reference successfully, except for characterizing the uncertainty of the estimates. Several alternative methods were considered for estimating stock size and mortality rates, representing a series of models with increasing complexity. From among these, the SCALE model was chosen as the preferred model for each management unit,

Index – based analysis

The Panel agreed with the Working Group that AIM (An Index Model) was not useful for stock assessment and the provision of management advice for monkfish, because of lack of coherence or lack of contrast in the survey and catch data. However, AIM was considered appropriate for exploratory data analysis.

Biomass dynamics analysis

A Bayesian surplus production (BSP) model was attempted. The Panel agreed with the Working Group that the BSP model was not useful for stock assessment and the provision of management advice for monkfish because of the sensitivity to the prior on r and the high imprecision of absolute magnitude estimates, which indicate that a solution surface is not well defined. The BSP was considered appropriate for exploratory data analysis.

Length-based mortality

Length-based mortality estimates were made using the method of Gedamke and Hoenig. The Panel agreed with the Working Group that the length-based method was not useful for stock assessment and the provision of management advice for monkfish because the following assumptions were not met: (1) growth does not change over time; (2) growth is modeled by the von Bertalanffy growth function; and (3) recruitment is constant over time. In addition, mortality rates in the southern area do not fit the early and most recent parts of the time series, and total mortality rates in the northern area are implausible during early part of time series (below 0). The Gedamke-Hoenig method was considered appropriate for exploratory data analysis.

Survey catch curves

Mortality was estimated from survey data using both cohort-based catch curves and the Heincke method. The Panel agreed with the Working Group that the survey catch curves were not useful for stock assessment and the provision of management advice for monkfish because sample sizes are very small when the data were binned into age categories by year. The values of Z for the 3+/4+ age group analysis from the Heincke method were highly variable and fell below zero several times.

Survey stage-based mortality

Mortality rates were estimated from annual surveys by tracking the abundance of one or more cohorts. This model suffered because of small sample sizes in some of the surveys and because it needed Linf which as mentioned above was not well supported by the ageing data. The Panel agreed with the Working Group that this method was not useful for stock assessment and the provision of management advice for monkfish, but was useful for exploratory data analysis.

Catch-survey analysis

A Collie-Sissenwine catch-survey analysis (CSA) was conducted for each management area. The Panel agreed with the Working Group that this method was not useful for stock assessment and the provision of management advice for monkfish because sample sizes were very small, the F estimates were unrealistically low (F = 0.02 to 0.09), and the catchability estimate was very low (q = 0.02).

Statistical Catch at Length (SCALE) model

The SCALE model is a forward projecting age-structured model tuned with total catches, catch at length or proportional catch at length, recruitment at a specified age, survey indices of abundance of the larger/older fish, and survey length distributions. The model requires mean lengths at age as inputs and does not require that the age-length data be fitted by a growth equation. This latter point is an advantage for the monkfish assessment, where the growth data appear linear over the exploited size range. A major positive aspect of the SCALE model is that it explicitly links all sources of information that previously were analyzed separately.

The Review Panel agreed with the Working Group that the SCALE model is the preferred model at this stage for use in stock status determination (TOR #6), short-term projections (TOR #7), and in management plan evaluation (TOR # 8).

However, the Panel expressed concerns that fishing mortality estimates were well below the assumed natural mortality rate during various periods of the time series, including the most recent years. This causes the estimated population numbers and biomass to be more dependent on a coefficient that is highly unknown and considered constant with age and time.

The Panel also expressed concern over the apparent noisy length data and poor fit of the model to the length composition of the adult component. Length classes of 2 cm or more might be more appropriate for this species that exhibits a large length range in both the catch and survey data.

2.3.5 If appropriate, update or redefine biological reference points (BRPs) that could be used annually for stock status determination, taking into account that survey vessels will change in 2008, and that BRPs must be objective and measurable.

The Review Panel concluded that the assessment team met this term of reference successfully. The Panel agreed with the Working Group that the length-based yield per recruit model should not be used to estimate Biological Reference Points, as had been done in the past for monkfish, because the von Bertalanffy growth function does not fit the observed growth for this species. Because of this lack of fit, it was agreed to use an age-based yield per recruit model to estimate fishing mortality based BRPs, and that this represents the best available modelling approach for monkfish. The Review Panel also agreed with the Working Group that the SCALE model represents the best available assessment model for monkfish and is the preferred model at this stage for redefining biomass-based BRPs.

2.3.6 Evaluate the current status of the stock assessment units relative to both the existing BRPs and the updated or redefined BRPs (see TOR 5).

The Review Panel concluded that the assessment team met this term of reference successfully. The Review Panel agreed with the Working Group that the existing BRPs should not be used and should be replaced by the redefined BRPs in the Working Group report.

2.3.7 Compute TALs and measures of uncertainty for Fishing Years 2007 and 2008 (and if possible, future years) under various levels of fishing mortality. If fishing mortality can not be estimated, consider alternative or proxy methodologies for computing TALs.

The Review Panel concluded that the Working Group partially met this term of reference. Full projections to 2007 and 2008 were not conducted in the absence of an agreed projection model, but the SCALE model was run out to 2009 to estimate future biomass trends using the TALs proposed in Framework 4 of the Monkfish Plan (5,000 mt in the northern management unit and 5,100 mt in the southern management unit). Biomass in both management units is expected to increase through 2009 at these respective TALs. However, the Working Group did not evaluate any measures of uncertainty in the trials conducted.

2.3.8 Evaluate the efficacy of management measures and control rules that have been used to rebuild monkfish to target levels. Specifically address whether the stocks can be rebuilt by 2010 under the existing rebuilding program, and indicate what the fishing mortality rates or catch limits would have to be. Consider alternative approaches with respect to the probability of attaining target levels and the relevance

of time lags in availability of information for formulation of management decisions.

The Review Panel concluded that the assessment team met this term of reference successfully. Using the revised BRPs and estimates of stock status, the monkfish resources in the two management units are not in an overfished condition and overfishing is not occurring.

2.3.9 Review research conducted to date that addresses research recommendations in the previous SARC-reviewed assessments. Incorporate any validated results into the current assessment. Update and prioritize Research Recommendations.

The Review Panel concluded that the assessment team met this term of reference successfully.

3 Acknowledgements

The Review Panel could not have completed its task without the hard work of the participating assessment scientists. Thanks also go to Laurel Col who served as rapporteur during the Review Panel meeting and to Dr. Jim Weinberg for his organizational help before, during, and after the Review Panel meeting.

4 References

ICES, 2007. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM). ICES CM 2007/ACFM:21. (http://www.ices.dk/iceswork/wgdetailacfm.asp?wg=WGHMM)