

SEDAR 27
Gulf of Mexico Menhaden Review

Florida Fish and Wildlife Research Institute
Saint Petersburg, Florida

November 1 – 4, 2011

Report prepared for:

Center for Independent Experts

Report prepared by:

John P. Wheeler
7 Medalsis Pond Road
Flatrock,
Newfoundland and Labrador
A1K1C9
Canada

Ph: (709) 437-6807
Email: johnwheeler@nl.rogers.com

Executive Summary

- The SEDAR 27 Gulf of Mexico menhaden (*Brevoortia patronus*) review was held at the Florida Fish and Wildlife Research Institute, Saint Petersburg, Florida, from November 1 – 4, 2011. Originally, SEDAR 27 was to include a review of southeast yellowtail snapper. However, this review was removed from the agenda prior to the meeting.
- The objective of the Panel was to conduct a detailed peer review of the results of the Gulf of Mexico menhaden assessment, including data inputs and analytical models, addressing each of the terms of reference, and summarizing this evaluation clearly in a Review Panel Report to provide adequate advice regarding stock status, management benchmarks, and appropriate future management actions.
- Three sources of data were available: catch data (1948 – 2010), catch sampling and catch at age (1964 – 2010), and four indices (three fishery independent and one fishery dependent).
- The Panel had few concerns regarding the catch data, catch sampling, and ageing. However, it had serious concerns with some of the indices, in particular a fishery independent gill net index of adult abundance, and a catch per unit of effort index derived from the commercial reduction fishery.
- Three models were presented in the assessment document. The analysts presented the Beaufort Assessment Model (BAM) as the base model, based upon conclusions from an assessment workshop. A Surplus Production Model (ASPIC) and a Stock Reduction Analysis (SRA) were presented to corroborate the results of the BAM.
- The Panel had strong criticisms regarding the formulation of the base BAM, and serious concerns regarding results of the model. These concerns could not be adequately addressed nor reconciled during the meeting. None of the models could be used to quantitatively characterize the current stock status of Gulf of Mexico menhaden.
- The Panel provided some qualitative advice, based primarily on the landings history and catch-at-age data from the reduction fishery, and what it considered to be a worst-case scenario from ASPIC model runs. These data suggest that the stock is not currently overfished and that overfishing is not currently occurring.
- Given that the Panel rejected the base model, it provided a detailed list of remedial measures and an appropriate approach for correcting the assessment.
- The Panel also provided a prioritized list of short-term and long-term recommendations.

Background

The Southeast Data, Assessment, and Review Panel (SEDAR 27) met at the Florida Fish and Wildlife Research Institute, in Saint Petersburg, Florida from November 1 – 4, 2011 to review the assessment of Gulf of Mexico menhaden. Originally, the Panel was also to review the assessment of southeast yellowtail snapper; however, this assessment was withdrawn from the process on October 24, 2011.

The Panel consisted of five members: the chair, Luis Barbieri from the Florida Fish and Wildlife Research Institute (FWRI), Will Patterson from the Gulf States Marine Fisheries Commission (GSMFC), and three external Center for Independent Experts (CIE) reviewers, Sven Kupschus, Patrick Cordue, and myself. There were no official advisory representatives to the Panel; however, there were current and retired scientific staff from the National Marine Fisheries Service (NMFS) Beaufort laboratory in North Carolina who provided valuable input to the assessment process. There was also a staff member from the GSMFC and representatives from the menhaden fishing industry. The FWRI provided a rapporteur for the meeting.

The terms of reference for the Gulf of Mexico menhaden stock assessment, the proposed meeting agenda, the assessment documents, and all background documents were posted and available for review on the South Atlantic Fisheries Management Council (SAFMC) FTP web site by approximately October 14, 2011.

The objective of the Panel was to conduct a detailed peer review of the results of the stock assessment, including data inputs and analytical models, addressing each of the terms of reference, and summarizing this evaluation clearly in a Review Panel Report to provide adequate advice regarding stock status, management benchmarks, and appropriate future management actions.

The current assessment was prepared by scientific staff from the NMFS Beaufort laboratory. It included a thorough documentation of all available data and the results of three modeling approaches. This was the first time that the Gulf of Mexico menhaden stock was reviewed under the SEDAR process. The review included a data workshop, an assessment workshop, and this final independent review workshop (SEDAR 27). The data and assessment workshops were not held under the auspices of SEDAR, and as such may not have had the same level of scrutiny. The previous most recent assessment of Gulf of Mexico menhaden was conducted in 2007 (Vaughan et al. 2007).

Gulf of Mexico menhaden are short-lived, maturing at age 1 and with a maximum age of 6 years. The menhaden fishery is an industrial one with the final products being fish oil and fish meal. The fishery, the second largest by volume in United States waters, occurs primarily in state-controlled waters from Texas to Florida with most landings from off the coast of Louisiana. It is a purse seine fishery, with approximately 70% of sets being directed by spotter aircraft. The fishing season extends from April through October, and for the most part is not under quota control. The fishery began in the 1940s and peaked with landings in excess of 800,000 t for six consecutive years during the 1980s. Landings within the last decade have averaged approximately 480,000 t annually. There has been consolidation within the industry over time. At its peak, there were 14 reduction factories

and 81 vessels; currently there are 4 factories and 41 vessels. The fishery is vertically integrated, as the companies own the fishing fleet.

This provided the background for the current SEDAR 27 Panel. Joe Smith, from the Beaufort laboratory, provided a history of the fishery and an analysis of the catch history and catch at age. Amy Schueller, also from Beaufort, was the lead analyst and presented the abundance indices, the assessment methodology and results of the Beaufort Assessment Model (BAM). Bezhad Mahmoudi, from the FWRI, presented the results of a Stock Reduction Analysis (SRA), and Mike Prager, a private consultant, presented the results of a Surplus Reduction Model (ASPIC).

The Panel reviewed the Gulf of Mexico menhaden assessment thoroughly. The chair, Luis Barbieri, ensured that the Panel completed its objectives in a professional and proficient manner within the allotted time.

Julie Neer, the SEDAR coordinator, compiled all assessment and background documents, and provided them to the Panel in a timely manner.

Wade Cooper, in his capacity as rapporteur, provided detailed notes that were of great value to the Panel in writing its report.

Description of Reviewer's Role in Review Activities

The terms of reference for the Gulf of Mexico menhaden assessment, the proposed meeting agenda, the assessment document, and all background documents were posted by Julie Neer on a FTP web site approximately two weeks prior to the SEDAR 27 review workshop. I read and reviewed all of the pertinent documents prior to the meeting.

During the SEDAR 27 review workshop, detailed presentations were given by Joe Smith, Amy Schueller, Bezhad Mahmoudi, and Mike Prager. These presentations were followed by extensive question, discussion, and review periods. On multiple occasions, the presenters were asked to provide further analyses that were subsequently reviewed during the meeting.

During the meeting, I participated in questioning the assessment analysts, in discussing the assessment results, in helping to formulate scientific advice, and in preparing the Review Panel Report.

Before the meeting concluded, the Panel completed a draft of the Review Panel Report. This was compiled by the Chair, based upon written contributions from each of the Panel members. A draft of this report was reviewed by the Panel before the meeting ended; the final report was reviewed and completed subsequent to the meeting.

To fulfill the requirements of the CIE, my CIE report was completed subsequent to the review meeting.

Summary of Findings

The Panel was provided with the following Terms of Reference and was asked to address each of these terms in its Panel Review Report:

1. Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment:
 - a. Discuss data strengths and weaknesses (e.g. temporal and spatial scale, gear selectivities, aging accuracy, sampling intensity).
 - b. Report metrics of precision for data inputs and use them to inform the model as appropriate.
 - c. Describe and justify index standardization methods.
 - d. Justify weighting or elimination of available data sources.
2. Evaluate models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points.
 - a. Did the model have difficulty finding a stable solution?
 - b. Were sensitivity analyses for starting parameter values, priors, etc. and other model diagnostics performed?
 - c. Have the model strengths and limitations been clearly and thoroughly explained?
 - d. Have the models been used in other peer reviewed assessments? If not, has new model code been verified with simulated data?
 - e. Compare and discuss differences among alternative models.
3. State and evaluate assumptions made for all models and explain the likely effects of assumption violations on model outputs, including:
 - a. Calculation of M.
 - b. Choice of selectivity patterns.
 - c. Error in the catch-at-age matrix.
 - d. Choice of a plus group for age-structured species.
 - e. Constant or variable ecosystem (e.g., abiotic) conditions.
 - f. Choice of stock-recruitment function.
 - g. Choice of reference points (e.g. equilibrium assumptions).
4. Evaluate uncertainty of model estimates and biological or empirical reference points.
 - a. Choice of weighting likelihood components.
5. Review the findings from the retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F, SSB), reference points, and/or management measures.
6. Recommend stock status as related to reference points.
7. Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

The Panel expressed concerns regarding the terms of reference and indicated that they were more appropriate for the assessment workshop, rather than for the review workshop. The SEDAR coordinator also had similar concerns and indicated that new terms of reference were being developed for future SEDAR assessments.

Given its eventual conclusion that the assessment could not be used to provide quantitative advice on stock status, the Panel did not address each of the terms of reference individually but framed its report around the following broader categories: sources of data, models, and qualitative advice.

Sources of Data

Three sources of data were available to the assessment analysts: catch data (1948 – 2010), catch sampling and catch at age (1964 – 2010), and four indices (three fishery independent and one fishery dependent).

The Panel expressed no major concerns with the catch history data. There was some discussion regarding the use of `hoppers` at reduction factories to estimate landings. A hopper is estimated to contain 304.5 kg of fish, based on measurements made in the 1960s. This has not since been verified, and estimates of landings assume that hopper sizes are consistent between all factories, have not changed over time, and that the hopper is completely full each time before being discharged.

Catch samples are taken from vessels at dock side before fish are discharged. A random sample of ten fish is taken from the top of the vessel hold, with the assumption that these fish are from the last set. Samples are then apportioned into 10 x 10 minute cells (latitude and longitude). There was a question regarding potential mixing of fish within the vessel hold, but the Panel was told that vessel holds are not flooded until at dock side, and therefore there is minimal redistribution of fish within the vessel until then. Runner boats are currently used to transport a limited amount of fish from some of the fishing fleet to the reduction factories. The same sampling design cannot be applied to runner boats and if the use of runner boats should increase, an alternate design will have to be established. There was also a question regarding how well a sample of ten fish may represent the catch. The Panel was told that prior to early 1970s, twenty fish were sampled per set. However, at that time it was found that between vessel variability was greater than within vessel variability and sampling was adjusted accordingly. No experiments have been conducted to determine adequate sample sizes.

Gulf of Mexico menhaden are aged from scales. Given that the species is relatively short-lived, scales have been shown to adequately estimate age. An ageing error matrix has been created based upon a study comparing ages from scales and otoliths (assuming that otolith ages are correct). The Panel had no concerns regarding the estimation of ages. The analysts noted that the individual who ages menhaden has been doing so since the 1960s and is nearing retirement. A new age reader will then have to be trained; cross validation will be essential. The Panel also suggested that a sample of scales from the entire time series be re-read to ensure that there was no drift in the assignment of ages over time.

Abundance indices generated considerable debate among the Panel and the analysts. Four abundance indices were available: state-based fishery independent seine and trawl indices used to estimate juvenile (age 0) fish, a state-based fishery independent gill net

index used to estimate adult (age 1+) fish, and a fishery dependent index of adult fish based upon catch per unit of effort (CPUE) from the reduction purse seine fishery.

There were concerns because whereas the two juvenile indices exhibited similar trends, the two adult indices exhibited opposite trends over time. The Panel also expressed concern that, with the exception of the fishery dependent index, none of the fishery independent indices were targeted specifically for menhaden. All fishery independent indices were state run, and for the most part were not standardized between states. It was also interesting to note that the gill net index had been unknown to the assessment analysts prior to the data workshop, even though it has been in existence in some states since the 1970s. The analysts used the seine index for age 0 fish in the base model and conducted a sensitivity run including the trawl index. The Panel indicated that both indices should have been included in the model, as they exhibited similar trends.

The analysts used the gill net index for age 1+ fish. At least one of the Panel members strongly disagreed with the use of the gill net index as it did not include the range of distribution of menhaden and, for the most part, covered an area closer to land than that of the commercial fishery. However, it was noted that this may be less of a concern as the sites fished in the gill net survey are also prime habitat for adult menhaden and, in some cases, are off limits to the fishery. The analysts also struggled with this index. Although a gill net index could be derived from multiple states, the analysts used data from Louisiana only, as these data did not require standardization between states, and covered the principle area of the fishery. The Panel questioned the Louisiana index as well, as it involved a process known as 'striking'. Gill nets were not fished passively, but were set in a circular fashion; fish were then driven into the net by means of a boat startling the fish. It was unclear to the Panel how the striking process could be standardized and whether such a process would result in a density estimate of fish. There were also concerns whether gill nets may be set to either target or avoid menhaden schools.

Some members of the Panel, including myself, disagreed with the use of the fishery-dependent reduction fishery index, mainly in principle as it was derived from a purse seine fishery. It was acknowledged that this fishery has changed considerably since its inception in the 1940s, with improved technology, larger vessels, and consolidation of reduction factories. Concerns were also expressed regarding hyperstability. The use of an allowance to account for changes in the fishery was also discussed but would have been somewhat arbitrary. There were also concerns regarding the selection of CPUE. Catch per vessel-ton-week was used; however, catch per set was better correlated with juvenile indices. The Panel indicated that a proper standardization was required before the reduction fishery CPUE could be considered for use as an index. The analysts did not use this index in the base model. At one point in its discussions, the Panel asked for separate model runs including the gill net and reduction fishery indices of adult abundance. However, the Panel eventually rejected the formulation and results of the base model and the issue of deciding which adult index to use was not fully resolved.

Models

Three models were presented in the assessment document. The analysts presented the Beaufort Assessment Model (BAM) as the base model, based upon conclusions from the assessment workshop. A Surplus Production Model (ASPIC) and a Stock Reduction Analysis (SRA) were presented to corroborate the results of the BAM.

The Panel spent considerable time discussing the formulation and results of the BAM. There was strong criticism regarding the analyst's decision to down-weight catch-at-age data in the early years of the model. The Panel indicated that this was the wrong approach to fix initial biomass to virgin biomass and suggested that the model should have been run only over the time period for which data were available. With regard to the results of the base BAM, the Panel had serious concerns with the residual pattern in ages, in particular the overestimation of age 3 fish and the underestimation of age 2 fish. A considerable portion of the meeting was devoted to requesting additional model runs to identify the cause of these residual patterns. The Panel's concerns were increased when a model run with dome-shaped selectivity over the entire time period did not result in a change in the residual pattern. Further runs, requested to explore the model structure, all exhibited similar initialization problems. The discussion culminated when a model run in which the initial age structure was allowed to be selected freely, resulted in a dramatic change in current abundance from the base model. The Panel concluded that it couldn't resolve all issues regarding formulation of the BAM during the meeting. Even if all issues were resolved, it would have resulted in a very different assessment than that recommended by the assessment workshop.

The Panel reviewed runs of a Surplus Production Model (ASPIC) that had been presented to the assessment workshop. Unlike the BAM, it included both juvenile indices (seine and trawl), and an adult gill net index based upon data from all states. The model had been rejected as a base model at the assessment workshop, primarily because of scaling issues related to F_{msy} . The Panel concurred as the results were biologically unrealistic and there were insufficient data to calculate bench marks. The Panel also had concerns because, as in the BAM, the model utilized the gill net index as an index of adult abundance. It was also noted that ASPIC does not utilize catch at age, the best available data set for this stock. The Panel did request and was provided with additional ASPIC runs, using the reduction fishery CPUE index as a worse case scenario of current stock status.

The Panel also reviewed a presentation on Stock Reduction Analysis (SRA). This model had been presented at the assessment workshop as a complementary analysis to provide a historical perspective on stock productivity. It was parameterized with two alternates, one with the gill net index and one with the reduction fishery index. However, unlike the BAM analyst, the SRA analyst used the gill net index based upon data from all states, rather than Louisiana only. The model provided extremely different trajectories of exploitable biomass for the two indices, and no way to determine which was more realistic. The Panel also had concerns regarding the selectivities used to calculate exploitable biomass, as they were taken from the BAM. Given these concerns, the Panel was unable to draw any quantitative conclusions from the SRA.

Qualitative Advice

The Panel concluded, and I concurred, that it could not use any of the three models, as presented, to provide quantitative advice on the current status of Gulf of Mexico menhaden.

The Panel provided some qualitative advice, based primarily on the landings history and catch-at-age data from the reduction fishery, and what it considered to be a worst-case scenario from ASPIC model runs. The landing data indicated that there were six consecutive years during the 1980s during which annual landings exceeded 800,000 t. There was no evidence that the stock subsequently crashed, and similarly, no evidence of a contraction in the age structure of landings. Annual landings within the last decade have been approximately 480,000 t, a dramatic reduction from peak landings in the 1980s. This suggests that the stock is not currently overfished and that overfishing is not currently occurring. This was corroborated by worst case ASPIC runs.

Review of Terms of Reference (as required by the CIE)

In the preceding Summary of Findings, I have elucidated, in detail, the approach taken by the Panel during the review workshop. However, in accordance with the CIE performance standards, I shall address each of the terms of reference, in less detail.

1. Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment:
 - a. Discuss data strengths and weaknesses (e.g. temporal and spatial scale, gear selectivities, aging accuracy, sampling intensity).
 - b. Report metrics of precision for data inputs and use them to inform the model as appropriate.
 - c. Describe and justify index standardization methods.
 - d. Justify weighting or elimination of available data sources.

Three sources of data were available: catch data (1948 – 2010), catch sampling and catch at age (1964 – 2010), and four indices (three fishery independent and one fishery dependent). The indices included: state-based fishery independent seine and trawl indices used to estimate juvenile (age 0) fish, a state-based fishery independent gill net index used to estimate adult (age 1+) fish, and a fishery dependent index of adult fish based upon CPUE from the reduction purse seine fishery.

The Panel had few concerns regarding the catch data, catch sampling, and ageing. However, it had serious concerns with some of the indices, in particular the adult indices derived from fishery independent gill net surveys, and the catch per unit of effort derived from the commercial reduction fishery.

The analysts used the gill net index for age 1+ fish. There were concerns that this index did not include the range of distribution of menhaden and, for the most part, covered an area closer to land than that of the commercial fishery. Although a gill net index could be derived from multiple states, the analysts used data from

Louisiana only, as these data did not require standardization between states, and covered the principle area of the fishery. The Panel questioned the Louisiana index as well, as gill nets were not fished passively, and fish were driven into the net by means of a boat startling the fish. It was unclear how this process could be standardized and whether such a process would result in a density estimate of fish. There were also concerns whether gill nets may be set to either target or avoid menhaden schools.

There were also concerns with the use of the fishery-dependent reduction fishery index, mainly in principle as it was derived from a purse seine fishery with the inherent issue of hyperstability. There were also concerns regarding the selection of CPUE. Catch per vessel-ton-week was used; however, catch per set was better correlated with juvenile indices. The Panel indicated that a proper standardization was required before the reduction fishery CPUE could be considered for use as an index. The analysts did not use this index in the base model.

The analysts used the seine index for age 0 fish in the base model and conducted a sensitivity run including the trawl index. The Panel indicated that both indices should be included, as they exhibited similar trends.

2. Evaluate models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points.
 - a. Did the model have difficulty finding a stable solution?
 - b. Were sensitivity analyses for starting parameter values, priors, etc. and other model diagnostics performed?
 - c. Have the model strengths and limitations been clearly and thoroughly explained?
 - d. Have the models been used in other peer reviewed assessments? If not, has new model code been verified with simulated data?
 - e. Compare and discuss differences among alternative models.

Three models were presented: the analysts presented the Beaufort Assessment Model (BAM) as a base model, based upon conclusions from the assessment workshop. A Surplus Production Model (ASPIC) and a Stock Reduction Analysis (SRA) were presented to corroborate the results of the BAM.

The Panel had strong criticism regarding the formulation of the base BAM, in particular with the analyst's decision to down-weight catch-at-age data in the early years of the model. The Panel indicated that the model should have been run only over the time period for which data were available. The Panel also had serious concerns with the results of the base BAM, in particular with the residual pattern in ages. Additional model runs were requested to identify the cause of these residual patterns. A model run with dome-shaped selectivity over the entire time period did not result in a change in the residual pattern. The Panel eventually concluded that it would be unlikely to resolve all issues regarding the formulation of the BAM during the meeting, and even so, would result in a very different assessment than that recommended by the assessment workshop.

The analyst provided numerous sensitivity analyses, but these were not examined in detail by the Panel, as it was more concerned with the model formulation and the residual patterns evident in the base run.

The Panel did not have any specific objections to the use of the BAM, only in its formulation. The model has been used in previous assessments and there is no reason not to use it in future assessments.

SRA and ASPIC model runs were rejected by the Panel as neither could currently provide a reliable assessment. The SRA model needs further development to use catch-at-age data, so that selectivities can be internally estimated. ASPIC is of limited utility for menhaden as it cannot use catch-at-age data and is not provided with information on the biological characteristics of the species. Also, ASPIC requires reliable adult abundance indices, which are not currently available.

3. State and evaluate assumptions made for all models and explain the likely effects of assumption violations on model outputs, including:
 - a. Calculation of M .
 - b. Choice of selectivity patterns.
 - c. Error in the catch-at-age matrix.
 - d. Choice of a plus group for age-structured species.
 - e. Constant or variable ecosystem (e.g., abiotic) conditions.
 - f. Choice of stock-recruitment function.
 - g. Choice of reference points (e.g. equilibrium assumptions).

Parameters of the base BAM included:

- an assumed constant age-specific natural mortality rate, scaled such that the age-2 mortality was 1.10, the mean from an Ahrenholz (1981) tagging study,
- dome-shaped selectivity for the commercial reduction fishery from 1948-1979, and flat-topped selectivity from 1980 – 2010,
- dome-shaped selectivity for the gillnet index,
- an ageing error matrix based on a comparison between scales and otoliths,
- fish age 4 and older considered as a plus group,
- an estimate of annual recruitment at age-0 with deviation parameters, conditioned about a Beverton-Holt stock recruitment curve,
- maximum sustainable yield (MSY) benchmarks, where overfishing was defined as $F/FMSY$ greater than one, and overfished defined as $SSB_{2010}/(0.5*SSB_{MSY})$ less than one,
- weighting of data components, including indices, gillnet length composition, and commercial reduction fishery age composition,
- estimation of steepness.

The Panel had serious concerns regarding the formulation of BAM and provided the following advice to address its concerns:

- Either start the model in 1948 with initial biomass equal to virgin biomass with equilibrium age structure and/or start when the age data begin and estimate initial age structure.
 - Only estimate the recruitment deviations during the period when there are data available to support the estimates.
 - Do not estimate steepness unless the biomass trajectory covers a broad range of biomass in terms of percent B_0 .
 - Aim for a parsimonious model in terms of the number of parameters; only introduce additional parameters if they can be more than justified in terms of improved model fit.
 - An age-invariant M is probably adequate for this model given the small number of age classes in the catch. It may be possible to estimate M given the extensive catch-at-age data.
 - Complex selectivity parameterizations are undesirable. Start with a single time invariant selectivity and introduce additional complexity only if necessary (e.g., blocking if supported by known/suspected changes in the fishery).
4. Evaluate uncertainty of model estimates and biological or empirical reference points.
- a. Choice of weighting likelihood components.

The Panel concluded that it could not use any of the three models, as presented, to provide quantitative advice on the current status of Gulf of Mexico menhaden. Consequently, no reliable reference points could be calculated.

5. Review the findings from retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F , SSB), reference points, and/or management measures.

Retrospective analyses were not evaluated as the Panel rejected the base BAM and neither the SRA nor ASPIC could provide reliable estimates of abundance.

6. Recommend stock status as related to reference points.

Reliable reference points could not be derived from any of the three models. The Panel provided qualitative advice on stock status only.

7. Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

The Panel provided detailed prioritized lists of short and long-term recommendations. It also provided a detailed list of remedial measures to improve future stock assessments. These are outlined in the next section of this report.

Conclusions and Recommendations

As indicated above, the Panel collectively concluded that it could not provide quantitative advice on the current status of Gulf of Mexico menhaden from any of the three models presented at the review workshop. The Panel did provide qualitative advice suggesting that the stock is not currently overfished and that overfishing is not occurring.

Panel's Recommendations

Given that the Panel rejected the base model, it did provide the following detailed list of remedial measures, as specified in the SEDAR instructions for review workshop panelists. These measures are taken directly from the Review Panel Report and reflect the collective thoughts of the Panel.

No remedial actions are required with regard to SRA and ASPIC, as such, in that neither can currently provide a reliable assessment. The SRA model needs further development to use catch-at-age data so that selectivities can be internally estimated. ASPIC is of limited utility for menhaden as it cannot use the catch-at-age data and is not provided with information on the biological characteristics of the species (e.g., cannot accurately estimate F_{MSY}). Also, a reliable ASPIC assessment requires reliable adult abundance indices, which are not currently available.

It should be possible to provide a reliable although potentially very uncertain stock assessment using the BAM package. However, preparatory work is required with regard to the current indices and the catch-at-age data, and the BAM runs need to be correctly implemented.

With regard to data inputs, more work needs to go into producing defensible abundance indices from existing data.

- The CDFR data should be used to construct a standardized CPUE time series (with catch as the response variable and various effort variables included as potential explanatory variables). The resulting time series would be an improvement on the existing reduction CPUE time series but would still need to be interpreted as a potentially hyper-stable index.
- The fishery independent data needs to be more fully analyzed, starting with a descriptive analysis of the temporal and spatial distribution of catch rates at stations. After that is done, it may be possible to determine better methods to combine data across states.
- Full documentation of proposed indices needs to be provided including standardization diagnostics and estimated effects. For indices derived by combining across states, state-year interactions should be investigated to see if there may be different trends between states.

The reduction fishery catch-at-age data should be checked for possible ageing problems:

- There are very few fish 3 years or older in the catch-at-age matrix from 1966 to 1970 inclusive. This corresponds to a period when multiple readers were used. Scales from the period 1964–1970 should be re-read by the current reader.
- A sample of scales throughout the whole time period should be re-read by the current reader to check for drift in the age readings.

For the BAM modeling:

- Either start the model in 1948 with initial biomass equal to virgin biomass with equilibrium age structure and/or start when the age data begin and estimate initial age structure.
- Only estimate the recruitment deviations during the period when there are data available to support the estimates.
- Do not estimate steepness unless the biomass trajectory covers a broad range of biomass in terms of percent B_0 .
- Aim for a parsimonious model in terms of the number of parameters; only introduce additional parameters if they can be more than justified in terms of improved model fit (use AIC or an even more stringent rule of thumb).
- An age-invariant M is probably adequate for this model given the small number of age classes in the catch. It may be possible to estimate M given the extensive catch-at-age data.
- Complex selectivity parameterizations are undesirable. Start with a single time invariant selectivity and introduce additional complexity only if necessary (e.g., blocking if supported by known/suspected changes in the fishery).
- The estimated CVs for indices derived from CPUE analysis and/or linear modeling are almost always far too low for stock assessment purposes. One rule of thumb is to set them at a starting value of 20% in each year.
- Continue to use number of tows for effective sample sizes of composition data (with a cap of 100 or 200).
- Always check the SDNRs to make sure they are approximately equal to 1 and, if not, use iterative re-weighting. After re-weighting, check that there is still an adequate fit to “reliable” abundance indices (if not, up-weight the abundance indices). Fully document the final CVs and effective sample sizes.
- Alternatively, or as a sensitivity test, follow the recommendation of Francis (2011) for weighting of composition data; this may give even lower effective sample sizes (than the capped number of tows).
- Do not use multipliers of the likelihood functions except as a quick way to test the sensitivity of results to emphasizing alternative data sets.
- Fully document the results of sensitivity runs including tables/figures with the estimates of all parameters for easy comparison across runs.
- Key outputs that are useful for understanding how a model is behaving are the biomass/egg-production trajectory in absolute terms and as a percentage of virgin biomass/egg-production. Effects can be very hard to understand when only B/B_{MSY} ratios are plotted. The trajectory of the absolute value of F is also useful.
- Include a sensitivity run which does not use any of the supposed adult abundance indices.

The Panel also provided the following prioritized list of recommendations in its Panel Review Report:

Short-term (prioritized):

- *Adult abundance index*: Review methods that could be used to provide a reliable fishery-independent adult-abundance time series. A pilot survey should be implemented as soon as possible. Development of a long-term time series is needed to increase the certainty of menhaden stock assessments.
- *Analysis of CDFR data*: These data may contain an abundance signal on a weekly and/or an annual basis. In the long-term, the data should be fully analyzed in this regard. In the short-term, a standardized CPUE time series should be developed from the data for use in stock assessment.
- *Further analysis of fishery independent state indices*: These data need to be fully analyzed with regard to determining the best methods to use the data to provide potential juvenile and adult abundance indices.
- *Ageing*: The consistency of the age readings throughout the whole time series should be checked. The current reader has read scales since 1969 and there may be some drift in her readings. Also, other readers participated up to the early 1970s and there is evidence of relative bias in the readings up to 1970, which should be investigated.
- *Further development of the SRA*: The incorporation of catch-at-age data into the SRA approach is encouraged as this would allow the method to provide a stand-alone stock assessment for menhaden.

Long-term (prioritized):

- *Adult abundance survey*: The existing state sampling of coastal waters is not adequate for providing a defensible adult abundance index. In the absence of such an index, stock assessment of menhaden will continue to be problematic. The development of a fishery-independent adult-abundance index should be given a very high priority. A review of possible methods is the first step (see short-term recommendations). Aerial surveying using visual estimation and/or LIDAR should be considered among the options.
- *Biological data*: All biological parameters pertinent to the stock assessment should be updated. Subsequently, they should be monitored every few years.
- *Catch sampling*: The potential bias associated with sampling only the last catch of the day should be investigated. It is important to know if there could be a bias and whether it is towards larger/older fish or smaller/younger fish.

My Recommendations

As for my own observations and recommendations, I thought that the analysts provided a very thorough documentation of the available data, and the parameterization and results of the three models. However, the assessment document was excessively long and therefore difficult to review. I would recommend that future assessment documents be more concise and include an executive summary.

I would also recommend that any assessment include documentation on changes from the previous assessment. This should include changes in available data, changes in modeling approach and parameterization, and any changes in the perception of stock status. Retrospective analyses are good but only capture changes in perception based upon

parameters in the current model, not necessarily the model used in the previous assessment.

I also felt that the current assessment could have benefited from greater collaboration between analysts. Three independent models were presented but there was no obvious interaction between the analysts for each model. For example, the BAM analyst used the gill net index from Louisiana only, whereas the SRA and ASPIC analysts used gill net data from all states. It is also unclear to me how the base BAM could have been recommended by participants at the assessment workshop, given the inadequacies identified at the review workshop.

With regard to the available data, I have two concerns that can easily be addressed. A random sample of ten fish per purse seine set does not appear to me to be adequate to characterize the age distribution of the catch. This could easily be confirmed by experimenting with different sample sizes. Also, it should be confirmed that hoppers at all reduction factories are the same size, have not changed over time, and that a hopper contains 304.5 kg of fish.

I must reiterate one of the principal concerns and recommendations of the Panel. This assessment suffered from the lack of a dedicated index of adult abundance, independent of the commercial fishery. As an external reviewer, it is hard to understand why such an index has not been established for the second largest United States fishery (by volume). The establishment of such an index is the highest long-term priority identified by the Panel. It would appear that there is an excellent opportunity for collaboration with industry in the development of an aerial survey. The Panel was told that 70% of purse seine sets are directed by spotter aircraft. This indicates that the infrastructure is available and that most menhaden schools are visible from the air. An aerial survey, conducted collaboratively with industry, is currently used in the assessment of Pacific sardines; Tom Jagielo should be contacted for further information.

Unlike some Panel members, I think that there is potential for a gill net index of abundance. I am less concerned with the temporal and spatial coverage of the existing gill net surveys, but more concerned with the 'striking' process used in the Louisiana survey. Given that this data set was unknown to the analysts prior to the data workshop, it requires further evaluation and potential experimentation to determine if such a survey provides a measure of fish density proportional to population density. It is also important that any gill net index include information from all states. I realize that it is unlikely, but this may require cooperation between states to standardize their survey methods!

The Panel struggled with accepting either of the adult indices of abundance. It would have been beneficial if the analysts could have been more forceful in providing their opinions, as they are in a better position to know the strengths and weaknesses of each index. When queried, the primary analyst indicated that she 'could go either way'; this was not helpful to the Panel.

In conclusion, I have a comment regarding the SEDAR process. For reviewers external to the United States stock assessment process, it is often difficult to determine for whom the scientific advice is being formulated. In this case, it was unclear prior to the review

workshop, that advice was being provided directly to the GSMFC and that the Review Panel Report would not go to the SSC. It was also unclear that the menhaden fishery occurs completely within waters under the jurisdiction of individual states and that the GSMFC wanted the assessment to inform states of potential problems with the fishery. It would have been beneficial to the Panel if these issues were made clearer in the SEDAR review workshop panelist instructions.

Appendix 1. Bibliography of Materials Provided for Review

SEDAR 27 Gulf of Mexico Menhaden - Workshop Document List

Document #	Title	Authors
Documents Prepared for the Data Workshop		
SEDAR27-DW-01	History of Assessments of the Menhaden Stock along the U.S. Gulf of Mexico Coast	Douglas S. Vaughan
SEDAR27-DW-02	Age, Growth and Reproduction of Gulf Menhaden	Douglas S. Vaughan, Joseph W. Smith and Amy M. Schueller
SEDAR27-DW-03	Life History-Based Estimates of Natural Mortality for Gulf Menhaden	Amy M. Schueller
SEDAR27-DW-04	History of the Gulf Menhaden Fishery and Reconstruction of Historical Commercial Landings	Joseph W. Smith and Douglas S. Vaughan
SEDAR27-DW-05	Harvest, Effort, and Catch-at-Age for Gulf Menhaden	Joseph W. Smith and Douglas S. Vaughan
SEDAR27-DW-06	Management Unit Definition for the Gulf Menhaden Stock in the U.S. Gulf of Mexico	Steve VanderKoooy
SEDAR27-DW-07	Habitat Description for the Gulf Menhaden Stock in the U.S. Gulf of Mexico	Steve VanderKoooy
SEDAR27-DW-08	Regulatory History for the Gulf Menhaden Stock in the U.S. Gulf of Mexico	Steve VanderKoooy
SEDAR27-DW-09	Report on the distribution and abundance of menhaden (<i>Brevoortia spp.</i>) larvae captured in ichthyoplankton samples during fishery-independent resource surveys in the Gulf of Mexico	Joanne Lyczkowski-Shultz and David S. Hanisko
SEDAR27-DW-10	Calculated discards of yellowtail snapper from commercial vertical line fishing vessels in southern Florida	Kevin J. McCarthy
SEDAR27-DW-11	Commercial Vertical Line Vessel Standardized Catch Rates of Yellowtail Snapper in southern Florida, 1993-2010	Kevin J. McCarthy
Documents Prepared for the Assessment Workshop		
SEDAR27-AW-01	Surplus production models of gulf menhaden, <i>Brevoortia patronus</i>	Michael H. Prager and Douglas S. Vaughan
Documents Prepared for the Review Workshop		
SEDAR27-RW-01	The Beaufort Assessment Model (BAM) with application to gulf	NOAA Beaufort Laboratory

	menhaden: mathematical description, implementation details, and computer code	
Final Stock Assessment Reports		
SEDAR27-SAR1	Gulf of Mexico Menhaden	
Reference Documents		
SEDAR27-RD01	Fishery Independent Sampling: Alabama	
SEDAR27-RD02	Fishery Independent Sampling: Mississippi	
SEDAR27-RD03	Fishery Independent Sampling: Florida	
SEDAR27-RD04	Fishery Independent Sampling: Texas	
SEDAR27-RD05	Fishery Independent Sampling: SEAMAP Trawl	
SEDAR27-RD06	Fishery Independent Sampling: Louisiana	
SEDAR27-RD07	Sampling Statistics in the Atlantic Menhaden Fishery	Alex Chester
SEDAR27-RD08	Gulf menhaden (<i>Brevoortia patronus</i>) in the U.S. Gulf of Mexico: Fishery characteristics and biological reference points for management	Douglas S. Vaughan, Kyle W. Shertzer, Joseph W. Smith
SEDAR27-RD09	Red snapper: Iterative re-weighting of data components in the Beaufort Assessment Model (SEDAR 24-RW-03)	NOAA Beaufort Laboratory

Appendix 2. Copy of the CIE Statement of Work

Attachment A: Statement of Work for John Wheeler

External Independent Peer Review by the Center for Independent Experts

SEDAR 27 Gulf of Mexico Menhaden and Southeast Yellowtail Snapper Review

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: SEDAR 27 will be an assessment review for conducted for Gulf of Mexico Menhaden and Southeast Yellowtail Snapper. The review workshop provides an independent peer review of SEDAR stock assessments. The term review is applied broadly, as the review panel may request additional analyses, error corrections and sensitivity runs of the assessment models provided by the assessment workshop panel. The review panel is ultimately responsible for ensuring that the best possible assessment is provided through the SEDAR process. The stocks assessed through SEDAR 27 are within the jurisdiction of the Gulf of Mexico and South Atlantic Fisheries Management Councils and the states of Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, and North Carolina. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have working knowledge and recent experience in the application stock assessment, statistics, fisheries science, and marine biology sufficient to complete the primary task of reviewing the technical details of the methods used for the assessment. Expertise with data poor assessment methods would be preferable. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Saint Petersburg, Florida during November 1-4, 2011.

Statement of Tasks: Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: <http://deemedexports.noaa.gov/sponsor.html>).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer’s views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

- 1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
- 2) Participate in the panel review meeting in Saint Petersburg, Florida during November 1-4, 2011.
- 3) In Saint Petersburg, Florida during November 1-4, 2011 as specified herein, conduct an independent peer review in accordance with the ToRs (**Annex 2**).
- 4) No later than November 18, 2011, each CIE reviewer shall submit an independent peer review report addressed to the “Center for Independent Experts,” and sent to Manoj Shrivani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Sampson david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

September 27, 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
October 18, 2011	NMFS Project Contact sends the CIE Reviewers the pre-review documents
November 1-4, 2011	Each reviewer participates and conducts an independent peer review during the panel review meeting
November 18, 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
December 2, 2011	CIE submits CIE independent peer review reports to the COTR

December 9, 2012	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director
------------------	---

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:

- (1) each CIE report shall be completed with the format and content in accordance with **Annex 1**,
- (2) each CIE report shall address each ToR as specified in **Annex 2**,
- (3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

William Michaels, Program Manager, COTR
 NMFS Office of Science and Technology
 1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-713-2363 ext 136

Manoj Shivilani, CIE Lead Coordinator
 Northern Taiga Ventures, Inc.
 10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
 Northern Taiga Ventures, Inc. (NTVI)
 22375 Broderick Drive, Suite 215, Sterling, VA 20166

RPerretti@ntvfederal.com

Phone: 571-223-7717

Key Personnel:

Julie A Neer, SEDAR Coordinator
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405
julie.neer@safmc.net

Phone: 843-571-4366

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.
2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.
 - a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.
 - b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.
 - c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.
 - d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
 - e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.
3. The reviewer report shall include the following appendices:
 - Appendix 1: Bibliography of materials provided for review
 - Appendix 2: A copy of the CIE Statement of Work
 - Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

SEDAR 27 Gulf of Mexico Menhaden and Southeast Yellowtail Snapper Review

1. Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment:
 - a. Discuss data strengths and weaknesses (e.g. temporal and spatial scale, gear selectivities, aging accuracy, sampling intensity).
 - b. Report metrics of precision for data inputs and use them to inform the model as appropriate.
 - c. Describe and justify index standardization methods.
 - d. Justify weighting or elimination of available data sources.
2. Evaluate models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points.
 - a. Did the model have difficulty finding a stable solution?
 - b. Were sensitivity analyses for starting parameter values, priors, etc. and other model diagnostics performed?
 - c. Have the model strengths and limitations been clearly and thoroughly explained?
 - d. Have the models been used in other peer reviewed assessments? If not, has new model code been verified with simulated data?
 - e. Compare and discuss differences among alternative models.
3. State and evaluate assumptions made for all models and explain the likely effects of assumption violations on model outputs, including:
 - a. Calculation of M.
 - b. Choice of selectivity patterns.
 - c. Error in the catch-at-age matrix.
 - d. Choice of a plus group for age-structured species.
 - e. Constant or variable ecosystem (e.g., abiotic) conditions.
 - f. Choice of stock-recruitment function.
 - g. Choice of reference points (e.g. equilibrium assumptions).
4. Evaluate uncertainty of model estimates and biological or empirical reference points.
 - a. Choice of weighting likelihood components.
5. Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F, SSB), reference points, and/or management measures.
6. Recommend stock status as related to reference points.
7. Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

Note – CIE reviewers typically address scientific subjects, hence ToRs usually do not involve CIE reviewers with regulatory and management issues unless this expertise is specifically requested in the SoW.

Annex 3: Agenda

SEDAR 27 Gulf of Mexico Menhaden and Southeast Yellowtail Snapper Review

Florida Fish and Wildlife Research Institute
Saint Petersburg, Florida
November 1-4, 2011

Tuesday

9:00 a.m.	Convene	
9:00 – 9:30 a.m.	Introductions and Opening Remarks <i>- Agenda Review, TOR, Task Assignments</i>	Coordinator
9:30 a.m. – 11:30 a.m.	Assessment Presentation	TBD
11:30 a.m. – 1:30 p.m.	Lunch Break	
1:30 p.m. – 3:30 p.m.	Continue Assessment Presentations	TBD
3:30 p.m. – 4:00 p.m.	Break	
4:00 p.m. – 6:00 p.m.	Panel Discussion <i>- Assessment Data & Methods</i> <i>- Identify additional analyses, sensitivities, corrections</i>	Chair

Tuesday Goals: Initial presentations completed, sensitivities and modifications identified.

Wednesday

8:30 a.m. – 11:30 a.m.	Panel Discussion <i>- Review additional analyses, sensitivities</i> <i>- Consensus recommendations and comments</i>	Chair
11:30 a.m. – 1:30 p.m.	Lunch Break	
1:30 p.m. – 3:30 p.m.	Panel Discussion	TBD
3:30 p.m. – 4:00 p.m.	Break	
4:00 p.m. – 6:00 p.m.	Panel Discussion	Chair

Wednesday Goals: Final sensitivities identified, Preferred models selected, Projection approaches approved, Summary report drafts begun

Thursday

8:30 a.m. – 11:30 a.m.	Panel Discussion <i>- Final sensitivities reviewed.</i> <i>- Projections reviewed.</i>	Chair
11:30 a.m. – 1:30 p.m.	Lunch Break	
1:30 p.m. – 3:30 p.m.	Panel Discussion or Work Session	Chair
3:30 p.m. - 4:00 p.m.	Break	
4:00 p.m. - 6:00 p.m.	Panel Work Session <i>- Review Consensus Reports</i>	Chair

Thursday Goals: Complete assessment work and discussions. Final results available. Draft Summary Report reviewed.

Friday

8:30 a.m. – 12:00 p.m.	Panel Work Session	Chair
12:00 p.m.	ADJOURN	

Appendix 3. Panel Membership and other pertinent information from meeting

Workshop Panel

Luiz Barbieri, Chair FWRI
 John Wheeler CIE Reviewer
 Patrick Cordue CIE Reviewer
 Sven Kupschus CIE Reviewer
 Will Patterson GSMFC-appointed Reviewer

Analytic Representation

Amy Schueller NMFS SEFSC Beaufort
 Bezhad Mahmoudi FWRI
 Mike Prager Prager Consulting

Rapporteur

Wade Cooper FWRI

Observers

Doug Vaughan GSMFC observer
 Ron Lukens Omega Protein
 Lew Coggins NMFS SEFSC Beaufort

Staff

Julie Neer SEDAR
 Rachael Silvas SEDAR
 Steve VanderKooy GSMFC