Center for Independent Experts (CIE) Reviewer's Report on the SEDAR 32/32A South Atlantic Blueline Tilefish and Gulf of Mexico Menhaden Review Workshop Morehead City, NC August 27-30, 2013

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Prepared for:

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EXECUTIVE SUMMARY

The SEDAR 32 Review Workshop for South Atlantic Blueline Tilefish (BLT) and the Gulf of Mexico menhaden stock assessments was held was at the at the Crystal Cove Civic Center, Morehead City, NC from August 27th to 30th, 2013. The main objectives of the meeting were to provide an independent review of the assessment input parameters, methods, models, analytical approaches, sensitivity analysis, uncertainties, outputs and stock status.

All travel arrangements for the CIE reviewers were organized by the CIE, while the local venue and the meeting room was the responsibility of the SEDAR coordinator from the South Atlantic Fishery Management Council. No logistic problems were encountered with travel or the meeting facility. Background material was available almost two weeks in advance, allowing plenty of time to prepare for the meeting. The review workshop adhered closely to the agenda provided prior to the meeting, although some deviations did occur in the discussion and questions of ongoing issues. Much of the success of the Review was due to the preparation and presentations of the assessment teams, who did an excellent job of providing overviews, and their willingness to respond to the Panel's requests for clarification and additional information.

South Atlantic Blueline Tilefish: After reviewing the input data, methods, analysis and results from the South Atlantic blueline tilefish (BLT) assessment the Review Panel concluded that the decisions made by the Data and Assessment Workshops were appropriate, generally sound, robust and made use of the best available data. The models and analytical approaches used for the assessment are commonly employed to evaluate stock status of fisheries and the sensitivity runs undertaken were sufficient to estimate uncertainties in the input parameters. All were within expected levels.

The primary model used for the BLT assessment was the Beaufort Assessment Model (BAM). A surplus-production model (ASPIC) a provided comparison of model results and was complementary to the primary model. The assessment results clearly show that this stock is overfished and that overfishing is occurring. With the exception of one sensitivity run (M=0.15), all scenarios estimated $SSB_{2011} < SSB_{msy}$ and $F_{(2009-2011)} > F_{msy}$. This evaluation of stock status is supported by both the BAM and ASPIC models. The BAM base configuration, as recommended by the Assessment Workshop (AW), was used to determine stock

status. Fishing mortality in 2011 was estimated as 0.39, which is greater than the estimate of Fmsy (0.302), Spawning biomass in 2011 is estimated as 445 thousand pounds, which is less than the estimate of Minimum Stock Size Threshold (489 thousand pounds).

Projections indicate that with F=0 the stock should build to above MSY by 2014 and with F<Fmsy in 1 to 2 years. Fishing at F=MSY and F=recovery the stock should gradually increase over 5-6 year. However, fishing at the current rate will only lead to a continuing decline in SSB. Research recommendations from the Data and Assessment Workshops were reviewed and prioritized. Guidance was provided for consideration on key improvements to data and modeling approaches that should be implemented before the next assessment.

Gulf of Mexico Menhaden: After a thorough review of the input data, modeling, sensitivity runs and results the Review Panel agreed that the data decisions made by the Data and Assessment Workshops for Gulf of Mexico menhaden were appropriate, generally sound, robust and properly applied. Uncertainties in the data inputs were also appropriately acknowledged. The models used for this assessment are commonly employed to evaluate stock status of fisheries and the sensitivity runs undertaken were sufficient to estimate uncertainties in the input parameters. All were within expected levels.

The primary model used for the Gulf of Mexico menhaden assessment was the Beaufort Assessment Model (BAM), a highly flexible, integrated analysis, statistical catch-at-age model. Surplus-production model (ASPIC) results were also provided for comparison and were complementary to the primary BAM model. Numerous sensitivity analyses and exploration of alternative scenarios were presented during the Assessment Workshop, and additional model exploration and sensitivity runs were requested during the Review Workshop. Fecundity is used as a proxy for SSB.

The Review Workshop (RW) Panel examined the consistency of the input data and population biological characteristics with the abundance estimates, exploitation, and biomass estimates. Panelists felt the base BAM parameterization chosen by the AW provided the best representation of stock status.

Currently there are no formal benchmarks established for Gulf of Mexico menhaden to evaluate if the stock is overfished or if over fishing is occurring.

Benchmarks for Gulf menhaden are currently being discussed and developed by the Gulf States Marine Fisheries Commission. However, the assessment team presented a suite of potential options commonly used to evaluate stock status for other fisheries in the region. The results suggest that the stock is not over fished and over fishing is not occurring. A surplus production model confirmed the evaluations. The Review Panel agreed with the AW conclusion on stock status.

No projections were undertaken for the Gulf of Mexico menhaden. Research recommendations from the Data and Assessment Workshops were reviewed and prioritized. Guidance was provided for consideration on key improvements to the data and modeling approaches that should be implemented before the next assessment.

1.0 BACKGROUND

South Atlantic Blueline Tilefish (*Caulolatilus microps*) and the Gulf of Mexico Menhaden (Brevoortia patronus) are assessed under the Southeast Data, Assessment, and Review (SEDAR) process. SEDAR is a cooperative Fishery Management Council process to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and US Caribbean. SEDAR is managed by the Caribbean, Gulf of Mexico, and South Atlantic Regional Fishery Management Councils in coordination with NOAA Fisheries and the Atlantic and Gulf States Marine Fisheries Commissions. The process involves constituents and stakeholders and includes field personnel, biologists, fishermen, database managers, stock assessment biologists, Council members and staff throughout each stage of the process. SEDAR is a publicly open approach designed to improve the quality of stock assessment through a series of workshops for the compiling, evaluating and reporting on the assessments. There are three workshops in the SEDAR process: A data workshop to review all the available data, to determine what data are appropriate for the assessment, and to identify data and research needs; a stock assessment workshop to formulate the stock assessment, to interpret information, and to identify how uncertainty is to be incorporated into the assessment; and, a peer review workshop to provide a rigorous and independent scientific review of the completed stock assessments. At the latter workshop the Review Panel provides a consensus report on the strengths and weaknesses in the assessment and makes recommendations to fishery managers for future data and research requirements.

In the USA these independent peer reviews are coordinated and managed by the National Marine Fisheries Service's (NMFS) Office of Science and Technology through the Center for Independent Experts (CIE). CIE reviewers/experts are selected by the CIE Steering Committee to conduct an impartial and independent peer review of scientific activities without conflicts of interest. Under the terms of the contract each reviewer is required to address predetermined Terms of Reference (Appendix 2). For the SEDAR 32/32A South Atlantic Blueline Tilefish and Gulf of Mexico Menhaden Review Workshop the Review Panel consisted of:

Steve Cadrin - Review Panel Chair, SAFMC SSC
Churchill Grimes - Reviewer, SAFMC SSC
Will Patterson – Reviewer, GSMFC Appointee
Gary Melvin - CIE Reviewer, Center for Independent Experts

Stephen Smith - CIE Reviewer, Center for Independent Experts
Kevin Stokes - CIE Reviewer, Center for Independent Experts

A complete list of participants, including the analytical team, observers, and advisory committee representatives, is provided in Appendix III for both assessments.

The specific tasks to be undertaken by the CIE reviewers for the independent external Panel review were to:

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 during the panel review meeting in Morehead City, North Carolina, from 27-30 August 2013.

3) Conduct an independent peer review in accordance with the ToRs (Appendix II - Annex 2a and 2b).

4) Individually submit an independent peer review report addressed to the "Center for Independent Experts," no later than September 13, 2013. Each CIE report shall be written using the format and content requirements specified in Appendix II - Annex 1, and address each ToR in Annex 2.

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1.1 Project Description

SEDAR 32 is a compilation of data, an assessment of the stock, and an assessment review conducted for South Atlantic blueline tilefish (BLT) and Gulf of Mexico menhaden. The CIE peer review is essentially responsible for ensuring that the best possible assessment has been provided through the SEDAR process. The South Atlantic BLT stock falls within the jurisdiction of the South Atlantic Fisheries Management Council and the state waters of North Carolina, South Carolina, Georgia, and Florida. The Gulf of Mexico menhaden stock falls within the jurisdiction of the Gulf States Marine Fisheries Commission and the state waters of Texas, Louisiana, Mississippi, Alabama, and Florida.

The tasks and timing associated with the Review Workshop begins with a pre-review of background documents: Approximately two weeks before the Review Workshop, the NMFS Project Contact sent (by electronic mail or made available at an FTP site) to the contract officer's representative (COR) the necessary background information and reports (i.e., working papers) for the reviewers to conduct the peer review, and COR then forwarded the documents to the contractor. Reviewers were responsible only for the pre-review documents that were delivered to the contractor in accordance to the Statement of Work (SoW) scheduled deadlines specified. The reviewers were responsible for reading all documents deemed as necessary in preparation for the peer review.

At the Review Workshop each reviewer shall conduct the independent peer review in accordance with the SoW and stock assessment ToRs, and shall not serve in any other role unless specified. Each 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 stock assessment ToRs. The NMFS Project Contact will be responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact will also be responsible for ensuring that the Chair understands the contractual role of the reviewers. The contractor can contact the COR and NMFS Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

After the panel review meeting, each reviewer is required to prepare an independent peer review report in the forma described in SoW. This report should explain whether each stock assessment ToR was or was not completed successfully during the SEDAR meeting. If any existing BRP or their proxies are considered inappropriate, each independent report shall include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report shall indicate that the existing BRPs are the best available at this time. Additional questions and pertinent information related to the assessment review addressed during the meetings that were not in the ToR's may be included in a separate section at the end of an independent peer review report.

The following report to the CIE reflects my independent opinions and views on the issues and questions identified in the terms of reference, statement of work, and the above goals and objectives. The report is, however, generally consistent

with the recommendations and conclusions of the other panel reviewers. Panel members met on the final day of the meeting to review their observations, conclusions, and recommendations. Overall there was agreement amongst the panel members regarding their conclusions and recommendations. This summary report also meets the requirements for south Atlantic blueline tilefish ToR # 8 and the Gulf of Mexico menhaden ToR #7.

2.0 REVIEW ACTIVITIES

The initial phase of the review process began with the provision of background material from the Data and Assessment Workshops and other research activities/results that contributed to the decision making process for the assessments. This included the final reports from both workshops as well as a large number of reference documents associated with data inputs and assessment methodology. In addition, a conference call was organized for August 21, 2013 to review the agenda, discuss initial perception of the assessment documents and to determine if any major problems were encountered that might be corrected prior to the meeting. Only a few minor editorial inconsistencies were identified.

The Review Workshop (RW) was held at the Crystal Cove Civic Center, Morehead City, NC from August 27th to 30th, 2013. Chaired by Steve Cadrin, the Panel consisted of six members and was supported by the stock assessment teams (mostly from the NMFS Southeast Fisheries Science Centre, Beaufort Lab). Lead analyst for the south Atlantic BLT assessment and the Gulf of Mexico menhaden assessment were Kevin Craig and Amy Scheuller, respectively. Both were responsible for the majority of the presentations, addressing questions, and providing additional information requests to the Review Panel. A complete list of participants for both assessments is provided in Appendix 3.

The RW began with introductions and a general welcome by the Chair. This was followed by a few housekeeping necessities, a review of the agenda and the Terms of reference for each stock. In general, the Review adhered to the agenda provided prior to the meeting to allow participants for the different assessments to attend the presentations and discussions of interest. The first two days, one day each, was allocated to each stock. Given the relatively small number of participants, the chair was flexible with input and questions during the presentation, however, the majority of questions and discussion was reserved for

after the presentations. Priority was given to the Review Panel members, followed by the fishing industry and other observers. All participants were provided an opportunity at the end each assessment presentation to ask questions or make comments relative to the fishery and the assessment.

Once the initial formalities associated with the RW were complete, the Chair moved quickly on the Terms of Reference for each stock. In this review each member of the panel was assigned specific TOR's to provide a summary and text for inclusion in the Panel report. The CIE reviewers were requested to prepare text for two or three of the TOR's from each of the stock assessments. The two general reviewers were assigned the task of merging the input from the CIE reviewers into coherent sections for the final report. Although this was not part of the ToR for the CIE reviewers, it was discussed and agreed to, based on the necessity for each CIE reviewer to address the same ToR in their report. The meeting then proceeded with the presentations and review of each stock assessment beginning with South Atlantic BLT on day 1 followed by the Gulf of Mexico menhaden on day 2. All day Thursday August 29 and Friday morning was reserved for review, and discussion of additional analysis and sensitivity runs requested by the Review Panel, Panel discussions of the overall assessment outcome related to analysis, and the development of consensus recommendations and comments.

The RW was conducted in a professional and timely manner with the Chair providing ample opportunity for clarification and discussion of issues among the participants. Throughout the meeting all CIE reviewers played an active role in the questioning, discussion, and request for additional information upon which to base the Panel's conclusions and make recommendations. Each CIE Reviewer also contributed to the specific subset of ToR's they were assigned at the beginning of the workshop, which were subsequently used in the Review Panel Consensus Report. The main output from the Workshop/review was to conduct and summarize an independent peer review of each stock in accordance with the ToR's. The ToR's and their associated recommendations/conclusions are discussed in the section that follows.

3.0 SUMMARY OF FINDINGS

Under the terms of the contract, the CIE review report shall include an independent peer review of ToRs for each stock assessed. In this case TOR's were developed specifically for both stocks reviewed at the assessment under the SEDAR process. In this summary report the ToR's for southern Atlantic BLT will be addressed first followed by the TOR's for the Gulf of Mexico Menhaden. Each ToR and sub-term will be discussed in the context of the best available information. Readers will likely discover relative consistency and overlap in the text for the other CIE reviewers and the Review Workshop report as there was general agreement in the summary, concerns and recommendations among the panel. In addition, unlike other reviews, the CIE reviewers made a significant contribution to the text contained within the Review Workshop report. Each CIE reviewer was assigned several TOR's for each stock to summarize for the Panel Report. Consequently, and in the absence of a finalized Panel Report (to be submitted after the CIE report due date), this summary report contains some of the same material submitted to the panel chair regarding the ToR's for inclusion in the Panel Report.

3.1 South Atlantic blueline tilefish assessment review

3.1.1 Evaluate the data used in the assessment, addressing the following:

a) Are data decisions made by the Data Workshop and Assessment Workshop sound and robust?

Overall the decisions made by the Data and Assessment Workshops for South Atlantic BLT were generally sound and robust. The data summary presented by Kevin Craig touched on a number of the key model input data sources. During the review the panel expressed concern about several subjects including the broad geographical distribution of the stock, natural mortality, maturity-at-age, ageing/growth, quality of the landings data, and the abundance indices. Each of these issues is described below and all were discussed and resolved to the best of the Panel's ability with the available information. In some instances additional information was requested by the Review Panel and was provided by the assessment team.

The stock/management area for this stock assessment extends from Rhode Island to Florida with all BLT landings used as input to the assessment model.

Unfortunately, there are no genetic studies or tagging data available for this species to define the management area; but many species exhibit a stock boundary along the US east coast at Cape Hatteras. BLT are pelagic spawners and as a consequence, it was suggested that larvae would be expected to be wide-ranging. However, previous work on golden tilefish indicates a stock break north and south of Cape Hatteras (Katz et al.1983). The Panel expressed concern that the stock area may be too broad given that the fishery appears to be focused in a few small areas. In addition, this species is known to be highly residential, occupying scour depressions in carbonate substratum and burrows in soft bottom (Able et al.1987). Such an aggregated species may be subject to local fisheries and depletion.

Natural mortality at age for the BLT assessment was determined based on estimates of K and $L\infty$ from Von Bertalanffy growth curves using the methods of Charnov et al. (2012) and is therefore highly dependent upon the quality of the age data. Considerable uncertainty in age determination for blueline tilefish was documented by Harris et al. (2004) and in the ageing error matrix for this assessment. The Panel agreed that scaling the mean M over the older ages to 0.1 was considered reasonable given the Hoenig estimate based on maximum age. A maximum M of 0.15 and a minimum of 0.05 was used for sensitivity testing based upon a CV of 54%. However, the lack of fish of age 15 and older in the landings data suggest that either M may be higher because the maximum age of 43 is questionable due to the uncertainty in ageing or Fishing mortality (F) was much higher than assumed. This would imply that the higher M alternative should receive more attention in the sensitivity analysis than the lower M, and perhaps M estimates higher than 0.15 should be considered.

No direct estimates of maturity at age were available for BLT. For the assessment maturity-at-age was based upon estimates for golden tilefish where 50% are mature at age 3 and 100% mature at age 4. While these results indicated a relatively younger maturity than might be expected for such a long-lived fish, similar results have been reported for other long-lived species in the region. However, maturity studies of golden tilefish, also suggest that functional maturity may occur at ages older than histological maturity because of territoriality, dominance and mate choice (Grimes et al. 1988 and McBride et al. 2013). If true for BLT, then the apparent truncation of age composition may be due to harvesting.

The von Bertalanffy growth curve indicates that 98% of total growth has been completed by age 15, therefore fish aged 15 yrs and older were assigned to a

plus group. The underlying growth data were obtained from sampling recent (last couple of years) landings for fisheries that appeared to target a very narrow range of ages (3-5 yrs. for recreational and 5-8 yrs. for commercial fisheries). There were no age composition data for landings in the earlier part of the time series when it was expected that larger/older fish should have represented a higher proportion of the population given a maximum age of 43 yrs. The reliability of the underlying assumptions of the initial age composition raises issues about the current estimates of M and F, as well the assumption of flat-topped selectivity. Furthermore, age composition data do not appear to track year-classes, even though high recruitment was estimated to have occurred just prior to the period when the bulk of the data were collected. Industry suggested that there may be differences in the spatial distribution of size/age class.

Age and growth information used in the assessment was extracted from Harris et al. 2004. This study did not rigorously validate putative ages and reported a low aging precision of about 60% within two years.

A comparative ageing study showed the agreement between readers was relatively poor. The ageing error matrix assumed a normal distribution to compare the results from two BLT readers. The symmetric distribution of errors was questioned as experience suggests that older ages tend to be more likely to be underestimated due to annuli packing at the otolith margin as the fish approach the asymptotic length. However, uncertainty in age determination as measured by the ageing error matrix was considered to be relatively small in comparison to other sources of uncertainty that had been identified.

The age compositions were fitted by the assessment model, yet the length compositions were removed from the analysis due to preliminary results indicating lack of fit. In light of the uncertainties associated with the ageing data, it seemed unusual that the length composition data would not be better fitted by the model.

b) <u>Are data uncertainties acknowledged, reported, and within normal or expected levels?</u>

Based on the Data Workshop (DW), the Assessment Workshop (AW), and the information presented at the AW, the uncertainties associated with this assessment were acknowledged and reported. For almost all data, the uncertainties were within normal and expected levels, except possibly those

associated with the ageing. The percent agreement between readers decreased rapidly (5%/year) from ~50% at age 3. This poor level of agreement is unusual for the young of such long living fish, yet it represents the best available data.

c) Are data applied properly within the assessment model?

All things considered the data were applied properly within the assessment.

d) Are input data series reliable and sufficient to support the assessment approach and findings?

The commercial and recreational catch rates are key datasets for both the BAM and ASPIC models. These fishery dependent CPUE indices represent the only annual abundance indices available and were developed using the standard approaches, (i.e., fit delta-GLM models to filter out annual trends from other factors associated with the data). The recreational index characterizes the earlier period when SSB was being fished down but it actually represents a period of very low levels of catch. The index was truncated in 1992 due to the limited samples. Unfortunately, there was no overlap between when the recreational index was truncated and the two commercial indices began.

Landings and catch-at-age were estimated for the entire geographic domain of the fishery, including those that came from north of 35N. However, CPUE was only computed for areas north of 28N and south of 35N. When the Panel examined nominal CPUE by latitude, regardless of fishery, it was higher north of 35N than the standardized composite CPUE used as an abundance index in the assessment. Consequently, the increased landings north of 35N are not being fully indexed. One implication is that the BAM model fits this increase in landings as an increase in recruitment, thus producing the greatest positive recruitment deviations in the model (see assessment document Fig. 3.13). This clearly has implications for projections of future stock productivity.

Landings data were considered to be reliable since 1974 and discarding for the commercial fishery was assumed to be negligible and consistent as there are no regulatory reasons for discarding (e.g., size limits). The recreational catch has been sporadic and low relative to the commercial catch until 2006. There was considerable discussion about the reliability of the recreational landing estimates for 2006 to 2008 including the very high discard estimate in 2007. Most of these landings appeared to have occurred in North Carolina waters and there was a

suggestion that the development of a “deep-drop” fishery may have driven the increase. The decrease in 2011 was due to the implementation of a deep water closure. Examination of the Marine Recreational Information Program (MRIP) data indicated that CVs for 2006 to 2011 decreased relative to the period before and the number of sample intercepts increased, both are indicative of increased fishing activity. However, the magnitude of landings relative to the commercial landings in those same years still seemed to be unprecedented and industry participants questioned the reliability of the recreational estimates.

3.1.2. Evaluate the methods used to assess the stock, taking into account the available data.

a) Are methods scientifically sound and robust?

The Beaufort Assessment Model (BAM) was used as the principal assessment tool for BLT. The BAM, implemented in AD Model Builder software (Fournier et al, 2012), is structured to allow implementation of forward projecting, statistical catch-at-age assessment models. Use of the BAM permitted the inclusion of all available types of data, including total annual removals from commercial and recreational fleets (landings and discards), age and length compositions, and indices of biomass abundance, with appropriate error distributions and use of priors on the parameters. Decisions on *a priori* data inclusion and exclusion are considered under ToR 1.

The specified assessment model used standard approaches to predicting landings, modeling growth and recruitment, and the BAM allowed an exploration of catchability and selectivity options.

The base case model and rationale for modeling decisions are well described in the AW report (section 3) and were further explored during the Review Workshop. The base case run included commercial and recreational landings, age composition data and three indices of abundance (recreational head boats, commercial long line and hand line). There was some concern that the recreational and commercial indices do not overlap but this was explored during the RW and the general patterns seem to be consistent. Length compositions were excluded by the AW due to concerns about inconstant sampling and conflicts in fitting. The AW concluded that length composition data help to inform selectivity estimates but conflicted with information in the abundance indices, did

not track year classes well, and added unnecessary noise. The Review Panel was concerned at this exclusion and the issue was explored further during the RW by looking at shadow fits comparing the base case predicted (but not fit) length compositions with the data and by examining model fits to the length composition data. The RW concluded that the residual patterns in the indices were not acceptable from the model that included length compositions, and the results could not be considered as a viable base case (or sensitivity run); the decision by the AW to exclude the length composition data was therefore upheld. Natural mortality was assumed constant through time but age-specific based on the method of Charnov (2013) and scaled consistent with maximum observed age. Steepness was fixed at 0.84 based on meta-analyses (Myers et al., 2002; Shertzer and Conn, 2012). Selectivities and catchabilities were all estimated as constant for the full assessment period (1974-2011).

b) Are assessment models configured properly and used consistent with standard practices?

The model was fit to the data using appropriate methods, consistent with standard practice. Analysis included iterative reweighting using the method of Francis (2011) and exploration of a variety of data configurations and parameterizations. The modeling processes and decision making resulting in a proposed base case run and sensitivity testing are well described in the AW Report and AW working documents and were further elaborated during the SEDAR 32 Review Workshop where additional diagnostics (likelihood components, weights, likelihood profiles) were made available. The modeling procedures adopted appear to be robust. Landings and discards were fit closely, and age composition data and abundance indices were fit to the degree that they are compatible and as indicated using the reweighting procedures. Landings and indices were fit using lognormal likelihoods. Age composition data were fit using robust multinomial likelihoods.

c) Are the methods appropriate for the available data?

The treatment of the data and the relative importance given to the various components were well explored by the AW and at the RW and appear appropriate. The model structure is adequate to capture the main patterns in the data.

In addition to the catch-at-age primary assessment, two biomass dynamics stock assessments were carried out using the ASPIC software, one fully age-aggregated and the other age structured. The biomass dynamics models were considered as confirmatory rather than alternative analyses, because the catch-at-age model makes fuller use of composition data and represents a more detailed investigation of population dynamics. The biomass dynamics models provide a useful comparison with the catch-at-age model results (Fig 1), which they broadly support, showing similar status of the stock in relation to MSY benchmarks (ToR 3). The biomass dynamics models are well known and the methods used were appropriately configured and implemented.

Monte Carlo Bootstrapping (MCB) was used to portray uncertainty around the model outputs, including the status estimates. MCB combines parametric bootstrapping to the landings and index data and resampling from the composition data. The Monte Carlo component entails drawing values of M and steepness from specified pdf's. Outputs provided are the quantiles of the distribution resulting from application of the MCB simulations. Each simulation applies to a single BAM model using the weights developed for the base case run. No reweighting procedures are used for individual realizations.

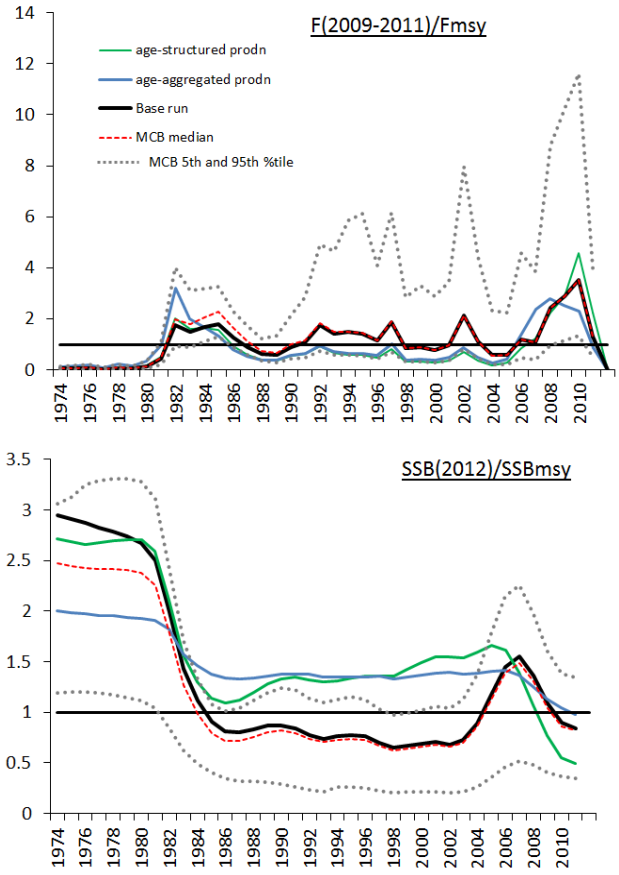

Figure 1. Trajectories of status benchmarks for the catch-at-age base case model, two biomass dynamics model runs, and the MCB analysis. Refer to key for explanation.

3.1.3 Evaluate the assessment findings with respect to the following:

a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?

The review panel examined the consistency of input data and population biological characteristics with abundance estimates, exploitation and biomass estimates. Overall the Review Panel agreed with the AW view that the base run provided the best representation of stock status and the use of MCB for projection estimates. The outputs are generally consistent with the inputs. The

review panel also noted that the MCB median estimates of biomass may also provide bases for evaluating stock status.

Initial examination of the sensitivity likelihoods suggested that a higher M may represent a creditable run and should be considered. However, additional information provided to the review panel by the assessment team supported the use of the base model M as input over the alternative of a higher M.

The Panel discussed the estimate of fishing mortality F and thought it may have been over estimated for projections because of changes in regulations and closures. However, examining the preliminary 2012 landings showed a substantial increase from 2011, thereby justifying the high F. Consideration might be given to using actual landings for future projections where 2012 is replaced with catch figures. As well the Panel suggests that 2011 be removed from three year estimate of F for 2013 and 2014.

b) Is the stock overfished? What information helps you reach this conclusion?

The RW Panel endorses the AW recommendation to determine stock status using the BAM base configuration. Based on the model estimates of SSB, the South Atlantic BLT is overfished by definition. Spawning biomass in 2011 is estimated as 445 thousand pounds, which is less than the estimate of Minimum Stock Size Threshold (489 thousand pounds), so the stock is overfished. SSB has been below SSB_{msy} for the past two years (2010-2011). The majority of viable sensitivity runs indicate that the SSB_{2011} was < SSB_{msy}. The only exception was the increase in M which indicated the SSB was greater than the SSB_{msy}. This was considered unlikely based on additional sensitivity runs requested by the Review Panel regarding M. Production model outputs of population status generally agreed with the catch-at-age model and indicate a B/B_{msy} of less than 1 in 2011.

c) Is the stock undergoing overfishing? What information helps you reach this conclusion?

Based on the Beaufort Assessment Model (BAM) base run estimate of fishing mortality (F), overfishing is occurring for the South Atlantic BLT. The geometric mean F over the past 3 years (F(2009-2011)/Fmsy) was greater (2.37) than 1.0

and has been for the past several years. The dramatic decrease in F(2011) to 1.30 was primarily the result of a fishery closure. Production model outputs all indicate an average F/Fmsy well in excess of 1.0.

d) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?

The Review Panel concurs with the AW use of the Beverton-Holt spawner recruit relationship to predict the recruitment of age -1 fish with a note of caution. The stock recruitment relationship was considered a major source of uncertainty. Recruitment estimates and MSY management quantities are based on a steepness that could not be estimated and was fixed at 0.84. Alternative proxies for MSY such as $F_{X\%}$ were examined but they too require an assumption about steepness.

e) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?

Based on the methods explored and the information available to the Review Panel, the quantitative estimates for determination of stock status were considered reliable and within the bounds of the uncertainties identified in the Assessment Document and the Review Panel's report.

3.1.4. Evaluate the stock projections, addressing the following:

a) Are the methods consistent with accepted practices and available data?

The methods used by the AW for projections are consistent with accepted practices in the region and elsewhere, and the available data. Initially the Review Panel had several concerns regarding the use of the Monte Carlo and bootstrap (MCB) approach as a measure of precision and to compute uncertainty. The MCB analysis is considered an approximation of uncertainty for an individual run. For BLT unconverged and unrealistic runs were removed (3200 reduced to 3043) from the analysis, however, there was still the possibility of including nonsense variable inputs that individually could occur within the established parameter bounds, but combined (biologically) could not, resulting in unrealistic outputs of R_0 and F_{msy}. All unfiltered runs were given equal weight and were included in the

estimate of uncertainty. These limitations were identified in the assessment report. In addition, there was the mixing of deterministic and stochastic parameters, the latter introducing process error. The review panel concluded that although the MCB approach is a common approach used in SEDAR assessments to estimate uncertainty, the results may be different if a true Bayesian approach was applied.

b) Are the methods appropriate for the assessment model and outputs?

In essence, the MCB process generates a stochastic version of the BAM model by introducing process error to the model components of natural mortality and steepness. The means of management quantities (MSY, B_{MSY}, F_{MSY}) from the MCB runs do not equal estimates from base run. Comparing estimates from the deterministic and stochastic version of the Schaefer population model indicated that the deterministic solutions for F_{MSY}, were not correct for the stochastic version (Bousquet et al. 2008). In fact, the direction of the differences observed between the MCB based estimates and those of the base run are in the direction predicted by the equations for the Schaeffer model. That is, F_{MSY} from the stochastic runs will be less than the deterministic estimates from the base run, MSY will be slightly higher for the stochastic estimates and B_{MSY} slightly lower. The size of the differences will be a function of the amount stochastic error in the model. These differences will not be apparent when looking only at ratio benchmarks as in Figure 1. It is important to note that for consistency, if MCB is used for projections, the MCB estimates of the management quantities should also be used for evaluating stock status.

c) Are the results informative and robust, and useful to support inferences of probable future conditions?

Projection results are informative and robust within the range of observations and inputs from the MCB. Currently F is estimated as the mean of the three previous years. Given the observed rapid changes in F and the preliminary landings estimates for 2012 and 2013 consideration might be given to using actual landings for future projections or to drop the 2011 from the estimate of F for 2013 and 14.

d) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

The assessment report identified and evaluated uncertainties associated with the assessment through the MCB approach. The report identifies the degree of uncertainty associated with M, ageing error, steepness, model component weights, indices and recruitment deviations. Some concern was expressed by the review panel about the appropriateness of using the mean F (high relative to the time series) for the previous three years given the high F's of 2009 and 2010 and the low value for 2011 for projections. However examination of the preliminary landings for 2012 and 2013 support the use of a large F. Preliminary landings data were requested the Review Panel and provided by the assessment team during the meeting.

3.1.5. Consider how uncertainties in the assessment, and their potential consequences, are addressed.

Uncertainty was explored in the assessment models using extensive sensitivity runs and likelihood profiling, retrospective analyses and Monte Carlo Bootstrapping (MCB). All of the methods used are standard and commonly employed in stock assessments. The AW reported on the various analyses with more material being provided and used in discussion at the RW. The application of methods appeared to be comprehensive and appropriately focused. Sensitivity runs as variants of the base case run were numerous and good information was provided on the impacts on fits (through detailed likelihood components and also weighting diagnostics, SDNRs, likelihood profiles, etc). However, such runs can only look at what the model structure accommodates and cannot consider, for example, processes such as fishery or environmentally induced geographic changes in distribution of the stock or fishery induced local depletion. There was much discussion at the RW on these issues and on data inclusion or exclusion in indices to represent stock abundance. Ultimately, the stock assessment assumed a single dynamic pool of fish and there was insufficient data at this time to support investigating alternative hypotheses. With the exception of this structural uncertainty, the other uncertainties in the assessment and its outputs have been appropriately and comprehensively considered.

Issues considered in sensitivity runs include variations in M and steepness, alternative maturity vector, adjustment of model weights and exclusion of each series of indices, allowing catchability to vary, inclusion of ageing error, and allowing recreational selectivity to be dome shaped. Issues of uncertainty not

covered explicitly in sensitivity tests include the quantum of landings assigned to recreational landings and especially discards in 2005-2007.

For the MCB approach a total of 3200 realizations were made using M and h values drawn from specified pdf's and with the landings, indices and age composition data bootstrapped. Each realization of the BAM model was run using the iteratively reweighted weights from the base case (it would have been impossible to automate this process for each of the 3200 realizations). However, it should be noted that reweighting can have major implications for fitting and parameter estimation and each realization may not be feasible. The degree to which this may, or may not, matter is model and data specific. As all realizations are afforded equal weight in determining distributions of outputs there is in general need for care in interpreting MCB results. For BLT, the SDNRs for all sensitivity tests are surprisingly good when runs are made using the base case weights. This is encouraging; however, this is no guarantee that the base case weights would in any way be appropriate for a specific M and h combination drawn from the pdfs, some may be incompatible.

Notwithstanding, the RW was comfortable that the AW had fully explored uncertainty to the extent possible and that the characterization of benchmark trajectories (Figure 1) and hence stock status (ToR 3) and projections (ToR 4) are suitable for informing management decisions.

3.1.6. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted.

Research recommendations for BLT were provided in the data and assessment Workshop documents (see reports) and were reviewed by the Panel in the context of the assessment. The Panel noted that many of these recommendations were broad in scope and reflected concerns across a range of deep-water species. The review Panel confined their attention to those specific to the stock assessment of South Atlantic BLT.

While the panel recognizes the necessity for research on stock structure, it recommended starting with the available information on describing the differences in demographics/life history characteristics of the species over the

range of the management area, before embarking on a broad scale genetic study. Additionally, the available information on habitat in the areas listed should be evaluated before initiating any new studies.

The Review Panel concluded that given this is an age-based assessment, comparison and calibration studies for the age determination should receive high priority along with marginal increment analysis to determine if the opaque zone is formed annually. In other words, conduct an age validation study. Protocols should be established for ageing, improved precision and the inclusion of age data from multiple readers/labs. Many species would probably benefit from expanding the MRIP program to include the collection of hard parts for aging for sampling.

The collection of information to better describe spawning season and spawning periodicity could probably start with fishery-dependent sources, but will need data from fishery-independent programs to cover the range of the species. The latter program would probably have to be tailored to provide samples across the deep-water snapper/grouper complex.

Studies of discard mortality should be a low priority given the current negligible discard rate in the commercial fishery. The collection of additional information on discards and catch (e.g, lengths, ageing material) is important especially for the areas north of Cape Hatteras, but would likely require an observer program be developed for all fisheries focusing on the deep-water snapper/grouper complex.

The BAM model is reliant on historical information and any data on size compositions, maximum size, etc., which can be retrieved from historical recreational fishing photos, could be quite useful. One of the main issues raised about the recreational fishery concerned the high landings in the mid-late 2000s, especially the high landing and discard estimates for 2007. Closer scrutiny of these estimates requires data at higher resolution than was apparently available for this stock assessment.

Developing a fishery-independent survey, sampling of deep-water habitats may elucidate habitat characteristics, and spatial distributions of BLT and other deep-water reef fishes. If a sufficient time series is developed, a fishery-independent index may be developed. However, the small size of the fishery may be prohibitive to the development of a fishery independent index of abundance for this species.

Recommendations/suggestions on possible ways to improve the SEDAR process are discussed under Conclusion and Recommendations (Section 4.0) of this report and are applicable to both stock assessments reviewed under SEDAR 32.

3.1.7. Provide guidance on key improvements in data or modeling approaches which should be considered when scheduling the next assessment.

The South Atlantic BLT assessment relies upon fishery dependent indexes of abundance to inform the Beaufort Assessment Model. No fishery independent indices are available for this stock. As such, the geographical distribution, seasonal movement, spawning, and consistency of the fishery over time have all had an impact on the indices and contribute to the uncertainty associated with the assessment. Whether or not the stock is truly a single spawning population distributed through the described range, or a series of multiple spawning components is, unknown given its broad spatial occurrence along the Atlantic coast. Changes in the state proportional contribution to total landings/catches from the commercial handline and longline fisheries implies a divergence from a more southerly dominated (Florida and South Carolina) fishery during the 1980's to a northern (North Carolina, especially above Cape Hatteras) focused fishery in more recent years. The reason(s) for these observed changes in landings are unknown. The changes in catch and subsequent catch rates used as indices of abundance may be a function of population dynamics, serial depletion, or a northerly migration in response to environmental variability. Further investigation of this issue should be undertake before the next assessment to insure the current commercial indices represent changes in abundance and not the adaption of the fishing fleets to availability. Development of a fishery independent index of abundance would help to resolve some of these issues, but is unrealistic given the small size of the fishery.

During the initial review and presentation of the stock assessment it was unclear that the commercial CPUE indices were being truncated or trimmed at Cape Hatteras, thereby excluding the effort data north of this area. Landings data used in the assessment model included all reported catches taken throughout the entire range of the stock. Given that a large portion of recent landings are being reported north of Cape Hatteras are not included in the commercial CPUE indices the effects these omissions on the abundance indices are unknown. The review panel suggests the increased catches be addressed and that this

apparent inconsistency between the indices and the fishery be resolved before the next assessment.

The BLT assessment uses three CPUE indices based on information from the Headboat (1980-92), handline (1993-10) and longline (1993-04) fisheries, with no data for 2011 due to a commercial and recreational closure. The recreational headboat time series was terminated due to the low number of trips/catches. No overlapping years between the Headboat index and the other two indices were used in the assessment suggesting uncertainty in the scaling of the indices. Limited information was, however, available for the headboat fishery over the entire time series, although sampling was poor after 1992. During the review the Panel requested additional analysis of the headboat time series to investigate if there were consistencies in CPUE patterns. When the headboat CPUE estimates were binned into three year averages the data generally tracked the ups and downs of the other indices, supporting the observed trends in abundance from the two commercial time series. The headboat data should be investigated further to determine if the times series can be extended, especially given the recent increases in headboat catches and sampling since 2008.

3.2 Gulf of Mexico menhaden assessment review

3.2.1. Evaluate the data used in the assessment, addressing the following:

a) Are data decisions made by the Assessment Workshop sound and robust?

The Review Panel agreed that the data decisions made by the Data and Assessment Workshops were generally sound and robust. Furthermore, after a thorough review of the data and a few requests for additional information the Panel concurred that the data generally were applied properly. Uncertainties in data inputs were also appropriately acknowledged.

b) Are data uncertainties acknowledged, reported, and within normal or expected levels?

Uncertainties in the data were acknowledged and reported within normal or expected levels. The Review Panel discussed several data concerns during the

workshop and requested additional information from the assessment team for clarification, to address the issues and to verify the uncertainties. These concerns fell into the broad categories of stock structure, landings, reproductive biology, and ageing and are discussed below.

The Gulf of Mexico menhaden stock ranges from western Florida through the northern Gulf of Mexico (GOM) to Campeche, Mexico, but their abundance is greatest in the north central GOM. After reviewing the information available the Review Panel agreed with the conclusion that no evidence exists to contradict the assumption that the population in the north central GOM constitutes a unit stock. However, there was some uncertainty as to whether population trends and demographics were similar in eastern and western portions of the species' range as the assessment and data tended to focus mostly on the central portion of the range where reduction fishery is concentrated.

Landings estimates were judged to be accurate as the reduction fishery is responsible for reporting nearly all landings and there has been a log system in place since 1964 for that fishery, including daily catch records. Cooperation by industry in supplying information to NMFS is impressive (weekly electronic reporting, 100% participation in voluntary program, access for port sampling and provision of freezer space for samples). The decision to start the landings time series in 1977 was quite reasonable given concerns about data quality for age composition data prior to 1977, inexplicable truncated age distributions in the early 1970s, species identification/composition and other issues with these early data as noted in past stock assessments. However, sensitivity analyses were conducted with the longer times series of age composition included.

The protocol for sampling menhaden to estimate length and age composition of the reduction fishery landings involves taking a haphazard sample from the top of a given boat's hold. Members of the Review Panel questioned if such a method provided a representative sample of the catch. Results from a 2012 study involving alternative sampling protocols suggest that sampling only from the top of a hold provides a biased sample of the catch, specifically underestimating numbers of older fish in the catch. For example, age-3 fish constituted less than 3% of the catch when sampled with the traditional method, while they were approximately 20% of samples taken from the start, middle, or end of hold pump-out. No age-4 fish were present in samples taken with the traditional method, but they constituted approximately 5% of landings sampled during the start or middle of pump-out.

There was some discussion about the lack of older fish in the estimated catch-at-age being due to older fish being less vulnerable to the fishery, if the spatial distribution of fish is age-specific. Major grounds for the fishery occur within 10 miles of the coast, but the species is estimated to extend out to 60 miles. Therefore, if older fish are found farther offshore or in smaller, non-targeted schools, then they may not be vulnerable to the fishery. This would conflict with the assumption of a logistic selectivity function for the reduction fishery. However, based on early-season catches that are generally taken farther offshore (10-20 miles), older fish do not appear to be farther offshore during the fishing months.

The Review Panel requested additional information on the spatial distribution of the fishery. The analysis, presented by the assessment team, on fishery hotspots composites for 2008, 2009 and 2011 fishing years was informative, but a longer time series of year-specific hotspots would have provided information on the spatial overlap between fishery- and fishery-independent indices of abundance used in the assessment. Plotting these hotspots may provide insight into the potential distribution of older fish off western Louisiana, as well as to the east of Alabama/Mississippi, areas not covered by either the seine or gillnet survey indices used in the assessment.

Fecundity was used as a metric for reproductive potential to compute a proxy for spawning stock biomass. A relationship produced in the early 1980s relating numbers of eggs to female length was used in this assessment to estimate length-specific fecundity in the model, thus larger, assumed older, fish are estimated to produce more eggs per individual than younger fish. Ovarian egg number may be a reliable index of SSB if all the ovary samples were at the same stage of reproductive development, but that would seem unlikely for existing menhaden fecundity data. Furthermore, Gulf menhaden have a protracted spawning season and are assumed to be an indeterminate batch spawner. If older fish produce more batches or higher quality eggs, then their contribution to stock-specific fecundity would be underestimated using the current approach. Lastly, it was noted that while fecundity is a common metric of reproductive potential in the region, it is not specified in the management plan as part of the stock status determination criteria.

Several issues exist with the aging protocols. Multiple scale readers aged fish in the 1960s to early 1970s, but only a single reader has aged fish since the 1970s. No formal protocol for aging appears to exist. Three informal analyses of aging accuracy or repeatability produced questionable results (e.g., 71% agreement

between otolith and scale derived age estimates; 82% agreement between age estimates from scales aged in 2005 and again in 2012; and, substantial disagreement in age estimates from the 1970s versus contemporary re-ageing of those samples). Given the short-lived nature of the fish, reader error of even one year can cause substantial bias in an age-based assessment. While the computed aging error matrix did not indicate directional bias, the assumption that the error was symmetric about ages precluded any other error pattern from being estimated. In most fishes, age of older individuals tends to be underestimated by scales as annuli pack at the scale margin and become difficult to discern. In fact, the assessment team conveyed that aging older menhaden (>2 yrs) with scales is more difficult than aging younger fish.

There was evidence of a shift in the estimated age composition of landings from mostly age-1 fish in the1960s-80s to mostly age-2 fish in more recent decades. Several hypotheses for the shift are discussed in the AW Report (e.g., habitat alteration affecting recruitment of juvenile fish in estuaries, decreased fishing mortality, recent contractions in the spatial distribution of the fishery, changing spatial distribution of age-1 menhaden, or the influence of hypoxic habitats on spatial distribution). However, re-aging of a sub-sample of scales from three years among each decade from 1970s to the 2000s indicated ages of fish sampled in the early portion of the time series, when multiple scale readers existed, may have been underestimated. Therefore, the AW removed the earliest years of the time series. No other bias in the ageing was identified.

c) Are data applied properly within the assessment model?

All things considered the data were applied properly within the assessment using standard approaches for standardizing variables and estimating the unknowns.

d) Are input data series reliable and sufficient to support the assessment approach and findings?

Natural Mortality (M) was estimated from an extensive tagging study conducted in the early 1970s (Ahrenholz 1991). The resultant estimate of M (1.22 y-1) was then scaled with the Lorenzen (1996) function to estimate declining M with age. After some discussion the RW concluded this approach was sound.

The Gulf of Mexico menhaden assessment is based on two reliable and apparently representative indices of abundance: a juvenile seine index and an adult gillnet index. A number of available fishery dependent and independent indices of abundance were excluded from being used in the model for various reasons by the AW. The SEAMAP juvenile trawl index which was highly correlated with the seine index was included in the SEDAR 27 assessment model, but dismissed here because it was judged that trawls are not efficient for pelagic species, the spatial extent of the survey was not appropriate for the resource, and the western portion of the survey has species identification problems. A research recommendation was included in the AW report for genetic sampling by size to resolve the species identification problem. Some concern was expressed by the RW that the gillnet index was limited to the Louisiana series. Data from the western and eastern portions of the resource area were excluded because of mixed species catches and species identification problems. Many of the potential surveys lacked ages (i.e., collection of hard parts for ageing). A larval survey was not used because of poor winter coverage, complex recruitment dynamics from larvae to fishery recruitment, and problems with species identification. Members of the Review Panel questioned why some of these indices were excluded prior to assessing their impact on model fit, such as through likelihood profiling.

A question arose about whether there could be a cryptic biomass of older (>3 years) fish that is not encountered by the fishery. Amy Schueller, the assessment lead, responded that older fish are captured in the gillnet survey. Further, if fish school by size or age, then small schools of larger, older fish may not be targeted by purse seiners.

Overall the Review Panel felt that the data input series were utilized appropriately and are sufficient to support the assessment outputs.

3.2.2. Evaluate the methods used to assess the stock, taking into account the available data.

a) <u>Are methods scientifically sound and robust?</u>

The Beaufort Assessment Model (BAM) was used as the principal assessment tool for the Gulf of Mexico menhaden stock. The BAM, implemented in AD Model

Builder software (Fournier et al. 2012), is structured to allow implementation of forward projecting, statistical catch-at-age assessment models. Use of the BAM permitted the inclusion of all available data types, including total annual removals from the commercial fleets (and the very small recreational catches), age and length compositions, and indices of biomass abundance, with appropriate error distributions and use of priors on parameters. Decisions on *a priori* data inclusion and exclusion are considered under ToR-1. The specified assessment model used standard approaches to predicting landings and modeling recruitment, and the BAM allowed an exploration of catchability and selectivity options.

The base case model and rationale for modeling decisions are well described in the AW report and were further explored during the RW. The base case run included commercial and recreational landings, age and length composition data and two indices of abundance, one each representing age 1 and age 2 fish. Natural mortality was estimated from tagging data, assumed to be constant through time, and was scaled among ages based on the method of Lorenzen (1996). Steepness of the Beverton-Holt spawner recruit (S-R) relationship was fixed at 0.7. Selectivities and catchabilities were all estimated as constant for the full assessment period (1977-2011).

b) Are assessment models configured properly and used consistent with standard practices?

The model was fit to the data using appropriate methods, consistent with standard practice. Analysis included iterative reweighting using the method of Francis (2011) and exploration of a variety of data configurations and parameterizations. The modeling processes and decision making that resulted in a proposed base case run and sensitivity testing are well described in the AW Report, which includes information on Likelihood components, weighting, SDNRs by data component and weight, likelihood profiles, etc. Further diagnostics were made available and elaborated during the RW.

c) Are the methods appropriate for the available data?

The treatment of the data and the relative importance given to the various components were well explored by the AW and at the RW and appear appropriate. The model structure is adequate to capture the main patterns in the data, thus the modeling procedures adopted appear to be robust. Landings and indices were fit using lognormal likelihoods. Age composition data were fit using

robust multinomial likelihoods. Landings were fit closely by the model, as were age composition data. Trends in abundance indices were generally fit by the model, but greater residuals existed for extreme index values (ie., those at the beginning or the end of the time series) that were not closely fit by the model.

In addition to the catch-at-age primary assessment, an age-aggregated biomass dynamics stock assessment was carried out using the ASPIC software. The biomass dynamics models was considered as a complementary rather than an alternative analysis because the catch-at-age model makes fuller use of composition data and represents a more detailed investigation of population dynamics, hence is better able to capture higher frequency changes in indices (e.g., recent high indices and catches). The biomass dynamics model provides a useful comparison with the catch-at-age model, which it broadly supports without capturing recent population changes. A number of sensitivity tests were carried out on the biomass dynamics model which demonstrated the robustness of conclusions based upon it. The biomass dynamics model used, implemented with ASPIC, is well known and commonly used in fisheries assessment. The methods were appropriately configured and implemented.

Monte Carlo Bootstrapping (MCB) was used to portray uncertainty around model outputs, including status estimates. MCB combines parametric bootstrapping to landings and indices data and resampling from composition data. The Monte Carlo component entails drawing values of M and steepness from specified pdf's. Outputs provided are the quantiles of the distribution resulting from application of the MCB simulations. Each simulation applies to a single BAM model using the weights developed for the base case run. No reweighting procedures are used for individual realizations.

The MCB approach was used to generate a stochastic version of the BAM model by introducing process error to the model components of natural mortality and steepness. Means of management quantities (MSY, B_{MSY}, F_{MSY}) from the MCB runs do not equal estimates from the base run. The direction of the differences observed between the MCB based estimates and those of the base run are in the direction predicted by Bousquet et al (2008). F_{MSY} from the MCB runs will be less than the deterministic estimates from the BAM base run, estimates of MSY will be slightly higher and those for B_{MSY} slightly lower. The size of the differences will be a function of the amount of stochastic error in the model. These differences will not be apparent when looking only at ratio benchmarks.

3.2.3. Evaluate the assessment findings with respect to the following:

a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?

The RW Panel examined the consistency of input data and population biological characteristics with abundance estimates, exploitation, and biomass estimates. Panelists felt the base BAM parameterization chosen by the AW provided the best representation of stock status and felt the usage of MCB for projection estimates was appropriate.

The menhaden fishery landings are dominated by age-2 fish with fishing occurring after this age group has spawned at least once. However, the selectivity pattern for the reduction fishery was flat topped, and there was uncertainty about the presence of older fish (age-3 and older) in fishery-independent gillnet catches versus their general absence in reduction fishery landings.

Very high F's were estimated within time series considered, especially during the 1980s. Fishing mortality has subsequently declined to range between 1.0 and 3.5 y-1. The 2011 full F was 2.36 y-1, with much lower Fs estimated for the older ages.

b) Is the stock overfished? What information helps you reach this conclusion?

Currently there are no formal benchmarks established for Gulf of Mexico menhaden to evaluate stock status in terms of being overfished or overfishing. The assessment team presented a suite of potential options for the Review Panel to evaluate. For SSB_{2011}/SSB_{med}, $SSB_{2011}/SSB_{30\%}$, $SSB_{2011}/SSB_{35\%}$, and $SSB_{2011}/SSB_{40\%}$ all BAM base run values exceeded 1.0. A surplus production confirmed the evaluations. Therefore, it is unlikely the Gulf menhaden stock would be evaluated to be overfished given commonly applied benchmarks in the region. The Review Panel agrees with the AW statement that the Gulf menhaden stock is not overfished.

c) Is the stock undergoing overfishing? What information helps you reach this conclusion?

F_{msy} was defined as infinite because of the stock population dynamics and the nature of the fishery. This assumption is valid as long as the fishery selectivity remains unchanged. The surplus production model produced results relative to estimates of MSY with no indication of exceeding the criteria typically used to evaluate overfishing. The Review Panel agrees with the AW general statement that no overfishing is occurring.

d) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?

No stock recruitment relationship was developed for this stock. Information on recruitment was based on the seine survey and the reproductive output based on population fecundity from BAM numbers at age.

e) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?

Managers are currently defining the goals and objectives for the Gulf menhaden fishery. Quantitative estimates for stock status determination are not defined and under discussion.

3.2.4. Consider how uncertainties in the assessment, and their potential consequences, are addressed.

Uncertainty was explored in the Gulf menhaden assessment modeling using extensive sensitivity runs and likelihood profiling, retrospective analyses, and MCB. All of the methods used are standard and widely used. The AW reported on the various analyses. The assessment team provided additional material when requested, which was used in discussion at the RW. The application of methods appears to be comprehensive and appropriately focused. Sensitivity runs as variants of the base case run are numerous with good information being

provided/reported on the impacts on fits (through detailed likelihood components and also weighting diagnostics, SDNRs, likelihood profiles, etc). Such runs can only look at what the model structure accommodates but cannot consider structural uncertainties such as alternative stock structures. No such structural uncertainties were identified for menhaden and the assessment and its outputs have been appropriately and comprehensively considered.

Issues considered in sensitivity runs include scaling and the form of M, S-R steepness and form, adjustment of model weights and exclusion of each series of indices, alternative selectivity assumptions for the commercial reduction fishery, start year, inclusion/exclusion of indices, alternative weightings, and alternative growth specification.

The MCB is alluded to above under ToR-2. A total of 5,000 realizations were made using M and h values drawn from specified probability density functions (PDFs) and with the landings, indices, and composition data bootstrapped. A total of 4,068 realizations were used to compile the final MCB quantile plots with realizations discarded if they did not converge or showed other poor behavior. The process for discarding realizations was not discussed in detail. Each realization of the BAM model was run using the iteratively reweighted weights from the base case (it would have been impossible to automate this process for each of the 4,068 realizations). It should be noted that reweighting can have major implications for fitting and parameter estimation and that each realization may not be feasible, possibly explaining why some realizations did not converge. The degree to which this may or may not matter is model and data-specific. As all realizations are afforded equal weight in determining distributions of outputs there is in general need for care in interpreting MCB results. For menhaden, the SDNRs for all sensitivity tests are surprisingly good (except for one case) when runs are made using the base case weights. However, this is no guarantee that for specific M and h combinations drawn from the PDFs, which may be incompatible, the base case weights would necessarily be appropriate.

Notwithstanding the above concern, the RW was comfortable that the AW had fully explored uncertainty to the extent possible and that the characterization of benchmark trajectories and hence stock status (ToR-3) are suitable for informing management decisions.

3.2.5. Consider the research recommendations provided by the Assessment workshop and make any additional recommendations or prioritizations warranted.

The RW panel suggested there should be an evaluation of the utility of using ovarian egg number as a proxy for SSB and notes that this will depend not only on biological considerations but also on age validation and errors, and selectivity determination. Ultimately, the utility of egg numbers versus SSB will depend on how status benchmarks and control rules are determined.

The Louisiana gillnet survey used in the menhaden assessment has a number of different mesh sizes and concern was expressed about developing a single index over these different mesh sizes, especially given the length frequencies presented in the assessment (AW Report, Fig. 5.44). The RW panel recommends evaluating the efficacy of developing separate indices by mesh or accounting for the different mesh sizes within the same index.

The panel did not see value in undertaking genetic studies to further elucidate Gulf menhaden population structure given the fishery operates in the center of the species distribution and it is unlikely that information gained would justify the expense of additional analyses. However, the RW panel did see considerable benefit in using simpler genetic techniques, such as DNA barcoding, to aid in species identification, which is currently problematic in several fishery-independent surveys conducted in peripheral range areas of Texas, Alabama, and Florida.

Throughout the course of the DW and AW, a number of items were identified as important research topics for future stock assessments. The RW Panel evaluated the various items listed and developed a consensus priority list that differs somewhat from those presented.

DATA ELEMENT	RECOMMENDATION	PRIORITY
FISHERY-INDEPENDENT ADULT INDEX	Collect Gulf menhaden ageing structures (scales and otoliths) from alternate fishing gears (e.g., gillnets and trawls) to determine gear selectivity. Need to expand efforts to age menhaden by state agencies. Determine readability of whole versus sectioned otoliths.	**Very High**
FISHERY-INDEPENDENT ADULT INDEX	Improve species identifications at the periphery of the Gulf menhaden's range in Texas and Alabama/Florida waters.	**Very High**
FISHERY-DEPENDENTSURVEYS	A Gulf-wide aerial survey may be a useful tool to measure adult Gulf menhaden abundance; "groundtruthing" for fish size and age and school size, would be a necessary adjunct to the survey.	**High**
FISHERY-DEPENDENTSURVEYS	Additional sampling needs to be conducted to address the homogeneity of the catch in the hold of the reduction fishery vessels at the four Gulf menhaden factories. Supplemental samples must be pulled from throughout the fishhold during the pumpout process to determine if the assumption that the traditional 'last set of the trip' accurately represents the age composition for the catch for the given port-week	**High**
FISHERY-INDEPENDENTJUVENILE INDEX	Improve species identifications at the periphery of the Gulf menhaden's range in Texas and Alabama/Florida waters.	**High**
FECUNDITY/MATURITY	The seminal study on fecundity and sexual maturity of Gulf menhaden was published thirty years ago (Lewis and Roithmayr 1981) with data from the late 1970s. It is recommended that a study should be initiated to re-examine the reproductive biology of gulf menhaden in the northern Gulf of Mexico, which includes updating fecundity estimates, maturity schedules(GSI), and sex ratios. Any study needs to reinvestigate whether gulf menhaden are determinant or in determinant spawners. Survey necessarily needs to include spawning from winter collections.	**High**
GENETICS AND STOCKSTRUCTURE	Identification of menhaden-specific nuclear DNA markers (preferably microsatellites or SNP's) using a lab-based DNA library screening techniques. Evaluation of these markers for use in genetic studies of Gulf menhaden	**Low**

GENETICS AND STOCK STRUCTURE	Identification in the Clupeid literature of potential new heterologous nuclear DNA markers (preferably microsatellites or SNP's) which will potentially enhance genetic sampling in Gulf menhaden.	**Low**
GENETICS AND STOCKSTRUCTURE	Reassessment of Gulf menhaden throughout its range using a larger, more informative genetic panel of markers than that described in Anderson (2006).	**Low**

Recommendations/suggestions on possible ways to improve the SEDAR process are discussed under Conclusion and Recommendations (Section 4.0) of this report and are applicable to both stock assessments reviewed under SEDAR 32.

3.2.6. Provide guidance on key improvements in data or modeling approaches which should be considered when scheduling the next assessment.

The Review Panel expressed some concern about the selectivity associated with the Louisiana gillnet survey used as an index of adult abundance for the assessment model. Probability density functions of length samples depict an expected distribution pattern for the smaller mesh sizes; however, the larger mesh sizes show a broad size distribution uncharacteristic of this gear type. The gillnet index also samples larger, and presumed older, fish than the commercial reduction fishery. This implies that the large fish are not being captured by the fishery and supports the dome shaped reduction fishery selectivity of 0.35 for ages 3 and 4 in the BAM base run assessment parameterization. However, a recent study to investigate sampling protocols in the reduction fishery, albeit small, suggests that the traditional reduction fishery sampling method may be missing larger fish when samples are only collected from the top of the hold. Further investigation of traditional sampling protocols and potential sampling bias should be undertaken before the next assessment.

The index is used to characterize the coast-wide stock following the age specific selectivity vector within the model. Understanding of the gillnet selectivity and reduction fishery sampling could resolve several fitting problems with the index and uncertainties in the model and should be considered for the next scheduled assessment.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The recommendations and conclusions in accordance with the ToR are described in detail in Section 3 of this report. Each term of reference and their sub-components identified for South Atlantic BLT and the Gulf of Mexico menhaden have been addressed. Section 4 contains a brief overview of the recommendations for each assessment reviewed. Many of the responses to the specific questions are redundant with the comments and recommendations presented in Section 3; however, they serve to reinforce the statements.

4.1 South Atlantic blueline tilefish

The Review Panel evaluated the data methods used in the assessment and concluded that overall the decisions made by the Data and Assessment Workshop for South Atlantic BLT were appropriate, generally sound and robust. The models used for the assessment are commonly employed to evaluate the stock status of other fisheries and the sensitivity runs undertaken were sufficient to estimate uncertainties in the input parameters and model outputs. All were within expected levels.

The assessment findings clearly show that, by benchmark definition, this stock is overfished and that overfishing is occurring. With the exception of one sensitivity run (M=0.15), all scenarios estimated $SSB_{2011} < SSB_{msy}$ and F_{2011} and $F_{(2009\text{-}2011)} > F_{msy}$. This evaluation of stock status is supported by both the BAM and ASPIC models. Spawning biomass in 2011 from the base run was estimated as 445 thousand pounds, which represents 91% estimate of Minimum Stock Size Threshold (489 thousand pounds). Fishing mortality was relatively high between 2008 and 2010, but dropped dramatically in 2011 due to a commercial and recreational closure. The 2011 F, however, remained above the defined threshold for overfishing in the base run and all sensitivity run, except for the higher M scenario.

The methods used by the AW for projections are consistent with accepted practices in the region and elsewhere, and the available data. Initially the Review Panel had a few concerns regarding the use of the MCB approach as a measure of precision and to compute uncertainty, but in the end concluded that the approach was appropriate. The review panel did, however, pointed out that although the MCB approach is a common approach used in SEDAR

assessments to estimate uncertainty, the results may be different if a true Bayesian approach was applied. After reviewing the preliminary 2012 and 2013 landings the Panel recommends that consideration be given using a different F in the projections. Current projections indicate that for an F=0 the stock should build to above MSY by 2014 and F<Fmsy in 1 to 2 years. Fishing at F=MSY and F=recovery the stock should gradually increase over 5-6 year. However, fishing at the current level will only lead to a continuing decline in SSB.

Uncertainty in the assessment models was explored using extensive sensitivity runs and likelihood profiling, retrospective analyses and Monte Carlo Bootstrapping (MCB). All of the methods used are standard and commonly employed in stock assessments. The Review Panel had an extended discussion and concern related to the geographical distribution of the resource and the single dynamic pool assumption for this stock (see section 3.0). Excluding the structural uncertainties, the uncertainties in the assessment and the outputs were deemed to have been appropriately and comprehensively considered. The RW felt that the AW had fully explored uncertainty to the extent possible and that the characterization of benchmark trajectories (Fig 1) and hence stock status and projections are suitable for informing management decisions.

The research recommendations provided by the Data and Assessment Workshops were reviewed and prioritized by the Panel (Section 3.1.6). The Panel noted that many of these recommendations were broad in scope and reflected concerns across a range of deep-water species; however, comments were restricted to those associated with South Atlantic BLT. The panel supported research recommends related to demographics, life history characteristics, and ageing of the species. The development of a fishery independent index would have benefits, but is likely unrealistic for such a small resource.

Several issues remain unclear for BLT related to stock structure and the indices which addressed would help to improve future assessments. The assessment assumes a single spawning population distributed throughout the described range, yet a series of multiple spawning components over its broad spatial occurrence could also explain many of the observations. Do the commercial indices used in the assessment represent changes in abundance or the adaption of the fishing fleets to availability? Further investigation of this issue should be undertaken. Currently a large portion of recent landings being reported north of Cape Hatteras are not included in the commercial CPUE indices. The review panel suggests the increased catches be addressed and that this apparent

inconsistency between the indices and the fishery be resolved before the next assessment. Finally, the headboat time series, terminated in 1992 should be revisited to determine if the series can be extended, especially given the recent increases in headboat catches and sampling since 2008.

4.2 Gulf of Mexico Menhaden

The Review Panel agreed that the data decisions made by the Data and Assessment Workshops were generally sound, robust and based on the best available data. Furthermore, after a thorough review of the data and a few requests for additional information, the Review Panel concurred that the data were generally applied properly. Uncertainties in data inputs were also appropriately acknowledged. The models used for the assessment are commonly employed to evaluate stock status of fisheries and the sensitivity runs undertaken sufficiently to estimate uncertainties in the input parameters. All were within expected levels.

Uncertainties in the assessment were acknowledged, examined, reported, and within normal or expected levels. The Review Panel discussed several data concerns during the workshop related to the broad categories of stock structure, landings, reproductive biology, and ageing that are briefly summarized below. All things considered, the data were applied properly within the assessment using standard approaches for standardizing variables and estimating the unknowns. Furthermore, the data input series were utilized appropriately and are sufficient to support the assessment outputs.

The Beaufort Assessment Model (BAM) was used as the principal assessment tool for the Gulf of Mexico menhaden stock. This permitted the inclusion of all available data types, including total annual removals from the commercial fleets (and small recreational catches), age and length compositions, and indices of biomass abundance, with appropriate error distributions and use of priors on parameters.

The base case model and rationale for modeling decisions are well described and fit to the data using appropriate methods, consistent with standard practice. The base case run and sensitivity testing includes information on likelihood components, weighting, SDNRs by data component and weight, and likelihood

profiles. Landings and indices were fit using lognormal likelihoods, while age composition data were fit using robust multinomial likelihoods. The treatment of the data and the relative importance given to the various components were well explored at both the Assessment and the Review workshops and appear appropriate. The Panel agreed that the model structure is adequate to capture the main patterns in the data, thus the modeling procedures adopted appear to be robust.

Uncertainty was explored in the Gulf menhaden assessment modeling using extensive sensitivity runs and likelihood profiling, retrospective analyses, and MCB. All of the methods used are standard and widely used.

For menhaden, the SDNRs for all sensitivity tests are surprisingly good (except for one case) when runs were made using the base case weights. Issues considered in sensitivity runs include scaling and the form of M, S-R steepness and form, adjustment of model weights and exclusion of each series of indices, alternative selectivity assumptions for the commercial reduction fishery, start year, inclusion/exclusion of indices, alternative weightings, and alternative growth specification. In the end the Panel felt comfortable that the AW had fully explored uncertainty to the extent possible and that the characterization of benchmark trajectories and hence stock status are suitable for informing management decisions.

Currently there are no formal benchmarks established for Gulf of Mexico menhaden to evaluate if the stock is overfished or if over fishing is occurring. The assessment team presented a suite of potential options used by other fisheries in the region. Comparison suggests that the stock is not over fished. A surplus production confirmed the evaluations. The Review Panel agreed with the AW conclusion on stock status. Fmsy was defined as infinite because of the stock population dynamics and the nature of the fishery. This assumption is valid as long as the fishery selectivity remains unchanged. The surplus production model showed no indication of exceeding the criteria typically used to evaluate overfishing. The Review Panel concurred with the AW general statement that it is unlikely overfishing is occurring.

The research recommendations provided by the Data and Assessment Workshops were reviewed and prioritized by the Panel (Section 3.2.5). Priority should be given to evaluation of the use egg number as a proxy for SSB and the

selectivity of gillnets used for the adult index of abundance. The Review Panel did not completely agree with the AW priorities. In particular the panel did not see value in undertaking genetic studies to further elucidate Gulf menhaden population structure, given the fishery operates in the center of the species distribution and it is unlikely that information gained would justify the expense of additional analyses. However, the RW panel did see considerable benefit in using simpler genetic techniques, such as DNA barcoding, to aid in species identification, which is currently problematic in several fishery-independent surveys conducted in peripheral range areas of Texas, Alabama, and Florida.

Key improvements in data and modeling approaches that may help with the next assessment are focused around the gillnet survey and sampling. The Review Panel expressed concern about selectivity associated with the Louisiana gillnet survey used as an index of adult abundance for the assessment model. Large fish taken in the survey are not being captured by the fishery suggesting a dome shaped in the reduction fishery selectivity for ages 3 and 4 in the BAM base run parameterization. However, traditional reduction fishery sampling methods appear to be missing larger fish when only collected from the top of the hold. Understanding of the gillnet selectivity and reduction fishery sampling could resolve several fitting problems with the index and uncertainties in the model and should be considered for the next scheduled assessment. It was also noted during the workshop that the seine survey may be discontinued. This could have serious implications for future assessments. The current surveys should be maintained and if possible improved.

4.3 The SEDAR Process

The Southeast Data, Assessment, Review (SEDAR) process provides an open and comprehensive approach to stock assessments. Through a series of three workshops, the data are reviewed, the assessment methods adopted and parameterized, and the end product peer reviewed by a panel of experts. This provides multiple opportunities for stakeholder input and discussion at all levels. SEDAR 32 was no exception. The Review Workshop examined two stock assessments; the South Atlantic BLT and the Gulf of Mexico menhaden. During (and before) the RW, vast amounts of background information via reports, scientific papers and presentations were provided to the Panel members. These documents formed the foundation of the assessments which were then

complemented by the assessment team's presentation and response to the Panel's questions.

The coordinators are to be congratulated on the selection of the Panel members. Between them they covered a broad spectrum of knowledge related to stock assessments, fish biology, surveying/sampling design and even local knowledge of the fishery. The chair was also well versed in stock assessment modeling methods and approaches. To his credit he ran a successful meeting and kept the entire group on track and on time. It was also a pleasure to have members of the fishery and the industry participates in the meeting. Their input on the fishery and local factors was extremely valuable when trying to understand some of the complexities or apparent inconsistencies in the data and the observations.

Overall the process was well coordinated and a positive experience as a reviewer with little room for improvement. The Panel members worked well together to come to agreement on issues and to form a consensus view. This may not always be the case depending upon the members. The only slightly negative aspect of the process was that all the detailed analysis and decisions regarding the assessments had been made prior to the Review Workshop. For several of the issues/discussions it would have been nice to explore the alternatives in more detail, as with most sources of uncertainty, the devil is in the detail. It was also noted that additional stocks were originally scheduled to be included in the review. Several Panel members felt strongly that two full stock assessments were about all that could be accommodated in the time allocated if a comprehensive review was expected. The recommendation would be to keep the number of stocks reviewed at a single meeting to a minimum, preferably no more than two, if they are as extensive as those for SEDAR 32.

DISCLAIMER

The information in this report has been provided for review purposes only. The author makes no representation, expressed or implied, as to the accuracy of the information and accepts no liability whatsoever for either its use or any reliance placed on it.

5.0 REFERENCES (only those acknowledged in this report)

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Harris, P.J., D.M. Wyanski, and P.T. Powers Mikell. 2004. Age, growth and reproduction of blueline tilefish along the southeastern coast of the United States, 1982-1999. Transactions of the American Fisheries Society 133:1190-1204.

Katz, S.J., C.B. Grimes and K.W. Able. 1983. Delineation of tilefish, Lopholatilus chamaeleonticeps, stocks along the U.S. east coast and in the Gulf of Mexico. Fish. Bull. 81(1):41-50.

McBride, R.S., T.E. Vidal and S.X. Cadrin. 2013. Changes in size and age at maturity of the northern stock of Tilefish (Lopholatilus chamaeleonticeps) after a period of overfishing. Fish. Bull. 111:161–174.

Appendix I: Bibliography of materials provided for review.

South Atlantic Blueline Tilefish

Document #	Title	Authors
Documents Prepared for the Review Workshop		
SEDAR32-RW01	The Beaufort Assessment Model (BAM) with application to blueline tilefish: mathematical description, implementation details, and computer code	NMFS-SFB 2013
SEDAR32-RW02	Catch Curves for blueline tilefish from the commercial handline and longline fleets	NMFS-SFB 2013
SEDAR 32 - AW	South Atlantic Blueline Tilefish – SECTION III: Assessment Workshop Report, August 2013.	SEDAR - 2013
Reference Documents		
SEDAR32-RD01	List of documents and working papers for SEDAR 4 (Caribbean – Atlantic Deepwater Snapper Grouper) – all documents available on the SEDAR website.	SEDAR 4
SEDAR32-RD02	Comparison of Reef Fish Catch per Unit Effort and Total Mortality between the 1970s and 2005–2006 in Onslow Bay, North Carolina	Rudershausen et al. 2008
SEDAR32-RD03	Source document for the snapper-grouper fishery of the South Atlantic region.	SAFMC 1983
SEDAR32-RD04	FMP, regulatory impact review, and final environmental impact statement for the SG fishery of the South Atlantic region	SAFMC 1983
SEDAR32-RD05	Age, growth and reproductive biology of blueline tilefish along the southeastern coast of the United States, 1982-99	Harris et al. 2004
SEDAR32-RD06	List of documents and working papers for SEDAR 9 (Gulf of Mexico Gray Triggerfish, Greater Amberjack, and Vermillion Snapper)	SEDAR 9
SEDAR32-RD07	Estimated Conversion Factors for Adjusting MRFSS Gulf of Mexico Red Snapper Catch Estimates and Variances in 1981-2003 to MRIP Estimates and Variances	Rios et al. 2012
SEDAR32-RD08	Estimates of Historic Recreational Landings of Spanish Mackerel in the South Atlantic Using the FHWAR Census Method	Brennan and Fitzpatrick 2012
SEDAR32-RD09	Excerpt from ASMFC Atlantic Croaker Stock Assessment & Peer Review Reports	ASMFC 2003

	2003 – Information on Jacquard Index	
SEDAR32-RD10	Survival estimates for demersal reef fishes released by anglers	Collins 1994
SEDAR32-RD11	Indirect estimation of red snapper (Lutjanus campechanus) and gray triggerfish (Balistes capriscus) release mortality	Patterson et al. 2002
SEDAR32-RD12	Estimating discard mortality of black sea bass (Centropristis striata) and other reef fish in North Carolina using a tag-return approach	Rudershausen et al. 2010
SEDAR32-RD13	Commercial catch composition with discard and immediate release mortality proportions off the southeastern coast of the United States	Stephen and Harris 2010
SEDAR32-RD14	Migration and Standing Stock of Fishes Associated with Artificial and Natural Reefs on Georgia's Outer Continental Shelf	Ansley & Harris 1981
SEDAR32-RD15	Age, Growth, and Reproductive Biology of the Gray Triggerfish (*Balistes capriscus*) from the Southeastern United States, 1992-1997	Moore 2001
SEDAR32-RD16	Size, growth, temperature, and the natural mortality of marine fish	Gislason et al. 2010
SEDAR32-RD17	Evolutionary assembly rules for fish life histories	Charnov et al. 2012
SEDAR32-RD18	A Review for Estimating Natural Mortality in Fish Populations	Siegfried & Sansó

Gulf of Mexico Menhaden

Document #	Title
SEDAR32A - **1.1**	2012 Dec 07 SEDAR32 Analyst CC summary (file type: Word)
SEDAR32A - **1.2**	2012 Dec 07 SEAMAP INDEX presentation 1 (file type: PowerPoint)
SEDAR32A - **1.3**	2012 Dec 07 Revised CDFR CPUE Index (file type: PowerPoint)
SEDAR32A - **1.4**	2012 Dec 07 Gillnet index (file type: PowerPoint)
SEDAR32A - **2.1**	2012 Dec 11 SEDAR32A Analyst CC summary (file type: Word)
SEDAR32A - **2.2**	2012 Dec 11 Langseth SEAMAP INDEX presentation 1 (file type: PowerPoint)
SEDAR32A - **3.1**	2013 Feb 05 SEDAR32A Analyst CC summary (file type: Word)
SEDAR32A - **3.2**	2013 Feb 05 Seine Index02-2013 (file type: PowerPoint)
SEDAR32A - **3.3**	2013 Feb 05 SEAMAP INDEX presentation 4 (file type: PowerPoint)

SEDAR32A - **3.4**	2013 Feb 05 Gillnet index and other data (file type: PowerPoint)
SEDAR32A - **4.1**	2013 March 8 SEDAR32A CC summary (file type: Word)
SEDAR32A - **4.2**	2013 March 8 Data webinar_draft (file type: PowerPoint)
SEDAR32A - **4.3**	2013 March 8 SEAMAP INDEX presentation 5 (file type: PowerPoint)
SEDAR32A - **5.1**	2013 March 26 SEDAR32A CC summary (file type: Word)
SEDAR32A - **5.2**	2013 March 26 Data webinar_final (file type: PowerPoint)
SEDAR32A - **6.1**	2013 May 9 SEDAR32A Conf Call Summary (file type: Word)
SEDAR32A - **6.2**	2013 May 9 BAM AW_webinar 1 (file type: PowerPoint)
SEDAR32A - **7.1**	2013 June 4 SEDAR32A Conf Call Summary (file type: Word)
SEDAR32A - **7.2**	2013 June 4 BAM AW_webinar 2 (file type: PowerPoint)
SEDAR32A - **7.3**	2013 June 4 Surplus production models for Gulf menhaden (file type: PowerPoint)
SEDAR32A - **8.0**	SEDAR32A AW Summary (file type: PDF)
SEDAR32A – **RW01**	The Beaufort Assessment Model (BAM) with application to Gulf menhaden: mathematical description, implementation details, and computer code (file type: PDF)
SEDAR32A - **RW02**	Benchmarks in Excel (file type: Excel)
SEDAR32A	Assessment Report
SEDAR32A	Assessment Supplement (assessment report figures, tables, appendices ONLY)

Appendix II: Statement of Work for Dr. Gary Melvin

External Independent Peer Review by the Center for Independent Experts

SEDAR 32 South Atlantic blueline tilefish and Gulf of Mexico menhaden assessment review

BACKGROUND

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 Representative (COR), 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.

SCOPE

Project Description SEDAR 32 will be a compilation of data, an assessment of the stock, and an assessment review conducted for South Atlantic blueline tilefish and Gulf of Mexico menhaden. The CIE peer review is ultimately responsible for ensuring that the best possible assessment has been provided through the SEDAR process. The South Atlantic blueline tilefish stock is within the jurisdiction of the South Atlantic Fisheries Management Council and the state waters of North Carolina, South Carolina, Georgia, and Florida. The Gulf of Mexico menhaden stock is within the jurisdiction of the Gulf States Marine Fisheries Commission and the state waters of Texas, Louisiana, Mississippi, Alabama, and Florida. . The Terms of Reference (ToRs) of the peer review are attached in **Annex 2a and 2b**.

OBJECTIVES

Requirements for CIE Reviewers: Three CIE reviewers shall have the necessary qualifications to complete an impartial and independent peer review in accordance with the tasks and ToRs described in the SoW herein. The CIE reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the tasks of the scientific peer-review described herein. 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 participate during a panel review meeting to conduct the independent peer review in Morehead City, North Carolina, from 27-30 August 2013.

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

Tasks prior to the meeting: The contractor shall independently select qualified reviewers that do not have conflicts of interest to conduct an independent scientific peer review in accordance with the tasks and ToRs within the SoW. Upon completion of the independent reviewer selection by the contractor's technical team, the contractor shall provide the reviewer information (full name, title, affiliation, country, address, email, and FAX number) to the contractor officer's representative (COR), who will forward this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The contractor shall be responsible for providing the SoW and stock assessment ToRs to each reviewer. The NMFS Project Contact will be responsible for providing the reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact will also be 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 COR prior to the commencement of the peer review.

Foreign National Security Clearance: Foreign National Security Clearance will not be necessary for this review because the panel review meeting will be conducted at a non-governmental facility.

Pre-review Background Documents: Approximately two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the COR the necessary background information and reports (i.e., working papers) for the reviewers to conduct the peer review, and the COR will forward these to the contractor. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the COR on where to send documents. The reviewers are responsible only for the pre-review documents that are delivered to the contractor in accordance to the SoW scheduled deadlines specified herein. The reviewers shall read all documents deemed as necessary in preparation for the peer review.

Tasks during the panel review meeting: Each reviewer shall conduct the independent peer review in accordance with the SoW and stock assessment ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and contractor.** Each 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 stock assessment ToRs as specified herein. The NMFS Project Contact will be responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact will also be responsible for ensuring that the Chair understands the contractual role of the reviewers as specified herein. The contractor can contact the COR and NMFS Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Tasks after the panel review meeting: Each reviewer shall prepare an independent peer review report, and the report shall be formatted as described in **Annex 1**. This report should explain whether each stock assessment ToR was or was not completed successfully during the SEDAR meeting. If any existing BRP or their proxies are considered inappropriate, each independent report shall include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report shall indicate that the existing BRPs are the best available at this time. Additional questions and pertinent information related to the assessment review addressed during the meetings that were not in the ToRs may be included in a separate section at the end of an independent peer review report.

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 during the panel review meeting in Morehead City, North Carolina, from 27-30 August 2013.
3) Conduct an independent peer review in accordance with the ToRs (**Annex 2a and 2b**).
4) No later than September 13, 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and Dr. David Sampson, CIE Regional Coordinator, via email to 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.

22 July 2013	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact

12 August 2013	NMFS Project Contact sends the stock assessment report and background documents to the CIE reviewers.
27-30 August 2013	Each reviewer participates during panel review meeting and conducts an independent peer review
13 September 2013	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
27 September 2013	CIE submits CIE independent peer review reports to the COR
4 October 2013	The COR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on changes. The COR 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 COR 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 COR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) The CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) The 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 COR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COR. The COR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

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Key Personnel:

NMFS Project Contact:

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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. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed. The CIE independent report shall be an independent peer review of each ToRs.

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

Annex 2a: Terms of Reference for the Peer Review

SEDAR 32 South Atlantic blueline tilefish assessment review

1. Evaluate the data used in the assessment, addressing the following:
   e) Are data decisions made by the Data Workshop and Assessment Workshop sound and robust?
   f) Are data uncertainties acknowledged, reported, and within normal or expected levels?
   g) Are data applied properly within the assessment model?
   h) Are input data series reliable and sufficient to support the assessment approach and findings?
2. Evaluate the methods used to assess the stock, taking into account the available data.
   d) Are methods scientifically sound and robust?
   e) Are assessment models configured properly and used consistent with standard practices?
   f) Are the methods appropriate for the available data?
3. Evaluate the assessment findings with respect to the following:
   f) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?
   g) Is the stock overfished? What information helps you reach this conclusion?
   h) Is the stock undergoing overfishing? What information helps you reach this conclusion?
   i) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   j) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?
4. Evaluate the stock projections, addressing the following:
   e) Are the methods consistent with accepted practices and available data?
   f) Are the methods appropriate for the assessment model and outputs?
   g) Are the results informative and robust, and useful to support inferences of probable future conditions?

h) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

5. Consider how uncertainties in the assessment, and their potential consequences, are addressed.
   - Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods
   - Ensure that the implications of uncertainty in technical conclusions are clearly stated.
6. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted.
   - Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
   - Provide recommendations on possible ways to improve the SEDAR process.
7. Provide guidance on key improvements in data or modeling approaches which should be considered when scheduling the next assessment.
8. Prepare a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. The CIE reviewers are contracted to conduct an independent peer review, therefore the contractual responsibilities of the CIE reviewers do not include the preparation of the Peer Review Summary.
   - 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.

The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made in the assessment, alternative model configurations are recommended, or additional analyses are prepared as a result of review panel findings regarding the TORs above.

Annex 2b: Terms of Reference for the Peer Review

SEDAR 32A Gulf of Mexico menhaden assessment review

1. Evaluate the data used in the assessment, addressing the following:
   e) Are data decisions made by the Assessment Workshop sound and robust?
   f) Are data uncertainties acknowledged, reported, and within normal or expected levels?
   g) Are data applied properly within the assessment model?
   h) Are input data series reliable and sufficient to support the assessment approach and findings?
2. Evaluate the methods used to assess the stock, taking into account the available data.
   d) Are methods scientifically sound and robust?
   e) Are assessment models configured properly and used consistent with standard practices?
   f) Are the methods appropriate for the available data?
3. Evaluate the assessment findings with respect to the following:
   f) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?
   g) Is the stock overfished? What information helps you reach this conclusion?
   h) Is the stock undergoing overfishing? What information helps you reach this conclusion?
   i) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   j) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?
4. Consider how uncertainties in the assessment, and their potential consequences, are addressed.
   - Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods
   - Ensure that the implications of uncertainty in technical conclusions are clearly stated.

5. Consider the research recommendations provided by the Assessment workshop and make any additional recommendations or prioritizations warranted.
    - Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
    - Provide recommendations on possible ways to improve the SEDAR process.
6. Provide guidance on key improvements in data or modeling approaches which should be considered when scheduling the next assessment.
7. Prepare a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. The CIE reviewers are contracted to conduct an independent peer review, therefore the contractual responsibilities of the CIE reviewers do not include the preparation of the Peer Review Summary.
    - 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.

The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made in the assessment, alternative model configurations are recommended, or additional analyses are prepared as a result of review panel findings regarding the TORs above.

Annex 3: Tentative Agenda

SEDAR 32/32A South Atlantic Blueline Tilefish and Gulf of Mexico Menhaden Review Workshop

Tuesday

9:00 a.m. Convene

9:00a.m. – 9:30a.m. Introductions and Opening Remarks **Coordinator**

- Agenda Review, TOR, Task Assignments

9:30a.m. – 12:00p.m. Assessment Presentation and Discussion (BLT*) TBD

12:00p.m. – 1:30p.m. Lunch Break

1:30 p.m. - 3:30 p.m. Panel Discussion **Chair**

- *Assessment Data & Methods*

- Identify additional analyses, sensitivities, corrections

3:30p.m. – 3:45 p.m. Break

3:30 p.m. - 5:00 p.m. Panel Discussion **Chair**

-Continue deliberations

5:00p.m. – 6:00p.m. Panel Work Session **Chair**

***Tuesday Goals*:** Initial BLT* presentation completed, sensitivities and modifications identified.

Wednesday

8:30 a.m. – 12:00 p.m. Assessment Presentation and Discussion (GM) TBD**

12:00 a.m. – 1:30 p.m. Lunch Break

1:30 p.m. - 3:30 p.m. Panel Discussion **Chair**

- *Assessment Data & Methods*

- Identify additional analyses, sensitivities, corrections

3:30p.m. – 3:45 p.m. Break

3:30 p.m. - 5:00 p.m. Panel Discussion **Chair**

-Continue deliberations

5:00p.m. – 6:00p.m. Panel Work Session **Chair**

***Wednesday Goals*:** Initial GM** presentation completed, sensitivities and modifications identified.

Thursday

8:30 a.m. – 12:00 p.m. Panel Discussion **Chair**

- Review additional analyses, sensitivities

12:00 a.m. – 1:30 p.m. Lunch Break

1:30 p.m. – 3:30 p.m. Panel Discussion **Chair**

-Continue deliberations

3:30 p.m. – 3:45 p.m. Break

3:45 p.m. – 5:00 p.m. Panel Discussion **Chair**

-Consensus recommendations and comments

5:00 p.m. - 6:00 p.m. Panel Work Session **Chair**

Thursday Goals: Final sensitivities identified, preferred models selected, projection approaches approved, Summary report drafts begun.

Friday

8:00 a.m. – 10:30 a.m. Panel Discussion **Chair**

- Review additional analyses, final sensitivities

- Projections reviewed.

10:30 a.m. – 10:45 p.m. Break

10:45 a.m. – 1:00 p.m. Panel Discussion or Work Session **Chair**

- Review Consensus Reports

1:00 p.m. ADJOURN

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

Appendix III: List of Participants

The following provides a list of participants in attendance at the SEDAR 32 Review Workshop for each stock assessment.

South Atlantic Blueline Tilefish.

Review Workshop Panelists

Steve Cadrin	Review Panel Chair	SAFMC SSC
Churchill Grimes	Reviewer	SAFMC SSC
Will Patterson	Reviewer	GSMFC Appointee
Gary Melvin	Reviewer	CIE
Stephen Smith	Reviewer	CIE
Kevin Stokes	Reviewer	CIE

Analytical Team

Kevin Craig	Lead analyst, SA BLT	NMFS Beaufort
Amy Scheuller	Lead analyst, GoM menhaden	NMFS Beaufort
Kyle Shertzer	Assessment Team	NMFS Beaufort
Erik Williams	Assessment Team	NMFS Beaufort
Katie Andrew	Assessment Team	NMFS Beaufort
Rob Cheshire	Assessment Team	NMFS Beaufort
Robert Leaf	Assessment Team	USM

Observers

Dewey Hemilright	Fishing Industry	Commercial, NC
Robert Johnson	Fishing Industry	Charter/Headboat

Council Representative

Michelle Duval	Council Member	SAFMC

Council and Agency Staff

Julia Byrd	SEDAR Coordinator	SEDAR
Julie O'Dell	Administration	SEDAR/SAFMC
Michael Errigo	Fishery Biologist	SAFMC Staff
Steve VanderKooy	IJF Program Coordinator	GSMFC
Jessica Stephen	Fishery Biologist	SERO
Brian Langseth	Observer	SEFSC Beaufort
Joe Smith	Observer	NOAA

Gulf of Mexico menhaden.

Review Workshop Panelists

Steve Cadrin	Review Panel Chair	SAFMC SSC

Churchhill Grimes	Reviewer	SAFMC SSC
Will Patterson	Reviewer	GSMFC Appointee
Gary Melvin	Reviewer	CIE
Stephen Smith	Reviewer	CIE
Kevin Stokes	Reviewer	CIE

Analytical Team

Kevin Craig	Lead analyst, SA BLT	NMFS Beaufort
Amy Scheuller	Lead analyst, GoM menhaden	NMFS Beaufort
Kyle Shertzer	Assessment Team	NMFS Beaufort
Erik Williams	Assessment Team	NMFS Beaufort
Katie Andrew	Assessment Team	NMFS Beaufort
Rob Cheshire	Assessment Team	NMFS Beaufort
Robert Leaf	Assessment Team	USM

Observers

Dewey Hemilright	Fishing Industry	Commercial, NC
Robert Johnson	Fishing Industry	Charter/Headboat

GSMFC Menhaden Advisory Committee

John Mareska,	ADCNR-MRD
Ron Lukens,	Omega Protein, Inc.
Behzad Mahmoud,I	FL FWC
Matt Hill,	MDMR
Jerry Mambretti,	TPWD
Harry Blanchet,	LDWF
Borden Wallace,	Daybrook Fisheries

Council Representative

Michelle Duval	Council Member	SAFMC

Council and Agency Staff

Julia Byrd	SEDAR Coordinator	SEDAR
Julie O'Dell	Admin.	SEDAR/SAFMC
Michael Errigo	Fishery Biologist	SAFMC Staff
Steve VanderKooy	IJF Program Coordinator	GSMFC
Jessica Stephen	Fishery Biologist	SERO
Brian Langseth	Observer	SEFSC Beaufort
Joe Smith	Observer	SEFSC Beaufort