Independent Peer Review Report on the SEDAR 27 Panel for Gulf of Mexico Menhaden and Southeast Yellowtail Snapper, held 1-4 November 2011, in St Petersburg, Florida

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Prepared for

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The week prior to the meeting in St. Petersburg the assessment for southeast Yellowtail snapper was withdrawn from the panel due to problems with the assessment, so that only the Gulf of Mexico Menhaden assessment was reviewed at the meeting. The 2011 draft assessment report for Gulf Menhaden and the supporting documentation was provided according to the scheduled timescale. All documentation was reviewed thoroughly ahead of the panel meeting. The review meeting was conducted through a series of presentations on the fishery, data and the assessment approaches by the stock assessment team. The panel sought to understand the linkages in the stock dynamics implied by model implementation and to ascertain their appropriateness given the understanding of biology, ecology and fisheries for the stock. This, in conjunction with the examination of the model diagnostics, allowed for panel requests to provide further model runs in the case of the BAM and ASPIC models to better understand the problems in the data and model sensitivity.

Main findings

A thorough description of the fishery and catch data collection were presented by the assessment team. The catch information was found to be more complete than for most stocks, and with only minor concerns regarding the historic aging of catches. In contrast, the information regarding indices of abundance was much poorer with the descriptions and diagnostics presented in only in rough detail. Further information provided to the panel during the review suggested that some of the choices with respect to index standardisation may have been suspect or required further refinement, in particular with respect to the adult abundance indices.

The panel was unable to fully assess the deficiencies in the proposed assessment model based on the Beaufort Assessment Model (BAM) framework due to implementation difficulties, particularly with respect to the initialisation of the historic biomass estimates. These difficulties precluded further investigations with respect to other possible model parameterisations in BAM and as such the proposed base model was deemed unsuitable for the provision of either quantitative or qualitative management advice.

The other modelling approaches (ASPIC and SSRA) carried out by the assessment workshop, more as ancillary information than as standalone assessments, were at best considered indicative of qualitative measures of management quantities due to the uncertainty in the available index information. The qualitative information coming from these models, particularly ASPIC, where a “worst case” scenario was implemented during the panel meeting, along with direct information from the catch-at-age matrix, suggested that the stock was unlikely to be depleted and that it was most probably not overfished. Beyond this statement the panel was uncomfortable to provide further evaluations as these would be mostly speculative.

Important recommendations:

A number of formal recommendations were advanced by the panel to improve future assessments, and these are specifically included in the panel report.

The most important requirement is for an unbiased index of adult abundance. Both the reduction fishery index and the fisheries independent LA gillnet index are thought to have deficiencies which make a linear relationship between index and stock size unlikely. One approach may be to standardise the reduction index by fisheries and/or spatio-temporal variables to account for developments in the fishery, although this will not get around the possibly more serious problem of hyper-stability in the index.

The BAM model implementation for menhaden needs a lot of further investigation before a suitable age based assessment can be accepted. At this time the model does not reflect plausible stock dynamics as indicated by the severe and inexplicable pattern of residuals, which given the large number of parameters used in the model should have been resolved. The panel examined some of the results and noted a number of problems with the model set-up, particularly the initialisation of the population biomass. However further issues remained so that it is not possible in my opinion to judge whether a feasible age structured model can be constructed with the available data. In reality we have not been able to explore the data through the eyes of the BAM model so we cannot conceivably make specific recommendations in terms of directions to attempt beyond the general principles for statistical catch-at-age modelling until a more responsive model implementation is available.

The ASPIC model provided some interesting insights into the stock dynamics, but was obviously very sensitive to the choice of adult index as these implied very different stock trends. The biggest problem with the ASPIC model was that it modelled population growth so that recruitment, natural mortality and individual growth were all confounded in the model. Therefore it was not possible to use the available information on age structure to verify or defend the ASPIC model and improvements in this model are almost entirely dependent on the provision of better adult abundance indices.

The SSRA model is an interesting approach to addressing the assessment with some promising theoretical advantages. However, here the model implementation was rendered inappropriate for the provision of advice by the use of the selectivities from the flawed BAM model implementation. In addition it appeared that recruitment deviances were allowed to vary so widely that the two contradicting adult indices could be matched almost perfectly despite indicating very much the same stock recruit dynamics. Use of the age structure in the model was now possible and in fact was carried out as one of the sensitivity runs. Unfortunately no diagnostics are available for this new implementation, nor does it currently resolve the issue of having taken the selectivities from the BAM model. With the formal inclusion of the age information in the model, internal estimation of selectivity should be possible. This approach should be further investigated.

The above recommendations are in keeping with the recommendations in the panel Summary Report, but represent only a subset of those presented in that report that I consider most pertinent for improvement of the assessments.

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1. BACKGROUND

In accordance with the Statement of Work (SOW: Appendix 2), I was contracted to participate as a CIE independent review panellist for the 2011 SEDAR 27 for Gulf of Mexico menhaden. This document represents my own findings and interpretation of the information provided, and is based on the panel meeting and discussions. However, some of the thoughts and conclusions were formulated in the process of writing this report, so may not be identical to or may go beyond those provided in the final official panel report.

2. REVIEW ACTIVITIES

The 2011 SEDAR 27 Panel for Gulf of Mexico Menhaden and Southeast Yellowtail Snapper was held at the Florida Marine Research Institute (FMRI), St Petersburg, Florida from 1 to 4 November 2011. The Terms of Reference for the STAR Panel are given in the SOW (Appendix 2: Annex 2).

Prior to the Review Workshop, I was provided with draft stock assessment reports and background documents for Gulf of Mexico menhaden, with the assessment for Southeast yellowtail snapper having been withdrawn from the review by the council. These were made available according to the agreed time-scale via an ftp site. The documents were thoroughly reviewed ahead of the review meeting in order to gain a full understanding of the rationale for the approach, and of the input data and assumptions used for the stock assessment.

Panel members, members of the assessment team, the SSC and other participants in the review are listed in Appendix I. The meeting was open to the public, and was attended by a number of industry consultants. The results of the data and assessment workshops were presented to the panel and other attendees, and the input data, assessment approaches, results and utility of the findings for management were evaluated through open discussion. Several work session for just panel and assessment team were instigated to allow for further investigations of particular issues with respect to the BAM model, but the pertinent results of these investigations were relayed to the meeting following the work sessions. The panel also formally requested some additional analyses and evaluations from the assessment team, including one of the observers. These requests were documented and presented to the assessment team, who undertook the analyses requested and provided appropriate feedback to the Panel.

The terms of reference for the review are addressed based on my own conclusions from the discussions at the meeting and those developed in writing this report, and are provided in response to the specific questions detailed below.

3. Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment:

The catch-at-age matrix is extensive in a temporal direction, but because the species is short-lived there are few ages available and even fewer fully selected ones for the model to be able to easily track cohorts. In addition, there appears to be little contrast in cohort strength, further complicating the determination of F for the stock. Nevertheless, given the documented precision in age reading and the relative weakness in the indices described below, every attempt should be made to ensure that this information forms the solid basis of any assessment of stock dynamics.

Evaluation of indices independent of the interplay with the catch-at-age matrix at the modelling stage is difficult, as was the evaluation of the indices in general for this assessment, owing to the lack of an acceptable assessment. Where indices were standardised, variance components could be assessed once the appropriate diagnostics had been provided. Bias components could not be evaluated external to a functioning model, so the assessments of this component are based entirely on a theoretical understanding of the interaction of the population with the gears and are therefore merely qualitative. Indices of juvenile abundance were provided in the form of a seine and a trawl index.

Trawl, seine and gillnet index:

The data workshop provided two coast-wide juvenile indices thought to be representative of 0-group menhaden abundance on the basis of the size of fish captured, because no formal age determination is conducted for the surveys by any of the Gulf states. The longer of the two indices using trawls starts in 1967, followed by the independent seine index beginning in 1978. Both indices have been compiled from state sampling programmes that started at different times and used different sampling designs. In order to cope with the spatial and temporal variability in sampling, it was necessary to standardise the indices. The delta-lognormal approach used to standardise these indices is frequently employed using independent variables such as month, state and year. In this case, the submodels were also allowed to account for differences in the environmental conditions while sampling. In general, the use of environmental conditions helps to reduce sampling variability when the conditions affect the spatial distribution of the species, but the method can introduce bias into the analysis when the overall abundance is influenced by the environmental variable. Strictly speaking, this should only be applied to fixed station data when the variable influences catchability directly, though not abundance. No diagnostics other than the residuals of the two submodels were available by year as entries in the report. Further detail on the effects of the submodels and indications of potential interactions between the variables would have been helpful, but at least for these two indices, the fact that they yielded similar information on cohort strength, despite almost complete independence, corroborated the appropriateness of the indices.

Although the adult gillnet index was treated in a similar fashion statistically, there were some serious concerns regarding its appropriateness given that the spatial distribution of samples barely overlaps with that of the fishery, and the notoriously difficult analysis of gillnet data, especially from multi-panel nets, even when set as strike nets. If mixing rates were high, the index may still be representative of the population as long as the spatial extent of the population was consistent between years, which could not be verified due to the spatial limitation of this index. Given the close proximity of the sampling stations for this index and those of the juvenile indices, one might have expected at least some correlation with the later information when lagged by a year. However, no such correlations existed.

On request, the panel was provided with the index information from the two submodels used to determine standardised abundance, and the year effects were reasonably correlated, suggesting that the abundance demonstrated by catches increases more or less linearly with the probability of encountering menhaden, in other words as menhaden abundance increases there are both more and larger schools. This is reassuring in terms of the statistical properties of the index, but it is not understood how gillnets of this nature can catch whole schools which at least in the area of the fishery were too large to be caught entirely by a single purse-seine, let alone a gillnet.

Consequently, the panel felt uncomfortable with the use of this index. Two versions of the gillnet index were provided, the first based on Louisiana data only, and the second covering all states for the period when Louisiana data were available. There were significant differences between the two versions of the index, particularly with respect to the 2008/9 data points.

Reduction index:

The reduction index, basically the landings divided by gross tonnage-weeks to correct for fleet restructuring, yielded the final index provided by the data workshop. The assessment workshop, like the review panel, had felt uncomfortable with its use, given that there was likely to have been significant technical development in the fleet over the index period. Personally, I feel that the question of hyper-stability caused by schooling behaviour in relation to schooling species exploited by gillnets is more problematic than technological creep. The earlier would lead to a much slower decline of the population, which would likely be picked up in the age structure of the population. For hyper-stability, this is unlikely to be the case, and population collapse could be quite sudden.

The problems with the gillnet index were thought to be more severe than for the reduction index, particularly because it may be possible to account for some of the technological advances biasing the estimates by assuming a rate of efficiency gain based on efficiency increases documented for other fisheries.

Although not provided as an age-structured index, the catch-at-age information was consistent with the landings of this index, and these data were therefore used to check for internal consistency of the index and coherence of the age structure. Values of log-CPUE by age and year were calculated from the index and plotted by age over time and as catch curves (Figures 1 and 2) The log–CPUE information suggests that age 2 abundance has been relatively constant throughout the period, whereas age 1 abundance has declined, with age 3 numbers increasing in absolute terms. This does not suggest a critical decline in the population unless a change in selectivity is masking the year signal. Similarly the catch curves suggest that there has been relatively little contrast in F and not much interannual variation in cohort strength. Neither of these properties will make it easy for a catch-at-age model to determine M or stock–recruitment parameters, although this is more a result of the fishery than the index itself.

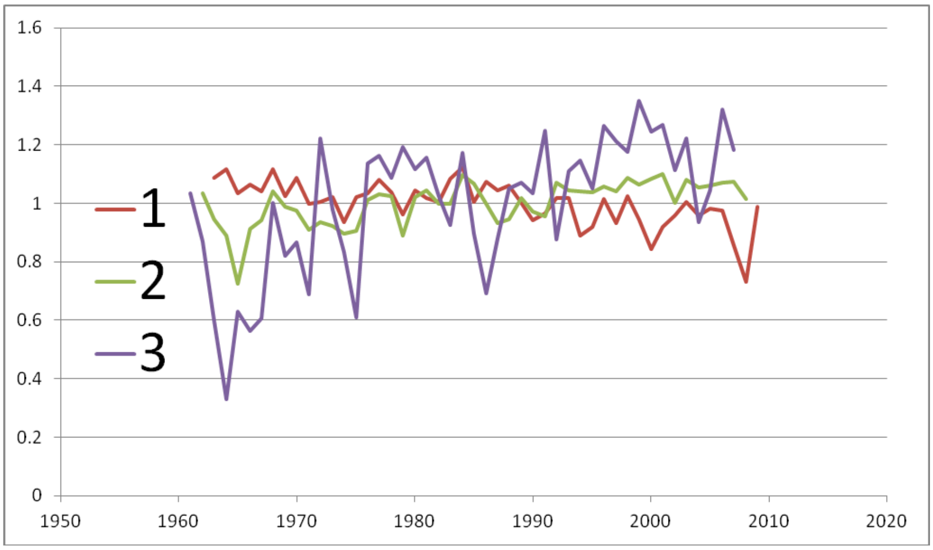

Figure 1: Log-CPUE means standardised by age for the reduction index over time shows the proportion of age1 fish declining in catches while age 3 fish abundance in catches increases over time. Age 2 catch rates appear to be more or less stable since the early part of the time-series.

Improvements to the standardisation of the index should be considered, given the importance of accurate adult abundance information. Standardisation using boats as a factor may not only provide a useful index of abundance but also a better understanding of the development of the fishery.

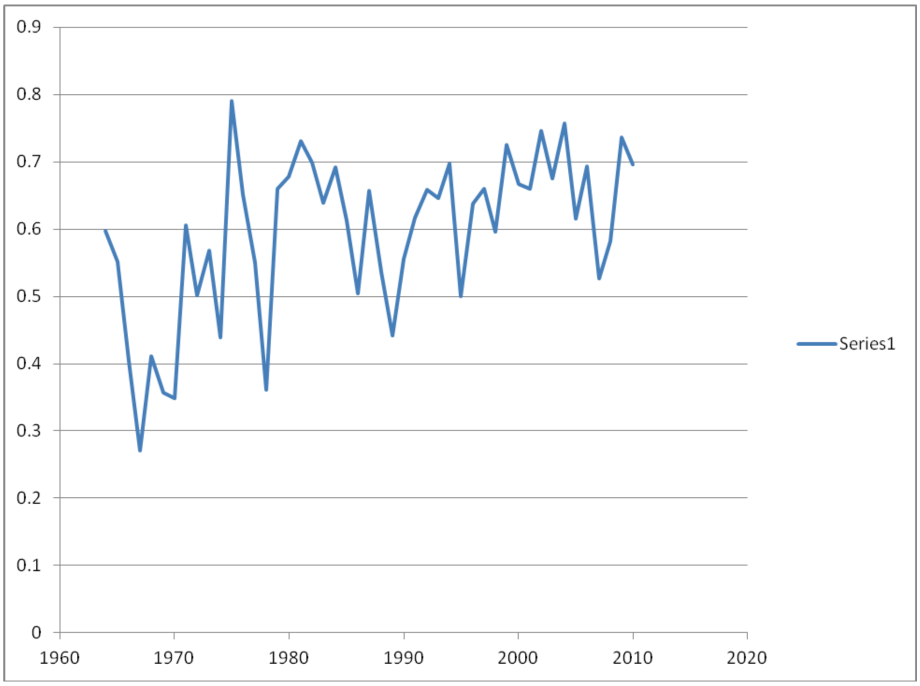

Figure 2: Relative change in instantaneous total mortality from age 2 to age 3 over time assuming constant catchability and selection. If selection is assumed equal for both ages these represent Zs.

Estimates of index precision

For the fisheries-independent indices, a combined delta-lognormal precision estimate was provided for use in the stock assessments. This seems to be a common approach for describing the certainty around the estimate. However, other methods have also been proposed. Francis suggested that indices should be expected to have at least a cv of 20%. Estimates that appear more precise particularly for over-dispersed values should be replaced by larger values. Alternatively one could also argue that the overall index variance information overestimates the uncertainty in the index information. Because generally surveys are stratified because of differences in mean abundance; overlooking strata information in the standardisation ignores the fact that some stations / areas consistently provide a greater proportion of the catches year on year. The fisheries-independent information should be examined more carefully to investigate persistent spatial patterns in the distribution of menhaden.

However, the main aim of providing realistic values of uncertainty around the indices is to ensure a balanced model (with respect to the various sources of information), using likelihood estimation. The proposed BAM model, though, uses user-defined weights in the minimisation as well as capped sample size estimates, suggesting that the choice of index-variance estimates is rather arbitrary anyway.

No weighting was applied to the index standardisation, but it is possible that this would have been appropriate, particularly for the all-states indices, where different sampling levels in conjunction with changes in the spatial distribution could have led to a less-than-linear relationship between abundance and index.

Stratified random samples need to be weighted by area to avoid biases caused by disproportionate sampling effort. This is also important in aggregating the indices from various state sampling programs along the coast as they reflect differing sampling intensities.

4. Evaluate models used to estimate population parameters (e.g. F, biomass, abundance) and biological reference points.

An extensive sensitivity analysis of the BAM model was carried out at the assessment workshop, the results of which were presented at the review. The model was insensitive to almost all changes in parametrisation and index information. On closer examination, it was discovered that the apparent stability was caused by the model running up against some bounds somewhere (not entirely resolved at the review meeting) rather than being a truly stable model.

Several attempts were made to free the model in order to allow it to fit the age structure of catches more appropriately. In the process it was discovered that initialisation of the starting age structure causes problems and that recruitment deviances had been implemented where there was no information available to determine them.

There was a problem too with the implementation of the trawl index. Once the initial age structure had been resolved by tying it to B_0 rather than trying to derive it from recruitment deviances discounted for M, the model was able to respond strongly to the seine index when sufficiently weighted. However, the trawl index on its own was unable to match this performance, despite the similarity. When both indices were included, the model was able to fit the recent trawl data reasonably well, but for data prior to the beginning of the seine data, it remained problematic, suggesting that the fit to the trawl data was merely due to the similarity of the two indices.

In addition, the model utilised the Louisiana gillnet index, the appropriateness of which had been thought to be questionable by the panel, because it was spatially segregated from the fishery and restricted to Louisiana only. A more promising source of information was the available effort data from the skippers’ logbooks. However, these data would require standardisation to correct for technological creep and structural changes in the fleet. No such information was available to convert landings into catch rate (CPUE) at the meeting. In the meantime, an attempt was made to use the available landings / days fished series to try to resolve the modelling issues.

In the end there was insufficient time to resolve the sizeable number of outstanding issues, nor was it within the remit of the panel to develop a new assessment, so the base model had to be rejected as the source of management advice. Results were insufficient too to judge whether the BAM framework was suitable to assess the stock, and although the model in general has been tested and used in other peer-reviewed assessments, it is clear that its implementation in the AD Model Builder template format is susceptible to the creation of errors in the code. Consequently, it is not possible here to argue that because the BAM has been verified in general, all implementations of it function appropriately, even from a purely mathematical stand point.

5. State and evaluate the assumptions made for all models and explain the likely effects of assumption violations on model outputs

Natural mortality in the model was estimated by way of Lorenzen M scaled to age 2 (M at 2 = 1.1). In earlier assessments, M had been assumed constant across all ages, which is unrealistic. Nevertheless, any change was unlikely to have a major impact on the ability of the model to fit the data or on the assessment of stock status, because the majority of the dynamics occur from age 2 to age 3, given the small catches at age 4+, and M at that age had not changed from the earlier assessment. Exploitation at age 1 appeared to be low, and in any case consisted largely of immature fish, so that an age-variant M would merely result in a rescaling of q for the relevant index, but not SSB. The appropriateness of the absolute value and whether it changes through time in response to environmental conditions is likely to be more important for this assessment than how it is scaled to age. Unfortunately, there is no current evidence to determine whether the level of M is appropriate, especially in the absence of an age-based assessment model. The range of values examined in the sensitivity analysis seems appropriate given the life history of the species, but because M is high, imprecision in this parameter will result in considerable uncertainty in the productive potential of the stock with respect to estimation of MSY, for example.

The use of time-varying M, based on interannual differences in size-at-age as suggested by the data workshop seems implausible, given the effect of in-year growth on sampling intensity. In addition, there are no long-term trends suggested by the analysis and variation is relatively minor, so this is unlikely to add significantly to our understanding of stock dynamics. The use of a time invariant M in the model appears to be a more sensible approach given the low variation in total mortality.

The choice of selectivity implemented in the BAM model appeared to be inefficient. Selectivity at age 1 was estimated in each year. Not only did this increase the number of parameters considerably, it also effectively removed the one source of information for which some independent verification existed, the young-of-the-year index. Assuming constant selectivity across years is essential for model stability, at least over reasonable time-blocks. The assessment used three time-blocks, the first two assuming dome-shaped selection and the later asymptotic selection, partly on the basis that historically there were fewer age 3 fish in the catch and partly because it was needed to aid model convergence as well as avoiding cryptic biomass problems in the assessment. However arbitrary time-blocks in selectivity to reduce residuals should not be used unless mesh size has changed or the spatial distribution of the fleet has changed in relation to ontogenetically distinct distributions of the stock. Frequently such arbitrary blocking is used to account for technological improvement in the fleets, but in modelling this should be linked with catchability rather than selectivity.

The age-based CPUE analysis described earlier supports the notion that the proportion of age 3 fish in the catch increased, but the increase is gradual and not consistent with the time-block chosen. An equally plausible hypothesis is that the number of fish aged 3 in the population has increased under constant selectivity. There is then a risk that the choice of selectivity and time-block may mask significant trends in the dynamics of the stock, a situation confounded by the small number of ages in the catches.

Removal of the early part of the catch series because of the large residuals in preliminary analysis should be reconsidered unless some plausible cause of such residuals (sampling / aging problems etc.) can be found. In this case, the problem is likely to be associated with initialisation of the starting age structure in the absence of tuning information, and the situation should be revisited once a suitable initial model has been found and model sensitivity to the early age data can be re-tested. *A priori* these data should be included for the development of the initial model.

The choice of stock–recruit function and the choice of MSY-based reference points are consistent with each other, but because of the lack of an appropriate model, it was not possible to determine whether these were appropriate. If it is assumed that the stock has never been below 0.5^*B_{msy} (and certainly not at low stock levels, judging by the raw data) as suggested by the BAM model, the parameter estimates of Beverton and Holt will be highly uncertain and a spawner per recruit (SPR) proxy based on the life history of the species would be more appropriate.

6. Evaluate uncertainty of model estimates and biological or empirical reference points

As the base model was not deemed to be reflective of the stock dynamics, no evaluation of the likelihood component was possible. In principle, though, the results of the inverse variance approach taken in the BAM model does provide useful information on uncertainty when the two sources are consistent, but will tend to heavily favour one over the other when contrasting dynamics are implied by each within the model, and hence will underestimate the uncertainty. In the BAM model, this situation is further complicated by the use of manual weighting factors for different sources of information, so the results are very difficult to predict and are almost certainly going to be subjective.

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

A retrospective analysis of the base model was conducted and showed the model to be highly stable in terms of SSB, F and recruitment. Although this was undoubtedly much influenced by the inappropriate model settings, it did indicate that there was a much larger retrospective bias in the estimation of F/F_{msy}. The cause of this was linked to the estimation of the steepness parameter. Given that there is little evidence of a dramatic change in SSB over the majority of the fishery let alone the most recent years, there is little chance that there is information in the data that could justify such a change in this estimate. To estimate steepness with any certainty, the stock needs to have been fished down to a low level, and generally it is better to fix steepness at an appropriate level and to use SPR as a management measure rather than B_{msy}.

8. Alternate assessment models

The assessment workshop provided two biomass-based models as alternative assessments to the BAM model. Generally, this type of assessment requires much less information, specifically with respect to age data. In order to remain parsimonious with less data, these models have to be constrained by more restrictive assumptions. In general, age-based models ought to be preferred when such data exist, as in this case. However, here the age information is limited to the catches, and preliminary data from the catch matrix / effort do not suggest that there has been a lot of contrast in either the cohort strength or the exploitation rate for almost the entire time-series. In addition, the age profile of catches is limited which in conjunction with the selectivities that largely limit catch data to ages 1–3 (of which one or more are partial) will greatly reduce the benefit of an explicit age-based model compared to a longer lived species. These factors suggest that a simpler approach may be justified.

A promising approach was the Bayesian implementation of the statistical stock reduction analysis (SSRA) developed by Carl Walters. Stock reduction analysis, put simply, attempts to recreate historical patterns in catch while maintaining a viable population structure given an assumed MSY and MSY exploitation rate (U_{msy}) and natural mortality. Internal to the model, these input parameters are converted to corresponding estimates of spawning biomass or equivalent, given fixed estimates of growth and maturity. In parallel, index information converted from susceptible biomass to total biomass by use of appropriately defined selectivity information informs the model on an appropriate set of Beverton and Holt stock–recruit parameters, which then in conjunction with an estimate of current exploitation rate (U) provides information on the cohort and exploitation trajectories through the history of the stock. The model is deterministic in the sense that there is a single set of Beverton and Holt parameters, conditional on the assumption of the current exploitation rate. In this way, the model is akin to a tuned virtual population analysis (VPA) model, though age-implicit, so that the information on recruitment is provided by the stock–recruit relationship rather than the age information from catches.

There were significant problems with implementation of this model, the first being that it used the selectivity patterns from the flawed proposed base model output. Estimates of selectivity are likely to have a significant influence on stock-status estimation for long-lived species, but its effect on such a short-lived species such as Gulf menhaden is likely to be less. However, fundamentally, the estimation of selectivity within the model should be preferred.

The model was able to maintain the population and provide similar estimates of MSY and F_{msy} irrespective of the conflicting adult indices used. Although this might be interpreted as confirmation of the results, closer examination of the index fits suggested that the model was insufficiently constrained in the scaling of its recruitment deviates if it is to be informative on reference points. In essence, despite simulated random recruitment, the model could replicate very different trends in abundance. Part of the problem is that the assumptions on stock productivity (MSY) are inputs into the model chosen in the range of 100 000 – 2 000 000, irrespective of the assumed current U. The difference between this and the posterior distribution of MSY is merely that the simulations were unable to maintain a viable population, so eliminating some of the lower range of MSY values. Consequently it is unsurprising that the maximal marginal probability of MSY and U_{msy} remain stable at similar levels if the current exploitation never reaches U_{ms}y levels. Higher rates of exploitation should be tested here, in order to gain insight into at least which of the indices provides more realistic information.

More fundamentally, I find the interpretation of the likelihood as presented for this assessment misleading. The marginal likelihoods are interpreted independently, but this is only appropriate when the joint likelihood is symmetrical. The assessment report suggests that irrespective of the current exploitation assumption and index used, MSY is >800 000 t, with U_{msy} between 0.7 and 0.8. However, examination of the joint likelihood suggests that the most likely scenario given the data is located at a much lower combination of MSY and U_{msy} (ca. 500 000 t, 0.5 highest intensity [red] in Figure 8.56) given the data and a value of U = 0.3. In contrast, the combination of the maximal marginal likelihoods falls into the green area, suggesting that such a combination of stock productivity is unlikely compared with other choices. As higher values of U are estimated, the lower values of MSY and U_{msy} are eliminated because of the catch history, irrespective of current exploitation, so the distribution of possible simulations contracts diagonally to the top right corner of the U_{msy} – MSY likelihood plot. The fact remains the stock has persisted and has steadily produced 500,000 t over a number of years, significantly longer than the generation time. Having some decent prior knowledge on current exploitation (it does not have to be exact, but should not be treated as a sensitivity analysis) is essential or the argument tends to become circular. Ever higher values of U drive more and more simulations to extinction, given the dynamics, so only those with the highest stock-productivity parameters survive, the posterior distribution of which not surprisingly has high levels of F_{msy}.

Another alternate model, ASPIC is not too dissimilar externally from the SSRA, in terms of its dynamics. However, it does not model population growth explicitly in the form of recruitment, individual growth and mortality, but assumes that there are trade-offs between these components and that an overarching production function such as the Schaefer model can be used to model the dynamics with significantly fewer parameters, so the only information other than landings needed is an index of adult biomass. Sadly, we do not have a reliable index of adult abundance index, and this is the crux of the problem.

Using the juvenile indices lagged by one year as an adult index is inappropriate, because they already suffer mortality at age 1, and if there are strong trends in F, these will not yet be reflected in the juvenile index. Consequently, the model runs had to be rejected as quantitative models of the stock dynamics. In any case, the model appeared to ignore the juvenile indices and focused mainly on the adult indices when fitting biomass data.

The more appropriate adult indices were the main drivers behind the base and sensitivity runs in the assessment report, and led to similar conclusions about the historical spawning-stock biomass (SSB) trajectories as in the SRA. Run 109 suggested that SSB had been increasing rapidly since 1988, whereas run 110 indicated a less steep but continued decline over the same period. However, stock status was currently close to $F = F_{msy}$ and $B = B_{msy}$ for the mainly reduction-index driven model, with a more optimistic stock status derived using the gillnet index. However both indices have significant problems as discussed above, so using a model that relies almost exclusively on these indices is unsatisfactory, in my opinion.

In an attempt to provide some information on stock status to managers, the review group attempted to at least identify such status qualitatively. In order to do so, a worst case scenario was developed using the reduction index, but discounting it for an annually compounded increase in efficiency of 2%. Although 2% would appear to be small over the period of the index, it does amount to a 3.4 fold increase in efficiency overall.

Four models were run with this adjusted index representing the permutations of the Fox vs. Schaefer production model and the inclusion/exclusion of the juvenile indices

All but the Schaefer / no juvenile index suggested that overfishing was not occurring in 2010, although most suggested that this had arisen in the recent past. The former model was also the most pessimistic with respect to the estimate of SSB, at around 0.75 of B_{msy}, but B_{msy} appeared to have reached equilibrium conditions and had started to rise in response to the decline in 2010. The other three models suggested that SSB had been increasing slightly since the early 2000s and was now close to or above B_{msy}.

These models are inappropriate to assess the stock, so no formal quantitative statement regarding the probability distributions around stock status is possible. This is as a result of the lacking reliable adult index and their sizeable sensitivity to certain assumptions, the validity of which cannot be appropriately tested in the absence of a fully quantitative model. Moreover, in terms of management advice, ASPIC is known to harbour significant difficulties in terms of the scaling of F. This is unimportant with respect to assessing stock status, but makes the comparison of F_{msy} with other models / stocks impossible. Any management measure such as the OFL that is based on absolute quantities will be difficult to derive from such a model.

9. Recommend stock status as related to reference points

In the absence of a suitable assessment model on which to base quantitative evaluation of stock status, the panel decided to resort to a more qualitative approach. Based on what should be considered four very pessimistic ASPIC runs developed at the panel meeting, it was concluded that it was unlikely that current F was above F_{msy} and hence that overfishing was unlikely to be occurring. SSB was also mostly near B_{msy} or above, except in the most pessimistic model, where it was stable. Although not entirely precautionary, the final conclusion was also that SSB was likely to be at B_{msy} and that the stock was currently unlikely to be overfished and certainly not depleted.

Personally I agree with this assessment as the best possible advice from the information currently available. The panel officially formed its conclusions around the ASPIC runs, and I agree with them, but my perception is only partly informed by the ASPIC runs. Examination of the principle data source (irrespective of any model) does not provide any indication of problems with the exploitation of the stock or its response to exploitation. Certainly there are no data that indicate the stock to be in imminent danger of collapse or mismanagement. The age information in the catch-at-age data, or used as I did in the form of an age-based CPUE index, implies long-term stable exploitation. Catch curves indicate that mortality has not changed dramatically since 1975, before which it was almost certainly increasing. Whereas the abundance of age 3 fish appears to have increased slightly, the abundance of 1-year-olds has declined by a similar margin. Although this information is potentially biased by technological improvements and / or hyper stability in catch rates, given this combination of effects it would be very unlikely that a dramatic decrease in abundance of older specimens was masked by a slightly stronger increase in the abundance of 3-year-olds in the catches through a change in selectivity while maintaining total mortality estimates for age 2 fish mostly constant. Much of the relative abundance information provided was not thought to be representative of the abundance of the stock. Although panel members agreed that there were problems, this judgement was based purely on theoretical grounds. Proper assessment of the potential bias in the information was in many ways hampered by the lack of a suitable age-based assessment model.

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

The panel provided a lengthy list of recommendations with respect to the assessment of Gulf of Mexico menhaden. Although I agree that the research aims listed there are appropriate in terms of general principles, I find it almost impossible to prioritise them in the absence of a functioning base-case model assessment. This must be the ultimate priority in the first instance.

The panel suggested several avenues for investigating better model set-up based on general statistical and mathematical principles, not specifically with respect to the proposed base model. How likely these are to resolve the model issues is unclear and will depend on the specific cause. There were, however, indications that some of the problems lay with the implementation of specific options in the template file for the BAM model specific to this assessment, which arose while performing some sensitivity runs at the meeting. Only once such a basic model is available to model the stock dynamics, no matter how biased, will it be possible to make progress on a prioritised list of research objectives.

Clearly, though, developing an unbiased adult abundance index would be useful. Development of a new fisheries-independent survey or spatial observations would be ideal, but clearly significant financial investment would be required and the information would only be useful for management once a reasonable time-series had been developed.

In contrast, the development of an effort-corrected CPUE time-series from logbook information would be cheaper and could provide useful information much sooner. However, those to whom the major concern is hyperstability rather than technological creep will still not be convinced that this presents unbiased estimates of abundance. I am one of the latter, not because I do not think that technological creep is important, but because it is unlikely to completely mask serious problems in a fishery. When stocks decline, they tend to decline dramatically as they approach “the cliff”. Technological creep may reduce the perception of the decline, but danger will be apparent nonetheless. With significant hyperaggregative behaviour or hyperstable gears in terms of CPUE) such as purse-seines, it is possible to approach much closer to the precipice of stock collapse. Often, the time between recognition and collapse is insufficient under such circumstances for management to respond or intervene. Stocks of menhaden are still abundant, so there is no question that currently the problem of hyperstability is not a big issue, but I feel on principle unable to recommend an index that on theoretical grounds at least is not more defensible than the one that currently exists (although it will admittedly have fewer flaws). Basically a new model is needed first.

One interesting avenue for circumventing some of the issues would be the use of the SSRA. Provided it is able to use the catch-at-age information, as appeared to be implied by one of the sensitivity runs, it should be able to internally estimate selectivity and as such at least serve as a useful tool for examining the potential bias of the two available adult indices, or indeed any further ones that might be developed.

Also, some diagnostics that can determine the extent of conflict between index information and catch information, such as the contribution to the likelihood of each, would be useful. Additionally, the model will need to be set up in a more constrained fashion, particularly with respect to the implied recruitment deviance (which may or may not already be the case in the new catch-at-age sensitivity run), and interpretation of the results will need to be based on joint likelihood rather than the marginal one if the former is found to be asymmetrical.

11. Conclusions:

The proposed base model has to be rejected on the basis that it is unsuitable in its current set-up to estimate the stock dynamics of Gulf of Mexico menhaden. The ability to provide advice on stock status was further compromised by the fact that almost all the information available contained the potential for bias, the extent of which could not be ascertained without comparing the base assessment for management. In other words, one must use other models and raw data, but only qualitatively.

Appendix 1:
SEDAR 27
Gulf of Mexico Menhaden
Workshop Document List

Document #	Title	Authors
Documents Prepared for the Data Workshop		
SEDAR27-DW-01	History of Assessments of the Menhaden Stock along the U.S. Gulf of Mexico Coast	Douglas S. Vaughan
SEDAR27-DW-02	Age, Growth and Reproduction of Gulf Menhaden	Douglas S. Vaughan, Joseph W. Smith and Amy M. Schueller
SEDAR27-DW-03	Life History-Based Estimates of Natural Mortality for Gulf Menhaden	Amy M. Schueller
SEDAR27-DW-04	History of the Gulf Menhaden Fishery and Reconstruction of Historical Commercial Landings	Joseph W. Smith and Douglas S. Vaughan
SEDAR27-DW-05	Harvest, Effort, and Catch-at-Age for Gulf Menhaden	Joseph W. Smith and Douglas S. Vaughan
SEDAR27-DW-06	Management Unit Definition for the Gulf Menhaden Stock in the U.S. Gulf of Mexico	Steve VanderKooy
SEDAR27-DW-07	Habitat Description for the Gulf Menhaden Stock in the U.S. Gulf of Mexico	Steve VanderKooy
SEDAR27-DW-08	Regulatory History for the Gulf Menhaden Stock in the U.S. Gulf of Mexico	Steve VanderKooy
SEDAR27-DW-09	Report on the distribution and abundance of menhaden (*Brevoortia spp*.) larvae captured in ichthyoplankton samples during fishery-independent resource surveys in the Gulf of Mexico	Joanne Lyczkowski-Shultz and David S. Hanisko
Documents Prepared for the Assessment Workshop		
SEDAR27-AW-01	Surplus production models of gulf menhaden, *Brevoortia patronus*	Michael H. Prager and Douglas S. Vaughan
Documents Prepared for the Review Workshop		
SEDAR27-RW-01	The Beaufort Assessment Model (BAM) with application to gulf menhaden: mathematical description, implementation details, and computer code	NOAA Beaufort Laboratory

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

Appendix 2: Statement of Work for Dr Sven Kupschus (Cefas)

External Independent Peer Review by the Center for Independent Experts

SEDAR 27 Gulf of Mexico Menhaden and Southeast Yellowtail Snapper Review

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

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

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

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

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

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

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

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

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

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

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

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

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

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

September 27, 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
October 18, 2011	NMFS Project Contact sends the CIE Reviewers the pre-review documents
November 1-4, 2011	Each reviewer participates and conducts an independent peer review during the panel review meeting
November 18, 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
December 2, 2011	CIE submits CIE independent peer review reports to the COTR
December 9, 2012	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

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

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

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

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

Support Personnel:

William Michaels, Program Manager, COTR
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Key Personnel:

Julie A Neer, SEDAR Coordinator
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405
julie.neer@safmc.net Phone: 843-571-4366

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

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

SEDAR 27 Gulf of Mexico Menhaden and Southeast Yellowtail Snapper Review

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

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

Annex 3: Agenda

SEDAR 27 Gulf of Mexico Menhaden and Southeast Yellowtail Snapper Review

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

Tuesday

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

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

Wednesday

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

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

Thursday

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

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

Friday

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

Appendix 3: Participants in the 2011 SEDAR 27 Panel for Gulf of Mexico Menhaden and Southeast Yellowtail Snapper held from 1st – 4th November 2011, FMRI, St Petersburg, Florida, USA

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

Analytic Representation
Amy Schueller .... NMFS SEFSC Beaufort
Bezhad Mahmoudi .... FWRI
Mike Prager .... Prager Consulting

Rapporteur
Wade Cooper .... FWRI

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

Staff
Julie Neer .... SEDAR
Rachael Silvas .... SEDAR
Steve VanderKooy .... GSMFC