Reviewer Report to the Center for Independent Experts on the Red Snapper Review Workshop (SEDAR 31) held April 29-May 3, 2013 in Gulfport, Mississippi

Prepared for:

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Executive Summary

This document contains my independent reviewer report of review activities and findings for the 31st Southeast Data, Assessment and Review (SEDAR 31) Review Workshop, held April 29 – May 3, 2013 in Gulfport, Mississippi. An assessment for red snapper in USA waters in the Gulf of Mexico, including the results of the data and assessment workshops, were reviewed at the meeting.

There is a very large amount of information available for red snapper, including landings for several directed commercial and recreational fisheries, bycatch estimates for other fisheries, several abundance indices covering different parts of their range for varying periods of time, age and length composition data for most fisheries and indices, and information from which life history parameter estimates, such as age-specific natural mortality, fecundity and growth, can be derived. The data used in the assessment and decisions made about life history were generally sound, although there is evidence indicative of potentially important population structuring that is not really captured in a model with a single stock-recruitment relationship and two sub-stocks (the East and West areas).

The analytical team chose to use Stock Synthesis 3 for this assessment, a decision that seems appropriate given the complexity of the assessment. However, the assessment was not completed prior to the Review Workshop and the Assessment Workshop report provided by for review was not complete or accurate, and the assessment could not be accepted or rejected for these reasons. The analytical team presented work as it was completed at the Review Workshop, and undertook many sensitivity analyses to help with the review of the available results. Based on what would have to be considered a hurried review, although I cannot accept or reject the model, I did not find evidence sufficient to reject the base model results as they pertain to the point estimates of abundance and exploitation. However, I do have concerns about 1) whether the stock-recruitment relationship is representative given the information about population structuring and mixing; 2) whether the methods being used to characterize uncertainty (which were not complete at the end of the Review Workshop) do fully characterize uncertainty both with respect to within the base model run, the uncertainty in the data, and with respect to other possible models; and 3) that the projections (which were also not completed by the end of the workshop) may not fully capture the uncertainty associated the retrospective analysis, potential alternate states of nature and implementation uncertainty. However, the approaches being proposed for the projections and characterization of uncertainty are not inconsistent with standard practices.

This report is one of three Center for Independent Experts (CIE) reviewer reports that are best read together with the Review Workshop Report to get a complete summary of the Review Workshop.

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1.0. Background

This document contains my independent reviewer report of review activities and findings for the 31st Southeast Data, Assessment and Review (SEDAR 31) Review Workshop, held April 29-May 3, 2013 in Gulfport, Mississippi. An assessment for red snapper, including the findings of the data and assessment workshops were reviewed at the meeting. Prior to the meeting, the review committee (Appendix 1) was provided with a Statement of Work (Appendix 2), including the Terms of Reference (TOR) for the assessment as well as for the review panel (RP). Assessment documents and background material (Appendix 3) were provided via a website and/or by email during the three weeks prior to the meeting, although not in accordance with the Schedule of Milestones and Deliverables in the Statement of Work. During the meeting there was a general consensus among the RP regarding most of the main discussion points and findings of the panel as outlined in the Review Workshop Report. This document contains a summary of those findings as well as my own opinions about this assessment.

2.0. Individual Reviewer Activities

Prior to the meeting I reviewed the assessment and background documents provided for the workshop. I participated in the Review Workshop in Gulfport, Mississippi, April 29 – May 3, 2013. This workshop benefited from the participation of fisheries representatives who were able to provide both background and personal experience with respect to red snapper. The analytical team (AT) from the Assessment Workshop presented the assessment results. The structure was fairly informal with discussion during each presentation. During the meeting, I actively participated as member of the meeting review panel and questioned several aspects of the assessment. These issues are expanded upon in the next section.

After the Review Workshop, I prepared this individual, independent report and assisted in writing the Review Workshop Report. As outlined in Appendix 3, this independent report is intended to summarize review activities completed during the panel review meeting, including providing a detailed summary of findings, conclusions, and recommendations for each TOR. The following sections in this document contain my personal perspectives about this assessment and its results.

It should be noted that, although the Data Workshop Report, workshop working papers and background material were provided to the assessment panel in accordance with the Schedule of Milestones and Deliverables in the Statement of Work, the Assessment Workshop Report was provided on Friday, April 26th for review beginning Monday, April 29th. This Assessment Workshop Report had not been reviewed by the Assessment Panel, and did not contain a sufficient description of the model to allow for a thorough review. Sections pertaining to the sensitivity analyses, evaluation of uncertainty, benchmarks and reference points, and projections were missing from the report. On the first day of the Review Workshop, the RP was informed of an error in the implementation of the productivity component of the model, as well a change to the way selectivity had been modeled from that described in the Assessment Workshop Report. The RP was presented with a new base model run via PowerPoint. Descriptions of the model changes, as well as some of the details of the model configuration were provided to the RP verbally during the meeting.

At the end of the Review Workshop, the RP had not seen a complete report documenting the methods and results of the assessment, an issue that significantly hindered both the RP's and my own ability to critically review the assessment. For these reasons, I agree with the RP consensus that the timing with which the Assessment Workshop Report was provided, the adequacy of the documentation, and the completeness of the assessment at the end of the Review Workshop significantly hindered the review process. As a result of these issues, the RP was unable to either accept or reject the assessment, and similarly, although I can provide a perspective about the assessment, I cannot presently endorse the assessment or provide statements about stock status based on the material available at the time of writing this report. My findings are also subject to uncertainty as a result. However, based on what would have to be considered a hurried review, although I cannot accept or reject the model, I did not find evidence sufficient to reject the base model results as they pertain to the point estimates of abundance.

3.0. Summary of Findings, Conclusions and Recommendations in Accordance with the TOR's

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

- Are data decisions made by the Data and Assessment Workshops sound and robust?

The data workshop report and supporting working papers thoroughly documented the very large amount of information available for assessing red snapper. The data used in the assessment were divided into life history information, commercial landings, recreational fisheries statistics, measures of population abundance, and discard mortality. In general, I think the data decisions made by the Workshops are sound and robust.

With respect to the life history information, I have some concerns with the conclusions about stock structure, and minor suggestions with respect to the estimation of age-specific natural mortality and the calculation of age-specific fecundity (specifically increased spawning frequency with age).

The Life History Working Group supported the two stock model, and I don't think this is unreasonable given the current state of knowledge. However, given the growing body of evidence, including recent genetic, otolith chemistry and oceanographic results, that indicates that red snapper have a metapopulation structure and exhibit demographic structuring on small spatial scales, I am not convinced that the current model, which may be also viewed as a one stock model with two sub-stocks (East and West) can capture the dynamics sufficiently to ensure that long-term maximum sustainable yield is met, particularly given that some areas are unlikely to be re-colonized by larval drift if depleted and variation in local productivity is unknown. These potential issues are expanded on in the sections on the stock-recruitment relationship, the projections and research recommendations, and are an area for future research.

The Data Workshop considered a few options for deriving age-specific natural mortality (M) estimates, settling on using Hoenig's method to derive a single value of M over the lifespan of the fish, and then re-scaling the Lorenzen relationship such that the average natural mortality rate for the exploited age classes was equal to the lifespan M. Although this approach is not uncommon in stock assessments, as pointed out by one of the other reviewers, the CV for Hoenig

(1983) method estimates of M is 0.54. Also, there are species and population assemblages for which mortality is higher for older/larger animals than for younger/smaller animals, such as Atlantic salmon, (e.g. Gibson et al. 2008) and Scotian Shelf Atlantic cod (Fu et al. 2001). Although I do not have a specific recommendation for an alternate approach, sensitivity analyses that include different functional forms for the age-mortality relationship could be considered in addition to simply higher or lower lifespan values.

Fecundity-at-age for this assessment was estimated using a model that included age-specific number of spawnings per year and batch fecundities (Porch et al. 2013). I think this approach is very reasonable, although it has been demonstrated that increases in fecundity and spawning frequency do not always result in proportionately greater numbers of offspring due to differences in egg size and egg survival, at least in Atlantic salmon (Reid and Chaput 2012). This is also a topic for future research if these relationships are to be further refined.

Commercial and recreational landings were well characterized by the Data Workshop and, with the exception of discards, were unchanged for the Assessment Workshop Report. Historical landings are subject to greater uncertainty, particularly with respect to size and age composition. Discard rates and quantities are also not well known, and the decision to assign higher variances to these data in the model seems appropriate. Bycatch in the shrimp fisheries are not well quantified, and the decision to use the shrimp fishing effort series as an index of the annual bycatch rates in this fishery also seems appropriate, particularly because red snapper are not being targeted. The overall assessment is quite complex, and this is an example of the ingenuity displayed by the workshop participants in finding ways to best quantify the effects of the many activities that affect the stock. Mortality associated with oil rig removal was described in the Data Workshop Report, and was also included in a sensitivity run showing little effect on the overall dynamics of the red snapper stock. As a very minor point, I would have liked to have seen oil rig removals included in the base model, if only to show its effect, although at present levels it doesn't appear that it would alter the conclusions of the assessment.

The Data Workshop Report contains a thorough review of the many fishery dependent and independent indices available for the stock. I did not find evidence that the decisions about which indices to include or the way they were incorporated into the model was inappropriate.

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

Data uncertainties are reasonably described in the Data Workshop Report and supporting working papers. Although personally I would have liked to have seen more detail about the accuracy and precision of the landings data, treating these data as well known is common in stock assessments.

- Are data applied properly within the assessment model?

For the most part, I believe the data are applied reasonably within the assessment model, although there were a few data decisions that would affect the model results. For example, with the exception of the discards, small variances were assigned to the landings forcing the model to fit these data very closely. This is the equivalent of assuming the landings are very well known, despite there being an error in the estimation of the landings (e.g. the recreational landings).

Additionally, initial attempts to fit the model to length composition data were not successful, so the analytical team converted the length composition data to age composition data using age-length keys. While both of these approaches are common in stock assessments, they do have the effect of removing some of the uncertainty from the assessment results. In the case of the length frequency data, some of the sample sizes were small, and the number of animals in each length category was small. As an alternative to converting length composition data to age composition data externally to the model, in my work, I've had some success fitting models by reducing the number of length categories (by using larger length increments), although it's unlikely that this would work in all cases, and I don't know what the effect of this data manipulation would be on the associated uncertainty.

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

Overall, I believe the input data series are reliable and sufficient to support the assessment approach (findings were incomplete at the Review Workshop).

3.2. Evaluate the methods used to assess the stock, accounting for only the available data:

- Are the methods scientifically sound, robust, and appropriate for the available data?

This assessment was carried out using Stock Synthesis 3 (Methot and Service 2011, NOAA Fisheries Toolbox 2011), an assessment package that provides a statistical framework for fitting population dynamics models to fishery and survey data. SS3 is designed to accommodate a wide variety of fishery data types, including length and age compositions, as well as multiple stock sub-areas (two were used in this assessment) and time periods. This assessment software is very flexible with many options for modeling processes such as growth, stock-recruitment, and the selectivity of fisheries and indices. It can also incorporate data uncertainty such as aging error. It is an appropriate tool for this assessment given the complex nature of the fisheries and indices available for this stock.

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

As configured, this is a very complex assessment model. Although many aspects of the assessment model configuration, such as the stock-recruitment relationship, the use of historical data, the incorporation of the length and age composition data, the use of the shrimp effort time series and the random walk for the selectivity parameters, were very well described in the Assessment Workshop Report, other aspects were not. For example, readers of the report were directed to the Stock Synthesis 3 (SS3) manual for descriptions of algorithms and options, but in some cases the selection of these options was not described. For example, I would have liked to have seen a more complete description of the likelihoods used for fitting the model.

Although the stock-recruitment component of the model did appear to be set up consistently with previous assessments and the current management of the stock, as an alternative to the single stock-recruitment relationship for the entire stock, I would have liked to have also seen model configurations that more closely match the newer information about population structuring. As

described by the AT during the Review Workshop, this could be difficult given the current configuration of SS3, particularly with respect to mixing between the two areas. One approach that would work with this configuration would be to run separate models for the east and west areas without mixing. Additionally, if the population structuring is such that re-colonization of depleted areas may be slow, inclusion of a time varying virgin recruitment parameter (for each area and allowing for more than one change through time) might help characterize changes in carrying capacity if some areas are not contributing to production at various points in time for this reason.

Although some aspects of the model configuration were not described in the workshop report, the analytical team provided clear descriptions of many details during the Review Workshop. Although it is difficult to be sure the model was properly configured given the issues described in Section 2 (for example, the analytical team identified an error in the model configuration after providing the Assessment Workshop Report that was not evident when reviewing the Assessment Workshop Report), I did not find evidence during the review that the model configuration was improper or inconsistent with standard practices.

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

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

For the reasons described in Section 2, I agree with the RP consensus that, due to the nature of the review process, it cannot accept or reject the finding of the assessment. However, despite my having some concerns with the assessment, I do concur with the review panel that during the review activities, evidence was not found to reject the assessment or to recommend changes to the corrected base model run with respect to its [point] estimates of abundance and exploitation. However, given the issues with the review process, I cannot fully endorse the results of this assessment. My primary concerns with the assessment relate to: 1) recruitment dynamics and the stock-recruitment relationship, 2) the estimation of the life history parameters, 3) the retrospective analysis, and 4) variances (or relative weightings) used for various datasets. These issues were discussed and explored at the Review Workshop, although I do not believe, in the absence of documentation of the corrected assessment, that a thorough enough review was possible such that I would be willing to recommend that the estimates are reliable enough that they should be used as a basis for management decisions without completion of the assessment documentation, review and endorsement by the Assessment Panel, and possibly further independent review. More specifically, the scenarios explored at the Review Workshop indicated that the model results appeared relatively insensitive to different weightings of the index and age-composition data series, but that they were sensitive to assumptions about the steepness parameter and natural mortality. As a minimum, the effects of these assumed values would need to be carried forward through the assessment before the abundance estimates could be used for making statements of stock status.

During the review meeting, I questioned the extent to which assumptions about life history parameters were determining the results of the assessment. Nearly all of the life history parameters, including natural mortality, growth, weight-length relationships, fecundity, and the

steepness of the stock-recruitment relationship were constants in the model; only the virgin recruitment levels for two time periods were estimated. Because, with the exception of the discards, removals from the population were assumed to be well known (by using a low assumed variance forcing the model to fit the landings well), the model scales the overall abundance up or down using the virgin recruitment parameters, in order to match the indices with adjustments to the estimated selectivities for the various fleets and indices. The RP questioned the extent to which the model was being informed by the data inputs versus the assumptions made when setting up the model, and sensitivity analyses did indicate that the assessment results differed if different values for steepness or natural mortality were used. This is a result that is not uncommon in stock assessment modeling, nor is it necessarily bad if the uncertainties associated with the assumptions are carried forward throughout the remainder of the assessment. Given the time constraints at the RW, appropriate alternative values for steepness sensitivity runs were not discussed. Other issues with the stock-recruitment relationship are discussed under the stock-recruitment TOR.

A retrospective analysis for the corrected base model was provided by the AT during the Review Workshop. As noted in the Review Workshop Report, although the retrospective analysis did not show a systematic bias, it did appear to indicate that the model could provide different abundance estimates with the inclusion of data for additional years. These differences could be important or not, depending on the scale over which abundance changes are being evaluated. On longer time scales, the differences in these estimates are small and would not lead to large differences in conclusions about the depletion of the stock from virgin levels (Figure 1), whereas these differences may be more important on shorter more recent time scales (Figure 2). Also as noted in the RW report, the estimate of the spawning biomass in the west in 2008 in the retrospective analysis increased by more than 50% when estimated using data to 2010. The estimate of 2008 spawning biomass in the west then decreased by about 15% with the inclusion of the 2011 data. Because there is no systematic pattern, there is no simple correction that can be applied. This source of uncertainty could be carried through to the statements about stock status, projections and other management advice.

In summary, although the model estimates appear to be more or less consistent with the indices and data available for the stock based on the model fits, there may be other sets of estimates that would also appear consistent, potentially with different abundance and productivity estimates.

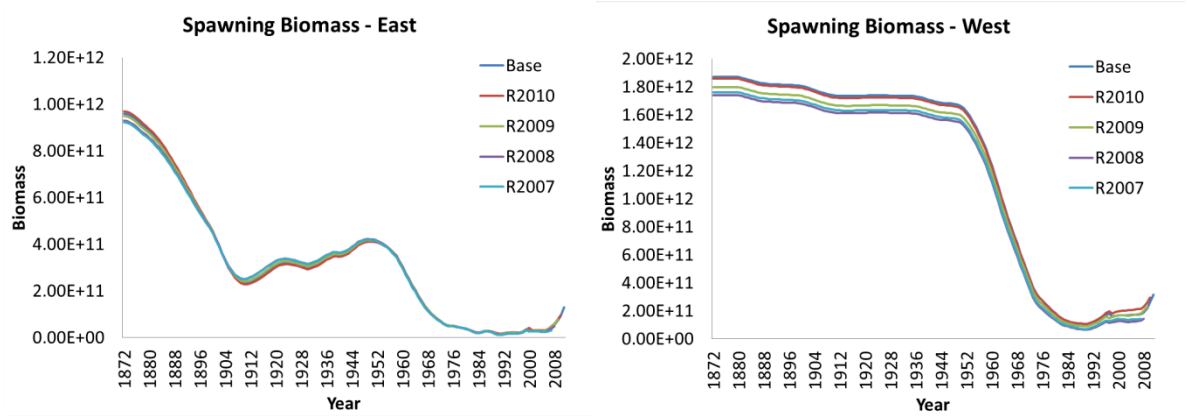

Figure 1. The retrospective analysis of the corrected base model from 1872 to 2011 (from SEDAR31_RW_Retrospectives.pptx – April 30, 2013).

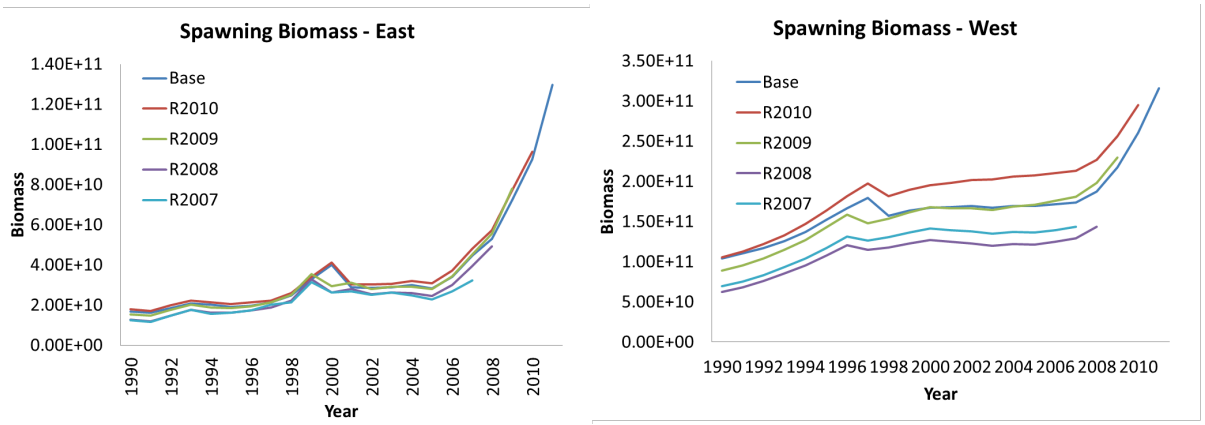

Figure 2. The retrospective analysis of the corrected base model showing the results from 1990 to 2011 (from SEDAR31_RW_Retrospectives.pptx – April 30, 2013).

With respect to the presentation of the fishing mortality rates, the AT presented time series of apical fishing mortality rates, as shown in Figure 3. Because the fleets have different selectivity patterns, these rates are not directly comparable. Additionally, because the selectivity patterns for each fleet are allowed to vary through time, the time series of fishing mortality rates are not really indicative of the overall impacts of the fishery on the stock. As an alternative, these results could be presented as the percent reduction in SPR associated with each fishery in each year. The results would then be presented in a common metric that would allow comparison of the effects both among fleets and through time.

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

Neither criteria for determining whether the stock is overfished or statements of stock status were provided in the Assessment Workshop Report, and although proxies for MSY were discussed at

the Review Workshop, no decisions were reached about the appropriateness of these proxies (comments are provided below under status determination criteria). A comparison of the corrected base model and several sensitivity runs (SensitivitySummaryTable_FINAL.xlsx – May 3, 2013) is indicative that $SSB_{2011}<SSB_{reference}$, based on SPR26% as a proxy for MSY.

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

Neither criteria for determining whether the stock is undergoing overfishing or statements of stock status were provided in the Assessment Workshop report, and although proxies for MSY were discussed at the Review Workshop, no decisions were reached about the appropriateness of these proxies. A comparison of the corrected base model and several sensitivity runs (SensitivitySummaryTable_FINAL.xlsx – May 3, 2013) is indicative that $F_{current}<F_{reference}$, when $F_{current}$ is the 2009-2011 average, based on SPR26% as a proxy for MSY.

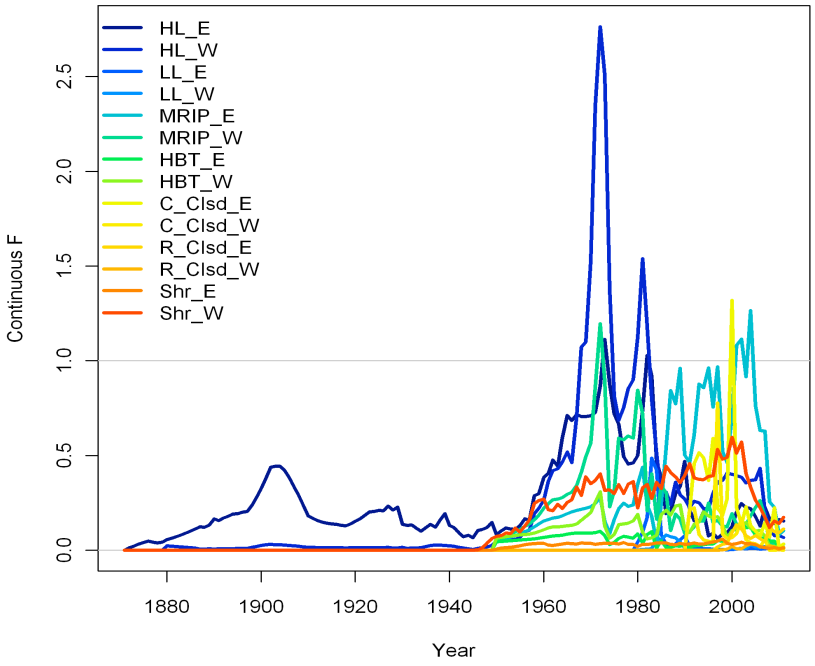

Figure 3. Time series of instantaneous fishing mortality rates for red snapper for the fleets included in the corrected base model (from SEDAR31_RW_BaseResults_4_29_13.ppt).

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

During the review workshop, I questioned whether the stock-recruitment relationship was informative, particularly for the evaluation of productivity in the context of deriving fishery reference points and for projecting future stock conditions outside the range of spawner abundances estimated for the more recent, data-rich time period. My primary concerns relate to the stock's meta-population structure, the extent to which the model may be able to accurately fit a stock-recruitment model given this structure, potential non-stationarity in the relationship, and the spawner abundance range available for estimating the stock-recruitment parameters.

The recruitment dynamic and meta-population structure described in Section 3.1 would be extremely difficult to model and the AT made some simplifying assumptions as a result. The stock-recruitment relationship used in the model was a single stock-recruitment relationship, that included annual deviates in the more recent, data-rich, time period, and that also included a time-varying parameter that distributed the recruits between the East and West areas. The decision to model recruitment in this way was made, at least in part, to match the configuration of SS3, which did not have the capacity to model the stock-recruitment dynamics independently with a low level of mixing between two areas except under a specific set of conditions. With a steepness parameter near one, this model has the capability to model the recruitment of the two stocks as if they were independent demographic units, but at lower steepness values, or if the values differed between the two areas, recruitment to the two stocks would not be independent and potentially this formulation would not work well if a single stock was depleted. Although likelihood profiling of the steepness parameter indicated a steepness value near one (this parameter was fixed at 0.99 for this reason), it was not clear to me that the model would be able to accurately estimate the recruitment dynamics for the two stocks particularly if their respective steepness values differed. I would have preferred to see a stock-recruitment model that better matched the description of the stock structure, or else simulation testing to demonstrate that the model can estimate the dynamics of red snapper in the two areas. As shown via sensitivity analyses at the Assessment Workshop, the assessment results are sensitive to the assumed steepness value.

The stock-recruitment relationship for the more recent time period is shown in Figure 4. As shown in the top panel, the first five years of data are not well fit by this model. I questioned if this was a data issue because the stock-recruitment relationship appears to shift beginning in 1989, one year before the beginning of the commercial discard time series in 1990. The AT explained that a similar pattern was evident in SEDAR 7, which didn't include the discard time series, and that the cause for this apparent shift in recruitment was more likely a signal in the age-frequency data. Additionally, although spawner biomass is highest during 2010 and 2011, these years have lower recruitments relative to other recent years. While there is comparatively little data for estimating recruitment in these two years, together with the earlier shift in the relationship, it is not known whether these represent non-stationarity in the spawner-recruitment relationship due to environmental changes within the Gulf or whether recruitment was lower in these years for some other reason.

As shown in Figure 4 (bottom panel), the range of spawner biomasses available in the recent, data-rich time period is very small relative to the range of spawner biomasses from zero to the

virgin spawner biomass (SSB_0). The estimated SSB_0 from the corrected base model is 4.71e+12 eggs, whereas the model estimated spawner biomasses during this time period range from about 1.21e+11 to about 4.45e+11 eggs. As such, the range of spawner biomasses available to estimate the virgin recruitment spans about 7% of the range from 0 to SSB_0, and all values are towards the lower end of the range (although as shown in the top panel, there are no data below 1.21e+11 eggs either). The AT attempted to address this issue by using historical data to extrapolate back to the inception of the fishery, but this method is also subject to uncertainty (a selectivity pattern is assumed and not all removals from the population are readily accounted for).

For these reasons, I am unconvinced that the stock-recruitment curve is reliable enough to be used for evaluation of productivity and future stock conditions outside the observed spawner biomass range in the more recent, data-rich time period. However, given the use of both recruitment deviates and a time varying parameter to assign recruitment to the two areas, I'm more comfortable that it might be sufficient to characterize recruitment in the more recent time period, in the sense that it might be flexible enough to estimate recent recruitment around a mean value (because the spawner biomass range is so narrow) rather than around a fitted relationship. Therefore, the formulation used may be less of an issue when estimating recent stock size than when projecting outside the range of available data, or when being used as a basis for estimating fishery benchmarks or reference points.

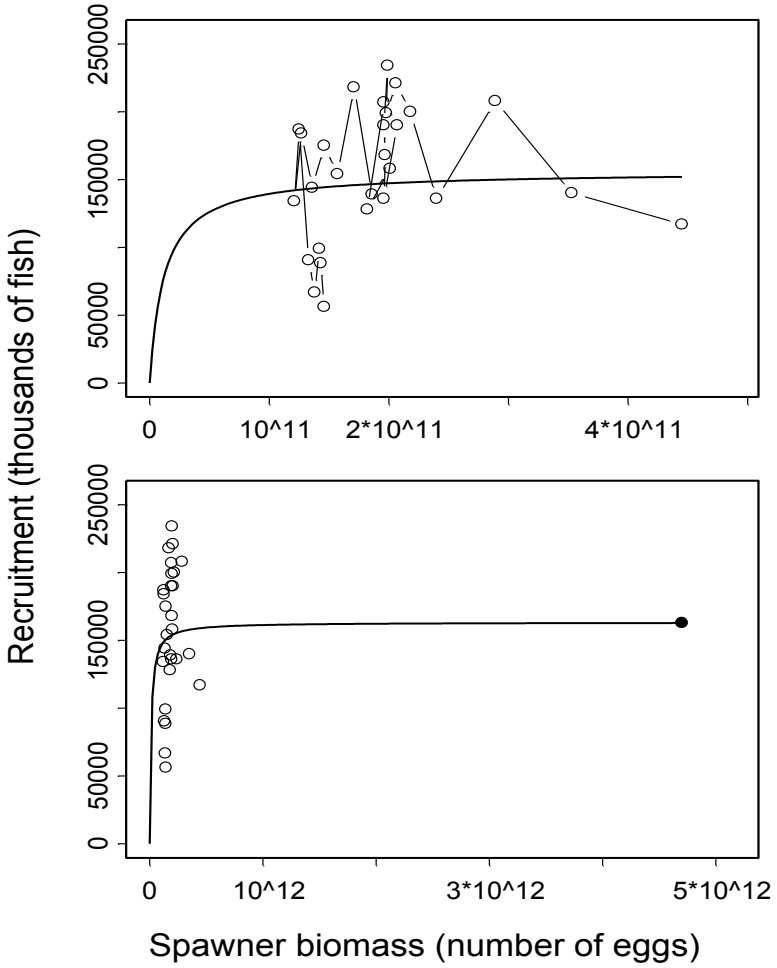

Figure 4. The stock-recruitment relationship for the 1984-2011 time period for the corrected base model presented at the review workshop. The upper panel shows the annual spawner-recruit estimates (points) and fitted relationship (heavy line) on the scale of the biomass estimates. The light line indicates the time series with the 2011 estimates the furthest to the right. The lower panel is similar, but plotted a biomass scale from zero to the virgin spawner biomass (black point). Data are from the model output file SS3-OUTPUT-BaseRun.xlsm provided at the Review Workshop, dated May 2, 2013.

- Are quantitative estimates of 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?

Quantitative estimates of status determination criteria were not provided in the Assessment Workshop Report and were not determined during the Review Workshop, although the analytical team did provide information about proxies for MSY midway through the Review Workshop

that were discussed in general terms. As noted in the Review Workshop Report, two topics were discussed: the use of a marginal F when calculating a proxy for MSY and whether a %SPR proxy for MSY should be based on the assumed steepness in the assessment model, or whether some other value should be used.

In general, I agree with the comments in the Review Workshop Report that the use of a marginal F to account for the reality that fishing effort for red snapper for all fleets (e.g. the shrimp fishery effort and closed season effort) is not under direct control, and that proportionally scaling up the fishing mortality for the other fisheries to find the F corresponding to the appropriate %SPR appears reasonable. I also agree with the comments in the Review Workshop Report that, with respect to the suggestion that the percent reduction in SPR should be based on the steepness assumed in the model (thereby using an MSY proxy consistent with the model used to derive the abundance time series, in this case F_{max}), there is not sufficient certainty in the spawner-recruitment relationship to warrant a change from the %SPR values currently being used or from the default value. As discussed, the uncertainty arises from at least four sources: 1) the steepness value is assumed, 2) there is limited contrast in spawner biomass time series for estimating the spawner-recruit parameters, 3) recruitment for the entire stock has decreased during the last 2 years even though spawner abundance has been increasing, and 4) there is evidence of a more complex population structure than is being modeled.

With respect to the question of whether there are other indicators that may be used to inform managers about stock conditions, although I do not have a specific recommendation for a different indicator, I do wonder if using a single indicator of stock conditions for red snapper in the Gulf of Mexico may preclude the rebuilding of depleted portions of the stock if other portions are not in a depleted state, or conversely, may preclude harvesting healthier portions of the stock if other portions are in a depleted state. As discussed in Section 3.1, there are recent genetic otolith chemistry and oceanographic results that show that red snapper have a metapopulation structure and exhibit independent demographic structuring on small spatial scales. Development of indicators of stock conditions on smaller spatial scales that account for this structuring may provide a better guidance about overall production potentially leading to higher long-term yields. Although presently speculative, this type of approach could be tested via simulation prior to being implemented.

3.4. Evaluate the stock projections, addressing the following:

Stock projections were not provided in the Assessment Workshop Report, and only deterministic projections were presented at the Review Workshop.

- Are the methods consistent with accepted practices and available data?

As described at the Review Workshop, the deterministic projections were done using SS3 and therefore would be consistent with the model, its structure, and the most recent abundance estimates. Fishing mortality was changed for the directed fleet only, consistent with the use of marginal F's as status determination criteria. However, because the projections are deterministic they do not reflect the uncertainty associated with the projections and therefore are not (presently) consistent with accepted practices. Stochastic projections were planned but were not completed in time for the Review Workshop.

- Are the methods appropriate for the assessment model and outputs?

As described above, the preliminary results provided at the Review Workshop are appropriate for the assessment model, but they do not incorporate uncertainty in the model output. These results cannot be considered appropriate for the model output for this reason. Again, stochastic projections were planned but were not completed in time for the Review Workshop.

- Are results informative and robust, and useful to support inferences of probable future conditions?

Because the projections are deterministic, they are only informative about the expected outcome in the absence of random variability, errors in the implementation, changes in life history parameters or changes in environmental conditions, a scenario which is unlikely. In order to be useful to support inferences about probable future conditions, I think the projections should incorporate, or minimally be accompanied by a description of the effects of: i) uncertainty in the life history parameters, ii) uncertainty in abundance-at-age in 2011, iii) covariance in model parameters, iv) potential productivity changes or alternate scenarios, and v) implementation uncertainty or alternate scenarios. Productivity changes are included because a single change in virgin recruitment levels is included in the assessment model and the recent recruitment estimates are low (although there are relatively few data contributing to these estimates). Implementation uncertainty is included because the fishing mortality for the six bycatch fleets is set at the 2011 exploitation rates, but is not directly controlled for red snapper. Uncertainty in the 2011 abundance-at-age could include the uncertainty shown in the retrospective analysis described in Section 3.3.

Irrespective of how the projections are carried out, rebuilding timelines will be highly uncertain. Projection results are known to be sensitive to assumed parameter variances and autocorrelations, which are very difficult to estimate. The use of these kinds of projections has been debated in the population viability analysis (PVA) literature. Although some authors have cautioned against the use of PVAs because the predictions, typically time to extinction or recovery, are almost always quite uncertain (e.g. Taylor 1995; McCarthy et al. 1996; Ludwig 1999), many authors believe that PVA's can be used to assess relative risk (e.g. Akçakaya & Raphael 1998; Beissinger & Westphal 1998; McCarthy et al. 2001).

With respect to selecting recovery strategies, McCarthy et al. (2003) used a simulation study and found that they were able to identify the better of two management strategies 67–74% of the time using 10 years of data, and 92–93% of the time with 100 years of data. Reed et al. (2002), argue that these relative evaluations are the most appropriate use of PVAs and can be used as a basis for choosing the most effective management strategy from a given set of possibilities (Lindenmayer & Possingham 1996). Because the projections used in this assessment for red snapper are analogous to PVA's, this is likely the best use of the projections in this assessment and the rebuilding timelines should be considered uncertain.

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

The projections were not completed in time to be included in the Assessment Workshop Report or to be fully presented and discussed at the Review Workshop. My comments with respect to the key uncertainties are provided above.

3.5. 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

Although the sections of the Assessment Workshop Report pertaining to uncertainty were not completed, the analytical team did provide presentations on the evaluation of uncertainty, including: 1) uncertainty within the base model run (via model parameter standard errors and a parametric bootstrap procedure); 2) uncertainty relating to alternative assumption about life history parameters (specifically natural mortality), 3) uncertainty relating the influence of various data inputs (via different weightings of data), and 4) uncertainty relating to the effects of adding new data on the model results (via the retrospective analysis previously described).

With respect to the uncertainty in the base model run, I agree with the RP comments that: 1) despite having relatively large variances for many of the annual index values, the model was constrained to fit some of the point estimates relatively well, and therefore did not fully capture the uncertainty in these indices; 2) that in this assessment, several of the variance parameters were fixed to values that were assigned subjectively, and 3) these uncertainties would be propagated through the model such that the variances of the estimated parameters would also be subjective. Although this approach is not ideal, it is also not uncommon in stock assessments. Although the AT did evaluate the effect of various data weighting schemes (combinations of variance parameters) on parameter estimates and model output, this approach does not address the effects on estimates of uncertainty associated with these estimates.

The AT presented an example of a Hessian-based, parametric bootstrap based on the original model run provided in the Assessment Workshop Report as conducted in SS3. In carrying out the bootstrap, the original data are not re-sampled, rather a new data set is created with the same variance properties that were assumed when analyzing the original data (Methot and Wetzell *in press*). To ensure that the simulated data sets reasonably approximate the original data, the assigned variance for the input data need to be approximately the same as the variability between the observed and expected values before creating bootstrap data sets (Methot and Wetzell *in press*), although it is unclear that this was undertaken in this example, or that given the small variances assigned to some data series, despite having relatively large standard errors associated with the data, that this approach would appropriately characterize the uncertainty in the model output. A non-parametric bootstrap in which new data sets are generated for the existing data would be expected to better carry forward the uncertainty associated with the data inputs.

The AT did evaluate uncertainty relating to alternative assumptions about natural mortality by running the model with both lower and higher fixed values for age-specific natural mortality, and at my request, did a sensitivity run with a low value of steepness. Biomass estimates appeared more sensitive to changes in these assumed values than they did to changing the relative weighting of various data sets, although these sensitivities were generally done in groups (e.g. the age composition data weighted more heavily than the indices, or vice versa). While it would have been nice to see the effects of individual data sets by fitting to them individually (where possible), I think this model is complex enough that a full exploration of the inputs and

assumptions would be time consuming to the point of being impractical. Additionally, based on discussion at the workshop, SS3 is not currently configured in a way that allows the uncertainty in the assumptions about stock structure and recruitment dynamics to be easily explored, although as described above, I believe this is a potentially important source of uncertainty in this assessment.

- Ensure that the implications of uncertainty in technical conclusions are clearly stated.

This section of the Assessment Workshop Report was not completed for review at the Review Workshop, and technical conclusions from the assessment were not available for review. From my perspective, the implications of uncertainty relating to the states of nature (productivity changes), population structuring, the retrospective analysis and the stock-recruitment relationship are sources of uncertainty that would not be directly captured in bootstrap simulations, status criteria determination, or projections from the base model run.

3.6. 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 with particular emphasis on the Deepwater Horizon Oil Spill.

As discussed throughout this document, in my opinion a key uncertainty in this assessment is the recruitment dynamics of stock, and more specifically whether considering the stock to be comprised to two or possibly several populations would lead to a better assessment and potentially a higher long-term yield. A second key uncertainty relates to time varying productivity as potentially indicated via the change in the virgin recruitment parameter between the two time periods, in the residual pattern in the recruitment in the recent time period, and the lower recruitments estimated for the last two years. Particularly if some areas can become depleted with slow re-colonization, the virgin recruitment parameter and the recruitment dynamics may be quite variable, and avoiding localized depletion may lead to higher long-term yields. The effects of both population structure and episodic productivity changes on long-term yield could be evaluated via simulation and could help determine whether modifications to the model to include greater degrees population structuring and reproductive isolation, and finer scale regulation based on localized stock status, would improve the assessment.

With respect to research recommendations from the workshops, recommendations were not provided in the Assessment Workshop Report, but several were provided in the Data Workshop Report. I believe the recommendations that include site- and habitat-specific regional comparisons are those that will be most informative about the potential effects of the Deepwater Horizon Oil Spill on status and the assessment, and will also help to inform the modeling recommended above. These specific recommendations are listed below (numbers are from the Data Workshop report). Most the other recommendations are expected to lead to better data and therefore also a better assessment. I also consider discard mortality a research priority.

> 2. Site and habitat specific comparisons from more regions of the Gulf are needed for estimation of age-0 and age-1 mortality, accounting for

shelf characteristics (e.g., width, slope, depth) in tests of density-dependent variation in M and emigration.

3.Broader understanding of habitat value and areal estimates of habitat (distribution—areas of trawlable vs. untrawlable bottom; more refined maps Gulf-wide etc) are needed to further inform the habitat limitation hypothesis for density dependence.

5. Evaluate the potential for sea-bottom restoration or other means to expand habitat and increase survival for post-settlement red snapper.

9. A general recommendation of the LHW is to expand design-based fishery-independent sampling to elucidate regional (i.e., eastern and western GOM) and sub-regional differences in the demographics of red snapper.

13.Additional research is necessary to further clarify regional reproductive and demographic differences.

14. More information is needed to understand movement of young and older adult red snapper across along shore barriers. In particular the LHW recommends a large scale tagging study focused west and east of the Mississippi River.

15. Telemetry versus tagging approaches need to be expanded and evaluated according to shelf characteristics; e.g. cross compared in areas with little natural hard bottom habitat (yet high artificial reefs) versus areas with relatively high areal coverage of hard bottom and with more dispersed artificial reefs.

16. The LHW recommends a workshop or research symposia be convened to synthesize results and assess methodology for estimating red snapper movements and home range.

4. Produce a SEAMAP larval index based on the abundance of red snapper larvae captured during SEAMAP summer shrimp/groundfish surveys (past and present). This survey has for a number of years now been expanded to include the entire northern Gulf of Mexico shelf. I don't need to remind you that the data from summer months (i.e. during peak red snapper spawning months) could be a far better indication of spawning production than data from the end of season from which the current SEAMAP larval index is derived.

5. Explore the utility of a larval red snapper index based on a comprehensive modeling approach that includes all SEAMAP stations (regardless of how many times they have been sampled over the time series) and both sampling gears, i.e. neuston and bongo samples. There are other likely explanatory variables (one for sure is salinity) that could ultimately improve the index.

- Provide recommendations on possible ways to improve the SEDAR process

Overall, based on my experience with this and other SEDAR reviews, I think that the SEDAR process does provide for a thorough review and evaluation of the available data, does provide for thorough consideration and review of analytical approaches and modeling results, does provide very good guidance on the information expected to result from the process (the TOR's are clear, particularly with respect to evaluation of stock status and projections) and does provide very good documentation of the process including decisions made throughout the assessment (for

example, the background documents are an excellent resource and provide information about analyses and data decisions that are sometimes not described in other processes).

At some point, this process fell behind schedule resulting in the analytical team working under a very tight deadline; in their still learning about the model when writing the Assessment Workshop Report (changes to the model were made after the production of the report); and in the production of a report and analytical results that were not complete at the end of the Review Workshop. Even with these issues, although the Review Panel was not able to endorse the results of the assessment due to the uncertainties resulting from the process, it was still able to provide comments on the data and analytical methods and they did not find evidence that the abundance point estimates they had seen should be rejected. That any review was possible speaks to the strength of the SEDAR process (and also to the knowledge, skill and hard work of the analytical team as demonstrated at the Review Workshop). My one recommendation is that in circumstances such as these, the flexibility is built into the process to allow for changes to timelines on relatively short time scales to allow for completion of the work prior to the review. Although I'm sure there are many scheduling considerations of which I'm not aware, my personal preference would have been to see the review meeting postponed until after Assessment Workshop Report was thoroughly completed and reviewed by the Assessment Panel, thereby allowing the Review Workshop to focus on the review rather than the initial presentation of results and descriptions of methods. Had this occurred, I think this assessment had the potential to be excellent.

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

I think a simulation study to evaluate the effects of population structure and mixing would be beneficial prior to the next assessment, particularly in the context of the projections. This is discussed at the start of Section 3.6.

3.8. Prepare a Peer Review Summary Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report in accordance with the project guidelines.

This TOR is ongoing at the time of writing of this independent reviewer report. Writing tasks for the Peer Review Summary were assigned to the RP members at the meeting and a draft Review Workshop Summary Report has been completed.

4.0. Acknowledgments

Thanks go to Luiz Barbieri for an excellent job in chairing the meeting, particularly for helping the review panel to understand how to deal with the issues arising from the timing with which review materials were provided as well as the completeness of this material. Brian Linton (assessment team lead), Clay Porch, Jakob Tetzlaff and Nancie Cummings presented the assessment and carried out further analysis at the request of the review panel while at the same time that they were working to complete parts of the assessment. It was very clear that they understood the data inputs and the model very well. I also wish to thank the other panel

members, Ben Blount, Jean-Jacques Maguire, Anders Nielsen and Will Patterson for stimulating discussions about the assessment, and Roberto Koeneke for coordinating the review on behalf of CIE and his assistance with travel arrangements. Ryan Rindone provided coordination around the meeting and guidance about the overall SEDAR process.

5.0. References

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6.0. Appendices

Appendix 1: Panel Membership
Appendix 2: CIE Statement of Work
Appendix 3: Bibliography of Materials Provided for Review

Appendix 1: Review Panel Membership.

Review Panel Membership

Luiz Barbieri	Chair	Gulf SSC
Will Patterson	Reviewer	Gulf SSC
Ben Blount	Reviewer	Gulf SSC
Jean-Jacques Maguire	Reviewer	CIE
Jamie Gibson	Reviewer	CIE
Anders Nielsen	Reviewer	CIE

Appendix 2: CIE Statement of Work.

Attachment A: Statement of Work for Dr. Jamie Gibson

SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

BACKGROUND

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 31 will be a compilation of data, a benchmark assessment of the stock, and an assessment review conducted for Gulf of Mexico red 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 stock assessed through SEDAR 31 is within the jurisdiction of the Gulf of Mexico Fishery Management Council and the state waters of Texas, Louisiana, Mississippi, Alabama, and Florida.

OBJECTIVES

Requirements for the reviewers: Three reviewers shall conduct an impartial and independent peer review of the stock assessments in accordance with the tasks, milestones, and terms of reference (ToRs) of this SoW. The reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the primary task of providing peer-review advice in compliance with the workshop Terms of Reference.

Appendix 2: CIE Statement of Work.

PERIOD OF PERFORMANCE

The reviewers shall conduct the tasks according to the schedule of milestones and deliverables as specified in this statement of work (SoW). Each reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein. The tentative schedule of milestones and deliverables is provided herein.

PLACE OF PERFORMANCE AND TRAVEL

Each reviewer shall conduct an independent peer review during a five day panel review meeting scheduled in Gulfport, Mississippi during April 29 through May 3, 2013.

STATEMENT OF TASKS

Each 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.

<u>Foreign National Security Clearance</u>: The reviewers shall participate during a panel review meeting at a government facility, and the NMFS Project Contact will be responsible for obtaining the Foreign National Security Clearance approval for the reviewers who are non-US citizens. For this reason, the reviewers shall provide by FAX (not by email) the 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/.

<u>Pre-review Background Documents</u>: 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 at the Gulfport, Mississippi during April 29 – May 3, 2013.
3) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than May 17, 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**.

Appendix 2: CIE Statement of Work.

DELIVERY

Each reviewer shall complete an independent peer review report in accordance with the SoW. Each reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each reviewer shall complete the independent peer review addressing each stock assessment ToR listed in **Annex 2**.

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

March 24, 2013	Contractor sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
April 14, 2013	NMFS Project Contact provides reviewers the pre-review documents
April 29 – May 3, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting in Gulfport, Mississippi.
May 17, 2013	Reviewers submit draft independent peer review reports to the contractor's technical team for independent review
May 29, 2013	Contractor submits independent peer review reports to the COR who reviews for compliance with the contract requirements
June 5, 2013	The COR distributes the final 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 COR within 10 working days after receipt of all required information of the decision on substitutions. 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 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: The deliverables shall be the final peer review report from each reviewer that satisfies the requirements and terms of reference of this SoW. The contract shall be successfully completed upon the acceptance of the contract deliverables by the COR based on three performance standards:

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

Appendix 2: CIE Statement of Work.

Upon the acceptance of each independent peer review report by the COR, the reports will be distributed to the NMFS Project Contact and pertinent NMFS science director, at which time the reports will be made publicly available through the government's website.

The contractor shall send the final reports in PDF format to the COR, designated to be William Michaels, via email William.Michaels@noaa.gov

Support Personnel:

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Key Personnel:

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Appendix 2: CIE Statement of Work.

Annex 1: Format and Contents of Independent Peer Review Report

1. The independent peer review report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The main body of the report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Findings of whether they accept or reject the work that they reviewed, and an explanation of their decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. For each assessment reviewed, the report should address whether each ToR of the Assessment Workshop was completed successfully. For each ToR, the Independent Review Report should state why that ToR was or was not completed successfully. To make this determination, the SEDAR chair and reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), 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 SEDAR 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 independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not others read the SEDAR Summary Report. The independent report shall be an independent peer review of each ToR, 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 this Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Appendix 2: CIE Statement of Work.

Annex 2: Terms of Reference

SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

1. Evaluate the data used in the assessment, addressing the following:
   - Are data decisions made by the Data and Assessment Workshops sound and robust?
   - Are data uncertainties acknowledged, reported and within normal or expected levels?
   - Are data applied properly within the assessment model?
   - Are input data series reliable and sufficient to support the assessment approach and findings?
2. Evaluate the methods used to assess the stock, accounting for only the available data:
   - Are the methods scientifically sound, robust, and appropriate for the available data?
   - Are assessment models properly configured and used consistent with standard practices?
3. Evaluate the assessment findings with respect to the following:
   - Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support inferences on stock status?
   - Is the stock overfished? What information helps you reach this conclusion?
   - Is the stock undergoing overfishing? What information helps you reach this conclusion?
   - Is there an informative stock-recruitment relationship? Is the stock-recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   - Are quantitative estimates of 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:
   - Are the methods consistent with accepted practices and available data?
   - Are the methods appropriate for the assessment model and outputs?
   - Are results informative and robust, and useful to support inferences of probable future conditions?
   - 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.

Appendix 2: CIE Statement of Work.

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 with particular emphasis on the Deepwater Horizon Oil Spill
- 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 Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report in accordance with the project guidelines.

The review panel may not request a new assessment. The review panel may request a limited number of additional sensitivity analyses and evaluations of alternative assumptions, and may correct errors identified in the assessment. Additional details regarding the latitude given to the review panel to deviate from assessments provided by the assessment workshop panel are provided in the SEDAR Guidelines and the SEDAR Review Panel Overview and Instructions.

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

Appendix 2: CIE Statement of Work.

Annex 3: Tentative Agenda

SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

Gulfport, Mississippi during April 29 – May 3, 2013

Monday

1:00 p.m.	**Convene**	
1:00 – 1:30	**Introductions and Opening Remarks**	**Rindone**
	- Agenda Review, TOR, Task Assignments	
1:30 – 5:00	**Assessment Presentations and Discussions**	**Linton, Saul**
5:00 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

Tuesday

8:00 a.m. – 11:30 a.m.	**Assessment Presentations**	**Linton, Saul**
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 3:30 p.m.	**Panel Discussion**	**Barbieri**
	- Assessment Data & Methods	
	- Identify additional analyses, sensitivities, corrections	
3:30 p.m. – 3:45 p.m.	**Break**	
3:45 p.m. – 5:00 p.m.	**Panel Discussion**	**Barbieri**
	- Continue deliberations	
	- Review additional analyses	
5:00 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

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

Wednesday

8:00 a.m. – 11:30 a.m.	**Panel Discussion**	**Barbieri**
	- Review additional analyses, sensitivities	
	- Consensus recommendations and comments	
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 3:30 p.m.	**Panel Discussion**	**Barbieri**
	- Final sensitivities reviewed.	
	- Projections reviewed.	
3:30 p.m. – 3:45 p.m.	**Break**	
3:45 p.m. – 5:00 p.m.	**Panel Discussion**	**Barbieri**
	- Review Consensus Reports	
5:00 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

Wednesday Goals: Final sensitivities identified, preferred models selected, projection approaches approved, final results made available. Summary report drafts begun.

Thursday

8:00 a.m. – 11:30 a.m.	**Panel Work Session**	**Barbieri**
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 3:30 p.m.	**Panel Work Session**	**Barbieri**
3:30 p.m. - 3:45 p.m.	**Break**	
3:45 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

Thursday Goals: Draft Summary Report reviewed.

Friday

8:00 a.m. – 1:00 p.m.	**Panel Work Session**	**Barbieri**
1:00 p.m.	**ADJOURN**	

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SEDAR 31- Gulf of Mexico Red Snapper Document List

Document Number	Title	Authors
Data Workshop Documents		
SEDAR31-DW01	Relative abundance of juvenile red snapper, *Lutjanus campechanus* in the northern Gulf of Mexico	Parsons
SEDAR31-DW02	Brief overview on Gulf of Mexico Red Snapper IFQ Program	Stephen
SEDAR31-DW03	Working Paper for Red Snapper Data Workshop (SEDAR 31)	Cowan, Boswell, Simonsen, Saari, and Kulaw
SEDAR31-DW04	Recreational Survey Data for Red snapper in the Gulf of Mexico	Matter
SEDAR31-DW05	Red snapper (*Lutjanus campechanus*) otolith ageing summary for collection years 2009-2011	Allman, Barnett, Trowbridge, Goetz, and Evou
SEDAR31-DW06	An Update to the Age Composition, Growth, and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery	Gazey, Gallaway, and Cole
SEDAR31-DW07	Expanded Annual Stock Assessment Survey 2011: Red Snapper Reproduction	Fitzhugh, Lang, and Lyon
SEDAR31-DW08	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Red Snapper	Campbell, Rademacher, Felts, Noble, Felts, and Salisbury
SEDAR31-DW09	Index of Abundance for Pre-Fishery Recruit Red Snapper from Florida Headboat Observer Data	O'Hop and Sauls
SEDAR31-DW10	Length frequency distributions for red snappers in the Gulf of Mexico from 1984-2011	Chih
SEDAR31-DW11	A Summary of Data on the Size Distribution and Release Condition of Red Snapper Discards from Recreational Fishery Surveys in the Gulf of Mexico	Sauls
SEDAR31-DW12	A comparison of the size and age of red Snapper, *Lutjanus campechanu*s, to the age of artificial reefs in the northern Gulf of Mexico	Syc and Szedlmayer
SEDAR31-DW13	Use of Ultrasonic Telemetry to Estimate Natural and Fishing Mortality of Red Snapper	Topping and Szedlmayer
SEDAR31-DW14	Fine-scale Movements and Home Ranges of Red Snapper *Lutjanus campechanus* Around Artificial Reefs in the Northern Gulf of Mexico	Piraino and Szedlmayer
SEDAR31-DW15	Spatio-temporal dynamics in red snapper reproduction on the West Florida Shelf, 2008-2011	Lowerre-Barbieri, Crabtree, Switzer, and McMichael
SEDAR31-DW16	Spatial distribution and occurrence of red snapper, *Lutjanus campechanus*, sampled off the Louisiana coast during nearshore trawl sampling efforts	Adriance and Sweda
SEDAR31-DW17	Summary report of the red snapper (Lutjanus	Campbell, Pollack, Henwood,

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	campechanus) catch during the 2011 expanded annual stock assessment (EASA)	Provaznik, and Cook
SEDAR31-DW18	On the comparisons of regional differences in the growth of red snappers from the Gulf of Mexico	Chih
SEDAR31-DW19	Abundance Indices of Red Snapper Collected in NMFS Bottom Longline Surveys in the northern Gulf of Mexico	Ingram and Pollack
SEDAR31-DW20	Red Snapper Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico	Pollack, Ingram, and Foster
SEDAR31-DW21	Examining delayed mortality in barotrauma afflicted red snapper using acoustic telemetry and hyperbaric experimentation	Stunz and Curtis
SEDAR31-DW22	Release mortality in the red snapper fishery: a synopsis of three decades of research	Campbell, Driggers, and Sauls
SEDAR31-DW23	Release Mortality Estimates for Recreational Hook-and-Line Caught Red Snapper Derived from a Large-Scale Tag-Recapture Study in the Eastern Gulf of Mexico	Sauls
SEDAR31-DW24	Fisheries-independent data for red snapper from reef-fish surveys on the West Florida Shelf, 2008-2011	Switzer, Keenan, and McMichael
SEDAR31-DW25	Estimated Conversion Factors for Adjusting MRFSS Gulf of Mexico Red Snapper Catch Estimates and Variances in 1981-2003 to MRIP Estimates and Variances	Rios, Matter, Walter, Farmer, and Turner
SEDAR31-DW26	Developing a survey methodology for sampling red snapper, *Lutjanus campechanus*, at oil and gas platforms in the northern Gulf of Mexico	Moser, Pollack, Ingram, Gledhill, Henwood, and Driggers
SEDAR31-DW27	Red Snapper (*Lutjanus campechanus*) larval indices of relative abundance from SEAMAP fall plankton surveys, 1986 to 2010	Pollack, Hanisko, Lyczkowski-Shultz, Jones, and Ingram
SEDAR31-DW28	Red Snapper Findings from the NMFS Panama City Laboratory Trap & Camera Fishery-Independent Survey – 2004-2011	DeVries, Ingram, Gardner, and Raley
SEDAR31-DW29	Artificial Structure and Hard-Bottom Spatial Coverage in the Gulf of Mexico	Mueller
SEDAR31-DW30	Shrimp Fishery Bycatch Estimates for Gulf of Mexico Red Snapper, 1972-2011	Linton
SEDAR31-DW31	Calculated red snapper discards in the Gulf of Mexico commercial vertical line and bottom longline fisheries: preliminary results	McCarthy
SEDAR31-DW32	Observer reported size distribution of Gulf of Mexico red snapper from the commercial vertical line and bottom longline fisheries	McCarthy
SEDAR31-DW33	Using a Censored Regression Modeling	Saul and Walter

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	Approach to Standardize Red Snapper Catch per Unit Effort Using Recreational Fishery Data Affected by a Bag Limit	
Assessment Workshop Documents		
SEDAR31-Assessment Workshop01	Headboat Discards for Red Snapper in the Gulf of Mexico	Matter and Walter
SEDAR31-Assessment Workshop02	Accounting for changes in fishing mortality when comparing density-dependent to density-independent mortality in Gulf of Mexico red snapper	Vincent
SEDAR31-Assessment Workshop03	Modeling the dependence of batch fecundity and spawning frequency on size and age for use in stock assessments of red snapper in U.S. Gulf of Mexico waters	Porch, Fitzhugh, and Linton
SEDAR31-Assessment Workshop04	The Effect of Hook Type on Red Snapper Catch	Saul, Walter, Shipp, Powers, and Powers
SEDAR31-Assessment Workshop05	Age Composition of Red Snapper Bycatch in the Gulf of Mexico Shrimp Fishery, 1997-2011	Linton
SEDAR31-Assessment Workshop06	Shrimp trawl index of abundance for Gulf of Mexico red snapper, 1967-1989	Linton
SEDAR31-Assessment Workshop07	Red Snapper Abundance Indices from Combined Bottom Trawl Surveys in the Eastern Gulf of Mexico	Pollack, Ingram, and Henwood
SEDAR31-Assessment Workshop08	A proposed methodology to incorporate ROV length data into red snapper stock assessments	Walter, DeVries, Drymon, Patterson, Powers, and Williams
SEDAR31-Assessment Workshop09	Reconstructed time series of offshore shrimp trawl effort in the Gulf of Mexico from 1945 to 1972 for use in the SEDAR 31 Gulf of Mexico red snapper assessment	Porch
SEDAR31-Assessment Workshop10	Use of the Connectivity Modeling System to estimate movements of red snapper recruits in the northern Gulf of Mexico	Karnauskas, Walter, and Paris
SEDAR31-Assessment Workshop11	Estimating historical recreational angler effort in the Gulf of Mexico for the private, charter, and headboat fishing modes	Rios
SEDAR31-Assessment Workshop12	Estimation of hook selectivity on red snapper (*Lutjanus campechanus*) during a fishery independent survey of natural reefs in the Gulf of Mexico	Pollack, Campbell, and Driggers
SEDAR31-Assessment Workshop13	Dauphin Island Sea Lab Bottom Longline Survey incorporation into the NMFS Bottom Longline Survey	Ingram
SEDAR31-Assessment Workshop14	Combined Index for Florida Fish and Wildlife Research Institute and NMFS Panama City Video Surveys	Ingram

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SEDAR31-Assessment Workshop15	Age frequency distributions estimated with reweighting methods for red snappers in the Gulf of Mexico from 1991 to 2011	Chih
SEDAR31-Assessment Workshop16	Changes in lengths-at-age and size selectivity of red snappers in the Gulf of Mexico from 2002 to 2011	Chih
SEDAR31-Assessment Workshop17	Response to comments on: *Age Composition, Growth and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery*	Gazey, Gallaway, and Cole
Review Workshop Documents		
SEDAR31-RW01		
Reference Documents		
SEDAR31-RD01	SEDAR 7 Stock Assessment Report	SEDAR
SEDAR31-RD02	2009 SEDAR 7 Update Assessment Report	SEDAR
SEDAR31-RD03	Red Snapper 2011 Projections Update	SEFSC
SEDAR31-RD04	Estimation of Fisheries Impacts Due to Underwater Explosives Used to Sever and Salvage Oil and Gas Platforms in the U.S. Gulf of Mexico	Minerals Management Service
SEDAR31-RD05	Age Composition, Growth, and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery	Gazey, Gallaway, Cole, and Fournier
SEDAR31-RD06	A Life History Review for Red Snapper in the Gulf of Mexico with an Evaluation of the Importance of Offshore Petroleum Platforms and Other Artificial Reefs	Gallaway, Szedlmayer, and Gazey
SEDAR31-RD07	Addressing Time-Varying Catchability	SEDAR
SEDAR31-RD08	Fishery-Independent Catch of Young-of-the-Year Red Snapper in the Texas Territorial Sea, 1985–2007	Dorf and Fisher
SEDAR31-RD09	Red Snapper Management History	GMFMC
SEDAR31-RD10	Home range and movement patterns of red snapper (*Lutjanus campechanus*) on artificial reefs	Topping and Szedlmayer
SEDAR31-RD11	Genetic variation and spatial autocorrelation among young-of-the-year red snapper (*Lutjanus campechanus*) in the northern Gulf of Mexico	Saillant, Bradfield, and Gold

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SEDAR31-RD12	Determining policy-efficient management strategies in fisheries using data envelopment analysis (DEA)	Griffin and Woodward
SEDAR31-RD13	Red Snapper Larval Transport in the Northern Gulf of Mexico	Johnson, Perry, Lyczkowski-Shultz, and Hanisko
SEDAR31-RD14	Estimation of the Source of Red Snapper Recruits to West Florida and South Texas with Otolith Chemistry: Implications for Stock Structure and Management	Patterson, Cowan, Barnett, and Sluis
SEDAR31-RD15	Trends in Gulf of Mexico Red Snapper Population Dynamics, 1979-85	Parrack and McClellan
SEDAR31-RD16	Effects of habitat complexity and predator exclusion on the abundance of juvenile red snapper	Piko and Szedlmayer
SEDAR31-RD17	Survival and movement of hatchery-reared red snapper on artificial habitats in the northern Gulf of Mexico	Chapin, Szedlmayer, and Phelps
SEDAR31-RD18	A Life History Review for Red Snapper in the Gulf of Mexico with an Evaluation of the Importance of Offshore Petroleum Platforms and Other Artificial Reefs	Gallaway, Szedlmayer, and Gazey
SEDAR31-RD19	The use of otolith shape analysis for ageing juvenile red snapper, *Lutjanus campechanus*	Beyer and Szedlmayer
SEDAR31-RD20	Validation of annual periodicity in otoliths of red snapper, *Lutjanus campechanus*	Szedlmayer and Beyer
SEDAR31-RD21	The Artificial Habitat as an Accessory for Improving Estimates of Juvenile Reef Fish Abundance in Fishery Management	Szedlmayer
SEDAR31-RD22	Home range and movement patterns of red snapper (*Lutjanus campechanus*) on artificial reefs	Topping and Szedlmayer
SEDAR31-RD23	Site fidelity, residence time and movements of red snapper *Lutjanus campechanus* estimated with long-term acoustic monitoring	Topping and Szedlmayer
SEDAR31-RD24	Proximity Effects of Larger Resident Fishes on Recruitment of Age-0 Red Snapper in the Northern Gulf of Mexico	Mudrak and Szedlmayer
SEDAR31-RD25	Estimates of Historic Recreational Landings of Spanish Mackerel in the South Atlantic Using the FHWAR Census Method	Brennan and Fitzpatrick

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SEDAR31-RD26	Declining Size at Age Among Red Snapper in the Northern Gulf of Mexico off Louisiana, USA: Recovery or Collapse?	Nieland, Wilson, and Fischer
SEDAR31-RD27	Examination of Red Snapper Fisheries Ecology on the Northwest Florida Shelf (FWC-08304): Final Report	Patterson, Tarnecki, and Neese
SEDAR31-RD28	Site Fidelity, Movement, and Growth of Red Snapper: Implications for Artificial Reef Management	Strelcheck, Cowan, and Patterson
SEDAR31-RD29	Factors Affecting Catch and Release (CAR) Mortality in Fish: Insight into CAR Mortality in Red Snapper and the Influence of Catastrophic Decompression	Rummer
SEDAR31-RD30	Effect of Circle Hook Size on Reef Fish Catch Rates, Species Composition, and Selectivity in the Northern Gulf of Mexico Recreational Fishery	Patterson, Porch, Tarnecki, and Strelcheck
SEDAR31-RD31	Effect of trawling on juvenile red snapper (*Lutjanus campechanus*) habitat selection and life history parameters	Wells, Cowan, Patterson, and Walters
SEDAR31-RD32	Habitat use and the effect of shrimp trawling on fish and invertebrate communities over the northern Gulf of Mexico continental shelf	Wells, Cowan, and Patterson
SEDAR31-RD33	Site Fidelity and Movement of Reef Fishes Tagged at Unreported Artificial Reef Sites off NW Florida	Addis, Patterson, and Dance
SEDAR31-RD34	Fish Community and Trophic Structure at Artificial Reef Sites in the Northeastern Gulf of Mexico	Dance, Patterson, and Addis
SEDAR31-RD35	A Review of Movement in Gulf of Mexico Red Snapper: Implications for Population Structure	Patterson
SEDAR31-RD36	Size selectivity of sampling gears targeting red snapper in the northern Gulf of Mexico	Wells, Boswell, Cowan, and Patterson
SEDAR31-RD37	Delineating Juvenile Red Snapper Habitat on the Northern Gulf of Mexico Continental Shelf	Patterson, Wilson, Bentley, Cowan, Henwood, Allen, and Dufrene
SEDAR31-RD38	Habitat- and Region-Specific Reproductive Biology of Female Red Snapper (*Lutjanus campechanus*) in the Gulf of Mexico	Kulaw
SEDAR31-RD39	Comparison of the Age and Growth of Red Snapper (*Lutjanus campechanus*) Amongst Habitats and Regions in the Gulf of Mexico	Saari

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SEDAR31-RD40	Oil Platforms and Red Snapper Movement and Behavior	McDonough
SEDAR31-RD41	Reconstructed time series of shrimp trawl effort in the Gulf of Mexico and the associated bycatch of red snapper from 1948 to 1972	Porch and Turner
SEDAR31-RD42	Individual-based modeling of an artificial reef fish community: Effects of habitat quantity and degree of refuge	Campbell, Rose, Boswell, and Cowan
SEDAR31-RD43	Literature Search and Data Synthesis of Biological Information for Use in Management Decisions Concerning Decommissioning of Offshore Oil and Gas Structures in the Gulf of Mexico	Versar, Inc.
SEDAR31-RD44	The Environmental Effects of Underwater Explosions with Methods to Mitigate Impacts	Keevin and Hempen
SEDAR31-RD45	Connections between Campeche Bank and Red Snapper Populations in the Gulf of Mexico via modeled larval transport	Johnson, Perry, and Lyczkowski-Shultz
SEDAR31-RD46	The commercial landings of red snapper in the Gulf of Mexico from 1872 to 1962	Porch, Turner, and Schirripa
SEDAR31-RD47	Estimates of Historical Red Snapper Recreational Catch Levels Using US Census Data and Recreational Survey Information	Scott
SEDAR31-RD48	MRFSS/MRIP Calibration Workshop: Ad-hoc Working Group Report	Salz, Miller, Williams, Walter, Drew, and Bray
SEDAR31-RD49	Survival of Red Grouper (*Epinephelus morio*) and Red Snapper (*Lutjanus campechanus*) Caught on J-Hooks and Circle Hooks in the Florida Recreational and Recreational-for-Hire Fisheries	Burns and Froeschke
SEDAR31-RD50	Circle Hook Requirements in the Gulf of Mexico: Application in Recreational Fisheries and Effectiveness for Conservation of Reef Fishes	Sauls and Ayala

Independent Peer Review Report SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

By

Jean-Jacques Maguire

Center for Independent Experts (CIE)

June 2013

Executive Summary

The SEDAR 31 process was plagued with delays and the process did not result in an agreed assessment prior to the Review Workshop. The Review Panel decided to proceed with the workshop to try to be helpful to the process but all Review Panel members were seriously concerned that due process had not been followed.

Most data decisions made by the Data and Assessment Workshops were generally sound and robust. However, as several of those had to be changed by the Assessment Workshop, it is clear that they were not all sound and robust. While there are no obvious reasons to think that the input data in the model at the end of the review workshop are not sound and robust, there was insufficient documentation to categorically state so. Data generally were applied properly and uncertainty in data inputs was appropriately acknowledged. Data have been changed by the Assessment Workshop and also by the Analytical Team. However, documentation of methods for these changes was lacking or absent. While it is likely that input data series are reliable and sufficient to support the assessment approach and findings, it is not possible to categorically say so because of the scant documentation available in the incomplete Assessment Report.

SS3 is appropriate for the data and the results appear to be robust. However, while SS3 is a highly flexible assessment tool, it is also highly structured with many options and built-in assumptions. As a result, it is sometimes difficult to ascertain the most important influence on the assessment results: the data or the assumptions in the model; the latter may be the case for red snapper as little changes in results were observed in the various sensitivity cases discussed below. The red snapper SS3 assessment is likely to be properly configured and used consistent with standard practices. However, given the scant documentation in the Assessment Workshop report, and the changes in model configuration and results it is not possible to be absolutely affirmative that the model is properly configured and used consistent with standard practices. More complete documentation, to be reviewed and approved by a group similar to the Assessment Workshop, would be required.

Because i) the Assessment Report was provided to the Review Panel much past the deadline and only 3 days before the Review Workshop, ii) the Assessment Report was seriously incomplete and iii) the assessment was still evolving at the end of the Review Workshop, the Review Panel cannot either accept or reject the findings of this assessment.

The Review Panel did not find that the abundance, exploitation and biomass estimates were reliable or that they should be used for inferences on stock status, although based on the model fits, they were more or less consistent with the biological characteristics of the stock. The Review Panel did not find evidence to reject the assessment results during its review activities, nor did it find evidence to recommend changes to the corrected base model run. However, given the inadequacy of the review process the Review Panel is not able to endorse the results of this assessment. Determinations of stock status and proxies for MSY were not provided in the incomplete Assessment Report and were not

determined during the Review Workshop. The Review Panel does not believe the SR curve is sufficiently reliable to be used for the evaluation of productivity and future stock conditions, particularly for spawner biomasses well outside the range of those available in this time period. Quantitative estimates of status determination criteria were not provided in the assessment workshop report and were not determined during the review workshop.

The deterministic projections were done directly from SS3 following accepted practices and consistent with available data. The projections may be informative for the whole stock but not for the individual east and west components. The projections assume that the recruits will distribute between the two areas according to the long term average of 35% East:65% West which is unlikely to happen. The projections were deterministic and while some uncertainties were discussed in the presentation, they were not acknowledged, discussed or reflected in projections results in writing. Stochastic projections were not completed in time for inclusion in the Assessment Workshop report or discussion at the Review Workshop.

The potential consequences of uncertainties in the assessment have not been presented, as only deterministic projections had been completed. This Review Panel is concerned that the reported uncertainties on quantities of interest are a consequence of the assumed (and fixed) observation variance parameters. No clear evidence of the appropriateness of these assumed values has been presented.

Background

SEDAR 31 was a compilation of data, a benchmark assessment of the stock, and an assessment review conducted for Gulf of Mexico red snapper. The review workshop is intended to provide 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 stock assessed through SEDAR 31 is within the jurisdiction of the Gulf of Mexico Fishery Management Council and the state waters of Texas, Louisiana, Mississippi, Alabama, and Florida.

The SEDAR 31 process was plagued with delays. While Center for Independent Experts (CIE) reviewers are not personally aware of the details and reasons for the delays, we were told that the delays started with the Data Workshop in August 2012. The physical Assessment Workshop was held in Miami in December 2012. It reviewed and changed several of the input data that were agreed at the Data Workshop but later found to have problems. The changes in input data are listed in the draft assessment document, but not explained in any detail. Because it had to review and correct inputs that were supposed to have been agreed at the Data Workshop, the Assessment Workshop was unable to complete its work during the physical meeting and eight webinars had to be held. This process, however, did not result in an agreed assessment prior to the Review Workshop.

The CIE Statement of Work specifies that "*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*" with April 14, 2013 as the deadline for the pre-review documents. CIE reviewers independently enquired about the availability of the pre-review documents with the SEDAR contact point on several occasions, but it was only on Friday April 26 in the morning, three days before the start of the Review Workshop on April 29, that a seriously incomplete Assessment Workshop report was received. The draft incomplete Assessment Report had been sent to the Assessment Workshop panel on Thursday morning April 25. The Assessment Panel was given less than 10 hours to comment; no comments were received.

At the beginning of the meeting, the Review Panel discussed how best to proceed given the delay in receiving the material, the incompleteness of the report and the expected continued evolution of the assessment. We were advised that we were under no obligation to proceed with the review and that cancelling the workshop was an option. A consensus was quickly reached that we should proceed with the workshop to try to be helpful to the process, but that this would not be a review workshop in the traditional SEDAR sense. We also agreed that we would reserve judgment on whether to accept or reject the assessment until later in the week. But it was clear that all Review Panel members were seriously concerned that due process had not been followed and that given the available documentation it would be difficult to thoroughly review the assessment.

The Analytical Team continued to work on the assessment during the weekend of April 27-28. At the start of the review workshop on April 29, the panel was informed that an error had been found in the assessment partially documented in the draft Assessment Document; this resulted in a new Base Case which was presented in PowerPoint slides. Descriptions of the model changes, as well as some of the details of the model configuration were provided to the Review Panel verbally during the meeting. The absence of written documentation significantly hindered the review process. The review panel agreed to evaluate the results of the new base case and consider the sensitivity runs suggested by the Assessment Workshop (including webinars).

Description of the Individual Reviewer's Role in the Review Activities

After enquiring a few times with the SEDAR contact person on when to expect to receive the Assessment Report, I read the webinar summaries and listened to a few of the recent webinars. I reviewed parts of the Data Report and some background documents. Once I received it, I reviewed the Assessment Report and found it to be severely incomplete and to contain numerous errors. I participated in the discussions of the Review Panel and drafted sections on methods and stock projections. I reviewed the Review Panel's draft report and provided comments to the chair and other participants. In my report below I have used material from the Review Report with modifications and additions. None of the modifications are in disagreement with the Review Report; they are simply

expressing the same ideas slightly differently. The additions have not been systematically placed at the end or at the beginning of the ToR.

Findings

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

- **Are data decisions made by the Data and Assessment Workshops sound and robust?**

Most data decisions made by the Data and Assessment Workshops were generally sound and robust. However, as several of those had to be changed by the Assessment Workshop, it is clear that they were not all sound and robust. While there are no obvious reasons to think that the input data in the model at the end of the review workshop are not sound and robust, there was insufficient documentation to categorically state so.

- **Are data uncertainties acknowledged, reported and within normal or expected levels?**

Likewise, data generally were applied properly and uncertainty in data inputs was appropriately acknowledged. The incomplete Assessment Report did not contain a full description of data inputs or how they were changed after the Data Workshop. Some data inputs were further changed by the Analytical Team following the submission of a seriously incomplete Assessment Report to the Review Workshop. These changes typically were presented to the Review Workshop in PowerPoint files that were projected to a screen in the meeting room. However, documentation of methods for these changes was lacking or absent.

- **Are data applied properly within the assessment model?**

Natural Mortality

The linear regression model approach developed by Hoenig (1983) to predict mortality from maximum observed longevity was used to estimate the average instantaneous natural mortality (M) over the life span of red snapper. The resultant estimate of M was used to rescale the Lorenzen relationship of declining M with age for ages >2 yr such that mean M on the exploited ages was equal to the lifespan M estimated with the Hoenig (1983) method.

The oldest age estimate in the data was 57 years and the Assessment Panel indicated the oldest fish that "had been validated by bomb radiocarbon dating was 38 years old." Instead of using either 57 or 38 yr as the estimate of maximum longevity, the Assessment Panel chose the midpoint (48 yr) between 38 and 57 yr to compute M with the Hoenig (1983) approach. The Review Panel questioned why 57 yr was not used as the estimate of maximum longevity given that the bomb radiocarbon method is not used to estimate the age of a given fish but instead is a method to validate annual opaque zone formation in otoliths. It should be further noted that annual opaque zone formation in red snapper otoliths has been validated or verified with a

variety of methods. The choice of the Assessment Panel of 48 years as the "typical" oldest age for red snapper in the Gulf of Mexico is reasonable.

Natural mortality at age is a fixed vector in the Stock Synthesis (SS3) model. MacCall (extended abstract in Brodziak et al. 2011) estimated the CV for Hoenig (1983) method estimates of M to be 0.54. This estimate could be incorporated into the model structure to allow M at age to vary accordingly.

Fish age is advanced one year on January 1 as the default in SS3, thus age-specific M values were adjusted to account for this given that mean birth date of red snapper is estimated to be July 1. It would be less subject to cause error to modify the code of SS3 such the birth date is taken into account and that M does not have to be manually adjusted to account for a birth date different from Jan. 1.

Growth

The Assessment Workshop re-estimated the von Bertalanffy growth function (VBGF) computed during the Data Workshop after it was discovered that the VBGF presented in the Data Workshop Report was estimated with size-at-age data collected only during 2009-2011. The VBGF was re-computed with the same methods but with data collected during 2003-2011 (Fig. 1), where 2003 was the first year in which maximum TL (i.e., the measure of length used in the assessment) was recorded for red snapper.

The new growth parameters are L∞ (max TL cm) = 85.6 cm, k = 0.192 y-1, t0 = -0.395. Like M, the growth curve was adjusted to account for the manner in which SS3 treats age. This was accomplished by adding 0.5 to t0, thus offsetting predicted size at age by 0.5 yr. The fit of the VBGF to the data (Fig. 1) appears to underestimate size at age for older (>25) fish, which is likely to affect the estimates of stock productivity.

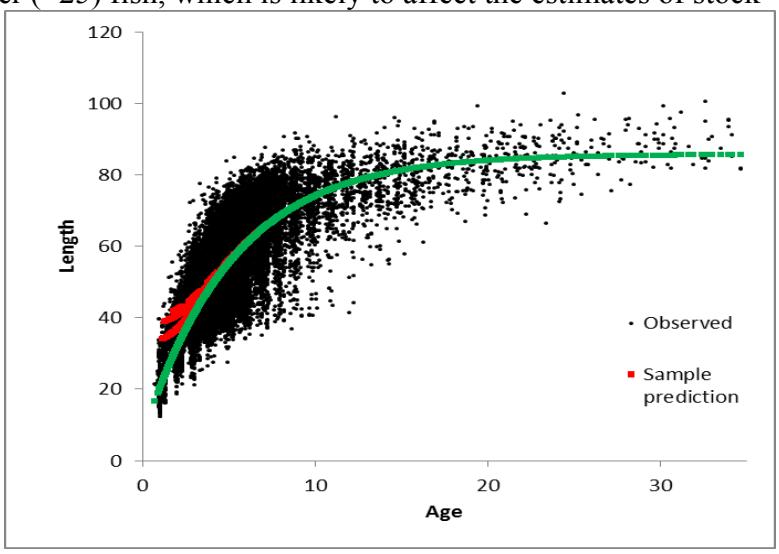

Figure 1: . Size at age data for red snapper aged by counting opaque zones in sagittal otoliths. The green line is the von Bertalanffy growth function fit to the data. See text for model parameter estimates.

Reproduction

Annual fecundity at age estimates were computed by Porch et al. (2013) for use as data inputs in the assessment model. However, the incomplete Assessment Report

contains no review of this methodology and the Review Panel was unable to review it either given time constraints.

Commercial Discards

Following the Assessment Workshop an issue was discovered with the analysis used to estimate commercial discards during the IFQ period (2007-2011). As a result, commercial discards were re-estimated for that time period.

Shrimp Trawl By-catch

The Assessment Workshop noted that trawl by-catch of juveniles was poorly estimated with the method proposed by the Data Workshop with large variances in all years. Instead of using direct estimates of by-catch as a model input, the Assessment Workshop decided to estimate shrimp trawl by-catch using the median of the annual by-catch estimates (1972-2011) from the Bayesian shrimp by-catch analysis (Linton 2012) and annual shrimp effort. This method was reviewed and used during SEDAR 28 (SEDAR 2013a, 2013b), but was not reviewed by the current Panel due to time constraints and scant specific documentation.

Fishery-independent survey length composition

The incomplete Assessment Report contains a description of how length data were combined among results of ROV studies from the northeastern Gulf. Further details of the method are provided in Walter et al. (2013). However, it is unclear from the incomplete Assessment Report how these data were actually incorporated into the assessment model.

Commercial Age Composition

The Assessment Workshop reweighted the age frequency distributions of commercial age composition by length frequency distributions to correct for disparities observed prior to 2000 (Chih 2013). This change seems appropriate.

The age composition of commercial discards for both the open and closed seasons was estimated separately for the eastern and western Gulf by applying age-length keys to length frequencies estimated from commercial observer data. The Assessment Workshop did not include western Gulf longline discard age composition given low sample sizes, which was deemed appropriate by the Review Panel.

Recreational age composition

The Assessment Workshop reweighted the age frequency distributions of recreational age composition by length frequency distributions to correct for disparities observed prior to 2000 (Chih 2013). This change seems appropriate.

Headboat discard age composition for the eastern Gulf was constructed by applying age-length keys to the length frequencies from the commercial observer program. Separate age-length keys for the eastern and western Gulf were used, which included length and age data from both commercial fisheries and recreational fisheries.

Abundance Indices

There is little information contained in the incomplete Assessment Report on the indices of abundance employed as data inputs in the SS3 model. However, the

indices were described either in the Data Report or in supplementary materials provided to the SEDAR 31 Panels. Typically, delta-lognormal models were computed to estimate relative abundance indices for red snapper while controlling for various sources of variance on abundance estimates (Lo et al. 1992). This is a standard approach although constructed indices were not reviewed in the incomplete Assessment Report. The Marine Recreational Fishery Statistics Surveys / Marine Recreation Information Program (MRFSS/MRIP) and headboat indices of abundance were constructed with a censored regression approach to account for changes in bag limits over time. They were specified in the SS3 model as fishery-independent surveys and not linked to their corresponding fishing fleets. This was done because they index total removals and not just landed catch. However, they were linked to the recreational fleets by mirroring selectivity patterns estimated for those fleets.

Discard Mortality

The meta-analysis approach described in the incomplete Assessment Report was used to estimate red snapper discard mortality rates for the commercial and recreational fisheries. Two time periods were specified for each sector: before and after the 2008 requirement to vent all live discards. The Review Panel noted that the pre-2008 (comm no vent) model fit to the commercial discard mortality data actually passed through the scatterplot of the data while the post-2008 (comm vent) model was fit well below existing commercial data (Fig. 2). A similar pattern was observed for the recreational fits in that pre-2008 model (rec no vent) passed through the center of the recreational discard mortality data while the post-2009 model (rec vent) was fit well below the majority of the discard morality at depth observations (Fig. 2). Time constraints precluded a more rigorous review of the meta-analytical approach used to estimate release mortality, but the Review Panel questioned if the post-2008 release mortality at depth functions were overly optimistic with respect to the probability a fish would survive catch and release.

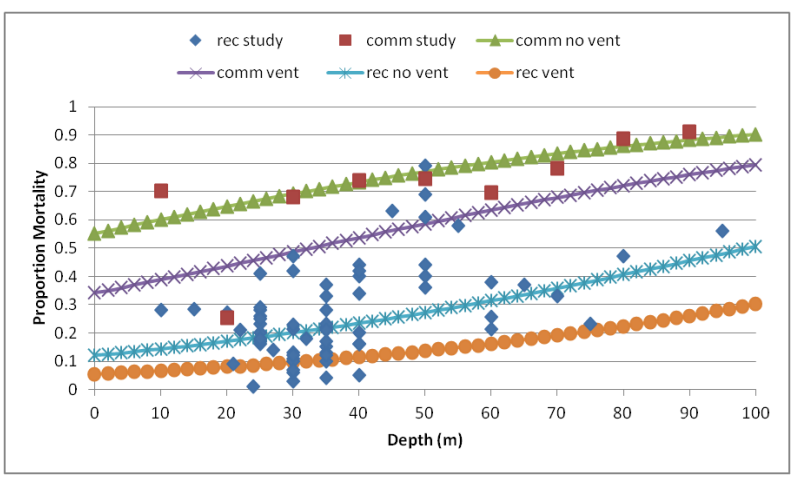

Figure 2: Result of the meta-analysis used to estimate release mortality of red snapper caught and released in the commercial (comm) and recreational (rec) red snapper fisheries. See text for details.

The Review Panel was concerned with the application of release mortality at depth models to the recreational fishery. Data collected by the iSnapper program were employed as proxies for average fishing behavior of the entire recreational fishery.

The appropriateness of this was questioned given that program participants were primarily charterboat captains and there were only 28 participating vessels during the study period (2011-12). However, the incomplete Assessment Report indicated that the average depths calculated from iSnapper data were similar to depths reported by recreational fishers at the Assessment Workshop and Webinars.

- **Are input data series reliable and sufficient to support the assessment approach and findings?**

Figure 3 below shows recreational landings since 1950 increasing steadily until the early 1980s then becoming more variable as yearly estimates become available. Data prior to the early 1980s are derived from steadily increasing estimates of effort over that time period. This is likely based on some observations and some assumed growth rate as it is not clear that recreational fishermen were more numerous or had more leisure time in the 60s and 70s than in the 80s and 90s. Yearly landings during 1950 to 1980 would also be expected to show yearly variability similar to that observed since the early 1980s instead of the smooth pattern in Figure 3.

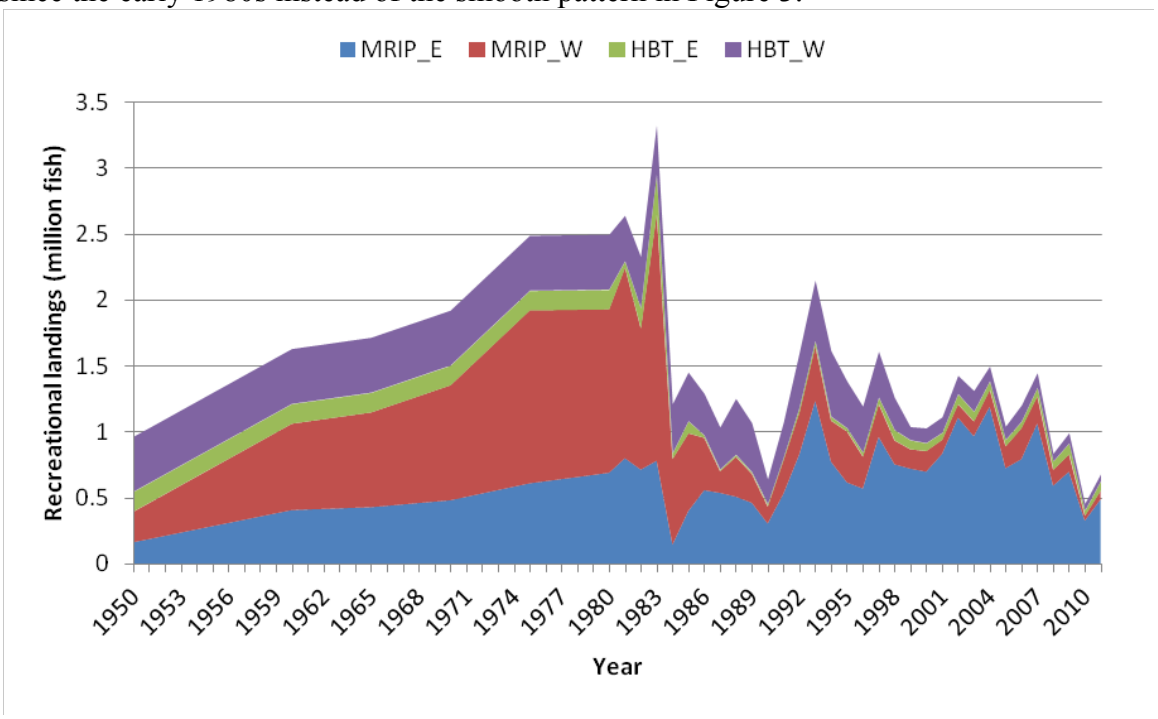

Figure 3: Slide 52 from file "SEDAR31_RW_DataInputs_4-25-13.ppt" showing recreational landings.

The handline fishery generally catches the largest proportion of Gulf red snapper but the fishery dependent index of stock size for this fleet stops in 2006. A new index was supposed to be calculated for the 2007-2011 period, but this was not possible.

The incomplete Assessment Report documents what data they agreed to change and what data were used (up to further changes later on if any), but does not always document the reason(s) for the change (page 6). For example, on page 12 "an issue was discovered with" the discard analysis, but there is no explanation of what the issue is. In other instances (page 13, discards in the longline fishery in the West) the reason for changing decisions made at the Data Workshop is given.

While it is likely that input data series are reliable and sufficient to support the assessment approach and findings, it is not possible to categorically say so because of the scant documentation available in the incomplete Assessment Report.

2. Evaluate the methods used to assess the stock, accounting for only the available data:

- **Are the methods scientifically sound, robust, and appropriate for the available data?**

The assessment uses Stock Synthesis 3 (Methot and Wetzel in prep), implemented as SS3, in the NOAA Fisheries Toolbox (http://nft.nefsc.noaa.gov/SS3.html). SS3 is scientifically sound and easily available on the NFT website. It is widely used on the west coast of the USA and it is increasingly used on the east coast as well as in several assessments of the International Council for the Exploration of the Sea (ICES) in the northeast Atlantic. The r4ss software (www.cran.r-project.org/web/packages/r4ss/index.html) was used to summarize and graph the SS3 outputs and to conduct the parametric bootstrap.

ICES (2012) classified SS3 as an Integrated Analysis model describing this class of model as tending "*to be highly general with regard to the types of data that can be included and, on the whole, they strive to analyze data with as little pre-processing as possible, for example using length composition data and information in the age-length key directly, rather than inputting the derived age composition data to the model*". ICES (2012) suggest that age-structured production models and statistical catch at age models can be considered special cases of Integrated Analysis models. The current implementation for red snapper started with using both length and age composition, but ended up using only the age composition.

SS3 is appropriate for the data and the results appear to be robust. However, while SS3 is a highly flexible assessment tool, it is also highly structured with many options and built-in assumptions. Because of its structure and underlying assumptions, SS3 can provide stock estimates and fisheries management benchmarks even when very little data are available, which is not the case for red snapper. It is also sometimes difficult to ascertain the most important influence on the assessment results: the data or the assumptions in the model; the latter may be the case for red snapper as little changes in results were observed in the various sensitivity cases discussed below.

- **Are assessment models properly configured and used consistent with standard practices?**

The red snapper SS3 assessment is likely to be properly configured and used consistent with standard practices as both Rick Methot, the developer of the stock synthesis assessment approach, and Ian Taylor who has been closely involved in the development of the software have been regularly called upon throughout the process of migrating from CATCHEM, the previous assessment model, to SS3 for this stock assessment.

At first, SS3 was fitted to length composition, but fitting quickly moved to ages as the

sampling is trying to obtain representative samples of the age composition, not of the length composition.

However, the model results presented in PowerPoint presentations to the panel during the Review Workshop differed substantially from those included in the incomplete Assessment Report sent to the panel three days before the Review Workshop. Given the scant documentation in the Assessment Workshop report, and the changes in model configuration and results it is not possible to be absolutely affirmative that the model is properly configured and used consistent with standard practices. More complete documentation, to be reviewed and approved by a group similar to the Assessment Workshop, would be required.

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

Because i) the Assessment Report was provided to the Review Panel much past the deadline and only three days before the Review Workshop, ii) the Assessment Report was seriously incomplete and iii) the assessment was still evolving at the end of the Review Workshop, the Review Panel cannot either accept or reject the findings of this assessment.
The incomplete Assessment Report was provided to the Review Panel Friday, April 26th for the review beginning Monday, April 29th. The incomplete Assessment Report had not been reviewed by the assessment panel, it contained errors, and the documentation of the model was inadequate for a thorough review. At the start of the Review Workshop, the Review Panel was informed of an analytical error as well as a change to the model configuration compared to the description in the incomplete Assessment Report. The Review Panel was presented with a new base model run via PowerPoint. Descriptions of the model changes, as well as some of the details of the model configuration were provided to the Review Panel verbally during the meeting. Other parts of the assessment, including proxies for MSY, sensitivity analyses, retrospective analyses and projections of future conditions were presented to the Review Panel verbally and by PowerPoint as they were developed throughout the workshop. However, by the end of the workshop, the Review Panel had not seen a fully completed and documented assessment. The Review Panel considered that the extremely tight timing, mode of communication and incompleteness of the documentation significantly hindered the review process

Notwithstanding, the Review Panel was very impressed with the performance of the Analytical Team. It was very clear that the Analytical Team had put considerable thought into the development of the assessment model. It was also clear from their responses to questions about the assessment that they understood the data inputs and the model very well. In addition to completing the assessment, they willingly completed additional sensitivity runs and provided further information requested by the Review Panel. Without these efforts, a review of any sort would not have been possible.

- **Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support inferences on stock status?**

The Review Panel did not find that the abundance, exploitation and biomass estimates were reliable or that they should be used for inferences on stock status, although based on the model fits, they were more or less consistent with the biological characteristics of the stock.

As configured, nearly all of the life history parameters, including natural mortality, growth, weight-length relationships, fecundity, and the steepness of the stock-recruitment (SR) relationship were constants in the model. Of the life history parameters, only the virgin recruitment (R0) for two time periods, together with deviates around the model for the more recent, data-rich time period, were estimated. The model was constrained to fit to the landings closely, such that with the exception of discards, removals from the population were assumed to be well known (but not their age distributions in the data-rich time period). As such, the model primarily scales the overall population size up or down using the R0 parameters while allowing for annual variability in recruitment. Based on analyses carried out at the Review Workshop, the model results for the recent time period apparently show little sensitivity to different weightings of the index and age-composition data, but do show some sensitivity to assumptions about fixed values such as natural mortality and steepness. The Review Panel, therefore, questioned if model results are being informed by the data inputs or by the assumptions made when setting up the model. The model results for the earlier time period were more sensitive to these assumptions. It would therefore be useful to include a feature in SS3 to show the contribution of each data source to the objective function as ASAP2 does (Figure 4 below).

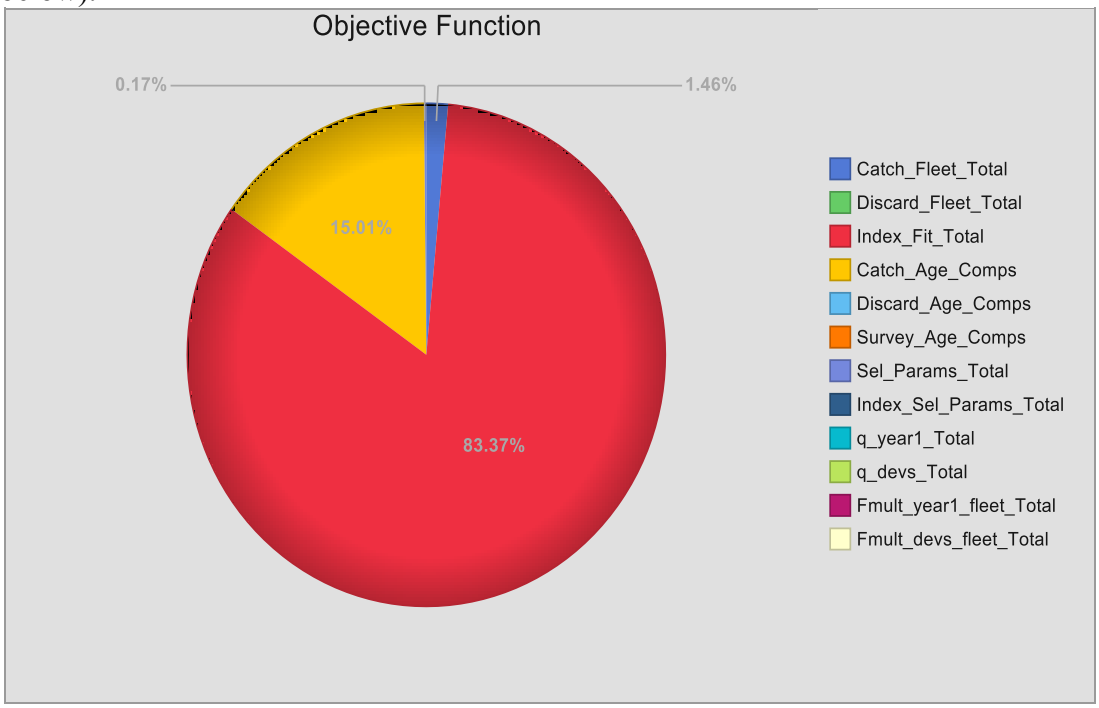

Figure 4: Illustration of how ASAP2 shows the contribution of each data source to the objective function.

A retrospective analysis for the corrected base model was provided by the Analytical Team. Although the retrospective analysis did not show a systematic bias, it did appear to indicate that the model could provide different abundance estimates with the inclusion of data for additional years. On the biomass scales starting at B0, the differences in these estimates are small and would not lead to large differences in conclusions about the depletion of the stock (Figure 5). However, on the scale of the abundances estimated for the more recent time period these differences are more significant. For example, the estimate of the spawning biomass in the west in 2008 in the retrospective analysis increased by more than 50% when estimated using data to 2010 (Figure 6). The estimate of 2008 spawning biomass in the west then decreased by 15% with the inclusion of the 2011 data. This issue appeared to be greater in the west than in the east.

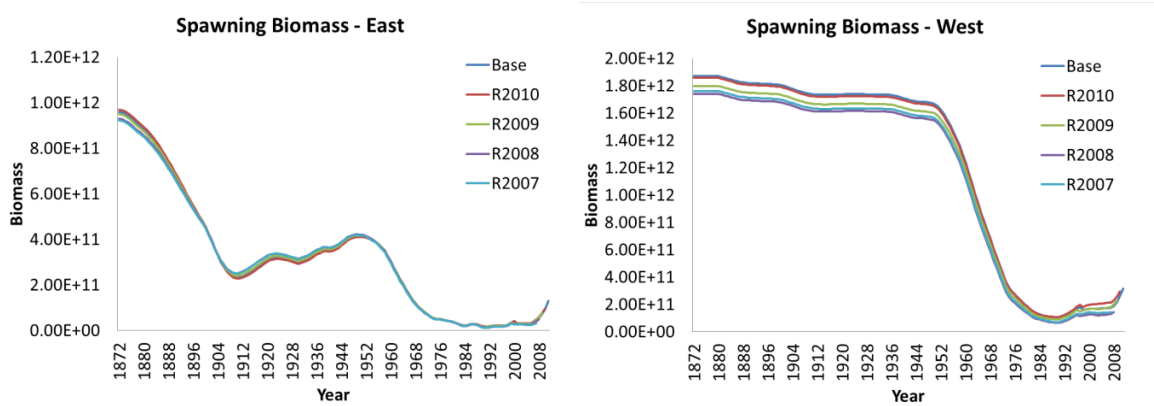

Figure 5: The retrospective analysis of the corrected base model from 1872 to 2011.

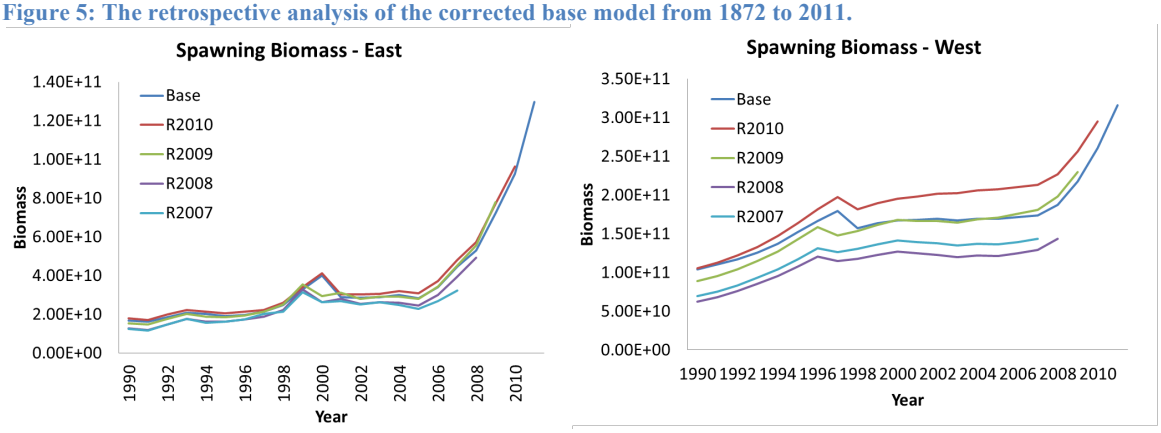

Figure 6: The retrospective analysis of the corrected base model showing the results from 1990 to 2011.

The Review Panel noted that despite having relatively large variances for many of the annual index values, the model was constrained to fit to the point estimates relatively well, and therefore did not fully capture the uncertainty in these indices. The implications of this decision are discussed under ToR 5 below.

Discard rates and discard mortality, particularly in the recreational fisheries, are not well known, and for some years and modes the fits to the discard data are poor. This

led the Review Panel to question whether this source of mortality is quantified appropriately in the base model run.

As indicated above, the Review Panel was not able to fully review the model, including the uncertainties in model results. Therefore, the Review Panel is not able to state whether the abundance, exploitation and biomass estimates are reliable. The Review Panel, however, considers that these estimates should not be used for inferences about stock status or as a basis for management decisions until a review has been completed using complete documentation. Although model results appear to be more or less consistent with the biological characteristics of the stock, there may be other sets of parameter estimates that could also appear consistent. The Review Panel recommends 1) that an addendum similar to the Assessment Workshop report is completed to fully document the assessment methods and results; 2) that this addendum is sent to the Assessment Panel for review and endorsement, and 3) that this report undergoes a further round of peer review.

Notwithstanding, the Review Panel did not find evidence to reject the assessment results during its review activities, nor did it find evidence to recommend changes to the corrected base model run. However, given the inadequacy of the review process the Review Panel is not able to endorse the results of this assessment.

- **Is the stock overfished? What information helps you reach this conclusion?**

Determinations of stock status and proxies for MSY were not provided in the incomplete Assessment Report and were not determined during the Review Workshop. The Analytical Team did provide information about proxies for FMSY midway through the review workshop which were discussed in general but did not lead to conclusion. Two topics were discussed: the use of a marginal F when calculating a proxy for FMSY and whether a %SPR proxy for FMSY should be based on the assumed steepness in the assessment model, or whether some other value should be used.

The marginal F approach accounts for the reality that fishing effort for all fleets cannot be controlled, specifically the effort in the shrimp fishery effort and in the closed season. Fishing mortality for the fisheries that can be controlled is scaled up proportionally to find the F corresponding to the appropriate %SPR, conditioned on the assumed shrimp and closed season effort series. Overall, the Review Panel tentatively agreed with the Analytical Team that this is a reasonable approach. The Analytical Team also showed how yield would change in response to changes in the fisheries that are not being specifically regulated for red snapper by-catch.

The Review Panel suggested that there may not be strong enough evidence to warrant a change from the %SPR values currently being used or from the default value because 1) the steepness value is assumed, 2) there is limited contrast in spawner biomass time series for estimating the spawner-recruit parameters, 3) recruitment for the entire stock has decreased during the last two years and was low even though spawner abundance has been increasing, and 4) there is evidence of a more complex population structure than is being modeled.

- **Is the stock undergoing overfishing? What information helps you reach this conclusion?**

Determinations of stock status were not provided in the assessment workshop report or determined during the review workshop. Proxies for FMSY were discussed, as described in the section above.

- **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 questioned whether the stock-recruitment relationship was informative, particularly over a wide abundance range. As discussed in the Data Report, the Life History Working Group continued to support the two stock model for Gulf red snapper. However, recent genetic otolith chemistry and oceanographic results suggest that red snapper have a meta-population structure and exhibits independent demographic structuring on small spatial scales. Additionally, there are oceanographic mechanisms that transport red snapper larvae from the western to the eastern Gulf during the summer, with evidence for exchange from east to west during September and October. Some areas are unlikely to be enhanced by larval drift, whereas in other areas larvae are likely to be entrained. Variation in localized productivity is not known. This type of recruitment dynamics would be extremely difficult to model and simplifying assumptions have to be made.

The model used a single stock-recruitment relationship that included annual deviates in the more recent, data-rich, time period, and that also included a time-varying parameter that distributed the recruits between the two areas. As described at the Review Workshop, the decision to model recruitment in this way was made, at least in part, because SS3 could deal with stock-recruitment relationships in the two areas.

With a steepness parameter near one, SS3 can model the recruitment of the two stocks as if they were separate demographic units, but at lower steepness values, recruitment to the two stocks is not independent and potentially would not work well if one of the stocks was depleted. Likelihood profiling of the steepness parameter indicated a steepness value near one and this parameter was fixed at 0.99.

Recruitment at virgin SSB (R0) was modeled as a time varying process for two blocks of time: one from 1872 to 1984, and one from 1984 to present. Random derivates around the SR relationship were included from 1972 to 2011, the years for which a year class signal can be estimated. The sigma parameter for the relationship was fixed at 0.3. In SS3, sigma is typically set to 0.6, thereby allowing for more variability in recruitment, but this led to biologically implausible model results with the Eastern stock collapsing. A near collapse of the Eastern stock occurred in the late 1980s - early 1990s and an intermediate value could be tried.

The SR relationship for the more recent time period is shown in Figure 7. The Review Panel noted two issues with this model:

1) the first five years of data are not fitted well and the SR relationship appears to shift beginning in 1989, one year before the beginning of the commercial discard time series in 1990. The Analytical Team explained that a similar pattern was

evident in SEDAR 7 (which didn't include the discard time series) and that the cause for this apparent shift in recruitment was more likely a signal in the age frequency data;

2) the range of spawner biomasses available in the time period is very small. The estimated B0 from the corrected base model is 4.71e+12 eggs, whereas the model estimated spawner biomasses during this time period range from about 1.21e+11 to about 4.45e+11 eggs. As such, the range of spawner biomasses available to estimate R0 spans about 7% of the range from 0 to B0, and all values are towards the lower end of the range.

The Analytical Team attempted to address this issue by using historical data to extrapolate back to the inception of the fishery, but this is subject to great uncertainty since a selectivity pattern needs to be assumed and not all removals from the population are accounted for. Additionally, although spawner abundance is highest during 2010 and 2011, these years have lower recruitments. While it is not known whether these represent non-stationarity in the spawner-recruitment relationship due to environmental change within the Gulf or whether recruitment was lower in these years for some other reason, they do introduce a further element of uncertainty into projections carried out using the estimated relationship.

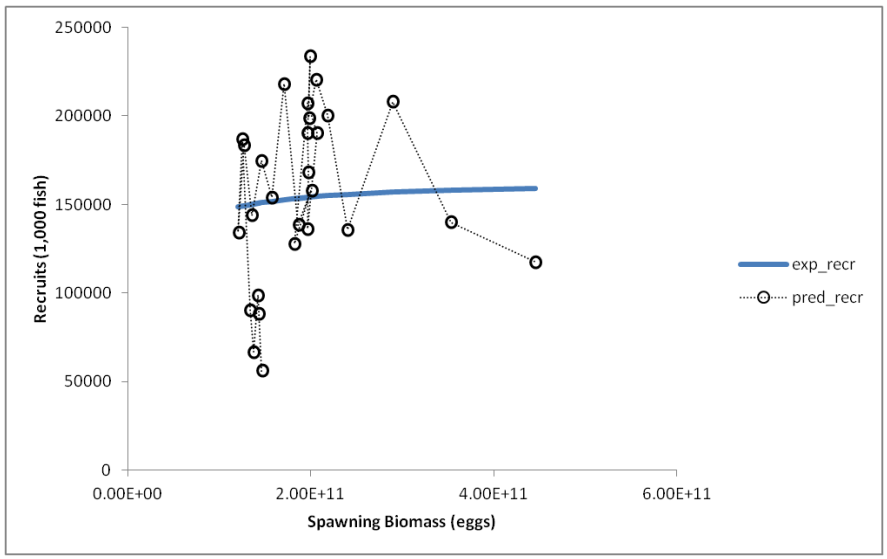

Figure 7: The stock-recruitment relationship for the 1984-2011 time period for the corrected base model presented at the review workshop. The most recent value is furthest to the right.

The Review Panel does not believe the SR curve is sufficiently reliable to be used for the evaluation of productivity and future stock conditions, particularly for spawner biomasses well outside the range of those available in this time period.

The Analytical Team was planning on running separate East and West models to be able to continue to have stock-recruitment relationships specific to each area, but this was not possible. This was mentioned during one of the PowerPoint presentations and not discussed. This could be an indication of a serious problem if the reason for not being able to run separate East and West models is that the models did not converge

when run separately. If the reason is lack of time, it may not be a serious problem. If lack of convergence is the reason this should be further investigated.

- **Are quantitative estimates of 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?**

Quantitative estimates of status determination criteria were not provided in the assessment workshop report and were not determined during the review workshop.

4. Evaluate the stock projections, addressing the following:

- **Are the methods consistent with accepted practices and available data?**

The deterministic projections were done directly from SS3 following accepted practices and consistent with available data.

Projections were run assuming that selectivity, discarding, and retention were the same as the three most recent years (2009-2011). Recruitment deviations for the projection period were derived from the stock-recruitment relationship and did not include inter-annual variation. Catch allocation used for the projections reflects the average distribution of fishing intensity among fleets during 2009-2011. Provisional landings data were used for the eight directed fleets for 2012 (commercial handline, commercial longline, recreational, and headboat). For the six by-catch fleets (commercial closed season, recreational closed season, and shrimp by-catch) removals for 2012 were assumed to be equal to removals in 2011.

- **Are the methods appropriate for the assessment model and outputs?**

As indicated above, the stock projections were done directly in SS3 and the method is thus appropriate for the model and output. The standard projection approach however had to be tweaked to account for changing F's in the directed fisheries.

- **Are results informative and robust, and useful to support inferences of probable future conditions?**

The projections may be informative for the whole stock but not for the individual east and west components. The projections assume that the recruits will distribute between the two areas according to the long term average of 35% East:65% West which is unlikely to happen. This would be particularly problematic if the recent steep decrease in recruitment to the East continues but there is no way of predicting what the proportions will be in the future. Recruitment of future year classes has been assumed to follow the pattern described by the stock-recruitment relationship which is unlikely to occur.

- **Are key uncertainties acknowledged, discussed, and reflected in the projection results?**

The projections were deterministic and while some uncertainties were discussed in the presentation, they were not acknowledged, discussed or reflected in projection results in writing. Stochastic projections were not completed in time for inclusion in the Assessment Workshop report or discussion at the Review Workshop.

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.**

The potential consequences of uncertainties in the assessment have not been presented, as only deterministic projections had been completed. However, the incomplete Assessment Report supplies a table (Table. 3.1.1.2) of model parameter estimates with corresponding standard deviations derived from the inverse Hessian matrix of the objective function at its minimum. This is a standard output based on a quadratic approximation. The rationale is that if the assessment model correctly describes the distribution of the observations (including their uncertainties), then those uncertainties are propagated to an uncertainty estimate for the estimated quantities of interest.

The Review Panel noted that the variance parameters were fixed to chosen values that could be considered arbitrary. For instance, the maximum sample size for the age composition data was set at 200 fish, which implies a certain variance in the assumed multinomial distribution. Likewise, landings were assigned a small standard error of 0.05, and the discard time series were assigned a large CV of 0.5. According to the incomplete Assessment Report (pages70-80) and discussions with the Analytical Team these values were chosen partly to obtain a certain relative weighting of the different sources of information, and partly from practical experience with the use of SS3. These values are not derived from data, but assigned subjectively, and hence the uncertainties propagated to the final estimates of interest will be subjective as well.

If the relative weightings for the separate sources of information are assigned correctly the point estimates should be correct, but not necessarily the estimates of uncertainty. Getting the correct uncertainty estimates requires the actual values for each of the assigned observation variance parameters to be set correctly. Judging from the magnitude of the supplied Pearson residual plots (e.g. figure 3.2.1.48, 2.3.1.60, and 2.3.1.66 of the incomplete Assessment Report) the distribution of the observations are not fully described.

In addition to the Hessian-based standard deviations, a parametric bootstrap simulation was presented at the Review Workshop. In a parametric bootstrap, multiple independent data sets are simulated according to the assumptions in the model, and estimation is carried out for each data set. Parametric bootstrap is an excellent tool for validating the model implementation, and to obtain a simulation-based—albeit otherwise exact—error propagation. The bootstrap simulation showed very consistent model outputs for all the simulated cases, and no problematic biases. However, the bootstrap simulations do not address the subjectivity of having uncertainty parameters directly specified (i.e., not estimated from the data). Instead of sampling new data sets based on the model assumptions, an alternative would be to simulate new data sets from the existing data sets, e.g. by re-sampling the residuals.

Certain data sources (e.g. natural mortality, maturity, and discard mortality) are included in the model as known inputs. This is common practice in assessment models, and some of these uncertainties would be picked up as larger observation uncertainties, if the observation uncertainties were estimated. A common approach for assessing the effect of such inputs is sensitivity analysis, where a few scenarios of selected high and low values are used as inputs to illustrate the effect on the quantities of interest. A wide range of sensitivity runs were presented during the review meeting (e.g., different natural mortality, age error, and removal of select indices). The overall conclusion was that changes were seen in the historic period (prior to ca. 1972), but in the recent period the model results were relatively consistent. This caused some concern, as for instance changing natural mortality would be expected to influence the estimates of fishing mortality. Also, some of the results were counterintuitive: using the alternate M vector resulted in higher recruitment but lower biomasses. This may have been a plotting error. Overall, all the sensitivity runs examined showed very little change in stock trajectory. This led me to the conclusion that model results seem to be robust to data. But one of the last sensitivity run showed that the model results are not robust to assumption: changing the steepness parameter to 0.8 rather than the assumed 0.99 resulted in stock size and MSY estimates one order of magnitude larger. This suggests that alternative modeling approaches less sensitive to such assumptions should be tried (ASAP?). If catch at age is reasonably reliable, a VPA approach could also be tried to get an order of magnitude estimate for the stock.

A comparison between the current candidate model (SS3) and the model previously used for red snapper (CATCHEM) was presented at the Review Workshop. The SS3 configuration was not identical to the configuration currently proposed for red snapper, but a configuration setup to match CATCHEM. Overall the results were close, but with some differences in abundance estimates in the historic period. No attempt to quantify assessment method uncertainty was presented.

This Review Panel is concerned that the reported uncertainties on quantities of interest are a consequence of the assumed (and fixed) observation variance parameters. No clear evidence of the appropriateness of these assumed values has been presented.

- **Ensure that the implications of uncertainty in the technical conclusions are clearly stated.**

As the Assessment Report was far from complete and because the base case assessment appeared to have settled only towards the end of the Review Workshop, it was not materially possible to complete this term of reference.

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

No research recommendations were presented in the Assessment Workshop report, but several were made by the Data Workshop. Below, the Review Panel highlights

research recommendations they feel should be emphasized, as well as provide new recommendations partly based on assessment methodology and results.

- **Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments with particular emphasis on the Deepwater Horizon Oil Spill**

Age and Mortality
The Review Panel recommends that research effort be focused on the issue of ageing error, both within and among ageing facilities. A more comprehensive analysis of ageing error should permit its inclusion in the SS3 model.
There appeared to be some confusion in the Data Report as to the purpose of and resultant data from bomb radiocarbon analysis of otoliths. This method is a means to evaluate the estimated birthdate of a fish relative to the Δ14C preserved in aragonitic structures, such as corals. Radioactive 14C was enriched in oceanic waters following above ground nuclear weapons testing in the late 1950s and early 1960s. Coral skeletons reflect this enrichment by having peak Δ14C values in skeletons formed during the early to mid 1960s and then declines thereafter. If opaque zones in otoliths are formed annually, then fish estimated to have birthdates in the early 1960s should have similar high Δ14C values at the core of their otoliths. Other radio chemistry validation techniques, such as 210Pb/226Ra dating, provide estimates of absolute fish age; bomb radiocarbon analysis only provides a relative age estimate but can be used to validate opaque zone formation. Both of these age validation techniques have been applied to red snapper, along with other validation and verification techniques. In fact, no other marine fish have been the subject of as many different age validation/verification studies as red snapper. Results of these studies are overwhelming: opaque zones in otoliths are formed annually.

Growth
The Review Panel recommends further analysis on the growth function fit to size at age data from 2003-11. The fitted model included in the assessment tends to overestimate size at age for fish <5 yr, overestimate size at age for fish 5-10 yr, and underestimate size at age for fish >25 yr. Part of this results from the manner in which the model accounts for variable size limits through time. However, the Review Panel expressed concern that some of the observed variability in size at age in the data resulted from ageing error between laboratories. In the future, modeling growth with a random effects approach may be more appropriate.

Population Structure
The Review Panel reiterates various research recommendations focused on the population structure of Gulf red snapper. Hydrographic models should continue to be employed to estimate potential larval dispersal within the US Gulf, between the eastern and western US, and on smaller spatial scales. A large-scale conventional tagging study might be useful to examine post-settlement mixing both between the eastern and western Gulf and within these areas. Lastly, advances in restriction site associated DNA (RAD) sequencing mean that much more powerful genetic

population structure analysis is now possible relative to historical mitochondrial DNA or microsatellite DNA approaches applied to Gulf red snapper.

Discard Mortality

Estimation of dead discards is a product of the number of discards and the discard mortality rate, both of which are highly uncertain for red snapper. Observer data in the shrimp trawl and directed commercial fisheries enable estimates of the magnitude of discards. There are much more limited data available in the recreational fishery to estimate the magnitude of discards. There are some observer-based estimates available for the headboat and charter boat sectors, but efforts to collect those data should be expanded. Reliance on self-reported discards in the MRIP to estimate discards in the private recreational sector is problematic with no clear solution. Electronic reporting through smartphone applications does provide for instantaneous reporting of discards, but the process relies on self-reporting which has been shown to be biased in other sectors where self-reporting and observer-based estimates of discards are available.

Further research appears warranted with respect to estimating the magnitude of discards among fishery sectors, as well as providing more robust estimates of post-release mortality. Few of the existing discard mortality studies address the issue of depredation on released fish and that should be a focus moving forward. Research indicate chronic effects of barotrauma which may lead to mortality in released red snapper and studies which simply examine surface condition or submergence of released fish may grossly underestimate release mortality. Therefore, a focus moving forward should be on conducting studies that examine both depredation on released fish and chronic versus acute mortality caused by catch and release.

Episodic Mortality Events

Episodic events have the potential to impact red snapper population ecology in the northern Gulf of Mexico. Among recent and ongoing events that have this potential are hypoxia associated with plumes of the Mississippi and other northern Gulf rivers, harmful algal blooms, particularly along the west Florida shelf, and the Deepwater Horizon Oil Spill (DHOS). Potential impacts of the DHOS were discussed during the Review Workshop but little work had been done attempting to examine potential impacts in either the Data or Assessment Workshops. In fact the words "Deepwater Horizon" appear only once in the Data Report and never in the incomplete Assessment Report. Part of this issue may stem from the fact that if potential impacts were restricted to recruitment effects then an assessment model would not capture that signal until affected cohorts moved into the fishery. Future assessments of Gulf red snapper should be conducted with the explicit goal of attempting to model any enduring DHOS effects.

- **Provide recommendations on possible ways to improve the SEDAR process**

The most critical need is for timeliness in completion of tasks and reports. The SEDAR process is complex and demanding, involving scientists with diverse areas of specialization and including a large array of issues and concerns. Completion of work requirements on schedule are challenging and demanding, but the better

deadlines are met, the more efficient and productive the process can be.

More standardization of report format would be helpful. Tables and graphs of input and output data should be included in the report and made available electronically. Sections of reports are written by different individuals and groups, all of which have their own writing styles and preferences, but content of reports would be improved if each workgroup provided summaries of their results and conclusions, enumerated or in paragraph form. In addition, a more uniform identification of procedural and research issues, presented at the end of each workgroup section would be informative. Proposals and rationale for further study has potential for moving forward directly on problems that are recognized as especially important.

When the assessment model is changed, Assessment Reports should systematically include a continuity run to show the influence of the data versus the influence of the changes in the model.

Given that the Assessment Workshop analyzes the extant databases for the species under consideration, the group would be well placed to be critically aware of the needs for additional data needs. Recommendations for future research could profitably be a standard part of their SEDAR report.

As indicated above in background, the SEDAR 31 process was plagued with delays. The Assessment Workshop was not able to complete its work because it had to do work that should have been completed at the Data Workshop. Eight webinars were organized to try complete the assessments, but this is not an efficient way to proceed. Webinars have two major shortcomings: 1) they do not act as a deadline for the production of material, and 2) they do not provide a good forum for meaningful discussion. Webinars should not exceed one hour and should be held to endorse decisions or agreed on text.

Given the delays, the three CIE reviewers agreed that it would have been preferable to cancel the meeting and convene one when an agreed complete assessment would have been available.

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

The Review Panel expressed serious concerns regarding the amount of time allotted for this assessment. As noted above, the Assessment Report was provided to the Review Panel on Friday, April 26th for a review beginning on Monday, April 29th. Furthermore, the Assessment Report had not been reviewed by the assessment panel. The Assessment Report was incomplete, contained errors, and the documentation of the model inadequate for a thorough review.

The Review Panel recommends that given the data and model complexities inherently associated with stock assessment of Gulf red snapper more realistic timelines be considered for the next assessment.

CIE reviewer Anders Nielsen suggested to profile on steepness only with recent years where recruitment is estimated to see if bounds would be hit.

It might be informative to compare the by-catch in the shrimp fishery with recruitment estimates to evaluate if the by-catch does provide and index of recruitment.

As indicated above, if catch at age is considered reasonably reliable, VPA methods could be run to compare with SS3 estimates.

8. Prepare a Peer Review Summary Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report in accordance with the project guidelines.

This report constitutes my summary evaluation of the stock assessment and discussion of the Terms of Reference.

Conclusions and Recommendations

The SEDAR 31 process was plagued with delays and the process did not result in an agreed assessment prior to the Review Workshop. The Review Panel decided to proceed with the workshop to try to be helpful to the process but all Review Panel members were seriously concerned that due process had not been followed.

Most data decisions made by the Data and Assessment Workshops were generally sound and robust. However, as several of those had to be changed by the Assessment Workshop, it is clear that they were not all sound and robust. While there are no obvious reasons to think that the input data in the model at the end of the review workshop are not sound and robust, there was insufficient documentation to categorically state so. Data generally were applied properly and uncertainty in data inputs was appropriately acknowledged but data had been changed by the Assessment Workshop and also by the Analytical Team. However, documentation of methods for these changes was lacking or absent. While it is likely that input data series are reliable and sufficient to support the assessment approach and findings, it is not possible to categorically say so because of the scant documentation available in the incomplete Assessment Report.

SS3 is appropriate for the data and the results appear to be robust. However, while SS3 is a highly flexible assessment tool, it is also highly structured with many options and built-in assumptions. As a result, it is sometimes difficult to ascertain the most important influence on the assessment results: the data or the assumptions in the model; the latter may be the case for red snapper as little changes in results were observed in the various sensitivity cases discussed below. The red snapper SS3 assessment is likely to be properly configured and used consistent with standard practices. However, given the scant documentation in the Assessment Workshop report, and the changes in model configuration and results it is not possible to be absolutely affirmative that the model is properly configured and used consistent with standard practices. More complete documentation, to be reviewed and approved by a group similar to the Assessment Workshop, would be required.

Because i) the Assessment Report was provided to the Review Panel much past the deadline and only three days before the Review Workshop, ii) the Assessment Report was seriously incomplete and iii) the assessment was still evolving at the end of the Review Workshop, the Review Panel cannot either accept or reject the findings of this assessment.

The Review Panel did not find that the abundance, exploitation and biomass estimates were reliable or that they should be used for inferences on stock status, although based on the model fits, they were more or less consistent with the biological characteristics of the stock. The Review Panel did not find evidence to reject the assessment results during its review activities, nor did it find evidence to recommend changes to the corrected base model run. However, given the inadequacy of the review process the Review Panel is not able to endorse the results of this assessment. Determinations of stock status and proxies for MSY were not provided in the incomplete Assessment Report and were not determined during the Review Workshop. The Review Panel does not believe the SR curve is sufficiently reliable to be used for the evaluation of productivity and future stock conditions, particularly for spawner biomasses well outside the range of those available in this time period. Quantitative estimates of status determination criteria were not provided in the assessment workshop report and were not determined during the review workshop.

The deterministic projections were done directly from SS3 following accepted practices and consistent with available data. The projections may be informative for the whole stock but not for the individual east and west components. The projections assume that the recruits will distribute between the two areas according to the long term average of 35% East:65% West which is unlikely to happen. The projections were deterministic and while some uncertainties were discussed in the presentation, they were not acknowledged, discussed or reflected in projections results in writing. Stochastic projections were not completed in time for inclusion in the Assessment Workshop report or discussion at the Review Workshop.

The potential consequences of uncertainties in the assessment have not been presented, as only deterministic projections had been completed. This Review Panel is concerned that

the reported uncertainties on quantities of interest are a consequence of the assumed (and fixed) observation variance parameters. No clear evidence of the appropriateness of these assumed values has been presented.

The Review Panel recommends that given the data and model complexities inherently associated with stock assessment of Gulf red snapper more realistic timelines be considered for the next assessment.

CIE reviewer Anders Nielsen suggested to profile on steepness only with recent years where recruitment is estimated to see if bounds would be hit.

It might be informative to compare the by-catch in the shrimp fishery with recruitment estimates to evaluate if the by-catch does provide and index of recruitment.

As indicated above, if catch at age is considered reasonably reliable, VPA methods could be run to compare with SS3 estimates.

Webinars have two major shortcomings: 1) they do not act as a deadline for the production of material, and 2) they do not provide a good forum for meaningful discussion. Webinars should not exceed one hour and should be held to endorse decisions or agreed on text.

Given the delays, the three CIE reviewers agreed that it would have been preferable to cancel the meeting and convene one when an agreed complete assessment would have been available.

References

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Chih, C. 2013. Age frequency distributions estimated with reweighting methods for red snappers in the Gulf of Mexico from 1991 to 2011. SEDAR31-AW15. SEDAR, North Charleston, SC.

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the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, LA.

Linton, B. 2012. Shrimp fishery by-catch estimates for Gulf of Mexico red snapper, 1972-2011. SEDAR31-DW30. SEDAR, North Charleston, SC.

Linton, B. 2013a. Age composition of red snapper by-catch in the Gulf of Mexico shrimp fishery, 1997-2011. SEDAR31-AW05. SEDAR, North Charleston, SC.

Linton, B. 2013b. Shrimp trawl index of abundance for Gulf of Mexico red snapper, 1967-1989. SEDAR31-AW06. SEDAR, North Charleston, SC.

Lo, N.C.H., L.D. Jacobson, and J.L. Squire. 1992. Indices of relative abundance from fish spotter data based on delta-lognormal models. *Canadian Journal of Fisheries and Aquatic Science* 49:2515 -2526.

Porch, C., G. Fitzhugh, and B. Linton. 2013. Modeling the dependence of batch fecundity and spawning frequency on size and age for use in stock assessments of red snapper in the U.S. Gulf of Mexico waters. SEDAR31-AW03. SEDAR, North Charleston, SC.

SEDAR. 2009. Stock assessment of red snapper in the Gulf of Mexico: SEDAR update assessment. SEDAR, North Charleston, SC.

Walter, J.F., M. Drymon, W. Patterson, S. Powers, and J. Williams. 2013. A proposed methodology to incorporate ROV length data into red snapper stock assessments. SEDAR31-AW08. SEDAR, North Charleston, SC. 16 pp.

Appendix 1: Bibliography of materials provided for review

SEDAR 31- Gulf of Mexico Red Snapper Document List

Document Number	Title	Authors
Data Workshop Documents		
SEDAR31-DW01	Relative abundance of juvenile red snapper, *Lutjanus campechanus* in the northern Gulf of Mexico	Parsons
SEDAR31-DW02	Brief overview on Gulf of Mexico Red Snapper IFQ Program	Stephen
SEDAR31-DW03	Working Paper for Red Snapper Data Workshop (SEDAR 31)	Cowan, Boswell, Simonsen, Saari, and Kulaw
SEDAR31-DW04	Recreational Survey Data for Red snapper in the Gulf of Mexico	Matter
SEDAR31-DW05	Red snapper (*Lutjanus campechanus*) otolith ageing summary for collection years 2009-2011	Allman, Barnett, Trowbridge, Goetz, and Evou
SEDAR31-DW06	An Update to the Age Composition, Growth, and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery	Gazey, Gallaway, and Cole
SEDAR31-DW07	Expanded Annual Stock Assessment Survey 2011: Red Snapper Reproduction	Fitzhugh, Lang, and Lyon
SEDAR31-DW08	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Red Snapper	Campbell, Rademacher, Felts, Noble, Felts, and Salisbury
SEDAR31-DW09	Index of Abundance for Pre-Fishery Recruit Red Snapper from Florida Headboat Observer Data	O'Hop and Sauls
SEDAR31-DW10	Length frequency distributions for red snappers in the Gulf of Mexico from 1984-2011	Chih
SEDAR31-DW11	A Summary of Data on the Size Distribution and Release Condition of Red Snapper Discards from Recreational Fishery Surveys in the Gulf of Mexico	Sauls
SEDAR31-DW12	A comparison of the size and age of red Snapper, *Lutjanus campechanus*, to the age of artificial reefs in the northern Gulf of Mexico	Syc and Szedlmayer
SEDAR31-DW13	Use of Ultrasonic Telemetry to Estimate Natural and Fishing Mortality of Red Snapper	Topping and Szedlmayer
SEDAR31-DW14	Fine-scale Movements and Home Ranges of Red Snapper *Lutjanus campechanus* Around Artificial Reefs in the Northern Gulf of Mexico	Piraino and Szedlmayer
SEDAR31-DW15	Spatio-temporal dynamics in red snapper reproduction on the West Florida Shelf, 2008-	Lowerre-Barbieri, Crabtree, Switzer, and

	2011	McMichael
SEDAR31-DW16	Spatial distribution and occurrence of red snapper, *Lutjanus campechanus*, sampled off the Louisiana coast during nearshore trawl sampling efforts	Adriance and Sweda
SEDAR31-DW17	Summary report of the red snapper (Lutjanus campechanus) catch during the 2011 expanded annual stock assessment (EASA)	Campbell, Pollack, Henwood, Provaznik, and Cook
SEDAR31-DW18	On the comparisons of regional differences in the growth of red snappers from the Gulf of Mexico	Chih
SEDAR31-DW19	Abundance Indices of Red Snapper Collected in NMFS Bottom Longline Surveys in the northern Gulf of Mexico	Ingram and Pollack
SEDAR31-DW20	Red Snapper Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico	Pollack, Ingram, and Foster
SEDAR31-DW21	Examining delayed mortality in barotrauma afflicted red snapper using acoustic telemetry and hyperbaric experimentation	Stunz and Curtis
SEDAR31-DW22	Release mortality in the red snapper fishery: a synopsis of three decades of research	Campbell, Driggers, and Sauls
SEDAR31-DW23	Release Mortality Estimates for Recreational Hook-and-Line Caught Red Snapper Derived from a Large-Scale Tag-Recapture Study in the Eastern Gulf of Mexico	Sauls
SEDAR31-DW24	Fisheries-independent data for red snapper from reef-fish surveys on the West Florida Shelf, 2008-2011	Switzer, Keenan, and McMichael
SEDAR31-DW25	Estimated Conversion Factors for Adjusting MRFSS Gulf of Mexico Red Snapper Catch Estimates and Variances in 1981-2003 to MRIP Estimates and Variances	Rios, Matter, Walter, Farmer, and Turner
SEDAR31-DW26	Developing a survey methodology for sampling red snapper, *Lutjanus campechanus*, at oil and gas platforms in the northern Gulf of Mexico	Moser, Pollack, Ingram, Gledhill, Henwood, and Driggers
SEDAR31-DW27	Red Snapper (*Lutjanus campechanus*) larval indices of relative abundance from SEAMAP fall plankton surveys, 1986 to 2010	Pollack, Hanisko, Lyczkowski- Shultz, Jones, and Ingram
SEDAR31-DW28	Red Snapper Findings from the NMFS Panama City Laboratory Trap & Camera Fishery-Independent Survey – 2004-2011	DeVries, Ingram, Gardner, and Raley
SEDAR31-DW29	Artificial Structure and Hard-Bottom Spatial Coverage in the Gulf of Mexico	Mueller
SEDAR31-DW30	Shrimp Fishery Bycatch Estimates for Gulf of Mexico Red Snapper, 1972-2011	Linton

SEDAR31-DW31	Calculated red snapper discards in the Gulf of Mexico commercial vertical line and bottom longline fisheries: preliminary results	McCarthy
SEDAR31-DW32	Observer reported size distribution of Gulf of Mexico red snapper from the commercial vertical line and bottom longline fisheries	McCarthy
SEDAR31-DW33	Using a Censored Regression Modeling Approach to Standardize Red Snapper Catch per Unit Effort Using Recreational Fishery Data Affected by a Bag Limit	Saul and Walter
Assessment Workshop Documents		
SEDAR31-AW01	Headboat Discards for Red Snapper in the Gulf of Mexico	Matter and Walter
SEDAR31-AW02	Accounting for changes in fishing mortality when comparing density-dependent to density-independent mortality in Gulf of Mexico red snapper	Vincent
SEDAR31-AW03	Modeling the dependence of batch fecundity and spawning frequency on size and age for use in stock assessments of red snapper in U.S. Gulf of Mexico waters	Porch, Fitzhugh, and Linton
SEDAR31-AW04	The Effect of Hook Type on Red Snapper Catch	Saul, Walter, Shipp, Powers, and Powers
SEDAR31-AW05	Age Composition of Red Snapper Bycatch in the Gulf of Mexico Shrimp Fishery, 1997-2011	Linton
SEDAR31-AW06	Shrimp trawl index of abundance for Gulf of Mexico red snapper, 1967-1989	Linton
SEDAR31-AW07	Red Snapper Abundance Indices from Combined Bottom Trawl Surveys in the Eastern Gulf of Mexico	Pollack, Ingram, and Henwood
SEDAR31-AW08	A proposed methodology to incorporate ROV length data into red snapper stock assessments	Walter, DeVries, Drymon, Patterson, Powers, and Williams
SEDAR31-AW09	Reconstructed time series of offshore shrimp trawl effort in the Gulf of Mexico from 1945 to 1972 for use in the SEDAR 31 Gulf of Mexico red snapper assessment	Porch
SEDAR31-AW10	Use of the Connectivity Modeling System to estimate movements of red snapper recruits in the northern Gulf of Mexico	Karnauskas, Walter, and Paris
SEDAR31-AW11	Estimating historical recreational angler effort in the Gulf of Mexico for the private, charter, and headboat fishing modes	Rios
SEDAR31-AW12	Estimation of hook selectivity on red snapper (*Lutjanus campechanus*) during a fishery independent survey of natural reefs in the Gulf	Pollack, Campbell, and Driggers

	of Mexico	
SEDAR31-AW13	Dauphin Island Sea Lab Bottom Longline Survey incorporation into the NMFS Bottom Longline Survey	Ingram
SEDAR31-AW14	Combined Index for Florida Fish and Wildlife Research Institute and NMFS Panama City Video Surveys	Ingram
SEDAR31-AW15	Age frequency distributions estimated with reweighting methods for red snappers in the Gulf of Mexico from 1991 to 2011	Chih
SEDAR31-AW16	Changes in lengths-at-age and size selectivity of red snappers in the Gulf of Mexico from 2002 to 2011	Chih
SEDAR31-AW17	Response to comments on: *Age Composition, Growth and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery*	Gazey, Gallaway, and Cole
Review Workshop Documents		
SEDAR31-RW01		
Reference Documents		
SEDAR31-RD01	SEDAR 7 Stock Assessment Report	SEDAR
SEDAR31-RD02	2009 SEDAR 7 Update Assessment Report	SEDAR
SEDAR31-RD03	Red Snapper 2011 Projections Update	SEFSC
SEDAR31-RD04	Estimation of Fisheries Impacts Due to Underwater Explosives Used to Sever and Salvage Oil and Gas Platforms in the U.S. Gulf of Mexico	Minerals Management Service
SEDAR31-RD05	Age Composition, Growth, and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery	Gazey, Gallaway, Cole, and Fournier
SEDAR31-RD06	A Life History Review for Red Snapper in the Gulf of Mexico with an Evaluation of the Importance of Offshore Petroleum Platforms and Other Artificial Reefs	Gallaway, Szedlmayer, and Gazey
SEDAR31-RD07	Addressing Time-Varying Catchability	SEDAR
SEDAR31-RD08	Fishery-Independent Catch of Young-of-the-Year Red Snapper in the Texas Territorial Sea, 1985–2007	Dorf and Fisher
SEDAR31-RD09	Red Snapper Management History	GMFMC

SEDAR31-RD10	Home range and movement patterns of red snapper (*Lutjanus campechanus*) on artificial reefs	Topping and Szedlmayer
SEDAR31-RD11	Genetic variation and spatial autocorrelation among young-of-the-year red snapper (*Lutjanus campechanus*) in the northern Gulf of Mexico	Saillant, Bradfield, and Gold
SEDAR31-RD12	Determining policy-efficient management strategies in fisheries using data envelopment analysis (DEA)	Griffin and Woodward
SEDAR31-RD13	Red Snapper Larval Transport in the Northern Gulf of Mexico	Johnson, Perry, Lyczkowski-Shultz, and Hanisko
SEDAR31-RD14	Estimation of the Source of Red Snapper Recruits to West Florida and South Texas with Otolith Chemistry: Implications for Stock Structure and Management	Patterson, Cowan, Barnett, and Sluis
SEDAR31-RD15	Trends in Gulf of Mexico Red Snapper Population Dynamics, 1979-85	Parrack and McClellan
SEDAR31-RD16	Effects of habitat complexity and predator exclusion on the abundance of juvenile red snapper	Piko and Szedlmayer
SEDAR31-RD17	Survival and movement of hatchery-reared red snapper on artificial habitats in the northern Gulf of Mexico	Chapin, Szedlmayer, and Phelps
SEDAR31-RD18	A Life History Review for Red Snapper in the Gulf of Mexico with an Evaluation of the Importance of Offshore Petroleum Platforms and Other Artificial Reefs	Gallaway, Szedlmayer, and Gazey
SEDAR31-RD19	The use of otolith shape analysis for ageing juvenile red snapper, *Lutjanus campechanus*	Beyer and Szedlmayer
SEDAR31-RD20	Validation of annual periodicity in otoliths of red snapper, *Lutjanus campechanus*	Szedlmayer and Beyer
SEDAR31-RD21	The Artificial Habitat as an Accessory for Improving Estimates of Juvenile Reef Fish Abundance in Fishery Management	Szedlmayer
SEDAR31-RD22	Home range and movement patterns of red snapper (*Lutjanus campechanus*) on artificial reefs	Topping and Szedlmayer
SEDAR31-RD23	Site fidelity, residence time and movements of red snapper *Lutjanus campechanus* estimated with long-term acoustic monitoring	Topping and Szedlmayer

SEDAR31-RD24	Proximity Effects of Larger Resident Fishes on Recruitment of Age-0 Red Snapper in the Northern Gulf of Mexico	Mudrak and Szedlmayer
SEDAR31-RD25	Estimates of Historic Recreational Landings of Spanish Mackerel in the South Atlantic Using the FHWAR Census Method	Brennan and Fitzpatrick
SEDAR31-RD26	Declining Size at Age Among Red Snapper in the Northern Gulf of Mexico off Louisiana, USA: Recovery or Collapse?	Nieland, Wilson, and Fischer
SEDAR31-RD27	Examination of Red Snapper Fisheries Ecology on the Northwest Florida Shelf (FWC-08304): Final Report	Patterson, Tarnecki, and Neese
SEDAR31-RD28	Site Fidelity, Movement, and Growth of Red Snapper: Implications for Artificial Reef Management	Strelcheck, Cowan, and Patterson
SEDAR31-RD29	Factors Affecting Catch and Release (CAR) Mortality in Fish: Insight into CAR Mortality in Red Snapper and the Influence of Catastrophic Decompression	Rummer
SEDAR31-RD30	Effect of Circle Hook Size on Reef Fish Catch Rates, Species Composition, and Selectivity in the Northern Gulf of Mexico Recreational Fishery	Patterson, Porch, Tarnecki, and Strelcheck
SEDAR31-RD31	Effect of trawling on juvenile red snapper (*Lutjanus campechanus*) habitat selection and life history parameters	Wells, Cowan, Patterson, and Walters
SEDAR31-RD32	Habitat use and the effect of shrimp trawling on fish and invertebrate communities over the northern Gulf of Mexico continental shelf	Wells, Cowan, and Patterson
SEDAR31-RD33	Site Fidelity and Movement of Reef Fishes Tagged at Unreported Artificial Reef Sites off NW Florida	Addis, Patterson, and Dance
SEDAR31-RD34	Fish Community and Trophic Structure at Artificial Reef Sites in the Northeastern Gulf of Mexico	Dance, Patterson, and Addis
SEDAR31-RD35	A Review of Movement in Gulf of Mexico Red Snapper: Implications for Population Structure	Patterson
SEDAR31-RD36	Size selectivity of sampling gears targeting red snapper in the northern Gulf of Mexico	Wells, Boswell, Cowan, and Patterson
SEDAR31-RD37	Delineating Juvenile Red Snapper Habitat on the Northern Gulf of Mexico Continental Shelf	Patterson, Wilson, Bentley, Cowan, Henwood, Allen, and Dufrene

SEDAR31-RD38	Habitat- and Region-Specific Reproductive Biology of Female Red Snapper (*Lutjanus campechanus*) in the Gulf of Mexico	Kulaw
SEDAR31-RD39	Comparison of the Age and Growth of Red Snapper (*Lutjanus campechanus*) Amongst Habitats and Regions in the Gulf of Mexico	Saari
SEDAR31-RD40	Oil Platforms and Red Snapper Movement and Behavior	McDonough
SEDAR31-RD41	Reconstructed time series of shrimp trawl effort in the Gulf of Mexico and the associated bycatch of red snapper from 1948 to 1972	Porch and Turner
SEDAR31-RD42	Individual-based modeling of an artificial reef fish community: Effects of habitat quantity and degree of refuge	Campbell, Rose, Boswell, and Cowan
SEDAR31-RD43	Literature Search and Data Synthesis of Biological Information for Use in Management Decisions Concerning Decommissioning of Offshore Oil and Gas Structures in the Gulf of Mexico	Versar, Inc.
SEDAR31-RD44	The Environmental Effects of Underwater Explosions with Methods to Mitigate Impacts	Keevin and Hempen
SEDAR31-RD45	Connections between Campeche Bank and Red Snapper Populations in the Gulf of Mexico via modeled larval transport	Johnson, Perry, and Lyczkowski-Shultz
SEDAR31-RD46	The commercial landings of red snapper in the Gulf of Mexico from 1872 to 1962	Porch, Turner, and Schirripa
SEDAR31-RD47	Estimates of Historical Red Snapper Recreational Catch Levels Using US Census Data and Recreational Survey Information	Scott
SEDAR31-RD48	MRFSS/MRIP Calibration Workshop: Ad-hoc Working Group Report	Salz, Miller, Williams, Walter, Drew, and Bray
SEDAR31-RD49	Survival of Red Grouper (*Epinephelus morio*) and Red Snapper (*Lutjanus campechanus*) Caught on J-Hooks and Circle Hooks in the Florida Recreational and Recreational-for-Hire Fisheries	Burns and Froeschke
SEDAR31-RD50	Circle Hook Requirements in the Gulf of Mexico: Application in Recreational Fisheries and Effectiveness for Conservation of Reef Fishes	Sauls and Ayala

Appendix 2: A copy of this Statement of Work

Attachment A: Statement of Work for Jean-Jacques Maguire

SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

BACKGROUND

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 31 will be a compilation of data, a benchmark assessment of the stock, and an assessment review conducted for Gulf of Mexico red 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 stock assessed through SEDAR 31 is within the jurisdiction of the Gulf of Mexico Fishery Management Council and the state waters of Texas, Louisiana, Mississippi, Alabama, and Florida.

OBJECTIVES

Requirements for the reviewers: Three reviewers shall conduct an impartial and independent peer review of the stock assessments in accordance with the tasks, milestones, and terms of reference (ToRs) of this SoW. The reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient

to complete the primary task of providing peer-review advice in compliance with the workshop Terms of Reference.

PERIOD OF PERFORMANCE

The reviewers shall conduct the tasks according to the schedule of milestones and deliverables as specified in this statement of work (SoW). Each reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein. The tentative schedule of milestones and deliverables is provided herein.

PLACE OF PERFORMANCE AND TRAVEL

Each reviewer shall conduct an independent peer review during a five day panel review meeting scheduled in Gulfport, Mississippi during April 29 through May 3, 2013.

STATEMENT OF TASKS

Each 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.

<u>Foreign National Security Clearance</u>: The reviewers shall participate during a panel review meeting at a government facility, and the NMFS Project Contact will be responsible for obtaining the Foreign National Security Clearance approval for the reviewers who are non-US citizens. For this reason, the reviewers shall provide by FAX (not by email) the 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/.

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 at the Gulfport, Mississippi during April 29 – May 3, 2013.
3) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than May 17, 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**.

DELIVERY

Each reviewer shall complete an independent peer review report in accordance with the SoW. Each reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each reviewer shall complete the independent peer review addressing each stock assessment ToR listed in **Annex 2**.

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

March 24, 2013	Contractor sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
April 14, 2013	NMFS Project Contact provides reviewers the pre-review documents
April 29 – May 3, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting in Gulfport, Mississippi.
May 17, 2013	Reviewers submit draft independent peer review reports to the contractor's technical team for independent review
May 29, 2013	Contractor submits independent peer review reports to the COR who reviews for compliance with the contract requirements
June 5, 2013	The COR distributes the final 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 COR within 10 working days after receipt of all required information of the decision on substitutions. 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 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: The deliverables shall be the final peer review report from each reviewer that satisfies the requirements and terms of reference of this SoW. The contract shall be successfully completed upon the acceptance of the contract deliverables by the COR based on three performance standards:

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

Upon the acceptance of each independent peer review report by the COR, the reports will be distributed to the NMFS Project Contact and pertinent NMFS science director, at which time the reports will be made publicly available through the government's website.

The contractor shall send the final reports in PDF format to the COR, designated to be William Michaels, via email William.Michaels@noaa.gov

Support Personnel:

William Michaels, Program Manager, COR
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1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
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Roger W. Peretti, Executive Vice President
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Key Personnel:

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Tampa, FL 33607
Ryan.Rindone@gulfcouncil.org Phone: 813-348-1630

Annex 1: Format and Contents of Independent Peer Review Report

1. The independent peer review report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The main body of the report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Findings of whether they accept or reject the work that they reviewed, and an explanation of their decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. For each assessment reviewed, the report should address whether each ToR of the SAW was completed successfully. For each ToR, the Independent Review Report should state why that ToR was or was not completed successfully. To make this determination, the SEDAR chair and reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), 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 SEDAR 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 independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not others read the SEDAR Summary Report. The independent report shall be an independent peer review of each ToR, 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 this Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference

SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

1. Evaluate the data used in the assessment, addressing the following:
   - Are data decisions made by the Data and Assessment Workshops sound and robust?
   - Are data uncertainties acknowledged, reported and within normal or expected levels?
   - Are data applied properly within the assessment model?
   - Are input data series reliable and sufficient to support the assessment approach and findings?
2. Evaluate the methods used to assess the stock, accounting for only the available data:
   - Are the methods scientifically sound, robust, and appropriate for the available data?
   - Are assessment models properly configured and used consistent with standard practices?
3. Evaluate the assessment findings with respect to the following:
   - Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support inferences on stock status?
   - Is the stock overfished? What information helps you reach this conclusion?
   - Is the stock undergoing overfishing? What information helps you reach this conclusion?
   - Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   - Are quantitative estimates of 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:
   - Are the methods consistent with accepted practices and available data?
   - Are the methods appropriate for the assessment model and outputs?
   - Are results informative and robust, and useful to support inferences of probable future conditions?
   - 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 with particular emphasis on the Deepwater Horizon Oil Spill
    - 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 Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report in accordance with the project guidelines.

The review panel may not request a new assessment. The review panel may request a limited number of additional sensitivity analyses and evaluations of alternative assumptions, and may correct errors identified in the assessment. Additional details regarding the latitude given to the review panel to deviate from assessments provided by the assessment workshop panel are provided in the SEDAR Guidelines and the SEDAR Review Panel Overview and Instructions.

** The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made, alternate 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 31 Gulf of Mexico Red Snapper Review Workshop
Gulfport, Mississippi during April 29 – May 3, 2013

Monday

1:00 p.m.	**Convene**	
1:00 – 1:30	**Introductions and Opening Remarks** **Rindone** *- Agenda Review, TOR, Task Assignments*	
1:30 – 5:00	**Assessment Presentations and Discussions**	**Linton, Saul**
5:00 p.m. - 6:00 p.m.	**Panel Work Session** **Barbieri**	

Tuesday

8:00 a.m. – 11:30 a.m.	**Assessment Presentations**	**Linton, Saul**
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 3:30 p.m.	**Panel Discussion** **Barbieri** **-** *Assessment Data & Methods* *- Identify additional analyses, sensitivities, corrections*	
3:30 p.m. – 3:45 p.m.	**Break**	
3:45 p.m. – 5:00 p.m.	**Panel Discussion** **Barbieri** *- Continue deliberations* *- Review additional analyses*	
5:00 p.m. - 6:00 p.m.	**Panel Work Session** **Barbieri**	

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

Wednesday

8:00 a.m. – 11:30 a.m.	**Panel Discussion** **Barbieri** *- Review additional analyses, sensitivities* *- Consensus recommendations and comments*
11:30 a.m. – 1:00 p.m.	**Lunch Break**
1:00 p.m. – 3:30 p.m.	**Panel Discussion** **Barbieri** *- Final sensitivities reviewed.* *- Projections reviewed.*
3:30 p.m. – 3:45 p.m.	**Break**
3:45 p.m. – 5:00 p.m.	**Panel Discussion** **Barbieri** *- Review Consensus Reports*
5:00 p.m. - 6:00 p.m.	**Panel Work Session** **Barbieri**

Wednesday Goals: Final sensitivities identified, preferred models selected, projection approaches approved, final results made available. Summary report drafts begun.

Thursday

8:00 a.m. – 11:30 a.m.	**Panel Work Session** **Barbieri**
11:30 a.m. – 1:00 p.m.	**Lunch Break**

1:00 p.m. – 3:30 p.m.	**Panel Work Session** **Barbieri**
3:30 p.m. - 3:45 p.m.	**Break**
3:45 p.m. - 6:00 p.m.	**Panel Work Session** **Barbieri**

Thursday Goals: Draft Summary Report reviewed.

Friday

8:00 a.m. – 1:00 p.m.	**Panel Work Session** **Barbieri**
1:00 p.m.	**ADJOURN**

Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Review Panelists

Luiz Barbieri	Chair	Gulf SSC
Will Patterson	Reviewer	Gulf SSC
Ben Blount	Reviewer	Gulf SSC
Jean-Jacques Maguire	Reviewer	CIE
Jamie Gibson	Reviewer	CIE
Anders Nielsen	Reviewer	CIE

Analytical Team

Brian Linton	Lead Assessment Scientist	NEFSC
Clay Porch	Other Assessment Scientist	SEFSC
Jakob Tetzlaff	Other Assessment Scientist	SEFSC
Nancie Cummings	Other Assessment Scientist	SEFSC

Observers

Mike Thierry	Appointed Observer	Charter Capt.
David Walker	Appointed Observer	Comm. Capt.
Russell Nelson	Observer	CCA
Wayne Werner	Observer	Comm. Capt.
Donnie Waters	Observer	Comm. Capt.
Bethann Hesselgrave	Observer	Commercial
Dale Diaz	Observer	MDMR

Staff

Ryan Rindone	SEDAR 31 Coordinator	SEDAR
Charlotte Schiaffo	Administrative Support	GMFMC
Jessica Stephen	Fishery Biologist	NMFS SERO

Center for Independent Experts (CIE) review report for the 2013 SEDAR 31 Stock Assessment of Gulf of Mexico Red Snapper

Anders Nielsen

June 2013

Executive Summary

This report is prepared for the Center for Independent Experts (CIE). It contains an independent and impartial review of the assessment of Gulf of Mexico Red Snapper, as presented in the assessment report and background documents listed in Appendix 1.

The process for this review was not optimal. The assessment report was received only three days prior to the beginning of the review meeting. With travel time included it allowed only limited time to review the assessment report itself prior to the meeting. In addition to the material arriving late, it was also substantially incomplete. Complete sections were missing on sensitivities, model results, evaluation of uncertainty, reference points, and projections. After arriving at the review meeting the base model was altered, so large parts of the submitted report needed to be changed. Much of the missing material was produced during the review meeting, presented via slides, but not documented as report sections to be reviewed. The reviewers (including this one) worked with what was produced, since we had all traveled there anyway, but with a substantially incomplete and undocumented assessment it was impossible to either accept or reject the findings in the assessment. This reviewer would suggest that a complete assessment report, approved by the assessment team itself should be submitted before the assessment is finally evaluated.

For the assessment itself the data was processed in a sound and robust way. They were likely applied properly in the assessment model, which is a highly configurable widely used standard model (Stock Synthesis), which is capable of handling the complex setup and the many different data sources. The results appear to be robust to a range of sensitivities. The uncertainty estimates of the final quantities of interest would be more convincing if fewer observation variance parameters were fixed at chosen values. The reference points and forward projections need more work, but an outline was presented. The main issue was the delayed and incomplete assessment report.

This is however not a critique of the assessment team. At the review meeting the assessment team worked constantly and was impressively efficient at producing the missing parts and the additional analysis requested by the reviewers. It was clear that they were able to answer any question posed by the panel, and that the fairly complex assessment setup for red snapper was carefully constructed.

Main recommendations to improve this assessment in the future are:

- Allow the assessment team time to finalize a complete assessment report.
- Setup a model configuration, which allows separate stock-recruitment relationships to be estimated for the separate areas (east and west).
- Investigate the appropriateness of the assumed uncertainties for the different data sources.

Background

This review was done at the request of the Center for Independent Experts (CIE). It reviews the 2013 SEDAR 31 assessment of Gulf of Mexico Red Snapper, which is led by assessment experts from the National Marine Fisheries Service in Miami. The meeting was held in Gulfport Mississippi from April 29 to May 3 2013. A prior SEDAR review was in 2005, with an update workshop in 2009. Prior to the meeting the review panelists were given a link to an ftp site with background documents (Appendix 1). This reviewer's statement of work can be found in Appendix 2, and a list of review meeting participants in Appendix 3.

Description of the reviewers role

This reviewer independently read all documents deemed necessary in preparation for the review, traveled and participated actively in the review meeting, contributed to the review panel's summary report, and independently authored this review report.

Findings for each term of reference

To ensure that all terms of reference are covered, and that comments are interpreted with reference to the correct terms, the terms are listed in gray boxes with corresponding reviewer comments following.

1. **Evaluate the data used in the assessment, addressing the following:**
   - **Are data decisions made by the Data and Assessment Workshops sound and robust?**
   - **Are data uncertainties acknowledged, reported and within normal or expected levels?**
   - **Are data applied properly within the assessment model?**
   - **Are input data series reliable and sufficient to support the assessment approach and findings?**

The review panel only received an incomplete draft of the assessment report on April 26th (three days prior to the review meeting). Missing sections included sensitivity analysis, some model diagnostics, some model outputs, reference points, and forward projections. The missing information was developed and presented during the review meeting in the form of slides and not as written paragraphs. The late and incomplete delivery of needed material has impeded an optimal review process.

The data decisions are generally well described in the assessment report, and were clearly and thoroughly presented on the first day of the meeting. It was clear that this part had already been processed by the data workshop, as this part of the report was complete, compared to the sections that followed. In only a few places had the assessment team deviated from the recommendations from the data workshop, and in those cases the reason was clearly stated and reasonable. Some documentation of methods is however missing for some of the data updates, and the report should be amended. The data are overall found to be sufficient and reliable to support the assessment approach, but certain inputs should be further validated.

The consistency strengthens confidence in the data processing, and data decisions are overall judged to be sound and robust. This reviewer also found that data were applied properly in the assessment model, especially since the assessment team were able to easily answer any question from the reviewers, and because the author of Stock Synthesis (Richard D. Methot) had been involved in setting up the model

for red snapper.

The input on growth was updated in the assessment report to use data from the period of 2003-2011, instead of only from 2009-2011. The fork-length (FL) to total-length (TL) and whole weight to maximum TL conversion factors were also updated.

The natural mortality data, which is used as a fixed input in the assessment model, is set based on the maximum observed age. The maximum age observed is 57, but the maximum radiocarbon validated age is 38. The assessment team used the midpoint. The two endpoints of this interval were investigated in a sensitivity analysis presented at the review meeting, but no major changes were seen in the recent time period.

In a couple of places in the data section (e.g., natural mortality and growth) data had to be time-scale adjusted to match the setup in Stock Synthesis, which assumes that recruitment occurs at the start of the year, where July 1st is a better match for red snapper. It is important to note that content of the data were not altered.

The discard data are important to this assessment, and here two issues are worth mentioning. First, the commercial discards have been updated for the period (2007-2011). The details of the update method should be in the report. Secondly, the discard mortality, as a function of depth, is derived from a meta analysis, which is a weighted logistic regression. This analysis should be further validated. From the figure in the assessment report (figure 2.7.1) it seems that the data points and the fitted curves do not match. At the review meeting an updated (color enhanced) figure was presented, but even that appeared to have a mismatch between the data points and the fitted curves. There could be two different reasons for this. Either something went wrong in fitting the curves (it is somehow parameterized wrong, or the internal optimizer in R failed), or the weighting of the data points is very unbalanced around the curve. If the latter is the case, then a suggestion could be to plot the data points scaled in size corresponding to their relative weighting, thereby illustrating exactly how much each point is contributing to the fitted curves.

A typo in the assessment report on page 16 in formula: log*x_i / (n_i - x_i), which should be replaced by something like es_i=log(x_i / (n_i – x_i)), was also repeated in the presentation.

The assessment report mentions that the annual bycatch estimates of red snapper from the shrimp fishery are having very large uncertainties in all years. For this reason it was decided to use the median of the annual median estimates from a Bayesian bycatch analysis for the years 1972-2011 in combination with the shrimp effort time series to get less uncertain annual bycatch estimates. This sounds appealing, but there is a potential risk of exchanging a large but known uncertainty with a bias of unknown size. If the bycatch fraction, which is assumed to be the median of the medians in all years, is in fact varying over time, then this procedure will introduce a bias, and this bias will not be part of the uncertainties assumed in the model.

Uncertainties are acknowledged, reported and within normal levels, but the extent to which they are followed through to the final estimates of interest will be addressed under Term of Reference 5.

2. Evaluate the methods used to assess the stock, accounting for only the available data:

- **Are the methods scientifically sound, robust, and appropriate for the available data?**
- **Are assessment models properly configured and used consistent with standard practices?**

The review panel only received an incomplete draft of the assessment report on April 26th (three days

prior to the review meeting). Missing sections included the sensitivity analysis, some model diagnostics, some model outputs, reference points, and forward projections. The missing information was developed and presented during the review meeting in the form of slides and not as written paragraphs. The late and incomplete delivery of needed material has impeded an optimal review process.

The assessment team should be complimented for setting up a model that actually attempts to describe an entire complex system of the two separate stock components, and the multitude of data sources.

The method Stock Synthesis itself is an obvious and well-tested model candidate. Stock Synthesis is more than a single model, as it can be configured to match a wide range of situations both in terms of describing the stock dynamics (the process), but also in terms of allowing many different observational likelihoods to match different data types. There is also great flexibility in specifying model parameters as unknowns to be estimated, as known parameters, or in-between (utilizing prior distributions). Stock Synthesis is widely used, and supported by many scientific publications (e.g. Methot 2009 and Methot & Taylor 2011). Stock Synthesis itself is scientifically sound, robust, and appropriate for the available data.

This reviewer struggles to answer if the model is properly configured and used consistent with standard practices. The assessment team is very experienced and has been assisted by the developer of Stock Synthesis (Richard D. Methot) in the application for red snapper, so it is unlikely that there are simple errors in the application. On the other hand, the assessment presented in the assessment report sent only three days prior to the review meeting was substantially different from the assessment presented at the meeting - due to changes in the setup of recruitment at virgin levels R0, and certain variance prior settings. This, in combination with the late arrival of the report, and the in-meeting presentation of key sections of the report with no documentation except slides and oral presentation, forces this reviewer to question if the assessment team, at this point in time, have arrived at their final assessment candidate. With the documentation currently available it is not possible to finally state that the assessment model has been properly configured and used consistent with standard practices, but equally it is not possible to state that is has not. It is recommended that the assessment team be allowed time to finish the documentation of their work, which can then be reviewed.

Two issues of minor importance with respect to the predefined options in Stock Synthesis were noticed during the meeting.

The year start issue, where multiple data sources had to be time-adjusted to match Stock Synthesis assumption of recruitment in the beginning of the year. The ideal solution would naturally be if Stock Synthesis was modified to allow the user to specify recruitment time. Another simple solution could be to define the years to start July 1st. If that would require a lot of other data sources (e.g. landings) to be re-compiled, then that would not be any simpler after all.

The recruitment function in this model is fairly complex. The model contains two stocks (east and west), but only one stock-recruitment relationship, which has a fixed steepness of almost one indicating no relationship between stock size and number of recruits. On top of this common recruitment, deviants with a fixed log-scale standard deviation of 0.3 are included. Finally the recruits are divided into the two areas via an average fraction with annual white noise deviations. The combined effect of this setup can be very difficult to predict. If the common recruitment deviations are dominating the annual fraction deviations, then the recruitment in east and west should be expected to be highly positively correlated. However, if the annual fraction deviations are dominating the common recruitment deviations then, the recruitment in east and west should be expected to highly negatively correlated. The resulting east-west recruitment can be seen in figure 1, and it is seen that there is a positive correlation, but it is not dramatically high. It is however difficult to judge to what extent this is caused

by the data, and to what extent this is caused by the combined effect of the fixed standard deviations (controlling the deviations). This would be a lot simpler if it was possible directly to specify independent stock-recruitment functions for the two stocks.

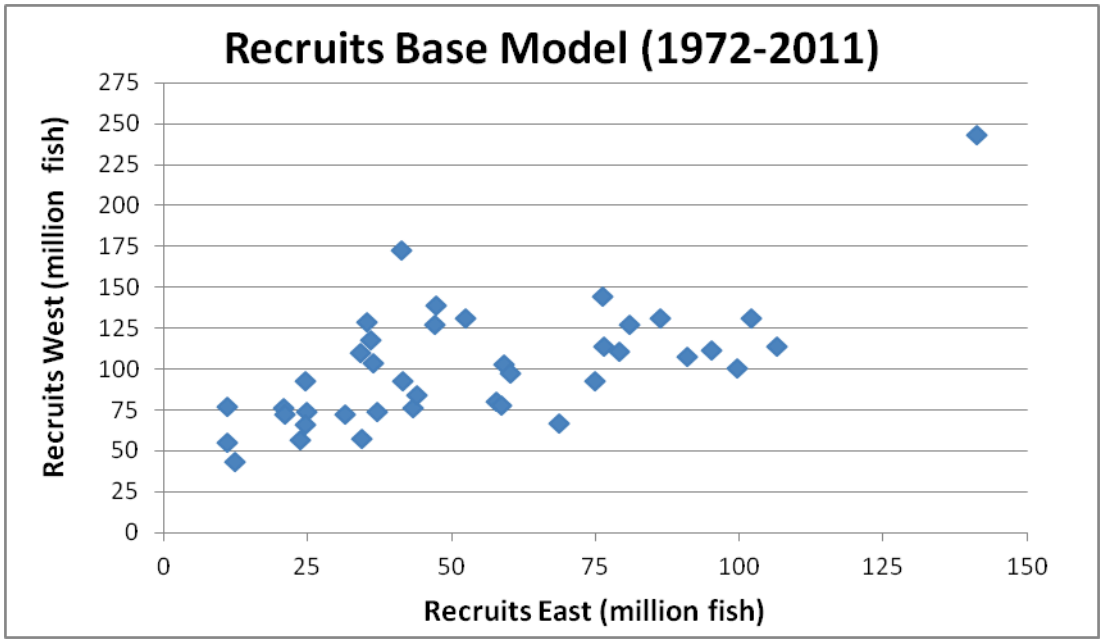

Figure 1: The estimated recruitment in west plotted against the estimated recruitment in east.

To strengthen confidence in the presented model and to further understand its workings it is also important that the comparisons with the previously used model CATCHEM and the many sensitivity runs, which were presented at the review meeting, are documented in a future version of the assessment report.

3. Evaluate assessment findings with respect to the following:

- **Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support inferences on stock status?**
- **Is the stock overfished? What information helps you reach this conclusion?**
- **Is the stock undergoing overfishing? What information helps you reach this conclusion?**
- **Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?**
- **Are quantitative estimates of 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?**

The review panel only received an incomplete draft of the assessment report on April 26th (three days prior to the review meeting). Missing sections included the sensitivity analysis, some model diagnostics, some model outputs, reference points, and forward projections. The missing information was developed and presented during the review meeting in the form of slides and not as written paragraphs. The late and incomplete deliverance of needed material has impeded an optimal review

process.

The abundance, exploitation, and biomass estimates are likely reliable, consistent with input data and population biological characteristics, and if so, useful to support inferences on stock status. However, given the present status of the documentation, and the comments already made under Term of Reference 2, it is not possible to make a final statement.

The results of the assessment model finally presented at the review meeting were shown to be very robust to a wide selection of suggested sensitivity analysis (e.g., changes in natural mortality, changes in discard mortality, removed indices, re-weighting of certain data sources). The sensitivities generally showed little or no changes in the recent data period, but some changes in the historic period. This is partly explained by the models variance assumptions, which are set up to match the landings very closely, and partly by the constant process controlling parameters such as steepness and recruitment at virgin levels R0.

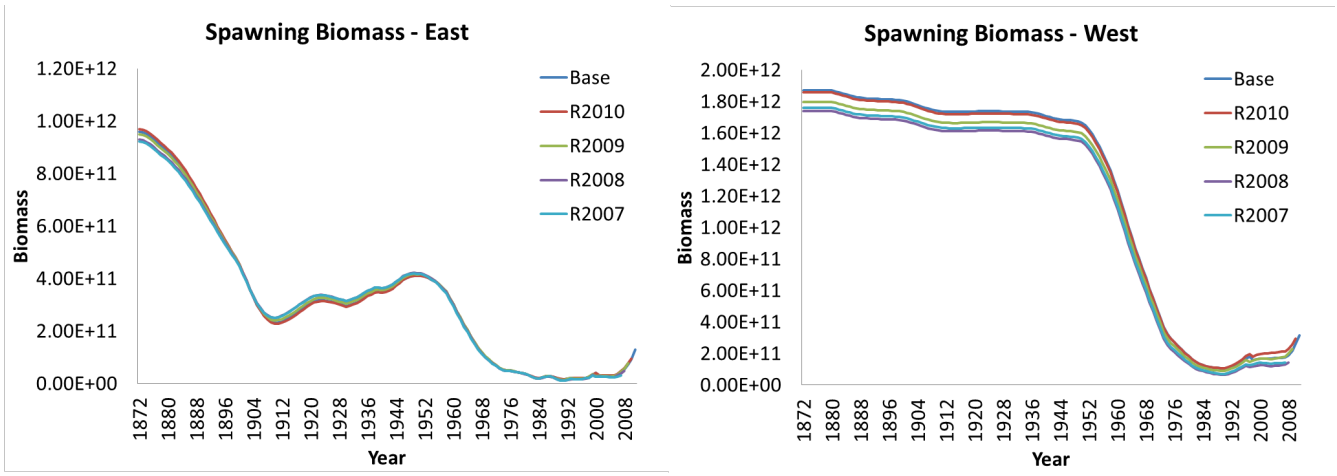

Figure 2: Retrospective analysis of spawning stock biomass

The retrospective analysis did not show any problems with systematic bias. The only slightly counter-intuitive model behavior seen from the retrospective analysis is that slicing off only the most recent 1-4 years of data can have a noticeable effect (5-10%) on the biomass estimate more than a hundred years back in time (figure 2). This is however the nature of these highly parameterized models, in which everything is connected, and the first long period only has sparse data.

Another interesting sensitivity analysis was requested by Jamie Gibson, one of the CIE reviewers, which was to change the assumed fixed steepness parameter from the value of 0.99 to 0.8. Changing this parameter showed big changes (a few outputs from the slides `SEDAR31_RW_Sensitivites2' page 7 are collected in table 1, and the effect on recent biomass is seen in figure 3).

Quantity	Baserun	Steepness 0.8
SSB unfished	4.71e12	6.81e13
TotBio unfished	326,409	4,723,500
SSB_MSY	9.46e11	1.95e13

Table 1: Changing steepness from 0.99 to 0.8.

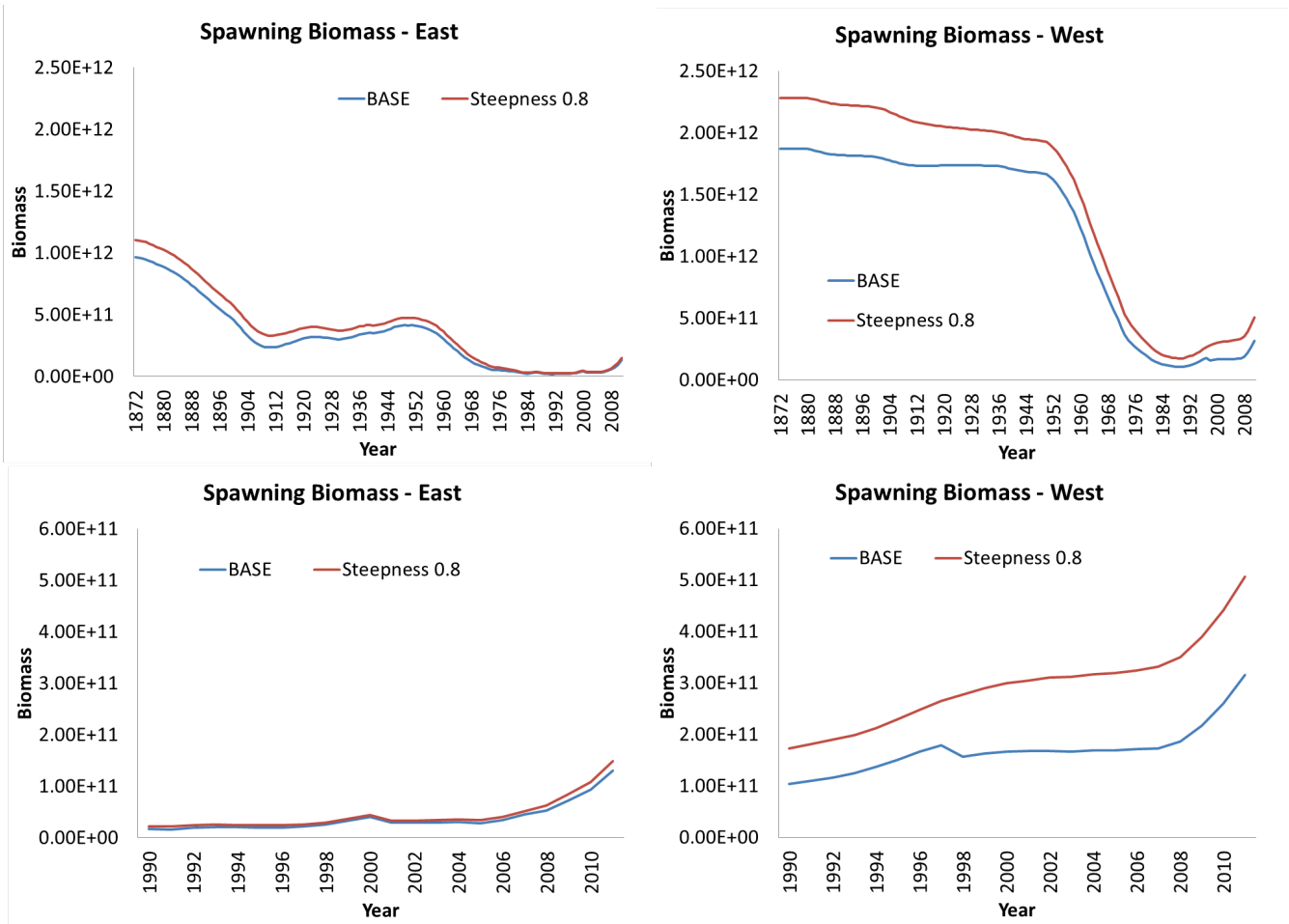

Figure 3: Effect on spawning stock biomass of changing assumed steepness to 0.8.

The collected lesson from the sensitivity analysis was that it was very difficult to change the recent abundance, exploitation, and biomass estimates, by altering the data inputs, or their relative weightings. This is positive in that the results are robust to these sometimes uncertain inputs, but on the other hand data should be informing the model, so changing the data should affect the estimates of interest.

Comparison to the previous model used for red snapper was presented on the last day, and the results showed a close match between the two models (figure 4). The differences are no greater than what was seen in the retrospective analysis within Stock Synthesis. This comparison strengthens confidence in both models, as these are two independent implementations of model code, presumably the data formatting is also different, so the data has been interpreted twice. The models have a lot of common assumptions, but even so this is a useful validation.

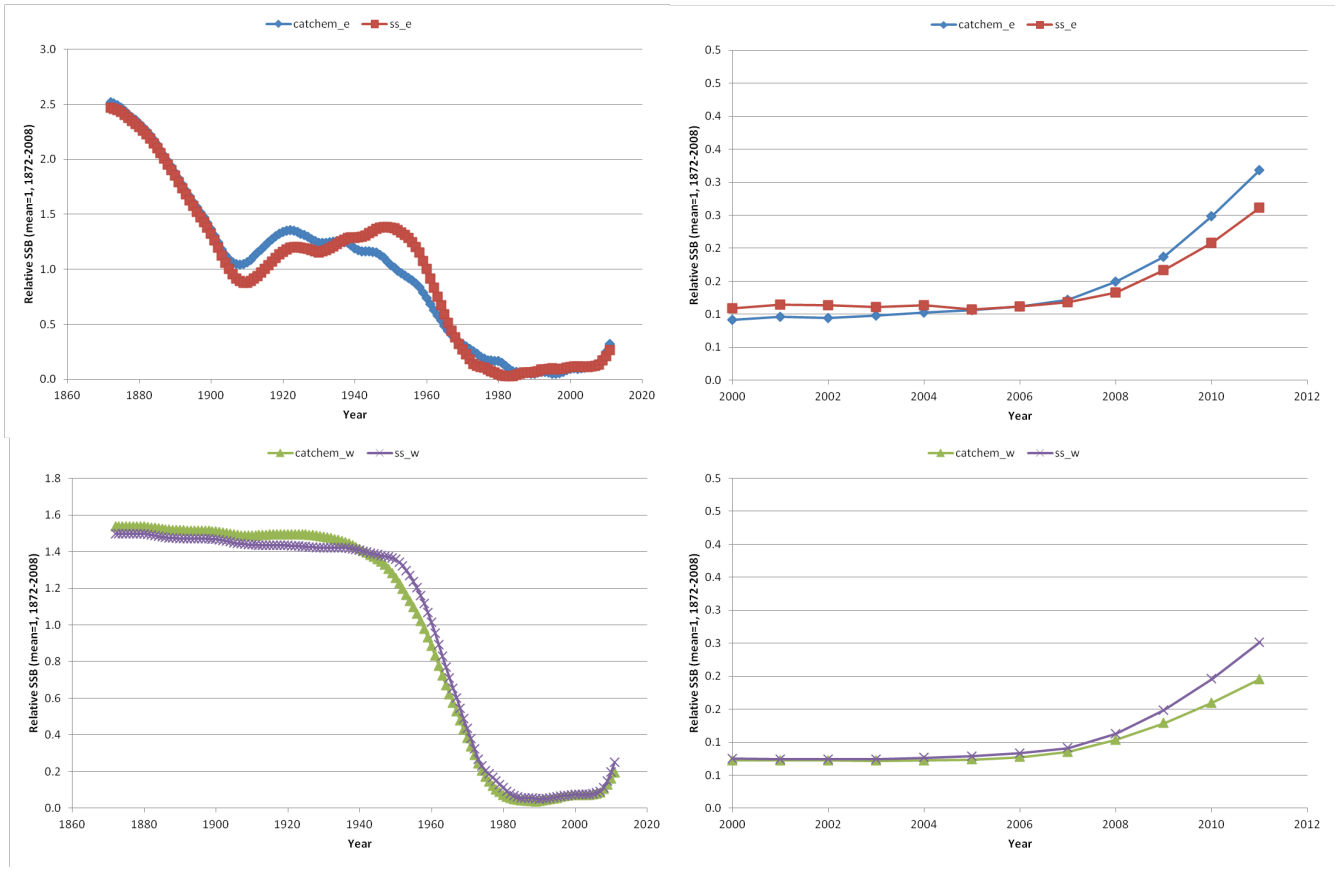

Figure 4: Spawning stock biomass estimates compared between CATCHEM and Stock Synthesis.

A stock is generally said to be overfished if the current spawning stock biomass estimate is below an agreed reference point, and similarly said to be undergoing overfishing if the current fishing mortality estimate is above an agreed reference point. However these reference points were not provided in the assessment report or determined during the review meeting, so these status questions cannot currently be answered.

The review panel participated in discussions about how to derive a proxy for MSY, and agreed that the marginal fishing mortality approach (setting fishing mortality based on the parts of fishing mortality that can be controlled) was sensible. It was also discussed if previously used proxy 26%SPR should still be used and whether that meant using 26%SPR, or using the same logic that was used then to derive the proxy, to derive a new SPR-based proxy. This reviewer's opinion is that, if the rationale for a reference point is that it is a proxy for MSY, then it should be updated if conditions change such that it is no longer a proxy for MSY.

The estimated stock-recruitment relationship is not informative, and not useful for evaluation of productivity and future stock conditions. As explained above (TOR 2) the stock-recruitment relationship is complex in this model, the steepness is set to almost one, and as such the actual stock-recruitment relationship in each area (east and west) is unfolding only within the two sets of deviations with fixed variances. Possibly a more informative stock-recruitment relationship could be estimated separately in each area.

No final quantitative estimates of status determination criteria were provided in the assessment report, or in the review meeting.

4. Evaluate the stock projections, addressing the following:

- **Are the methods consistent with accepted practices and available data?**
- **Are the methods appropriate for the assessment model and outputs?**
- **Are results informative and robust, and useful to support inferences of probable future conditions?**
- **Are key uncertainties acknowledged, discussed, and reflected in the projection results?**

The review panel only received an incomplete draft of the assessment report on April 26th (three days prior to the review meeting). Missing sections included the sensitivity analysis, some model diagnostics, some model outputs, reference points, and forward projections. The missing information was developed and presented during the review meeting in the form of slides and not as written paragraphs. The late and incomplete deliverance of needed material has impeded an optimal review process.

No stock projections were produced prior to this review meeting, but deterministic projections were presented during the last days of the review meeting.

The methods are consistent with accepted practices and available data, and appropriate for the assessment model, as they follow standard procedures. The only thing to notice is that changing fishing mortality only in the directed fishery had to be accounted for, which is the difference between the two sets of projections slides provided.

The projection results are based on the results from the assessment model, so given its current status of not being sufficiently documented the projection results cannot be considered informative and robust, and useful to support inferences of probable future conditions, but as stated above the method used to move forward is within an accepted standard.

As mentioned in the review summary report, the splitting of the projection into the two areas (east and west) according to the long-term average could be problematic, because it is unknown if the recent low recruitment in the east will continue. Several fishermen voiced this concern at the review meeting based on their observations at sea. Projections showing both scenarios could be conducted.

No stochastic projections were presented in the assessment report or at the review meeting, so at present, key uncertainties are not 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 the technical conclusions are clearly stated.**

The review panel only received an incomplete draft of the assessment report on April 26th (three days prior to the review meeting). Missing sections included the sensitivity analysis, some model diagnostics, some model outputs, reference points, and forward projections. The missing information was developed and presented during the review meeting in the form of slides and not as written paragraphs. The late and incomplete deliverance of needed material has impeded an optimal review process.

Uncertainties in assessments are generally used to calculate the risk of being below or above a specific target, and thereby to define safe ranges for future fishing. The assessment report contained no projections, and at the review meeting only deterministic projections were presented, so the potential consequences of the uncertainties cannot be addressed.

The assessment report supplies a table (Table. 3.1.1.2) of model parameter estimates with corresponding standard deviations derived from the inverse hessian matrix of the objective function at its minimum. This is a standard output based on a quadratic approximation. The rationale is that if the assessment model correctly describes the distribution of the observations (including their observation uncertainties), then those uncertainties are propagated to an uncertainty estimate for the estimated quantities of interest.

For the assessment presented it is chosen to fix the variance parameters to arbitrary values. For instance it is chosen to set the maximum sample size at 200 fish for the age composition data (p.79), which implies a certain variance in the multinomial distribution assumed, landings are assigned a small standard error of 0.05 (p.80), and discard time series are assigned a large CV of 0.5 (p.80). According to assessment report (p.70-80) and the assessment team's presentation, the values are chosen partly to obtain a certain relative weighting of the different sources of information, and partly from practical experience with using Stock Synthesis.

The important thing is that these values are not derived from data, but assign subjectively, and hence the uncertainties propagated to the final estimates of interest will be subjective as well.

Assuming the relative weighting of the separate sources of information are assigned correctly would give the correct estimate (point estimate), but not the correct estimate of its uncertainty. Getting the correct uncertainty estimates requires the actual value of each of the assigned observation variance parameters to be correct. Judging from scales of the supplied Pearson residual plots (e.g., Figures 3.2.1.48, 2.3.1.60, and 2.3.1.66) the distribution of the observations is not fully described.

In addition to the Hessian based standard deviations, a parametric bootstrap simulation was presented at the review meeting. In a parametric bootstrap multiple independent data sets are simulated according to the assumptions in the model, and estimation is carried out for each data set. Parametric bootstrap is an excellent tool for validating the model implementation, and to obtain a simulation based, but otherwise exact, error propagation. This is important to study if the non-linear model equations are causing biased estimates. The bootstrap simulation showed very consistent model outputs for all the simulated cases, and no problematic biases. However, the bootstrap simulations do not address the subjectivity of uncertainty specification, as all data sets are simulated from the assumed variance parameters.

If the assessment panel wanted to investigate the uncertainties in the data, and how these translate into uncertainties on quantities of interest a similar non-parametric bootstrap scheme could be used. Instead of sampling new data sets based on the model assumptions, new data sets could be simulated from the existing data sets, for instance by re-sampling the residuals.

Certain data sources (e.g., natural mortality, maturity, and discard mortality) are included in the model as known inputs. This is common practice in assessment models, and some of these uncertainties would be picked up as larger observation uncertainties, if the observation uncertainties were estimated. Sensitivity analyses were presented at the review meeting to study the effect of these inputs (e.g., different natural mortality, age error, and removing of selected indices). The overall conclusion was that changes were seen in the historic period (prior to ca. 1972), but in the recent period the model results were visually unchanged. This caused some concern, as for instance changing natural mortality would be expected to influence the estimates of fishing mortality.

A slightly related analysis is the so-called jitter analysis. Here 50 runs were presented where the initial values were varied by 10%. The goal is to demonstrate that the model finds the same solution (minimum) every time. For the base model presented at review meeting this was not the case, as the negative log likelihood alternated between two solutions about 6 units apart (figure 5). It was however demonstrated, that for the quantities of interest the results were the same for both solutions. The difference could be in the parts of the model controlling the uncertainties, and hence it should also be investigated if the two different solutions also produce the same uncertainty estimates for the quantities of interest.

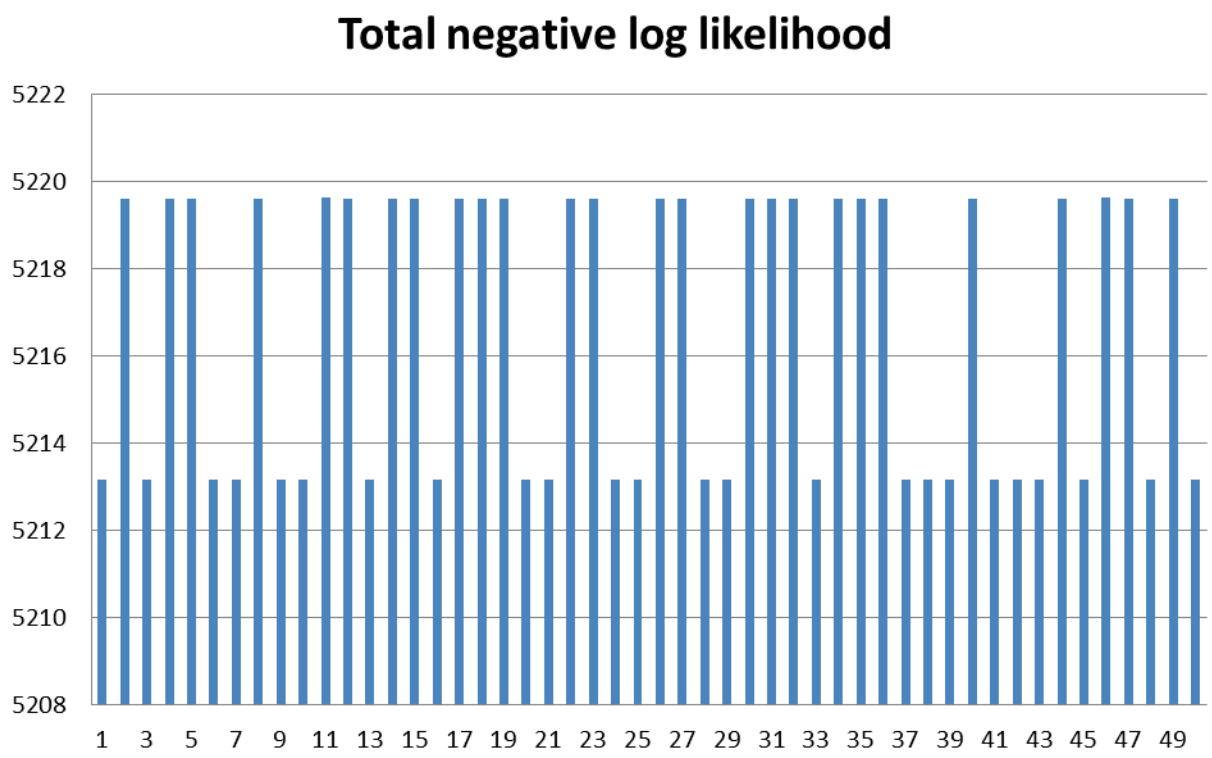

Figure 5: Result of 50 jitter runs for the total negative log likelihood.

A comparison between current candidate model (Stock Synthesis) and the model previously used for red snapper (CATCHEM) was presented at the review meeting, and the results were in close agreement (figure 4). No attempt was made to quantify assessment method uncertainty.

This reviewer is concerned that the reported uncertainties on quantities of interest are a consequence of the assumed and fixed observation variance parameters, and the assessment panel did not present evidence of the appropriateness of these assumed values.

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 with particular emphasis on the Deepwater Horizon Oil Spill.**
- **Provide recommendations on possible ways to improve the SEDAR process.**

There were no recommendations listed in the in the assessment report.

The data report lists research recommendations to improve landings data, discard data, and length/age data. Of these any effort to improve the discard data is important to the assessment. The length/age data improvements could possibly help the long term development of an assessment where Stock Synthesis was also configured to use length data directly.

The assessment, but most importantly the projections, would be helped by a mapping of the areas likely to be affected long term by the Deepwater Horizon Oil Spill. If these are substantial it would be useful to including such information in the assessment model.

With this review in mind the most important improvement of the SEDAR process would be to not start the process before the assessment team hand in the final assessment report, and if unforeseen events delay the process, then it would be best to cancel or postpone the review meeting.

Another issue with respect to the SEDAR process is the time line of the joint summary report and the independent reports. To this reviewer it would seem more logical if the independent reports were completed and submitted before work on the joint report was started. As it is now input to both are required at the same, which will lead to overlapping subjects.

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

Recommendations are listed in the section on "conclusions and recommendations".

8. Prepare a Peer Review Summary Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report in accordance with the project guidelines.

The report was prepared in collaboration with the other reviewers. This reviewer especially helped shape the sections on uncertainties in the assessment.

Terms of reference from the assessment report.

This reviewer is asked to evaluate if each term of reference from the stock assessment working group report was completed successfully. Below follows the terms of reference, and below each is this reviewers comment following the `!'.

1. Review and provide justification for any changes in data following the data workshop and any analyses suggested by the data workshop. Summarize data as used in each assessment model.

! Done.

2. Develop population assessment models that are compatible with available data and document input data, model assumptions and configuration, and equations for each model considered. Consider past modeling approaches (SEDAR 7 (2004), SEDAR 7 Update (2009)).

! Done, but documentation not complete.

3. Incorporate known applicable environmental covariates into the selected model, and provide justification for why any of those covariates cannot be included at the time of the assessment.

! Done.

4. Provide estimates of stock population parameters, if feasible.

- Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, and other parameters as appropriate given data availability and modeling approaches
- Include appropriate and representative measures of precision for parameter estimates

! Done, but documentation incomplete.

5. Characterize uncertainty in the assessment and estimated values.

- Consider uncertainty in input data, modeling approach, and model configuration
- Provide appropriate measures of model performance, reliability, and 'goodness of fit'
- Provide a continuity model consistent with the prior assessment configuration, if one exists, updated to include the most recent observations. Alternative approaches to a strict continuity run that distinguish between model, population, and input data influences on findings, may be considered
- Provide measures of uncertainty for estimated parameters

! Done, but could be improved by estimating more of the variance parameters from data. Documentation incomplete.

6. Provide yield-per-recruit, spawner-per-recruit, and stock-recruitment evaluations.

! Done, documentation incomplete.

7. Provide estimates of stock status for management criteria consistent with applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards for each model run presented for review.

- Evaluate existing or proposed management criteria as specified in the management summary
- Recommend proxy values when necessary

! Not finalized, but approach outlined.

8. Provide declarations of stock status relative to management benchmarks, or alternative data poor approaches if necessary.

! Not finalized due to previous TOR.

9. Project future stock conditions (biomass, abundance, and exploitation) and develop rebuilding schedules if warranted; include estimated generation time. Stock projections (in both biomass and number of fish) shall be developed in accordance with the following:

a) If stock is overfished:

F=0, FCurrent, FMSY, FOY

F=FRebuild (max that permits rebuild in allowed time)

b) If stock is undergoing overfishing:

F= FCurrent, FMSY, FOY

c) If stock is neither overfished nor undergoing overfishing:

F= FCurrent, FMSY, FOY

d) If data limitations preclude classic projections (i.e. A, B, C above), explore alternate models to provide management advice

! Done, documentation incomplete.

10. Provide a probability density function for the base model, or a combination of models that represent alternate states of nature, presented for review.

- Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments for use with the Tier 1 ABC control rule
- Provide justification for the weightings used in producing combinations of models

! Not completed.

11. Provide recommendations for future research and data collection.

- Be as specific as practicable in describing sampling design and intensity
- Emphasize items which will improve future assessment capabilities and reliability
- Recommend an appropriate interval and type for the next assessment

! No additional recommendations added in section 3.3.

12. Prepare a spreadsheet containing all model parameter estimates, all relevant population information resulting from model estimates, and projection and simulation exercises. Include all data included in assessment report tables and all data that support assessment workshop figures.

! Done.

13. Complete the Assessment Workshop Report (Section III: SEDAR Stock Assessment Report).

! Incomplete.

Conclusions and recommendations

Validate the discard release mortality. The meta analysis to describe the discard release mortality as a function of depth could be repeated and verified. Assuming it is correct a better graphical representation of the fit should be produced. This is not a big task provided that the data are still available, but the current plot indicates a lack of fit.

Separate stock-recruitment relationships. Setup a model configuration, which allow separate stock-recruitment relationships to be estimated for the separate areas (east and west). This will hopefully produce more informative stock-recruitment relationships, and remove the need for fixing the steepness at 0.99. It will also allow other more local effects (e.g., environmental) to be included in the relationship.

Appropriateness of the assumed variances. Investigate the appropriateness of the assumed uncertainties for the different data sources. A first step could be to try to estimate some of the observation parameters while keeping others fixed. Stock Synthesis (and AD Model Builder) is a good tool for these investigations.

Improved discard data. Follow the research recommendations for discard from the data report.

References

Methot, R.D. Jr. and I.G. Taylor 2011. Adjusting for Bias due to Variability of Estimated Recruitments in Fishery Assessment Models. Can. J. Fish. Aquat. Sci. 68: 1744-1760.

Methot, R.D. 2009. Stock Assessment: Operational Models in Support of Fisheries Management. In Beamish and Rothschild (ed) Future of Fishery Science - Proceedings of the 50th Anniversary Symposium of the American Institute of Fishery Research Biologists, Seattle, WA. Springer. Fish & Fisheries Series, Vol. 31: 137-165.

APPENDIX 1: Bibliography of materials provided for review

SECTION III: SEDAR Assessment Workshop Report

SECTION II: SEDAR Data Workshop Report

In addition slide packs:

RW NCummings PPT Wednesday[1].pptx
SEDAR31_reviewWorkshop_baseModelConfig_v2.pptx
SEDAR31_RW_AdditionalPlots_5-2-13.pptx
SEDAR31_RW_AgeCompReweight_5-1-13.ppt
SEDAR31_RW_AgeError_4-30-13.ppt
SEDAR31_RW_BaseResults_4-29-13.ppt
SEDAR31_RW_CATCHEMvsSS_4-30-13.ppt
SEDAR31_RW_DataInputs_4-25-13.ppt
SEDAR31_RW_Diagnostics.pptx
SEDAR31_RW_ModelWeight.pptx
SEDAR 31 RW Profiling and Sensitivity Presentation.ppt
SEDAR31_RW_Projections2.pptx
SEDAR31_RW_Projections.pptx
SEDAR31_RW_PropRetained_5-1-13.pptx
SEDAR31_RW_ReferencePts_5-1-13.pptx
SEDAR31_RW_Retrospectives.pptx
SEDAR31_RW_Sensitivites2.pptx
SEDAR31_RW_Sensitivity.pptx
SEDAR31_RW_StockRecruit_5-1-13.pptx
SEDAR31_RW_TimeVarySteepness_4-30-13.pptx
SEDAR31_RW_Uncertainty.pptx
SEDAR31_RW_YPRCurve_5-2-13.ppt

Document Number	Title	Authors
Data Workshop Documents		
SEDAR31-DW01	Relative abundance of juvenile red snapper, *Lutjanus campechanus* in the northern Gulf of Mexico	Parsons
SEDAR31-DW02	Brief overview on Gulf of Mexico Red Snapper IFQ Program	Stephen
SEDAR31-DW03	Working Paper for Red Snapper Data Workshop (SEDAR 31)	Cowan, Boswell, Simonsen, Saari, and Kulaw
SEDAR31-DW04	Recreational Survey Data for Red snapper in the Gulf of Mexico	Matter
SEDAR31-DW05	Red snapper (*Lutjanus campechanus*) otolith ageing summary for collection years 2009-2011	Allman, Barnett, Trowbridge, Goetz, and Evou
SEDAR31-DW06	An Update to the Age Composition, Growth,	Gazey, Gallaway, and

	and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery	Cole
SEDAR31-DW07	Expanded Annual Stock Assessment Survey 2011: Red Snapper Reproduction	Fitzhugh, Lang, and Lyon
SEDAR31-DW08	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Red Snapper	Campbell, Rademacher, Felts, Noble, Felts, and Salisbury
SEDAR31-DW09	Index of Abundance for Pre-Fishery Recruit Red Snapper from Florida Headboat Observer Data	O'Hop and Sauls
SEDAR31-DW10	Length frequency distributions for red snappers in the Gulf of Mexico from 1984-2011	Chih
SEDAR31-DW11	A Summary of Data on the Size Distribution and Release Condition of Red Snapper Discards from Recreational Fishery Surveys in the Gulf of Mexico	Sauls
SEDAR31-DW12	A comparison of the size and age of red Snapper, *Lutjanus campechanu*s, to the age of artificial reefs in the northern Gulf of Mexico	Syc and Szedlmayer
SEDAR31-DW13	Use of Ultrasonic Telemetry to Estimate Natural and Fishing Mortality of Red Snapper	Topping and Szedlmayer
SEDAR31-DW14	Fine-scale Movements and Home Ranges of Red Snapper *Lutjanus campechanus* Around Artificial Reefs in the Northern Gulf of Mexico	Piraino and Szedlmayer
SEDAR31-DW15	Spatio-temporal dynamics in red snapper reproduction on the West Florida Shelf, 2008-2011	Lowerre-Barbieri, Crabtree, Switzer, and McMichael
SEDAR31-DW16	Spatial distribution and occurrence of red snapper, *Lutjanus campechanus*, sampled off the Louisiana coast during nearshore trawl sampling efforts	Adriance and Sweda
SEDAR31-DW17	Summary report of the red snapper (Lutjanus campechanus) catch during the 2011 expanded annual stock assessment (EASA)	Campbell, Pollack, Henwood, Provaznik, and Cook
SEDAR31-DW18	On the comparisons of regional differences in the growth of red snappers from the Gulf of Mexico	Chih
SEDAR31-DW19	Abundance Indices of Red Snapper Collected in NMFS Bottom Longline Surveys in the northern Gulf of Mexico	Ingram and Pollack
SEDAR31-DW20	Red Snapper Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico	Pollack, Ingram, and Foster
SEDAR31-DW21	Examining delayed mortality in barotrauma afflicted red snapper using acoustic telemetry and hyperbaric experimentation	Stunz and Curtis
SEDAR31-DW22	Release mortality in the red snapper fishery: a synopsis of three decades of research	Campbell, Driggers, and Sauls

SEDAR31-DW23	Release Mortality Estimates for Recreational Hook-and-Line Caught Red Snapper Derived from a Large-Scale Tag-Recapture Study in the Eastern Gulf of Mexico	Sauls
SEDAR31-DW24	Fisheries-independent data for red snapper from reef-fish surveys on the West Florida Shelf, 2008-2011	Switzer, Keenan, and McMichael
SEDAR31-DW25	Estimated Conversion Factors for Adjusting MRFSS Gulf of Mexico Red Snapper Catch Estimates and Variances in 1981-2003 to MRIP Estimates and Variances	Rios, Matter, Walter, Farmer, and Turner
SEDAR31-DW26	Developing a survey methodology for sampling red snapper, *Lutjanus campechanus*, at oil and gas platforms in the northern Gulf of Mexico	Moser, Pollack, Ingram, Gledhill, Henwood, and Driggers
SEDAR31-DW27	Red Snapper (*Lutjanus campechanus*) larval indices of relative abundance from SEAMAP fall plankton surveys, 1986 to 2010	Pollack, Hanisko, Lyczkowski- Shultz, Jones, and Ingram
SEDAR31-DW28	Red Snapper Findings from the NMFS Panama City Laboratory Trap & Camera Fishery-Independent Survey – 2004-2011	DeVries, Ingram, Gardner, and Raley
SEDAR31-DW29	Artificial Structure and Hard-Bottom Spatial Coverage in the Gulf of Mexico	Mueller
SEDAR31-DW30	Shrimp Fishery Bycatch Estimates for Gulf of Mexico Red Snapper, 1972-2011	Linton
SEDAR31-DW31	Calculated red snapper discards in the Gulf of Mexico commercial vertical line and bottom longline fisheries: preliminary results	McCarthy
SEDAR31-DW32	Observer reported size distribution of Gulf of Mexico red snapper from the commercial vertical line and bottom longline fisheries	McCarthy
SEDAR31-DW33	Using a Censored Regression Modeling Approach to Standardize Red Snapper Catch per Unit Effort Using Recreational Fishery Data Affected by a Bag Limit	Saul and Walter
Assessment Workshop Documents		
SEDAR31-AW01	Headboat Discards for Red Snapper in the Gulf of Mexico	Matter and Walter
SEDAR31-AW02	Accounting for changes in fishing mortality when comparing density-dependent to density-independent mortality in Gulf of Mexico red snapper	Vincent
SEDAR31-AW03	Modeling the dependence of batch fecundity and spawning frequency on size and age for use in stock assessments of red snapper in U.S. Gulf of Mexico waters	Porch, Fitzhugh, and Linton
SEDAR31-AW04	The Effect of Hook Type on Red Snapper Catch	Saul, Walter, Shipp, Powers, and Powers

SEDAR31-AW05	Age Composition of Red Snapper Bycatch in the Gulf of Mexico Shrimp Fishery, 1997-2011	Linton
SEDAR31-AW06	Shrimp trawl index of abundance for Gulf of Mexico red snapper, 1967-1989	Linton
SEDAR31-AW07	Red Snapper Abundance Indices from Combined Bottom Trawl Surveys in the Eastern Gulf of Mexico	Pollack, Ingram, and Henwood
SEDAR31-AW08	A proposed methodology to incorporate ROV length data into red snapper stock assessments	Walter, DeVries, Drymon, Patterson, Powers, and Williams
SEDAR31-AW09	Reconstructed time series of offshore shrimp trawl effort in the Gulf of Mexico from 1945 to 1972 for use in the SEDAR 31 Gulf of Mexico red snapper assessment	Porch
SEDAR31-AW10	Use of the Connectivity Modeling System to estimate movements of red snapper recruits in the northern Gulf of Mexico	Karnauskas, Walter, and Paris
SEDAR31-AW11	Estimating historical recreational angler effort in the Gulf of Mexico for the private, charter, and headboat fishing modes	Rios
SEDAR31-AW12	Estimation of hook selectivity on red snapper (*Lutjanus campechanus*) during a fishery independent survey of natural reefs in the Gulf of Mexico	Pollack, Campbell, and Driggers
SEDAR31-AW13	Dauphin Island Sea Lab Bottom Longline Survey incorporation into the NMFS Bottom Longline Survey	Ingram
SEDAR31-AW14	Combined Index for Florida Fish and Wildlife Research Institute and NMFS Panama City Video Surveys	Ingram
SEDAR31-AW15	Age frequency distributions estimated with reweighting methods for red snappers in the Gulf of Mexico from 1991 to 2011	Chih
SEDAR31-AW16	Changes in lengths-at-age and size selectivity of red snappers in the Gulf of Mexico from 2002 to 2011	Chih
SEDAR31-AW17	Response to comments on: *Age Composition, Growth and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery*	Gazey, Gallaway, and Cole
Review Workshop Documents		
SEDAR31-RW01		
Reference Documents		
SEDAR31-RD01	SEDAR 7 Stock Assessment Report	SEDAR
SEDAR31-RD02	2009 SEDAR 7 Update Assessment Report	SEDAR

SEDAR31-RD03	Red Snapper 2011 Projections Update	SEFSC
SEDAR31-RD04	Estimation of Fisheries Impacts Due to Underwater Explosives Used to Sever and Salvage Oil and Gas Platforms in the U.S. Gulf of Mexico	Minerals Management Service
SEDAR31-RD05	Age Composition, Growth, and Density-Dependent Mortality in Juvenile Red Snapper Estimated from Observer Data from the Gulf of Mexico Penaeid Shrimp Fishery	Gazey, Gallaway, Cole, and Fournier
SEDAR31-RD06	A Life History Review for Red Snapper in the Gulf of Mexico with an Evaluation of the Importance of Offshore Petroleum Platforms and Other Artificial Reefs	Gallaway, Szedlmayer, and Gazey
SEDAR31-RD07	Addressing Time-Varying Catchability	SEDAR
SEDAR31-RD08	Fishery-Independent Catch of Young-of-the-Year Red Snapper in the Texas Territorial Sea, 1985–2007	Dorf and Fisher
SEDAR31-RD09	Red Snapper Management History	GMFMC
SEDAR31-RD10	Home range and movement patterns of red snapper (*Lutjanus campechanus*) on artificial reefs	Topping and Szedlmayer
SEDAR31-RD11	Genetic variation and spatial autocorrelation among young-of-the-year red snapper (*Lutjanus campechanus*) in the northern Gulf of Mexico	Saillant, Bradfield, and Gold
SEDAR31-RD12	Determining policy-efficient management strategies in fisheries using data envelopment analysis (DEA)	Griffin and Woodward
SEDAR31-RD13	Red Snapper Larval Transport in the Northern Gulf of Mexico	Johnson, Perry, Lyczkowski-Shultz, and Hanisko
SEDAR31-RD14	Estimation of the Source of Red Snapper Recruits to West Florida and South Texas with Otolith Chemistry: Implications for Stock Structure and Management	Patterson, Cowan, Barnett, and Sluis
SEDAR31-RD15	Trends in Gulf of Mexico Red Snapper Population Dynamics, 1979-85	Parrack and McClellan
SEDAR31-RD16	Effects of habitat complexity and predator exclusion on the abundance of juvenile red snapper	Piko and Szedlmayer
SEDAR31-RD17	Survival and movement of hatchery-reared red snapper on artificial habitats in the northern Gulf of Mexico	Chapin, Szedlmayer, and Phelps

SEDAR31-RD18	A Life History Review for Red Snapper in the Gulf of Mexico with an Evaluation of the Importance of Offshore Petroleum Platforms and Other Artificial Reefs	Gallaway, Szedlmayer, and Gazey
SEDAR31-RD19	The use of otolith shape analysis for ageing juvenile red snapper, *Lutjanus campechanus*	Beyer and Szedlmayer
SEDAR31-RD20	Validation of annual periodicity in otoliths of red snapper, *Lutjanus campechanus*	Szedlmayer and Beyer
SEDAR31-RD21	The Artificial Habitat as an Accessory for Improving Estimates of Juvenile Reef Fish Abundance in Fishery Management	Szedlmayer
SEDAR31-RD22	Home range and movement patterns of red snapper (*Lutjanus campechanus*) on artificial reefs	Topping and Szedlmayer
SEDAR31-RD23	Site fidelity, residence time and movements of red snapper *Lutjanus campechanus* estimated with long-term acoustic monitoring	Topping and Szedlmayer
SEDAR31-RD24	Proximity Effects of Larger Resident Fishes on Recruitment of Age-0 Red Snapper in the Northern Gulf of Mexico	Mudrak and Szedlmayer
SEDAR31-RD25	Estimates of Historic Recreational Landings of Spanish Mackerel in the South Atlantic Using the FHWAR Census Method	Brennan and Fitzpatrick
SEDAR31-RD26	Declining Size at Age Among Red Snapper in the Northern Gulf of Mexico off Louisiana, USA: Recovery or Collapse?	Nieland, Wilson, and Fischer
SEDAR31-RD27	Examination of Red Snapper Fisheries Ecology on the Northwest Florida Shelf (FWC-08304): Final Report	Patterson, Tarnecki, and Neese
SEDAR31-RD28	Site Fidelity, Movement, and Growth of Red Snapper: Implications for Artificial Reef Management	Strelcheck, Cowan, and Patterson
SEDAR31-RD29	Factors Affecting Catch and Release (CAR) Mortality in Fish: Insight into CAR Mortality in Red Snapper and the Influence of Catastrophic Decompression	Rummer
SEDAR31-RD30	Effect of Circle Hook Size on Reef Fish Catch Rates, Species Composition, and Selectivity in the Northern Gulf of Mexico Recreational Fishery	Patterson, Porch, Tarnecki, and Strelcheck
SEDAR31-RD31	Effect of trawling on juvenile red snapper (*Lutjanus campechanus*) habitat selection and life history parameters	Wells, Cowan, Patterson, and Walters

SEDAR31-RD32	Habitat use and the effect of shrimp trawling on fish and invertebrate communities over the northern Gulf of Mexico continental shelf	Wells, Cowan, and Patterson
SEDAR31-RD33	Site Fidelity and Movement of Reef Fishes Tagged at Unreported Artificial Reef Sites off NW Florida	Addis, Patterson, and Dance
SEDAR31-RD34	Fish Community and Trophic Structure at Artificial Reef Sites in the Northeastern Gulf of Mexico	Dance, Patterson, and Addis
SEDAR31-RD35	A Review of Movement in Gulf of Mexico Red Snapper: Implications for Population Structure	Patterson
SEDAR31-RD36	Size selectivity of sampling gears targeting red snapper in the northern Gulf of Mexico	Wells, Boswell, Cowan, and Patterson
SEDAR31-RD37	Delineating Juvenile Red Snapper Habitat on the Northern Gulf of Mexico Continental Shelf	Patterson, Wilson, Bentley, Cowan, Henwood, Allen, and Dufrene
SEDAR31-RD38	Habitat- and Region-Specific Reproductive Biology of Female Red Snapper (*Lutjanus campechanus*) in the Gulf of Mexico	Kulaw
SEDAR31-RD39	Comparison of the Age and Growth of Red Snapper (*Lutjanus campechanus*) Amongst Habitats and Regions in the Gulf of Mexico	Saari
SEDAR31-RD40	Oil Platforms and Red Snapper Movement and Behavior	McDonough
SEDAR31-RD41	Reconstructed time series of shrimp trawl effort in the Gulf of Mexico and the associated bycatch of red snapper from 1948 to 1972	Porch and Turner
SEDAR31-RD42	Individual-based modeling of an artificial reef fish community: Effects of habitat quantity and degree of refuge	Campbell, Rose, Boswell, and Cowan
SEDAR31-RD43	Literature Search and Data Synthesis of Biological Information for Use in Management Decisions Concerning Decommissioning of Offshore Oil and Gas Structures in the Gulf of Mexico	Versar, Inc.
SEDAR31-RD44	The Environmental Effects of Underwater Explosions with Methods to Mitigate Impacts	Keevin and Hempen
SEDAR31-RD45	Connections between Campeche Bank and Red Snapper Populations in the Gulf of Mexico via modeled larval transport	Johnson, Perry, and Lyczkowski-Shultz

SEDAR31-RD46	The commercial landings of red snapper in the Gulf of Mexico from 1872 to 1962	Porch, Turner, and Schirripa
SEDAR31-RD47	Estimates of Historical Red Snapper Recreational Catch Levels Using US Census Data and Recreational Survey Information	Scott
SEDAR31-RD48	MRFSS/MRIP Calibration Workshop: Ad-hoc Working Group Report	Salz, Miller, Williams, Walter, Drew, and Bray
SEDAR31-RD49	Survival of Red Grouper (*Epinephelus morio*) and Red Snapper (*Lutjanus campechanus*) Caught on J-Hooks and Circle Hooks in the Florida Recreational and Recreational-for-Hire Fisheries	Burns and Froeschke
SEDAR31-RD50	Circle Hook Requirements in the Gulf of Mexico: Application in Recreational Fisheries and Effectiveness for Conservation of Reef Fishes	Sauls and Ayala

APPENDIX 2: Statement of Work

SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

BACKGROUND

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 31 will be a compilation of data, a benchmark assessment of the stock, and an assessment review conducted for Gulf of Mexico red 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 stock assessed through SEDAR 31 is within the jurisdiction of the Gulf of Mexico Fishery Management Council and the state waters of Texas, Louisiana, Mississippi, Alabama, and Florida.

OBJECTIVES

Requirements for the reviewers: Three reviewers shall conduct an impartial and independent peer review of the stock assessments in accordance with the tasks, milestones, and terms of reference (ToRs) of this SoW. The reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the primary task of providing peer-review advice in compliance with the workshop Terms of Reference.

PERIOD OF PERFORMANCE

The reviewers shall conduct the tasks according to the schedule of milestones and deliverables as specified in this statement of work (SoW). Each reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein. The tentative schedule of milestones and deliverables is provided herein.

PLACE OF PERFORMANCE AND TRAVEL

Each reviewer shall conduct an independent peer review during a five day panel review meeting scheduled in Gulfport, Mississippi during April 29 through May 3, 2013.

STATEMENT OF TASKS

Each 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.

<u>Foreign National Security Clearance</u>: The reviewers shall participate during a panel review meeting at a government facility, and the NMFS Project Contact will be responsible for obtaining the Foreign National Security Clearance approval for the reviewers who are non-US citizens. For this reason, the

reviewers shall provide by FAX (not by email) the 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/.

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 at the Gulfport, Mississippi during April 29 – May 3, 2013.
3) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than May 17, 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**.

DELIVERY

Each reviewer shall complete an independent peer review report in accordance with the SoW. Each reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each reviewer shall complete the independent peer review addressing each stock assessment ToR listed in **Annex 2**.

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

March 24, 2013	Contractor sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
April 14, 2013	NMFS Project Contact provides reviewers the pre-review documents
April 29 – May 3, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting in Gulfport, Mississippi.
May 17, 2013	Reviewers submit draft independent peer review reports to the contractor's technical team for independent review
May 29, 2013	Contractor submits independent peer review reports to the COR who reviews for compliance with the contract requirements
June 5, 2013	The COR distributes the final 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 COR within 10 working days after receipt of all required information of the decision on substitutions. 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 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: The deliverables shall be the final peer review report from each reviewer that satisfies the requirements and terms of reference of this SoW. The contract shall be successfully completed upon the acceptance of the contract deliverables by the COR based on three performance standards:

(1) each report shall be completed with the format and content in accordance with **Annex 1**,

(2) each report shall address each stock assessment ToR listed in **Annex 2**,
(3) each report shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Upon the acceptance of each independent peer review report by the COR, the reports will be distributed to the NMFS Project Contact and pertinent NMFS science director, at which time the reports will be made publicly available through the government's website.

The contractor shall send the final reports in PDF format to the COR, designated to be William Michaels, via email William.Michaels@noaa.gov

Support Personnel:

William Michaels, Program Manager, COR
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Roger W. Peretti, Executive Vice President
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Key Personnel:

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Ryan.Rindone@gulfcouncil.org Phone: 813-348-1630

Annex 1: Format and Contents of Independent Peer Review Report

1. The independent peer review report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The main body of the report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Findings of whether they accept or reject the work that they reviewed, and an explanation of their decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. For each assessment reviewed, the report should address whether each ToR of the SAssessment Workshop was completed successfully. For each ToR, the Independent Review Report should state why that ToR was or was not completed successfully. To make this determination, the SEDAR chair and reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), 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 SEDAR 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 independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not others read the SEDAR Summary Report. The independent report shall be an independent peer review of each ToR, 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 this Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference

SEDAR 31 Gulf of Mexico Red Snapper Review Workshop

1. Evaluate the data used in the assessment, addressing the following:
   - Are data decisions made by the Data and Assessment Workshops sound and robust?
   - Are data uncertainties acknowledged, reported and within normal or expected levels?
   - Are data applied properly within the assessment model?
   - Are input data series reliable and sufficient to support the assessment approach and findings?
2. Evaluate the methods used to assess the stock, accounting for only the available data:
   - Are the methods scientifically sound, robust, and appropriate for the available data?
   - Are assessment models properly configured and used consistent with standard practices?
3. Evaluate the assessment findings with respect to the following:
   - Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support inferences on stock status?
   - Is the stock overfished? What information helps you reach this conclusion?
   - Is the stock undergoing overfishing? What information helps you reach this conclusion?
   - Is there an informative stock-recruitment relationship? Is the stock-recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   - Are quantitative estimates of 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:
   - Are the methods consistent with accepted practices and available data?
   - Are the methods appropriate for the assessment model and outputs?
   - Are results informative and robust, and useful to support inferences of probable future conditions?
   - 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 with particular emphasis on the Deepwater Horizon Oil Spill
   - 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 Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report in accordance with the project guidelines.

The review panel may not request a new assessment. The review panel may request a limited number of additional sensitivity analyses and evaluations of alternative assumptions, and may correct errors identified in the assessment. Additional details regarding the latitude given to the review panel to deviate from assessments provided by the assessment workshop panel are provided in the SEDAR Guidelines and the SEDAR Review Panel Overview and Instructions.

** The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made, alternate 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 31 Gulf of Mexico Red Snapper Review Workshop

Gulfport, Mississippi during April 29 – May 3, 2013

Monday

1:00 p.m.	**Convene**	
1:00 – 1:30	**Introductions and Opening Remarks**	**Rindone**
	- Agenda Review, TOR, Task Assignments	
1:30 – 5:00	**Assessment Presentations and Discussions**	**Linton, Saul**
5:00 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

Tuesday

8:00 a.m. – 11:30 a.m.	**Assessment Presentations**	**Linton, Saul**
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 3:30 p.m.	**Panel Discussion**	**Barbieri**
	- Assessment Data & Methods	
	- Identify additional analyses, sensitivities, corrections	
3:30 p.m. – 3:45 p.m.	**Break**	
3:45 p.m. – 5:00 p.m.	**Panel Discussion**	**Barbieri**
	- Continue deliberations	
	- Review additional analyses	
5:00 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

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

Wednesday

8:00 a.m. – 11:30 a.m.	**Panel Discussion**	**Barbieri**
	- Review additional analyses, sensitivities	
	- Consensus recommendations and comments	
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 3:30 p.m.	**Panel Discussion**	**Barbieri**
	- Final sensitivities reviewed.	
	- Projections reviewed.	
3:30 p.m. – 3:45 p.m.	**Break**	
3:45 p.m. – 5:00 p.m.	**Panel Discussion**	**Barbieri**
	- Review Consensus Reports	
5:00 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

Wednesday Goals: Final sensitivities identified, preferred models selected, projection approaches approved, final results made available. Summary report drafts begun.

Thursday

8:00 a.m. – 11:30 a.m.	**Panel Work Session**	**Barbieri**
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 3:30 p.m.	**Panel Work Session**	**Barbieri**
3:30 p.m. - 3:45 p.m.	**Break**	
3:45 p.m. - 6:00 p.m.	**Panel Work Session**	**Barbieri**

Thursday Goals: Draft Summary Report reviewed.

Friday

8:00 a.m. – 1:00 p.m.	**Panel Work Session**	**Barbieri**
1:00 p.m.	**ADJOURN**	