2008 SEDAR 15 Stock Assessment Review

for

The Center for Independent Experts

Feb 2008

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Executive Summary

The SEDAR 15 Review Panel provided an independent peer review of key decisions of and outputs from Data and Assessment Workshops for South Atlantic red snapper, greater amberjack and mutton snapper. The review was held January 28th to 1st February 2008 at the Holiday Inn Brownstone Hotel in Raleigh, North Carolina. Data and assessment reports were presented to the Panel, and issues considered against the Review Panel's Terms of Reference through open discussion. Additional assessment runs were requested and results considered. The Panel examined whether the Data and Assessment Workshop responses to their Terms of Reference were adequate, complete, and scientifically sound, and determined whether base case analyses were preferred for determining stock status and developing management references.

The base run for each assessment was found to be the most appropriate for management advice. However, the results were conditioned on the assumptions made within that assessment model. In turn, there were a number of uncertainties, which are fully documented within the SEDAR 15 Review Panel consensus report. Results from equally plausible alternative runs illustrated the level of uncertainty, although population status estimates seemed *generally* robust to this.

This CIE reviewer's comments were fully incorporated in the Consensus report. In the current report, generic and assessment-specific observations and recommendations are presented against each of the Review Panel Terms of Reference (Appendix 1). Only key or additional issues to those presented in the Consensus Report are highlighted within this report.

1. Evaluate the adequacy, appropriateness, and application of data used in the assessment.
In the red snapper and greater amberjack assessments, strong assumptions were made on the historical catch time series to which the model was fitted. While estimated current stock status appeared relatively robust to these assumptions, the historical landings time series warrants further investigation. **Recommendation 1**: Continue to investigate data sources to improve knowledge on historical catch levels. **Recommendation 2**: Examine alternative plausible hypotheses for historical catch levels to identify the sensitivity of assessments to assumptions.

The CPUE time series developed through application of the Stephens and MacCall (2004) method can result in bias if the catch species complex changes over time. **Recommendation 3**: Examine potential bias arising from the Stephens and MacCall approach by examining available data for changes in species composition over time. Assess potential bias by fitting models to data that include only catches noted as containing the focal species (as done for some assessments), rather than all landings that might include the focal species.

The impact of seasonal (May-June) bag limits for mutton snapper on commercial CPUE indices warrants further investigation. **Recommendation 4**: Examine the seasonal commercial mutton snapper CPUE data to see whether the bag limit period should be separated from the time series.

If targeted fisheries develop for the species, or future management action restricts fishing activities, current fishery-dependent population indices may become biased. **Recommendation 5**: Develop and continue time series of fishery independent indices that encompass the geographic range of each stock. See also recommendation 15.

In all assessments, assumptions were made on the rate of discard mortality from different fishery components, in particular within the historical time period. These were based upon limited observations, and increased uncertainty in model outputs. **Recommendation 6**: Monitor uptake of circle hooks within the red snapper fishery, and its impact on discard mortality. Monitor the red snapper commercial fishery for changes in discarding practices that could reduce post-capture mortality. See also recommendation 16. **Recommendation 7**: Examine the effect of alternative hypotheses for discard selectivity on stock assessment results.

2. Evaluate the adequacy, appropriateness, and application of methods used to assess the stock.
In all three assessments a variety of assessment models were used. These outputs were supported by results from catch curve analyses suggested by the Review Panel. Use of alternative models provided an insight on the level of uncertainty in stock status due to model structure.

Although general preference for age-structured models is understandable, allowing the impact of management actions on gear selectivity to be modelled, the length and age time series of data available is relatively limited. Continued collection of ageing information is likely to reduce this uncertainty.

The weighting of likelihood components in red snapper and greater amberjack catch-at-age models was relatively *ad hoc*, weightings being adjusted in order to achieve the 'best fit' of the model to data. Alternative approaches would allow other assessment scientists to recreate fits consistently. **Recommendation 8**: Develop a systematic basis for selecting likelihood weights for model components.

Reasonable stock-recruitment relationship estimates were derived for greater amberjack. For the other two species, the stock-recruitment relationship was uncertain. **Recommendation 9**: Where assessments result in uncertain stock-recruitment relationships, perform sensitivity analyses to examine the impact on estimates of current and projected future stock status (see red snapper assessment).

The mutton snapper ASAP model forced a dome-shaped selectivity at age. This may underestimate SSB. Additional runs requested by the Review Panel to investigate this further using an alternative age-structured model could not be completed during the review session, and hence investigation of this issue is incomplete. **Recommendation 10**: Include the option for an asymptotic selectivity function in future model development. Look further at the impact of selectivity assumptions on mutton snapper assessment results.

3. Recommend appropriate estimates of stock abundance, biomass, and exploitation measures.
For all three stocks, the base run was selected as the 'best' representation of current stock status. This estimate is conditioned on assumptions made within the

corresponding assessment model. Results from equally plausible alternative model runs illustrated the levels of uncertainty in stock status.

4. Evaluate the methods used to estimate population benchmarks and management parameters (e.g. MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies); provide estimated values for management benchmarks, a range of allowable catches (ABC), and declarations of stock status relative to benchmarks.
For greater amberjack, use of MSY-based metrics of stock status was justified given the contrast in stock-recruitment data. For the other species, uncertainty in the stock-recruitment relationship suggested that MSY proxies be used for benchmarks.

All benchmarks estimates are conditioned upon the assessment methods used and assumptions made. The biological and economic performance of benchmarks can only be viewed within the context of the fishery and data collection and management framework. **Recommendation 11**: To fully evaluate population benchmarks and methods used to estimate them, examine their robustness against alternative plausible states of nature through Management Strategy Evaluation.

5. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status; recommend appropriate estimates of future stock condition (e.g. exploitation, abundance, biomass).
The approaches used underestimate uncertainty in future projections; indeed, mutton snapper projections were deterministic. For all stocks, the starting point of projections was constant, whereas uncertainty in current population status is demonstrated by the results of different sensitivity analyses. Longer-term stock status within projections assumes that stock dynamics remain constant. This is unlikely, particularly for stocks recovering from overexploitation. Projections become increasingly uncertain where they move beyond the stage where the existing estimated population dominates the stock, and recruitment estimates (from uncertain stock-recruitment relationships) begin to strongly influence stock biomass levels.

6. Evaluate the adequacy, appropriateness, and application of methods used to characterise uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.
Uncertainty was primarily examined through a large number of sensitivity runs, and by examining different assessment model approaches. For all assessments, however, there was a need to understand the impact of uncertainty on assessment results. **Recommendation 12**: To more fully characterise uncertainty, Bayesian approaches could be considered. Development of these methods requires assessment personnel to have sufficient time and resources. In turn, fuller use of the outputs from assessment models developed using ADMB (e.g. the Hessian) could help identify the relative levels of components contributing to the overall uncertainty. **Recommendation 13**: To systematically examine uncertainty within assessments, a grid-based system could be used, where population parameters are varied separately across a plausible range (1st order effects), and then in tandem (2nd order effects) where necessary.

7. Ensure the stock assessment results are clearly and accurately presented in the stock assessment report and advisory report, and that reported results are consistent with Review Panel recommendations.
This reviewer confirms the findings of the Review Panel.

8. Evaluate the SEDAR process. Identify any terms of reference which were inadequately addressed by the data or assessment workshops; identify any additional information or assistance which will improve review workshops; suggest improvements or identify aspects requiring clarification.
This reviewer confirms the findings of the Review Panel.

9. Review the research recommendations provided by the data and assessment workshops and make any additional recommendations warranted. Clearly indicate research and monitoring needs that may appreciably improve the reliability of future assessments. Recommend an appropriate interval for the next assessment.
This reviewer supports the recommendations for future research made by the respective Data and Assessment workshops. In particular, future research should focus upon areas that will directly improve the assessment performance. Specifically:

Age data for all species were limited, which impacts age-based stock assessments. **Recommendation 14**: The time series of adequate age information should be increased for all species.

The absence of fishery-independent indices of population abundance meant some assessments were potentially affected by both changes in fishery targeting, and management interventions. **Recommendation 15**: Continued development of a robust and comprehensive fishery independent index of population abundance is encouraged.

Discard mortality estimates were generally uncertain, based on limited *in-situ* fishery observations. **Recommendation 16**: Improve discard mortality estimates through observer programmes and co-operation with the fishermen.

Assumptions for the rate of catchability increase had notable impacts on assessment results. **Recommendation 17**: This reviewer endorses the plans for a SEDAR workshop quantifying technical 'creep' in fisheries.

The Review Panel noted the potential to develop triggers for management based upon data time series. **Recommendation 18**: The effectiveness and robustness of proposed data time series triggers should be tested through Management Strategy Evaluation.

Background

South East Data, Assessment, and Review (SEDAR) is a process for fisheries stock assessment development and review conducted by the South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils; NOAA Fisheries Southeast Fisheries Science Center (SEFSC) and Southeast Regional Office (SERO); and the Atlantic and Gulf States Marine Fisheries Commissions. SEDAR is organized around three workshops: data, assessment, and review. Input data are compiled during the data workshop, population models are developed during the assessment workshop, and an independent peer review of the data, assessment models, and results is provided by the review workshop. SEDAR documents include working papers prepared for each workshop, supporting reference documents, and a SEDAR stock assessment report. The SEDAR stock assessment report consists of a data report produced by the data workshop, a stock assessment report produced by the assessment workshop, and a peer review consensus report prepared by the review workshop.

SEDAR is a public process conducted by the Fishery Management Councils in the Southeast US. All workshops, including the review, are open to the public and noticed in the Federal Register. All documents prepared for SEDAR are freely distributed to the public upon request and posted to the publicly accessible SEDAR website. Verbal public comment during SEDAR workshops is taken on an 'as needed' basis; the workshop chair is allowed discretion to recognize the public and solicit comment as appropriate during panel deliberations. Written comments are accepted in accordance with existing Council operating procedures. The names of all participants, including those on the Review Panel, are revealed.

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 Review Panel task is specified in terms of reference.

The SEDAR 15 Review Panel was composed of three Center for Independent Experts (CIE)-appointed reviewers, one reviewer appointed by the South Atlantic Council, and a chair appointed by the SEFSC director. Council staff, Council members, and Council AP and SSC members attended as observers. Members of the public were free to attend the SEDAR review workshop.

This document represents the individual CIE Reviewer Report on the results of the Review Panel deliberations on the assessments of south Atlantic red snapper (*Lutjanus campechanus*), greater amberjack (*Seriola dumerili*) and mutton snapper (*Lutjanus analis*) on which the reviewer sat, at the request of the Center for Independent Experts (see Appendix 1). The author was provided with the Data and Assessment Workshop reports for each species (see bibliography), and participated fully in the SEDAR Review Panel process.

Description of review activities

This review was undertaken by Dr Graham Pilling at Cefas (Lowestoft, UK) and during the SEDAR Review Panel held in Raleigh, North Carolina, at the Holiday Inn Brownstone Hotel. The SEDAR Review Panel was convened during January 28th to 1st February 2008.

The documentation (see bibliography) was reviewed at Cefas, prior to travel. Dr Pilling actively participated in the SEDAR panel meeting in Raleigh and assisted with development of the SEDAR Review Panel meeting report. This separate report to CIE was completed on return to Cefas.

The lead assessment scientists presented the individual data and assessment reports to the Panel, and issues were considered against the Review Panel's Terms of Reference through open discussion. In turn, additional assessment runs were requested by the Review Panel and further consideration of these results made. The Review Panel examined whether the Data and Assessment Workshop's responses to their Terms of Reference were adequate, complete, and scientifically sound, and determined whether the base case analyses were preferred for determining stock status and developing management references.

Summary of findings

The meeting of the SEDAR 15 Review Panel for South Atlantic red grouper, greater amberjack, and mutton snapper stock assessments represented the culmination of an extended period of scientific analysis, data, and assessment meetings. Overall, the data workshop (DW) and assessment workshops (AW) should be commended in developing and refining assessments for these stocks. In turn, this author would like to thank the stock assessment teams for their responsiveness to requests during the Review Panel meeting, and the clarity of their reporting.

This CIE reviewer's comments were fully incorporated in the SEDAR 15 Review Panel consensus report. Below, my summary of findings is presented against each of the Review Panel Terms of Reference (Appendix 1). Within these, generic and assessment-specific observations and recommendations are developed. Note that only where this reviewer notes key or additional issues to those presented in the Consensus Report are they highlighted here. All other comments can be found in the Consensus Report.

Numbered recommendations (in bold) refer to the correspondingly numbered items within the conclusions and recommendations section of this report.

1. Evaluate the adequacy, appropriateness, and application of data used in the assessment

1.1. Historical time series

In both the red snapper and greater amberjack assessments, strong assumptions were made on the uncertain historical recreational catch time series to which the model was fitted.

For red snapper, two historical time series (prior to the 1980s) were developed. The first assumed a linear decline back to 1945. The second was developed from three point estimates in 1960, 1965 and 1970 developed from salt-water angler surveys. These reports suggested very high historical catches, a fact that was supported by images from the period which showed numerous very large red snappers caught by recreational headboat fishermen. This evidence suggested that the linear declining catch history was less likely. Although the exact level of catches cannot be known, the second time series does suggest that historical catches were higher than today, and that the red snapper population was larger than current levels. The uncertainty was further examined by a number of additional analyses requested by the Review Panel. These were found to have little effect on the relative level of estimated current biomass to benchmark levels.

For greater amberjack, a linear decline between the 1980s and 1945 was also assumed. As noted for red snapper, additional information existed from salt-water Angler surveys in the years 1960, 1965, and 1970. In these data sources, jack species were grouped into a guild ('jacks') and hence specific amberjack landing levels could not be identified. However, it was felt that the data available did not suggest major deviation from the linear assumption made.

Given the uncertainty over the historical landings time series, it warrants further investigation. See **Recommendations 1 and 2**.

1.2. Fishery dependent and independent indices

Estimates of effort and catch levels frequently involved application of the Stephens and MacCall (2004) method, which uses multiple logistic regression to estimate a probability for each trip in which the focal species may have been caught, given other species caught on that trip. This approach has the potential to result in a biased CPUE time series if the catch species complex is changing over time. See **Recommendation 3**.

The impact of seasonal (May-June) spawning period bag limits for mutton snapper on commercial CPUE indices was questioned. At this time CPUE may not be representative of the spawning biomass/population (indeed, there is an issue of CPUE estimates from spawning aggregations). See **Recommendation 4**.

Many of the species assessed were not specifically targeted by fishermen, and hence represented a bycatch. As a result, commercial and recreational indices were more likely to follow population levels. However, for some species there is the potential for a targeted fishery to develop, while for others management action has the potential to restrict activities. At this point current population indices may become more biased. The lack of a reliable fishery independent index of abundance, particularly for red snapper and greater amberjack, is therefore an issue. See **Recommendation 5**.

1.3. Discard mortality estimates

In all the assessments, assumptions had to be made on the rate of discard mortality from different fishery components. These were generally based upon limited observations of the fishery.

In the case of red snapper, discard mortality rates were high, particularly from commercial vessels due to a prolonged post-capture period on deck before discarding took place. It was noted that some fishermen are moving to the use of circle hooks, which may result in lower discard mortality. For greater amberjack, discard selectivity was assumed to have the same profile as that of the fishery. However, historically (before a greater degree of greater amberjack targeting took place) discarding of larger individuals may have occurred. This differs from the assumption that zero discards occurred in the commercial fishery prior to 1992. Assumptions on discarding within the mutton snapper assessment model were also required, both as a result of a lack of information on depth of capture and the need to assume discard selectivities historically in the face of changes in minimum size regulations. These assumptions increased uncertainty in model outputs. See **Recommendations 6 and 7**.

2. **Evaluate the adequacy, appropriateness, and application of methods used to assess the stock.**

2.1. Model uncertainty

In all three assessments, a variety of assessment models were used. For example, statistical catch-at-age (SCA) and production models were used in the red snapper and greater amberjack assessments. The results of these analyses were supported by catch curve analyses suggested by the Review Panel. The use of alternative models provided an insight on the level of uncertainty in stock status due to model structure. It resulted in a range of stock reconstructions that better reflected uncertainty in knowledge of stock status. In the majority of cases, the results from different assessment approaches suggested similar stock status and population trajectories.

General preference for age-structured models is understandable, given the potential to model the impact of management actions on gear selectivity. However, there is some concern given the relatively limited time series of length and age data available from the fishery, and uncertainty in ageing for particular species. The impact of this on population estimates was examined through alternative assessment runs. In turn, continued collection of ageing information is likely to reduce the uncertainty resulting from this (see section 9).

2.2. Model likelihood weighting

It was noted that for red snapper and greater amberjack, a large number of runs were performed, which included a wide range of different relative weightings on the likelihood components. However, the relative weighting of likelihood components in these catch-at-age models between the different runs was relatively *ad hoc*, with weightings being adjusted in order to achieve the 'best fit' of the model to data. This approach was arbitrary, and alternative approaches would allow other assessment scientists to recreate fits consistently. Weighting approaches also differed between the two species, with CPUE rather than landings data being attributed a higher weight in the greater amberjack model. This was based on the logic that there was uncertainty in species identification, and hence the landings data were not 'trusted'. The Review Panel requested an additional run with similar weighting logic to the red snapper, which resulted in an equally good fit to the data. Although the Review Panel did not suggest this replace the base run, this alternative represented an equally plausible representation of stock status. See **Recommendation 8**.

2.3. Estimates of the stock-recruitment relationship

Values estimated from the models for the stock-recruitment relationship directly impact upon the values of population benchmarks and frequently projected future population status.

The panel considered that reasonable estimates of the stock-recruitment relationship were derived for greater amberjack. There was felt sufficient contrast in the spawning stock biomass and recruitment data, and sufficient data were present around the plateau of the relationship, to define a biologically realistic relationship. For the other two species, the estimated stock-recruitment relationship was uncertain. For example, the high steepness value for red snapper, which implied a population highly robust to fishing when in combination with an estimated age at maturity of around 1.5 years,

seems both at odds with the population decline seen in recent years, and biologically unlikely. See **Recommendation 9**.

Uncertainty in the stock-recruitment relationship had knock-on implications for the choice of population benchmarks for stocks (see section 4).

2.4. Selectivity assumptions for mutton snapper

The ASAP model used for mutton snapper forced a dome-shaped selectivity at age for all gears. This had the potential to underestimate the SSB, as older ages would not be 'caught' in the model due to the lower selectivity. Examination of a model run where selectivity of commercial gears had been 'forced' to be asymptotic suggested a similar relative F level but higher SSB target, suggesting the population was more overfished than in the base run. Furthermore, the age structure estimates from that model run underestimated the numbers of older (plus-group) fish in the longline catches, which might result from the dome-shaped selectivities of the other gears and their greater impact on the younger ages. Additional runs requested by the Review Panel to investigate this further using an alternative age-structured model could not be completed during the review session. See **Recommendation 10**.

3. **Recommend appropriate estimates of stock abundance, biomass, and exploitation measures.**

For all three stocks, the base run was selected as the 'best' representation of the current stock status. However, as noted by the Review Panel, this estimate is conditioned on assumptions made within the corresponding assessment model used.

The equally plausible alternative runs presented for each species provided an illustration of the levels of uncertainty in stock status. Alternative assumptions could yield equally plausible but different values. Indeed, for particular species (e.g. greater amberjack), specific assumptions within the assessment model could suggest a slightly different stock status relative to reference points.

4. **Evaluate the methods used to estimate population benchmarks and management parameters (e.g. MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies); provide estimated values for management benchmarks, a range of allowable catches (ABC), and declarations of stock status relative to benchmarks.**

For greater amberjack, the Review Panel endorsed the use of MSY-based metrics of stock status. This was felt justified given the contrast in stock-recruitment data and reasonable knowledge of the stock-recruitment relationship asymptote that resulted.

For the other two species, uncertainty in the estimated stock-recruitment relationship led the Review Panel to suggest that proxies for MSY be used as population benchmarks. This reviewer supports that decision.

All population benchmarks derived from the stock assessments are conditioned upon the assessment methods used and assumptions made for each species. However, the biological and economic performance of those benchmarks can only be viewed within the context of the fishery, the data collection framework, assessment model, reference points and management tools applied. See **Recommendation 11**.

5. **Evaluate the adequacy, appropriateness, and application of the methods used to project future population status; recommend appropriate estimates of future stock condition (e.g. exploitation, abundance, biomass).**

As noted by the Review Panel, the projection approaches used, which generally incorporated stochasticity from the stock-recruitment relationship, will underestimate uncertainty in future projections. Indeed, the mutton snapper projections were deterministic. For all stocks, the starting point of projections was constant, whereas uncertainty in current population status is demonstrated by the results of different sensitivity analyses. While the Panel felt that these projections were adequate and appropriate, and likely a qualitative representation of future status under particular conditions, any representation of uncertainty should not be considered.

Longer-term stock status within projections assumes that stock dynamics remain constant. This is unlikely to be the case, particularly for stocks recovering from overexploitation. Furthermore, projections become increasingly uncertain where they move beyond the stage where the existing estimated population dominates the stock, and recruitment estimates (from the uncertain stock-recruitment relationship) begin to strongly influence stock biomass levels.

6. **Evaluate the adequacy, appropriateness, and application of methods used to characterise uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.**

The assessment approach primarily examined uncertainty through a large number of sensitivity runs, and by examining different assessment model approaches. In general, the results of sensitivity runs were consistent in their estimates of stock status relative to population benchmarks. Sensitivity runs, while helping characterise levels of uncertainty, do not fully represent the uncertainty present, nor allow the division of that uncertainty between its causes (e.g. model, measurement, etc.). In addition, for all assessments there was a need to understand the impact of uncertainty on assessment results. See **Recommendations 12** and **13**.

7. **Ensure the stock assessment results are clearly and accurately presented in the stock assessment report and advisory report, and that reported results are consistent with Review Panel recommendations.**

This reviewer confirms the findings of the Review Panel.

8. **Evaluate the SEDAR process. Identify any terms of reference which were**

inadequately addressed by the data or assessment workshops; identify any additional information or assistance which will improve review workshops; suggest improvements or identify aspects requiring clarification.

This reviewer confirms the findings of the Review Panel.

9. **Review the research recommendations provided by the data and assessment workshops and make any additional recommendations warranted. Clearly indicate research and monitoring needs that may appreciably improve the reliability of future assessments. Recommend an appropriate interval for the next assessment.**

This reviewer supports the recommendations for future research made by the respective Data and Assessment workshops. In particular, future research should focus upon areas that will directly improve the assessment performance. Specifically:

Age data for all species were limited, and this had significant impacts on stock assessments. See **Recommendation 14**.

Many of the assessments lacked a fishery-independent index of population abundance, and hence were potentially affected by both changes in targeting by the fishery, and management interventions. See **Recommendation 15**.

Discard mortality estimates were generally uncertain, based on few *in-situ* samples from commercial and recreational vessels. See **Recommendation 16**.

Assumptions for the rate of catchability increase had notable impacts on assessment results. See **Recommendation 17**.

The Review Panel noted the potential to develop triggers for management based upon data time series. See **Recommendation 18**.

Conclusions/Recommendations

This reviewer endorses the findings of the Review Panel consensus report. Within this section I have provided generic and assessment-specific observations and recommendations. Recommendations were also noted in the Review Panel consensus report. Some of the recommendations below support and expand upon these, where I felt merit in highlighting key or additional issues.

Recommendation 1: Continue to investigate data sources to improve knowledge on historical red snapper and greater amberjack catch levels.

Recommendation 2: Examine alternative plausible hypotheses for historical catch levels to identify the sensitivity of assessments to assumptions made.

Recommendation 3: Examine the potential bias arising from application of the Stephens and MacCall approach by examining available species composition data for changes in the species complex. Examine the impact of bias on model results by (for example) fitting models to data that include only catches noted as containing the focal species (as done for some assessments), rather than all landings that might include the focal species.

Recommendation 4: Examine the seasonal commercial CPUE data for mutton snapper in more detail, to see whether the bag limit period should be separated from the time series.

Recommendation 5: Develop and continue time series of fishery independent indices that encompass the geographic range of the stocks in question. See also recommendation 15.

Recommendation 6: Monitor the uptake of circle hooks within the red snapper fishery, and its impact on discard mortality. Monitor the red snapper commercial fishery for changes in discarding practices that could reduce post-capture mortality. See also recommendation 16.

Recommendation 7: Examine the effect of alternative hypotheses for discard selectivity on the results from each stock assessment.

Recommendation 8: Develop a systematic basis for selecting likelihood weights for model components. For example, base weights on the perceived reliability of data sources and other *a priori* knowledge.

Recommendation 9: As performed for red snapper, where assessments result in uncertain stock-recruitment relationships, perform sensitivity analyses to examine the impact on estimates of current and projected future stock status.

Recommendation 10: This reviewer endorses the need to develop ASAP, or a new assessment model, to include the option for an asymptotic selectivity function. There is also a need to look further at the impact of selectivity assumptions on mutton snapper assessment results.

Recommendation 11: To fully evaluate the choice of population benchmarks, and methods used to estimate them, examine their robustness against alternative plausible states of nature through Management Strategy Evaluation.

Recommendation 12: To more fully characterise uncertainty in assessment outputs, Bayesian approaches could be considered. As noted by the Review Panel, development of these methods requires assessment personnel to have sufficient time and resources. In turn, fuller use of the outputs from assessment models developed using ADMB (e.g. the Hessian) could help identify the relative levels of components contributing to the overall uncertainty.

Recommendation 13: To systematically examine uncertainty within assessments, a grid-based system could be used, where population parameters are varied separately across a plausible range (1st order effects), and then in tandem (2nd order effects) where necessary.

Recommendation 14: Given their influence on age-based assessments, the time series of adequate age information should be increased for all species.

Recommendation 15: Continued development of a robust and comprehensive fishery independent index of population abundance is encouraged. This is particularly important where management action could affect fishing practices and hence the current fishery-based indices used in many of the assessments.

Recommendation 16: Improve the estimates of discarding through observer programmes and co-operation with the fishermen. Management actions may increase discarding in future, and hence estimates need to be improved and updated.

Recommendation 17: This reviewer endorses the plans for a SEDAR workshop quantifying technical 'creep' in fisheries.

Recommendation 18: The effectiveness and robustness of any proposed data time series management triggers should be tested through Management Strategy Evaluation.

Bibliography

Primary documentation

SEDAR (2007). SEDAR 15A SA and GOM Mutton snapper data workshop report. 217p.

SEDAR (2008) SEDAR 15 Stock Assessment Report 1 (SAR 1) South Atlantic Red Snapper Peer Review Document. 344p.

SEDAR (2008). SEDAR 15 Stock Assessment Report 2 (SAR 2) South Atlantic Greater Amberjack Peer Review Document. 348p.

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Appendix 1. Statement of work

Statement of Work for Dr. Graham Pilling

SEDAR 15 Stock Assessment Review
South Atlantic Greater Amberjack, Red Snapper, and Mutton Snapper
January 28 - February 1, 2008
Raleigh, North Carolina

SEDAR Overview:

South East Data, Assessment, and Review (SEDAR) is a process for fisheries stock assessment development and review conducted by the South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils; NOAA Fisheries Southeast Fisheries Science Center (SEFSC) and Southeast Regional Office (SERO); and the Atlantic and Gulf States Marine Fisheries Commissions. SEDAR is organized around three workshops: data, assessment, and review. Input data are compiled during the data workshop, population models are developed during the assessment workshop, and an independent peer review of the data, assessment models, and results is provided by the review workshop. SEDAR documents include working papers prepared for each workshop, supporting reference documents, and a SEDAR stock assessment report. The SEDAR stock assessment report consists of a data report produced by the data workshop, a stock assessment report produced by the assessment workshop, and a peer review consensus report prepared by the review workshop.

SEDAR is a public process conducted by the Fishery Management Councils in the Southeast US. All workshops, including the review, are open to the public and noticed in the Federal Register. All documents prepared for SEDAR are freely distributed to the public upon request and posted to the publicly accessible SEDAR website. Verbal public comment during SEDAR workshops is taken on an 'as needed' basis; the workshop chair is allowed discretion to recognize the public and solicit comment as appropriate during panel deliberations. Written comments are accepted in accordance with existing Council operating procedures. The names of all participants, including those on the Review Panel, are revealed.

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The SEDAR 15 Review Panel will be composed of three Center for Independent Experts (CIE)-appointed reviewers, one reviewer appointed by the South Atlantic Council, and a chair appointed by the SEFSC director. Council staff, Council members, and Council AP and SSC members will attend as observers. Members of the public may attend SEDAR review workshops.

Overview of CIE Peer Review Process:

The Office of Science and Technology implements measures to strengthen the National Marine Fisheries Service's (NMFS) Science Quality Assurance Program (SQAP) to ensure the best available high quality science for fisheries management. For this reason, the NMFS Office of Science and Technology coordinates and manages a contract for obtaining external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of stock assessments and various scientific research projects. The primary objective of the CIE peer review is to provide an impartial review, evaluation, and recommendations in accordance to the Statement of Work (SoW), including the Terms of Reference (ToR) herein, to ensure the best available science is utilized for the National Marine Fisheries Service management decisions.

The NMFS Office of Science and Technology serves as the liaison with the NMFS Project Contact to establish the SoW which includes the expertise requirements, ToR, statement of tasks for the CIE reviewers, and description of deliverable milestones with dates. The CIE, comprised of a Coordination Team and Steering Committee, reviews the SoW to ensure it meets the CIE standards and selects the most qualified CIE reviewers according to the expertise requirements in the SoW. The CIE selection process also requires that CIE reviewers can conduct an impartial and unbiased peer review without the influence from government managers, the fishing industry, or any other interest group resulting in conflict of interest concerns. Each CIE reviewer is required by the CIE selection process to complete a Lack of Conflict of Interest Statement ensuring no advocacy or funding concerns exist that may adversely affect the perception of impartiality of the CIE peer review. The CIE reviewers conduct the peer review, often participating as a member in a panel review or as a desk review, in accordance with the ToR producing a CIE independent peer review report as a deliverable. At times, the ToR may require a CIE reviewer to produce a CIE summary report. The Office of Science and Technology serves as the COTR for the CIE contract with the responsibilities to review and approve the deliverables for compliance with the SoW and ToR. When the deliverables are approved by the COTR, the Office of Science and Technology has the responsibility for the distribution of the CIE reports to the Project Contact.

CIE Reviewer Requirements:

The CIE shall provide three CIE reviewers to conduct independent peer reviews in accordance with the ToR and Schedule herein, and each CIE reviewer's duties shall not exceed a maximum of 14 days for pre-review preparations, conducting the peer review at the SEDAR 15 panel review meeting, and completion of the CIE independent peer review reports. The CIE reviewers shall participate as technical reviewers on the SEDAR 15 Review Panel that will consider assessments of South Atlantic greater amberjack, red snapper, and mutton snapper, and these stocks are assessed within the jurisdiction of the South Atlantic Fishery Management Council and the states of North Carolina, South Carolina, Georgia, and Florida. The CIE reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology to complete their primary task of conducting an impartial and independent CIE peer review report in accordance with the ToR to determine if the best available science is utilized for fisheries management decisions. The CIE reviewers shall not provide comments on fisheries management decisions.

Statement of Tasks for CIE Reviewers

Roles and responsibilities:

1. Approximately 3 weeks prior to the meeting, CIE reviewers shall be provided with stock assessment reports, associated supporting documents, and review workshop instructions including terms of reference. CIE reviewers shall read these documents to gain an in-depth understanding of the stock assessment, the resources and information considered in the assessment, and responsibilities as reviewers.

2. During the Review Panel meeting, reviewers shall participate in panel discussions on assessment methods, data, validity, results, uncertainties, recommendations, and conclusions as guided by the terms of reference. Each CIE reviewers shall conduct an independent peer review and participate in development of a peer review consensus summary report for each assessment reviewed, as described in Annex I. CIE reviewers may be asked to serve as an assessment leader during the review to facilitate preparing first drafts of review summary reports.

3. Following the Review Panel meeting, reviewers shall work with the chair to complete and review the peer review consensus summary reports. Reports shall be completed, reviewed by all panelists, and comments submitted to the Chair by February 15, 2008.

4. Following the Review Panel meeting, each reviewer appointed by the CIE shall prepare an individual CIE reviewer report. These reports shall be submitted to the CIE no later than February 22, 2008, addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David Sampson, via email to David.Sampson@oregonstate.edu, and to Mr. Manoj Shivlani, via email to mshivlani@ntvifederal.com. See Annex II for complete details on the report outline.

   The duties of each review panelist shall not exceed a maximum of 14 workdays; several days prior to the meeting for document review; five days at

the SEDAR meeting; and several days following the meeting to complete the independent peer review in accordance with the ToR, and to ensure final review comments and document edits are provided to the Chair.

The CIE reviewers shall conduct necessary preparations prior to the peer review, conduct the peer review, and complete the deliverables in accordance with the ToR and deliverable dates herein.

Prior to the Peer Review: The CIE shall provide the CIE reviewers contact information (name, affiliation, address, email, and phone) to the Office of Science and Technology COTR no later than the date as specified in the SoW, and the COTR will forward this information to the Project Contact.

Pre-review Documents: Approximately two weeks before the peer review, the Project Contact will send the CIE reviewers the necessary documents for the peer review, including supplementary documents for background information. The CIE reviewers shall read the pre-review documents in preparation for the peer review. This list of pre-review documents may be updated prior to the panel review meeting. Meeting materials will be forwarded electronically to Review Panel participants and made available through the internet (http://www.sefsc.noaa.gov/sedar/); printed copies of any documents are available by request. The names of reviewers will be included in workshop briefing materials.

Panel Peer Review Meeting: The CIE reviewers shall participate and conduct the peer review participate during a panel review meeting as specified in the dates and location of the attached Agenda and Schedule of Deliverable.

The review workshop will take place at the Holiday Inn Brownstone in Raleigh, North Carolina, from 1:00 p.m. Monday, January 28, 2008 through 1:00 p.m. Friday, February 1, 2008. The Project Contact is responsible for the facility arrangements.

Please contact Dale Theiling (SEDAR Coordinator; (843) 571-4366, Dale.Theiling@safmc.net) or John Carmichael, (Science and Statistics Program Manager; (843) 571-4366, John.Carmichael@safmc.net) for additional details.

Hotel arrangements:

Holiday Inn Brownstone
1707 Hillsborough Street
Raleigh, NC 27605
Phone: (919) 828-0811 / (800) 331-7919

Group "SEDAR" Rate: $80 + (12.75% tax of 10.20) = $90.20; rate is guaranteed through December 14, 2007.

SEDAR Review Workshop Panel Tasks:

The SEDAR 15 review workshop panel will evaluate assessments of South Atlantic greater amberjack, red snapper, and mutton snapper. During the evaluation the panel will consider data, assessment methods, and model results. The evaluation

will be guided by terms of reference that are specified in advance. The review workshop panel will document its findings regarding each assessment in a peer review consensus summary (Annex I). (Note that the consensus summary is a SEDAR product, not a CIE product.) Separate CIE reviewer reports will be produced as described in Annex II to provide distinct, independent analyses of the technical issues and of the SEDAR process.

Each CIE reviewer shall participate on the SEDAR 15 workshop panel to conduct an impartial and independent peer review with the purpose of determining whether the best available science was utilized. This review shall be conducted in accordance with SEDAR Guidelines and the specific Terms of Reference (ToR) specified below. Each CIE reviewer shall contribute to a SEDAR consensus summary in accordance with Annex I that will be compiled by the Review Panel Chair, and shall produce a CIE independent peer review report in accordance with Annex II.

Terms of Reference:

SEDAR 15 Review Workshop Terms of Reference (apply to each stock):

1. Evaluate the adequacy, appropriateness, and application of data used in the assessment.

2. Evaluate the adequacy, appropriateness, and application of methods used to assess the stock.

3. Recommend appropriate estimates of stock abundance, biomass, and exploitation measures.

4. Evaluate the methods used to estimate population benchmarks and management parameters (*e.g., MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies*); provide estimated values for management benchmarks, a range of allowable catch (ABC), and declarations of stock status relative to benchmarks.

5. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status; recommend appropriate estimates of future stock condition (e.g., exploitation, abundance, biomass).

6. Evaluate the adequacy, appropriateness, and application of methods used to characterize uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

7. Ensure that stock assessment results are clearly and accurately presented in the stock assessment report and advisory report and that reported results are consistent with Review Panel recommendations.

8. Evaluate the SEDAR Process. Identify any terms of reference which were inadequately addressed by the data or assessment workshops; identify any additional information or assistance which will improve review workshops; suggest improvements or identify aspects requiring clarification.

9. Review the research recommendations provided by the data and assessment workshops and make any additional recommendations warranted. Clearly indicate research and monitoring needs that may appreciably improve the

reliability of future assessments. Recommend an appropriate interval for the next assessment.

10. Prepare a peer review consensus summary summarizing the panel's evaluation of each stock assessment and addressing each term of reference. (Reports to be drafted by the panel during the review workshop with a final report due two weeks after the workshop ends.)

The Review Panel may request additional sensitivity analyses, evaluation of alternative assumptions, and correction of errors identified in the assessments provided by the assessment workshop panel; the Review Panel may not request a new assessment. Additional details regarding the latitude given 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 (1) corrections are made in the assessment, (2) alternative model configurations are recommended, or (3) additional analyses are prepared as a result of Review Panel findings regarding the TORs above.

These Terms of Reference may be modified prior to the Review Workshop. If so, final terms of reference will be provided to the reviewers with the workshop briefing materials.

SEDAR Review Workshop Panel Supplementary Instructions

The Review Panel Chair is responsible for reviewing documents prior to the workshop, conducting the meeting during the workshop in an orderly fashion, compiling and editing the peer review consensus summary for each species assessed and submitting it to the SEDAR Coordinator by a deadline specified by the SEDAR Steering Committee. The Review Panel chair will work with SEDAR staff to complete the SEDAR advisory report. The Review Panel chair may participate in panel deliberations and contribute to report preparation.

Review panel members are responsible for (1) reviewing documents prior to the workshop, (2) participating in workshop discussions addressing the terms of reference, (3) preparing assessment summaries and consensus reports during the workshop, and (4) finalizing SEDAR documents within two weeks of the conclusion of the workshop. Each reviewer appointed by the CIE is responsible for preparing an additional CIE reviewer report as described in Annex II.

The Chair and SEDAR Coordinator will work with the appointed reviewers to assign tasks during the workshop. For example, the Chair may appoint one panelist to serve as assessment leader for each assessment covered by the review, with the leader responsible for providing an initial draft consensus report text for consideration by the panel. Reviewers may alternatively be assigned particular terms of reference to address initially. Regardless of how initial drafting is accomplished, all panelists are expected to participate in discussion of all terms of reference and contribute to all aspects of the review.

The Review Panel's primary responsibility is to determine if assessment results are based on sound science, appropriate methods, and appropriate data. During

the course of the review, the panel is allowed limited flexibility to deviate from the assessment provided by the assessment workshop. This flexibility may include (1) modifying the assessment configuration and assumptions, (2) requesting a reasonable number of sensitivity runs, (3) requesting additional details and results of the existing assessments, or (4) requesting correction of any errors identified. However, the allowance for flexibility is limited, and the Review Panel is not authorized to conduct an alternative assessment or to request an alternative assessment from the technical staff present. The Review Panel is responsible for applying its collective judgment in determining whether proposed changes and corrections to the presented assessment are sufficient to constitute an alternative assessment. The Review Panel chair will coordinate with the SEDAR Coordinator and technical staff present to determine which requests can be accomplished and to prioritize desired analyses.

Any changes in assessment results stemming from modifications or corrections solicited by the Review Panel will be documented in an addendum to the assessment report. If updated estimates are not available for review by the conclusion of the workshop, the Review Panel shall consult with technical staff present and the SEDAR Coordinator to develop an acceptable process for reviewing the final results within the time allotted for completion of the project.

The Review Panel should not provide advice addressing specific management actions. Such advice will be provided by existing Council committees, such as the Science and Statistical Committee and Advisory Panels, following completion of the assessment. The Review Panel is free to point out items of concern regarding past or present management actions that relate to population conditions or data collection efforts.

If the Review Panel finds an assessment deficient to the extent that technical staff present cannot resolve the deficiencies during the course of the workshop, or the panel deems that desired modifications would result in a new assessment, then the Review Panel shall provide in writing the required remedial measures, including an appropriate approach for correcting and subsequently reviewing the assessment.

Workshop Final Reports:

The SEDAR Coordinator will send copies of the final Review Panel consensus report and the complete SEDAR stock assessment report for each stock assessed to Mr. Manoj Shivlani at the CIE.

Submission and Acceptance of CIE Reports:

Upon review and acceptance of the CIE reports by the CIE Coordination and Steering Committees, CIE shall send via e-mail the CIE reports to the COTRs (William Michaels William.Michaels@noaa.gov and Stephen K. Brown Stephen.K.Brown@noaa.gov) at the NMFS Office of Science and Technology by the date in the Schedule of Deliverables. The COTRs will review the CIE reports to ensure compliance with the SoW and ToR herein, and have the responsibility of approval and acceptance of the deliverables. Upon notification of acceptance, CIE shall send via e-mail the final CIE report in *.PDF format to the COTRs. The COTRs at the Office of Science and Technology have the responsibility for the distribution of the final CIE reports to the Project Contacts.

The COTR shall provide the final CIE reviewer reports to:

SEFSC Acting Director: Alex Chester, NMFS Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149 (email, Alex.Chester@NOAA.gov)

SEDAR Coordinator: Dale Theiling, SAFMC, 4055 Faber Place Drive, Suite 201, North Charleston, SC 29405 (email, Dale.Theiling@safmc.net). (SEDAR shall provide the final CIE Reviewer Reports to the SEDAR Steering Committee and Executive Directors of those Councils having jurisdiction over the included stocks)

Schedule of Deliverables:

February 1, 2008:	Review Panel completes first draft of Review Panel consensus reports (conclusion of review workshop)
February 15, 2008:	Review Panel submits final draft Review Panel consensus reports to workshop Chair.
February 22, 2008:	workshop Chair submits final Review Panel consensus reports and SEDAR advisory reports to SEDAR Coordinator.
February 22, 2008:	CIE technical reviewers submit individual reviewer reports to CIE.
February 29, 2008:	SEDAR Coordinator submits final Review Panel consensus reports and SEDAR stock assessment reports to CIE.
March 7, 2008:	CIE submits individual CIE reviewer reports to the COTR.
March 11, 2008:	COTR notifies CIE regarding individual reviewer report acceptance.
March 13, 2008:	CIE provides final individual CIE reviewer reports to COTR.
March 21, 2008:	COTR provides final CIE reviewer reports to SEFSC Acting Director and SEDAR Coordinator.
March 26, 2008:	SEDAR submits individual CIE reviewer reports to the SEDAR Steering Committee and Councils.

Key Personnel:

Contracting Officer's Technical Representative (COTR):

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

Stephen K. Brown
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
Stephen.K.Brown@noaa.gov   Phone: 301-713-2363 ext 133

Contractor Contacts:

Manoj Shivlani, CIE Primary Coordinator
10600 SW 131st Court, Miami, FL 33186
mshivlani@ntvifederal.com   Phone: 305-383-4229

Roger Peretti, NTVI Regional Director
Northern Taiga Ventures, Inc., 814 W. Diamond Ave., Ste. 250, Gaithersburg, MD 20878
rperetti@ntvifed.com   Phone: 301-212-4187.

SEDAR Project Contact (or Emergency):

Dale Theiling, 4055 Faber Place Drive, Suite 201, North Charleston, SC 29405
Dale.Theiling@safmc.net   Phone: 843-571-4366.

Request for Changes:

Requests for changes shall be submitted to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the Contractor within 10 working days after receipt of all required information of the decision on substitutions. The contract will be modified to reflect any approved changes. The Terms of Reference (ToR) and list of pre-review documents herein may be updated without contract modification as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToR are not adversely impacted.

Draft Agenda

SEDAR 15: South Atlantic Greater Amberjack, Red Snapper, and Mutton Snapper
January 28 - February 1, 2008

Monday

1:00 p.m.	**Convene**
1:00 – 1:30	**Introductions and Opening Remarks (JC/Chair)**
	- Agenda Review, TOR, Task Assignments
1:30 – 3:30	**Red Snapper Presentation (Dr Kyle Shertzer)**
3:30 – 4:00	**Break**
4:00 – 6:00	**Red Snapper Discussion (Chair)**
	- Data, Methods and Results evaluation
	- Identify Additional Analyses

Tuesday

8:30 a.m. – 11:30 a.m.	**Red Snapper Discussion (Chair)**
	- Review additional analyses and sensitivities
	- Initial recommendations and comments
11:30 a.m. – 1:30 p.m.	**Lunch Break**
1:30 p.m. – 3:30 p.m.	**Greater Amberjack presentation (Dr Erik Williams)**
3:30 p.m. – 4:00 p.m.	**Break**
4:00 p.m. – 6:00 p.m.	**Greater Amberjack Discussion (Chair)**
	- Data, Methods and Results evaluation
	- Identify additional analyses, sensitivities and corrections

Wednesday

8:00 a.m. – 12:00 a.m.	**Greater Amberjack Discussion (Chair)**
	- Review additional analyses, sensitivities
	- Initial recommendations and comments
11:30 a.m. – 1:30 p.m.	**Lunch Break**
1:30 p.m. – 3:30 p.m.	**Mutton Snapper presentation (Dr Bob Muller)**
3:30 p.m. – 4:00 p.m.	**Break**
4:00 p.m. – 6:00 p.m.	**Mutton Snapper discussion (Chair)**
	- Data, Methods and Results evaluation
	- Identify additional analyses, sensitivities and corrections

Thursday

8:30 a.m. – 11:30 a.m.	**Mutton Snapper Discussion (Chair)**
	- Review additional analyses, sensitivities
	- Initial recommendations and comments
11:30 a.m. – 1:30 p.m.	**Lunch Break**
1:30 p.m. – 3:30 p.m.	**Review Panel Consensus Summary (Chair)**
	- Review Consensus Report sections
3:30 p.m. - 4:00 p.m.	**Break**
4:00 p.m. - 6:00 p.m.	**Review Workshop Advisory Report (Chair)**
	- Review draft summary reports

Friday

8:30 a.m. – 1:00 p.m.	**Final Review of Panel Documents (Chair)**
	- Final review of consensus reports and summary reports
1:00 p.m.	**ADJOURN**

Annex I. SEDAR Review Panel Consensus Summary Report Contents

I. Terms of Reference
List each Term of Reference and provide a summary of Panel discussions and recommendations regarding the particular item. Include a clear statement indicating whether or not the criteria in the Term of Reference are satisfied.

II. Further Analyses and Evaluations
Summary and findings of Review Panel analytical requests not previously addressed in TOR discussion above.

III. Additional Comments
Summary of any additional discussions not captured in the Terms of Reference statements.

IV. Recommendations for Future Workshops
Panelists are encouraged to provide general suggestions to improve the SEDAR process.

V. Reviewer Statements
Each individual reviewer should provide a statement attesting whether or not the contents of the Consensus Report provide an accurate and complete summary of their views on the issues covered in the review. Reviewers may also make any additional individual comments or suggestions desired.

ANNEX II: Contents of CIE Independent Peer Review Report

1. The reviewer report shall be prefaced with an executive summary of findings and recommendations.

2. The main body of the reviewer's report shall consist of a background, description of the individual reviewer's role in the review activities, a summary of findings, and summary of conclusions and recommendations in accordance with the ToR. Reviewers shall elaborate on any points raised in the Consensus Summary Report that they feel might require further clarification. Reviewers shall provide a critique of the SEDAR process including suggestions for improvements of both process and products. Reviewers should not simply repeat the contents of the consensus summary reports.

3. The reviewer report shall include as separate appendices a copy of the CIE Statement of Work and a bibliography that includes all materials provided for review.

Please refer to the following website for additional information on report generation: http://www.rsmas.miami.edu/groups/cie.