

Peer Review of
SEDAR 14 Stock Assessment Review:
Caribbean Yellowfin Grouper, Mutton Snapper, and Queen Conch

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Report to

Independent System for Peer Review

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Executive Summary

- This report evaluates assessments of Caribbean yellowfin grouper, mutton snapper and queen conch undertaken as SEDAR 14.
- No formal assessment was presented for any of the three species, nor was there any attempt to derive population benchmarks for management or to project future population status. This was because the SEDAR 14 Data and Assessment Workshops concluded that the available data resources are inadequate to provide information on stock status. The review panel strongly agreed with this conclusion.
- Fishery removals data are uncertain and incomplete. This applies particularly to queen conch, for which the recreational component is unknown for most years.
- The analyses and exploratory assessments undertaken by the Data and Assessment Workshops were statistically rigorous and well conducted.
- Generalized linear modeling techniques were used to provide standardized CPUE indices. An objective approach was taken to identifying logbook records relevant to fishing for each species, but problems remained with records for which a number of trips had been aggregated.
- Standardized CPUE indices provide some information on abundance trends in mutton snapper, to the extent that they improved the power of length-based analyses to detect changes in mortality.
- Three periods differing in overall mortality were identified using time-series of mean length data and CPUE for mutton snapper. Results from a length-based model suggest that mortality of mutton snapper has been lower over recent years than during the early 1990s. There is some corroboration of this trend from effort data.
- The length-based model is scientifically excellent, and is the best basis currently available for drawing inferences about mutton snapper mortality. The main drawback of the model is that recruitment effects on mean size are not accounted for. The results of model fitting are considered indicative, but could not be used to provide management advice at present.
- Yellowfin grouper are very rare in the catch. There is currently no basis for drawing inferences about stock status.
- It is suggested that mutton snapper and yellowfin grouper be considered alongside other reef fish species in a mixed fishery assessment approach. This might involve identification of segments of the fishery characterized by gear and mode of fishing and by the assemblage of species targeted.
- CPUE indices were considered not to measure changes in queen conch abundance, largely because divers were able to fulfill their daily quotas irrespective of conch density.
- Fishery-independent resources surveys appear to hold the most promise for future assessment of queen conch. The most recent available survey data suggests an

increase in conch abundance. An increase in the spatial coverage of surveys is recommended.

- Comparison of queen conch densities between areas of the Caribbean differing in intensity of fishing appears to be a promising approach to placing resource survey estimates of abundance in the context of possible population benchmarks. Marine Protected Areas may be a useful source of information on unfished densities around Puerto Rico and the US Virgin Islands.
- Recommendations are made for improvements to the collection of commercial fishery statistics. In addition to striving for improved compliance with reporting requirements, it is recommended to start a program of random catch sampling, including collection of biological sampling data.
- Recommendations are made for the improvement of the Marine Recreational Fishery Statistics Survey, and for the inclusion of queen conch within this survey.
- Comments are made about the inclusion of data poor species within the SEDAR program. Two separate intersessional workshops are suggested for reef fish species and for queen conch.

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 for each species consists of a data report produced by the data workshop, a stock assessment report, and a peer review consensus report prepared by the review workshop. Assessment findings are summarized in an Advisory Report that serves as an Executive Summary for the SEDAR Stock Assessment Report.

The SEDAR 14 review panel was composed of three reviewers appointed by the Center for Independent Experts (CIE) and a chair appointed by the SEFSC. The review meeting was also attended by assessment scientists from the SEFSC, observers appointed by the Caribbean Fisheries Management Council (CFMC), independent observers and staff from SEDAR, SEFSC and CFMC.

The SEDAR 14 review panel evaluated assessments of Caribbean yellowfin grouper (*Mycteroperca venenosa*), mutton snapper (*Lutjanus analis*) and queen conch (*Strombus gigas*). During the evaluation the panel considered data, assessment results and model results according to the Terms of Reference (ToR) set out in Annex 2. The review panel's primary responsibility was to ensure that assessment results are based on sound science, appropriate methods and appropriate data. A peer review Consensus Report was prepared for each species, summarizing the views of the panel under each ToR. The present report is an individual CIE reviewer report representing my own views on the stock assessment data, methods and results. The report does not attempt to duplicate comments and recommendations contained in the Consensus Reports, but provides additional emphasis and elaboration where necessary.

Description of Review Activities

Documents from the SEDAR 14 Data Workshop and Assessment Workshop were supplied by email, starting two weeks before the start of the review meeting and sent incrementally over the course of a week. A final document was sent, as it became available, four days before the meeting. This allowed time to read the reports and gain a good understanding of the data resources available for assessment, the approaches taken to data analysis and the interpretation of assessment results. There was also the opportunity to examine some of the voluminous supporting documentation in the form of working papers and supplementary documents mounted on the SEDAR website.

The SEDAR 14 Review Workshop was held in the Hotel El Convento in Old San Juan, Puerto Rico, starting at 1.00 pm on Monday 23 July and finishing at 1.00 pm on Friday 27 July 2007. In addition to the timetabled activities (see meeting Agenda in Annex 2) there were visits to fishery landing places on the early mornings of Wednesday 25 July and Thursday 26 July. During the first two days of the meeting there were presentations on the data and assessments by SEFSC scientists. During and after the presentations there were in-depth discussions, comments and questions among all participants at the meeting. It was particularly useful to have feedback from those closely involved with fishery management and the monitoring of fishing activities (CFMC and Puerto Rico DNR), although unfortunately there were no representatives for the US Virgin Islands at the meeting.

Additional analyses of data for yellowfin grouper and mutton snapper were carried out following the initial presentations, and the results of these analyses were presented during Wednesday to Friday, 25-27 July. These stimulated further discussion, and the results of the further analyses were taken on board in the Consensus Reports drafted by the three CIE reviewers during the meeting.

A separate Consensus Report was prepared for each species, with the species divided among reviewers: the yellowfin grouper report was drafted by Henrik Sparholt, the mutton snapper report was drafted by Mike Armstrong and the queen conch report was drafted by the author. Review panel recommendations and comments under each ToR were presented to all meeting participants on the afternoon of 26 July. Feedback from the meeting participants was taken into account in the final drafts of each report. The review panel reached a clear consensus on all issues relating to the data and assessments. The final drafts of the Consensus Reports were submitted to the Review Workshop Chair by Friday 10 August, after email discussions between the three CIE reviewers during the two weeks following the workshop meeting.

The Review Workshop meeting was efficiently chaired by John Butler and coordinated by John Carmichael, with effective computing and administrative support by Tyree Davis and Rachael Lindsay. The entire meeting was conducted in a spirit of openness and cooperation by all participants.

Summary of Findings

No formal assessment was presented for any of the three species considered by SEDAR 14, nor was there any attempt to derive population benchmarks for management or to project future population status. As described in the Consensus Reports, the review panel was in full agreement with the Assessment Workshop that the available data resources are inadequate to provide information on the stock status of yellowfin grouper, mutton snapper and queen conch. The question now is how to move forward from the current unsatisfactory situation towards a future in which management of these species can be placed on a sound quantitative basis. It is not the intention of this report to repeat what has already been stated very clearly in the Consensus Reports, but as a context it is worth emphasizing that the single most important issue for assessment and management is the quality and completeness of the fishery monitoring data. Regardless of the future directions for assessment and management, it is crucial that there should be accurate, unbiased recording of fishery removals by species and of the associated fishing effort from all sectors of the fishery, both commercial and recreational.

The task of the technical reviewer is usually to provide constructive criticism of the models and methods used to infer stock status in relation to criteria for sustainable exploitation and of the way in which assessment outcomes have been used to provide advice on fishery management. In the present case this clearly is not appropriate, since the data were inadequate to allow definitive assessments to be performed or advice to be offered. Nevertheless, it is still appropriate to comment on some of the analyses and trial assessment runs that were undertaken as exploratory investigations of the available data, on the principle that these might be used to form the basis of future stock assessments. The assessment issues are generic rather than particular to species. They are listed below under: fishery-dependent indices; fishery-independent indices; and assessment models.

Fishery-dependent indices

Commercial catch per unit effort (CPUE) records can potentially be used to construct an index of abundance under certain restrictive conditions/assumptions. Among others, these include:

- the ability of fishers to find the target organism is linearly related to its abundance;
- the unit of fishing effort is a linear function of fishing power;
- the efficiency with which fishers find and remove the target organism does not change over time;
- the targeting behavior of the index fishing fleet is the same in all years, *i.e.* it is the same sector or cross-section of the overall fishery.

There is some scope for the use of statistical techniques to meet the second and third of these conditions, but it is broadly true that all of these conditions (and others) need to be met before CPUE statistics can be regarded as proportional to stock density. Some or all

of these conditions appear to be violated for CPUE estimates for each species considered by SEDAR 14.

Yellowfin grouper and mutton snapper are taken alongside a suite of other reef fish species. The approach of the Assessment Workshop to identifying the relevant fishing records for calculating CPUE of each species was to use the Stephens and MacCall (2004) method of subsetting logbook data on the basis of species composition taken during individual fishing trips. In the absence of information on the habitat and location where fishing occurred, this is a sensible and objective approach, but the targeting behavior of the fishery still seems to be ill-defined.

The units of effort appear to be even more ill-defined. Fishing trip is a very coarse unit of effort, and appears not to be easily inferred from the fishing records. Several trips are often combined on the same record, and the 'NTRIPS' field of the record is often missing or obviously in error. The assessment scientists appear to have done everything in their power to deal with this problem. Unless a review and re-entry of past paper records could yield additional information that is not currently computerized, there is little that can be done to improve this situation. Even accepting this, it is of course important that every effort should be made to improve the quality of record-keeping for the future.

One area where examination of past fishing records may be helpful is in the matching of trap catch records with information on soak times. It was suggested during the review meeting that trap soak time may have increased from 3-4 days in the 1980s to 7 days in more recent years, but no account of this has been taken in estimating standardized abundance indices. Potentially this is a very important factor in determining CPUE of mutton snapper and other species, although the relationship of catch with soak time may be asymptotic or even dome-shaped rather than linear. Certainly it will be important to determine whether this may have affected the apparent increases in trap CPUE seen over the past decade. Apparently soak time data are available back to 1988 but are not yet computerized. There was some discussion at the review meeting of the man-power that would be needed to enter and check these data. It is recommended that the necessary resources be committed to allow this task to be undertaken.

Generalized linear modeling (GLM) techniques were used to analyze the CPUE data and develop standardized indices of abundance for both Puerto Rico (all three species) and the US Virgin Islands (queen conch only). Lognormal and delta lognormal model types were applied, with bias-adjusted AIC statistics used in selection of model terms and interactions modeled as random effects. The modeling procedure and examination of model diagnostics appear to have been commendably rigorous, and it seems that the resulting indices of abundance are as satisfactory as possible given the limitations of the data. The following comments may be offered:

- It needs to be made clear exactly how the final standardized indices have been derived, and how the two elements of the delta lognormal models were combined. Are the standardized indices basically year effects from the model? What factor levels were chosen in estimating the probability of a non-zero catch? How were the standardized indices scaled with the raw indices?

- It would be useful to see some exploration of zero-inflated Poisson or negative binomial models (Maunder & Punt, 2004). These might offer a more parsimonious alternative to the delta models.
- Modeling year interactions as a random effect within the models may be justified if there has been a random change in the distribution of the population with respect to the interacting factor (usually area). However, this should be carefully distinguished from cases where there is a systematic heterogeneity in population trends. For example, if the Year*Municipality interactions for Puerto Rico mutton snapper hook and line CPUE and trap CPUE were actually systematic rather than random, this would suggest either that CPUE should be examined at a smaller spatial scale or that there should be some kind of averaging over areas. It would also be informative to present the results of models without interaction factors, to see what trends (spurious or otherwise) may have been enhanced or masked by the inclusion of interactions.

Of the three species considered by SEDAR 14, only for Puerto Rico mutton snapper did there appear to be any hope of using CPUE data to construct meaningful indices of abundance. Hook and line fishery and trap fishery indices were able to improve the power to draw inferences on likely changes in mutton snapper mortality based on mean size data. Even in the case of mutton snapper, however, literal interpretations of stock trends from CPUE indices would be of questionable validity – the trap CPUE shows increases over time that were not matched by changes in hook and line CPUE. In the case of yellowfin grouper, the fish was simply too rare in the catches to allow meaningful analysis. It is unclear whether this was because of low abundance or because yellowfin grouper are not often targeted, perhaps owing to their reputation for ciguatoxicity.

It would be helpful to consider both mutton snapper and yellowfin grouper as components of a mixed fishery. Analysis of the species composition of catches, at the most disaggregated level possible within the data, could allow identification of particular ‘métiers’ – segments of the fishery characterized by gear and mode of fishing and by the assemblage of species targeted. It will be important to distinguish between highly targeted fishing activities, *e.g.* directed at spawning aggregations, and more general reef fishing activities. Analysis of data on indicator species within these métiers, or on multi-species indices, may be more robust than single species assessments. This is particularly the case for species such as yellowfin grouper for which there is unlikely ever to be a satisfactory data resource. Such species may always have been rare in the catch, and it is difficult to draw inferences about what an unfished stock may have looked like. For the commoner species, multi-species analyses should provide some corroboration of trends and patterns seen at the individual species levels.

The suggestion to consider reef fish assessments in a multi-species context is consistent with recommendations in the Consensus Reports for mutton snapper and yellowfin grouper. Queen conch presents a rather different case in that it is possible to identify the conch fishery as a discrete unit, directed at a single species, *i.e.* conch fishing is a separately identifiable métier. In this sense it is less of a problem to calculate CPUE since the identification of records relevant to conch fishing is relatively straightforward. Unfortunately, however, the resulting CPUE estimates, in whatever way they are

standardized, appear unlikely to reflect changes in conch abundance. At the beginning of this section were listed some of the conditions that would allow CPUE data to be used in an index of abundance. The queen conch fishery fails at the first condition: divers are apparently able to fulfill their daily catch quota for queen conch, irrespective of the density of conch on the ground, hence catch per trip is invariant with density. As noted in the Assessment Workshop report, queen conch CPUE is at best an indicator of aggregation density rather than population abundance. The Assessment Workshop pointed out a number of examples of CPUE remaining stable despite strong evidence from other sources of changes in queen conch abundance. The review panel agreed strongly with the conclusion of the Assessment Workshop that queen conch CPUE cannot be treated as an index of conch abundance. Even the availability of data on diver hours appears not to improve the utility of CPUE estimates, principally because search time (to find conch aggregations) is not included in the effort measure and dive duration during conch fishing is dictated mostly by tank capacity.

Further research may reveal aspects of the conch fishing process that are responsive to abundance. Inevitably, this will involve the collection of more comprehensive information from fishers. At present, however, it seems unlikely that a fishery-dependent index of abundance will be possible for queen conch in the near future. This does not, of course, mean that the collection of fishery data on queen conch should be neglected. Comprehensive, unbiased information on the scale and trends in both removals and effort by the fishery will always remain the firmest foundation for assessment and management.

Fishery-independent indices

The Data Workshop reports list 14 different fishery-independent data sources that might yield information on the abundance of the three species considered by SEDAR 14. Most of these are very restricted in spatial or temporal coverage, hence are of limited value for overall stock assessments. Nevertheless, for both mutton snapper and queen conch it was possible to combine visual survey estimates of density with NOAA habitat classification maps to provide island-wide estimates of overall abundance in 2004-06 for Puerto Rico, St Croix and St John. The primary assumption underlying these estimates is that the density measured in a particular habitat type is representative of the entire extent of that habitat. Whilst this assumption is unlikely to be true in practice – differences between areas in fishing pressure and other factors are likely to cause differences in density even within habitat types – it does provide a defensible first basis for estimating overall abundance, if only because it excludes areas obviously unsuitable for a particular species.

The two main drawbacks of these fishery-independent resource survey estimates are: (i) that the spatial coverage of the surveys is low; and (ii) that the number of individuals recorded is also very low, particularly for mutton snapper. The first of these drawbacks means that there is scope for bias in the estimates, since, as noted above, the surveyed habitat area is not necessarily representative of all areas of habitat given the same classification. Both drawbacks mean that the precision of overall estimates is very low. For mutton snapper, this probably means that the resource survey estimates are of very

limited utility at present, particularly as there is no historical basis for comparison. Given increased survey coverage, and repeated surveys in future years, the value of the resource surveys may increase for mutton snapper and other reef fish species. Given a suite of fish species recorded alongside one another during the surveys, the data could be used to derive multi-species indices in a similar way to that suggested for fishery-dependent data.

At present, the resource surveys are of most obvious utility for queen conch, for which it is possible to draw comparisons with previous surveys undertaken in Puerto Rico and the US Virgin Islands since 1981¹. These comparisons are indicative of some increases in conch abundance, although nominal confidence limits are very wide (and true confidence limits probably even wider). Given improved spatial coverage, and possibly stratification by area as well as habitat, these surveys will probably provide the best basis for stock assessment of Caribbean queen conch in the future. The Assessment Workshop Report provides a comparison of queen conch density estimates between different areas of the Caribbean, suggesting this as a basis for evaluating stock status and developing population benchmarks such as B_{msy} . As discussed in the Consensus Report, the review panel was very supportive of this promising approach, and commented on two issues relevant to its further development: (i) conch densities within Marine Protected Areas around Puerto Rico and the US Virgin Islands may offer a better basis for evaluating unfished densities than comparisons with quasi-unexploited areas elsewhere in the Caribbean; and (ii) the ‘Allee effect limit’, being the threshold density below which reproduction may be compromised, is likely to apply to local densities, which given patchy distribution may be very different from averages at the island level.

Assessment models

The Assessment Workshop considered analytical assessments for mutton snapper and queen conch. For the latter species, production models were fitted to data from Puerto Rico and St Croix using the ASPIC package. These assessments were rejected primarily on the grounds that the diver CPUE is not an effective index of abundance. Stability of CPUE forced the production model to give unrealistic estimates of MSY well above current landings. Incomplete data on fishery yield (absence of recreational landings estimates for conch in most years) was also cited as a reason for rejecting the production models. The review panel was in full agreement with the decision of the Assessment Workshop not to pursue this assessment approach for queen conch. At present, there seems little likelihood of being able to apply this or any other analytical assessment method to queen conch in the near future.

¹ Note that there are discrepancies between the figures presented in the Assessment Workshop Report and those in the working paper SEDAR 14-AW3, and within the Assessment Workshop Report between the text on p.13 and Table 2 on p.17. For example: SEDAR 14-AW3 gives Puerto Rico abundance as 1,304,893 conch for Puerto Rico, whereas the 2006 figure in the Assessment Workshop Report is 5,019,393; Table 2 of the Assessment Workshop Report gives adult numbers for 2006 and total numbers for 1995 (labelled as 1996) and 2001.

Production modeling was also rejected for mutton snapper, on the grounds of uncertainty about the substantial recreational component of the total fishery yield. Instead, a length-based approach was used to estimate overall mortality. Beverton & Holt (1956, 1957) provide an estimator for mortality under equilibrium conditions, based on growth parameters and mean size above the length at full selection by the fishing gear. Gedamke & Hoenig (2006) extend this method, relaxing the equilibrium assumption by modeling the transition in mean size after a change in mortality. The Assessment Workshop used mean length data from the Puerto Rico trap fishery to estimate two mortality rates for mutton snapper over the period 1982-96, with an increase in mortality occurring around the late 1980s or early 1990s. Extension of the method to include a likelihood component for CPUE data provided the statistical power to estimate a reduction in mortality during the mid to late 1990s. In response to requests from the review panel, the method was also applied to data from the Puerto Rico hook and line fishery. Earlier it had been judged that the length at full selection (L_c) could not be estimated from the length-frequency distribution for hook and line catches. However, on further examination it proved possible to undertake various analyses. Most importantly this involved dividing the data between spawning and non-spawning seasons, for which the length-frequency distributions of mutton snapper catches differed markedly. It was also possible to incorporate a selectivity curve into the analysis, although this was done on a somewhat *ad hoc* basis. The different analyses yielded different absolute estimates of total mortality, but similar proportional changes and similar times of change, thus providing some corroboration of the conclusion that recent mortality of mutton snapper has been at lower levels than during the early 1990s.

These length-based models have been rigorously developed², and rigorously applied to the mutton snapper data. The main drawback is that recruitment processes are not included in the model. A decline in recruitment would cause an increase in mean size, interpreted by the model as a decrease in mortality – an optimistic assessment outcome resulting from an adverse population trend. Of course, declining recruitment should eventually be evident in the CPUE trend, but it is likely to be a number of years before the conflict in signal was apparent between the mean size and CPUE trends, particularly given the large uncertainty associated with both measures. In the present case, it seems that a decline in recent fishing effort³ lends plausibility to the interpretation of the recent increase in mean size as resulting from a decrease in mortality. As stated by the assessment scientists at the Review Workshop, it would be possible to include a recruitment process into the length-based model, but this would depend on the availability of a recruitment index. Given the levels of length sampling, it seems unlikely that a recruitment index could be developed for mutton snapper over past years.

² The one model element that puzzled me was one of the equations used in integrating catch data. Equation 2 in SEDAR RW-01 has $N = R / Z$, based on Ricker (1975). Without having access to Ricker's handbook, this seems to me to be approximately true only at low values of Z. It may be that factoring out of terms causes the proportionality $I_1 / I_2 = Z_2 / Z_1$ to be true anyway, but it would be interesting to see a full development of these equations.

³ Interpretation of effort trends over the longer term appears to be more hazardous.

In conclusion, the length-based assessment for mutton snapper provided indicative results, but did not provide any of the values that would be needed for a formal assessment or for associated population benchmarks. Notwithstanding the suggestion above to move towards multi-species assessments, the approach will certainly be worth applying to mutton snapper (and other species?) in the future, even if only for exploratory purposes. Aside from the concerns about recruitment, issues that will need to be addressed further include:

- Sensitivity to growth parameters. Precise values of growth parameters appear uncertain. Growth parameters based on otolith readings may be questionable for tropical species. Tagging studies could be used to estimate growth parameters directly, thus shedding light on the interpretation of otoliths.
- Spatial variability. The likelihood of large variations in local size compositions may mean that good spatial coverage of length sampling may be needed to achieve satisfactory estimates of overall mean size.

No analytical assessment was attempted for yellowfin grouper. Given their rarity in the catches, the best prospect for future assessment of this species is to consider it as one component of a wider assemblage of reef fish species.

Conclusions

The conclusion of this review is that the SEDAR 14 Data and Assessment Workshops have done everything in their power to assemble the relevant data on yellowfin grouper, mutton snapper and queen conch around Puerto Rico and the US Virgin Islands, and to use these data to draw what inferences are possible about the stock status of these three species. The data analyses have been statistically rigorous and realistic in their scope. The results of analyses for mutton snapper and queen conch are at least indicative of stock trends, and for these two species there are data and analyses to provide at least some historical perspective for future assessments. Unfortunately this does not extend to being able to provide usable estimates of stock abundance, biomass and exploitation or of associated benchmark statistics in the present. Stock assessments have not been possible for the simple reason that the data are inadequate.

It should not be concluded, however, that SEDAR 14 has been a waste of time and resources. It has been a valuable exercise in drawing together the available data and highlighting its deficiencies, and it has provided the opportunity to set out possible directions for future research and monitoring of these and similar stocks in the Caribbean. The Consensus Reports for each species contain many recommendations for future data collection and approaches to assessment, most of them emanating from the Data and Assessment Workshops. Further recommendations are given below. If sound, quantitative advice on management of fisheries for these species is to be possible in the future, it is essential to capitalize on this opportunity to move forward. SEDAR 14 and its outputs should be seen as a crucial context for this future progress.

Recommendations

I fully agree with the recommendations set out in the Consensus Report for each species. Inevitably, my personal recommendations in this report will tend to overlap with those of the Consensus Reports, but the intention is to emphasize or amplify rather than to duplicate.

Commercial fishery statistics

- The first and most important recommendation for all three species considered by SEDAR 14 must be to strive towards gaining complete and unbiased estimates of total removals by the commercial fisheries and of the effort used to take them. There are two mutually inclusive approaches to this goal: (i) strive for 100% compliance with reporting requirements; and (ii) institute a program of random catch sampling (spatially and temporally stratified, as appropriate), from which complete fishery removals can be estimated under the assumption that sampled landings are representative of all license holders. The first method is more subject to bias, given that some landings reports could well be misleading, even if not intentionally so. The second method would be less precise, but also less subject to bias.
- Alongside estimation of commercial removals quantities, every effort should be made to characterize the structure of landings. For the two fish species, this would at least involve measurements of length. A biological sampling program of this kind could be undertaken alongside random catch sampling.
- Development of recruitment indices should be seen as a priority for mutton snapper and other reef fish species (see also fishery-independent surveys). This might be possible to develop on the basis of biological sampling data.
- There should be efforts to improve the quality of catch records submitted by fishery license holders. If possible, fishers should be encouraged not to aggregate more than one trip on an individual record.
- There should be some investigation of the uncertainty in past landings introduced by the method of calculating expansion factors. As suggested in the Consensus Reports, this might be achieved by bootstrap sampling among the submitted catch records. Fishers with different durations of compliance with reporting requirements should be compared to examine the extent to which compliant fishers are representative of all fishers at times of low overall compliance.
- Where available, past paper records of fishing activities should be re-examined to assess the quality of current computerized records. There is at least scope for matching soak times with catches for trapping records, and there may be other opportunities for increasing and improving the data qualifiers available for standardization of CPUE.
- It is essential that species-specific removals data be recorded for the US Virgin Islands.

Recreational fishery statistics

- Queen conch should be included in the Marine Recreational Fishery Statistics Survey (MRFSS).
- The MRFSS should be continued in all areas, including the US Virgin Islands.
- There should be a biological sampling program for recreational fishing, measuring at least the length composition of catches. This program could be within or outside the MRFSS.
- It is recommended that there be some assessment of the uncertainty associated with estimating the recreational component of the overall catch. If the uncertainty is unacceptably high then this should be taken to indicate that increased sampling of the recreational catch is necessary.
- Species-specific discard rates should be investigated for the recreational fishery, accompanied by research into the survival rate of discards.

Fishery-independent surveys

- The spatial coverage of resource surveys should be expanded as much as possible. This applies particularly to coverage of habitats important for queen conch, for which resource surveys are likely to be the primary source of information on stock status.
- It is recommended to investigate the possibility of using beam trawls to survey queen conches. If trawls can be used non-destructively in the appropriate habitats, this might offer the possibility to achieve greater spatial coverage than is possible by visual surveys.
- If information is available on the intensity of fishing in different areas, it is recommended to use this as a stratifying factor for resource surveys. This could (a) allow some assessment of possible fishing impacts, and (b) improve the statistical basis for extending survey averages over areas of unsurveyed habitat. Surveys within Marine Protected Areas may be particularly useful in that they may (eventually) provide insight into unfished densities (especially for queen conch).
- Development of recruitment indices should be seen as a priority for mutton snapper and other reef fish species (see also commercial catch statistics). This might be possible to develop as a component of visual surveys.

Life-histories

- For queen conch there is a need to estimate the spatial scale of population processes at different life-history stages. In particular, the identification of source and sink areas for conch recruitment could have profound consequences for spatial management of the fisheries. It is also relevant to ask whether unit stocks for conch exist at a smaller or larger scale than the shelves on which the islands are situated. Coupled models of hydrodynamics and larval behavior may be the most suitable approach into research into processes occurring at spatial and temporal scales relevant to fishery management.

- The spatial scale at which the ‘Allee effect limit’ is operative should be investigated. This would involve examination of the patchiness of conch spawning distributions.
- Tagging studies aimed at validating growth parameters are recommended for mutton snapper.
- Tagging studies aimed at measuring mortality and population size (*e.g.* Frusher & Hoenig, 2001; Dunnington *et al.* 2005) should be attempted for both queen conch and mutton snapper. Short-term intensive tagging studies (*e.g.* Bell *et al.*, 2003) would be an option for making local density estimates and estimating catchability parameters.

Future stock assessments and the SEDAR process

- It is recommended to continue development of the approaches to assessment of queen conch stocks taken by the Assessment Workshop. Fishery-independent resource surveys are recommended as the most promising basis for future assessment of queen conch stocks around Puerto Rico and the US Virgin Islands. The success of this will depend heavily on increased spatial coverage of these surveys. Comparisons of conch density between areas experiencing different fishing intensity are recommended as a basis for derivation of likely values for population benchmarks.
- Assessments for mutton snapper and yellowfin grouper should be undertaken as part of a multi-species approach to assessing mixed fisheries, as advocated in the Consensus Reports. For at least mutton snapper, this would not preclude further development of standardized CPUE indices and length-based mortality estimators.
- Consideration should be given to how data poor species should be included in the SEDAR program. SEDAR 14 has been successful in highlighting the research and monitoring priorities for yellowfin grouper, mutton snapper and queen conch, and in identifying future possibilities for assessment. Nevertheless, it may be appropriate to design an alternative meeting format and terms of reference for species that are known *a priori* to be unsuitable for formal stock assessments at this time. The Consensus Reports contain proposals for two types of intersessional workshop: (i) to develop a mixed fishery approach to assessment of reef fish species within the next 12-18 months; and (ii) to evaluate progress in data collection for queen conch within the next three years, as a precursor to a formal stock assessment. It is strongly recommended that both of these proposals be put into practice.

References

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- Beverton, R.J.H. & Holt, S.J., 1956. A review of methods for estimating mortality rates in fish populations, with special reference to sources of bias in catch sampling. *Rapports et Procès-verbaux des Réunions, Conseil International pour l'Exploration de la Mer*, **140**, 67-83.
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- Frusher, S.D. & Hoenig, J.M., 2001. Strategies for improving the precision of fishing and natural mortality estimates from multiyear tagging models: a case study. *Marine and Freshwater Research*, **52**, 1649-1655.
- Gedamke, T. & Hoenig, J.M., 2006. Estimating mortality from mean length data in nonequilibrium situations, with application to the assessment of goosfish. *Transactions of the American Fisheries Society*, **135**, 476-487.
- Maunder, M.N. & Punt, A.E., 2004. Standardizing catch and effort data: a review of recent approaches. *Fisheries Research*, **70**, 141-159.
- Stephens, A. & MacCall, A., 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. *Fisheries Research*, **70**, 299-310.

ANNEX 1: Bibliography of materials provided during the review meeting

Review workshop working papers and documents

Working Papers:

SEDAR14-RW01	Estimating mutton snapper mortality rates from mean lengths and catch rates in non-equilibrium conditions.	Gedamke and Porch
SEDAR14-RW02	SEDAR 14 Assessment Workshop Data and analytical status overview	SEDAR 14 AW Panel
SEDAR14-RW03	Standardized visual counts of mutton off the US Virgin Islands and their possible use as indices of abundance.	Gedamke and Porch
SEDAR14-AW01-1	Updated commercial catch per unit effort indices for mutton snapper line and pot fisheries in Puerto Rico, 1983-2006. Addendum 1 to SEDAR14-AW01.	Cummings, N.
SEDAR14-AW05-1	Revised estimates of mutton snapper total mortality rates from length observations. Addendum 1 to SEDAR14-AW05	Gedamke, T.

Reference Documents:

SEDAR14-RD49 US Geol. Surv., Carib. Field Station, St. John, USVI 2003	Temporal analysis of monitoring data on reef fish assemblages inside Virgin Islands National Park and around St. John, US Virgin Islands, 1988-2000	Beets, J. and A. Friedlander
SEDAR14-RD50 TAFS 135:476-487 2006	Estimating mortality from mean length data in nonequilibrium situations, with application to the assessment of goosfish.	Gedamke, T. and J. M. Hoenig
SEDAR14-RD51 Caribbean Coral Reef Institute (CCRI) 2007	Reef fish spawning aggregations of the Puerto Rican shelf. Final Report	Ojeda, E.

ANNEX 2: Statement of Work

Consulting Agreement between NTVI and Dr. Michael Bell

SEDAR 14 Stock Assessment Review

Caribbean yellowfin grouper, mutton snapper, and queen conch

July 23 - 27, 2007

San Juan, Puerto Rico

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. Assessment findings are summarized in an Advisory Report that serves as an Executive Summary for the SEDAR Stock Assessment Report.

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. 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. 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, correction of errors, and sensitivity runs of the assessment model provided by the assessment workshop. 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 14 review panel will be composed of three Center for Independent Experts (CIE)-appointed reviewers, one reviewer appointed by the Caribbean Fishery Management Council, and a chair appointed by the SEFSC director. Council staff,

Council members, and Council Advisory Panel and Scientific and Statistical Committee (SSC) members will attend as observers. Members of the public may attend SEDAR review workshops.

CIE Request:

NMFS-SEFSC requests the assistance of three fisheries assessment scientists from the CIE to serve as technical reviewers for the SEDAR 14 review panel that will consider assessments of Caribbean yellowfin grouper, mutton snapper, and queen conch. Reviewer tasks are listed below.

The stocks assessed through SEDAR 14 are within the jurisdiction of the Caribbean Fishery Management Council, the US Virgin Islands, and Puerto Rico.

The review workshop will take place at the Hotel El Convento in San Juan, Puerto Rico, from 1:00 p.m. Monday, July 23, 2007 through 1:00 p.m. Friday, July 27, 2007.

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.

Please contact John Carmichael (SEDAR Program Manager; 843-571-4366 or John.Carmichael@safmc.net) for additional details.

Hotel arrangements:

Hotel El Convento
100 Cristo Street
Old San Juan, PR 00901
Phone: (787) 723-9036
Fax: (787) 723-0754

Group “SEDAR” Rate: \$195 + (12% tariff, 9% tax, \$3 tax, \$2 maid) = \$243.06; guaranteed through May 22, 2007.

(NOTE: Hotel will charge one night upon reservation)

SEDAR Review Workshop Panel Tasks:

The SEDAR 14 Review Workshop Panel will evaluate assessments of Caribbean yellowfin grouper, mutton snapper, and queen conch. 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). The Consensus Summary is a SEDAR product, not a product of the CIE. Separate CIE reviewer reports will also be produced, as described in Annex II, to provide additional, independent analyses of the technical issues and of the SEDAR process.

SEDAR 14 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.
4. Evaluate the methods used to estimate population benchmarks and management parameters; recommend values for management benchmarks and a range of ABC and provide declarations of stock status.
5. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status; recommend appropriate estimates of future stock condition.
6. Evaluate the adequacy, appropriateness, and application of methods used to characterize uncertainty, considering input data, model fit, and model configuration. Ensure that the implications of uncertainty with regard to status determinations and management values are clearly stated.
7. Ensure that assessment results are clearly and accurately presented in the Stock Assessment Report and SEDAR Advisory Report, and that reported results are consistent with Review Panel recommendations.
8. Evaluate the SEDAR Process. Identify any Terms of Reference that were inadequately addressed by the Data or Assessment Workshops; identify any additional information or assistance that will improve Review Workshops; and suggest improvements or identify aspects requiring clarification.
9. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations warranted. Clearly indicate the research and monitoring needs that may appreciably improve the reliability of future assessments. Recommend an appropriate interval for the next assessment and indicate whether a benchmark or update assessment should be considered.
10. Prepare a Peer Review Consensus Summary summarizing these evaluations and addressing each Term of Reference. (Consensus Report to be drafted by the Panel)

during the review workshop with a final report due two weeks after the workshop ends.)

NOTES: 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 corrections are made in the assessment, alternative model configurations are recommended, or additional analyses are prepared as a result of review panel findings regarding the TORs above.

These Terms of Reference may be modified prior to the Review Workshop. 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 Program Manager 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 reviewers are responsible for reviewing documents prior to the workshop, participating in workshop discussions addressing the terms of reference, preparing assessment summaries and consensus reports during the workshop, and 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 Program Manager 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 initially address. 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 ensure that 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 modifying the assessment configuration and assumptions, requesting a reasonable number of sensitivity runs, requesting additional details and results of the existing assessments, or 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 technical staff present to determine which requests can be accomplished and 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 agree to a process for reviewing the final results.

The review panel should not provide specific management advice. Such advice will be provided by existing Council Committees, such as the Science and Statistical Committee and Advisory Panels, following completion of the assessment.

If the Review Panel finds an assessment deficient to the extent that technical staff present cannot correct 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.

Statement of Tasks for Technical Reviewers:

1. Approximately three weeks prior to the meeting, the reviewers shall be provided with the stock assessment reports, associated supporting documents, and review workshop instructions including the Terms of Reference. Reviewers shall read these documents to gain an in-depth understanding of the stock assessment, the resources and information considered in the assessment, and their responsibilities as reviewers.
2. During the Review Panel meeting, reviewers shall participate in panel discussions on assessment methods, data, validity, results, recommendations, and conclusions as guided by the Terms of Reference. The reviewers also shall participate in the development of a Peer Review Consensus Summary report for each assessment reviewed, as described in Annex I. Reviewers may be asked to serve as an assessment leader during the review to facilitate preparing first drafts of review reports.
3. Following the Review Panel meeting, the 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 August 10, 2007.
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 August 17, 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 Shivilani, via email to mshivilani@rsmas.miami.edu. See Annex II for complete details on the report outline.

The duties of each CIE panelist shall occupy 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 ensure final review comments and document edits are provided to the Chair and to complete a CIE review report.

Workshop Final Reports:

The SEDAR Program Manager 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:

The CIE shall provide via e-mail the individual CIE Reviewer Reports to the COTR, Dr. Stephen Brown (stephen.k.brown@noaa.gov) for review and approval, based on compliance with this Statement of Work, by August 24, 2007. The COTR shall notify the CIE via e-mail regarding acceptance of the reports within two working days of receipt. Within two working days of the COTR's approval, the CIE shall provide the final individual CIE Reviewer Reports to the COTR in pdf format.

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 Program Manager: John Carmichael, SAFMC, 4055 Faber Place Drive, Suite 201, North Charleston, SC 29405 (email, John.Carmichael@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:

- July 27, 2007: Review Panel completes first draft of Review Panel Consensus Reports (conclusion of Review Workshop)
- August 10, 2007: Review Panel submits final draft Review Panel Consensus Reports to Workshop Chair.
- August 17, 2007: Workshop Chair submits final Review Panel Consensus Reports and SEDAR Advisory Reports to SEDAR Program Manager.
- August 17, 2007: CIE Technical Reviewers submit individual Reviewer Reports to CIE.
- August 29, 2007: SEDAR Program Manager submits final Review Panel Consensus Reports and SEDAR Stock Assessment Reports to CIE.
- September 7, 2007: CIE submits individual CIE Reviewer Reports to the COTR.
- September 11, 2007: COTR notifies CIE regarding individual Reviewer Report acceptance.
- September 13, 2007: CIE provides final individual CIE Reviewer Reports to COTR.
- September 19, 2007: COTR provides final CIE Reviewer Reports to SEFSC Acting Director and SEDAR Program Manager.
- September 21, 2007: SEDAR submits individual CIE Reviewer Reports to the SEDAR Steering Committee and Councils.

For Additional Information or Emergency:

SEDAR contact: John Carmichael, 4055 Faber Place Drive, Suite 201, North Charleston, SC 29405. Phone: 843-571-4366; cell phone (843) 224-4559. Email: John.Carmichael@safmc.net.

Draft Agenda

SEDAR 14: Caribbean Yellowfin Grouper, Mutton Snapper, and Queen Conch July 23 - 27, 2007

Monday

1:00 p.m. 1:00 – 1:30	Convene Introductions and Opening Remarks Coordinator <i>- Agenda Review, TOR, Task Assignments</i>	
1:30 – 3:30	Assessment Presentation	TBD
3:30 – 4:00	Break	
4:00 – 6:00	Continue Presentation/Discussion	Chair

Tuesday

8:30 a.m. – 11:30 a.m.	Assessment Presentation	Chair
11:30 a.m. – 1:30 p.m.	Lunch Break	
1:30 p.m. – 3:30 p.m.	Panel Discussion <i>- Assessment Data & Methods</i> <i>- Identify additional analyses, sensitivities, corrections</i>	TBD
3:30 p.m. – 4:00 p.m.	Break	
4:00 p.m. – 6:00 p.m.	Panel Discussion <i>- Continue deliberations</i> <i>- Review additional analyses</i>	Chair

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

Wednesday

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

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

Thursday

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

Thursday Goals: Complete assessment work and discussions. Final results available. Draft Consensus Reports reviewed .

Friday

8:30 a.m. – 1:00 p.m.	Panel Work Session	Chair
1:00 p.m.	ADJOURN	

Annex I. SEDAR Review Panel Consensus Summary Report Contents

I. Terms of Reference

List each Term of Reference, and include a summary of the Panel discussion 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

Provide a 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 Reviewer Report

1. The reviewer report shall be prefaced with an executive summary of findings and recommendations.
2. The main body of the reviewer report shall consist of a background, description of review activities, summary of findings, and conclusions and recommendations. Reviewers are encouraged to elaborate on any points raised in the Consensus Summary Report that they feel might require further clarification. Reviewers are encouraged to provide any criticisms and suggestions for improvement of the SEDAR process. Reviewers are not required to repeat comments and recommendations contained in 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>.