Center for Independent Experts (CIE) Independent Peer Review Report of the SEDAR 30 Caribbean Blue Tang and Queen Triggerfish assessment review

Dr. Massimiliano Cardinale

March 2013

Executive Summary

• This document is the individual Center for Independent Experts (CIE) review report of the SEDAR 30 Caribbean blue tang and queen triggerfish assessments conducted during February 2013 and provided at the request of the CIE (see Attachment A).

• This report solely represents the views of the independent reviewer (Dr. Massimiliano Cardinale).

• This reviewer does not completely agree with all of the findings reported in the SEDAR 30 Caribbean queen triggerfish assessment report, while the reviewer is in general agreement concerning the blue tang assessment report. Findings that are reported in the SEDAR 30 Caribbean blue tang and queen triggerfish assessments reports are not necessarily fully repeated in this individual report. This report focuses on clarifications of elements contained in the Summary Report and some additional views of the individual reviewer about how data for queen triggerfish could have been better explored to derive more robust estimates of exploitation rates and thus stock status.

• The assessment team tackled all of the review terms of reference (TORs).

• This reviewer believes that the SEDAR 30 has done a good job in carrying out the assessment, analysing all available source of data, modelling uncertainty and providing a full sensitivity analysis of both the data and the models. However, the reviewer is of the opinion that data for queen triggerfish are underutilised and that the reader is left with the doubt that more could have been done in terms of data analysis to derive estimates of exploitation rates and thus stock status for this species.

• For Caribbean blue tang, the report gives the impression that stability in average length is taken as an indication of a low level of F. The reviewer disagrees with this idea, and considers that given the available information the status of the stock should be considered as unknown.

• Further recommendations aimed at improving the data source used in the Caribbean queen triggerfish and blue tang assessment were made. These are based on additional future research and further re-analysis and modelling of the original data set.

Introduction

SEDAR 30 Caribbean blue tang and queen triggerfish assessments reports and associated background documents containing detailed information on the data used in the assessment were provided to the independent reviewer (Dr. Massimiliano Cardinale) well in advance of the deadline scheduled for the 28th of February 2013. The reports were reviewed at the request of the CIE (see Attachment A).

Description of review activities

This review was undertaken by Dr. Massimiliano Cardinale as desk work during February 2013 at the request of the CIE (see Attachment A).

Relevant documents (see bibliography, Attachment B) were made available four weeks prior to the deadline through email and via a link to an ftp or SEDAR 30 website (https://grunt.sefsc.noaa.gov/sedar/Sedar_Documents.jsp?WorkshopNum=30&FolderType=Assessment). The documentation was reviewed prior to the deadline and the deadline was met. The background information and assessments of Caribbean blue tang and queen triggerfish was presented through two documents (see Attachment A). Background information relevant to this review are presented in a series of appendices, including: CIE Statement of Work (Attachment A); a bibliography (Attachment B), report format (Annex 1); Terms of Reference (Annex 2); Comments included here are provided following the terms of reference (TORs) (Annex 2) and are those of this independent reviewer only. The list of main documents provided as background material is included in Attachment B. Additional presentations and documentations were made available during the meeting and were continuously updated under the ftp or SEDAR 30 website (https://grunt.sefsc.noaa.gov/sedar/Sedar_Documents.jsp?WorkshopNum=30&FolderType=Assessment).

Summary of findings

Recommendations

1. Estimate time series of landings per unit of effort (LPUE) for Puerto Rico queen triggerfish and investigate the possibility to derive the proportion of queen triggerfish within triggerfish and blue tang within surgeonfish from the Trip Interview Program (TIP) data. This would allow estimating the total number of fish landed by size class for the main gear (i.e. traps and pots) for both species, combining landings information with the size frequency data from the TIP (see also comments under ToR2).

2. Explore also the quality of the effort data for both species from the TIP, with the aim to produce an effort standardized time series of length frequency distribution (LFD) for queen triggerfish and blue tang.

3. **Queen triggerfish catch data from Puerto Rico traps and pots:** Estimate the total number of fish landed by size class for the main gear (i.e. traps and pots), combining the landings information with the size frequency data from the TIP; Statistical slicing of the total number of fish landed by size class by the main gear (i.e. traps and pots) to estimate the number of fish landed per age class for years with sufficient length measurements (i.e. for years from 1983 to 1988; a general rule of thumb would be to use years with more than 150 or 200 individuals); Estimation of Z from the catch curve or using a pseudocohort analysis (i.e. VIT when only one or few years of data are available); Conducting a yield-per-recruit (YPR) analysis to estimate F_{01} as proxy for F_{MSY} to be compared against estimate of M

4. **TIP data of queen triggerfish:** Explore the use of effort data from the TIP survey to produce an effort standardized time series of LFD for years with sufficient length measurements (a general rule of thumb would be to use years with more than 150 or 200 individuals); statistical slicing of the total number of fish caught by size class by the main gear (i.e. traps and pots) to estimate the total number of fish per age class; estimation of Z from the catch curve or using a pseudocohort analysis (i.e. VIT when only one or few years of data is available)

5. The reviewer considers that ProdBiom method (see Abella et al.,1997) might be more appropriate for the estimation of M as it combines in a single framework the growth parameters, the length weight relationship and information on the longevity of the species. Or at least it should be used along with the other methodologies presented in the reports.
6. The reviewer is of the opinion that the combination of large L_{inf} and low k are the most plausible set of VBF parameters for queen triggerfish, given what has been presented in SEDAR 30 AW 03 and according to information available in the literature, and therefore they should have been given more weight in the evaluation of the stock status.
7. The reviewer considers F_{MSY}=M as a large oversimplification, which ignores selectivity that has a large impact on F_{MSY}. The assessment team should try to estimate catch at age data from LFD (which is possible for certain combinations of years and gear type) and conduct a VIT and an YPR analysis for queen triggerfish based on selected yearly data to verify how realistic is the F_{MSY}=M assumption.
8. For Caribbean blue tang, there is some implication in the report that stability in average length is taken as an indication of a low level of F. The reviewer disagrees with this idea, and considers that given the available information the status of the stock should be considered as unknown.
9. Selectivity studies should be conducted to estimate the effect of the mesh size of the traps on the amount and size distribution of the catches of Caribbean queen triggerfish and blue tang.

Terms of Reference (ToR)

ToR1: Evaluate the data used in the assessment, addressing the following:

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

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

c) Are data applied properly within the assessment model?

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

Puerto Rico reported landings of Caribbean queen triggerfish and Caribbean blue tang have been adjusted for incomplete reporting using so-called expansion factors to estimate the total real landings. It is however unclear, both from the assessment report and from the background documents, how the expansion factor has been estimated (which is the source of the factors), how large the factors are, and if they vary between years for the different areas.

In general, I feel that the landings and effort data are underutilised, especially for Puerto Rico queen triggerfish, for which landings are reported to the level of species. Even the simple estimation of a LPUE time series for Puerto Rico, would have been an useful addition, especially for evaluating estimated time-changes in mortality derived from the Gedamke and Hoenig (2006) method. Also, simple production models might have been tested as an attempt to validate or corroborate the results from the Gedamke and Hoenig (2006) method.

I accept that it is difficult to utilise landings data for Caribbean blue tang as they are reported within the species-group surgeonfish, but especially for short times series such as St. Thomas and St. John, an assumption of constant proportion of landings of blue tang within the species-group surgeonfish could be made. This would allow building CPUE time series also for the other areas and species. In general, I wonder if the TIP data could provide an estimate of the proportion of both species in the landings, when landings data are provided as a species group instead that at the species level. In other words, it would be a useful addition to know if an estimate of the proportion of queen triggerfish within triggerfish and blue tang within surgeonfish might be derived from the TIP data from which the LFD are also derived.

Although it is reasonable to assume that some form of effort data has been collected during the TIP, it is not clear from the assessment reports if such information exists. This has been specified neither in the assessment reports nor in the background information document (i.e. SEDAR 30 AW 02). Effort data from TIP would give a rather different dimension to the LFD as they could provide information more similar to a survey and thus could be useful for estimating stock parameters such as Z and relative changes in population size, especially for queen triggerfish.

Again, considering the large uncertainty associated with the estimate of Z from the Gedamke and Hoenig (2006) method (i.e. violation of constant selectivity assumption, and uncertainty in the VBF parameters), the assessment team should have tried to produce another source of information concerning the exploitation status of the queen triggerfish stock.

I agree instead with the way the assessment team dealt with the available data for Caribbean blue tang. The large uncertainty in the reported Von Bertalanffy (VBF) parameters and, given the fact that this species presents an initial fast growth but a very high longevity, makes the length data uninformative regarding individual ages after age 5. With such large uncertainty in the basic growth parameters, to which both M and F (and F_{MSY}) depend and, due to the peculiar growth characteristics of the species, I agree with the assessment team that it is not possible to use length data to define the stock status of the species. A further difficulty with the use of length data for Caribbean blue tang is the fact that L_c is almost as large as L_{inf}, which makes most of the age classes for which the age could be in theory derived from length information not fully exploited. In this situation, age data are crucial for a robust assessment of this species.

Recreational data for both species are also presented but they are too sparse for allowing any kind of analysis. In this context, the reviewer agrees with the evaluation made by the assessment team.

Recommendations: Estimate time series of CPUE for Puerto Rico queen triggerfish and investigate the possibility of deriving the proportions of queen triggerfish within triggerfish and blue tang within surgeonfish from the TIP data. This would allow estimating the total number of fish landed by size class for the main gear (i.e. traps and pots) for both species, combining landings information with the size frequency data from the TIP (see also comments under ToR2).

Explore also the quality of the effort data for both species from the TIP, with the aim to produce an effort standardized time series of LFD for queen triggerfish and blue tang.

ToR2: Evaluate the methods used to assess the stock, taking into account the available data.

a) Are methods scientifically sound and robust?

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

The methodology (i.e Gedamke and Hoenig (2006) method) used to estimate Z has been applied correctly and I consider it as one that is robust and is an appropriate alternative for deriving estimates of exploitation given the available data. However, as for the landings data, and considering the uncertainty associated with the method used, I consider that the length data for queen triggerfish have been underutilised. Thus, other methods should have been used in conjunction with the Gedamke and Hoenig (2006) method to derive estimate of exploitation rates for this species.

For queen triggerfish from Puerto Rico, length frequency data (LFD) from the trap and pot fisheries between 1983 and 1988 are sufficient to estimate the total number of fish caught by the main gear (i.e. traps and pots) by age class, at least for the first 4-6 age classes, which constitutes the main bulk of the catches (compare for example Figures 9 and 10). A recent method has been developed (statistical slicing; see Kell and Kell 2011; Scott et al., 2011) to generate age-structured data for stock assessment from length frequency data and VBF growth curve parameters. The method is very flexible and offers a sophisticated framework for converting numbers at length to numbers at age as well as estimating the mean length at age assuming different distributions of the length data (i.e. Gaussian, gamma and lognormal).

This would allow the assessment team to obtain another and possibly more robust estimate of Z and F (assuming that M is known) from the same length data and to compare them with those derived from the Gedamke and Hoenig (2006) method. In theory, this would also allow for conducting a yield per recruit (YPR) analysis (at least based on the historical part of the times series) and derive estimates of F_{MSY} (using F_{01} as a proxy), which are independent from the estimates of M and take into account selectivity at size/age. Historical estimates of F would be crucial to evaluate the results from the Gedamke and Hoenig (2006) method as well as YPR would be important to define a more robust estimate of F_{MSY}.

However, I also realise that this is conditional on the standardization of the LFD by fishing effort to make them comparable between years and to allow for the catch curve analysis and estimates of Z. For example, the yearly number of trips from which the LFD are derived would be a reasonable index of the effort and sufficient to make the LFD comparable between years. This would allow the use of the statistical slicing method and the catch curve analysis (see also comments and recommendations under ToR2).

Another method that can be used to derive estimates of mortality is the VIT (Lleonart and Salat, 2000), which is even more flexible because it can be used also when a single year of LFD and growth parameters are available, thus no effort standardization of the LDF is needed. The method is extensively used in similar data situations with several Mediterranean stocks (e.g. STECF 2012). VIT conducts a virtual population analysis (VPA) assuming a steady state. This is a rather strong assumption for species such as small pelagic fish species, with highly fluctuating abundance due to both variable recruitment and relatively low number of age classes, but it is a much more likely assumption for demersal fish species such as triggerfish for which the population is made up of several age classes. As it requires knowledge of the catches over one year only (Lleonart and Salat, 2000) it might be used for years, areas and species for which the data allow for such an analysis. In addition to the above mentioned data, VIT requires a number of biological parameters as growth, length-weight relationship, natural mortalities and percentage mature by size or age, and proportions caught by each fishing gear (when available, but these parameters are not necessary). These parameters are all available for queen triggerfish and reported in SEDAR 30 AW 02 and thus they might be used.

For several years, the sample size of queen triggerfish from Puerto Rico is too low to conduct such kinds of analyses. However, this also applies to the estimation of average length used in the Gedamke and Hoenig (2006) method and constitutes a further argument why the assessment team should have combined different approaches to estimate Z and tried a more thorough utilisation of the available data, especially for those years with large sample size of individual length data.

The situation is different for blue tang due to the large uncertainty in the reported Von Bertalanffy (VBF) parameters and, given the fact that the species presents an initial fast growth but a very high longevity, it makes the length data uninformative regarding individual ages after age 5. Therefore, for blue tang, the exploration of the slicing method and the VIT are not feasible and the reviewer agrees with the assessment team concerning the methodology used for assessing this species.

Another method to estimate M is ProdBiom (Abella et al., 1997). The main advantage of this method is that it combines in a single framework the growth parameters, the length weight relationship and information on the longevity of the species. Also, it is able to derive estimates of M by age class, which are very useful in VIT models. It generally gives values of M which are slightly smaller than other methods, thus also avoiding failure to detect overfishing because of unrealistically high values of M. The reviewer considers that Prodbiom might be more appropriate for the estimate of M or it should be used along with the other methodologies presented.

In general, the reviewer considers that the reader is left with the doubt that much more could have been done if there had been a few more assumptions for the queen triggerfish, or at least the assessment team should have explored the possibility of using different methodologies than the Gedamke and Hoenig (2006) method to derive estimates of exploitation rates and F_{MSY}.

Recommendations:

Queen triggerfish catch data from Puerto Rico trap and pots

- Estimate the total number of fish caught by size class for the main gear (i.e. traps and pots), combining the landings information with the size frequency data from the TIP.

- Statistical slicing of the total number of fish landed by size class by the main gear (i.e. traps and pots) to estimate the number of fish landed per age class for years with sufficient length measurements (i.e. for years from 1983 to 1988; a general rule of thumb would be to use years with more than 150 or 200 individuals).

- Estimation of Z from the catch curve or using a pseudocohort analysis (i.e. VIT when only one or few years of data are available).

- Conducting an YPR analysis to estimate F_{01} as a proxy for F_{MSY} to be compared against using M as a proxy for F_{MSY}.

TIP data of queen triggerfish

- Explore the use of effort data from the TIP survey to produce an effort standardized time series of LFD for years with sufficient length measurements (a general rule of thumb would be to use years with more than 150 or 200 individuals).

- Statistical slicing of the total number of fish caught by size class by the main gear (i.e. traps and pots) to estimate the total number of fish per age class.

- Estimation of Z from the catch curve or using a pseudocohort analysis (i.e. VIT) when only one or few years of data is available.

Use the ProdBiom method (Abella et al., 1997) to estimate M along with the other methodologies presented here.

ToR3: Evaluate the assessment findings with respect to the following:

a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?
b) Is the stock overfished? What information helps you reach this conclusion?
c) Is the stock undergoing overfishing? What information helps you reach this conclusion?

Generally, a lot of emphasis is given in estimating the uncertainty, which is obviously fine, but with little critical considerations of the likelihood of each of the tested scenarios. This will automatically overestimate the uncertainty and make the evaluation of the stock status even more complicated. This is a more prominent issue for Caribbean queen triggerfish compared to blue tang. As the assessment team correctly pointed out, the key items here are the VBF parameters, which are used to estimate Z, M and F (and F_{MSY}) for both species. It is clear from Table 7 in the assessment report and Table 2 in SEDAR30 AW 03 that the L_{inf} of queen triggerfish estimated by Manooch and Drennon (1987) is generally lower or much lower than L_{max} estimated by other studies in the same area, although no details are given on the number of individuals analysed in these studies. L_{inf} is assumed to range from 37.3 to 45.6, which is in the lower range of the reported L_{max}. The impression I have is that L_{inf} is likely larger than 46.5 and thus the sensitivity analysis should have included also larger L_{inf} and lower k as L_{inf} and k are generally negatively correlated. This has direct consequences on the estimation of M and F, which are likely to be over- and underestimated, respectively. Moreover, L_{inf} and k are negatively correlated, which makes several of the scenarios tested and presented in figure 17, 19 and 21 unrealistic and also inflates the level of uncertainty in the Z estimates. Interestingly, figure 17, 19 and 21 showed that Z estimated for the combination of extreme range of L_{inf} and k are very similar, again corroborating the idea that uncertainty is largely overestimated by the way the sensitivity analysis is set up.

The reviewer is of the opinion that the combination of large L_{inf} and low k are the most plausible set of VBF parameters, given what has been presented in SEDAR30 AW 03 and therefore they should have been given more weight in the evaluation of stock status.

The situation is different for blue tang due to the large uncertainty in the reported VBF parameters, which, together with the fact that the species presents an initial fast growth but a very high longevity, makes the length data uninformative of individual age after age 5. Thus, the reviewer agrees with the assessment team that it is not possible to precisely define the stock status for the Caribbean blue tang and that age-based data are crucial in the future. Stability in mean length is difficult to interpret in this case, and without a robust estimate of the absolute vale of Z it cannot be interpreted as an indication of sustainable fishing. Thus, I consider that the stock status is unknown and age data are needed in the future as also pointed out by the assessment team in their general conclusions.

A lot of emphasis has been given to test the effect of L_c on the Z estimates, which was then revealed by the sensitivity analysis to be very small, instead of critically assigning different likelihood to the different scenarios. The authors correctly stress that the estimates are dependent on the parameters but they fail to give critical support to one or fewer scenario over the others to reduce the number of scenarios and help with the evaluation of the stock status.

The impression is that the assessment team is more prone to consider queen triggerfish as being not subject to overexploitation although they correctly stress the fact that the data are not enough to make firm conclusions on the stock's status. However, from Tables 19 and 21, several scenarios indicated that F was in excess of F_{MSY}, which I would interpret as an indication of overfishing being highly likely but this does not emerge from the text of the report. The reviewer also considers F_{MSY}=M as a large oversimplification, which ignores selectivity that has a large impact on F_{MSY}. I would try to estimate catch at age data from LFD and conduct an YPR analysis based on selected yearly data to have an idea of how realistic is this assumption.

For Caribbean blue tang, there is some implication in the report that stability in average length is viewed as an indication of a low level of F. The reviewer disagrees with this view, and considers that given the available information the status of the stock should be considered as unknown.

Recommendations

The reviewer is of the opinion that the combination of large L_{inf} and low k are the most plausible set of VBF parameters, given what has been presented in SEDAR30 AW 03 and therefore they should have been given more weight in the evaluation of the stock's status.

The reviewer considers F_{MSY}=M as a large oversimplification, which ignores selectivity that has a large impact on F_{MSY}. The assessment team should try to estimate catch at age data from LFD and conduct a VIT and an YPR analysis for queen triggerfish based on selected yearly data to have an idea of how realistic is this assumption.

For Caribbean blue tang, the report gives the impression that stability in average length is taken as an indication of low level of F. The reviewer disagrees with this view, and considers that given the available information the status of the stock should be considered as unknown.

ToR 4. Evaluate the stock projections, addressing the following:
a) Are the methods consistent with accepted practices and available data?
b) Are the methods appropriate for the assessment model and outputs?
c) Are the results informative and robust, and useful to support inferences of probable future conditions?
d) Are key uncertainties acknowledged, discussed, and reflected in the projection results ?..........................

The ToR could not be conducted due to data restrictions.

Recommendations

None.

ToR 5. Consider how uncertainties in the assessment, and their potential consequences, are addressed.
• Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods.
• Ensure that the implications of uncertainty in technical conclusions are clearly stated.

See comments under ToR3.

Recommendations

None.

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

• Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
• Provide recommendations on possible ways to improve the SEDAR process.

The assessment team do provide an exhaustive shopping list for future data to be collected, which would greatly improve the capability of assessing the status of the Caribbean queen triggerfish and blue tang stock. However, I also suggest that effort should be devoted to selectivity experiments aimed to evaluate the theoretical changes in selectivity linked with the historical changes in the mesh size of the traps.

Recommendations

Conduct selectivity studies on the effect of the mesh size of the traps on the amount and size distribution of the catches of queen triggerfish and blue tang.

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

See comments under ToR 2 and 3.

Recommendations

None

The key information contained in the introduction of both the assessment for U.S. Caribbean queen triggerfish and the one for blue tang is the management table and the table with the changes in management regulations. The management table should indicate the unit for the value of MSST, MSY and OY, which are now missing. On the other hand, the table with the changes in management regulations is very detailed but without any information about the selectivity of the different mesh size for the traps. Therefore, the reported information is rather uninformative and it is basically impossible to evaluate how these changes might have affected the selectivity of the fisheries. This is crucial information as violating the assumption of time invariant selectivity would affect directly the model output in this case and makes the utilisation of the landings data more complicated. I suggest that effort should be devoted to selectivity experiments aimed to evaluate the theoretical changes in selectivity linked with the historical changes in the mesh size of the traps (see also recommendations in ToR6).

Conclusions

The assessment team should be commended for their effort, timing and clarity in presenting the results. However, I consider that data are underutilised and the uncertainty overestimated by the sensitivity set up used. Also, the lack of alternative estimates of Z beside those coming from the Gedamke and Hoenig (2006) method makes it difficult to evaluate the results and assess the status of the Caribbean queen triggerfish stock. A series of recommendations on how to improve the data utilisation and provide alternative estimates of the exploitation rates have been given under the specific ToRs.

For Caribbean blue tang, the report gives the impression that stability in average length is an indication of a low level of F. The reviewer disagrees with this view, and considers that given the available information the status of the stock should be considered as unknown.

The basic data and model framework were adequately presented through documents and were circulated well in advance of the review. A possible improvement for the presentation of the result in the report could be the creation of a *Glossary* and an *Acronyms* list at the end of the document. This will greatly facilitate the reading of the report for the public.

Reference list

Abella A., Caddy J., Serena F., 1997. Do natural mortality and availability decline with age? An alternative yield paradigm for juvenile fisheries, illustrated by the hake *Merluccius merluccius* in the Mediterranean. Aquat. Liv. Res., 10: 257-269.

Laurence T. Kell and Alexander Kell. A comparison of age slicing and statistical age estimation for mediterranean sword_sh (xiphias gladious). Collect. Vol. Sci. Pap. ICCAT, 66(4):1522{1534, 2011.

Lleonart, J. & Salat, J., 2000. VIT (version 1. 1): Software for fishery analysis. User's manual. On ligne: http//www.faocopemed.org/es/activ/infodif/vit.htm.

Scientific, Technical and Economic Committee for Fisheries (STECF) – Assessment of Mediterranean Sea stocks – part 1 (STECF 12-19). (eds. Cardinale M. (Chairman) Osio C. & Charef A.). 2012. Publications Office of the European Union, Luxembourg, EUR 25602 EN, JRC 76735, 502 pp.

Scott F, Osio G, Cardinale M 2011. Comparison of age slicing methods - Working Document in support to the STECF Expert Working Group 11-12 Assessment of Mediterranean Sea stocks - part II. EUR 25054 EN. Luxembourg.

Attachment A: Statement of Work for Dr. Massimiliano Cardinale

External Independent Peer Review by the Center for Independent Experts

SEDAR 30 Caribbean blue tang and queen triggerfish assessment review

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

Project Description SEDAR 30 will be a compilation of data, an assessment of the stock, and an assessment review conducted for Caribbean blue tang and queen triggerfish. The CIE peer review is ultimately responsible for ensuring that the best possible assessment has been provided through the SEDAR process. The stocks assessed through SEDAR 30 are within the jurisdiction of the Caribbean Fisheries Management Council and the territorial waters of Puerto Rico and the U.S. Virgin Islands. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall have the necessary qualifications to complete an impartial and independent peer review in accordance with the tasks and ToRs described in the SoW herein. The CIE reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the tasks of the scientific peer-review described herein. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct the desk review during 4-7 February 2013, therefore no travel will be required.

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

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

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

Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator.** The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements.

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

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

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.

2) During February 4-7, 2013 as specified herein, conduct an independent desk peer review in accordance with the ToRs (**Annex 2**).

3) No later than February 21, 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Sampson david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

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

14 January 2013	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
18 January 2013	NMFS Project Contact sends the stock assessment report and background documents to the CIE reviewers.
4-13 February 2013	Each reviewer conducts an independent desk peer review
19 February 2013	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
7 March 2013	CIE submits CIE independent peer review reports to the COR
14 March 2013	The COR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on changes. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

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

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

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

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

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

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed. The CIE independent report shall be an independent peer review of each ToRs.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work

Annex 2: Terms of Reference for the Peer Review

SEDAR 30 Caribbean blue tang and queen triggerfish assessment review

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

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

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

   - Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
   - Provide recommendations on possible ways to improve the SEDAR process.

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

Attachment B: List of main documents provided as background material

Draft Stock Assessment:
Section1_blue tang_v1.pdf
SectionII_S30_Blue_tang_AW_report_complete_w_watermark.pdf
Section1_queen_triggerfish_v1.pdf
SectionII_S30_Queen_triggerfish_AW_report_w_watermark.pdf

Background Materials:
S30 Doc List.pdf
S30_FTP site instructions.pdf
S30_AW_01_SummaryRecreationalBlueTangQueenTriggerfish.pdf.
S30_AW_02_SummaryTIP.pdf
S30_AW_03_Rios_Life History Review.pdf
S30_AW_04_Caribbean queen triggerfish and blue tang landings.pdf