Independent Peer Review of the SEDAR 37 South Atlantic & Gulf of Mexico Hogfish

Prepared for the Center for Independent Experts

By

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September 2014

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Executive Summary

- This document is the individual CIE Reviewer Report of the SEDAR 37 South Atlantic and Gulf of Mexico hogfish (*Lachnolaimus maximus*) desk-based CIE review. The review was conducted during July 2014 and solely represents the views of the independent reviewer (Geoff Tingley).

- Assessments for each of three hogfish stocks (WFL, EFL/FLK and GA-NC)[1] were clearly presented and documented, including detailed descriptions of the input data and an appropriate level of coverage of the uncertainties.

- The assessments presented all include time-series of data described as indices of abundance; however, some of these are extremely unlikely to index abundance. This issue is sufficiently important that this reviewer does not believe that these assessments should be accepted as 'best science' until this issue is rectified.

- Recent advances in stock discrimination incorporating genetic analyses greatly improved the understanding of the stock structure for this species and materially assisted in developing these stock assessments.

- The 2013 assessment for South Atlantic and Gulf of Mexico hogfish stocks shows considerable improvement over the previous assessment conducted in 2004. This appears to be principally due to some focused research and additional data collection, both identified as required in the earlier assessment process.

- All three of the hogfish stocks have significant data limitations that impact on the provision of good quality stock assessments but continuing improvements to address this should be possible and should be attempted.

- Re-examining aspects of the data inputs, especially the approach to developing and retaining abundance indices in the assessment, are likely to yield improved model fits.

- The assessment team recognized shortcomings in the analyses for these stocks and made some appropriate recommendations aimed at improving the current approach to the hogfish stock assessments through additional research.

- Specific recommendations aimed at improving the stock assessment approach for these stocks are made by the reviewer under Term of Reference 7 (page 12).

[1] WFL= Western Florida; EFL/FLK = Eastern Florida/Florida Keys; and GA-NC = Georgia to North Carolina.

Background

This desk-based review of the 2013 Stock Assessment Report for Hogfish (*Lachnolaimus maximus*) in the South Atlantic and Gulf of Mexico was conducted as part of an independent review of the overall assessment process under the Center for Independent Experts (CIE).

Documents were clearly presented and contained few omissions or typographical errors. The support provided by the SEDAR staff was excellent.

All views expressed in this report are solely those of the independent reviewer.

The fisheries for hogfish in the South Atlantic and Gulf of Mexico are complex, encompassing a number of different fishing methods, most of which are difficult to monitor consistently or effectively. These difficulties are exacerbated by a complex spatial distribution of habitat and thus fish abundance and also by the majority of the fishery being recreational.

It is of note that considerable improvements in input data have been achieved since the previous assessment for hogfish was conducted in the early 2000s (see SEDAR 6, 2004). It will be important to build upon these improvements in future.

Description of Review Activities

This review was undertaken by Geoff Tingley between the 7th and 28th July 2014 as part of the SEDAR 37 review of the 2013 Stock Assessment Report for Hogfish in the South Atlantic and Gulf of Mexico. This review was delayed by approximately one month, as instructed by email, from the originally scheduled dates. The final submission date for this review report was changed to reflect the overall change in the review dates from 30th June to 28th July 2014.

The supporting documents (see Bibliography, Appendix 1) for the assessment were provided to the reviewer in electronic format adequately in advance of the review date. The assessment and supporting documentation were reviewed against the specific Terms of Reference (ToR) provided by the CIE (see Appendix 2). In order to understand more of the background and some details of the input data, the reviewer also accessed publicly available reports from the previous hogfish assessment (SEDAR 6).

Background information relevant to this review is presented in appendices to this review report, as required by the ToR for this review. These are Appendix 1: Bibliography of documents; and Appendix 2: CIE Statement of Work (which includes background information and Annexes describing (i) the Format and Contents of the CIE Peer Review Report, and (ii) Terms of Reference for the Peer Review, for SEDAR 37 South Atlantic and Gulf of Mexico hogfish review.

Comments are provided against the specific ToR given in Annex 2 of Appendix 2 and are solely those of the reviewer.

Summary of Findings

The South Atlantic and Gulf of Mexico hogfish assessment team should be commended for their thorough and professional approach to processing the basic data and developing and applying the models for a complex of stocks and fisheries to provide advice to managers, with the exception of how time-series of data were included as indices of abundance. A summary of findings and recommendations from this reviewer is presented below.

The findings of this reviewer are reported within relevant sections, addressing each of the ToR as set out in Annex 2 of Appendix 2.

Overall findings

The approaches to stock definition and modeling were thorough and sound, with the modeling appropriately addressing uncertainty through a wide range of sensitivities to the principle assumptions. The input data were clearly described and prepared for use. However, the lack of critical quality selection criteria in the selection of some of the input data, especially for time-series presented as indices of abundance, is considered a significant weakness of these assessments.

These fisheries have a general paucity of data that increases uncertainty in any stock assessment. While many of these uncertainties have been fully addressed, others remain unaddressed and intractable, and raise doubts about the robustness of the assessment outputs.

Summary

- The use of recent genetic studies to better define hogfish stock structure enabled all data to be appropriately spatially defined for use as inputs to the assessments for the different hogfish stocks.
- The majority of uncertainties in the input data, parameter assumptions and model structure were appropriately explored in the treatment of the input data and in sensitivity runs to the base case models.
- Two areas where uncertainty was not deemed to have been adequately addressed are (i) with respect to developing and selecting indices of abundance, and (ii) in the implicit assumptions made about the representativeness of the biostatistical data sampled from the various fisheries (e.g. length frequency and age data).
- The assessments presented all include time-series of data that are described as indices of abundance but are unlikely to be so. This issue is sufficiently important that this reviewer does not believe that these assessments should be accepted as 'best science', raising doubts about the validity of the assessment outputs.
- Development of an approach and subsequent application to quality-test the various time-series of data as possible indices of abundance prior to their inclusion in these assessments is required. This may yield improved model fits to key indices of abundance as well as improvements in the robustness of and confidence in the assessment results.
- The assessment team did a thorough job of preparing the various data sets and in developing and applying the models.

Comments on Individual Terms of Reference

1. *Evaluate the data used in the assessment, addressing the following:*
   a) *Are data decisions made by the assessment panel 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?*

It is clear from the types and amount of data available to assess hogfish, that it would be appropriate to describe these fisheries as data poor or data limited. The quantities and quality of the data available, much of it coming from recreational fisheries, are borderline in terms of being able to adequately support stock assessments. The best quality data have been collected for specific purposes (genetic discrimination) or through specific programs (life history data) to address previously defined data gaps relevant to assessments. Such limitations in the basic data available would be expected to create some difficult issues for an assessment team to address. These issues have generally been addressed in a sound, appropriate and robust manner by the hogfish assessment team.

The uncertainties in the data are reported and mostly acknowledged. This included clear descriptions of the uncertainties in the catch history, the patchiness in the spatial and temporal distribution of length frequency and age data from the three stock areas, and uncertainties in the estimated selectivity and natural mortality parameters. The uncertainties in the data used to derive the catch-per-unit-effort (CPUE) and fishery-independent survey time-series are also appropriately addressed. However, this was not followed through to an evaluation of the likelihood of the various time-series actually indexing stock abundance, which is an important omission.

A number of unusual variations in data presented are neither commented on nor explained. For example, effort levels in some of the fisheries were highly variable to a level that warrants further investigation, especially as there was no discussion of why this should occur and whether the data were usable (see FLK/EFL hook-and-line effort in Table 6.4.1. and WFL hook-and-line effort for 2009 in Table).

Appropriate biological data for hogfish were considered, analysed, reported on and used in the assessment. The genetic information was used to good effect in defining stock boundaries that were then consistently applied to all other datasets throughout the assessments. The other data considered included catch distribution (temporal, spatial and depth), length frequency, age, maturity (age, sex and size), sexual transition (age, size, depth, location), growth and natural mortality (M).

Information on catches (i.e. landings and discards) is fairly uncertain but this has been appropriately highlighted and dealt with, especially for the earlier years of the fishery. Length frequency and age data are very patchily available in time and space and in low numbers from most of the fisheries. Given the known difficulties of collecting appropriate data from small scale, mostly recreational fisheries, the uncertainties are within expected levels.

In the absence of detailed discard mortality data, the assumed discard mortalities appear reasonable but would bear further explanation of why particular values were selected, and the scale of potential impacts of error in the assumptions could be further explored.

To improve future assessments, the collection of the spatially and temporally patchy biological data from the fisheries, especially length frequency and age data, needs to be made more consistent in future.

The majority of the input data series are adequately reliable, and, with uncertainty taken into account, have been properly used within the assessments. There are two areas of concern where this does not appear to be the case and that merit further consideration. In particular, all three stocks have multiple time-series of what are described as indices of abundance, including both fishery-dependent and fishery-independent indices.

Having options to develop multiple time-series that could be used as indices of abundance is really useful in assessments of otherwise data poor fisheries. However, unquestioning acceptance that a time-series of CPUE or a fisheries independent survey does index abundance can introduce substantive problems in an assessment if it is not an index. This can downgrade the model fit to some or all of the other data sets, including other, genuine indices of abundance. In these assessments, all of the time-series presented were included, with no reported review about whether the time-series were likely to index stock abundance or not, or whether they were in opposition to other putative indices for the same stock.

For example, there is no consideration of the spatial coverage of data in SEDAR37-01 beyond the accepted stock boundaries and some habitat differences in the FLK/SEFL area. The model implicitly assumes that each group of trips are (i) representative of the fishery and (ii) covering the same spatial area in each time period (month, year). It may be that this is the case but there is no consideration or analysis of this and it is not possible for the reviewer to judge based on evidence, whether this assumption is likely to be correct or not. Given the length of some of the time-series of CPUE, it is difficult to believe, *a priori*, that the spatial distribution of the fishery is the same in each year. It is even more unlikely that the spatial coverage of the different fisheries by the often limited sampling effort will be either representative or adequately similar between years to enable a derived CPUE series to be considered a good index of abundance.

Reasons for doubting the validity of some of the time-series, requiring specific sensitivities to justify inclusion of an index in the assessment, or for fully rejecting some of the time-series used in these assessments, can be made based on one or more criteria.

The following examples explore this.

(i) It is implausible that the two-fold change in abundance in the WFL stock indicated by hook-and-line index between 2011 and 2012 is valid (Figure 8.2.1.2); similarly, the near four-fold increase between 2009 and 2010 for the WFL hook-and-line index is even harder to accept as real (Figure 8.2.2.2).

(ii) The very low value for the WFL video surveys in 2007 compared to the years either side (a 15-fold drop from 2006 followed by a 24-fold increase to 2008) makes this extremely unlikely to be a valid index as it stands. At least possible reasons for the

low value of 2007 data point should have been explored and, if justified, the point could have been removed from the standardization (Figure 8.2.4.1).

(iii) There is a clear issue with the quality of the standardization of the FLK/SEFL[2] commercial Florida trip tickets hook-and-line index, where 13 of the 19 data points are below the standardized index. There is also a clear trend in the residuals (early years above, later years below) (Figure 8.2.1.4).

(iv) Some of the time-series used as indices of abundance in the assessment are clearly in opposition, which is recognized in the report by the assessment team. For example, for the FLK/EFL[3] fisheries the CPUE time-series from the commercial logbooks from the hook-and-line fishery has an increasing trend, while that from the spear fishery has a decreasing trend and are in such stark opposition that is difficult to justify the inclusion of both within the assessment (Figure 8.2.10.1). These measures cannot both be indexing the whole stock (or even the same component); therefore, one or other should be excluded from the assessment. If no justifiable case for exclusion can be made for either time-series, then this should be addressed through sensitivities that exclude first one and then the other, testing the overall goodness of fit of the model to all datasets to help define the most appropriate course of action.

(v) The coefficients of variation (CVs) on the baitfish index for the WFL stock are so large that this index is unlikely to add much to the assessment and it could be omitted from the base case of future assessments, possibly functioning as a sensitivity only.

Sensitivities to test the impact of different indices on the stock assessments (Sections 11.1.7.2 and 11.2.7.2.2) only removed time-series one at a time. While this should have identified issues due to particularly influential time-series, it is unlikely to have adequately addressed issues in the assessments caused by pairs of indices in opposition, as described in (iv) above (Figure 8.2.10.1).

The modelling package Stock Synthesis (SS) is designed to permit use of multiple input data sets such as abundance indices. However, getting an acceptable outcome relies on the ability of SS to 'balance' its fits to the input data. Where there are good data (quality and quantity) this may work, as those datasets that match will work together to override those that may be erroneous. However, where the other data (e.g. length frequency data or age data) are of poor quality due to lack of temporal or spatial coverage or low and variable sample sizes, it becomes considerably less likely that the model will be able to find the 'correct', i.e. real world, outcome.

It is recommended that there should be a specific requirement for assessment teams to consider the quality of the time-series being considered as abundance indices. This consideration should take account of evidence, or if evidence is lacking, logical argument, that supports or opposes the likelihood of the time-series indexing the stock in question. Where time-series are found to be unlikely or highly unlikely to index abundance they should be omitted from the assessment. Where the evidence or logical argument is inconclusive, the value of the time-series can be addressed through running sensitivities. One specific objective of this approach should be to eliminate the inclusion of multiple times series that show opposing trends in abundance within the same model run. Where

[2] FLK/SEFL = Florida Keys/Southeast Florida.
[3] FLK/EFL = Florida Keys/Eastern Florida.

opposing indices exist, their impacts upon the fits and outcomes of the assessments should be explored using sensitivity runs.

The only other area where it is arguable that uncertainties were not adequately addressed in the assessment relates to those input data sampled from the various fisheries. The assessment team notes that spatial and temporal coverage are important (in terms of abundance indices) and go on to note that this is rarely achieved in practice (Section 8.1.1). The issue of spatial and temporal coverage of the abundance indices has been dealt with above; however, it is also true that the sampling of the length frequency and age data from fisheries should also be adequately representative, to be of most use in assessments. In relatively small and complex fisheries, such as these for hogfish (multiple fleets; mostly recreational effort; spatially structured habitat; sexual transition based on size, age and location; etc.), obtaining sufficient length and age data is an achievement in itself. However, it should be recognised that the spatial and temporal coverage of these data sampled from the fisheries are more likely to be unrepresentative of the fisheries from which they sampled than will be the case is less structured, often larger scale and less complex fisheries, unless specific efforts have been made to ensure that representativeness is achieved.

The assessment report is silent on whether the length and age data from the different fisheries are representative or not. Given the structure of the fisheries, and the low level of and temporal variability in sampling, it is the reviewer's opinion that these datasets are unlikely to be representative of the fisheries from which they were sampled. The assessments under review did not address this possible lack of representativeness in the fisheries sampled data.

Ideally, future stock assessments should define whether or not any of these datasets are representative of the fisheries that they come from. If found to be unrepresentative, the relative scale of divergence from representativeness should be explored and the impacts of this evaluated as an uncertainty in the assessment. In the absence of such definition, assessments should still seek to explore the impacts of lack of representativeness on the fit of the model to the data and the robustness of the model outcomes (e.g. stock status).

With the exceptions of the lack of understanding about the representativeness of the fisheries sampling and the lack of critical evaluation of the value of the various putative indices of abundance, given a fairly difficult set of data to work with, the assessment team have done a thorough job of preparing the data for assessment. The data are adequately reliable and sufficient to support the modelling approach and are applied properly within the assessment. The apparent lack of critical review of the validity of the abundance indices could be serious issue in terms of potential error in the estimation of stock status for these stocks and does not meet the thresholds of proper application and reliability.

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?*

The methods used to develop the stock assessments for the three stocks are scientifically sound and robust. As far as is possible to ascertain in a desk-based review, the assessment models have been configured properly and used in a manner consistent with standard practices. The methods applied are appropriate for the available data.

For example, Stock Synthesis assumes that landings are precisely known and there is uncertainty about landings for most of the fisheries harvesting hogfish from the three stocks. These uncertainties have, however, been appropriately addressed, especially through the use of sensitivity model runs.

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?*

The use of the model to produce population benchmarks and management information for the three stocks are appropriate. However, the reliability of the abundance, exploitation, and biomass estimates are compromised by the appropriateness of aspects of the data input decisions, specifically the inclusion of time-series expected to index stock abundance where there is evidence that they are probably not reliable indices.

The extent to which the assessment results been compromised, in terms of stock status and performance against management quantities such as the overfished and overfishing thresholds, is not possible to determine without additional assessment work. It is, therefore, not possible to be explicit about the stock status or performance of the stocks against management thresholds until the issue of the inclusion of inappropriate '*indices of abundance*' is appropriately addressed.

4. *Evaluate the stock projections, rebuilding timeframes, and generation times, 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 approaches used to develop projections, rebuild timeframes and generation times are appropriate. The use of projections that extend to two decades exceeds what would normally be accepted as robust even for a high quality assessment. In this case, given the quality of the input data, running projections over such long timeframes is likely to be unreliable and is also unnecessary. A table of three or five year projections would be useful for a range of realistic fishing mortalities (F), including current F. In terms of defining rebuild time-scales, a maximum projection period of about 10 years would be sufficient.

All projections were developed from the base case model (Section 11.1.10) and so did not address uncertainty in either data inputs, assumed values or model structure. Running projections from a base model only is not that unusual, although where assessments have high uncertainty, using selected sensitivity runs to explore the impact of projected stock status against management targets and a range of catch scenarios, is common. Given the overall quality of the input data (patchy length frequencies and age data in time and space; difficulties in defining the fisheries selectivities and issues with the inclusion of dubious abundance indices), these assessments could reasonably be described as having higher than normal uncertainty. It would, therefore, have been expected that key uncertainties would have been explored through to the projections.

Evaluating the information content and robustness of the results suffers from the same issue of needing to remove unreliable '*index*' data series before such an evaluation can reliably be conducted. As such, the results cannot really be described as robust, although they probably do retain an ability to inform on broad aspects of future performance, but with a higher level of associated uncertainty than would be desirable.

5. *Consider how uncertainties in the assessment, and their potential consequences, are addressed.*
   a) *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*
   b) *Ensure that the implications of uncertainty in technical conclusions are clearly stated.*

A key uncertainty in many stock assessments where there are multiple stocks is the quality and robustness of the knowledge about stock structure. Through some targeted genetic research, prioritised through the assessment process, this uncertainty has been substantially reduced for hogfish in the South Atlantic and Gulf of Mexico.

The majority of other uncertainties have been clearly expressed and addressed through the wide range of sensitivities to variability and uncertainty in the different input data, model structure, and parameter assumptions.

More effort to address uncertainties could and perhaps should have been directed to the quality and representativeness of, for example, the length frequency and age sampling from the various fisheries.

6. *Consider the research recommendations provided and make any additional recommendations or prioritizations warranted.*
   a) *Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.*
   b) *Provide recommendations on possible ways to improve the SEDAR process.*

a) *Research and monitoring recommendations:*

- In a fishery with multiple data deficiencies, one of the potential objects of modeling is to identify those datasets that, by their inadequacy, associated uncertainties or absence, have a disproportionate impact on the outcomes of the assessment that managers have a particular interest in. This can then provide a coherent input to the prioritization of future research effort aimed at improving the assessment most effectively. More effective progress may be made by using the model outputs to review the immediate future research focus and prioritization.

Four recommendations are made in the assessment document but are not prioritized. The prioritization recommended by the reviewer of these, is as follows:

1) Improve the biostatistical sampling of hogfish.
2) Develop/ improve the fishery-independent surveys for the GA-NC stock and fisheries.
3) Conduct focused life history studies for the FLK/EFL and GA-NC stocks.
4) Develop a life-history study to address male contribution to spawning reproductive potential.

The first two of these recommendations are by far the more important, as these sit right at the heart of delivering acceptable stock assessments for these stocks.

b) *SEDAR process improvement recommendations:*

The organizational approach, provision of clear ToR and provision of documents for the SEDAR process is of a very high standard. The recommendation that follows addresses minor issues that particularly address the needs of external reviewers and general readers alike in understanding these fisheries and the complex assessments in a relatively short space of time. It is recommended that the following issues be considered for inclusion in future SEDAR assessment reports.

- A report structure with fully consecutive page numbering would have made the reading and reviewing the report easier.
- A list of acronyms should be included in the report. There was no list of acronyms in the assessment report which, given the number of acronyms used, would have been

very useful and would have expedited the work of the review (see for example http://sero.nmfs.noaa.gov/sustainable_fisheries/more_info/documents/pdfs/glossary_of_fishery_terms.pdf).

- Tables in assessment reports need to be appropriately formatted to enable effective interpretation of their information content: in a number of key tables in the assessment report, the columns of figures were neither right-justified nor aligned at the decimal point and the numbers had variable decimal places. The numbers in some of the tables were overly precise (i.e. there are too many places of decimals). While minor in themselves, these make reading the tables for scale, errors, outliers and areas of transition, both slower and harder.
- A map describing the key stock areas, locations and boundaries referred to, would have aided the reader's understanding of the spatial context of the fisheries, the stock structure, and sampling locations referred to.

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

- It is recommended that there should be a specific requirement for assessment teams to consider and report on the quality of all time-series being considered as abundance indices. This consideration should take account of evidence, or if evidence is lacking, logical arguments that support or oppose the likelihood of each time-series indexing the stock in question. Where time-series are found to be unlikely or highly unlikely to index abundance they should be omitted from the assessment. Where evidence and/or logical arguments are inconclusive, the value of the time-series may be addressed through running sensitivities. Specific objectives of this approach should be to (i) raise the quality standard of the input data to help improve the fit of the model to the data and increase the robustness of the assessment; and (ii) to eliminate the inclusion of times-series that show opposing trends in abundance within the same model run where the time-series relate to the whole stock or the same stock components.
- Length frequency and age samples from these fisheries are of borderline quality for enabling adequate stock assessments for the three hogfish stocks to be developed. Sampling in more recent years has been better than that from earlier years but ideally should be improved further. It is recommended that a more consistent approach to obtaining sufficient samples that are representative of each fishery in each year be developed. An approach that aims to obtain a balance of samples from the different fisheries and stocks should be developed and implemented. This will help enable stock assessments of adequate quality to be developed in future. This is essentially the same as the recommendation to 'improve the biostatistical sampling of hogfish' made by the assessment team (see section 6 above).

Appendix 1: Bibliography

SEDAR 37 Florida Hogfish Working Document List

SEDAR37-01	Seyoum S, Collins AB, Puchulutegue C, McBride RS, Tringali MD. 2014. Genetic population structure of hogfish (Labridae: *Lachnolaimus maximus*) in the southeastern United States.
SEDAR37-02	Cooper W. 2014. Commercial catch per unit effort of hogfish (*Lachnolaimus maximus*) from Florida Trip Ticket landings, 1994-2012.
SEDAR37-03	Cooper W. 2014. Recreational catch per unit effort of hogfish (*Lachnolaimus maximus*) in the Southeast US using MRFSS-MRIP intercept data, 1991-2012.
SEDAR37-04	Cooper W. 2014. Relative index of abundance from visual order-of-magnitude REEF surveys applied to Hogfish (*Lachnolaimus maximus*) in the Southeast US, 1994-2012.
SEDAR37-05	Switzer TS, Keenan SF, McMichael RH Jr, DeVries DA, Gardner CL, Raley P. 2013. Fisheries-independent data for Hogfish (*Lachnolaimus maximus*) from reef-fish video surveys on the West Florida Shelf, 2005-2012.
SEDAR37-06	Switzer TS, Fischer KM, McMichael RH Jr. 2013. Fisheries-independent data for juvenile Hogfish (*Lachnolaimus maximus*) from the annual FWRI SEAMAP trawl survey, 2008-2012.
SEDAR37-07	Switzer TS, Fischer KM, McMichael RH Jr. 2013. Fisheries-independent data for juvenile Hogfish (*Lachnolaimus maximus*) from the annual baitfish survey, 2002-2012.
SEDAR37-08	Switzer TS, Keenan SF, McMichael RH Jr, Fischer KM. 2013. Fisheries-independent data for juvenile Hogfish (*Lachnolaimus maximus*) from polyhaline seagrasses of the Florida Big Bend, 2008-2012.
SEDAR37-09	Smith SG, Ault JS, Bohnsack JA, Blondeau J, Acosta A, Renchen J, Feeley MJ, Ziegler TA. 2013. Fisheries-independent data for hogfish (*Lachnolaimus maximus*) from reef-fish visual surveys in the Florida Keys and Dry Tortugas, 1994-2012.
SEDAR37-10	Bachelor and Reichert. 2014. Summary information for hogfish *Lachnolaimus maximus* seen on videos collected by the SouthEast Reef Fish Survey in 2010 – 2012 between North Carolina and Florida.
SEDAR37-11	Hiltz et al. 2014. Standardization of commercial catch per unit effort of hogfish (*Lachnolaimus maximus*) from South Carolina Trip Ticket landings, 2004-2012.
SEDAR37-12	McCarthy. 2014. Analysis of Hogfish data from Coastal Fisheries Logbook Program (CFLP).
SEDAR37-13	Collier. 2014. Standardization of commercial catch per unit effort of hogfish (*Lachnolaimus maximus*) from North Carolina Trip Ticket landings.

Appendix 2: Statement of Work

Attachment A: Statement of Work for Dr. Geoff Tingley

External Independent Peer Review by the Center for Independent Experts

SEDAR 37: South Atlantic and Gulf of Mexico Hogfish Assessment Desk 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 37 will be a compilation of data, a benchmark assessment of the stock, and CIE assessment review conducted for South Atlantic and Gulf of Mexico hogfish. The desk review provides an independent peer review of SEDAR stock assessments. The review is responsible for ensuring that the best possible assessment is provided through the SEDAR process and will provide guidance to the SEFSC to aid in their review and determination of best available science, and when determining if the assessment is useful for management. The stocks assessed through SEDAR 37 are within the jurisdiction of the South Atlantic and Gulf of Mexico Fishery Management Councils, and the states of Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, and North Carolina. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall have the necessary qualifications to complete an impartial and independent peer review in accordance with the statement of work (SoW) tasks and terms of reference (ToRs) specified herein. The CIE reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the tasks of the 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 participate and conduct an independent peer review as a desk review; therefore travel will not 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 contact information 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 assessment and other pertinent background documents for the peer review. 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) Conduct an impartial and independent peer review in accordance with the tasks and ToRs specified herein, and each ToRs must be addressed (**Annex 2**).
3) No later than June 30, 2014, 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**.

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

15 May 2014	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
1 June 2014	NMFS Project Contact sends the stock assessment report and background documents to the CIE reviewers.
9-20 June 2014	Each reviewer shall conduct an independent desk peer review
30 June 2014	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
13 July 2014	CIE submits CIE independent peer review reports to the COR
20 July 2014	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.

Support Personnel:

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Key Personnel:

NMFS Project Contact:

Julie Neer, SEDAR Coordinator
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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, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

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

Annex 2 – Terms of Reference

SEDAR 37: South Atlantic and Gulf of Mexico Hogfish Assessment Desk Review

1. Evaluate the data used in the assessment, addressing the following:
   a) Are data decisions made by the assessment panel 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.
   Are methods scientifically sound and robust?
   a) Are assessment models configured properly and used consistent with standard practices?
   b) 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, rebuilding timeframes, and generation times, 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 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.
8. Prepare a Peer Review Report summarizing the Reviewer's evaluation of the stock assessment and addressing each Term of Reference.