Center for Independent Experts (CIE) Independent Peer Review Report

on

Review Workshop

for

SEDAR 49 Gulf of Mexico Data-Limited Species:
Red Drum, Lane Snapper, Wenchman, Yellowmouth Grouper, Speckled Hind, Snowy Grouper, Almaco Jack, Lesser Amberjack

Prepared by

Yong Chen, Ph.D.

Professor of Fisheries
University of Maine
Orono, ME 04469

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I. Executive Summary

The Review Workshop of SEDAR 49 Gulf of Mexico Data-Limited Species: Red Drum, Lane Snapper, Wenchman, Yellowmouth Grouper, Speckled Hind, Snowy Grouper, Almaco Jack, Lesser Amberjack was held in Miami, FL on November 1-3, 2016. It is part of SEDAR 49 which consists of a Data Workshop, Stock Workshop, and Review Workshop for the Gulf of Mexico Data-Limited Species. The Review Workshop provides an independent peer review of SEDAR 49 stock assessment aiming for ensuring that the best possible assessment is provided through the SEDAR process. The fish stocks included in SEDAR 49 are within the jurisdiction of the South Atlantic and Gulf of Mexico Fisheries Management Councils and the states of Florida, Georgia, South Carolina, and North Carolina, Mississippi, Alabama, Louisiana, and Texas. The CIE reviewers are instructed to conduct an impartial and independent peer review of SEDAR 49 according to the SoW and ToRs.

The Gulf Council provided all the necessary logistics support, documentation, data, and background information requested for the review. The analytic team that conducted data-limited stock assessment for the eight species and other scientists and managers involved in the process were open to suggestions and provided additional information upon request. The review contact, Julie A Neer, who is the SEDAR Coordinator, and analytic team accommodated all the requests the Review Panel made for alternative assessment runs and extra information. The whole process was open and constructive and all materials were sent to me in a timely manner. As a CIE reviewer, I evaluated SEDAR 49 Gulf of Mexico Data-limited Species stock assessment with respect to the pre-determined ToRs.

I would like to commend the analytic team for providing all the necessary background information on the DLMtool (MSE platform used to evaluate harvest control rules for providing catch advice), life history, catch, fishery-dependent and fishery-independent abundance index data, stock assessment history, and management issues for these eight data-limited fish species. I was impressed by the breadth of expertise and experience of the analytic team, the amount of effort spent to compile the data, the openness of discussion for considering alternative approaches/suggestions, and the constructive dialogue between the Review Panel and other participants throughout the Review Workshop.

Overall, I believe the DLMtool evaluated in the SEDAR 49 provides a rather comprehensive framework for assessing the performance of various approaches for developing catch advice in the assessment and management of data-limited fish species with respect to various uncertainties in the data and models. The protocol developed for providing catch advice appears to be scientifically sound and adequately addresses management requirements. In particular, I would like to commend the analytic team for their efforts and openness in addressing uncertainty in the assessment, and in exploring alternative model configurations and alternative performance measures used to compare the performance of different harvest control rules for developing catch advice. However, I believe some important questions still need to be addressed and there is still room for improvement. These include improving the quality and quantity of input information, tailoring the DLMtool (including the harvest control rules, operating model, performance measures and built-in constraints) configuration and parameterization to fish species in the Gulf of Mexico, conducting more in-depth model diagnoses, and better

understanding of simulation outputs. More detailed recommendations/conclusions can be found in Section V of this report.

II. Background

The Review Workshop of SEDAR 49 Gulf of Mexico Data-Limited Species: Red Drum, Lane Snapper, Wenchman, Yellowmouth Grouper, Speckled Hind, Snowy Grouper, Almaco Jack, Lesser Amberjack was held in Miami, FL November 1-3, 2016. It is part of SEDAR 49 which consists of a Data Workshop, Stock Workshop, and Review Workshop for the Gulf of Mexico Data-Limited Species. The Review Workshop provided an independent peer review of SEDAR 49 stock assessments aiming for ensuring that the best possible assessment is provided through the SEDAR process. The fish stocks included in SEDAR 49 are within the jurisdiction of the South Atlantic and Gulf of Mexico Fisheries Management Council and the states of Florida, Georgia, South Carolina, and North Carolina, Mississippi, Alabama, Louisiana, and Texas. The CIE reviewers were instructed to conduct an impartial and independent peer review of SEDAR 49 according to the SoW and ToRs.

The SEDAR 49 is not a typical stock assessment process which usually involves data compilation, stock assessment, determination of stock status and stock projections for various levels of removals. It has two issues to be considered: (1) methodology: determining if the new approach (i.e., DLMtool) is better than the current approach designed for Tier 3A and Tier 3B stocks in the Gulf of Mexico, and what should be done to further improve the method so that it is tailored to the biology and fisheries of species in the Gulf of Mexico; and (2) assessment: determining if the model configuration and parameterization, simulation design, performance measures and selection of harvest control rules are appropriate for providing catch advice for the particular species considered in this study.

The eight species were selected for the SEDAR 49 based on data availability and reliability. The SEDAR 49 Gulf of Mexico data-limited species Data Workshop compiled relevant data, evaluated their quantity and quality, and finalized the data recommendations for the SEDAR 49 Assessment Workshop. The SEDAR 49 Data Workshop addressed the following data issues that are important for the stock assessment for each of the eight selected fish species: stock structure and unit stock definitions, life history information including natural mortality, length at 50% and 95% maturity, von Bertalanffy growth parameters (t0, k, Linf), length-weight relationship, maximum age, and steepness; possible abundance index data from both fishery-independent and fishery-dependent sources; total removal including catches in commercial landings and discards by gear, recreational landings and discards by fishing model, and other discards and relevant mortalities; length/age composition data; length-at first capture and full selection; and stock depletion status. The sources of uncertainty and error, and possible limitations regarding temporal and spatial coverages, were evaluated for each data set; the quality of the data were numerically ranked; and the levels of uncertainties associated with some of those data were quantified.

Three assessment methods for data-limited fish stocks were considered in the SEDAR 49 Assessment Workshop. The first one is the Data-Limited Methods Toolkit (DLMtool; Carruthers

et al. 2014, Carruthers et al. 2015, Carruthers and Hordyk 2016), which provides a platform that uses a standardized analytical process for evaluating the performance of multiple data-limited models in a simulation environment using management strategy evaluation (MSE). Once viable methods are identified within the MSE, these methods are then utilized to determine a catch recommendation based on the best available data. The second approach considered was a mean length-based mortality estimator assuming non-equilibrium conditions to estimate the total mortality rate (Gedamke and Hoenig 2006), and fishing mortality was then estimated as the difference of the total mortality minus natural mortality. A yield-per-recruit and spawner-per-recruit analysis was then conducted to estimate biological reference points which are then used to compare with the fishing mortality to evaluate fisheries status. The third analytical approach was a catch curve analysis for fish stocks with adequate information to estimate the total mortality rate (Beverton and Holt 1957).

The 2nd and 3rd approaches are pretty common for data-limited stock assessment, while the first approach DLMtool, reviewed extensively in 2014 (Newman et al., 2014), reflects recent progress made in the field of data limited fish stock assessment. However, the accessibility and user-friendly design of the software DLMtool may result in abuse of its utility (Dowling et al. 2015). A structured procedure is recommended to avoid potential misuse of the DLMtool (Carruthers 2015). It should be noted that many methods currently included in the DLMtool were developed for specific regional fisheries and may need adjustment to reflect the management objectives and biology of fishes in the Gulf of Mexico. The SEDAR 49 took the following three-step approach to evaluate the performance of the DLMtool in providing catch advice: (1) identify possible data-limited catch advice methods based on data availability; (2) evaluate the feasible methods in simulation through MSE to eliminate catch advice methods which exhibit pathological behavior (e.g., chronic overfishing) and to identify viable methods according to a set of pre-defined performance measures; and (3) use identified viable methods for providing management advice. For each species, the fishery in the MSE was simulated based on the stock and fleet dynamics with the parameters identified in the Data Workshop. All three analytic approaches were considered. The robustness with respect to assumptions and uncertainties in data and models and biological realisms of outputs were evaluated to identify methods with consistent performance across multiple ranges of stock status relative to an unfished state (i.e., the depletion level).

A review of operating model inputs, recommended input parameters and relevant justifications is provided for each species in their respective SEDAR 49 Assessment Process working papers: Red Drum (Sagarese et al. 2016d), Lane Snapper (Sagarese et al. 2016b), Wenchman (Sagarese et al. 2016g), Yellowmouth Grouper (Sagarese et al. 2016h), Snowy Grouper (Sagarese et al. 2016e), Speckled Hind (Sagarese et al. 2016f), Lesser Amberjack (Sagarese et al. 2016c), and Almaco Jack (Sagarese et al. 2016a). An updated working paper (Sagarese et al. 2016) was made available prior to the Review Workshop which corrected some minor errors in the DLMtool parameterization.

The SEDAR Coordinator, Julie Neer who is the point of contact for SEADR 49, provided all the necessary logistics support, documentation, data, and background information I requested. The scientists involved in the process were open for suggestions and provided additional information upon request. The analytic team worked very hard to accommodate all the requests

the review panel made for different test runs and extra information. The whole process was very open and constructive.

As a CIE reviewer, I evaluated SEDAR 49 Gulf of Mexico Data-limited Species stock assessment for Red Drum, Lane Snapper, Wenchman, Yellowmouth Grouper, Speckled Hind, Snowy Grouper, Almaco Jack, Lesser Amberjack with respect to the pre-determined Terms of Reference. As instructed, this report includes an executive summary (Section I), a background introduction (Section II), a description of my role in the review activities (Section III), my comments on each item listed in the Terms of Reference (ToRs, Section IV), a summary of my comments and recommendations (Section V), and references (Section VI). The final part of this report (Section VII) includes a collection of appendices including the Statement of Work (SoW).

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

My role as a CIE independent reviewer is to conduct an impartial and independent peer review of the Review Workshop of SEDAR 49 Gulf of Mexico Data-Limited Species: Red Drum, Lane Snapper, Wenchman, Yellowmouth Grouper, Speckled Hind, Snowy Grouper, Almaco Jack, Lesser Amberjack with respect to the pre-defined Terms of Reference.

Two weeks prior to the review workshop in Miami, FL, I received the instruction from the SEDAR Coordinator to download the relevant materials from the SEDAR webpage. I downloaded and read the Data Workshop report, Stock Assessment Report, and all other reports, working papers, and reference papers and the SoWs (and ToRs) prior to my trip to the SEDAR 49 (see Appendix I for the list of documents).

The Review workshop was held from November 1 to 3, 2016 in Sonesta Coconut Grove Miami hotel in Miami, FL (see Appendix II for the schedule). The workshop was attended by scientists from SEFSC, GOMFMC, and various other organizations (see the List of Participants in Appendix III).

Presentations were given during the review workshop to provide the Review Panel with information on the rules used by GOMFMC for setting up catch advice, various data sets including catch data, fisheries-dependent and fisheries-independent abundance indices, life history parameters and related uncertainties compiled in the SEDAR 49 Data Workshop and available for the Review Workshop, DLMtool software and its applications and parameterizations for the eight fish species considered in the SEDAR 49, process and outputs of the SEDAR 49 Assessment Workshop, stock assessment history and current status (see the list of presentations in Appendix I). I was actively involved in the discussion during the presentation by (1) questioning and asking for clarification on data, model, model parameterization, uncertainty, justification, and interpretations; (2) making observations of the process; and (3) making comments and suggestions for alternative approaches and more analyses. I also interacted with relevant scientists who presented the talks and asked for further clarifications and references. I also provided relevant references to scientists who wanted to discuss the questions I raised at their presentations in greater details.

After all the presentations and discussions in the first two days, the Review Panel worked with the analytic team to develop a series of sensitivity analyses to evaluate impacts of various DLMtool model configurations on the performance of different harvest control rules for catch advice. The scenario design follows the ensuing principle: changing one variable at a time so that we can ensure that changes observed in modeling can be solely attributed to the change we made. Because of time limitation, the additional runs were limited to Wenchman, which is typical for its data availability and quality, and the same runs were conducted towards the end of the Review Workshop and after the workshop which were very nicely summarized in an Addendum (Addendum: SEDAR 49 Gulf of Mexico Data-Limited Species) sent to the Review Panel after the Review Workshop. The following test runs were requested and conducted:

- Evaluate impacts of the beta parameter, which is an exponential index defining the relationship between abundance index and stock biomass and has a default value of 1 in the DLMtool, on the results of the base MSE to determine whether this parameter is driving trends in biomass and catch related to the index of abundance. This evaluation was requested because catch advice for some methods do not correspond to the change in biomass (i.e., catch does not increase with increased biomass and vice versa) in the simulation;
- Assess the impact of the assessment interval (three-year interval) to determine whether this may change viability of methods and performance;
- Assess the impact of including interannual variability in the von Bertalanffy asymptotic length (Linf) parameter (15-20% interannual variability) to determine whether this modification degrades the performance of the length-based indicator methods;
- Analyze individual simulation behavior for model outputs (B/BMSY, F/FMSY, Biomass, Fishing Mortality, Total Removals), because the average and the 5th and 95th percentiles of 1000 simulation runs might be masked by averaging everything together;
- Explore the interquartile range in the trajectory plots for model outputs (B/BMSY, F/FMSY, Biomass, Fishing Mortality, Total Removals);
- Explore the trends in data inputs for the index of abundance and index of mean length between reference periods and recent periods for species where index-based and length-based methods were viable to evaluate if the reference period is not reflective of a target level we want to achieve;
- Assess the impact of greater uncertainty in the observation error for the index of abundance to determine whether this modification may degrade the performance of the index-based methods;
- Assess the impact of greater uncertainty in the observation error for the index of abundance (CV fixed at 1.0) to determine whether this modification may degrade the performance of the index-based methods;
- Assess the impact of estimated natural mortality (fixed at 0.06) from the catch curve analysis on the results of the base MSE for Red Drum to determine whether this modification may change viability of methods and performance;
- Assess the impact of lower assumed steepness (fixed steepness at lower bound; no other changes) to determine whether this modification may change the viability of methods and performance;
- Assess the impact of including interannual variability (15-20% interannual variability) and a gradient in the Linf parameter (range: ±5%) to determine whether this modification may degrade the performance of the length-based methods;

- Revisit the calculation of performance metrics PNOF, B50, and Bbelow20 from a simulation perspective (i.e., across years for each simulation; obtain metric over simulations as opposed to over simulations * years).

As a Review Panel member, I was actively involved in developing test run scenarios, discussing outputs and their implications, and identifying issues related to test runs.

IV. Summary of Findings

My detailed comments on each item of the ToRs are provided under their respective subtitles from the ToRs (see below).

1. Review any changes in data following the Data/Assessment workshop and any analyses suggested by the workshop. Summarize data as used in each assessment model. Provide justification for any deviations from Data/Assessment Workshop recommendations.

The analytic team presented the results and recommendations of the SEDAR 49 Data Workshop. The data reviewed and compiled for the eight fish species in the Data Workshop included key life history parameters, stock structure, landings in commercial and recreational fisheries, discards and relevant mortality, fishing efforts, fishery-dependent and fishery-independent abundance indices, information on stock depletion, size and age compositions, and reference periods defined by the Council SSC for Tier 3 fish species. The quantity (i.e., spatial and temporal coverage) was evaluated and the semi-quantitative scores of reliability were provided for life history, total removals, abundance indices, and size composition to help advise the selection of data sets and assessment models. Choices of the input data for the SEDAR Assessment Workshop were justified, and are well documented in the Data Workshop report.

The data used in the Assessment Workshop were presented and evaluated in the Review Workshop. The specific values used in the Assessment Workshop for some parameters (e.g., beta defining the relationship between abundance index and stock biomass; steepness h; natural mortality M; von Bertalanffy growth parameters; and reference time periods) and their associated uncertainties and subsequent impacts on the evaluation of different methods for providing catch advice were evaluated and discussed, which resulted in requests for additional simulations runs (see Section III for the list of additional runs). These additional runs evaluated the robustness of the catch advice methods regarding uncertainty in these parameters and helped us better understand the roles of different parameters in achieving management objectives quantified by the performance metrics. These runs listed in Section III of this report represent alternative model parameterizations and were only done for Wenchmen at the Review Workshop because of time limitation. After the Review Workshop, these runs were done for all the species (SEDAR Addendum: SEDAR 49). In general, the alternative runs conducted in the Review Workshop suggested that key performance measures such as the probability of not overfishing, the probability of the biomass being above 50% Bmsy, and the probability of biomass being below 20% Bmsy were usually within similar ranges as those derived in the SEDAR 49 Assessment Workshop (Addendum: SEDAR 49), implying that the conclusions on the conservation and

fisheries performance metrics derived in the Assessment Workshop might be robust with respect to the uncertainty associated with the input data.

2. Evaluate the data used in the assessment, including discussion of the strengths and weaknesses of data sources and decisions, and consider the following:

A large body of the information was compiled from different sources for the SEDAR 49. The information includes stock structure and unit stock definitions, life history information including natural mortality, length at 50% and 95% maturity, von Bertalanffy growth parameters (t0, k, Linf), length-weight relationship, maximum age, and steepness; possible abundance index data from both fishery-independent and fishery-dependent sources; total removals including catches in commercial landings and discards by gear, recreational landings and discards by fishing model, and other discards and relevant mortalities; length/age composition data; length-at first capture and full selection; and stock depletion status. Implicit and explicit assumptions associated with all three analytic approaches were also described in the SEDAR Assessment Report. I would like to commend the SEDAR 49 Life History Working Group (LHWG) for putting such a comprehensive data set together.

a) *Are data decisions made by the DW and AW sound and robust?*

Following data were compiled and available for the eight species:
- Red Drum: life history data (VBGF, W-L, M, h, and life span), fisheries statistics (catch, effort, LFC and LFS), catch-at-age composition, abundance index, and reference Fmsy from meta-analysis;
- Lane Snapper: fisheries data, mean length (recreational private and headboat from 1986 – 2014), abundance index (Headboat survey), efforts, and life history data;
- Wenchman: Fisheries data, mean length, abundance index from NMFS small pelagic survey from 2002-2004 and 2006-2013, and life history data;
- Yellowmouth Grouper: Fisheries data (1990-2014), abundance from SEAMAP video survey, and life history data;
- Snowy Grouper: Fisheries data (1990-2014) and life history information;
- Speckled Hind: Fisheries data (1997-2014), efforts, and life history information;
- Lesser Amberjack: Fisheries data (1991-2009) and abundance index (SEAMAP video survey); and
- Almaco Jack: Fisheries data (1991-2014), mean catch from recreational boats from 1991-2014, and abundance index (SEAMAP video survey).

These data made Red Drum the only species suitable for all three analytical methods considered and the DLMtool was the only method applicable to all the species.

Some data sets may be problematic. For example, some von Bertalanffy growth parameters may not be biologically realistic and the rationale for the choice of depletion levels was not clearly described. For a Tier 3 species, a reference time period has been pre-determined by the Gulf Council to represent time periods of relatively constant catch (no trend). However, the rationale for the determination of the reference time period is not well documented and justified. Furthermore, the reference time periods determined in the past might not reflect current

regimes of productivity and/or spatio-temporal distribution of fishing grounds for some fish stocks, making these reference time periods inappropriate. The appropriateness of these reference time periods needs to be re-evaluated. Stock depletion is another issue that may need to be evaluated. Assumed stock depletion history plays an important role in simulating the fishery using the operating model in the MSE, and an unrealistic depletion history can lead to an unrealistic simulated fishery, which can certainly affect the confidence in evaluating the reliability of performance of different catch advice approaches in the MSE. Although three levels of alternative depletion levels (i.e., low, medium, and high) were considered for each species to evaluate the robustness of conclusions with respect to uncertainty associated with depletion history, an unrealistic depletion history can still influence the confidence in the outputs of the simulation. The limited spatio-temporal coverage of monitoring programs may also bring in issues with the quality of length/age-composition data. Having said the above, most compiled information in the SEDAR 49 represents the best available information for the stock assessment, and the decisions made by the Data Workshop and Assessment Workshop tend to be sound and robust with respect to the conclusions derived in the assessment.

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

I would like to commend the data working group and analytic team for providing detailed documentation on uncertainty associated with each data set and explicit and implicit assumptions (also should be considered as part of the data, especially for the data limited stock assessment) associated with each approach they used. This transparency makes the discussion in the Review Workshop much more constructive, efficient and effective. In general, the uncertainties associated with fisheries-dependent and fisheries-independent data are typical and within levels one would expect for data of such a nature. Most species included in the SEDAR 49 are bycatch species and have relatively low economic values. There may be issues of species being mis-identified and misreported in both commercial and recreational fisheries, leading to biased estimates of total removal data.

c) Are data applied properly within the assessment model?

Most methods for developing catch advice in the DLMtool were proposed for a specific species outside of the Gulf of Mexico, and the model parameterization and configuration may be inappropriate if the models are used directly. The analytic team has shown itself to be fully aware of this issue. They developed a structured approach for the model parameterization and configuration under the guidance of the relevant experts (e.g., the developers of DLMtool). They applied the data properly within the assessment model.

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

For most species included in the SEDAR 49 the input data series tend to be reliable and sufficient to support the assessment approach and findings. For some species (e.g., Snowy Grouper) for which only catch data are available (i.e., Tier 3), issues with reference time period resulted in difficulty developing catch advice using the DLMtool. For fish species like Red Drum, a lot of information is available, and they are not necessarily data-limited species. There is a need to re-classify fish species with the availability of substantial fishery-dependent and fishery-

independent information into other categories (i.e., not in Tier 3) so that more stock assessment approaches can be explored for providing catch advice.

3. Evaluate and discuss the strengths and weaknesses of the methods used to assess the stock, taking into account the available data, and considering the following:

Although three approaches (i.e., DLMtool, length composition, and catch curve) were considered in this study, the focus is the DLMtool which, based on data availability, is applicable to the eight species. To avoid mis-use the DLMtook software, a 3-step approach was used in the SEDAR 49: (1) determine an appropriate method based on data availability (catch-based, index-based, or length-based) each of which requires different input data; (2) evaluate those methods to identify viable methods based on defined performance measures; and (3) use identified viable methods to provide management advice. Overall, the use of DLMtool is scientifically sound and robust in assessing the eight data-limited species. The process of model parameterization and configuration is well structured and implicit and explicit assumptions are well documented. A large number of sensitivity analyses were conducted to evaluate the robustness of the assessment with respect to different depletion history, variability/uncertainty in some key life history parameters (e.g., growth and natural mortality), and uncertainty in catch and abundance indices. A suite of performance measures used to evaluate different assessment methods consider both conservation (i.e., make sure stock biomass is not too low) and fisheries production (i.e., fisheries outputs). The DLMtool MSE was parameterized based on the best available information which was compiled based on extensive literature review for each species. The simulation setting in the DLMtool allows for the systematic incorporation of uncertainty associated with input data in the evaluation of different harvest control rules for developing catch advice.

a) Are the data-limited methods scientifically sound and robust?

Overall, the use of DLMtool is scientifically sound and robust in assessing the eight data-limited species. The operating model used in the DLMtool is commonly used in simulating fisheries population dynamics and peer-reviewed, and most harvest control rules were applied and published. Thus, the DLMtool tends to be scientifically sound and robust. However, I do have the following concerns:

- Most approaches incorporated in the DLMtool are for fisheries outside the Gulf of Mexico with very different management objectives and exploitation history, and they were developed for the management of depleted fish stocks with different life history processes. Thus, the model parameterization and configuration might not be suitable for fisheries in the Gulf of Mexico. Detailed evaluation for alternative parameterization and configuration is required to have a better understanding of modeling behaviors.

- Model assumptions and strength/weakness are explicitly listed for each assessment model, but no explicit statements were made regarding how/whether these assumptions were violated and potential consequences in providing catch advice.

- There is a need to have some reality check for the simulated fishery in the simulation to ensure the depletion history simulated in the MSE realistically reflect real fisheries dynamics (at least to a certain degree).

- For some species with abundance index data, an alternative model such as a surplus production model can be used and it will be interesting to compare the results from DLMtool with those derived from the production model for these species.

b) Are the methods appropriate given the available data?

Given the data availability, the proposed analytic method is appropriate for all the species. For Red Drum, a larger quantity of data is available, and it perhaps cannot be considered a data-limited species. However, this does not mean that the data-limited methods used in this study are not appropriate for Red Drum. The following issues were raised at the Review Workshop regarding the appropriateness of the methods:

- The catch curve and length composition methods are not suitable for most species included in this assessment.

- The DLMtool is suitable for all the species, but they are configured for fisheries of different a nature (mostly targeted species) outside the Gulf of Mexico with different life history processes and exploitation history, more studies on model configuration and parametrizations (e.g., some scalar values in defining harvest control rules, and parameters in defining the operation model, and performance measures) are needed for their appropriateness for fish species in the Gulf of Mexico.

- The Von Bertalanffy growth model may yield some biologically unrealistic size-at-age data (especially for very young and/or old ages), because of lack of size-at-age data for young and old fishes.

c) Are the data-limited models configured properly and used in a manner consistent with standard practices?

Overall the data-limited models are configured properly. A structured approach was used in the SEDAR 49 Assessment Workshop to parameterize and configure the DLMtool for each species, including a thorough evaluation of data availability, data quality, and parameterization of the operating models. In general, the approach is consistent with standard practices in fisheries stock assessment. However, some issues may need attentions including unrealistic values for key life history parameters and their variabilities, unrealistic assumptions on temporal and spatial variability of some model parameters, inconsistency of built-in parameters (e.g., scalar parameters in defining harvest control rules) between species involved in the SEDAR 49 and species for which the method was developed, lack of understanding of impacts of built-in constraints, and not-so-well-defined reference time periods. More work needs to be done to address those issues.

d) Are the quantitative estimates produced reliable? Does the method produce management metrics (e.g. OFL, ABC) or other indicators (e.g. trends in F or Z, probability of overfishing) that may be used to inform managers about stock trends and conditions?

Given the data quality and quantity, in general the quantitative estimates derived tend to be reliable and can be used to help develop management metrics such as ABC and OFL, although the estimates yielded in the SEDAR 49 differ from those estimated in a traditional stock assessment. The SEDAR 49 generates a series of performance metrics to quantify potential impacts of a list of selected harvest control rules on conservation measures (e.g., probability of not overfishing, probability of biomass above a pre-determined level) and fisheries outputs (e.g., total catch, variability of catch among years) in an MSE setting. An appropriate harvest control rule was then identified for providing catch advice based on the comparison of the performance metrics. Although various metrics measuring probability of overfishing (or having stock overfished) and trends of fishing mortality and stock biomass were produced, they correspond to a particular harvest control rule that was tested, and may not necessarily reflect historical trends and current status of stock and fisheries. For the eight species considered in the SEDAR 49, most of them are caught as bycatch species, and the traditional fisheries management target metrics (e.g., Bmsy, Fmsy) may not be suitable performance measures.

4. Consider how uncertainties in the assessment, and their potential consequences, are addressed.

Uncertainty associated with the population, data, and assessment models was addressed via Monte Carlo simulation and sensitivity analysis in SEDAR 49 stock assessment.

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.

The SEDAR 49 developed and employed a structured approach to systematically evaluate possible impacts of uncertainties associated with the parameters in the operating models and variables/data used in developing catch advices. This approach includes:

Monte Carlo simulations were conducted to capture the uncertainties associated with the parameters in the use of operating model to simulate the fisheries for evaluating the performance of 11 methods considered for developing catch advices. Uncertainties associated with some key life history parameters (e.g., von Bertalanffy growth parameters Linf, K and t0 with correlations of these three parameters being considered in random sampling; natural mortality rate; steepness h; beta defining hyperdepletion/hyperstability and weight-length relationship??) and fishery parameters (i.e., total removals, length at first capture, and length at full capture) were quantified with lower and upper boundaries (or CVs) largely defined based on meta-analyses of existing data, previous studies and expert opinions. One thousand simulation runs were conducted with these model parameters being randomly drawn from the uniform distributions defined by their lower and upper boundaries.

Uncertainty associated with the total removals for all the eight species was quantified with CVs defined in the Data Workshop based on the CVs defined for total commercial and recreational catches and discard mortalities. The abundance indices from fishery-independent and/or fishery-dependent programs were also quantified for all the eight species based on the best available information at the Data Workshop.

The quality of different data was quantified with reliability scoring systems at the Data Workshop based on the source of the data, spatio-temporal coverages of sampling programs, sample sizes, likelihood of species misidentification, and other factors (e.g., changes in fishermen's fishing behaviors as a result of changes in management regulations). The semi-quantitative scores of data quality were used in the selection of feasible methods for catch advice.

Sensitivity analyses were also conducted to evaluate the robustness of performance of feasible catch advice methods regarding uncertainties associated with scalars built in various methods. The simulation of the fishery by the operating model is conditional on the assumed depletion level which is usually unknown. Possible impacts of violating the assumed depletion level were evaluated by running all three possible depletion scenarios (i.e., lightly, moderately, and heavily depleted) for each method identified as feasible for each species.

All the methods for catch advice that were deemed feasible based on the data availability and quality were considered and evaluated for all the eight species in this study, indicating that variability associated with choices of catch advice methods were considered.

Although the coverage of uncertainty sources is very comprehensive for all the eight species at SEDAR 49, some extra analyses can be done to further improve our understanding of impacts of uncertainties on the development of catch advice using the DLMtool.

Evaluate all the default values and built-in constraints used for the methods included in the DLMtool software because these methods were developed for fisheries outside the Gulf of Mexico and their associated parameters are likely inappropriate and there is a need to carefully evaluate their suitability for the Gulf of Mexico fisheries.

Current simulations were run with uncertainty of all the sources being incorporated, which may make the identification of impacts of a single uncertainty source difficult, and a structured simulation design may be needed to isolate and identify impacts of an individual uncertainty source.

Different levels/forms of uncertainty for some key parameters/data (e.g., annual variability in growth parameters, annual variability in total removals, different levels of variability in the index of abundance, etc.) need to be considered to have a better understanding of impacts of these uncertainties.

Possible correlations between steepness parameter h versus natural mortality and parameters quantifying reproductive potentials may need to be considered in the simulations.

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

The possible implications of uncertainty of various sources on technical conclusions are clearly stated in the selection of methods for developing catch advice, and the relevant mechanisms were discussed in the Review Report and at the Review Workshop.

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

The research recommendations made at the SEDAR 49 Data and Assessment Workshops are very comprehensive for the improvement of data quality and quantity, better understanding of all the components included in the DLMtool, and better adoption of the DLMtool to the Gulf of Mexico fish stocks through improved model configurations and parameterizations. I make the following recommendations for additional research to further improve data quality and quantity and assessment modeling process (listed under following subtitles).

• *Clearly denote research and monitoring that could improve the reliability of future assessments.*

Sea sampling and port sampling programs may need to be enhanced for these eight species to improve the quality of estimates for the discards and discard mortality. Some studies on barotrauma may be needed to better understand the mortality caused by the discarding process in both commercial and recreational fisheries.

The choice of reference time period for Tier 3A and 3B fish stocks is apparently not suitable for some of the species considered in the SEDAR 49, and needs to be re-evaluated given possible changes in the ecosystem and additional information available.

Given the information available, some species included in the SEADR 49 (e.g., Red Drum) may not be suitable for being classified as Tier 3 species, which requires the use of potentially inappropriate reference time periods pre-determined by the Gulf Council. There is a need to explore the possibility of re-classifying such species so that more methods can be explored in developing catch advice.

• *Provide recommendations on possible ways to improve the SEDAR process.*

The SEDAR 49 was not a typical stock assessment process which usually involves data compilation, stock assessment, determination of stock status and stock projections for various levels of removals. It has two issues to be considered: (1) methodology: determining if the new approach (i.e., DLMtool) is better than the current approach designed for Tier 3A and Tier 3B stocks in the Gulf of Mexico and what should be done to further improve the method so that it tailors the biology and fisheries of species in the Gulf of Mexico; and (2) assessment: determining if the model configuration, simulation and sensitivity analysis design, and selection of catch advice methods/harvest control rules are appropriate for a particular species considered in this study. However, the SEDAR 49 Review Workshop TORs were still same as those for a

typical SEDAR process. Some modifications may need to be made in the future for an atypical SEDAR Review Workshop TORs to better tailor the issues to be addressed.

SEDAR 49 Data, Assessment and Review Workshops were held in sequence. The Review Panel only attended the Review Workshop. Although the reports of both the Data and Assessment Workshops summarize relevant process and outcomes very nicely, there is a lack of full understanding of how certain conclusions/recommendations were made, because there was no member of the Review Panel who had attended all three workshops. It would be beneficial for consistency to have a Review Panel member attend all three workshops.

Because the SEDAR 49 is not a typical SEDAR stock assessment, the management advice (e.g., catch levels) identified in the assessment may not be ABC, OFL, or other biological reference points commonly derived in a typical SEDAR stock assessment. This again calls for the revision of relevant TORs for the Data and Assessment Workshops.

6. Consider whether the stock assessment constitutes the best scientific information available using the following criteria as appropriate: relevance, inclusiveness, objectivity, transparency, timeliness, verification, validation, and peer review of fishery management information.

In general, the SEDAR 49 stock assessment uses the best available information and best available methods in a transparent and constructive way and yields some information which can help guide the development of management advice, given the limitation of data quality and quantity. This suggests that the SEDAR 49 stock assessment constitutes the best scientific information available.

Relevance: The compilation of a large body of biological and fisheries information from various sources and configuration and parametrization of the DLMtool in SEDAR 49 is highly relevant for the development of a stock assessment that uses the best available scientific information in evaluating and identifying optimal harvest control rules to develop catch advice for data-limited Gulf of Mexico fish stocks.

Inclusiveness: Overall, SEDAR 49 Data and Assessment Workshops explored a great diversity of data and quantitative methods for developing catch advice. This includes data of almost all sources (i.e., directly measured data from state and federal monitoring programs and secondary data obtained from the literature including biological information for similar species) and methods developed around the world for data-limited fish stocks. The analytic team was also very willing and open to including the suggestions made by the Review Panel at the Review Workshop.

Objectivity: the DLMtool includes a large number of methods/harvest control rules for developing catch advice. The SEDAR 49 Data and Assessment Workshops have used highly objective and structured protocols to evaluate data quality and identify appropriate methods/harvest control rules for the eight species. These protocols are well documented and reviewed through the SEDAR data and assessment process. Possible exceptions are assumptions made for the data and methods such as temporal variation in life history parameters, the exploitation history (the depletion level), and choice of reference time period.

Transparency: All the materials presented in the SEDAR 49 Data, Assessment and Review Workshops are fully documented and publicly available. The discussions at the Review Workshop are recorded. The quality and quantity of all input data sets are well evaluated and documented. The choice of the input parameters for the DLMtool, sensitivity scenarios, and subsequent results are all well documented and publicly available. The whole review process was also very open and transparent, and the analytic team responded to all the requests made by the review panel at the Review Workshop.

Timeliness: The SEDAR 49 Data, Assessment, and Review Workshops are arranged in a timely manner to explore the usefulness of the DLMtool in developing catch advice for the assessment and management of the Gulf of Mexico data-limited fish stocks. All the materials were made available, and all of our requests for additional analyses were addressed in a timely fashion.

Verification: The SEDAR 49 process and deliverables comply with legal requirements under the Magnuson-Stevens Act (2007) for developing and monitoring of fishery management plans. However, this is not a typical stock assessment and information on stock status is not the focus of this assessment.

Validation: The SEDAR 49 Data, Assessment, and Review Workshops were conducted to provide the fisheries managers with peer-reviewed stock assessments and catch advice. The choice of the model parameters were always checked for biological realism the and modeling results were validated if empirical information was available. The process was open and fully transparent to stakeholders.

Peer review: The SEDAR 49 process includes the Review Workshop at which the outcomes of the Data and Assessment Workshops were fully peer-reviewed by a review panel consisting of experts appointed from the Center for Independent Experts (CIE reviewers) and members of the GMFMC SSC. The Review Panel report and the independent CIE reviews are publicly available.

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

Overall, I believe that the data compilation, evaluation and analysis in the SEDAR 49 and the application of the data-limited assessment methods in the DLMtool have provided some critical information for fisheries management that was previously unavailable for these species. However, tailoring the framework used in SEDAR 49 to provide catch advice for the Gulf of Mexico data-limited fish stocks would be a significant step that should be taken prior to the next assessment for these species. My major and specific recommendations for improvements in data and modeling approach can be found in Section V.

8. Prepare a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference.

A separate Peer Review Summary Report was prepared to summarize the Panel's evaluation of the stock assessment with respect to each Term of Reference.

V. Conclusions and Recommendations

I would like to commend the data working group, analytic team and other participants in the SEDAR 49 process for compiling and providing extremely comprehensive background information on key life history parameters, data from fishery-dependent and fishery-independent monitoring programs, methods/harvest control rules for developing catch advice and other relevant stock assessment and management issues. I was impressed by the breadth of expertise and experience of the analytical team, the amount of effort spent to compile all the information and the configuration and parameterization of the DLMtool models for the eight Gulf of Mexico fish stocks, the openness of discussion for considering alternative approaches/suggestions, and the constructive dialogues between the Review Panel and other participants throughout the Review Workshop. I observed on many occasions constructive interactions and dialogue in the review. All the materials were sent to me in a timely manner and almost all the requests for extra information and extra runs were addressed promptly.

The SEDAR 49 is not a typical stock assessment process which usually involves data compilation, stock assessment, determination of stock status and stock projections for various levels of removals. It addresses two issues: (1) methodology: to determine whether the new approach (i.e., DLMtool) is better than the current approach designed for Tier 3A and Tier 3B stocks, and what research needs to be done to further improve the method so that it can be tailored for the biology and fisheries for fish stocks in the Gulf of Mexico; (2) Assessment: to determine whether the model configuration, simulation design, and selection of catch advice method are appropriate for the eight Gulf of Mexico data-limited fish species considered in the SEDAR 49. In addition to some of the recommendations made in the TORs, the following recommendations and conclusions were made regarding these two issues:

- Although stock structure is briefly discussed in the Data Workshop report, limited information is available to support the unit stock for most species. Red Drum is known for showing large spatial variability in life history, indicating a potential complex stock structure in the Gulf of Mexico. There is some genetic evidence for separate Western and Eastern Gulf stocks for Lane Snapper, as well as for hybridization with Yellowtail Snapper. There is little genetic or other information suitable for stock identification for other species considered in the SEDAR 49 (i.e., Wenchman, Yellowmouth Grouper, Snowy Grouper, Speckled Hind, Lesser Amberjack, and Almaco Jack). Stock structure information for more extensively studied and related species was used to support the single stock assumption. More studies are needed for delineating the stock structure for the eight species.

- The covariance between von Bertalanffy growth parameters K and Linf was considered in the simulation. However, the covariance between two parameters defining the weight-length

relationship, which are usually negatively correlated, was not considered in the simulation. Covariance of other parameters such as those between steepness and natural mortality and parameters defining maturation-length should also be considered to ensure drawing of biologically realistic values in the simulations.

- The temporal trend in the median (or 95% confidence intervals, interquantile range) values of 1000 simulation runs for the total removal often do not correspond well with the temporal trend in stock biomass in the projection (i.e., an increased biomass is often associated with a reduced catch, instead of an increased catch as one would expect based on the harvest control rules being evaluated). However, individual runs tend to show such a correspondence between the temporal trends of stock biomass and catch advice. I think this may result from large variability among simulation runs and/or the results produced some runs being too close to built-in constraints. This issue may lead to misinterpretation of simulation results, potentially resulting in mis-identification of harvest control rules, and should be addressed in future research.

- Size-at-age data were not available for the Gulf of Mexico Lesser Amberjack (growth information used in the SEDAR 49 was from the South Atlantic) and Almaco Jack. They need to be collected in future research.

- No direct estimates for steepness (h) were available for the stocks considered. Plausible ranges for h were determined from reviews based on related species with similar biology. Although some sensitivity analyses were conducted to evaluate impacts of uncertainty in steepness on the simulation of fish population dynamics and selection of harvest control rules in MSE, more studies may be needed based on single runs (not the average of 1000 runs) for better understanding of the roles of h values, in particular with respect to values of other related parameters such as natural mortality and maturation in the MSE. Potential impacts of temporal variation in steepness, reflecting changes stock productivity as a result of a changing ecosystem, may also need to be evaluated.

- The DMLtool does not allow natural mortality (M) to change over exploited size/age groups, which is different from a regular data-rich stock assessment in the Southeastern region which often accounts for size/age-dependence in mortality rates. This age-specific difference in natural mortality may be an issue for the Red Drum fishery, which mainly targets juveniles in the state waters. No direct estimates of M were available for any stock except for Red Drum. Uncertainty in M was quantified as the range of point estimates derived from the revised Hoenig estimator for plausible values of maximum age, which is likely to underestimate true uncertainty in M because of lack of consideration of uncertainty associated with point estimates. Moreover, the use of only one method to estimate M, rather than use of multiple methods based on different life history parameters, may underestimate uncertainty and represents a departure from previous practice. This issue needs to be evaluated.

- Fishing effort plays an important role in the simulation of fish exploitation history using the operating model in the DLMtool. It was estimated based on the fishing fleet that accounted for the largest proportion of the total removals. Recreational data were determined by the

Data Workshop to be most representative for Red Drum, Lane Snapper, Almaco Jack, and Yellowmouth Grouper. Commercial data were recommended as most representative for Speckled Hind (bottom longline data), Snowy Grouper (bottom longline data), Lesser Amberjack (vertical line data), and Wenchman (finfish trawl data). Estimates of temporal trends of fishing effort tend to be sound, but more information on the variability of the spatial distribution of fishing effort over time needs to be better evaluated for a better understanding of exploitation history, which can be very important in the identification of suitable performance measures, parameterization of the operating model, and interpretation of simulation results.

- Catch advice for some species requires comparing current catch, abundance index or mean length to relevant indicators derived for a reference period that essentially provides a management target, which makes a reference period important. Reference periods for Tier 3 fish stocks were chosen by the Gulf Council to represent periods of approximately constant catch, but the rationale for this criterion is not well documented and unclear, and should be re-evaluated. This becomes particularly important given the change in the ecosystem.

- The SEDAR 49 assumes constant parameters for the operating model in the MSE simulation. Given the long time period involved in the simulation, some life history parameters such as growth and natural mortality may change as a result of changes in the ecosystem. Uncertainty for some input data may be reduced as a result of improved monitoring programs. Thus, considering temporal variability in the parameters in the operating model may be necessary.

- Stock assessment intervals of ten years of were assumed in the SEDAR Assessment Workshop. A request was made at the SEDAR Review Workshop for a more frequent stock assessment interval (i.e., three-year interval). More studies are still needed to evaluate impacts of different stock assessment frequency on the evaluation of harvest control rules with respect to performance measures.

- Although all eight species included in the SEDAR 49 are classified as Tier 3 species, which calls for use of the reference time period defined by the Gulf Council in developing catch advice, the amount of information available for some of these species (e.g., Red Drum) could make them Tier 2 species. There is a need for a careful study to evaluate possible impacts of re-classifying these species into Tier 2 species based on the determination of suitable harvest control rules.

- Total removals include mortality of all sources and perhaps represent the best available information. CVs of total removals were assumed to be same over all the years, which may not be a reasonable assumption. An evaluation is needed to justify this assumption.

- The analysts evaluated changes in fishing grounds over time and regulations to identify possible impacts of such a change on data such as size composition and CPUEs. The temporal inconsistency of spatial distribution of the fishing grounds makes the interpretation of CPUE series and composition data difficult. A map of stock distributional area and major

fishing grounds should be provided for each fish species for a better understanding of spatio-temporal change of fishing ground and relevant input data for the DLMtool.

- A large number of sensitivity scenarios were considered in this assessment to evaluate the robustness of the choice of different harvest controls with respect to the uncertainty associated with input data, parameters and configuration of the operating model and parameters defining harvest control rules. Although such sensitivity analyses are very useful, large quantity of outputs may make the interpretation difficult and result in additional uncertainty in the interpretation. I recommend that an in-depth analysis be conducted to identify possible sources of uncertainty for a given set of data, and relevant analysis should be done to reduce the uncertainty and improve data quality BEFORE the data are used in stock assessment. Trying to resolve all uncertainties in the DLMtool may complicate interpretations.

- Although I believe that the data compilation, evaluation and analysis in the SEDAR 49 and the application of the DLMtool are scientifically and technically sound, tailoring the framework used in SEDAR 49 to provide catch advice for the Gulf of Mexico data-limited fish stocks still needs significant research effort. Particular attention should be paid to a better understanding of parameterization and configuration of harvest control rules that were developed for species with different life history and exploitation history. For example, scalars in defining harvest control rules are not designed for the Gulf of Mexico fisheries and need to be adjusted so that they are comparable with the GOM fisheries. Given the flexibility and a large number of choices that the DMLtool provides for the operating models, simulations, and harvest control rules/management procedures, a guideline needs to be developed for a structured approach using background information on data quality and quantity, fish life history and local ecosystem to select and justify choices made in the configuration and parameterization of the DLMtool.

- The SEDAR 49 was focused on accommodating many sensitivity analyses in the MSE simulations to evaluate potential impacts of uncertainty associated with various parameters and input data. Although this is necessary in the early stage of parameterizing and configuring the DLMtool, I believe more effort should be spent on model diagnoses based on individual runs to better understand the interactions between simulated dynamics of fish stocks and relevant behavior of different harvest control rules.

- MSE was used to compare HCR performance. The dynamics of populations simulated by the operating model are driven by fishing effort, conditional on depletion level (Bcur/Bvirgin), and other life history parameters. Key life history and fishery parameters are derived from previous studies. The goal is to simulate a fishery close to the actual fishery, but no testing has been done, making it impossible to evaluate if the simulated fishery is similar to the fishery of interest. Although some sensitivity analyses were done regarding different parameterizations of the operating model, it is still unclear if the simulated fishery is similar in nature to the fishery being simulated (not to mention if it is a reproduction of the "real" fishery).

- Implementation error was not considered in the SEDAR 49, which is unrealistic. Studies need to be done to evaluate impacts of implementation errors on the evaluation of harvest control rules.

- Although term TAC was used in the DLMtool, it may not be an appropriate term. The catch recommendation evaluated in the DLMtool is more like a catch advice for SSC to set OFL and ABC. There is a need to discuss the relationship between the term TAC used in the SEDAR 49 (and DLMtool) and OFL and ABC commonly used in a typical stock assessment.

- Most species are bycatch species and there is no direct control of their management. An implementation error can simulate potential errors arising as a bycatch.

- The SEDAR 49 is the first step to moving forward with the DLMtool which provides an MSE framework to systematically evaluate performance of alternative harvest control rules, leading to the identification of appropriate harvest control rules for the management of fish stock of interest. This type of exercise is costly at its initial model set-up stage, because great efforts are needed to review relevant literature, compile critical information, parameterize the operating model, identify key uncertainty sources, develop a simulation study, and design a sensitivity analysis to evaluate possible consequences of violating some of the key assumptions. However, once the model is set up and fine-tuned to mimic the biology and fisheries of a particular species in the Gulf of Mexico, running the model with new information will become easy with few costs.

VI. References

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Sagarese, S.R., J. J. Isely, and M.W. Smith 2016. Revised Results for the Generic Implementation of Itarget0 and Ltarget0 for Lane Snapper, Wenchman, Lesser Amberjack, and Almaco Jack. SEDAR49-RW-01. SEDAR, North Charleston, SC. 40 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016a. Review of Operating Model Parameters for SEDAR 49: Almaco Jack. SEDAR49-AW-01, SEDAR, North Charleston, South Carolina. 18 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016b. Review of Operating Model Parameters for SEDAR 49: Lane Snapper. SEDAR49-AW-02, SEDAR, North Charleston, South Carolina. 17 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016c. Review of Operating Model Parameters for SEDAR 49: Lesser Amberjack. SEDAR49-AW-03, SEDAR, North Charleston, South Carolina. 18 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016d. Review of Operating Model Parameters for SEDAR 49: Red Drum. SEDAR49-AW-04, SEDAR, North Charleston, South Carolina. 17 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016e. Review of Operating Model Parameters for SEDAR 49: Snowy Grouper. SEDAR49-AW-09, SEDAR, North Charleston, South Carolina. 17 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016f. Review of Operating Model Parameters for SEDAR 49: Speckled Hind. SEDAR49-AW-08, SEDAR, North Charleston, South Carolina. 18 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016g. Review of Operating Model Parameters for SEDAR 49: Wenchman. SEDAR49-AW-05, SEDAR, North Charleston, South Carolina. 18 pp.

Sagarese, S. R., J. J. Isely, and M. W. Smith. 2016h. Review of Operating Model Parameters for SEDAR 49: Yellowmouth Grouper. SEDAR49-AW-06, SEDAR, North Charleston, South Carolina. 17 pp.

VII-1. Appendix 1: Bibliography of materials provided for review

(1) Documents received prior to the review

Document #	Title	Authors	Date Submitted
SEDAR49-DW-01	Shrimp Fishery Bycatch Estimates for Gulf of Mexico Data Limited Species: Wenchman and Lane Snapper, 1972-2014	Jeff Isely	6 April 2016 Updated: 20 June 2016
SEDAR49-DW-02	Catch per unit effort indices and Effort Time-series for SEDAR 49 Data Limited Species captured in the Gulf of Mexico Recreational Headboat Fishery (1986 – 2015)	Matthew S. Smith and Adyan Rios	28 April 2016
SEDAR49-DW-03	Timeseries of effort and nominal abundance indies derived from the Gulf of Mexico recreational private and charter fishery for the species included in the SEDAR 49 data limited stock assessment	Matt Smith	Not Received
SEDAR49-DW-04	Review of bycatch in the Gulf menhaden fishery with implications for the stock assessment of red drum	Skyler R. Sagarese, Matthew A. Nuttall, Joseph E. Serafy and Elizabeth Scott-Denton	27 April 2016
SEDAR49-DW-05	Gulf of Mexico Data-Limited Species Life History Compilation	Molly S. Adams, Skyler R. Sagarese, and Adyan B. Rios	18 April 2016
SEDAR49-DW-06	Lane snapper *Lutjanus synagris* Findings from the NMFS Panama City Laboratory Trap & Camera Fishery-Independent Survey 2004-2014	D.A. DeVries, C.L. Gardner, P. Raley, and K. Overly	22 April 2016
SEDAR49-DW-07	The Red Drum (*Sciaenops ocellatus*) spawning population in the eastern Gulf of Mexico: composition, site fidelity, and size	Susan Lowerre-Barbieri, Mike Tringali, Joel Bickford, Sarah Burnsed, and Mike Murphy	20 April 2016
SEDAR49-DW-08	Summary of length data and length frequency distributions for eight data limited species collected in the Gulf of Mexico from 1981 to 2015	Article I. Ching-Ping Chih	27 April 2016

SEDAR49-DW-09	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Almaco Jack	Matthew D. Campbell, Kevin R. Rademacher, Paul Felts, Brandi Noble, Joseph Salisbury, John Moser, Ryan Caillouet	29 April 2016
SEDAR49-DW-10	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Lane Snapper	Matthew D. Campbell, Kevin R. Rademacher, Paul Felts, Brandi Noble, Joseph Salisbury, John Moser, Ryan Caillouet	29 April 2016
SEDAR49-DW-11	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Lesser Amberjack	Matthew D. Campbell, Kevin R. Rademacher, Paul Felts, Brandi Noble, Joseph Salisbury, John Moser, Ryan Caillouet	29 April 2016
SEDAR49-DW-12	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Snowy grouper	Matthew D. Campbell, Kevin R. Rademacher, Paul Felts, Brandi Noble, Joseph Salisbury, John Moser, Ryan Caillouet	29 April 2016
SEDAR49-DW-13	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Speckled Hind	Matthew D. Campbell, Kevin R. Rademacher, Paul Felts, Brandi Noble, Joseph Salisbury, John Moser, Ryan Caillouet	29 April 2016
SEDAR49-DW-14	Size Composition of Eight SEDAR49 Data Limited Species by Sector and Gear	J.J. Isely, M.W. Smith and C-P Chih	3 May 2016
SEDAR49-DW-15	Almaco jack *Seriola rivoliana* Findings from the NMFS Panama City Laboratory Trap & Camera Fishery-Independent Survey 2004-2014	D.A. DeVries, C.L. Gardner, P. Raley, and K. Overly	29 April 2016
SEDAR49-DW-16	Current Status of Adult Red Drum (*Sciaenops ocellatus*) in the North Central Gulf of Mexico: An Update of Abundance, Age Composition, and Mortality Estimates	Crystal L. Hightower, J. Marcus Drymon, and Sean P. Powers	2 May 2016 Updated: 8 May 2016
SEDAR49-DW-17	Lane Snapper Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico	Adam G. Pollack, David S. Hanisko and G. Walter Ingram, Jr.	2 May 2016 Updated: 11 May 2016
SEDAR49-DW-18	Wenchman Abundance Indices from MSLABS Small Pelagics Surveys in the Northern Gulf of	Adam G. Pollack, David S. Hanisko and G. Walter Ingram, Jr.	2 May 2016 Updated: 11 May 2016

	Mexico		
SEDAR49-DW-19	Wenchman Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico	Adam G. Pollack, David S. Hanisko and G. Walter Ingram, Jr.	2 May 2016 Updated: 11 May 2016
SEDAR49-DW-20	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Wenchman	Matthew D. Campbell, Kevin R. Rademacher, Paul Felts, Brandi Noble, Joseph Salisbury, John Moser, Ryan Caillouet	4 May 2016
SEDAR49-DW-21	SEAMAP Reef Fish Video Survey: Relative Indices of Abundance of Yellowmouth grouper	Matthew D. Campbell, Kevin R. Rademacher, Paul Felts, Brandi Noble, Joseph Salisbury, John Moser, Ryan Caillouet	4 May 2016
SEDAR49-DW-22	Summary of length and weight data for seven data limited species collected during NMFS and SEAMAP fishery-independent surveys in the Gulf of Mexico	David S. Hanisko and Adam Pollack	20 May 2016
Documents Prepared for the Assessment Process			
SEDAR49-AW-01	Review of Operating Model Parameters for SEDAR 49: Almaco Jack	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	12 July 2016
SEDAR49-AW-02	Review of Operating Model Parameters for SEDAR 49: Lane Snapper	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	12 July 2016 Updated: 12 August 2016
SEDAR49-AW-03	Review of Operating Model Parameters for SEDAR 49: Lesser Amberjack	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	12 July 2016
SEDAR49-AW-04	Review of Operating Model Parameters for SEDAR 49: Red Drum	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	12 July 2016 Updated: 12 August 2016
SEDAR49-AW-05	Review of Operating Model Parameters for SEDAR 49: Wenchman	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	12 July 2016 Updated: 12 August 2016
SEDAR49-AW-06	Review of Operating Model Parameters for SEDAR 49: Yellowmouth Grouper	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	12 July 2016 Updated: 12 August 2016
SEDAR49-AW-07	Synthesis of Literature on Von Bertalanffy Growth Parameter Correlations	Nancie Cummings, Skyler Sagarese and Bill Harford	29 July 2016
SEDAR49-AW-08	Review of Operating Model Parameters for SEDAR 49:	Skyler R. Sagarese, J. Jeffery Isely, and Matthew	12 August 2016

	Speckled Hind	W. Smith	
SEDAR49-AW-09	Review of Operating Model Parameters for SEDAR 49: Snowy Grouper	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	12 August 2016
SEDAR49-AW-10	Technical description of operating models in data-limited methods toolkit (DLMtool)	William J. Harford, Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	30 August 2016

Documents Prepared for the Review Workshop

SEDAR49-RW-01	Revised Results for the Generic Implementation of Itarget0 and Ltarget0 for Lane Snapper, Wenchman, Lesser Amberjack, and Almaco Jack	Skyler R. Sagarese, J. Jeffery Isely, and Matthew W. Smith	21 October 2016

Final Stock Assessment Reports

SEDAR49-SAR1	Gulf of Mexico Data-limited Species	SEDAR 49 Panels	

Reference Documents

SEDAR49-RD01	Spatial and size distribution of red drum caught and released in Tampa Bay, Florida, and factors associated with the post-release hooking mortality	Kerry E. Flaherty, Brent L. Winner, Julie L. Vecchio, and Theodore S. Switzer
SEDAR49-RD02	Evaluating the current status of red drum (*Sciaenops ocellatus*) in offshore waters of the North Central Gulf of Mexico: age and growth, abundance, and mercury concentration	Crystal LouAllen Hightower
SEDAR49-RD03	DLMtool: Data-Limited Methods Toolkit (v3.2)	Tom Carruthers and Adrian Hordyk
SEDAR49-RD04	Evaluating methods for setting catch limits in data-limited fisheries	Thomas R. Carruthers, André E. Punt, Carl J. Walters, Alec MacCall, Murdoch K. McAllister, Edward J. Dick, Jason Cope
SEDAR49-RD05	Evaluating methods for setting catch limits in data-limited fisheries: Supplemental Appendix A	Thomas R. Carruthers, André E. Punt, Carl J. Walters, Alec MacCall, Murdoch K. McAllister, Edward J. Dick, Jason Cope
SEDAR49-RD06	Performance review of simple management procedures	Thomas R. Carruthers, Laurence T. Kell, Doug D. S. Butterworth, Mark N. Maunder, Helena F. Geromont, Carl

		Walters, Murdoch K. McAllister, Richard Hillary, Polina Levontin, Toshihide Kitakado, and Campbell R. Davies
SEDAR49-RD07	Performance review of simple management procedures: Supplemental Appendix A	Thomas R. Carruthers, Laurence T. Kell, Doug D. S. Butterworth, Mark N. Maunder, Helena F. Geromont, Carl Walters, Murdoch K. McAllister, Richard Hillary, Polina Levontin, Toshihide Kitakado, and Campbell R. Davies
SEDAR49-RD08	Generic management procedures for data-poor fisheries: forecasting with few data	H. F. Geromont and D. S. Butterworth

(2) Documents received during the review

SEDAR49-Addendum	Summary of analyses requested by Review Panel	SEDAR 49 Analytical Team

(3) Presentations at the Review Workshop

Presentation I at the SEDAR 49 Assessment Review Workshop	Gulf of Mexico ABC Control Rule and DLM Theory in a Nutshell	Jeff Isely, Skyler Sagarese, Matthew Smith
Presentation II at the SEDAR 49 Assessment Review Workshop	SEDAR 49 Assessment Introduction	Skyler Sagarese, Jeff Isely, and Matthew Smith
Presentation III at the SEDAR 49 Assessment Review Workshop	SEDAR 49 Assessment Data Review	Skyler Sagarese, Jeff Isely, and Matthew Smith
Presentation IV at the SEDAR 49 Assessment Review Workshop	SEDAR 49 Assessment Results	Skyler Sagarese, Jeff Isely, and Matthew Smith
Presentation V at the SEDAR 49 Assessment Review Workshop	Review of U.S. Fisheries Management Framework and Data Limited Approaches	Skyler Sagarese, Jeff Isely, and Matthew Smith

Presentation VI at the SEDAR 49 Assessment Review Workshop	Catch Only Scenarios	Skyler Sagarese, Jeff Isely, and Matthew Smith

VII-2. Appendix 2: Statement of Work for Dr. Yong Chen

External Independent Peer Review by the Center for Independent Experts

SEDAR 49 Gulf of Mexico Data-Limited Species Assessment Review Workshop

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 Technical Representative (COTR), 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 49 will be a compilation of data, an assessment of the stock, and CIE assessment review conducted for Gulf of Mexico Data-Limited Species. The review workshop provides an independent peer review of SEDAR stock assessments. The term review is applied broadly, as the review panel may request additional analyses, error corrections and sensitivity runs of the assessment models provided by the assessment panel. The review panel is ultimately responsible for ensuring that the best possible assessment is provided through the SEDAR process. The stocks assessed through SEDAR 49 are within the jurisdiction of the South Atlantic and Gulf of Mexico Fisheries Management Council and the states of Florida, Georgia, South Carolina, and North Carolina, Mississippi, Alabama, Louisiana, and Texas.   The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have working knowledge expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the primary task of providing peer-review advice in compliance with the workshop Terms of Reference. Experience with data-limited or catch-free assessment methods would be preferred. Each CIE reviewer's duties shall not exceed a maximum of 17 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in **Miami, FL from November 1-3, 2016**.

Statement of Tasks: Each CIE reviewers 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 COTR, 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, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/
http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-nationalregistration-system.html

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.

Panel Review Meeting: 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 can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements).

The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

CIE reviewers shall conduct an impartial and independent peer review of the assessment in accordance with the SoW and ToRs herein.

A description of the SEDAR Review process can be found in the SEDAR Policies and Procedures document:
http://sedarweb.org/docs/page/SEDARPoliciesandProcedures_Oct15_FINAL_update.pdf

The CIE reviewers may contribute to a Summary Report of the Review Workshop produced by the Workshop Panel.

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.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

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

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the panel review meeting in Miami, Florida from November 1-3, 2016, and conduct an independent peer review in accordance with the ToRs **(Annex 2)**.
3) No later than December 2, 2016, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Dr. Manoj Shivlani, CIE Lead Coordinator, via email to mshivlani@ntvifederal.com, and Dr. David Sampson, CIE Regional Coordinator, via email to david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

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

September 27, 2016	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
October 18, 2016	NMFS Project Contact sends the CIE Reviewers the pre-review documents
November 1-3, 2016	Each reviewer participates and conducts an independent peer review during the panel review meeting
December 2, 2016	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
December 16, 2016	CIE submits CIE independent peer review reports to the COTR
December 23, 2016	The COTR 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 COTR within 10 working days after receipt of all required information of the decision on changes. The COTR 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 COTR 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 COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR 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 COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:
Allen Shimada NMFS Office of Science and Technology 1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910 Allen Shimada@noaa.gov   Phone: 301-427-8174

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
mshivlani@ntvifederal.com Phone: 305-968-7136

Key Personnel:

NMFS Project Contact:

Julie A Neer SEDAR Coordinator 4055 Faber Place Drive, Suite 201 North Charleston, SC 29405 (843) 571-4366
julie.neer@safmc.net

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.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

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

Annex 2: Terms of Reference for the Peer Review

SEDAR 49 Gulf of Mexico Data-limited Species Review Workshop

1. Review any changes in data following the Data/Assessment workshop and any analyses suggested by the workshop. Summarize data as used in each assessment model. Provide justification for any deviations from Data/Assessment Workshop recommendations.
2. Evaluate the data used in the assessment, including discussion of the strengths and weaknesses of data sources and decisions, and consider the following:
    a) Are data decisions made by the DW and AW 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?
3. Evaluate and discuss the strengths and weaknesses of the methods used to assess the stock, taking into account the available data, and considering the following:
    a) Are the data-limited methods scientifically sound and robust?
    b) Are the methods appropriate given the available data?
    c) Are the data-limited models configured properly and used in a manner consistent with standard practices?
    d) Are the quantitative estimates produced reliable? Does the method produce management metrics (e.g. OFL, ABC) or other indicators (e.g. trends in F or Z, probability of overfishing) that may be used to inform managers about stock trends and conditions?
4. 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.
5. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted.
    • Clearly denote research and monitoring that could improve the reliability of future assessments.
    • Provide recommendations on possible ways to improve the SEDAR process.
6. Consider whether the stock assessment constitutes the best scientific information available using the following criteria as appropriate: relevance, inclusiveness, objectivity, transparency, timeliness, verification, validation, and peer review of fishery management information.
7. Provide guidance on key improvements in data or modeling approaches that should be considered when scheduling the next assessment.
8. Prepare a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference.

Annex 3: Tentative Agenda

SEDAR 49 Gulf of Mexico Data-limited Species Review Workshop
November 1-3, 2016
Miami, Florida

Tuesday

9:00 a.m.	**Introductions and Opening Remarks**	**Coordinator**
	- Agenda Review, TOR, Task Assignments	
9:30 a.m. – 11:30 a.m.	**Assessment Presentations**	**Analytic Team**
	- Assessment Data & Methods	
	- Identify additional analyses, sensitivities, corrections	
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 6:00 p.m.	**Assessment Presentations (continued)**	**Analytic Team**
	- Assessment Data & Methods	
	- Identify additional analyses, sensitivities, corrections	
6:00 p.m. – 6:30 p.m.	**Public comment**	**Chair**

Tuesday Goals: Initial presentations completed, sensitivity and base model discussion begun

Wednesday

8:00 a.m. – 11:30 a.m.	**Panel Discussion**	**Chair**
	- Assessment Data & Methods	
	- Identify additional analyses, sensitivities, corrections	
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 6:00 p.m.	**Panel Discussion/Panel Work Session**	**Chair**
	- Continue deliberations - Review additional analyses	
	- Recommendations and comments	

Wednesday Goals: sensitivities and modifications identified, preferred models selected, projection approaches approved, Report drafts begun

Thursday

8:00 a.m. – 11:30 a.m.	**Panel Discussion**	**Chair**
	- Final sensitivities reviewed.	
	- Projections reviewed.	
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 5:30 p.m.	**Panel Discussion or Work Session**	**Chair**
	- Review Reports	
5:30 p.m. – 6:00 p.m.	**Public comment**	**Chair**
6:00 p.m.	**ADJOURN**	

Thursday Goals: Complete assessment work and discussions, final results available. Draft Reports reviewed.

VII-3. Appendix III: List of Participants

Workshop Panel
Luiz Barbieri   Chair   Gulf SSC
Panayiota Apostolaki   CIE Reviewer
Yong Chen   CIE Reviewer
Jamie Gibson   CIE Reviewer
Kai Lorenzen   Gulf SSC
Joe Powers   Gulf SSC

Analytic Representation
Skyler Sagarese   SEFSC, Miami
Jeff Isely   SEFSC, Miami
Shannon Cass-Calay   SEFSC, Miami

Appointed Observers
Ben Blount   Gulf SSC
Claudia Friess   Gulf Appointee

Attendees
Shanae Allen   FWRI
Jay Grove   FWC
Bill Harford   Univ. of Miami
Matthew Johnson   SEFSC
Mike Larkin   SERO
Michekke Masi   FWRI
Kevin McCarthy   SEFSC
Michael Schirripa   SEFSC
Matthew Smith   SEFSC
Beth Wrege   SEFSC

Staff
Julie Neer   SEDAR
Ryan Rindone   GMFMC Staff
Charlotte Schiaffo   HMS