CIE Reviewer's Independent Report on the SEDAR 39 2014 and 2015 assessments of Gulf of Mexico smoothhound shark complex and Atlantic dusky smoothhound shark (*Mustelus canis*).

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Prepared for

Center for Independent Experts

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Executive Summary

The SEDAR 39 Review Workshop (RW) for Gulf of Mexico (GoM) smoothhound shark complex (*Mustelus canis*, *M. norrisi* and *M. sinusmexicanus*) and Atlantic dusky smoothhound shark (*M. canis*) met in Panama City, Florida, from Tuesday, February 10 to Thursday, February 12 2015. The meeting was chaired by Dr. Carolyn Belcher from the SEDAR Highly Migratory Species Advisory Panel. The Review Panel (the Panel) was composed of three scientists affiliated with the Center for Independent Experts: Robin Cook, Joel Rice, and Neil Klaer. The meeting format included presentations by the assessment teams mixed with questions and open discussion. Additional analyses were requested by the Panel from the Assessment Team and the results of those were also subsequently presented. The Panel participated in the review of each term of reference. The meeting was open to the public although no public comments or questions were received.

Findings for the Gulf of Mexico smoothhound shark complex

The GoM smoothhound complex comprises three species that the Data Workshop (DW) has conceded cannot currently be separately identified by fishery observers or commercial fishers reliably by eye. Growth of *M. canis* and *M. sinusmexicanus* has been treated as similar, although they have quite different fecundity, as measured by the average number of pups. The growth of *M. norrisi* is different to the other two species mostly by not growing as long. Almost the entire total fishing mortality for the complex is from highly uncertain estimated discards from the shrimp trawl fishery. Such a situation provides a difficult challenge both to the work of the DW and AW, but the majority of the data decisions made by the DW and AW were sound and robust.

Uncertainties in total catch, growth parameters and natural mortality were all acknowledged by the DW and ranges for those values were provided for use in the stock assessment. An uncertainty that I believe deserves some acknowledgement is stock boundary within the GoM, and possible catches outside that boundary (e.g. by Mexico) that might influence the complex.

Four fishery-independent abundance indices were put forward by the DW as usable for stock assessment. The indices are highly variable and are available for different starting years, with the SEAMAP summer groundfish survey being longest, starting in 1982. There is some agreement among the indices overall, showing an increasing trend in recent years.

The form of available data does not allow the application of age structured or species-specific assessment models, so the choice of a biomass dynamic model (here a Bayesian state-space Schaefer model) for the assessment is appropriate. Given the particular challenges in assessing this complex, as a first assessment the model has been appropriately applied to the data.

The current status of the stock is most likely not overfished since the base run and all the sensitivity runs all lie in the region where the ratio N_{cur}/N_{msy} is >1. The stock is most likely not experiencing overfishing since the base run and all the sensitivity runs all lie in the region where the ratio H_{cur}/H_{msy} is <1. Additional runs requested at the review meeting did not alter these conclusions. The status estimates are reliable as long as the time trend in the catch is reliably reconstructed, and trends in the abundance indices are also reliable. There are some questions on both of these aspects, but no immediate solutions, so the model results represent the best available at present.

Projections provided an acceptable exploration of the uncertainty related to data sources and model assumptions to illustrate robustness. These generally showed that the 2012 catch level is unlikely to lead to overfishing or an overfished condition in the future. Only the low catch sensitivity predicted that not even constant catches at the 2012 level would allow for <30% probability becoming overfished or of overfishing occurring in the future.

The Panel agreed with the research recommendations of the DW and AW, particularly those to better characterize the total mortality of smoothhound bycatch of the shrimp trawl fishery. Given considerable uncertainty in the bycatch historically, it was also recommended that an assessment procedure be developed that incorporated estimation of the historical catch by including information on fishing effort.

I have included some additional recommendations on simulation work that could be done to examine species at particular risk if managed within a complex, examination of whether there may be a simple and cost effective means for estimating total catch of the individual species in future, and examination of any evidence for possible time trends in the post-discard mortality rate for the shrimp trawl fishery.

Findings for Atlantic dusky smoothhound shark

The stock boundaries and movement patterns of Atlantic *M. canis* are reasonably well defined. Data examined by the DW and used by the stock assessment included estimated landings and post-release mortality of discards from four commercial fleets and recreational catches. Recent catches from the combined "commercial other" have increased, but the majority of catches are still from landings of the commercial gillnet fishery. There are no age compositions available, but much length composition data associated with each of the major fisheries. There are 10 fishery-independent abundance indices available (all from trawling) that were considered reliable by the DW. Rankings for the indices were assigned by the DW, with the highest ranking given to the fall NEFC bottom trawl survey. Data decisions made by the DW and AW were generally sound and robust.

Data uncertainties were evaluated via sensitivity analysis for fishing fleet selectivity, model start year, abundance index ranking, catch, stock productivity and use of a combined hierarchical abundance index.

Stock synthesis has been extensively used, tested and validated elsewhere, and was an appropriate choice for this assessment given the available data.

The base case assessment abundance, biomass and exploitation estimates are consistent with the majority of the input data (note that there are some inconsistent CPUE series and some poor fits to the length frequency data) and are useful to support perceptions of stock trends. Inferences about the stock status need to be interpreted with care given the uncertainty in the stock recruitment relationship. Estimated recruitment deviations generally show a pattern of negative deviations earlier in the series and positive later, with a high degree of autocorrelation. The pattern indicates either a systematic effect not accounted for by the model (e.g. cycling environmental conditions affecting recruitment strength), or model mis-specification of the stock-recruitment relationship.

Based on the accepted base case and sensitivities presented, the range of sensitivity models indicate that the population is above MSY and the exploitation rate is lower than F_{MSY}. It is likely that the stock is not overfished nor is it experiencing overfishing, but this is conditioned on the stock recruitment relationship which may be unreliable. The Panel is of the opinion that the range of sensitivities investigated appropriately captures the uncertainty regarding the states of nature and therefore the implications regarding the reference points. The Panel does note however that the recent year's stock status is near the F_{CURRENT} / F_{MSY} =1 bound for some of the sensitivities.

The method used for stock projections was found to be appropriate, although possible improvements were suggested. Uncertainty due to plausible alternative states of nature were characterised through the projection of the selected sensitivity analyses. Projection results for the base case indicated that levels of fixed removals less than or equal to 550 (1000s of sharks) resulted in at least a 70% probability of maintaining SSF_t, above SSF_{MSY} during the years 2013 – 2022.

The Panel made recommendations for improvement of the stock assessment by closer integration of projections with the SS3 assessment, improvement of fit to the length compositions via different functional forms and fitting of growth parameters, examination of approaches to appropriately weight the length compositions, and investigation of model uncertainty by applying alternative models that make different structural assumptions.

I have elaborated on a refinement of the current procedure used by the DW to decide rankings for abundance indices.

1 Introduction

1.1 Background

The SEDAR 39 Review Workshop (RW) for Gulf of Mexico (GoM) smoothhound shark complex (*Mustelus canis*, *M. norrisi* and *M. sinusmexicanus*) and Atlantic dusky smoothhound shark (*M. canis*) met in Panama City, Florida, from Tuesday, February 10 to Thursday, February 12 2015. The meeting was chaired by Dr. Carolyn Belcher from the SEDAR Highly Migratory Species Advisory Panel. The review panel (the Panel) was composed of three scientists affiliated with the Center for Independent Experts: Robin Cook, Joel Rice, and Neil Klaer. Representatives from the Southeast Fisheries Science Center Panama City, South Atlantic Fishery Management Council, New England Fisheries Science Center, Southeastern Fisheries Association, SEDAR, and Highly Migratory Species management were also present at the meeting.

Reports from the SEDAR 39 Assessment Workshop and Data Workshop (DW) as well as all associated background documents were made available via a secure FTP site to the Panel on 23 January prior to the review meeting. During the meeting, all documents were available electronically via the same FTP site.

The meeting format included presentations by the assessment teams mixed with questions and open discussion. Additional analyses were requested by the Panel from the Assessment Team and the results of those were also subsequently presented. A summary of those analyses should be available as an appendix of the summary report. The Panel participated in the review of each term of reference. The meeting was open to the public although no public comments or questions were received by the Panel.

1.2 Review Activities

Activities of the reviewers were shared during the meeting. It was a requirement that a first draft of the summary report be produced during the Review Workshop. Initial drafting of the report against the Terms of Reference (TORs) was divided among the reviewers and I drafted the text for Atlantic smoothhound TOR2 on the strengths and weaknesses of the Stock Synthesis (SS) stock assessment method, and TOR4 on strengths and weaknesses of the projection method (so those sections here have similar words here to the summary report). Draft text for the summary report was compiled with the assistance of the chair on Thursday of the meeting, with further compilation and editing in the two weeks following the meeting.

2 Review of Gulf of Mexico smoothhound shark complex and Atlantic dusky smoothhound shark assessments

2.1 Terms of reference

The Panel considered the assessments in light of the terms of reference provided as follows:

1. 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?

2. 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 methods scientifically sound and robust?

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

   c) Are the methods appropriate for the available data?

3. Evaluate the assessment findings and consider the following:

   a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?

   b) Is the stock overfished? What information helps you reach this conclusion?

   c) Is the stock undergoing overfishing? What information helps you reach this conclusion?

   d) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?

   e) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?

4. Evaluate the stock projections, including discussing strengths and weaknesses, and consider the following:

   a) Are the methods consistent with accepted practices and available data?

b) Are the methods appropriate for the assessment model and outputs?

c) Are the results informative and robust, and useful to support inferences of probable future conditions?

d) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

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

•Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods.

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

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

•Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.

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

7. 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.

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

9. Ensure that stock assessment results are clearly and accurately presented in the Stock Assessment Report and that reported results are consistent with Review Panel recommendations. If there are differences between the AW and RW due to the reviewer's request for changes and/or additional model runs, etc. describe those reasons and results.

10. CIE Reviewer may contribute to a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference.

2.2 Findings by term of reference for Gulf of Mexico smoothhound complex

2.2.1 Evaluate the data used in the assessment, including discussion of the strengths and weaknesses of data sources and decisions

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

The GoM smoothhound complex comprises three species that the DW has conceded cannot currently be separately identified by fishery observers or commercial fishers reliably by eye. Growth of *M. canis* and *M. sinusmexicanus* has been treated as similar, although they have quite different fecundity, as measured by the average number of pups. The growth of *M. norrisi* is different to the other two species mostly by not growing as long. Almost the entire total fishing mortality for the complex is from highly uncertain estimated discards from the shrimp trawl fishery. Such a situation provides a difficult challenge both to the work of the DW and AW, but the majority of the data decisions made by the DW and AW were sound and robust.

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

Uncertainties in total catch, growth parameters and natural mortality were all acknowledged by the DW and ranges for those values were provided for use in the stock assessment.

Post release discard mortality for the shrimp trawl fishery (likely the most important fishing mortality component) was assigned a range of 0-37% - a wide range indeed. Application of fixed small and large values to total shrimp trawl effort leads to greatly different estimates of total fishing mortality.

An uncertainty that I believe deserves some acknowledgement is stock boundary within the GoM, and possible catches outside that boundary (e.g. by Mexico) that might influence the complex. There is not a great deal of information about the fine scale distribution of each species within the Gulf, but what I could find suggested that *M. canis* was distributed throughout the GoM, while the other two species have a more restricted range (*M. norrisi* mostly within the US EEZ, and *M. sinusmexicanus* restricted to two smaller areas, one inside and one outside the US EEZ). Tagging of *M. canis* in the Atlantic shows that it makes considerable annual migrations between Massachusetts and Florida, so it may also be that the species moves widely in the GoM (potentially across the US EEZ). However, as the total fishing mortality is already highly uncertain, this only increases that uncertainty.

c) Are data applied properly within the assessment model?

The form of available data does not allow the application of age structured or species-specific assessment models, so the choice of a biomass dynamic model for the assessment is appropriate. The Bayesian state-space Schaefer surplus production model used assumes that catch is known perfectly and that survey indices are observed with error. As catches are highly uncertain, this dimension was dealt with among the alternative states of nature, or sensitivity analyses. Given the particular challenges in assessing this complex, as a first assessment the model has been appropriately applied to the data.

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

Catch data are highly uncertain particularly due to uncertainty in scaling total shrimp trawl fishing effort to total catch via observer CPUE, and post-release discard mortality. These uncertainties have been acknowledged and carried through the assessment as sensitivities.

Four fishery-independent abundance indices were put forward by the DW as usable for stock assessment. The indices are highly variable and are available for different starting years, with the SEAMAP summer groundfish survey being longest, starting in 1982. There is some agreement among the indices overall, showing an increasing trend in recent years (as shown by the hierarchical combined index). Alternative index weighting was examined to some extent using sensitivity analyses. Indices were given equal rankings by the DW. I have provided some notes about the ranking procedure under TOR6 for Atlantic smoothhound and possible improvements, which may allow better discrimination among series.

2.2.2 Evaluate and discuss the strengths and weaknesses of the methods used to assess the stock, taking into account the available data

a) Are methods scientifically sound and robust?

The assessment method is appropriate and sufficiently robust given the current state of knowledge of the species complex and uncertainties in catch and abundance indices.

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

The main configuration options available in the application of the Bayesian model were in the choice of priors. Those chosen followed standard practice in that there was an effort to make them as least informative as possible. This was partially achieved, but the Panel noted that the priors were generally not greatly updated by the data, and that K tended towards the upper bound of the prior.

c) Are the methods appropriate for the available data?

Given the available data, the Bayesian state-space Schaefer model is appropriate. Such models have been used previously for stocks in similar circumstances. The application of such a model to a complex rather than a single species assumes that the species essentially have the same biological characteristics and population dynamics. I have provided some notes on additional work that could be done to examine this under TOR6, but as the species here are fairly similar biologically, other uncertainties in this assessment probably have higher priority.

2.2.3 Evaluate the assessment findings

a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?

Abundance, exploitation and biomass estimates from the model are consistent with the input data and population biological characteristics. The consistency of stock status across sensitivity analyses improves confidence in the results.

b) Is the stock overfished? What information helps you reach this conclusion?

The stock is most likely not overfished since the base run and all the sensitivity runs all lie in the region where the ratio N_{cur}/N_{msy} is >1. Addition runs requested at the review meeting that included alternative catch series did not alter this conclusion.

c) Is the stock undergoing overfishing? What information helps you reach this conclusion?

The stock is most likely not experiencing overfishing since the base run and all the sensitivity runs all lie in the region where the ratio H_{cur}/H_{msy} is <1. Additional runs requested at the review meeting that included alternative catch series did not alter this conclusion.

d) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?

A stock recruitment relationship is not specifically estimated by the stock assessment, but is implied by the population growth rate parameter *r* and the carrying capacity *K*. The value for *r* appears to be plausibly derived, but, as noted previously, the value for *K* is less informed by the available data.

e) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?

Stock status was expressed as the ratios N_{cur}/N_{msy} and H_{cur}/H_{msy}. These ratios are rather insensitive to the biomass scale fitted by the model, and therefore the absolute scale of the catch (largely driven by the post-release discard mortality rate from the shrimp fishery). The status estimates are reliable as long as the time trend in the catch is reliably reconstructed, and trends in the abundance indices are also reliable. There are some questions on both of these aspects, but no immediate solutions, so the model results represent the best available at present.

2.2.4 Evaluate the stock projections, including discussing strengths and weaknesses

a) Are the methods consistent with accepted practices and available data?

Projections were carried out by running the Schaefer model forward for 10 years from MCMC samples taken from the model fit under a range of fixed catch levels. This procedure is consistent with accepted practice and available data. As a general rule, all sources of current uncertainty should be accounted for by projections, but process error was not included. A means for addressing this was not arrived at during the RW, but should be considered for the future.

b) Are the methods appropriate for the assessment model and outputs?

The methods are appropriate for the assessment model and outputs.

c) Are the results informative and robust, and useful to support inferences of probable future conditions?

Projections were made to determine the probability of reaching an overfished or overfishing condition after 10 years for 6 different multipliers of the estimated 2012 catch levels from 0 to 4 for the base case and 6 sensitivities. This provided an acceptable exploration of the uncertainty in results to illustrate robustness. Only the low catch sensitivity predicted that not even constant catches at the 2012 level would allow for <30% probability becoming overfished or of overfishing occurring in the future.

d) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

Uncertainties included in the projections from the MCMC sampling and from the range of sensitivities adequately capture the uncertainties for the current assessment. Further work is required to better incorporate process error in the projections.

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

a) Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods.

The current assessment model and projections have adequately captured the uncertainties related to data sources and model assumptions. As the most important source of uncertainty is probably the level and trend of the catch, further work beyond the simple upper and lower catch scenarios should be considered for future assessments, as discussed under TOR6.

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

Results presented show that stock implications for most of the examined scenarios conclude that the population is above B_{MSY} and that the current exploitation rate is lower than F_{MSY} and that continued catches at current levels are unlikely to lead to overfishing or the population to be overfished.

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

a) Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.

The Panel agreed with the research recommendations of the DW and AW, particularly those to better characterize the total mortality of smoothhound bycatch of the shrimp trawl fishery. Given considerable uncertainty in the bycatch historically, it was also recommended that an assessment procedure be developed that incorporated estimation of the historical catch by including information on fishing effort – which should be more precisely known.

While it is acknowledged that the species within the smoothhound complex are quite similar biologically, it has been recognised by studies elsewhere (e.g. Gaichas et al. 2012) that individual more vulnerable species within a complex can be adversely affected by aggregated management. This vulnerability may be due to particular species interactions or environmental sensitivity and not just individual species productivity characteristics. Such simulation work could be carried out for the Gulf smoothhound complex to determine whether any of the species may be particularly at risk.

The three species in the Gulf smoothhound complex have thus far proved impossible to tell apart visually, and there do not appear to be plans to allow for future estimation of annual total catch per species due to this problem (unless diagnostic morphological features are found). It would be advantageous for future assessments to have such information. Simple and cost effective methods to allow catch estimation per species should be investigated (e.g. random genetic sampling of the catch by observers).

The historical catch series is highly uncertain and derives mostly from post-release mortality of the shrimp trawl fishery. Sensitivity to alternative possible catch series was examined through the construction of alternative high and low versions. Current stock status as estimated by the model is mostly insensitive to alternatives that mostly just scale the entire catch series catch up or down. Of more influence on current status is alternative trends in the historical catch, which may be likely given the large uncertainty overall. It would be beneficial to examine whether or not there are reasons that the post-release discard mortality rate from the shrimp fishery is likely to have remained fixed through time (presumably because of relatively unchanged fishing practices). If not, catch series with alternative trends might also be examined as sensitivities. Should a model be developed that allows catch estimation, large deviations in particular years may also be better explained by the gathered evidence.

b) Provide recommendations on possible ways to improve the SEDAR process.

Overall, the SEDAR process is a good one that promotes close examination of fishery data and alternative structures and assumptions in stock assessments to provide stock status advice to management as well as measures of the uncertainty in that advice. There is a need for refinement of the process used by the DW to determine rank values for abundance indices that I have outlined in more detail under TOR6 for the Atlantic smoothhound.

2.2.7 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.

Relevant experts highlighted major uncertainties in stock assessment input data and assessed the quality of abundance indices. These elements have been taken through to the stock assessment in a transparent, timely and objective manner. Transparency would be improved by including the WinBUGS code for the model in the assessment documentation.

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

Suggestions were made by the Panel under TOR6 for the development of an assessment procedure that allows for incorporation of uncertainty in catches.

2.2.9 Ensure that stock assessment results are clearly and accurately presented in the Stock Assessment Report and that reported results are consistent with Review Panel recommendations. If there are differences between the AW and RW due to the reviewer's request for changes and/or additional model runs, etc. describe those reasons and results.

The panel requested additional runs as part of its review. The panel considers the base case as presented along with the sensitivity runs to adequately capture the best available science and the status of the stock.

10. CIE Reviewer may contribute to a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference.

All three CIE reviewers provided consensus on the language that appears in the Peer Review Summary Report.

References

Gaichas S, Gamble R, Fogarty M, Benoit H and others (2012) Assembly rules for aggregate-species production models: simulations in support of management strategy evaluation. Mar Ecol Prog Ser 459:275–292

2.3 Findings by term of reference for Atlantic dusky smoothhound

2.3.1 Evaluate the data used in the assessment, including discussion of the strengths and weaknesses of data sources and decisions

The stock boundaries and movement patterns of Atlantic *M. canis* are reasonably well defined. Data examined by the DW and used by the stock assessment included estimated landings and post-release mortality of discards from four commercial fleets and recreational catches. Recent catches from the combined "commercial other" have increased, but the majority of catches are still from landings of the commercial gillnet fishery. There are no age compositions available, but much length composition data associated with each of the major fisheries. There are 10 fishery-independent abundance indices available (all from trawling) that were considered reliable by the DW. Rankings for the indices were assigned by the DW, with the highest ranking given to the fall NEFC bottom trawl survey. It is unfortunate that no abundance index was available from the gillnet fishery, but the Panel agreed with the decision by the DW to reject an observer CPUE index from that fishery due to probable bias.

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

Data decisions made by the DW and AW were generally sound and robust. Where somewhat arbitrary but important decisions on how to treat the data were made (e.g. setting model starting conditions and year, uncertain population productivity characteristics, use of DW index ranks), the assessment team (AT) has made reasonable efforts to examine the implications of those decisions through sensitivity analyses.

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

Data uncertainties were evaluated via sensitivity analysis for fishing fleet selectivity, model start year, abundance index ranking, catch, stock productivity and use of a combined hierarchical abundance index. The Panel agreed that those acceptably captured plausible possible states of nature. Use of the DW abundance index rankings directly in the assessment proved problematic, and I believe that a major reason for this is that current rankings confound information about time series length, measurement CVs, process error and bias. See additional comments on a potential way to improve this under TOR6.

c) Are data applied properly within the assessment model?

The data are applied properly within the assessment model. Age-structured stock assessments are normally improved if age composition data are available. Stock Synthesis (SS) is fundamentally an age-structured model, so this also applies to SS. Using SS, age compositions may entered simply as annual age-frequencies, or more usefully as annual age-at-length compositions. Most often with age samples, age, length and sex would be available for each individual sample. Age-at-length data are used by stock synthesis to allow fitting of growth parameters (including CVs) within the model while also accounting for selectivity effects and optimizing the fit to length-only composition data. This is superior to the situation here where growth parameters were fitted externally to the assessment model. Even single years of representative age-at-length data can allow a model such as SS to better characterize fitted growth parameters in particular. Unfortunately, direct age composition information is not available for this assessment, but assessment models for this stock in future could potentially be improved if such data were collected and made available, particularly from the fishing fleets that account for most of the catch. Age data from vertebrae of similar shark species (e.g. *Mustelus antarcticus* in Australia) are collected by fishery observers, demonstrating that it should be technically achievable, depending on available resources. Even without additional age data collection it may be useful to investigate input of the data used to externally fit the von Bertalanffy parameters in the data report (Figure 2.12.2) as age-at-length data into the SS model.

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

The data are sufficient to support the assessment approach and support the assessment findings. One of the benefits of this assessment is that this species is well studied with respect to the biology, and this helps constrain the model. However the catch statistics rely in part on catch reconstruction rather than actual catch. Further there is no reliable information regarding the catch prior to 1981, making estimation of the initial depletion problematic. Abundance indices are noisy and show conflicting trends.

2.3.2 Evaluate and discuss the strengths and weaknesses of the methods used to assess the stock, taking into account the available data

a) Are methods scientifically sound and robust?

Stock synthesis is available from the NOAA toolbox, has been extensively used, tested and validated elsewhere, and can accept a large variety of catch, abundance index and age/length composition data sources. In particular, age/length composition is used at the raw annual sampled level, rather than as a derivative source such as a catch at age matrix or an age-length key. A weakness of SS is in the complexity of the model itself and the vast range of choices available to the analyst on how to configure any particular implementation. This means that analysts require considerable training and experience to make best use of the platform, and to acquire knowledge of the latest best practice for some configuration choices. A particular area of difficulty is in comparatively weighting different data sources (in this case length or survey abundance) both within and among each series.

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

The SS assessment has been carried out with two main objectives. Firstly as a bridging analysis for comparison with results from the more traditionally applied state-space Bayesian surplus production model, and secondly to apply a method most appropriate to the available data. The first objective has led to an SS implementation that has placed more emphasis on the derivation and estimation of selectivity parameters for the various fleets and surveys than might otherwise have been the case with an entirely new SS model.

The base model was configured to estimate a starting biomass (via an initial equilibrium recruitment level r_0), recruitment deviations in each year, and a large number of selectivity parameters. To take full advantage of SS, some important biological parameters such as natural mortality or growth would also be estimated by the model. However, as the base model has been constructed to concentrate particularly on selectivity, the additional estimation of these other parameters has proved difficult. The base model cannot fit all available abundance indices well as they completely conflict in some cases. Fits to available length data show mis-fits particularly for young fish and the plus group in many years. Length fits for the main gillnet fishery were much improved by the shift to dome-shaped selectivity for the base model. It may be that the overall fit to the data could be most improved by attempting to fit natural mortality and/or growth, rather than additional fine tuning of selectivity parameters.

Common practice is that recruitment deviations are estimated by the model for recruitment prior to the starting year based on the estimated CV of those earlier deviations. An objective method is to allow deviations to be estimated for those early years where the estimated CV is low. Examination of the estimated CVs for a minimally modified base show that deviations appear to be well estimated after about 1974, giving a period of 7 years prior to the model start year for which deviations should be estimated. Implementation of this procedure was examined in sensitivity analyses developed during the RW, which proved to have minimal impact on the management implications of the base case.

Common practice is also to attempt to estimate initial *F* values for fishing fleets that have non-zero catches historically prior to the start of the model. Implementation of this procedure was also examined for the effect on management implications of the base case as sensitivity analyses during the RW, which also proved to be minimal.

Standard practice for relative weighting among data sources within an SS model recommends ensuring that abundance indices are fitted in preference to age or length composition data as composition data are often noisy, and the primary source of signal for population abundance should be from abundance indices. In recent years there has been much work towards the development of a precise standardised method to carry this out, but at present such a procedure is not generally available. The procedure used by the assessment team does ensure that abundance indices are given more weight than they would receive if standard iterative re-weighting input CVs and sample sizes were applied to all sources, so the recommendation is satisfied.

Estimated recruitment deviations generally show a pattern of negative deviations earlier in the series and positive later, with a high degree of autocorrelation. The pattern indicates either a systematic effect not accounted for by the model (e.g. cycling environmental conditions affecting recruitment strength), or model mis-specification of the stock-recruitment relationship. There is not currently a simple stock recruitment relationship in SS that would easily account for such behaviour, so no simple change to the base case could be recommended at this time to account for such behaviour. Recent recruitment deviations have been near zero, and the overall variability in estimated deviations is currently treated as random noise. Further work is required to investigate how best to account for the systematic pattern, but the RP agrees that there are no candidates currently available, and that the current base does best represent our current knowledge on how to deal with the problem.

Model convergence was assumed if the standard error of parameter estimates could be derived from the inverted Hessian matrix. Other diagnostics were also examined including excessive CVs on estimated quantities, parameters on bounds, patterns in length composition, unusually large individual likelihood components and high or non-informative parameter correlations. Model AIC, RMSE and K-S tests were used for comparison among alternative models. These are standard and recommended practice for SS models. An additional method that requires a great increase in model run time is the use of MCMC – both as a confirmation of convergence, and also as a method of construction and analysis of the posterior distribution for estimated quantities. The use of MCMC is encouraged, although the additional time and analysis required for each individual assessment is also acknowledged.

c) Are the methods appropriate for the available data?

Use of SS as the primary assessment method is an appropriate choice given the available data: various conflicting fishery independent survey abundance indices with different associated selectivity patterns, and also a great deal of length-frequency data either collected directly from the fisheries, or associated with survey indices.

2.3.3. Evaluate the assessment findings

a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?

The base case assessment abundance, biomass and exploitation estimates are consistent with the majority of the input data (note that there are some inconsistent CPUE series and some poor fits to the length frequency data) and are useful to support perceptions of stock trends. Inferences about the stock status need to be interpreted with care given the uncertainty in the stock recruitment relationship.

b) Is the stock overfished? What information helps you reach this conclusion? & c) Is the stock undergoing overfishing? What information helps you reach this conclusion?

Based on the accepted base case and sensitivities presented (SEL2 and internally estimated selection parameters) the range of sensitivity models indicate that the population is above MSY and the exploitation rate is lower than F_{MSY} (see figure 4.24.b in the assessment report). It is likely that the stock is not overfished nor is it experiencing overfishing, but this is conditioned on the stock recruitment relationship which may be unreliable. The Panel is of the opinion that the range of sensitivities investigated appropriately captures the uncertainty regarding the states of nature and therefore the implications regarding the reference points. The Panel does note however that the recent year's stock status is near the F_{CURRENT} / F_{MSY} =1 bound for some of the sensitivities.

d) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?

The stock recruitment curve is largely set by the steepness value which was not estimated in the model but rather calculated by demographic methods. Steepness is the main driver of productivity and appears to be acceptably calculated. The Panel notes that in comparison to many teleost species this is a relatively robust method for sharks as they have well studied fecundity. The Panel notes that the currently implemented stock recruitment relationship is the best available at this point but does not appear to capture the pattern of natural variability estimated by the model.

e) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?

The estimates of the stock status appear reliable assuming the stock and recruitment is adequately modeled, especially when the sensitivities are taken into account. Additionally the model estimated that the stock is more lightly exploited in the terminal year (2012) than in the two previous years. The Panel agrees with the methods used and the determination of the stock status, however the Panel notes that the use of 40%SPR or $F_{0.1}$ proxies for MSY may avoid the problems of uncertainty in the stock-recruitment relationship.

The Panel notes that common SEDAR practice is to define stock status as the average of the last few (often 3) years of the assessment, and that this assessment reports the terminal year.

2.3.4 Evaluate the stock projections, including discussing strengths and weaknesses

a) Are the methods consistent with accepted practices and available data?

Accepted practice for stock projection is to account for as much of the uncertainty characterized by the stock assessment into forward stochastic simulations. The method employed by the assessment team achieves this standard through Monte Carlo simulations drawn from the asymptotic standard errors and parameter correlations estimated by the SS assessment.

b) Are the methods appropriate for the assessment model and outputs?

Besides annual recruitment deviations and selectivity, the base case stock assessment only estimates the value for one simple population parameter, r_0 (initial equilibrium unexploited recruitment). The resulting error for r_0, F_{2012} (terminal fishing mortality - a derived quantity) and the standard deviation of recruitment deviations were used in projections from a stock assessment to propagate uncertainty into the future. The standard error of the estimated deviations was used to generate random bias-adjusted log-normal variability in future recruitments, assuming the fitted stock-recruitment relationship.

Alternative commonly used procedures include projection directly from MCMC draws, or from alternative population states derived from re-fitting the model to bootstrapped re-sampling of the input data. These alternatives are superior to the method used, as they don't assume that the errors in estimated parameters are characterized by normal distributions, as do the approximate asymptotic ones calculated via inversion of the Hessian. However, examination of the range of variation achieved by the applied procedure indicates adequate performance assuming that the recruitment variability has been appropriately modelled.

c) Are the results informative and robust, and useful to support inferences of probable future conditions?

Projection results for an assessment examine the stock condition indicators of principal interest to managers, and also the variation in those quantities in a robust and informative manner. Results are provided as key summary statistics and also as time series for 21 alternative fixed catch scenarios for the projection period of 10 years. Projection results for the base case indicated that levels of fixed removals less than or equal to 550 (1000s of sharks) resulted in at least a 70% probability of maintaining SSF_t, above SSF_{MSY} during the years 2013 – 2022.

d) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

Uncertainty due to plausible alternative states of nature were characterised through the projection of the selected sensitivity analyses. There were other sensitivity analyses examined as model diagnostics (e.g. the model based on externally estimated selectivities) that were not included in the set of plausible states of nature, and the RP agrees with the choices made in this selection.

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

a*) Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods.*

I agree with the comments made in the summary report.

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

I agree with the comments made in the summary report.

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

a) Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.

I agree with the recommendations made in the summary report.

b) Provide recommendations on possible ways to improve the SEDAR process.

I agree with the recommendations made in the summary report and add more detail regarding the process used by the DW to rank abundance indices below.

A refinement of the process used by the DW to comparatively rank abundance indices would assist improving the use of the rankings in stock assessments. The rankings should reflect information about the relative reliability of abundance indices independently from the measured CVs, the length of the series, or the specific length/age composition the index relates to (if associated length and/or age data are available and used to estimate selectivity) because all of these factors are available to and normally accounted for already by the stock assessment. An index ranking is of most benefit for a stock assessment if it conveys information about how much freedom the stock assessment should be given in allowing for additional process error for an index, compared to other available indices. Index ranking at the DW should concentrate on relative sources of additional process error and also potential bias of the indices based on their expert knowledge – for example if an index is from the margins of the stock distribution, or may have been influenced by changes in collection procedures that were not accounted for in the index standardisation. Strong evidence of bias would be the main criterion for the rejection of an index.

2.3.7 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.

I agree with the comments made in the summary report. In addition, there has been work elsewhere on the development of standards for the presentation of SS assessments in assessment reports – particularly on which diagnostics should routinely be included. Unweighted individual likelihood components across all sensitivity runs are one that I would include. It may be useful for SEDAR to consider the development of such standards for SS assessments also.

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

I agree with the comments made in the summary report.

2.3.9 Ensure that stock assessment results are clearly and accurately presented in the Stock Assessment Report and that reported results are consistent with Review Panel recommendations. If there are differences between the AW and RW due to the reviewer's request for changes and/or additional model runs, etc. describe those reasons and results.

The Panel did request additional runs as part of its review however none of the plausible runs resulted in a change in stock status. The Panel considers the base case as presented along with the sensitivity runs to adequately capture the best available science and the status of the stock.

2.3.10 CIE Reviewer may contribute to a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference.

All three CIE reviewers provided consensus on the language that appears in the Peer Review Summary Report.

Appendix 1: Bibliography of materials provided for review

Document #	Title	Authors	Date Submitted
Documents Prepared for the Data Workshop			
SEDAR39-DW-01	Tag and recapture data for smoothhound sharks, *Mustelus* spp., in the Gulf of Mexico and US South Atlantic: 1998-2012	Dana M. Bethea and William B. Driggers III	14 March 2014
SEDAR39-DW-02	Standardized catch rates of smooth dogfish from the SEAMAP-South Atlantic Shallow Water Trawl Survey	E. Cortés and J. Boylan	9 May 2014
SEDAR39-DW-03	Preliminary catches of smoothhound sharks	E. Cortés and H. Balchowsky	9 May 2014
SEDAR39-DW-04	Relative abundance of *Mustelus spp*. in the Gulf of Mexico based on observer data collected in the reeffish bottom longline fishery	John Carlson and Elizabeth Scott-Denton	30 April 2014
SEDAR39-DW-05	Shrimp Fishery Bycatch Estimates for Smoothhound Sharks in the Gulf of Mexico, 1972-2012	Xinsheng Zhang, Enric Cortés, Dean Courtney and Elizabeth Scott-Denton	12 May 2014
SEDAR39-DW-06	Smoothhound Abundance Indices from NMFS Bottom Longline Surveys in the Western North Atlantic and Northern Gulf of Mexico	Adam G. Pollack and G. Walter Ingram, Jr.	7 May 2014 Updated 22 May 2014
SEDAR39-DW-07	Smoothhound Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico	Adam G. Pollack and G. Walter Ingram, Jr.	20 May 2014 Updated 22 May 2014
SEDAR39-DW-08	Smoothhound Abundance Indices from NFMS Small Pelagics Surveys in the Northern Gulf of Mexico	Adam G. Pollack and G. Walter Ingram, Jr.	9 May 2014 Updated 16 May 2014
SEDAR39-DW-09	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the Northeast Fisheries Observer Program	C.T. McCandless and J.J. Mello	30 June 2014
SEDAR39-DW-10	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the Rhode Island Department of Environmental Management trawl surveys	C.T. McCandless and S.D. Olszewski	30 June 2014
SEDAR39-DW-11	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the University of Rhode Island trawl survey conducted by the Graduate School of Oceanography.	C.T. McCandless	17 June 2014
SEDAR39-DW-12	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the	C.T. McCandless and K. Gottschall	17 June 2014

	Long Island Sound Trawl Survey conducted by the Connecticut Department of Energy and Environmental Protection		
SEDAR39-DW-13	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the Peconic Bay Small Mesh Trawl Survey conducted by the New York State Department of Environmental Conservation	C.T. McCandless and C. Grahn	17 June 2014
SEDAR39-DW-14	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the New Jersey Division of Fish and Wildlife ocean trawl surveys	C.T. McCandless, J. Pyle, G. Hinks and L. Barry	17 June 2014
SEDAR39-DW-15	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the Delaware Division of Fish and Wildlife 30-foot otter trawl survey	C.T. McCandless and M. Greco	17 June 2014
SEDAR39-DW-16	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) longline surveys in Delaware Bay	C.T. McCandless	30 June 2014
SEDAR39-DW-17	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the Ocean Gillnet Program conducted by the North Carolina Division of Marine Fisheries	C.T. McCandless, C. Stewart, and H. White	30 June 2014
SEDAR39-DW-18	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the University of North Carolina shark longline survey south of Shakleford Banks	C.T. McCandless, F.J. Schwartz, and John J. Hoey	17 June 2014
SEDAR39-DW-19	Standardized indices of abundance for Smooth Dogfish, *Mustelus canis*, from the South Carolina Department of Natural Resources red drum longline survey	C.T. McCandless and B. Frazier	30 June 2014
SEDAR39-DW-20	Mark/Recapture Data for the Smooth Dogfish, *Mustelus Canis*, in the western North Atlantic from the NEFSC Cooperative Shark Tagging Program	N. E. Kohler, P. A. Turner, M. Pezzullo, and C. T. McCandless	19 May 2014 Updated 17 June 2014
SEDAR39-DW-21	A Preliminary Review of Post-release Live-discard Mortality Rate Estimates in Sharks for use in SEDAR 39	Dean Courtney	18 May 2014 Updated: 20 June 2014
SEDAR39-DW-22	Identification, Life History and Distribution of *Mustelus canis*, *M. norrisi* and *M. sinusmexicanus* in the northern Gulf of Mexico	Lisa M. Jones, William B. Driggers III, Kristin M. Hannan, Eric R.	16 May 2014 Updated: 22 May 2014

		Hoffmayer, and Christian M. Jones	
SEDAR39-DW-23	Discards of *Mustelus canis* in the coastal gillnet fishery off the Southeast United States	John Carlson, Alyssa Mathers, and David Gloeckner	9 May 2014 Addendum: 22 May 2014
SEDAR39-DW-24	Biomass. Abundance and distribution of smooth dogfish (Mustelus canis) from the Northeast Fisheries Science Center and Massachusetts Department of Marine Fisheries trawl surveys	Katherine A, Sosebee, Jeremy King, Michele Traver, and Larry Alade	19 May 2014 Updated: 24 June 2014
SEDAR39-DW-25	Estimation of smooth dogfish discards in the Northeast United States fisheries using data collected by the Northeast Fisheries Observer Program	Katherine A, Sosebee	16 May 2014 Updated: 18 June 2014
SEDAR39-DW-26	Discards of *Mustelus spp*. in the Gulf of Mexico reeffish bottom longline fishery	John Carlson, Elizabeth Scott-Denton, and Kevin McCarthy	14 May 2014 Addendum: 21 May 2014
SEDAR39-DW-27	SEDAR 39 Indices Report Cards	S39 Indices WG	18 June 2014
SEDAR39-DW-28	Seasonal Distribution of *Mustelus canis* off the Atlantic coast of the U.S.	Melissa M. Giresi, William B. Driggers, R. Dean Grubbs, Jim Gelsleichter, Eric R. Hoffmayer	21 May 2014
SEDAR39-DW-29	Initial Comparison of Genetic Population Structure of *Mustelus canis* using the mitochondrial gene, NADH-2	Melissa M. Giresi and David S. Portnoy	21 March 2014
SEDAR39-DW-30	Size composition and indices of relative abundance of the smooth dogfish (*Mustelus canis*) in the near shore Atlantic Ocean	Robert J. Latour, Christopher F. Bonzek, and J. Gartland	16 June 2014
SEDAR39-DW-31	Length/weight relationships and life history data for *Mustelus canis* off of the Atlantic coast of the U.S.	Eric R. Hoffmayer, William B. Driggers, R. Dean Grubbs, Melissa M. Giresi, Jim Gelsleichter, Robert Latour	22 May 2014
Documents Prepared for the Assessment Process			
SEDAR39-AW-01	Review of Available Length Composition Data Submitted for use in the SEDAR 39 *Mustelus canis* Atlantic Stock Assessment	Dean Courtney	10 Sept 2014
SEDAR39-AW-02	Hierarchical analysis of U.S Atlantic Smooth dogfish and Gulf of Mexico smoothhound species indices of	Cami McCandless	15 Oct 2014

Documents Prepared for the Review Workshop			
SEDAR39-RW-01	Projections for the SEDAR 39 Atlantic Smooth Dogfish (*Mustelus canis*) Stock Assessment Report Base Model Configuration	Dean Courtney	30 Jan 2015
SEDAR39-RW-02			
Final Stock Assessment Reports			
SEDAR39-SAR1	Atlantic Smoothhound Shark	SEDAR 39 Panels	
SEDAR39-SAR2	Gulf of Mexico Smoothhound shark complex	SEDAR 39 Panels	
Reference Documents			
SEDAR39-RD01	Reproductive biology of the smooth dogfish, *Mustelus canis*, in the northwest Atlantic Ocean	Christina L. Conrath & John A. Musick	
SEDAR39-RD02	Age and growth of the smooth dogfish (*Mustelus canis*) in the northwest Atlantic Ocean	Christina L. Conrath, James Gelsleichter, & John A. Musick	
SEDAR39-RD03	A review of the smooth-hound sharks (GENUS *Mustelus,* FAMILY TRIAKIDAE) of the western Atlantic Ocean, with descriptions of two new species and a new subspecies	Phillip C. Heemstra	
SEDAR39-RD04	Smooth Dogfish (*Mustelus canis*) Fin-to-Carcass Ratio Project	Marin Hawk, Russ Babb, and Holly White	
SEDAR39-RD05	Occurrence, catch rates, and length frequencies for smooth dogfish (*Mustelus canis*) caught in the VIMS Longline Survey: 1974-2006	R. Dean Grubbs and John A. Musick	
SEDAR39-RD06	A review of integrated analysis in fisheries stock assessment	Mark N. Maunder and Andre A. Punt	
SEDAR39-RD07	Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management	Richard D. Methot Jr, and Chantell R. Wetzel	
SEDAR39-RD08	Appendix A: Technical Description of the Stock Synthesis assessment program	Richard D. Methot Jr, and Chantell R. Wetzel	
SEDAR39-RD09	Model selection for selectivity in fisheries stock assessments	Andre E. Punt, F. Hurtado-Ferro, F. and A.R. Whitten	
SEDAR39-RD10	Bayesian surplus production model with the Sampling Importance Resampling algorithm (BSP): a User's Guide	Murdoch K. McAllister and Elizabeth A. Babcock	
SEDAR39-RD11	Adjusting for bias due to variability of estimated recruitments in fishery assessment models	Richard D. Methot, Jr. and Ian G. Taylor	

SEDAR39-RD12	Package ‘r4ss’: r code for Stock Synthesis	Ian Taylor, Ian Stewart, Allan Hicks, Tommy Garrison,Andre Punt, John Wallace, Chantel Wetzel, James Thorson, Yukio Takeuchi, Cole Monnahan, and other contributors
SEDAR39-RD13	User Manual for Stock Synthesis - Model Version 3.24s	Richard D. Methot Jr.
SEDAR39-RD14	FINAL REPORT FOR THE ASSESSMENT METHODS WORKING GROUP SUMMARIZING THE DOMESTIC SHARK P* STANDARDIZATION WORKSHOP	DEAN L. COURTNEY ENRIC CORTÉS XINSHENG ZHANG
SEDAR39-RD15		

Appendix 2: A copy of the CIE Statement of Work

Attachment A

Statement of Work

External Independent Peer Review by the Center for Independent Experts

SEDAR 39 HMS Smoothhound Sharks 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 39 will be a compilation of data, an assessment of the stocks, and CIE assessment review conducted SEDAR 39 HMS Smoothhound sharks. 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 39 are within the jurisdiction of the Highly Migratory Species Division of NOAA Fisheries and the states of Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, and North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine. 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 should have 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. Each CIE reviewer's duties shall not exceed a maximum of 14 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 **Panama City, Florida** during **February 10-12, 2015.**

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-national-registration-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.

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 at the **Panama City, Florida during February 10-12, 2015**.
3) **In Panama City, Florida during February 10-12, 2015** as specified herein, conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than **February 26, 2015**, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Sampson d*avid.sampson@oregonstate.edu*. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

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

January 6, 2015	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
January 27, 2015	NMFS Project Contact sends the CIE Reviewers the pre-review documents
February 10-12, 2015	Each reviewer participates and conducts an independent peer review during the panel review meeting
February 26, 2015	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
March 12, 2015	CIE submits CIE independent peer review reports to the COTR
March 19, 2015	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.

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

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

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   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: Tentative Terms of Reference for the Peer Review

SEDAR 39 HMS Smoothhound Sharks Assessment Review Workshop

1. 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?
2. 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 methods scientifically sound and robust?
   b) Are assessment models configured properly and used consistent with standard practices?
   c) Are the methods appropriate for the available data?
3. Evaluate the assessment findings and consider the following:
   a) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?
   b) Is the stock overfished? What information helps you reach this conclusion?
   c) Is the stock undergoing overfishing? What information helps you reach this conclusion?
   d) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   e) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?
4. Evaluate the stock projections, including discussing strengths and weaknesses, and consider the following:
   a) Are the methods consistent with accepted practices and available data?
   b) Are the methods appropriate for the assessment model and outputs?
   c) Are the results informative and robust, and useful to support inferences of probable future conditions?
   d) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

5. Consider how uncertainties in the assessment, and their potential consequences, are addressed.
   - Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods.
   - Ensure that the implications of uncertainty in technical conclusions are clearly stated.
6. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted.
   - Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
   - Provide recommendations on possible ways to improve the SEDAR process.
7. 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.
8. Provide guidance on key improvements in data or modeling approaches which should be considered when scheduling the next assessment.
9. Ensure that stock assessment results are clearly and accurately presented in the Stock Assessment Report and that reported results are consistent with Review Panel recommendations. If there are differences between the AW and RW due to the reviewer's request for changes and/or additional model runs, etc. describe those reasons and results.
10. CIE Reviewer may contribute to a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference.

Annex 3: Tentative Agenda

SEDAR 39 HMS Smoothhound Sharks Review Workshop

Panama City, Florida
10-12 February 2015

Tuesday

9:00 a.m.	**Introductions and Opening Remarks** *- Agenda Review, TOR, Task Assignments*	**Coordinator**
9:30 a.m. – 11:30 a.m.	**Assessment Presentations – Gulf of Mexico** **-** *Assessment Data & Methods* *- Identify additional analyses, sensitivities, corrections*	**Enric Cortés**
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:00 p.m. – 6:00 p.m.	**Assessment Presentations – Atlantic** **-** *Assessment Data & Methods* *- Identify additional analyses, sensitivities, corrections*	**Dean Courtney**

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

Wednesday

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

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

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

Appendix 3: List of participants

Workshop Panel
Carolyn Belcher, Chair .... HMS AP
Robin Cook .... CIE Reviewer
Neil Klaer .... CIE Reviewer
Joel Rice .... CIE Reviewer

Analytic Representation
Enric Cortés .... SEFSC, Panama City
Dean Courtney .... SEFSC, Panama City
Xinsheng Zhang .... SEFSC, Panama City

Council Representation
Anna Beckwith .... SAFMC
Ben Hartig .... SAFMC

Appointed Observers
Peter Barile .... SFA
Kathy Sosebee .... NEFSC

Staff
Julie Neer .... SEDAR
Julie O'Dell .... SAFMC Staff
Karyl Brewster-Geisz .... HMS