Report on SEDAR 29 Highly Migratory Species Gulf of Mexico Blacktip Shark Review

Prepared for the Center for Independent Experts

By

Stephen J. Smith
383 Portland Hills Drive
Dartmouth, Nova Scotia
Canada B2W 6R4
smithsj@eastlink.ca

July 2012

EXECUTIVE SUMMARY

A Center of Independent Experts (CIE) review panel was convened to conduct a desk review of the stock assessment of SEDAR 29 highly migratory species Gulf of Mexico Blacktip Sharks. The current assessment provided an update to stock status last evaluated in SEDAR 11 in 2006. In 2006, three different production models were fit to the data and all models indicated that the stock was not overfished and overfishing was not occurring.

In the current assessment, an extensive review was conducted of available data including additional fisher-independent and dependent time series, as well as recent findings on growth and fecundity for blacktip sharks. The evaluation of the fit of the age-based production model and data uncertainties was comprehensive. The evaluation of stock status with respect to not being overfished or overfishing not occurring was robust to all of the various scenarios used to the test the model and the data. However, the relative uncertainty of the catch series had to be set much lower than that for the abundance indices for the parameters of the population model to be estimable. The model fit the catch data quite closely while fitting flat lines to all of the abundance indices. In the end, most of the information on trend came from the catch and effort data. The authors of the assessment concluded that the statistical standardization of the abundance indices was insufficient and the indices provided did not adequately reflect changes in relative abundance. The usefulness of these indices should be evaluated before the next assessment. The potential impact of the process errors in the model on the appropriate estimates for the MSY reference points should also be investigated.

Overall, the model characterized the blacktip shark population as being relatively unaffected by the fishery. Given the lack of any other information to conclude the contrary it was difficult to argue against this assessment.

BACKGROUND

The stock status of Gulf of Mexico blacktip sharks was first reviewed under the SEDAR process in 2006 along with other shark species (SEDAR 11). The review panel consisted of a CIE Chair, 2 CIE reviewers, and two independently invited reviewers. Three different production models were fit to the data and all models indicated that the stock was not overfished and overfishing was not occurring. In the current assessment, an extensive review was conducted of available data including additional fishery independent and dependent time series, as well as recent findings on growth and fecundity of blacktip sharks. Unlike the previous review in which the reviewers met with the assessment team in Panama City, this review was conducted independently by two CIE reviewers within their individual home locales.

DESCRIPTION OF THE INDIVIDUAL REVIEWER'S ROLE IN THE REVIEW ACTIVITIES

This review was established to be a desk review (Appendix 2) and therefore solely dependent upon the background and assessment documentation as supplied. All background documents

were to be sent to the reviewers by May 8, 2012 with the assessment document following on May 31, 2012. The CIE scheduled the panel review for 4–15 June 2012.

SUMMARY OF FINDINGS BY TERM OF REFERENCE

1. Evaluate the data used in the assessment, addressing the following:

   The SEDAR review committee is to be commended for large amount of information that was processed for this stock assessment. There was such a large amount of information that it was difficult for this reviewer to give it adequate attention in the time allotted. Compounding this problem was the fact that much of the documentation in many of the supporting working papers was preliminary and incomplete as identified in the Indices of Abundance Score Cards working paper (WP23).

   a) Are data decisions made by the assessment panel sound and robust?

      The data review was quite extensive and resulted in a number of changes to the catch series, discards, abundance indices, selectivities, growth, maturity and fecundity parameters. As far as I can tell the decisions were based on a thorough review of the information presented.

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

      Data uncertainties were presented and some were evaluated through the sensitivity analyses conducted on the assessment model.

   c) Are data applied properly within the assessment model?

      The data were prepared according to standard and best practices with respect to their inclusion in the assessment model.

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

      As noted above the review of the potential and included indices by SEDAR was extensive but the associated documentation supplied for the CIE review is still in a preliminary state. Issues raised below may have been discussed at the meetings and the follow-up webinars but I could not find them in the documents supplied.

      The 2006 CIE review had also observed that the indices used had exhibited conflicting trends. This time additional indices were included in the analysis but overall there does not seem to be much improvement to the overall picture. On page 65 of the assessment report (SEDAR 29 SAR SECTION II), the authors state:

      > In general, the poor fit to some of the indices is caused in part by high interannual variability that does not seem to be compatible with the life history of the species, suggesting that the statistical standardization of the indices done externally to the model may not have included all factors that help explain relative abundance.

      Most of the fishery independent and dependent indices working papers used the so-called “delta” model for statistical standardization of the indices catch-per-unit effort (CPUE) observations were modeled using a binomial model for the data expressed as

zero or non-zero CPUE, while the lognormal model was used for the actual observations of CPUE greater than zero. Separate generalized linear or generalized linear mixed effects models were fit to the zero/nonzero and CPUE>0 data to account for factors such as area, hooks, year, etc.

This approach was ascribed to Lo et al. (1992) who actually did not use a binomial distribution to model the zero/nonzero data, and instead, modeled the proportion of non-zero records p as a lognormal via the transformation $\log(p+1)$. On the other hand, Stefánsson (1996) did use a binomial distribution for zero/nonzero data but used a gamma distribution for the CPUE>0. In both studies, models were fit to the two kinds of data separately and then the results were combined with approximations for the associated variances. Many of the working papers use generalized linear mixed effects models and as far as I know, no one has extended these approximations to the mixed effects model case (required for CVs).

It was not obvious from the working papers but I assume that the log normal models are fit by log transforming CPUE>0 and simply using a normal family with identity link. If this is the case then how was the year effect back-transformed to the original scale (as per Gavaris 1980)? Note that using the gamma family and log link would avoid problems with this kind of back-transformation.

An alternative approach using Poisson-gamma distributions, a particular case of the Tweedie type distributions where both zeroes and non-zeroes are included in the same distribution was not used here. This approach has been applied to CPUE data elsewhere (e.g., Candy 2004) and is available in R packages for generalized linear models (http://www.r-project.org/package=tweedie) and generalized linear mixed effects models (http://cran.r-project.org/web/packages/cplm/cplm.pdf). Rudimentary comparisons between the delta and Tweedie approach have not indicated significant difference between the two (Shono, 2008) but I am not aware of anyone comparing how well the variance estimates perform for each method.

In the delta models used here factors such as area, hook size, and depth intervals were treated as fixed effects and screened for inclusion in the final model by a forward or backward stepping approach, χ^2 or F tests and, when found, factors included in Year interaction terms were recast as random effects. The support for this latter approach was referenced to Ortiz and Arocha (2004) who base their support on a reference to Cooke (1997). In fact Cooke (1997) cautions that there can be cases where automatic conversion to random effects would not be warranted due to temporal or other trends.

Area (WP01, WP12) and hook type (WP02) were often identified as factors exhibiting interaction with Year. In other cases there was no indication that interactions were tested in the model (e.g., WP03, WP22), although areal coverage and hook type changed over time for WP03. Interactions between area and year can arise when coverage by area is inconsistent over time as is evident in WP03, indicating aliased effects. Conversion to random effects is simply sweeping this problem under the carpet and a missing data approach should be investigated as suggested by Maunder and Punt (2004).

Similarly, a temporal trend in the size of hooks used or type of hooks used will appear as an interaction and unless other information is available, changes in catch efficiency and stock abundance could be aliased as well.

Finally, a number of papers reported that initially all effects were treated as fixed effects and screened using analysis of deviance, AIC or BIC within GLM. The next step was to convert some factors to random effects and fit a GLMM evaluating the effects again (e.g., WP03, WP02). Variable screening in a GLMM is a bit of an art with many measures (likelihood ratio tests) being approximations (Pinheiro and Bates 2000). Based on the information provided, I could not determine if random effects had been tested using REML fits or fixed effects had been tested using ML fits as per Pinheiro and Bates (2000) and Zurr et al. (2009).

It is difficult to answer the question of whether the input data series are reliable and sufficient enough to support the assessment approach and findings. The authors of the stock assessment have their doubts, given that they fit their model assuming the CV for their catch series was five times higher than that for the abundance indices. As noted above, these same authors suggest that statistical standardization of the indices may be at fault but this is also difficult to investigate with the information at hand. It appears that most, and in some cases all, of the ancillary information was included in the delta model analyses. There may be methodological problems but again this was difficult to assess given the material available.

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

   a) Are methods scientifically sound and robust?

      The population models, index standardization methods, growth, recruitment, maturity and selectivity methods are all sound and robust in terms of the knowledge base of knowing what to expect based on their having been used elsewhere on data from other species.

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

      The configuration and use of the assessment models are consistent with best practices but the need to set the CV multipliers as was done to get the model to work was worrisome (see below).

   c) Are the methods appropriate for the available data?

      These kinds of methods are appropriate for the kinds of data used in this assessment but the real question in the end is whether these data are informative about the impact of the fishery on the blacktip shark population. The model predicts the catch quite closely (Figure 3.6.9) while fitting a horizontal line to all of the abundance indices (Figure 3.6.10), a reflection of setting the CV multipliers to place much more confidence on the catch data relative to the abundance indices. As noted in the text, poorer model fits and parameter estimates hitting boundaries resulted when the CV multipliers were set to be more similar. Again the authors point out "…the lack of consistent signal and [presence of] interannual variability in the indices…" At best,

setting the CV multiplier for the indices to five times that for the catch data, ignores any trend in the data and scales the catch (along with selectivities, etc.) by the overall mean of the indices.

3. Evaluate the assessment findings with respect to the following:

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

      While the assessment results point to a fishery that has had a small impact on the population since 1981, the authors point out throughout the document that the abundance indices appear to be as a group inconsistent indicators of the impact of the fishery on the population and as individual indices, exhibit little signal that was consistent with the catch series. This lack of signal could be interpreted as support for the contention that the fishery has had minor impact on the population in which case there will need to be effort put into reducing the variability in the indices to make them more sensitive to potential future changes in the population.

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

      All scenarios presented in the assessment point to the stock not being overfished. However, the population dynamics model used in this assessment includes process error. In a recent paper (Bousquet et al. 2008), it was demonstrated that the standard deterministic estimates for MSY and FMSY in a Schaefer surplus production model will not correspond the stochastic solutions when process error is included. In fact the deterministic estimates will be overoptimistic relative to the stochastic solutions. The difference between the two kinds of estimates will be a function of the magnitude of the process error. In addition, for process errors above a certain limit, the biomass distribution will no longer be stationary and no solution will exist. I don't believe that this finding is limited to the Schaefer model and similar results may hold for the production model used in this stock assessment.

      There were no details given in the documents on how MSY and FMSY were calculated in this assessment or whether the impact of the process error was investigated. If these quantities were calculated in a deterministic framework then based on the results in Bousquet et al. (2008), the current stock status may not be as optimistic as featured here. Further investigation will be required before it can be determined if incorporation of process error into the calculation of the reference points would change the determination of the current stock status in this case.

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

      All scenarios presented in the assessment point to the stock not undergoing overfishing. However, as discussed in above in 3b, there may be a question of the impact of process error on the calculation of FMSY.

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

Available stock and recruitment estimates are limited to the upper right of the Beverton-Holt curve (Figure 3.6.13.) and as such are not informative on the lower end of the curve. However, there seems to be some information on the predicted virgin recruitment given the comparison between the prior and posterior distributions in Figure 3.6.16. The resultant estimates for steepness and maximum lifetime reproductive rate were reported to be in line with expectations based on life history — an improvement over the previous assessment. All other things being equal, this stock recruitment curve represents the best information available for evaluating 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?

See discussion in 3b and 3c.

4. Evaluate the stock projections, rebuilding timeframes, and generation times, addressing the following:

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

Given that the stock was found not to be overfished with no overfishing occurring, no projections were presented in the document. Generation time was estimated to be 11.5 years along with related estimates of the time required to increase by R0 (11.2 years) and mean age of the parents of offspring in a stable age distribution (10.9 years). All of these estimates are consistent given the maturity-at-age ogives.

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

No projections were given.

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

Generation time estimates are consistent with the data and can be used to support inferences of probable future conditions.

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

No projections were given.

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 evaluation of uncertainty focused on model performance (jitter, retrospective analysis), model structure (continuity analysis, weighting schemes, scenarios 6, 11, and 12) and data used (remaining scenarios). This process was quite comprehensive and I cannot suggest any others that could have been done.

I would suggest that it was not surprising that in the high and low catch scenarios (9 and 10), the catches were fit very well (page 68 of assessment report). The CV multipliers were retained as per the base case, so the same overall assumptions of relative uncertainty were also retained. Further, these results suggest that there was little information in the abundance indices that could differentiate between the two scenarios.

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

None of the results from the uncertainty investigations indicated that the stock status differed from the base case to any great degree. This was clearly discussed in the text.

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

The following research recommendations were listed in the assessment document.

- Conduct age, growth and reproductive studies of blacktip sharks in the western Gulf of Mexico.
- Examine the stock structure of blacktip sharks in the Gulf of Mexico using genetic analyses, continued conventional tagging and advanced tagging technologies.
- Benchmark assessment to be undertaken focusing on treating blacktip sharks in the eastern and western Gulf of Mexico as separate stocks.
- A brief technical document should be produced to define "post release", "at vessel mortality", "status" and other terms for consistency and future discussions.
- Mexican colleagues must be involved in the next assessment to improve data inputs.
- Continue to work to achieve good species identification for weighouts/landings/reporting for commercial fisheries. Continue to have workshops for fishers/dealers to learn species identification. Workshops for recreational fishermen to work towards better species ID are also needed.
- Add a discards section to the logbooks for commercial fisheries.
- More research is necessary on post-release live discard mortality for both commercial and recreational fisheries

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

All of the research recommendations provided above are pertinent to refining the stock assessment and should be pursued. However, research should be conducted on determining whether the fact that the abundance indices used were not very informative was either due to "inadequate statistical standardization" of the indices or the possibility that none of these indices really track the population at all. If the current indices continue to be as variable and contradictory as they have been, the next assessment will contain the same caveats on the use of these indices and the model will continue to be mainly driven by the catch and effort series.

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

The large amount of material along with the incomplete documentation of many of the background working papers made it difficult to evaluate all aspects of this stock assessment as a desk review. I believe that my review would have benefited from personal interaction with the assessment team. I would recommend that the next time this stock is assessed that SEDAR hold a site-based review with CIE panel reviewers present.

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

As discussed in 6a, more work needs to be done to determine the usefulness of the abundance indices currently being used including the consideration of starting a new monitoring series or augmenting one or more of the current ones.

The potential impact of process error on the calculation of the MSY reference points was raised in 3b. The next assessment should include more details on how the MSY reference points were calculated including whether or not the impact of the process error was included.

CONCLUSIONS and RECOMMENDATIONS

The current stock assessment of Gulf of Mexico blacktip sharks not only contains an additional six years of data but also changes in the catch series (separate recreational catch and Mexican catch series), additional abundance indices, additional selectivity curves and new life history information. The evaluation of the fit of the age-based production model and data uncertainties was comprehensive. The evaluation of stock status with respect to not being overfished or with overfishing not occurring was robust to all of the various scenarios used to the test the model and the data.

However, the parameters in the model were not estimable until the CV multipliers had been set so that the catch and effort series were treated with a higher degree of certainty than the abundance indices. Every abundance index used or considered to be used was modeled using the delta approach to remove the potential effects of different variables such as depth, hook type or size, area, etc. In the end, the model fit a flat trajectory to the abundance indices but fit the catch data very closely. The authors of the assessment concluded that the statistical standardization of the abundance indices was insufficient and the indices provided did not adequately reflect changes in relative abundance. The usefulness of these indices should be evaluated before the next assessment.

The population dynamics model used in this assessment includes process error and recent work has shown that in the case of the Schaefer surplus production model, proper incorporation of the process error will lead to lower estimates of the MSY reference

points compared to the standard deterministic based estimates. The next assessment should include more details on how the MSY reference points were calculated including whether or not the impact of the process error was included.

Overall, the model characterized the blacktip shark population as being relatively unaffected by the fishery. Given the lack of any other information to conclude the contrary it was difficult to argue against this assessment.

REFERENCES USED BY REVIEWER

Bousquet, N., T. Duschesne and L-P. Rivest. 2008. Redefining the maximum sustainable yield for the Schaefer population model including multiplicative noise. J. Theor. Biol. 254:65–75.

Candy, S. G. 2004. Modelling catch and effort data using generalized linear models, the Tweedie distribution, random vessel effects and random stratum-by-year effects. CCAMLR Science. 11: 59–80.

Cooke, J.G. 1997. A procedure for using catch-effort indices in Bluefin tuna assessments (revised). Col. Vol. Sci. Pap. ICCAT. 46: 228–232.

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Can. J. Fish. Aquat. Sci., 37:2272–2275.

Lo, N.C., Jacobson, L. D., & Squire, J. L. (1992) Indices of relative abundance from fish spotter data based on delta lognormal models. Can. J. Fish. Aquat. Sci. 49: 2515–2516.

Ortiz, M. and F. Arocha. 2004. Alternative error distributions for standardization of catch rates of non-target species from a pelagic longline fishery: billfish species in the Venezuelan tuna longline fishery. Fish. Res. 70: 275–297.

Pinheiro, J. and D. Bates. 2000. Mixed effects models in S and S-Plus. Springer-Verlag, New York, USA.

Shono, H. 2008. Application of the Tweedie distribution to zero-catch data in CPUE analysis. Fish. Res. 93: 154–162

Stefánsson, G. 1996. Analysis of groundfish survey abundance data: combining the GLM and delta approaches. ICES J. Mar. Sci. 53: 577–588.

Zuur, A.L., E.N. Ieno, N.J. Walker, A.A. Saveliev and G. M. Smith. 2009. Mixed effects models and extensions in ecology with R. Springer, New York, USA

Appendix 1: Bibliography of materials provided for review

SEDAR29-WP-01	**Relative abundance of blacktip shark, Carcharhinus limbatus, from the eastern Gulf of Mexico**	**John Carlson, Dana Bethea, John Tyminski, and Robert Hueter**
SEDAR29-WP-02	**Standardized catch rates of blacktip sharks (Carcharhinus limbatus) in the U.S. Gulf of Mexico from the Shark Bottom Longline Observer Program, 1994-2010**	**John K.Carlson, Loraine Hale, Alexia Morgan, and George Burgess**
SEDAR29-WP-03	**Indices of Blacktip Shark Based on NMFS Bottom Longline Surveys (1995–2011)**	**Walter Ingram**
SEDAR29-WP-04	**Commercial Bottom Longline Vessel Standardized Catch Rates of Blacktip Sharks in the Gulf of Mexico and US South Atlantic, 1996-2010**	**Kevin McCarthy**
SEDAR29-WP-05	**Standardized catch rates for Gulf of Mexico Blacktip Sharks from the U.S. Pelagic longline logbook using generalized linear mixed models**	**Enric Cortés and Ivy Baremore**
SEDAR29-WP-06	**Standardized catch rates of blacktip sharks from the Everglades National Park Creel Survey**	**John K. Carlson and Jason Osborne**
SEDAR29-WP-07	**Tag and recapture data for blacktip shark, Carcharhinus limbatus, in the Gulf of Mexico: 1999-2010**	**Dana M. Bethea, John K. Carlson, and Mark A. Grace**
SEDAR29-WP-08	**Updated catches of Gulf of Mexico blacktip sharks**	**Enric Cortés and Ivy Baremore**
SEDAR29-WP-09	**Reproduction of the blacktip shark Carcharhinus limbatus in the Gulf of Mexico**	**Ivy E. Baremore and Michelle S. Passerotti**
SEDAR29-WP-10	**A standardized CPUE index of abundance for Gulf of Mexico blacktip sharks from the Marine Recreational Statistics Survey (MRFSS)**	**Elizabeth A. Babcock**
SEDAR29-WP-11	**Catch rates and size distribution of blacktip shark Carcharhinus limbatus in the northern Gulf of Mexico, 2006-2010**	**J. Marcus Drymon and Sean P. Powers**
SEDAR29-WP-12	**Relative abundance of blacktip shark based on a fishery-independent gillnet survey off Texas**	**Walter Bubley, John K. Carlson,**
SEDAR29-WP-13	**Standardized catch rates of blacktip sharks (Carcharhinus limbatus) collected during a gillnet survey in Mississippi coastal waters, 1998-2011**	**Eric Hoffmayer, Glenn Parsons, Jill Hendon, and Adam Pollack**
SEDAR29-WP-14	**Standardized catch rates of blacktip sharks (Carcharhinus limbatus) collected during a bottom longline survey in Mississippi coastal waters, 2004-2011**	**Eric Hoffmayer,Jill Hendon, and Adam Pollack**
SEDAR29-WP-15	**Standardized catch rates of blacktip sharks (Carcharhinus limbatus) collected during a SEAMAP bottom longline survey in Mississippi/Louisiana coastal waters from**	**Jill M. Hendon, Eric R. Hoffmayer and Adam G. Pollack**

	2008 to	
SEDAR29-WP-16	Mark/Recapture Data for the Blacktip Shark, Carcharhinus limbatus, in the Gulf of Mexico from the NEFSC Cooperative Shark Tagging Program	William Swinsburg, Nancy E. Kohler, Patricia A. Turner, and Camilla T. McCandless
SEDAR29-WP-17 A	Preliminary Review of Post-release Live-discard Mortality Estimates for Sharks	Dean Courtney
SEDAR29-WP-18	Updates to age and growth parameters for blacktip shark, Carcharhinus limbatus, in the Gulf of Mexico	Michelle S. Passerotti and Ivy E. Baremore
SEDAR29-WP-19	Commercial Bottom Longline Vessel Standardized Catch Rates of Blacktip Sharks in the United States Gulf of Mexico, 1996-2010, with targeting determined using logistic regression	Kevin McCarthy
SEDAR29-WP-20	Dead discards of blacktip sharks in the Gulf of Mexico shark bottom longline fishery	Kevin McCarthy and John Carlson
SEDAR29-WP-21	A combined fishery independent gillnet series for juvenile blacktip sharks in the eastern Gulf of Mexico	John Carlson, Robert Hueter, Eric Hoffmayer, and Walter Ingram
SEDAR29-WP-22	Standardized catch rates of blacktip sharks (Carcharhinus limbatus) collected during bottom longline surveys in Mississippi, Louisiana, and Alabama coastal waters from 2004 to 2010	Eric Hoffmayer, Jill Hendon, Marcus Drymon, Sean Powers, Adam Pollack, and John Carlson
SEDAR29-WP-23	Indices of abundance score cards	SEDAR 29 Panel
SEDAR29-WP-24	A state space, age-structured production model (SSASPM) with application to Gulf of Mexico blacktip shark: computer code	Enric Cortés
Final Stock Assessment Reports		
SEDAR21-SAR	Gulf of Mexico Blacktip Shark	
Reference Documents		
SEDAR29-RD01	SEDAR 11 (LCS) Final Stock Assessment Report	SEDAR 11 Panels
SEDAR29-RD02	Distributions of Sharks across a Continental Shelf in the Northern Gulf of Mexico	J. Marcus Drymon, Sean P. Powers, John Dindo, Brian Dzwonkowski, and Terry Henwood
SEDAR29-RD03	Microsatellite and mitochondrial DNA analyses of the genetic structure of blacktip shark (Carcharhinus limbatus) nurseries in the northwestern Atlantic, Gulf of Mexico, and Caribbean Sea	D.B. Keeney, M.R. Heupel, R.E. Hueter, and E.J. Heist
SEDAR29-RD04	Estimation of catches of sandbar (Carcharhinus plumbeus) and blacktip (C. limbatus) sharks in the Mexican fisheries of Gulf of Mexico (SEDAR 11-DW-06)	R. Bonfil and E. Babcock
SEDAR29-RD05	Abundance Indices Workshop: Developing protocols for submission of abundance indices to the SEDAR process	SEDAR Procedural Workshop I
SEDAR29-RD06	Do differences in life history exist for blacktip sharks, Carcharhinus limbatus, from the United States South Atlantic Bight and Eastern Gulf of Mexico?	John K. Carlson, James R. Sulikowski, Ivy E. Baremore

SEDAR29-RD07	**Hierarchical analysis of blacknose, sandbar, and dusky shark CPUE indices (SEDAR21-AW-01)**	**Paul Conn**

Appendix 2: Statement of Work for Stephen Smith

External Independent Peer Review by the Center for Independent Experts

SEDAR 29 Highly Migratory Species Gulf of Mexico Blacktip Shark Review

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's 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 29 will be a compilation of data, a standard assessment of the stock, and CIE assessment review conducted for HMS Gulf of Mexico Blacktip shark. The desk review provides an independent peer review of SEDAR stock assessments. The review is responsible for ensuring that the best possible assessment is provided through the SEDAR process and will provide guidance to the SEFSC to aid in their review and determination of best available science, and to HMS when determining if the assessment is useful for management. The stocks assessed through SEDAR 29 are within the jurisdiction of the Highly Migratory Species Division of NOAA Fisheries and the states of Texas, Louisiana, Mississippi, Alabama, and Florida. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have working knowledge and recent experience in the application of stock assessment, statistics, fisheries science, and marine biology sufficient to complete the primary task of reviewing the technical details of the methods used for the assessment. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review as a desk review, therefore no travel is required.

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, and other pertinent information. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

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

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

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

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

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than 19 June 2012, 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 to 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.

21 May 2012	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact.
4 June 2012	NMFS Project Contact sends the stock assessment report and background documents to the CIE reviewers. Background documents may be sent to the CIE reviewers one week earlier.
4-15 June 2012	Each reviewer conducts an independent peer review as a desk review.
19 June 2012	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator.
3 July 2012	CIE submits the CIE independent peer review reports to the COTR.
10 July 2012	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).

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).

Support Personnel:

William Michaels, Program Manager, COTR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-427-8155

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPerretti@ntvifederal.com Phone: 571-223-7717

Key Personnel:

NMFS Project Contact:

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

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.

3. The reviewer report shall include the following appendices:

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

Annex 2: Terms of Reference for the Peer Review

SEDAR 29 HMS Gulf of Mexico Blacktip Shark

1. Evaluate the data used in the assessment, addressing the following:
   e) Are data decisions made by the assessment panel sound and robust?
   f) Are data uncertainties acknowledged, reported, and within normal or expected levels?
   g) Are data applied properly within the assessment model?
   h) Are input data series reliable and sufficient to support the assessment approach and findings?
2. Evaluate the methods used to assess the stock, taking into account the available data.
   d) Are methods scientifically sound and robust?
   e) Are assessment models configured properly and used consistent with standard practices?
   f) Are the methods appropriate for the available data?
3. Evaluate the assessment findings with respect to the following:
   f) Are abundance, exploitation, and biomass estimates reliable, consistent with input data and population biological characteristics, and useful to support status inferences?
   g) Is the stock overfished? What information helps you reach this conclusion?
   h) Is the stock undergoing overfishing? What information helps you reach this conclusion?
   i) Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   j) Are the quantitative estimates of the status determination criteria for this stock reliable? If not, are there other indicators that may be used to inform managers about stock trends and conditions?
4. Evaluate the stock projections, rebuilding timeframes, and generation times, addressing the following:
   e) Are the methods consistent with accepted practices and available data?
   f) Are the methods appropriate for the assessment model and outputs?
   g) Are the results informative and robust, and useful to support inferences of probable future conditions?
   h) Are key uncertainties acknowledged, discussed, and reflected in the projection results?

5. Consider how uncertainties in the assessment, and their potential consequences, are addressed.
    - Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods
    - Ensure that the implications of uncertainty in technical conclusions are clearly stated.
6. Consider the research recommendations provided and make any additional recommendations or prioritizations warranted.
    - Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
    - Provide recommendations on possible ways to improve the SEDAR process.
7. Provide guidance on key improvements in data or modeling approaches which should be considered when scheduling the next assessment.
8. Prepare a Peer Review Report summarizing the Reviewer's evaluation of the stock assessment and addressing each Term of Reference.