Reviewer's Report of SEDAR 24 Assessment Review Workshop on Atlantic Red Snapper

By

Robin Cook

Prepared for

The Center for Independent Experts

44 North Deeside Road
Bieldside
Aberdeen AB15 9DR
United Kingdom

Executive Summary

1. Atlantic Red Snapper was reviewed as part of the SEDAR 24 process by a panel of four experts including three independent experts from the CIE. The review took place in Savannah, GA from 12th-14th October 2010.
2. The consultant reviewed the available documents before the meeting, participated in the review workshop and contributed to the Summary report.
3. Data used in the assessment were appropriate and consisted of landings, discards, commercial CPUE, length compositions and age compositions. All data sources are subject to high uncertainty. No fishery independent abundance indices were available.
4. The main assessment was BAM, an age structured forward projection model with observation error and is therefore both adequate and appropriate for the assessment. Additional assessments were carried out using a surplus production model, ASPIC.
5. The base assessment from the BAM runs was considered appropriate for estimates of abundance, biomass and exploitation, though it represents just one of many plausible interpretations of the data.
6. Although estimates of F_{msy} and B_{msy} differed greatly between various assessment runs, the ratios of F/Fmsy and B/Bmsy were very stable and all suggested the stock was experiencing overfishing and was overfished. These ratios are, however, all conditioned on a Beverton-Holt stock recruitment function and a different structural model may significantly change the perception of the state of the stock.
7. Methods to project future population status were considered to be adequate and appropriate but with some concern that the level of uncertainty in the projections was too low. The longer term projects are probably only indicative of rebuilding times and should not be regarded as accurate estimates.
8. Uncertainty was examined using Monte Carlo bootstrap on the assessment input values and data, a sensitivity analysis and the use of alternative assessment models. All these analyses suggested the stock was overfished and experiencing overfishing. The Monte Carlo bootstrap and the sensitivity analysis tended only to explore a restricted range of uncertainty and it seems likely that the evaluation of stock status could be more uncertain than the assessment might suggest. Sensitivity to the recruitment assumption needs to be investigated further.
9. The SEDAR process worked well with the documentation well prepared and good meeting facilities. Consideration needs to be given to the way the draft assessment report is reviewed before the main Assessment Review Workshop.
10. Research recommendations from the data and assessment workshops were supported by the Review Panel and these were classified into first and second tier priority. Particular priorities for further investigation should be the sensitivity to the recruitment function and the uncertainty in the catch data.

Background

1. Red snapper is an important commercial and recreational fishery resource and is a focal species in the management of the US South Atlantic Snapper-Grouper complex. The SEDAR 24 process involves a compilation of data, a benchmark assessment of the stock, and an assessment review. Since the previous benchmark assessment of the stock in SEDAR 15 new data have been made available for the recreational catch and discard data. The present assessment was initially intended to be an update assessment but was treated in the workshop as a full benchmark assessment. CIE experts were appointed to act as independent peer reviewers for:

    i.   the Data Workshop (1 CIE reviewer);
    ii.   the draft Assessment Report (1 CIE reviewer);
    iii. the Assessment Review Workshop (3 CIE reviewers, 1 SAFMC-SSC reviewer).

2. Under item (ii) the draft assessment report was sent to a CIE reviewer prior to the finalization of the Assessment Report. This was intended to provide an opportunity for the assessment team to undertake updated assessment runs and hence reduce analytical work at the Review Workshop. The final report included changes suggested by the reviewer as well as those from the wider public.

    The review was conducted in Savannah, GA, from the 12th -14th October 2010.

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

3. Prior to the meeting the reviewer accessed documents from the SEDAR ftp site and reviewed the main assessment reports. Immediately before the meeting commenced the reviewer met with the chair and the other Panel members to agree responsibilities during the meeting. I agreed to draft text for the Panel report in respect of ToRs 4 and 6. During the meeting the reviewer participated in the discussions and agreed additional analysis requests with the Panel. Following the conclusion of the plenary session, the reviewer prepared draft text for the summary report and agreed the draft report with the Panel. In the days following the meeting the reviewer corresponded with the chair and panel members to reach final agreement on the Summary Report.

Summary of Findings for each ToR

Evaluate the adequacy, appropriateness, and application of data used in the assessment.

4. The assessment used catch data in biomass and numbers, age compositions, length compositions and CPUE indices from fishery sources. Some data on discards were available.

5. The catch data come from both the commercial fishery and the (larger) recreational fishery. For early years much of the data is derived, notably for the recreational fishery. A mean weight of fish in the recreational fishery and the ratio between commercial landings and the recreational landings has been used to derive the data. Other assumptions were made about the growth of the fishery where no catch data were available. Overall this means that early catch data are not reliable and should be regarded as illustrative. An important point to note is that when fitting the BAM assessment model high weight was given to the catch data implying it is far more precise than any other data used and this effectively drives the assessment.

6. Some age and length data were available and initially all these data were included in the assessment. Following a reviewer's comments on the draft assessment report length data were omitted where age composition data were available to avoid using data twice (since the age compositions are derived from length compositions). At face value, this appears a reasonable thing to do but it does remove information on the variance of length at age used in the model and it may be worth re-considering the omission of the data.

7. Although CPUE indices were available, these were derived from fishery data and, while they were standardized to account for potential bias, there remains the possibility that such bias still exists. It would be highly desirable to try to develop a fishery independent abundance index to overcome this problem.

8. While there are clearly weaknesses in the data, they should be regarded as appropriate and adequate to perform an assessment

Evaluate the adequacy, appropriateness, and application of methods used to assess the stock.

9. The stock has relatively sparse data and the principal assessment model (BAM) is able to make good use of this limited information to gain insight into the longest possible time series of population estimates. BAM is an age structured forward projection model with observation error and is therefore both adequate and appropriate for the assessment.

10. The complexity of BAM and the absence of hard information on certain quantities (e.g. natural mortality, changes in catchability, etc) means that a number of pragmatic assumptions have to be made to run the model and this will inevitably lead to debate about the validity of the assumptions. In my view the simplifying assumptions made are all defendable and while alternative assumptions could be made, these would not necessarily provide a better assessment. I was concerned, however, about the high weighting given to the catches which implies these are precisely estimated. The assessment team argued that catches provide the only information to scale the stock estimates and therefore merit high weight. While the scaling issue is important, my impression was that the high weighting was done more for computational convenience rather than realism and I think the influence of the catch data on the assessment merits much more analysis as they drive the assessment yet are quite uncertain for early years.

11. The draft assessment report was independently reviewed before the Assessment Review Workshop and as a result, the data weighting in the model objective function was changed from fixed to iteratively reweighted. The change was recommended to provide more realistic weighting to the various data components. This approach is commonly used but has its weaknesses also. In this case the model fit appeared to deteriorate and allowed high weight to be given to a short time series. There was insufficient time between the reviewer's comments and the Assessment Review Workshop to fully explore this problem so it is difficult to judge whether this change was actually an improvement. It is a problem which merits further analysis but which should not affect the current perception of the state of the stock.

12. In addition to the BAM assessment, a simpler surplus production model (ASPIC) was also applied using the catch and CPUE indices. Although ASPIC is not able to make use of age structured and length structured data, it is an appropriate assessment tool since it avoids having to make assumptions about selectivity and the distribution of length at age. It is also appropriate for exploring model uncertainty. The ASPIC model was applied appropriately but it is noteworthy that the treatment of the catch data differed from BAM due to the way recreational catch had to be converted to biomass from numbers. The catch stream used is lower, especially in early years and perhaps explains why ASPIC suggested the extent of overfishing was lower that the BAM estimates. The difference is important because as indicated above BAM was run with high weight on the catch, yet a somewhat arbitrary change in the way catch is derived appears to make a large change to the position of the stock relative to F_{msy}.

Recommend appropriate estimates of stock abundance, biomass, and exploitation.

13. The panel spent a considerable amount of time addressing this term of reference. It proved very difficult to choose a singe realization that stood out as being 'best'. Much of the debate centered on the use of iterative reweighting, which while appropriate, appeared to worsen the model fit. For pragmatic reasons the BAM base run was suggested as the run from which to take estimates of abundance, biomass and exploitation. It is very important to appreciate that the base run is only one of many equally plausible runs and it is suggested mainly because it makes use of the best expert knowledge in configuring the model.

14. The way output is generated from BAM can give the impression that the values in the whole time series of population estimates are all equally valid. In practice, prior to the mid 1970s when scientific data improved the amount of information for the model, the early year values are little more than theoretical estimates predicated on assumptions of historical constancy in the fishery and the stock. Hence it is unwise to interpret the stock trajectory from the 1950s to the mid 1970s as representing what actually occurred.

Evaluate the methods used to estimate population benchmarks and management parameters (*e.g., MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies*); recommend appropriate management benchmarks, provide estimated values for management benchmarks, and provide declarations of stock status.

15. The MSY benchmarks were calculated using a Beverton-Holt recruitment curve estimated from within the model. The Beverton-Holt curve has a number computationally convenient attributes that make it the curve of choice for many assessments. Unfortunately most stock-recruitment curves cannot be estimated with any precision and this assessment is no exception. Consequently there is a question mark about the reliability of the MSY values not least because the estimated recruitment curve has few values to define the asymptote and steepness proved problematic to estimate. The various sensitivity runs all placed the stock in the overfished/overfishing category on the basis of ratios of F/Fmsy and B/Bmsy. This gives the appearance of robustness but all the runs are conditioned on the same stock-recruitment function. A trial run of the BAM model with a Ricker stock-recruitment function suggested that the MSY values might be very different, though it was not possible at the workshop to quality assure this analysis. In view of the apparent very large decline in the stock in relation to MSY benchmarks and the indications from the preliminary Ricker analysis of high sensitivity, it would be desirable to investigate the robustness of the benchmark calculations especially in relation to the recruitment function.

16. Without more specific evidence to the contrary, the Panel supported the view that the stock was overfished and experiencing overfishing.

Evaluate the adequacy, appropriateness, and application of the methods used to project future population status; recommend appropriate estimates of future stock condition (e.g., exploitation, abundance, biomass).

17. Projections were based in the BAM model results for the base run. This run was subjected to a parametric bootstrap and projections then were initialized from one of the bootstrap realizations. This incorporates uncertainty in the initial population parameters including stock size. Process error in recruitment was included in stochastic projections. This is an appropriate method for projections though the uncertainty derived from the bootstrap is likely to be an underestimate. It is inevitable that the projections soon become dominated by model generated values as the calculation moves forward in time and observed year classes drop out of the projected population. Given the very large uncertainty in recruitment on which the projections depend, it is unlikely that estimates beyond a few years have very much meaning and should be treated with appropriate caution. It is probably reasonable to conclude that rebuilding will take decades but the likely rebuilding times suggested by the projections should not be regarded as precise, particularly in view of the uncertainty in the stock-recruitment relationship.

18. The projections illustrate a challenging problem for fishery managers as the moratorium on red snapper landings appears to have a minimal effect in rebuilding the stock. This is caused by discard mortality and implies that for rebuilding to occur, a different management intervention is required.

Evaluate the adequacy, appropriateness, and application of methods used to characterize uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters. Comment on the degree to which methods used to evaluate uncertainty reflect

and capture the significant sources of uncertainty. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

19. Uncertainty in the assessment was characterized through the use of a Monte Carlo parametric bootstrap and a sensitivity analysis. The parametric bootstrap explores uncertainty in the input values and data rather than the model fit itself which would require bootstrapping the model residuals. As a result the uncertainty from this approach is likely to underestimate uncertainty in the main assessment. Nevertheless it does provide some insights into the uncertainties.

20. The sensitivity analysis examined a wide range of alternative values which gives a full picture of the direction and rate of change of the assessment in response to modest changes to parameter values. In some cases, such a F_{init}, it would have been preferable to explore a wider range of parameter values and the panel asked for additional runs to be performed. These illustrated that the higher F_{init} values improved the model fit while giving less plausible perceptions of stock depletion. This suggests an area worthy of further investigation.

21. The ASPIC runs can be viewed as a means of looking at model uncertainty in the assessment given their rather different structural assumptions about age structure and recruitment. These runs did show differences in the extent of over fishing and overfished state and appear at least in part to be due to the way the catch data are utilized by the model compared with BAM. Examining alternative assessment models is an extremely useful way of exploring uncertainty and I would recommend the other model formulations are attempted in the future to gain more insight into the assessment results.

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.

22. The Panel ensured this ToR was complied with.

Evaluate the SEDAR Process as applied to the reviewed assessment and identify any Terms of Reference which were inadequately addressed by the Data or Assessment Workshops.

23. The SEDAR process is mature and works well. Relevant documents were available approximately one week before the meeting which was adequate to review the main papers. It was not possible in the time available to review all the data workshop documents and given that the Data Workshop had been independently reviewed I assumed that there was little further need for review.

24. An unexpected development was that the draft assessment report was independently reviewed before the Review Panel meeting and changes were made to the assessment report as a result. This does rather question the respective roles of the intermediate review and the final review with a danger of the Review Panel reviewing the reviewer. There was discussion of this issue during the meeting with a general unease about it. There is an argument for an independent challenge function during the assessment work itself to ensure that model

assumptions and methods are justified. There is also an argument for external expertise during the assessment to provide different insight for the analysis. However, this is a somewhat different role to independent review. It might be worth reflecting on how best to use external expertise during the assessment process.

Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted. Clearly denote research and monitoring needs that could improve the reliability of future assessments. Recommend an appropriate interval for the next assessment, and whether a benchmark or update assessment is warranted.

25. The panel reviewed and endorsed the research recommendations from the Data and Assessment Workshops. It also classified these into tier 1 and tier 2 priorities.

26. From the perspective of the assessment I would suggest that the highest priority is to examine the role of the stock recruitment assumption as it appears to have a potentially large effect on the assessment and the estimation of benchmarks. It might help to explain why the stock appears to be so far from MSY.

27. I also believe that more analysis needs to be done on the dependence of the assessment on the catch data. These are highly uncertain but are treated as very precise in the assessment. This is not a healthy state of affairs and it is important to know whether the dependence of the assessment on the catch data provides a reliable interpretation of the state of the stock. There is a danger of getting a good fit to unreliable information.

Prepare a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report no later than November 1, 2010.

28. The Panel prepared the report as required.

Conclusions

29. The SEDAR process functions well in providing a participatory forum to prepare data, perform and review assessments.

30. The red snapper assessment is relatively data poor with high uncertainty on the catches, limited age and length compositions and no fishery independent abundance indices. There is probably sufficient data since the mid 1970s to give an adequate estimate of stock trends and fishing mortality rate but estimates for earlier years are likely to be unreliable.

31. Assessment methods used were advanced and comparable to state-of-the-art methods in many other assessments. Executing the main assessment model (BAM) requires a number of assumptions to be made that were tested using, *inter alia*, sensitivity analysis. These provide a good indicator of the local sensitivity but probably do not give an adequate measure of

global sensitivity. A major source of uncertainty that should be investigated is the stock-recruitment assumption as this may influence the perception that the status of the stock is overfished and experiencing overfishing.

32. The BAM assessment model was able to interpret the data in many different ways depending on its configuration. While the relative stock status did not change greatly, the point estimates of benchmarks, stock abundance and fishing mortality rate varied considerably. This is somewhat disconcerting and suggests that there is insufficient information in the data to obtain reliable estimates. It points to the need explore model uncertainty more fully by using a greater variety of methods than was used in the assessment report.

33. Projections from the assessment should be regarded as indicative of long rebuilding times but not accurate estimates of the probability of attaining rebuilding targets. Shorter term projections of up to five years may be more reliable as these will be driven by year classes that have been estimated from real data.

Recommendations

a) It would be highly desirable to try to develop a fishery independent abundance index to improve the reliability of the assessment and avoid possible bias in arising from the commercial CPUE. (point 7 above)

b) The influence of the catch data on the assessment merits much more analysis as they have a large influence on the assessment yet are quite uncertain for early years. (point 10 above)

c) It would be desirable to investigate the robustness of the benchmark calculations in relation to the choice of stock-recruitment function. (point 15 above)

d) Higher F_{init} values improved the model fit while giving less plausible perceptions of stock depletion. This problem should be investigated. (point 20 above)

e) Examining alternative assessment models is an extremely useful way of exploring uncertainty and I would recommend the other model formulations are attempted in the future to gain more insight into the assessment results. (point 21 above)

f) It might be worth reflecting on how best to use external expertise during the assessment process. (point 24 above)

Appendix 1. Documents Prepared for the Workshop

Documents Prepared for the Review Workshop		
SEDAR24-RW01	The Beaufort Assessment Model (BAM) with application to red snapper: mathematical description, implementation details, and computer code	Sustainable Fisheries Branch, NMFS 2010
SEDAR24-RW02	Paper not completed, withdrawn on 9-29-10	
SEDAR24-RW03	Red snapper: Iterative re-weighting of data components in the Beaufort Assessment Model	Sustainable Fisheries Branch, NMFS 2010
Final Assessment Reports		
SEDAR24-SAR	Assessment of Red Snapper in the US South Atlantic	To be prepared by SEDAR 24
Reference Documents		
SEDAR24-RD01	Age, Growth, And Reproduction Of The Red Snapper, *Lutjanus Campechanus*, From The Atlantic Waters Of The Southeastern U.S.	D. B. White, S. M. Palmer 2004
SEDAR24-RD02	Age and growth of red snapper, *Lutjanus Campechanus*, from the southeastern United States	S. McInerny 2007
SEDAR24-RD03	Commercial catch composition with discard and immediate release mortality proportions off the southeastern coast of the United States	J. A. Stephen, P. J. Harris 2010
SEDAR24-RD04	The 1960 Salt-Water Angling Survey, USFWS Circular 153	J. R. Clark c.1962
SEDAR24-RD05	The 1965 Salt-Water Angling Survey, USFWS Resource Publication 67	D. G. Deuel, J. R. Clark 1968
SEDAR24-RD06	1970 Salt-Water Angling Survey, NMFS Current Fisheries Statistics Number 6200	D. G. Deuel 1973
SEDAR24-RD07	Lecture Notes on Coastal and Estuarine Studies, #10 Fisheries Management, Ch VII Marine Sport Fisheries	J. L. McHugh 1984
SEDAR24-RD08	Survey of Offshore Fishing in Florida	M. A. Moe, Jr. 1963
SEDAR24-RD09	Geographic Comparison of Age, Growth, Reproduction, Movement, and Survival of Red Snapper off the State of Florida	K. M. Burns, N. J. Brown-Petterson, R. M. Overstreet 2006

SEDAR24-RD10	Regional Differences in Florida Red Snapper Reproduction	N. J. Brown-Petterson, K. M. Burns, R. M. Overstreet 2008
SEDAR24-RD11	Evaluation of the Efficacy of the Minimum Size Rule in the Red Grouper and Red Snapper Fisheries With Respect to J and Circle Hook Mortality and Barotrauma and the Consequences for Survival and Movement	K. M. Burns 2009
SEDAR24-RD12	Survival of Released Red Snapper progress Report	R. O. Parker, Jr. 1985
SEDAR24-RD13	Survival of Released Reef Fish—A Summary of Available Data (Preliminary)	R. O. Parker, Jr. 1991
SEDAR24-RD14	Incorporating Mortality from Catch and Release into Yield-per-Recruit Analyses of Minimum-Size Limits	J. R. Waters, G. R. Huntsman 1986
SEDAR24-RD15	Modified hooks reduce incidental mortality of snapper (*Pagrus auratus*: Sparidae) in the New Zealand commercial longline fishery	T. J. Willis, R. B. Millar 2001
SEDAR24-RD16	Key principles for understanding fish bycatch discard mortality	M. W. Davis 2002
SEDAR24-RD17	Indirect Estimation of Red Snapper (Lutjanus campechanus) and gray Triggerfish (*Balistes capriscus*) Release Mortality	W. F. Patterson, III, G. W. Ingram, Jr., R. L. Shipp, J. H. Cowan, Jr. 2002
SEDAR24-RD18	Red Snapper Discards in Texas Coastal waters-a Fishery Dependent Onboard Survey of Recreational Headboat Discards and Landings	B. A. Dorf 2003
SEDAR24-RD19	Partitioning Release Mortality in the Undersized Red snapper Bycatch: Comparison of Depth vs. Hooking Effects	K. M. Burns, N. F. Parnell, R. R. Wilson, Jr. 2004
SEDAR24-RD20	Catch-and-release science and its application to conservation and management of recreational fisheries	S. J. Cooke, H. L. Schramm 2007
SEDAR24-RD21	Discard composition and release fate in the snapper and grouper commercial hook-and-line fishery in North Carolina, USA	P. J. Rudershausen, J. A. Buckel, E. H. Williams 2007
SEDAR24-RD22	Evaluating the physiological and physical consequences of capture on post-release survivorship in large pelagic fishes	G. B. Skomal 2007
SEDAR24-RD23	Release Mortality of Undersized Fish from the Snapper–Grouper Complex off the North Carolina	A. S. Overton, J. Zabawski, K. L.

	Coast	Riley 2008
SEDAR24-RD24	Capture depth related mortality of discarded snapper (*Pagrus auratus*) and implications for management	J. Stewart 2008
SEDAR24-RD25	Linking ''Sink or Swim'' Indicators to Delayed Mortality in Red Snapper by Using a Condition Index	S. L. Diamond, M. D. Campbell 2009
SEDAR24-RD26	Does Venting Promote Survival of Released Fish?	G. R. Wilde 2009
SEDAR24-RD27	Field Experiments on Survival Rates of Caged and Released Red Snapper	G. R. Gitschlag, M. L. Renaud 1994
SEDAR24-RD28	Red Snapper in the Northern Gulf of Mexico: Age and Size Composition of the Commercial Harvest and Mortality of Regulatory Discards	D. L. Nieland, A. J. Fischer, M. S. Baker, Jr., C. A. Wilson, III 2007
SEDAR24-RD29	Factors Affecting Catch and Release (CAR) Mortality in Fish: Insight into CAR Mortality in Red Snapper and the Influence of Catastrophic Decompression	J. L. Rummer 2007
SEDAR24-RD30	Evaluation of The Efficacy of the Current Minimum Size Regulation for Selected Reef Fish Based on Release Mortality and Fish Physiology	K. M. Burns, N. J. Brown-Peterson, R. M. Overstreet 2008
SEDAR24-RD31	American Fishes - A Popular Treatise upon the Game and Food Fishes of North America with Especial Reference to Habits and Methods of Capture	G. B. Goode, T. Gill 1903
SEDAR24-RD32	Proceedings: Colloquium on Snapper-Grouper Fishery Resources of the Western Central Atlantic Ocean	H. R. Bullis, Jr., A. C. Jones 1976
SEDAR24-RD33	Growth and Mortality of Red Snappers in the West-Central Atlantic Ocean and Northern Gulf of Mexico	R. S. Nelson, C. S. Manooch, III 1982
SEDAR24-RD34	Yield Per Recruit Models of Some Reef Fishes of the U. S. South Atlantic Bight	G. R. Huntsman, C. S. Manooch, III, C. B. Grimes 1983
SEDAR24-RD35	Population Assessment of the Red Snapper, *Lutjanus campechanus*, from the Southeastern United States	C. S. Manooch, III, J. C. Potts, D. S. Vaughan, M. L. Burton 1997
SEDAR24-RD36	Executive Summary: Review of Recreational Fisheries Survey Methods	National Research Council 2006

SEDAR24-RD37	Spawning Locations for Atlantic Reef Fishes off the Southeastern U.S.	G. R. Sedberry, O. Pashuk, D. M. Wyanski, J. A. Stephen, P. Weinbach 2006
SEDAR24-RD38	More Red Snapper Discussion	J. H. Cowan, Jr. 2009
SEDAR24-RD39	A Perspective of the Importance of Artificial Habitat on the Management of Red Snapper in the Gulf of Mexico	R. L. Shipp, S. A. Bartone 2009
SEDAR24-RD40	National Survey of Fishing and Hunting	Dept Interior 1955
SEDAR24-RD41	National Survey of Fishing and Hunting 1960	Dept Interior 1960
SEDAR24-RD42	FMP, Regulatory Impact Review, and Final Environmental Impact Statement for the SG Fishery of the South Atlantic Region	SAFMC 1983
SEDAR24-RD43	Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Gulf of Mexico) – Red Snapper	D. Morgan 1988
SEDAR24-RD44	Evaluation of Multiple Factors Involved in Release Mortality of Undersized Red Grouper, Gag, Red Snapper and Vermilion Snapper	K. M. Burns, C. C. Koenig, F. C. Coleman 2002
SEDAR24-RD45	Physiological Effects of Swim Bladder Overexpansion and Catastrophic Decompression on Red Snapper	J. L. Rummer, W. A. Bennet 2005
SEDAR24-RD46	A Review of Movement in Gulf of Mexico Red Snapper: Implications for Population Structure	W. F. Patterson, III 2007
SEDAR24-RD47	J and Circle Hook Mortality and Barotrauma and the Consequences for Red Snapper Survival	K. M. Burns 2009
SEDAR24-RD48	Procedural Guidance Document 2 - Addressing Time-Varying Catchability	SEDAR 2009
SEDAR24-RD49	Final Report on Bioeconomic Analysis of the Red Snapper Rebuilding Plan and Transferable Rights Policies in the Gulf of Mexico with Supplementary Technical Document to the Final Report	W. L. Griffin, R. T. Woodward 2009
SEDAR24-RD50	Comments On SPR-Based Benchmarks For Red Snapper Stocks in the Southeastern USA	R. Methot, P. Rago, G. Scott 2009
SEDAR24-RD51	The Recreational fishery in South Carolina: The Little River Story	V. G. Burrell 2000
SEDAR24-RD52	Southeastern U.S. Deepwater Reef Fish Assemblages, Habitat characteristics, Catches, and	R. O. Parker, R. W. Mays 1998

	Life History Summaries	
SEDAR24-RD53	American Game and Food Fishes pp 410-412	D. S. Jordan, B. W. Evermann 1908
SEDAR24-RD54	Comparison of two approaches for estimating natural mortality based on longevity.	D. A. Hewitt, J. M. Hoenig 2005.
SEDAR24-RD55	Notes on the red snapper fishery	J. W. Collins 1886
SEDAR24-RD56	Southeast Region Headboat Survey Program Description	K. Brennan 2010
SEDAR24-RD57	Biological-Statistical Census of the Species Entering Fisheries in the Cape Canaveral Area	W. W. Anderson, J. W. Gehringer 1965
SEDAR24-RD58	Abundance Indices Workshop: Developing protocols for submission of abundance indices to the SEDAR process. SEDAR Procedures Workshop 1	SEDAR 2008
SEDAR24-RD59	Source Document for the Snapper-Grouper Fishery of the South Atlantic Region	SAFMC 1983
SEDAR24-RD60	Projected Combined Effects of Amendments 13C, 16, and 17A Regulations on south Atlantic Red Snapper Removals. SERO-LAPP-2009-07(Rev)	SERO v Jan 2010
SEDAR24-RD61	Catch Characterization and Discards within the Snapper Grouper Vertical Hook-and-Line Fishery of the South Atlantic United States	Gulf & SA Fisheries Foundation 2008
SEDAR24-RD62	Returns from the 1965 Schlitz Tagging Program Including a Cumulative Analysis of Previous Results	D. S. Beaumariage 1969
SEDAR24-RD63	Length of Recall Period and Accuracy of Estimates from the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation	W. L. Fisher, A.E. Grambsch, D.L. Eisenhower, D.R. Morganstein 1991
SEDAR24-RD64	Shelf -edge and upper slope reef fish assemblages in the South Atlantic Bight: habitat characteristics, spatial variation, and reproductive behavior	C. M. Schobernd, G. R. Sedberry 2009
SEDAR24-RD65	A survey of the number of anglers and of their fishing effort and expenditures in the coastal recreational fishery of Florida	Ellis et al., 1958
Previous SEDARs Documents of Interest		
SEDAR7-DW13	The steepness stock-recruit parameter for red snapper in the Gulf of Mexico (Lutjanus campechanus): what can be learned from other fish stocks?	M. K. McAllister 2004

SEDAR7-DW19	Estimating Catches and fishing Effort of the Southeast United States Headboat Fleet, 1972-1982	R. L. Dixon, G. R. Huntsman, Undated Draft
SEDAR7-AW16	Estimates of Historical Red Snapper Recreational Catch Levels Using US Census Data and Recreational Survey Information	G. P. Scott 2004
SEDAR7-SAR1	Stock Assessment Report Gulf of Mexico Red Snapper, SEDAR7 Assessment Report 1	SEDAR 2005
SEDAR17-RD18	The summer flounder chronicles: Science, politics, and litigation, 1975-2000.	M. Teceiro 2002
SEDAR17-RD20	Comparing 1994 angler catch and harvest rates from on-site and mail surveys on selected lakes.	B. Roach, J. Trial, and K. Boyle 1999.
SEDAR17-RD23	Effects of recall bias and nonresponse bias on self-report estimates of angling participation.	M. A. Tarrant, M. J. Manfredo, P. B. Bayley, R. Hess 1993
SEDAR19-DW05	Evaluation of the 1960, 1965, and 1970 U.S. Fish and Wildlife Service salt-water angling survey data for use in the stock assessment of red grouper (Southeast US Atlantic) and black grouper (Southeast US Atlantic and Gulf of Mexico)	R. Cheshire, J. O'Hop 2009
SEDAR7-DW51	MSY, Bycatch and Minimization to the "Extent Practicable"	J. E. Powers 2004
SEDAR19-RD27	The Natural Mortality Rate of Gag Grouper: A Review of Estimators for Data-Limited Fisheries.	T. J. Kenchington

Appendix 2: Statement of Work for Dr. Robin Cook

External Independent Peer Review by the Center for Independent Experts

SEDAR 24 Review on South Atlantic Red Snapper Assessment

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 24 will be a compilation of data, a benchmark stock assessment, and an assessment review for US South Atlantic red snapper conducted under the Southeast Data, Assessment and Review (SEDAR) process. The assessment will be conducted for the South Atlantic Fishery Management Council (SAFMC), which has responsibility for management of the South Atlantic snapper-grouper complex fishery, of which red snapper is a member. The lead assessment agency will be the Southeast Fisheries Science Center of the US National Marine Fisheries Service (NMFS). Other entities involved in the data evaluation and assessment development processes will be the four US South Atlantic States, the NMFS Southeast Regional Office, other NMFS data providers and analysts, and fisheries representatives.

 Red snapper is an important commercial and recreational fishery resource and is a focal species in the management of the US South Atlantic Snapper-Grouper complex. The most recent assessment was a benchmark accomplished in 2008, via SEDAR 15. Additional discard mortality and historic recreational fishery data have been acquired since SEDAR 15. The SEDAR 24 peer review will involve a panel composed of a chair named by SAFMC from its Science and Statistics Committee (SSC), two reviewers from the SAFMC SSC, and three CIE reviewers.   The duties of CIE panelist shall not exceed 12 workdays; several days prior to the meeting for document review; three workshop days; and several days following the workshop to complete the independent peer review in accordance with the Terms of Reference, and to ensure final review comments and document edits are provided to the Chair. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have expertise, background, and recent experience in stock assessment, statistics, fisheries science, and marine biology sufficient to complete their primary tasks (1) to conduct an impartial and independent peer review in accordance with the Review Workshop Terms of Reference to determine if the best available science is utilized for fisheries management decisions, and (2) to present the review in writing. 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 Savannah, Georgia during 12-14 October 2010.

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.

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 Savannah, Georgia during 12-14 October 2010.
3) During 12-14 October 2010 in Savannah, Georgia as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than 22 October 2010, 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 David Sampson david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

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

7 September 2010	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
29 September 2010	NMFS Project Contact sends the CIE Reviewers the pre-review documents
12-14 October 2010	Each reviewer participates and conducts an independent peer review during the panel review meeting
22 October 2010	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
29 October 2010	CIE submits CIE independent peer review reports to the COTR
1 November 2010	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. 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) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

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

Support Personnel:

William Michaels, Contracting Officer's Technical Representative (COTR)
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov   Phone: 301-713-2363 ext 136

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:

Kari Fenske, SEDAR Coordinator
4055 Faber Place Drive, Suite 201, North Charleston, SC 29405
Kari.fenske@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.

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

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

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

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

   e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

SEDAR 24 Review Workshop

1. Evaluate the adequacy, appropriateness, and application of data used in the assessment.
2. Evaluate the adequacy, appropriateness, and application of methods used to assess the stock.
3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
4. Evaluate the methods used to estimate population benchmarks and management parameters (*e.g., MSY, Fmsy, Bmsy, MSST, MFMT, or their proxies*); recommend appropriate management benchmarks, provide estimated values for management benchmarks, and provide declarations of stock status.
5. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status; recommend appropriate estimates of future stock condition (e.g., exploitation, abundance, biomass).
6. Evaluate the adequacy, appropriateness, and application of methods used to characterize uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters. Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty. Ensure that the implications of uncertainty in technical conclusions are clearly stated.
7. 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.*
8. Evaluate the SEDAR Process as applied to the reviewed assessment and identify any Terms of Reference which were inadequately addressed by the Data or Assessment Workshops.
9. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted. Clearly denote research and monitoring needs that could improve the reliability of future assessments. Recommend an appropriate interval for the next assessment, and whether a benchmark or update assessment is warranted.
10. Prepare a Peer Review Summary summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report no later than November 1, 2010.

* The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made in the assessment, alternative model configurations are recommended, or additional analyses are prepared as a result of review panel findings regarding the TORs above.

Annex 3: Agenda

Savannah, Georgia during 12-14 October 2010

Tuesday

1:00 p.m.	**Convene**	
1:00 – 1:30	**Introductions and Opening Remarks**	**Coordinator**
	- Agenda Review, TOR, Task Assignments	
1:30 – 3:30	**Assessment Presentation**	**TBD**
3:30 – 4:00	**Break**	
4:00 – 6:00	**Continue Presentation/Discussion**	**Chair**

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

Wednesday

8:00 a.m. – 11:30 a.m.	**Panel Discussion**	**Chair**
	- *Assessment Data & Methods*	
	- Identify additional analyses, sensitivities, corrections	
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:30 p.m. – 3:30 p.m.	**Panel Discussion**	**Chair**
	- Continue deliberations	
	- Review additional analyses	
3:30 p.m. – 4:00 p.m.	**Break**	
4:00 p.m. – 6:00 p.m.	**Panel Discussion/Panel Work Session**	**Chair**
	- Recommendations and comments	

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

Thursday

8:00 a.m. – 11:30 a.m.	**Panel Discussion**	**Chair**
	- Final sensitivities reviewed.	
	- Projections reviewed.	**Chair**
11:30 a.m. – 1:00 p.m.	**Lunch Break**	
1:30 p.m. – 3:30 p.m.	**Panel Discussion or Work Session**	**Chair**
	- Review Reports	
4:00 p.m.	**ADJOURN**	

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

Appendix 3: Panel Membership

Anne Lange, (Chair), SAFMC-SSC

Mike Armstrong, CIE

John Boreman, SAFMC-SSC

Noel Cadigan, CIE

Robin Cook, CIE