



Independent Expert's Report of the South East Data, Assessment, and Review meeting (SEDAR 20) for Menhaden (*Brevoortia tyrannus*) and Atlantic Croaker (*Micropogonias undulatus*), Charleston, SC, 8-12 March 2010

Prepared for the Center for Independent Experts

By

Dr Chris Darby

May 2010

**Cefas Contract
C3809**

COMMERCIAL IN CONFIDENCE

This document is the individual CIE Reviewer report of the SEDAR 20 Atlantic croaker and Atlantic menhaden review. It represents the view of the independent reviewer Dr Chris Darby.

MEETING

The South East Data, Assessment, and Review Meeting (SEDAR 20), Charleston, SC 8 – 12 March 2010 reviewing the assessment of Atlantic menhaden (*Brevoortia tyrannus*) and Atlantic croaker (*Micropogonias undulatus*).

PRIOR TO THE MEETING

Contacts

Contacts between Panel's reviewers were by e-mail and a telephone conference. The TOR were discussed and clarification sought (see below). Roles were assigned to the Panel members and suggestions made for additional information that would aid the review e.g. documents linking sections in the assessment documents to the TOR and examples of the advice that would result from the process; both allowing the context of the assessments to be discerned. The preparations allowed a swift transition into the meeting when convened.

Terms of reference

There was initial confusion with respect to the Panel's Terms of Reference; those provided read as if the Panel should be conducting the analysis rather than the assessment team. Discussions with SEDAR staff clarified the Panel's role in ensuring that the assessment team conducted the analysis provided a report sufficient to meet the TOR.

Logistics

The FTP site setup for the meeting allowed rapid dissemination of information and results and was extremely valuable prior to and during the meeting.

Draft assessment reports were available for review a week before the meeting on the site; sufficient time for the reviewers to download and conduct a general review of the assessment reports but, limited time for a detailed review of the large reports for both species. This was addressed by the Panel Chair assigning detailed roles for each species to the Panel members.

CONDUCT OF THE MEETING

The SEDAR meeting was well chaired by Kim McKown and, in combination with the well organized facilities, resources and background support provided by Dale Theiling and the SEDAR support staff, the meeting ran to schedule in a relaxed, productive format.

The time assigned to the meeting was appropriate with sufficient time for discussion and clarification of the work presented, further analysis when required and detailed discussions on each TOR for both species.

It is unfortunate that the open meeting format was not taken up more fully by the fishing industry or representatives of the sports fishers. Comments on the assessment report text and management process were provided by industry observers present at the meeting, but the opportunity was not taken to contribute to the assessment process and add their experience on the stocks' recent dynamics and status.

THE REVIEW PROCESS

The assessment coordinators were well prepared, draft assessment reports were available for review a week before the meeting, presentations and discussions were open and balanced, and sufficient time was allowed for discussions on each issue.

Suggestions for more detailed analysis and clarification studies were readily accepted and additional work required by the Panel was completed in time for subsequent discussions. The ability, attitude, and team-work demonstrated by the assessment team were of a comparable standard to assessment meetings that I have attended within ICES, Canada, and at SARC reviews.

Data

Data for both stocks was reasonably well described and illustrated. There was a tendency to omit maps which would help with the "You are here" aspect for those from out of the area, but these were quickly provided on request.

Both assessment teams are conscious as to where gaps in data require attention and where model output and the resulting stock status determination are sensitive to differing data configurations. This is especially the situation for Atlantic croaker where the scale of the estimated stock size is so different that only the trends are considered to be well estimated, not the absolute levels. There is large sensitivity in the estimation of recruitment levels, juvenile mortality rates and the stock reference levels to the inclusion of the shrimp fishery by-catch of croaker.

Assessment models

The review of the menhaden assessment was more straightforward than that of the croaker because the assessment of that species is carried out with a model that has been in use for a number of years and has been through a series of developments. Suggestion from the Panel covered different ways of looking at model output and diagnostics and alternative approaches to collating the fleet calibration data. The Panel requested a number of sensitivity runs which established that there was no major sensitivity in the stock status to the assumptions used as the basis of the assessment.

The development of the Atlantic croaker model is obviously at an early stage and there have been several approaches attempted on the way to its formulation. The current model structure is considered appropriate for assessment of the stock and the assessment team members are aware of its potential to provide the required stock metrics from the data that they have available. The Panel made several comments on the model structure and appropriate diagnostics that should be taken into consideration in future developments. However, as

discussed above, the major difficulty for the assessment of croaker and its status determination is not the model structure but the catch data to which the model is fitted.

STOCK STATUS

The status of the stocks as reported in the assessment reports and reviewed in the Panel's report is consistent with the results from the assessment models. I contributed to and agree with all the comments and conclusions.

Atlantic menhaden

The Assessment Team's conclusions, supported by the Review Panel, that "*the stock status determination is "not overfished" and there is "no overfishing", relative to the current reference points*" is appropriate and based on appropriate analyses of the available data and the current reference levels used for status determination. However, concern was raised over the use of the F_{med} as a reference level given that F_{med} is a replacement line above which only 50% of the recruitment is located; generally the level is not considered precautionary.

Atlantic croaker

The Assessment Team's conclusions, supported by the Review Panel, were that "*In 2008 overfishing was probably not occurring. There has been an upward trend in biomass since the 1980s and a decreasing trend in F. There has also been an expansion in age classes in the catch and indices, which is consistent with increasing biomass and decreasing F. However, the evaluation of stock status relative to reference points could not be made as a result of the uncertainty introduced by the lack of appropriate information on the shrimp by-catch.*" These are appropriate and based on appropriate analyses of the available data. Concern was raised over the estimation of the level of shrimp by-catch which could constitute a substantial number of 0 group fish. When estimates of the by-catch are included in the assessment there is a marked revision in the estimated 0 group recruitment level, SSB and mortality rate time trends; the stock status relative to reference points is revised substantially.

THE PANEL REPORT

The SEDAR 20 Panel report was prepared during and after the meeting and discusses all of the issues raised by the review team. I contributed to and agree with all the comments and conclusions of that report and consider that it is an accurate description of the Panel's views. I have no major additional issues that I consider were omitted from the report.

ATLANTIC MENHADEN

SUMMARY

The SEDAR 20 Panel report on Atlantic menhaden was prepared during and after the meeting and discusses all of the issues raised by the review team. I contributed to and agree with all the comments and conclusions of that report and consider that it is an accurate description of the Panel's views. I have no major additional issues that I consider were omitted from the report.

The Panel's conclusions that "overfishing was not occurring and the 2008 point estimate of fecundity was above the fecundity threshold and target, the status determination is that the stock is not overfished" are appropriate and based on appropriate analyses of the available data and the current reference levels used for status determination.

However, concern was raised over the use of the Fmed as a reference level. Given that Fmed is the replacement line above which 50% of the recruitment is located, the level is not considered precautionary and is dependent on the exploitation history and time series of information available.

There are ways in which the assessment model structure and the approach to using the data in the assessment model can be refined but this will not influence the conclusions as to the status of the stock and the level of exploitation.

INDIVIDUAL TERMS OF REFERENCE

1. *Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment:*
 - a. *Discuss data strengths and weaknesses (e.g. temporal and spatial scale, gear selectivities, aging accuracy, sampling intensity).*
 - b. *Report metrics of precision for data inputs and use them to inform the model as appropriate.*
 - c. *Describe and justify index standardization methods.*
 - d. *Justify weighting or elimination of available data sources.*

The data used in the assessment process were well presented and characterized. The assessment team was conscious as to where gaps in data require attention using additional information and is trying to address the shortcomings. The model used to fit the data allows for the data uncertainty within its structure.

The Atlantic menhaden fishery was treated as one east coast stock - which is appropriate to the information available. Time variant growth, weight, and maturity at age were derived from fishery dependent and independent data. Time variant natural mortality was estimated using a multi-species virtual population analysis (MSVPA).

Having used similar MSVPA output from the North Sea MSVPA models I consider this an appropriate usage of the data and an appropriate model for M; there were differences between

Panel members on this conclusion but the sensitivity in the assessment results to the application was relatively small.

The menhaden assessment model is fitted to commercial and recreational landings at age data, a fishery dependent adult index, developed from a pound net survey, and a juvenile index based on beach seine information. There were concerns from the panel that the models used to standardise the indices from the adult and juvenile data had been used to fill gaps in the time series. It was considered that the assessment model would be better suited to this and that this would therefore be a more appropriate approach for future developments.

Suggestions from the Panel covered different ways of looking at model output and diagnostics and alternative approaches to collating the fleet calibration data. The Panel requested a number of sensitivity runs which established that there was no major sensitivity in the stock status to the assumptions used as the basis of the assessment.

2. *Evaluate models used to estimate population parameters (e.g., F , biomass, abundance) and biological reference points.*

a. Did the model have difficulty finding a stable solution?

b. Were sensitivity analyses for starting parameter values, priors, etc. and other model diagnostics performed?

c. Have the model strengths and limitations been clearly and thoroughly explained?

d. Have the models been used in other peer reviewed assessments? If not, has new model code been verified with simulated data?

e. Compare and discuss differences among alternative models.

My only variance with some of the Panel members on this TOR was that having used the MSVPA models within the assessment of the North Sea stocks I have a little more confidence in them than others. I noted to the Assessment Team that the ICES MSVPA model has been migrated from an exact VPA to a separable model (SMS) and that it may be worth exploring the new approach with the menhaden data; although it would not be expected to make a significant difference to the trends in the estimated mortality rates.

The Beaufort Assessment Model (BAM) was accepted for the final assessment results. It has similar characteristics to a number of assessment models and was considered appropriate. There were suggestions from the Panel concerning differing definitions of the fleets used within the model, the modeling approach used to fill gaps in the data and some model assumptions with respect to the accuracy of the input data. All were addressed within sensitivity analyses.

A test case reference run was specified by the Panel based on a series of changes to the base model that were considered appropriate; the fit of the model improved with the changes, but the model estimates and stock status determination were consistent with the base assessment. Convergence checks, sensitivity analyses etc established no major problems with the model fit and estimates and the base model was accepted for the determination of stock status.

3. *Evaluate the potential for conducting assessments at a sub-regional level (e.g. Chesapeake Bay).*

Recent research results are consistent with a single Atlantic coast-wide menhaden stock. Data are available to enable assessments at a sub-regional level but would give no improvement in the determination of stock status (it would most likely add more noise).

4. *State and evaluate assumptions made for all models and explain the likely effects of assumption violations on model outputs, including:*

- a. *Calculation of M .*
- b. *Choice to incorporate constant or time-varying M and catchability.*
- c. *Choice of selectivity patterns.*
- d. *Choice of time steps in models.*
- e. *Error in the catch-at-age matrix.*
- f. *Choice of a plus group for age-structured species.*
- g. *Constant ecosystem (abiotic and trophic) conditions.*
- h. *Choice of stock-recruitment function.*
- i. *Choice of reference points (e.g. equilibrium assumptions).*

Each of the model sensitivities listed under a - h were examined by the Assessment Team and the results presented to the Panel. There were no major sensitivities that would lead to the conclusion that the stock status determination from the base model was considered as inappropriate.

Concern was raised over the use of the F_{med} as a reference level (TOR 4i), given that F_{med} is a replacement line above which only 50% of the recruitment is located; generally the level is not considered precautionary. The Panel recommended that alternative reference points be considered and chosen on the basis of providing better protection for SSB or population fecundity relative to the unfished level.

5. *Evaluate uncertainty of model estimates and biological or empirical reference points.*
a. *Choice of weighting likelihood components.*

Although almost all sensitivity runs gave the same stock status determination as the base run, bootstrap analysis of the base run showed a high degree of uncertainty in the overfishing status of the stock in 2008; approximately 40% of the runs indicate overfishing based on the current reference levels. This is a concern.

6. *Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F , SSB), reference points, and/or management measures.*

I agree that this term of reference was met and with the conclusions within the Panel report addressing this TOR. There were no retrospective patterns in the fit of the base model that would give cause for concern.

7. *Recommend stock status as related to reference points.*

The Assessment Team's conclusion that the stock status determination is “not overfished” and there is “no overfishing”, relative to the current reference points, is valid. However uncertainties in the assessment data and the fit of the model indicate that there could have been overfishing in 2008. There are concerns about the use of Fmed as a reference point which would have an effect on stock status if that were to be revised.

8. *Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.*

This TOR was addressed by the Assessment Team and the Panel and recommendations are included within the Panel report.

ATLANTIC CROAKER

SUMMARY

The SEDAR 20 Panel report on Atlantic croaker was prepared during and after the meeting and discusses all of the issues raised by the review team. I contributed to and agree with all the comments and conclusions of that report and consider that it is an accurate description of the Panel's views. I have no major additional issues that I consider were omitted from the report.

The Assessment Team's conclusion that in 2008 overfishing was probably not occurring is most likely justified; biomass has been increasing since the 1980s and F decreasing in recent years. The age range has been increasing and old fish are becoming increasingly abundant. However, it is not possible to determine the overfished status with accuracy due a problem with the determination of the discards from the shrimp fisheries. If the discard rate of 0 group fish is significant (estimates of by-catch indicate it could be as large as or larger than the directed harvest in some years) stock productivity could be degraded and the stock overfished by the shrimp fishery. The recommendation for the development of a time series of estimates of effort and by-catch from the shrimp fishery is essential to the appropriate determination of stock status.

INDIVIDUAL TERMS OF REFERENCE

1. *Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment, including the following but not limited to:*
 - a. *Discuss the effects of data strengths and weaknesses (e.g. temporal and spatial scale, gear selectivities, aging accuracy, sample size, standardization of indices) on model inputs and outputs.*
 - b. *Report standard errors of inputs and use them to inform the model if possible.*
 - c. *Justify weighting or elimination of available data sources.*

The Atlantic croaker fishery was assessed as one east coast stock which is appropriate to the information available. The assessment is fitted to commercial, recreational landings and discards proportions at age, one fishery dependent index and four fishery independent indices. Growth, weight, maturity, and natural mortality at age were developed using both fishery dependent and independent information. The data used in the assessment process was well presented and characterized by the Assessment Team who were conscious as to where gaps in data require attention. There was a tendency to omit maps which would help with the "You are here" aspect for those for out of the area, but these were quickly provided on request.

After some refinement to the multinomial formulation, the model used to fit the data was considered appropriate to model the uncertainty observed and recorded within the well established data sources. However, the estimation of stock status relative to reference levels was shown to be extremely sensitive to by-catch levels in the shrimp fishery (which are virtually unknown) and the inclusion of the recreational CPUE series.

Estimates of by-catch indicate that it could be as large as, or larger than, the directed harvest in some years and, based on the information that the by-catch is predominantly 0-group, this

would represent a significant reduction in the potential productivity from the stock. The Assessment Team developed shrimp by-catch estimates using the ratio of croaker catch to shrimp catch from a few observed years. The method applied assumes that the croaker by-catch tracks shrimp catches, whereas it would be expected to be a function of the directed shrimp effort and the year class strength of the croaker. The Panel raised this issue as a major concern.

Concerns were also raised about the methodology used to derive indices of abundance from the recreational CPUE series. There is a lack of signal within the time series and the panel were concerned that the methodology used to derive it is inappropriate; the data set was excluded from the base model run which was a valid decision.

Refinements to the modeling of other data sources were suggested by the Panel, but these would only refine the estimated stock status and trends and would not result in significant sensitivities.

2. *Evaluate models used to estimate population parameters (e.g., F , biomass, abundance) and biological reference points.*

a. *Did the model have difficulty finding a stable solution? Were sensitivity analyses for starting parameter values, priors, etc. and other model diagnostics performed?*

b. *Have the model strengths and limitations been clearly and thoroughly explained?*

c. *If using a new model, has it been tested using simulated data?*

d. *Has the model theory and framework been demonstrated and documented in the stock assessment literature?*

There was concern within the Panel that the model used for the assessment was not complete; in that it had not been tested against off the shelf models that are available with similar structures or against simulated data. There had obviously been a large amount of work put into a series of model developments using differing frameworks; some of which had led to dead ends.

The Panel considered that the analysis framework (ADMB) and assessment model structure presented by the Assessment Team were suited to the information available but there was a need for further refinement. The reasons were discussed with the Assessment Team and ideas for development explored with them.

Having noted that the model development was "incomplete" the Panel did not consider that the use of a more refined analysis tool would change the trends in the estimated stock abundance and fishing mortality to any great extent or the conclusions drawn from the analysis. As discussed under TOR (1) the major uncertainty in the assessment estimates is the level of by-catch from the shrimp fishery and the utility of the recreational CPUE series. A different model formulation would not alter the estimated trends or scaling relative to reference levels, it would only refine the estimates. The conclusions as to the stock status (undefined) and the trends in the stock (increasing) and fishing mortality (decreasing) would be expected to be unchanged.

3. *State and evaluate assumptions made for all models and explain the likely effects of assumption violations on synthesis of input data and model outputs. Examples of assumptions may include (but are not limited to):*

- a. *Calculation of M .*
- b. *Choice to use (or estimate) constant, time-varying, or age-varying M and catchability.*
- c. *No error in the catch-at-age or catch-at-length matrix.*
- d. *Choice of a plus group.*
- e. *Population is at equilibrium.*
- f. *Constant ecosystem (abiotic and trophic) conditions.*
- g. *Choice of stock-recruitment function.*
- h. *Choice of proxies for MSY-based reference points.*
- i. *Determination of stock structure.*

Each of the model sensitivities listed under a - i were examined by the Assessment Team and the results presented to the Panel. As described previously the sensitivities to these assumptions were minor compared to those from the data used in the model fit. Two main concerns were raised by the Panel and addressed by the Assessment Team.

The Panel considered that a maturity for age 0 at 43% was unlikely for a species that spawns primarily in the autumn and winter. Following a review with the Assessment Team the maturity ogive from the previous assessment, which assumes that 0 group are not mature, was applied within the assessment formulation. The change to maturity would have a major influence on the assessment if large numbers of 0-group were added as a result of the addition of a significant by-catch by the shrimp fishery. The determination of an accurate and consistent approach to the maturity of the youngest ages is essential to a well defined assessment.

The assumption of a population age structure at equilibrium in the first year was also considered inappropriate (TOR 3e), when strong year class effects were apparent throughout the catch at age data. Following discussions with the Assessment Team the starting populations for each cohort present within the first year were estimated, improving the fit of the model.

4. *Evaluate uncertainty of model estimates and biological or empirical reference points.*

The uncertainty of model estimates and biological and empirical reference points is dominated by the catch data sets to which the model is fitted rather than the estimation procedure or model structure. The magnitude of the shrimp by-catch estimates is the dominant determinant in the uncertainty of the model estimates and the productivity of the stock; they could represent a significant reduction in the potential productivity from the stock.

5. *Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F , SSB), reference points, and/or management measures.*

Retrospective analyses were presented to address this TOR but were of limited use given the uncertainty deriving from the data to which the model was fitted.

6. *Recommend stock status as related to reference points:*
 - a. *Biomass threshold and target.*
 - b. *F threshold and target.*

The conclusion from the review that: *"In 2008 overfishing was probably not occurring. There has been an upward trend in biomass since the 1980s and a decreasing trend in F. There has also been an expansion in age classes in the catch and indices, which is consistent with increasing biomass and decreasing F"* is consistent with the findings of the Assessment Team and the Panel review. The major problem is that an evaluation of stock status relative to reference points could not be made as a result of the uncertainty introduced by the lack of appropriate information on the shrimp by-catch. The method used to calculate the biomass and fishing mortality thresholds and targets was considered appropriate for future reference.

7. *Compare trends in population parameters and reference points with current and proposed modeling approaches. If outcomes differ, discuss potential causes of observed discrepancies.*

This TOR was addressed by the Assessment Team and reviewed by the Panel. Comparisons were made with an alternative age structured production model and with a biomass dynamic model. All model structures gave similar perceptions of increasing biomass levels and decreasing mortality rates. All suffered from the shrimp by-catch issue.

8. *If a minority [stock assessment] report has been filed, explain majority reasoning against adopting approach suggested in that report. The minority report should explain reasoning against adopting approach suggested by the majority.*

There was no minority report

9. *Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.*

This TOR was addressed by the Assessment Team and the Panel and comments are included within the Panel report.

Appendix 1: Bibliography

SEDAR 20
Atlantic Menhaden and Atlantic Croaker
ASMFC and SEDAR 20 Workshops Document List

Document #	Title	Authors
Documents Prepared for the Data Workshops		
SEDAR20-ASMFC_DW01	History of Assessments of the Atlantic Menhaden Stock along the U.S. Atlantic Coast	D. Vaughan, April 2009
SEDAR20-ASMFC_DW02	Reconstructing Historical Commercial Landings of Atlantic Menhaden	D. Vaughan, June 2009
SEDAR20-ASMFC_DW03	Life-History Based Estimates of Natural Mortality for Atlantic Menhaden	D. Vaughan, M. Cieri, G. Nesslage, 2009
SEDAR20-ASMFC_DW04	Growth and Reproduction of Atlantic Menhaden	D. Vaughan, J. Smith, E. Williams, 2009
SEDAR20-ASMFC_DW05	Commercial Harvest and Catch-at-Age for Atlantic Menhaden	J. Smith, D. Vaughan, & J. Brust, 2009
SEDAR20-ASMFC_DW06	Estimating the size and age composition of the B-2 fish (caught and released alive) in the recreational fishery for red drum and spotted seatrout in South Carolina	C. J. McDonough, C.A. Wenner, 2009
SEDAR20-ASMFC_DW07	Croaker and Red Drum Aging Workshop Proceedings	SCDNR, 2008
SEDAR20-ASMFC_DW08	Ageing Atlantic croaker (<i>Micropogonias undulatus</i>) using otolith transverse cross-sections	Center for Quantitative Fisheries Ecology & VA Marine Res Comm, undated
SEDAR20-ASMFC_DW09	Documentation and reduction of bycatch in North Carolina fisheries	K. Brown, 2009
SEDAR20-ASMFC_DW10		
SEDAR20-ASMFC_DW11		
SEDAR20-ASMFC_DW12		
SEDAR20-DW17		
SEDAR20-DW18		
Documents Prepared for the Assessment Workshop		
SEDAR20-AW01		
SEDAR20-AW02		
SEDAR20-AW03		
SEDAR20-AW04		
SEDAR20-AW05		
SEDAR20-AW06		
SEDAR20-AW07		
Documents Prepared for the Review Workshop		
SEDAR20-RW01		

Draft Assessment Reports		
S20-CroakerDraft SAR	ASMFC Atlantic Croaker Draft Assessment Report	ASMFC Croaker TC and SAS
S20- Menhaden Draft SAR	ASMFC Atlantic Menhaden Draft Assessment Report	ASMFC Menhaden TC and SAS
Final Assessment Reports		
S20-ASMFC-SAR01	Assessment of the Atlantic Croaker Stock	To be prepared following Review Workshop
S20-SAR02-ASMFC	Assessment of the Atlantic Menhaden Stock	To be prepared following Review Workshop
Reference Documents		
	Population dynamics and potential of fisheries stock enhancement: practical theory for assessment and policy analysis. Philosophical Transactions of the Royal Society of London, Series B 360 (1453):171-189.	Lorensen, K. (2005).
	A multispecies approach to subsetting logbook data for purposes of estimating CPUE. Fisheries Research (Amsterdam) 70(2-3):299-310.	Stephens, A., and MacCall, A. (2004).
	The analytic component to the standardized bycatch reporting methodology omnibus amendment: sampling design and estimation of precision and accuracy. NMFS/NEFSC, Reference Document 06-22.	Wigley, S. E., Rago, P. J., Sosebee, K. A. and Palka, D. L. (2006).
	Synchronous multidecadal fish recruitment patterns in Chesapeake Bay, USA. Can. J. Fish. Aquat. Sci. 66:496-508.	Wood, R. J. and Austin, H.M. (2009)
SEDAR20-RD01		
SEDAR20-RD02		
SEDAR20-RD03		
SEDAR20-RD04		

ACRONYMS

AW	Assessment Workshop
DW	Data Workshop
RD	Research Document
RW	Review Workshop
SAR	Stock Assessment Report
SAS	Stock Assessment Subcommittee
TC	Technical Committee

Some additional, particularly graphic, material was presented during the meeting, either at the request of the Panel or because the technical teams considered that it would be helpful to address a specific issue. This material was all efficiently placed on the ftp server for the Panel and workshop participants to access.

Appendix 2: Statement of Work

Attachment A: Statement of Work for Dr. Chris Darby (CEFAS)

External Independent Peer Review by the Center for Independent Experts

SEDAR 20 Atlantic Menhaden and Atlantic Croaker 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 with 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.com.

Project Description: SEDAR 20 will be peer reviews of assessments of Atlantic menhaden and Atlantic croaker stocks conducted by the respective stock assessment subcommittees of the Atlantic States Marine Fisheries Commission (ASMFC). The Southeast Data, Assessment and Review (SEDAR) process will coordinate the peer reviews during a single workshop. SEDAR peer reviews typically involve a panel composed of one NOAA/NMFS chair, one reviewer selected by the resource management agency, and three CIE reviewers. The lead assessment agency is the Atlantic States Marine Fisheries Commission with consultation by the Southeast Fisheries Science Center, NMFS. Peer reviews of the Atlantic menhaden and Atlantic croaker stock assessments are approved items of the SEDAR Steering Committee assessment schedule. Atlantic menhaden is an important industrial and bait fishery resource and contributes to commercial fisheries in portions of its range. It is also recognized as a vital ecological resource as a prey species. The most recent assessment of Atlantic menhaden was the 2006-update of a full assessment conducted in 2003. Atlantic croaker is an important recreational fishery resource and contributes significant commercial landings throughout its range on the Atlantic coast. The most recent assessment of Atlantic croaker status was in 2004 and presents stock status for the mid-Atlantic region. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have working knowledge and recent experience in the application of stock assessment, statistics, fisheries science, and marine biology to complete their primary task of conducting an impartial and independent peer review report in accordance with the Terms of Reference to determine if the best available science is utilized for fisheries management decisions. 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 North Charleston, South Carolina during 8-12 March 2010.

Statement of Tasks: Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who will forward this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

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

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

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

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

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

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

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

- 1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
- 2) Participate during the panel review meeting in North Charleston, South Carolina during 8-12 March 2010.
- 3) In North Charleston, South Carolina during 8-12 March 2010 as specified herein, conduct an independent peer review in accordance with the ToRs (**Annex 2**).
- 4) No later than 26 March 2010, 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 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 shall 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.

1 February 2010	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
22 February 2010	NMFS Project Contact sends the CIE Reviewers the pre-review documents
8-12 March 2010	Each reviewer participates and conducts an independent peer review during the panel review meeting
26 March 2010	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
8 April 2010	CIE submits CIE independent peer review reports to the COTR
15 April 2010	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Science 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 or 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 be 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 the regional Science Center Director.

Key Personnel:

William Michaels, Contracting Officer's Technical Representative (COTR)

NMFS Office of Science and Technology

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Dale Theiling, SEDAR 20 Coordinator, NMFS Project Contact

South Atlantic Fishery Management Council

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

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.
2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.
 - a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.
 - b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.
 - c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.
 - d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
 - e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.
3. The reviewer report shall include the following appendices:
 - Appendix 1: Bibliography of materials provided for review
 - Appendix 2: A copy of the CIE Statement of Work
 - Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

SEDAR 20 Atlantic Menhaden and Atlantic Croaker Review

Atlantic Menhaden

Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment:

- Discuss data strengths and weaknesses (e.g. temporal and spatial scale, gear selectivities, aging accuracy, sampling intensity).

- Report metrics of precision for data inputs and use them to inform the model as appropriate.

- Describe and justify index standardization methods.

- Justify weighting or elimination of available data sources.

Evaluate models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points.

- Did the model have difficulty finding a stable solution?

- Were sensitivity analyses for starting parameter values, priors, etc. and other model diagnostics performed?

- Have the model strengths and limitations been clearly and thoroughly explained?

- Have the models been used in other peer reviewed assessments? If not, has new model code been verified with simulated data?

- Compare and discuss differences among alternative models.

Evaluate the potential for conducting assessments at a sub-regional level (e.g. Chesapeake Bay).

State and evaluate assumptions made for all models and explain the likely effects of assumption violations on model outputs, including:

- Calculation of M.

- Choice to incorporate constant or time-varying M and catchability.

- Choice of selectivity patterns.

- Choice of time steps in models.

- Error in the catch-at-age matrix.

- Choice of a plus group for age-structured species.

- Constant ecosystem (abiotic and trophic) conditions.

- Choice of stock-recruitment function.

- Choice of reference points (e.g. equilibrium assumptions).

Evaluate uncertainty of model estimates and biological or empirical reference points.

- Choice of weighting likelihood components.

Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F, SSB), reference points, and/or management measures.

Recommend stock status as related to reference points.

Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

Atlantic Croaker

1. Evaluate precision and accuracy of fishery-dependent and fishery-independent data used in the assessment, including the following but not limited to:

- a. Discuss the effects of data strengths and weaknesses (e.g. temporal and spatial scale, gear selectivities, aging accuracy, sample size, standardization of indices) on model inputs and outputs.
 - b. Report standard errors of inputs and use them to inform the model if possible.
 - c. Justify weighting or elimination of available data sources.
2. Evaluate models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points.
 - a. Did the model have difficulty finding a stable solution? Were sensitivity analyses for starting parameter values, priors, etc. and other model diagnostics performed?
 - b. Have the model strengths and limitations been clearly and thoroughly explained?
 - c. If using a new model, has it been tested using simulated data?
 - d. Has the model theory and framework been demonstrated and documented in the stock assessment literature?
3. State and evaluate assumptions made for all models and explain the likely effects of assumption violations on synthesis of input data and model outputs. Examples of assumptions may include (but are not limited to):
 - a. Calculation of M.
 - b. Choice to use (or estimate) constant, time-varying, or age-varying M and catchability.
 - c. No error in the catch-at-age or catch-at-length matrix.
 - d. Choice of a plus group.
 - e. Population is at equilibrium.
 - f. Constant ecosystem (abiotic and trophic) conditions.
 - g. Choice of stock-recruitment function.
 - h. Choice of proxies for MSY-based reference points.
- i. Determination of stock structure.
 4. Evaluate uncertainty of model estimates and biological or empirical reference points.
 5. Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F, SSB), reference points, and/or management measures.
 6. Recommend stock status as related to reference points:
 - a. Biomass threshold and target.
 - b. F threshold and target.
 7. Compare trends in population parameters and reference points with current and proposed modeling approaches. If outcomes differ, discuss potential causes of observed discrepancies.
 8. If a minority [stock assessment] report has been filed, explain majority reasoning against adopting approach suggested in that report. The minority report should explain reasoning against adopting approach suggested by the majority.
 9. Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

Annex 3: Tentative Agenda SEDAR 20 Atlantic Menhaden and Atlantic Croaker Review

**SEDAR 20 REVIEW WORKSHOP
Atlantic Menhaden and Atlantic Croaker**

**Hilton Garden Inn – Charleston
5265 International Blvd., North Charleston, South Carolina**

TENTATIVE AGENDA

TBN, Chair

Mr. Dale Theiling, SEDAR Coordinator

Monday, March 8, 2010

1:00pm – 5:30pm Afternoon Session

Convene	Chair		
Introductions and Opening Remarks	Chair	and	SEDAR
Coordinator			
Agenda Review	Chair		
TOR Review	Chair		
Task Assignments	Chair		
Croaker Data Presentation	Linda Barker		
Croaker Assessment Presentation	Laura Lee		
	Katie Drew		
Croaker Assessment Discussion	Review Panel and Analysts		

Tuesday, March 9, 2010

8:00am - 11:30am Morning Session

Croaker Assessment Discussion	Review Panel
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12:00nn Lunch

2:00pm – 5:30pm Afternoon Session

Menhaden Management History	Brad Spears
Menhaden Data Presentation	Doug Vaughan (data)
	Rob Latour (indices)
	Matt Cieri (MSVPA and M)
Menhaden Assessment Presentation	Doug Vaughan (model selection)
	Erik Williams (Beaufort Assessment Model)
	Behzad Mahmoudi (complementary model)
Menhaden Assessment Discussion	Review Panel and Analysts

Wednesday, March 10, 2010

8:00am - 11:30am Morning Session

Menhaden Assessment Discussion	Review Panel and Lead Analyst
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2:00pm – 5:30pm Afternoon Session
Stock Topical Discussions as needed Review Panel

Thursday, March 11, 2010

8:00am - 11:30am Morning Session
Complete Croaker Topical Discussions Review Panel
Croaker Review Workshop Report Review Panel

12:00nn Lunch

2:00pm – 5:30pm Afternoon Session
Complete Menhaden Topical Discussions Review Panel
Menhaden Review Workshop Report Review Panel
Croaker Assessment Summary Report Panel, Stock Leader,
Coordinator
Menhaden Assessment Summary Report Panel, Stock Leader,
Coordinator

Friday, March 12, 2010

8:00am - 11:30am Morning Session
Final Review of Panel Documents Chair

12:00nn Adjournment Chair

Discussion Topics

- Evaluation of data and their preparation and presentation
- Choice and utilization of assessment models and methods
- Continuity run from previous assessment(s)
- Alternative assessment approaches
- Identification of additional analyses, sensitivities, and corrections
- Review of additional analyses and sensitivities
- Initial Review Workshop recommendations and comments
- Review of Data and Assessment Workshop research recommendations
- Identify Review Panel research recommendations
- Improvement of the SEDAR process
- Assure all Terms of Reference are addressed
- Develop and review draft Review Panel Report sections
- Finalize workshop recommendations
- Finalize Review Panel Report
- Post-Review Workshop tasks and products due Chair and CIE

The timing of particular events is tentative, and the Chair may modify this schedule during the workshop as needed to complete stated tasks. However, to accommodate travel planning the workshop will start as scheduled and will conclude no later than the stated time.

SEDAR is a public process, and the public is welcome to attend SEDAR workshops. Although no formal public comment period is scheduled, the workshop Chair will allow opportunity during the meeting for the public in attendance to comment on discussion items.



Cefas

