
**Reviewer Report to the Center for Independent Experts on the Atlantic Red
Drum Stock Assessment Review (SEDAR 18) held August 24-28, 2009 in
Atlanta, Georgia.**

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Executive Summary

This document contains my independent reviewer report of review activities and findings for the 18th Southeast Data, Assessment and Review (SEDAR 18) Review Workshop, held August 24-28, 2009 at the Doubletree Hotel, 3342 Peachtree Road, NE, Atlanta, Georgia. Assessments for Atlantic red drum, including the findings of the data and assessment workshops, were reviewed at the meeting. I found that the assessments for both stocks provided a basis for management advice.

The current distribution of red drum in the Atlantic Ocean, as indicated by commercial and recreational landings, extends from southern Florida to Chesapeake Bay. Information available for delineating population structure for red drum was reviewed at the meeting. Although it was recognized that the potential for much finer scale population structuring exists, the reviewers accepted the Data Workshop recommendation for continuing the division of the Atlantic red drum population into two stocks: Northern defined as North Carolina and north and Southern defined as South Carolina and south.

The assessment team used a statistical catch-at-age model, implemented using AD Model Builder (ADMB), to assess the status of both northern and southern red drum. This type of model is very appropriate given the kinds of data available for these stocks. ADMB is an appropriate tool for its implementation. Although the models were considered appropriate, neither model produced output that was fully satisfactory. In the case of the northern model, the fit and associated abundance time series were largely determined by the tagging results and the uncertainty in the model output (as evidenced by standard errors on parameter estimates) appeared to be underestimated. When the tagging component was not included in the model, abundance estimates converged at very high values indicating a high sensitivity to the inclusion and weighting of the tagging data. For the southern stock, standard errors on model parameters were relatively large, but perhaps not unrealistically so given the input data. At times, the convergence of the southern stock model was questioned, and model results do exhibit a retrospective pattern.

Despite the concerns expressed about the northern red drum assessment model, the model was thought to be informative of the age 1 – 3 abundance and exploitation rates, but not those of the older age groups. The analyses indicate an increase in abundance of age 1-3 red drum in the northern region from a low of about 152,000 in 1990 to about 1,200,000 in 1999. Age 1-3 abundance has been in the range of about 500,000 to 1,000,000 since that time. The analyses also indicate that the exploitation rate on age 1-3 red drum decreased rapidly from 1989 to 1992 and has been in the range of 0.08 to 0.38 since that time.

Although issues exist with the southern red drum stock assessment model, it was thought to be informative of the relative trends of age 1-3 abundance and exploitation rates, but not the absolute abundance and exploitation, and not those of the older age groups. Abundance of age 1-3 red drum in the southern region appeared to increase between 1989 and 1992, followed by a slight increase from 1993 to 1998, followed by a slight increase until 2007. Exploitation rates for age 1-3 red drum in the southern region have fluctuated, but appear to have a slight increasing trend from 1992 to 2007.

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1.0. Background

This document contains my independent reviewer report of review activities and findings for the 18th Southeast Data, Assessment and Review (SEDAR 18) Review Workshop, held August 24-28, 2009 at the Doubletree Hotel, 3342 Peachtree Road, NE, Atlanta, Georgia. Assessments for Atlantic red drum, including the findings of the data and assessment workshops and status of the stocks, were reviewed at the meeting. Prior to the meeting, the review committee (Appendix 1), were provided with a Statement of Work (Appendix 2), including the Terms of Reference (TOR) for the assessment as well as for the review panel (RP). Assessment documents and background material (Appendix 3) were provided via a website and/or by email during the three weeks before the meeting. During the meeting there was a general consensus among the RP on nearly all of the main discussion points and findings of the panel as outlined in the Review Workshop Report. This document contains a summary of those findings as well as my own views about these assessments.

2.0. Individual Reviewer Activities

Prior to the meeting I reviewed all the assessment and background documents provided for the workshop. As part of my pre-meeting preparation, I reviewed the model formulation and code and identified two concerns: one pertaining to way the model was formulated to estimate initial abundances and one pertaining to the way in which annual abundance was decremented for mortality prior to the surveys (see Section 3.2 for details). Prior to the workshop, I participated in two teleconferences, intended to familiarize the RP with SEDAR processes and the assessment in general. These teleconferences resulted in a list of potential issues (listed in the Review Workshop Report) that the RP wished to discuss during the review workshop. This list was forwarded to the assessment team (AT) prior to the workshop and served as a guide to discussions during the review. In the days prior to the workshop, the AT reran the model to address the listed concerns. As a result of their efforts prior to the meeting, the Review Workshop was able to proceed with consistent descriptions of the data inputs, model formulation and model results.

I participated in the Review Workshop in Atlanta, Georgia, from August 24-28, 2009. Although this workshop was open to the public, there was no representation from the fishing industry or the public sector. The assessment leaders from the stock assessment workshop presented the assessment results. The structure was fairly informal with a lot of discussion after each presentation, an approach that worked well in this case. During the review, I suggested the use of the delta method to obtain standard errors for derived parameters (e.g. annual abundance), a method easily implemented using AD-Model Builder (ADMB), as well as the use of ADMB's Bayesian capacity to explore how well various quantities were being estimated. Additionally, in an attempt to address the high uncertainty in the older-age-class, first-year abundances for the southern stock, I explored an alternate model formulation for estimating abundance-at-age in the first year and suggested that two of the selectivity parameters treated as constants could be estimated in the model. I provided ADMB code for these items to the AT. Further details are provided in Sections 3.2 and 3.5.

After the review workshop, I prepared this individual, independent report, assisted in writing the Review Workshop Report, and assisted in ensuring that the results reported were consistent with the workshop findings. As outlined in Appendix 3, the independent report should summarize review activities completed during the panel review meeting, including providing a detailed summary of findings, conclusions, and recommendations for each TOR. The following section in this document contains my findings for the northern and southern Atlantic red drum assessments.

3.0. Summary of Findings, Conclusions and Recommendations in Accordance with the TOR's

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

The RP reviewed the Data Workshop Report, the revisions to the data inputs described in the Assessment Workshop Report, and the supporting documentation. Together, these documents provided a comprehensive overview of the information available for the assessment of Atlantic red drum.

A key question in any assessment is the selection of appropriate stock units. The current distribution of red drum in the Atlantic Ocean, as indicated by commercial and recreational landings, extends from southern Florida to Chesapeake Bay. The AT reviewed genetic information available for red drum, including mitochondrial DNA work indicating a weak subdivision of red drum into Gulf of Mexico (GoM) and Atlantic components; mitochondrial and microsatellite data, within the GoM showed temporal, but not spatial, stability in allele frequencies; and mitochondrial and microsatellite data for Atlantic populations, both indicating little to no level of spatial structuring among estuaries. As pointed out by the AT, the Atlantic spatial scale of both these later projects was limited and possibly confounded by low sample sizes. Spatial patterns appeared to indicate that the variability could not to be partitioned into discrete geographic subpopulations, instead showing a pattern of isolation by distance. The Data Workshop recommended that, since gene flow could not be definitively defined geographically, a wider geographic context than the current state-based management would likely be appropriate. Additionally, the Data Workshop recommended the continued application of the division of the Atlantic red drum population into two regions: Northern defined as North Carolina and north and Southern defined as South Carolina and south. The RP accepted these recommendations, noted that the proposed stock structure for red rum is consistent with fishery management along the coast, but also noted that there is likely some mixing between these proposed stocks.

Much of the discussion on stock structure at the Review Workshop centered on the topic of whether there are one or two stocks. The term stock and population were used somewhat interchangeably. Given that red drum spawn in estuaries, there is the potential for homing, particularly given that some of the tagging data indicates relatively little movement, at least for some fish. As such, there is the potential for a much larger number of populations than two. It was noted that the genetic methods being used to identify "stocks" are the same as those being used to identify Designatable Units or Evolutionarily Significant Units under Canadian and US endangered species legislation, units that may comprise more than one population. In cases

where genetic divergence is recent, or where a low level of straying exists between populations, or if sampling occurs during periods when populations are mixed, no apparent population structuring may be detected using these methods, even when it does exist. As has been shown with Pacific salmon, if a finer scale population structure does exist, then less productive populations could potentially become overfished if harvested in mixed population fisheries at levels consistent with the average productivity. Although the stock structure proposed in this assessment is a practical recommendation given current available information and management, further research on this topic is recommended using several methods including morphometrics, otolith microchemistry and tagging, with an emphasis on sample collection at a time when populations would be disaggregated (e.g. mature fish during spawning).

A thorough review of the information pertaining to commercial and recreational landings, harvests, discards, biological characteristics of the catch and discard mortality was provided in the Data Workshop Report. Commercial landings were available from all states from Florida to Massachusetts, although biological characteristics of the landings were not available for all gear types in all years, requiring some “pooling” of information over gear types. The high degree of pooling across gear types in the years prior to 1989 led to the suggestion that the earlier years be removed from the model (see Sections 3.2 and 3.8). The RP recommended that the discard ratio from 2004-2006 be applied to the full time series, a recommendation I support given that discarding almost certainly occurred prior to 1999.

The Data Workshop also provided thorough descriptions of the fishery dependent and independent survey data that could be used to assess relative abundance trends. As clearly shown by the AT, none of the surveys cover the full range of either the northern or southern stock, and most surveys only targeted younger animals. As such, it is not clear the extent to which surveys trends may be influenced by movement rather than changes in abundance, and with the exception of one survey in the southern region, information on the abundance in older age classes is lacking. Notwithstanding these observations, the AT made several practical decisions about which surveys to include in the assessment model as well as how to include them. I am in agreement with these decisions for both the northern and southern stocks.

The available tagging data for both the northern stock (North Carolina) and southern stock (South Carolina Gamefish Tagging Program) was presented in the workshop reports. Estimates of the fishing mortality rates from the northern stock tagging program were included in the assessment model and had a marked influence on the model results. The southern tagging data were not included. As discussed in Sections 3.2 and 3.8, I would have preferred to see the raw data (numbers tagged and recaptured) appropriately included in both models to ensure that the assumptions and constants in the external analysis are consistent with those in the model.

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

The assessment team used a statistical catch-at-age model (SCAA), implemented using ADMB, to assess the status of both northern and southern red drum. The model was set up to estimate abundance-at-age in the first year and age-1 abundance in all years; abundance-at-age for other age classes was estimated by projecting the population forward from these starting abundances

using an exponential decay function including both natural mortality and fishing mortality. Fishing mortality was modeled using a separability assumption. The model for northern red drum was fit to the commercial landings, commercial proportions-at-age, annual estimates of fishing mortality from an external analysis of tagging data, and a set of abundance indices from surveys. The model for southern red drum was fit to commercial landings, commercial proportions-at-age and a set of survey indices. Log-normal error structures were used for all model components except the proportions-at-age for which a multinomial likelihood was used. Parameters estimated in the model were the starting abundances by age, the age-1 abundances for each year, the fully recruited fishing mortality for each year, the selectivity parameters, and catchability coefficients for the surveys. In the final versions of the model, 134 parameters were estimated for the northern stock and 157 parameters were estimated for the southern stock. The difference in the number of parameters is due to differences in the number of fisheries and indices for the two stocks.

I believe that a SCAA model is very appropriate given the kinds of data available for these stocks. ADMB is an appropriate tool for its implementation. As discussed previously, limited data were available for the reconstructing catch-at-age for some fisheries leading to uncertainty in the reconstructed catch-at-age. SCAA models, which do not require the assumption that catch-at-age is known without error, are appropriate for these types of data. The modeling framework is also very flexible in that model assumptions and alternatives, as well as the influence of various datasets on the model output, can be easily evaluated. In my opinion, the error structures assumed for fitting the models were very reasonable.

Although I believe the models are appropriate, neither model was fully satisfactory as implemented. Prior to the start of the review meeting, a review of the model code and data input files found that the model code used to correct abundance for natural mortality occurring prior to the survey was not correctly implemented. The length of time between the start of the year and the time of the survey was input in months, whereas the code was written as if the input was in years. Additionally, one of the survey input vectors was not in the correct order. A third issue identified prior to the meeting related to over-parameterization of the initial abundances-at-age and age-1 recruitments. A mean and a set of deviates, one for each year or age class were being estimated in each case. As a result one more parameter than needed was being estimated in each case (e.g. 7 parameters being estimated to fill in 6 values for the ages 2-to-7+, first-year abundances). The AT addressed these concerns prior to the review meeting, allowing the review to proceed with consistent descriptions of the data inputs, model formulation and model results.

The AT did express some concerns with the fits of the models for both the northern and southern stocks. In the case of the northern model, the fit and associated abundance time series were largely determined by the tagging results. When the tagging component was not included in the model, abundance estimates converged at potentially implausibly high values indicating a high sensitivity to the inclusion and weighting of the tagging data. Standard errors on model parameters for the southern stock were relatively large, but perhaps not unrealistically so given the input data.

Three other concerns with the northern model were the way in which the tagging data were included in the model, the plausibility of the early abundances in the plus group, and the use of

the geometric means as data inputs for the survey data. The RP did note that in the earlier years, some of the fishing mortality rates obtained from the external tagging analysis appeared very high. Additionally, the initial size of the age-7+ group in the north appeared quite high relative to the abundance of other age groups (it was roughly 5 times greater in size than would be expected if the population was at an equilibrium age structure given the age-6 abundance estimate and assuming no fishing mortality).

During the meeting, I used the post-convergence MCMC methods available within ADMB as a method for exploring the parameter space to determine how well model parameters were being estimated. In the case of the southern stock model, these analyses indicated that the older-age-class, first-year abundances were not being well estimated (see Section 3.5).

These observations led to further exploration of the model formulation in attempts to alleviate these issues, although these attempts were not completely satisfactory. As clearly shown by the AT, relatively little data were available for reconstructing catch-at-age for the years before 1989. The reconstruction has proceeded with data “borrowing” across fisheries. The RP suggested that starting the model in 1989 would largely address this concern. As a result the earlier years were dropped from the model for the final model runs.

The AT choose to model the fishery selectivities by estimating the age specific selectivities for ages 1 to 3 as separate parameters, and assumed that the selectivity for age-4 and age-5 were 0.1 and 0.05 that of age-3 and that the selectivities for ages-6 and older were the same as age-5. The RP agreed with the AT that given the observed pattern in the catch-at-age (potentially bi-modal), this approach was preferable over the use of a parametric selectivity curve (logistic, normal, double half-normal). However, as an alternative to assuming constant values for the scalars for age-4 and age-5 selectivity, I suggested that these quantities could be estimated in the model. This suggestion was carried forward for the final model runs resulting in minor improvements in model fits. The RP noted that a small penalty was being used, which had the effect of pulling the selectivity parameter estimates toward a common value. Removing this penalty led to potential convergence issues, so the RP accepted its use.

Although these suggested changes above were considered reasonable, the issue of how well the initial abundances were being estimated was not alleviated by these changes. However, although the resulting abundances were considered suspect for this reason as well as the retrospective pattern in the southern stock, the large number of model changes and sensitivity runs did not provide strong evidence that overfishing was occurring. The RP concluded that the final model for the northern stock was appropriate for estimating abundance and exploitation for age-3 and younger fish, but not for the older age-classes, and that the southern stock final model was appropriate for estimating relative (but not absolute) abundance and exploitation of red drum up to and including age-3. I concur with this conclusion.

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

As described above, I agree with the RP conclusion that the northern stock model is informative of the age 1 – 3 abundance and exploitation rates, but not those of the older age groups. The analyses indicate an increase in abundance of age 1-3 red drum in the northern

region from a low of about 152,000 in 1990 to about 1,200,000 in 1999 (Figure 1), and that age 1-3 abundance has been in the range of about 500,000 to 1,000,000 since that time. The analyses also indicate that the exploitation rate on age 1-3 red drum decreased rapidly from 1989 to 1992 and has been in the range of 0.08 to 0.38 since that time (Figure 2). Estimates of total abundance and spawner biomass from the model are considered suspect.

Additionally, I agree with the RP conclusion that the southern stock model is informative of the relative trends of age 1-3 abundance and exploitation rates (both not necessarily the absolute abundance and exploitation), but not those of the older age groups. Abundance of age 1-3 red drum in the southern region appeared to increase between 1989 and 1992, followed by a slight increase from 1993 to 1998, followed by a slight increase until 2007. Exploitation rates for age 1-3 red drum in the southern region have fluctuated, but appear to have a slight increasing trend from 1992 to 2007.

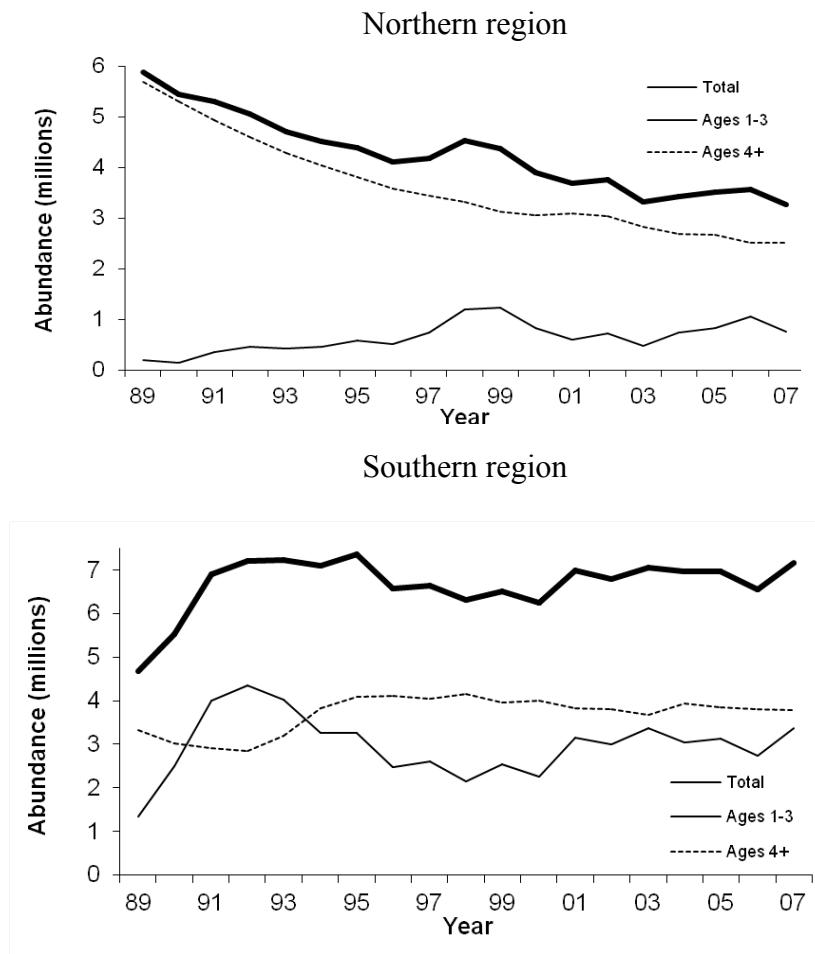


Figure 1. Estimated beginning-of-the-year abundance for red drum in the northern (top panel) and southern (bottom panel) stock areas from 1989 to 2007 (from the Workshop Report Addendum). Note the estimates of abundance for ages 4+ are considered suspect for both regions as is the magnitude (but not trend) of the southern stock ages 1-3 abundances.

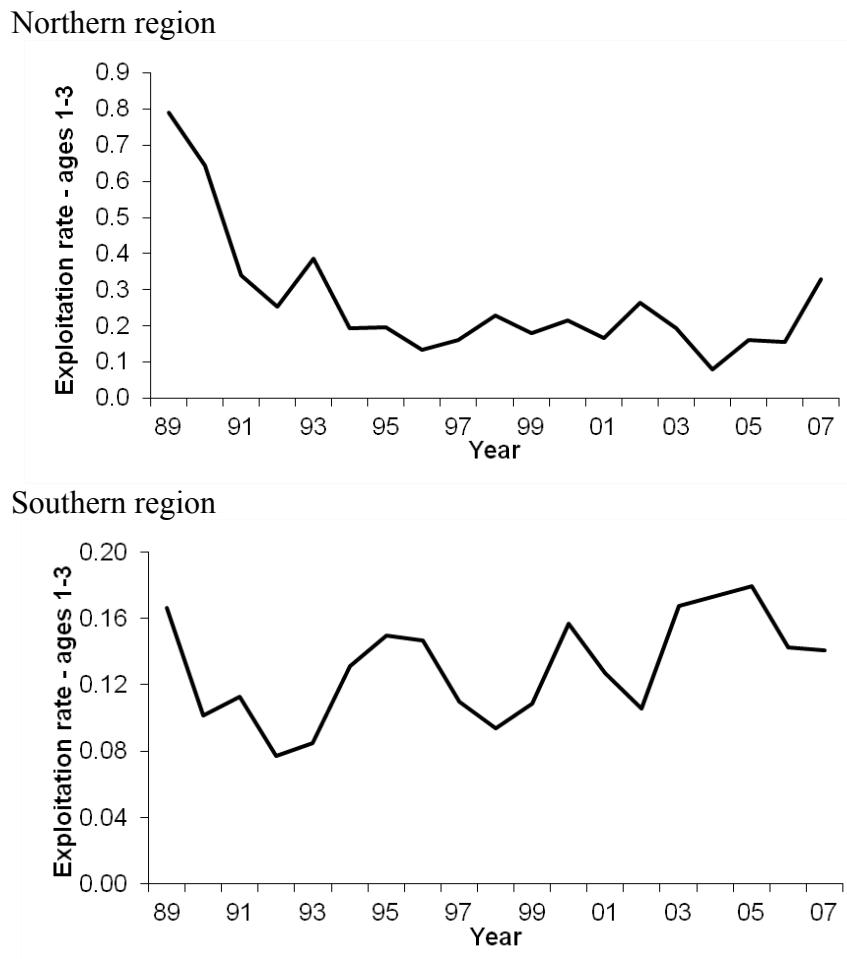


Figure 2. Estimated annual exploitation rate for red drum ages 1-3 in the northern and southern regions during 1989-2007 (from the Workshop Report Addendum). Note that the magnitude (but not trend) in the exploitation rate for the southern stock is considered suspect.

3.4. Evaluate the methods used to estimate population benchmarks and management parameters (e.g., static spawning potential ratio); provide estimated values for management benchmarks, and declarations of stock status. Evaluate the population metric used by managers to determine the stock status and, if appropriate, recommend alternative measures.

The AT considered the use of several population benchmarks (reference points), proposed the continued use of sSPR for determining whether overfishing was occurring, and additionally proposed the use of an escapement ratio (sEsc) as another metric for overfishing. Although theoretically, production model estimates of the fishing mortality at MSY, spawner biomass at MSY (SSB_{MSY}) and the unfished spawner biomass could have been calculated from the model output, the AT choose not to do this due at least in part to the uncertainty in the estimated spawner biomass time series. I believe this was the correct decision given both the uncertainty in

the final model output and the short duration of the time series relative to the longevity of the animal (40 and 60 years). In the absence of estimates of SSB_{MSY}, the assessment is informative about whether overfishing is occurring, but not whether the stocks are in an overfished state.

With respect to the two reference points proposed by the AT for whether overfishing is occurring, I have a marked preference for sSPR over sESC. Static SPR ratios have been thoroughly investigated for many stocks to provide guidance on appropriate ratios for the reference points. These investigations have not occurred for sESC, so no such guidance is available. Given the life history characteristics of red drum, I agree with the AT and RP decisions that the use of the status quo reference levels, 30% sSPR for a threshold and 40% sSPR as a target fishing reference point, is appropriate for red drum. I also agree with the recommendation to use a three-year average sSPR as the value to compare against the reference level. This recommendation is made on a practical basis, given that using a value for a single year could lead to rapid management change in response to annual variability, whereas if a longer time period is used, it could slow management actions when they are required.

For the northern red drum stock, sSPR in 2007 (the average for the years 2005-2007) is centered above 40% sSPR and the lower 95% confidence bound is also above 40% sSPR (Figure 3). The average sSPR has been above the threshold (30%) since 1994 and with the exception of one year (2002) has been at or above the target (40%) since 1996 (Figure 4). As such, it is likely that overfishing is not occurring.

There is less certainty for the southern stock of red drum. The distribution of sSPR in 2007 is very wide, with a confidence interval from about 20% to 80% (Figure 3). However, about 82% of the probability is above 30% sSPR. Sensitivity and retrospective analyses did not find strong evidence that average sSPR in 2007 is below 30%; results taken together with the base model run, appears indicative that overfishing is not likely occurring. Further work is required before a stronger statement can be made. Note as well (and conditional on the caveats provided throughout this document with respect to this assessment), sSPR appears to be trending downwards (Figure 4), indicating increasing fishing pressure on this stock. This conclusion is also uncertain given the wide confidence intervals about the annual sSPR estimates.



Figure 3. Posterior distributions of average (2005-2007) sSPR from MCMC analyses of the base case assessment models (North: left panel; South: right panel). For comparison, the vertical lines show the asymptotic estimates of the mean +/- 2 s.e. from the baseline assessment runs.

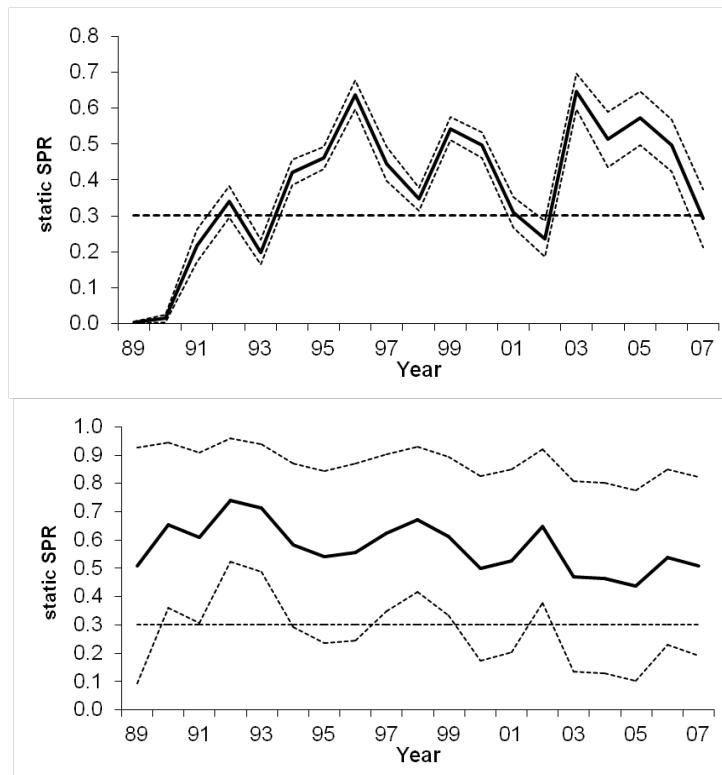


Figure 4. Estimated annual static spawning potential ratios (solid lines) and 95% confidence intervals (dashed lines) for the northern (top) and southern (bottom) red drum stocks from 1989 to 2007. The horizontal dashed lines represent the 30% sSPR threshold level (adapted from the Workshop Report Addendum).

3.5. Evaluate the adequacy, appropriateness, and application of methods used to characterize uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

The Assessment Team provided standard errors for the estimated model parameters based on normal approximations as well as profile likelihoods for the sSPR and escapement ratios as indicators of the probability of whether overfishing is occurring. These methods are appropriate. The decision by the AT to implement the SCAA in ADMB did provide the potential for further characterization of uncertainty that had not been explored by the AT. During the review meeting, the use of the delta method (easily implemented within ADMB) was suggested for obtaining standard errors on derived model output (e.g. annual sSPR) and provided sample code to illustrate its implementation was provided to the AT. This approach was adopted to assess uncertainty in derived quantities such as annual total abundance in the final model runs.

Additionally, the use of ADMB's Bayesian capabilities was proposed during the review as a method for further evaluation of the uncertainty in derived quantities as well as a method to explore the parameter space to determine if some parameters were being poorly estimated (this was the case for the older-age, first-year abundances). ADMB uses a Markov Chain Monte Carlo (MCMC) algorithm to approximate the posterior distribution for parameters of interest. MCMC is a stochastic simulation method used to evaluate complex integrals in order to derive posterior distributions. ADMB uses the Metropolis Hastings algorithm to generate the Markov chain, using a multivariate normal distribution based on the variance-covariance matrix for the model parameters as the proposal function. If the chain is long enough, the posteriors will be reasonably well approximated. Strictly speaking, in this application the resulting distributions are not Bayesian posterior probability distributions because the objective function included penalties and therefore was not strictly a likelihood function. The RP did agree that it was useful diagnostic for exploring the model. When implementing the method, I used a chain of 3,000,000 iterations after a burn in of 300,000 iterations, and sampled every 3,000th iteration to derive the posterior distributions. Autocorrelation in the chain was still somewhat problematic at this level of thinning (Figures 5 and 6). The analyses showed that although the initial abundances for ages 2 to 3 may be reasonably estimated (Figure 5), the initial abundances for ages 4 to 7+ are not well estimated. However, the more recent total abundance and sSPR estimates are better determined, although confidence intervals are wide (Figure 6). Also, despite the considerable uncertainty in the starting abundances for older age classes, the confidence intervals based on the normal approximations roughly matched the MCMC results for sSPR during the most recent years (Figure 6 and Section 3.4). AD-Model Builder also produces a variance-covariance matrix that can be a useful diagnostic tool, but this was not explored during the Review Workshop.

In addition to the uncertainty in the final model output, there is additional uncertainty that results from decisions about which data to include in the model as well as uncertainty in the model formulation. The AT explored several model scenarios via model weighting and compared the sum of the standardized residuals to select a preferred model. I considered this to be a reasonable approach.

The AT also explored the sensitivity of the sSSPR ratios to other model assumptions (e.g. constants used in deriving the selectivity curves, levels of discard mortality). These explorations did not find strong evidence that overfishing was occurring for either stock.

A key source of uncertainty in the assessment, identified by the AT and further explored during the Review Meeting, was the virtual lack of information (data) for either stock on the abundance of older fish. The older age abundances were linked to younger ages via assumptions about selectivity, and it was not clear how the overall assessment results were affected by this lack of information. Additionally, for the northern stock, as pointed out by the AT, the model output was largely dictated by the tagging results, indicating that the status signal in the survey data may not be consistent with the information obtained from tagging. This issue was not resolved during the review workshop. For the southern stock, a rather odd retrospective pattern emerged in the final model run: As annual data were removed from the model input, the sSSPR and abundances had similar trends but varied in magnitude. Due to time constraints, this pattern could not be fully explored during the meeting, and it is possible that the pattern was the result of convergence issues (identified in some other model runs) rather than something more pathological. As a result of these uncertainties, the RP conditionally accepted some conclusions drawn from the model as described in Section 3.2. Subject to this conditional acceptance of the model results, and given the relatively good agreement between the MCMC output and the estimated standard errors provided by the AT, I believe the methods used by the AT to characterize uncertainty in the model output are adequate and sufficient.

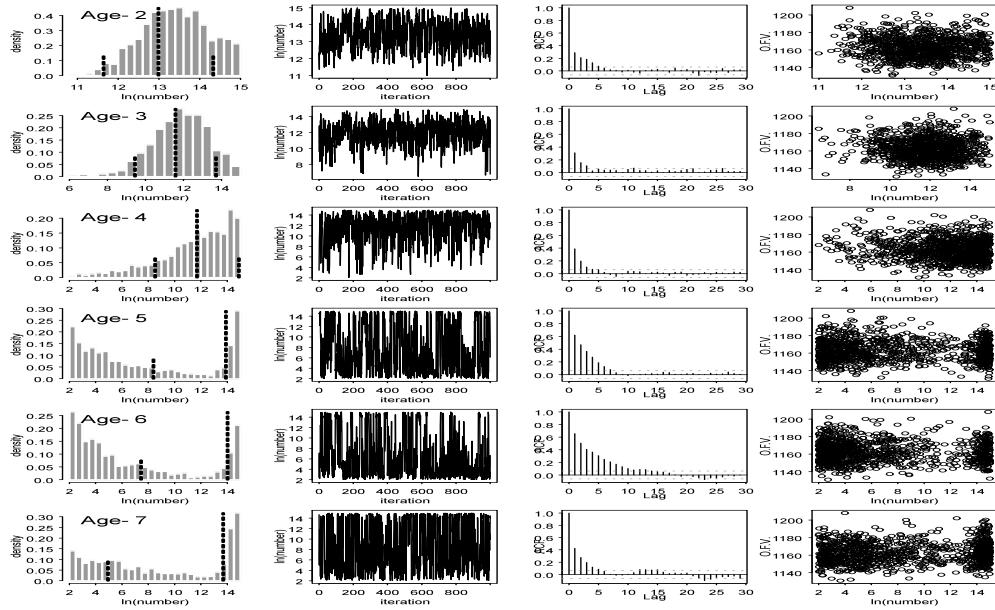


Figure 5. Southern model MCMC output for the log of the first-year-number-at-age for ages 2 to 7+ (rows 1 to 6 respectively). The first column shows the probability density (the dashed lines are the maximum likelihood estimate and its 95% confidence intervals), the second column shows the thinned chain, the third column shows the auto-correlation in the chain, and the fourth column is a plot of the objective function value versus the estimate.

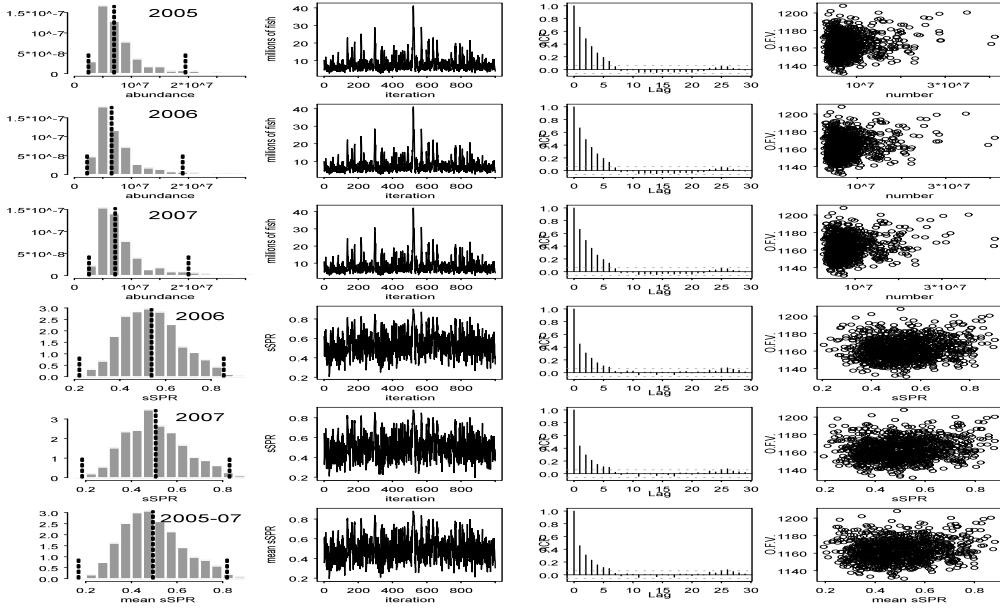


Figure 6. Southern model MCMC output for the total abundance in 2005-2007 (first three rows), annual sSPR for 2006 and 2007 (next two rows) and for the 2005-2007 mean sSPR (bottom row). The first column shows the probability density (the dashed lines are the maximum likelihood estimate and its 95% confidence intervals), the second column shows the thinned chain, the third column shows the auto-correlation in the chain, and the fourth column is a plot of the objective function value versus the estimate.

3.6. Ensure that stock assessment results are clearly and accurately presented in the Stock Assessment Report and Summary Report and that reported results are consistent with Review Panel recommendations.

This TOR is ongoing at the time of writing of this independent reviewer report (this report is due before the Summary Report).

3.7. Evaluate the SEDAR Process. Identify any Terms of Reference which were inadequately addressed by the Data or Assessment Workshops; identify any additional information or assistance which will improve Review Workshops; suggest improvements or identify aspects requiring clarification.

In spite of some of the uncertainties in the results, I believe the SEDAR process has, overall, led to a comprehensive assessment of the red drum stock. Provision of the data workshop and assessment workshop reports as summaries of a considerable amount of background material, together with the background material, is an efficient way to ensure a thorough review of the assessment. I appreciated having access to the model code and hence the capacity to explore the model prior to the meeting, and found the review workshop format sufficiently flexible to allow modifications to the assessment to occur at the meeting. As a minor point, although I think in this instance the reviewers expertise well matched with the assessment, I think it would be helpful if a very brief description of the assessment and methods was provided to potential CIE reviewers, to provide the opportunity for potential reviewers to apply for assessments for which they believe they are best suited as reviewers.

My comments on the extent to which specific TORs for the Data and Assessment Workshops are:

Data Workshop

- I. Characterize stock structure and develop a unit stock definition. Provide a map of species and stock distribution(s).

This TOR was addressed. Further comments with respect to this TOR are provided in Section 3.1 of this report.

- II. Tabulate available life history information (e.g., age, growth, natural mortality, reproductive characteristics, discard mortality rates); provide appropriate models to describe natural mortality, growth, maturation, and fecundity by age, sex, or length as applicable; and provide appropriate relations between length and weight and between various length measures; evaluate the adequacy of available life-history information for input into stock assessments and recommend life history information for use in population modeling.

This TOR was addressed. Further comments with respect to this TOR are provided in Section 3.1 of this report.

III. Evaluate all available tag/recapture data for use in estimating mortality rates, both natural and fishing, within appropriate strata (e.g., age, size classes, areas); estimate tag/recapture-based selectivity vectors for fishery units, by length or age.

This TOR was partially addressed. The tagging data for the southern stock was not included in the assessment model, although it was not clear that the southern assessment could not have been improved by the inclusion of these data. Although the tagging data were well described, the evaluation of the tagging data was not fully documented in the workshop reports. Given that some of the fishing mortality estimates in the earlier years from the northern tagging data intuitively seemed very high, documentation of the decision process to use these data would have been useful.

IV. Consider relevant fishery dependent and independent data sources to develop measures of population abundance; document all programs used to develop indices; address program objectives, methods, coverage, sampling intensity, and other relevant characteristics; provide maps of survey coverage; develop relative abundance indices by appropriate strata (e.g., age, size, area, and fishery); provide measures of precision; evaluate the degree to which available indices represent fishery and population conditions; evaluate stock enhancement effects on indices.

This TOR was addressed. Although considerably more information about the measures of population abundance could have been included in the workshop reports, the level of documentation in the reports seemed sufficient to me, and considerable detail was available in the background documentation.

V. Characterize catch for each fishery unit (e.g., commercial hook and line, recreational, commercial gill net), including both landings and discard removals, in pounds and number; discuss the adequacy of available data for accurately characterizing harvest and discard by species and fishery unit; for estimated catch provide measures of precision; provide all available data on the length and age distributions of the catch, both harvest and discard; provide figures of the amount of fishery effort and harvest; also, provide a timeline of all fishery regulations relevant to the above fishery units, such as size limits, caps, and gear restrictions.

This TOR was addressed thoroughly in the Data Workshop Report and updated in the Assessment Workshop Report. The tables showing when and where data were pooled for the catch-at-length/age were particularly useful during the assessment review.

VI. Provide recommendations for future research in areas such as sampling, fishery monitoring, and stock assessment; evaluate sampling intensity by sector (fleet), area, and season.

This TOR was addressed in the Data Workshop Report. Further comments with respect to this TOR are provided in Section 3.8 of this reviewer report.

VII. Develop a spreadsheet of potential assessment model input data that incorporates the decisions and recommendations of the Data Workshop. Review and approve the contents of the input spreadsheet within 6 weeks prior to the Assessment Workshop.

This TOR was reported as addressed at the review workshop through the development and review of a data workbook.

VIII. Prepare complete documentation of workshop actions and decisions (Section II. of the SEDAR assessment report); prepare a list of tasks to be completed following the workshop, including deadlines and personnel assignments.

This TOR was addressed in the Data Workshop and Assessment Workshop reports.

Assessment Workshop

I. Review any changes in data following the data workshop, any completed analyses suggested by the data workshop; summarize data as used in each assessment model; provide justification for any deviations from Data Workshop recommendations.

This TOR was addressed in the Assessment Workshop Report.

II. Develop population assessment models that are compatible with available data and recommend which model and configuration is deemed most reliable or useful for providing advice relative to current management metric (static SPR levels); document all input data, assumptions, and equations; document model code in an AW working paper; if chosen assessment model differs from that used previously (Vaughan and Carmichael 2000) include a continuity case run of that model to determine, as best as possible, the effect of changing assessment models.

This TOR was addressed in the Assessment Workshop Report. Further comments with respect to this TOR are provided in Section 3.2 of this reviewer report.

III. Provide estimates of stock population parameters (fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, discard removals, etc.) by age and other relevant categorizations (i.e., fleet or sector); include representative measures of precision for parameter estimates.

This TOR was addressed. Further comments with respect to this TOR are provided in Section 3.3 of this report.

IV. Characterize scientific uncertainty in the assessment and estimated values, considering components such as input data sources, data assumptions, modeling approach, and model configuration; provide appropriate measures of model performance, reliability, and goodness of fit.

This TOR was addressed (see Sections 3.2 to 3.5 of this reviewer report for comments relevant to this TOR).

V. Provide yield-per-recruit, spawner-per-recruit, and stock-recruitment evaluations, including figures and tables of complete parameters.

This TOR was mostly addressed. The AT did provide estimates of the yield-per-recruit and spawner-per-recruit, and did provide a figure showing the spawner-recruit data. Given the uncertainties associated with the abundance of older age classes and hence spawner biomass, the AT choose not to provide estimates of spawner-recruit parameters or their associated reference points. I agree with this decision.

VI. Provide estimates of spawning potential ratio consistent with the goal of Amendment 2 to the Interstate FMP for Red Drum (i.e., to achieve and maintain optimum yield for the Atlantic coast red drum fishery as the amount of harvest that can be taken while maintaining the Static Spawning Potential Ratio at or above 40%).

This TOR was addressed.

VII. Evaluate the impacts of past and current management actions on the stock, with emphasis on determining progress toward stated management goals and identifying possible unintended fishery or population effects.

This TOR was addressed.

VIII. Consider the data workshop research recommendations; provide additional recommendations for future research and data collection (field and assessment); be as specific as possible in describing sampling design and sampling intensity.

This TOR was addressed in the Assessment Workshop Report. Further comments with respect to this TOR are provided in Section 3.8 of this reviewer report.

IX. Prepare an accessible, documented, labeled, and formatted spreadsheet containing all model parameter estimates and all relevant population information resulting from model estimates and any projection and simulation exercises. Include all data included in assessment report tables, all data that support assessment workshop figures, and those tables required for the summary report.

This TOR was fully addressed via the spreadsheets used to summarize and plot model output.

X. Complete the Assessment Workshop Report (Section III of the SEDAR Stock Assessment Report), prepare a first draft of the Summary Report, and develop a list of tasks to be completed following the workshop.

This TOR was addressed in the Assessment Workshop Report.

3.8. Review the research recommendations provided by the Data and Assessment workshops and make any additional recommendations warranted. Clearly indicate the research and monitoring needs that may appreciably improve the reliability of future assessments. Recommend an appropriate interval for the next assessment.

The RP did review the research recommendations from Data and Assessment workshops, with good agreement among the RP members. As such, many of the comments below mirror those in the Review Workshop Report. I also agree that addressing some of the recommendations will take some time and an appropriate interval for the next assessment (assuming progress in the interim) should be about five years. From my own perspective, the top four areas for research are:

1. Further analysis of the existing tagging data including integration of the tagging data into the assessment models. In this assessment, the tagging results for the northern stocks were included in the assessment model, whereas the tagging data for the southern stock were not included. In the north, there was the question of the plausibility of some of the early fishing mortality rates, and as incorporated (fishing mortality estimated external to the model and then used as a data input) it has a marked influence on the assessment model results, but in a way that uncertainty in the initial estimates would not be carried through the assessment. Assumed natural mortality rates differed between the two analyses. Integration of the tagging analysis into the assessment models, thereby ensuring that constants and errors derived in the model are appropriately treated throughout the analysis, in my opinion should be a priority. Other assumptions could also be evaluated (e.g. how reporting rates and/or tag loss may have changed through time) via this integration. A similar evaluation (via integration) of the southern region tagging data is also warranted. I do believe that an appropriately designed tagging program will help not only with the assessment, but also with delineation of populations.
2. It is my opinion that the SCAA model tabled during this assessment is close to a good model for these stocks and I endorse the continued development of the model. In addition to the suggestions about tagging above, further work on the first year abundances for older age classes could help address the uncertainty in the initial abundance-at-age leading to a better model. This may require assumptions about the age structure, or possibly a reduction in first age in the plus group. Additionally, it was proposed at the Review Workshop that for this assessment, the first few years of data should be dropped from the model due to the high degree of data pooling to obtain proportions-at-age in those years. I think further exploration of this recommendation could be useful. For example, it may be possible to keep the catch data, but not the proportions-at-age, thereby extending the time period for which abundance estimates can be obtained.
3. As discussed throughout the documentation produced during this review, a study of the broader survey program in the context of the overall assessment is warranted. A first step towards this objective did take place as part of the Data Workshop in choosing surveys to be included in the assessment. A major gap appears to exist with respect to older animals.

4. While it is not always feasible, I think it is at least preferable that management units and assessments are at the level of the population. Biomass- and productivity-based reference points are typically based on population dynamics theory assuming a closed population, and dynamics can be difficult to ascertain if models include data for stock that are either partial (e.g. if indices change in response to movement) or mixed (if productivity is some composite from several populations whose productivities vary in time). Additionally, lower productivity populations can be impacted to a greater extent than higher productivity populations if both are taken in a mixed stock fishery. As such, identifying the population structure of the stocks, as well as which stocks are being harvested in each fishery, is in my opinion a priority. Otolith microchemistry, tagging studies, morphometric comparisons and genetic research could all be applied towards this objective (but see comments below).

With respect to the research recommendations from the data workshop, my comments are:

1. The ASMFC-approved multi-state sampling program of adult Atlantic red drum from Florida to Virginia represents a unique opportunity to obtain critical comprehensive data. Specifically relevant to the genetic population structure evaluation is the concurrent aging of the fish, which will allow for the determination if any detected genetic structure is the result of differential age composition of the reproductive stock, particularly in light of the proposed temporal genetic heterogeneity (Chapman et al. 2002) and suspected age structure differences from the GoM. The combined age-specific life history and genetic knowledge will allow for greater interpretive capabilities of the genetic data as well as provide the needed life history information necessary for an accurate estimate of effective population sizes for Atlantic red drum.
 - a. I concur with the RP position that this project is a low priority for leading to improvements to the assessment of red drum stock status. Although I do believe that further detailed investigation into population structure is quite important, genetics is only one of the tools available to address this question. Genetic analyses may be of limited utility if there are low levels of gene flow among populations or if population divergence has been recent.
2. Updated maturity schedules and fecundity information for adult Atlantic red drum from Florida to Virginia is lacking; just as there are suspected age structure differences between the Atlantic and GoM stocks, maturity schedules and fecundity estimates are also suspected to be different in the Atlantic stock.
 - a. I do support this research recommendation, albeit with an emphasis on the maturity schedules. Although fecundity is also of interest, from an assessment perspective, the vast majority of assessments use spawner biomass as a proxy of egg deposition.
3. Further study is needed to determine discard mortality estimates for the Atlantic coast, both for recreational and commercial gears. Additionally, discard estimates should examine the impact of slot-size limit management and explore regulatory discard impacts due to high-grading.

- a. Particularly given the shift towards catch-and-release recreational fishing, I support this recommendation. Additionally, sub-lethal effects of catch-and release may also be important and warrant consideration.
- 4. Dedicated northern and southern region larval and juvenile recruitment indices, as well as a Virginia adult recruitment index are recommended to provide more informative trends for future assessment processes
 - a. In my opinion, larval indices as indicators of spawner biomass can be difficult to interpret due to confounding effects of environmental variability, variable spawning duration and high early mortality, and as such I hesitate to support this recommendation. Future assessments may well benefit from additional age-structured surveys, although I think further evaluation in the context of gaps in the assessment model would be beneficial.
- 5. Continued cooperation between state ageing labs, such as the October 2008 red drum ageing workshop, to provide consistent age verification between labs; additionally, otolith microchemistry should be approached to look at state differences between regions for stock differentiation.
 - a. If aging methods are not consistent, further work on this issue is warranted. With respect to otolith microchemistry, I fully support this recommendation as a method for discriminating among populations, evaluating whether homing is occurring and determining which populations are present in mixed stock fisheries.
- 6. Identification of juvenile and adult habitat requirements and loss rates would provide more informative information for future management planning
 - a. This recommendation does not directly pertain to stock assessments
- 7. Continued and expanded observer coverage for the NC and VA gill net fisheries (5-10% coverage)
 - a. I support this recommendation.
- 8. Expand observer coverage to include other gears of concern (i.e. haul seine, pound net, trawls).
 - a. I support this recommendation.
- 9. Expand biostatistical sampling (ages and lengths) to better cover all statistical strata (gears/states - principally NC and VA) – more ages proportional to lengths, preferably otoliths.
 - a. I support this recommendation, particularly given assumptions that had to be made about the size and age of fish taken in fisheries in order that an age structured model could be applied. Review of the sample design in the context of gaps in the assessment prior to undertaking the field program is recommended.
- 10. Have experts in survey design and implementation review historical data
 - a. I agree with the RP that it is not clear what is being proposed here.

11. The recreational statistics workgroup supports ongoing efforts to improve recreational and for-hire data collection through the Marine Recreational Information Program (MRIP)
 - a. I agree with the RP that support for this recommendation is based on the degree to which it improves the overall stock assessment
12. We support inclusion of volunteer logbook data for length
 - a. Here, I also agree with the RP that support for this recommendation is conditional on the degree to which it informs stock assessment, and that the experimental design including analytical methods are key for a successful program.
13. Adult sampling with the goal of small population estimates or density estimates through tag-recapture methods to evaluate trends in abundance over time. Secondarily, this would help with delineate the stock distribution and mixing rates.
 - a. In my opinion, a tagging study to help delineate populations and mixing rates would be quite useful. It is not clear to me that small population size estimates would be useful before population units are established.
14. Suggests a workshop on adaptive sampling techniques as applied to wildlife populations as well as other techniques that can be applied to aggregated species.
 - a. I do support that further design work on an integrated survey program, consistently applied among states and designed to meet the needs of the assessment model, is warranted. Although not really a research recommendation, the proposed workshop may be beneficial if it helps towards this higher objective.
15. Encourage that States continue on with current surveys, and with current methodologies. If sampling methodologies change, the workgroup suggests some consistency exist between the original and new methodologies.
 - a. See comments on surveys above. I agree that some level of consistency can be important, although this is somewhat dependent on the utility of the existing survey. This again falls under the need for a broader evaluation of the survey program.
16. Age structure established for surveys internally rather through external age-length keys
 - a. Given that 1) gear selectivity can influence age-length keys and 2) length-at-age can vary among locations and through time, I do support this recommendation.

With respect to the research recommendations from the assessment workshop, my comments are:

1. Determine batch fecundity estimates of red drum
 - a. As mentioned above, it is not clear to me how this information would be used to improve the assessment.
2. Conduct experiments using logbooks etc. to develop estimates of the B2 catch in both the North and South regions

- a. See above (data workshop recommendation 12).
- 3. Further identify the selectivity of age classes of the B2 catch in both regions
 - a. I also support this recommendation to the extent with data can be collected to allow estimation of selectivity within the model.
- 4. Determine if existing and historic recreational tagging programs can be used to evaluate better B2 selectivities.
 - a. See comments above on the tagging program (which I endorse).

3.9. Prepare a Peer Review Consensus 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 Consensus Report within 3 weeks of workshop conclusion.

The review workshop resulted in the need to re-run the assessment models and to update the assessment documents. Although the AT did an excellent job of updating model results at the workshop, due to time constraints full documentation could not be completed at the workshop. As a result, the timelines for preparation of the consensus summary and this independent review were delayed one week. Tasks for each RP member (assignment of sections of the Summary to be drafted) and the AT (lists of tables and figures required for the Summary) were assigned at the meeting. At the time of the writing of this independent report, a draft Peer Review Consensus Summary was nearing completion and appeared to be on schedule for completion by October 2, 2009.

4.0. Acknowledgments

This assessment review meeting was a very pleasant and productive meeting as a result of the hard work of many people. Thanks to Robert O'Boyle, for an excellent job in chairing the meeting, particularly getting us started early and keeping us on schedule; to Mike Murphy, (assessment team lead) for his Herculean efforts keeping up with the requests from the assessment team; and to Lee Paramore, Joe Gris and Mike Denson, for their many contributions to the discussions and review. I also wish to thank the other panel members, Kevin Stokes, Norm Hall and Matthew Cieri, for stimulating discussions both during and around the meeting; and Manoj Shivilani for his work coordinating the review on behalf of CIE and his assistance with travel arrangements. Dale Theiling, Rachael Lindsay, Patrick Gilles and Nicola Meserve provided valuable coordination around the meeting, logistic and technical support, and ongoing guidance about the overall SEDAR process.

5.0. Appendices

Appendix 1: Panel Membership

Appendix 2: CIE Statement of Work

Appendix 3: Bibliography of Materials Provided for Review

Appendix 1: Review Panel Membership.

Review Panel Membership

Member	Role
Dr. Robert O'Boyle	Chair and Reviewer Consultant
Dr. Matthew Cieri	Independent Reviewer; ASMFC- ME DNR
Dr. Dr. Kevin Stokes	Independent Reviewer; CIE
Dr. Norm Hall	Independent Reviewer; CIE
Dr. Jamie Gibson	Independent Reviewer; CIE

Attachment A: Statement of Work for Dr. Jamie Gibson

External Independent Peer Review by the Center for Independent Experts

SEDAR 18 - Atlantic Red Drum

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract to provide external expertise through the Center for Independent Experts (CIE) to conduct impartial and independent peer reviews of NMFS scientific projects. This Statement of Work (SoW) described herein was established by the NMFS Contracting Officer's Technical Representative (COTR) and CIE based on the peer review requirements submitted by NMFS Project Contact. CIE reviewers are selected by the CIE Coordination Team and Steering Committee to conduct the peer review of NMFS science with project specific Terms of Reference (ToRs). Each CIE reviewer shall produce a CIE independent peer review report with specific format and content requirements (**Annex 1**). This SoW describes the work tasks and deliverables of the CIE reviewers for conducting an independent peer review of the following NMFS project.

Project Description: SEDAR 18 will be a compilation of data, a benchmark assessment of stock, and an assessment review for Atlantic red drum conducted under the SEDAR (Southeast Data, Assessment and Review) process. SEDAR peer reviews typically involve a panel composed of one NOAA/NMFS chair, one reviewer selected by each resource management agency (1 for SEDAR 18), and three CIE reviewers. The lead assessment agency will be the Atlantic States Marine Fisheries Commission (ASMFC). The Southeast Regional Office, NMFS will be involved. Assessment of the Atlantic stock of red drum is an approved item of the SEDAR Steering Committee assessment schedule. Red drum is an important recreational fishery resource and contributes to commercial fisheries on the Atlantic coast. The most recent assessments of red drum are: Atlantic in 2000 and Florida both coasts in 2005. Considerable additional life history and fishery data have been collected since these assessments. Significant changes in stock status have been documented due to management efforts and population abundance. The purpose of the review is to ensure the assessment is based on sound scientific methods and provides information that is robust and adequate for determining stock status. The review is conducted by a panel of experts during a week-long workshop that is open to the public. Assessment team representatives will present their findings to the review panel which will then address a series of Terms of Reference. Reviewers will critique the assessment and document their findings in a written report that they prepare during the workshop and complete within two weeks of its conclusion. 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**.

Appendix 2: CIE Statement of Work.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein. CIE reviewers shall have the expertise, background, and experience to complete an independent peer review in accordance with the SoW and ToRs herein. CIE reviewer shall have expertise and working experience in stock assessment, statistics, fisheries science, and marine biology.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the SEDAR 18 panel review meeting scheduled in Atlanta, Georgia during August 24-28, 2009.

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 (name, affiliation, and contact details) to the COTR, who forwards 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 information concerning other 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., name, contact information, birth date, passport number, travel dates, and country of origin) to the NMFS Project Clearance 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 the CIE reviewers all 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 on where to send documents. The CIE reviewers shall read all documents in preparation for the peer review.

Review workshop panelists receive the Assessment Report, including sections prepared by the data and assessment workshops; supplemental analytical materials including all working papers and reference documents from prior workshops; and general information regarding the Review Workshop, including the agenda, report outlines, terms of reference, and participant list. This list of pre-review documents may be updated up to two weeks before the peer review. Any delays in

Appendix 2: CIE Statement of Work.

submission of pre-review documents for the CIE peer review will result in delays with the CIE peer review process, including a SoW modification to the schedule of milestones and deliverables. Furthermore, the 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.

Panel Review Meeting: Each CIE reviewers shall conduct the independent peer review in accordance with the SoW and ToRs. **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 in the contract SoW. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Instructions to reviewers and the chair are provided in Annex 5. Reviewers are expected to review documents prior to the workshop, participate in panel discussions critiquing and evaluating the assessment, and contribute to preparation of the Review Panel Report documenting the panel's findings for each Term of Reference. The review workshop will be run by a chair who may also serve in a limited review capacity and will prepare an executive summary for the workshop panel report.

The Review Panel Chair is responsible for compiling, editing, and submitting the Review Panel Report to the SEDAR Coordinator by a deadline specified in the assessment schedule. At the start of the workshop the Chair will assign each panelist specific duties, such as drafting specific Review Panel Report sections. The Chair may select one panelist to serve as assessment leader for each stock assessment under review. The assessment leader is responsible for preparing initial drafts of the Review Panel Report for the assigned assessment. Such duties may be further subdivided if workshop manpower allows. The ASMFC will provide a rapporteur to take notes on the discussions so that panelists can more fully participate in discussions and assist the analytical team in documenting panel recommendations.

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 will assist the Chair of the review panel with contributions to the Review Panel Report. CIE reviewers are not required to reach a consensus, and should instead provide a brief summary of their views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs, and ensure final review comments and document edits are provided to the Chair.

Appendix 2: CIE Statement of Work.

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 LOCATION and DATES as called for in the SoW, and conduct an independent peer review in accordance with the ToRs (Annex 2);
- 3) No later than 11 September 2009, each CIE reviewer shall submit an independent peer review report addressed to the “Center for Independent Experts,” and sent to Mr. Manoj Shivilani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and to Dr. David Sampson, CIE Regional Coordinator, via email to david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in Annex 2;
- 4) CIE reviewers shall address changes as required by the CIE review in accordance with the schedule of milestones and deliverables.

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

22 July 2009	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
10 August 2009	NMFS Project Contact sends the CIE Reviewers the pre-review documents
24-28 August 2009	Each reviewer participates and conducts an independent peer review during the panel review meeting in Atlanta, Georgia
11 September 2009	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
25 September 2009	CIE submits CIE independent peer review reports to the COTR
01 October 2009	The COTR distributes the final CIE reports to the NMFS Project Contact, the Lead Assessment Agency Contact, and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be made through the Contracting Officer’s Technical Representative (COTR) who submits the modification for approval to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the CIE 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 Terms of Reference (ToR) of the SoW as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToRs and deliverable schedule are not adversely impacted. The SoW and ToRs cannot be changed once the peer review has begun.

Appendix 2: CIE Statement of Work.

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. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (the 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 have 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 notification of 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 approved CIE reports to the NMFS Project Contact, the Lead Assessment Agency Contact, and regional Center Director.

Key Personnel:

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Appendix 2: CIE Statement of Work.

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.
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, 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 detailed summary of findings, 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 Review Panel 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 proceedings and findings of the meeting, regardless of whether or not they read the Review Panel Report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the Review Panel Report.
3. The reviewer report shall include as separate appendices as follows:

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.

Appendix 2: CIE Statement of Work.

Annex 2: Terms of Reference for the Peer Review

SEDAR 18 - Atlantic Red Drum

Approved by the South Atlantic State-Federal Fisheries Management Board
October 23, 2008

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., static spawning potential ratio); provide estimated values for management benchmarks, and declarations of stock status^{*}. Evaluate the population metric used by managers to determine the stock status and, if appropriate, recommend alternative measures.
5. Evaluate the adequacy, appropriateness, and application of methods used to characterize uncertainty in estimated parameters. Provide measures of uncertainty for estimated parameters^{*}. Ensure that the implications of uncertainty in technical conclusions are clearly stated.
6. Ensure that stock assessment results are clearly and accurately presented in the Stock Assessment Report and Summary Report and that reported results are consistent with Review Panel recommendations^{**}.
7. Evaluate the SEDAR Process. Identify any Terms of Reference which were inadequately addressed by the Data or Assessment Workshops; identify any additional information or assistance which will improve Review Workshops; suggest improvements or identify aspects requiring clarification.
8. Review the research recommendations provided by the Data and Assessment workshops and make any additional recommendations warranted. Clearly indicate the research and monitoring needs that may appreciably improve the reliability of future assessments. Recommend an appropriate interval for the next assessment.
9. Prepare a Peer Review Consensus 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 Consensus Report within 3 weeks of workshop conclusion.

* The review panel may request additional sensitivity analyses, evaluation of alternative assumptions, and correction of errors identified in the assessments provided by the assessment workshop panel; the review panel may not request a new assessment. Additional details regarding the latitude given the review panel to deviate from assessments provided by the assessment workshop panel are provided in the *SEDAR Guidelines* and the *SEDAR Review Panel Overview and Instructions*.

** 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.

Appendix 2: CIE Statement of Work.

Annex 3: Tentative Agenda

SEDAR 18 REVIEW WORKSHOP Atlantic Red Drum

**Doubletree Buckhead Atlanta
3342 Peachtree Road, NE, Atlanta, Georgia**

TBN by NMFS, Chair
Mr. Dale Theiling, SEDAR Coordinator

Monday, August 24, 2009

1:00pm – 5:30pm	Afternoon Session	
Convene		
Introductions and Opening Remarks		SEDAR Coordinator and Chair
Agenda Review, TOR Review		Chair
Task Assignments		Chair
Assessment Presentation		Lead analyst
Assessment Discussion		Review Panel and Lead analyst

Tuesday, August 25, 2009

8:00am - 11:30am	Morning Session	
Assessment Discussion		Review Panel
12:00nn Lunch		
2:00pm – 5:30pm	Afternoon Session	
Topical Discussions		Review Panel

Wednesday, August 26, 2009

8:00am - 11:30am	Morning Session	
Topical Discussions		Review Panel
12:00nn Lunch		
2:00pm – 5:30pm	Afternoon Session	
Topical Discussions		Review Panel

Thursday, August 27, 2009

8:00am - 11:30am	Morning Session	
Topical Discussions		Review Panel
12:00nn	Lunch	
2:00pm – 5:30pm	Afternoon Session	

Appendix 2: CIE Statement of Work.

	Review Workshop Report	Review Panel
<i>Friday, August 28, 2009</i>		
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 workshop recommendations and comments
- Data and Assessment Workshop Research Recommendations
- Identify Review Panel research recommendations
- Improvement of the SEDAR process
- Assure all Terms of Reference are addressed
- Develop draft Review Panel Report sections
- 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.

Appendix 2: CIE Statement of Work.

Annex 4: Review Panel Report

Executive Summary

I. Terms of Reference

List each Term of Reference, and include a summary of the Panel discussion regarding the particular item. Include a clear statement indicating whether or not the criteria in the Term of Reference are satisfied.

II. Analyses and Evaluations

Summary results and findings of review panel analytical requests.

Note: The Review Panel Report becomes Chapter 2 of the Review Workshop Report.

Appendix 2: CIE Statement of Work.

Annex 5: SEDAR Review Workshop Panelist and Chair Instructions

Tasks, Responsibilities, and Supplemental Instructions for SEDAR Review Workshop Participants

SEDAR Review Workshop Overview

SEDAR Review Workshops provide independent peer review of stock assessments prepared through SEDAR data and assessment workshops. The goal of the review is to ensure that the assessment and results presented are scientifically sound and that managers are provided adequate advice regarding stock status, management benchmarks, and the general nature of appropriate future management actions. The Review Panel has limited authority to request additional analyses, corrections of existing analyses and sensitivity runs.

An analytical and presentation team, composed of a subset of the Assessment Workshop panel and representing the primary analysts for each assessment, will be present at the workshop to present assessment findings, provide an overview of assessment data, provide additional results or model information, and prepare any additional analyses requested by the Review Panel. Although many individuals contribute to a SEDAR assessment, the Review Panel is ultimately responsible for ensuring that the best possible assessment is provided through the SEDAR process.

The review panel shall not provide specific management advice. Such advice will be provided by existing Council Committees, such as the Science and Statistical Committee and Advisory Panels, following completion of the assessment.

SEDAR review workshop panels are typically composed of a Chair, 3 reviewers appointed by the CIE (Center for Independent Experts), and 1 reviewer appointed by each Council having jurisdiction over the stocks under review. All reviewers are independent, meaning that they should not have contributed to the assessment under review and should not have a role in any management actions that may stem from the assessment. Each Council may appoint several official observers, typically including representatives of the Council, its SSC, and appropriate Advisory Panels.

All SEDAR workshops, including the Review Workshop, are open, transparent, public processes administered according to the rules and regulations governing Federal Fishery Management Council operations. All SEDAR workshops are recorded and transcripts of workshop discussions may be prepared upon request through the SEDAR Steering Committee. The names and affiliations of reviewers will be disclosed in the review workshop documents. The Review Workshop Report will be publicly distributed along with the other SEDAR Workshop working papers and workshop reports. The public may submit written comments in accordance with Council guidelines once the report is disseminated to the relevant Council.

Review workshop panelists receive the Assessment Report, including sections prepared by the data and assessment workshops; supplemental analytical materials including all working papers and reference documents from prior workshops; and general information regarding the Review Workshop, including the agenda, report outlines, terms of reference, and participant list.

Appendix 2: CIE Statement of Work.

Review panelists are expected to read and review the provided materials to become familiar with the assessment.

The charge to each SEDAR Review Workshop is specified in Terms of Reference. During the review the Review Workshop panel will prepare a Review Panel Report for each stock assessed addressing each of the Terms of Reference. The summary should represent the views of the group as a whole, but shall also include any dissenting views of individual panelists if appropriate. Outlines and example documents will be provided by SEDAR staff.

Review Workshop Panel General Instructions

The Review Panel Chair is responsible for compiling, editing, and submitting the Review Panel Report to the SEDAR Coordinator by a deadline specified in the assessment schedule. At the start of the workshop the Chair will assign each panelist specific duties, such as drafting specific report sections. The Chair may select one panelist to serve as assessment leader for each stock assessment under review. The assessment leader is responsible for preparing initial drafts of text addressing Terms of Reference for the assigned assessment. Such duties may be further subdivided if workshop manpower allows. The SEFSC will provide a rapporteur to take notes on the discussions so that panelists can more fully participate in discussions and assist the analytical team in documenting panel recommendations.

The Review Panel's primary responsibility is to ensure that assessment results are based on sound science, appropriate methods, and appropriate data. During the course of review, the panel is allowed limited flexibility to deviate from the assessment provided by the Assessment Workshop. This flexibility may include modifying the assessment configuration and assumptions, requesting a reasonable number of sensitivity runs, requesting additional details and results of the existing assessments, or requesting correction of any errors identified. However, the allowance for flexibility is limited, and the review panel is not authorized to conduct an alternative assessment or to request an alternative assessment from the technical staff present. The SEDAR Steering Committee recognizes that determining when modifications constitute an 'alternative' assessment is a subjective decision, and has therefore determined that the Review Panel is responsible for applying its collective judgment in determining whether proposed changes and corrections to the presented assessment are sufficient to constitute an alternative assessment. The Review Panel Chair will coordinate with the SEDAR Coordinator and technical staff present to determine which requests can be accomplished and prioritize desired analyses.

Any changes in assessment results stemming from modifications or corrections solicited by the review panel will be documented in an addendum to the assessment report. If updated estimates are not available for review by the conclusion of the workshop, the review panel shall agree to a process for reviewing the final results. Any additional or supplemental analyses requested by the Review Panel and completed by the Analytical team shall, at the discretion of the chair and panel, be either documented through a supplemental report or included in the Review Panel Report.

If the Review Panel finds an assessment deficient to the extent that technical staff present cannot correct the deficiencies during the course of the workshop, or the Panel deems that desired modifications would result in an alternative assessment, then the Review Panel shall

Appendix 2: CIE Statement of Work.

provide in writing the required remedial measures suggest an appropriate approach for correcting the assessment and subsequently reviewing the corrected assessment.

Review Workshop Panel Participant Information

Serving as a review workshop panelists is a considerable time commitment that requires more than simply the daily sessions of the review workshop. Panelists will need to set aside time in the weeks prior to the workshop to review data and assessment documents. During the workshop, time beyond that of the scheduled daily sessions may be required to complete workshop tasks and reports. Time is required following the workshop to review and finalize panel reports.

Review panelists are expected to author workshop reports and may conduct supplementary analyses or data summaries. Panelists should come prepared with a laptop computer for these tasks.

The SEDAR Steering Committee and SEDAR Coordinator establish deadlines for document submission. SEDAR staff distributes working documents and support materials (agenda, participant instructions) to workshop participants, typically two weeks prior to the workshop.

SEDAR Workshop Panelist Code of Conduct

- SEDAR workshop panels decisions shall be based on science. Discussions and deliberations shall not consider possible future management actions, agency financial concerns, or social and economic consequences.
- SEDAR Review Workshop Panels are encouraged to reach a group consensus that all participants can accept, which may include agreeing to acknowledge and present multiple possibilities. If this is not feasible, then each reviewer may state their individual opinion with regard to the Terms of Reference and are responsible for providing appropriate text that captures their opinion for the Review Panel Report.
- Personal attacks will not be tolerated. Advancement in science is based on disagreement and healthy, spirited discourse is encouraged. However, professionalism must be upheld and those who descend into personal attacks will be asked to leave.
- SEDAR workshop panelists are expected to support their discussions with appropriate text and analytical contributions. Each panelist is individually responsible for ensuring that their points and recommendations are addressed in workshop reports; they should not rely on others to address their concerns.
- Panelists are expected to provide constructive suggestions and alternative solutions; criticisms should be followed with recommendations and solutions.

Review Workshop Networking and IT

A wireless network is available at each SEDAR workshop to provide internet and file server access. All reports and documents pertaining to the review will be available on the server. IT staff will be available during the review workshop to aid each participant in securing network access.

Review Workshop Chair, Reviewer, and Support Staff Responsibilities

Appendix 2: CIE Statement of Work.

Review Workshop Chair:

1. Approximately 3 weeks prior to the Assessment Review Panel workshop the Chair shall be provided with same document package provided to the Technical Reviewers and appointed observers, including stock assessment reports and associated documents. The Chair shall read and review all documents to gain an in-depth understanding of the stock assessment under consideration and the data and information considered in the assessment.
2. Approximately 1 week prior to the workshop the Chair may be asked to participate in a conference call with the SEDAR Coordinator and representatives of the stock assessment teams to review the final agenda, plan for presentations, and meeting format.
3. During the Assessment Review Workshop the Chair shall control and guide the meeting, including the coordination of presentations, discussions, and task assignments.
4. During the Assessment Review Workshop the Chair may participate in technical discussions and serve as a technical reviewer.
5. During the Assessment Review Workshop the Chair shall work with the SEDAR Coordinator and the analytical and presentation team to manage the workload of panel requests and recommendations. At the conclusion of each session the Chair shall provide prioritized task lists to the analytical team and SEDAR Coordinator.
6. The Chair shall facilitate preparation and writing of the Review Panel Report. Review panel members, agency staff, and others present at the meeting will assist the Chair as needed. The Chair shall be responsible for the editorial content of Panel reports, and the Chair shall be responsible for ensuring that reports are produced and distributed to appropriate contacts on schedule (see “Final Reports” below).
7. The SEDAR coordinator shall assist the Assessment Review Panel Chair prior to, during, and after the meeting to ensure that documents are distributed in a timely fashion.
8. Expected Time Obligation: It is estimated that the Chair’s duties shall occupy up to 14 days: several days prior to the Review Panel meeting for document review, five days for the workshop, and several days following the meeting to ensure that the final documents are completed.

Review Workshop Technical Reviewer:

1. Approximately three weeks prior to the meeting, the reviewers shall be provided with the stock assessment reports, associated supporting documents, and review workshop instructions including the Terms of Reference. Reviewers shall read these documents to gain an in-depth understanding of the stock assessment, the resources and information considered in the assessment, and their responsibilities as reviewers.
2. During the Review Panel meeting, reviewers shall participate in panel discussions on assessment methods, data, validity, results, recommendations, and conclusions as guided by the Terms of Reference. The reviewers shall develop a Review Panel Report for each assessment reviewed. Reviewers may be asked to serve as an assessment leader during the review to facilitate preparing first drafts of review reports.

Appendix 2: CIE Statement of Work.

3. Following the Review Panel meeting, reviewers shall work with the chair to complete and review the Review Panel Reports. Reports shall be completed, reviewed by all panelists, and comments submitted to the Chair within two weeks of the conclusion of the workshop.
4. Additional obligation of CIE-appointed reviewers: Following the Review Panel meeting, each reviewer appointed by the CIE shall prepare an individual CIE Reviewer Report and submit it in accordance with specifications provided in the Statement of Work.

Review Workshop Support Staff:

SEDAR Coordinator: Arrange workshop and handle meeting logistics; distribute workshop materials and notices; support chair and reviewers during review workshop; coordinate with chair and analytical team to prioritize panel task requests; address procedural issues that arise; distribute final workshop products in accordance with SEDAR protocols.

Analytical and Presentation Team: Present data overview and assessment results, address panel questions and comments as required; complete panel requests for additional analyses or model corrections in accordance with SEDAR guidelines; document any analyses conducted during the workshop.

Rapporteur: Take notes on panel discussion of assigned species for use by technical reviewers in preparing initial report drafts, assist SEDAR Coordinator, Chair, and Analytical team in addressing panel requests and completing workshop documents as necessary.

IT Support: Set-up and manage the SEDAR network to provide internet and file server capabilities during the workshop, work with hotel or vendor contacts to provide internet and email access, ensure all participants are able to access the network, and address any IT-related issues that arise during the workshop

SEDAR Administrative Assistant: Provide general support to workshop participants, coordinate with hotel banquet and events staff to facilitate proper room arrangements and daily catering orders, record workshop sessions, manage submitted documents and written statements for administrative record.

SEDAR Review Workshop Panel Report Outline

Executive Summary

I. Terms of Reference

List each Term of Reference, and include a summary of the Panel discussion regarding the particular item. Include a clear statement indicating whether or not the criteria in the Term of Reference are satisfied.

II. Analyses and Evaluations

Summary results and findings of review panel analytical requests..