S E D A R

Southeast Data, Assessment, and Review

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SEDAR 18

Workshop Research Recommendations

Atlantic Red Drum

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Section IV. Research Recommendations

Contents: Page Numbers and One-way Links

1. Data Workshop 1
   1.1 Recommendations of the Life History Work Group 1
   1.2 Recommendations of the Commercial Work Group 1
   1.3 Recommendations of the Recreational Work Group 2
      1.3.1 Review of Historical Data 2
      1.3.2 Marine Recreational Information Program (MRIP) 2
      1.3.3 Volunteer Logbook 2
   1.4 Recommendations of the Indices Work Group 2
2. Assessment Workshop 2
   2.1 Recommendations of the Assessment Panel 2
3. Review Workshop 2
   3.1 Review of Data Workshop Recommendations 3
      3.1.1 Life History Workgroup 3
         3.1.1.1 The ASMFC-approved multi-state sampling program of adult Atlantic red drum from Florida to Virginia 3
         3.1.1.2 Updated adult maturity schedules and fecundity information from Florida to Virginia 3
         3.1.1.3 Further study to determine discard mortality estimates for recreational and commercial gears; impact of slot-size limit management; regulatory discard impacts due to high-grading 3
         3.1.1.4 Dedicated northern and southern region larval and juvenile recruitment indices; Virginia adult recruitment index 3
         3.1.1.5 Continued cooperation between state ageing labs to provide consistent age verification; otolith microchemistry should be approached for stock differentiation 3
         3.1.1.6 Identification of juvenile and adult habitat requirements and loss rates 4
      3.1.2 Commercial Work Group 4
         3.1.2.1 Continued and expanded observer coverage for the NC and VA gill net fisheries (5-10% coverage) 4
         3.1.2.2 Expand observer coverage to include other gears of concern (i.e. haul seine, pound net, trawls) 4

3.1.2.3 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 4
3.1.3 Recreational Work Group 4
3.1.3.1 Have experts in survey design and implementation review historical data 4
3.1.3.2 Improve recreational and for-hire data collection through the Marine Recreational Information Program (MRIP) 4
3.1.3.3 Inclusion of volunteer logbook data for length 4
3.1.4 Indices Work Group 5
3.1.4.1 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 delineate stock distribution and mixing rates. 5
3.1.4.2 Workshop on adaptive sampling techniques as applied to wildlife populations and other techniques that can be applied to aggregated species. 5
3.1.4.3 Encourage States continue current surveys with current methodologies. If sampling methodologies change, maintain consistency between original and new methodologies. 5
3.1.4.4 Age structure established for surveys internally rather through external age-length keys 5
3.2 Recommendations of Assessment Workshop (1 – 5 June 2009) 5
3.2.1 Determine batch fecundity estimates of red drum 5
3.2.2 Conduct experiments using logbooks etc. to develop estimates of the B2 catch in both the North and South regions 5
3.2.3 Further identify selectivity of age classes of the B2 catch in both regions 5
3.2.4 Determine if existing and historic recreational tagging programs can be used to evaluate better B2 selectivities 6
3.3 Recommendations of Review Workshop 6
3.3.1 Needs of Current Assessments 6
3.3.1.1 Current Surveys 6
3.3.1.2 Adult Survey 6
3.3.1.3 Existing Tagging Data 6
3.3.1.4 Tagging Data Model Integration 6
3.3.1.5 Data Set Weighting 7
3.3.1.6 Proportion-at-Age Sample Size 7
3.3.1.7 Size Frequency 7
3.3.1.8 Effects of Age 4+ Abundance Constraints 7

3.3.1.9 Effects of Data Inconsistency on Uncertainty 7
3.3.1.10 Confirmation of Convergence 8
3.3.1.11 Over-Parameterization 8
3.3.1.12 Fishing Mortality Estimates Based on Tagging Data 8
3.3.2 Recommend an appropriate interval for the next assessment 8

1. Data Workshop

1.1 Recommendations of the Life History Work Group

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.

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.

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.

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.

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.

Identification of juvenile and adult habitat requirements and loss rates would provide more informative information for future management planning

1.2 Recommendations of the Commercial Work Group

- Continued and expanded observer coverage for the NC and VA gill net fisheries (5-10% coverage).
- Expand observer coverage to include other gears of concern (i.e. haul seine, pound net, trawls).
- 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.

1.3 Recommendations of the Recreational Work Group

1.3.1 Review of Historical Data

Have experts in survey design and implementation review historical data.

1.3.2 Marine Recreational Information Program (MRIP)

The recreational statistics workgroup supports ongoing efforts to improve recreational and for-hire data collection through the Marine Recreational Information Program (MRIP).

1.3.3 Volunteer Logbook

We support inclusion of volunteer logbook data for length.

1.4 Recommendations of the Indices Work Group

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.

Suggests a workshop on adaptive sampling techniques as applied to wildlife populations as well as other techniques that can be applied to aggregated species.

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.

Age structure established for surveys internally rather through external age-length keys.

2. Assessment Workshop

2.1 Recommendations of the Assessment Panel

The assessment panel reviewed the research recommendations from the data workshop report. Additional research recommendations developed at the Assessment Workshop are:

- Determine batch fecundity estimates of red drum.
- Conduct experiments using logbooks etc. to develop estimates of the B2 catch in both the North and South regions.
- Further identify the selectivity of age classes of the B2 catch in both regions.
- Determine if existing and historic recreational tagging programs can be used to evaluate better B2 selectivities.

3. Review Workshop

In reply to RW Term of Reference 8 the Review Panel reviewed the research recommendation of the Data Workshop and the Assessment Workshop and provided research recommendations of its own.

3.1 Review of Data Workshop Recommendations

3.1.1 Life History Workgroup

3.1.1.1 The ASMFC-approved multi-state sampling program of adult Atlantic red drum from Florida to Virginia

The Review Panel considers this project low priority for leading to improvements to the assessment of red drum stock status. The Review Panel considers that further investigation into population structure is important. However, genetic analyses are only one of the tools available to address this question and may be of limited utility if there are low levels of gene flow among populations or if population divergence has been recent. It was not clear to the Review Panel how knowledge of the effective population size would be expected to improve the assessment.

3.1.1.2 Updated adult maturity schedules and fecundity information from Florida to Virginia

The Review Panel supports research to better characterize maturity schedules of red drum for the northern and southern stocks, given the observed differences in growth in these resources. This study would require a specially designed sampling plan given the potential bias due to age- and possible maturity-dependent processes.

3.1.1.3 Further study to determine discard mortality estimates for recreational and commercial gears; impact of slot-size limit management; regulatory discard impacts due to high-grading

The Review Panel recommends the establishment of programs to provide on-going estimates of commercial discard and recreational live release mortality using appropriate statistical methods. While specifically targeted studies are useful, it is through time series of these data that patterns emerge and insight is gained on both mortality rates and influential processes.

3.1.1.4 Dedicated northern and southern region larval and juvenile recruitment indices; Virginia adult recruitment index

The Review Panel does not support the establishment of larval surveys to provide indices of spawning biomass. Larval surveys can only provide general indications of spawning biomass. There are more direct sampling approaches to assess spawning biomass. Further, the Review Panel recommends evaluation of the broader survey program needs (see section 2.1.8.3).

3.1.1.5 Continued cooperation between state ageing labs to provide consistent age verification; otolith microchemistry should be approached for stock differentiation

On-going cooperation between state ageing labs should be standard best practice; the Review Panel notes its concern if this is not occurring. It is thus highly supportive of this recommendation.

In relation to the recommendation on otolith microchemistry, the Review Panel considers that this project would be of value if the life stage linkage between estuarine and offshore red drum were incorporated into the study. There is uncertainty on the origins of offshore adult red drum in relation to the early life history stages in the estuarine habitat which could be resolved by this study.

3.1.1.6 Identification of juvenile and adult habitat requirements and loss rates

As this recommendation does not directly pertain to improvements in the stock assessment but rather to management, the Review Panel defers comment.

3.1.2 Commercial Work Group

3.1.2.1 Continued and expanded observer coverage for the NC and VA gill net fisheries (5-10% coverage)

The Review Panel notes that observer coverage in the NC fishery during 2004-06 was adequate but didn't provide an indication of annual variability in discard rates. The Panel thus supports expanded observer coverage in State and Federal fisheries as appropriate to allow better on-going characterization of discards in directed and non-directed fisheries. As noted earlier, while specifically targeted studies are useful, it is through time series of these data that patterns emerge and insight is gained on both mortality rates and influential processes. Specifically, it is important that this program identify the main factors that cause both high vulnerability of red drum to fishing gear (e.g. salinity, temperature) and high post – release mortality (e.g. hook type).

3.1.2.2 Expand observer coverage to include other gears of concern (i.e. haul seine, pound net, trawls)

As with the previous recommendation, the Review Panel supports expanded observer coverage in State and Federal fisheries as appropriate to allow better on-going characterization of discards in directed and non-directed fisheries.

3.1.2.3 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

The Review Panel recommends that this project only be undertaken based upon a statistical analysis which would specify the details of a sampling program required to comprehensively characterize the age/size composition of removals.

3.1.3 Recreational Work Group

3.1.3.1 Have experts in survey design and implementation review historical data

Sampling design is fundamental to any survey activity but it is unclear what is being proposed. Thus, the Review Panel cannot comment on this recommendation.

3.1.3.2 Improve recreational and for-hire data collection through the Marine Recreational Information Program (MRIP)

The Review Panel supports this recommendation to the degree that it informs the stock assessment of red drum.

3.1.3.3 Inclusion of volunteer logbook data for length

The Review Panel supports this recommendation to the degree it informs stock assessment of red drum. Further, the statistical methods used to analyze the collected data require careful consideration given that there does not currently appear to be an experimental design for the volunteer program.

3.1.4 Indices Work Group

3.1.4.1 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 delineate stock distribution and mixing rates.

This recommendation is unclear. Thus, the Review Panel cannot comment.

3.1.4.2 Workshop on adaptive sampling techniques as applied to wildlife populations and other techniques that can be applied to aggregated species.

See the Review Panel's recommendation on surveys (RW Report Section 2.1.8.3). There, the need for the study of the broader survey program needs is identified.

3.1.4.3 Encourage States continue current surveys with current methodologies. If sampling methodologies change, maintain consistency between original and new methodologies.

As with the previous recommendation, see the Review Panel's recommendation on surveys (RW Report Section 2.1.8.3). There, the need for the study of the broader survey program needs is identified.

3.1.4.4 Age structure established for surveys internally rather through external age-length keys

Best practice is that survey-specific age/length keys are developed and applied to that survey's size frequency information to provide age-based estimates of abundance. Thus, the Review Panel endorses this recommendation.

3.2 Recommendations of Assessment Workshop (1 – 5 June 2009)

3.2.1 Determine batch fecundity estimates of red drum

The Review Panel does not support this recommendation as it will not significantly improve the red drum stock assessments. While more precise estimates of fecundity could be provided, it is unclear how these would be used given the uncertainties in the estimation of age 4^+ female abundance.

3.2.2 Conduct experiments using logbooks etc. to develop estimates of the B2 catch in both the North and South regions

See the Review Panel's response to the Data Workshop's recommendation on volunteer logbook data (section 2.1.8.1), where the need for careful consideration of the statistical analyses to be employed on these datasets was noted.

3.2.3 Further identify selectivity of age classes of the B2 catch in both regions

Assuming that adequate size frequency information is collected for the B2 catch, the Review Panel supports explorations of assessment model formulations that fit modeled size frequencies to the observations (see section 2.1.8.3).

3.2.4 Determine if existing and historic recreational tagging programs can be used to evaluate better B2 selectivities

See previous recommendation.

3.3 Recommendations of Review Workshop

3.3.1 Needs of Current Assessments

The Review Panel considered the needs of the two red drum assessments that were additional to those noted in the Data and Assessment workshops. These covered issues spanning input data, assessment model and benchmarks.

3.3.1.1 Current Surveys

The Review Panel recommends study of the broader survey program to better identify gaps in current activities and potential expansion / refocusing of current surveys. At present, it is difficult to discern where improvements to the overall survey program could be made. This study could be undertaken through simulation work to evaluate how proposed new survey activities would better inform stock assessment and management.

3.3.1.2 Adult Survey

The Review Panel notes the gap in synoptic indices of adult abundance and age composition which are critical to improvements in the red drum stock assessments. It recommends that a survey to provide indices of abundance for ages 4 and older be established but in the context of the previous recommendation. During the Review Workshop, mention was made of apparent gaps in the size frequencies (i.e., red drum present in these distributions at smaller sizes and again at larger sizes but with few observations in between). The Review Panel recommends development of testable hypotheses on the biological basis of this apparent missing size frequency information. Survey activity could then be designed to challenge these hypotheses.

3.3.1.3 Existing Tagging Data

The Review Panel recommends that a comprehensive analysis of existing tagging data for use in the assessment models be undertaken and, based upon this, there be consideration of additional tagging activities (based upon a statistical design for both the northern and southern stocks to provide age-based estimates of population abundance and fishing mortality). This activity could also provide estimates of movement which can confound estimation of stock parameters. It would be worthwhile to consider State- Space methods as has been recently employed to estimate fishing mortality and migration rates of some New England groundfish stocks (Miller and Andersen, 2008).

3.3.1.4 Tagging Data Model Integration

Further on the tagging data, the Review Panel strongly recommends integration of the tagging analysis into the assessment models, thereby ensuring that parameters and error estimates derived in the model are appropriately treated throughout the analysis. This would ensure that the tagging data are appropriately weighted in the assessment model and are not afforded undue weighting compared to other information.

3.3.1.5 Data Set Weighting

The Review Panel recommends exploration of iterative re-weighting to better define weightings for the contribution of each data set. The contribution of the survey indices to the negative log-likelihood calculated by the assessment model should be modified to allow for both the variance associated with sampling, i.e. related to the CVs calculated for the surveys, and an additional variance component due to "fluctuations in ... the fraction of the population present in the sites being surveyed" (Punt et al., 2002). An example is presented by DeOliveira et al. (2007), who cite Butterworth et al. (1993). Essentially, the inclusion of this additional variance provides an iterative re-weighting of the survey indices and avoids the need for including an arbitrary, subjective, external weighting, such as that currently employed in the assessment model. A similar approach may need to be adopted for other components of the objective function if the observations are derived from samples that are not fully representative.

3.3.1.6 Proportion-at-Age Sample Size

The effective sample size that is currently employed when calculating the negative log-likelihood of the proportion-at-age data, i.e., the square root of the number of fish in the age-length key for the year or two if no age-length key was available for the year, should be compared with the value that is currently calculated in the ADMB implementation of the model using the method described by McAllister and Ianelli (1997, Appendix 2, Equation 2.5). Such a comparison might indicate whether the effective sample size currently used is appropriate.

3.3.1.7 Size Frequency

The Review Panel recommends exploration of assessment model formulations that fit modeled size frequencies, based upon age-based population dynamics to the size frequency observations. This would facilitate use of size frequency data when data for age / length keys are too sparse to reliably derive age composition.

3.3.1.8 Effects of Age 4+ Abundance Constraints

The Review Panel recommends exploration of imposing constraints on the size of the age 4^+ abundance to determine whether or not model fits are improved.

3.3.1.9 Effects of Data Inconsistency on Uncertainty

Possible inconsistencies among the various data sets that contribute to the objective function of the assessment model should be explored by plotting the likelihood profiles for each component across the ranges of feasible values for the parameters that represent the major axes of uncertainty. By examining the resulting plots, it is possible to identify the values of the parameters that minimize the negative log-likelihood of the different components, and thereby identify those parameters that most influence the values of the parameter estimates. Identification of inconsistencies among the data sets provides a focus for re-assessing the extent to which inconsistent data sets are representative of the variables that they are intended to measure.

3.3.1.10 Confirmation of Convergence

Convergence of the assessment models for the base, sensitivity and retrospective runs should be confirmed by "jittering" the initial parameter values and re-fitting the model a number of times, e.g. 100, then comparing the resulting parameter estimates and values of the objective function (e.g., Methot, 2007). Exploration of the consequences of "jittering" may also reveal whether the model converges to a region of parameter space in which the Hessian is positive definite, noting that, in several of the retrospective runs, the Hessian was found to be non-positive definite.

3.3.1.11 Over-Parameterization

Highly-correlated parameters indicate that the parameter estimates to which the model has converged are likely not to be unique, and that the model may be over-parameterized. In future stock assessments, the Review Panel recommends that the parameter correlation matrix should be explored.

3.3.1.12 Fishing Mortality Estimates Based on Tagging Data

The Review Panel recommends exploration of use of estimates of fishing mortality directly from the tagging data (i.e. northern stock) as the basis for stock assessment and guidance for fisheries management. Current stock assessments are undertaken every five years or so and involve the collection and synthesis of a wide array of data. The tagging program, as long as it is designed appropriately, can directly provide estimates of fishing mortality at a higher frequency than the current statistical catch-at-age (SCA) formulations. It also has the benefit of having wide fishery visibility and support. Through a simulation exercise, such as Management Strategy Evaluation (MSE), the efficacy of using the tagging-derived fishing mortality estimates between applications of the SCA assessment could be explored. The use of the tagging information directly to inform management decision rules could also be investigated.

3.3.2 Recommend an appropriate interval for the next assessment

Key issues which influence the appropriate interval until the next red drum assessments are significant advances on the research agenda and the nature of management actions. It is evident that until progress on many of the research recommendations outlined in this report is made, future assessments will suffer many of the same uncertainties that have influenced the current assessments. It would be inappropriate to undertake assessments before the key ones are addressed. If management requires more immediate assessment input, then consideration should be given to more immediate addressing of the tagging-related recommendations as these may provide improvements in the relatively short-term. The last Review Panel recommendation on MSE-style simulations is of particular note in this regard. This approach would allow evaluation of the assessment approach (e.g. SCA, tagging analysis) in the context of the management tools in use.

Under these conditions, it is likely that the next assessment should not be undertaken within at least five years.