

**Report on the 2004 South East Data, Assessment, and Review (SEDAR 5)
Workshop to Review the Assessments of the Status of the Stocks of King Mackerel
Atlantic and Gulf of Mexico Migratory Units**

By

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Executive Summary

The SEDAR 5 panel review workshop on King mackerel assessments was competently chaired, and conducted in a spirit of cooperation and teamwork. The assessments were conducted by SEFSC stock assessment biologists, and were subject to a very open peer review process that identified the most likely sources of uncertainty. The Review Panel unanimously agreed that the assessments were based on an appropriate age-structured assessment model and the best available data, with exception for a minority disputing the applied mixing rate between the two migratory groups. A majority of panel members agreed that reliable estimates of mixing proportions could not be established from existing data, and therefore chose the base-run assumption that Gulf king mackerel represent 100% of the population in the mixing zone. This base-run assumption about mixing rates, used in previous assessments, was disputed by a minority of panel members, who argued that existing data supported an even split between Atlantic and Gulf migratory groups in the mixing zone. After a lively and thorough discussion, no consensus was reached on using estimated mixing rates instead of assuming 100% Gulf mackerel in the mixing zone. A minority report that suggested to use an even split in the mixing zone was thus included as an appendix. I side with the majority opinion on this issue and strongly disagree with the views of one scientist presented in Appendix 2. The base model was chosen by the majority after rejecting the reliability of mixing rate estimates, and not based on management considerations outside the scope of this review. I agree with the majority of the Panel members that the potential effect of using alternative estimates of mixing rates was appropriately evaluated through sensitivity analysis. The Assessment Report states that results of the current Gulf assessment indicate the Gulf king mackerel migratory group is rebuilding, while the Atlantic migratory stock has been rebuilt and remains stable. I support this statement.

Several potential sources of bias and uncertainty in the input data were identified during the review. Uncertainty in the stock assessments results from the extensive dependence

on fisheries-dependent indices of abundance, exaggerated by the limited information about discards. Improved monitoring of the stocks will require fisheries-independent survey indices of abundance and adequate data on discards from all fishery segments.

1. Background

The South East Data, Assessment, and Review (SEDAR) process is part of the NMFS-Southeast Fisheries Science Center's program for quality control and assurance of stock assessments in the South East region. The SEDAR process is conducted by the South Atlantic Fisheries Management Council (SAFMC) in close coordination with NMFS and the Interstate Commissions to ensure the scientific quality and credibility of stock assessments, and to assure that they continue to support effective fishery management. The SEDAR process comprises a Data Workshop, an Assessment Workshop, and a Stock Assessment Review Workshop conducted in sequence. This is a report on the SEDAR 5 Stock Assessment Review Workshop for King mackerel, held in Miami, FL at the NMFS Southeast Fisheries Science Center (SEFSC) from April 5 to 8, 2004. This report presents my evaluation of the review process, and briefly summarizes the findings and recommendations, with focus on my experience as a reviewer on the panel. This report should be read in conjunction with the two reports prepared by the review panel.

2. Description of review activities

Data and Assessment Workshop reports for the two migratory stocks under consideration, South Atlantic and Gulf King Mackerel, were made available for review before the meeting. I received the voluminous documentation only 5 days before the start of the meeting, and thus only had limited time to review the material beforehand. Apparently, the other panel members received the documentation 2 weeks prior to the meeting.

The SEDAR 5 Stock Assessment Review Workshop for King mackerel was chaired by Dr. Henrik Sparholt (CIE) and coordinated by John Carmichael in an organized and effective manner. The workshop was conducted in a spirit of cooperation and teamwork. During the review meeting, each stock assessment was presented by the responsible assessment expert, and reviewed by the panel. The 11-member review panel represented a broad area of expertise in fisheries, and included participants from the:

- NMFS-Southeast Fisheries Science Center, Galveston, TX
- NMFS-Northeast Fisheries Science Center, Woods Hole, MA
- South Atlantic and Gulf Fisheries Management Councils
- NC Department of Marine Fisheries
- Gulf and South Atlantic fishermen associations
- Center for Independent Experts (chair and reviewer)

Review activities during the workshop involved panel discussions on assessment validity and results, and the development of consensus recommendations and conclusions following the presentation of assessments for each migratory group. Dr. Gerry Scott and his staff of stock assessment scientists from SEFSC did an outstanding job presenting the assessment results, and provided expert knowledge whenever asked. Dr. Liz Brooks from the SEFSC did an excellent job documenting the consensus review comments for inclusion in the reports authored by the panel. The SEFSC assessment scientists and supporting staff were very helpful throughout the review meeting by answering questions related to the panel's interpretation of the available data and results. The effectiveness of the review process was substantially enhanced by the contributions from the Assessment Workshop/Review Panel Support Staff and from the South Atlantic Fisheries Management Council Staff and sub-committee members. In most cases, this diverse group of fisheries experts could clarify issues related to assessment models and the available input-data.

The review panel focused on the evaluation of the adequacy and appropriateness of:

- Fishery-dependent and independent data used in the assessment (i.e. was the best available data used in the assessment);
- Application of models used to assess these species and to estimate population benchmarks (MSY, Fmsy, Bmsy and MSST, i.e. Sustainable Fisheries Act items);
- Models used for rebuilding analyses.

The review panel reviewed the assessments in detail, and had thorough discussions on how to best deal with overlapping distributions of Atlantic and Gulf king mackerel in the respective assessments (“the mixing issue”).

During the week following the review meeting, the entire panel took part in the development of the two summary reports by providing input, and by reviewing comments from fellow panel members. The consensus report covers the terms of reference in detail, and includes all research recommendations that I considered to be of highest priority.

3. Summary of findings

3.1. Input Data

Data evaluated as inputs to the assessments included

- Stock distributions and overlap
 - Historic tagging studies,
 - Recent studies of otolith shape and microchemistry,
 - DNA-microsatellite data
- Catch and harvest by size, age, and sex
 - Trip tickets,
 - Log-book programs,
 - Marine recreational Fishery Statistics Survey (MRFSS),
 - NMFS Headboat survey,
 - Texas Parks and Wildlife Coastal Creel survey
- Discard in directed commercial fishery
 - Self-reporting log-book program
- Life history parameters (growth parameters, fecundity at age)
 - Historic and updated growth curves,
 - Age-length and egg-length from the literature
- Abundance indices
 - Recreational and commercial CPUE,
 - Fisheries-independent surveys (SEAMAP)

The panel focused on the accuracy and reliability of the input-data, and sought information about the availability of additional data that potentially could be used to enhance the stock assessments. I consider the input data applied, including stock-recruitment relationships and the abundance indices used for tuning, to be adequate and appropriate for the stock assessments. Nevertheless, it is of concern that the abundance indices and estimates of population characteristics rely heavily on fisheries-dependent data. It is well known that CPUE from commercial and recreational fisheries often fail to track the true status of the stock for wide variety of fisheries (e.g., Gunderson 1994, and numerous references therein). The VPA method is particularly sensitive to inaccurate information on catches at age, for example related to limited sampling coverage (spatially and temporally) of landings, and unreported discards. Ulltang (1996) shows discrepancy between VPA and fisheries-independent abundance indices from trawl and acoustic surveys.

A majority of panel members agreed that reliable estimates of mixing proportions could not be established from existing data, and therefore voted to apply the current base assumption that Gulf king mackerel represent 100% of the population in the mixing zone. This assumption about mixing rates, used in previous assessments, was disputed by a minority of panel members, who argued that existing data supported an even split between Atlantic and Gulf migratory groups in the mixing zone. After a lively and

thorough discussion, no consensus was reached on using estimated mixing rates instead of assuming 100% Gulf mackerel in the mixing zone.

3.2. Assessment and Projection Models

The Review Panel unanimously agreed that the FADAPT VPA method employed was appropriate given the available data, although it was suggested that alternative methods such as Integrated Catch at Age (ICA, Patterson and Melvin, 1996) be considered in future assessments because it might be more stable in the case of King mackerel where F is not much larger than M . The panel agreed with the base assessments and projection, with exception for a minority disputing the applied mixing rate between the two migratory groups. The panel documented its review findings in a Peer Review Panel Consensus Report that includes detailed comments on the individual species assessments and the Panel's findings on the status of the stock and the fishery. The panel also co-authored a Summary Stock Status Report in support of the Fisheries Management Council. I agree with these findings and recommendations, which incorporated all my input.

4. Conclusions and recommendations

In my opinion, this fifth SEDAR review process clearly supports the Council's objective to continually improve the quality of stock assessments and their relevance to support sound fishery management. The review process was open, and the assessment scientists from SEFSC did a great job presenting the assessments to the panel. The panel members had broad and complimentary expertise that covered all the review subjects. The panel greatly benefited from the input from the meeting support staff and other attendees, throughout the review process.

The review process worked well overall. The workshop meeting was competently chaired, and conducted in a spirit of cooperation and teamwork. The follow-up editing process via e-mail was suitable for dealing with minor technical editorial comments, but a conference call among all panel members might have been more appropriate for dealing with one dispute regarding the incorporation of mixing rate estimates in the assessment. I believe the SEDAR 5 was a very open peer review process that fairly evaluated the stock assessments based on scientific criteria. In contrast to the opinion provided by one panel member (Appendix 2 in the consensus report), I do not agree that management considerations unduly influenced the review process. I feel that the stock assessments were based on suitable methods and the best available data, and that the most likely sources of uncertainty were identified. I support the conclusions and recommendations that are detailed in the SEDAR 5 workshop review panel consensus and advisory reports, and side with the majority decision to adopt the assumption on mixing rates.

I strongly agree with the research recommendations provided in the consensus report. It is important that estimates of age-composition of commercial and recreational discards, and

of discard mortality be obtained. It is strongly recommended that fisheries-independent surveys be expanded, and eventually assigned more weight in the tuning process. Fisheries-independent surveys should be designed to provide indices of abundance for the full age range in the stock. This would likely require multi-seasonal sampling and the combined use of multiple sampling gears and hydro-acoustics.

Improved estimates of mixing rates between the two migratory stocks should be obtained through carefully designed tagging programs. It is also recommended that the promising otolith shape and microchemistry analysis further pursued, and that mixing rates in the mixing zone be estimated for the summer and winter periods. Data from Mexican catches need to be obtained to improve the accuracy of Gulf king mackerel assessments.

If feasible, I recommend that the uncertainty in assessments caused by sampling variability in estimated landings in number by age be further evaluated. Sensitivity runs for current assessments indicate that the variability in catch-at-age may not be fully accounted for. I recommend that bootstrapping be applied to age-length keys from to port sampling data in connection with the model runs, with trips being the primary sampling unit for resampling. Results in Vølstad et al. (1997) indicate that the effective sample size for estimating proportions at age in landings can be substantially lower than the number of fish sampled for age, and is better approximated by the number of hauls (or trips) sampled. The latter approximation is used in the assessments of Alaska Pollock.

The use of multiple survey indices for “tuning” can introduce a bias of unknown magnitude in the assessments of Atlantic and Gulf king mackerel. In current assessments, the multiple abundance indices are assigned equal weights, regardless of their coverage with respect to size and distribution of king mackerel, or the precision of each series. One way to reduce such bias is to combine overlapping survey estimates by using a composite estimator with weights determined by coverage and precision of each abundance series, and then apply the combined series in tuning the model. Additional post-stratification might be appropriate when surveys overlap only in a sub-area or during a limited time. Examples of the combination of multiple indices are presented in Korn and Graubard (1999) and Rao (2003). The external analysis of multiple survey indices of abundance might provide a better understanding of the input data, make the weighting more transparent, and result in a more parsimonious stock assessment model.

References

- Gunderson, D.R. 1994. *Surveys of Fisheries Resources*, John Wiley & Sons.
- Korn, E.L. and B.I. Graubard. 1999. *Analysis of Health Surveys*. John Wiley & Sons.
- Rao, J.N.K. 2003. *Small Area Estimation*. John Wiley & Sons.
- Ulltang, Ø 1996. Stock assessment and biological knowledge: can prediction uncertainty be reduced? *ICES Journal of Marine Science* 53: 659-675.

Vølstad, J.H, W.R. Richkus, S. Gaurin, and R. Easton. 1997. Analytical and Statistical Review of Procedures for Collection and Analysis of Commercial Data Used for Management and Assessment of Groundfish Stocks in the U.S. Exclusive Economic Zone Off Alaska. Prepared for the U.S. Department of Commerce, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, Washington. 172 pp.

Appendix A: Material Provided prior to SEDAR 5 panel review workshop:

Document #	Title	Authors
Documents Reviewed at the Data Workshop		
SEDAR5-DW-1	Estimating Catches and Fishing Effort of the Southeast United States Headboat Fleet, 1972-1982.	Dixon, R.L. and G.R. Huntsman
SEDAR5-DW-2	2003 Report of the MSAP	MSAP
SEDAR5-DW-3	Regulatory Overview of South Atlantic and Gulf of Mexico King Mackerel	Carmichael, J.T.
SEDAR5-DW-4	A general description of the SEAMAP larval king mackerel dataset with indices of larval occurrence and abundance, 1982 to 2000	Lyczkowski-Shultz, J. and D. S. Hanisko
SEDAR5-DW-5	A review of the stock structure of king mackerel off the southeastern US.	DeVries, D. and W. Patterson
SEDAR5-DW-6	A literature review of the growth of king mackerel in the Southeastern United States	Cummings, N. J., D. DeVries, and C. Palmer
SEDAR5-DW-7	A summary of king mackerel <i>Scomberomorus cavalla</i> age data from the Panama City Laboratory, NOAA Fisheries, 1997 – 2003.	Palmer, C. and D. DeVries
SEDAR5-DW-8	Review of the catch sizing and sexing and ageing of king mackerel <i>Scomberomorus cavalla</i> from US Gulf of Mexico and South Atlantic fisheries	Ortiz, M., P. L. Phares, and N. J. Cummings
SEDAR5-DW-9	Preliminary analysis of king mackerel tag data from the cooperative tagging center	Diaz, G. A.
SEDAR5-DW-10	A method for analyzing the abundance and mortality of Atlantic and Gulf king mackerel when the two stocks are presumed to intermix	Porch, C. E.
SEDAR5-DW-11	Discrimination between Gulf of Mexico and Atlantic Ocean king mackerel with otolith shape analysis and otolith microchemistry: A progress report	Patterson, W. E., T.R. Clardy, D. A. DeVries, Z. Chen, and C. Palmer
SEDAR5-DW-12	Estimates of king mackerel discards for the Atlantic and Gulf Migratory groups	Poffenberger, J.
SEDAR5-DW-13	Standardized Catch rates of king mackerel from US Gulf of Mexico and South Atlantic recreational fisheries	Ortiz, M. and P. L. Phares
SEDAR5-DW-14	Standardized catch rates of king and Spanish mackerels from US Gulf of Mexico and South Atlantic recreational fisheries	Ortiz, M.
SEDAR5-DW-15	Standardized catch rates of Spanish and king mackerel from the North Carolina commercial fisheries	Ortiz, M. and L. Sabo

Documents Reviewed at the Assessment Workshop		
SEDAR5-AW-1	Estimated von Bertalanffy growth curves for king mackerel stocks in the Atlantic and Gulf of Mexico	Brooks, E. N., Ortiz, M.
SEDAR5-AW-2	Sensitivity of stock assessment analysis of Gulf of Mexico king mackerel to alternative methods for estimation the historic catch at age matrix 1981-2002	Ortiz, M.
SEDAR5-AW-3	Stock Assessment Analysis on Gulf of Mexico King Mackerel	Ortiz, M.
SEDAR5-AW-4	Virtual Population Analyses of Atlantic and Gulf King Mackerel Using Tag-Recapture data and Alternative Models of Migration.	Porch, C. E., G. A. Diaz
SEDAR5-AW-5	Revision and Update of the stock assessment analyses on King Mackerel stocks 2003	Ortiz, M.
SEDAR5-AW-6	Release locations of tagged king mackerel	Diaz, G.
SEDAR5-AW-7	Discrimination Amount US South Atlantic and Gulf of Mexico King Mackerel with Otolith Analysis and Otolith Microchemistry. Summary of MARFIN Grant No. NA17FF2013	Shipp, R. L. and W. F. Patterson III.
SEDAR5-AW-8	Stock Assessment analysis on king and Spanish mackerel stocks. Report to the MSAP, 2003. SFD Cont. SFC-2003-008.	anon.
MARFIN NA57-FF-0295	Genetic analysis to determine mixing proportions by season of Western Atlantic and Gulf of Mexico stocks of king mackerel.	Gold, J. R.
Fisheries Research 57(2002):51-62	Using otolith shape analysis to distinguish eastern Gulf of Mexico and Atlantic Ocean stocks of king mackerel	DeVries, D. A., C. B. Grimes, and M. H. Prager.
MSAP/98/10	What if mixing area fish are assigned to the Atlantic Migratory Group instead of the Gulf of Mexico Migratory Group	Legault, C. M.
Documents Provided for the Review Workshop		
SEDAR5-AR-1	Stock Assessment of Atlantic and Gulf King Mackerel	Anon.

Documents Provided at the start of the meeting:

Legault, Christoffer, M. (probably 2000 but not stated). Status Review of King Mackerel in the Gulf of Mexico. Feature Article. NMFS Southeast Fisheries Science Center, Miami, Florida.

Legault, C.M., Powers, J.E. Restrepo, V.R. 2002. Mixed Monte Carlo/Bootstrap Approach to Assessing King and Spanish Mackerel in the Atlantic and Gulf of Mexico: Its Evolution and Impact. American Fisheries Society Symposium, 27:37-44.

Power, J.E. and Restrepo, V.R. 1993. Evaluation of Stock Assessment Research for the Gulf of Mexico King mackerel: Benefits and Costs to Management. North American Journal of Fisheries Management, 13:15-26.

Powers, J.E. 1996. Benchmark Requirements for Recovering Fish Stocks. North American Journal of Fisheries Management, 16:495-504.

SEDAR5-AW-/Appendix. Sensitivity of Stock Assessment Analysis of the Gulf of Mexico King Mackerel to Alternative Growth Parameters.

Additional Material Consulted:

Improving Fish Stock Assessments. National Academy Press. Washington, DC, 1998. 176 pp.

Improving the Collection, Management, and Use of Marine Fisheries Data, 2000. Ocean Studies Board, National Research Council, 236 pp.

Appendix B:

STATEMENT OF WORK

Consulting Agreement between the University of Miami and Versar, Inc.

March 10, 2004

South East Data, Assessment, and Review (SEDAR) is a joint process of the South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils, NOAA Fisheries SEFSC and SERO, and the Atlantic and Gulf States Marine Fisheries Commissions for stock assessment and review. The program provides a framework for independent peer review of stock assessments undertaken jointly by NMFS-SEFSC, three Regional Fishery Management Councils, two Interstate Fishery Commissions, and state fishery agencies in the southeast. SEDAR uses a three-phase approach: a data workshop, an assessment workshop, and a peer review panel workshop. The peer review panel is composed of stock assessment experts, other scientists, and representatives of council, fishing industries, and non-governmental conservation organizations. Final SEDAR documents include a stock assessment report produced by the data and assessment workshops, a review panel report evaluating the assessment (drafted during the review panel workshop), a report that presents the peer-reviewed assessment results, and collected stock assessment documents considered in the SEDAR process.

NMFS-SEFSC requests the assistance of two assessment scientists from the CIE: one to serve as Chair and one to serve as a technical reviewer for the SEDAR 5 Review Panel that will consider assessments for Atlantic and Gulf migratory groups of king mackerel. No consensus opinion between the two CIE panelists is sought.

These migratory groups of king mackerel under assessment are within the jurisdiction of the South Atlantic and Gulf of Mexico Fishery Management Councils and respective southeastern states and fishery commissions. The review workshop for SEDAR 5, Atlantic and Gulf king mackerel stock assessments, will take place at the SEFSC Miami Laboratory, Miami FL from April 5, 2004 (beginning at 2:00 pm) through April 8, 2004 (ending at 1:00 pm). Meeting materials will be forwarded electronically and in hard copy. Please contact John Carmichael (SEDAR Coordinator; 843-571-4366 or 252-728-8708 or John.Carmichael@safmc.net) for additional details.

SEDAR Assessment Review Panel Tasks:

The SEDAR Assessment Review Panel will evaluate the king mackerel stock assessments, input data, assessment methods, and model results as put forward in stock assessment reports. The Assessment Review Panel will:

1. Evaluate the adequacy and appropriateness of fishery-dependent and independent data used in the assessment (i.e. was the best available data used in the assessment).
2. Evaluate the adequacy, appropriateness and application of models used to assess these species and to estimate population benchmarks (MSY, Fmsy, Bmsy and MSST, i.e. Sustainable Fisheries Act items).
3. Evaluate the adequacy, appropriateness, and application of models used for rebuilding analyses.
4. Develop recommendations for future research for improving data collection and the assessment.
5. Prepare a Peer Review Panel Report summarizing the peer review panel's evaluation of the king mackerel stock assessments. (Drafted during the Assessment Review Panel workshop with a final report due two weeks after the workshop ends.)
6. Prepare a Draft Summary Stock Status Report. (Drafted during the Assessment Review Panel workshop with a final report due two weeks after the workshop ends.)

The Assessment Review Panel's primary duty is to review the assessments presented. In the course of this review, the Chair may request a reasonable number of sensitivity runs, additional details of the existing assessments, or similar items from technical staff. However, the review panel is not authorized to conduct an alternative assessment or to request an alternative assessment from the technical staff present. If the review panel finds that an assessment does not meet the standards outlined in Items 1 through 3, above, the panel will outline in its report the remedial measures that the panel proposes to rectify those shortcomings.

Reviewer Tasks:

It is estimated that the Review Panelist duties will occupy a maximum of 14 workdays; several days prior to the meeting for document review; four days at the SEDAR meeting, and several days following the meeting to ensure that final review comments on documents are provided to the Chair and to complete a CIE review report.

Roles and responsibilities:

1. Prior to the meeting the CIE reviewer shall be provided with the stock assessment reports and associated documents for South Atlantic and Gulf King mackerel migratory groups. The reviewer shall read these documents to gain an in-depth understanding of the stock assessment and the resources and information considered in the assessment.
2. During the Review Panel meeting, the reviewer shall participate, as a peer, in panel discussions on assessment validity, results, recommendations, and conclusions. The reviewer also shall participate in the development of the Peer Review Panel Report and Summary Stock Status Report;
3. Following the Review Panel meeting, the reviewer shall review and provide comments to the Panel Chair on the Draft Peer Review Panel Report and Summary Stock Status Report.
4. No later than April 28, 2004, the reviewer shall submit a written CIE Reviewer Report¹ consisting of the findings, analysis, and conclusions, addressed to the “University of Miami Independent System for Peer Review,” and sent to Dr. David Sampson, via email to David.Sampson@oregonstate.edu, and to Mr. Manoj Shivlani, via email to mshivlani@rsmas.miami.edu. The report shall address points 1-4 under the above heading: SEDAR Assessment Review Panel Tasks. See Annex I for details on the report outline.

SEDAR contact: John Carmichael, One Southpark Circle, Suite 306, Charleston, SC 29407. Phone: 843-571-4366. Email: John.Carmichael@safmc.net.

¹ The written Reviewer report will undergo an internal CIE review before it is considered final. After completion, the CIE will create a PDF version of the Reviewer report that will be submitted to NMFS and the consultant.

ANNEX I: Contents of Reviewer Report.

1. The reviewer report shall be prefaced with an executive summary of findings and/or recommendations.
2. The main body of the reviewer report shall consist of a background, description of review activities, summary of findings, and conclusions/recommendations.
3. The reviewer report shall also include as separate appendices the bibliography of materials provided by the Center of Independent Experts and a copy of the Statement of Work.