

TERMS OF REFERENCE

For the 2019 ASMFC Atlantic Menhaden Single-Species Benchmark Peer Review and the 2019 ASFMC Atlantic Menhaden Ecological Reference Points Benchmark Peer Review

Terms of Reference for the Atlantic Menhaden Single-Species Peer Review

1. Evaluate the thoroughness of data collection and the presentation and treatment of fishery-dependent and fishery-independent data in the assessment, including the following but not limited to:
 - a. Presentation of data source variance (e.g., standard errors).
 - b. Justification for inclusion or elimination of available data sources,
 - c. Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size),
 - d. Calculation and/or standardization of abundance indices.
2. Evaluate the methods and models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, including but not limited to:
 - a. Evaluate the choice and justification of the preferred model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of the species?
 - b. If multiple models were considered, evaluate the analysts' explanation of any differences in results.
 - c. Evaluate model parameterization and specification (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M, stock-recruitment relationship, choice of time-varying parameters, plus group treatment).
3. Evaluate the diagnostic analyses performed, including but not limited to:
 - a. Sensitivity analyses to determine model stability and potential consequences of major model assumptions
 - b. Retrospective analysis
4. Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.
5. If a minority report has been filed, review minority opinion and any associated analyses. If possible, make recommendation on current or future use of alternative assessment approach presented in minority report.
6. Recommend best estimates of stock biomass, abundance, and exploitation from the assessment for use in management, if possible, or specify alternative estimation methods.

7. Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment, or, if appropriate, specify alternative methods/measures.
8. Review the research, data collection, and assessment methodology recommendations provided by the TC and make any additional recommendations warranted. Clearly prioritize the activities needed to inform and maintain the current assessment, and provide recommendations to improve the reliability of future assessments.
9. Recommend timing of the next benchmark assessment and updates, if necessary, relative to the life history and current management of the species.
10. Prepare a peer review panel terms of reference and advisory report summarizing the panel's evaluation of the stock assessment and addressing each peer review term of reference. Develop a list of tasks to be completed following the workshop. Complete and submit the report within 4 weeks of workshop conclusion.

Terms of Reference for Atlantic Menhaden Ecological Reference Points Peer Review

1. Evaluate the justification for the inclusion, elimination, or modification of data from the Atlantic menhaden single-species benchmark assessment.
2. Evaluate the thoroughness of data collection and the presentation and treatment of additional fishery-dependent and fishery-independent data sets in the assessment, including but not limited to:
 - a. Presentation of data source variance (e.g., standard errors).
 - b. Justification for inclusion or elimination of available data sources,
 - c. Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size),
 - d. Calculation and/or standardization of abundance indices.
3. Evaluate the methods and models used to estimate Atlantic menhaden population parameters (e.g., F , biomass, abundance) that take into account Atlantic menhaden's role as a forage fish, including but not limited to:
 - a. Evaluate the choice and justification of the recommended model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of the species?
 - b. If multiple models were considered, evaluate the analysts' explanation of any differences in results.
 - c. Evaluate model parameterization and specification as appropriate for each model (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M , stock-recruitment relationship, choice of time-

varying parameters, choice of ecological factors).

4. Evaluate the methods used to estimate reference points and total allowable catch.
5. Evaluate the diagnostic analyses performed as appropriate to each model, including but not limited to:
 - d. Sensitivity analyses to determine model stability and potential consequences of major model assumptions
 - e. Retrospective analysis
6. Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.
7. If a minority report has been filed, review minority opinion and any associated analyses. If possible, make recommendation on current or future use of alternative assessment approach presented in minority report.
8. Recommend best estimates of stock biomass, abundance, exploitation, and stock status of Atlantic menhaden from the assessment for use in management, if possible, or specify alternative estimation methods.
9. Review the research, data collection, and assessment methodology recommendations provided by the TC and make any additional recommendations warranted. Clearly prioritize the activities needed to inform and maintain the current assessment, and provide recommendations to improve the reliability of future assessments.
10. Recommend timing of the next benchmark assessment and updates, if necessary, relative to the life history and current management of the species.
11. Prepare a peer review panel terms of reference and advisory report summarizing the panel's evaluation of the stock assessment and addressing each peer review term of reference. Develop a list of tasks to be completed following the workshop. Complete and submit the report within 4 weeks of workshop conclusion.