Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

July 31, 2013

TO: **Atlantic Menhaden Management Board**

FROM: **Atlantic Menhaden Technical Committee**

RE: **TC Review of Sulikowski et al. Aerial Survey Design for Atlantic Menhaden**

The Atlantic Menhaden Technical Committee was tasked by the Management Board (M-13-057) with reviewing a survey proposal titled *A comprehensive aerial survey design: comparing biomass estimates of Atlantic menhaden captured within and outside the normal fishery range and the implications for improved management of this resource* and authored by Dr. James Sulikowski, Dr. Alexia Morgan, and Ms. Amy Carlson from the University of New England. A brief summary of the TC's review and detailed responses to each Term of Reference are provided below.

SUMMARY

Based on the information provided, this study is unlikely to produce biomass estimates with a high degree of confidence or to provide data that will be highly applicable to the 2014 assessment. The TC concluded that adequate statistical justification for the proposed survey methodology was not presented in the proposal. Also, the spatial area covered by this survey would focus on sampling the mid- and northern portions of the stock; therefore, the use of these data alone to help characterize selectivity of the reduction fishery would produce biomass estimates that would be biased high and characterization of the stock's age structure would be biased towards older ages.

This study may offer a slight benefit to the 2014 assessment by providing a small data set for use in age-structure comparisons, sensitivity analyses, or development of statistical priors for parameter estimates. However, it is unlikely these data would be used in the base run of the 2014 assessment given the pilot nature of this study and its limited temporal and spatial coverage. Even if these data proved useful for the assessment, the TC is concerned that they may not be available until after the January 2014 Data Workshop.

If the survey design is adequately developed and successfully implemented over a longer time series, these data would be useful for future benchmark assessments. The TC recommends the authors conduct further simulation and power analysis work prior to implementation of any large scale aerial survey. Additional consultation on development of this proposed survey may require more time than the TC can afford at present if it is to meet the deadlines for the upcoming benchmark stock assessment in 2014.

M13-068

TERMS OF REFERENCE REPORT

TOR1. Are the goals and objectives of this study clearly stated?

Although the goals and objectives of the study were not clearly stated, the TC interpreted them as:

Goal: To obtain new fishery-independent data to inform management of Atlantic menhaden

Objectives:

1) To determine and compare estimates of stock abundance and age structure between the region north of the reduction fishery's range and the region within which the reduction fishery operates, and
2) To improve reduction fishery selectivity estimates for the stock assessment.

The TC recognizes the importance of obtaining new fishery-independent information and would welcome the successful implementation of a statistically robust aerial survey designed to quantify the latitudinal gradient in biomass and age structure of the Atlantic menhaden stock. The TC also made a minor clarifying note that the proposed study would focus on estimating availability of menhaden-at-age to the reduction fishery from Virginia northward, but would not estimate gear selectivity of the purse-seine fishery.

TOR 2. Evaluate the merits of this survey design given the goals of the study.

a. Is the survey technique and design appropriate for estimating the biomass and age of menhaden during the summer and fall months?

The TC recommends more careful analyses be performed to determine the appropriate number of transects and samples required for estimation of menhaden biomass at desired levels of precision. Estimating biomass and age structure of the Atlantic menhaden stock across such a wide area should involve the use of simulations and/or power analysis that incorporate measured variability from the 2011 pilot survey and other studies to determine the adequate number of transects and biological samples to collect. There was no information regarding data simulations in the reviewed proposal.

The TC noted that this proposal focuses on sampling a subset of the Atlantic menhaden's range from Virginia northward. However, Atlantic menhaden range from Maine to Florida and a third of the historical annual landings came from regions south of Virginia where younger, smaller fish predominate; therefore, the use of these data alone to help characterize selectivity of the reduction fishery would produce biomass estimates that would be biased high and characterization of the stock's age structure would be biased towards older ages.

Regarding biological sampling, the TC noted that a goal of 50 fish per set may be too high given the proven homogeneity of fish within a set. For comparison, the commercial sampling program has been selecting a subset of 10 fish since the 1970s. Given the greatest variability is found between sets, the goal for the collection of biological samples should be to collect samples from a wide range of sets. Note that NMFS Beaufort staff volunteered to age all samples collected, but requested that the authors budget for and dedicate staff time to mounting scales before delivery to the Beaufort lab.

If the TC's concerns with sampling design could be addressed, these data could be useful for comparing size and age structure between samples collected from the bait fishery and those available farther offshore. To make this comparison, an assumption would be made that 2013 is a typical, representative year for demonstrating age and size structure of the Atlantic menhaden stock.

b. Is the survey design appropriate for comparing menhaden in southern fishing grounds with regions to the north at a time corresponding to peak fishing activities?

The TC noted that the spatial strata proposed in this study are based on the extent of the reduction fishery and do not necessarily reflect strata that are biologically meaningful. Focusing sampling efforts in areas from Virginia northward will not yield data that will be fully representative of the entire stock. The TC also noted that incorporation of this type of data may require development of a spatially-explicit assessment model and restructuring of the annual time step in the current model.

The TC voiced concern about the need to avoid double counting fish throughout the sampling time frame. The proposed sampling window is late summer through mid-November. However, by the beginning of October, northern fish begin to appear in the southern region. The TC suggests limited sampling beyond the end of September. Ending the survey earlier in the season might also make it possible for the data to be considered at the January 2014 Data Workshop.

c. Evaluate the technical merits of the proposed methods for estimating biomass from this survey.

In addition to the concerns mentioned above in TOR 2a, the TC noted that schools can form or disappear quickly. Although the TC recognizes there are serious practical limitations involved in deploying aerial and purse seine survey crews, it should be noted that the methods as described in the proposal (conducting aerial surveys to obtain counts on one day and collection of biological samples on different days) would not allow for direct comparison of transect counts and school size. However, if additional spotter pilot estimates are obtained on sampling days, ground verification of school size and composition could be conducted. The TC also noted that many schools will be too large to fully encircle and expressed concern that eliminating those schools from sampling might bias results.

The TC was also concerned that the options to space transects 2 nautical miles apart was too close relative to the inherent variability in school area and size. Also, given there are not enough days in the month to collect that many samples even under good weather conditions and double counting could become a problem (tagging papers have documented schools moving 10-15km/day), the TC suggests the authors explore the more widely spaced transect options in their proposal or create more substrata.

Finally, the TC noted that a linear relationship between surface area and biomass of menhaden schools is highly unlikely. The PIs may wish to consider adding an analysis of the data that used a nonlinear relationship (e.g., 3-parameter Michaelis-Menton) similar to that developed for Pacific sardine.

d. Do the data collected by this study have the potential to inform the reduction fishery selectivity curve in the current stock assessment model? Could it be used in a different type of stock assessment model?

The objective of estimating selectivity within the scope of this study alone does not seem feasible. Selectivity is a function of two components: 1) the probability of capture, and 2) the temporal and spatial availability of the fish to the fishery. This study appears to focus on quantifying the availability of fish to the reduction fishery from Virginia northward. These data would need to be paired with additional fishery-independent data from the southern portion of the range and fishery-dependent data, most likely in an assessment framework, in order to provide a complete analysis of fishery selectivity.

The TC would need to conduct extensive discussions to determine how best to incorporate this type of data into the current or alternative assessments (either explicitly in the model or in data preparations outside the model). The TC is currently considering a wide range of modeling approaches for the 2014 benchmark stock assessment and has not concluded discussions on how the 2014 assessment modeling framework will be different from previous assessments. Therefore, it is too soon for the TC to say how these data would be incorporated into this or other models that will be considered.

2. At minimum, how many years of data would need to be collected before this survey would be considered for use in the following manner in a benchmark stock assessment for Atlantic menhaden? Comment on any additional uses not listed below.

The TC noted that it is impossible to say exactly how many years of data would be needed without examining the exact implementation of the study design and precision of the resulting estimates. However, the TC can comment in general on the anticipated usefulness of these data in the short-term (1-2 year implementation) versus long-term monitoring program development.

a. As biological samples

i. to help characterize length/age structure of the population

This study has the potential to provide new information on the age structure of a portion of the stock (Virginia northward), if the precision is reasonable for one year's worth of data. However, the desired level of precision achieved by this sampling design was not provided by the authors, so the TC could not provide comment on its appropriateness.

ii. to help characterize purse seine reduction fleet selectivity

See 1d above.

b. To provide absolute estimates of abundance or biomass

As mentioned in 2a above, this study has the potential to estimate summer/fall 2013 biomass of Atlantic menhaden for the portion of the stock from Virginia northward if the number of samples is adequate given the desired level of precision. However, the desired level of precision achieved by this sampling design was not provided by the authors, so the TC could not determine if the sampling scheme proposed was adequate.

c. To provide priors on abundance/biomass or selectivity parameters in a Bayesian framework

This study may offer a slight benefit to the 2014 assessment by providing a small data set for use in sensitivity analyses or developing statistical priors for parameter estimates.

d. **To develop an index of abundance.**

Development of an index of abundance was not a stated goal of this study. The proposal is limited at present to collecting one year of data which would not be useful for development of an index of abundance. An abundance index would require more work on sampling design, implementation of a pilot study, evaluation of data collected, and a minimum of 5-6 years of full survey implementation (not including pilot data years) before consideration in the stock assessment.

4. Would this study provide information to address a TC research recommendation or recommendations?

If properly designed and implemented, this study could provide data to address the TC's short-term research recommendation to "Work with industry to collect age structure data outside the range of the fishery'' as identified in the 2012 assessment update.

5. Summarize the overall utility of this study for:

a. The 2014 benchmark stock assessment

This study may offer a slight benefit to the 2014 assessment by providing a small data set for use in age-structure comparisons, sensitivity analyses, or development of statistical priors for parameter estimates. However, it is unlikely these data would be used in the base run of the assessment given the pilot nature of this study and its limited temporal coverage. Even if these data proved adequate for use in the assessment, the TC is concerned that they may not be available until after the January 2014 Data Workshop.

- **b. Future benchmark stock assessments (2016+)**

If properly designed, implemented, and continued over a series of years, this study has the potential to provide useful data for the stock assessment. However, given the short time period allowed for this study, it may prove more fruitful to concentrate on conducting the proper simulation and survey design preparatory work needed to improve the precision and accuracy of such a large-scale undertaking as an aerial survey.