APPENDIX D2: ASMFC SINGLE-SPECIES RESEARCH RECOMMENDATIONS

ATLANTIC MENHADEN

ASMFC Special Report #81: Prioritized Research Needs in Support of Interjurisdictional Fisheries Management June 2004 (ASMFC, 2004c)

Prioritized Research Needs

1. Evaluate effects of selected environmental factors on growth, survival and abundance of juvenile and adult menhaden, particularly in Chesapeake Bay and other coastal nursery areas.

    - Develop and test methods for estimating size of recruiting year-classes of juveniles using fishery-independent survey techniques.
    - Determine how loss/degradation of critical estuarine and nearshore habitat affects growth, survival and abundance of juvenile and adult menhaden abundance.
    - Monitor landings, size, age, gear, and harvest area in the reduction and bait fisheries, and determine age composition by area. Enhance biostatistical sampling of bait samples in purse seine fisheries for Virginia and New Jersey to improve stock assessment.
    - Study the ecological role of menhaden (predator-prey relationships, nutrient enrichment, oxygen depletion, etc.) in major Atlantic coast embayments and estuaries.
    - The feasibility of estimating year-class strength using biologically stratified sampling design should be evaluated. The efforts could be supported by process studies linking plankton production to abundance of young menhaden (need resources).

2. Evaluate use of coastal power plant impingement data as a possible means to estimate young-of-the-year menhaden abundance.

    - Monte Carlo simulations should be conducted to evaluate precision of VPA.
    - Alternative measures of effort, including spotter pilot logbooks, trip length, or other variables, should be evaluated. Spotter pilot logbooks should be evaluated for spotter plane search time, GPS coordinates, and estimates of school sizes observed by pilots.
    - Re-evaluate menhaden natural mortality, by age and response to changing predator population sizes.

3. Determine the effects of fish diseases (such as ulcerative mycosis and toxic dinoflagellates) on the menhaden stock.

    - Determine the effects of regulations on the fishery, the participants, and the stock.

- Growth back-calculation studies should be pursued to investigate historical trends in growth rate. The NMFS has an extensive database on scale growth increments that should be utilized for this purpose.

4. Monitor fish kills along the Atlantic coast and use the NMFS Beaufort Laboratory as a repository for these reports.

5. Develop bycatch studies of menhaden by other fisheries. DISCARDS

6. Periodically monitor the economic structure and sociological characteristics of the menhaden reduction industry.

Atlantic Menhaden Stock Assessment Report for Peer Review: Stock Assessment Report No. 04-01 (Supplement), February 2004 (ASMFC, 2004a)

Research and Monitoring Recommendations (number reflects relative ranking with 1 being the
highest priority)

1. Conduct new size and age at maturity research by geographic regions along the Atlantic
coast.

- Develop coast wide tagging program to examine stock structure, spatial and temporal patterns in movement and migration, and to estimate exchange rate among geographic regions (i.e., inshore-offshore and latitudinal).
- Develop a spatially explicit age-structured model to account for spatial and temporal differences in size/age distributions, size/age at maturity, and fishing effort and catchability rates.
- Develop statistical sampling methods to improve catch and effort statistics in the recreational fishery. Evaluate extent of recreational netting of menhaden for bait purposes.
- Monitor landings, size, age, gear, and harvest area in the reduction and bait fisheries, and determine age composition by area. Maintain biostatistical sampling of bait samples in purse seine fisheries for Virginia and New Jersey and enhance this sampling in Maryland, the Potomac, and North Carolina to improve stock assessment (ongoing).
- Study the ecological role of menhaden (predator-prey relationships, nutrient enrichment, oxygen depletion, etc.) in major Atlantic coast embayments and estuaries (predator-prey interactions being evaluated through ASMFC multispecies efforts). Re-evaluate menhaden natural mortality by age and the response to changing predator population sizes (evaluated through MS model, incorporated variable *M* in assessment).

- Maintain and expand seine indices estimating size of recruiting year-classes of juveniles using fishery-independent survey techniques, particularly needed in mid-Atlantic region (ongoing research).
- Periodically monitor the economic structure and sociological characteristics of the menhaden reduction industry (Committee on Economic and Social Sciences - CESS).
- Determine the effects of regulations on the fishery, the participants and the stock (CESS ongoing project).
- Define local depletion in qualitative and quantitative terms. Determine environmental influences. Studies should not be limited to Chesapeake Bay.

2. Evaluate effects of selected environmental factors on growth, survival and abundance of juvenile and adult menhaden, particularly in Chesapeake Bay and other coastal nursery areas (NMFS/CBO ongoing project).

- Determine how loss/degradation of critical estuarine and nearshore habitat affects growth, survival, and abundance of juvenile and adult menhaden abundance.
- Evaluate use of coastal power plant impingement data as a possible means to estimate young-of-the-year menhaden abundance (ASMFC MSC project).

3. Determine the causes of fish diseases (such as ulcerative mycosis and toxic dinoflagellates) on the menhaden stock (ongoing research in MD/VA).

- Monitor fish kills along the Atlantic coast and use the NMFS Beaufort Laboratory as a repository for these reports (ongoing).
- Investigate the amount or extent of bycatch in the menhaden fishery. Evaluate whether a statistically valid observer program is needed to document possible sea turtle interactions with the various gear types. Develop bycatch studies of menhaden by other fisheries.
- Alternative measures of effort, including spotter pilot logbooks, trip length, or other variables, should be evaluated. Spotter pilot logbooks should be evaluated for spotter plane search time, GPS coordinates, and estimates of school sizes observed by pilots.

Terms of Reference & Advisory Report to Atlantic Menhaden Stock Assessment Peer Review: Stock Assessment Report No. 04-01, February 2004 (ASMFC, 2004b)

1. Issue: There is no adult abundance index to tune the population model.

- Evaluate commercial purse seine fishery effort (vessel/weeks) series as a possible tuning index in the model. Evaluate any measure of effort contained in this or other data series.
- Evaluate the data collected in the Captain's Daily Fishing reports for an adult abundance index. If these data are not useful, explore the utility of a commercial fishery-based adult index, developed jointly with the fishermen, for future assessments.

2. Issue: Recent relative productivities of menhaden nursery areas coast wide are unknown.

    - Investigate if there are any existing studies that could assist in evaluating current productivity.
    - Develop protocols to quantify contribution of different nursery areas to the adult stock.

3. Issue: M-at-age is an improvement over constant M assumption. However, there is concern that not all key sources of mortality have been accounted for and little is known about the temporal patterns of mortality.

    - Identify key sources of non-fishing mortality for menhaden.
    - Enhance the coverage of the MSVPA to more predator and prey species.
    - Determine if there are temporal patterns in these sources.
    - Validate assumptions about applying results from MSVPA to the 1955-1980 period.

4. Issue: There have been large changes in size-at-age over the 1955-2002 period. These trends are not a problem for the model but could have an impact on forecasts.

    - Evaluate historical change in size (weight and length) at age using existing data (e.g., scale incremental widths).

5. Issue: There are patterns in residuals of numbers at age for commercial catch estimated by the model.

    - Investigate if the selectivity model is causing this pattern.
    - Look at spatial changes in fishing pattern as well as fish distribution.

6. Issue: Current fecundity estimates are from studies in the 1980s and earlier.

    - Update the fecundity-at-size estimates and maturity ogives.

7. Issue: Cannot address local depletion questions with the current model.

    - Investigate methods to determine the proportion of the stock that may reside in a particular area in any one season and whether regional reference points can be developed to address local depletion.
    - Extend these methods to track changes in distribution over time.

8. Issue: Control plot determination of overfishing/overfished is based on point estimates only.

    - Develop uncertainty measures or risk analysis for control plots.

9. Issue: It is difficult to distinguish between results of different models and model assumptions.

    - Develop measures (goodness of fit and complexity) to screen multiple models.

10. Issue: The assessment model assumes a unit stock.

    - Test this assumption using otolith microchemistry and/or genetic markers.

STRIPED BASS

ASMFC Special Report #81: Prioritized Research Needs in Support of Interjurisdictional Fisheries Management June 2004 (ASMFC, 2004c)

Prioritized Research Needs

1. Develop refined and cost-efficient coastal monitoring regime for striped bass stocks, including spawning stock biomass modeling and virtual population analysis (VPA).

2. Conduct sensitivity analysis on current state and federal fishery-dependent and -independent monitoring programs to determine which, if any, may be eliminated.

3. An evaluation of the overfishing definition should be made relative to uncertainty in biological parameters.

4. Simulation models should be developed to look at the implications of overfishing definitions relative to development of a striped bass population which will provide "quality" fishing. Quality fishing must first be defined.

5. Quota calculation methods should be refined which allow better estimates among various components of the fishery.

6. Examine differential reporting rates between commercial and recreational fishermen using high reward tags.

7. Develop studies to provide information on the magnitude of hook and release and bycatch mortality, including factors that influence their magnitude and means of reducing or eliminating this source of mortality.

8. Further study should be conducted on the discrepancy in ages between scale-based and otolith-based ages. Particular emphasis should be placed on comparisons with known age fish determined from coded wire tags. Comparisons should be made among age readers and areas.

9. Increase sea sampling of commercial fisheries, such as the dogfish gillnet fishery which may have high levels of discards.

10. Continue in-depth analysis of migrations, stock composition, etc. using mark-recapture data.

11. Continue to conduct research to determine limiting factors affecting recruitment and possible density implications.

12. Determine inherent viability of eggs and larvae.

13. Additional research should be conducted to determine the pathogenicity of the IPN virus isolated from striped bass to other warm water and marine species, such as flounder,
menhaden, shad, largemouth bass and catfish.

Report of the 36th Northeast Regional Stock Assessment Workshop (36th SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments

- Conduct a workshop to evaluate an appropriateness of scales in ageing old fish.
- Explore applicability of Bayesian framework to striped bass assessment.
- Develop the model that will combine VPA and tagging data.

ASMFC Special Report #81: Prioritized Research Needs in Support of Interjurisdictional Fisheries Management June 2004 (ASMFC, 2004c)

Prioritized Research Needs

High Priority

- Collect catch and effort data including size and age composition of the catch, determine stock mortality throughout the range, and define gear characteristics. In particular, increase length-frequency sampling, particularly in fisheries from Maryland and farther north.
- Develop latitudinal, seasonal, and gear specific age-length keys for the Atlantic coast. Increase sample sizes to consider gear specific keys.
- Derive estimates of discard mortality rates and the magnitude of discards for all commercial gear types from both directed and non-directed fisheries. In particular, quantify trawl bycatch, refine estimates of mortality for below minimum size fish, and focus on factors such as distance from shore and geographical differences. Update the scale – otolith comparison for weakfish.

Medium Priority

- Define reproductive biology of weakfish, including size at sexual maturity, maturity schedules, fecundity, and spawning periodicity. Continue research on female spawning patterns: what is the seasonal and geographical extent of "batch" spawning; do females exhibit spawning site fidelity?
- Conduct hydrophonic studies to delineate weakfish spawning habitat locations and environmental preferences (temperature, depth, substrate, etc.) and enable quantification of spawning habitat.
- Compile existing data on larval and juvenile distribution from existing databases in order to obtain preliminary indications of spawning and nursery habitat location and extent.
- Continue studies on mesh-size selectivity; up-to-date (1995) information is available only for North Carolina's gillnet fishery. Mesh-size selectivity studies for trawl fisheries are particularly sparse.
- Assemble socio-demographic-economic data as it becomes available from ACCSP.
- Additional investigation is needed in developing consistent otolith-based catch matrices including the EM algorithm.
- The impact of ageing errors and other statistical uncertainties in the catch-at-age matrix on virtual population analysis (VPA) should be included. Retrospective analyses are needed on all VPA approaches investigated.
- Develop a spawner recruit relationship

Summary Report by the Chair on the 40th North East Regional Stock Assessment Review Committee (SARC)

Recommendations for Future Assessments

- There exists a considerable amount of information that in principle should permit an assessment using catch-at-age analysis. The basic information should be thoroughly evaluated as to its suitability for this approach.
- The commercial and recreational data should be examined with regard to its precision and accuracy, both in terms of the absolute estimates of catches and its age composition.
- The survey catch rates at age should be evaluated with respect to the spatial and temporal distribution of age groups over time to try to gain an understanding of why there are no consistent year-class signals within surveys.
- The survey distributions should be compared to observed changes in the pattern of the fisheries for weakfish to try to explain the inconsistencies in the trends observed in the different series.
- Work should be undertaken to validate the ageing methods employed.
- It is of primary importance to carefully evaluate the input data in terms of the information content regarding relative year-class strength. This evaluation could take the form of more statistically based GLM approach along the lines of the graphical analysis (i.e., Pope-Shepherd-Nicholson analysis of year-class, age and year effects). Alternatively the survey analysis approach suggested by Cook (1997) and subsequent developments under SURBA could have merit in this regard.
- It seems unlikely that statistical modeling will be able to reconcile the very different perspective on year-class strength between the fishery-independent surveys and the index obtained from the NMFS Marine Recreational Fisheries Statistics Survey. This problem should be given urgent attention through a focused research project that considers alternative hypotheses for the divergence.

The SARC was informed about a possible ecological explanation for the possible decline of the weakfish stock that requires review. Other explanations related to the survey indices and the recreational fishery statistics under the amended FMP also need to be given careful consideration.

BLUEFISH

ASMFC Special Report #81: Prioritized Research Needs in Support of Interjurisdictional Fisheries Management June 2004 (ASMFC, 2004c)

Prioritized Research Needs

1. Data needs:
   a) Sampling of size and age composition of the fisheries by gear type and statistical area should be increased.
   b) Commercial and recreational landings of bluefish should be targeted for biological data collection wherever possible.
   c) Increase intensity of biological sampling of the NER commercial and coast wide recreational fisheries.

2. Continue research on species interactions and predator-prey relationships. A scale-otolith age comparison study needs to be completed for bluefish.

3. Explore alternative methods for assessing bluefish, such as length-based and modified DeLury models.

4. Measures of CPUE under different assumptions of effective effort should be evaluated to allow evaluation of sensitivity of results.

5. Initiate fisheries dependent and independent sampling of offshore populations of bluefish during winter months.

6. Conduct research to determine the timing of sexual maturity and fecundity of bluefish.

7. Work should continue on catch and release mortality.

8. Any archived age data for bluefish should be aged and used to supplement North Carolina DMF keys in future assessments.

9. Conduct research on oceanographic influences on bluefish recruitment, including information on migratory pathways of larval bluefish.

10. Study tag mortality and retention rates for the American Littoral Society dorsal loop and other tags used for bluefish.

11. A coastal surf-zone seine study needs to be initiated to provide more complete indices of juvenile abundance.

12. Test the sensitivity of the bluefish assessment to assumptions concerning age-varying M, levels of age-0 discard, and the selection pattern.

13. Increase sampling frequencies when bluefish are encountered, especially when medium size fish are encountered.

14. Scientific investigations should be conducted on bluefish to develop an understanding of the long-term, synergistic effects of combinations of environmental variables on various biological and sociological parameters such as reproductive capability, genetic changes, and suitability for human consumption.

15. Studies on the interactive effects of pH, contaminants, and other environmental variables on survival of bluefish.

16. Investigate the relationship of epidemic dermatological disease of bluefish exhibited in the Tar-Pamlico estuary to environmental toxics or other parameters.

17. Investigate the distribution of adult bluefish (particularly the spring-spawned cohort) in the South Atlantic Bight and juvenile bluefish (including the pelagic stage); and develop precise information on the distribution and relative abundance of bluefish in inshore areas, especially estuaries and embayments.

41st Northeast Regional Stock Assessment Workshop (SAW-41) Stock Assessment Review Committee (SARC) Meeting, Chair's Report (NEFSC, 2005)

Short-term

- Continue to develop statistically appropriate models for this stock, including valuation of uncertainty and sensitivity. This modeling should also test sensitivity to data quality. The BTC should avoid double use of the data as model input.
- Evaluate the fishery-independent surveys used to tune the model with special emphasis on determining if the state surveys can be combined to yield better temporal and spatial representation of stock abundance. The BTC should encourage the states to coordinate their survey efforts for bluefish to improve the quality of data that can be obtained. We suggest a workshop to address this and other data issues.
- Evaluate the use of otolith and scale ageing of bluefish. We suggest this be a separate workshop to evaluate the best ageing structure and its reliability for stock assessment input. After the evaluation, intensify collection of age data from commercial and recreational fisheries, and evaluate the validity of combining age classes across years in an ALK.

Long-term

- Improve sampling coast wide by gear and fishery sector to obtain information with special emphasis on mid-size fish. This may require alternative fishery-independent assessment methodologies (such as lidar, archival tagging, sonar).
- Increase fishery-independent sampling to better represent the population's offshore and southern habitat.

Determine if discard mortality of 15% for the recreational fishery is accurate.