Atlantic States Marine Fisheries Commission

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MEMORANDUM

December 5, 2012

To: Atlantic Menhaden Management Board
From: Atlantic Menhaden Technical Committee
RE: Technical Committee Report to the Board on Recommendations for Draft Amendment 2

The Atlantic Menhaden Technical Committee (TC) met by conference call on November 21 and 29, 2012 to discuss biological implications of the options outlined in Draft Amendment 2 to the Menhaden FMP. In addition, the TC addressed Board assigned tasks of identifying appropriate biological sample size and implications for overall reproductive potential from various harvest allocation strategies. Summaries of the discussions and appropriate TC recommendations are presented below.

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Biological sampling requirements
The TC conducted an analysis using data from recent years to determine the number of biological samples required to characterize bait fishery landings (McNamee 2012). Sampling requirements were evaluated for several spatial and temporal breakdowns, and for varying levels of precision, to determine sample sizes necessary to characterize the size and age structure of the bait fishery. Generally speaking, sample sizes needed to characterize size structure in time were larger than those needed to characterize size structure by age, and sampling requirements were larger in the Chesapeake Bay (CB) region than New England (NE) and Mid-Atlantic (MA) regions. Higher precision also required larger sample sizes. Sample size requirements for the combined NE-MA region were approximately 25% to 100% greater than current sampling levels, while sample requirements for the CB region were approximately 4 to 40 times current sampling levels. Significantly increasing sample sizes would be burdensome for samplers, the vessels being sampled, and the biologists who prepare and age the samples. Therefore, the TC

recommended minimum sampling levels that are modestly larger than those seen in recent years. Following a number of years of data collection at the recommended level, a re-analysis can be performed to see if the sampling is reaching a desired level of precision. The additional samples will allow better estimation of biological characteristics of the catch without undue burden on agencies and the fishery. The TC also determined that the required samples should be distributed across the fishery (all gears, all states) relative to their contribution of the total landings in order to get as accurate a representation of the fishery as possible. The recommended annual sampling requirements for the bait fishery are one ten-fish sample per 300 MT landed in the New England and Mid-Atlantic regions, and one ten-fish sample per 200 MT landed in the Chesapeake Bay region.

The TC did not conduct an analysis to determine sample size for the reduction fishery. Reduction fishery sampling intensity is described in the February 2004 benchmark stock assessment report (Section 5.1.1.4; ASMFC 2004). Biological sampling is based on a two-stage cluster design, and it is conducted over the range of the fishery, both temporally and geographically (Chester 1984). The TC recommends sampling of the reduction fishery is maintained at least at the current sampling intensity until a thorough evaluation is conducted by the TC.

Relative spawning potential of the bait and reduction fisheries

The TC conducted an analysis to estimate the relative reproductive potential of the bait and reduction fisheries (Sharov 2012). For each fishery, one ton of harvest was deconstructed to number of fish at length using average length frequency distributions, weight at length estimates, and length at age estimates from biological sampling for the period 1986-2011. The numbers at age were multiplied by fecundity at age estimates to estimate total fecundity at age, and this was summed across ages to estimate total fecundity for one ton of harvest. This provided an instantaneous estimate of reproductive potential per ton of harvest for each fishery. Results showed that the reproductive potential of the bait fishery is approximately double that of the reduction fishery on a per ton basis. This result is logical seeing as the bait fishery tends to harvest older, more mature fish.

The analysis of instantaneous reproductive potential (above) does not take into consideration contributions to the reproductive potential as fish age and spawn in successive years. To address this scenario, numbers at age in year one of the analysis were decremented by age-specific natural mortality rates until each cohort reached age 8. Reproductive potential in each year was estimated as the number at age times fecundity at age. Overall “lifetime” fecundity of one ton of harvest was then found by summing across ages and years. This method assumes a total harvest moratorium ($F = 0$) to allow the maximum number of fish to reach age 8 (best case scenario). Results indicate overall lifetime reproductive potential of the bait fishery is still approximately 10% greater than the reduction fishery.

The analyses above indicates that if all fish “saved” were able to reach maximum age and spawn multiple times, per-ton reproductive potential of the bait fishery is approximately 10% greater than the reduction fishery. Alternatively, if all fish “saved” spawned only one additional time, then the per-ton reproductive potential of the bait fishery is approximately 100% higher than the reduction fishery. Neither of these scenarios is likely, but they are useful in providing bounds on the relative reproductive potential of the two fisheries. In order to determine the true relationship, it is necessary to have the actual fishing mortality rate which cannot be known for the future.

The TC identified three potential scenarios that the Board might want to consider when determining the most appropriate harvest allocation. These include harvest reductions proportional to the overall harvest of the two fisheries; harvest reductions proportional to the overall spawning potential of the fishery; and harvest reductions to achieve the maximum benefit to spawning potential. Specific results of these options depend on a number of input options, including the definition of recent harvest (3 year or 5 year average), the allocation among sectors (3 year, 5 year, 7 year, max 3 years, etc.), and the percent harvest reduction (represented in Amendment 2 as multipliers of 1.0, 0.9, 0.8, 0.75, 0.5 which correspond to harvest reductions of 0%, 10%, 20%, 25%, and 50%, respectively), all of which are included for Board consideration in Draft Amendment 2, as well as the ratio of reproductive potential (range 1.1:1 to 2:1; Sharov 2012).

Examples of the possible results from these options are summarized in Tables 1 and 2. Both examples assume a baseline landings of 213,500 MT (3 year average), and historic allocation of 21.55% for the bait fishery and 78.45% for the reduction fishery (3 year average), and a 10% harvest reduction. Table 1 assumes a ratio of reproductive potential of 1.1:1, while Table 2 assumes a ratio of 2:1.

Under option 1, each fishery would take an equivalent proportional reduction in harvest (10% in this example), resulting in an overall 10% reduction in harvest and 10% savings in reproductive potential. Under option 2, overall reproductive potential is calculated as the reproductive potential per ton from each fishery multiplied by the number of tons harvested in that fishery and summed across the two fisheries. In this scenario, the bait fishery would take a slightly larger proportional cut in harvest because it contributes slightly more to the overall reproductive potential of the fishery. The overall harvest cut is still 10%, and the savings in reproductive potential is also approximately 10%. Under option 3, the maximum savings in reproductive potential is achieved by taking the entire harvest reduction (21,350 MT) from the bait fishery because of that fishery's higher reproductive potential. The bait fishery takes a very large proportional reduction (46%), but the additional savings in reproductive potential is only slightly higher than the other options (11.5% for option 3 in Table 1 and 16.4% for option 3 in Table 2 compared to 10% for options 1 and 2 in both tables). Note, however, that the reproductive potential savings achieved under this scenario could be achieved any number of ways (*e.g.* 23,485 MT – 42,700 MT reduction from reduction fishery only) but would result in a larger proportional harvest cut (multiplier < 0.9 in this scenario).