Atlantic States Marine Fisheries Commission

ADDENDUM V TO AMENDMENT 1 TO THE ATLANTIC MENHADEN FISHERY MANAGEMENT PLAN

Alternative Reference Points and Fishery Management Tools

ASMFC Vision Statement:
Healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015.

November 2011

1.0 Introduction

The Atlantic States Marine Fisheries Commission (ASMFC) has coordinated interstate management of Atlantic menhaden (*Brevoortia tyrannus)* in state waters (0-3 miles) since 1981. Atlantic menhaden is currently managed under Amendment 1 and Addenda I-IV to the Fishery Management Plan (FMP). Management authority in the exclusive economic zone (EEZ, 3-200 miles from shore) lies with NOAA Fisheries. As defined by Amendment 1, the management unit includes the entire Atlantic menhaden resource throughout the range of the species within U.S. waters of the northwest Atlantic Ocean from the estuaries eastward to the offshore boundaries of the EEZ.

At the March 2011 Atlantic Menhaden Management Board meeting, the Board initiated a draft Addendum to consider changes to the current fishing mortality reference point (F) and changes in management measures for use in regulating the fishery with the following motion: *Move to recommend to the ISFMP Policy Board to task the Multispecies Technical Committee and the Atlantic Menhaden Technical Committee 1) to proceed with work on multi-species approach as a priority and 2) have Menhaden Technical Committee prepare and present annual recruitment information to the Board and 3) utilize the goal to increase abundance and SSB and initiate an addendum to implement an interim reference point of 15% MSP (maximum spawning potential) level and develop a suite of management measures the Board could use in managing the fishery.*

Through the Addendum process, the Board took action to set new interim biological reference points for menhaden. This addendum codifies the use of $F_{15\%}$ maximum spawning potential[1] (MSP) as an interim $F_{threshold}$ reference point and $F_{30\%}$ MSP as an interim F_{target} reference point to avoid overfishing and increase abundance and spawning stock biomass. It is the intention of the Board to move towards a multi-species approach for Atlantic menhaden reference points in the future, after additional work has been completed by the Multispecies Technical Committee.

2.0 Management Program

2.1 Statement of the Problem

During the 2010 Atlantic menhaden benchmark stock assessment, the Peer Review Panel noted that menhaden population abundance had declined steadily and recruitment had been low since the last peak observed in the early 1980s. Fishing at the F threshold reference point in the terminal year (2008) has resulted in approximately 8% of the MSP. Therefore, the Panel recommended alternative reference points be considered that provide greater protection for spawning stock biomass (SSB) or population fecundity relative to the unfished level. The previous biological reference points as established by Addendum I to Amendment 1 were F_{target} = 0.96, and $F_{threshold}$= 2.2. The 2010 benchmark assessment estimated fishing mortality for the terminal year (2008) to be 2.28, indicating that fishing mortality had exceeded the threshold resulting in overfishing. Amendment 1 stated that when overfishing is occurring the Board

[1] The MSP approach identifies the fishing mortality rate necessary to maintain a given level of stock fecundity (number of mature eggs) relative to the potential maximum stock fecundity under unfished conditions. A 15% MSP would equate to a fishing mortality rate threshold required to maintain approximately 15% of the spawning potential of an unfished stock. An unfished stock is equal to 100% MSP.

should take steps to reduce F to the target (the previous F target 0.96 corresponds to approximately 20% MSP).

2.2 Background

2.2.1 Reference Points

A new benchmark assessment was completed and reviewed in May 2010. The results of this assessment are the most recent information available on the status of the stock through the 2008 fishing year. The originally reviewed and approved assessment from May 2010 was revised and rerun in the winter of 2010 because of a computer coding error. The revised report was approved for management use by the Board in March 2011 (ASMFC 2010).

Previous, biological reference points for classifying stock status were based on Addendum I to Amendment 1 (ASMFC 2004). The Amendment identifies target and threshold reference points for fishing mortality and population fecundity for stock status definition. These reference points were developed from the historic spawning stock per recruit (SSB/R) relationship.

The fishing mortality threshold ($F_{threshold}$) was set at the level that allows for the stock to replace itself. This level of fishing mortality is often known as *F* replacement (F_{rep}) or *F* median (F_{med}) and is calculated by inverting the median value of recruitment (R) and spawning stock biomass (SSB) ratio (R/SSB) and comparing this value to the SSB/R curve following the method of Sissenwine and Shepherd (1987). Overfishing was said to be occurring when F in the terminal year of the latest assessment is greater than the F_{med} estimate. The F_{2008} value was 2.28. F_{med} was calculated using the fecundity per recruit rather than SSB per recruit relationship[2]. This approach was chosen in Addendum I over the more commonly used SSB per recruit relationship to account for the fact that older female menhaden release more eggs than younger female menhaden per unit of female biomass.

The target F value, or F_{target} was based on the 75th percentile of observed recruitment and fecundity ratio and was consistent with the method used for estimating the threshold F (F_{med}). The F_{target} was 0.96.

The population fecundity target reference point ($FEC_{target;}$ where FEC is the number of maturing or ripe eggs) is used as the measure of reproductive capacity corresponding to F_{med} (as described above). The FEC is used as the proxy for the biomass reference point, which is the more commonly used reference point for other marine species. FEC_{target} is currently 18.628 trillion eggs. $FEC_{threshold}$, the current overfished threshold reference point based on the fecundity-per-recruit relationship used for the overfishing definition, is one-half of FEC_{target}. The stock is said to be overfished when FEC in the terminal year of the latest assessment is less than the $FEC_{threshold}$ estimate. The current $FEC_{threshold}$ is 9.314 trillion eggs. To calculate the values for

[2] Prior to the 2010 Benchmark Assessment, the F_{med} reference point was calculated using F weighted by age 2+ abundance. In the 2010 benchmark the F_{med} was calculated in 2 ways: (1) F weighted by age 2+ abundance as in previous assessments and (2) Full F. The 2010 Peer Review Report recommended using Full F. From this point forward all F estimates and F reference points for Atlantic menhaden will be calculated using Full Fs and thus will differ from previous assessments and ASMFC documents due to the change in how the Fs are calculated for fishing mortality reference points.

these reference points, FEC_{target} was determined by multiplying the fecundity-per-recruit value corresponding to F_{med} by median recruitment from all years. The $FEC_{threshold}$ was assumed to be 50% of this value. Because reference points are based on observed values of recruitment and fecundity, and growth and fecundity at age that vary annually, biological reference points may also vary annually when new observations are added to the time series.

Given the accepted biological reference points, stock status was determined based on the assessment terminal year estimate relative to its corresponding targets and thresholds. Biological reference points have been estimated based on the results of the base run of the stock assessment. The terminal year fishing mortality rate F_{2008} (full F) was estimated to be 2.28, which is 103.6% of its limit (and 237.5% of its target). Correspondingly, the terminal year estimate of population fecundity FEC_{2008} was estimated at 18.449 trillion eggs or 99% of FEC_{target} (and 198% of $FEC_{threshold}$). Hence, the stock is not considered to be overfished, but overfishing was occurring in the terminal year of 2008. Given the overfishing (F_{med}) definition of Amendment 1 and Addendum I, overfishing has occurred in 32 of the last 54 years but was not occurring during the previous nine years, 1999-2007. Other indicators of stock status, such as trends in recruitment and fishing mortality on fully recruited ages, raise concerns about the appropriateness of the current reference points for Atlantic menhaden (ASMFC 2010).

Over the period of known exploitation, menhaden recruitment appears to be independent of fishing mortality and spawning stock biomass, indicating environmental factors may be the defining factor in the production of good year classes. If menhaden recruitment is largely environmentally driven, adoption of an MSP approach may not result in better recruitment. However, there is a possibility that the stock may be able to take greater advantage of favorable environmental conditions if a larger percentage of spawning adults remain in the population.

2.2.3 Description of the Fishery (Updated information since Amendment 1 was published)

2.2.3.1 Commercial Reduction Fishery

Atlantic menhaden have supported one of the largest fisheries since colonial times. In 2004, there were only two reduction plants operating on the Atlantic coast, Omega Protein in Reedville, VA. and Beaufort Fisheries in Beaufort, NC (Cheuvront 2004:1). Since February 2005, Omega Protein's plant in Reedville, Virginia, with eleven vessels operating in 2010, is the only active menhaden reduction factory on the Atlantic coast. In addition to traditional menhaden use in the agricultural (both aquatic and land) and soluble industries, the oil has been refined to produce omega-3 fish oil products for human consumption, including food additives and capsules in recent years.

The 2010 Atlantic menhaden harvest for reduction purposes was 183,085 mt. This is up 27.3% from the 2009 landings of 143,800 mt, and up 19.9% from the previous 5-year (2005-2009) average of 152,747 mt (Figure 1). The average reduction harvest for the last ten years was 170,400 mt.

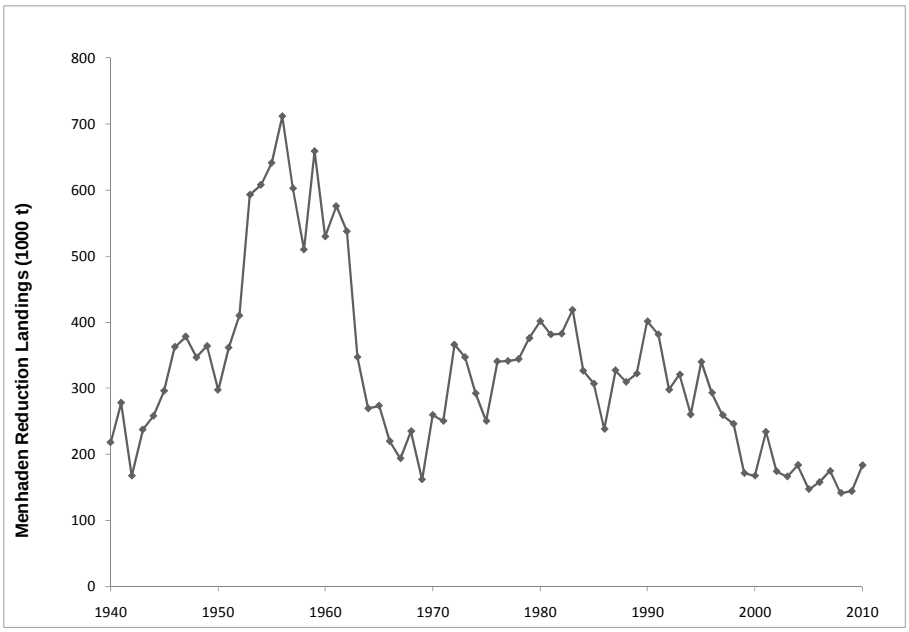

Figure 1. Landings from the reduction purse seine fishery (1940–2010) for Atlantic menhaden.

2.2.3.2 Commercial Bait Fishery

The harvest of menhaden as bait for a variety of commercial and recreational uses is associated with a range of directed fisheries using purse seines, pound and gill nets, and bycatch in fisheries targeting other species (using haul seines, pound nets and trawls). The dead bait is used in pots and for commercial hook and line fisheries, while live baits are important for recreational "slow trolling" in the hook and line fishery.

The New England operators are fairly small, typically with one harvest vessel, with the size ranging from the mid-30s to 90 feet in length. Smaller operators also have a "carry" boat to take the catch to shore. Each vessel requires seven to ten crew members, with support employees on shore to accommodate the business end of the operation, along with unloading, packing, salting, and other shipping preparations. The range of the New England fleet is substantial, from Maine to New Jersey, on a seasonal basis, late spring to fall. As the boats travel from location to location, they purchase dock space, food, and fuel from the local communities. In Maine there are also two to three herring seiners who switch to harvesting menhaden for bait on an opportunistic basis even if outside of the Gulf of Maine (Jeff Kaelin, personal communication).

Smith and O'Bier (2011) report that the bait fishery in the Chesapeake Bay is a major contributor to the total bait landings of menhaden. The number of vessels reduced from eight during the 1990s to four in 2009 due to management restrictions. Their sizes and original purposes varied. Four of the five vessels fishing the past few years are less than 100 feet in length. The fishing season extends from early May to late November.

Historically, the in-state bait fishery in North Carolina has operated on an even smaller scale than in New England. Very small operators, some associated with marinas, use cast nets in the late afternoon or early morning during the summer months. In addition to harvesting bait for crab fishing, one type of operation keeps the fish alive in holding tanks or nets for "slow trolling" for king mackerel, or bottom fishing for cobia. The operators anchor near the pathway of early

morning recreational anglers in boats ranging from 17 to 30 feet in length as they leave their moorings to fish in the bays or inshore outside of inlets. Nearshore head and charter boats also purchase menhaden. The fish are sold by the dozen and are kept alive in live bait wells in the sportfishing boats. In the past, licensing on the part of commercial fishermen for bait required a special permit, but that has been changed. Licenses which allow the use of commercial gear for purposes other than purse seining can now be used for bait fishing.

Total reported annual landings of Atlantic menhaden for bait on the Atlantic coast averages about 36,000 mt for the period 1985-2010 (Table 1). The reported bait landings in 2010 increased from the previous year to 44,000 mt. The Chesapeake Bay region has been the largest harvester of menhaden bait since the 90s, with the Mid-Atlantic only exceeding the bay harvest in 1992, 1997 and 2010. In 2010, the Chesapeake Bay harvest declined to 17,880 mt. The Mid-Atlantic bait harvest increased in 1992 and then decreased in 2003–2006. The Mid-Atlantic harvest increased to the record value of 23,065 metric tons in 2010. The New England bait harvest was less than 1,000 mt from the mid-90s to 2004. In 2005 the harvest began to increase and reached approximately 8,000 mt in 2007 and has since declined to 2,320 mt in 2010. The South Atlantic harvest has been less than 1,000 mt for the last nine years.

Table 1. Menhaden Bait Landings by Region (1985 – 2010) [in 1,000s of metric tons]

Year	New England (ME – CT)	Mid-Atlantic (NY – MD Coast)	Chesapeake Bay (MD Bay, VA, PRFC)	South Atlantic (NC – FL)	Total (ME – FL)
1985	6.15	1.82	16.42	2.27	26.66
1986	13.75	1.33	10.46	2.44	27.98
1987	13.28	1.29	13.50	2.56	30.63
1988	19.73	1.21	12.43	2.88	36.25
1989	9.54	1.58	16.48	3.41	31.02
1990	11.19	4.49	11.06	4.07	30.80
1991	14.47	7.98	10.40	3.39	36.23
1992	12.44	13.04	10.45	3.10	39.03
1993	11.64	13.40	15.65	2.10	42.80
1994	0.43	17.81	17.72	3.17	39.14
1995	4.08	17.18	19.55	1.57	42.39
1996	0.04	16.20	18.49	0.58	35.31
1997	0.14	17.60	17.13	1.66	36.53
1998	0.21	15.34	22.49	1.33	39.37
1999	0.15	12.78	21.94	1.32	36.20
2000	0.19	14.50	19.65	0.97	35.30
2001	0.08	12.18	22.67	1.37	36.31
2002	0.69	11.50	23.73	1.14	37.06
2003	0.12	8.00	24.93	0.79	33.85
2004	0.03	9.60	25.33	0.50	35.47
2005	1.02	8.18	28.97	0.66	38.83
2006	1.56	9.89	14.50	0.51	26.45
2007	2.61	17.10	22.54	0.55	42.80
2008	7.78	17.55	21.15	0.31	46.79
2009	3.71	15	19.26	0.99	37.87
2010	2.32	23.07	17.88	0.62	43.88

2.2.3.3 Recreational Fishery

Menhaden are important bait in many recreational fisheries; some recreational fishermen employ cast nets to capture menhaden or snag them with hook and line for use as bait, both dead and live. Recreational harvest is not well captured by the Marine Recreational Information Program (MRIP) because there is not a known identified direct harvest for menhaden. MRIP intercepts typically capture the landed fish from recreational trips as fishermen come to the dock or on the beach. Since menhaden caught by recreational fishermen are used as bait during their trip, they will not be a part of the catch that is typically seen by the surveyor completing the intercept.

The recreational catch has varied over time with a high of 672.25 mt in 1992 and a low of zero metric tons in 2009. The average harvest since 1981 is 126 mt. Landings have averaged 95 mt over the last 5 years. (Figure 2).

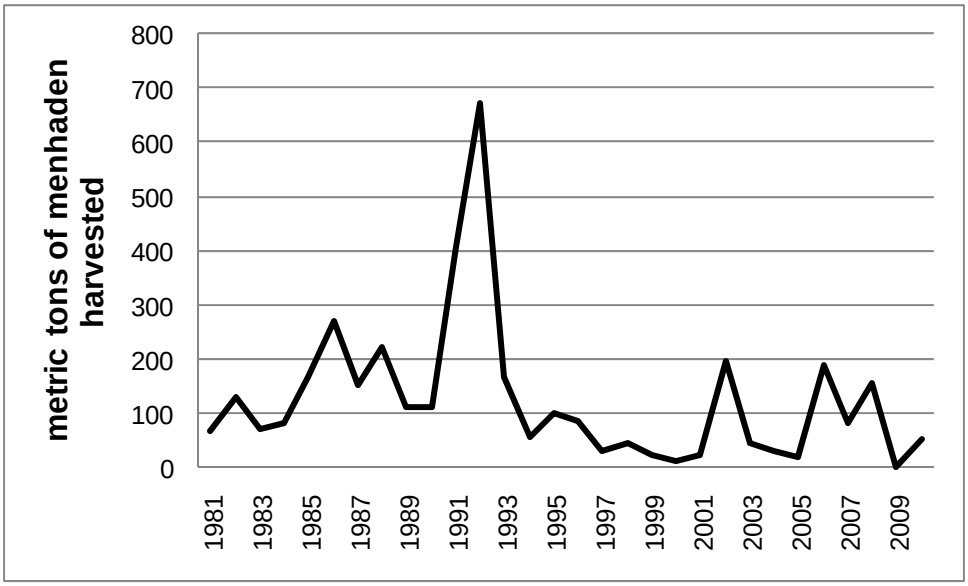

Figure 2. Atlantic Menhaden Recreational Harvest (A1+B1) from 1981-2010. Source: "Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division**.** [June 30, 2011]

2.2.3.4 Ecological Role (this section is not meant to replace the ecological role section 1.2.1.11 of Amendment 1, but provide additional information since the publication of Amendment 1)

During the late 1990s, Atlantic menhaden gained attention for their role as the main food source of striped bass. When upper Chesapeake Bay striped bass were observed emaciated and with skin lesions, researchers determined there was a 97% decline in ratios of forage-sized menhaden to striped bass in the decade leading up to the outbreak (Uphoff 2003). Through their low trophic position and high fecundity, Atlantic menhaden support a large number of fish populations, including striped bass (Walter et al. 2003).

While juvenile and adult Atlantic menhaden are omnivorous filter-feeders that utilize eutrophic estuarine systems, they may not mitigate the effects of excessive nutrient loading to the extent once thought. The phytoplankton community in estuaries can be extremely diverse (Marshall et al. 2005) with a wide range of shapes and sizes. Many of these species are smaller than the

minimum filtration thresholds (7-8 μm for juveniles and 15-20 μm for adults) determined through morphological analyses of the menhaden feeding apparatus (Friedland et al. 2006), meaning they are not efficiently retained by menhaden. Furthermore, Kemp et al. (2005) suggested a potential shift in estuarine phytoplankton communities (including Chesapeake Bay) to being dominated more and more by smaller organisms. Experimental studies of juvenile (Friedland et al. 1984, Lynch et al. 2010) and adult (Durbin and Durbin 1975, Lynch et al. 2010) menhaden filtration corroborate the minimum thresholds reported by Friedland et al. (2006). In fact, a recent study by Friedland et al. (in press) found that the abundance of adult menhaden tracked changes in zooplankton abundance, but did not respond to changes in phytoplankton abundance (except when they presumably avoided a toxic dinoflagellate bloom), suggesting that adult menhaden may actually promote primary production in estuaries.

Several studies have attempted to quantify the impact of filtration by juvenile and adult Atlantic menhaden on estuarine water quality. In general, these studies either concluded that the impacts were relatively small (Rippetoe 1993, Durbin and Durbin 1998, Dalyander and Cerco 2010), or that the range of possible impacts was large with the most likely scenario being small (Gottlieb 1998, Lynch et al. 2010, Lynch et al. 2011). With the exception of Lynch et al. (2011), these studies provided population-level estimates, which required highly uncertain estuarine-specific estimates of abundance. The study by Lynch et al. (2011) used a fixed number of menhaden to address the management decision to cap the reduction fishery harvest in Chesapeake Bay at 109,020 mt/year. They concluded that removing the entire annual allotment likely results in a negligible impact on Chesapeake Bay water quality.

2.3 Management Program

2.3.1 Reference Points Management –

The section below will replace section I of Addendum I to Amendment I of the Atlantic menhaden FMP.

Fishing Mortality Threshold: 15% MSP as an F threshold

The F threshold is set at the level corresponding to 15% of maximum spawning potential ($F_{15\% MSP} = 1.32$).

The Management Board will evaluate the current F with respect to its reference points before proposing any additional management measures. If the current F exceeds the threshold level, the Board will take steps to reduce F to the target level; if current F exceeds the target, but is below the threshold, the Board should consider steps to reduce F to the target level. If current F is below the target F, then no action would be necessary to reduce F.

Given the results of the 2010 assessment, overfishing is occurring because the current F of 2.28 exceeds the threshold of 1.32. A reduction in F would be necessary to be below the threshold.

B. Fishing Mortality Target:

The higher percent MSP target emphasizes the importance of menhaden's ecological role. Since 1955 the F estimate has only been below $F_{20\%MSP}$ once, in 1960 (Figure 3).

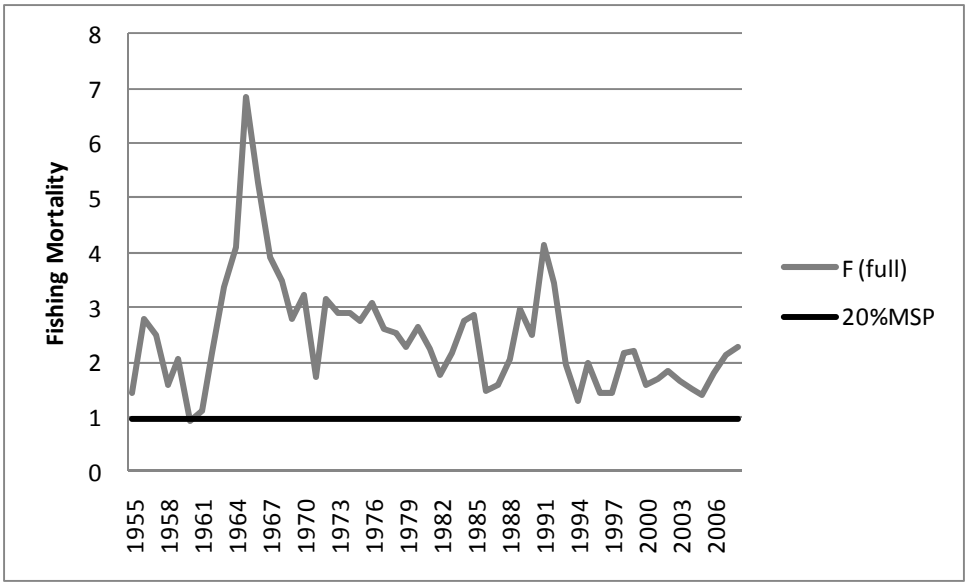

Figure 3. Atlantic Menhaden fishing mortality rates from 1955-2008.

Target: 30% MSP as an F target
The F target is set at the level corresponding to 30% MSP ($F_{30\% MSP}$ =0.62).

The Management Board will evaluate the current F with respect to the fishing mortality reference points before proposing any additional management measures. If the current F exceeds the threshold level, the Board will take steps to reduce F to the target level; if current F exceeds the target, but is below the threshold, the Board should consider steps to reduce F to the target level. If current F is below the target F, then no action would be necessary to reduce F.

Given the results of the 2010 assessment, overfishing is occurring because the current F of 2.28 exceeds the threshold 1.32. A reduction in F would be necessary to reach the target.

According to Goodyear (1993), if a description of a stock-recruitment relationship is lacking, as it is in Atlantic menhaden, a 30% MSP is recommended as a reasonable first-choice proxy. Mace and Sissenwine (1993) recommended $F_{30\% MSP}$ as an upper range that on average provides population replacement, but much of this work is based on a large number of species that are both short and long lived.

It is important to note that future harvest limits will depend on the population size. In the event of a positive response in recruitment as a result of increasing spawning stock biomass, the total allowable harvest achieved at the target mortality rate may increase. Therefore, gains rather than reductions may occur while keeping the fishing mortality rate at F_{target}.

2.3.2 Achieving Biological Reference Points
As indicated in the section above, overfishing is occurring based on the F level in 2008, the terminal year of the most recent stock assessment. At the November 2011 Atlantic Menhaden Management Board meeting, the Board initiated an amendment to address overfishing. This

amendment will consider a timeline to achieve the new fishing mortality reference points and the types of management tools that will be implemented to reduce F to the new reference points.

3.0 Social and Economic Impacts

Any form of new regulations on the commercial side, including both the reduction and bait sectors, will impact the industry in some way, whether they are in the form of trip limits, gear restrictions, seasonal or area closures, reduced quotas, or reduced allocations. Other than a total closure to commercial fishing, or the closure of the Chesapeake Bay, it is difficult to measure which of these will have the severest impact on the industry as a whole, the work force, the local communities that benefit from the industry, the region, and of course the nation, with the data now available.

Reduction Fishery

What is known at this time is that a reduction in the total allowable catch, no matter the form (seasonal or area closures, gear changes, etc.) would directly impact the Chesapeake reduction fishery employment profile. Potential reductions in workforce are estimated to be proportional to reductions in harvest. Past experience has shown that any such impacts or dislocations normally fall on the shoulders of the least skilled, least educated, marginally employed, and poorest sections of the affected communities. In some cases, the dislocations have been found to appreciably add to the full year public assistance roles of those who had previously sought such assistance only during the off season (Blomo et al. 1988). These kinds of impacts have to be weighed against the overall biological health of the menhaden biomass, the nation's health,[3] and the impact of no action on the economically and socially significant recreational domain as well. Accurate impacts indexed to specific measures can only be estimated by data which are currently unavailable.

Bait Fishery

Commercial fishermen who depend on menhaden harvesting to sell as bait would be impacted to the extent they could not have a suitable alternative. It is difficult to provide any direct and indirect impacts in the sector at this time. New England operators indicate that the most dramatic impact on their fishing operations would be inside, or bay, closures. This would require them to fish in rougher waters outside of inlets. Seasonal closures would affect their migration from location to location to follow the schools of fish. Gear restrictions in New Jersey (no pumps allowed) already create a hardship for harvesting, especially when weather is, or about to become, an issue.

In both cases, i.e. reduction and bait sectors of the commercial domain, there would be the immediate economic impact in this difficult economy.

Importance of menhaden to other fisheries along the Atlantic Coast

Menhaden are not only important to the fisheries that target menhaden, but they are also important to those fisheries that use menhaden as a bait to catch other species along the Atlantic coast. Below is a sub sample of the importance of menhaden to other fisheries. It is meant to

[3] That is, via access to Omega 3 fatty acids per the wide ranging claims made by Omega Protein on its web site, and which are not adequately available from sources other than menhaden oil.

give the public an idea of other fisheries that use menhaden, it is not meant to be a comprehensive list of menhaden use.

Historically, Maine has a bait market of approximately 60 mt. In recent years, this market was dominated by Atlantic herring. But recent precipitous declines in the herring quota have led to a resultant increase in the purchase of Atlantic menhaden as bait. One of the larger Maine bait dealer reported purchasing 5.5 million pounds of fresh and 90.7 mt of frozen menhaden in 2008 and 3,628.7 mt of fresh and 680.4 mt of frozen in 2010 (Terry Stockwell, personal communication). The majority of the bait is used in Maine's American lobster fishery. In 2010, the Maine lobster fishery ex-vessel value was approximately $310 million dollars. It is difficult to assess how much menhaden is purchased by dealers and brought into the state because dealer to dealer purchases are not reported.

Massachusetts bait dealers reported purchasing 2,222.6 mt of menhaden in 2010. Over 80% of those fish were caught by large purse seine vessels off the coast of New Jersey (NMFS Stat. Areas 612, 614, 615, 616, 621), but were landed in the Massachusetts ports of Fall River and Gloucester and sold as lobster bait. Menhaden was the second most important species used for bait in Massachusetts in 2010, comprising approximately 7% of the total bait landings (Table 2). However, menhaden become a particularly important source of bait for the lobster fishery when Atlantic herring are unavailable.

There is also a small local fishery that target menhaden in Massachusetts state waters. These fish are typically caught via cast net or gillnet and are used for bait in recreational sportfisheries. In 2010, these landings totaled approximately 23.1 mt (Table 3).

Menhaden are also indirectly important to a number of other Massachusetts fisheries as a forage species. In particular, Nelson et al. (2003) found menhaden to be a key dietary component for striped bass during their seasonal residency in Massachusetts coastal waters. Menhaden were a common, if not the most common (in terms of weight, number or frequency), stomach content item of striped bass sampled by area, and more prevalent than other clupeids combined in all sampled areas. Striped bass is arguably the most sought after recreational species in Massachusetts, and the state's commercial fishery has also generated over $3 million in ex-vessel sales in recent years (personal communication with NOAA Fisheries).

Table 2. Massachusetts bait landings by species in 2010, as reported by dealers to the SAFIS database.

Species	Bait Landings (mt)	Percent of Total
Atlantic Herring	26,301.2	86.9%
Atlantic Menhaden	2,244.6	7.4%
Atlantic Mackerel	960.2	3.2%
Skate Species	700.2	2.3%
Other Species	69.6	0.2%
Total	30,275.8	100.0%

Table 3. Massachusetts menhaden landings by gear category in 2010, as reported by dealers to the SAFIS database.

	Purse Seine	Castnet/Gillnet
Landings (mt)	2,221.4	23.2
fishermen selling	6	7
dealers purchasing	10	10
average ex-vessel price	$0.11	$1.43

In South Carolina, Atlantic menhaden are not the focus of any directed commercial or recreational fisheries. However, juvenile menhaden are regularly targeted throughout the spring and summer for use as live bait in a number of recreational fisheries including, but not limited to, those targeting cobia, red drum, king and Spanish mackerel, spotted seatrout, striped bass, southern flounder, and various shark species. Menhaden are also collected to a lesser extent for use as bait for blue crab and stone crab trapping. These menhaden are collected using cast nets in estuarine and nearshore waters and no licenses or reporting are required, thus estimating the magnitude of the catch is not possible at this time. Nevertheless, menhaden are an important component of numerous fisheries which are important to our state's anglers.

Recreational Fishery

Recreational angler use of menhaden as bait would be impacted, first, to the extent that gear used to catch live bait would be limited or prohibited, and there would not be a suitable alternative. There would be derivative (i.e. multiplier) effects into the coastal communities that serve this sector with sales of fuel, food, tackle, room rentals, etc. as well.

Second, one of the nagging issues confronting managers is whether and how menhaden abundance or lack thereof, would affect the recreational angler community in terms of effort and economic impact. Presumably the response to the issue would directly affect decisions regarding commercial harvesting of menhaden in the reduction and bait producing domains.

Impacts to the Stock

If overfishing continues, the population abundance could decline over time decreasing the number available menhaden for harvest for both commercial and recreational fisheries as well as for the ecological services menhaden provide. This loss in harvest over the long-term could have a negative economic impact on both industries.

Socio-Cultural Impacts

What are more difficult to measure would be the socio-cultural and community organizational impacts. The reason is not because they are not measurable but that such impacts lag behind those directly into the economic sector, and there are no funds available to research this issue over time at present. However they are no less sinister, just a bit more delayed, and slowly eat away at the valued historical traditions that characterize the quaint nature of our treasured coastal communities, populations, occupations and their accompanying customs.

4.0 Compliance

Management programs addressing the biological reference points for Atlantic menhaden will be effective immediately upon approval of the addendum document.

Appendix 1.

State	Met Reporting Requirement of Section 4.2.5.1	Summary of Regulations and Reporting
ME	Yes	Commercial license and endorsement if gillnetting. Unlawful to fish more than 2000 feet of bait gillnet in territorial waters. Bait gillnet shall have less than 3.5 inches diamond or square stretch mesh throughout the entire net. Area pilot program with daily catch limits and vessel restrictions. Reporting requirements cover all baitfish fisheries, including gillnets and purse seines.
NH	Yes	State law prohibits the use of mobile gear in state waters.
MA	Yes	No specific menhaden regulations. Purse seining prohibited in some areas (mostly nearshore), and no purse seines larger than 100 fathoms may be used. Mandatory dealer reporting (SAFIS).
RI	Yes	Menhaden harvest by purse seine for reduction (fish meal) purposes is outlawed. Mandatory dealer reporting (SAFIS). Daily reporting by bait purse seine fishery. No purse seines larger than 100 fathoms may be used. Commercial gear and vessels need to be inspected and may not have a useable fish storage capacity greater than 120,000 pounds. Daily catch limit of 80,000 pounds per vessel, limit increases to 120,000 pounds when standing stock estimates reaches 3,000,000 pounds. When 50% of estimated weekly standing stock is harvested, and harvest is above a 1,500,000 pound threshold, the fishery closes until further notice. Permanent closures in specific areas.
CT	Yes	Purse seines prohibited in state waters. Menhaden can be caught by other gear and sold as bait. Personal gillnet restricted to mesh greater than 3 inches and net shall not exceed 60 feet in length.
NY	Yes	Mandatory reporting for all commercial food fish license holders, this includes all who harvest menhaden. Purse seines limited to certain times/areas. Purse seine season commences on the Monday following the fourth day of July and ending on the third Friday in October.
NJ	Yes	Prohibited purse seining for reduction purposes in state waters. Mandatory reporting for purse seine (bait) fishery. Bait fishery subject to gear restrictions and closed seasons. In 2011, implemented a limited entry program for purse seine fishery. To purchase a license applicant must have purchased a license at least one year during 2002-2009 and a license in 2010. Length of vessel under permit is allowed to increase by 10% (not to exceed 90 feet) and up to 20% greater horsepower.

DE	Yes	Purse-seine fishery prohibited since 1992. No specific regulation of gillnetting for menhaden.
MD	Yes	Purse-seine fishing prohibited; menhaden harvested by pound net primarily.
PRFC	Yes	All trawling and purse nets are prohibited. Mandatory commercial fishing reporting. In 2011, Pound net fishery which is limited entry must use at least six PRFC approved fish cull panels properly installed in each pound net to help release undersized fish.
VA	Yes	Implemented reporting requirement for bait seine/snapper rigs in 2002. The reduction fishery landings in VA are reported via daily catch records and CDFRs to the NMFS. Unlawful to use any net with stretch mesh size of less than 1 3/4 inches.
NC	Yes	Mandatory commercial fishery reporting (trip ticket). Combination of gear restrictions and seasonal and area closures (e.g., no purse seine fishing within 3 miles of coast of Brunswick Co. from May – October).
SC	Yes	Purse seines prohibited in state waters; mandatory dealer reporting; requests *de minimis* status.
GA	Yes	Mandatory commercial fishery reporting (trip ticket); state waters closed to purse seine fishing; requests *de minimis* status.
FL	Yes	Purse seines prohibited in state waters; primarily a cast net fishery; mandatory commercial fishery reporting (trip-ticket); requests *de minimis*.

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