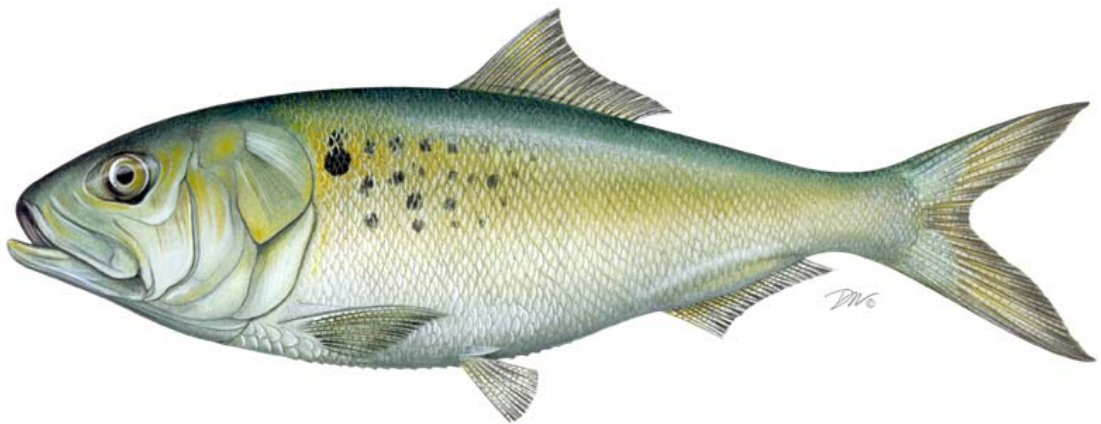


**2012 REVIEW OF THE FISHERY MANAGEMENT PLAN
AND STATE COMPLIANCE
FOR THE 2011
ATLANTIC MENHADEN (*Brevoortia tyrannus*) FISHERY**



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2012 REVIEW OF THE FISHERY MANAGEMENT PLAN AND STATE COMPLIANCE FOR ATLANTIC MENHADEN (*Brevoortia tyrannus*)

Management Summary

<u>Date of FMP:</u>	Original FMP: August 1981
<u>Amendments:</u>	Plan Revision: September 1992 Amendment 1: July 2001
<u>Addenda:</u>	Addendum 1-V
<u>Management Unit:</u>	Maine through Florida
<u>States With Declared Interest:</u>	Maine – Florida, excluding Pennsylvania
<u>Additional Jurisdictions:</u>	Potomac River Fisheries Commission, National Marine Fisheries Service, United States Fish and Wildlife Service
<u>Active Boards/Committees:</u>	Atlantic Menhaden Management Board, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, and Plan Review Team
<u>Stock Status:</u>	Coastwide stock is not overfished, but overfishing is occurring (revised assessment; ASMFC 2011)

I. Status of the Fishery Management Plan

Amendment 1 to the Interstate Fisheries Management Plan (FMP) for Atlantic Menhaden was approved at the 2001 Spring Meeting of the Atlantic States Marine Fisheries Commission (Commission). Management authority is vested in the states because the vast majority of landings come from state waters. All Atlantic coast states and jurisdictions except Pennsylvania and the District of Columbia have declared an interest in the Atlantic menhaden management program. The goal of Amendment 1 is “to manage the Atlantic menhaden fishery in a manner that is biologically, economically, socially and ecologically sound while protecting the resource and those who benefit from it.”

Amendment 1, developed during 1999-2000, established new overfishing/overfished definitions based on fishing mortality and spawning stock biomass (SSB). Addendum I to Amendment 1, approved in August 2004, revised the biological reference points, changed the frequency of stock assessments, and updated the habitat section. The biomass target and threshold are based on fecundity instead of SSB. A new fishing mortality target and threshold were also adopted. Stock assessments take place every third year, however, the Technical Committee is required to meet annually to review the previous year’s landings and indices.

Addendum II, approved in October 2005, initiated a research program to examine the possibility of localized depletion of menhaden in Chesapeake Bay. Read more about the research in Section V of this report. Addendum III, approved in Fall 2006, established a harvest cap for the reduction fishery in the Chesapeake Bay. The annual total allowable harvest from the Chesapeake Bay by the reduction fishery is set at 109,020 metric tons. If harvest is greater than the cap in a given year, the cap will be reduced by the overage amount for the following year. Similarly, if harvest is less than the cap, the cap can be increased to a maximum of 122,740 metric tons for the following year. The cap established by Addendum III remains in effect through the 2010 fishing season. Addendum IV, approved in November 2009, extends the provisions of Addendum III and the Chesapeake Bay reduction fishery harvest cap through 2013.

Addendum V, approved in November 2011 establishes a new F threshold and target rate based on maximum spawning potential (MSP) with the goal of increasing abundance, spawning stock biomass, and menhaden availability as a forage species.

Draft Amendment 2, initiated in 2012, proposes changes to the management program to reduce fishing mortality to the new $F_{30\%msp}$ target approved through Addendum V.

II. Status of the Stock

A benchmark stock assessment was initiated in 2009, and peer reviewed through SEDAR in March 2010. 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 fishing mortality (F) threshold reference point in the terminal year (2008) has resulted in approximately 8% of the maximum spawning potential (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. In November 2011, the Atlantic Menhaden Management Board responded to that recommendation and adopted new F reference points via Addendum V, but retained the same biomass reference points.

Based on the 2010 benchmark assessment, the terminal year fishing mortality rate (*full F*¹) was estimated to be 2.28, which is 178% of its threshold (and 368% of its target). Correspondingly, the terminal year estimate of population fecundity was estimated at 99% of its fecundity target (and 198% of its limit). Hence, the stock is not considered to be overfished, but overfishing was occurring in the terminal year (2008).

Data used in the assessment included abundance indices, recorded landings, and samples of annual size and age compositions from the landings. Juvenile abundance seine indices from seven states were developed (two more than in the last peer reviewed assessment in 2003). The

¹ 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.

pound net index from the PRFC was improved to reflect a better unit of fishing effort. Landings and catch-in-numbers-at-age data were updated from the reduction and bait fisheries, and reconstructed historically back to 1873 for use in an alternate model configuration. A matrix of natural mortality (M) at age was obtained from a recent update of the peer-reviewed MSVPA-X model (SARC 2005), allowing for age- and year-varying estimates of M .

Alternate assessment models were considered as potential base models. The statistical catch at age model developed at NMFS Laboratory in Beaufort was selected as the base assessment model. A base assessment model run was developed and sensitivity model runs were made to evaluate performance of the assessment model to different assumptions regarding input data and stock dynamics.

The next stock assessment is an update assessment planned for summer of 2012.

III. Status of Assessment Advice

The peer review panel drafted a report including its conclusions of the assessment and recommendations for moving forward. Below is a summary of their applicable findings.

- The Panel was also concerned about the use of F_{med} and the fecundity associated with it as reference points. The concern is that there is no information on the relationship of the target and threshold fecundity in relation to virgin fecundity levels. Projections were run to examine this, and the estimated annual fecundity since 1998 was only 5 to 10% of the virgin fecundity.
 - Through Addendum V, the Board implemented new fishing mortality reference points based on maximum spawning potential (MSP) in November 2011.
- The Panel recommends that a model specification similar to the Panel's reference run be considered for future assessments. This includes capped effective sample size at 200, allow the gaps in the pound net index and bait fishery age composition where data are not available, modification of the reduction and bait fleets to northern and southern fleets, and time-varying domed selectivity for the southern region.

This model specification combines information of the bait and reduction fisheries occurring together regionally because they are essentially using the same gear but fishing on different age components of the stock in the two areas. Removing the estimated age composition and indices for years where it is absent is desirable because the data from years where it is available is providing the correct amount of information, from a statistical perspective, to the assessment model. Allowing domed selectivity of the fisheries in the southern region allows for the lack of availability of older fish in that region when the fishery is occurring. The reduction of effective sample sizes is intended to better reflect the actual information content of the age composition data (the residuals in the base model were inconsistent with the large assumed effective sample sizes). Also, the time-varying selectivity in the southern region had the best AIC of comparable runs and reduced the undesirable pattern of residuals in the southern fishery.

IV. Status of the Fishery

The 2011 coastwide harvest of Atlantic menhaden (reduction and bait [preliminary]) was 228,800 metric tons; this is up less than 1% from the 227,000 metric tons landed in 2010. The 2011 harvest for reduction purposes only was 174,021 metric tons. This is down 5% from the 2010 landings of 183,085 metric tons, and up 8.7% from the previous 5-year (2006-2010) average of 159,962 metric tons (Figure 1). Omega Protein's plant at Reedville, Virginia, is the only active Atlantic menhaden reduction factory on the Atlantic coast, and operated with approximately ten vessels in 2011.

The preliminary estimate of the coastwide bait harvest for 2011 is 54,800 metric tons; this is up 25% from the 2010 bait harvest of 43,875 metric tons, and up 36% from the average harvest of the previous five years (2005-2009) of 40,201 metric tons. Moreover, bait landings in 2011 were the highest in time series that began in 1985 (Figure 1).

The increase in bait landings in 2011 were mainly attributed to higher landings in the Mid Atlantic region (Figure 2). The Chesapeake Bay and South Atlantic regions also had higher landings in 2011 than 2010, but not to the magnitude observed in the Mid-Atlantic. New England observed a significant decrease in landings in 2011, comprising approximately 0.2% of total bait landings.

V. Status of Research and Monitoring

Commercial fisheries monitoring

Reduction fishery – The NMFS Southeast Fisheries Science Center Beaufort Laboratory in Beaufort, North Carolina, continues to monitor and process landings and biosamples data collected on the Atlantic menhaden purse-seine reduction fishery. The Beaufort Laboratory processes and ages all reduction samples collected on the East Coast. In addition, the purse-seine reduction fishery continues to provide Captains Daily Fishing Reports (CDFRs) to the Beaufort Laboratory where NMFS personnel enter data into a database for storage and analysis.

Bait fishery – The SAFIS daily electronic dealer reporting system allows near real time data acquisition for federally permitted bait dealers in the Mid-Atlantic and Northeast. However through 2012, landings by Virginia's purse-seine for-bait vessels (snapper rigs) in Chesapeake Bay have been tabulated (at season's end) using CDFRs maintained on each vessel during the fishing season. A bait-fishery sampling program for size and age composition (of mostly the purse-seine catch) has been conducted since 1994. In New Jersey and New England, state fisheries personnel collect and process the bait samples and forward the data to the NMFS Beaufort Laboratory. In 2010, the Potomac River Fisheries Commission began collecting samples for size and age composition from their pound net fishery; Beaufort Laboratory personnel process the fish. The Beaufort Laboratory ages all bait samples collected.

Atlantic menhaden research

The following research projects relevant to menhaden assessment and management have been recently completed:

- Publication: Lynch, P., Brush, Mark J., and Latour, Robert J. 2011. *Simulated short-term impacts of the Atlantic Menhaden reduction fishery on Chesapeake Bay water quality*. *North American Journal of Fisheries Management* 31(1): 70-78.
 - A simulation study was performed to estimate the monthly and annual water quality impacts caused by the reduction fishery harvesting its current total allowable catch in Chesapeake Bay of Atlantic menhaden, a filter-feeding fish that consume phytoplankton. The study concluded that average feeding rates are relatively low and that the probable impact of the fishery on water quality is negligible.
- Publication: Lozano, C. & Houde, E. D. 2013. *Factors contributing to variability in larval ingress of Atlantic menhaden, Brevoortia tyrannus*. *Estuarine, Coastal and Shelf Science* 118:1-10.
 - A larval ingress study was conducted at the Chesapeake Bay mouth during 2005-2008. Two peaks in larval menhaden spawning activity were identified – one in November/December and a second in January/February – with stronger recruitment resulting from the later pulse. Environmental variables were not correlated consistently with temporal and spatial variability in abundance of larvae at ingress. Larval abundance was not correlated with juvenile survey abundance in the three study years.
- Report (Not peer-reviewed, funded by Omega Protein): Sulikowski, J., Morgan, A., Carlson, A., and Butterworth, D. 2012. *Inferences from aerial surveys on the abundance of Atlantic menhaden from outside the normal fishery range: implications for improved management of this resource*.
 - A pilot study was initiated to test the feasibility of an aerial survey for menhaden in New England to estimate the abundance of ages 3+ that may reside outside the area fished. The ratio of estimated biomass for the northern vs. southern region was estimated through the use of commercial spotter plane data from the fishery. Results suggest that biomass estimates of menhaden in absolute terms for the New England survey was negatively biased, possibly due to deep-swimming schools not observed. The relative biomass ratio suggested that New England biomass may be more than twice that of southern region biomass.

The following research projects relevant to menhaden assessment and management are ongoing:

- Dr. Robert Latour of the Virginia Institute of Marine Science is developing a statistical design for an aerial survey of adult Atlantic menhaden along the Eastern Seaboard of the United States. An aerial survey could be used to develop a coastwide adult index of abundance which is currently lacking in the stock assessment. Funding for implementation of the aerial survey has not been identified.
- Dr. Cynthia Jones and Mr. Jason Schaffler of Old Dominion University are using stable isotope and trace element analyses to assess Atlantic menhaden population structure and connectivity, and to identify essential areas. Signatures of juvenile menhaden from Massachusetts to Florida are being determined and adults collected from the fishery are being assigned back to region of origin. To date, age-1 trace element analysis is complete, and juvenile signature analysis from 2009-2011 is nearly complete.

- Drs. Edward Houde and David Secor at the University of Maryland Center for Environmental Science Chesapeake Biological Laboratory are comparing the precision of relative abundance estimates of YOY menhaden sampled by seining and mid-water trawling gears in principal sub-estuaries of the Chesapeake Bay. Hydrographic and environmental correlates associated with YOY menhaden catches will be investigated. Size, age, and spatial variability of YOY caught will be compared with Maryland DNR juvenile index surveys. The first field season was completed in 2012; however, funding for future research is uncertain.

VI. Status of Management Measures and Issues

The Board initiated development of Amendment 2 to establish management measures for all fishing sectors and gear types to implement the new fishing mortality reference points approved in Addendum V. The percent of harvest reductions associated with the new reference points as well as the management plan implementation process and timeline will be identified in Draft Amendment 2.

At the same time, the Board placed a high priority on continuing work on developing ecosystem reference points using a multispecies modeling approach (MSVPA). Ecosystem reference points would explicitly address the forage needs of menhaden's predator species such as striped bass, weakfish, and bluefish. This work is anticipated to take some time because of its complexity.

VII. Implementation of FMP Compliance Requirements for 2011

All states are required to submit annual compliance reports by April 1.

Amendment 1 to the Interstate FMP for Atlantic Menhaden requires all states to implement the reporting requirement contained in *Section 4.2.5.1*. All menhaden purse seine and bait seine vessels (or snapper rigs) are required to submit the Captain's Daily Fishing Reports (CDFRs). Existing reporting requirements may serve as an alternative to implementing this measure. Table 1 shows state compliance with this requirement and current regulations and reporting.

The cap for reduction landings from the Chesapeake Bay was set at 122,740 metric tons for 2011. Reported reduction landings from Chesapeake Bay for 2011 were approximately 46,259 metric tons. The reported harvest was approximately 62,761 metric tons below the annual 109,020 metric ton cap. Therefore the maximum underage is applied to the 2012 cap, which is set at 122,740 metric tons.

VIII. Research Needs/ PRT Recommendations

Compliance Recommendation

South Carolina, Georgia, and Florida have requested *de minimis* status for the 2012 fishing season. Amendment 1 does not exempt *de minimis* states from the compliance criterion (mandatory reporting for purse seine or bait seine vessels). All three states require mandatory reporting (South Carolina from dealers; Georgia and Florida from harvesters), and purse seines

are prohibited in their state waters. Annual compliance reports are required from all states, including those granted *de minimis* status. The PRT Recommends that South Carolina, Georgia, and Florida be granted *de minimis* status.

The Board unanimously approved *de minimis* status for South Carolina, Georgia and Florida for the 2012 fishing year through fax poll vote.

Reporting Recommendations

The PRT requests that:

- All menhaden bait landings are reported to the Technical Committee, even though the compliance criteria are only related to purse seines.
- New York investigates whether the state gill net landings are included in the NMFS Commercial Database or ACCSP Data Warehouse figures.
- New York includes in its annual compliance reports a summary table of menhaden landings by major gear type for each year. Landings by minor gear types can be grouped into one column.
- Maine includes in its annual compliance reports a summary table of menhaden landings by year by major gear type for at least the past five, preferably ten years. The PRT acknowledges these data are confidential.

IX. Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). Updated 2011. Atlantic Menhaden Stock Assessment and Review Panel Reports. SAR No. 10-02. 325 pp.

Table 1. Atlantic Menhaden Plan Review Team compliance review summary for 2011

State	Met Reporting Requirement of Amendment 1	Summary of Regulations
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.
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.
RI	Yes	Menhaden harvest by purse seine for reduction (fish meal) purposes is outlawed. No purse seines larger than 100 fathoms in length or 15 fathoms in depth may be used. Commercial gear and vessels need to be inspected and may not have a useable fish storage capacity greater than that that can hold 120,000 pounds of menhaden. Daily catch limit of 120,000 pounds per vessel when standing stock estimate reaches 3,000,000 pounds. When 50% of estimated weekly standing stock is harvested, or estimated weekly standing stock drops below 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	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. 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	The annual menhaden harvest cap for the purse seine fishery for Atlantic menhaden shall be no more than 109,020 metric tons, subject to annual adjustment for underages or overages, and shall not exceed 122,740 metric tons in any one year. It is unlawful for any person to take or catch with a purse net in the waters of the Commonwealth menhaden between the Saturday following the third Friday in November and the Sunday proceeding the first Monday in May. In waters east of the Chesapeake Bay Bridge Tunnel within the three-mile limit such prohibition shall be between the Friday before Christmas and the Sunday preceding the first Monday in May. It is also unlawful for any person to use any purse net or other net having a stretched mesh of less than 1 ¾ inches. Any purse seine vessel or bait seine vessel (snapper rig) licensed to take menhaden by purse net is required to submit the Captain's Daily Fishing Reports to the National Marine Fisheries Service, in accordance with the provision of Amendment 1, effective July 1, 2001.
NC	Yes	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; requests de minimis status.
GA	Yes	State waters closed to purse seine fishing; requests de minimis status.
FL	Yes	Purse seines prohibited in state waters; primarily a cast net fishery; requests de minimis.

Table 2. Menhaden Bait Landings by Region (1985 – 2011) [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	15.00	19.26	0.99	38.96
2010	2.32	23.07	17.88	0.62	43.88
2011	0.12	33.77	18.44	1.66	53.98

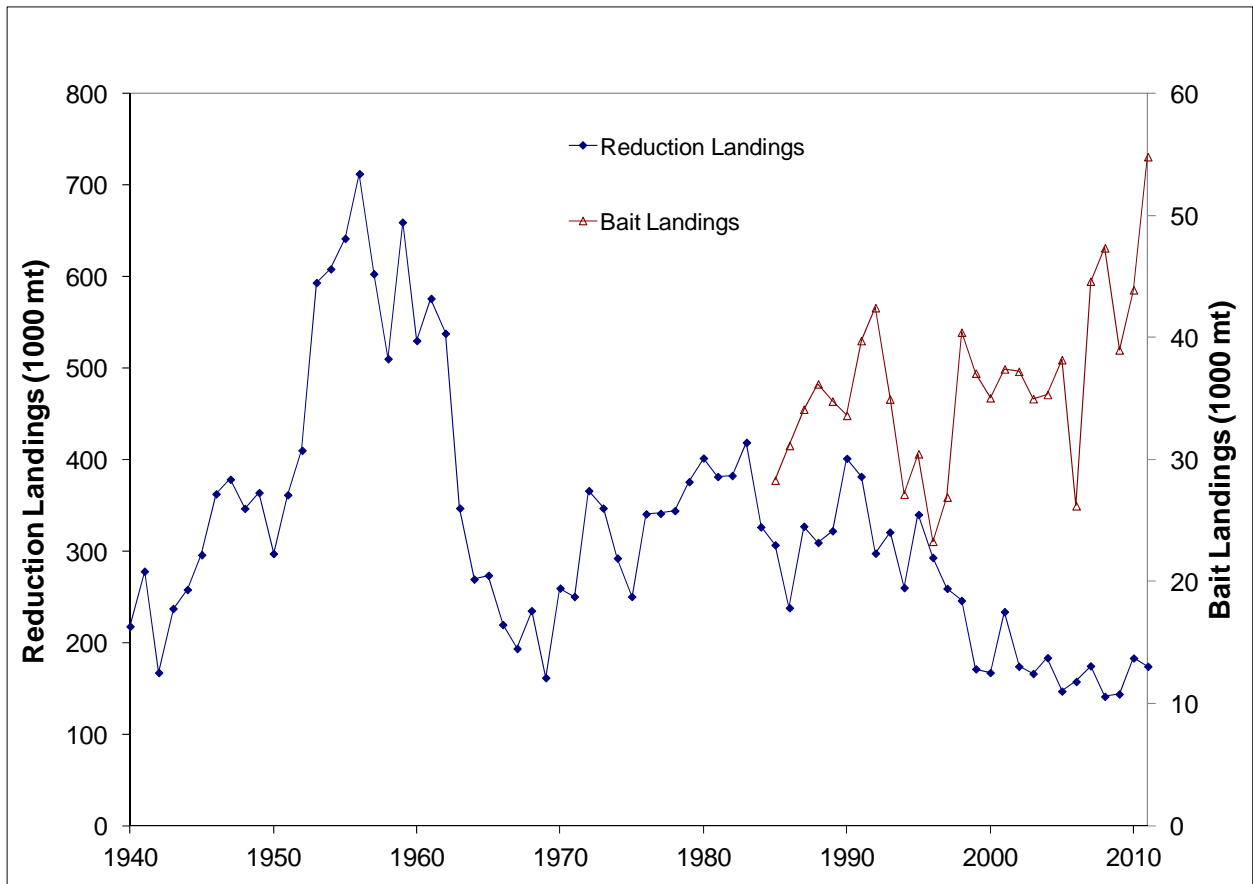


Figure 1. Landings from the reduction purse seine fishery (1940–2011) and bait fishery (1985–2011) for Atlantic menhaden.

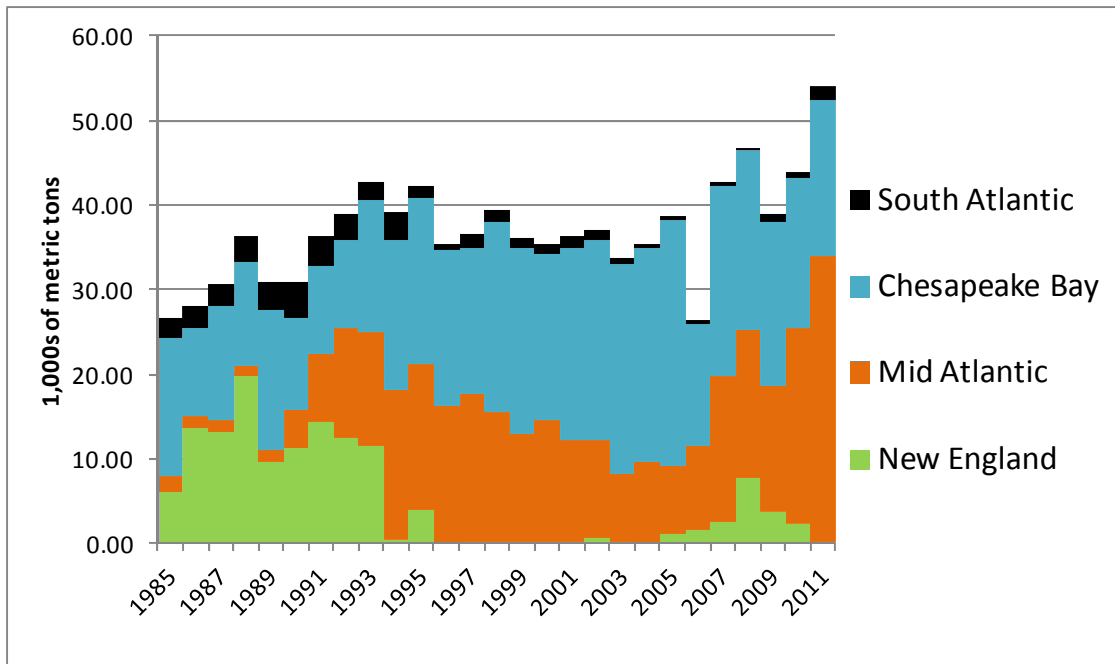


Figure 2. Annual landings by region from the Atlantic menhaden bait fishery, 1985–2011.