

Species Profile: Atlantic Menhaden

Benchmark Stock Assessment Sheds New Light on Stock Condition; Board to Consider Long-term Management Goals

Introduction

Atlantic menhaden (*Brevoortia tyrannus*) are a small, oily, schooling fish of historical, economic, and ecological importance. Historically, menhaden supported large-scale commercial reduction fisheries bringing considerable growth to Atlantic coastal communities. Today, the reduction fishery is a fraction of what it once was with one processing plant and several vessels operating on the Atlantic coast. The reduction fishery is so named because menhaden are processed (or reduced) into other products, such as agricultural fertilizer, fishmeal and oil, as well as livestock and aquaculture feeds. Additionally, menhaden are becoming increasingly valuable for use as bait in many important fisheries, including American lobster and blue crab commercial fisheries and striped bass recreational fisheries. Ecologically, the species plays an important role in marine ecosystems as a forage fish (prey) for many fish, sea birds, and marine mammals. As such, the Commission places a high priority on developing ecosystem-based reference points for management use in order to account for the forage needs of menhaden's predator species such as striped bass, weakfish, and bluefish. The 2015 benchmark stock assessment, which was recently approved by the Atlantic Menhaden Board for management use, alters our understanding of the status of the stock. As a result, current management measures may be reassessed to more equitably balance human use and ecological factors.

Life History

Atlantic menhaden occupy estuaries and coastal waters from northern Florida to Nova Scotia and are believed to consist of a single population. Adult and juvenile menhaden form large, near-surface schools, primarily in estuaries and nearshore ocean waters from early spring through early winter. By summer, menhaden schools stratify by size and age along the coast, with older and larger menhaden found farther north. During fall-early winter, menhaden of all sizes and ages migrate south around the North Carolina capes to spawn.

Sexual maturity begins as early as age one to just before age three, with major spawning areas from the Carolinas to New Jersey. The majority of spawning occurs primarily offshore (20-30 miles) during winter. Buoyant eggs hatch at sea, and larvae are carried into estuarine nursery areas by ocean currents. Juveniles spend most of their first year in estuaries, migrating to the ocean in late fall.

Menhaden are very efficient filter feeders. Water is pushed through specialized gill rakers that are formed into a basket that allows them to capture plankton. Menhaden are an important component of the food chain, providing a link between primary production and higher organisms by consuming plankton and providing forage for species such as striped bass, bluefish, and weakfish, to name just a few.

Commercial Fishery

The Atlantic menhaden commercial fishery consists of a reduction fishery and a bait fishery. The reduction fishery, named because it processes the whole fish into fish meal, fish oil, and fish solubles, first began in New England during the early 1800s and spread south after the Civil War. The reduction fishery grew with the advent of purse seine after the Civil War in the mid-

Species Snapshot

Atlantic Menhaden
Brevoortia tyrannus



Common Names:

menhaden, bunker, mossbunker, poggy, fatback, bugmouth, skipjack

Species Range:

Atlantic coast of North America from Nova Scotia to northern Florida

Family:

Clupeidae (includes herring, sardine, and shad species)

Interesting Facts:

- The modern record for the largest menhaden landed occurred in Reedville, VA in 1996, measuring in at 19.4" and weighing 3.4 lbs.
- Pre-colonial Native Americans called menhaden 'munawhatteaug,' which means fertilizer.
- A large crustacean parasite is commonly found in the mouth of Atlantic menhaden; hence its common name "bugmouth."
- Adults can filter 6-7 gallons of water/minute.
- Ethel Hall, with NMFS Beaufort Lab, has been ageing Atlantic menhaden for over 40 years using a 1967 Eberbach projector.
- Adults can filter 6-7 gallons of water/minute.

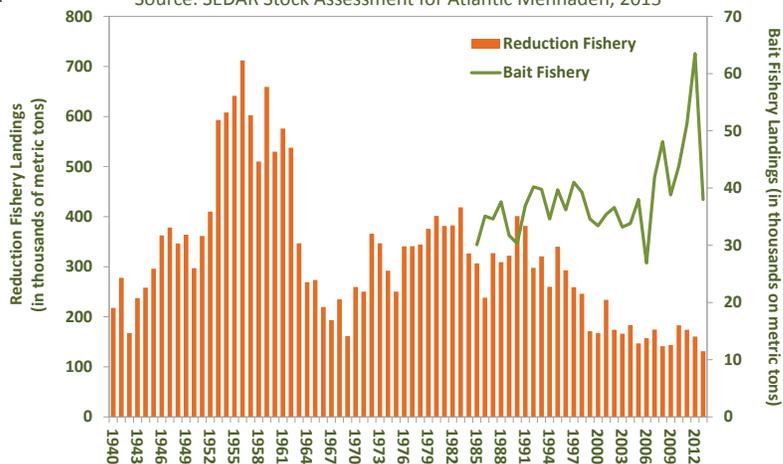
Stock Status: Not overfished and not experiencing overfishing



Photo © John Surrick, Chesapeake Bay Foundation

Atlantic Menhaden Landings by Reduction and Bait Fisheries

Source: SEDAR Stock Assessment for Atlantic Menhaden, 2015



Timeline of Management Actions: FMP ('81); FMP Revision ('91); Amendment 1 ('01); Addendum I ('04); Addendum II ('05); Addendum III ('06); Addendum IV (2'09); Addendum V ('11); Amendment 2 ('12); Addendum I ('13)

southern Maine. In the 1960s, the Atlantic menhaden stock contracted geographically, and many of the fish factories north of the Chesapeake Bay closed because of a scarcity of fish. Reduction landings dropped to a low of 161,000 mt in 1969. In the 1970s and 1980s, the menhaden population began to expand (primarily due to a series of above average year classes entering the fishery), and reduction landings rose to around 300,000-400,000 mt. Adult menhaden were again abundant in the northern half of their range and, as a result, reduction factories in New England and Canada began processing menhaden again by the mid-1970s. However, by 1989 all shore-side reduction plants in New England had closed, mainly because of odor abatement regulations.

During the 1990s, the Atlantic menhaden stock contracted again (as in the 1960s), largely due to a series of poor to average year classes. Over the next decade, several reduction plants consolidated or closed, resulting in a significant reduction in fleet size and fishing capacity. By 2005, there was only one remaining reduction plant in operation on the Atlantic coast processing menhaden into fishmeal and oil, which is located in Virginia and still operational today.

Beginning in 2013, as required under Amendment 2 to the Interstate Fishery Management Plan for Atlantic Menhaden (Amendment 2) and in response to the results of the 2010 benchmark stock assessment, total harvest levels of menhaden were reduced by at least 20% from the average of 2009-2011 landings. The 2013 reduction fishery harvest was 131,034 mt, an 18% decrease from harvest in 2012 (160,627 mt) and 24% below average landings from 2010-2012 (172,600 mt). Seven purse-seine vessels landed Atlantic menhaden during the 2013 season. Most of the catch occurred in the waters off of Virginia and New Jersey.

The coastwide bait fishery supplies fishermen with bait for popular commercial (e.g., American lobster and blue crab) and sport fish (e.g.,

1800s. Purse seine landings reached a high point in the 1950s with peak landings of 712,100 metric tons (mt) in 1956. At that time, over 20 menhaden reduction factories ranged from northern Florida to



Atlantic Menhaden Assessment Q&A

What Data Were Used?

The Atlantic menhaden assessment used two types of data. The first was fishery-dependent data, which includes commercial landings and portside samples taken to obtain weight, length, and age distribution information. The second was fishery-independent data, which includes data collected through scientific research and surveys. To develop a coastwide index of juvenile relative abundance, 16 surveys were used from across the states, including seine surveys, trawl surveys, and an electrofishing survey. Nine new indices of state survey data were used to develop two adult abundance indices, and the selectivity of these indices was estimated with length data.

What Models Were Used?

The Beaufort Assessment Model (BAM) was chosen based on model performance, reliability, flexibility, and assumption requirements. The BAM is a statistical catch-at-age model that estimates population size at age and recruitment in 1955 and then projects the population forward in time to 2013. The model estimates trends in population dynamics, including abundance at age, recruitment, spawning stock biomass, egg production, and fishing mortality rates. The BAM was configured to account for differences in selectivity introduced by each of the fishery fleets, a modeling technique called fleets-as-areas.

What is the Status of the Stock?

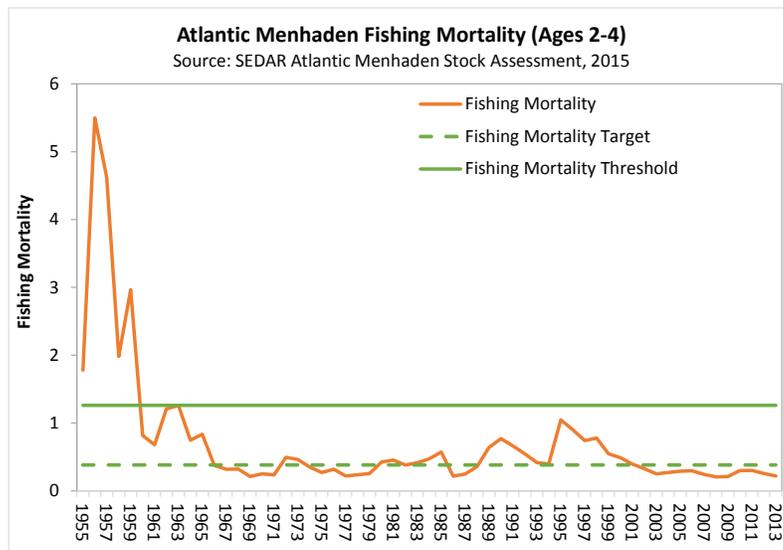
The assessment results indicate that the Atlantic menhaden stock is not overfished and overfishing is not occurring, relative to the current

2014 Atlantic Menhaden Quotas		
State	2014 Quota (mt)	2014 Quota (lbs)
ME	66.58	146,787
NH	0.05	112
MA	1417.94	3,126,024
RI	30.29	66,779
CT	29.50	65,034
NY	93.76	206,695
NJ	18924.42	41,721,164
DE	22.33	49,230
MD	2320.98	5,116,874
PRFC	1049.69	2,314,174
VA	144272.84	318,066,790
NC	833.23	1,836,948
SC	-	-
GA	-	-
FL	30.39	66,995
TOTAL	169092	372,783,605

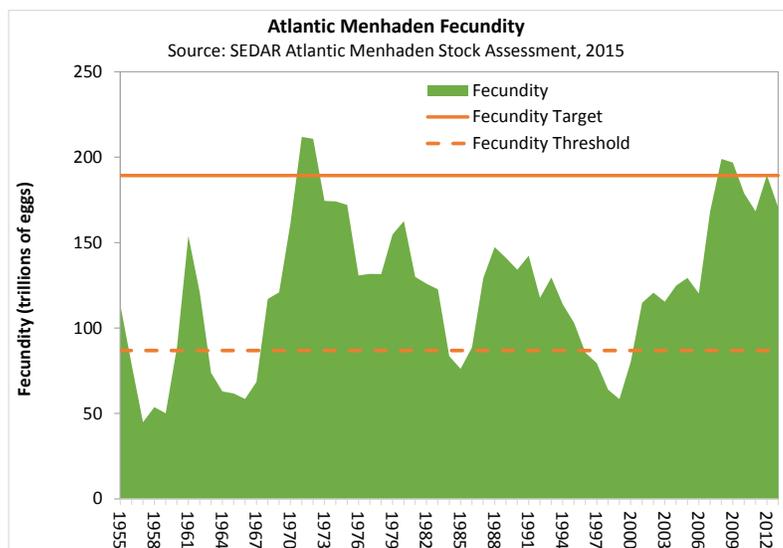
striped bass and bluefish), and has grown throughout its history along with the expansion of many fisheries that utilize menhaden as bait. Landings for bait have recently dipped due to the aforementioned reduction; levels for 2013 were 35,043 mt, 34% below the average landings during 2010-2012 (52,900 mt). However in 2012, bait landings peaked at an all-time high of 63,540 mt. The bait fishery has increased in relative importance from New England to North Carolina. This is evident in the increasing percent of total menhaden landings that are attributed to the bait fishery. Between 2001 and 2012, the percent of total landings that were used for bait rose from 13% to a high of 28% in 2012. In 2013, bait harvest composed approximately 22% of the total menhaden harvest. In recent years, the majority of bait landings have been harvested from Virginia and New Jersey waters, followed by Massachusetts and Maryland.

Status of the Stock

The 2015 benchmark stock assessment indicates that Atlantic menhaden are neither overfished nor experiencing overfishing. Fishing mortality rates have remained below the overfishing threshold (1.26) since the 1960s, and have hovered around the overfishing target (0.38) through the 1990s. In 1999, fishing mortality dropped below the target and was estimated to be 0.22 in 2013 (the latest year in the assessment). In other words, fishing mortality has been decreasing throughout the history of the fishery, and is now 42% below the target, meaning that overfishing is not occurring.



The biological reference point used to determine the fecundity target is defined as the mature egg production one would expect when the population is being fished at the threshold fishing mortality rate. Population fecundity, a measure of reproductive capacity, was estimated to be well above both the threshold and the target in recent years. In fact, in 2013, fecundity is estimated to have been 10% below the target value (189 trillion eggs) which is calculated to be 170



biological reference points based on maximum spawning potential.

Why Are These Findings Different from Those of the 2010 Benchmark Assessment?

Through the consideration of new and existing datasets and the exploration of alternative model configurations, significant changes were made during the 2015 assessment to address the issues identified with the 2010 assessment. These include:

- Maturity at age was corrected with new datasets, which resulted in a higher estimated proportion of mature fish at ages 1-3, meaning the stock has higher reproductive potential than previously estimated.
- The adult indices of relative abundance were expanded with larger and more complete datasets.
- Larger menhaden are not captured as often as smaller menhaden by the fisheries, a fact that was accounted for in the 2015 assessment but not the 2010 assessment.

What Data Are Needed?

The Atlantic menhaden stock assessment would be improved by the development of a coastwide fishery-independent survey to replace or supplement the existing indices. Accurate information on trends in abundance over time is critical for determining stock status and population trajectory in stock assessments. Also, development of a model that treats the stock as multiple regional stocks would be beneficial once sufficient age-specific data on movement rates of menhaden are available. Regional modeling would help to better characterize the movements of both the population and fishery, allowing for better management practices on a regional basis.

trillion eggs. This means the Atlantic menhaden population is not overfished.

Atlantic Coastal Management

Atlantic menhaden are currently managed under Amendment 2, approved in 2012. Amendment 2 established a 170,800 mt total allowable catch (TAC) that began in 2013. The established TAC represents a 20% reduction from the average landings of 2009-2011 and an approximate 25% reduction from 2011 landings, which accounts for the recent decline seen in commercial landings. The TAC was established by Amendment 2 in response to the 2010 benchmark stock assessment, which reported that menhaden were not overfished but were experiencing overfishing.



The Amendment allocates the TAC on a state-by-state basis based on landings history of the fishery from 2009-2011. States are required to close their fisheries when the state-specific portion of the TAC has been reached; any overages must be paid back the following year. Under the Amendment, 1% of the overall TAC is set aside for episodic events. If the episodic event set aside quota is unused as of October 31, it is redistributed to all the states on November 1 based on the Amendment 2 allocation percentages.

Amendment 2 also adopted new biological reference points for biomass which are based on maximum spawning potential, with the goal of increasing abundance, spawning stock biomass, and menhaden availability as a forage species.

Next Steps

Following the acceptance of the 2015 benchmark stock assessment for management use, the Board tasked the Technical Committee with conducting a thorough review of the peer review findings. The Board also tasked the Technical Committee to run projections that explore how various TAC levels will impact stock status. The Board will review the projection analyses at the Commission's Spring Meeting and further deliberate on management objectives and a TAC that will address the needs of the reduction and bait fisheries as well as the ecological services menhaden provides.

The Board also continues to place a high priority on developing ecosystem-based reference points (ERP) for management use. The ERPs are designed to account for the forage needs of menhaden's predator species such as striped bass, weakfish, and bluefish. The Board is working to develop specific objectives to provide direction to the working group at the Commission's spring meeting in May.

Under Amendment 2, the allocation of the TAC among states is to be reviewed three years after implementation. Allocation will be reevaluated based on updated landings history in 2016.

For more information, please contact Mike Waine, Senior Fishery Management Plan Coordinator, at mwaine@asmfc.org.

