

# Providing for Forage of Atlantic Menhaden

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The Science Center for Marine Fisheries (SCeMFIS) requested technical assistance to update previous analyses (Himchak 2016) to derive the portion of an Atlantic menhaden year class that is implicitly allocated to the ecosystem through the assumed rate of natural mortality in the stock assessment relative to the catch allocated to the fishery (bait and reduction combined). Information from the 2020 benchmark stock assessment of Atlantic menhaden (SEDAR 2020a) were used to inform the calculations.

## Summary

The updated and revised Beaufort Assessment Model (BAM) application to Atlantic menhaden (SEDAR 2020a) estimates that the current stock biomass almost the highest on record, and the current total fishing mortality is much less than historical levels, much less than the management reference points, and much less than the rate of natural mortality. The fishery removes a very small portion of the available population, leaving an abundance of menhaden available for forage.

## Stock Assessment (SEDAR 2020a)

The Atlantic States Marine Fisheries Commission's (ASMFC) 2020 Atlantic menhaden stock assessment brought encouraging news for the species. The Atlantic menhaden fishery is sustainable, and menhaden are neither overfished nor experiencing overfishing. The Atlantic menhaden fishery today includes ten active vessels and one processing plant located in Reedville, Virginia—a decrease from 150 vessels and 23 plants coastwide when fishing mortality peaked in 1956. The bait fishery landed approximately 10% of total menhaden from 1985 to 2000 and bait landings increased to 20% of total landings from 2001 to 2017.

Estimates of stock biomass peaked at 7 million tons in the 1959, decreased to 1 million tons in 1973 and increased to relatively abundant stock sizes since the mid-1990s (e.g., 5 million tons in 2017, the 5<sup>th</sup> highest estimate in the time series). One important revision in the SEDAR 69 assessment was the application of tagging-based estimates of natural mortality, which are greater than previously assumed values. These direct estimates of natural mortality rate are much more informative than the previous conventional approximations that were derived from life history traits. This revised assumption resulted in larger stock size estimates and greater productivity for deriving management reference points and the abundance of menhaden available for forage. Estimates of stock biomass since the 1990s are similar from the single-species assessment (BAM) and several multi-species models that explicitly account for forage and predation (SEDAR 2020b).

The assessment also provided very positive measurements for several key indicators of a healthy stock. One such metric, fishing mortality, was among the lowest in the assessment time series in 2017, with sustainable fishing effort. Estimates of fishing mortality suggest that fishing was relatively intense from

the 1950s to the 1980s, but there was a substantial reduction to relatively low fishing mortality since the early 1990s. The estimate of current fishing mortality is 50% of the target reference point and 18% of the overfishing threshold. The exploitation rate (% of deaths from fishing relative to total deaths including natural mortality) is 0% for age-0, 1% for age-1, 5% for age-2, 10% for age-3, 6% for age-4 and 1% for ages five and older.

Another important measurement, fecundity, has reached a near-record high, and is well above the threshold level set by the ASMFC. Fecundity is one of the best measurements that fisheries managers have for determining whether or not a species is being managed sustainably. According to the assessment, the menhaden stock is producing more than enough eggs to successfully maintain the coastwide population. The current stock size (2017 fecundity) is substantially greater than the management target or threshold reference points. The current stock fecundity is 134% of the target and 178% of the threshold. Additionally, the menhaden fishery takes several steps to avoid interfering with menhaden spawning, such as ending the fishing season before peak spawning migration begins to protect spawning-aged menhaden.

Providing for Forage

Over the ten-year period from 2008-2017, the menhaden fishery harvested an average of less than one percent of the total menhaden population (Figure 1), with the remaining percent of the menhaden stock left in the ocean to serve as food for predators and other species. The fishery largely catches menhaden between the ages of 1 and 4. It harvested less than one percent of the age-1 abundance, 7 percent of age-2 abundance, 10 percent of age-3 abundance, and 3 percent of age-4 abundance during the 2008-2017 period (Figure 2). The fishery does not target juvenile menhaden, which primarily serve as a food source for predator species. Similarly, the fishery rarely harvests older menhaden, which are the more fertile spawners. The harvest of both juvenile and older menhaden as a percentage of the total menhaden catch is negligible (Figure 2).

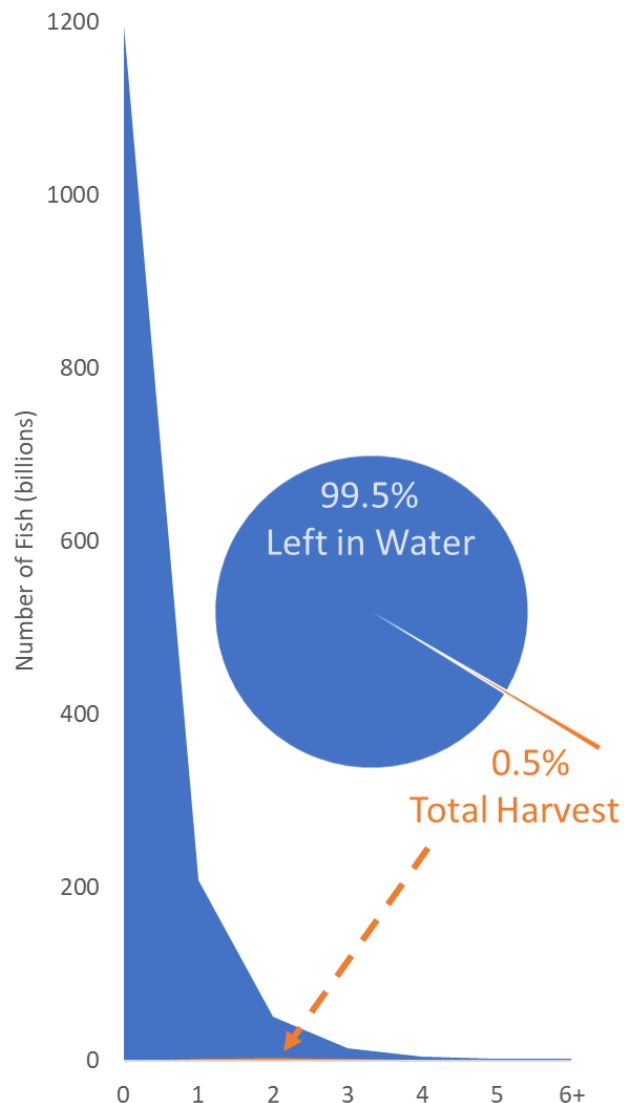


Figure 1. Number of fish harvested by the fishery compared to population size at age 0 (years 2008-2017)

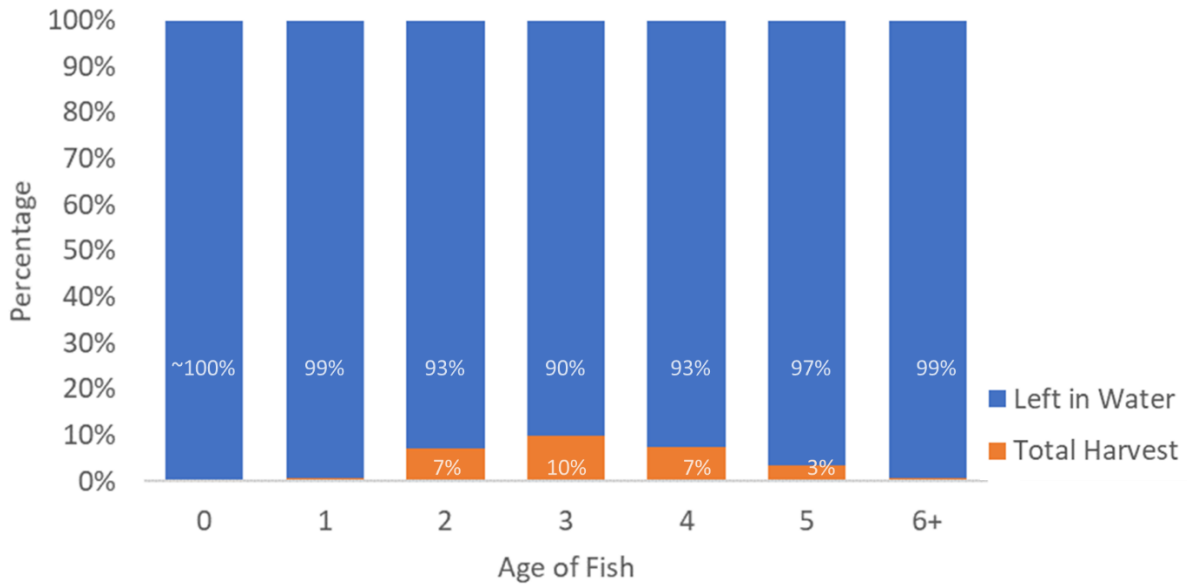


Figure 2. Proportion of total population by age harvested vs not harvested (years 2008-2017).

### References

Himchak, P. 2016. The Fate of an Atlantic Menhaden Year Class. <http://menhadencoalition.org/wp-content/uploads/2016/03/Fate-of-an-Atlantic-Menhaden-Year-Class-Final.pdf>

SEDAR. 2020a. SEDAR 69 – Atlantic Menhaden Benchmark Stock Assessment Report. SEDAR, North Charleston SC. 691 pp. available online at: <http://sedarweb.org/sedar-69>

SEDAR. 2020b. SEDAR 69 – Atlantic Menhaden Ecological Reference Points Stock Assessment Report. SEDAR, North Charleston SC. 560 pp. available online at: <http://sedarweb.org/sedar-69>

### Menhaden Fishing Terms

- **Fishing Mortality** measures the rate at which fish are removed from the stock by the fishery. Excessive levels of fishing mortality lead to overfishing.
- **Fecundity** is a metric of the reproductive capacity of a fish stock, measured by the number of eggs being produced by the stock. It is a key measure of whether or not a stock is able to sustain itself and potentially increase its numbers.
- **Overfishing** occurs when fishing mortality is too high, and too many fish are being removed from a stock. Overfishing levels are determined by fisheries managers like the ASMFC. Atlantic menhaden is not experiencing overfishing.
- **Overfished** is a stock status used when a stock is below the minimum population size set by fisheries managers. Atlantic menhaden is not overfished.
- **Spawning** occurs when menhaden reproduce, which can occur as early as age 1. The measure of the spawning success of the stock is known as **Recruitment**.