

Does the Atlantic menhaden fishery satisfy Principle 1: Sustainable target fish stocks?

Principle 1: A fishery must be conducted in a manner that does not lead to overfishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

1. Recruitment

In fisheries science, the term “young-of-the-year” (YoY) represents fish in their first year of life. The YoY index shows recruitment levels, or the estimated number of fish that survive to enter the fishery and become available for catch. The largest recruitment of Atlantic menhaden (i.e. high YoY index) occurred in the 1970’s and 1980’s, but has dropped to a historic low for the past 25 years of survey data (1992-2016). Scientists have had difficulties relating these trends to fishing pressure and adult fish biomass or abundance, some suggest that recruitment might be driven by external factors such as water quality, climate conditions, predation, and primary productivity, but this relationship remains uncertain.

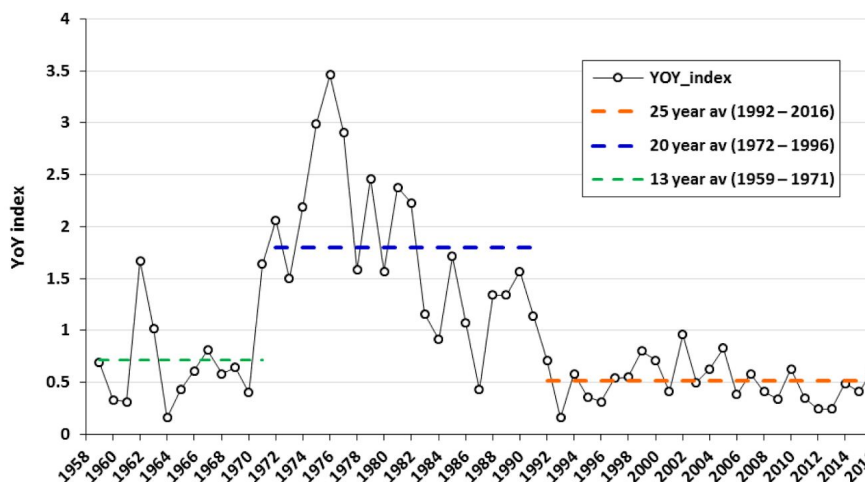


Figure 42. YoY index with additional lines showing the 20 year averages for 1997 – 2016 and 1977 – 1996.

2. Abundance and biomass

Although recruitment and abundance for Atlantic menhaden have been low over the past few decades, biomass has increased within the past decade (see figure below). Data on age structure of the menhaden population suggest that more individuals in the *oldest* age class, which are considerably heavier than younger fish, are surviving and responsible for the increasing trend in biomass.

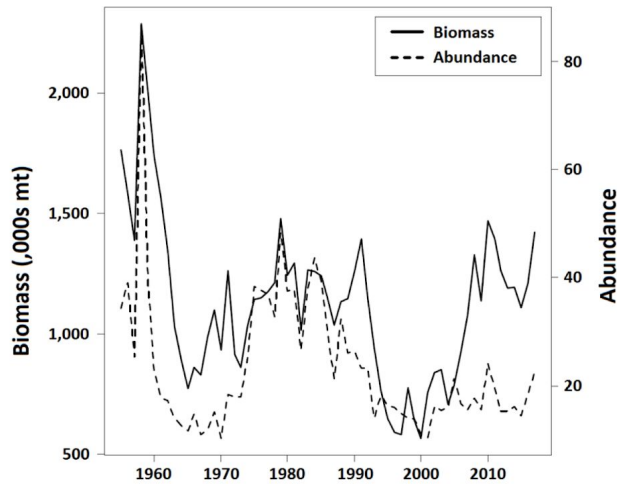


Figure 16. Biomass (,000s mt) and abundance over time for Atlantic menhaden (1959 – 2016).

3. Landings

Abundance and recruitment for Atlantic menhaden have decreased over the past decade, but total landings have also decreased (from about 1996-2015). This decrease in total landings resulted from fewer processing plants along the U.S. Atlantic coast and a total allowable catch limit for the fishery that was first established in 2013.

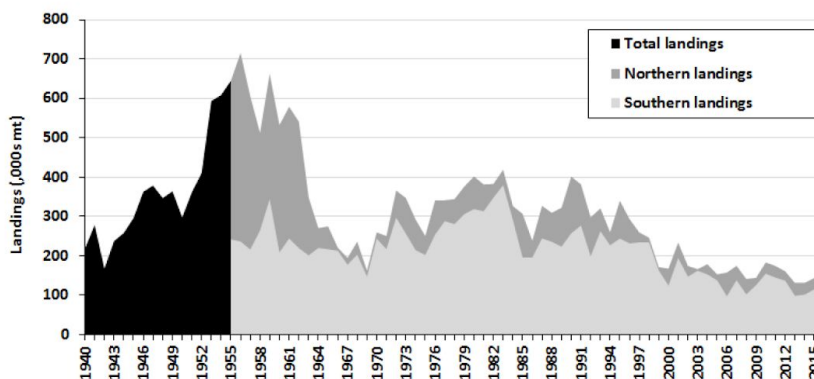


Figure 21. Total menhaden reduction landings (,000s mt) (1940 – 2016), divided into northern and southern reduction landings after 1955.

Total landings for the past few years can be further divided into age classes. Menhaden typically reach sexual maturity in their third year of life (late age class 2 according to the SAI Global Report). However, in 2017, a large percentage of the total landings of menhaden were younger than sexual maturity (Figure 4 on page 28 from SAI Global Report).

(Source: Dignan, S., Mateo I., Allain, R. J. (2019). Marine Stewardship Council Full Assessment Final Report, For: Omega Protein Corporation U.S. Atlantic menhaden purse seine (Report No. MSC030). Retrieved from Marine Stewardship Council's website: <https://fisheries.msc.org/en/fisheries/omega-protein-corporation-u.s.-atlantic-menhaden-purse-seine/@@assessments>)

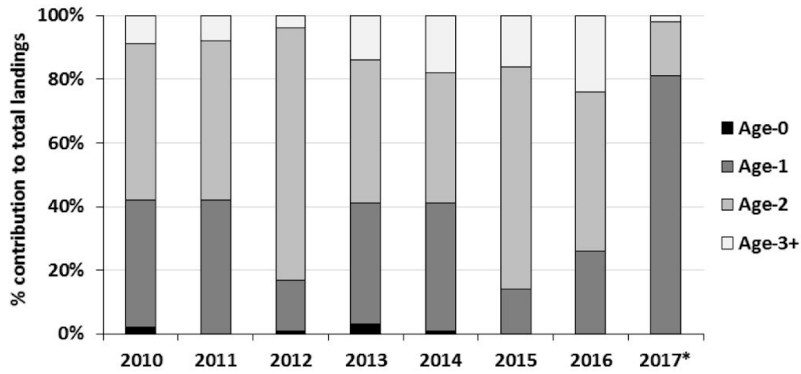


Figure 4. % age contribution to total landings in the Atlantic menhaden reduction fishery (2010 – 2017) (Source: NOAA 2018).

Does the Atlantic menhaden fishery satisfy Principle 2: Environmental impact of fishing?

Principle 2: Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

Considerations:

1. Bycatch of non-endangered species
2. Bycatch of endangered, threatened, or protected species: marine mammals, turtles, corals
3. Threats to habitats
4. Threats to ecosystems

1. Bycatch of non-endangered species:

Two types of non-endangered species:

1. Primary species - (i.e., species that are managed, have undergone stock assessments)
 - See Table 1 below
2. Secondary species (i.e., species that are not fished, no stock assessments in place)
 - American harvestfish, Atlantic thread herring, Bullnose ray, Cownose ray, Hogchoker, Ladycrab, Silverperch, Spidercrab, Spiny butterfly ray, Vermillion snapper, Witch flounder

Note: Each species of non-endangered species (both primary and secondary) bycatch make up <1% of the menhaden catch

Table 1. Primary species in the Atlantic menhaden purse seine fishery

Species	Latin	Overfishing?	Overfished?	B/Bmsy or B/Bmsy proxy	Source
American butterfish	<i>Poronotus triacanthus</i>	No	No	1.74	NMFS 2014
Atlantic croaker	<i>Micropogonias undulates</i>	Unknown	Unknown		ASMFC 2018a
Atlantic striped bass	<i>Morone saxatilis</i>	No	No	0.81	ASMFC 2018a
Black drum	<i>Pogonias cromis</i>	No	No		ASMFC 2018a
Blue crab	<i>Callinectes sapidus</i>	No	No	0.68	CBSAC 2018
Bluefish	<i>Pomatomus saltatrix</i>	No	No	0.86	ASMFC 2018a
Red drum*	<i>Sciaenops ocellatus</i>	No	Unknown		ASMFC 2018a
Sandbar/Brown shark	<i>Carcharhinus plumbeus</i>	No	Yes	0.66	NMFS 2016
Spanish mackerel	<i>Scomberomorus maculatus</i>	No	No		ASMFC 2018a
Spot	<i>Leiostomus xanthurus</i>	Unknown	Unknown		ASMFC 2018a
Summer flounder/Fluke	<i>Paralichthys dentatus</i>	Yes	No	0.58	ASMFC 2018a
Weakfish	<i>Cynoscion regalis</i>	No	Yes		ASMFC 2018a

* Based on the area in which the menhaden fishery operates these are most likely to be from the Northern red drum stock.

2. Bycatch of endangered, threatened, or protected species: marine mammals (dolphins and whales), turtles, and corals

a) Dolphins

Historically, the mid-Atlantic menhaden purse seine fishery reported an annual incidental take of one to five common bottlenose dolphins (NMFS 1991, pp. 5 – 73). Since then, large bycatch excluders are now widespread throughout the fishing fleet. More recently (during 2011 – 2015), there were no documented mortalities or serious injuries in mid-Atlantic menhaden purse seine gear of common bottlenose dolphins.

Any vessel owner or operator participating in the Atlantic menhaden fishery must report all incidental mortalities and injuries of marine mammals that occur during commercial fishing operations to the National Marine Fisheries Service (NMFS) within 48 hours of the end of the fishing trip. As a Category II fishery, all fishers participating in Atlantic menhaden purse seine fishery are required to accommodate an onboard observer (trained biologist that collects catch data) upon request, however there has been very limited federal observer coverage since 2008, but no incidents have been observed.

Note: There are three categories (I, II, III), with Category I posing the greatest risk to marine mammals.

b) Humpback whales:

There are no records of the menhaden fishery incidentally killing or injuring humpbacks. The potential impacts of the fishery are limited to indirect effects (e.g. through the removal of forage fish).

c) Turtles:

The level of interactions between the menhaden fishery and sea turtles are likely to be extremely low. Where they do occur, they are not likely to result in mortality or serious injury. This is due to the fact that in general, purse seines are not left underwater for extended periods of time, meaning the risk of sea turtle mortality from forced submergence is low compared to other gear types.

d) Corals:

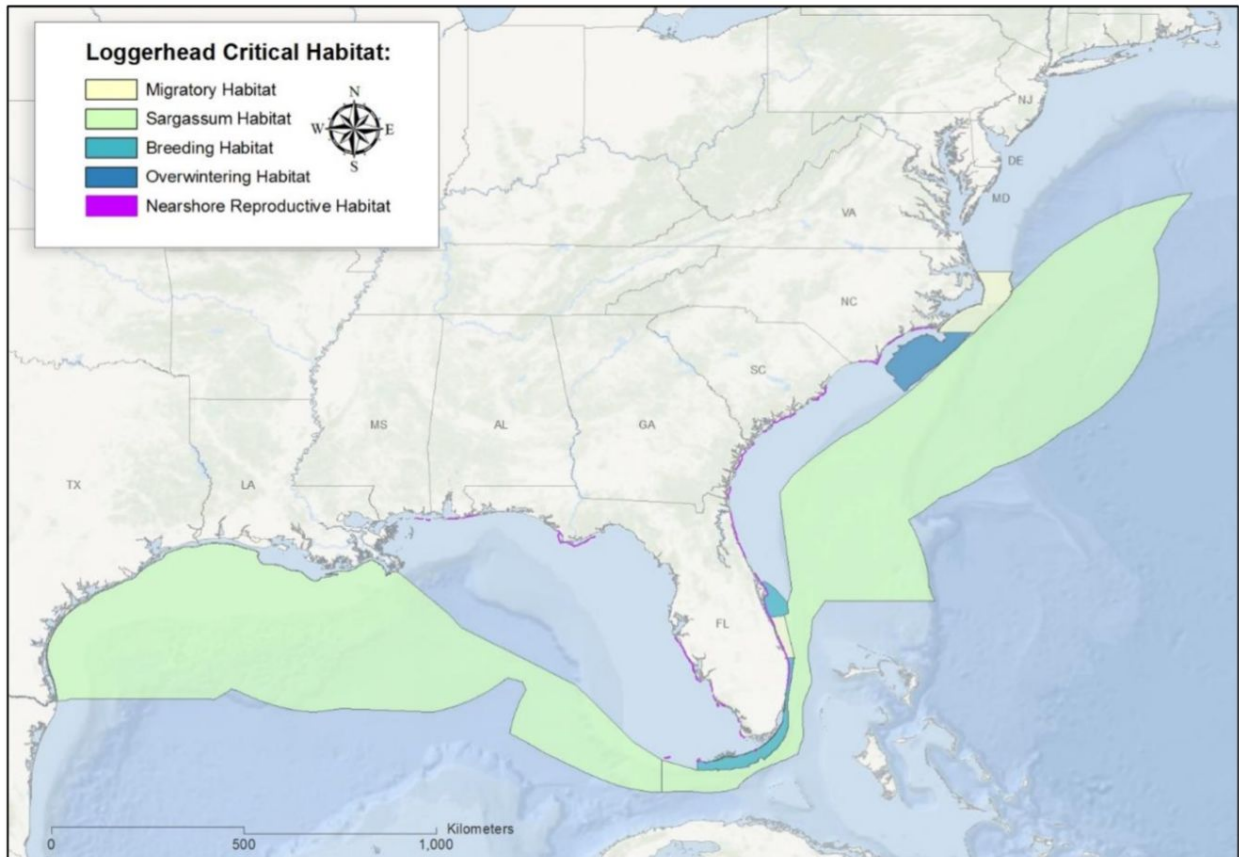
There are no interactions between protected coral species (elkhorn coral, staghorn coral) and the Atlantic menhaden fishery

3. Threats to habitats

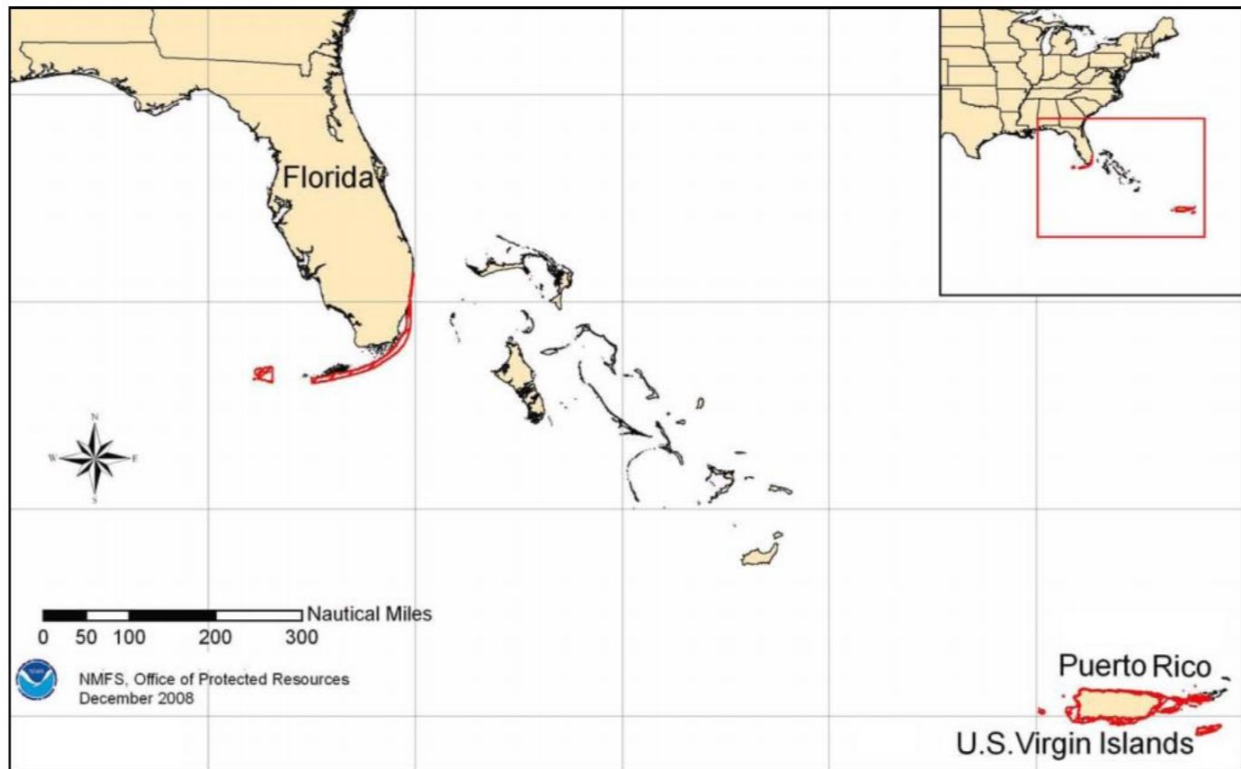
Atlantic menhaden is mainly caught by purse seines, which is a gear that operates in the water column. Although contact with the bottom may occasionally occur in purse seine fisheries, particularly in shallow waters, physical and biological impact on the seafloor is usually low.

Another habitat consideration is whether or not the fishery will have any effect on habitats designated as “critical” to endangered species. Below are maps of critical habitats for loggerhead turtles, elkhorn and staghorn corals, and right whales.

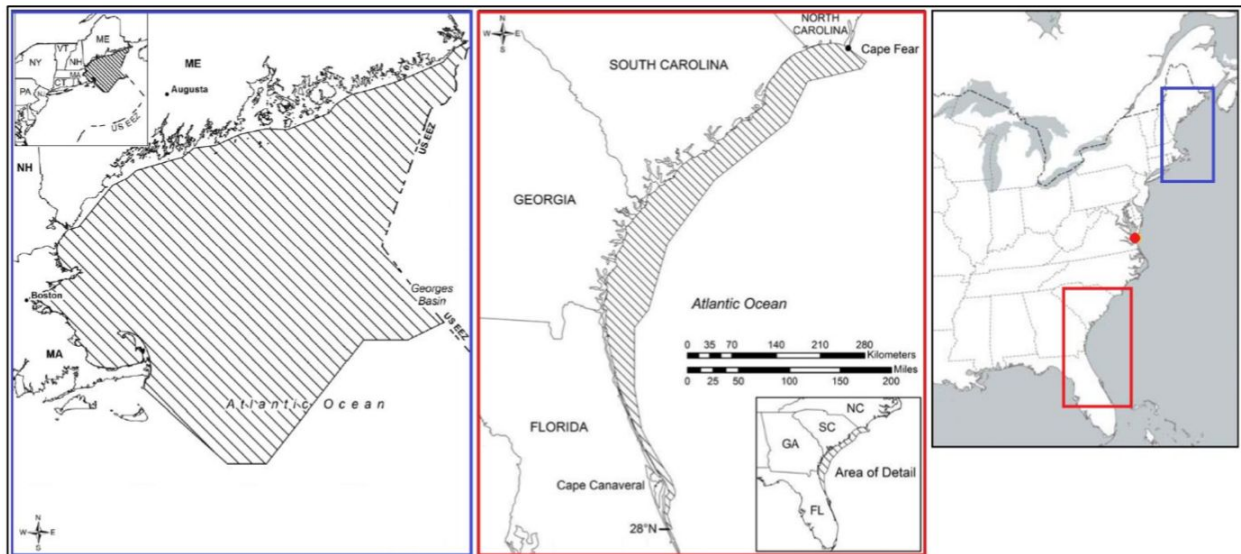
Loggerhead Turtle Critical Habitat:



Elkhorn and Staghorn Critical Habitat



Right whale critical habitat for foraging (blue) and calving (red)



(Source: Dignan, S., Mateo I., Allain, R. J. (2019). Marine Stewardship Council Full Assessment Final Report, For: Omega Protein Corporation U.S. Atlantic menhaden purse seine (Report No. MSC030). Retrieved from Marine Stewardship Council's website: <https://fisheries.msc.org/en/fisheries/omega-protein-corporation-u.s.-atlantic-menhaden-purse-seine/@@assessments>)

4. Threats to ecosystems

Menhaden are part of the Northeast Large Marine Ecosystem, which has the following characteristics (NOAA, 2016):

- Production of microscopic plants at the base of the food web has declined over the last three years.
- Fish condition (weight at a given length) has declined for a substantial number of species since 2000.
- Landings for commercial and recreational fish have declined but commercial scallop and lobster landings remain strong.
- A total of nine stocks are currently classified as overfished and six continue to experience overfishing.
- Right whale and seal populations continue to increase.
- Elasmobranch and small pelagic fish biomass has increased over the last several decades.

A study by Buchheister et al. (2017) found that striped bass were the most impacted of any species by menhaden population fluctuations. A separate study (SEDAR 2015) calculated that managers should aim for a fishing mortality rate of 0.29. According to Buccheister et al.'s model, if menhaden were fished at this rate, striped bass would be reduced by 28% (from 100% to about 78%).

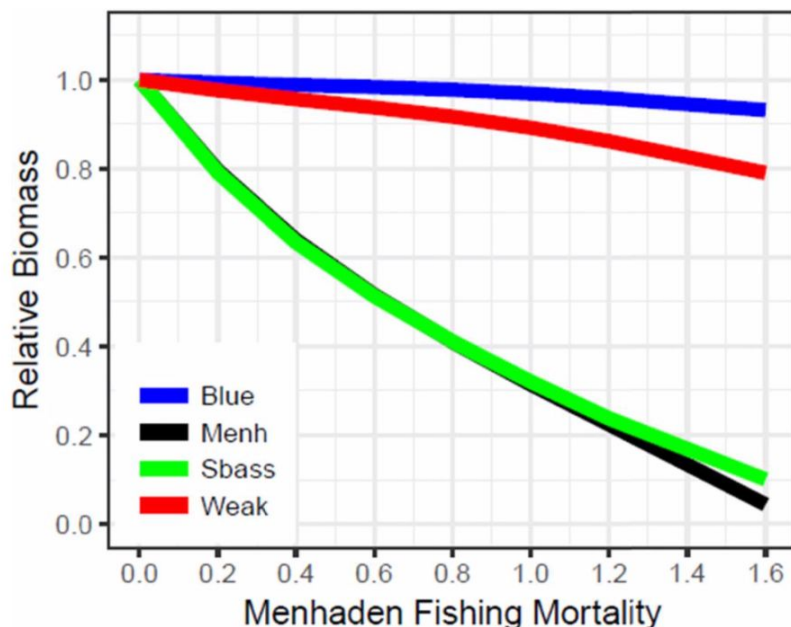


Figure 1. Simulated relative biomass for menhaden and three predators as functions of fishing mortality scenarios. Colored lines represent bluefish (blue), menhaden (black), striped bass (green), and weakfish (red) (Source: Buccheister et al. 2017)

Does the Atlantic menhaden fishery satisfy Principle 3: Effective management?

Principle 3: The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

1. Jurisdictions of Fishing Operations

Based on the latest available information, the Atlantic commercial reduction menhaden fishery is predominantly fished in the territorial waters of the Commonwealth of Virginia. The Atlantic menhaden fishery operates primarily in state management jurisdictions.

2. State Management System

All fifteen Atlantic seaboard states are members of the Atlantic States Marine Fisheries Commission (ASMFC). They include: Connecticut, Delaware, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, and Virginia. Each member state is represented by three commissioners.

A coastal Atlantic menhaden fishery management plan (FMP) was developed by the ASMFC in 1981. The plan was revised in 1992, replaced by Amendment 1(2001) and currently managed under Amendment 2 (2012). The ASMFC's Menhaden Management Board tracks and regulates harvest under Amendment 2 to the Interstate Fishery Management Plan for Atlantic menhaden. Although the ASMFC is made up of representatives of all member states, seasons, catch limits and other management measures must generally be approved by the governmental bodies in each applicable state before they are implemented. In other words, the ASMFC does not have direct control over states' fishery management measures. Additionally, while there are some landings from the federal waters* between 3-200nm (nautical miles) from shore, management authority is vested in the states because the large majority of menhaden are caught in the state waters within 3nm of shore.

*The Assessment Team was unable to report on the extent of Omega Proteins' participation in the Atlantic Menhaden fishery in federal waters as we were informed by ASMFC the information was confidential and could not be disclosed.

3. Federal Management System

As previously stated, the Atlantic menhaden fishery operates primarily in state management jurisdictions. Consequently, the primary influence of federal laws and regulations on the menhaden resource is through the maintenance and enhancement of habitat, preservation of water quality and food supplies and control of pollution.

Federal fishery management is conducted under the authority of the *Magnuson-Stevens Fishery Conservation and Management Act*, originally enacted in 1976 as the Fishery Conservation and Management Act.

Federal agencies involved, either directly or indirectly, in the management of the menhaden fishery include the National Park Service (NPS), the US Army Corps of Engineers (USACE), the US Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Administration (NOAA), and the Environmental Protection Agency (EPA). These agencies along with various state agencies administer programs to regulate land and water use, pollution control, wetlands protection, and other activities that could affect menhaden populations.

The *Atlantic Coastal Fisheries Cooperative Management Act* is instrumental in supporting and encouraging the development, implementation, and enforcement of effective interstate conservation and management of Atlantic coastal fishery resources. It recognizes that the failure by one or more Atlantic states to fully implement a coastal fishery management plan can affect the status of Atlantic coastal fisheries, and can discourage other states from fully implementing coastal fishery management plans. Prior to the passage of this Act, state implementation of a Commission fishery management plan was voluntary, with the exception of the Fishery Management Plan for Atlantic Striped Bass.

Along the Atlantic coast of the US, there are 3 Regional Fishery Management Councils that are responsible for developing fishery management plans and recommending management measures to the Secretary of Commerce through the National Marine Fisheries Service (NMFS). The Atlantic commercial menhaden fishery in federal waters is not regulated or managed by the Councils. The ASMFC is the only entity with a management plan for Atlantic menhaden and there is no cooperative or complementary plan in federal waters.

4. Enforcement

The Law Enforcement Committee (LEC) is a standing committee appointed by the ASMFC Commission. In general, the Committee provides information on law enforcement issues, brings resolutions addressing enforcement concerns before the ASMFC Commission, coordinates enforcement efforts among states, exchanges data, identifies potential enforcement problems, and monitors enforcement of measures incorporated into the various interstate fishery management plans. The LEC is comprised of law enforcement representatives from each

member state, the US Fish and Wildlife Service, NOAA Fisheries, the US Coast Guard, and the US Department of Justice.

Requests were made to acquire background MCS (Monitoring, Control, and Surveillance) operational data from appropriate management/regulatory agencies, and, where possible, data of particular relevance to Omega Protein's purse seine reduction fishery. Federal and/or state confidentiality provisions were invoked which restricted the Assessment Team's access to information.

The Office of Law Enforcement (OLE) investigates violations of marine resource protection laws. Two NOAA OLE divisional offices are involved in enforcement in areas that overlap with the menhaden fishery. They are the Southeast Division (SED) covering federal waters off Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina and North Carolina, and the Northeast Division covering federal waters off Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland and Virginia.

In FY 2015 the Northeast Division (NED) documented 813 incidents (Figure 38), and the Southeast Division (SED) documented 538 incidents (Figure 39). The NED and SED do not specify which, if any, of these incidents relate to the Atlantic menhaden fishery specifically.

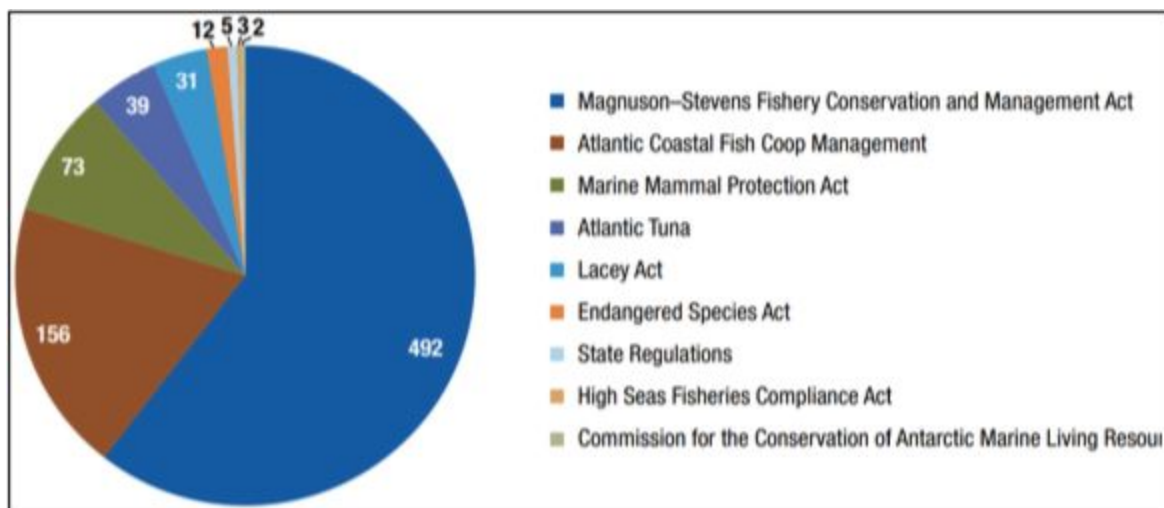


Figure 38. Disposition of Incidents by Federal Statute for Fiscal Year 2015 - Northeast Division (NED) Source: OLE Annual Report FY 2016.

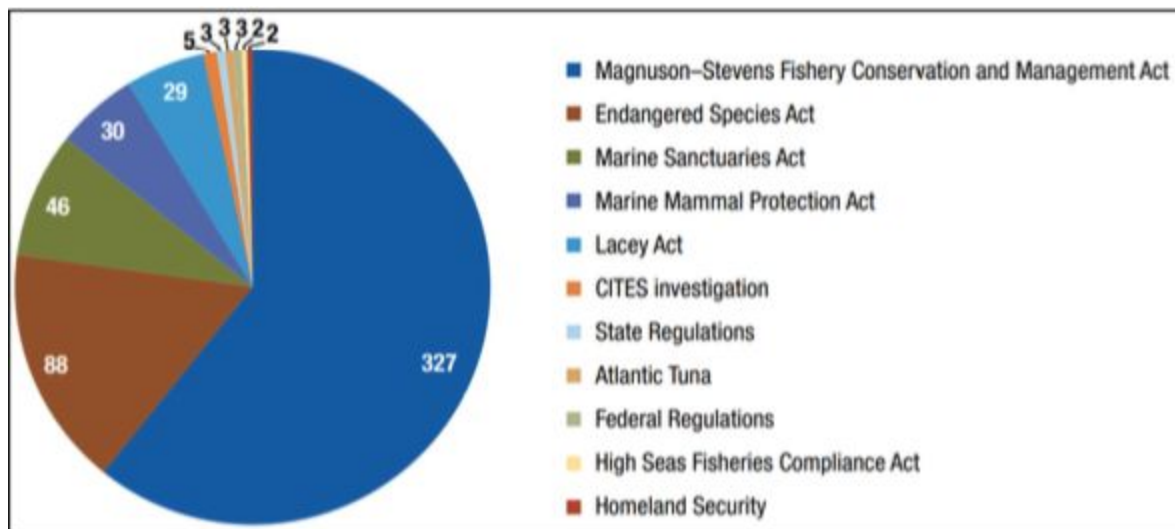


Figure 39. Disposition of Incidents by Federal Statute for Fiscal Year 2015 - Southeast Division (SED). Source: OLE Annual Report FY 2016.

As stated previously, the Atlantic commercial reduction menhaden fishery is predominantly fished in the territorial waters of the Commonwealth of Virginia. The Virginia Marine Police (VMP) comprise the largest division within the Virginia Marine Resources Commission, and are responsible for enforcing state and federal commercial and recreational fishery laws and regulations. Menhaden fisheries inspections by the Virginia Marine Police constitute a very small fraction of annual overall inspections (Table 18). The Virginia Marine Resources Commission also reported that no summons or citations were issued for the reporting years.

Table 18. Menhaden specific enforcement data for Virginia State waters (0 to 3 nm from shore) for years 2014 to 2017⁵⁵. Source: Virginia Marine Resources Commission's Basic Activity Summary Report.

Year	Menhaden		Overall		Total	
	Hours	Inspections	Hours	Inspections	Hours	Inspections
2017 ⁵⁶	16.5	102	8,892	81,564	57,049	264,743
2016	60.5	53	16,447	140,301	100,472	424,921
2015	44.5	194	16,950	134,739	104,991	404,410
2014	37.0	225	16,595	139,096	100,203	388,107

(Source: Dignan, S., Mateo I., Allain, R. J. (2019). Marine Stewardship Council Full Assessment Final Report, For: Omega Protein Corporation U.S. Atlantic menhaden purse seine (Report No. MSC030). Retrieved from Marine Stewardship Council's website: <https://fisheries.msc.org/en/fisheries/omega-protein-corporation-u.s.-atlantic-menhaden-purse-seine/@@assessments>)