DRAFT

AFFECTED ENVIRONMENT

Amendment 8

to the

Atlantic Herring Fishery Management Plan

Update August 2017

CONTENTS

1.0 AFFECTED ENVIRONMENT

The Affected Environment is described in this document based on valued ecosystem components (VECs), including: target species, non-target species, predator species, physical environment and Essential Fish Habitat (EFH), protected resources, and human communities. VECs represent the resources, areas and human communities that may be affected by the management measures under consideration in this amendment. VECs are the focus, since they are the "place" where the impacts of management actions are exhibited.

1.1 TARGET SPECIES

This section describes the life history and stock population status for Atlantic herring, as well as herring's role as forage in the ecosystem. The Council manages the Atlantic herring fishery under the Atlantic Herring FMP. A complete description of the Atlantic herring resource is in Section 7.1 of the FEIS for Amendment 1 to the Herring FMP. Updated information is in the Amendment 5 EIS and Framework 2 to the Herring FMP (which includes the 2013-2015 Atlantic herring fishery specifications). The following subsections update information through 2013/2014 where possible and summarize the stock status and recent biological information for Atlantic herring. Based on the best available science, the Atlantic herring resource is not overfished at this time and overfishing is not occurring (the stock is considered rebuilt).

The Atlantic herring (*Clupea harengus*), is widely distributed in continental shelf waters of the Northeast Atlantic, from Labrador to Cape Hatteras. Herring is in every major estuary from the northern Gulf of Maine to the Chesapeake Bay. They are most abundant north of Cape Cod and become increasingly scarce south of New Jersey (Kelly & Moring 1986).

Spawning occurs in the summer and fall, starting earlier along the eastern Maine coast and southwest Nova Scotia (August – September) than in the southwestern GOM (early to mid-October in the Jeffreys Ledge area) and GB (as late as November - December; Reid et al. 1999). In general, GOM herring migrate from summer feeding grounds along the Maine coast and on GB to SNE/MA areas during winter, with larger individuals tending to migrate farther distances. Presently, herring from the GOM (inshore) and GB (offshore) stock components are combined for assessment purposes into a single coastal stock complex.

1.1.1 Distribution and Life History [to be added]

1.1.2 Migration [to be added]

1.1.3 Stock Definition [to be added]

1.1.4 Trends in Abundance and Biomass [to be added]

1.1.1 Atlantic Herring Stock Status

The Atlantic herring operational (update) assessment meeting was held in Woods Hole, MA on April 8-9, 2015. This assessment serves as an update to the SAW/SARC 54 benchmark assessment conducted in 2012.

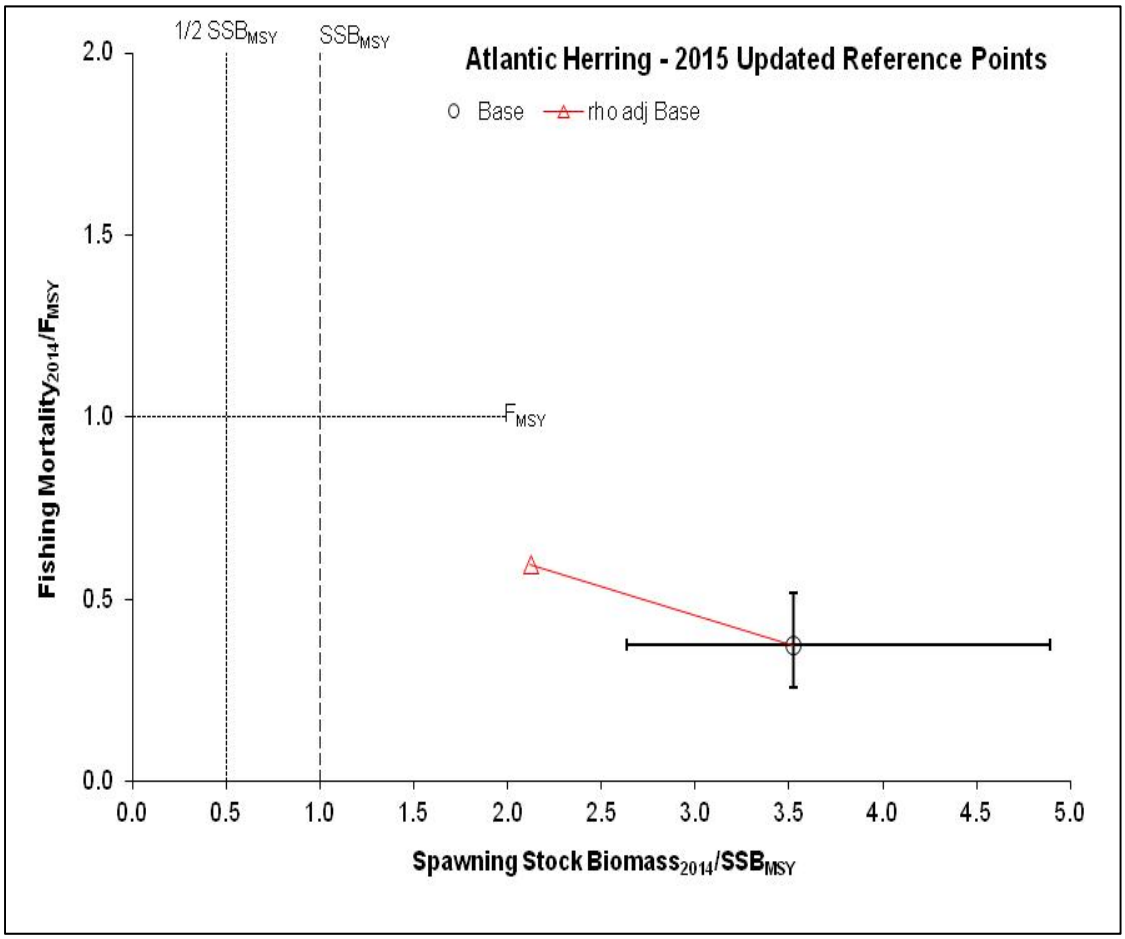
Overall, the updated assessment indicates that the Atlantic herring resource continues to remain well above its biomass target (rebuilt), and fishing mortality remains well below the F_{MSY} threshold (not overfishing). A retrospective pattern re-emerged when updating the assessment

model, which suggests that Atlantic herring spawning stock biomass (SSB) is likely to be overestimated and fishing mortality (F) is likely to be underestimated in the terminal year of the assessment. Resolution of a technical error in the contribution of recruitment to the objective function (i.e., negative log-likelihood) of the assessment model also affected the severity of the retrospective pattern. As a result, the assessment review panel applied a retrospective adjustment to the SSB and F values for the terminal year (2014) using Mohn's Rho. The retrospective adjustments resulted in approximately a 40% decrease in the terminal year (2014) SSB estimate and a 60% increase in the 2014 F estimate. Even with the retrospective adjustments, the Atlantic herring stock complex remains above the biomass target and below the fishing mortality threshold (Table 1, Figure 1).

Table 1 - Atlantic herring reference points and terminal year SSB/F estimates from the Benchmark Assessment (2012) and Update Assessment (2015)

	2012 SAW 54 Benchmark	**2015 Update (Non-Adjusted)**	**2015 Update (Retro-Adjusted)**
Terminal Year SSB	518,000 mt (2011)	1,041,500 mt (2014)	**622,991 mt (2014)**
Terminal Year F	0.14 (2011)	0.10 (2014)	**0.16 (2014)**
SSB_{MSY}	157,000 mt	311,145 mt	
F_{MSY}	0.27	0.24	
MSY	53,000 mt	77,247 mt	

Figure 1 - Atlantic herring operational assessment: 2014 fishing mortality and SSB relative to F_{MSY} and SSB_{MSY} reference points, including retrospective adjustment (red line)



Note: Error bars represent 10th and 90th percentiles of 2014 F/SSB estimates.

The results of the 2015 operational assessment form the basis of the SSC and Council recommendations for the 2016-2018 specifications of OFL and ABC. The operational assessment report and the May 20, 2015 SSC report contain more detailed information.

1.1.2 Considerations Related to Scientific Uncertainty

With respect to the 2015 Atlantic herring operational assessment, the re-emerging retrospective pattern, assumptions about natural mortality (M), and the mismatch between implied consumption and estimated consumption appear to be the primary sources of uncertainty (see discussion in following subsections).

The size/strength of the 2011 year class and other sources of uncertainty were also identified in the assessment report. However, signals related to the 2011 year class (possibly the second-largest on record) are similar to those for the 2008 year class that were noted in the 2012 Atlantic herring benchmark stock assessment. The update assessment indicates that the 2008 year class has persisted through the fishery as the strongest on record.

1.1.2.1 Retrospective Pattern

Since the benchmark assessment, an issue with the contribution of recruitment to the negative log likelihood in the assessment framework, ASAP, was discovered. This issue was resolved for the operational assessment. Differences in results and diagnostics between the benchmark and the update are partially attributable to the likelihood issue. Resolving the likelihood issue had the effect of changing the scale of estimates (e.g., increasing abundance estimates), particularly in recent years. Regardless of the likelihood issue, diagnostic problems (e.g., retrospective patterns) were present in the update assessment. Resolving the likelihood issue only amplified these diagnostic problems (e.g., worsening retrospective patterns). To account for retrospective bias, the assessment review panel made a retrospective adjustment to the terminal year (2014) estimates of SSB (40%) and F (60%). The retrospective-adjusted estimates of SSB, F, and numbers-at-age are utilized for the short-term (2016-2018) catch projections. No retrospective adjustment was applied to the benchmark terminal year (2011) biomass and fishing mortality estimates that were utilized in the projections for the 2013-2015 Atlantic herring fishery specifications.

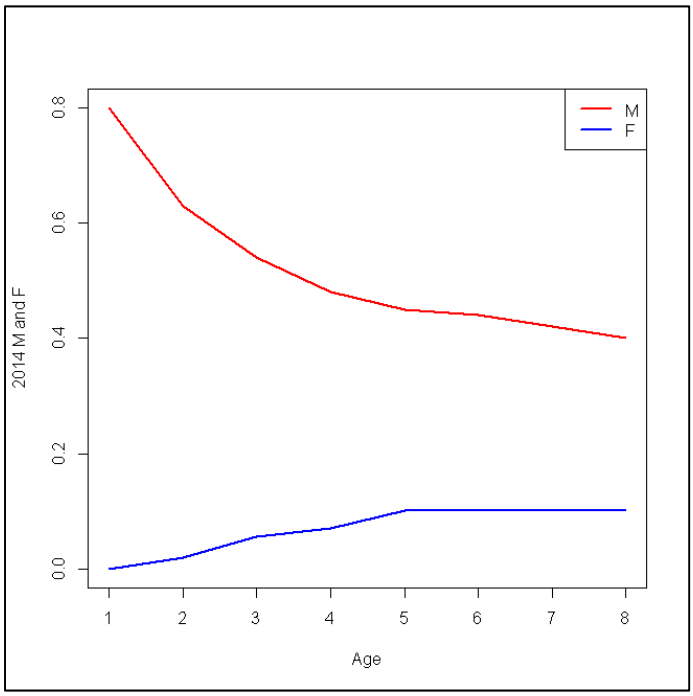
The reemergence of the retrospective pattern suggests a fundamental diagnostic problem with the assessment model that remains a cause for concern. However, it appears that the stock would remain above the biomass target and below the fishing mortality thresholds even if the 80% confidence intervals (i.e., 90th and 10th percentiles) associated with the terminal year estimates of F and SSB (Figure 1, p. 5) are applied to the retrospective-adjusted estimates (i.e., stock status would not change, 2014 F would remain below the threshold, and 2014 SSB would remain above the target).

1.1.2.2 Natural Mortality and Consumption

Additional uncertainty is associated with the treatment of natural mortality (M) in the assessment model and the divergence between NMFS' consumption estimates (based on stomach content data) and levels of consumption implied by the input M values in the assessment model. The mismatch between estimated and implied consumption became apparent when the assessment model was updated. This may not be of significant concern because of the possible inaccuracy of consumption estimates derived from the food habits data. These data can be extremely sensitive to presence/absence of herring in just a few stomach samples. While food habits data are used to estimate consumption by teleost predators (fish), estimates of consumption by marine mammals, seabirds, and some larger predators (e.g., tuna) are derived from prior research and assumed to be constant in recent years; these data may not be complete. Moreover, consumption of Atlantic herring and other species may change due to factors other than M (e.g., herring abundance, spatial overlap).

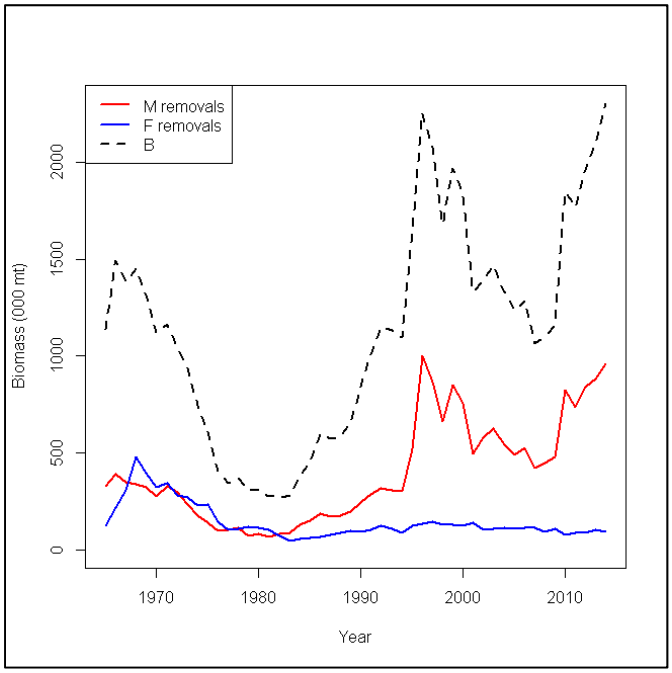
The assessment model assumes a significant amount of natural mortality on Atlantic herring, particularly at younger ages, before the fish experience mortality from the fishery. Figure 2shows how the assessment model treats natural mortality (red line) and fishing mortality (blue line) by age class in 2014. Thus, the model assumes that M is a much higher fraction of total mortality than fishing mortality. Figure 3 illustrates removals from fishing mortality and natural mortality estimated from the assessment model relative to total biomass over the entire time series.

Figure 2 - Atlantic Herring Operational Assessment: 2014 estimated natural mortality (M) and fishing mortality (F) by age



Source: Atlantic Herring Operational Assessment Meeting, April 8-9, 2015.

Figure 3 - Atlantic Herring Operational Assessment: Estimated removals from natural mortality (M) and fishing mortality (F) relative to total estimated biomass (B)



Source: Atlantic Herring Operational Assessment Meeting, April 8-9, 2015.

1.1.3 Importance of Herring as Forage

Atlantic herring play an important role as forage in the Northeast U.S. shelf ecosystem. They are eaten by a wide variety of fish, marine mammals, birds, and (historically) by humans in the region. The structure of the Northeast U.S. shelf ecosystem features multiple forage species rather than a single dominant forage species. Herring share the role of forage here with many other species including sandlance, mackerels, squids, and hakes, although herring are distinguished by a high energy density (caloric content) relative to other pelagic prey in the ecosystem. This diversity of forage options leads to a complex and diverse food web supporting many different predators. The relative importance of herring as forage varies by predator group, due to differences in predator life history, foraging style, and bioenergetics. Therefore, predator responses to changing herring populations vary, and depend on the extent to which other forage is available.

In the Northeast Fisheries Science Center fish food habits database, Atlantic herring are found most often in the stomachs of spiny dogfish, Atlantic cod, and silver hake. Although these three species most commonly have herring in their diets, herring make up no more than 20% of the diet composition for any of these predators; these are generalist predators (Link & Almeida 2000; Smith & Link 2010). Similarly, diet estimates for marine mammals show that herring are important, but not dominant, generally comprising 10-20% of diets for baleen whale, toothed whales, and pinnipeds (Smith et al. 2015). Juvenile hake and herring are important forage for puffins in the Gulf of Maine, along with sandlance, and recently, juvenile haddock and redfish (Kress et al. 2016). Common and Arctic tern chicks in the Gulf of Maine were fed primarily juvenile herring and juvenile hake in equal amounts, followed by sandlance, and other fish (Hall et al. 2000). Endangered Species Act-listed Atlantic salmon, as adults at sea, feed on forage fishes such as herring, mackerel, sandlance, and capelin (off Greenland; Renkawitz et al. 2015). Large adult bluefin tuna are one of the few potentially herring-dependent predators (~half of the diet is herring) in the Northeast U.S. shelf ecosystem (Chase 2002; Logan et al. 2015). However, recent studies suggest that bluefin tuna may require large herring, rather than abundant herring, to maintain body condition (Golet et al. 2015).

In some ecosystems, pelagic schooling fishes are major predators of the pelagic eggs and larvae of other fish. However, fish eggs and larvae appear to be only a small component of Atlantic herring diet in federal waters of the Northeast U.S. shelf. Invertebrates (copepods, krill, amphipods, and other zooplankton) make up the majority (68%) of identified herring prey in the NEFSC food habits database, while fish larvae, eggs, and all other vertebrates combined make up less than 5% of herring diet (27% of stomach contents could not be identified). This database reflects mainly adult herring food habits on the continental shelf of the Northeast U.S. from 1992-the present. Limited information also suggests that juvenile herring primarily eat invertebrates and only rarely fish eggs and larvae in nearshore Gulf of Maine waters (Sherman & Perkins 1971).

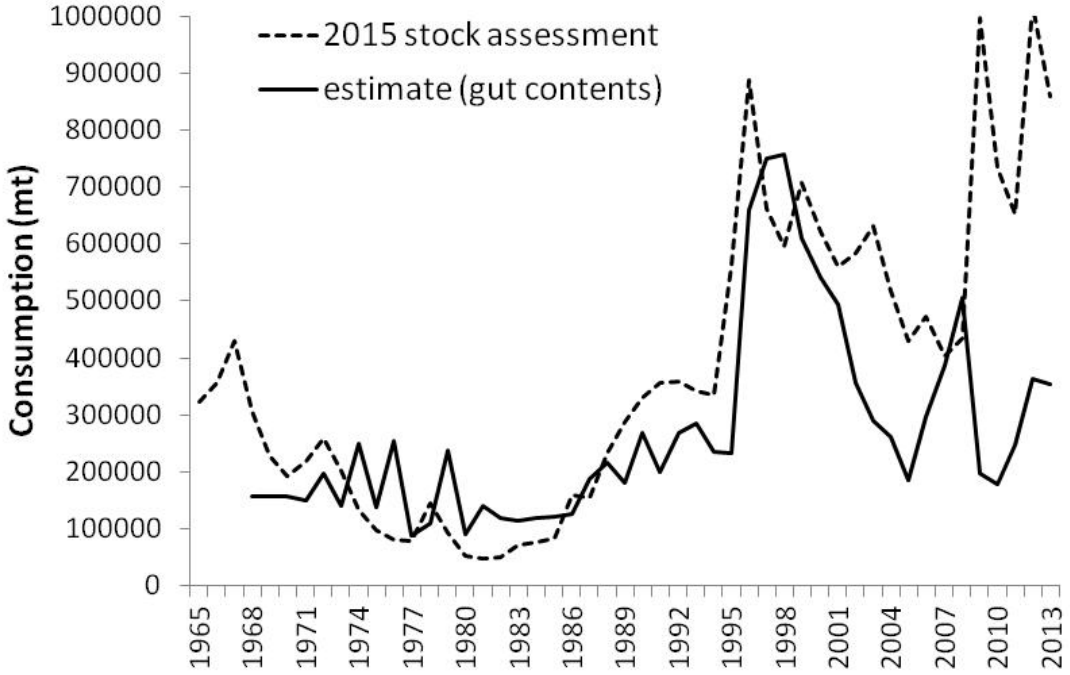
Climate and environmental conditions can be major drivers of pelagic fish dynamics. In the Northeast U.S., Atlantic herring and other pelagics have lower biological sensitivity to climate risks than other species in the region due to high mobility, but as a result, have a high potential to change distribution. Overall, experts have rated the impact of climate change on Atlantic herring in this ecosystem to be negative to neutral relative to other Northeast species. All Northeast U.S. species have high or very high exposure to climate change risks, as this ecosystem is changing more rapidly than much of the world ocean (Hare et al. 2016).

In the Atlantic herring stock assessment, the amount of herring assumed to be taken by predators (e.g., piscivorous fish, seabirds, highly migratory species, marine mammals) has varied annually (Figure 1, dashed line). The 2015 stock assessment assumed that, during 2009-2013, an annual average of 852,000 mt of Atlantic herring was eaten by predators, which equaled 44% of average total biomass (1.92M mt) over the same period. The amount of herring assumed to be consumed by predators in the assessment is based on natural mortality rates and estimates of herring consumption largely based on gut contents data, which also vary annually (Figure 1, solid line), with an annual average of 268,000 mt during that time. The gut contents data are from NMFS surveys, and are highly imprecise and likely biased. The short-term projections used to provide catch advice (overfishing limit, acceptable biological catch) assume a similar amount of herring are consumed as assumed in the stock assessment. More information is available in the 2015 Atlantic Herring Operational Assessment report (Deroba 2015).

The Ecosystem-Based Fishery Management PDT report on scientific advice for accounting for ecosystem forage requirements (NEFMC 2015) and assessment reports (e.g., Deroba 2015) may be referenced for sample estimates of predator consumption. In recent years, marine mammal consumption of herring is similar to commercial fishery landings, averaging 105,000 mt/year. Bluefin tuna and blue sharks have recently consumed 20-25,000 mt/year. Seabirds consume a relatively small amount of herring, conservatively estimated at about 3-5 mt/year. According to the NEFSC diet database, herring constitutes roughly 20% of the diet of cod and spiny dogfish. There is also some evidence which suggest it is not just volume of herring available, but the age structure of that forage base that is important in the energy budgets of predators (Diamond & Devlin 2003; Golet, et al. 2015).

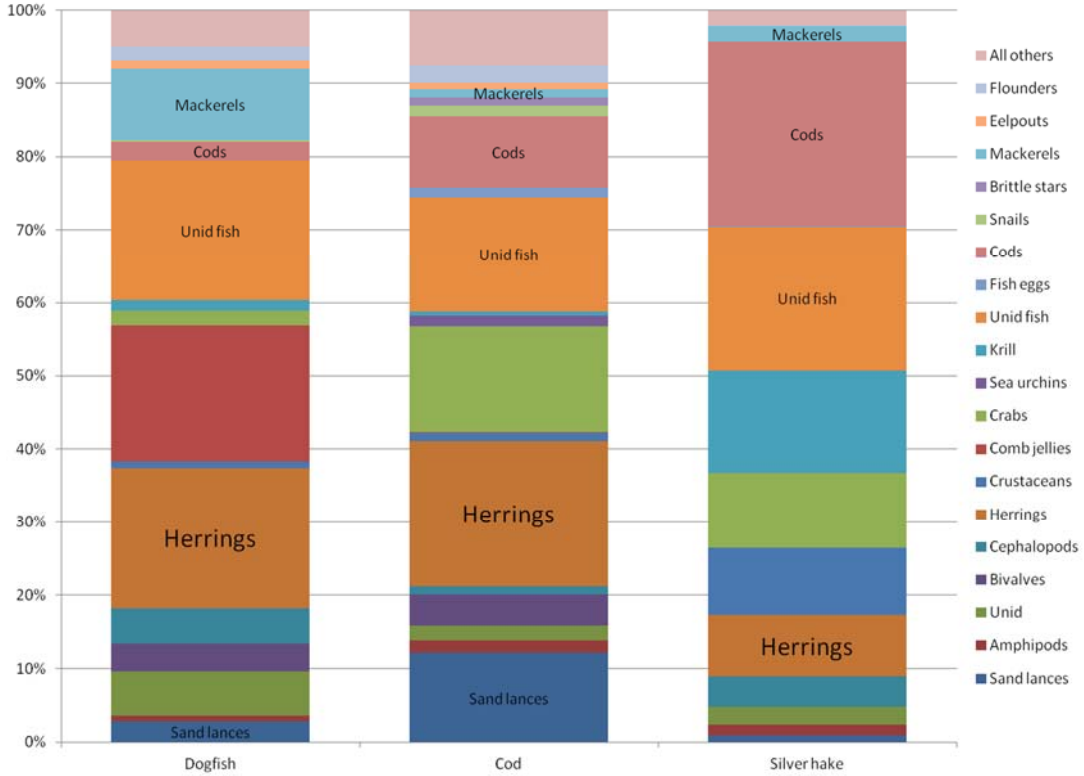
The amount of Atlantic herring needed for forage is the amount below which predators are negatively impacted. Estimates of this need do not currently exist and would vary by the abundance of predators and other prey. To summarize, consumption estimates can be generated, but that is different than what is necessary – which is a difficult question to answer definitively.

Figure 4 - Atlantic herring consumption by predators



Source: Deroba (2015).

Figure 5 - Estimated diet from Gulf of Maine, Georges Bank, and southern New England combined for spiny dogfish, Atlantic cod, and silver hake



Source: NEFSC diet database, 1973-2012.

1.2 NON-TARGET SPECIES (BYCATCH)

Non-target species refers to species other than Atlantic herring which are caught/landed by federally permitted vessels while fishing for herring. The MSA defines *bycatch* as fish that are harvested in a fishery, but are not retained (sold, transferred, or kept for personal use), including economic discards and regulatory discards (16 U.S.C. § 1802(2)). The MSA mandates the reduction of *bycatch*, as defined, to the extent practicable (16 U.S.C.§ 1851(a)(9)). Incidental catch, on the other hand, is typically considered to be non-targeted species that are harvested while fishing for a target species and is retained and/or sold. In contrast to bycatch, there is no statutory mandate to reduce incidental catch. When non-target species are encountered in the Atlantic herring fishery, they are either discarded (bycatch) or they are retained and sold as part of the catch (incidental catch). The majority of catch by herring vessels on directed trips is Atlantic herring, with extremely low percentages of bycatch (discards). Atlantic mackerel is targeted in combination with Atlantic herring during some times of the year in the southern New England and Mid-Atlantic area and is therefore not considered a non-target species.

Due to the high-volume nature of the Atlantic herring fishery, non-target species, including river herring (blueback herring and alewives), shad (hickory shad and American shad), and some groundfish species (particularly haddock), are often retained once the fish are brought on board (Amendment 5 FEIS, p. 173). The catch of non-target species in the directed Atlantic herring fishery can be identified through sea sampling (observer) data collected by the Northeast Fisheries Observer Program (NEFOP). Portside sampling data collected by MADMF and MEDMR can be utilized to estimate catch of any non-target species that are landed. Dealer and VTR data can be used to identify/cross-check incidental landings of some non-target species that may be separated from Atlantic herring.

The primary non-target species in the directed Atlantic herring fishery are **groundfish (particularly haddock)** and the **river herring/shad (RH/S) species**. Dogfish, squid, butterfish, Atlantic mackerel are also common non-target species in the directed Atlantic herring fishery (mackerel and some other non-target species catch is often landed and sold). Comprehensive information about the catch of these species in the Atlantic herring fishery is in Section 5.2 of Amendment 5 and Sections 3.2 and 3.3 of Framework 3 to the Atlantic Herring FMP.

[add more about haddock and RH/S]

[info coming from NEFOP]

1.3 NON-PROTECTED PREDATOR SPECIES THAT FORAGE ON HERRING

This section includes a description of the life history and stock population status for the major predators of Atlantic herring, which are not protected under the Endangered Species Act and/or the Marine Mammal Protection Act such as whales and sea birds. Section 1.4 summarizes the life history and stock status information for species that are protected under various environmental laws including marine mammals, protected fish species, sea turtles, and seabirds. This section focuses on other key predators of Atlantic herring such as tuna, some species managed under the Groundfish FMP, and striped bass.

1.3.1 Bluefin Tuna

Population status: Atlantic bluefin tuna (*Thunnus thynnus*) are a commercially important species across the temperate waters of the Atlantic Ocean. They are long lived (up to 40 years) and large in size, reaching 13 ft in length and weights up to 2,000 lb. Bluefin tuna are a pelagic species, and although they spend most of their time near the ocean surface, they are capable of diving to depths over 1,000 m. They are found in Atlantic waters from the Gulf of Mexico north to Newfoundland, and west to the Mediterranean Sea, and are able to thrive in a wide range of conditions due in part to their ability to maintain a consistent body temperature across cold and warm water temperatures (SCRS 2013).

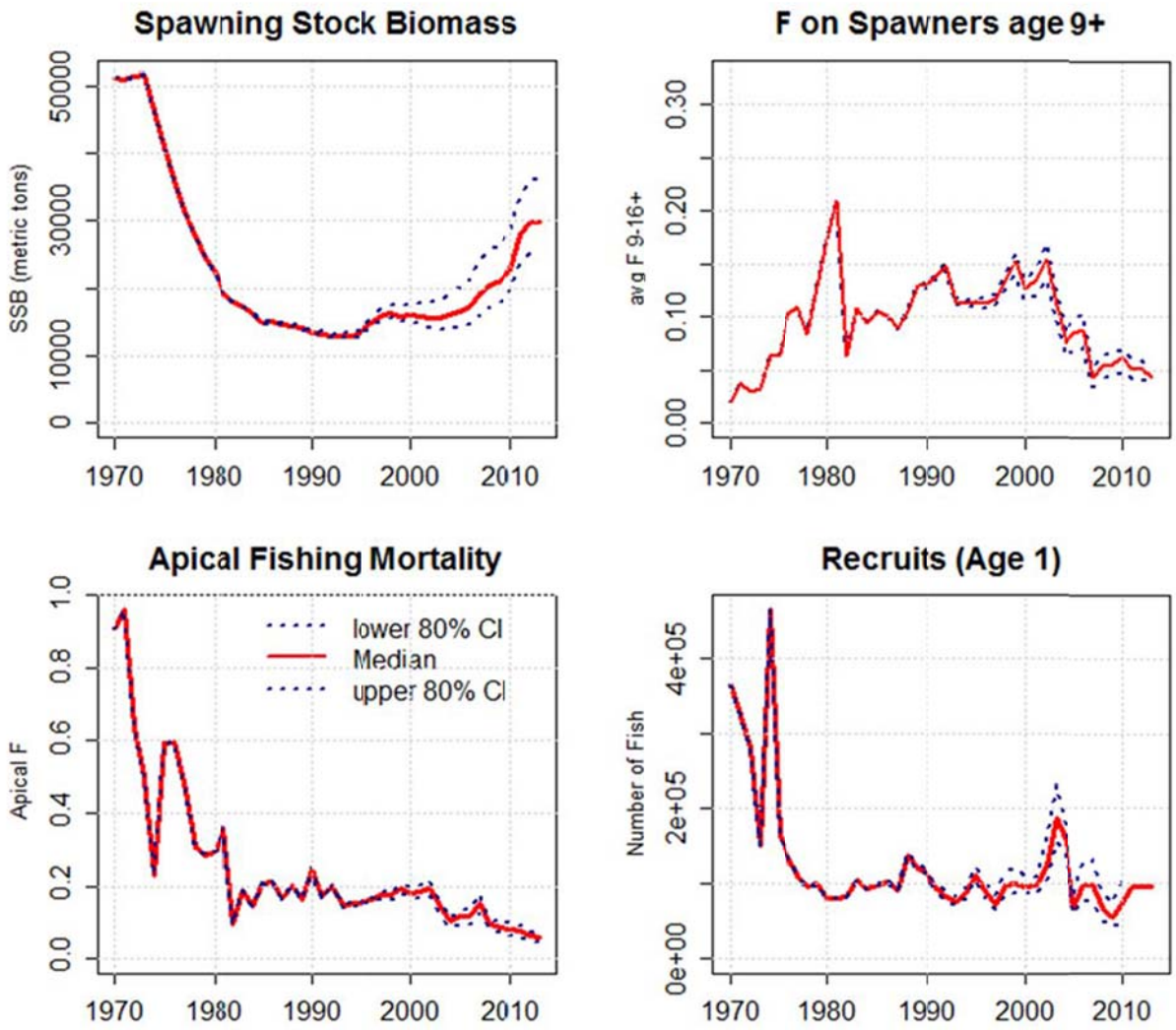
Bluefin tuna are opportunistic feeders with a diet that consists of various species of fish, crustaceans, mollusks, jellyfish, planktonic tunicates, and sponges. Juveniles tend to rely heavily on crustaceans, fish, and cephalopods, while adults primarily eat available baitfish. During the spawning season in the Gulf of Mexico (April-June), bluefin feed on both passive (tunicates) and active (fishes, mollusks, crustaceans) prey. When bluefin enter the Gulf of Maine (May-June), their diet centers around Atlantic herring and other fish including sand lance (Chase 2002), while more northerly individuals rely heavily on herring and Atlantic mackerel (Pleizier et al. 2012), 2012). Sharks, large fish, and marine mammals prey upon bluefin tuna (NMFS 2014b).

Recruitment estimates for bluefin were very high in the early 1970s (Figure 6). From about 1977 to 2011, recruitment varied without trend, apart from exceptionally large classes in 2002-03. Stock assessment results indicate the SSB for bluefin tuna peaked at over 300,000 mt in the late 1950s and early 1970s. SSB steadily declined until the early 1990, where it stabilized at between 25-30% of 1970 levels until 2002. Stocks rebounded upon implementation of the rebuilding plan in 1998/1999. Beginning in 2003, there was a steady rise from about 32% of the 1970 SSB to about 55% in 2013. By 2015, bluefin SSB has risen by over 70% since the rebuilding plan began in 1998. Additionally, fishing mortality on both juveniles (age 2-5) and large spawners (age 9+) is down substantially since 2003 (SCRS 2013).

Management measures for bluefin tuna have been based on the premise that there are two Atlantic bluefin stocks (eastern and western), which are divided by the 45°W meridian. Bluefin tuna are oviparous and iteroparous batch spawners, and females may produce up to 10M eggs per year. Eastern bluefin stocks are thought to mature at around 25 kg, which generally occurs around age 4. The stock assessments used in developing management measures use the assumptions that western bluefin mature around 145 kg (age 9), spawn only in the Gulf of Mexico and Florida Straights, and demonstrate homing behavior to spawning sites. Although a recent study by Richardson, et al. (2016) disproves some of these assumptions, a new model has not been developed to account for bluefin life history as is currently understood. Thus, this

section provides information based on knowledge at the time of the most recent stock assessment.

Figure 6 - Bluefin tuna biomass, fishing mortality, and recruitment, 1970-2012



Notes: Median estimates of (a) spawning biomass (age 9+), (b) fishing mortality on spawners, (c) apical fishing mortality (F on the most vulnerable age class) and (d) recruitment for the base virtual population analysis (VPA) model. The 80% confidence intervals are indicated with dotted lines. The recruitment estimates for the last three years of the VPA are considered unreliable and have been replaced by the median levels corresponding to the low recruitment scenario (SCRS 2013).

It should be noted that ICCAT and NMFS apply different thresholds for stock status determination of bluefin tuna as follows:

- ICCAT considers overfishing to be occurring when $F_{year}/F_{MSY} > 1.0$. NMFS considers overfishing to be occurring when $F_{year} > F_{MSY}$. These two definitions are functionally equal.

- ICCAT considers bluefin stocks to be overfished when $SSB_{current}/SSB_{MSY}$ is < 1. NMFS considers bluefin to be overfished when $SSB_{current}/SSB_{MSY}$ is < 0.86.

In the last full ICCAT stock assessment in 2012, two alternative recruitment scenarios were used. The low potential recruitment scenario assumed that the stock could not reach the high recruitment levels observed in the early 1970s, while the high potential recruitment scenario assumed that those levels could be reached. Thus, the stock assessment produced two sets of results, and the status of the stock depends upon which recruitment scenario is considered.

Under the low recruitment scenario, the stock is not overfished and overfishing is not occurring. Under the high recruitment scenario, the stock is overfished and overfishing is occurring. Because there is no strong evidence to favor either scenario, the two scenarios are seen as reasonable lower and upper bounds on rebuilding potential. The 2014 stock assessment looked at indices developed to examine trends in abundance on a smaller scale (e.g., SW Nova Scotia CPUE, U.S. Rod & Reel, Gulf of Mexico Larval Survey). The data showed conflicting trends across different areas and metrics. Overall, the stock assessment models used in 2014 adjusted the SSB estimated in the 2012 assessment upward by 5%, but this adjustment did not change the overfished/overfishing determination in either recruitment scenario.

Richardson et al. (2016) provided evidence that the premises used in the stock assessment was flawed. They found unequivocal evidence that western stocks also spawn in the Slope Sea, an area on the Atlantic coast north of the Gulf Stream and northeast of the U.S. continental shelf. In addition to finding a substantial number of larval bluefin in this area, endocrine testing of tuna caught in the Gulf of Maine and adjacent Slope Sea indicated that all bluefin greater than 131 cm FL (age-5) were fully mature. Spawning area was likely partitioned by size, with larger bluefin (500 lb+) generally spawning in the Gulf of Mexico and smaller fish (80-500 lb) spawning in the Slope Sea. Bluefin may alternately spawn in the Slope Sea and the Gulf of Mexico in different years. In addition, the population structure of bluefin tuna is likely more complex than previously thought, as spawners from the Slope Sea may originate from both the western and eastern population stocks. Stable isotope analysis has demonstrated that, while little mixing occurs in bluefin found in the Gulf of Mexico or in the Mediterranean Sea, other areas (e.g., North Carolina winter fishing grounds, Canadian maritimes, Central North Atlantic) showed a substantial amount of stock mixing (Secor 2015). Recent and ongoing studies are attempting to better understand stock structure and mixing, which may lead to better estimates of fishing mortality.

Due partially to this study, there is a great deal of uncertainty associated with the state of bluefin stocks. The amount of mixing that occurs between eastern and western stocks is not well understood, and varies based on the type of data used in mixing estimations (e.g., tagging, isotope analysis) and the modeling assumptions. The assumptions used in estimating mixing, spawning age and potential, and recruitment appear to be flawed, which likely skews estimates used in stock assessments. In addition, many indices used in the 2014 stock assessment update show conflicting trends, and individual indices may unduly influence estimates. In some cases, removal of just one of the indices may shift the overall biomass estimate for a stock by up to 33% (SCRS 2013). Collection of more data and incorporation of recently collected data into future stock assessment is necessary to improving estimates of parameters used in bluefin management.

Management: Tuna in the Atlantic Ocean and adjacent seas are jointly managed by NOAA and the International Commission for the Conservation of Atlantic Tunas (ICCAT). The Convention entered formally into force in 1969, and there are 48 Contracting Parties, including the U.S., Canada, and other nations from the U.N., Africa, and Asia. ICCAT coordinates research and develops scientific-based management advice on behalf of its members for tuna and tuna-like species. In accordance with the Convention, ICCAT also compiles bycatch information caught during tuna fishing in the Convention area (http://www.iccat.es/en/introduction.htm).

In 1998, ICCAT adopted a 20-year international recovery plan to rebuild stocks of bluefin tuna and in 1999, NOAA implemented the recovery plan into an FMP. The rebuilding plan was continued under the consolidated Highly Migratory Species (HMS) FMP in 2006. The rebuilding plan takes into account scientific uncertainties associated with the status of the bluefin stock. NOAA implemented Amendment 7 to the HMS FMP in 2014 to bring U.S. bluefin management into compliance with the ICCAT standards by reducing dead discards in both the directed and incidental bluefin fisheries and by optimizing the ability for all bluefin permit categories to harvest their full quota(NMFS 2014b).

The bluefin tuna fishery is managed through a quota system. Quotas are divided between eastern and western bluefin stocks, and the U.S. receives 54% of the western bluefin tuna quota. The U.S. quota is further subdivided into recreational and commercial categories and by gear types. Catch in bluefin fisheries is managed by gear restrictions, minimum fish sizes, closed areas, trip limits, and other measures.

Tuna Reliance on Herring Important linkages do exist between bluefin tuna and Atlantic herring (Golet et al. 2013; Golet, et al. 2015). Aggregations of bluefin and herring are associated with each other, though not all herring aggregations have bluefin present (Schick et al. 2004; Schick & Lutcavage 2009). The bluefin tuna fishery is located throughout the entire Gulf of Maine, which is an important tuna foraging ground (Mather et al. 1995). The large bluefin tuna that are targeted in commercial fisheries generally enter the Gulf of Maine beginning in May and June of each year. Bluefin spend up to six months in this area feeding on high energy prey such as Atlantic herring (Chase 2002). Historically, large catches of bluefin have been landed in the Kettle, Cape Cod Bay, Stellwagen Bank, Jeffreys Ledge, Great South Channel, Ipswich Bay, Platts Bank, Cashes Ledge, Georges Bank, Wilkinson's Basin, and the Schoodic Ridges. This is not a comprehensive list, rather a highlight of some of the areas which have yielded large landings.

Bluefin rely on herring for a substantial portion of their diet and come to the Gulf of Maine specifically to feed on herring as a lipid source (Golet, et al. 2013; Logan, et al. 2015). They are highly dependent upon herring, which comprises up to an estimated 70% of their diet (Logan, et al. 2015). Bluefin body condition has historically increased during this feeding period (Rodriguez-Marin et al. 2015). Recently, a trend has emerged in which these tuna have difficulty acquiring the lipids needed to improve body condition late in the season. Thus, they are often found in relatively lean condition. Golet et al. (2015) found that, in spite of high herring abundance, bluefin were unable to improve body condition by feeding on them. The authors asserted that a shift in the size structure of Atlantic herring with fewer older and larger fish was to blame for the decline in bluefin condition, and concluded that bluefin body condition is sensitive to the size (and thus lipid content) of prey even when prey is abundant.

Declines in herring weight and size-at-age have been drastic recently, as average herring weight has declined by 55% between 1981 and 2010. The herring population in the Gulf of Maine show a strong inverse relationship between the number of adult herring and mean length-at-age, with indications that this relationship is a function of overall herring stock numbers (Melvin & Stephenson 2007). In addition, Greene et al. (2013) found that bottom-up changes in Gulf of Maine ecosystems may be impacting herring growth. Low rates of fishing mortality (Deroba 2015) and historic changes in herring harvest patterns by fleet indicate that changes in the weight and size-at-age for herring are due to population level changes, not fleet selectivity (Golet, et al. 2015).

The decline in bluefin condition in the Gulf of Maine may have wide-ranging impacts ecologically. Because bluefin fecundity is influenced by weight, smaller bluefin body conditions may result in decreased egg production and reproductive potential (Medina et al. 2002). In addition, fewer large bluefin may remain in the Gulf of Maine because the smaller herring in this area may not improve or maintain body condition. Instead, these fish may forage in areas where herring body condition has not declined and thus larger herring are more prevalent (e.g., Scotian Shelf, Gulf of St. Lawrence). In this manner, the herring condition decline has changed the historical distribution of bluefin tuna (Golet, et al. 2015). The decline in bluefin condition may negatively affect users of the bluefin resource economically. Because of the decline in bluefin condition, foreign and domestic buyers and consumers may find smaller bluefin less desirable, resulting in a decline in income from captured tuna. In addition, fishers may have to travel greater distances to fishing grounds to capture the larger, more profitable tuna that no longer forage in the Gulf of Maine.

1.3.2 Large mesh multispecies (groundfish)

There are 13 species managed under the Northeast Multispecies Fishery Management Plan (FMP) as large mesh (groundfish) species, based on fish size and type of gear used to harvest the fish: American plaice, Atlantic cod, Atlantic halibut, Atlantic wolffish, haddock, pollock, redfish, ocean pout, yellowtail flounder, white hake, windowpane flounder, winter flounder, and witch flounder. Several large mesh species are managed as two or more stocks based on geographic region. The NMFS food habits data indicate that herring contributes to diet of several groundfish species: Atlantic cod, haddock, white hake, pollock, Atlantic halibut (<10% per species; Smith & Link 2010). The commercial fishery catches all of these species, but the recreational fishery focuses on GOM cod and GOM haddock (NEFMC 2017).

Population status: Of the seven groundfish stocks, for which herring is an important prey item, three are considered overfished and overfishing is occurring for two – as of the 2015 stock assessments (Table 2; NEFMC 2016).

Management: Groundfish has been managed since 1977 with the adoption of a groundfish plan for cod, haddock, and yellowtail flounder. This plan first relied on hard quotas, but the quota system ended in 1982 with the adoption of the Interim Groundfish Plan, which controlled fishing mortality with minimum fish sizes and codend mesh regulations. The Northeast Multispecies FMP replaced this plan in 1986, initially continuing to control fishing mortality with gear restrictions and minimum mesh size, and used biological targets based on a percentage of maximum spawning potential. The FMP has had many revisions in subsequent years. Since 2010, the vast majority of the fishery has been managed with a catch share program, in which

self-selected groups of commercial fishermen (i.e., sectors) are allocated a portion of the available catch.

Table 2 – Status of selected Northeast groundfish stocks for FY2016

Stock	2015 Assessments	
	Overfishing?	Overfished?
Gulf of Maine cod	Yes	Yes
Georges Bank cod	Unknown	Yes
Georges Bank haddock	No	No
Gulf of Maine haddock	No	No
White hake	No	No
American plaice	No	No
Pollock	No	No
Atlantic halibut	Unknown	Yes
Source: Groundfish Framework 56 (NEFMC 2017).		

1.3.3 Striped bass

Population status: [to be completed]

Management: [to be completed]

1.4 PROTECTED SPECIES: FISH, SEA TURTLES, MARINE MAMMALS, SEABIRDS

Protected species are those afforded protections under the Endangered Species Act (ESA; species listed as threatened or endangered under the ESA) and/or the Marine Mammal Protection Act (MMPA). Table 3 provides a list of protected species that occur in the affected environment of the Atlantic herring FMP and the potential for the fishery to impact the species, specifically via interactions with Atlantic herring fishing gear. A summary of the life history and stock status of seabirds has been added to this section as well (Section 1.4.4). Some species of seabirds are protected under the ESA, and others are not but are predator species of Atlantic herring. Because Atlantic herring was identified as an important predator species of some seabirds in this ecosystem during development of this action, this VEC was expanded to include information about seabirds that prey on Atlantic herring in this region. The human communities, namely birdwatching ecotourism, has been included in the Human Communities section as well.

Table 3 - Species protected under the ESA and/or MMPA that may occur in the affected environment of the herring FMP

Species	**Status**[2]	***Potential to interact with Atlantic herring fishing gear?***
Cetaceans		
North Atlantic right whale (Eubalaena glacialis)	***Endangered***	***No***
Humpback whale, West Indies DPS, (*Megaptera novaeangliae*)	Protected (MMPA)	Yes
Fin whale (Balaenoptera physalus)	***Endangered***	***Yes***
Sei whale (Balaenoptera borealis)	***Endangered***	***Yes***
Blue whale (Balaenoptera musculus)	***Endangered***	***No***
Sperm whale (Physeter macrocephalus	***Endangered***	***No***
Minke whale (*Balaenoptera acutorostrata*)	Protected (MMPA)	Yes
Pilot whale (Globicephala spp.)[3]	***Protected (MMPA)***	***Yes***
Pygmy sperm whale (*Kogia breviceps*)	Protected (MMPA)	No
Dwarf sperm whale (*Kogia sima*)	Protected (MMPA)	No
Risso's dolphin (*Grampus griseus*)	Protected (MMPA)	Yes
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Protected (MMPA)	Yes
Short Beaked Common dolphin (*Delphinus delphis*)	Protected (MMPA)	Yes
Atlantic Spotted dolphin (*Stenella frontalis*)	Protected (MMPA)	No
Striped dolphin (*Stenella coeruleoalba*)	Protected (MMPA)	No
Beaked whales (*Ziphius and Mesoplodon spp*)[4]	Protected (MMPA)	No
Bottlenose dolphin (Tursiops truncatus)[5]	***Protected (MMPA)***	***Yes***
Harbor porpoise (*Phocoena phocoena*)	Protected (MMPA)	Yes
Pinnipeds		
Harbor seal (*Phoca vitulina*)	Protected (MMPA)	Yes
Gray seal (*Halichoerus grypus*)	Protected (MMPA)	Yes

Species	Status[2]	*Potential to interact with Atlantic herring fishing gear?*
Harp seal (*Phoca groenlandicus*)	Protected (MMPA)	Yes
Hooded seal (*Cystophora cristata*)	Protected (MMPA)	No
Sea Turtles		
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Yes
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Yes
Green sea turtle, North Atlantic DPS (*Chelonia mydas*)	Threatened	Yes
Loggerhead sea turtle (*Caretta caretta*), Northwest Atlantic Ocean DPS	Threatened	Yes
Hawksbill sea turtle (*Eretmochelys imbricate*)	Endangered	No
Fish		
Atlantic salmon	Endangered	Yes
Atlantic sturgeon *(Acipenser oxyrinchus)*		
Gulf of Maine DPS	Threatened	Yes
New York Bight DPS, Chesapeake Bay DPS, Carolina DPS & South Atlantic DPS	Endangered	Yes
Critical Habitat		
Northwest Atlantic DPS of Loggerhead Sea Turtle	ESA (Protected)	No
North Atlantic Right Whale Critical Habitat	ESA (Protected)	No

Notes:

Marine mammal species (cetaceans and pinnipeds) italicized and in bold are considered MMPA strategic stocks.[1] Shaded rows indicate species who prefer continental shelf edge/slope waters (i.e., >200 meters).

[1] A strategic stock is defined under the MMPA as a marine mammal stock for which: (1) the level of direct human-caused mortality exceeds the potential biological removal level; (2) based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; and/or (3) is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA (Section 3 of the MMPA of 1972).

[2] Status is defined by whether the species is listed under the ESA as endangered (i.e. at risk of extinction) or threatened (i.e. at risk of endangerment), or protected under the MMPA. Marine mammals listed under the ESA are also protected under the MMPA. Candidate species are those species for which ESA listing may be warranted.

[3] There are 2 species of pilot whales: short finned (*G. melas melas*) and long finned (*G. macrorhynchus*). Due to the difficulties in identifying the species at sea, they are often referred to as *Globicephala spp*.

[4] There are multiple species of beaked whales in the Northwest Atlantic. They include the cuvier's (*Ziphius cavirostris*), blainville's (*Mesoplodon densirostris*), gervais' (*Mesoplodon europaeus*), sowerbys' (*Mesoplodon bidens*), and trues' (*Mesoplodon mirus*) beaked whales. Species of *Mesoplodon* are difficult to identify at sea, therefore, much of the available characterization for beaked whales is to the genus level only.

[5] This includes the Western North Atlantic Offshore, Northern Migratory Coastal, and Southern Migratory Coastal Stocks of Bottlenose Dolphins.

Cusk are a NMFS "candidate species" under the ESA. Candidate species are those petitioned species for which NMFS has determined that listing may be warranted under the ESA and those species for which NMFS has initiated an ESA status review through an announcement in the Federal Register. If a species is proposed for listing the conference provisions under Section 7 of

the ESA apply (see 50 CFR 402.10); however, candidate species receive no substantive or procedural protection under the ESA. As a result, this species will not be discussed further in this and the following sections; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on candidate species from any proposed action. Additional information on cusk can be found at: http://www.nmfs.noaa.gov/pr/species/esa/candidate.htm.

1.4.1 Protected Species and Critical Habitat Not Likely to be Affected (via interactions with gear or destruction of essential features of critical habitat) by the Atlantic Herring FMP

Based on available information, it has been determined that this action is not likely to affect (via interactions with gear or destruction of essential features of critical habitat) multiple ESA listed and/or marine mammal protected species or any designated critical habitat (see **Error! Reference source not found.**). This determination has been made because either the occurrence of the species is not known to overlap with the area primarily affected by the action and/or there have never been documented interactions between the species and the primary gear type used to prosecute the Atlantic herring fishery (i.e., purse seine, bottom otter trawl (small mesh), mid-water (including pair) trawl; Waring et al. 2014; 2015; Waring et al. 2016) (Hayes *et al*. 2017; NMFS NEFSC FSB 2015, 2016; http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html). In the case of critical habitat, this determination has been made because operation of the Atlantic herring fishery will not affect the essential physical and biological features of North Atlantic right whale or loggerhead (NWA DPS) critical habitat and therefore, will not result in the destruction or adverse modification of any species critical habitat (NMFS 2014a) (NMFS 2015a,b).

1.4.2 Protected Species Potentially Affected by the Proposed Action

1.4.2.1 Sea Turtles

Kemp's ridley, leatherback, the North Atlantic DPS of green and the Northwest Atlantic DPS of loggerhead sea turtle are the four ESA-listed species of sea turtles that occur in the affected environment of the Atlantic herring fishery. Three of the four species are hard-shelled turtles (i.e., green, loggerhead, and Kemp's ridley). Additional background information on the range-wide status, descriptions, and life histories of these four species can be found in a number of published documents, including sea turtle status reviews and biological reports (Conant et al. 2009; Hirth 1997; NMFS & USFWS 1995; 2007a; b; 2013; TEWG 1998; 2000; 2007; 2009); NMFS and USFWS 2015; Seminoff et al. 2015), and recovery plans for the loggerhead sea turtle (Northwest Atlantic DPS; NMFS & USFWS 2008), leatherback sea turtle (NMFS & USFWS 1992; 1998b), Kemp's ridley sea turtle (NMFS & USFWS 2011), and green sea turtle (NMFS & USFWS 1991; 1998a).

A general overview of sea turtle occurrence and distribution in waters of the Northwest Atlantic Ocean is provided below to assist in understanding how the Atlantic herring fishery overlaps in time and space with sea turtles. Maps depicting the range wide distribution and occurrence of sea turtles in the Greater Atlantic Region can be found at the following websites: https://www.greateratlantic.fisheries.noaa.gov/protected/section7/listing/index.html; http://marinecadastre.gov/; and, http://seamap.env.duke.edu/.

Hard-Shelled Sea Turtles: In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, Massachusetts, although their presence varies with the seasons due to changes in water temperature (Braun-McNeill et al. 2008; Braun & Epperly 1996; Epperly, Braun & Chester 1995; Epperly, Braun, Chester, et al. 1995; Mitchell et al. 2003; Shoop & Kenney 1992; TEWG 2009). While hard-shelled turtles are most common south of Cape Cod, MA, they are known to occur in the Gulf of Maine. Loggerheads, the most common hard-shelled sea turtle in the Greater Atlantic Region, feed as far north as southern Canada. Loggerheads have been observed in waters with surface temperatures of 7 °C to 30 °C, but water temperatures ≥11 °C are most favorable (Epperly, Braun, Chester, et al. 1995; Shoop & Kenney 1992). Sea turtle presence in U.S. Atlantic waters is also influenced by water depth. While hard-shelled turtles occur in waters from the beach to beyond the continental shelf, they are most commonly found in neritic waters of the inner continental shelf (Blumenthal et al. 2006; Griffin et al. 2013; Hawkes et al. 2006; Hawkes et al. 2011; Mansfield et al. 2009; McClellan & Read 2007; Mitchell, et al. 2003; Morreale & Standora 2005) (Braun-McNeill and Epperly 2002).

Hard-shelled sea turtles occur year-round in waters off Cape Hatteras, North Carolina and south. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States and also move up the Atlantic Coast (Epperly, Braun & Chester 1995; Epperly, Braun, Chester, et al. 1995; Epperly, Braun & Veishlow 1995; Griffin, et al. 2013; Morreale & Standora 2005) (Braun-McNeill and Epperly 2002), occurring in Virginia foraging areas as early as late April and on the most northern foraging grounds in the Gulf of Maine in June (Shoop & Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by September, but some remain in Mid-Atlantic and Northeast areas until late fall. By December, sea turtles have migrated south to waters offshore of NC, particularly south of Cape Hatteras, and further south (Epperly, Braun, Chester, et al. 1995; Griffin, et al. 2013; Hawkes, et al. 2011; Shoop & Kenney 1992).

Leatherback Sea Turtles: Leatherbacks, a pelagic species, are known to use coastal waters of the U.S. continental shelf and to have a greater tolerance for colder water than hard-shelled sea turtles (Dodge et al. 2014; Eckert et al. 2006; James et al. 2005; Murphy et al. 2006; NMFS & USFWS 2013). Leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (Dodge, et al. 2014; James, et al. 2005; James et al. 2006; NMFS & USFWS 1992). They are found in more northern waters (i.e., Gulf of Maine) later in the year (i.e., similar time frame as hard-shelled sea turtles), with most leaving the Northwest Atlantic shelves by mid-November (Dodge, et al. 2014; James, et al. 2005; James, et al. 2006).

1.1.1.1. Large Whales

Humpback, fin, sei, and minke whales are found throughout the waters of the Northwest Atlantic Ocean. In general, these species follow an annual pattern of migration between low latitude (south of 35ºN) wintering/calving grounds and high latitude spring/summer foraging grounds (primarily north of 41N; NMFS 1991; 2010a; b; Waring, et al. 2014; 2015; Waring, et al. 2016) (Hayes et al. 2017). This, however, is a simplification of whale movements, particularly as it relates to winter movements. It remains unknown if all individuals of a population migrate to low latitudes in the winter, although, increasing evidence suggests that for some species (e.g., humpback whales), some portion of the population remains in higher latitudes throughout the winter (Clapham et al. 1993; Swingle et al. 1993; Vu et al. 2012; Waring, et al. 2014; 2015;

Waring, et al. 2016) (Hayes et al. 2017). Although further research is needed to provide a clearer understanding of large whale movements and distribution in the winter, the distribution and movements of large whales to foraging grounds in the spring/summer is well understood. Movements of whales into higher latitudes coincide with peak productivity in these waters. As a result, the distribution of large whales in higher latitudes is strongly governed by prey availability and distribution, with large numbers of whales coinciding with dense patches of preferred forage (Payne et al. 1986; Payne et al. 1990; Schilling et al. 1992; Waring, et al. 2014; 2015; Waring, et al. 2016) (Hayes et al. 2017). For additional information on the biology, status, and range-wide distribution of each whale species refer to: Waring et al. (2014), Waring et al. (2015), Waring et al. (2016), Hayes et al. (2017); NMFS (1991; 2010a; 2011a).

To further assist in understanding how the Atlantic herring fishery may overlap in time and space with the occurrence of large whales, a general overview on species occurrence and distribution in the area of operation for the Atlantic herring fishery is provided in the following table (Table 4).

Table 4 - Large whale occurrence in the affected environment of the Atlantic herring fishery

Species	Prevalence and Approximate Months of Occurrence
Humpback	• Distributed throughout all continental shelf waters of the Mid-Atlantic (Southern New England included), Gulf of Maine, and Georges Bank throughout the year. • New England waters (Gulf of Maine and Georges Bank regions) = **Foraging Grounds** (approximately March-November). • Mid-Atlantic waters: Migratory pathway to/from northern (high latitude) foraging and southern (West Indies) calving grounds. • Increasing evidence of whales remaining in mid- and high- latitudes throughout the winter. Specifically, increasing evidence of wintering areas (for juveniles) in Mid-Atlantic (e.g., waters in the vicinity of Chesapeake and Delaware Bays; peak presence approximately January through March) and Southeastern coastal waters.
Fin	• Distributed throughout all continental shelf waters of the Mid-Atlantic (Southern New England included), Gulf of Maine, and Georges Bank throughout the year. • Mid-Atlantic waters: o Migratory pathway to/from northern (high latitude) foraging and southern (low latitude) calving grounds; and o Possible offshore calving area (approximately October-January). • New England (Gulf of Maine and Georges Bank/ Southern New England) waters = **Foraging Grounds** (greatest densities spring through summer; lower densities fall through winter). Important foraging grounds include: o Massachusetts Bay (esp. Stellwagen Bank); o Great South Channel; o Waters off Cape Cod (~40-50 meter contour); o Gulf of Maine; Perimeter (primarily eastern) of Georges Bank; and o Mid-shelf area off the east end of Long Island. • Evidence of wintering areas in mid-shelf areas east of New Jersey Stellwagen Bank; and eastern perimeter of Georges Bank.

Species	Prevalence and Approximate Months of Occurrence
Sei	• Uncommon in shallow, inshore waters of the Mid-Atlantic (SNE included), Georges Bank, and Gulf of Maine; however, occasional incursions during peak prey availability and abundance. • Primarily found in deep waters along the shelf edge, shelf break, and ocean basins between banks. • Spring through summer, found in greatest densities in offshore waters of the Gulf of Maine and Georges Bank; sightings concentrated along the northern, eastern (into Northeast Channel) and southwestern (in the area of Hydrographer Canyon) edge of Georges Bank.
Minke	• Widely distributed throughout continental shelf waters (<100m deep) of the Mid-Atlantic (Southern New England included), Gulf of Maine, and Georges Bank. • Most common in the EEZ from spring through fall, with greatest abundance found in New England waters; fall through spring widespread and common in deep-ocean waters.
Sources: NMFS (1991; 2010a; 2011a), Hain et al. (1992), Payne et al. (1984; 1990), CETAP (1982), Clapham et al. (1993), Swingle et al. (1993), Vu et al. (2012), Risch et al. (2013), Waring et al. (2014; 2015; 2016), Hayes et al. 2017.	

1.1.1.2. Small Cetaceans and Pinnipeds

Small cetaceans can be found throughout the year in waters of the Northwest Atlantic Ocean (Waring, et al. 2014; 2015; Waring, et al. 2016) (Hayes *et al*. 2017). Within this range, however, there are seasonal shifts in species distribution and abundance. In regards to pinnipeds, species are found in the nearshore, coastal waters of the Northwest Atlantic Ocean. They are primarily found throughout the year or seasonally from New Jersey to Maine; however, increasing evidence indicates that some species (e.g., harbor seals) may be extending their range seasonally into waters as far south as Cape Hatteras, North Carolina (35ºN) (Waring et al. 2007; Waring, et al. 2014; 2015; Waring, et al. 2016) (Hayes *et al*. 2017).

To further assist in understanding how Atlantic herring fishery may overlap in time and space with the occurrence of small cetaceans and pinnipeds, a general overview of species occurrence and distribution in the affected environment of this amendment is provided in Table 5.

Table 5 - Small cetacean and pinniped occurrence in the affected environment of the Atlantic herring fishery

Species	Prevalence and Approximate Months of Occurrence
Atlantic White-Sided Dolphin	• Distributed throughout the continental shelf waters (primarily to 100 meter isobath) of the Mid-Atlantic (north of 35ºN), Southern New England, Georges Bank, and Gulf of Maine; however, most common in continental shelf waters from Hudson Canyon (~ 39ºN) to Georges Bank, and into the Gulf of Maine. • **January-May**: low densities found from Georges Bank to Jeffreys Ledge. • **June-September**: large densities found from Georges Bank through the Gulf of Maine.

Species	Prevalence and Approximate Months of Occurrence
	• **October-December**: intermediate densities found from southern Georges Bank to southern Gulf of Maine. • South of Georges Bank (Southern New England and Mid-Atlantic), low densities found year round, with waters off Virginia and NC representing southern extent of species range during winter months.
Short-Beaked Common Dolphin	• Regularly found throughout the continental shelf-edge-slope waters (primarily between the 100-2,000 meter isobaths) of the Mid-Atlantic, Southern New England, and Georges Bank (esp. in Oceanographer, Hydrographer, Block, and Hudson Canyons). • Less common south of Cape Hatteras, NC, although schools have been reported as far south as the Georgia /South Carolina border. • **January-May**: occur from waters off Cape Hatteras, NC, to Georges Bank (35° to 42°N). • **Mid-summer-fall**: occur primarily on Georges Bank with small numbers present in the Gulf of Maine; Peak abundance found on Georges Bank in the autumn.
Risso's Dolphin	• **Spring through fall**: Distributed along the continental shelf edge from Cape Hatteras, NC, to Georges Bank. • **Winter**: distributed in the Mid-Atlantic Bight, extending into oceanic waters. • Rarely seen in the Gulf of Maine; primarily a Mid-Atlantic continental shelf edge species (can be found year round).
Harbor Porpoise	• Distributed throughout the continental shelf waters of the Mid-Atlantic (north of 35°N), Southern New England, Georges Bank, and Gulf of Maine. • **July-September**: concentrated in the northern Gulf of Maine (waters < 150 meters); low numbers can be found on Georges Bank. • **October-December**: widely dispersed in waters from NJ to Maine; seen from the coastline to deep waters (>1,800 meters). • **January-March**: intermediate densities in waters off NJ to NC; low densities found in waters off NY to Gulf of Maine. • **April-June**: widely dispersed from NJ to ME; seen from the coastline to deep waters (>1,800 meters).
Bottlenose Dolphin	**<u>Western North Atlantic Offshore Stock</u>** • Distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic from Georges Bank to FL. • Depths of occurrence: ≥40 meters **<u>Western North Atlantic Northern Migratory Coastal Stock</u>** • Warm water months (e.g., July-August): distributed from the coastal waters from the shoreline to approximately the 25-meter isobaths between the Chesapeake Bay mouth and Long Island, NY.

Species	Prevalence and Approximate Months of Occurrence
	• Cold water months (e.g., January-March): stock occupies coastal waters from Cape Lookout, NC, to the NC/VA border. **<u>Western North Atlantic Southern Migratory Coastal Stock</u>** • **October-December**: stock occupies waters of southern NC (south of Cape Lookout) • **January-March**: stock moves as far south as northern FL. • **April-June**: stock moves north to waters of NC. • **July-August**: stock is presumed to occupy coastal waters north of Cape Lookout, NC, to the eastern shore of VA.
Pilot Whales: *Short- and Long-Finned*	**<u>Short-Finned Pilot Whales</u>** • Except for area of overlap (see below), primarily occur south of 40ºN • May through December (approximately): distributed primarily near the continental shelf break of the Mid-Atlantic and Southern New England; beginning in the fall, individuals appear to shift to southern waters (i.e., 35ºN and south). **<u>Long-Finned Pilot Whales</u>** • Except for area of overlap (see below), primarily occur north of 42ºN. • Winter to early spring: primarily distributed along the continental shelf edge-slope. • Late spring through fall (: movements and distribution shift onto/within Georges Bank, the Great South Channel, and Gulf of Maine. **<u>Area of Species Overlap:</u>** between approximately 38ºN and 41ºN.
Harbor Seal	• Primarily distributed in waters from NJ to ME; however, increasing evidence indicates that their range is extending into waters as far south as Cape Hatteras, NC (35ºN). • **Year Round**: waters of ME • **September-May**: waters from New England to NJ.
Gray Seal	• Distributed in waters from NJ to ME. • Year Round: waters from ME to MA. • September-May: waters from Rhode Island to NJ.
Harp Seal	• Winter-Spring (approximately January-May): waters from ME to NJ.
Hooded Seal	• Winter-Spring (approximately January-May): waters of New England.

Notes: Information presented in table is representative of small cetacean occurrence in the Northwest Atlantic continental shelf waters out to the 2,000 m isobath.

Sources: Waring et al. (2007; 2014; 2015; 1992; 2016), Hayes et al. (2017), Payne and Heinemann (1993), Payne et al. (1984), Jefferson et al. (2009).

1.1.1.3. Atlantic Sturgeon

The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. Atlantic sturgeon from all five DPSs have the potential to be located anywhere in this marine range (ASSRT 2007; Dadswell 2006; Dadswell et al. 1984; Dovel & Berggren 1983; Dunton et al. 2010; Erickson et al. 2011; Kynard et al. 2000; Laney et al. 2007; O'Leary et al. 2014; Stein et al. 2004a; Waldman et al. 2013; Wirgin et al. 2015; Wirgin et al. 2012) (Dunton et al. 2012; Dunton et al. 2015; Wirgin et al. 2 2015b). Based on fishery- independent and dependent data, as well as data collected from tracking and tagging studies, in the marine environment, Atlantic sturgeon appear to primarily occur inshore of the 50 m depth contour (Dunton, et al. 2010; Erickson, et al. 2011; Stein, et al. 2004a; Stein et al. 2004b); however, Atlantic sturgeon are not restricted to these depths, as excursions into deeper continental shelf waters have been documented (Collins & Smith 1997; Dunton, et al. 2010; Erickson, et al. 2011; Stein, et al. 2004a; b; Timoshkin 1968). Data from fishery-independent surveys and tagging and tracking studies also indicate that some Atlantic sturgeon may undertake seasonal movements along the coast (Dunton, et al. 2010; Erickson, et al. 2011) (Wipplehauser 2012). For instance, tagging and tracking studies found that satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight, at depths greater than 20 m, during winter and spring, while in the summer and fall, Atlantic sturgeon concentrations shifted to the northern portion of the Mid-Atlantic Bight at depths less than 20 m (Erickson, et al. 2011).

Within the marine range of Atlantic sturgeon, several marine aggregation areas have been identified adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard (i.e., waters off North Carolina, Chesapeake Bay, and Delaware Bay; New York Bight; Massachusetts Bay; Long Island Sound; and Connecticut and Kennebec River Estuaries); depths in these areas are generally no greater than 25 m (Bain et al. 2000; Dunton, et al. 2010; Erickson, et al. 2011; Laney, et al. 2007; O'Leary, et al. 2014; Oliver et al. 2013; Savoy & Pacileo 2003; Stein, et al. 2004a; Waldman, et al. 2013) (Wipplehauser 2012; Whipplehauser and Squiers 201). Although additional studies are still needed to clarify why these particular sites are chosen by Atlantic sturgeon, they may serve as thermal refuge, wintering sites, or marine foraging areas (Dunton, et al. 2010; Erickson, et al. 2011; Stein, et al. 2004a).

1.1.1.4. Atlantic Salmon

The wild populations of Atlantic salmon are listed as endangered under the ESA. Their freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, while the marine range of the Gulf of Maine DPS extends from the Gulf of Maine (primarily northern portion of the Gulf of Maine) to the coast of Greenland (Fay et al. 2006; NMFS & USFWS 2005)(NMFS and USFWS 2016). In general, smolts, post-smolts, and adult Atlantic salmon may be present in the Gulf of Maine and coastal waters of Maine in the spring (beginning in April), and adults may be present throughout the summer and fall months (Baum 1997; Fay, et al. 2006; Hyvarinen et al. 2006; Lacroix & Knox 2005; Lacroix & McCurdy 1996; Lacroix et al. 2004; NMFS & USFWS 2005; Reddin 1985; Reddin & Friedland 1993; Reddin & Short 1991; Sheehan et al. 2012) (USASAC 2004; NMFS and USFWS 2016). For additional information on the on the biology, status, and range-wide distribution of the Gulf of Maine DPS of Atlantic salmon refer to NMFS and USFWS (2005)(2016); Fay et al. (2006).

1.4.3 Gear Interactions with Protected Species

Several protected species are vulnerable to interactions with various types of fishing gear. Interaction risks vary by gear type, quantity, and soak or tow time. Available information on gear interactions with a given protected species (or species group) is provided in the sections below. These sections are not a comprehensive review of all fishing gear types known to interact with a given species; focus is placed on interaction risks associated with purse seines, bottom (small mesh) trawls, or midwater trawls, the primary gear types used in landing Atlantic herring.

1.4.3.1 Gear Interactions with Sea Turtles

Bottom Otter Trawl. Sea turtle interactions with bottom trawl gear have been observed on Georges Bank, and in the Mid-Atlantic; however, most of the observed interactions have occurred in the Mid-Atlantic (Warden 2011a; b) (Murray 2015). As no sea turtle interactions with bottom trawl gear have been observed in the Gulf of Maine, and few sea turtle interactions have been observed on Georges Bank, there is insufficient data available to conduct a robust model-based analysis on sea turtle interactions with bottom trawl gear in these regions or produce a bycatch estimate for these regions. As a result, the bycatch estimates and discussion below are for bottom trawl gear in the Mid-Atlantic.

Bottom trawl gear poses an injury and mortality risk to sea turtles, specifically due to forced submergence (Sasso and Epperly 2006). Green, Kemp's ridley, leatherback, loggerhead, and unidentified sea turtles have been documented interacting (e.g., bycaught) with bottom trawl gear. However, estimates are available only for loggerhead sea turtles. Warden (2011a; b) estimated that from 2005-2008, the average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic[1] was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls, but released through a Turtle Excluder Device (TED).[2] The 292 average annual observable loggerhead interactions equates to approximately 44 adult equivalents (Warden 2011a; b). Most recently, Murray (2015) estimated that from 2009-2013, the total average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic[3] was 231 (CV=0.13, 95% CI=182-298); this equates to approximately 33 adult equivalents (Murray 2015). Bycatch estimates provided in Warden (2011a) and Murray (2015) are a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, which Murray (2008) estimated at 616 sea turtles (CV=0.23, 95% CI over the nine-year period: 367-890). This decrease is likely due to decreased fishing effort in high-interaction areas (Warden 2011a; b).

Mid-Water Trawl: NEFOP and ASM observer data from 1989 to 2015 show five leatherback sea turtle interactions with mid-water trawl gear; the primary species landed during these interactions was tuna (NMFS NEFSC FSB 2015, 2016). These takes were in the early 1990s in an

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[1] Warden (2011a) defined the Mid-Atlantic as south of Cape Cod, Massachusetts, to about the North Carolina/South Carolina border.

[2] TEDs allow sea turtles to escape the trawl net, reducing injury and mortality resulting from capture in the net. Approved TEDs are required in the shrimp and summer trawl fishery. For further information on TEDs see 50 CFR 223.206 and 68 FR 8456 (February 21, 2003).

[3] Murray (2015b) defined the Mid-Atlantic as the boundaries of the Mid-Atlantic Ecological Production; roughly waters west of 71°W to the North Carolina/South Carolina border)

experimental HMS fishery that no longer operates. No takes have been documented in other mid-water trawl fisheries operating in the Greater Atlantic Region. Based on this and the best available information, sea turtle interactions in mid-water trawl gear in the Greater Atlantic Region are expected to be rare.

Purse Seine: Sea turtle interactions with this gear type are possible; however, based on available information (NMFS NEFSC FSB 2015, 2016), the risk of a sea turtle interacting with purse seine is expected to be low. Sea turtle may be capture in the net and could become entangled in the mesh. Captured turtles can be released alive if they are quickly retrieved and removed from the net.

1.4.3.2 Gear Interactions with Atlantic Sturgeon

Bottom Otter Trawl: Atlantic sturgeon interactions (i.e., bycatch) with bottom trawl gear have been observed since 1989; these interactions have the potential to result in the injury or mortality of Atlantic sturgeon (NMFS NEFSC FSB 2015, 2016). Three documents, covering three time periods, that use data collected by the Northeast Fisheries Observer Program to describe bycatch of Atlantic sturgeon in bottom trawl gear: Stein et al. (2004b) for 1989-2000; ASMFC (2007) for 2001-2006; and Miller and Shepard (2011) for 2006-2010; none of these documents provide estimates of Atlantic sturgeon bycatch by Distinct Population Segment. Miller and Shepard (2011), the most recent of the three documents, analyzed fishery observer data and VTR data to estimate the average annual number of Atlantic sturgeon interactions in otter trawl in the Northeast Atlantic that occurred from 2006 to 2010. This timeframe included the most recent, complete data and as a result, Miller and Shepard (2011) is considered to be the most accurate predictor of annual Atlantic sturgeon interactions in the Northeast bottom trawl fisheries (NMFS 2013).

Based on the findings of Miller and Shepard (2011), NMFS (2013) estimated that the annual bycatch of Atlantic sturgeon in bottom trawl gear to be 1,342 sturgeon. Miller and Shepard (2011) reported observed Atlantic sturgeon interactions in trawl gear with small (< 5.5 in) and large (≥ 5.5 in) mesh sizes and concluded that, based on NEFOP observed sturgeon mortalities, relative to gillnet gear, bottom trawl gear posed less risk of mortality to Atlantic sturgeon. Estimated mortality rates in gillnet gear were 20.0%, while those in otter trawl gear were 5.0% (Miller & Shepard 2011) (NMFS 2013). Similar conclusions were reached in Stein et al. (2004b) and ASMFC (2007) reports; after review of observer data from 1989-2000 and 2001-2006, both studies concluded that observed mortality is much higher in gillnet gear than in trawl gear. However, an important consideration to these findings is that observed mortality is considered a minimum of what actually occurs and therefore, the conclusions reached by Stein et al. (2004b), ASMFC (2007), and Miller and Shepard (2011) are not reflective of the total mortality associated with either gear type. To date, total Atlantic sturgeon mortality associated with gillnet or trawl gear remains uncertain.

Mid-Water Trawl: To date, there have been no observed/documented interactions with Atlantic sturgeon in mid-water trawl gear (NMFS NEFSC FSB 2015, 2016). Based on this information, mid-water trawl gear is not expected to pose an interaction risk to any Atlantic sturgeon and therefore, is not expected to be source of injury or mortality to this species.

Purse Seine: Capture of sturgeon in purse seine gear type is possible; however, interactions have been extremely rare over the past 26 years. NEFOP and ASM observer data from 1989-2015 show two Atlantic sturgeon interactions with purse seine gear targeting Atlantic herring in the

Gulf of Maine (NMFS NEFSC FSB 2015, 2016); these interactions were recorded in 2004 and 2005, prior to the listing of Atlantic sturgeon under the ESA. Based on this information, although Atlantic sturgeon interactions with purse seine gear are possible, the risk of an interaction is expected to be low.

1.4.3.3 Gear Interaction with Atlantic Salmon

Bottom Otter Trawl: Atlantic salmon interactions (i.e., bycatch) with bottom trawl have been observed since 1989; in many instances, these interactions have resulted in the injury and mortality of Atlantic salmon (NMFS NEFSC FSB 2015, 2016). According to the Biological Opinion issued by NMFS Greater Atlantic Regional Fisheries Office on December 16, 2013, NMFS Northeast Fisheries Science Center's (NEFSC) Northeast Fisheries Observer and At-Sea Monitoring Programs documented a total of 15 individual salmon incidentally caught on more than 60,000 observed commercial fishing trips from 1989 through August 2013 (Kocik et al. 2014) (NMFS 2013); of those 15 salmon, four were observed caught in bottom trawl gear (Kocik (NEFSC), pers. comm (February 11, 2013) in NMFS 2013).The genetic identity of these captured salmon is unknown; however, the NMFS 2013 Biological Opinion considers all 15 fish to be part of the Gulf of Maine Distinct Population Segment, although some may have originated from the Connecticut River restocking program (i.e., those caught south of Cape Cod, Massachusetts). Since 2013, no additional Atlantic salmon have been observed in bottom trawl gear (NMFS NEFSC FSB 2015, 2016). Based on the above information, bottom trawl interactions with Atlantic salmon are likely rare (NMFS 2013) (Kocik, et al. 2014).

Purse Seine and Mid-Water Trawl: To date, there have been no observed/documented interactions with Atlantic salmon and mid-water trawl or purse seine gears (NMFS NEFSC FSB 2015, 2016). Based on this information, mid-water trawls or purse seines are not expected to pose an interaction risk to any Atlantic salmon and therefore, are not expected to be source of injury or mortality to this species.

1.4.3.4 Gear Interactions with Marine Mammals

Depending on species, marine mammal interactions have been observed in bottom trawl, purse seine, and/or mid-water trawl gear. Pursuant to the MMPA, NMFS publishes a List of Fisheries (LOF) annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injuries and/or mortalities of marine mammals in each fishery (i.e., Category I=frequent; Category II=occasional; Category III=remote likelihood or no known interactions). In the Northwest Atlantic, the 2017 LOF (82 FR 3655 (January 12, 2017)) categorizes the Gulf of Maine herring purse seine fishery as a Category III fishery and commercial bottom trawl (Northeast and Mid-Atlantic) and mid-water trawl fisheries (Northeast or Mid-Atlantic) as Category II fisheries.

1.4.3.4.1 Large Whales

Bottom Otter and Mid-Water Trawls: With the exception of one species, there have been no observed interactions with large whales and trawl (bottom or mid-water) gear. The one exception is minke whales, which have been observed seriously injured and killed in both types of trawl gear. Over the past 10 years, there have been two observed minke whales incidentally taken in mid-water trawl gear. These occurred in 2009 and 2013, with the 2009 incident resulting from entanglement in NOAA research mid-water trawl gear (whale released alive, but seriously injured), and the 2013 incident resulting from entanglement in a Northeast mid-water trawl

(including pair trawl) fishery (whale was dead, moderately decomposed) (http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html; Henry et al. 2015; Waring, et al. 2016). Based on the latter incident, as provided in Waring et al. (2016), the estimated annual average minke whale mortality and serious injury from the Northeast mid-water trawl (including pair trawl) fishery from 2009 to 2013 is 0.2; Hayes et al. (2017) provided the same estimated annual average minke whale mortality and serious injury from the Northeast mid-water trawl (including pair trawl) fishery from 2010 to 2014.

In bottom trawl gear, to date, interactions have only been observed in the northeast bottom trawl fisheries. From the period of 2008-2012, the estimated annual mortality attributed to this fishery was 7.8 minke whales for 2008 and zero minke whales from 2009-2012; no serious injuries were reported during this time. Based on this information, from 2008-2012, the estimated annual average minke whale mortality and serious injury attributed to the northeast bottom trawl fishery was 1.6 (CV=0.69) whales (Waring, et al. 2015). Lyssikatos (2015) estimated that from 2008-2013, mean annual serious injuries and mortalities from the northeast bottom trawl fishery were 1.40 (CV=0.58) minke whales. Serious injury and mortality records for minke whales in U.S. waters from 2010-2014 showed zero interactions with bottom trawl (northeast or Mid-Atlantic) gear (Henry et al. 2016; Hayes et al. 2017).

Based on above information, trawl gear is likely to pose a low interaction risk to any large whale species. Should an interaction occur, serious injury or mortality to any large whale is possible; however, relative to other gear types discussed below (i.e., fixed gear), trawl gear represents a low source serious injury or mortality to any large whale.

Purse Seine: Since 2008, three humpback whales and one fin/sei whale have been documented as interacting with purse seines, specifically those operating in the Gulf of Maine targeting Atlantic herring. All interactions, however, resulted in the animals being released from the nets unharmed (Henry, et al. 2015; Waring, et al. 2016) (Hayes *et al*. 2017; http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html). Based on this information, although interactions are possible with large whales, purse seines are not expected to pose a serious injury or mortality risk to these species.

1.4.3.4.2 Small Cetaceans and Pinnipeds

Bottom and Mid-Water Trawl Gear: Small cetaceans and pinnipeds are vulnerable to interactions with bottom and/or mid-water trawl gear (Waring, et al. 2014; 2015; Waring, et al. 2016)(Read *et al*. 2006; Hayes *et al*. 2017; 82 FR 3655 (January 12, 2017)).[4] Based on the most recent five years of observer data (2010-2014), Table 6 provides a list of species that have been observed (incidentally) seriously injured and/or killed by List of Fisheries Category II trawl fisheries that operate in the affected environment of the Atlantic herring fishery (Hayes *et al*. 2017; 82 FR 3655 (January 12, 2017)).

[May want to insert observed take maps in this section]

[4] For additional information on small cetacean and pinniped interactions prior to those provided in Waring et al. 2014a, see: http://www.nmfs.noaa.gov/pr/sars/region.htm

Table 6 - Small cetacean and pinniped species observed seriously injured and/or killed by Category trawl fisheries in the affected environment of the Atlantic herring fishery

Fishery	Category	Species Observed or reported Injured/Killed
Mid-Atlantic Mid-Water Trawl-Including Pair Trawl	II	White-sided dolphin
		Gray seal
		Harbor seal
Northeast Mid-Water Trawl-Including Pair Trawl	II	Short-beaked common dolphin
		Long-finned pilot whales
		Gray seal
		Harbor seal
Northeast Bottom Trawl	II	Harp seal
		Harbor seal
		Gray seal
		Long-finned pilot whales
		Short-beaked common dolphin
		White-sided dolphin
		Harbor porpoise
		Bottlenose dolphin (offshore)
		Risso's dolphin
Mid-Atlantic Bottom Trawl	II	White-sided dolphin
		Short-beaked common dolphin
		Risso's dolphin
		Bottlenose dolphin (offshore)
		Gray seal
		Harbor seal
Sources: Hayes *et al*. 2017; MMPA LOF 82 FR 3655 (January 12, 2017).		

In 2006, based on observed mid-water trawl interactions with long-finned pilot whales, short - finned pilot whales, common dolphins, and white sided dolphins, the Atlantic Trawl Gear Take Reduction Team (ATGTRT) was convened to address the incidental mortality and serious injury of these species incidental to bottom and mid-water trawl fisheries operating in both the New England and Mid-Atlantic regions. Because none of the marine mammal stocks of concern to the ATGTRT are classified as a "strategic stock", nor do they currently interact with a Category I fishery,[5] it was determined that development of a take reduction plan was not necessary. In lieu of a take reduction plan, the ATGTRT agreed to develop an Atlantic Trawl Gear Take Reduction Strategy (ATGTRS). The ATGTRS identifies informational and research tasks, as well as education and outreach needs the ATGTRT believes are necessary to provide the basis for decreasing mortalities and serious injuries of marine mammals to insignificant levels

[5] Category I fisheries have frequent incidental mortality and serious injury of marine mammals.

approaching zero. The ATGTRS also identifies several voluntary measures that can be adopted by certain trawl fishing sectors to potentially reduce the incidental capture of marine mammals.[6]

Purse Seine: There have been no observed small cetacean interactions with purse seines used to prosecute any Greater Atlantic Region fishery (primarily Gulf of Maine Atlantic herring). As a result, this gear type is not expected to pose an interaction risk with small cetacean species, and therefore, is not expected to be source of serious injury or mortality to any small cetacean.

Purse seines; however, specifically those operating in the Gulf of Maine targeting Atlantic herring, are known to interact with pinniped species. Since 2004, pinniped species have been observed in purse seine gear; none of these interactions have resulted in mortality or confirmed serious injury to the seal (Table 7; Waring *et al*. 2014b; Hayes *et al*. 2017; http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html). As a result, although interactions are possible with seals, we do not expect purse seines to pose a serious injury or mortality risk to these species. This conclusion is further supported by the fact that the List of Fisheries has identified the Gulf of Maine Atlantic herring purse seine fishery as a Category III fishery, that is, a fishery that causes a remote to no likelihood of causing serious injury or mortality to marine mammals.

Table 7 - 2004-2014 Observed gray and harbor seal interactions with the Gulf of Maine Atlantic herring purse seine fishery

Seal Species	Number of Observed Interactions	Released Alive (No Serious Injury or Mortality)
Unknown	16	Yes
Harbor Seal	21	Yes
Gray Seal	114	Yes

1.4.4 Seabirds

[to be developed – focus on species that eat herring only, i.e. common tern]

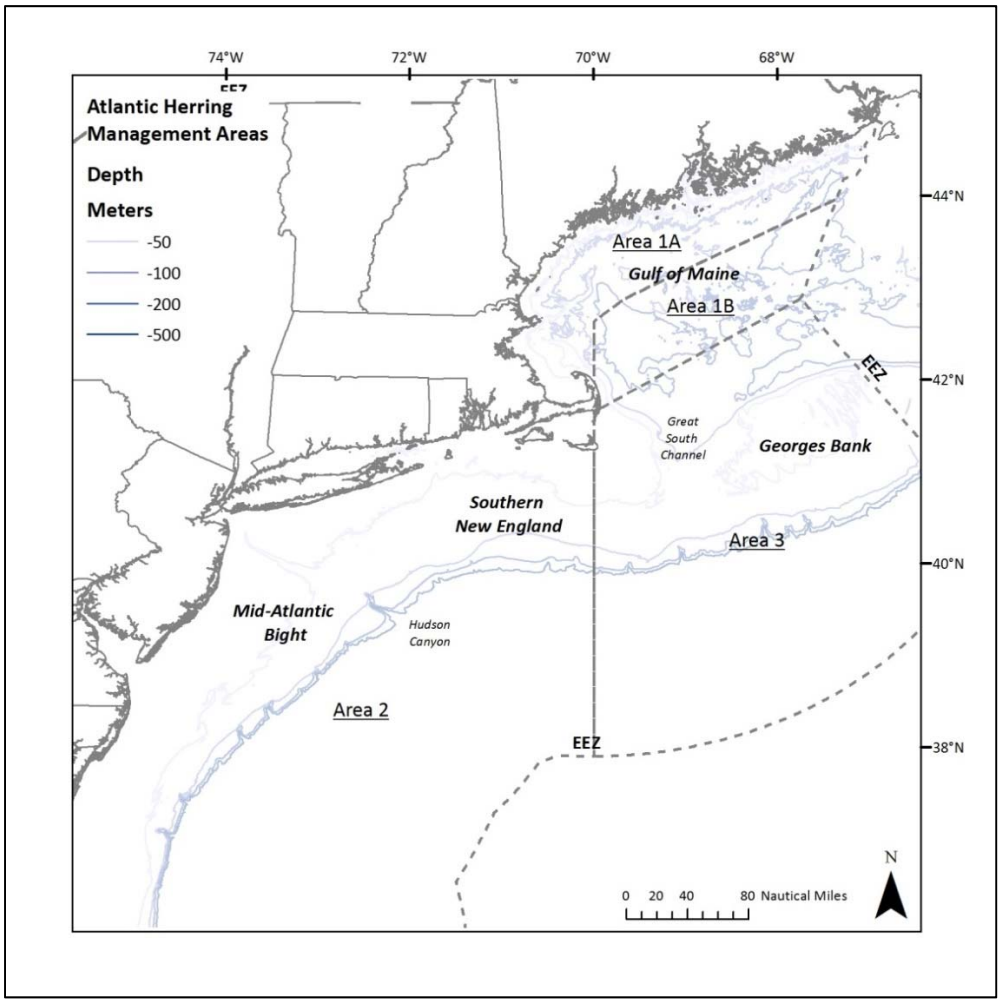
[6] For additional details on the ATGTRS, visit: http://www.greateratlantic.fisheries.noaa.gov/Protected/mmp/atgtrp/

1.5 PHYSICAL ENVIRONMENT AND ESSENTIAL FISH HABITAT

1.1.1 Physical Environment

The Atlantic herring fishery is prosecuted in four areas defined as Areas 1A, 1B, 2, and 3 (Figure 7). These areas collectively cover the entire northeast U.S. shelf ecosystem, which has been defined as the Gulf of Maine south to Cape Hatteras, North Carolina, extending from the coast seaward to the edge of the continental shelf, including offshore to the Gulf Stream (Sherman et al. 1996). Three distinct sub-regions, the Gulf of Maine, Georges Bank, and the southern New England/Mid-Atlantic region, were described in the Affected Environment section of Amendment 5 to the Atlantic Herring FMP, based on a summary compiled for the gear effects technical memo authored by Stevenson et al. (2004). Roughly, Areas 1A and 1B cover the Gulf of Maine, Area 2 covers southern the New England/Mid-Atlantic region, and Area 3 covers Georges Bank.

Figure 7 – Atlantic Herring Management Areas and the Northeast U.S. shelf ecosystem



1.1.2 Essential Fish Habitat

1.5.1.1 Essential Fish Habitat for Atlantic herring

The original EFH designation for Atlantic herring was developed as part of EFH Omnibus Amendment 1 in 1998. Omnibus Habitat Amendment 2, which includes updates to the EFH designation for herring, as well as for other Council-managed species, is undergoing review and should be published during 2017 or 2018. The new designations for adults and juveniles identify nearly the entire Gulf of Maine as EFH, and designate additional areas on the southern half of Georges Bank. The updated larval designation will be similar to the current one. The updated egg designation is the most different from the original, with many additional areas identified as EFH based on the distribution of very small larvae. The updated EFH designation for herring is provided below. Interactive maps of EFH for each species and life stage are available on NOAA EFH Mapper http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html. The mapper will be updated to reflect changes proposed in OHA2 once the amendment is published. Additional details are provided in Volume 2 (designations), Appendix A (designation methods), and Appendix B (supplementary information) of Omnibus Habitat Amendment 2 (http://www.nefmc.org/library/omnibus-habitat-amendment-2).

Eggs: Inshore and offshore benthic habitats in the Gulf of Maine and on Georges Bank and Nantucket Shoals in depths of 5-90 meters on coarse sand, pebbles, cobbles, and boulders and/or macroalgae at the locations shown in Map 1. Eggs adhere to the bottom, often in areas with strong bottom currents, forming egg "beds" that may be many layers deep.

Larvae: Inshore and offshore pelagic habitats in the Gulf of Maine, on Georges Bank, and in the upper Mid-Atlantic Bight, as shown on Map 2, and in the bays and estuaries listed in Table 8. Atlantic herring have a very long larval stage, lasting 4-8 months, and are transported long distances to inshore and estuarine waters where they metamorphose into early stage juveniles ("brit") in the spring.

Juveniles: Intertidal and sub-tidal pelagic habitats to 300 meters throughout the region, as shown on Map 3, including the bays and estuaries listed in Table 8. One and two-year old juveniles form large schools and make limited seasonal inshore-offshore migrations. Older juveniles are usually found in water temperatures of 3 to 15°C in the northern part of their range and as high as 22°C in the Mid-Atlantic. Young-of-the-year juveniles can tolerate low salinities, but older juveniles avoid brackish water.

Adults: Sub-tidal pelagic habitats with maximum depths of 300 meters throughout the region, as shown on Map 3, including the bays and estuaries listed in Table 8. Adults make extensive seasonal migrations between summer and fall spawning grounds on Georges Bank and the Gulf of Maine and overwintering areas in southern New England and the Mid-Atlantic region. They seldom migrate beyond a depth of about 100 meters and – unless they are preparing to spawn – usually remain near the surface. They generally avoid water temperatures above 10°C and low salinities. Spawning takes place on the bottom, generally in depths of 5-90 meters on a variety of substrates (see eggs).

Table 8 – Atlantic herring EFH designation for estuaries and embayments.

Estuaries and Embayments	Larvae	Juveniles	Adults
Passamaquoddy Bay	S,M	S,M	S,M
Englishman/Machias Bay	S,M	S,M	S,M
Narraguagus Bay	S,M	S,M	S,M
Blue Hill Bay	S,M	S,M	S,M
Penobscot Bay	S,M	S,M	S,M
Muscongus Bay	S,M	S,M	S,M
Damariscotta River	S,M	S,M	S,M
Sheepscot River	S,M	S,M	S,M
Kennebec / Androscoggin	S,M	S,M	S,M
Casco Bay	S,M	S,M	S
Saco Bay	S,M	S,M	S
Wells Harbor	S,M	S,M	S
Great Bay	S,M	S,M	S
Hampton Harbor*	S,M	S,M	S
Merrimack River	M	M	
Plum Island Sound*	S,M	S,M	S
Massachusetts Bay	S	S	S
Boston Harbor	S	S,M	S,M
Cape Cod Bay	S	S	S
Buzzards Bay		S,M	S,M
Narragansett Bay	S	S,M	S,M
Long Island Sound		S,M	S,M
Gardiners Bay		S	S
Great South Bay		S	S
Hudson River / Raritan Bay	S,M	S,M	S,M
Barnegat Bay		S,M	S,M
New Jersey Inland Bays		S,M	S,M

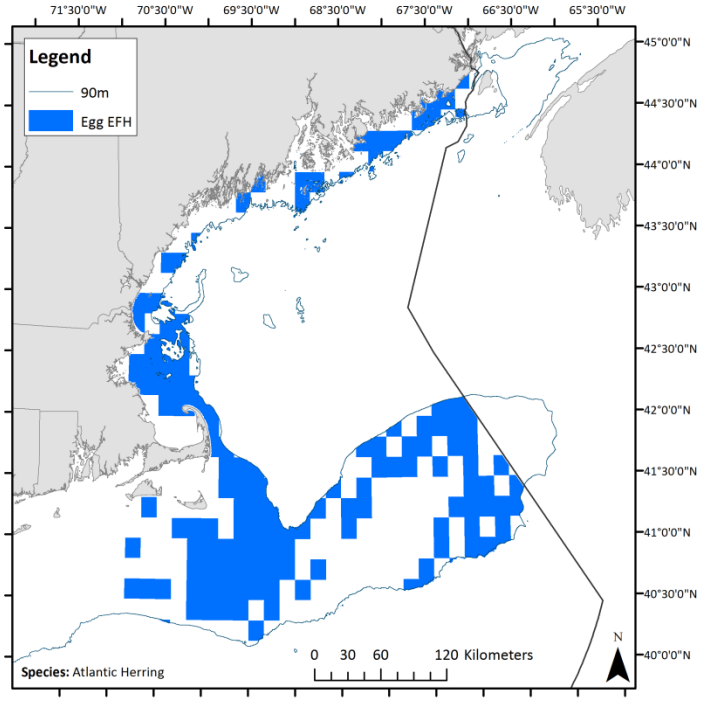
Estuaries and Embayments	Larvae	Juveniles	Adults
Delaware Bay		S,M	S
Chesapeake Bay			S

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).

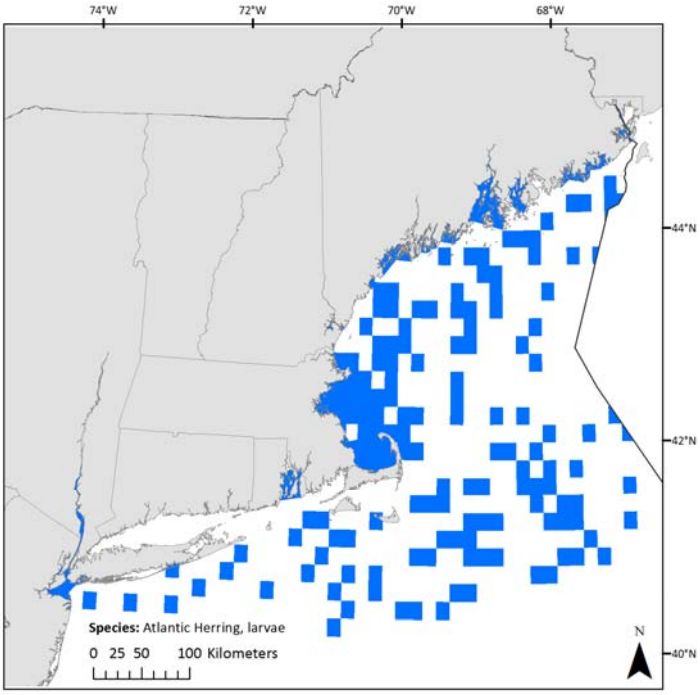
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).

** = This water body was not included in the original ELMR reports, but it was included in the salinity zone maps that were appended to all the relevant fishery management plans and amendments which implemented the no action EFH designations; EFH designations were inferred in these locations if there were ELMR-based designations in the adjacent north and south locations.*

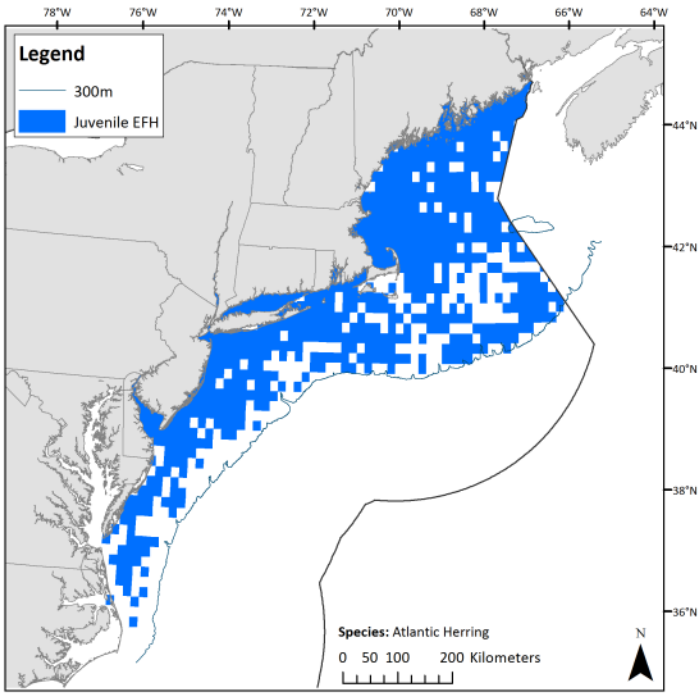
Map 1 – Atlantic herring egg EFH.



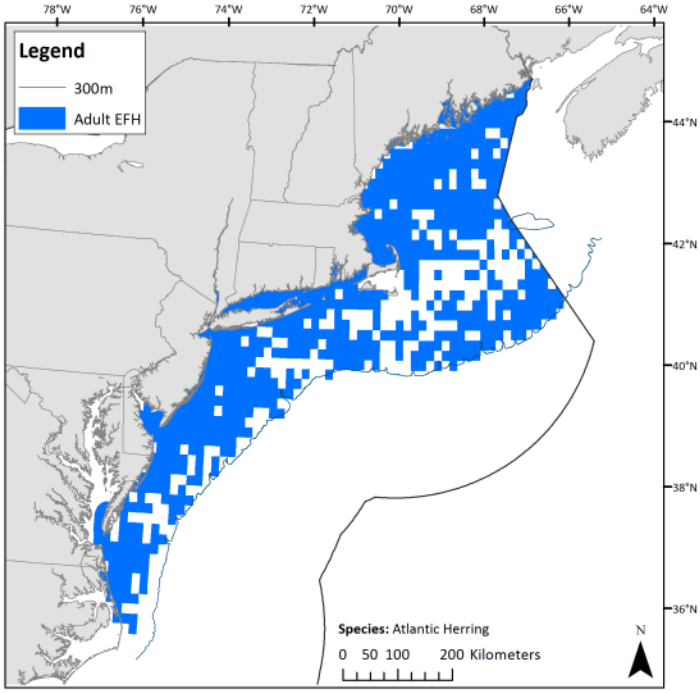
Map 2 – Atlantic herring larval EFH.



Map 3 – Atlantic herring juvenile EFH.



Map 4 – Atlantic herring adult EFH.



1.5.1.2 Essential Fish Habitat for Other Species

The environment that could potentially be affected by the Proposed Action has been identified as EFH for the benthic life stages of the species listed in Table 9. Additional information is in the FMP document that most recently updated each species' EFH designation (last column in Table 9), or on the EFH mapper referenced above. Note that the Mid-Atlantic Fishery Management Council is currently reviewing their EFH designations. Updated designations could be available prior to completion of Amendment 8, depending on the timing of the amendment and the EFH review.

Table 9 - Sources for current EFH designation information. OHA2 = Omnibus Habitat Amendment 2.

Species	Authority	Plan Managed Under	Last update
Monkfish	NEFMC, MAFMC	Monkfish	OHA2
Atlantic herring	NEFMC	Atlantic Herring	OHA2
Atlantic salmon	NEFMC	Atlantic salmon	OHA2
Atlantic sea scallop	NEFMC	Atlantic Sea Scallop	OHA2
American plaice	NEFMC	NE Multispecies	OHA2
Atlantic cod	NEFMC	NE Multispecies	OHA2
Atlantic halibut	NEFMC	NE Multispecies	OHA2
Atlantic wolffish	NEFMC	NE Multispecies	OHA2
Haddock	NEFMC	NE Multispecies	OHA2
Ocean pout	NEFMC	NE Multispecies	OHA2
Offshore hake	NEFMC	NE Multispecies	OHA2

Species	Authority	Plan Managed Under	Last update
Pollock	NEFMC	NE Multispecies	OHA2
Red hake	NEFMC	NE Multispecies	OHA2
Redfish	NEFMC	NE Multispecies	OHA2
Silver hake	NEFMC	NE Multispecies	OHA2
White hake	NEFMC	NE Multispecies	OHA2
Windowpane flounder	NEFMC	NE Multispecies	OHA2
Winter flounder	NEFMC	NE Multispecies	OHA2
Witch flounder	NEFMC	NE Multispecies	OHA2
Yellowtail flounder	NEFMC	NE Multispecies	OHA2
Barndoor skate	NEFMC	NE Skate Complex	OHA2
Clearnose skate	NEFMC	NE Skate Complex	OHA2
Little skate	NEFMC	NE Skate Complex	OHA2
Rosette skate	NEFMC	NE Skate Complex	OHA2
Smooth skate	NEFMC	NE Skate Complex	OHA2
Thorny skate	NEFMC	NE Skate Complex	OHA2
Winter skate	NEFMC	NE Skate Complex	OHA2
Red crab	NEFMC	Red Crab	OHA2
Spiny dogfish	MAFMC/NEFMC	Spiny Dogfish	Original FMP
Atlantic surfclam	MAFMC	Atlantic Surfclam Ocean Quahog	Amendment 12
Ocean quahog	MAFMC	Atlantic Surfclam Ocean Quahog	Amendment 12
Bluefish	MAFMC	Bluefish FMP	Amendment 1
Atlantic mackerel	MAFMC	Squid, Mackerel, Butterfish	Amendment 11
Butterfish	MAFMC	Squid, Mackerel, Butterfish	Amendment 11
Longfin squid	MAFMC	Squid, Mackerel, Butterfish	Amendment 11
Shortfin squid (*Illex*)	MAFMC	Squid, Mackerel, Butterfish	Amendment 11
Black sea bass	MAFMC	Summer Flounder, Scup, and Black Sea Bass	Amendment 12
Scup	MAFMC	Summer Flounder, Scup, and Black Sea Bass	Amendment 12
Summer flounder	MAFMC	Summer Flounder, Scup, and Black Sea Bass	Amendment 12
Tilefish	MAFMC	Tilefish	Amendment 1

1.6 HUMAN COMMUNITIES

Amendment 8 considers and evaluates the effect management alternatives may have on people's economy, way of life, traditions, and community. These social and economic impacts may be driven by changes in fishery flexibility, opportunity, stability, certainty, safety, and/or other factors. While it is possible that social and economic impacts could be solely experienced by individuals, it is more likely that impacts would be experienced across communities, gear types, and/or vessel size classes.

Summarized here are the fisheries and human communities most likely to be impacted by the Alternatives under Consideration. Social, economic and fishery information presented herein is useful in describing the response of the fishery to past management actions and predicting how the Amendment 8 alternatives may affect human communities. Additionally, this section establishes a descriptive baseline for the fishery with which to compare actual and predicted future changes that result from management actions.

1.6.1 Herring Fishery

1.6.1.1 Background Information

Atlantic herring has been integral to New England's industry and culture since at least the 1700s (Smylie 2004, p. 76-84). Today, the U.S. Atlantic herring fishery occurs over the Northwest Atlantic shelf region from Cape Hatteras to Maine, including an active fishery in the inshore Gulf of Maine and seasonally on Georges Bank (Figure X map of stock area). The Atlantic herring resource is managed as one stock complex, but this stock is thought to be comprised of inshore and offshore components that segregate during spawning. In recognition of the spatial structure of the herring resource, the Atlantic herring Annual Catch Limit (ACL) is divided into sub-ACLs and assigned to four herring management areas. Area 1 is the Gulf of Maine (GOM) divided into an inshore (Area 1A) and offshore section (Area 1B); Area 2 is located in the coastal waters between MA and NC (generally referred to as southern New England/Mid-Atlantic), and Area 3 is on Georges Bank (GB).

The Atlantic herring fishery is generally prosecuted south of New England in Area 2 during the winter (January-April), and oftentimes as part of the directed mackerel fishery. There is overlap between the herring and mackerel fisheries in Area 2 and in Area 3 during the winter months, although catches in Area 3 tend to be relatively low. The herring summer fishery (May-August) is generally prosecuted throughout the GOM in Areas 1A, 1B and in Area 3 (GB) as fish are available. Restrictions in Area 1A have pushed the fishery in the inshore GOM to later months (late summer). The midwater trawl (single and paired) fleet is restricted from fishing in Area 1A in the months of January through September because of the Area 1A sub-ACL split (0% January-May) and the purse seine-fixed gear only area (all of Area 1A) that is effective June-September. A sub-ACL split for Area 1B (0% January – April, 100% May – December) is effective for all vessels during the 2014 and 2015 fishing years.

Fall and winter fishing (September-December) tends to be more variable and dependent on fish availability; the Area 1A sub-ACL is always fully used, and the inshore GOM fishery usually closes around November. As the 1A and 1B quotas are taken, larger vessels become increasingly dependent on offshore fishing opportunities (Georges Bank, Area 3) when fish may be available. Atlantic herring is also caught in state waters and in the New Brunswick weir fishery.

1.6.1.2 Atlantic Herring Catch

The Atlantic herring stockwide ACL and management area sub-ACLs are tracked/ monitored based on the ***total catch – landings and discards***, which is provided and required by herring vessels through the vessel monitoring system (VMS) catch reports and vessel trip reports (VTRs) as well as through Federal/state dealer data. Atlantic herring harvesters are required to report discards in addition to landed catch through these independent reporting methods.

NMFS' catch estimation methods for the Atlantic herring fishery are described in detail in both Framework Adjustment 2 and Framework Adjustment 3 to the Atlantic Herring FMP (Section 3.6.1 of Framework 3, NEFMC 2014). The following bullets briefly describe how catch estimates have been derived:

- 2004-2006 Atlantic herring catch estimates are provided from quota management implemented by NMFS through the Atlantic Herring FMP and are based on interactive voice reporting (IVR) data from the call-in system used to monitor TACs. Reported herring discards are included in the totals.
- 2007-2009 Atlantic herring catch estimates are based on IVR data supplemented with dealer data. Reported herring discards are included in the totals.
- 2010-current Atlantic herring catch estimates are based on a comprehensive methodology developed by NMFS in response to Amendment 4 provisions and the need to better monitor sub-ACLs. Catch estimates are based on landings data obtained from dealer reports (Federal and State), supplemented with VTRs (Federal and State of Maine) with the addition of discard data from extrapolated observer data.

The vast majority of the Atlantic herring resource is harvested in Federal waters (Table 10). Catch by Federal permit holders that occurs in State waters is reported and counted against the sub-ACLs. Catch by state-only permit holders is monitored by the ASMFC and is not large enough to substantially affect management of the Federal fishery and the ability to remain under the sub-ACLs (Section 1.6.1.13). Catch in the New Brunswick weir fishery is accounted for under the management uncertainty buffer (Section 1.6.1.14).

Atlantic herring catch has been variable from 2004-2016, averaging 90,000 mt, with the highest catch in 2009 (103,943 mt) and lowest in 2016 (64,801 mt;

Table 11; Figure 8). However, the quota allocated to the fishery (stockwide ACL) has decreased during this time. Consequently, the Atlantic herring fishery has become more fully used in recent years, with the exception of 2015 when the fishery became constrained by the Georges Bank Haddock catch cap accountability measure. Total catch is substantially lower today than during the late 1960s to mid-1970s, during the years of foreign fishing (peak at 477,767 mt in 1968; Deroba 2015).

The temporal and spatial variability of the Atlantic herring fishery may be understood by examining the quota use in each management area on a monthly basis over the course of the fishing year. In general, the fishery concentrates in Area 2 during the first few months of the year, then effort shifts towards Area 1A through the summer and fall, as well as into Area 3 during the fall and early winter. Area 1B is used throughout the year as fish and markets are available.

Table 10 - Atlantic herring catch (mt), 1970-2014

Year	mobile	U.S. fixed	Total U.S. catch	NB weir	Total catch
1970	302,107	4,316	**306,423**	15,070	**321,493**
1971	327,980	5,712	**333,692**	12,136	**345,828**
1972	225,726	22,800	**248,526**	31,893	**280,419**
1973	247,025	7,475	**254,500**	19,053	**273,553**
1974	203,462	7,040	**210,502**	19,020	**229,522**
1975	190,689	11,954	**202,643**	30,816	**233,459**
1976	79,732	35,606	**115,338**	29,207	**144,545**
1977	56,665	26,947	**83,612**	19,973	**103,585**
1978	52,423	20,309	**72,732**	38,842	**111,574**
1979	33,756	47,292	**81,048**	37,828	**118,876**
1980	57,120	42,325	**99,445**	13,526	**112,971**
1981	26,883	58,739	**85,622**	19,080	**104,702**
1982	29,334	15,113	**44,447**	25,963	**70,410**
1983	29,369	3,861	**33,230**	11,383	**44,613**
1984	46,189	471	**46,660**	8,698	**55,358**
1985	27,316	6,036	**33,352**	27,864	**61,216**
1986	38,100	2,120	**40,220**	27,885	**68,105**
1987	47,971	1,986	**49,957**	27,320	**77,277**
1988	51,019	2,598	**53,617**	33,421	**87,038**
1989	54,082	1,761	**55,843**	44,112	**99,955**
1990	54,737	670	**55,407**	38,778	**94,185**
1991	78,032	2,133	**80,165**	24,574	**104,739**
1992	88,910	3,839	**92,749**	31,968	**124,717**
1993	74,593	2,288	**76,881**	31,572	**108,453**
1994	63,161	539	**63,700**	22,242	**85,942**
1995	106,179	6	**106,185**	18,248	**124,433**
1996	116,788	631	**117,419**	15,913	**133,332**
1997	123,824	275	**124,099**	20,551	**144,650**
1998	103,734	4,889	**108,623**	20,092	**128,715**
1999	110,200	654	**110,854**	18,644	**129,498**
2000	109,087	54	**109,141**	16,830	**125,971**
2001	120,548	27	**120,575**	20,210	**140,785**
2002	93,176	46	**93,222**	11,874	**105,096**
2003	102,320	152	**102,472**	9,008	**111,480**
2004	94,628	96	**94,724**	20,685	**115,409**
2005	93,670	68	**93,738**	13,055	**106,793**
2006	102,994	1,007	**104,001**	12,863	**116,864**
2007	81,116	403	**81,519**	30,944	**112,463**
2008	84,650	31	**84,681**	6,448	**91,129**
2009	103,458	98	**103,556**	4,031	**107,587**
2010	67,191	1,263	**68,454**	10,958	**79,412**
2011	82,022	421	**82,443**	3,711	**86,154**

2012	87,164	9	**87,173**	504	**87,677**
2013	95,182	9	**95,191**	6,431	**101,622**
2014	92,651	518	**93,169**	2,149	**95,318**
Source: Deroba (2015). *Note:* The NB weir catch includes the shutoff fishery.					

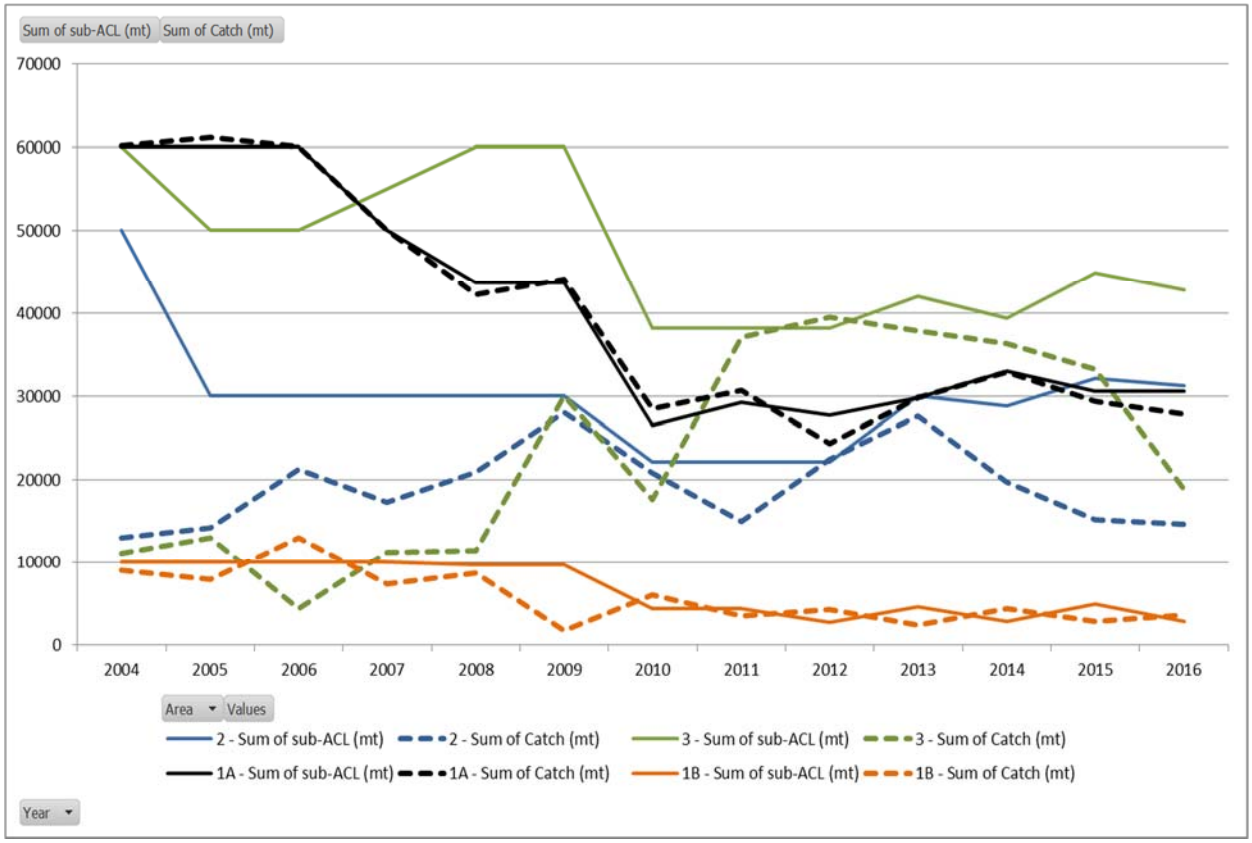
Table 11 - Atlantic herring sub-ACL allocations and catch by year and management area, 2004-2016

Year	Sub-Area	sub-ACL (mt)	Catch (mt)	% Harvested
2004	1A	60,000	60,095	100%
	1B	10,000	9,044	90%
	2	50,000	12,992	26%
	3	60,000	11,074	18%
2005	1A	60,000	61,102	102%
	1B	10,000	7,873	79%
	2	30,000	14,203	47%
	3	50,000	12,938	26%
2006	1A	60,000	59,989	100%
	1B	10,000	13,010	130%
	2	30,000	21,270	71%
	3	50,000	4,445	9%
2007	1A	50,000	49,992	100%
	1B	10,000	7,323	73%
	2	30,000	17,268	58%
	3	55,000	11,236	20%
2008	1A	43,650	42,257	97%
	1B	9,700	8,671	89%
	2	30,000	20,881	70%
	3	60,000	11,431	19%
2009	1A	43,650	44,088	101%
	1B	9,700	1,799	19%
	2	30,000	28,032	93%
	3	60,000	30,024	50%
2010	1A	26,546	28,424	107%
	1B	4,362	6,001	138%
	2	22,146	20,831	94%
	3	38,146	17,596	46%
2011	1A	29,251	30,676	105%
	1B	4,362	3,530	81%
	2	22,146	15,001	68%
	3	38,146	37,038	97%
2012	1A	27,668	24,302	88%
	1B	2,723	4,307	158%
	2	22,146	22,482	102%
	3	38,146	39,471	103%

2013	1A	29,775	29,820	100%
	1B	4,600	2,458	53%
	2	30,000	27,569	92%
	3	42,000	37,833	90%
2014	1A	33,031	32,898	100%
	1B	2,878	4,399	153%
	2	28,764	19,626	68%
	3	39,415	36,323	92%
2015	1A	30,580	29,406	96%
	1B	4,922	2,889	59%
	2	32,100	15,214	47%
	3	44,910	33,256	74%
2016	1A	30,524	27,806	91%
	1B	2,844	3,624	127%
	2	31,227	14,594	47%
	3	42,765	18,777	44%

Note: Shaded rows are sub-ACL overages.
Source: GARFO [confirm 2016 numbers]

Figure 8 – Atlantic herring sub-ACLs (solid lines) and catch (dashed lines) by year and management area, 2004-2016



1.6.1.3 Current Specifications

The Atlantic herring ABC for 2016-2018 is at the level recommended by the SSC (111,000 mt, Table 12, Table 13) and maintains the 2013-2015 specification of management uncertainty for 2016-2018. The management uncertainty buffer is specified at 6,200 mt to account for catch in the New Brunswick weir fishery. All other Atlantic herring fishery specifications for 2016-2018 are unchanged, including set-asides and the seasonal (monthly) distribution of sub-ACLs (Table 2). There is a provision that would allow for 1,000 mt of Atlantic herring to be returned to the Area 1A fishery from the management uncertainty buffer if certain conditions are met.

Table 12 - 2016-2018 Atlantic herring fishery specifications

Specification	2016-2018
OFL	2016 – 138,000 2017 – 117,000 2018 – 111,000
ABC	111,000
Management Uncertainty	6,200 (Value in 2015)
ACL/OY	104,800[1]
DAH	104,800
DAP	100,800
USAP	0
BT	4,000
Area 1A Sub-ACL (28.9%)	30,300
Area 1B Sub-ACL (4.3%)	4,500
Area 2 Sub-ACL (27.8%)	29,100
Area 3 Sub-ACL (39%)	40,900
RSA	3%
FGSA	295

[1]***NB Weir Payback Provision –*** If, by considering landings through ***October 1*****,** NMFS determines that under 4,000 mt has been caught in the NB weir fishery, NMFS will allocate an additional 1,000 mt to the Area 1A sub-ACL to be made available to the directed herring fishery as soon as possible, through the remainder of the fishing year (until the AM is triggered). If this occurs, the stockwide Atlantic herring ACL would increase to **105,800 mt**.

Table 13 - Seasonal (monthly) sub-ACL divisions, 2016-2018

Area	Seasonal sub-ACL division
1A	0% January-May; 100% June-December
1B	0% January-April; 100% May-December

These specifications include the Council's recommendations for river herring/shad catch caps in the directed Atlantic herring fishery for the 2016-2018 fishing years (Table 14). The proposed RH/S catch caps would continue to apply to midwater trawl vessels in the Gulf of Maine and Cape Cod Catch Cap Areas, and to both midwater trawl and small mesh bottom trawl vessels in the southern New England/Mid-Atlantic Catch Cap Area (see RH/S Catch Cap Areas, Figure X) on all trips landing over 6,600 pounds of Atlantic herring. No RH/S catch cap would be adopted for the GB Catch Cap Area.

Table 14 - River herring/shad catch caps, 2016-2018

RH/S Catch Cap Area	2016-2018 RH/S Catch Cap (mt)
GOM	Midwater Trawl – 76.7
CC	Midwater Trawl – 32.4
SNE/MA	Midwater Trawl – 129.6 Bottom Trawl – 122.3
GB	0

1.6.1.4 Atlantic Herring Permit Categories

Amendment 1 to the Herring FMP established a limited access program in the herring fishery with three limited access (A, B, C) and one open access (D) permit category (Table 15). The Category E Atlantic herring permit was established through Amendment 5 (implemented March 2014). Vessels that have not been issued a limited access herring permit, but that have been issued a limited access mackerel permit, are eligible for this permit.

Table 15 - Atlantic herring permit categories

	Category	Description
Limited Access	A	Limited access in all management areas.
	B	Limited access in Areas 2 and 3 only.
	C	Limited access in all management areas, with a 25 mt (55,000 lb) Atlantic herring catch limit per trip and one landing per calendar day.
Open Access	D	Open access in all management areas, with a 3 mt (6,600 lb) Atlantic herring catch limit per trip and one landing per calendar day.
	E	Open access in Areas 2 and 3 only, with a 9 mt (20,000 lb) Atlantic herring catch limit per trip and landing per calendar day.

1.6.1.5 Atlantic Herring Vessels

The following describes the vessels participating in the Atlantic herring fishery from 2008-present, including nominal revenues for herring trips. Here, an active herring trip is defined liberally as any trip in which at least one pound of Atlantic herring is retained. Since 2008, the number of vessels with an Atlantic herring permit has decreased annually (Table 16). This includes a decrease in the limited access directed fishery vessels (Categories A and B), with 36 permitted in 2016. In 2015, X% of the limited access vessels were active (defined broadly as landing at least one pound of Atlantic herring during the fishing year). Many of the Category A,

B, and C vessels are also active in the Atlantic mackerel fishery (managed by the MAFMC). For the open access vessels, just 3-5% of the Category D permits have been active since 2008. The Category E permit was implemented during permit year 2013 (May-April). In 2014, there were 53 E permits issued, mostly to vessels with a D permit as well. About 11% of the E permits were active that year.

Table 16 - Fishing vessels with federal Atlantic herring permits, 2008-2016

Permit Category		2008	2009	2010	2011	2012
Limited Access	A	44 (64%)	44 (66%)	43 (63%)	42 (64%)	38 (61%)
	B/C	5 (40%)	4 (75%)	4 (75%)	4 (50%)	4 (50%)
	C	53 (13%)	51 (25%)	51 (33%)	45 (20%)	46 (24%)
	Total	**102 (34%)**	**99 (45%)**	**98 (48%)**	**91 (52%)**	**88 (41%)**
D		2,390 (3%)	2,373 (3%)	2,231 (5%)	2,038 (4%)	2,026 (4%)
		2013	**2014**	**2015**	**2016**	
Limited Access	A	39 (63%)	40 (67%)	42 (X%)	36 (X%)	
	B, C	4 (75%)	4 (50%)	4 (X%)	4 (X%)	
	C	44 (34%)	41 (21%)	41 (X%)	37 (X%)	
	Total	**87 (42%)**	**86 (44%)**	**87 (X%)**	**77 (X%)**	
Open Access	D	1,935 (4%)	1,817 (3%)	1,747 (X%)	1,616 (X%)	
	D/E	6	52 (11%)	54 (X%)	53 (X%)	
	E	0	1*	1*	1*	
	Total	**1,941 (4%)**	**1,870 (3%)**	**1,802 (X%)**	**1,670 (X%)**	

Sources: NMFS Permit database (*http://www.nero.noaa.gov/permits/permit.html*) and VTR database. *Note:* In parentheses are the percent active vessels, defined as having landed at least one pound of Atlantic herring. This includes all pair trawl vessels, whose partner vessel landed the catch. Data as of August 2015 (2008-2012) and September 2016 (2013-2016).
n/a = The Category E permits could first be issued at the end of 2013, but could not become active until 2014.
*Data confidentiality restrictions preclude reporting the percent active.

Although there have been far fewer active limited access versus open access vessels, the limited access vessels account for about 97% of annual Atlantic herring landings and revenues (Table 17).

Table 17 – Percent contribution of herring vessels by permit category to total landings, 2013-2016

Permit Category		2013	2014	2015	2016
Limited Access	A	X%	X%	X%	X%
	B/C	X%	X%	X%	X%
	C	X%	X%	X%	X%
Open Access (all D and E)		X%	X%	X%	X%

Source: NMFS VTR database. This includes all pair trawl vessels, whose partner vessel landed the catch. Data as of Month 2016.
n/a = The Category E permits could first be issued at the end of 2013, but could not become active until 2014.
*Data confidentiality restrictions preclude reporting the percent contribution of vessels with just a Category E permit. Thus, Categories D and E are combined here.

1.6.1.5.1 Limited Access Category A Vessels

The Category A vessels comprise the majority of fishery landings (Table 17). In 2016, these vessels ranged in length from 21' to 146' (including inactive vessels), and 72% are over 80' (Table 18).

Table 18 - Vessel length for vessels with a Category A herring permit, 2014-2016

Year		2013	2014	2015	2016
Vessel length	<60	2	3	5	2
	60-80	7	8	8	8
	>80	30	29	29	26
	Total	**39**	**40**	**42**	**36**

Source: NMFS Permit database (*http://www.nero.noaa.gov/permits/permit.html*). Data as of September 2016.

Table 19 reports the landings by species and in Herring Management Areas of Category A herring vessels. Category A permit holders caught mackerel, menhaden and squid primarily in Area 2.

Table 19 – Landings by species for vessels with a Category A herring permit, 2013-2016

Area	Species	2013	2014	2015	2016
1A	Herring	[update]			
	Mackerel				
	Menhaden				
	Squid				
	Other				
1B	Herring				
	Mackerel				
	Menhaden				
	Squid				
	Other				
2	Herring				
	Mackerel				
	Menhaden				
	Squid				
	Other				
3	Herring				
	Mackerel				
	Menhaden				

	Squid				
	Other				
Total	**Herring**				
	Mackerel				
	Menhaden				
	Squid				
	Other				
Source: NMFS VTR data C = Confidential.					

1.6.1.5.2 Limited Access Category B/C and C Vessels

In 2016, vessels with a Category B/C or C permit ranged in length from 34' to 94' (including inactive vessels), and just 15% are over 80', primarily in the 60-80' range (Table 20). There are no vessels currently with just a Category B permit. Vessels either carry a B/C combination or just a C permit (limited access incidental catch). Thus, other fisheries are important to these vessels, more so than the Category A vessels.

Table 20 - Vessel length for vessels with a Category B/C or C herring permit, 2013-2016

Year		2013	2014	2015	2016
Vessel length	<60	17	16	16	14
	60-80	26	24	23	21
	>80	5	5	6	6
	Total	**48**	**45**	**45**	**41**
Source: NMFS Permit database (*http://www.nero.noaa.gov/permits/permit.html*). Data as of September 2016.					

Table 21 reports the landings of Category B/C and C permit vessel, summarized by the species caught and the area in which they were fished for. Category C permit holders caught menhaden, squid, and "Other" species primarily in Area 2, although some "Other" were caught in areas 1A and 3.

Table 21 - Herring Category B/C and C vessel landings by species, 2013-2016

Area	Species	2013	2014	2015	2016
1A	Herring	[update]			
	Mackerel				
	Menhaden				
	Squid				
	Other				
1B	Herring				
	Mackerel				
	Menhaden				
	Squid				
	Other				
2	Herring				

	Mackerel				
	Menhaden				
	Squid				
	Other				
3	Herring				
	Mackerel				
	Menhaden				
	Squid				
	Other				
Total	**Herring**				
	Mackerel				
	Menhaden				
	Squid				
	Other				
Source: NMFS VTR data C = Confidential.					

1.6.1.5.3 Open Access Category Vessels (D and E)

In 2016, vessels with a Category D and/or E permit ranged in length from 6' to 159' (including inactive vessels), and just 15% are over 80', primarily in the 60-80' range (Table 20). Other fisheries are important to these vessels, more so than the limited access vessels.

Table 22 - Vessel length for vessels with a Category D and/or E herring permit, 2013-2016

Year		2013	2014	2015	2016
Vessel length	<60	1,383	1,324	1,259	1,139
	60-80	348	346	338	329
	>80	210	200	205	202
	Total	**1,941**	**1,870**	**1,802**	**1,670**
Source: NMFS Permit database (*http://www.nero.noaa.gov/permits/permit.html*). Data as of September 2016.					

Unlike Categories A-C, Category D and E vessels (open access incidental catch) are numerous and participate in a wide variety of fisheries throughout the Northeast region. Category D vessels only land a small amount of herring. Table 23reports the landings of Category D and E permit vessels, summarized by the species caught and the area in which they were fished for.

Table 23 - Herring Category D and E vessel landings by species, 2013-2016

Area	Species	2013	2014	2015	2016
1A	Herring	[update]			
	Mackerel				
	Menhaden				
	Squid				
	Other				

1B	Herring				
	Mackerel				
	Menhaden				
	Squid				
	Other				
2	Herring				
	Mackerel				
	Menhaden				
	Squid				
	Other				
3	Herring				
	Mackerel				
	Menhaden				
	Squid				
	Other				
Total	**Herring**				
	Mackerel				
	Menhaden				
	Squid				
	Other				
Source: NMFS VTR data C = Confidential.					

1.6.1.6 Fishery Effort

Atlantic herring vessels primarily use purse seines, single midwater trawls or midwater pair trawls for fishing gear, with the midwater pair trawl fleet harvesting the majority of landings since 2008 (Table 24, Table 25). Some herring vessels use multiple gear types during the fishing year. Single and pair trawl vessels generally fish in all areas (October-December in Area 1A), though Areas 1A and 1B account for less of their overall landings in recent years. The purse seine fleet fishes primarily in Area 1A and to a lesser extent, Areas 1B and Area 2, though in recent years, purse seines have not been active in Area 2. The single midwater trawl has been most active in Area 3. Small mesh bottom trawl vessels represented 5% of herring landings since 2008; other gear types (e.g., pots, traps, shrimp trawls, hand lines) comprise under 0.5% of the fishery. [include spatial distribution of effort]

Table 26 characterizes the fishing days, number of trips taken, and thousands of pounds landed by the area that was fished, the Category permit held, and the year. The number of fishing days for Category D vessels increased considerably between 2008 and 2010, likely due to changes in regulations of other fisheries, such as Amendment 16 to the Multispecies FMP. The number of trips and days fell in 2009 in Area 1B for Category A vessels but rebounded in 2010, while rising in Area 2 in 2009. [update]

Table 27 characterizes the fishing days, number of trips taken, and thousands of pounds landed by the area that was fished, the gear type, and the year. Area 2 has seen an increase in the number of bottom and midwater trawls fishing in the area, and Area 1B has had the number of

purse seines fishing within vary over the last three years. Area 2 and 3 has had fluctuating numbers of vessels fishing within them over the past three years.

Table 24 - Atlantic herring landings by fishing gear type and area, 2008-2011

Gear Type	Area 1A (mt)	Area 1B (mt)	Area 2 (mt)	Area 3 (mt)	Total
Bottom Trawl	463 (0.3%)	1 (0%)	14,288 (16%)	117 (0.1%)	**14,869 (4%)**
Single Midwater Trawl	6,340 (5%)	3,246 (17%)	4,886 (5%)	12,830 (14%)	**27,302 (8%)**
Midwater Pair Trawl	56,769 (43%)	12,612 (64%)	68,336 (76%)	78,518 (86%)	**216,235 (65%)**
Purse Seine	69,074 (52%)	3,696 (19%)	2,221 (2%)	0 (0%)	**74,991 (22%)**
Other	817 (0.6%)	0 (0%)	17 (0%)	1 (0%)	**834 (0.2%)**
Total	**133,463 (100%)**	**19,555 (100%)**	**89,748 (100%)**	**91,466 (100%)**	**334,231 (100%)**

Source: VTR database. September 2012.
Note: Data include all vessels that landed one pound or more of Atlantic herring.

Table 25 - Atlantic herring landings by fishing gear type and area, 2012-2014

Gear Type	Area 1A (mt)	Area 1B (mt)	Area 2 (mt)	Area 3 (mt)	Total
Bottom Otter Trawl	534 (1%)	16,967 (64%)	0 (0%)	267 (0%)	**17,768 (7%)**
Single and Pair Midwater Trawl	14,677 (18%)	9,068 (34%)	44,746 (100%)	110,227 (100%)	**178,718 (67%)**
Purse Seine	68,409 (82%)	310 (1%)	0 (0%)	0 (0%)	**68,719 (26%)**
Other	3 (0%)	0 (0%)	3 (0%)	0 (0%)	**6 (0%)**
Total	**83,623 (100%)**	**26,345 (100%)**	**44,749 (100%)**	**110,494 (100%)**	**265,211 (100%)**

Source: VTR database. August 2015. [update through 2016]
Note: Data include all vessels that landed one pound or more of Atlantic herring. Single and pair midwater trawl data are combined due to data confidentiality restrictions.

Table 26 - Herring trips, days, and herring landed (thousands of pounds) by area caught and category permit, 2008-2010 [update]

		Area 1A			Area 1B			Area 2			Area 3		
		2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Category A	Days at Sea	727	768	703	153	80	181	797	930	748	230	523	435
	Number of Trips	275	279	250	57	25	51	182	249	171	53	119	105
	000's of Pounds Landed	88,392	94,043	54,417	20,133	5,534	12,127	47,874	57,152	38,538	24,964	65,673	36,576
Category BC	Days at Sea							34	67	55			
	Number of Trips							31	62	48			
	000's of Pounds Landed							1,305	3,144	1,624			
Category C	Days at Sea	98	133	193	7			83	112	152		10	12
	Number of Trips	98	108	140	2			43	50	74		3	3
	000's of Pounds Landed	126	910	1,132	*C			23	196	522		*C	*C
Category D	Days at Sea	194	141	382	1		3	324	406	444	12		10
	Number of Trips	186	129	376	1		1	257	334	334	2		3
	000's of Pounds Landed	927	154	834	*C		*C	37	43	89	*C		*C

Source: NMFS VTR data
BC permits are vessels that had both B and C permits during the same year; C permits are vessels that only had a C permit during a year.
**C denotes a value for which under 3 boats reported, and cannot be reported for confidentiality reasons.*

Table 27 - Herring trips, days, and herring landed (thousands of pounds) by area caught and gear type, 2008-2010 [update]

		Area 1A			Area 1B			Area 2			Area 3		
		2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Bottom Trawl	Days at Sea	227	149	280	7		3	516	600	743	12	25	20
	Number of Trips	227	138	269	2		1	264	362	336	2	5	4
	000's of Pounds Landed	267	239	320	*C		*C	4,487	9,327	8,278	*C	200	1
Midwater Trawl	Days at Sea	17	46	32	31	13	40	49	129	75	22	64	103
	Number of Trips	4	18	11	10	3	10	11	22	18	5	13	24
	000's of Pounds Landed	2,506	4,565	4,643	2,984	*C	2,279	1,214	3,446	3,259	2,113	5,218	9,670
Pair Trawl	Days at Sea	222	203	298	71	46	103	562	634	405	208	444	330
	Number of Trips	66	79	89	27	13	26	131	162	97	48	104	80
	000's of Pounds Landed	32,496	41,838	33,644	11,574	3,494	7,708	43,535	47,756	29,221	22,851	60,259	26,765
Purse Seine	Days at Sea	498	578	464	52	21	38						2
	Number of Trips	211	215	205	21	9	15						1
	000's of Pounds Landed	53,605	48,304	16,439	5,606	1,395	2,140						*C

Source: VTR data
BC permits are vessels that had both B and C permits during the same year; C permits are vessels that only had a C permit during a year.
**C denotes a value for which under 3 boats reported, and cannot be reported for confidentiality reasons*

1.6.1.7 Fishery Employment

As in most fisheries in the country, the crew members of vessels do not receive a set wage; instead, they are compensated through the share system. Currently, crew share is usually 30-40%, and there is some variability in the way expenses are paid. For example, sometimes the variable costs are deducted "off the top." In this case, variable costs are subtracted from gross revenues and crew receives their share of those net proceeds. In other systems, the crew receives their share of gross revenues minus all of the variable costs. About 15 years ago, the shares were divided evenly with 50% to the owner, 50% split among the crew. Slowly, however, that ratio has changed.

Average crew sizes for Category A and B permit holders rage from four to ten people (Table 28 and Table 29), based on VTR reported crew sizes, by the home port listed in permit data and the gear used as listed in the VTR data, respectively.

Table 28 - Average crew size (including captain) by homeport for Category A and B vessels, 2008-2010 [update]

		2008	2009	2010	Average Across Years
MA	BOSTON	6	6	6	6
	GLOUCESTER	6	6	6	6
	NEW BEDFORD	5	5	5	5
	Average for MA	6	6	6	6
ME	BATH	6	5	4	5
	CUNDYS HARBOR	6	6	6	6
	HAMPDEN	7	7	7	7
	OWLS HEAD		5	4	5
	PORTLAND	6	6	6	6
	Average for ME	6	6	6	6
NH	NEWINGTON	6	5	5	6
	Average for NH	6	5	5	6
NJ	CAPE MAY	4	5	5	5
	Average for NJ	4	5	5	5
RI	DAVISVILLE	10	10	10	10
	NEWPORT	4	3	3	3
	POINT JUDITH	4	4	4	4
	Average for RI	5	4	5	5

Source: NMFS VTR data

Table 29 - Average crew size (including captain) by gear category (A and B), 2008-2010 [update]

	Gear	2008	2009	2010
Category A	Bottom trawl	6	5	6
	Mid-water trawl	5	6	5
	Pair trawl	5	5	5
	Purse Seine	6	7	6
	Average	6	6	5
Category B	Bottom trawl	4	4	3
Source: NMFS VTR data.				

Average crew sizes for Category C permit vessels range from two to five people (Table 30 and Table 31), based on VTR reported crew sizes, by the home port listed in permit data and the gear used as listed in the VTR data, respectively. The larger crews tend to come from ports in Massachusetts, New Jersey and New York.

Table 30 - Average crew size (including captain) by homeport for category C vessels, 2008-2010 [update]

		2008	2009	2010	Average Across Years
MA	GLOUCESTER	4	4	4	4
	NEWBURYPORT			3	3
	ROCKLAND		3	3	3
	Average for MA	4	4	4	4
ME	NEW HARBOR		5		5
	SOUTH BRISTOL		5	5	5
	Average for ME		5	5	5
NH	HAMPTON	2	2	3	2
	PORTSMOUTH	2		2	2
	RYE	2	2	2	2
	SEABROOK	2		2	2
	Average for NH	2	2	2	2
NJ	CAPE MAY	3		4	4
	Average for NJ	3		4	4
NY	MONTAUK	3	4	4	4
	Average for NY	3	4	4	4
RI	POINT JUDITH	2	2	2	2
	Average for RI	2	2	2	2

Source: NMFS Permit and VTR data

Table 31 - Average crew size (including captain) by gear type for Category C vessels, 2008-2010 [update]

Gear	2008	2009	2010
Bottom trawl	2	3	3
Purse seine		5	5
Average	2	4	4
Source: NMFS VTR data.			

1.6.1.8 Atlantic Herring Carrier Vessels

The Letters of Authorization (LOAs) issued by NMFS for the Atlantic herring fishery currently allow an unlimited amount of herring (or the amount allowed by the vessels' herring permit) to be transferred at-sea: (a) from herring catcher vessels to carriers; (b) between federally permitted herring vessels; and (c) from herring catcher vessels to non-permitted vessels for personal use as bait.

Table 32In 2010, 50 vessels received a LOA carrier exemption, doubling the number issued in 2006 (Table 23). Carrier activity, as reported in VTRs, was down though, from 58 reports in 2009 to 49 in 2010 (Table 33). Vessels can be issued both exemption types within one fishing year.

The list of vessels wanting to engage in carrier activities will change from year to year, and some of the vessels with Category D permits may already have VMS required by multispecies and scallop permits. The number of D vessels with LOAs increased from 11 in 2008 to 21 in 2010. These tables also illustrate the number of smaller vessels (under 50 feet) already have VMS, required by the herring permit that they possess.

Table 32 - Total herring vessels that received a letter of authorization by year and type of exemption [update]

Year	Transfer at sea LOA (#)	Carrier LOA (#)	Total LOA
2006	19	6	25
2007	27	16	43
2008	26	13	39
2009	23	18	41
2010	35	15	50
***Source:* NMFS permit data.**			

Table 33 - Total VTR herring carrier reports by year, 2007-2010 [update]

Year	Total VTR reports
2007	46
2008	33
2009	58
2010	49

1.6.1.9 Atlantic Herring Dealers and Processors

The number of Atlantic herring dealers has remained fairly constant since 2012 at just over 280 (Table 34). Dealer permits can be issued and cancelled throughout the year, so at any given time, the number of active dealer permits could fluctuate from the totals reported. Most of the Atlantic herring dealers are based in Maine, Massachusetts, Rhode Island, New York, and New Jersey.

Processing, with respect to the Atlantic herring fishery, is defined in the regulations as *the preparation of Atlantic herring to render it suitable for human consumption, bait, commercial uses, industrial uses, or long-term storage, including but not limited to cooking, canning, roe extraction, smoking, salting, drying, freezing, or rendering into meat or oil.* The definition of processing does not include trucking and/or transporting fish.

In many cases, a dealer of Atlantic herring is also involved in processing. Here, dealer activity is described followed by profiles of several business typical of the approximately 280 current dealers (and processors).

Table 34 - Atlantic herring dealer permits issued, 2012-2016 [update]

	2012	2013	2014	2015	2016
United States					
ME	76	83	84	85	77
NH	8	7	7	8	8
MA	57	61	60	62	67
RI	35	32	27	26	29
CT	2	2	3	3	4
VT	1	1	1	1	1
NY	52	50	50	48	49
NJ	26	26	26	28 (1)*	29(1)*
PA	2	2	2	2	4
DE	1		1	1	1
MD	3	3	3	2	2
VA	7	7	8	8	7
NC	9	8	8	8	8
GA	1	1	0	0	0
Canada					
NB	1	1	1	1	1
NS	1	3	3	3	3
Total					
	282	**287**	**284**	**286(1)**	**286(1)**

Source: GARFO permit database as of 7/31/2015. 2016 data as of September 2016.

Notes: 2015 permit counts are preliminary due to ongoing issuance. Individual entities may possess more than one permit type, i.e., total permits issued not equal to total number of dealers.

* One at-sea dealer permit has been issued in 2015 and 2016.

1.6.1.9.1 Dealer Activity

Table 35 shows the percent of herring dealers that purchased herring by the state that they purchased herring and the state in which they are registered. For instance, in 2010, dealers that were registered in Massachusetts bought 90% of their total herring purchases from landings within the state of Massachusetts, but purchased 7% of their herring from landings in Maine. They purchased no herring from New Jersey or New York, and 2% of their herring purchased was from landings that occurred within the state of Rhode Island. For the most part dealers purchased herring where were landed in their state , but Massachusetts and Maine had some out-of-state purchases. The significant numbers of dealers in Maine likely reflects the numbers and dispersal of small lobster fishing communities along the Maine coast that rely on herring as lobster bait.

Table 35 - Percent of herring purchased by federally permitted dealers, by state of registration, 2007-2010 [update]

2007		State of Purchase						Total Revenue
		MA	ME	NJ	NY	RI	Other	
State of Registration	MA	**82%**	9%	0%	0%	9%	0%	4,603
	ME	22%	**75%**	0%	0%	2%	1%	10,585
	NJ	2%	0%	**98%**	0%	0%	0%	421
	NY	2%	0%	1%	**98%**	0%	0%	18
	RI	1%	0%	0%	0%	**99%**	0%	372
	Other	32%	24%	0%	0%	0%	**44%**	118

2008		State of Purchase						Total Revenue
		MA	ME	NJ	NY	RI	Other	
State of Registration	MA	**91%**	7%	0%	0%	2%	0%	7,188
	ME	29%	**69%**	0%	0%	1%	0%	11,161
	NJ	6%	0%	**89%**	0%	0%	4%	468
	NY	0%	0%	0%	**99%**	0%	1%	36
	RI	8%	0%	0%	0%	**92%**	0%	330
	Other	56%	15%	0%	0%	0%	**29%**	255

2009		State of Purchase						Total Revenue
		MA	ME	NJ	NY	RI	Other	
State of Registration	MA	**96%**	2%	0%	0%	2%	0%	8,439
	ME	27%	**70%**	0%	0%	3%	1%	10,594
	NJ	0%	0%	**100%**	0%	0%	0%	1,168
	NY	12%	0%	0%	**88%**	0%	0%	24
	RI	5%	0%	0%	0%	**95%**	0%	603
	Other	50%	17%	0%	0%	0%	**33%**	468

2010		State of Purchase						Total Revenue
		MA	ME	NJ	NY	RI	Other	
State of Registration	MA	**90%**	7%	0%	0%	2%	0%	5,576
	ME	22%	**77%**	0%	0%	1%	0%	10,414
	NJ	0%	0%	**99%**	0%	1%	0%	246
	NY	0%	0%	9%	**91%**	0%	0%	9
	RI	2%	0%	0%	0%	**98%**	0%	630
	Other	7%	16%	0%	0%	0%	**77%**	279

Source: NMFS Dealer data

Note: "Other" includes the states of Connecticut, Delaware, Maryland, North Carolina, New Hampshire, and Virginia, to protect confidentiality.

1.6.1.9.2 Example Dealers and Processors [finish update]

The businesses summarized provide a snapshot of typical business involved in dealing and/or processing Atlantic herring. This information has been voluntarily provided by the businesses and has not been verified by the Herring PDT through any independent sources of information. Information was provided between November 2016 and May 2017.

BBS Lobster Trap Co. (Machiasport, ME)

Established in 1972 in Bourne, MA, Lobster Trap is a wholesale seafood distributor with facilities in Bourne, MA, Machiasport and Steuben, ME, as well as various storage locations in Canada. The subsidiary BBS Lobster Trap Company (http://www.lobstertrap.com/bbslobster) owns four lobster pounds and two buying stations in Machiasport and Steuben. The Maine locations service more than 40 lobster boats providing bait, fuel, and supplies. While considered secondary to their primary purpose, bait is a large operation, with storage capacity of 2 million pounds. Fresh and frozen whole herring, cuttings, and other varieties are sold in both retail and wholesale quantities (D. Walsh, pers. comm., 2017).

Cape Seafoods (Gloucester, MA)

Largely family-owned and operated, Cape Seafoods was established in 2001 specifically to process herring and mackerel. The products include frozen food grade herring and mackerel (blast frozen, whole round), sold domestically and internationally. In addition, Cape Seafoods' wholesale bait shop makes fresh, salted and frozen bait available, primarily for lobstermen but also tuna fishermen. The company's semi-automatic equipment packs whole round 20kg boxes. It has blast freezing capacity for up to 250 mt per day, cold-storage for about 4,000 pallet spaces, and a facility to store 300 tons of salted herring for bait. Bait is trucked all over and the drivers tend to be from Gloucester or nearby.

Prior to the drop in quotas, Cape Seafoods typically handled 25,000-30,000 tons of both species per year, but now only about 13,000 tons. Prior to the seasonal closure (January-April) of Area 1B, a significant percentage of the year's herring was landed January through March, though February weather could constrain vessels, and in March, the herring could start getting "feedy." The vessels target mackerel in March, but haddock accountability measures constrain their searches for mackerel. Herring from Georges Bank (Area 3) is usually caught in May until the quota is harvested (typically by mid-summer). In October and November, the vessels fish in Area 1A and in December in Area 2.

Employee numbers range from 25 to 50, depending on the volume of fish received. There are usually 24 seasonal employees supplied by an agency. When work was more predictable, many of the same employees would return each year.

In 1998, Cape Seafoods' partner company, Western Sea Fishing, owned three fishing vessels that fished half the year as scallopers and half as midwater trawlers. After Cape Seafoods opened in 2001, one vessel was sold and the other two enlarged to carry 450mt per vessel. Since then, these vessels have worked exclusively as herring and mackerel midwater trawlers. A third vessel was built due to market demand, strong quotas, and access to fish. With the three vessels, Western Sea employed 25 full-time, year-around. With the series of regulatory changes, one vessel was

sold, the Cape Seafoods facility was down-sized, staff was significantly reduced, catch dropped at least 50%, the company lost market share and has been operating at a loss. For the first time, survival of Cape Seafoods Inc. and Western Sea Fishing Company, along with their employees and infrastructure, is truly threatened.

Channel Fish Co., Inc. (East Boston, MA)

For more than 50 years, Channel Fish Company (http://channelfishco.com/) has been supplying the seafood industry with fresh and frozen fish products. A family-owned business, Channel Fish employs nearly 100 people in East Boston, Massachusetts, where it produces seafood for many markets, including frozen and salted fish for human consumption, animal feed, and lobster bait. Today, they are a leading supplier of frozen fish products to the pet food industry. Some of the major species processed are Atlantic herring, Atlantic mackerel, Atlantic menhaden, and Loligo squid. Channel Fish's pumping station on the Chelsea Creek in Boston Harbor is currently the only active pier in Boston for unloading small pelagic species. Channel Fish also trucks fresh herring and other species to its facility from points ranging from Downeast Maine to Cape May, NJ.

Connor Brothers (Blacks Harbour, NS)

In the late 1800's, two brothers fished from an open skiff off Blacks Harbour, then built a fishing weir to catch sardine-sized herring. A few years later, they started canning the small herring, eventually becoming the world's largest producer of canned sardines. Today, Connors Bros. Clover Leaf Seafoods Company produces a variety of shelf-stable seafood, most of which is sold under the Brunswick label (T. Hooper, pers. comm., 2017).

Lund's Fisheries, Incorporated (Cape May, NJ)

This family-owned company, established in 1954, purchases, produces and distributes nearly 75,000,000 pounds of fresh and frozen fish annually and employs about 200 people (full and part time). Currently, the company concentrates on mackerel, herring, illex and loligo squid and menhaden; although scup, butterfish, black sea bass, summer flounder, sea scallops, croaker, sea trout, bluefish and monkfish are also produced. Herring landed primarily from October to April is sold fresh for lobster bait and in blast or sea-frozen packs for other bait, and human and zoo food. Fresh and frozen seafood is sold domestically and internationally.

Lund's owns 15 vessels and another 15 typically deliver a variety of species of seafood to the facility. While most are home-ported in Cape May, other independently-owned vessels land in Rhode Island, New York, Virginia and North Carolina. Seven company-owned tractors and trailers deliver seafood from Maine to Texas. The ice plant produces 40 tons daily with a storage capacity of 100 tons. Lund's has a daily freezing capacity of 500 metric tons. An affiliated company, Shoreline Freezers in Bridgeton, NJ, can store up to 12,000 tons of frozen products. Lund's also has a West Coast production facility that freezes 5 to 15 million pounds of loligo squid annually (J. Kaelin, pers. comm., 2017).

The Northern Pelagic Group (NORPEL, New Bedford, MA)

NORPEL was established in 2002 as a pelagic processing plant, focusing primarily on herring (70%) and mackerel (30%). Herring is processed year around, while mackerel is primarily January-April. Norpel owns one fishing vessel, though it is not currently fishing. In addition, a variety of other boats deliver to the facility. Norpel exports herring to Nigeria for human consumption and provides herring for the bait market. Customers for bait include local

lobstermen and tuna fishermen, but occasionally an unanticipated market opens to fulfill an emergency need for herring or mackerel. In the last year, the company started grinding a specific combination of fish species to supply a pet food company, and bought one reefer truck to accommodate the grinding operation.

The company employs about 70 individuals when freezing herring and mackerel (including full and part time positions). Most seasonal employees are of Central American descent. Six to eight engineers and managers work for the processing plant full-time.

Processing capacity is 320 mt per day; freezing 2,240 mt per week in 40 vertical plate freezers. For a time, the company processed 30,000 to 40,000 mt annually; however, last year only 5,500 mt was frozen, due to the regulations that lead to the loss of a number of herring boats and the abundance of haddock that is a "choke" species for herring fishermen. On-site storage capacity of fresh fish in RSW holding tanks was about 600 mt, but now only 240 mt can be held in the tanks. There is additional cold storage available in an adjacent facility.

Purse Line Bait (Sebasco Estates, ME)

Purse Line Bait has been purchasing Atlantic herring for lobster bait since about 1993. Herring is purchased from purse seiners and trawl vessels landing in Maine and Massachusetts, pogies from New Jersey, and redfish and other species from around New England. The fish is trucked to their main facility in Sebasco Estates, ME where it is salted and barreled, then sold to about 40 lobster buyers between Harpswell and Rockland, ME. Purse Line has two freezer facilities, in Sebasco and Harpswell, where about 2M pounds of product can be stored for the times when no product is coming in. Americold Cold Storage in Portland, ME is used for overflow. Eighty-five percent of their sales are to lobster buyers, with the remainder sold off dump trucks. Of about 20M pounds in overall sales per year, 12M are herring, 5M are pogies, and 3M are redfish and other species. In addition to purchasing from herring vessels, Purse Line Bait also purchases herring from Cape Seafoods in Gloucester, MA, O'Hara Corporation in Rockland, ME and from other sources. Purse Line Bait owns 10 trucks, employs about 8 or 9 people full-time, year around and 4 or 5 more seasonally.

Seafreeze, Ltd. (N. Kingstown, RI)

Seafreeze was established in 1984 by two fishermen. The company fishes and freezes at sea herring, mackerel, illex and loligo squid, and butterfish. Two high-capacity freezer trawlers, with 350 mt holding capacity, together can freeze about 110 mt of seafood per day in their plate freezers. While herring is primarily a back-up fishery, since it is available year around; most of the other species have a season. Mackerel's season is usually December to May, illex is May to October, loligo is September to April and butterfish is December to March. Seafreeze sells frozen product domestically (30%) and internationally (70%), including bait to longline fleets. Eastern Europe and Asia purchase from Seafreeze; Canada purchases mackerel for bait; illex is used domestically for bait in groundfish, swordfish and tuna fisheries, as well as in the lobster and crab fisheries. Zoos and aquariums also purchase Seafreeze products. The company's cold storage facility capacity is 12,000 mt. The plant employs 60 full-time people including 10 administrative and managerial staff; 20 fishing vessel crew working rotating shifts; and 15 individuals in the storage facility.

Regulatory changes in the loligo fishery and groundfish have required shifts among the fisheries. The company has found it essential to diversify so that they are not too dependent on any one

species. They have also increased their cold storage facility, allowing them to operate as a public cold storage facility.

1.6.1.10 Border Transfer

"Border Transfer" is U.S.-caught herring shipped to Canada via Canadian carrier vessels and used for human consumption. This specification is not a set-aside; rather, it is a maximum amount of Atlantic herring caught from Area 1A that can be transshipped to Canadian vessels for human consumption. GARFO tracks BT use through a separate dealer code. Specification of BT has remained at 4,000 mt since the implementation of the Atlantic Herring FMP. Table 36 indicates a decrease in BT from 1994-2013, with 2011 using 838 mt (21% of 4,000 border transfer mt). No BT occurred from 2008-2010, but some amount occurred in 2011-2013.

Table 36 - Herring catch in Area 1A shipped to Canada via Canadian carrier vessels (i.e., border transfer), 1994 – 2013 [update]

Year	Border transfer (mt)
1994	2,456
1995	2,117
1996	3,690
1997	1,280
1998	1,093
1999	839
2000	1,546
2001	445
2002	688
2003	1,311
2004	184
2005	169
2006	653
2007	53
2008	0
2009	0
2010	0
2011	946
2012	788
2013	838
Source: NMFS.	

1.6.1.11 Fishery Economics

Prices. Between 2008-2014, Atlantic herring catch ranged from 72,852-103,943 mt annually, while nominal prices generally ranged from about $160-350 per mt (Figure 9 and Figure 10). Overall, Atlantic herring prices have been increasing over time, with a peak in 2013. Atlantic herring caught in the Northeast U.S. is eaten by consumers worldwide and used as lobster bait. There are likely to be good substitutes for both uses; therefore, prices are likely insensitive to quantity changes.

In general, prices will decrease when quantity supplied increases, and prices will increase when quantity supplied decreases. The extent to which prices are responsive to changes in quantities supplied (and therefore by changes in ACLs and sub-ACLs) depends on the availability of good substitutes. If good substitutes are available, then prices will not be sensitive to changes in quantity supplied. However, if good substitutes are not available, then prices will be quite sensitive to changes in quantity supplied.

Figure 9 - Average nominal price per metric ton of Atlantic herring, 2008-2012 [update]

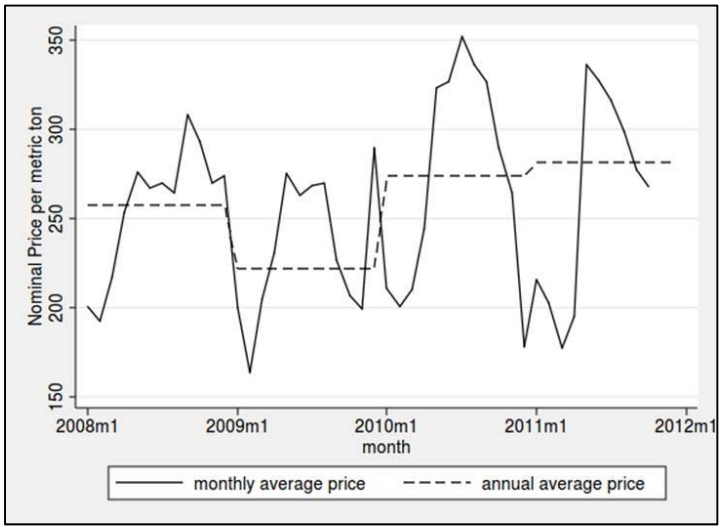
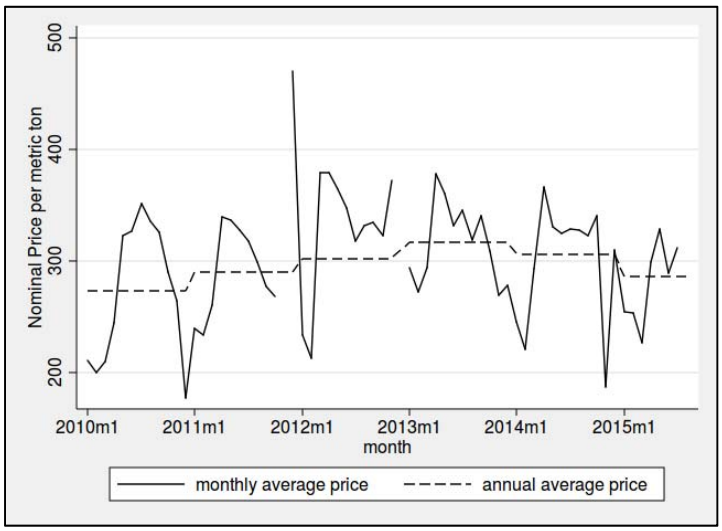


Figure 10 - Average nominal price per metric ton of Atlantic herring, 2010-2015



Revenue by state. [insert]

Revenue by permit category. Table 37 has percentage of total revenue from Atlantic herring by the total revenue for each permit category from 2008-2011 for trips landing Atlantic herring, showing the contribution of Atlantic herring revenues to those trips. Category A vessels catching Atlantic herring in Areas 1A, 1B, and 3 are catching herring almost exclusively (e.g., Category A vessels in Area 1A derived 98% of revenue from herring when landing herring). However, when these vessels catch herring in Area 2, a substantial portion of revenues (nearly 40%) are attributable to other species. Category C and D vessels have derived relatively small amounts of revenue from herring trips. The remainder of the revenue for these vessels is derived from other species (e.g., whiting).

Table 37 - Percent of total revenue from Atlantic herring by total revenue for each permit category and management area for trips landing Atlantic herring, 2008-2011

	Category A	Category B/C	Category C	Category D
Area 1A	99.9%		55.1%	32.8%
Area 1B	99.7%			
Area 2	61.6%	94.8%	6.7%	2.5%
Area 3	96.8%			1.2%
Total	**86.4%**	**94.8%**	**30.3%**	**11.2%**

Table 38 updates Table 37 for 2012-2014, showing the importance of each management area to vessels of the different permit categories. Category A vessels caught Atlantic herring almost exclusively in all areas, more so than in 2008-2011 (Table 37). Area 2 continues to be important for Category B and C vessels. The open access permit vessels (Category D and E) still derive relatively little revenue from Atlantic herring (14% overall).

Table 38 - Importance of Atlantic herring for each permit category and management area, 2012-2014

	Category A	Category B or C	Category D or E
Area 1A	98%	42%	26%
Area 1B	85%		minimal*
Area 2	85%	77%	9%
Area 3	92%		minimal*
Total	**92%**	**69%**	**14%**

Note: "Importance" measured as the percentage of total revenue derived from Atlantic herring for trips that retained herring.

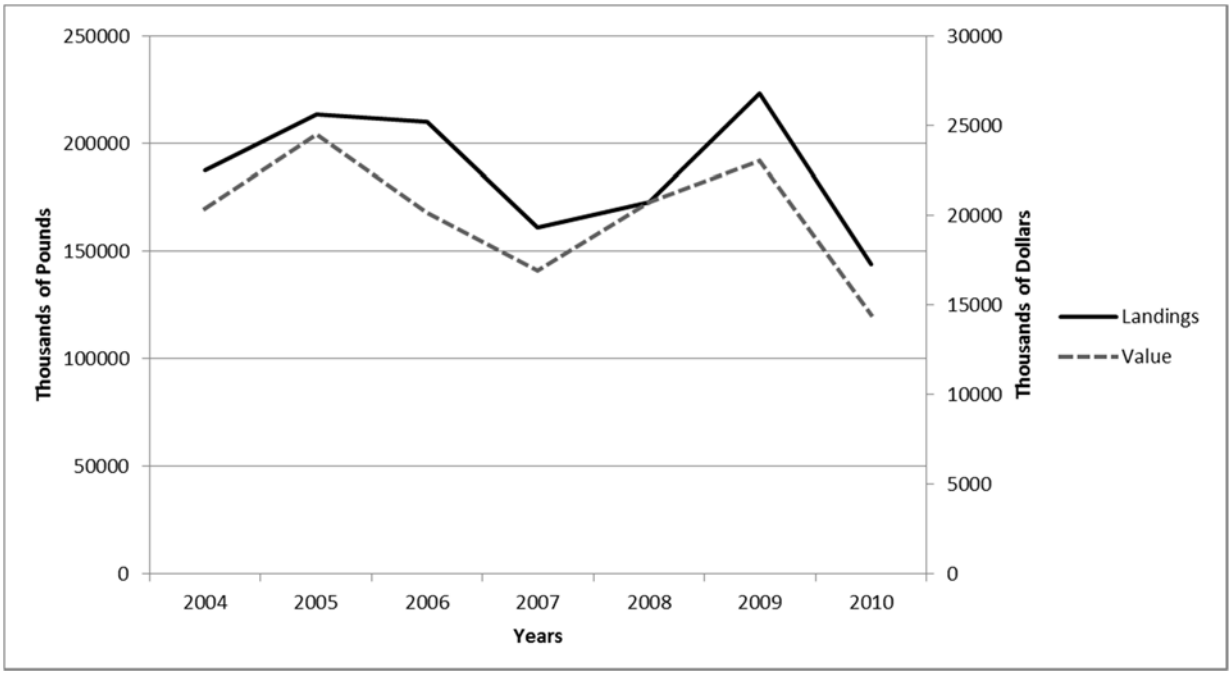
* There was a very small amount of herring revenue for the D/E vessels in these areas.

Note: The information provided in this section is based on herring VTR and Dealer data through 2010, however 2010 data are preliminary at the time of this writing; final 2010 catch totals will be provided by NMFS when available. Where noted, economic values have been adjusted for inflation using the Bureau of Labor Statistics Producer Price Index for Unprocessed Finfish, with the base set to January 2009. [update]

Figure 11 contains the total annual landings, in thousands of pounds, and value, in thousands of 2009 dollars, on a yearly scale. There is a slight downward trend, although 2005 and 2009 showed a slight increase from 2004 and 2008, respectively. Fishery value peaked in 2005 at a little over $27M for the over 200M pounds landed, however landings peaked in 2009. In 2010, there were 143,666,029 pounds of Atlantic herring were sold by federally permitted dealers for a total ex-vessel value of $17,918,000. This represents a 22% decrease in revenues from the 2009 fishing year, primarily due to the implementation of the 2010-2012 fishery specifications, which included significant reductions in herring catch limits. Figure 12 shows the total landings, in thousands of pounds, and the average real price per pound, in dollars, from 2005 to 2010, on a monthly time scale. Prices are cyclical and tend to be higher in the summer months and lower during the winter. This may be related to demand for herring as bait in the lobster fishery.

Categories A and B vessels specialize in small pelagics (herring, mackerel, and squid) while most of the C and D vessels catch herring either incidentally or seasonally in smaller amounts.

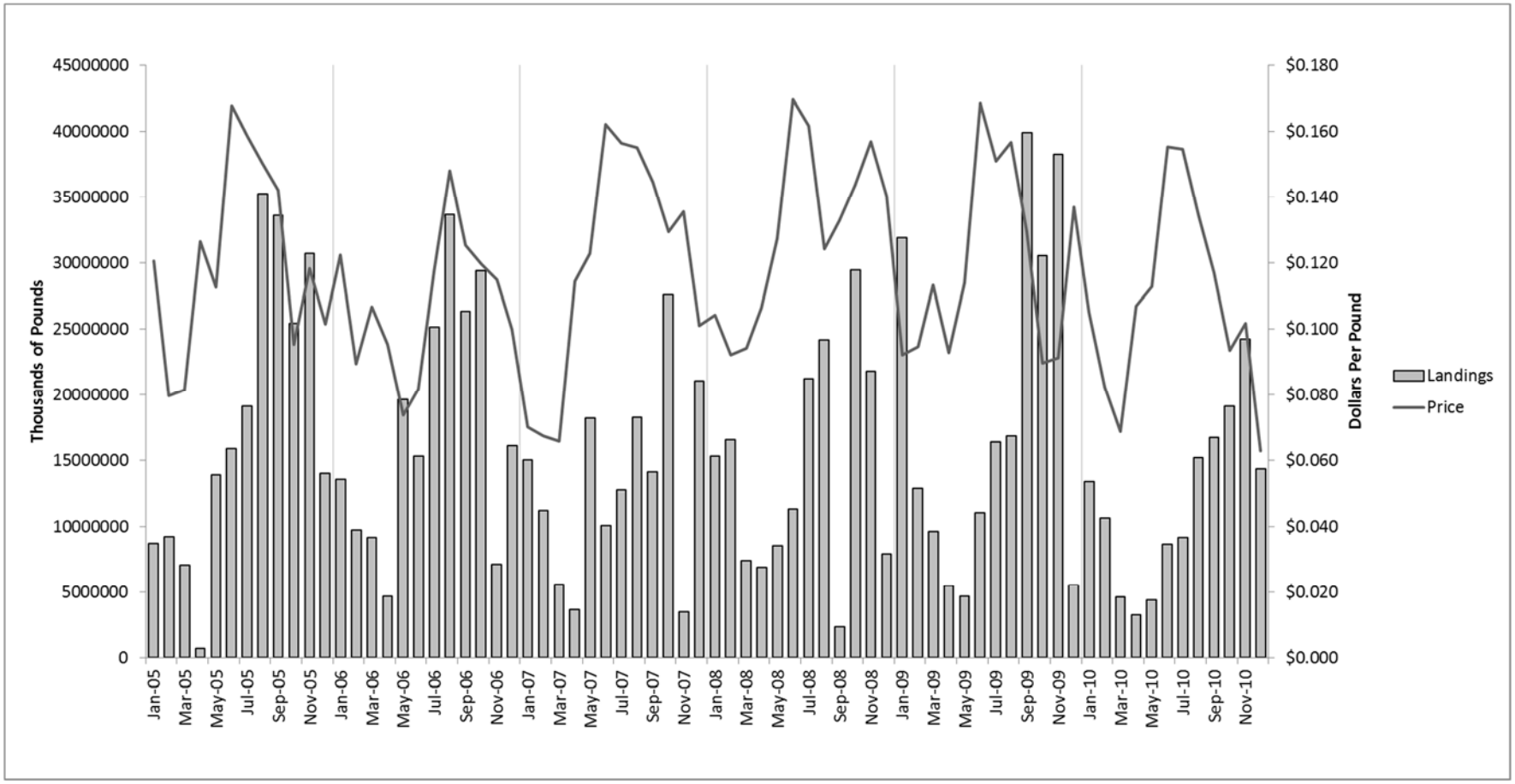
Figure 11 - Total annual landings (thousands of pounds) and value of herring (thousands of 2009 dollars), 2004 - 2010[update]



Source: Dealer data
Note: Numbers have been adjusted for inflation based on 2009 data.

Table 39 reports revenue and landings broken down by species, and the permit category to which the boat belonged from 2007 to 2010. For 2007, vessels were classified into the "new" Amendment 1 limited access categories (A/B/C/D), instead of the pre-Amendment 1 (1/2) categories.

Figure 12 - Total landings (thousands of pounds) and average price per pound (dollars), 2005 – 2010 [not needed?]



Source: NMFS dealer data.

Note: numbers have been adjusted for inflation based on 2009 data.

Table 39 - Total revenue (thousands of nominal dollars) and landings (thousands of pounds), by species caught and vessel category, 2007-2010 [update]

		Herring		Menhaden		Mackerel		Squid		Other	
	Category	Revenue	Landings	Revenue	Landings	Revenue	Landings	Revenue	Landings	Revenue	Landings
2007	A and B	19,102	167,077	364	6,300	6,908	60,690	9,739	22,745	12,850	8,142
	C	245	1,726	658	10,189	41	133	1,968	2,535	13,483	8,414
	D	457	4,745	1,383	21,096	362	3,350	16,583	20,304	485,582	190,375
2008	A and B	21,723	182,606	1,598	16,482	6,162	48,438	10,845	29,138	11,385	7,529
	C	26	152	791	11,959	47	150	4,172	7,014	20,054	12,451
	D	129	1,000	2,286	28,508	139	601	18,745	22,733	483,974	192,250
2009	A and B	23,919	225,651	361	3,752	8,409	49,135	10,008	34,813	10,778	6,196
	C	183	1,112	530	7,632	62	226	3,778	4,875	18,856	13,525
	D	33	215	1,359	17,334	217	923	14,802	21,205	481,273	195,363
2010	A and B	18,449	142,627	451	4,518	3,158	21,103	11,591	30,549	15,857	9,331
	C	322	1,655	673	10,291	44	157	3,170	4,593	21,725	13,896
	D	150	916	1,237	16,350	84	322	12,974	15,007	550,708	195,078

Source: NMFS Dealer data.

Note: The species category "Other" includes any other federally permitted species besides herring, menhaden, mackerel and squid.

The dependence of Category A and B vessels on small pelagics is illustrated in Table 40, which reports the fraction of revenue for the four permit Categories from 2007 to 2010. Category C vessels derived at 81.9% of their total revenues from species which were not small pelagics, while category D vessels derived over 97% of their revenue from those species. Clearly, the Category C and D vessels are not relying on the herring fishery for a large fraction of their fishery income – herring composes 1.9% and 0.2% of total revenue for those two permit categories.

Table 40 - Percent dependence of herring vessels on different species by permit category, calculated using revenue

		2007	2008	2009	2010	Average Across All Years
Category A	Herring	36%	44%	49%	44%	43%
	Menhaden	1%	3%	1%	2%	2%
	Mackerel	19%	14%	13%	7%	13%
	Squid	12%	15%	14%	18%	15%
	Other	32%	25%	23%	30%	27%
Category B	Herring	*C	*C	17%	13%	13%
	Menhaden	*C	*C	*C	*C	0%
	Mackerel	5%	1%	*C	0%	2%
	Squid	38%	42%	40%	29%	37%
	Other	45%	49%	41%	57%	48%
Category C	Herring	2%	0%	2%	3%	2%
	Menhaden	2%	3%	3%	2%	2%
	Mackerel	0%	0%	0%	0%	0%
	Squid	7%	13%	12%	13%	11%
	Other	88%	84%	83%	82%	84%
Category D	Herring	0%	0%	0%	0%	0%
	Menhaden	0%	0%	0%	0%	0%
	Mackerel	0%	0%	0%	0%	0%
	Squid	2%	2%	2%	2%	2%
	Other	97%	97%	97%	97%	97%

Source: NMFS Dealer data.

Note: The species category "Other" includes any other federally permitted species besides herring, menhaden, mackerel and squid.

*C = confidential

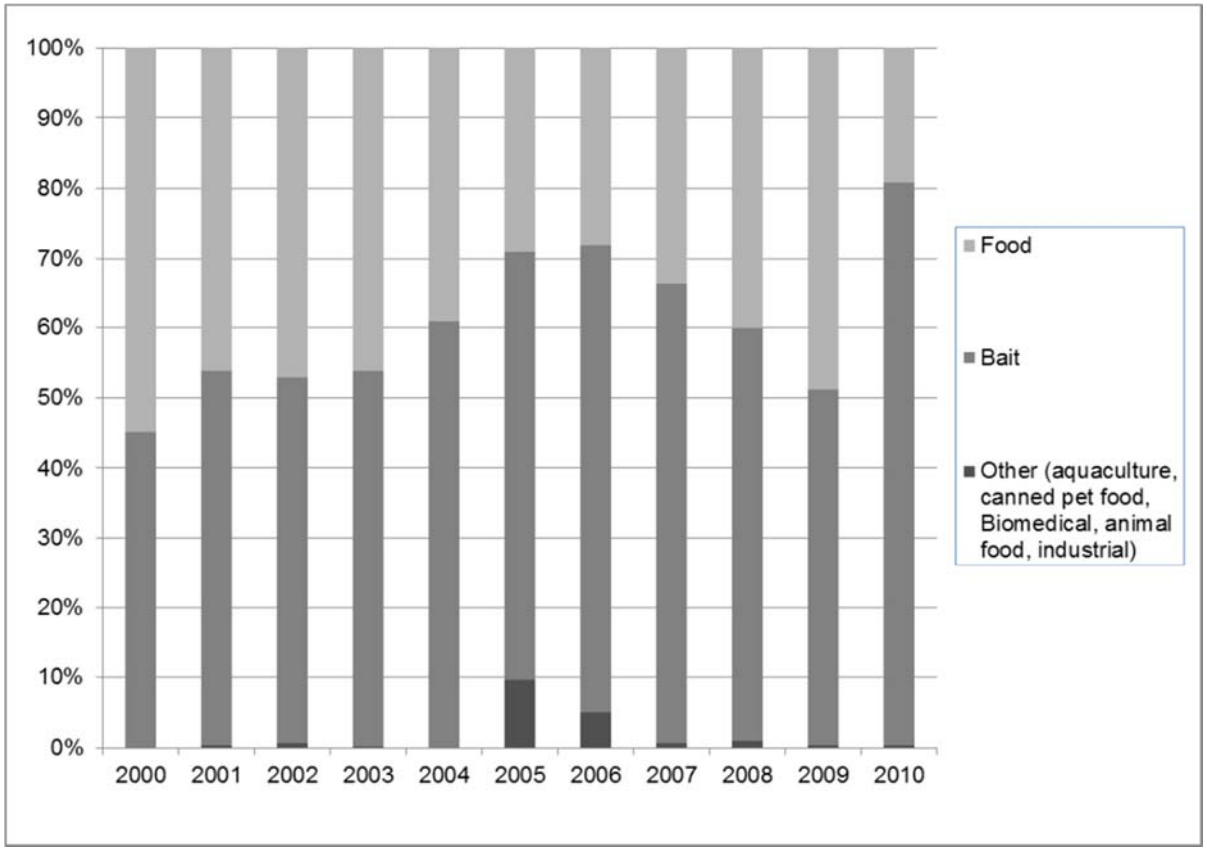
Vessel Costs. [update]

1.6.1.12 Use of Atlantic Herring and Substitute Goods

Used as bait: A large proportion of herring catch is used as bait. NMFS collects ex-vessel prices and does not systematically collect information about bait prices. Figure 13 has the percentage of reported herring landings used for bait and food from the dealer database during 2000-2010. Since 2001, over 50% of herring landings are sold for bait on an annual basis. Herring landings that were used as bait increased steadily from 2000 to 2006, from under 50% to over 70%. From 2007 -2009, the percentage of herring being used as bait decreased to about 50%, however in 2010 over 80% of the herring catch was used as bait. A small amount of the herring catch is used for non-food and non-bait purposes; this peaked in 2005 at nearly 10% and has declined steadily since that time. For ports in Maine (61%) and Massachusetts (36%), 97% of all herring landed was used for bait (NMFS dealer data).

Herring is used as bait for many fisheries, such as lobster, tuna, and various recreational fisheries. Generally, the herring used for bait goes through a large wholesale dealer to smaller dealers and lobster wharfs along the coast. The wholesale dealers generally have facilities where they sort, barrel, freeze and store bait for redistribution. The locations and processing and selling techniques also vary. For a more detailed description of herring as bait, and some the various ways in which herring are processed and sold, see Amendments 1 and 5.

Figure 13 - Herring landings reported for food, bait, and other uses, 2000-2010 [update]



Source: NMFS Dealer Data

The lobster industry, particularly in Maine, is dependent on herring as a bait source, though it depends on price and availability. A 2008 survey of 6,832 lobster license holders in Maine revealed that 58% of respondents answered "very much" to the question "Could the supply or price of herring for bait impact your decisions on how to fish?" (MEDMR 2008). For lobstermen surveyed from Maine, New Hampshire and Massachusetts who harvest in Lobster Conservation Management Area A (inshore Gulf of Maine), herring is the predominant bait source (Table 41). South of Massachusetts, lobstermen tend to use skate or other bait, as herring tends to break down in warmer water.

Table 41 - Bait use in the inshore Gulf of Maine lobster fishery

	Maine							NH	MA
	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Zone G		
Herring	90%	86%	73%	73%	84%	37%	75%	60%	76%
Pogies	3%	2%	0%	15%	14%	39%	11%	4%	13%
Redfish	1%	8%	12%	4%	1%	19%	8%	0%	0%
Racks	1%	2%	1%	2%	0%	1%	1%	26%	6%
Alewives	1%	1%	0%	1%	0%	0%	0%	0%	0%
Other	4%	2%	13%	5%	0%	4%	4%	9%	4%
Source: Dayton et al. (2014).									

New Hampshire vessels may be less dependent on herring as a bait source than the aforementioned survey indicates. Atlantic herring is a small percentage of the bait used by these vessels (Table 42), ranging between 1.8% in 2010 and 4.6% in 2005. In terms of herring per trap just in Lobster Management Area (LMA) 1, the most used was in 2005 and the least in 2010. This correlates with overall high and low points in the percent of herring bait used. Historically, Atlantic herring is used for bait by smaller inshore vessels more than larger offshore vessels, because it is typically less expensive; in addition, alternative bait options like skates tend to be preferred for longer soaks in offshore waters.

Table 42 - Bait use in the lobster fishery in New Hampshire, 2005-2011

Year	Herring Bait (lbs)	Other Bait (lbs)	Total Bait (lbs)	% Herring of all Bait	# Types of Bait	Herring Per Trap LMA 1 (lbs)
2005	8,200	169,725	177,925	4.6%	11	0.33
2006	9,700	293,125	302,825	3.2%	13	0.20
2007	8,300	226,350	234,650	3.5%	10	0.18
2008	7,658	247,000	254,658	3.0%	12	0.16
2009	8,825	189,690	198,515	4.4%	11	0.25
2010	3,350	181,728	185,078	1.8%	11	0.14
2011	6,100	249,900	256,000	2.4%	9	0.21
Source: NH Fish & Game Department.						

In the bait market, Atlantic menhaden, managed by the Atlantic States Marine Fisheries Commission, is one substitute for Atlantic herring. Use of menhaden for bait has increased in

importance relative to fish meal and oil. Between 2001 and 2012, the percent of total menhaden landings that were used for bait rose from 13% to a high of 28% in 2012 (63,540 mt). In 2013, bait harvest was about 22% of the total menhaden harvest. Menhaden landings for bait have recently dipped due to reductions in allowable catch; landings in 2013 were 35,043 mt, 34% below the average landings during 2010-2012 (52,900 mt) (ASMFC 2015c). During 2008-2011, *ex-vessel* menhaden prices ranged from $139-$169 per mt. This is about 33-50% lower than *ex-vessel* herring prices. If the quantity of Atlantic herring supplied into the bait market declines dramatically, more menhaden may be used as bait, moderating the increases in herring prices. Menhaden is primarily used to produce fish meal and oil. However, the Atlantic Herring FMP prohibits use of herring for fish meal, so herring is not a substitute in the production of those goods.

Used as food: Limited amounts of Atlantic herring are consumed as food domestically. In the world market, there is likely one substitute: European herring. U.S. production of Atlantic herring is quite small relative to the worldwide production. Since total U.S. landings of Atlantic herring have been near 100,000 mt annually, while total worldwide landings of Atlantic herring are near 2,000,000 mt. Therefore, U.S. producers of herring as human food are likely to be price takers on the world market. This means that moderate changes in the quantity of herring produced for food are unlikely to have an effect on price of herring.

1.6.1.13 State Waters Catch of Atlantic Herring

The vast majority of the Atlantic herring resource is harvested in Federal waters. Catch by Federal permit holders that occurs in State waters is reported and counted against the sub-ACLs. Catch by state-only permit holders is monitored by the ASMFC and is not large enough to substantially affect management of the Federal fishery and the ability to remain under the sub-ACLs (Table 43). Total Atlantic herring catch by vessels fishing in state waters was about 19 mt in 2015. The recent state-only permitted commercial landings of Atlantic herring are by fishermen in Maine, about three using fixed gear and about three using purse seines.

The Council specifies a set-aside for West of Cutler fixed gear fishermen (FGSA), currently 295 mt. The unused portion of the FGSA is returned to the Area 1A fishery after November 1. The ASMFC's requirement that fixed gear fishermen must report through IVR (and therefore have catch counted against the sub-ACL) has reduced any management uncertainty associated with State waters landings to an unsubstantial amount. Additionally, MEDMR requires the Maine state commercial fixed gear fishermen to comply with the federal IVR weekly reporting requirements and regulations as well as reporting monthly to MEDMR.

Table 43 - Atlantic herring landings from fixed gear fishery, before and after November 1 rollover date

Year	Sub-ACL Closure Date	Area 1A Sub-ACL (mt)	Cumulative Catch (mt) by Dec 31	Fixed Gear Landings (mt)	
				Jan-Oct	Nov-Dec
2004	11/19/2004	60,000	60,095	49	0
2005	12/2/2005	60,000	61,102	53	0
2006	10/21/2006	50,000	59,989	528	0
2007	10/25/2007	50,000	49,992	392	0
2008	11/14/2008	43,650	42,257	24	0

2009	11/26/2009	43,650	44,088	81	0
2010	11/17/2010	26,546	28,424	823	0
2011	10/27/2011	29,251	30,676	23	0
2012	11/5/2012	27,668	24,302	0	0
2013	10/15/2013	29,775	29,820	6	0
2014	10/26/2014	33,031	32,898	8	0
2015	[update]	30,580	29,406	15	0
2016		30,524	27,806	2	0
Source: GARFO, ASMFC.					

1.6.1.14 Canadian Catch of Atlantic Herring

Catch of the Atlantic herring stock complex in Canadian waters consists primarily of fish caught in the New Brunswick (NB) weir fishery. During the benchmark stock assessment for Atlantic herring (2012), the SARC 54 Panel noted that the contribution of the Atlantic herring stock on the Scotian Shelf region is unknown. It is generally assumed that juvenile fish (age 1 and 2) caught in the NB weir fishery are from the inshore (GOM) component of the Atlantic herring stock complex, while adult fish (age 3+) caught in the NB weir fishery are from the SW Nova Scotia stock complex (4WX). NB weir fishery catch is not tracked in-season against the U.S. Atlantic herring ACL. Rather, the annual expected catch in the NB weir fishery is estimated and then subtracted from the ABC, as an element of the management uncertainty buffer, to calculate the stockwide Atlantic herring ACL for the U.S. fishery. The NB weir catch estimates only include weir catch and not catch from the shutoff fishery. Catch from shutoffs generally represent a small component of the total NB weir fishery catch.

The overall trend in landings since 1990 has been downward (Table 10), and landings from 2000 have dropped from 20,209 mt in 2001 to 4,031 mt in 2009, but increased in 2010 back to 10,958 mt. The same trend can also be seen in the NB weir landings from 1964 to 2011 (Table 44).

- The NB weir fishery catch is quite variable and dropped to just under 6,500 mt in 2008. The NB weir fishery landings totaled about 30,944 mt in 2007 and 6,448 mt in 2008.
- The most recent five-year average of NB weir landings (2007–2011) is 11,218 mt, and the most recent ten-year average (2002-2011) is 12,358 mt.
- Extremely low landings during the 2008 fishing year decreased these moving averages, especially the ten-year average.
- The 2010 fishing year had NB weir landings of 10,958 mt and decreased in 2011 to 3,711 mt.

Table 45 has the herring landings by month for weirs located in New Brunswick from 1978 to 2014. Landings from the NB weir fishery have always been somewhat variable; however, the fishery occurs primarily during the late summer and fall months (June-October). The NB weir fishery is dependent on many factors including weather, fish migration patterns, and environmental conditions. Over the time series, catch from the NB weir fishery occurring after October averaged under 4% of the total reported for the year from the fishery.

Table 44 - Number of active weirs and the catch per weir in the New Brunswick, Canada fishery, 1978-2014

Year	NB Weir Catch (mt)	No. Active Weirs	Catch Per Weir (mt)
1978	33,570	208	162
1979	32,477	210	155
1980	11,100	120	92
1981	15,575	147	102
1982	22,183	159	140
1983	10,594	143	88
1984	8,374	116	72
1985	26,724	156	171
1986	27,515	105	262
1987	26,622	123	216
1988	32,554	191	200
1989	43,475	171	255
1990	38,224	154	258
1991	23,713	143	166
1992	31,899	151	212
1993	31,431	145	216
1994	20,622	129	160
1995	18,198	106	172
1996	15,781	101	156
1997	20,416	102	200
1998	19,113	108	181
1999	18,234	100	191
2000	16,472	77	213
2001	20,064	101	199
2002	11,807	83	142
2003	9,003	78	115
2004	20,620	84	245
2005	12,639	76	166
2006	11,641	89	131
2007	30,145	97	311
2008	6,041	76	79
2009	3,603	38	95
2010	10,671	77	139
2011	2,643	37	71
2012	494	4	124
2013	5,902	49	120
2014	1,571	26	60
Long-Term	18,962 mt	110 weirs	163 mt
3-Year	2,656 mt	26	101 mt
5-Year	4,256 mt	39	103 mt
10-Year	8,535 mt	57	130 mt

Source: Department of Fisheries and Oceans Canada.

Table 45 - Monthly weir landings (mt) for weirs located in New Brunswick, 1978-2014

YEAR	MONTH												Year Total
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1978	3	0	0	0	512	802	5,499	10,275	10,877	4,972	528	132	33,599
1979	535	96	0	0	25	1,120	7,321	9,846	4,939	5,985	2,638	74	32,579
1980	0	0	0	0	36	119	1,755	5,572	2,352	1,016	216	0	11,066
1981	0	0	0	0	70	199	4,431	3,911	2,044	2,435	1,686	192	14,968
1982	0	17	0	0	132	30	2,871	7,311	7,681	3,204	849	87	22,181
1983	0	0	0	0	65	29	299	2,474	5,382	3,945	375	0	12,568
1984	0	0	0	0	6	3	230	2,344	2,581	3,045	145	0	8,353
1985	0	0	0	0	22	89	4,217	8,450	6,910	4,814	2,078	138	26,718
1986	43	0	0	0	17	0	2,480	10,114	5,997	6,233	2,564	67	27,516
1987	39	21	6	12	10	168	2,575	10,893	6,711	5,362	703	122	26,621
1988	0	12	1	90	657	287	5,993	11,975	8,375	8,457	2,343	43	38,235
1989	0	24		95	37	385	8,315	15,093	10,156	7,258	2,158	0	43,520
1990	0	0	0	0	93	20	4,915	14,664	12,207	7,741	168	0	39,808
1991	0	0	0	0	57	180	4,649	10,319	6,392	2,028	93	0	23,717
1992	0	0	0	15	50	774	5,477	10,989	9,597	4,395	684	0	31,981
1993	0	0	0	0	14	168	5,561	14,085	8,614	2,406	470	10	31,328
1994	0	0	0	18	0	55	4,529	10,592	3,805	1,589	30	0	20,618
1995	0	0	0	0	15	244	4,517	8,590	3,956	896	10	0	18,228
1996	0	0	0	0	19	676	4,819	7,767	1,917	518	65	0	15,781
1997	0	0	0	8	153	1,017	6,506	7,396	5,316	0	0	0	20,396
1998	0	0	0	0	560	713	3,832	8,295	5,604	525	0	0	19,529
1999	0	0	0	0	690	805	5,155	9,895	2,469	48	0	0	19,063
2000	0	0	0	0	10	7	2,105	7,533	4,940	1,713	69	0	16,376
2001	0	0	0	0	35	478	3,931	8,627	5,514	1,479	0	0	20,064
2002	0	0	0	0	84	20	1,099	6,446	2,878	1,260	20	0	11,807
2003	0	0	0	0	257	250	1,423	3,554	3,166	344	10	0	9,003
2004	0	0	0	0	21	336	2,694	8,354	8,298	913	3	0	20,620
2005	0	0	0	0	0	213	802	7,145	3,729	740	11	0	12,639
2006	0	0	0	0	8	43	1,112	3,731	3,832	2,328	125	462	11,641
2007	182	0	20	30	84	633	3,241	11,363	7,637	6,567	314	73	30,145
2008	0	0	0	0	0	81	1,502	2,479	1,507	389	49	32	6,041
2009	0	0	0	0	5	239	699	1,111	1,219	330	0	0	3,603
2010	0	0	0	6	64	1,912	2,560	3,903	1,933	247	46	0	10,671
2011	0	0	0	0	0	250	656	1,097	500	140	0	0	2,643
2012	0	0	0	0	29	140	5	5	98	217	0	0	494
2013	0	0	0	0	7	612	1,517	1,797	1,051	919	0	0	5,902
2014	0	0	0	0	0	70	130	147	449	774	0	0	1,571

1.6.1.15 Imports/Exports[insert]

1.6.1.16 Shoreside Support

Beaver Enterprises Inc. (Rockland, ME)

In 2009, Beaver Enterprises Inc., founded in 1975, sold their plant to Linda Bean, a lobster dealer. Beaver is no longer in the lobster bait business, but instead focuses on selling salt to herring operations all over the region including in Rockland and Kittery, ME, Gloucester, MA and Rhode Island. The salt business is easier than the herring business, because salt "keeps" whereas herring deteriorates quickly.

Beaver is probably the largest salt purveyor in the region for the fishing industry. The owner started small, but was able to grow large enough quickly enough to develop "buying power". He buys directly from the three largest producers, Morton, Cargill's and U.S. Salt. Beaver Enterprises averages deliveries of two trailer-truck loads per day of salt.

Without herring, Beaver Enterprises would be out of business. Herring fishermen have always salted their product. Typically, of 400 pounds of barreled herring, 80 pounds is salt (i.e., 20% of herring bait weight is salt). The ASMFC landing days restrictions has increased salt demand.

The cost of overhead is higher than it was in the past with the need for cold storage, plus bait is more expensive, as is the cost of fuel. It is harder for the "little guys," who used to be able to make a day's pay with one truckload of fish, for example.

Beaver Enterprises does do some fish hauling. For example, they recently transported a ton of pogies (22 vats) from Lund's (Cape May, NJ) to O'Hara's (Rockland, ME), spending $1000 in fuel. (Wayne Stinson 2011, personal communication)

Maritime International (New Bedford, MA)

Much of the processed product from NORPEL (Section 1.6.1.9.2) is shipped overseas via Maritime International Inc. (http://www.maritimeinternational.org/), with a facility adjacent to NORPEL in New Bedford. Overseas shipment occurs in high cube refrigerated containers designed to hold the product at the optimal temperature of –18°F (0°C) to ensure freshness. Maritime International can arrange for either containerized cargo shipments or bulk/tramper carriage of nearly 4,000 mt per shipment.

During the scoping process for Amendment 1, Maritime International provided estimates of financial expenditures associated with NORPEL cargo vessel loading operations - based on one cargo vessel remaining in port for three days and spending money in the community for transportation, restaurants and entertainment, doctors, propane suppliers, and other associated industries. Estimates of expenditures associated with pilot boat operators, vessel agents, customs agents, lift trucks, courier services, and other items required to prepare the cargo ship for transport were also provided. With a potential of 15 cargo vessels per year, Maritime International estimated expenditures of at least $3.2 million in addition to those associated with processing, storage, container shipments, and local distribution.

1.6.1.17 Atlantic Herring Research Set-Aside Program [update]

1.6.2 Other Managed Resources and Fisheries

In addition to Atlantic herring, many other fisheries could be impacted by the Alternatives under Consideration. The mackerel and herring fisheries are often prosecuted in conjunction, and the lobster fishery is highly dependent on herring as bait. Herring is either a fishery bait source and/or a natural prey item for bluefin tuna, groundfish, and striped bass, which have commercial and recreational fisheries associated with them. Herring is also a prey for whales, other marine mammals, and sea birds, which have ecotourism industries associated with them.

1.6.2.1 Atlantic mackerel fishery

***Population status*:** The Atlantic mackerel stock was most recently assessed via a Transboundary Resource Assessment Committee in 2010, which analyzed data through 2008. The overfished and overfishing status is unknown as a result of that assessment (TRAC 2010), though mackerel will be assessed in November 2017 by the NEFSC.

Management: Many vessels that participate in the Atlantic herring fishery are also active in the Atlantic mackerel fishery, which is managed by the Mid-Atlantic Fishery Management Council through the Atlantic Mackerel, Squid, and Butterfish (MSB) Fishery Management Plan. More information about mackerel management is at: http://www.mafmc.org/msb.

Fishery: There are three commercial limited access Atlantic mackerel permit categories. When the directed fishery is open, there are no trip limits for Tier 1, Tier 2 has a 135,000 pound trip limit and Tier 3 has a 100,000 pound trip limit, which is reduced to 20,000 pounds if it catches 7% of the commercial quota. Open access incidental permits have a 20,000 pound per trip limit. There is also a smaller recreational fishery for mackerel (including private/rental and party/charter).

The directed fishery is primarily comprised by Tier 1 vessels. In 2016, there were 30 Tier 1 vessels (Table 46), 24 of which also had an Atlantic herring Category A permit (67% of all Herring Category A vessels also had a Tier 1 Mackerel permit in 2016). The Tier 1 vessels are primarily (70%) over 80' in length (Table X).

Table 46 - Number of vessels with Atlantic mackerel permits stratified by Atlantic herring permit category, 2016

Mackerel Permit Category	Herring permit categories							
	A	B/C	C	D	D/E	E	none	Total
Tier 1	24	0	5	0	1	0	0	**30**
Tier 2	2	1	5	2	14	0	0	**24**
Tier 3	1	2	11	25	38	1	1	**79**
Source: NMFS Permit database (*http://www.nero.noaa.gov/permits/permit.html*). Data as of September 2016.								

Table 47 - Vessel length for vessels with an Atlantic mackerel permit, 2016

Year		Tier 1	Tier 2	Tier 3	Total
Vessel length	<60	1	2	22	**25**
	60-80	8	13	50	**71**
	>80	21	9	7	**37**

	Total	**30**	**24**	**79**

Source: NMFS Permit database (http://www.nero.noaa.gov/permits/permit.html). Data as of September 2016.

Total landings of Atlantic mackerel (foreign and domestic) peaked at about 400,000 mt in 1973, but have been under 100,000 mt per year since 1977. Except for a peak in the early 2000s of about 40,000-55,000 mt, U.S. domestic landings have generally been under 30,000 mt since the 1960s (MAFMC 2015) and under 10,000 mt since 2011 (

Table 48). Mackerel catches since 2008 have generally been under 50% of the total mackerel quota (NEFSC 2016). Revenue from the mackerel fishery has been under $5M per year since 2010 (MAFMC 2016b).

Table 48 – Atlantic mackerel catch (mt) and quota 2005-2015 [check]

Year	U.S. Domestic				Canadian Landings	Total Catch	Quota	% Quota Caught
	Commercial Landings	Recreational						
		Landings	Discards					
2005	42,209	1,033	553		54,621	98,417	115,000	86%
2006	56,640	1,491	85		53,649	111,866	115,000	97%
2007	25,546	596	88		53,016	79,246	115,000	69%
2008	21,734	755	358		29,671	52,518	115,000	46%
2009	22,634	599	280		42,231	65,744	115,000	57%
2010	9,877	845	122		38,753	49,597	115,000	43%
2011	533	947	7		11,401	12,888	47,395	27%
2012	5,333	668	22		6,468	12,491	36,264	34%
2013	4,372	887	62		7,431	12,752	36,264	35%
2014	5,905	788	68		6,545	13,306	33,821	39%
2015*	5,616	1,157	56		3,868	10,697	20,872	51%

Source: NEFSC (2016, Tables 1 & 2).
* preliminary

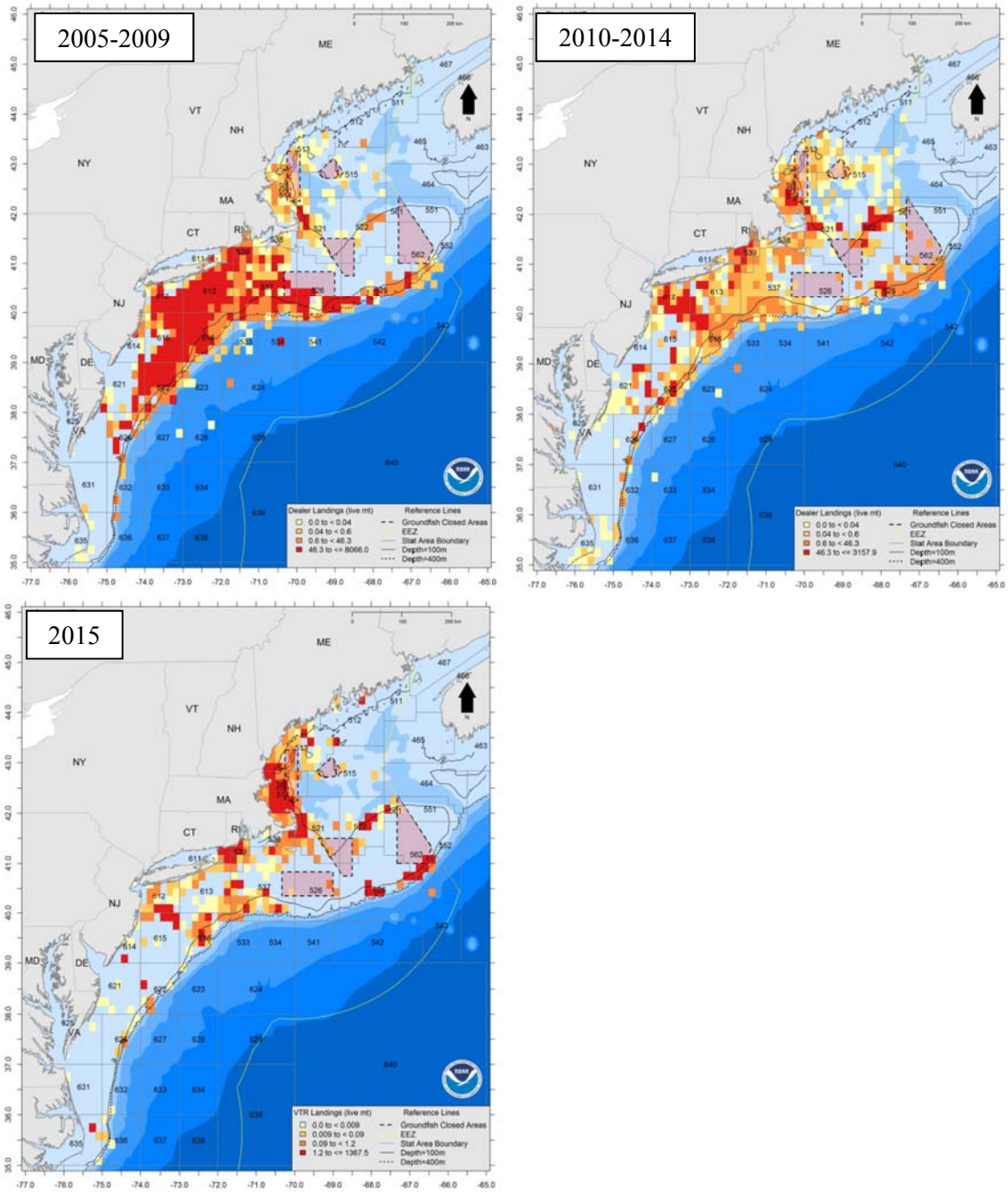
In 2013, the first year that the mackerel fishery became a limited access fishery, and there were 149 vessels issued a limited access mackerel permit (Tier 1-3). Of those, 45 (30%) had over 1% of their total revenue from mackerel, but just 9 (6%) had over 25% of their total revenue from mackerel. Generally, mackerel is a primary fishery for a small handful of vessels (MAFMC 2015).

During 2005-2009, when annual domestic mackerel landings were 23,000-58,000 mt, the fishery was primarily focused in the waters of Mid-Atlantic and Southern New England, though there was fishing in the Gulf of Maine and the southern flank of Georges Bank (

Table 49). In more recent years, with much lower landings, the fishery has been less concentrated in the Mid-Atlantic, and waters of Rhode Island and in the Gulf of Maine have continued to be important, as have both the northern and southern flank of Georges Bank.

Members of the MAFMC MSB Advisory Panel reported in May 2016 that shifting of thermal habitat suitability is likely impacting the distribution and/or productivity of MSB species, a topic that will be examined in the 2017 mackerel assessment. The AP also noted that Atlantic herring management limits mackerel fishing, such as the summer closure of Herring Management Area 1A to midwater trawl gear, herring spawning closures, and recently, the Georges Bank haddock catch cap accountability measure, which closed most of Georges Bank to herring fishing October 22, 2015 to April 30, 2016 (MAFMC 2016a).

Table 49 - Atlantic mackerel commercial landings, 2005-2015



Source: NEFSC (2016). NMFS Dealer data for 2005-2014, VTR data for 2015.

1.6.2.2 American lobster fishery

Population status: American lobsters (*Homarus americanus*) are benthic crustaceans found in U.S. waters from Maine to New Jersey inshore and Maine to North Carolina offshore. Lobsters tend to be solitary, territorial, and exhibit a relatively small home range of 5-10 km^2, although large mature lobsters living in offshore areas may migrate inshore seasonally to reproduce, and southern inshore lobsters may move to deeper areas to seek cooler temperatures on a seasonal or permanent basis.

The 2015 peer-reviewed stock assessment report indicated a mixed picture of the American lobster resource, with record high stock abundance throughout most of the Gulf of Maine (GOM) and Georges Bank (GBK) and record low abundance and recruitment in Southern New England (SNE). The 2015 peer reviewed stock assessment (ASMFC, 2015) used a new model which incorporated lobster size and a broader range of data. GOM and GBK were previously assessed as separate stock units; however, due to evidence of seasonal migrations by egg-bearing females between the two stocks, the areas were combined into one biological unit.

The assessment found the GOM/GBK stock was experiencing record stock abundance and recruitment (not overfished, not experiencing overfishing). While model results show a dramatic overall increase in stock abundance in the GOM/GBK, population indicators show young-of-year estimates are trending downward. This indicates a potential decline in recruitment in the coming years, and the Panel recommended that the ASMFC be prepared to impose restrictions should recruitment decline. The Panel also noted that productivity has been lower in the past, and warned that current levels of fishing would not be sustainable if recruitment were to decline again.

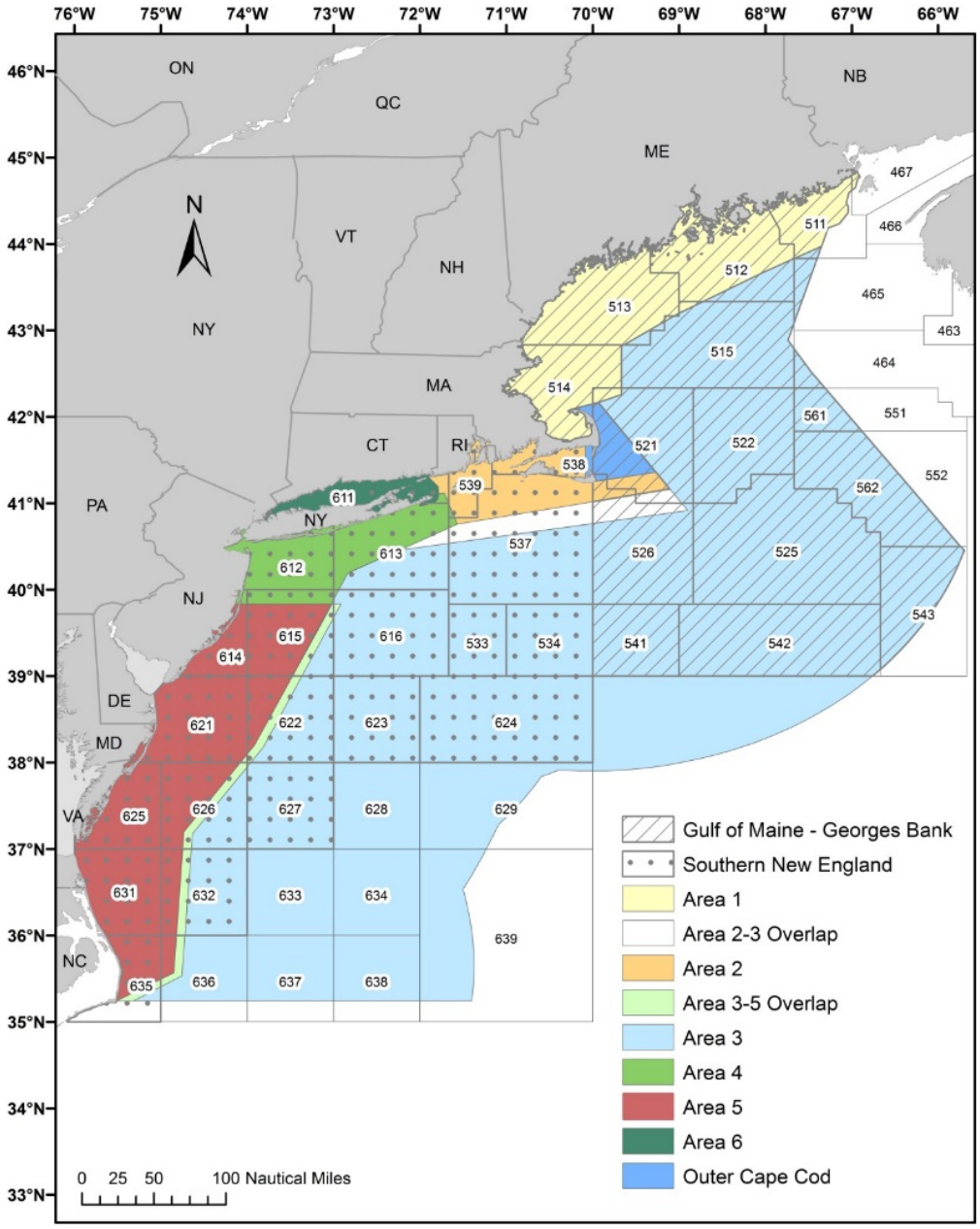
Conversely, the assessment found the SNE stock is severely depleted, though overfishing was not occurring. Abundance indices were determined to be at or near time-series lows. Recruitment indices show the stock has continued to decline and is in recruitment failure. However, the overfishing determination for SNE may be misleading and unreliable, because the methods used to estimate fishing mortality are not designed for such low biomass situations. The inshore portion of the SNE stock is in particularly poor condition with surveys showing a contraction of the population. This decline is expected to impact the offshore portion of the stock, which is dependent on recruitment from inshore. Landings in SNE are expected to decline since the extremely poor year classes which have settled since 2008 have yet to recruit to the fishery (ASMFC 2015a). The distress experienced by the SNE stock had been examined in 2010, and it was found that the stock was continuing to fall lower than the assessment. It was suggested that a combination of environmental and biological changes, as well as continued fishing was leading the stock to experience a recruitment failure. This recruitment failure was in turn preventing the stock from rebuilding (ASMFC 2010).

Management: Lobster is jointly managed, by the Atlantic States Marine Fisheries Commission in state waters (0-3 nm from shore) and by NMFS in federal waters (3-200 mi from shore). The fishery occurs within the three stock units: Gulf of Maine, Georges Bank, and Southern New England, each with an inshore and offshore component. Today, American lobster is managed under Amendment 3, which provides the flexibility to make changes to the management program through addenda, allowing resource and fishery concerns to be addressed promptly. Seven lobster management areas (LMAs; Map 5) were created through Amendment 3, as well as a Lobster Conservation Management Team (LCMT) for each management area. Made up of

industry representatives, the LCMTs are responsible for recommending changes to their management plans. The documents for each addenda can be found at the Commission's website: www.asmfc.org.

The fishery is managed using minimum and maximum carapace length; limits on the number and configuration of traps; possession prohibitions on egg-bearing (buried) and v-notched female lobsters, lobster meat, or lobster parts; prohibitions on spearing lobsters; and limits on non-trap landings and entry into the fishery (ASMFC 2015a). The most recent addendum, Addendum XVIII, reduces trap allocations by 50% for LCMA 2 and 25% for LCMA 3.

Map 5 - ASMFC lobster management areas



Fishery: The American lobster fishery has seen incredible expansion in effort and landings over the last 40 years and is now one of the top fisheries on the U.S. Atlantic coast. In the 1920s, lobster landings were about 11M lbs. Landings were fairly stable between 1950 and 1975, around 30M pounds; however, from 1976 – 2008, landings tripled, reaching 92M pounds in 2006. Landings continued to increase and peaked in 2013 at over 150M pounds. Landings leveled off, but remained high at 147M pounds in both 2014 and 2015 (Table 50), but again jumped to over 158M pounds ($666.7 M) in 2016. The largest contributors to the fishery are Maine and Massachusetts, with 83% and 11% of the recent landings, respectively. Landings, in descending order, also occurred in New Hampshire, Rhode Island, New Jersey, Connecticut, New York, Maryland, Delaware, and Virginia.

Table 50 - Total lobster landings (lbs) by state, 2009-2015

	ME	NH	MA	RI	CT	NY	NJ + south[a]	Total
2009	81,175,847	2,985,166	11,781,490	3,174,618	451,156	731,811	238,267	**100,538,355**
2010	95,506,383	3,658,894	12,768,448	3,258,221	432,491	813,513	692,480	**117,130,430**
2011	104,693,316	3,917,461	13,717,192	2,513,255	191,594	344,232	689,000	**126,066,050**
2012	125,759,424	4,236,740	14,917,238	2,932,388	236,846	275,220	978,767	**149,336,623**
2013	127,773,264	3,822,844	15,738,792	2,149,266	133,008	248,267	756,494	**150,621,935**
2014	124,440,799	4,939,310	15,060,352	2,387,321	141,988	216,630	619,565	**147,805,965**
2015	122,212,133	4,716,084	16,418,796	2,879,874	158,354	146,624	505,985	**147,037,850**
Average	**111,651,595 (83%)**	**4,039,500 (3.0%)**	**14,343,187 (11%)**	**2,756,420 (2.1%)**	**249,348 (0.19%)**	**396,614 (0.30%)**	**640,080 (0.48%)**	**134,076,744 (100%)**

Source: ASMFC lobster data warehouse (M. Cieri, pers. comm., 2017).
[a] "South" includes Delaware, Maryland and Virginia.

Landings typically occur from inshore areas, and lobsters are most abundant inshore from Maine through New Jersey, with abundance declining from north to south. Offshore, lobsters occur from Maine through North Carolina. Area 1 (inshore Gulf of Maine) has the highest landings, 80% of total harvest between 1981 and 2012. This is followed by LCMA 3 (offshore), 9% of total landings. Dramatic declines in the catch from inshore SNE since 1999 have been attributed to waters increasingly exceeding the lobster thermal stress threshold of 20°C (ASMFC 2015a).

In Maine, the fishery is most active during the months of July to November. For the years 2004-2016, about 85% of the pounds landed were landed in those months (Table 51). Just 4% of landings occurred in the months of January to April (www.maine.gov).

There was an average of 8,315 vessels issued commercial lobster permits for the fishery in state waters each year between 2009 and 2013, and 3,080 vessels were issued federal permits (Table 52), though in most cases, a vessel holding a federal permit also holds a state permit. Thus, there are about 8,300 vessels in the lobster fishery. The State of Maine has issued the largest number of state permits, recently averaging 5,163 (62%). For Maine, about 85% of the permits are active (~4,400). For New Nampshire, about 70% of the permits issued were active during 2009-2013.

Table 51 - Average Maine commercial lobster landings (pounds and value) by month, 2004-2016

	Average pounds		Average value	
January	1,308,027	1%	$5,975,882	2%
February	570,693	1%	$3,225,004	1%
March	561,699	1%	$3,577,798	1%
April	1,102,204	1%	$6,478,832	2%
May	2,471,323	3%	$11,669,067	3%
June	4,218,268	4%	$18,237,197	5%
July	14,296,658	15%	$47,888,908	14%
August	20,949,668	22%	$67,362,446	19%
September	18,286,093	19%	$63,786,998	18%
October	18,086,518	19%	$64,513,527	18%
November	11,101,952	11%	$39,496,026	11%
December	4,322,768	4%	$16,618,840	5%
Total	**97,275,872**	**100%**	**$348,830,527**	**100%**

Source: www.maine.gov, accessed July 2017.
Note: 2016 data are preliminary.

Table 52 – Commercial lobster licenses issued by jurisdiction, 2009-2013

Year	ME	NH	MA	RI	CT	NY	NJ	State total	NMFS	Total
2009	5,376	365	1,314	979	220	375	109	**8,738**	3,176	**11,914**
2010	5,226	347	1,278	948	206	360	109	**8,474**	3,141	**11,615**
2011	5,155	333	1,245	922	180	344	109	**8,288**	3,119	**11,407**
2012	5,079	334	1,214	905	161	334	109	**8,136**	3,003	**11,139**
2013	4,979	322	1,188	874	142	326	109	**7,940**	2,963	**10,903**
Average	**5,163**	**340**	**1,248**	**926**	**182**	**348**	**109**	**8,315**	**3,080**	**11,396**

Source: ASMFC (2015a).

Reliance on herring as bait: The lobster industry depends greatly on herring bait to sustain itself. Between 1981 and 2013, 96% of all lobster landed was harvested using traps (ASMFC 2015a). Small-scale truckers, bait shop owners, and related business all participate in the commercial bait venture. Bait can be delivered dockside via trucks. In the past, trucks picked up the bait from canneries and community sites up and down the coast to service smaller bait shops or lobster fishing 'gangs' (Acheson 1987). The canneries are gone now, but herring is still delivered to important lobster communities. Island-bound and isolated lobster fishermen may also pick up bait directly off herring vessels, or have it brought out on ferries. In recent years, the shift has been towards herring vessels landing directly in island ports (e.g., Vinalhaven). A small proportion of lobster bait has been supplied by the freezer plants in Massachusetts (Cape Seafoods, NORPEL). While bait choices vary with individual fishermen's preferences and fishery, lobster vessels in the State of Maine are perhaps the most dependent on herring for bait. Recently, however, pogies (menhaden) have also proved popular. Major dealers in Maine offer

herring, pogies, redfish and flounder, haddock, carp racks, tuna heads, and Pacific rockfish, with prices ranging from $0.15 - $0.44. In part due to the ASMFC limits on landing days, much of the herring is salted and frozen. Initially, lobstermen found the frozen product to be difficult to handle, but according to reports from dealers, they have adjusted. Lobster vessels in Massachusetts and New Hampshire also depend on herring for bait, but this dependency on herring decreases in more southern areas. Section 1.6.1.12 contains more information about Atlantic herring as a bait source.

1.6.2.3 Bluefin tuna fishery

Bluefin tuna in are known to feed on herring, and the tuna fishery is dependent upon herring for bait. The overlap between the Atlantic herring fishery and the Atlantic bluefin tuna (BFT) fishery is diverse; herring vessel operations overlap with bluefin tuna fishing effort at given areas and times. As such, herring vessels may potentially remove herring resources that impact the behavior of BFT in a given area. The bluefin tuna fishery landed an average of 838 mt between 2011 and 2015, with the majority of catch coming from the commercial rod and reel and longline fisheries in the northwest Atlantic (Table 53). In 2015, over 856 mt was caught by commercial vessels in U.S. waters, valued at $8,820,000 (

Table 54).

Recreational Bluefin Fishery: The recreational fishery is allocated 19.7% of the bluefin catch. Charter and headboats may fish under either the Recreational Angler category or the General commercial category on a given trip. The rules are based on the size category of the first bluefin retained on each trip, and whether that tuna fits under the size limit of the recreational or commercial fishery. Landings on charter/headboats are counted toward the corresponding quota category determined by the size of fish landed on that trip. The bluefin tuna recreational fishery targets medium, large, and giant bluefin tuna. The fishery generally occurs off of North Carolina from December - January, and becomes active off of Cape Cod and in the Gulf of Maine in summer and early fall. The recreational fishery requires use of handgear (i.e., rod and reel, handline), with the exception that charter and headboats may also fish with bandit gear (i.e., vertical hook and line gear attached to vessel; retrieved by manual, electric, or hydraulic reels) or a green-stick (e.g., actively trolled mainline elevated above surface of water with up to 10 hooks or gangions).

Table 53 - U.S. landings (mt) of Atlantic bluefin tuna, by area and gear (2011-2015)

Area	Gear	2011	2012	2013	2014	2015
NW Atlantic	Longline	216.3 (23.9%)	189.4 (20.9%)	153.0 (16.9%)	171.7 (19.0%)	70.8 (7.8%)
	Handline	0.9 (0.1%)	1.3 (0.1%)	0.5 (0.1%)	0.0 (0%)	0.0 (0%)
	Purse seine	0.0 (0%)	1.7(0.2%)	42.5 (4.7%)	41.8 (4.6%)	38.8 (4.3%)
	Harpoon	70.1 (7.7%)	52.3 (5.8%)	45.0 (5.0%)	67.5 (7.5%)	77.1 (8.5%)
	Commercial rod & reel	419.5 (46.4%)	419.5 (46.4%)	249.5 (27.6%)	378.9 (41.9%)	581.4 (64.3)
	Recreational rod & reel	148.6 (16.4%)	148.7 (16.4%)	131.4 (14.5%)	99.6 (11.0%)	112.9 (12.5%)
	Trawl	0.4 (<0.1%)	0.0 (0%)	0.0 (0%)	0.0 (0%)	0.0 (0%)
Gulf of Mex.	Longline	13.2 (1.5%)	101.2 (11.2%)	33.5 (3.7%)	41.3 (4.6%)	6.9 (0.8%)
NC Area 94a	Longline	11.3 (1.2%)	3.9 (0.4%)	3.5 (0.4%)	8.9 (1.0%)	8.3 (0.9%)

Caribbean	Longline	0.6 (0.1%)	0.9 (0.1%)	0.4 (<0.1%)	0.0 (0%)	0.0 (0%)
All areas	**All gears**	**904.7 (100%)**	**919.0 (100%)**	**658.9 (100%)**	**810.0 (100%)**	**896.2 (100%)**
Source: NMFS, 2016.						

Table 54 - Commercial landings and revenue of bluefin tuna by catch location, 2015

	0 - 3 miles from U.S. coast	3 - 200 miles from U.S. coast	High Seas or off foreign coasts	Total U.S. Landings
Landings (mt)	16	840	0	856
Revenue ($ thousands)	$31K	$8,789K	$0K	$8,820K
Source: Fisheries of the United States (2015).				

Commercial Bluefin Fishery: Commercial handgear vessels that wish to sell catch must obtain one of the three types of commercial handgear permits: Atlantic Tunas General (rod and reel, harpoon, handline, bandit gear), Atlantic Tunas Harpoon (harpoon only), or HMS Charter/Headboat. These vessels are required to sell all catch to permitted Atlantic tuna dealers, and must comply with the regulations of the U.S. Coast Guard of the state in which catch is landed. The fleet is largely composed of privately owned vessels that are over 7 m in length. Fishermen commonly use bait, preferably herring, mackerel, mullet, butterfish, squid, whiting, ballyhoo, and menhaden. Fishing area and catch rates are highly variable due to bluefin abundance and distribution, which is influenced by oceanographic and ecological conditions.

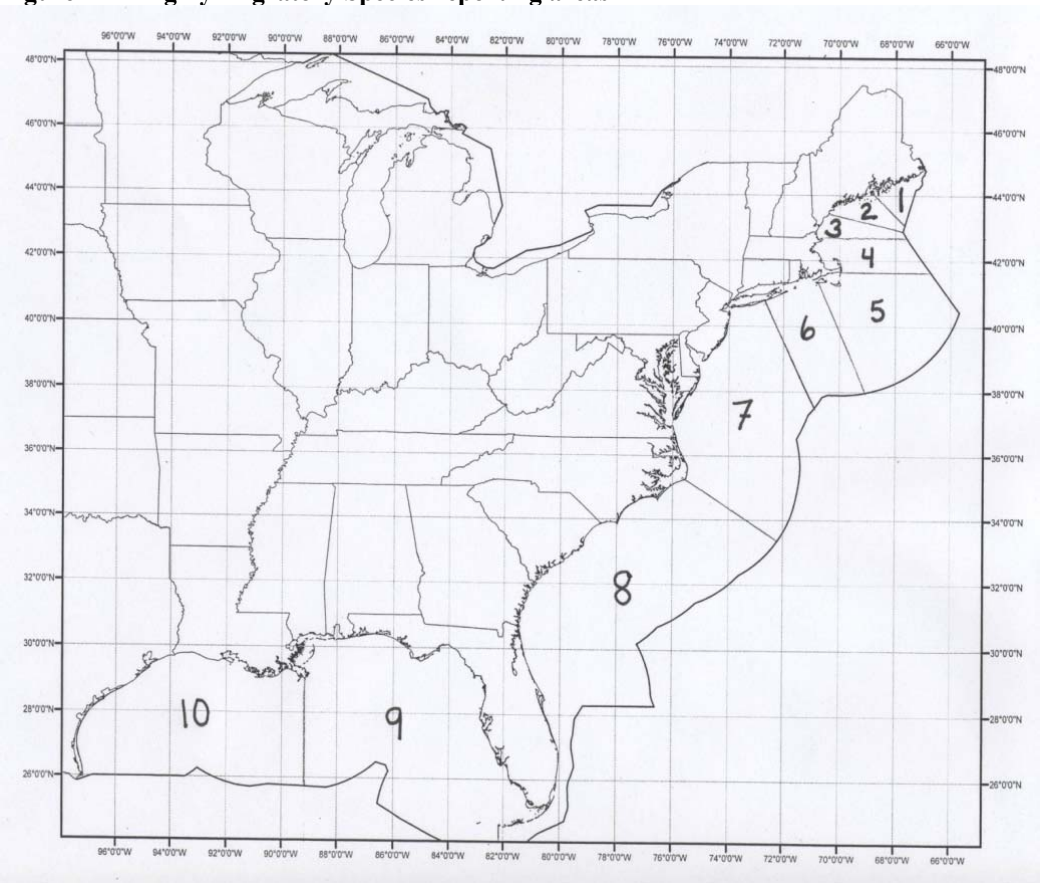
Commercial bluefin tuna fishermen work off an annual quota which is divided up among the three permit categories. The general category receives the largest allocation and has within season allocations. If the catch limit is reached before August 31, the fishery will close and reopen again in September. September has its own quota as does October, and there is a winter allocation. The fishery has not closed due to reaching any of these within season quotas since the 1990s. The bluefin season occurs when there are ample fish to catch, but generally runs from June through October or November, and occasionally into December.

Of the commercial landings in 2015, about 90% are attributed to the Northeast reporting areas (Figure 14, Areas 1-6, Gulf of Maine to Southern New England). The bluefin tuna fishery is located throughout the entire Gulf of Maine, but is also flourishing in southern states including Virginia and the Carolinas.

Bluefin Tuna and Herring Fishery Overlaps: Of the ten U.S. Atlantic HMS reporting areas (Figure 14), Areas 1 to 7 fall overlap with the Atlantic herring stock area (Figure #). Since 1996, 93% of all U.S. bluefin tuna landings are from these areas (Table 55). Areas 4 and 5 are the areas with the highest proportion of total landings during this time period, 27% and 36%, respectively. These are the areas to the east and southeast of Massachusetts.

The two months with the highest bluefin tuna landings from 1996-2015 are September (26%) and October (25%) (Table 56). From only HMS Area 4, July (24%) and September (28%) had the highest landings, though since 2011, September and October had the highest landings (**Table 57**). However, in Areas 1-3 to the north, the fishery occurs primarily in July-September; October landings were just 8% of the total from 1996-2015 (Table 58).

Figure 14 – Highly Migratory Species reporting areas



Source: NMFS Highly Migratory Species (HMS) office.

Table 55 – Bluefin tuna landings (dressed weight, lbs) by HMS reporting area, 1996-2015

Area	1996-2000		2001-2005		2006-2010		2011-2015		Total	
1	54,010	1%	13,139	0%	2,416	0%	80,823	2%	150,388	1%
2	899,461	14%	485,765	9%	207,718	8%	657,995	16%	2,250,939	12%
3	1,408,474	22%	506,456	9%	321,435	12%	443,337	11%	2,679,702	14%
4	1,826,228	28%	788,045	14%	918,798	34%	1,643,206	39%	5,176,277	27%
5	2,149,052	33%	3,122,402	55%	778,324	29%	870,192	21%	6,919,970	36%
6	32,830	1%	50,687	1%	44,305	2%	83,042	2%	210,864	1%
7	22,143	0%	184,607	3%	37,221	1%	292,713	7%	536,684	3%
Other	97,880	2%	495,940	9%	354,318	13%	100,132	2%	1,048,270	6%
Total	6,490,078	100%	5,647,041	100%	2,664,535	100%	4,171,440	100%	18,973,094	100%
Source: NMFS/GARFO/HMS office. Data as of October 2016.										

Table 56 – Bluefin tuna landings (dressed weight, lbs) by month, 1996-2015

Month	1996-2000		2001-2005		2006-2010		2011-2015		Total	
June	371,237	6%	200,947	4%	170,300	6%	345,587	8%	1,088,071	6%
July	1,645,787	25%	635,682	11%	229,511	9%	626,707	15%	3,137,687	17%
Aug.	1,257,806	19%	645,229	11%	392,388	15%	516,404	12%	2,811,827	15%
Sept.	2,006,236	31%	1,210,802	21%	666,003	25%	1,096,067	26%	4,979,108	26%
Oct	1,091,708	17%	2,247,095	40%	551,757	21%	801,267	19%	4,691,827	25%
Nov.	54,732	1%	138,323	2%	279,619	10%	340,650	8%	813,324	4%
Dec.	62,572	1%	462,541	8%	214,214	8%	187,716	5%	927,043	5%
Jan.-May	0	0%	106,422	2%	160,743	6%	257,042	6%	524,207	3%
Total	6,490,078	100%	5,647,041	100%	2,664,535	100%	4,171,440	100%	18,973,094	100%

Table 57 – Bluefin tuna landings (dressed weight, lbs) by month in HMS Area 4, 1996-2015

Month	1996-2000		2001-2005		2006-2010		2011-2015		Total	
June	158,669	9%	56,360	7%	75,697	8%	153,110	9%	443,836	9%
July	641,452	35%	185,828	24%	105,677	12%	296,916	18%	1,229,873	24%
Aug.	361,261	20%	212,621	27%	168,200	18%	211,271	13%	953,353	18%
Sept.	494,086	27%	158,571	20%	300,019	33%	476,433	29%	1,429,109	28%
Oct	170,216	9%	149,282	19%	224,704	24%	373,026	23%	917,228	18%
Nov.-Jan.	544	0%	25,383	3%	44,501	5%	132,450	8%	202,878	4%
Total	1,826,228	100%	788,045	100%	918,798	100%	1,643,206	100%	5,176,277	100%

Table 58 – Bluefin tuna landings (dressed weight, lbs) by month in HMS Areas 1-3, 1996-2015

Month	1996-2000		2001-2005		2006-2010		2011-2015		Total	
June	171,849	7%	109,158	11%	80,903	15%	101,174	9%	463,084	9%
July	772,334	33%	311,437	31%	109,088	21%	251,428	21%	1,444,287	28%
Aug.	598,242	25%	335,977	33%	177,978	33%	264,473	22%	1,376,670	27%
Sept.	686,993	29%	173,736	17%	133,617	25%	354,697	30%	1,349,043	27%
Oct	132,527	6%	74,062	7%	28,128	5%	163,260	14%	397,977	8%
Nov.-May	0	0%	990	0%	1,855	0%	47,123	4%	49,968	1%
Total	2,361,945	100%	1,005,360	100%	531,569	100%	1,182,155	100%	5,081,029	100%

1.6.2.4 Large mesh multispecies (groundfish)

The overall trend since the start of sector management through 2013 has been a decline in groundfish landings (42.3M lbs (19,200 mt) in FY2013), revenue ($58.7M in FY2013), the number of vessels with a limited access groundfish permit (1,119 in FY2013), and the number of vessels with revenue from at least one groundfish trip (316 in FY2013). The groundfish fishery has had a diverse fleet of vessels sizes and gear types. Over the years, as vessels entered and exited the fishery, the typical characteristics defining the fleet changed as well. The decline in active vessels has occurred across all vessel size categories. Since FY2009, the 30' to < 50' vessel size category, which has the largest number of active groundfish vessels, experienced a 38% decline (305 - 159 active vessels). The <30' vessel size category, containing the least number of active groundfish vessels, experienced the largest (50%) reduction since FY2009 (34 - 17 vessels). The vessels in the largest (≥75') vessel size category experienced the least reduction (30%) since FY2009 (Murphy et al 2013).

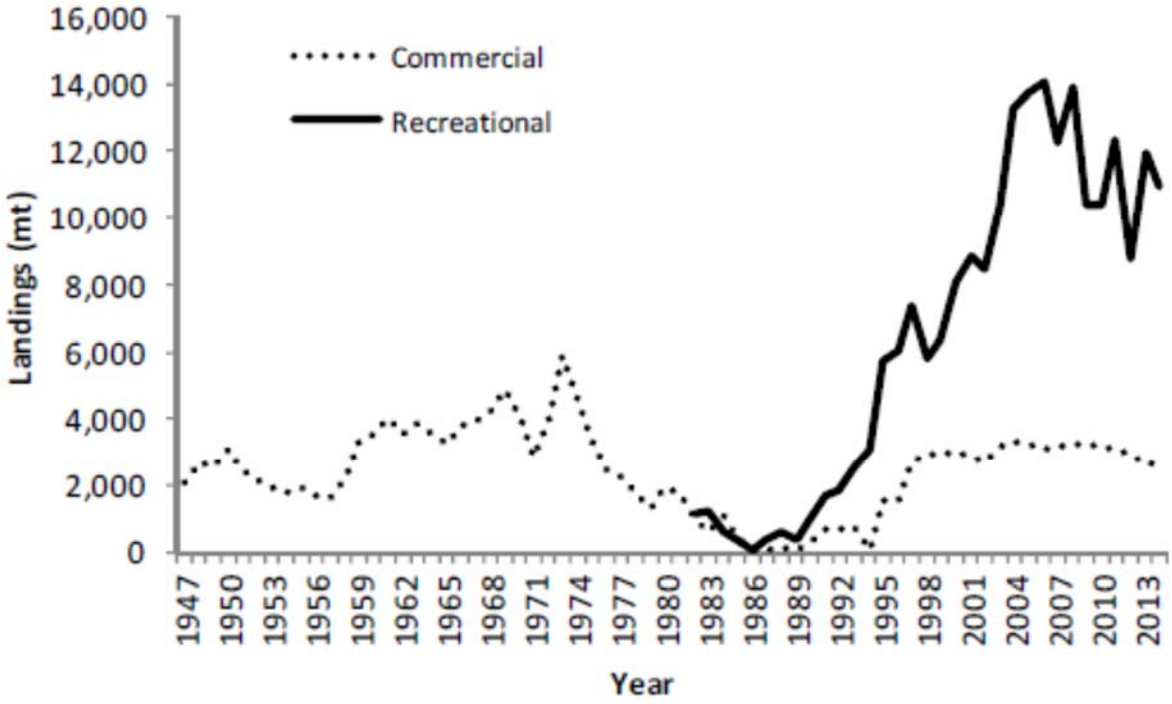
1.6.2.5 Striped bass fishery

The striped bass fishery occurs from Maine to North Carolina. The recreational fishery for striped bass has increased from 1982 through 2014 (1,010 mt in 1990) with a peak in 2006 (14,082 mt) (Figure 15). The recreational fishery has occurred since the 1990s in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina (no NC harvest in 2012 -2014). In 2014, the three states with the most recreational striped bass harvested (by numbers) were Maryland (33%), New York (23%), and Massachusetts (15%) (ASMFC 2015b).

For the commercial striped bass fishery, it has occurred since the 1990s in Massachusetts, Rhode Island, New York, Delaware, Maryland, Virginia, North Carolina (no NC harvest in 2013 and 2014), and the Potomac River Fisheries Commission. Total commercial landings harvest from 2005 to 2014 averaged 3,162 mt, with a slight decline in recent years. The commercial harvest primarily occurs in Maryland and states to its south. In 2014, 7.9% of the commercial striped bass harvested (by numbers) occurred in Massachusetts, 1.4% in Rhode Island, and 6.9% in New York (ASMFC 2015b).

For the recreational fishery, the only data are collected through the Marine Recreational Information Program (MRIP). However, MRIP includes no spatial data for catch locations at sea.

Figure 15 - Coast-wide commercial and recreational striped bass harvest, 1940s - present



Source: ASMFC (2015b).

Table 59 - 2014 commercial and recreational harvest (numbers) of striped bass by state

State	Commercial		Recreational	
	(#)	(% total)	(#)	(% total)
ME			20,750	1.2%
NH			6,415	0.4%
MA	60,619	7.9%	277,138	15.5%
RI	10,468	1.4%	103,516	5.8%
CT			86,763	4.8%
NY	52,903	6.9%	409,342	22.9%
NJ			225,910	12.6%
DE	14,894	1.9%	8,774	0.5%
MD	370,661	48.4%	583,028	32.6%
PRFC	81,429	10.6%	n/a	
VA	175,324	22.9%	67,486	3.8%
NC	0	0.0%	0	0.0%
Total	**766,298**	100.0%	**1,789,122**	100.0%

Source: ASMFC (2015b).
Note: MA commercial includes fish for personal consumption.

The Massachusetts Division of Marine Fisheries manages the fishery using 14 statistical areas within state waters. Figure 16 and Figure 17 map the landings and CPUE (pounds per fishing hours) within each area from 2010 to 2014. Area 9, to the east of Cape Cod, has had relatively high landings throughout the time series, and areas to the east and south of Cape Cod have had relatively high CPUE. Figure 18 tracks the landings and CPUE over time each year, showing that most of the landings have occurred between mid-July and mid-August. Decreased CPUE over the length of the season could be an indicator of decreased striped bass availability, but the landings data do not show consistent increases or decreases in CPUE across seasons.

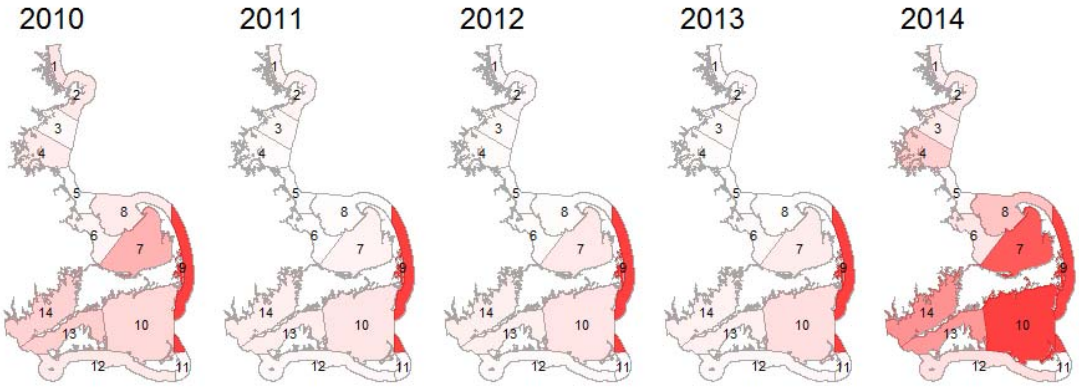
Striped bass are typically present in Massachusetts waters between May and October, yet the commercial fishery (the only source of spatial fishery-dependent data) occurs over a much narrower timeframe (Kneebone, Hoffman, Dean, Fox, et al. 2014). Prior to 2014, the commercial striped bass fishery began each year on July 11 and closed when the quota was exhausted, which was typically in 5-7 weeks. In 2013, the fishery closed after 5 weeks, and then reopened for an additional two weeks in late August, after it became evident that there was quota remaining. In 2014, regulations changed the fishery start date to June 23rd, and a reduced trip limit led to a more protracted season (11 weeks).

Neither recreational nor commercial striped bass fishing is allowed outside of state waters, per federal law. However, striped bass are abundant in federal waters and frequently cross this state/federal jurisdictional boundary (Kneebone, Hoffman, Dean & Armstrong 2014). Coast-wide, the recreational fishery accounts for 60-70% of total removals in recent years. In Massachusetts, the recreational/commercial ratio is about 85%/15%.

As part of an effort to estimate the predation mortality of striped bass on Atlantic menhaden, all available data sources for diet composition of striped bass were assembled and summarized (SEDAR 2015). A total of 28 data sources were identified that included over 40,000 individual stomachs examined. On a coast-wide and annual basis, herring species comprise <10% of striped bass diets. At specific times and regions (e.g., Gulf of Maine in summer/fall), Atlantic herring may comprise up to 30% of the diet.

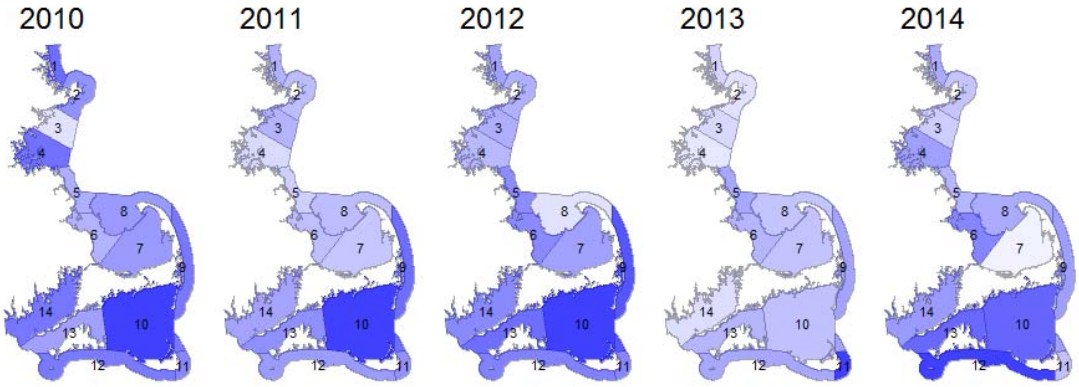
While there are no specific rules that explicitly prevent midwater trawling for herring in Massachusetts state waters, there are regulations that effectively prohibit this activity: 1) There is no exemption from the 6" minimum mesh size for herring fishing (as there is for the whiting and squid fisheries); and 2) A "coastal access permit" is required to fish with mobile gear in MA state waters, which has a maximum vessel length of 72 feet. There are very few coastal access permits (CAP), and there has been a moratorium on issuing new CAP permits since 1995.

Figure 16 - Spatial pattern in landings (pounds) for Massachusetts striped bass commercial fishery, 2010-2014



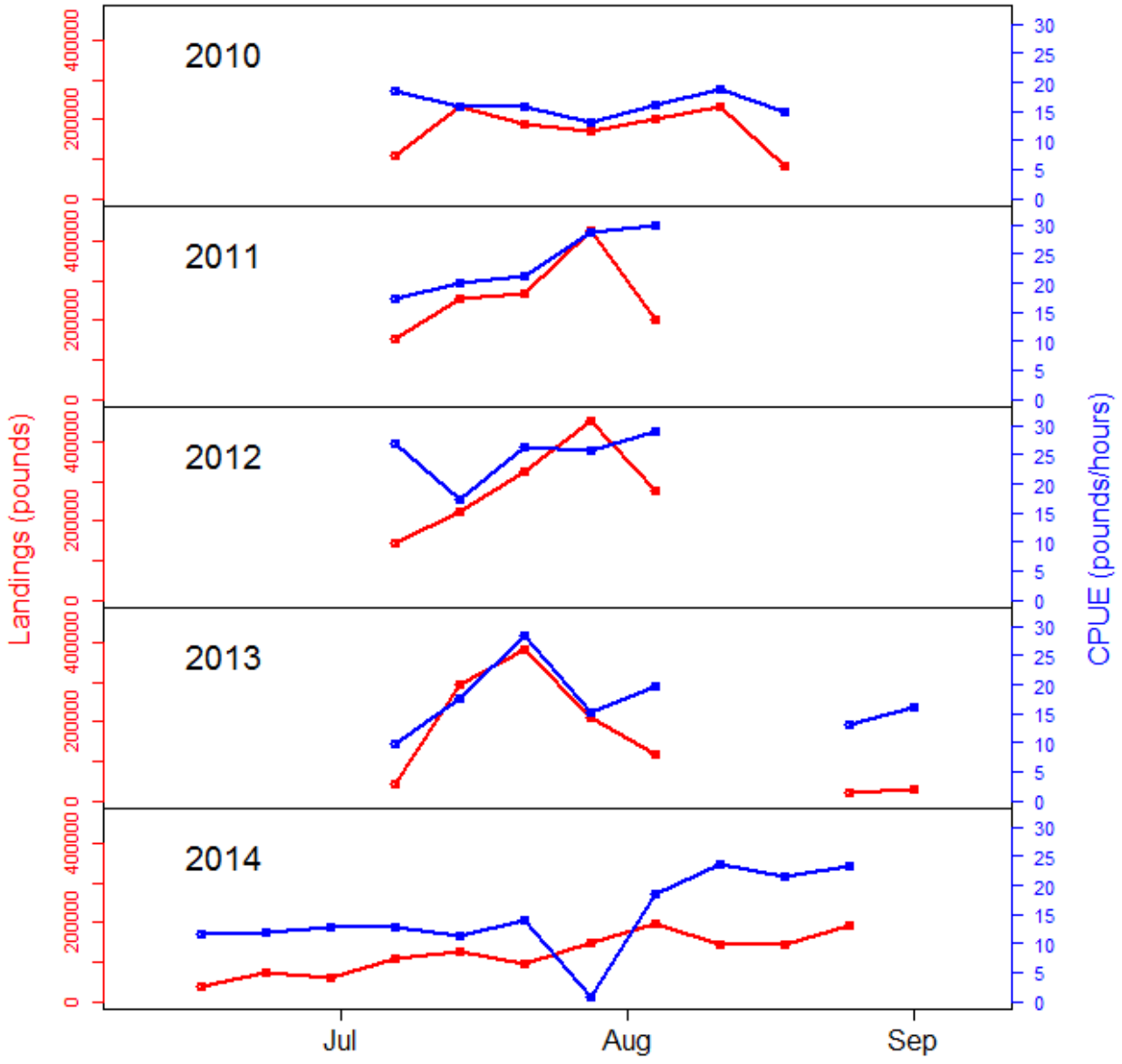
Source: MADMF (2016).

Figure 17 - Spatial pattern in CPUE (pounds / fishing-hours) for Massachusetts striped bass commercial fishery, 2010-2014



Source: MADMF (2016).

Figure 18 - Seasonal profile of Massachusetts commercial striped bass fishery, 2010-2014



Source: MADMF (2016).

1.6.2.6 Other recreational fisheries

Many recreational fisheries exist in the Northeast, and several depend on herring as a source of bait as well as a source of food for the fish that they target. The following review of recreational fisheries comes from the fisheries of the United States, which offers a comprehensive overview of recreational fisheries in the U.S. A full breakdown of the different recreationally fished

species by year and weight is offered therein, as well as by distance from shore and by number of live releases.

The recreational fisheries serve many purposes for the residents of the Atlantic Coast states. In 2009, there were close to 44M trips that caught over 198M fish, trips which serviced nearly 6.4M residents. Over 31% of those trips were made in the waters managed by the NEFMC. Commonly caught fish on the trips that occurred in federally managed waters include black sea bass, summer flounder, Atlantic cod, dolphinfish, and bluefish. 62% of all the prior mentioned trips were ones in which the fishing was done mostly in inland waters.

States stand to benefit from recreational activity as well. In 2009, the state of New Jersey, New York, and Massachusetts had the most number of angler trips, with 5,444 trips; 4,917 trips, and 3,603 trips, respectively. Connecticut had 1,462 trips; while Maine had 1,014, and Rhode Island 1,042. The state of New Hampshire had the fewest, with 414 trips. The numbers of trips taken in 2008 were similar in magnitude by state. The trend in states is similarly mimicked in the number of finfish both harvested and released by recreational fishermen in 2008 and 2009, however Connecticut was much closer in ranking to Massachusetts.

Due to the eclectic nature of the fisheries entailed in the recreational community, there is no one management body that oversees all recreational fisheries. Instead, there is a mixture of management from the NMFS, NEFMC, MAFMC, ASMFC, and state agencies that are not divided by the value of the resource. For instance, some stocks such as black sea bass are managed by the ASMFC and represent 1,022 mt of harvest in 2008 and 1,269 mt in 2009. Atlantic cod, however, are managed under the NEFMCs Groundfish FMP, and represent 1,905 mt of recreational catch in 2008 and 1,677 mt in 2009. The MAFMC manages bluefish, which were worth 8,717 mt of recreational catch in 2008 and 6,290 mt in 2009. There are a wide range of bodies that assess the health and status of the stocks that are recreationally fished as well.

There are multiple forms of data on recreational fisheries available. Data is gathered through state and regional logbook programs, a coastal household telephone survey, a telephone survey of for-hire fishing vessel operators, and a field intercept survey of completed angler fishing trips. Amendment 16 to the Groundfish FMP used data that came from the Marine Recreational Information Program (MRIP, formerly the MRFSS) and recreational party/charter logbook data. The party/charter mode logbook data can be used to characterize numbers of participating vessels, trips, and passengers.

The MRIP is a source for catch statistics including harvested and released catch, distance from shore, size distribution of harvested catch, catch class (numbers of fish per angler trip), and seasonal distribution of harvested catch. The MRIP is a relatively new initiative from NMFS which is focused on counting and reporting marine recreational catch and effort. The point of MRIP is to provide the detailed, timely, scientifically sound estimates that fisheries managers, stock assessors and marine scientists need to ensure the sustainability of ocean resources, as well as address head-on stakeholder concerns about the reliability and credibility of recreational fishing catch and effort estimates.

1.6.2.7 Ecotourism industries

Atlantic herring is a forage species for whales, other marine mammals and birds in the Northeast. Thus, the whale and bird watching industries have an interest in the health of the Atlantic herring population. If fewer marine mammals or birds are in the area to observe, the industry would be

able to provide fewer boats and tours to the public. Furthermore, whales and some sea birds are known to respond to prey availability, and may become increasingly difficult to find. The number of marine mammals and birds needed to support the industries is unknown, but limited economic data on the whale watching industry does exist.

Whale watching: The whale watching season runs from April to October, occasionally into November, with fin, humpback, and minke whales being the key species of interest. Humpback whales are known to feed on herring, particularly in the Gulf of Maine, but also sand lance and other small fish. Humpbacks feed during the spring, summer and fall in the western North Atlantic (Waring, et al. 2015). Their distribution in this region is largely correlated with prey, though behavior and bathymetry are factors as well (Payne, et al. 1986; Payne, et al. 1990).

Whales tend to congregate on large oceanographic features, which is where schooling prey can be found. A good portion of a whale watching trip involves finding the whales, which results in spent fuel. If schools of herring were to stop schooling or reduce in number and whales were to subsequently stop congregating, the whale watching industry could be affected by the extra expenditure of fuel to find them, even if whales are present in the area (Lee 2010).

O'Conner et al. (2009) characterized the whale watching industry in 2008 as attracting 910,071 passengers participating boat-based trips by 31 operators from ports in Maine, New Hampshire, Massachusetts and Rhode Island, with $35M total revenue (Table 60). This snapshot represents a decline in the number of passengers and operators, but an increase in revenue from a similar snapshot in 1998. Ticket prices in 2008 were around $40 for adults and $30 for children on a 4-hour cruise. Up to 400 passengers can fit on some vessels. The industry was estimated to employ 730 people.

Table 60 - New England whale watching, 1998 and 2008

Year	Whale watchers (#)	Operators (#)	Direct expenditure	Indirect expenditure	Total expenditure
1998	1,240,00	36	$30,600,000	$76,650,000	$107,250,000
2008	910,07	31	$35,000,000	$91,000,000	$126,000,000
Source: O'Conner et al (2009).					

In 2017, there are 22 dedicated whale watching companies with 34 vessels from Maine to New Jersey and several in Delaware and Virginia (Table 61). There are roughly 30 smaller, charter and 6-pack whale watch operations as well in the Northeast (GARFO). Important ports for whale watching in the Gulf of Maine include Bar Harbor, Maine; Rye, New Hampshire; and Gloucester, Boston, and Provincetown, Massachusetts (Lee 2010).

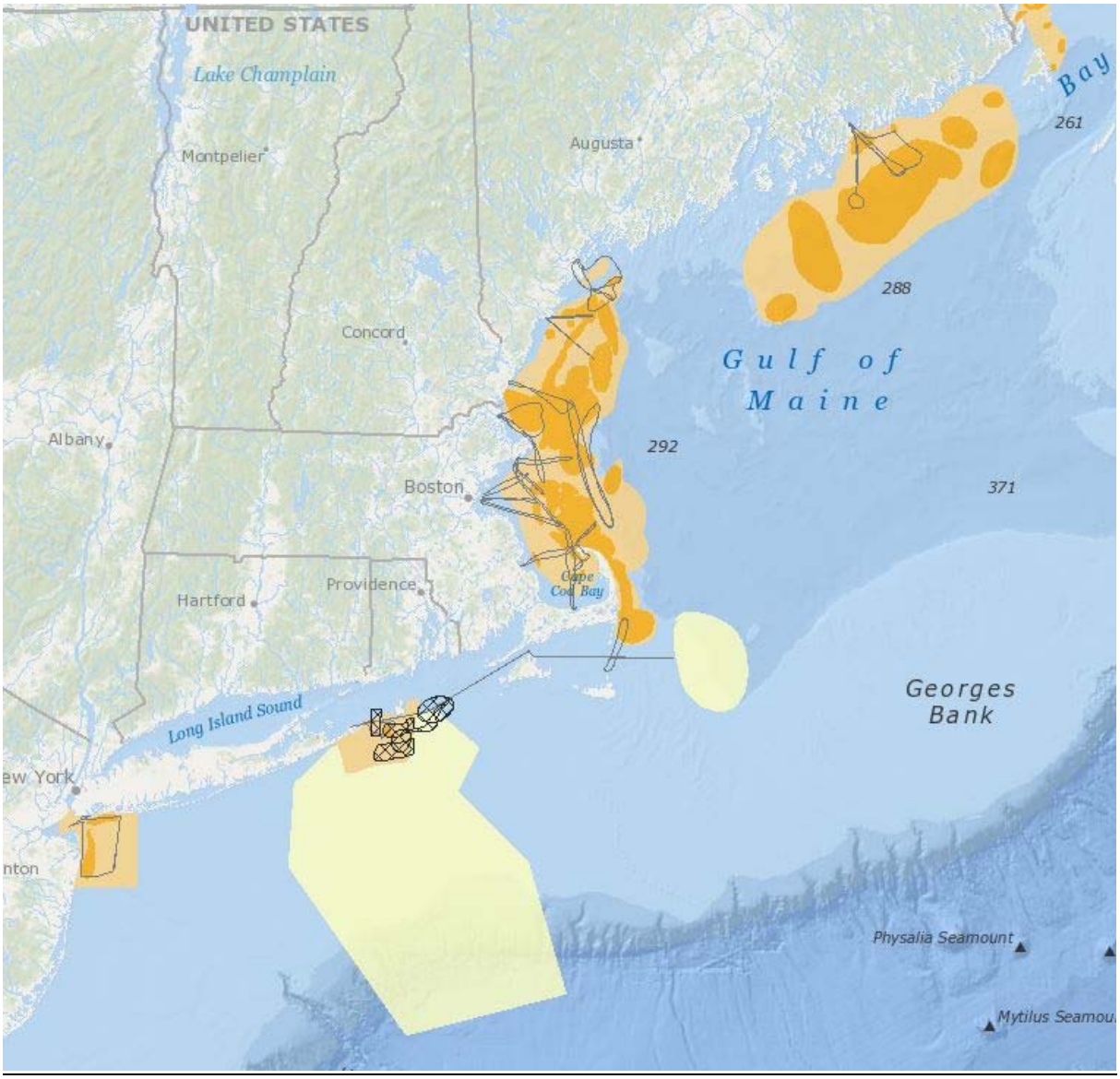
Whale watch companies do not report to NMFS where they go and what protected species they see. However, many, if not all, whale watch vessels carry naturalists on board to collect data. The naturalists are from research or conservation organizations. The Bar Harbor Whale Watch Company has been collecting data (e.g., number of humpbacks and finbacks, location and date) since the 1990s, but in 2003, started carrying scientists from Allied Whale on every trip. Their data are digitized, and he has offered to help obtain the data. The Blue Ocean Society, The Whale and Dolphin Conservation, Provincetown Center for Coastal Studies, and College of the Atlantic also provide scientists for trips by other companies that do excursions to Jeffries Ledge, Stellwagen Bank, and other areas (Z. Klyver, pers. comm., 2015).

Table 61 - Whale watching companies in the Northeast U.S., 2017

State	Company name	Port	Number of vessels
ME	Bar Harbor Whale Watch	Bar Harbor	2
	Boothbay Harbor Capt. Fish's Whale Watch	Boothbay Harbor	3
	First Chance Whale Watch	Kennebunk	1
	Odyssey Whale Watch	Portland	1
NH	Atlantic Fleet Whale Watch	Rye	1
	Granite State Whale Watch	Rye	1
MA	Boston Harbor Cruises/New England Aquarium	Boston	4
	Cape Ann Whale Watch	Gloucester	1
	Capt Bill and Sons Whale Watch	Gloucester	1
	Captain John Boats	Plymouth	2
	Dolphin Fleet of Provincetown	Provincetown	4
	Hyannis Whale Watch Cruises	Barnstable	1
	Newburyport Whale Watch	Newburyport	1
	Seven Seas Whale Watch	Gloucester	1
	Shearwater Excursions Whale Watch	Nantucket	1
RI	Frances Fleet	Narragansett	2
	Seven B's V	Narragansett	1
NY	American Princess Fleet	Neponset	1
	Viking Fleet	Montauk	1
	Joseph DiLiberto	Montauk	1
NJ	Cape May Whale Watcher	Cape May	1
	Cape May WW & Research Center & Starlight Fleet	Cape May	2
Source: GARFO			

Figure 19 shows commercial whale watching areas as mapped by whale watch industry participants in the Northeast Coastal and Marine Recreational Use Characterization Study conducted by SeaPlan, the Surfrider Foundation, and Point 97 under the direction of the Northeast Regional Planning Body. Whale watch owners, operators, naturalists, and data managers attended participatory mapping workshops to map areas where whale watching takes place in the region, while also providing information about seasonality, species, and overall industry trends.

Figure 19 - Map of commercial whale watching areas



Source: Northeast Ocean Data Explorer, http://www.northeastoceandata.org/data-explorer/

Legend:

- **Light orange = General use areas.** The full footprint of whale watch activity in 2010 – 2014.
- **Dark orange = Dominant use areas.** Areas routinely used by most users.
- **Lines = Transit routes.** Areas used for transit to and from general or dominant use areas.
- **Yellow = Supplemental areas.** Areas used for closely-related activities and infrequent specialty trips.
- **Hatched = RI Ocean Special Area Management Plan areas.** Areas that are part of the Rhode Island Ocean Special Area Management plan and are symbolized separately to reflect different data collection methodologies.

Seabird watching: New England is a popular destination for seabird watching, particularly Petit Manan and Machias Seal islands within the Maine Coastal Islands National Wildlife Refuge (off the coast of Steuben and Machiasport). The seabird tourism industry in Maine generally runs May-July, when most seabirds come to land to nest. In 2001, 120 companies were identified as providing recreational seabird viewing in Maine, with about two thirds located in the Penobscot Bay area or to the east. Seabird viewing is a primary focus of 10-15% of these companies; it is an incidental service for the remainder. Trip prices ranged from $36 for a one to four hour excursion to $425 for multi-day excursions. It was estimated that 5,000-7,500 trips were taken annually with seabird viewing as a primary purpose and 350,000 to 450,000 trips with seabird viewing as a secondary purpose (e.g., whale watching trips). The value of seabird tourism in Maine was estimated at $5 to $10 million in 2001. An earlier survey in 1996 of active bird watchers in Maine, indicated that 45% of respondents lived out of state, in over 30 states and one Canadian province (USFWS 2005, p. 3-13). The Friends of Maine Coastal Islands National Wildlife Refuge website has links to 17 seabird tour boat operators in Downeast and Midcoast Maine (Table 62; mainecoastislands.org).

Table 62 – Seabird watching companies in Maine, 2017

Region	Port	Company names
Downeast	Bar Harbor	Bar Harbor Whalewatch
	Cutler	Bold Coast Charter
	Milbridge	Downeast Coastal Cruises; Robertson Sea Tour Adventures
	Stonington	Old Quarry Ocean Adventures; The Mail Boat
Midcoast	Rockland	Breakwater Kayak; Maine Windjammer Association; Matinicus Excursions
	Boothbay	Cap'n Fish Whale Watch Cruises; Maine Kayak; Tidal Transit Kayak
	New Harbor	Hardy Boat Cruises
	Bath	Long Reach Cruises
	Damariscotta	Midcoast Kayak
	Port Clyde	Monhegan Boat Line
	Bremen	Sail Muscongus
Source: Friends of Maine Coastal Islands National Wildlife Refuge (mainecoastislands.org, accessed July 2017).		

Seabird watching also occurs in New Hampshire (e.g., Rye, Hampton) and Massachusetts (Newburyport) in conjunction with whale watching (www.auduon.org).

1.6.3 Fishing Communities

1.6.3.1 Overview

Consideration of the economic and social impacts on fishing communities from proposed fishery regulations is required by the National Environmental Policy Act (NEPA 1970) and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA 2007).

National Standard 8 of the MSFCMA (16 U.S.C. § 1851(a)(8)) stipulates that:

> *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

A "fishing community" is defined in the MSFCMA (16 U.S.C. § 1802(17)), as:

> *A community which is substantially dependent on or substantially engaged in the harvesting or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community.*

Determining which fishing communities are "substantially dependent" on and "substantially engaged" in the Atlantic herring fishery can be difficult. Although it is useful to narrow the focus to individual communities in the analysis of fishing dependence, there are a number of potential issues with the confidential nature of the information. There are privacy concerns with presenting the data in such a way that proprietary information (landings, revenue, etc.) can be attributed to an individual vessel or a small group of vessels. This is particularly difficult when presenting information on ports that may only have a small number of active vessels.

To gain a better perspective on the nature of the Atlantic herring fishery and the character of the affected human environment, a broader interpretation of fishing community has been applied to include almost all communities with a substantial involvement in or dependence on the Atlantic herring fishery. In terms of National Standard 8 (NS 8), some of the communities identified in this section may not fit the strict interpretation of the criteria for substantial dependence on fishing. The fishing communities that meet the legal definition (as promulgated through NS 8) are likely to be considered a subset of the broader group of communities of interest that are engaged in the herring fishery and identified in this document.

Because Atlantic herring is widely used as bait for the lobster fishery, especially in Maine, it is not practical to identify every community with substantial involvement in the lobster fishery (and consequently some level of dependence on the herring fishery) for assessment in this document. Instead, some of the communities of interest are selected, in part, because of their involvement in or dependence on the lobster fishery; assessment of the impacts of measures on these communities should provide enough context to understand the potential impacts on any community with substantial involvement in the lobster fishery. Parallels can be drawn between the communities that are identified in this section and other similar communities engaged in the lobster fishery.

National Standard 8 requires the Council to consider the importance of fishery resources to affected communities and provide those communities with continuing access to fishery resources, but it does not allow the Council to compromise the conservation objectives of the management measures. "Sustained participation" is interpreted as continued access to the fishery within the constraints of the condition of the resource.

1.6.3.2 Communities of Interest

There have been over 150 communities that have been a homeport or landing port to one or more active Atlantic herring fishing vessels since 1997. These ports primarily occur from Maine to Virginia. The level of activity in the herring fishery has varied across time. This section seeks to identify the communities for which Atlantic herring is particularly important, including communities active in the Atlantic herring fishery, and those dependent on herring as a bait source or prey item in the ecosystem. Information in this section is largely based on demographic data collected by the U.S. Census and fishery data collected by NMFS, much of which are available on the NEFSC website (NEFSC 2013). Clay et al. (2007) has a detailed profile of each port, including important social and demographic information. While these data describe a community's dependence on the Atlantic herring fishery, it is important to remember that at least some of the individual vessels therein are even more dependent on Atlantic herring. In some cases, the groups of communities identified above have been disaggregated so that information specific to certain communities can be provided and so that important details about individual communities are not lost.

1.6.3.2.1 Atlantic Herring Fishery

Engagement in and reliance on Atlantic herring fishery: Using the NMFS Community Vulnerability Indicators provides a broader view of the degree of involvement of communities in fisheries than simply using pounds or revenue of landed fish (Jepson & Colburn 2013). The indicators portray the importance or level of dependence of commercial or recreational fishing to coastal communities, and were used to help identify the Atlantic herring Communities of Interest for this action. The degree of engagement in or reliance on the Atlantic herring fishing is based on multiple sources of information, averaged over five years, 2011-2015, using dealer data.

- *The engagement index* incorporates the pounds and value of landed Atlantic herring, the number of herring dealers buying fish in that community, and the number of vessels with herring landings.
- *The reliance index* is a per capita measure using the same data as the engagement index, but divided by total population in the community.

Using a principal component and single solution factor analysis, each community receives a factor score, which is translated into a ranking of low, medium, medium-high, or high. A score of 1.0 or more places the community at 1 standard deviation above the mean (or average) and is considered highly engaged or reliant. Communities with scores of 0.0-0.49 have low engagement. More information about the indicators may be found at: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/index

The indicators reveal that there are 71 communities that have an Atlantic herring fishery engagement and reliance index in the range of low to high. Reported in Table 63 are the 20 communities that have a ranking of at least medium for either engagement or reliance. In general, the fishing communities with low populations (e.g., in eastern Maine) have a medium to

low engagement index, but a relatively higher reliance index. Portland, Gloucester, and New Bedford are highly engaged in the Atlantic herring fishery, but have high populations, so have lower reliance indices. Just one community scores high on both engagement and reliance indices: Rockland, Maine.

Table 63 – Atlantic herring fishing community engagement and reliance indicators

State	Community	Community Index	
		Engagement	Reliance
ME	Machiasport	Low	Medium
	Jonesport	Low	High
	Gouldsboro	Medium	High
	Stonington	Medium	High
	Rockland	High	High
	Vinalhaven	Low	High
	Matinicus Isle	Low	Med-High
	Friendship	Low	Medium
	South Bristol	Low	High
	Portland	High	Medium
MA	Gloucester	High	Med-High
	New Bedford	High	Low
RI	N. Kingstown	Medium	Low
	Narragansett/Pt. Judith	High	Medium
NY	Montauk	Med-High	Med-High
	Hampton Bays/Shinnecock	Med-High	Low
NJ	Belford	Low	Medium
	Barnegat Light, NJ	Low	Med-High
	Cape May	Medium	Medium
Source: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/index			

Community of Interest Criteria. The *Communities of Interest* for the Atlantic herring fishery meet at least one of the following criteria:

1. Atlantic herring landings of at least 10M pounds (4,536 mt) per year from 2007-2016, or anticipated landings above this level based on interviews and documented fishery-related developments.
2. Port infrastructure dependent in part or whole on Atlantic herring (e.g., herring dealers, pump stations).
3. Dependence on herring as bait (e.g., for lobster and/or tuna fisheries).
4. Geographic isolation in combination with some level of dependence on the Atlantic herring fishery.
5. Use of Atlantic herring for value-added production.
6. A ranking of "medium-high" or "high" for engagement in or reliance on the Atlantic herring fishery, according to the NMFS Community Vulnerability Indicators.

Updates to these criteria since their use in Amendment 5 are: a) updating the timeframe for herring landings in Criterion #1 (from 1997-2008 to 2007-2016); and b) adding Criterion #6, as the information for which has since become available from the NEFSC/Social Sciences Branch.

Communities identified. There are 17 communities that meet one or more of these criteria (Table 64). For Criteria #3, as there are well-over 5,000 vessels landing lobster in ports from Maine to Virginia, a subset of representative ports are included here. Herring is used as bait primarily in ports from Maine to Massachusetts. Ports with landings over 10M lbs each year from 1997-2008, a criterion in Amendment 5, is included for comparison purposes. The communities meeting this criterion are unchanged, with the exception of New Bedford, which meets the criterion under the more recent time period. In Amendment 5, Lubec/Eastport, Maine was a *Community of Interest*, but this community is not included in Table 64, as the value-added production plant that was located there is now closed. Of these 17 communities, 11 have non-confidential landings and are described further in Section 1.6.3.3.

Table 64 - *Communities of Interest* in the Atlantic herring fishery

State	Community	Landings >10M lbs.		Infra-struct.	Bait	Isolation	Value-added	Rank
		(97-08)	(07-16)					
ME	Jonesport			√	L	√		√
	Gouldsboro			√	L	√		√
	Stonington			√	L	√		√
	Rockland	√	√	√	L			√
	Vinalhaven			√	L	√		√
	Matinicus			√	L	√		√
	South Bristol			√	L			√
	Sebasco			√	L			
	Portland	√	√	√	L			√
MA	Gloucester	√	√	√	L,T			√
	New Bedford		√	√	L,T		√	√
RI	Narragansett/ Pt. Judith			√			√	√
NY	Montauk			√	T			√
	Hampton Bays/ Shinnecock			√				√
NJ	Barnegat Light			√	T			√
	Cape May			√	T			

L = port likely reliant on herring bait for the lobster fishery.
T = port identified as a Highly Migratory Species community in the HMS FMP. A portion of the tuna fishery uses herring as bait.

States and Landing Ports. During the period 2007-2016, Atlantic herring was landed in eight states (not including confidential states), with the most landings occurring in Maine and Massachusetts, averaging 82M and 79M lbs., respectively, per year (Table 65). Within these states, Atlantic herring was landed in 130 ports. Gloucester and Portland have been the top two landing ports during this time period.

Table 65 – Landings revenue to states, and Atlantic herring *Communities of Interest*, 2007-2016

State/Port	Top port ranking	2007-2016 Landings		Herring Permits [a]	Herring Dealers [a]
		Total	Average		
Maine		822	82M	62	103
Portland	#2	374M	37M	33	80
Rockland	#4	294M	29M	20	67
Stonington	#6	52M	5.2M	12	33
Vinalhaven	#10	20M	2.0M	8	7
Jonesport	#12	17M	1.7M	8	13
S. Bristol	#19	5.1M	0.5M	6	4
Other (n=35)*		59M	5.9M	39	72
New Hampshire		47	4.7M	26	32
Massachusetts		793	79M	66	97
Gloucester	#1	439M	44M	39	83
New Bedford	#3	324M	32M	28	63
Other (n=11)		31M	3.1M	29	45
Rhode Island		117	12M	58	35
Point Judith	#5	71M	7.1M	171	29
Other (n=9)		46M	4.6M	20	14
Connecticut		1.4M	0.1M	11	6
New York		0.9M	0.1M	73	30
Montauk	#39	0.2M	0.0M	45	16
Hampton Bays/ Shinnecock	#37	0.3M	0.0M	29	16
Other (n=12)		0.4M	0.0M	14	13
New Jersey		47M	4.7M	56	12
Maryland		0.1M	0.0M	11	3
Confidential state(s)		6.7M	0.7M	9	7
Total	**130**	**1,806M**	**181M**	**291**	**190**

[a] Totals may not equal the sum of the parts, because permits can land in multiple ports/states.
*Prospect Harbor, Maine is the top 9th port in terms of landings during this time period (27M total, 2.7M average), yet it does not qualify as an Atlantic herring *Community of Interest*.
Source: Dealer data, accessed July 2017.

Home Ports

Of the Atlantic herring *Communities of Interest*, Gloucester and New Bedford, Southern RI, and Cape May are homeports with largest concentrations of vessels that have Atlantic Herring limited access directed fishery permits, Categories A and B (Table 66). Mid-Coast ME, Portland and Seacoast NH also are home to a few of these permit holders. Beyond the communities of interest, a few Category A and B permit holders have homeports in Bath, Cundys Harbor, Hampden, and Matinicus ME; Boston and Woods Hole MA; and Wanchese NC. For the most part, these vessels use a community of interest as a landing port. The distribution of important homeports for Atlantic herring vessels is largely unchanged between 2011 and 2016, particularly for the limited access vessels.

Table 66 - Distribution of vessels with herring permits which have an Atlantic herring community of interest as a homeport, 2011 and 2016

Homeport		Atlantic Herring Permit Category					
		Limited Access (A, B, C)		Open Access (D, E)		Total	
		2011	2016	2011	2016	2011	2016
ME	Portland	3	3	37	33	40	36
	Rockland	1	1	2	2	3	3
	Stonington/Deer Isle	1	0	1	2	2	2
	Vinalhaven	0	0	2	3	2	3
	Lubec/Eastport	0	0	2	1	2	1
	Sebasco Estates	0	0	3	2	3	2
	Maine, other	11	7	213	150	224	159
NH	Seacoast	6	4	104	94	110	98
MA	Gloucester	8	6	191	116	199	122
	New Bedford	12	10	210	183	222	193
	Massachusetts, other	10	8	407	329	417	337
RI		15	14	124	112	139	126
NJ	Cape May	14	12	100	77	114	89
	New Jersey, other	0	0	207	173	207	173
Other		12	12	521	393	533	405

Source: NMFS permit database (*http://www.nero.noaa.gov/permits/permit.html*), accessed September 2016.

Between 2007 and 2010, the majority of herring was landed in Massachusetts, Maine, New Jersey, and Rhode Island. Table 67 characterizes each state that fish were landed in from vessels that held a herring permit by the species landed and year, by showing the revenue and landings for each. Massachusetts landed the most herring, and Maine had the second highest landings in all years. Menhaden caught by herring permit holders were landed primarily in New Jersey, and mackerel caught by herring permit holders were landed primarily in Massachusetts. Squid landed by herring permit holders was caught primarily in New Jersey and Rhode Island.

Table 67 - Total revenue (thousands of dollars) and landings (thousands of pounds) of all species by landed states and species for vessels with Atlantic herring permits, 2007-2010[update]

		2,008		2,009		2,010	
		Revenue	Landings	Revenue	Landings	Revenue	Landings
CT	Herring	*C	*C	*C	*C	*C	*C
	Menhaden	*C	*C	*C	*C	*C	*C
	Mackerel	17	83	33	119	12	39
	Squid	562	488	497	484	662	554
	Other	12,211	5,004	11,772	5,671	12,381	5,771
MA	Herring	11,702	100,864	12,399	130,778	7,986	69,574
	Menhaden	1,780	15,264	871	9,240	676	6,843
	Mackerel	4,064	37,511	3,498	31,324	1,358	12,394
	Squid	1,543	1,596	1,112	1,242	1,606	1,374
	Other	264,674	102,846	263,253	104,692	328,976	110,172
ME	Herring	9,001	71,133	8,793	69,275	9,103	59,267
	Menhaden	279	2,744	45	467	*C	*C
	Mackerel	2	18	2	6	34	183
	Squid	6	7	*C	*C	1	1
	Other	19,270	13,779	16,804	12,277	19,347	13,210
NH	Herring	120	979	350	3,306	430	3,730
	Menhaden	0	0	0	0	0	0
	Mackerel	3	19	6	21	2	7
	Squid	1	1	0	0	0	0
	Other	13,497	7,522	13,828	8,617	15,614	7,471
NJ	Herring	404	6,256	1,176	13,261	227	3,701
	Menhaden	2,573	38,556	1,210	17,622	1,662	24,097
	Mackerel	1,308	8,857	1,998	10,071	428	4,392
	Squid	8,273	23,902	7,177	28,256	7,619	21,721
	Other	88,232	21,222	87,647	24,712	101,870	24,000
NY	Herring	4	25	4	21	2	13
	Menhaden	8	49	10	58	8	54
	Mackerel	43	167	44	141	23	90
	Squid	5,480	5,617	4,713	4,494	4,525	4,013
	Other	22,768	11,219	30,272	13,456	18,882	12,029
RI	Herring	645	4,495	1,412	10,331	1,167	8,854
	Menhaden	*C	*C	*C	*C	0	0
	Mackerel	910	2,534	3,103	8,588	1,415	4,422
	Squid	17,826	27,011	14,917	25,762	12,770	20,422
	Other	29,266	26,862	24,002	23,248	25,624	24,955

Source: Dealer data
*C = confidential

1.6.3.2.2 Other Fisheries/Ecotourism

There are several other fisheries, as well as the ecotourism industry, that are potentially impacted by this action. The lead management entity for each has taken has used different criteria for determining the port communities particularly important to the industry/fishery.

Mackerel: Many vessels that participate in the Atlantic herring fishery are also active in the Atlantic mackerel fishery. In 2016, there were 39 ports from Maine to North Carolina that are

either a homeport or a primary landing port to vessels with Atlantic Mackerel limited access permits. Key ports identified in the Mackerel, Squid, Butterfish FMP had at least $100,000 in ex-vessel revenues from mackerel during 2011-2013 (combined) included (from more mackerel dollars to less): North Kingstown, RI; Gloucester, MA; New Bedford, MA; Cape May, NJ; Portland, ME, and Point Judith, RI (MAFMC 2015).

American Lobster: The American lobster fishery is the primary end user of Atlantic herring as bait. American lobster is landed in many port communities on the Atlantic coast. The ASMFC does not identify key ports in the FMP for this fishery, but in 2015, 18 of the top 20 ports for lobster landed value were in Maine, and two were in Massachusetts (Table 68).

Table 68 - Top 20 landing ports for American lobster by revenue, 2015

State	Port	Revenue	# of vessels	# of dealers
ME	Stonington	$62M	367	10
ME	Vinalhaven	$39M	222	12
ME	Friendship	$21M	165	10
ME	Beals	$20M	234	5
ME	Spruce Head	$17M	130	10
ME	Portland	$17M	230	21
MA	Gloucester	$16M	202	24
ME	Rockland	$13M	163	4
ME	Swans Island	$11M	93	4
ME	Southwest Harbor	$11M	109	8
ME	Bass Harbor	$11M	91	7
ME	Milbridge	$11M	76	13
ME	Port Clyde	$10M	103	10
ME	Owls Head	$10M	71	4
ME	Jonesport	$9.8M	178	6
ME	Tenants Harbor	$9.7M	92	11
ME	Steuben	$9.4M	71	11
ME	Cushing	$9.1M	68	9
ME	Winter Harbor	$8.4M	39	3
MA	New Bedford	$8.3M	91	22
Source: ACCSP, accessed August 2017.				

Bluefin Tuna: Atlantic herring is important to tuna as a prey item in the ecosystem as well as a bait source for a subset of the fishery. NMFS has identified 28 fishing communities important to the Highly Migratory Species fishery (including 53 species of tunas, swordfish, sharks, etc.) defined by the proportion of HMS landings in the town, the relationship between the geographic communities and the fishing fleets, socioeconomic research, community studies, and input from advisory bodies (NMFS 2011b). The communities in Maine to New Jersey are: Gloucester and New Bedford, MA; Wakefield RI; Montauk, NY; and Barnegat Light, Brielle, and Cape May, NJ. For Maine to New Jersey in 2011, 45% of the angling permits, 53% of the charter and headboat permits, and 71% of the commercial tuna permits are located in Massachusetts and Rhode Island (Table X).

Commercial Groundfish: Atlantic herring is important to groundfish as a prey item in the ecosystem as well; it is a bait source for a very minor subset of the commercial fishery (more important for recreational bait).There are over 400 communities that have been the homeport or landing port to one or more commercial Northeast groundfish fishing vessels since 2008. Of these, 10 ports have been identified as primary commercial groundfish port communities (and 22 secondary ports), based on the level of commercial groundfish activity in the port (Table 69). Primary ports have, during FY 2009-FY 2013, at least $100,000 average annual revenue (for all species, not just groundfish) and are in the top ten ranking in regional quotient or local quotient (confidential ports excluded). Secondary ports are in the top 11-30 ranking in regional or local quotient (same revenue threshold) (NEFMC 2017).

Recreational: Atlantic herring is important to recreational fisheries as a prey item in the ecosystem as well as a bait source for a subset of the fishery. The relevant recreational fisheries are primarily tuna, striped bass, and groundfish. In the fishery management plans for these fisheries, criteria for identifying key recreational fishing communities have not been identified. For Amendment 8, the NMFS Community Vulnerability Indicators have been used to do so. The indicators portray the importance or level of dependence of recreational fishing to coastal communities. The degree of engagement in or reliance on recreational fishing is based on multiple sources of information (Jepson & Colburn 2013). [to be completed]

Ecotourism: The Friends of the Maine Coastal Island National Wildlife Refuge lists several seabird watching businesses in Maine on its website. These businesses are located 11 communities in Maine. GARFO records indicate there are currently 17 whale watching businesses, in communities from Maine to New Jersey (Section 1.6.2.7; Table 69).

Table 69 – Key port communities for the herring fishery and other fisheries potentially impacted by Amendment 8, Maine to New Jersey [add recreational]

State	Port	Industry					
		Herring	Mackerel	Lobster	Tuna	Groundfish	Ecotourism
ME	Cutler						B
	Jonesport	H		L			
	Beals			L			
	Milbridge			L			B
	Steuben			L			
	Gouldsboro	H					
	Winter Harbor			L			
	Bar Harbor						B/W
	Southwest Harbor			L			
	Bass Harbor			L			
	Swans Island			L			
	Stonington	H		L			B
	Rockland	H		L			B
	Vinalhaven	H	M	L			
	Owls Head			L			
	Matinicus	H					
	Spruce Head			L		S	
	Port Clyde			L		S	B
	Tenants Harbor			L			
	Cushing			L			
	Friendship			L			
	Bremen						B
	New Harbor						B
	S. Bristol	H					
	Damariscotta						B
	Boothbay Harbor					S	B/W
	Bath						B
	Sebasco	H					
	Cundy's Harbor					S	
	Portland	H		L		P	W
	Saco					S	
	Cape Porpoise					S	
	Kennebunkport					S	W
NH	Portsmouth					P	
	Rye					P	B/W
	Seabrook					P	

	Hampton					S	B/W
MA	Newburyport					S	B/W
	Rockport					P	B
	Gloucester	H	M	L	T	P	W
	Boston					P	B/W
	Scituate					P	B/W
	Marshfield					S	B
	Plymouth					S	B/W
	Sandwich					S	
	Barnstable					S	W
	Dennis					S	
	Provincetown					S	W
	Chatham					P	B
	Harwichport					P	
	Nantucket					P	W
	Woods Hole					S	
	New Bedford	H	M	L	T	P	
RI	N. Kingstown		M				
	Narragansett/Pt. Judith	H	M			P	W
	Wakefield				T		
	Newport					S	
CT	Stonington					S	
NY	Montauk	H			T	S	W
	Hampton Bays/Shinnecock	H					
	Neponset						W
NJ	Barnegat Light	H			T		
	Brielle				T		
	Cape May	H	M		T		W
H = herring; M = mackerel; P = primary groundfish; S = secondary groundfish; B = seabird watching; W = whale watching							

1.6.3.3 Port Descriptions

Described here are the 11 fishing communities that have a "high" Atlantic herring fishery engagement and/or reliance index (Section 1.6.3.2.1).

1.6.3.3.1 Maine ports

Jonesport, ME

General: Jonesport is a fishing community in Washington County, Maine, with a population of 1,370 as of 2010. In 2011-15, 22% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Jonesport; the poverty rate was 16%; and the population was 99% white, non-Hispanic (U.S. Census 2017). Jonesport has a high fishing engagement index and a high fishing reliance index (Colburn & Jepson 2012).

In 2015, Jonesport was the homeport and primary landing port listed by GARFO for 60 and 66 federal fishing permits, respectively (GARFO 2017). Total landings in Jonesport were valued at over $11M, 2% of the state-wide total ($591M). American lobster accounted for $9.8M (89%) of the 2015 landings in Jonesport, landed by 157 vessels and sold to 6 dealers (Table 70; ACCSP, 2017).

Herring fishery: Since 2007, Jonesport has been the 12th highest port in terms of Atlantic herring landings (average 1.7M/year; 1% of total; Table 65). These landings are attributed to eight Atlantic herring federal permits, sold to 13 dealers. In 2015, Jonesport was the homeport and primary landing port listed by GARFO for four and five Category D federal fishing permits, respectively (GARFO 2017). Thus, Jonesport is likely not the primary port for several herring vessels. Jonesport is involved in the Atlantic herring fishery primarily through its dependence on herring for lobster bait and for its geographic isolation (Section 1.6.3.2.1). Jonesport shares characteristics with many other small, somewhat isolated communities in Maine dependent on herring for lobster bait. The Atlantic herring fishing engagement and reliance indices are low and high, respectively, for Jonesport (Colburn & Jepson 2012).

Table 70 - Top five species landed by value in Jonesport ME, 2015

Species	Revenue ($)	Vessels	Dealers
American lobster	$9.8M	157	6
Sea scallop	$0.89M	94	3
Sea mussel	$0.55M	7	3
Atlantic halibut	$0.071M	34	3
Note: Data for one of the five top species landed are confidential. *Source:* ACCSP, as of August 2017.			

Stonington, ME

General: Stonington is a fishing community in Hancock County, Maine, with a population of 1,043, as of 2010. In 2011-2015, 33% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Stonington; the poverty rate was 15%; and the population was 97% white, non-Hispanic (U.S. Census 2017). Stonington has a high fishing engagement index and a high fishing reliance index (Colburn & Jepson 2012).

In 2015, Stonington was the homeport and primary landing port listed by GARFO for 89 and 90 federal fishing permits, respectively (GARFO 2017). Total landings in Stonington were valued at over $63M, 11% of the state-wide total ($591M). American lobster accounted for $62M (98%) of the 2015 landings in Stonington, landed by 372 vessels and sold to 10 dealers (Table 71; ACCSP, 2017).

Shoreside support services and fishing-related organizations based in Stonington include the Maine Center for Coastal Fisheries (coastalfisheries.org), the Stonington Lobster Cooperative (http://www.stoningtonlobstercoop.com), Island Fishermen's Wives Association (http://islandfishermenswivesassociation.org), and Commercial Fisheries News (www.fish-news.com/cfn/).

Herring fishery: Since 2007, Stonington has been the 6th highest port in terms of Atlantic herring landings (average 5.2M/year; 3% of total; Table 65). These landings are attributed to 12 Atlantic herring federal permits, sold to 33 dealers. In 2015, Stonington was the homeport listed by

GARFO for no Atlantic herring federal fishing permits and the primary landing port listed for two Category D permits (GARFO 2017). Thus, Stonington is likely not the primary port for several herring vessels. Stonington is involved in the Atlantic herring fishery primarily through its dependence on herring for lobster bait and for its geographic isolation (Section 1.6.3.2.1). Stonington shares characteristics with many other small, somewhat isolated communities in Maine dependent on herring for lobster bait. The Atlantic herring fishing engagement and reliance indices are medium and high, respectively, for Stonington (Colburn & Jepson 2012).

Other fisheries/ecotourism: Stonington is a bird watching destination, with two companies located in town: Old Quarry Ocean Adventures (www.oldquarry.com) and The Mail Boat (isleauhautferryservice.com; Table 62).

Table 71 - Top five species landed by value in Stonington ME, 2015

Species	Revenue ($)	Vessels	Dealers
American lobster	$62M	372	10
Sea scallop	$0.48M	38	11
Atlantic halibut	$0.23M	39	5
Atlantic rock crab	$0.034M	33	5
Note: Data for one of the five top species landed are confidential. *Source:* ACCSP, as of August 2017.			

Rockland, ME

General: Rockland is a fishing community in Knox County, Maine, with a population of 7,297, as of 2010. In 2011-2015, 4% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Rockland, the poverty rate was 14%; and the population was 96% white, non-Hispanic (U.S. Census 2017). Rockland has a high fishing engagement index and a medium fishing reliance index (Colburn & Jepson 2012).

In 2015, Rockland was the homeport and primary landing port listed by GARFO for 14 and 12 federal fishing permits, respectively (GARFO 2017). Total landings in Rockland were valued at over $18M, 3% of the state-wide total ($591M). American lobster accounted for $13M (72%) of the 2015 landings in Rockland, landed by 141 vessels and sold to 4 dealers (Table 72; ACCSP, 2017).

Herring fishery: Since 2007, Rockland has been the 4th highest port in terms of Atlantic herring landings (average 29M/year; 16% of total; Table 65). In 2015, herring was one of the top five species landed in Rockland, valued at $4.4M, landed by 6 vessels and sold to 31 dealers (Table 72; ACCSP, 2017). Rockland meets Criterion #1 for an Atlantic herring *Community of Interest*: having at least 10M pounds of landings per year from 2007-2016. These landings are attributed to 20 Atlantic herring federal permits, sold to 67 dealers. In 2015, Rockland was the homeport listed by GARFO for no Atlantic herring federal fishing permits and the primary landing port listed for two Category A and two Category D permits (GARFO 2017). Thus, Rockland is likely not the primary port for several herring vessels.

Rockland is also involved in the Atlantic herring fishery in its dependence on herring for lobster bait (Section 1.6.3.2.1). Shoreside support services based in Rockland include several lobster bait dealers, large and small, and a pumping station for offloading herring, which is trucked to other ports. In addition, there are freezer facilities to store lobster bait and ice services in Rockland.

The Atlantic herring fishing engagement and reliance indices are high and high, respectively, for Rockland (Colburn & Jepson 2012).

Other fisheries/ecotourism: Rockland is a bird watching destination, with three companies located in town: Breakwater Kayak, Maine Windjammer Assoc., and Matinicus Excursions (Table 62).

Table 72 - Top five species landed by value in Rockland ME, 2015

Species	Revenue ($)	Vessels	Dealers
American lobster	$13M	141	4
Atlantic herring	$4.4M	6	31
Note: Data for three of the five top species landed are confidential. *Source:* ACCSP, as of August 2017.			

Vinalhaven, ME

General: Vinalhaven is an island fishing community in Knox County, Maine, with a year-round population of 1,165, as of 2010 (swells in the summer). In 2011-2015, 36% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry in Vinalhaven, the poverty rate was 12%; and the population was 94% white, non-Hispanic (U.S. Census 2017). Vinalhaven has a high fishing engagement index and a medium-high fishing reliance index (Colburn & Jepson 2012).

In 2015, Vinalhaven was the homeport and primary landing port listed by GARFO for 49 and 51 federal fishing permits, respectively (GARFO 2017). Total landings in Vinalhaven were valued at over $40M, 7% of the state-wide total ($591M). American lobster accounted for $39M (98%) of the 2015 landings in Vinalhaven, landed by 221 vessels and sold to 12 dealers (Table 73; ACCSP, 2017).

Herring fishery: Since 2007, Vinalhaven has been the 10th highest port in terms of Atlantic herring landings (average 2.0M/year; 1% of total; Table 65). These landings are attributed to eight Atlantic herring federal permits, sold to seven dealers. In 2015, Vinalhaven was the homeport listed by GARFO for no Atlantic herring federal fishing permits and the primary landing port listed for two Category A and five Category D permits (GARFO 2017). Thus, the Atlantic herring vessels that offload on Vinalhaven are primary based on the mainland. There is a public ferry service from Rockland, but its storage capacity is too small to satisfy the bait market.

Vinalhaven is also involved in the Atlantic herring fishery in its dependence on herring for lobster bait and its geographic isolation (Section 1.6.3.2.1). Shoreside support services based in Vinalhaven include the Vinalhaven Fishermen's Cooperative, locally owned by lobstermen and supplying the island with bait and fuel and distributing their lobsters to customers globally (vinalhavencoop.com). There are several lobster wholesale and packaging companies operating on Vinalhaven. There is little on-island bait storage capacity, so islanders are dependent on deliveries by herring vessels. Bait dealers on Vinalhaven pay a higher price for bait than dealers on the mainland, as there is limited bait storage capacity on the island and insufficient space on the ferry that transports goods and people from the mainland to make regular bait transshipments during the height of the lobster season. The Atlantic herring fishing engagement and reliance indices are low and high, respectively, for Vinalhaven (Colburn & Jepson 2012).

Other fisheries: Vinalhaven is a key port for the mackerel fishery (Table 69).

Table 73 - Top five species landed by value in Vinalhaven, ME, 2015

Species	Revenue ($)	Vessels	Dealers
American lobster	$39M	221	12
Sea scallop	$0.064M	7	3
Atlantic halibut	$0.018M	10	3
Atlantic rock crab	$0.016M	53	8
Note: Data for one of the five top species landed are confidential. *Source:* ACCSP, as of April 2017.			

South Bristol, ME:

General: South Bristol is a fishing community in Lincoln County, Maine, with a population of 892 as of 2010. In 2011-2015, 5% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in South Bristol; the poverty rate was 11%; and the population was 99% white, non-Hispanic (U.S. Census 2017). South Bristol has a medium-high fishing engagement index and a medium-high high fishing reliance index (Colburn & Jepson 2012).

In 2015, South Bristol was the homeport and primary landing port listed by GARFO for 26 and 27 federal fishing permits, respectively (GARFO 2017). Total landings in South Bristol were valued at over $5.9M, 1% of the state-wide total ($591M). American lobster accounted for $5.9M of the 2015 landings in South Bristol, landed by 77 vessels and sold to 4 dealers (Table 74; ACCSP, 2017).

Herring fishery: Since 2007, South Bristol has been the 19th highest port in terms of Atlantic herring landings (average 0.5M/year; 0.3% of total; Table 65). These landings are attributed to six Atlantic herring federal permits, sold to four dealers. In 2015, South Bristol was the homeport listed by GARFO for two Category C and six Category D Atlantic herring federal fishing permits and the primary landing port listed for one Category A permit, two category C permits, and six Category D permits (GARFO 2017). Thus, the Atlantic herring vessels that offload in South Bristol may primarily be based in South Bristol.

South Bristol is also involved in the Atlantic herring fishery in its dependence on herring for lobster bait (Section 1.6.3.2.1). Shoreside support services based in South Bristol include the South Bristol Fisherman's Cooperative, which was created in the 1970s and has a current membership of over 35 fishermen, supplying the community with bait and fuel and distributing their lobsters (e.g., packing and shipping) to customers (www.southbristolcoop.com). The Atlantic herring fishing engagement and reliance indices are low and high, respectively, for South Bristol (Colburn & Jepson 2012).

Table 74 - Top five species landed by value in South Bristol ME, 2015

Species	Revenue ($)	Vessels	Dealers
American lobster	$5.9M	77	4
Note: Data for four of the five top species landed are confidential. *Source:* ACCSP, as of August 2017.			

Portland, ME

General: Portland is a fishing community in Cumberland County, Maine, with a population of 66,194, as of 2010. In 2011-2015, 0.5% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Portland; the poverty rate was 20%; and the population was 83% white, non-Hispanic (U.S. Census 2017). Portland has a high fishing engagement index and a low fishing reliance index (Colburn & Jepson 2012). In 2015, Portland was the homeport and primary landing port listed by GARFO for 69 and 95 federal fishing permits, respectively (GARFO 2017). Total landings in Portland were valued at $35M, 6% of the state-wide total ($591M). American lobster accounted for $17M (49%) of the 2015 landings in Portland, landed by 218 vessels and sold to 21 dealers (Table 75; ACCSP, 2017).

Herring fishery: Since 2007, Portland has been the 2nd highest port in terms of Atlantic herring landings (average 37M/year; 20% of total; Table 65). Portland meets Criterion #1 for an Atlantic herring *Community of Interest*: having at least 10M pounds of landings per year from 2007-2016. These landings are attributed to 33 Atlantic herring federal permits, sold to 80 dealers. In 2015, Portland was the homeport listed by GARFO for two Category A, one Category C, 30 Category D, and one Category D/E Atlantic herring federal fishing permits. Portland was the primary landing port listed for three Category A permits, one category C permit, and 30 Category D permits, and one Category D/E permits (GARFO 2017). Thus, more Atlantic herring vessels offload in Portland than are based there.

Portland is also involved in the Atlantic herring fishery in its dependence on herring for lobster bait (Section 1.6.3.2.1). Shoreside support services based in Portland include several dealers, processors, and other infrastructure that supports the herring fishery. Opening in 1986, the Portland Fish Exchange is America's first all-display seafood auction (www.pfex.org). In addition to serving as a herring dealer, it rents space to store salted herring. Several lobster bait dealers and a pumping station for offloading herring are located in Portland. Several facilities in Portland process lobsters including Cozy Harbor Seafood, Inc. (www.cozyharbor.com), and Inland Seafood (www.inlandseafood.com). Portland's infrastructure includes major highways, shipping terminals, and an airport. The port also provides many additional fishing-related services including ice, fuel, and vessel maintenance/repair services. The Atlantic herring fishing engagement and reliance indices are high and medium, respectively (Colburn & Jepson 2012).

Other Fisheries/Ecotourism: Portland is a primary port for the groundfish fishery (Table 69). Recreational fishing companies based in Portland (or South Portland) include: Go Fish! Charters (www.gofishmaine.com), Fishing with Matt and Josh (www.mainecharterfishing.com), and Morning Flight Charters (www.morningflightcharters.com). Portland is home to one whale watching company, Odyssey Whale Watch (Table 61).

Table 75 - Top five species landed by value in Portland ME, 2015

Species	Revenue ($)	Vessels	Dealers
American lobster	$17M	218	21
Atlantic herring	$8.1M	8	50
Pollock	$1.9M	32	5
White hake	$0.90M	27	3
Goosefish (monkfish)	$0.58M	27	4
Source: ACCSP, as of August 2017.			

1.6.3.3.2 Massachusetts ports

Gloucester, MA

General: Gloucester is a fishing community in Essex County, Massachusetts, with a population of 28,789, as of 2010. In 2011-2015, 1% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Gloucester; the poverty rate was 9%; and the population was 94% white, non-Hispanic (U.S. Census 2017a). Gloucester has a high fishing engagement index and a medium fishing reliance index (Colburn & Jepson 2012).

In 2015, Gloucester was the homeport and primary landing port listed by GARFO for 214 and 232 federal fishing permits, respectively (GARFO 2017). Total landings in Gloucester were valued at $44M, 8% of the state-wide total ($524M). American lobster accounted for $16M (36%) of the 2015 landings in Gloucester, landed by 199 vessels and sold to 24 dealers (Table 76; ACCSP, 2017).

Herring fishery: Since 2007, Gloucester has been the highest port in terms of Atlantic herring landings (average 44M/year; 24% of total; Table 65). Gloucester meets Criterion #1 for an Atlantic herring *Community of Interest*: having at least 10M pounds of landings per year from 2007-2016. These landings are attributed to 39 Atlantic herring federal permits, sold to 83 dealers. In 2015, Gloucester was the homeport listed by GARFO for five Category A, three Category C, and 128 Category D Atlantic herring federal fishing permits. Gloucester was the primary landing port listed for four Category A permits, three category C permit, and 137 Category D permits (GARFO 2017). Thus, more Atlantic herring vessels register their vessels (are based) in Gloucester than have actively landed there.

Gloucester is also involved in the Atlantic herring fishery in its dependence on herring for lobster bait (Section 1.6.3.2.1). Shoreside support services based in Gloucester include several dealers, processors, and other infrastructure that supports the herring fishery. Several lobster bait dealers and a pumping station for offloading herring are located in Gloucester. The port also provides many additional fishing-related services including ice, fuel, and vessel maintenance/repair services. Cape Seafoods, one of the largest processors of herring for frozen export, is located at the State Pier and owns several dedicated pelagic fishing vessels. The Atlantic herring fishing engagement and reliance indices are high and medium-high, respectively, for Gloucester (Colburn & Jepson 2012).

Other Fisheries/Ecotourism: Gloucester is home to three whale watching companies: Cape Ann Whale watch, Capt. Bill and sons Whale Watch, and Seven Seas Whale Watch (Table 61). Gloucester is a key port for the tuna and mackerel fisheries and a primary port for the groundfish fishery (Table 69).

Table 76 - Top five species landed by value in Gloucester MA, 2015

Species	Revenue ($)	Vessels	Dealers
American lobster	$16M	199	24
Atlantic herring	$5.3M	9	25
Haddock	$3.8M	70	13
Goosefish (monkfish)	$2.5M	70	9
Acadian redfish	$2.5M	55	12
Source: ACCSP, as of August 2017.			

New Bedford, MA

General: is a fishing community in Bristol County, Massachusetts, with a population of 95,072, as of 2010. In 2011-2015, 2% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry in New Bedford; the poverty rate was 23%; and the population was 66% white, non-Hispanic (U.S. Census 2017a). New Bedford has a high fishing engagement index and a medium fishing reliance index (Colburn & Jepson 2012). In 2015, New Bedford was the homeport and primary landing port listed by GARFO for 220 and 242 federal fishing permits, respectively (GARFO 2017). Total landings in New Bedford were valued at $322M, 62% of the state-wide total ($524M). Sea scallops accounted for $245M (76%) of the 2015 landings in New Bedford, landed by 276 vessels and sold to 28 dealers (Table 77; ACCSP, 2017).

Herring fishery: Since 2007, New Bedford has been the 3rd highest port in terms of Atlantic herring landings (average 32M/year; 18% of total; Table 65). New Bedford meets Criterion #1 for an Atlantic herring *Community of Interest*: having at least 10M pounds of landings per year from 2007-2016. These landings are attributed to 28 Atlantic herring federal permits, sold to 63 dealers. In 2015, New Bedford was the homeport listed by GARFO for eight Category A, three Category C, 174 Category D, and nine Category D/E Atlantic herring federal fishing permits. New Bedford was the primary landing port listed for eight Category A permits, two category C permits, and 189 Category D permits, and nine Category D/E permits (GARFO 2017). Thus, New Bedford is the homeport and primary landing port for the largest number of permits in the fishery.

New Bedford is also involved in the Atlantic herring fishery in its dependence on herring for lobster bait (Section 1.6.3.2.1). Shoreside support services based in New Bedford include several dealers, processors, and other infrastructure that supports the herring fishery. Several lobster bait dealers and a pumping station for offloading herring are located in New Bedford. NORPEL, one of the largest processors of herring for frozen export, is located in New Bedford (Section 1.6.1.9.2). New Bedford's infrastructure includes shipping terminals (Maritime International, Section 1.6.1.16) and access to major highways and nearby airports. The port also provides many additional fishing-related services including ice, fuel, and vessel maintenance/repair services. The Atlantic herring fishing engagement and reliance indices are high and low, respectively, for New Bedford (Colburn & Jepson 2012).

Other Fisheries/Ecotourism: New Bedford is a primary port for the groundfish fishery (Table 69). Recreational fishing companies based in New Bedford include: Captain Leroy's Deep Sea Fishing, Mac-atac Sportfishing, Viking Fleet, and Walsh's Deep Sea Fishing (www.portofnewbedford.org). Viking Fleet also offers whale watching trips. New Bedford is a key port for the tuna and mackerel fisheries.

Table 77 - Top five species landed by value in New Bedford MA, 2015

Species	Revenue ($)	Vessels	Dealers
Sea scallop	$245M	276	28
Atlantic surfclam	$12M	18	11
American lobster	$8.3M	103	22
Haddock	$6.4M	50	9
Winter flounder	$5.7M	57	8
Source: ACCSP, as of August 2017.			

1.6.3.3.3 Rhode Island ports

Narragansett/Point Judith

General: Point Judith is a fishing community in the town of Narragansett, in Washington County, Rhode Island. Narragansett has a population of 15,865, as of 2010. In 2011-2015, 1% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Narragansett; the poverty rate was 16%; and the population was 95% white, non-Hispanic (U.S. Census 2017). Narragansett/Point Judith has a high fishing engagement index and a medium fishing reliance index (Colburn & Jepson 2012).

In 2015, Point Judith was the homeport and primary landing port listed by GARFO for 112 and 138 federal fishing permits, respectively (GARFO 2017). Total landings in Point Judith were valued at $46M, 56% of the state-wide total ($82M). Many of Point Judith's vessels are active in fisheries managed by the MAFMC. Inshore longfin squid accounted for $13M (29%) of the 2015 landings in Point Judith, landed by 98 vessels and sold to 17 dealers (Table 78; ACCSP, 2017).

Herring fishery: Since 2007, Point Judith has been the 5th highest port in terms of Atlantic herring landings (average 7.1M/year; 4% of total; Table 65). These landings are attributed to 171 Atlantic herring federal permits (the most of any *Community of Interest*), sold to 29 dealers. In 2015, Point Judith was the homeport listed by GARFO for two Category A, two Category B/C permits, seven Category C, 54 Category D, and eight Category D/E Atlantic herring federal fishing permits. Point Judith was the primary landing port listed for two Category A permits, three Category B/C permits, seven category C permits, 60 Category D permits, and 12 Category D/E permits (GARFO 2017). Thus, the Atlantic herring vessels that offload in Point Judith may primarily be based in Point Judith.

Shoreside support services based in Point Judith include several dealers, processors, and other infrastructure that supports the herring fishery. Several lobster bait dealers and a pumping station for offloading herring are located in Point Judith. The port also provides many additional fishing-related services including ice, fuel, and vessel maintenance/repair services. Herring is also trucked to Maine for processing. The Atlantic herring fishing engagement and reliance indices are high and medium, respectively, for Point Judith (Colburn & Jepson 2012).

Other Fisheries/Ecotourism: Point Judith is a primary port for the groundfish fishery (Table 69). Recreational fishing companies based in Point Judith include: L'il Toot Charters (tuna, July – October; cod, April – November) and Captain Sheriff's Fishing Charters (tuna, cod). Point Judith is a key port for the mackerel fishery. At least two whale watch companies are based in Narragansett.

Table 78 - Top five species landed by value in Point Judith, RI 2015

Species	Revenue ($)	Vessels	Dealers
Inshore longfin squid	$13M	98	17
American lobster	$7.0M	109	14
Sea scallop	$5.7M	36	14
Summer flounder	$5.3M	326	20
Scup	$3.6M	254	21
Source: ACCSP, as of August 2017.			

1.6.3.3.4 New York ports

Montauk

General: Montauk is a fishing community in the town of East Hampton in Suffolk County, New York. Montauk has a population of 3,326 as of 2010. In 2011-2015, 2% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Montauk; the poverty rate was 12.6%; and the population was 83% white, non-Hispanic (U.S. Census 2017). Montauk has a medium-high fishing engagement index and a medium-high fishing reliance index (Colburn & Jepson 2012).

In 2015, Montauk was the homeport and primary landing port listed by GARFO for 128 federal fishing permits (GARFO 2017). Total landings in Montauk were valued at over $12M, 24% of the state-wide total ($51M). Many of Montauk's vessels are active in fisheries managed by the MAFMC. Inshore longfin squid accounted for $3.5M of the 2015 landings in Montauk, landed by 50 vessels and sold to 21 dealers (Table 79; ACCSP, 2017).

Herring fishery: Since 2007, Montauk has been the 38th highest port in terms of Atlantic herring landings (average 0.0M/year; >1% of total; Table 65). These landings are attributed to 45 Atlantic herring federal permits, sold to 16 dealers. In 2015, Montauk was the homeport and primary landing port listed by GARFO for one Category A, four Category C, 78 Category D, and four Category D/E Atlantic herring federal fishing permits (GARFO 2017). Thus, the Atlantic herring vessels that offload in Montauk may primarily be based in Montauk. Though landings are minor in Montauk, there are a number of vessels participating in the fishery.

Shoreside support services based in Montauk include several dealers, processors, and other infrastructure that supports the herring fishery. The port also provides additional fishing-related services including ice, fuel, and vessel maintenance/repair services. The Long Island Commercial Fishermen's Association is based in Montauk. Inlet Seafood Restaurant is owned by six commercial fishermen and opened in 2006 as an offshoot of Montauk Inlet Seafood, which claims to be the largest packer/shipper of fresh seafood in New York (www.inletseafood.com). The Atlantic herring fishing engagement and reliance indices are medium-high for Montauk (Colburn & Jepson 2012).

Other Fisheries/Ecotourism: Montauk is a secondary port for the groundfish fishery (Table 69). Charter fishing companies based in Montauk tend to focus on tuna, striped bass and include Double D Charters and Montauk Fishing Charters. At least two whale watch companies are based in Montauk (Table 61). Montauk is a key port for the tuna fishery.

Table 79 - Top five species landed by value in Montauk, NY 2015

Species	Revenue ($)	Vessels	Dealers
Longfin inshore squid	$3.5M	50	21
Tilefish	$3.2M	7	10
Scup	$2.6M	117	18
Summer flounder	$1.7M	98	23
Silver hake	$1.3M	37	15
Source: ACCSP, as of August 2017.			

Hampton Bays/Shinnecock

General: Hampton Bays and Shinnecock here are considered to be the same community. Shinnecock is the name of the fishing port located in Hampton Bays in Suffolk County, New York, on the barrier island next to Shinnecock Inlet, and does not actually refer to a geopolitical entity. Fishermen use either port name in reporting their catch, but they are considered to be the same physical place.

Hampton Bays has a population of 13,603 as of 2010. In 2011-2015, 0.4% of the civilian employed population aged 16 years and over worked in farming, fishing, and forestry occupations in Hampton Bays; the poverty rate was 6.6%; and the population was 67% white, non-Hispanic (U.S. Census 2017). Hampton Bays/Shinnecock has a medium-high fishing engagement index and a low fishing reliance index (Colburn & Jepson 2012). In 2015, Hampton Bays/Shinnecock was the homeport and primary landing port listed by GARFO for 42 federal fishing permits (GARFO 2017). Total landings in Hampton Bays and Shinnecock were valued at over $4M and over $0.38M, respectively. Collectively, this accounts for 8% of the state-wide total ($51M). Many of Hampton Bays and Shinnecock's vessels are active in fisheries managed by the MAFMC. Inshore longfin squid accounted for $1.9M of the 2015 landings in Hampton Bays and Shinnecock, landed by at least 39 vessels and sold to 13 dealers (Table 80, Table 81; ACCSP, 2017).

Herring fishery: Since 2007, Hampton Bays/Shinnecock has been the 37th highest port in terms of Atlantic herring landings (average 0.0M/year; >1% of total; Table 65). These landings are attributed to 29 Atlantic herring federal permits, sold to 16 dealers. In 2015, Hampton Bays/Shinnecock was the homeport and primary landing port listed by GARFO for 27 and 28 Category D Atlantic herring federal fishing permits, respectively (GARFO 2017). Thus, the Atlantic herring vessels that offload in Hampton Bays/Shinnecock may primarily be based in Hampton Bays/Shinnecock. Though landings are minor in Hampton Bays/Shinnecock, there are a number of vessels participating in the fishery. The Atlantic herring fishing engagement and reliance indices are medium-high and low for Hampton Bays/Shinnecock, respectively (Colburn & Jepson 2012).

Other Fisheries/Ecotourism: Charter fishing companies based in Hampton Bays/Shinnecock tend to focus on cod, porgies, bluefish, tuna, striped bass and include Shinnecock Star and Outlaw Charters.

Table 80 - Top five species landed by value in Hampton Bays, NY 2015

Species	Revenue ($)	Vessels	Dealers
Longfin inshore squid	$1.8M	39	13
Goosefish (monkfish)	$0.73M	29	14
Sea scallop	$0.56M	6	7
Summer flounder	$0.53M	34	18
Scup	$0.17M	37	15
Source: ACCSP, as of August 2017.			

Table 81 - Top five species landed by value in Hampton Bays/Shinnecock, NY 2015

Species	Revenue ($)	Vessels	Dealers
Summer flounder	$0.15M	19	11
Longfin inshore squid	$0.090M	9	7
Scup	$0.051M	13	9
Bluefish	$0.51M	21	10
Goosefish (monkfish)	$0.30M	13	10
Source: ACCSP, as of August 2017.			

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3.0 GLOSSARY

ABC Control Rule (ABC CR). The specified approach to setting the ABC for a stock or stock complex as a function of scientific uncertainty in the estimate of OFL and any other scientific uncertainty. The ABC control rule will consider uncertainty in factors such as stock assessment issues, retrospective patterns, predator-prey issues, and projection results. The ABC control rule will be specified and may be modified based on guidance from the SSC during the specifications process. Modifications to the ABC control rule can be implemented through specifications or framework adjustments to the Herring FMP (in addition to future amendments), as appropriate.

Acceptable Biological Catch (ABC). The maximum catch that is recommended for harvest, consistent with meeting the biological objectives of the management plan. The MSA interpretation of ABC includes consideration of biological uncertainty (stock structure, stock mixing, other biological/ecological issues), and recommendations for ABC should come from the NEFMC SSC. ABC can equal but never exceed the OFL.

OFL – Scientific Uncertainty = ABC (Determined by SSC)

Annual Catch Limit (ACL). A stockwide ACL accounts for both scientific uncertainty (through the specification of ABC) and management uncertainty (through the specification of the stockwide ACL and buffer between ABC and the ACL). The ACL is the annual catch level specified such that the risk of exceeding the ABC is consistent with the management program. The ACL can equal but never exceed the ABC. ACL should be set lower than the ABC as necessary due to uncertainty over the effectiveness of management measures. The stockwide Atlantic herring ACL equates to the U.S. optimum yield (OY) for the Atlantic herring fishery and serves as the level of catch that determines whether accountability measures (AMs) become effective. The AM for the stockwide ACL, total fishery closure at 95%, reduces the risk of overfishing.

ABC – Management Uncertainty = Stockwide ACL = OY

Bycatch: (v.) The capture of nontarget species in directed fisheries which occurs because fishing gear and methods are not selective enough to catch only target species. (n.) Fish which are harvested in a fishery but are not sold or kept for personal use, including economic discards and regulatory discards but not fish released alive under a recreational catch and release fishery management program.

Capacity: The level of output a fishing fleet is able to produce given specified conditions and constraints. Maximum fishing capacity results when all fishing capital is applied over the maximum amount of available (or permitted) fishing time, assuming that all variable inputs are utilized efficiently.

Catch: The sum total of fish killed in a fishery in a given period. Catch is given in either weight or number of fish and may include landings, unreported landings, discards, and incidental deaths.

Continental shelf waters: The waters overlying the continental shelf, which extends seaward from the shoreline and deepens gradually to the point where the sea floor begins a slightly steeper descent to the deep ocean floor; the depth of the shelf edge varies, but is approximately 200 m in many regions.

Days absent: An estimate by port agents of trip length. This data was collected as part of the NMFS weighout system prior to May 1, 1994.

Discards: Animals returned to sea after being caught; see *bycatch (n.).*

Essential Fish Habitat (EFH): Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH designation for most managed species in this region is based on a legal text definition and geographical area that are described in the Habitat Omnibus Amendment (NEFMC 1998).

Exclusive Economic Zone (EEZ): A zone in which the inner boundary is a line coterminous with the seaward boundary of each of the coastal States and the outer boundary is line 200 miles away and parallel to the inner boundary

Exempt fisheries: Any fishery determined by the Regional Director to have <5% regulated species as a bycatch (by weight) of total catch according to 50 CFR 648.80(a)(7).

Fishing effort: The amount of time and fishing power used to harvest fish. Fishing power is a function of gear size, boat size and horsepower.

Framework adjustments: Adjustments within a range of measures previously specified in a fishery management plan (FMP). A change usually can be made more quickly and easily by a framework adjustment than through an amendment. For plans developed by the NEFMC, the procedure requires at least two Council meetings including at least one public hearing and an evaluation of environmental impacts not already analyzed as part of the FMP.

Landings: The portion of the catch that is harvested for personal use or sold.

Limited-access permits: Permits issued to vessels that met certain qualification criteria by a specified date (the "control date").

Localized depletion: When harvesting takes more fish than can be replaced either locally or through fish migrating into the catch area within a given time period.

Metric ton: A unit of weight equal to a thousand kilograms (1kgs = 2.2 lbs.). A metric ton is equivalent to 2,205 lbs. A thousand metric tons is equivalent to 2.2 million lbs.

Northeast Shelf Ecosystem: The Northeast U.S. Shelf Ecosystem has been described as including the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream.

Overfishing Limit (OFL): The catch that results from applying the maximum fishing mortality threshold to a current or projected estimate of stock size. When the stock is not overfished and overfishing is not occurring, this is usually F_{MSY} or its proxy.

$$\mathbf{OFL \geq ABC \geq ACL}.$$

Statistical area: A delineated area of ocean used to track where fish were caught. NMFS overlays a grid of statistical areas onto nautical charts to accurately identify specific areas of the ocean. Statistical areas are approximately one degree square although in many cases they do not correspond exactly to specific latitudes and longitudes.

Stock: A grouping of fish usually based on genetic relationship, geographic distribution and movement patterns. A species, subspecies, geographical grouping, or other category of fish capable of management as a unit.

Stock area: A group of connected statistical areas that defines the geographic distribution of a particular population of an individual species. For example, the Gulf of Maine (GOM) cod stock area comprises statistical areas 464, 465, 467, 510, 511, 512, 513, 514, and 515. All catch of cod in any of these stock areas is attributed to the GOM cod stock.

Total Allowable Catch (TAC): The amount (in metric tons) of a stock that is permitted to be caught during a fishing year. This value is calculated by applying a target fishing mortality rate to exploitable biomass.

Valued Ecosystem Component (VEC): A resource or environmental feature that is important (not only economically) to a local human population, or has a national or international profile, or if altered from its existing status, will be important for the evaluation of environmental impacts of industrial developments, and the focusing of administrative efforts.