

*Fishery Management Report No. X*  
*of the*  
*Atlantic States Marine Fisheries Commission*



**Draft Amendment 3 to the  
Interstate Fishery Management Plan for Atlantic Herring**

**For approval for public comment**

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ATLANTIC STATES MARINE FISHERIES COMMISSION

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Prepared by

Atlantic States Marine Fisheries Commission  
Atlantic Herring Plan Development Team  
and Atlantic Herring Advisory Panel

In coordination with

New England Fishery Management Council  
Atlantic Herring Plan Development Team

ASMFC Plan Development Team Members:

Melissa Yuen (ASMFC), PDT Chair  
Renee Zobel (NH DFW), Technical Committee Chair  
Dr. Matthew Cieri (ME DMR)  
Micah Dean (MA DMF)  
Dr. Madeline Hall-Arber (MIT Sea Grant)  
Lori Steele (NEFMC)

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## **1.0 INTRODUCTION**

### **1.0 Background Information**

#### **1.1.1 Statement of the Problem**

Atlantic herring (*Clupea harengus*), also known as sea herring, is an oceanic schooling fish that is important to the ecosystem as a forage species and to industry as bait for lobster, blue crab, and tuna. This resource also serves as a food fish, typically canned, pickled, or smoked. The U.S. Atlantic herring fishery is currently managed as a single stock through complementary plans by the Atlantic States Marine Fisheries Commission (ASMFC) and New England Fishery Management Council (NEFMC). However, there is evidence suggesting several spawning aggregations. Generally, the resource has been divided into an inshore Gulf of Maine (GOM) and an offshore Georges Bank (GB) component. Individual spawning aggregations have been identified, but methods have not been developed to distinguish discrete units. Tagging studies have shown that herring from New Brunswick and the Scotian shelf of Canada may be intermixed with those in the United States waters. However, since the degree of mixing is unknown.

The Atlantic herring resource is currently not overfished and overfishing is not occurring (*Section 2.5*). The changing climate of oceanographic conditions to which herring migration patterns may be linked, concerns over the bycatch and incidental catch of river herring species, and needs of the herring fleet has generated interest in reviewing spawning protections, maintaining traditional use patterns in the fishery, and increasing the bait fishery.

Amendment 3 was developed in coordination with the New England Fishery Management Council as the Council developed Framework Adjustment 4 to the Federal Fishery Management Plan for Atlantic Herring.

Some of the specific issues covered by this amendment, include:

- Spawning Area Efficacy
- Fixed Gear Set Aside Provision
- Empty Fish Hold Provision

#### **1.1.2 Benefits of Implementation**

This Amendment, when fully implemented and in conjunction with the Council plan, is intended to enhance spawning protections for Atlantic herring in the Gulf of Maine and create an incentive for better managed fishing practices to reduce impacts to species which are ecologically associated with Atlantic herring while minimizing adverse effects on participants in the fishery.

##### *1.1.2.1 Social and Economic Benefits*

The goal of the herring management plan is to enhance spawning protections for Atlantic herring, incentivize sustainable fishing practices, and improve accounting of directed sea herring catch as well as bycatch and incidental catch of river herring species while providing access to

stakeholders who depend on herring. Adequate protections of the reproductive stock of sea herring ensures a stable fishery over time and in turn provides a measure of security to individuals and communities dependent on the resource. Presumably, the outcomes will be continued availability and accessibility to the fish, and better quality and prices. The empty fish hold provision incentivizes market-appropriate catches (better business planning) and will make conditions aboard the vessel safer.

#### *1.1.2.2 Ecological Benefits*

When implemented, Amendment 3 is designed to enhance protection of the inshore spawning stock by reducing disruption of spawning activity and catch of ripe fish. The empty fish hold provision creates an incentive for fishermen to harvest more sustainably to meet market demands, thereby reducing the removal of fish that will not be utilized (and dumped at sea). It also ensures better accounting of sea herring catch as well as bycatch monitoring of river herring species by preventing double-counting of trips.

### **1.2 Description of the Resource**

Atlantic herring are distributed along the Atlantic coast from North Carolina to the Canadian Maritime provinces in inshore and offshore waters, including in every major estuary from the northern Gulf of Maine to the Chesapeake Bay, to the edge of the continental shelf. Management of the Atlantic herring resource centers on three major stocks of herring in the Gulf of Maine region that spawn in geographically discrete areas on Georges Bank (GB) and Nantucket Shoals (NS), in coastal waters of the Gulf of Maine (GOM) and off southwest Nova Scotia. Each of these major spawning areas is composed of a number of smaller spawning grounds. Observations of year to year changes in the abundance of adults on individual spawning grounds, in response to fishing pressure, tend to confirm the view that each of these areas supports a discrete spawning aggregation (or sub-stock) of herring (Stephenson, 1998).

Some degree of stock differentiation was achieved with early enzyme electrophoresis research (Ridgway et al., 1970, 1971), but more recent attempts to differentiate geographically isolated fall spawning stocks in eastern Canada and the northeast U.S. on the basis of genetic characteristics have been unsuccessful (Kornfield et al., 1982; Kornfield and Bogdanowicz, 1987; Safford and Brooke, 1992). Nevertheless, discrete spawning stocks occupy the three fairly distinct locations in the Gulf of Maine region. Evidence for separate stocks in the Gulf of Maine region is also derived from discrete larval distribution patterns (Iles and Sinclair, 1982), differences in spawning times and locations (Boyar et al., 1973; Haegele and Schweigert, 1985) and distinct biological characteristics, such as growth rates (Anthony and Waring, 1980), meristic and morphometric counts and measurements (Anthony, 1981; Safford, 1985) and the incidence of parasites (McGladdery and Burt, 1985). Despite the differences, herring that spawn on Georges Bank, Nantucket Shoals and in coastal waters of the Gulf of Maine are assessed in the U.S. as a single coastal stock complex at this time.

Each of these major spawning areas is composed of a number of smaller, discrete spawning sites. Herring that spawn on these individual sites have been observed to have distinct age compositions and their abundance from year to year changes in response to the amount of fishing

that occurs at each site. These observations tend to confirm the view that each of these areas supports a discrete spawning aggregation (or sub-stock) of herring (Stephenson, 1998; NEFMC). Some of these discrete spawning sites are located within 10-15 miles of each other (e.g. Trinity Ledge and Lurcher Shoals off the southwest coast of Nova Scotia).

The most compelling evidence supporting the existence of separate Gulf of Maine and Georges Bank-Nantucket Shoals stocks was the collapse of the large Georges Bank-Nantucket Shoals stock in the early 1970s after several years of heavy exploitation by foreign fishing fleets. This stock remained in a depressed state for about ten years, during which time the smaller Gulf of Maine stock continued to support a strong coastal fishery. Both of these stocks are transboundary stocks since adult herring occupy both sides of the U.S.-Canada boundary on Georges Bank and because juvenile and adult herring on the New Brunswick shore of the Bay of Fundy are believed to originate from spawning grounds in U.S. and Canadian waters (Stephenson et al., 1998, NEFMC, 2005).

It is recognized that conspecific herring populations often differ in productivity and may not support equal levels of exploitation. Thus, appropriate fishing levels may not be the same for the different populations within the stock complex. In recent years there has been increasing emphasis on preserving all aspects of biodiversity, including within species diversity. The biological rationale for preserving this diversity is that such variation allows adaptation to changing conditions. The economic rationale is that the decrease or elimination of population richness may lead to the loss of fisheries, such as occurred during the mid-1970s when the Georges Bank herring stock collapsed (Overholtz et al., 2004).

## **1.2.1 Species Life History**

### *1.2.1.1 Herring as forage*

Herring is an important species in the food web of the northwest Atlantic. Herring eggs are deposited on the bottom and incubate for about 10 days. They are subject to predation by a variety of demersal fish species, including winter flounder, cod, haddock and red hake. Juvenile herring, especially “brit” (age-1 juveniles) are preyed upon heavily due to their abundance and small size.

Atlantic herring is an important prey species for a large number of piscivorous fish, elasmobranchs (sharks and skates), marine mammals and seabirds in the northeastern U.S. Unlike other pelagic fishes such as Atlantic mackerel, herring are smaller and vulnerable to predation over most, if not all, of their life (Overholtz et al., 2000). Estimates of the percent composition of Atlantic herring (or of two broader taxonomic groups that include Atlantic herring, menhaden, shad, and river herring) in the diets of 15 species of elasmobranchs and finfish in the northeast shelf ecosystem are summarized in Table 1. Stomach content data compiled from fish collected after 1990 are more indicative of current conditions since the Atlantic herring stock was in a collapsed state during the 1980s and started to recover in the early 1990s. The trends in the percentage of herrings in the diet of Atlantic cod follow this change in the population sizes for Atlantic herring.



[Needs to be updated] *Atlantic herring stock assessments are performed using an annual natural mortality rate that is equivalent to an 18% biomass removal from the stock. We used the difference between the results of the recent Canadian and U.S. stock assessments for the most recent year (2001/2002) to define an intermediate “best” stock size estimate of 1.2 million mt, and the most recent biomass estimates from the two assessments (0.6 and 1.8 million mt) to define the upper and lower population sizes for the resource. Multiplying these numbers by 18% generates a “reserve” of 250,000 mt as a forage base for predators (with a range of 108,000 to 324,000 mt). These calculations suggest that even if the Atlantic herring resource was being fully utilized, a sufficient biomass is being reserved to feed species of finfish, elasmobranchs and marine mammals that rely on the resource for food. That was not the case during the early 1990s when predation rates were higher (Overholtz et al., 2000) and herring were less abundant. It would also not be true if the current estimates of herring population size were too high. However, because the Atlantic herring resource is currently under-utilized, a greater quantity of herring are available as food for predators than is provided by the natural mortality “reserve.” Because of the uncertainty associated with the recent stock size estimate, however, the amount of “surplus” herring biomass that is currently available as forage for predators is not known.*

#### *1.2.1.2 Age and Growth*

In U.S. waters, Atlantic herring reach a maximum length of about 39 cm (15.6 inches) and an age of about 15-18 years (Anthony, 1972; NEFMC, 2005). Male and female herring grow at about the same rate and become sexually mature beginning at age 3, with most maturing by age 4 (NEFMC, 2005). Growth rates vary greatly from year to year, and to some extent from stock to stock, and appear to be influenced by many factors, including temperature, food availability and population size. Juvenile growth is rapid during the first year of life, with a marked slowing at the onset of maturity. Juveniles in coastal Maine waters reach 90-125 mm by the end of their first year of life. There has been a marked reduction in size and weight-at-age of adult herring in U.S. waters of the northwest Atlantic beginning in the mid-1980s (Overholtz et al., 2004), a trend that appears to be related to increased population size and recovery of the Georges Bank spawning stock.

#### *1.2.1.3 Spawning, Reproduction, and Early Life History*

[PDT to update with new analysis of spawning and maturity] *Atlantic herring are believed to return to natal spawning grounds throughout their lifetime to spawn (Ridgway, 1975; Sinderman, 1979; NEFMC, 2005). This behavior is fundamental to the species’ ability to maintain discrete spawning aggregations and is the basis for hypotheses concerning stock structure in the northwest Atlantic. Evidence for this homing behavior is provided by a tagging study in Newfoundland which showed a 73% return rate of adult Atlantic herring to the same spawning grounds where they were tagged (Wheeler and Winters, 1984) and by observations of year-to-year changes in the abundance and age composition of spawning aggregations on discrete banks and shoals off southwest Nova Scotia (Stephenson et al., 1998).*

*Spawning occurs in specific locations in the Gulf of Maine in depths of 20-50 meters (about 60-300 feet), on coastal banks such as Jeffreys Ledge and Stellwagen Bank located 8-40 km offshore, along the eastern Maine coast between the U.S.-Canada border and at various other*

*locations along the western Gulf of Maine. Herring also spawn on Nantucket Shoals and Georges Bank, but not further south. In Canada, spawning occurs south of Grand Manan Island (in the entrance of the Bay of Fundy) and on various banks and shoals south of Nova Scotia (Figure 2). Spawning occurs in the summer and fall, starting earlier along the eastern Maine coast and southwest Nova Scotia (August-September) than in the southwestern Gulf of Maine (early to mid-October in the Jeffreys Ledge area and as late as November-December on Georges Bank) (Reid et al., 1999; NEFMC, 2005). Herring in the Gulf of Maine region usually reproduce at relatively high temperatures (10-15° C) and at high salinities (NEFMC, 2005). Herring do not spawn in brackish water.*

*The eastern Maine-Grand Manan spawning ground is an important source of larvae, which are transported to the southwest along the Maine coast (Graham and Townsend, 1985; Townsend et al., 1986). The larvae overwinter in bays, estuaries and nearshore waters and become juveniles in the spring. Those juvenile that survive until the following spring and summer (age-2) are harvested as sardines in the coastal fishery. Larvae that hatch on Jeffreys Ledge, another important coastal spawning ground in the Gulf of Maine, are mostly transported shoreward (Cooper et al., 1975), although some overwinter in nearshore waters on the Maine coast (Lazzari and Stevenson, 1991).*

*Atlantic herring spawn on the bottom in discrete locations by depositing adhesive eggs that stick to any stable bottom substrate, including lobster pots and anchor lines. In some cases, the same spawning sites are used repeatedly, sometimes more than once a year (Stevenson, 1989; NEFMC, 2005). Jeffreys Ledge appears to be the most important spawning ground in the Gulf of Maine based on the number of spawning and near-spawning adults found there (Boyar et al., 1973).*

*Eggs are laid in layers and form mats or carpets. In the Gulf of Maine region, egg mats as thick as 4-5 cm have been observed in discrete egg beds that have varied in size from 0.3-1.4 km<sup>2</sup>. One very large egg bed surveyed on Georges Bank in 1964 covered an area of about 65 km<sup>2</sup> (Noskov and Zinkevich, 1967). Herring eggs in the Gulf of Maine region are deposited on gravel and rocky substrate, but are also found on sand, shells and shell fragments and occasionally on macroalgae. Spawning sites are located in areas with strong bottom currents (1.5-3 knots), which prevents the accumulation of fine sediment and provides circulation to supply oxygen and remove metabolites (Reid et al., 1999; NEFMC, 2005). Hatching success remains relatively high down to 20-25% dissolved oxygen (Aneer, 1987; NEFMC, 2005).*

*Atlantic herring are synchronous spawners, producing eggs once a year once they reach maturity. Depending on their size and age, female herring can produce from 55,000 to 210,000 eggs (Kelly and Stevenson, 1983). Once they are laid on the bottom, herring eggs are preyed upon by a number of fish species, including cod, haddock, red hake, sand lance, winter flounder, smelt, tomcod, cunner, pollock, sculpins, skates, mackerel and even herring themselves (Munroe, 2002; NEFMC, 2005). Egg predation and adverse environmental conditions often result in high egg mortalities. Egg incubation periods are temperature dependent and range from 10-15 days in the Gulf of Maine (Munroe, 2002; NEFMC, 2005). Hatching success is also temperature dependent; in experimental studies, all eggs held at 15° C hatched and none hatched at 0-5° C or at 20° C.*

*Larvae are about 4-10 mm (0.25 in) in length at hatching, which occurs 10-15 days after the eggs are deposited on the bottom (Fahay, 1983). The pelagic larval phase is relatively long in Atlantic herring lasting 4-8 months in the Gulf of Maine, depending on the timing of spawning (Reid et al., 1999; NEFMC, 2005). Larvae are transported long distances from spawning grounds where they over-winter in coastal bays and estuaries. In the Gulf of Maine, the prevailing surface currents flow to the westward, transporting larvae that hatch in eastern Maine to the Sheepscot estuary in mid-coast Maine, a straight-line distance of about 150 km (Graham, 1982; Townsend, 1992). Boyar et al. (1973) reported that most of the recently hatched larvae from the southern end of Jeffreys Ledge are transported shoreward. Herring larvae from Nantucket Shoals and Georges Bank are widely dispersed and tend to drift to the southwest (Sindermann, 1979; Lough et al., 1980; Grimm, 1983; NEFMC, 2005). Metamorphosis occurs in the spring at a length of about 40 mm (1.5 in). Schooling behavior begins in the late larval and early juvenile, or “brit,” stages. Young-of-the-year herring undergo a general offshore movement in the summer and fall and they are believed to spend the winter in deep coastal waters.*

*The persistence of discrete aggregations of larvae for several months after hatching over tidally mixed continental shelf spawning grounds in the Gulf of Maine and elsewhere, despite the presence of fairly strong longshore currents, has provided the basis for a larval “retention hypothesis” (Iles and Sinclair, 1982). This hypothesis states that Atlantic herring stock structure in an area like the Gulf of Maine is determined by larval distribution and retention patterns and that the maximum stock size in that area is determined by the number, location and extent of geographically stable retention areas. Such retention areas have been described off southwest Nova Scotia, around Grand Manan Island and on Georges Bank (Iles and Sinclair, 1982). More recently, they have been described in eastern Maine waters adjacent to Grand Manan (Chenoweth et al., 1989).*

*Mortality of Atlantic herring in the larval stage is very high since the larvae remain vulnerable to very low temperatures and a limited food supply for a prolonged period during winter, especially in the shallow nearshore and estuarine waters (Townsend and Graham, 1981; Graham et al., 1991). Campbell and Graham (1991) developed an ecological model in order to examine which factors affected larval survival to the early juvenile stage. Some of the conclusions of that study were:*

- *Larval herring recruitment in Maine coastal waters is the result of a complex interaction of many processes, no one of which is truly dominant;*
- *Two year-old recruitment to the Maine herring fishery is established in the larval stage in some years and not until the brit stage in others;*
- *Larval food supply in autumn and winter, along with the quantity and distribution of spawning, are primary factors controlling herring recruitment to the brit stage for those years when the larval stage is critical;*
- *When larval survival is above a threshold, density-dependent predation on brit can reduce year-class size (the assumption being that the brit become the food of choice for opportunistic pelagic and demersal predators when brit exceed an abundance threshold);*

- *Temperature and longshore transport are secondary factors determining survival that may be most important through their interaction with primary factors;*
- *In most years, more larvae survive the winter in the coastal areas than in the estuaries and embayments; and*
- *The distribution of larvae along the Maine coast in springtime is largely a function of the variable movement of larvae.*

#### 1.2.1.4 Migration

Adult herring undertake extensive seasonal migrations between summer spawning grounds on Georges Bank and in the Gulf of Maine and overwintering areas in southern New England and the mid-Atlantic region. Stock mixing occurs during the winter and spring as fish migrate south. Thermal oceanic fronts between colder, less saline continental shelf water and warmer, more saline continental slope water provide an abundance of plankton and other food sources and greatly influence the migratory behavior of this species (Sindermann, 1979; Kelly and Moring, 1986; NEFMC, 2005).

There are distinct migratory patterns for each spawning stock off the northeast coast of the U.S.:

- The Nova Scotia stock spends the summer and fall months in southwest Nova Scotia and overwinters in Chedabucto Bay in northeastern Nova Scotia, but also mixes to some extent with the two southern stocks.
- The Georges Bank/Nantucket Shoals stock overwinters south of Cape Cod, can be found feeding in the Gulf of Maine in the spring and early summer and spawn southeast of Nantucket or on Georges Bank in the fall (Sindermann, 1979; Tupper et al., 1998; Munro, 2002; NEFMC, 2005;). After spawning, adults from Georges Bank move south again to overwinter with the oldest and largest fish migrating as far south as Chesapeake Bay.
- The migratory patterns of the coastal Gulf of Maine herring stock is not as well documented. It is believed that they may migrate southwest along the coast after spawning to overwinter south of Cape Cod, in Massachusetts Bay and other coastal areas of southern New England (Tupper et al., 1998; Reid et al., 1999; NEFMC, 2005). The waters off Cape Cod seem to constitute a mixing area for these stocks, where different groups pass at various times of the year (Sindermann, 1979; NEFMC, 2005).

Migration patterns of individual herring stocks are usually persistent year to year (Creaser and Libby, 1988; Reid et al., 1999; NEFMC, 2005). The spatial and temporal isolation of these different stocks occurs chiefly during spawning, with intermixing of these groups occurring during the non-spawning phases of migration (Sinclair and Iles, 1985; Reid et al., 1999; Munro, 2002; NEFMC, 2005). Adults from the two U.S. stocks mix during their winter migration to southern New England and mid-Atlantic waters and separate out onto their respective spawning grounds following a return northward migration in the spring. Adults that spawn off southwest Nova Scotia are not believed to mix to any significant degree with herring that spawn on Georges Bank or in the Gulf of Maine (Stephenson et al., 1998; NEFMC, 2005).

Juvenile herring in all stocks tend to remain in coastal areas throughout the year (Stewart and Arnold, 1994; NEFMC, 2005). Juveniles overwinter closer to the coast than adult herring,

moving into the deeper waters of bays or offshore in the winter where they stay close to the bottom (Reid et al., 1999; Overholtz, 2004; NEFMC, 2005). Smaller fish have greater temperature tolerances and juvenile Atlantic herring have been found to produce higher levels of antifreeze proteins than adults, adaptations that may allow them to withstand the colder coastal waters in the winter (NEFMC, 2005; Munro, 2002). Tagging studies have also indicated that juveniles migrate little during the summer (Waring, 1981; Stobo, 1983; Overholtz et al., 2004; NEFMC, 2005). Juveniles from several populations may mix in a given area (Stewart and Arnold, 1994) and aggregations of juvenile herring along the coast of Maine and New Brunswick are likely derived from a variety of spawning grounds (Overholtz et al., 2004; NEFMC, 2005).

#### *1.2.1.5 Schooling*

Despite the vast amount of literature available on the herring resource, there still exists a significant lack of knowledge about herring behavior and the impacts of fishing and various activities on fish behavior. There are several important characteristics about herring to acknowledge:

- Herring are obligate schoolers. They prefer to swim in large schools and cease to act as individual fish, but rather act as one unit in a large school.
- The sensory systems of herring are very well developed. The ability of herring to hear, see, and sense movement (through the lateral line) allows them to sense other fish in the area, school in the dark, and react to changes in water pressure. These factors also influence the way herring react to fishing gear.
- Herring have sensitivity to a wide frequency range and are most sensitive to sounds in the frequency region where fishing vessels (and research vessels) have the maximum sound energy output. Herring are very sensitive to noise and have been shown to make directed responses to approaching vessels. Results of some studies indicate that the fish can hear trawlers at distances up to 3 kilometers.
- The visual senses of herring allow the fish to see at very low light levels ( $10^{-5}$  lux). Herding responses are mainly visual, and visually elicited avoidance reactions have been observed.
- Herring exhibit distinct migratory patterns, both seasonally (large-scale) and diurnally (night/day, small-scale). Migration is also affected by food availability and other environmental conditions (temperature, salinity, predators).
- Herring have very good buoyancy control. They can gulp and release air to fill and void their swim bladders as needed. The fish can sink very quickly if necessary.

Pelagic fishes school for hydrodynamic reasons, for reproduction, migration and feeding and to aid in surviving predatory attack (Freon and Misund, 1999; NEFMC, 2005). Schooling is a natural state for pelagic fishes and given a stimulus, fish like herring will react and then return to this state. When confronted by danger such as a predator or mid-water trawl, pelagic fish will quickly decrease their interfish distance (packing density) and try to avoid the stimulus (Freon et al., 1992; NEFMC, 2005). This will result in contortion, compression and stretching of the school and may result in short-term distortion or dispersion of the fish (Freon et al., 1993; NEFMC, 2005). This avoidance behavior will cease, however, as soon as the fish are out the near field (proximity) of the trawl or predator (Freon and Misund, 1999; NEFMC, 2005). The

normal reaction of herring to a trawl or purse seine is to increase their swimming speed and dive downwards, thereby trying to avoid the gear. In a study of Finnish pair trawling, visual and acoustic observations suggest that herring displayed an avoidance reaction in 34% of 493 midwater trawl hauls where fish were near the trawl mouth (Suuronen et al., 1997; NEFMC, 2005). Fish were observed to swim rapidly downward when they were within 5 m of the trawl and then return to their previous depth as soon as the trawl had passed. Herring react to midwater trawl and purse seines in much the same manner that they react to predators by trying to avoid and then regroup.

A recent study of the spatial dynamics of the Gulf of Maine/Georges Bank herring complex showed that herring maintained their school structure and interschool integrity in spite of very large reduction in overall biomass during the 1970s (Overholtz, 2004; NEFMC, 2005). Landings records from purse seine and midwater trawl vessels indicate that there were herring present in the Jeffreys Ledge region during all the months from April to October of 2001. Observations during herring acoustic cruises conducted by NMFS during 1997-2000 indicate nothing more than short-term disturbance of herring during midwater trawling and acoustic surveying operations. Fishing operations by at least a dozen large midwater trawlers conducted over a several month period during 2001 on Georges Bank caused no apparent changes in the distribution of pre-spawning herring as evidenced by hydroacoustic surveys conducted during September and October 2001 (NEFMC, 2005). There appears to be no scientific evidence either local or worldwide that midwater trawling or purse seining causes any long-term dispersal of herring.

## **1.2.2 Stock Assessment Summary**

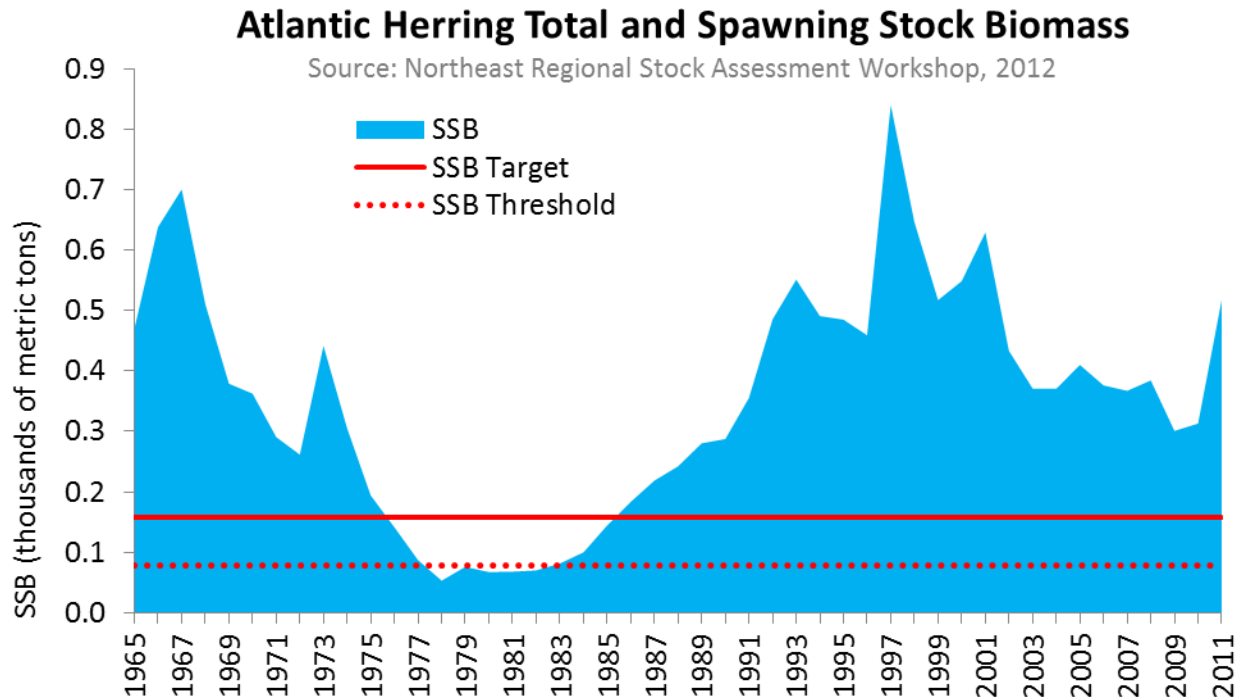
### *1.2.2.1. Abundance and Present Condition*

The 2012 federal benchmark stock assessment (SAW/SARC 54), which considers data through 2011, determined that Atlantic herring in Georges Bank and Gulf of Maine is not overfished and not experiencing overfishing; in fact, it is rebuilt. Maximum sustainable yield (MSY) reference points were estimated to be  $F_{MSY} = 0.27$ ,  $SSB_{MSY} = 157,000$  mt ( $\frac{1}{2} SSB_{MSY} = 78,500$ ), and  $MSY = 53,000$  mt. Based on a comparison of the MSY reference points with the estimates of  $F$  and  $SSB$  for 2011, overfishing is not occurring and the stock is not overfished.

### *1.2.2.2. Spawning Stock and Total Biomass*

Based on the ASAP model used in the 2012 stock assessment, the Atlantic herring spawning stock biomass (SSB) was estimated to be 517,930 mt (1.1 billion lbs) in 2011. Over the time series from 1965 - 2011, SSB ranged from a low of 53,349 mt (117.6 million lbs) in 1978 to a high of 839,710 mt (1.9 billion lbs) in 1997 (Figure 1). SSB generally declined during 1997-2010, but increased in 2011 to an estimated 1,322,446 mt (2.9 billion lbs). Total biomass was ranged from a minimum of 180,527 mt (406.7 million lbs) in 1982 to a maximum of 1,936,769 mt (4.3 billion lbs) in 2009. Total biomass and SSB showed similar trends over time, but with 1-2 year lag because the total biomass includes immature recruits, while SSB characterizes mature fish only. There was a strong cohort in 2009 that accounts for the greater biomass in recent years.

**Figure 1.** Total and spawning stock biomass and thresholds of Atlantic herring from 1965 to 2011. Total biomass is based on January 1 estimates.



#### 1.2.2.3. Recruitment

With the exception of 2009, Age-1 recruitment since 2006 has been below the 1996-2011 average of 15.8 billion fish. The 2009 age-1 recruitment, however, was the largest in the time series at 59.4 billion fish. This large 2009 age-1 cohort consistently appeared in all sources of data that contain age composition.

#### 1.2.2.4. Fishing Mortality

Atlantic herring's fishing mortality (F) peaked in 1971 at a rate of 0.79. Since then, the F rate remained high and began declining in the 1980s, following the trend of decreasing stock biomass, until it dropped to a historic low of 0.13 in 1994. Since then, F has remained below the  $F_{MSY}$  threshold of 0.27, with a slight increasing trend until overfishing occurred in 2009 ( $F_{2009} = 0.32$ ). The F in 2010 and 2011 was relatively low because of the presence of a strong cohort that increased the stock biomass.

### 1.3 Description of the Fishery

#### 1.3.1 Commercial Fishery

The Atlantic herring resource occurs in waters off Canada and the United States, and fisheries

exist in both countries. Based on the total catch (including discards) by the U.S. fixed gear and mobile gear and Canada's New Brunswick weir fisheries, a majority of the fish are caught by the U.S. commercial fleet (time series average of 87%).

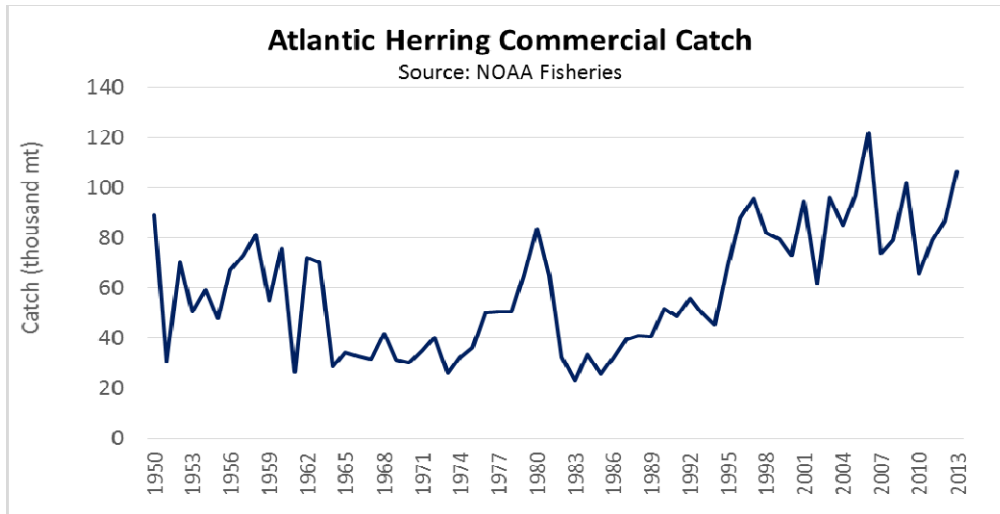
In the U.S., the Atlantic herring fishery is predominantly commercial; recreational catch accounts for less than 1% of the overall catch. Over the time series from 1950 to 2013, annual commercial catch by the United States Atlantic herring fleet was generally flat with a slightly declining trend between 1950 through 1983, when it reached a historic low of 23,254 mt (51.3 million lbs) (Figure 3). Since then, catch has increased and peaked in 2009 with 101,859 mt (224.6 million lbs) and averaged about 69,981 mt (154.3 million lbs) (Figure 2). Annual catch averaged 82,407 mt (181.7 million lbs) from 1993, when FMP was implemented, through 2013. In 2013, catch totaled 106,375 mt (234.5 million lbs), an increase from 2012's 85,883 mt (189.3 million lbs).

Throughout the past decade, the commercial Atlantic herring industry has been consistent in terms of landing states and primary gears. Based on the 10-year average from 2004-2013, a combined 88% of total sea herring catch was landed in Maine and Massachusetts. From 2011-2013, Maine received about 50% of the total landings each year. Sea herring is primarily caught by trawl gears, which accounted for nearly 70% of total landings in the past decade, followed by purse seine for 20% of landings. Table 1 shows the primary gears (trawl and purse seine) by state from 2009-2013. A majority of the coastwide landings are caught during the months of June through October (Table 2, Figure 3).

The U.S. Atlantic herring fishery is managed as four management areas: inshore Gulf of Maine (Area 1A), offshore Gulf of Maine (Area 1B), Southern New England (Area 2), and Georges Bank (Area 3). In addition to the complementary measures in the federal plan, the Interstate Atlantic herring FMP implements specific measures for Area 1A's fishery, which supplies bait for lobster, tuna, blue crab, and striped bass fisheries. Management measures include "days out" effort control, spawning area closures, and seasonal quota allocation. Using the annual specifications process, fisheries managers adapt these measures each year to provide herring between June and December, when demand for lobster bait is highest and fishermen can sell their herring catch for premium value.

**Figure 2.** Atlantic herring catch from 1950 to 2013.





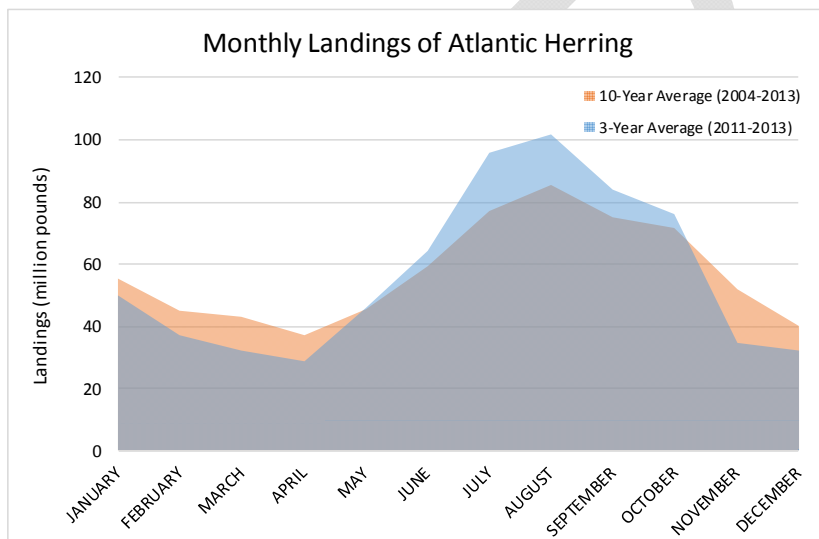
**Table 1.** Atlantic herring landings by primary gears and state in metric tons. Due to data confidentiality, landings by other gears are not provided.

<b>Year</b>	<b>State</b>	<b>Trawl</b>	<b>Purse Seine</b>
2009	MA	54,544	1,214
2009	ME	8,639	19,139
2009	Other NE	1,035	369
2009	Mid-Atl	10,344	0
2010	MA	29,180	1,056
2010	ME	15,395	9,678
2010	Other NE	1,242	42
2010	Mid-Atl	5,504	0
2011	MA	24,919	492
2011	ME	23,536	18,513
2011	Other NE	461	225
2011	Mid-Atl	3,349	0
2012	MA	30,205	1,092
2012	ME	24,443	17,371
2012	Other NE	1,084	0
2012	Mid-Atl	5,725	0
2013	MA	29,677	568
2013	ME	22,243	22,248
2013	Other NE	708	0
2013	Mid-Atl	11,119	0

**Table 2.** Coastwide landings of Atlantic herring by month, in thousands of pounds (Source: ACCSP).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2000	40,671	51,482	45,331	32,625	43,889	62,620	78,607	75,022	65,179	68,955	39,421	29,585
2001	58,125	40,151	36,070	42,059	50,119	63,552	69,903	80,710	72,752	68,588	56,383	44,132
2002	47,621	47,358	45,814	46,672	41,084	56,625	78,706	55,728	63,171	64,360	47,555	34,792
2003	42,445	39,541	52,227	31,829	44,123	64,001	75,200	78,420	76,041	77,485	62,545	49,863
2004	57,516	69,134	65,467	41,525	48,964	66,753	72,253	78,047	76,699	57,939	70,685	48,564
2005	52,715	50,790	49,849	47,545	48,262	62,007	67,205	84,628	80,583	67,424	72,332	43,545
2006	70,973	60,003	63,253	42,082	51,473	53,420	72,403	86,486	78,777	86,760	49,408	49,269
2007	42,715	31,625	50,098	45,837	51,136	49,192	58,829	67,361	56,285	68,922	36,973	52,249
2008	60,343	45,595	34,968	39,874	38,994	55,295	72,928	82,244	53,408	70,270	55,422	36,518
2009	68,838	43,874	37,569	30,440	34,976	56,442	71,182	73,274	90,658	73,064	73,451	31,229
2010	51,072	39,268	33,421	36,693	41,417	55,942	69,456	76,163	61,342	62,915	58,412	42,275
2011	40,112	29,478	29,895	26,810	43,214	62,879	84,906	98,439	87,698	79,036	34,161	27,879
2012	64,822	50,090	29,410	29,385	52,524	69,869	108,488	99,592	85,497	69,419	36,736	25,320
2013	45,220	31,954	37,515	30,090	41,783	60,514	93,838	106,475	78,106	79,915	32,612	43,073

**Figure 3.** Coastwide landings of Atlantic herring by month, in millions of pounds.



### **1.3.2 Recreational Fishery**

The recreational Atlantic herring fishery accounts for less than 1% of total catch in the U.S. A small recreational fishery for Atlantic herring exists, providing late fall to early spring fishing opportunities for both shore and boat anglers. Most Atlantic herring catches are reported during March-April and November-December, with some catches reported from September-October. The Marine Recreational Fishery Statistics Survey (MRFSS) does not sample during January-February in the north or mid-Atlantic subregions and because herring may be taken during this period, total catch may be underestimated. The herring caught by hook and line anglers are taken as a secondary species in a mixed fishery with Atlantic mackerel (*Scomber scombrus*).

### **1.3.3 Subsistence Fishing**

There is no known subsistence fishery for Atlantic herring along the east coast of the U.S.

### **1.3.4 Non-Consumptive Factors**

Non-consumptive factors for herring are indirect. It is actually herring's role as forage for marine mammals and seabirds that is important. For example, the whale watch industry has expanded in the past few years and seabirds attract additional "non-consumptive" attention.

### **1.3.5 Interactions with Other Fisheries, Species, or Users**

#### *1.3.5.1 Bait*

Atlantic herring serves as an important bait for many commercial and recreational fisheries, including lobster, tuna, and striped bass. Increased fishing effort in the lobster fishery has been observed over the past three decades and lobster landings have continued to markedly increase throughout the 1980s and early 1990s, both of which place increased pressure on the herring resource.

While bait herring for the tuna fishery can be purchased from dealers or other boats, some tuna vessels are known to catch herring for use as live bait in this fishery. The use of small pelagic gillnets to catch herring for this purpose is authorized under the Northeast Multispecies Plan. There are no statistics on the extent of this practice or the amount of herring that is taken for this purpose. Some industry participants have estimated that 50-90% of the vessels fishing for tuna in New England waters may be catching herring as bait.

#### *1.3.5.2 Forage*

Atlantic herring are an important forage species for many marine finfish, marine mammals and birds in the Northwest Atlantic ecosystem. While available information to quantify the importance of herring as a forage species is not available at this time, there is a substantial amount of literature (Volume II, *The Role of Atlantic Herring, Clupea harengus, in the Northwest Atlantic Ecosystem* by the NEFMC) that describes the role that herring plays in the ecosystem and estimates the amount of herring consumed by various fish, marine mammal and seabird species. The first step to account for the importance of herring as a forage species in the herring management program is to compile and consider available information on the subject;

the second step is to identify where information is lacking and prioritize research needs to fill the data gaps.

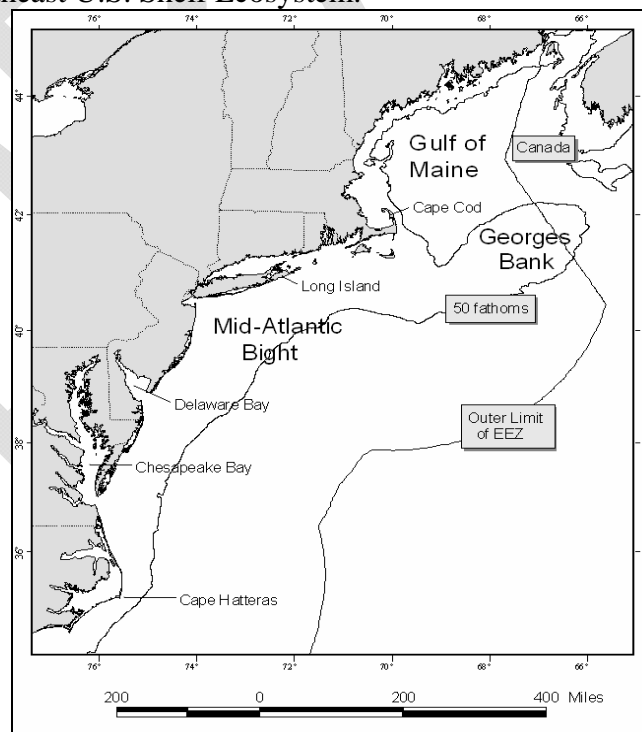
## 1.4 Habitat Considerations

The New England Fisheries Management Council has identified the Essential Fish Habitat (EFH) for herring and other species it manages, and is proposing updated designations through its Draft Omnibus Habitat Amendment 2. The applicable provisions of this document that relate to Atlantic herring are incorporated into this FMP by reference. This includes the description and identification of herring EFH, the threats to EFH from fishing and non-fishing activities, and the conservation and enhancement measures to protect EFH for Atlantic herring.

### 1.4.1 Habitat Important to the Stocks

The Northeast U.S. Shelf Ecosystem (Figure 4) 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 (Sherman et al., 1996; NEFMC, 2005). The continental slope includes the area east of the shelf, out to a depth of 2000 m. Four distinct subregions comprise the NOAA Fisheries Northeast Region: the Gulf of Maine, Georges Bank, the Mid-Atlantic Bight and the continental slope. Occasionally another subregion, southern New England, is described; however, discussions of any distinctive features of this area have been incorporated into the sections describing Georges Bank and the Mid-Atlantic Bight (NEFMC, 2005).

**Figure 1.** Map of Northeast U.S. Shelf Ecosystem.



The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and strong currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, North Carolina. The continental slope begins at the continental shelf break and continues eastward with increasing depth until it becomes the continental rise. Atlantic herring do not commonly occur over the continental slope (NEFMC, 2005). A more detailed description of habitat important to herring can be found in the Source Document for Amendment 1.

#### *1.4.1.2 Identification and Distribution of Habitat and Habitat Areas of Particular Concern (Essential Fish Habitat)*

The Atlantic States Marine Fisheries Commission does not have the authority to designate Essential Fish Habitat (EFH) as required by the Magnuson Stevens Fishery Conservation and Management Act (MSFCMA). The New England Fishery Management Council has identified EFH for a range of species, including Atlantic herring, in order to meet the requirements of MSFCMA as amended by the Sustainable Fisheries Act. The ISFMP Policy Board approved a recommendation in June 1998 to include Council EFH designation for FMPs or Amendments that are developed jointly or in association with a Council. Essential Fish Habitat (EFH) for Atlantic herring is described in NEFMC (1998a) as those areas of the coastal and offshore water (out to the offshore boundary of the EEZ) that are designated in Figure 5.

**Eggs:** Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine and Georges Bank as depicted in Figure 5. Eggs adhere to the bottom, forming extensive egg beds that may be many layers deep. Generally, the following conditions exist where Atlantic herring eggs are found: water temperature below 15° C, depths from 20-80 meters and a salinity ranges from 32-33‰. Herring eggs are most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Herring eggs are most often observed during the months from July through November.

**Larvae:** Pelagic waters in the Gulf of Maine, Georges Bank and southern New England that comprise 90% of the observed range of Atlantic herring larvae as depicted in Figure 5. Generally, the following conditions exist where Atlantic herring larvae are found: sea surface temperatures below 16° C, water depths from 50-90 meters, and salinities around 32‰. Herring larvae are observed between August and April, with peaks from September through November.

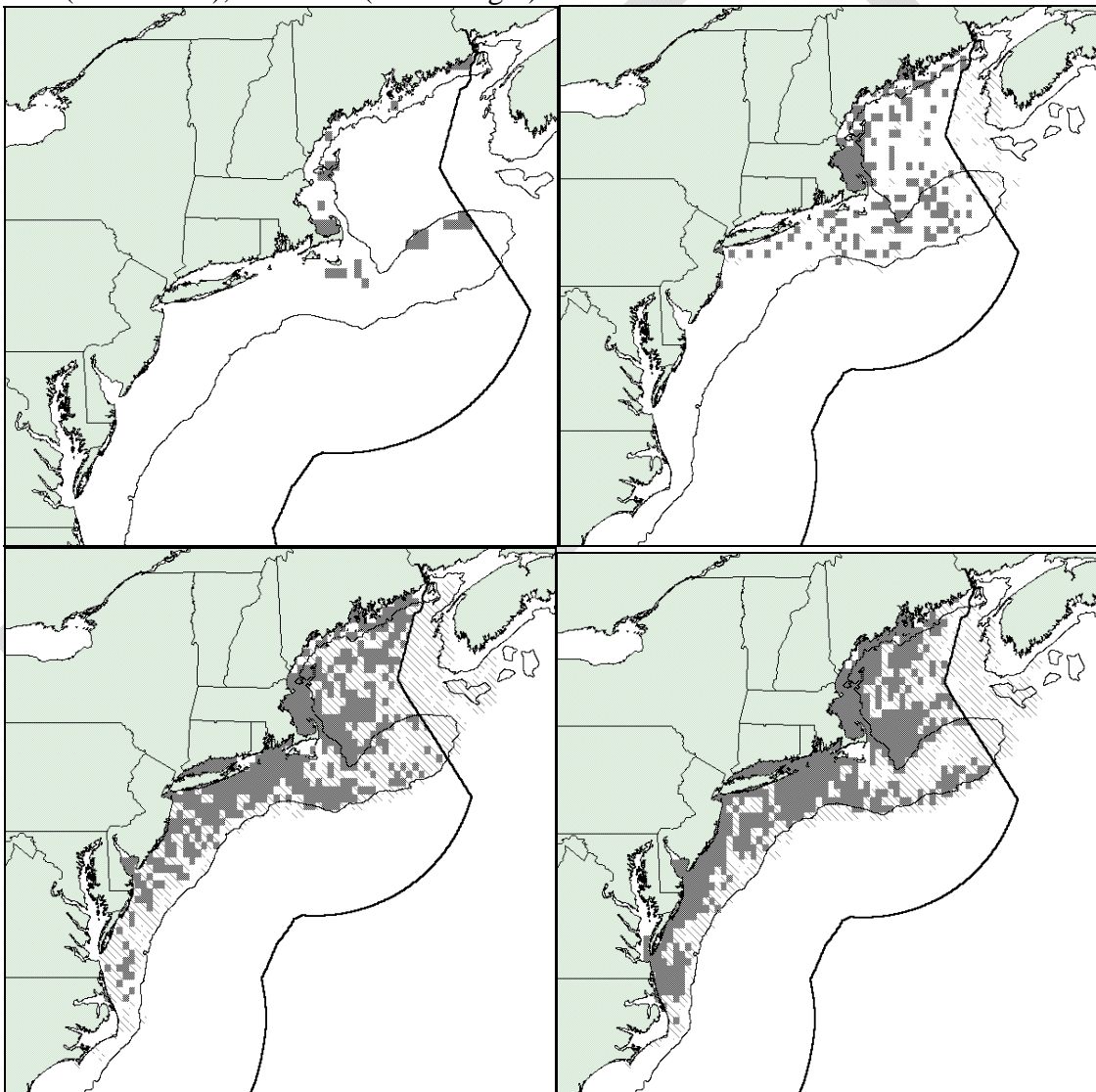
**Juveniles:** Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted in Figure 5. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10° C, water depths from 15-135 meters and a salinity range from 26-32‰.

**Adults:** Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted in Figure 5. Generally, the

following conditions exist where Atlantic herring juveniles are found: water temperatures below 10° C, water depths from 20-130 meters and salinities above 28‰.

**Spawning Adults:** Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted in Figure 8. Generally, the following conditions exist where spawning Atlantic herring adults are found: water temperatures below 15° C, depths from 20-80 meters and a salinity range from 32-33‰. Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Herring are most often observed spawning during the months from July through November.

**Figure 2.** NEFMC EFH designation for Atlantic herring eggs (top left), larvae (top right), juveniles (bottom left), and adult (bottom right).



#### 1.4.1.3 Present Condition of Habitats and Habitat Areas of Particular Concern

A detailed description of habitat quality and habitat areas of particular concern can be found in the Source Document for Amendment 1.

#### *1.4.1.4. Ecosystem Considerations*

**Forage:** Atlantic herring's role as forage, and its association with other forage species of concern (i.e. river herring and shad species) in the northwest Atlantic ecosystem has recently become a concern to many stakeholders.

**Other Northeast Region Species:** The area where the Atlantic herring fishery takes place has been identified as EFH for species managed under the following Federal Fishery Management Plans: Northeast Multispecies; Atlantic Sea Scallop; Atlantic Monkfish; Summer Flounder, Scup and Black Seabass; Squid, Atlantic Mackerel and Butterfish; Atlantic Surf Clam and Ocean Quahog; Atlantic Bluefish; Atlantic Billfish; and Atlantic Tuna, Swordfish and Shark. All EFH descriptions and maps can be viewed on the NMFS Northeast Regional Office website (NEFMC, 2005).

**Anthropogenic Impacts on Atlantic Herring and their Habitat:** Habitat alteration and disturbance can occur through natural processes and human activities. Natural disturbances to habitat can result from summer droughts, winter freezes, heavy precipitation, and strong winds, waves, currents and tides associated with major storms (i.e. hurricanes and northeasters) and global climatic events such as El Nino. Biotic factors, including bioturbation and predation, may also disturb habitat (Auster and Langton MS, 1998 and in press). These natural events may have detrimental effects on habitat, including disrupting and altering biological, chemical and physical processes, and may impact fish and invertebrate populations. Potential adverse effects to habitat from fishing and non-fishing activities may include direct (e.g. contamination or physical disruption), indirect (e.g. loss of prey or reduction of species diversity), site-specific or habitat wide impacts, including individual, cumulative or synergistic consequences of the actions. Non-fishing threats to habitat may include the intentional or accidental discharge of contaminants (i.e. heavy metals, oil, nutrients, pesticides, etc.) from non-point and point sources, and direct habitat degradation from human activities (i.e. channel dredging, marina/dock construction, etc.).

Riverine, inshore and offshore habitats are subject to numerous chemical, biological and physical threats. Riparian habitat is being degraded and altered by many human activities. Inshore regions are variable environments that are threatened by many sources of degradation. Deep-sea habitats are stable and contain less resilient communities than habitats found within inshore waters (Radosh et al., 1978) that are altered by unnatural stress. Pelagic environments in coastal and offshore areas are potentially essential habitat for many marine organisms throughout substantial stages of ontogenetic development. These areas can also be disrupted. Chemical, biological, and physical threats can potentially limit survivorship, growth and reproductive capacity of fish and shellfish species and populations

The major threats to marine and aquatic habitats are a result of increasing human population, which is contributing to an increase of human generated pollutant loadings. These pollutants are being discharged directly into riverine and inshore habitats by way of point and non-point

sources. The development of coastal regions to accommodate more people leads to an increase in unwanted runoff, such as toxicants, nutrients and pesticides. Humans attempt to control and alter natural processes of aquatic and marine environments for an array of reasons, including industrial uses, coastal development, port and harbor development, erosion control, water diversion, agriculture, and silviculture. Environmental conditions of fish and shellfish habitat are altered by human activities (see Wilk and Barr, 1994 for review) and threatened by non-point and point sources of pollution.

**Environmental Contaminants:** The effects of copper on eggs and larvae of Atlantic herring were reported by Blaxter (1977). Mortality of newly hatched larvae was high at copper concentrations of 1,000 micrograms per liter (mcrg/l). Eggs incubated in 30 mcrg/l had relatively high mortality and premature hatching; 70% of the larvae hatched were deformed. Larvae were more resistant to copper than eggs; survival of larvae was impaired only at concentrations  $\geq$  1,000 mcrg/l. The vertical migration of larvae was impaired at copper concentrations of  $\geq$  300 mcrg/l.

Tests on the effects of sulfuric pollutants such as iron sulfate and hydrogen sulfate, showed that a dilution of 1:8,000 significantly reduced egg fertilization and hatching success, decreased egg diameter, retarded embryonic growth, shortened the incubation period, and increased the rate of structural abnormalities in newly hatched larvae (Kinne and Rosenthal 1967). Larval prey-catching ability was impaired in 1:32,000 and 1:24,000 dilutions; locomotory performance was seriously affected at a 1:16,000 dilution. Permanent deformities and death occurred within a few days at a 1:8,000 dilution.

Studies of dinitrophenol effects on herring embryonic development indicated that low concentrations (0.01 to 0.05 micromole/l) increased embryo activity and altered heart rates significantly (Rosenthal and Stelzer 1970). Various embryonic malformations were also observed. A dinitrophenol concentration of 0.1 micromole/l caused up to a 400% increase in the normal embryonic respiration rate (Stelzer et al. 1971).

Blaxter and Hunter (1982) reported that eggs and larvae held under films of crude oil in concentrations of 1 to 20 ml/l, or in emulsions, experienced toxicities that varied with the origin of the oil. For oil from a particular source, the fractions with the lower boiling points seemed more harmful (Kuhnhold 1969; cited in Kelly and Moring, 1986). In tests on oil dispersants, larvae did not avoid horizontal gradients, but swam into surface dispersant layers and were narcotized (Wilson, 1974). The survival of herring eggs and larvae was highest in water with low biological oxygen demand and low nitrate levels (Baxter and Steele, 1973).

#### **1.4.2 Description of Programs to Protect, Restore, Preserve and Enhance Atlantic Herring Habitat**

Federal marine pollution research and monitoring activities are coordinated by NOAA's National Ocean Pollution Program Office. Short and long-term anthropogenic effects on the marine environment are also assessed. NOAA's Ocean Pollution Program Office coordinates interagency responsibilities while the Ocean Assessments Division (OAD) of the Office of Oceanography and Marine Assessments, National Ocean Service, manages assessments.



## **1.5 Impacts of the Fishery Management Program**

### **1.5.1 Biological and Environmental Impacts**

### **1.5.2 Social Impacts**

#### *1.5.2.1 Recreational Fishery*

Herring management affects the recreational fishery indirectly by controlling the availability of herring for bait and for forage (drawing the target species closer to shore where they are then accessible to the recreational industry). As long as management measures work to ensure that herring is not overfished, the recreational fishery will benefit. Although biomass estimates and research indicates that herring as forage is plentiful, to the extent that the measures slow the rate of catch, spreading the TAC over the year, the perception of recreational fishermen is likely to be that herring would be available as forage for a longer period.

#### *1.5.2.2 Commercial Fishery*

##### **Issue 1: Spawning Area Closure in Massachusetts-New Hampshire Area**

An extension of the MA-NH spawning area closure from four to six weeks would have a negative impact on the herring industry. Fishermen and bait dealers expressed that the cost to business outweighs the unwarranted protections for a rebuilt stock. According to the 2012 stock assessment, the spawning stock biomass of Atlantic herring spawning stock biomass in 2011 was 517,930 mt, which is 230% above the  $SSB_{MSY}$  of 157,000 mt. As the stock is not overfished, there is no biological justification for additional precautionary measures. A six-week closure would significantly reduce the fishing opportunities. As a case study, the MA-NH spawning area was closed from September 21 through October 19 during the 2012 fishing year. Continued sampling of commercial catches detected ongoing spawning activity, and consequently, the spawning closure resumed for two more weeks (October 30 through November 13, 2012). With the directed fisheries closing effective November 5, 2012 in Area 1A (TAC closure), fishing opportunity in the MA-NH area was open for one week during 2012's Trimester 3.

Additionally, fishermen expressed the concern that effort by midwater trawlers would be displaced farther northeast, where smaller fish are located, if the spawning closure lasted for six weeks.

##### **Issue 2: Fixed Gear Rollover**

The federal and state FMPs, which are consistent, allow for a 500 MT fixed gear set aside. Currently, specifications are 295 MT, with set-aside expiring on October 31. Based on recent observations of herring after November 1, fixed gear fishermen have asked for the rollover provision to be removed so they can continue fishing through the remainder of the year, until the TAC has been reached. In other words, fixed gear fishermen can continue to utilize their set-aside throughout the year.

Removal of the fixed gear set-aside rollover provision would have a neutral impact to industry,

but would require costs to implement consistent adjustments to the state and federal management plans. The fixed gear set-aside is a small portion of the total allowable catch (from 2013-2015, fixed gear set-aside was specified at 295 mt of the base 31,200 mt Area 1A sub-quota). There is potential for a low number of fishermen to increase utilization of fixed gears. While some fishermen have provided anecdotal evidence of Atlantic herring occurring in the Gulf of Maine after November 1, most likely due to recent changes in oceanographic conditions, landings data for a ten-year period from 2004 to 2013 indicates that no sea herring have been caught by fixed gear in November and December (Table 3). In addition, a removal of the rollover provision brings forth questions on year-to-year rollover if not fully utilized, and may lead to a quota allocation for the fixed gear fishery.

Considering the resources needed to implement consistent regulations between the interstate and federal fishery management plans and the small portion of potential fishing opportunity created with the removal of the rollover provision, the benefit does not justify the cost of adjusting the fixed gear set-aside rollover provision at this time. Additional studies are needed to demonstrate that a true shift in sea herring migration patterns and fish are indeed occurring in the Gulf of Maine.

**Table 3.** Atlantic herring landings taken by the fixed gear fishery before and after rollover provision effective date on November 1.

<b>Year</b>	<b>TAC Closure Date</b>	<b>Sub-Quota (mt)</b>	<b>Cumulative Catch (mt) by Dec31</b>	<b>Fixed Gear Landings (mt) Jan-Oct</b>	<b>Fixed Gear Landings (mt) Nov-Dec</b>
2004	11/19/2004	60,000	60,071	49	0
2005	12/2/2005	60,000	61,570	53	0
2006	10/21/2006	50,000	59,980	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	27,741	823	0
2011	10/27/2011	29,251	29,359	23	0
2012	11/5/2012	27,668	25,057	0	0
2013	10/15/2013	29,775	29,820	0*	0*

\* = preliminary

### **Issue 3: Empty Fish Hold Provision**

A requirement for fish holds to be empty of fish prior to a fishing trip departure would have a positive impact to industry. This option will be an incentive for fishermen to fish more efficiently to market demands by prohibiting vessels from returning to sea with unsold fish in the holds.

Waivers: There has been no documentation of the frequency and reasons for unmarketable fish. According to members of industry, instances that would require waivers occur infrequently, but

there is no data to inform the appropriate number of waivers at this time. A new waiver system can provide a record to inform managers and industry of the fishing and marketing practices. The empty fish hold provision applies to vessels departing on a fishing trip (i.e. declared into the fishery), but not for vessels transporting fish from port to port (i.e. not declared into the fishery). Therefore, waivers would not be required for vessels transporting fish from dock to dock. At this time, industry supports no limit on waivers issued for legitimate reasons to match the Council's approved option.

#### *1.5.2.3 Subsistence Fishery*

Insufficient data has been collected to comment in detail. It is uncertain to what extent herring may support subsistence fishing in the Mid-Atlantic or South and there does not appear to be subsistence fishing for herring in the Northeast. Because the amendment is attempting to control fishing on herring to smooth out the year's landings, it is anticipated that the measures here will help maintain access to herring for subsistence needs.

#### *1.5.2.4 Non-consumptive Factors*

Herring is considered a primary forage fish for tuna, whales and various other species targeted by recreational fishermen. Consequently, as the commercial herring industry has rebuilt in the last few years, considerable anxiety has developed in other sectors about whether or not too many herring are being caught. There is no reason to conclude that herring is overfished (according to the biomass estimates), but perception and anxiety can affect community dynamics and governance. This is an issue that will continue to be discussed and debated; therefore, the ASMFC will monitor the debate as it develops.

### **1.6 Location of Technical Documentation for FMP (*refers reader to citations only*)**

1.6.1 Review of Resource Life History and Biological Relationships

1.6.2 Stock Assessment Document

1.6.3 Social Assessment Document (*if available*)

1.6.4 Economic Assessment Document (*if available*)

1.6.5 Law Enforcement Assessment Document (*if available*)

1.6.6 Habitat Background Document (*if available*)

## **2.0 GOALS AND OBJECTIVES**

### **2.1 History and Purpose of the Plan**

#### **2.1.1 History of Prior Management Actions**

***FMP*** (November 1993)

Management of USA Northwest Atlantic herring stocks beyond territorial waters was commenced in 1972 through the International Commission for the Northwest Atlantic Fisheries (ICNAF). The international fishery was regulated by ICNAF until USA withdrawal from the organization in 1976 with Congressional passage of the Magnuson Fishery Conservation and Management Act (MFCMA). Under the aegis of the MFCMA, the New England Fishery Management Council (Council) developed a Fishery Management Plan (FMP) for herring, which was approved by the Secretary of Commerce and was implemented on December 28, 1978. Over the interim period (1976-1978), foreign fishing for herring in USA waters was regulated through a Preliminary Management Plan (PMP) prepared by the National Marine Fisheries Service (NMFS 1995). In 1982, this plan was withdrawn by NMFS and herring was placed on the prohibited species list, eliminating directed fisheries for herring by foreign nationals within the US EEZ and requiring that any herring bycatch by such vessels be discarded. In 1983, an Interstate Herring Management Plan was adopted by the states of Maine, Massachusetts, New Hampshire and Rhode Island, which implemented a series of spawning closures. The states from Maine to New Jersey, acting through the ASMFC, adopted a new FMP in 1994 to address the growth of the herring resource and interest in Internal Waters Processing (IWP) operations.

***Amendment 1*** (February 1999)

ASMFC's Amendment 1 to the Atlantic Herring Fishery Management Plan (FMP) was developed to complement the NEFMC's federal management plan; it was designed to minimize regulatory differences in fisheries conducted in state and federal waters. Amendment I established management goals and objectives for the U.S. Atlantic herring resource that can only be reached through the successful implementation of both the interstate and federal management plans. The management scheme relies on a total allowable catch (TAC) with effort control measures to avoid overfishing. TACs are developed for specific management areas to reflect the current state of knowledge concerning migratory behavior and mixing rates of the sub-components of Atlantic herring.

Amendment 1 defines overfishing and biological reference points based on an estimate of maximum sustainable yield (MSY) for the entire stock complex. In order to maintain consistency between Amendment 1 and NEFMC's FMP, ASMFC's Atlantic Herring Section adopted the same overfishing definition and biological reference points as in the federal plan, which were created under guidelines stipulated in the revised Magnuson-Stevens Fishery Conservation and Management Act (MSA) prior to the 2006 re-authorization. Both FMPs provide a process for setting annual specifications and contain institutional frameworks for developing and implementing future management action involving the ASMFC, the New England and Mid-Atlantic Councils, and (possibly) Canada. The plans also include state and federal spawning closures/restrictions and recommendations to prevent damage to herring spawning habitat and egg beds. State effort controls include specific "days out" of the week to slow the fishery's catch rates and extend the fishing season in Management Area 1A.

***Addendum I to Amendment 1*** (July 2000)

The Section approved Addendum I to re-address the protection of spawning areas and change the due date for annual state compliance reports to February 1. Because NOAA Fisheries disapproved the spawning closures for the federal waters of Management Area 1A (inshore Gulf

of Maine), ASMFC developed Addendum I to redefine the state waters spawning areas outlined in Amendment 1. Addendum I also includes measures designed to reduce the exploitation and disruption of herring spawning aggregations by imposing a landing restriction in state ports for herring caught in the spawning areas, except that some states allow a 20% tolerance for spawn herring (Maine and Massachusetts).

**Technical Addendum #1A** (October 2001) was approved to change the delineation of the Eastern Maine spawning boundary because the spawning aggregations were not adequately protected in 2000.

**Addendum II to Amendment 1** (February 2002)

Addendum II was developed in conjunction with NEFMC's Framework Adjustment 1 to allocate the Management Area 1A's TAC on a seasonal basis. This addendum also specifies the procedures for allocating the annual Internal Waters Processing (IWP) quota.

**Amendment 2** (March 2006)

The essential management components of ASMFC's Amendment 2 are consistent with the federal Amendment 1 (final rule published in March 2007). These provisions include identical management area boundaries, joint TAC specifications setting process between NEFMC and ASMFC, and closure of an area when 95% of TAC is harvested and reduction of the possession limit to a 5% bycatch allowance. Despite coordinated development between Amendment 2 and the federal Amendment 1, there remained some inconsistencies. The east of Cutler exemption in *Section 4.3.2.4* of Amendment 2 was not adopted in the federal plan, as it was found to be "inconsistent with National Standard 1 and 3 of the Magnuson-Stevens Act." Conversely, Amendment 1 contains a midwater trawl prohibition in Area 1A from June 1 – September 30, which is not included in the Amendment 2. It is unlikely that there are mid-water trawl vessels lacking federal permits.

**Technical Addendum I to Amendment 2** (August 2006)

Upon implementation of Amendment 2, there was inconsistent interpretation of the Zero Tolerance provision. Therefore, a technical addendum was developed to clarify that prohibits any vessel from fishing for, taking, landing, or possessing "spawn" herring within a restricted spawning area except for incidental bycatch and transiting provisions.

**Addendum I to Amendment 2** (February 2009)

Addendum I was intended to address effort in Area 1A. It includes a number of tools for the Section to use in order to maintain a steady supply of herring throughout the fishing season. Under Addendum I, states adjacent to Area 1A must set quotas, but can use bi-monthly, trimester, or seasonal quotas and can distribute quota from January – May to later on in the fishing season when the demand and price is greater—as best meets the need of the fishery. This addendum also includes measures to close the fishery when 95% of the quota allocation is harvested and the ability to roll quota into later periods in the event of an under harvest. States are also required to implement weekly reporting in order to manage quotas in a timely manner.

**Addendum II** (December 2010)

In March 2011, NOAA Fisheries approved Amendment 4 to the federal FMP, bringing it under compliance with the MSA's annual catch limit requirements. Addendum II was developed to mirror the federal Amendment 4. It revises the specifications process and definitions to be consistent with the federal management scheme, in which specifications can be set for up to three years based on best available science. Addendum II also establishes a threshold of 95% of an area's TAC for fishery closure and overage paybacks as accountability measures.

***Addendum V*** (October 2012)

Intended to provide clarify and eliminate inconsistent spawning regulations among various interstate Atlantic herring FMP documents, Addendum V replaces all spawning regulations in previous management documents. It establishes provisions for determining spawning events and the implementation of area closures, and increases the sampling size from two sample of 50 fish to two samples of 100 fish or more. Addendum V includes new boundaries for the four management areas and identifies the locations of spawning areas subject to closures (Figure 1).

***Addendum VI*** (August 2013)

Developed to complement the NEFMC's Framework Adjustment 2 (final rule published in October 2013), Addendum VI established new provisions and consistent management measures for the four Atlantic herring management areas. States were allowed to seasonally split sub-ACLs for each management area to benefit the fishery. Up to 10% of unused sub-ACL can be carried over to the following fishing year after data is available, provided that the stockwide ACL has not been caught. Addendum VI also set new triggers: a directed fishery will close when 92% of an area's sub-ACL is projected to be reached, and the stockwide fishery will close when 95% of the total ACL is projected to be reached. There is a 2,000 lb trip limit to allow for incidental bycatch of sea herring for the remainder of the fishing year. In addition, Addendum VI allows for these the directed fishery closure triggers to be set through the specification process.

### **2.1.2 Purpose and Need for Action**

The Commission and New England Council have reviewed the status of the Atlantic herring resource and the condition of the industry that utilizes this resource. The Commission and the Council have determined that sufficient management problems exist to warrant the development and implementation of a complementary interstate and Federal program for conservation and management.

Some of the specific concerns covered by this amendment, include:

- Spawning Area Efficacy
- Fixed Gear Set Aside Provision
- Empty Fish Hold Provision

### **2.2 Goals**

The goals of Amendment 3 to the Interstate Fishery Management Plan for Atlantic Herring are:

- To achieve, on a continuing basis, optimum yield (OY) for the United States fishing industry and to prevent overfishing of the Atlantic herring resource. Optimum yield is the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, taking into account the protection of marine ecosystems, including maintenance of a biomass that supports the ocean ecosystem, predator consumption of herring, and biologically sustainable human harvest. Optimum yield is based on the maximum sustainable yield (MSY) as reduced by any relevant economic, social, or ecological factor, and, in the case of an overfished fishery, provides for rebuilding to a level consistent with producing MSY.
- To provide for the orderly development of the offshore and inshore fisheries, taking into account the viability of current participants in the fishery.

### 2.3 Objectives

To meet the goals of Amendment 3, the following objectives shall guide the development of the interstate management program for Atlantic herring:

- To harvest the U.S. Northwest Atlantic herring resource consistent with the definition of overfishing contained in Amendment 3.
- To prevent the overfishing of discrete spawning units consistent with the national standards.
- To avoid patterns of fishing mortality by age which adversely affect age structure of the stock.
- To provide adequate protection for spawning herring and prevent damage to herring egg beds.
- To promote U.S. and Canadian cooperation in order to establish complementary and real-time management practices.
- To implement management measures in close coordination with other Federal and State FMPs.
- To promote research and improve the collection of information in order to better understand herring population dynamics, biology, and ecology, improve science in order to move to real-time management and to improve assessment procedures and cooperation with Canada.
- To achieve full utilization from the catch of herring, including minimizing waste from discards in the fishery.
- To maximize domestic use, such as lobster bait, sardines, and other products for human consumption, and encourage value-added product utilization.
- To promote the utilization of the resource in a manner, which maximizes social and economic benefits to the nation and taking into account the protection of marine ecosystems and its value as a forage species.

### 2.4 Specification of Management Unit

The management unit for this amendment is defined as the Atlantic herring (*Clupea harengus harengus*) resource throughout the range of the species within U.S. waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the Exclusive Economic Zone (EEZ). Because the management unit is limited to U.S. waters, it does not include the entire range of the Atlantic herring stock complex. Various components of the stock complex migrate

through Canadian waters, beyond the Atlantic States Marine Fisheries Commission's range of management. The Atlantic herring stock complex is interstate, state-federal and transboundary in nature; therefore, effective assessment and management can be enhanced through cooperative efforts with state, federal, and Canadian scientists and fisheries managers.

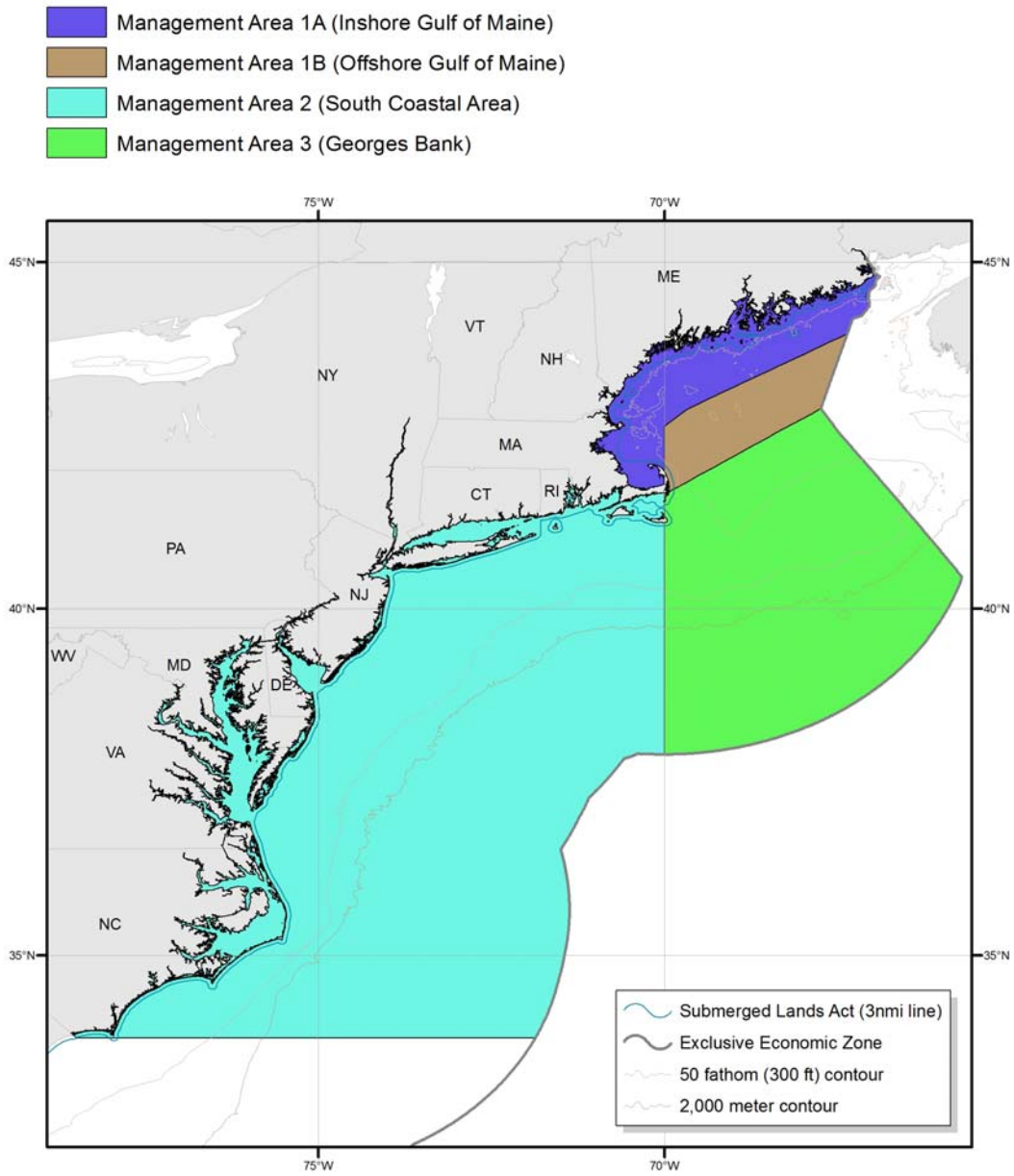
The states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey, and the National Marine Fisheries Service have declared an interest in Atlantic herring.

#### 2.4.1 Management Areas

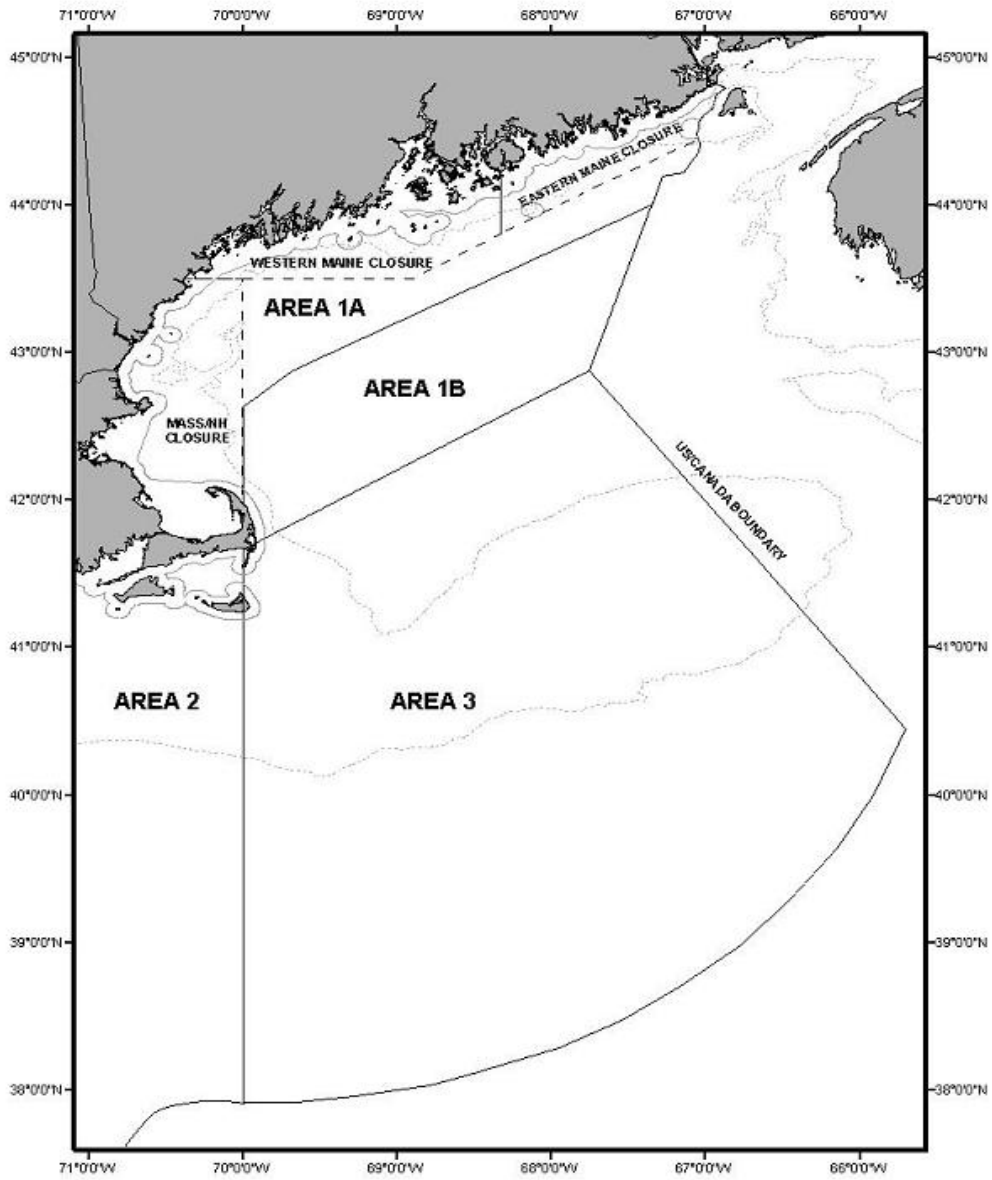
Currently, Atlantic herring is managed under four management areas in the Gulf of Maine, Georges Bank, and Southern New England (Figure 6). The Gulf of Maine is split into an inshore area (Area 1A) and offshore (Area 1B). The three existing spawning areas are located within Area 1A (Figure 7).



**Figure 6.** Current Atlantic herring management areas.



**Figure 7.** Spawning areas are located within inshore Gulf of Maine (Area 1A).



## **2.5 Definition of Overfishing**

The 2012 stock assessment for Atlantic herring (54<sup>th</sup> SAW) employed a Beverton-Holt stock-recruitment curve, estimated internally to the ASAP base run, to produce maximum sustainable yield (MSY) reference points through 2011. The overfishing definition is  $F_{MSY} = 0.27$ . The stock is considered overfished if SSB is less than half of  $SSB_{MSY}$ .  $SSB_{MSY}$  was estimated at 157,000 metric tons (mt). The base ASAP run estimated fishing mortality at age 5 in 2011 to be 0.14 and SSB in 2011 was 517,930 mt. Therefore, the base ASAP run suggests that overfishing is not occurring and that the stock is not overfished.

## **2.6 Stock Rebuilding Program**

A rebuilding program is not applicable for the Atlantic herring complex at the present time; however, if it is determined that the herring resource is experiencing overfishing or has become overfished, the Atlantic herring Section will initiate and develop a rebuilding schedule at that time.

## **2.7 Resource Community Aspects**

Due to the unique and important role that Atlantic herring play in the ecosystem, management considerations should be broader than just traditional fisheries management. Atlantic herring support a valuable commercial fishery for human consumption and provide bait for other fisheries. Herring also serve as an important prey species for fish, birds and marine mammals. *Section 1.3.5* describes the importance of herring as a forage species.

## **2.8 Implementation Schedule**

[TBD if approved]

## **3.0 MONITORING PROGRAM SPECIFICATIONS/ELEMENTS**

The Atlantic Herring Technical Committee will meet at least once each year to review the stock assessment and all other relevant and current data pertaining to stock status. The Technical Committee will report on all required monitoring elements outlined in *Section 3* and forward any recommendations to the Atlantic Herring Section. The Technical Committee shall also report to the Management Board the results of any other monitoring efforts or assessment activities not included in *Section 3* that may be relevant to the stock status of Atlantic Herring or indicative of ecosystem health and interactions.

The Atlantic Herring Advisory Panel will meet at least once each year to review the stock assessment and all other relevant data pertaining to stock status. The Advisory Panel will forward its report and any recommendations to the Management Board.

The Atlantic Herring Plan Review Team will annually review implementation of the

management plan and any subsequent adjustments (addenda), and report to the Management Board on any compliance issues that may arise. The PRT will also prepare the annual Atlantic Herring FMP Review and coordinate the annual update and prioritization of research needs (see *Section 6.0*).

The Section encourages all state fishery management agencies to pursue full implementation of the Atlantic Coastal Cooperative Statistics Program (ACCSP), which will meet the monitoring and reporting requirements of this FMP. The Section recommends a transition or phased-in approach be adopted to allow for full implementation of the ACCSP. Until such time as the ACCSP is implemented, the Section encourages state fishery management agencies to initiate implementation of specific ACCSP modules, and/or pursue pilot and evaluation studies to assist in development of reporting programs to meet the ACCSP standards (please refer to the ACCSP Program Design document for specific reporting requirements and standards). The ACCSP partners are the 15 Atlantic coastal states (Maine - Florida), the District of Columbia, the Potomac River Fisheries Commission, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the three Fishery Management Councils, and the Atlantic States Marine Fisheries Commission. Participation by program partners in the ACCSP does not relieve states from their responsibilities in collating and submitting harvest/monitoring reports to the Commission as may be required under this FMP [Amendment].

### **3.1 Assessment of Annual Recruitment**

The Technical Committee and Stock Assessment Subcommittee will review annually the status of Atlantic herring recruitment to the coastal stock complex and “other specific groups of herring” as directed by the Section.

### **3.2 Assessment of Spawning Stock Biomass**

The Technical Committee and Stock Assessment Subcommittee will review annually the spawning stock biomass of the Atlantic herring coastal stock complex and “other specific groups of herring” as directed by the Section.

### **3.3 Assessment of Fishing Mortality Target and Measurement**

The Technical Committee and Stock Assessment Subcommittee will review annually the fishing mortality rate of the Atlantic herring coastal stock complex and “other specific groups of herring” as directed by the Section.

### **3.4. Catch and Landings Information**

Prior to 1994, U.S. landings were collected by a combination of canning industry reports and reports by NMFS port agents. After 1994, harvesters using Vessel Trip Reports (VTR) directly reported U.S. landings data. With implementation of the FMP in 1999, harvesters have been required to use both VTR and Interactive Voice Reports (IVR). Federally licensed dealers are also required to submit monthly reports (NEFMC, 2005 1999).

Harvesters report VTR data on a monthly basis. Because harvesters give location data (coordinates or Loran) on a per trip basis, this reporting system allows for summarizing catch information from specific areas. VTR data are useful for stock assessment and effort evaluation, but because they are reported on a monthly basis, the data are not useful for quota monitoring (NEFMC, 2005 2001).

Using the IVR call-in system, harvesters report catches by management area on a weekly schedule. Although trip level information and location data are not reported, this system is useful for near real time quota monitoring. IVR data are not generally useful for stock assessments, or to address management questions that require information by area or gear.

Any marine fishery products landed in any state must be reported by a dealer or a marine resource harvester acting as a dealer in that state. Any marine resource harvester or aquaculturist who sells, consigns, transfers, or barter marine fishery products to anyone other than a dealer would themselves be acting as a dealer and would therefore be responsible for reporting as a dealer.

Dealer reports include detailed information on amounts landed, price paid and utilization of landings, usually on a per trip basis. The dealer reports do not contain information on area of catch.

Both IVR and VTR data include landings to foreign vessels by domestic harvesters. Dealer data only include landings made to domestic dealers. NMFS and state observers collect data on landings to foreign processing or fishing vessels. At the end of a fishing year, all reporting systems are analyzed to detect and reconcile discrepancies.

The ACCSP commercial data collection program will be a mandatory, trip-based system with all fishermen and dealers required to report a minimum set of standard data elements (refer to the ACCSP Program Design document for details). Submission of commercial fishermen and dealer reports will be required by the 10<sup>th</sup> of each month.

### **3.4.2 Biological Information**

The ACCSP program design calls for the collection of baseline biological data on commercial, for-hire, and recreational fisheries. Biological data for commercial fisheries will be collected through port sampling programs and at-sea observers. Biological data for recreational fisheries will be collected in conjunction with the access-intercept survey. Biological data for for-hire fisheries will be collected through existing surveys and at-sea observer programs. A minimum set of standard data elements will be collected in all biological sampling programs (refer to the ACCSP Program Design document for details). Priorities and target sampling levels will be determined by the ACCSP Biological Review Panel, in coordination with the Discard/Release Prioritization Committee.

### **3.4.3 Social Information**

No ongoing data collection or monitoring is planned; however, the herring industry has very active representation and participates on the advisory panel, so will certainly provide information about any serious social impacts of regulatory change. The ACCSP is currently developing a comprehensive coastwide data collection program that will include social data.

### **3.4.4 Economic Information**

Federal Atlantic herring dealers will continue to submit trip-level landings reports on a monthly basis. These data include the vessel name, gear type, general catch area and amount purchased and can be used for future economic assessments. The ACCSP is currently developing a comprehensive coastwide data collection program that will include economic data.

### **3.4.5 Observer Programs**

The NMFS at-sea observer program is a mandatory program. As a condition of state and/or federal permitting, vessels shall be required to carry at-sea observers when requested. Once states have fully implemented the ACCSP bycatch/observer module, they are then required to have mandatory observer coverage (~5%). A minimum set of standard data elements will be collected through the ACCSP at-sea observer program (refer to the ACCSP Program Design document for details). Specific fisheries priorities and sampling levels will be determined by the Discard/Release Prioritization Committee.

The NEFMC is currently developing an observer omnibus amendment.

### **3.5 Bycatch Reduction Program**

Under this management measure, Amendment 2 recommends each state develop a bycatch monitoring program for state permitted vessels participating in the directed herring fishery that mirrors the federal requirements. As such, no action would be taken to implement more specific requirements for observer coverage in the Atlantic herring fishery in state waters. Vessels engaged in the herring fishery and which hold a federal permit would continue to take observers on their vessels as requested by the National Marine Fisheries Service (NMFS). Observer coverage would continue at the discretion of the NMFS. The information collected from independent fisheries observers helps to improve the collection of bycatch information and improve the monitoring of bycatch in the fishery. With better information, more effective management measures are able to be implemented to discourage bycatch and discards.

If the NEFMC implements bycatch caps, the ASMFC Atlantic Herring Section may initiate an addendum via adaptive management (*Section 4.7*) to modify the Interstate Management Program so that it is complementary to the Federal regulations.

### **3.6 Tagging Studies/Program**

### **3.7 Habitat Program**

Currently there is no habitat program designed specifically for Atlantic herring. The NEFMC is proposing updated designation of the Essential Fish Habitat (EFH) for herring and other species it manage through its Draft Omnibus Habitat Amendment 2.

## **4.0 MANAGEMENT PROGRAM IMPLEMENTATION**

### **4.1 Recreational Fisheries Management Measures**

At this time, Draft Amendment 3 does not propose management measures for the recreational fishery.

### **4.2 Commercial Fisheries Management Measures**

#### **4.2.1 Issue 1: Spawning Area Efficacy**

Addendum V to Amendment 2 contains the comprehensive spawning regulations for Atlantic herring in Management Area 1A. Currently, there are three designated spawning areas within Management Area 1A (inshore Gulf of Maine): Eastern Maine, Western Maine, and Massachusetts/New Hampshire (Figure 1). Spawning herring are protected by closures to the fishery. To detect ripening of adult herring at the start of each spawning event, the FMP requires sampling of commercial catch no later than August 1 for the Eastern and Western Maine spawning areas, and September 1 for Massachusetts/New Hampshire.

Closure dates pertaining to spawning events are based on sufficient sampling from commercial fishing. The sufficient sample size is comprised of at least two 100-fish samples in the two length categories (i.e. greater than or equal to 28 cm and between 24 and 28 cm in length). The current regulatory language states closures in a given area will begin seven days after the determination that female herring from a specific area have reached 20% mean gonadosomatic index (GSI) for fish greater than or equal to 28 cm in length and 15% mean GSI for fish greater than or equal to 24 cm. Spawning closures last for four weeks. If catch sampling continues to detect spawning herring, then the closure will resume for another two weeks.

In the event sufficient samples are not available, then closures will begin on the following default dates and last for four weeks.

Eastern Maine	August 15
Western Maine	September 1
Massachusetts/New Hampshire	September 21

The Atlantic Herring Plan Development Team (PDT) reviewed spawning area boundaries and closure dates in the MA/NH spawning area and recommends extending the spawning closure by a minimum of two weeks. This adjustment of the closure period would better protect spawning sea herring.

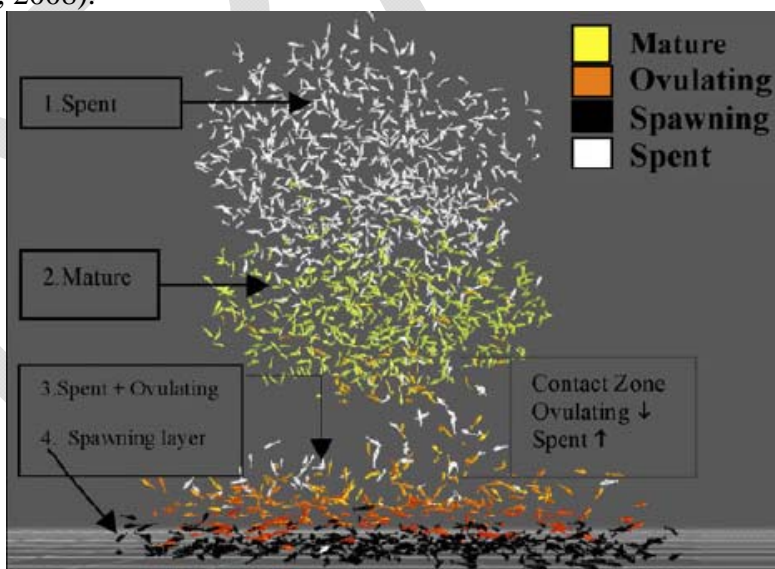
Anecdotal reports from industry suggested there may be variation in the spawning season within

the MA/NH area (i.e., spawning occurs earlier to the north). However, upon review of the GSI data from both the Massachusetts Division of Marine Fisheries and ME DMR sampling programs, this does not appear to be the case. In fact, both programs track each other well and the combined dataset appears well-suited to continue to inform the initiation of the MA/NH spawning closure (Figure 4). Therefore, the PDT has found the current spawning area boundaries are adequate and further sub-areas are not warranted.

Another issue remains regarding the duration of the closure period. The rules governing the spawning closure also include a mechanism to extend or re-close the area, should 25% of spawning herring be found in fishery-dependent sampling. However, there is reason to believe a substantial gear bias exists with respect to herring maturity stages; certain maturity stages may be unavailable to specific gear types, depending upon where in the water column they operate.

Atlantic herring are a pelagic species, yet become demersal during spawning. This causes a vertical stratification of maturity stages, with spawning fish residing closest to the seafloor, and developing, spent and juvenile fish above them in sequence (Figure 8). This means the composition of maturity stages in a sample of herring is largely dependent upon the gear type (i.e., bottom trawls are more likely to collect spawning fish than mid-water trawls or purse seines). This affects scientists' ability to describe the completion of the spawning season, and calls into question the usefulness of the 25%-spawning re-closure rule. However, given the presence of some amount of spawning fish after the closure, a longer closure period may be warranted.

**Figure 8.** Vertical stratification by maturity stage within a school of spawning Atlantic herring (Vabo and Skaret, 2008).



### Management Options for Issue 1: Spawning Area Efficacy

**Issue 1, Option 1: Status Quo:** By default, spawning area closure will last four (4) weeks. Catch sampling of the fishery will resume at the end of the initial four-week closure period. If catch sampling indicates significant numbers of spawn herring are ~~still being harvested in the area~~, closures will resume for an additional two weeks. Significant



numbers of spawn herring is defined as 25% or more mature herring, by number in a catch sample, have yet to spawn. Mature or “spawn” herring are defined as Atlantic herring in ICNAF gonadal stages V and VI.

**Issue 1, Option 2: Two-Week Extension to the Massachusetts-New Hampshire Spawning Area:** The MA-NH spawning area closure will last six (6) weeks. The additional two weeks will serve as a default extended closure in lieu of continued sampling and reclosure.

#### **4.2.2 Fixed Gear Set-Aside Provision Adjustment**

Amendment 2 to the Atlantic Herring FMP established that 500 mt of the Area 1A TAC is set aside for fixed gear fisheries operating in Area 1A (weirs and stop seines) west of Cutler. This set-aside is available to fixed gear fishermen in Area 1A until November 1. If the set-aside has not been utilized by the fixed gear fisheries west of Cutler by November 1, it will then be made available to the remainder of the herring fleet fishing in Area 1A until the directed fishery in 1A closes. If 92% of the Area 1A TAC has already been reached by November 1 (and the directed herring fishery in 1A is therefore closed), the set-aside will be released as part of the 5% set-aside for incidental catch in 1A (at a 2,000-lb trip limit).

The 2013 – 2015 specifications package includes a fixed gear set-aside of 295 mt. Any unused portion of this set-aside after November 1 is rolled into the Area 1A sub-total to be used by other gears. The date for this rollover was set at November 1 because historically, Atlantic herring have moved off of Maine’s coast by the end of the year.

In recent years, Atlantic herring has been known to occur along the mid-coast of Maine through November. Fixed-gear fishermen have requested the unused fixed gear set-aside would not be rolled into the Area 1A sub-quota on November 1 in order to maintain access to a dedicated quota for the fixed gear fishery. Furthermore, fishermen expect a demand for bait in the lobster fishery through end of the year.

The PDT discussed the need for adjusting the fixed-gear set aside rollover provision. Historically, the fish have migrated away from the Gulf of Maine coast by November. In the past decade, fixed gear landings have not fully utilized the set aside of 295 mt (most recent 10-year average is 197.4 mt, or 67% of the set-aside) and landings after November 1 have been 0 mt (Table 4). The last year in which Atlantic herring were caught after Nov 1<sup>st</sup> occurred in 1993. Also, there have not been significant changes in the fishing behavior for sea herring or species depending upon it (ex. lobster).

**Table 4:** Fixed gear catches (stop seine, weir, pound net) in metric tons from Maine 2004 to 2013. Note: data cannot be parsed by month given confidentiality issues. 2013 catch data is preliminary.

Year	Jan-Oct	Nov & Dec	Total
2004	49.0	0	49.0
2005	52.8	0	52.8
2006	528.4	0	528.4
2007	391.8	0	391.8
2008	24.3	0	24.3
2009	81.1	0	81.1
2010	823.4	0	823.4
2011	23.7	0	23.7
2012	0	0	0
2013*	0	0	0
Average	197.4	0.0	197.4

The PDT noted, should fixed-gear fishermen exceed the 295 mt set-aside, it has access to the total Area 1A sub-quota. There is no biological basis for or against adjusting the rollover provision of the fixed-gear set aside, but there may be socioeconomic reasons.

Another concern with changing the rollover provision is, if implemented, there will be inconsistent set aside measures for state and federal rules.

**Management Options for Issue 2: Fixed Gear Set-Aside Rollover Provision**

**Issue 2, Option 1: Status Quo:** The fixed gear set-aside will be available to fixed gear fishermen in Area 1A until November 1. If the set-aside has not been utilized by the fixed gear fisheries west of Cutler by November 1, it will then be made available to the remainder of the herring fleet fishing in Area 1A until the directed fishery in 1A closes. *Fixed gear fishermen can continue fishing and landings will count towards the Area 1A sub-quota.* If 92% of the Area 1A TAC has already been reached by November 1 (and the directed herring fishery in 1A is therefore closed), the set-aside will be released as part of the 5% set-aside for incidental catch in 1A (at a 2,000 lb trip limit).

**Issue 2, Option 2: Remove the fixed gear set-aside rollover provision:** The fixed gear set-aside will be available to fixed gear fishermen west of Cutler through December 31. When 92% of the Area 1A TAC has been reached, all directed herring fisheries in Area 1A will close. Unused portions of the fixed gear set-aside will not be rolled from one year to the next.

### Issue 3: Empty Fish Hold Provision

Draft Amendment 3 to the Atlantic herring FMP proposes an option requiring vessel holds to be empty of fish prior to leaving the dock on a fishing trip. This measure is intended to be an incentive to harvest more efficiently to meet market demands, thereby discourage dumping of unsold herring that may result from lower sales than expected. In addition, the option is intended to improve documentation of catch by avoiding double-counting of fish landed from multiple trips, particularly bycatch and incidental catch of river herring. Mixing fish from multiple trips has the potential to compromise landings data used to inform harvest control measures and bycatch avoidance programs, and leaving fish in the vessel's hold could preclude a portside sampler from observing the entirety of a trip.

Currently, there is no management measure for emptying holds of fish prior to departing for a fishing trip in the interstate or federal Atlantic Herring management plans. There is concern that fish from multiple trips can be mixed if the holds are not completely emptied. This has the potential to compromise landings data used to inform harvest control measures and bycatch avoidance programs. Furthermore, leaving fish in the vessel's hold prevents portside samplers from observing the entirety of a trip, which hinders the operation of bycatch monitoring and avoidance programs.

In its Draft Framework Adjustment 4, the New England Fishery Management Council approved a requirement for vessel holds to be empty of fish prior to leaving a dock. The Council adopted Alternative 2.1.2, Alternative 2, Option C: a waiver may be issued for instances when there are fish in the holds after inspection by an appropriate law enforcement officer. This alternative would only apply to Category A and B boats. The intent is for waivers to be issued for refrigeration failure and non-marketable reported fish. Option 2, below, matches the preferred option.

When a vessel departs for a fishing trip, it is considered "declared" into the fishery. Upon tying to the dock, a vessel is considered to have declared out of the fishery and landed. The fish are accounted for by vessel monitoring reports (VMS), vessel trip reports (VTR) and by dealer records. These reports are trip-specific, and the data is used to inform harvest control measures and bycatch avoidance programs.

The PDT recognizes fishermen may have surplus catch that cannot be sold and is a challenge to dispose. The proposed requirement to empty vessel holds of fish may be an incentive to curb wasteful fishing practices and harvest more efficiently to meet market demands. In addition, this provision would eliminate the practice of keeping fish in a hold from one fishing trip and mixing with catch from another trip, which would result in inaccurate VMS, VTR, and dealer reports, as well as missing data for bycatch observations. The PDT noted there needs to be consideration for enforcement, unforeseen events that make it impossible to sell fish, and vessels that land at multiple ports.

### **Management Options for Issue 3: Empty Fish Hold Provision**

**Issue 3, Option 1: Status Quo:** No empty fish hold provision. There is no requirement to empty vessel holds of fish prior to a fishing trip departure.

**Issue 3, Option 2: Empty Fish Hold Provision:** This option would require that fish holds on Category A/B Atlantic herring vessels are empty of fish before leaving the dock on any trip when declared into the Atlantic herring fishery. A waiver may be issued for instances when there are fish in the hold after inspection by an appropriate law enforcement officer (the intent is for waivers to be issued for refrigeration failure and non-marketable fish that have been reported by the vessel). Only vessels departing on a fishing trip (i.e. declared into the fishery) are required to have holds empty of fish. As such, waivers would not be required for vessels transporting fish from dock to dock.

A government official must verify the amount of fish in a hold, reason(s) for unmarketable fish, and vessels transporting fish to multiple ports.

### **4.3 For-Hire Fisheries Management Measures**

At this time, Draft Amendment 3 does not propose management measures for the for-hire fishery.

### **4.5 Habitat Conservation and Restoration**

#### **4.5.1 Preservation of Existing Habitat**

Protection of habitat essential for herring spawning is vital to ensure the continued recovery and health of this species. States should identify any locations where herring consistently return to spawn in order to provide some protective measures to egg beds when and if necessary. Monitoring of these locations may also provide an indication of relative spawning component size.

#### **4.5.2 Habitat Restoration, Improvement, and Enhancement**

1. State marine fisheries agencies should identify state permitting and planning agencies, which regulate those activities likely to adversely affect Essential Fish Habitat (EFH) and habitats, either by destruction of habitat or degradation of quality. The marine fisheries agency should work with the relevant permitting or planning agency in each state to develop permit conditions and planning considerations to avoid or mitigate adverse impacts on EFH. Standard permit conditions and model policies that contain mitigation techniques should be developed. The development of Memoranda of Understanding (MOU's) with other state agencies are recommended for joint review of projects and planning activities to ensure that habitat protections are adequately incorporated.

For example, dredging windows should be established to avoid impacts to Atlantic herring egg EFH and spawning activity. Dredging windows should be coordinated to ensure practical opportunities for permitted dredging to take place.

2. When it is expected that impacts will occur from an anthropogenic activity, but probably not above some *de minimis* level, prohibition of the activity may not be warranted, but the marine fisheries agency should request that the appropriate agency consider requiring application of Best Management Practices for the activity.
3. State marine fisheries agencies should coordinate with state water quality agencies and state coastal zone management agencies to ensure that Clean Water Act Section 319 non-point source control plans and Coastal Zone Act Reauthorization Amendment Section 6217 coastal non-point source control plans are developed and implemented so as to minimize adverse impacts of non-point source pollution on herring and herring EFH. In particular, marine fisheries agencies should consider whether areas such as EFH for eggs merit designation as critical coastal areas under state 6217 programs (non-point source pollution control under the Coastal Zone Management Act amendments of 1990) due to water quality impacts to fish habitat, and should provide input to the 6217 lead agencies (identified in the Source Document).
4. State marine fisheries agencies should coordinate with appropriate state agencies to strengthen compliance with National Pollutant Discharge Elimination System (NPDES) or State Pollutant Discharge Elimination System (SPDES) permits.
5. State marine fisheries agencies should work with state coastal zone management agencies to determine whether: 1) additional state policies for habitat protection should be adopted under the state coastal management program; 2) additional federal activities should be added to the state coastal management programs list of activities subject to state consistency review; and 3) the state is fully utilizing the Coastal Zone Management Act federal consistency process for protection of fish habitats.
6. When states have identified habitat restoration as a need, state marine fisheries agencies should coordinate with other agencies to ensure that habitat restoration plans are developed, and funding is actively sought for plan implementation and monitoring.
7. State marine fisheries agencies should coordinate with and provide input to the state water quality agency in development and updating of the Clean Water Act section 303(d) list (priority list of water not meeting state water quality standards). In addition, state marine fisheries agencies should review the adequacy of water quality standards to protect herring and should participate in the triennial review of the state water quality standards.
8. State marine fisheries agencies should review oil spill prevention and response plans for preventing accidental release and recommending prioritized response in EFH.
9. State marine fisheries agencies should work closely with the appropriate Coast Guard District Office in the development, amendment, and implementation of area wide oil spill contingency plans.

10. State marine fisheries agencies should work closely with water quality agencies in the development or revision of river basin plans to identify degraded or threatened resources and recommend preventative, remedial or mitigation measures.
11. State marine fisheries agencies should work with the appropriate agencies to develop contaminated sediment remediation plans or active sediment pollution prevention programs for areas with or susceptible to sediment contamination.
12. State marine fisheries agencies should coordinate with appropriate National Estuary Program (NEP) committees to ensure that NEP Comprehensive Coastal Management Plans (CCMPs) identify and implement habitat protection and restoration needs.

State marine fisheries agencies should assist industrial siting councils in siting new power plants so that impingement and entrainment of Atlantic herring are minimized.

State marine fisheries agencies should work with the appropriate agencies to establish and enforce "no discharge" zones, and promote education of recreational boaters to reduce contamination of nearshore waters from chronic fuel spills and waste disposal.

#### **4.5.3 Avoidance of Incompatible Activities**

Federal and state fishery management agencies should take steps to limit the introduction of compounds that are known or suspected to accumulate in Atlantic herring tissue and which pose a threat to human health or Atlantic herring health. Each state should establish windows of compatibility for activities known or suspected to adversely affect herring life stages and their habitats (such as navigational dredging, bridge construction, and dredged material disposal) and notify the appropriate construction or regulatory agencies in writing. Projects involving water withdrawal from spawning or nursery habitats (e.g. power plants, irrigation, water supply projects) should be scrutinized to ensure that adverse impacts resulting from larval/ juvenile impingement, entrainment, and/or modification of flow, temperature and salinity regimes due to water removal will not adversely impact Atlantic sturgeon spawning stocks, including early life stages. Each state which contains spawning and nursery areas within its jurisdiction should develop water use and flow regime guidelines which are protective of Atlantic sturgeon spawning and nursery areas and which will ensure to the extent possible the long-term health and sustainability of the stock. States should endeavor to ensure that proposed water diversions/withdrawals from rivers tributary to spawning and nursery habitats will not reduce or eliminate conditions favorable to Atlantic herring use of these habitats.

#### **4.5.4 Fisheries Practices**

The use of any fishing gear or practice which is documented by management agencies to have an unacceptable impact on Atlantic herring (e.g. habitat damage or bycatch mortality) should be prohibited within the effected essential habitats (e.g. trawling in spawning areas or primary nursery areas should be prohibited).

## **4.6 ALTERNATIVE STATE MANAGEMENT REGIMES**

Once approved by the Atlantic Herring Management Board, states are required to obtain prior approval from the Board of any changes to their management program for which a compliance requirement is in effect. Other non-compliance measures must be reported to the Board but may be implemented without prior approval from the Section. A state can request permission to implement an alternative to any mandatory compliance measure only if that state can show to the Section's satisfaction that its alternative proposal will have the same conservation value as the measure contained in this amendment or any addenda prepared under Adaptive Management (*Section 4.6*). States submitting alternative proposals must demonstrate that the proposed action will not contribute to overfishing of the resource. All changes in state plans must be submitted in writing to the Section and to the Commission either as part of the annual FMP Review process or the Annual Compliance Reports.

### **4.6.1 General Procedures**

A state may submit a proposal for a change to its regulatory program or any mandatory compliance measure under this amendment to the Commission, including a proposal for *de minimis* status. Such changes shall be submitted to the Chair of the Plan Review Team, who shall distribute the proposal to the Management Board, the Plan Review Team, the Technical Committee, the Stock Assessment Committee and the Advisory Panel.

The Plan Review Team is responsible for gathering the comments of the Technical Committee, the Stock Assessment Committee and the Advisory Panel, and presenting these comments as soon as possible to the Board for decision.

The Atlantic Herring Section will decide to approve the state proposal for an alternative management program if it is consistent with the applicable target fishing mortality rate and the goals and objectives of this amendment.

### **4.6.2 Management Program Equivalency**

The Atlantic Herring Technical Committee, under the direction of the Plan Review Team, will review any alternative state proposals under this section and provide to the Atlantic Herring Management Board its evaluation of the adequacy of such proposals.

### **4.6.3 *De minimis* Fishery Guidelines**

The ASMFC Interstate Fisheries Management Program Charter defines *de minimis* as “a situation in which, under the existing condition of the stock and scope of the fishery, conservation and enforcement actions taken by an individual state would be expected to contribute insignificantly to a coastwide conservation program required by a Fishery Management Plan or amendment” (ASMFC, 2000).

**States may apply for *de minimis* status if, for the last *three* years, the combined average commercial landings (by weight) constitute less than one percent (1%) of the coastwide commercial landings for the same *three*-year period.** States may petition the Atlantic Herring Section at any time for *de minimis* status, if their fishery falls below the threshold level. Once *de minimis* status is granted, designated states must submit annual reports to the Board justifying the continuance of *de minimis* status. States are encouraged to include *de minimis* requests as part of their annual compliance reports.

## **4.7 ADAPTIVE MANAGEMENT**

The Atlantic Herring Section may vary the requirements specified in this amendment as a part of adaptive management in order to conserve the Atlantic herring resource. Specifically, the Board may change target fishing mortality rates and harvest specifications, other measures designed to prevent overfishing of the stock complex or any spawning component. Such changes will be instituted to be effective on the first fishing day of the following year, but may be put in place at an alternative time when deemed necessary by the Section. These changes should be discussed with the appropriate federal representatives and Councils prior to implementation in order to be complementary to the regulations for the EEZ.

### **4.7.1 General Procedures**

The Plan Review Team will monitor the status of the fishery and the resource and report on that status to the Atlantic Herring Management Board annually, or when directed to do so by the Board. The Plan Review Team will consult with the Technical Committee, the Stock Assessment Committee and the Advisory Panel, if any, in making such review and report. The report will contain recommendations concerning proposed adaptive management revisions to the management program.

The Atlantic Herring Management Board will review the report of the Plan Review Team and may consult further with Technical Committee, the Stock Assessment Committee or the Advisory Panel. The Board may direct the PRT to prepare an addendum to make any changes it deems necessary. The addendum shall contain a schedule for the states to implement its provisions.

The Plan Review Team will prepare a draft addendum as directed by the Board and shall distribute it to all states for review and comment. A public hearing will be held in any state that requests one. The Plan Review Team will also request comment from federal agencies and the public at large. After a 30-day review period, the Plan Review Team will summarize the comments and prepare a final version of the addendum for the Management Board.

The Management Board shall review the final version of the addendum prepared by the Plan Review Team and shall also consider the public comments received and the recommendations of the Technical Committee, the Stock Assessment Committee and the Advisory Panel. The Board shall then decide whether to adopt, or revise and then adopt, the addendum.



Upon adoption of an addendum implementing adaptive management by the Board, states shall prepare plans to carry out the addendum, and submit them to the Section for approval according to the schedule contained in the addendum.

#### **4.7.2 Measures Subject to Change**

The following measures are subject to change under adaptive management upon approval by the Atlantic Herring Section:

- (1) MSY or MSY proxy;
- (2) Management area boundaries or additional management areas;
- (3) Size, timing, or location of a new or existing spawning area closure;
- (4) Closed area other than a spawning closure;
- (5) Restrictions in the amount of fishing time;
- (6) Days at sea system, including options transferability or leasing of DAS;
- (7) Adjustments to OY, TACs, DAP, DAH, JVP, IWP, or the Reserve;
- (8) Adjustments to the amount of Canadian catch deducted when determining specifications;
- (9) Distribution of the TAC to an area or time period;
- (10) Gear restrictions (such as *gear type*, mesh size, etc.) or requirements (such as bycatch reduction devices, etc.);
- (11) Measures to address bycatch and bycatch monitoring (such as seasonal, and temporal closures, bycatch caps, gear restriction, and closed fishing seasons);
- (12) Vessel size/horsepower restrictions; vessel size limits/upgrade restrictions
- (13) Closed seasons;
- (14) Minimum fish size;
- (15) Trip limits;
- (16) Seasonal or area quotas; seasonal allocation of area TACs
- (17) In-season adjustments;
- (18) Changes to the overfishing definition;
- (19) Vessel tracking system;
- (20) Restrictions for prohibitions on mealing or a roe fishery;
- (21) Quota monitoring tools, such as vessel operator or dealer reporting requirements;
- (22) Permit upgrading or splitting limitations, and vessel upgrading restrictions;
- (23) Measures to reduce gear conflicts, such as;
  - a) Mandatory monitoring of a radio channel by fishing vessels;
  - b) Gear location reporting by fixed gear fishermen and mandatory plotting by mobile gear fishermen;
  - c) Standards of operation when gear conflicts occur;
  - d) Fixed gear marking or setting practices;
  - e) Gear restrictions for certain areas and/or at certain times of the year;
  - f) Vessel monitoring systems;
  - g) Restrictions on the maximum number of fishing vessels;
  - h) Special permitting conditions;
- (24) Measures to address information from multispecies stock assessments;
- (25) Management of the roe fishery

- (26) Herring Processor Survey
- (27) Sector allocation/effort control
- (28) Any other management measures currently included in Amendment 2.

This list will be modified to include the same measures listed as the frameworkable measures listed in the NEFMC's Amendment 1 to the federal FMP for Atlantic Herring.

#### **4.8 EMERGENCY PROCEDURES**

Emergency procedures may be used by the Atlantic Herring Section to require any emergency action that is not covered by or is an exception or change to any provision in Amendment 2. Procedures for implementation are addressed in the ASMFC Interstate Fisheries Management Program Charter, Section Six (c)(10) (ASMFC, 2000).

#### **4.9 MANAGEMENT INSTITUTIONS**

The management institutions for Atlantic herring shall be subject to the provisions of the ISFMP Charter (ASMFC, 2000). The following is not intended to replace any or all of the provisions of the ISFMP Charter. All committee roles and responsibilities are included in detail in the ISFMP Charter and are only summarized here.

##### **4.9.1 ASMFC and the ISFMP Policy Board**

The ASMFC (Commission) and the ISFMP Policy Board are generally responsible for the oversight and management of the Commission's fisheries management activities. The Commission must approve all fishery management plans, and amendments, including this Amendment 2, and must also make all final determinations concerning state compliance or noncompliance. The ISFMP Policy Board reviews any non-compliance recommendations of the various Management Boards and Sections and, if it concurs, forwards them on to the Commission for action.

##### **4.9.2 Atlantic Herring Section**

The Atlantic Herring Section is established by Amendment 1 to the Compact creating the Commission (Public Law 539, as amended) and is generally responsible for carrying out all activities under this Amendment. It establishes and oversees the activities of the Plan Development or Plan Review Team, the Technical Committee and the Stock Assessment Subcommittee and requests the establishment of the Commission's Atlantic Herring Advisory Panel. Among other things, the Board makes changes to the management program under adaptive management and approves state programs implementing the amendment and alternative state programs under *Sections 4.6* and *4.7*. The Section reviews the status of state compliance with the FMP or amendment at least annually. If it determines that a state is out of compliance, the Board reports its determination to the ISFMP Policy Board under the terms of the ISFMP Charter.

#### **4.9.3 Atlantic Herring Plan Development / Plan Review Team**

The Atlantic Herring Plan Development Team (PDT) and the Atlantic Herring Plan Review Team (PRT) will be composed of a small group of scientists and/or managers whose responsibility is to provide all of the technical support necessary to carry out and document the decisions of the Atlantic Herring Management Board. The ASMFC FMP Coordinator chairs both. The Atlantic Herring PDT/PRT is directly responsible to the Board for providing information and documentation concerning the implementation, review, monitoring and enforcement of Amendment 2. The Atlantic Herring PDT/PRT shall be comprised of personnel from state and federal agencies who have scientific and management ability and knowledge of Atlantic herring. The PDT will be responsible for preparing all documentation necessary for the development of Amendment 2, using the best scientific information available and the most current stock assessment information. The PDT will either disband or assume inactive status upon completion of Amendment 2. Alternatively, the Board may elect to retain PDT members as members of the PRT or appoint new members. The PRT will provide annual advice concerning the implementation, review, monitoring, and enforcement of Amendment 2 once the Commission has adopted it.

#### **4.9.4 Atlantic Herring Technical Committee**

The Atlantic Herring Technical Committee will consist of representatives from state or federal agencies, Regional Fishery Management Councils, Commission, university or other specialized personnel with scientific and technical expertise and knowledge of the Atlantic herring fishery. The Board will appoint the members of the Technical Committee and may authorize additional seats as it sees fit. Its role is to act as a liaison to the individual state and federal agencies, provide information to the management process, and review and develop options concerning the management program. The Technical Committee will provide scientific and technical advice to the Management Board, PDT and PRT in the development and monitoring of a fishery management plan or amendment.

#### **4.9.5 Atlantic Herring Stock Assessment Subcommittee**

The Atlantic Herring Stock Assessment Subcommittee shall be appointed by the Technical Committee at the request of the Section and will consist of scientists with expertise in the assessment of the Atlantic herring population. Its role is to assess the Atlantic herring population and provide scientific advice concerning the implications of proposed or potential management alternatives, or to respond to other scientific questions from the Board, Technical Committee, PDT or PRT. The Stock Assessment Subcommittee will report to the Technical Committee.

#### **4.9.6 Atlantic Herring Advisory Panel**

The Atlantic Herring Advisory Panel was established according to the Commission's Advisory Committee Charter. Members of the Advisory Panel are citizens who represent a cross-section of commercial fishing interests and others who are concerned about Atlantic herring conservation and management. The Advisory Panel provides the Board with advice directly concerning the Commission's Atlantic herring management program.

#### **4.9.7 Federal Agencies**

##### ***4.9.7.1 Management in the Exclusive Economic Zone (EEZ)***

Management of Atlantic herring in the EEZ is currently under the jurisdiction of the New England Fishery Management Council under the Magnuson-Stevens Act (16 U.S.C. 1801 et seq.). In the absence of a Council Fishery Management Plan, management is the responsibility of the NMFS as mandated by the Atlantic Coastal Fishery Conservation and Management Act (16 U.S.C. 5105 et seq.) and the Magnuson-Stevens Act (16 U.S.C. 1801 et seq.). The NEFMC is currently developing an amendment to the federal FMP for Atlantic herring, scheduled for implementation by the 2006 fishing year.

##### ***4.9.7.2 Federal Agency Participation in the Management Process***

The Commission has accorded the United States Fish and Wildlife Service (USFWS) and the NMFS voting status on the ISFMP Policy Board in accordance with the Commission's ISFMP Charter. Due to the makeup of Sections under the ISFMP Charter, no federal agencies are accorded voting status on the Atlantic Herring Management Board; however, the NMFS participates on the Atlantic Herring Plan Development Team, Plan Review Team, Technical Committee and Stock Assessment Subcommittee.

##### ***4.9.7.3 Consultation with Fishery Management Councils***

In carrying out the provisions of Amendment 2, the states, as members of the Atlantic Herring Section, shall closely coordinate with the New England Fishery Management Council in order to cooperatively manage the Atlantic herring population. In accordance with the Commission's ISFMP Charter, a representative of the New England Fishery Management Council may be invited to participate as a full member of the Atlantic Herring Section.

#### **4.10 RECOMMENDATIONS TO THE SECRETARIES FOR COMPLEMENTARY ACTION IN FEDERAL WATERS**

The Atlantic States Marine Fisheries Commission believes that the measures contained in Amendment 2 are necessary to prevent overfishing of the Atlantic herring resource and to allow growth in the fishery. The Atlantic States Marine Fisheries Commission recommends that the federal government promulgate all necessary regulations to implement complementary measures in federal waters that are contained in *Section 4.0*. In addition, Amendment 2 calls for the Atlantic Herring Section to make additional changes to Amendment 2 via adaptive management. As such changes are made, the Management Board will recommend additional measures to the Secretary. The Commission recognizes that such action may be taken under the Atlantic Coastal Fisheries Cooperative Management Act or the Magnuson-Stevens Fishery Conservation and Management Act. In addition, the Commission urges adoption and implementation of NEFMC's Amendment 1 to the Fishery Management Plan for Atlantic herring when complete.

## **4.11 COOPERATION WITH OTHER MANAGEMENT INSTITUTIONS**

The Atlantic Herring Plan Review Team, Technical Committee and Management Board shall regularly communicate with fishery managers in Canadian agencies to help ensure the sustainability of the Atlantic herring resource. Canadian fishery managers and their officials shall be invited to ASMFC discussions on Atlantic herring conservation as needed, especially when discussing transshipment issues and cross-border trade.

## **5.0 COMPLIANCE**

Full implementation of the provisions of this amendment is necessary for the management program to be equitable, efficient and effective. States are expected to implement these measures faithfully under state laws. The Atlantic States Marine Fisheries Commission will continually monitor the effectiveness of state implementation and determine whether states are in compliance with the provisions of this fishery management plan. This section sets forth the specific elements states must implement in order to be in compliance with this fishery management plan, and the procedures that will govern the evaluation of compliance. Additional details of the procedures are found in the ASMFC Interstate Fisheries Management Program Charter (ASMFC, 2000).

### **5.1 MANDATORY COMPLIANCE ELEMENTS FOR STATES**

A state will be determined to be out of compliance with the provisions of this fishery management plan, according to the terms of Section Seven of the ISFMP Charter if:

- § its regulatory and management programs to implement *Section 4* have not been approved by the Atlantic Herring Section; or
- § it fails to meet any schedule required by *Section 5.1.2*, or any addendum prepared under adaptive management (*Section 4.7*); or
- § it has failed to implement a change to its program when determined necessary by the Atlantic Herring Section; or
- § it makes a change to its regulations required under *Section 4* or any addendum prepared under adaptive management (*Section 4.7*) without prior approval of the Atlantic Herring Section.

#### **5.1.1 Mandatory Elements of State Programs**

To be considered in compliance with this fishery management plan, all state programs must include harvest controls/a regime of restrictions for Atlantic herring fisheries consistent with the requirements of *Sections 4.1, 4.2 and 4.3*; except that a state may propose an alternative management program under *Section 4.6*, which, if approved by the Section, may be implemented as an alternative regulatory requirement for compliance.

In addition, the Atlantic Herring Section will monitor bycatch of Atlantic herring in other fisheries and report excessive bycatch problems to the management authority for the fishery causing the bycatch.

### ***5.1.1.1 Regulatory Requirements***

States may begin to implement Amendment 2 after final approval by the Commission. Each state must submit its required Atlantic herring regulatory program to the Commission through the ASMFC staff for approval by the Atlantic Herring Section. During the period from submission, until the Management Board makes a decision on a state's program, a state may not adopt a less protective management program than contained in this management plan or contained in current state law. The following lists the specific compliance criteria that a state/jurisdiction must implement in order to be in compliance with Amendment 2:

1. Each jurisdiction must enact spawning area restrictions that are at least as restrictive or more than those in (*Section 4.3*);
2. Each jurisdiction shall prohibit the landing of herring from a management area or sub-area when the TAC has been attained in that area or sub-area (*Section 4.3*);
3. Each jurisdiction shall prohibit directed fishing for herring in state waters when the TAC has been attained in that area or sub-area (*Section 4.3*);
4. Each jurisdiction shall prohibit the landing of herring to an Internal Waters Processing (IWP) operation that were harvested from an area or sub-area closed to directed herring fishing (*Section 4.3*);
5. Each jurisdiction shall require that (daily) herring landings from fixed gear fisheries be reported on a weekly basis in order to monitor progress toward attaining the TAC (*Section 4.3*); and
6. Each jurisdiction shall annually provide a report on any mealing activity of herring occurring in their state, specifically, the amount in weight of herring processed into meal or like product, biological sampling results and location of catch by NMFS statistical area or Management Area.

Once approved by the Atlantic Herring Management Board, states are required to obtain prior approval from the Board of any changes to their management program for which a compliance requirement is in effect. Other measures must be reported to the Board but may be implemented without prior Board approval. A state can request permission to implement an alternative to any mandatory compliance measure only if that state can show to the Board's satisfaction that its alternative proposal will have the same conservation value as the measure contained in this amendment or any addenda prepared under Adaptive Management (*Section 4.7*). States submitting alternative proposals must demonstrate that the proposed action will not contribute to overfishing of the resource. All changes in state plans must be submitted in writing to the Board and to the Commission either as part of the annual FMP Review process or the Annual Compliance Reports.

### ***5.1.1.2 Monitoring Requirements***

The PDT and Technical Committee will work to develop appropriate protocols for designing fishery-independent surveys for Atlantic herring. Such surveys may be implemented under *Section 4.7* (Adaptive Management) through the Commission's addendum process including the opportunity for public comment.

### ***5.1.1.3 Research Requirements***

The PDT and Technical Committee will prioritize the research needs for Atlantic herring. Appropriate programs for meeting these needs may be implemented under *Section 4.7* (Adaptive Management) through the Commission's addendum process including the opportunity for public comment.

### ***5.1.1.4 Law Enforcement Requirements***

All state programs must include law enforcement capabilities adequate for successfully implementing that state's Atlantic herring regulations. The adequacy of a state's enforcement activity will be monitored annually by reports of the ASMFC Law Enforcement Committee to the Atlantic Herring Plan Review Team. The first reporting period will cover the period from January 1 – December 31.

### ***5.1.1.5 Habitat Requirements***

There are no mandatory habitat requirements for Atlantic herring. See *Section 4.4* for Habitat Recommendations.

### **5.1.2 Compliance Schedule**

Reports on compliance must be submitted to the Commission by each jurisdiction annually, no later than *February 1*.

Each state must submit an annual report concerning its Atlantic herring fisheries and management program for the previous calendar year. A standard compliance report format has been prepared and adopted by the ISFMP Policy Board. States should follow this format in completing the annual compliance report.

## **5.2 PROCEDURES FOR DETERMINING COMPLIANCE**

Detailed procedures regarding compliance determinations are contained in the ISFMP Charter, Section Seven (ASMFC, 2000). The following summary is not meant in any way to replace the language found in the ISFMP Charter.

In brief, all states are responsible for the full and effective implementation and enforcement of fishery management plans in areas subject to their jurisdiction. Written compliance reports as specified in the Plan or Amendment must be submitted annually by each state with a declared interest. Compliance with Amendment 2 will be reviewed at least annually. The Atlantic Herring Management Board, ISFMP Policy Board or the Commission, may request the Atlantic Herring Plan Review Team to conduct a review of plan implementation and compliance at any time.

The Atlantic Herring Section will review the written findings of the PRT within 60 days of receipt of a State's compliance report. Should the Section recommend to the Policy Board that a state be determined out of compliance, a rationale for the recommended non-compliance finding will be included addressing specifically the required measures of Amendment 2 that the state has not implemented or enforced, a statement of how failure to implement or enforce the required measures jeopardizes Atlantic herring conservation, and the actions a state must take in order to comply with Amendment 2 requirements.

The ISFMP Policy Board shall, within thirty days of receiving a recommendation of non-compliance from the Atlantic Herring Section, review that recommendation of non-compliance. If it concurs in the recommendation, it shall recommend at that time to the Commission that a state be found out of compliance.

The Commission shall consider any Amendment 2 non-compliance recommendation from the Policy Board within 30 days. Any state, which is the subject of a recommendation for a non-compliance finding is given an opportunity to present written and/or oral testimony concerning whether it should be found out of compliance. If the Commission agrees with the recommendation of the Policy Board, it may determine that a state is not in compliance with Amendment 2 and specify the actions the state must take to come into compliance.

Any state that has been determined to be out of compliance may request that the Commission rescind its non-compliance findings, provided the state has revised its Atlantic herring conservation measures or shown to the Board and/or Commission's satisfaction that actions taken by the state provide for conservation equivalency.

### **5.3 ANALYSIS OF ENFORCEABILITY OF PROPOSED MEASURES**

The ASMFC Law Enforcement Committee will, during the implementation of this amendment, analyze the enforceability of new conservation and management measures as they are proposed.

## **6.0 MANAGEMENT AND RESEARCH NEEDS**

During the development of this amendment, the Council, in conjunction with ASMFC as well as the Herring PDT and Advisory Panel, identified the following data and research needs. Addressing current data deficiencies will improve the long-term management of the Atlantic herring fishery.

### **6.1 STOCK ASSESSMENT AND POPULATION DYNAMICS**

- Continue commercial catch sampling of Atlantic herring fishery (risk of losing funding after the 2004-2005 season) according to ACCSP protocols
- Continue to utilize the inshore and offshore hydroacoustic and trawl surveys to provide an independent means of estimating stock sizes. Collaborative work between NMFS,



DFO, State agencies and the herring industry on acoustic surveys for herring should continue to be encouraged.

- Develop tagging and morphometric studies to explore uncertainties in stock structure and the impacts of harvest mortality on different components of the stock. Although tagging studies may be problematic for assessing survivorship for a species like herring, they may be helpful in identifying the stock components and the proportion of these components taken in the fishery on a seasonal basis.
- Examine the root causes of the discrepancy between Forward Projection and ADAPT assessments.
- Pursue the development of a dedicated pelagic survey technique utilizing hydroacoustic and trawling methods to provide another direct and independent means of estimating stock sizes. Collaborative work between NMFS, DFO, State agencies and the herring industry on acoustic surveys for herring should be encouraged.
- Potential changes in catchability within spring bottom trawl survey indices should be investigated.
- Organize annual U.S.-Canada workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

### **6.1.1 Biology/Community Ecology**

- Reinvestigate the estimation of age-3 herring, the natural mortality rate assumed for all ages, the use of catch-per-unit-effort tuning indices and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring.
- Evaluate the concept of a minimum biologically-acceptable level biomass (MBAL) for the herring coastal stock complex. Determine the adequacy of present methods and data to determine MBAL if appropriate.
- Possible effects of density-dependence (e.g. reduced growth rates at high population size) on parameter estimates used in assessments should be examined.
- Synthesize predator/prey information and conduct investigations to address information gaps; investigate the role of herring in the Northwest Atlantic ecosystem and the importance of herring as a forage species for other commercial fish stocks; assess the importance of herring as forage relative to other forage species in the region.

## **6.2 RESEARCH AND DATA NEEDS**

### **6.2.1 Biological**

- Identify known herring spawning areas. Establish critical spawning habitat areas or special management zones to protect spawning aggregations of herring and/or demersal egg masses.
- Investigate bycatch and discards in the directed herring fishery.
- Develop a long-term strategy for assessing individual spawning stocks as a basis for more effective management of any heavily exploited portion(s) of the stock complex. Evaluate the merit of acoustic surveys and other techniques to achieve sub-stock complex monitoring.

- Develop new approaches to estimating recruitment (i.e. juvenile abundance) from fishery-independent data.
- Consider using NEFSC fall survey mean weights at age as the spawning stock mean weight at age in the estimation of biological reference points. Evaluate alternative catch weights at age.
- Investigate alternative methods of estimating mean weight at age used to determine the age composition of U.S. and Canadian landings from the coastal stock complex.
- Conduct a retrospective analysis of herring larval and assessment data to determine the role larval data plays in anticipating stock collapse and as a tuning index in the age-structured assessment.
- Continue resource monitoring activities, especially larval surveys to indicate the relative importance of individual spawning areas and stocks and the degree of spawning stock recovery on Georges Bank and Nantucket Shoals.
- Evaluate the concept of a fixed spawning stock size or spawning target for the herring coastal stock complex. Determine the adequacy of present methods and data to set a target if more appropriate.
- Investigate the effects of averaging maturity rates over blocks of years to help smooth some of the inter-annual variability in the calculation of spawning stock biomass.
- Consider potential discards if fishing mortality increases in the future.
- Investigate the validity extremely high recruitment in recent years.
- Investigate bycatch/discards in the directed herring fishery through both at-sea and portside sampling.
- Develop and test gear modifications to minimize interactions with non-target species in the herring fishery.

### **6.2.2 Social and Economic**

- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry.
- Develop socio-economic analyses appropriate to the determination of optimum yield.
- Organize annual US-Canada workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

## **7.0 PROTECTED SPECIES**

In the fall of 1995, Commission member states, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) began discussing ways to improve implementation and enforcement of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) in state waters. In November 1995, the Commission, through its Interstate Fisheries Management Program (ISFMP) Policy Board, approved an amendment of its ISFMP Charter (section 6(b)(2)) so that protected species and their interactions with ASMFC managed fisheries are addressed in the Commission's fisheries management planning process. Specifically, the Commission's fishery management plans (FMP) will describe impacts of state fisheries on certain marine mammals and endangered species (collectively termed “protected

species”), and recommend ways to minimize these impacts. The following section outlines: (1) the federal legislation that guides protection of marine mammals and sea turtles, (2) the protected species with potential fishery interactions; (3) the specific type(s) of fishery interaction; (4) population status of the affected protected species; and (5) potential impacts to Atlantic coastal state and interstate fisheries.

## **7.1 MARINE MAMMAL PROTECTION ACT (MMPA) REQUIREMENTS**

The 1994 amendments to the MMPA established both short- and long-term goals for reducing mortality and serious injury, or bycatch, of marine mammals incidental to commercial fisheries. The amendments also established take reduction plans (TRPs) and stakeholder-based take reduction teams (TRTs) as the mechanisms for achieving these goals. The MMPA requires NMFS to convene TRTs to develop TRPs for each strategic stock that interacts with a Category I or II fishery, fisheries with “frequent” or “occasional” marine mammal bycatch, respectively. (Fisheries that have a remote likelihood of or no known bycatch of marine mammals are classified in Category III.) A strategic stock is defined as a stock: (1) for which the level of direct human-caused mortality exceeds the potential biological removal (PBR)<sup>1</sup> level; (2) which is declining and is likely to be listed under the ESA in the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or as a depleted species under the MMPA. In the short-term (within six months of implementation), TRPs must reduce marine mammal bycatch to levels below a marine mammals stock’s potential biological removal level. In the long-term (within five years of implementation), TRPs must reduce marine mammal bycatch to insignificant levels approaching a zero mortality and serious injury rate taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans.

The 1994 amendments also required fishermen in Category I and II fisheries to register under the Marine Mammal Authorization Program (MMAP), the purpose of which is to provide an exception for commercial fishermen from the general taking prohibitions of the MMPA; to take on board an observer if requested to do so by the Secretary of Commerce; and to comply with any applicable TRP or emergency regulations. All commercial fishermen, regardless of the category of the fishery in which they participate, must report all marine mammal bycatch.

Section 101(a)(5)(E) of the MMPA requires the authorization of the incidental taking of individuals from marine mammal stocks listed as threatened or endangered under the ESA in the course of commercial fishing operations if it is determined that (1) incidental mortality and serious injury will have a negligible impact on the affected species or stock; (2) a recovery plan has been developed or is being developed for such species or stock under the ESA; and (3) where required under section 118 of the MMPA, a monitoring program has been established, vessels engaged in such fisheries are registered in accordance with section 118 of the MMPA, and a take reduction plan has been developed or is being developed for such species or stock.

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<sup>1</sup> PBR is the number of human-caused deaths per year each stock can withstand and still reach an optimum population level. This is calculated by multiplying “the minimum population estimate” by “½ stock’s net productivity rate” by “a recovery factor ranging from 0.1 for endangered species to 1.0 for healthy stocks.”

Permits are not required for Category III fisheries; however, any serious injury or mortality of a marine mammal must be reported.

## 7.2 ENDANGERED SPECIES ACT REQUIREMENTS

The taking of endangered sea turtles and marine mammals is prohibited under section 9 of the ESA. NMFS may issue section 4(d) protective regulations necessary and advisable to provide for the conservation of threatened species. There are several mechanisms established in the ESA to avoid the takings prohibition in section 9. First, a 4(d) regulation may include less stringent requirements intended to reduce incidental take and thus allow for the exemption from the taking prohibition. Section 10(a)(1)(B) of the ESA authorizes NMFS to permit, under prescribed terms and conditions, any taking otherwise prohibited by section 9 of the ESA, if the taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Finally, section 7(a) requires NMFS to consult with each federal agency to ensure that any action that is authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species. Section 7(b) authorizes incidental take of listed species after full consultation and identification of reasonable and prudent alternatives or measure to monitor and minimize such take.

## 7.3 PROTECTED SPECIES WITH POTENTIAL FISHERY INTERACTIONS

There are numerous species that inhabit the range of the Atlantic herring management unit covered under this FMP that are protected under the MMPA and ESA. Twelve species are classified as endangered or threatened under the ESA, while the remainder are protected by the provisions of the MMPA.

### Cetaceans

Northern right whale ( <i>Eubalaena glacialis</i> )	Endangered
Humpback whale ( <i>Megaptera novaeangliae</i> )	Endangered
Fin whale ( <i>Balaenoptera physalus</i> )	Endangered
Blue whale ( <i>Balaenoptera musculus</i> )	Endangered
Sei whale ( <i>Balaenoptera borealis</i> )	Endangered
Sperm whale ( <i>Physeter macrocephalus</i> )	Endangered
Minke whale ( <i>Balaenoptera acutorostrata</i> )	Protected
Harbor porpoise ( <i>Phocoena phocoena</i> )	Protected
Risso's dolphin ( <i>Grampus griseus</i> )	Protected
Pilot whale ( <i>Globicephala</i> spp.)	Protected
White-sided dolphin ( <i>Lagenorhynchus acutus</i> )	Protected
Common dolphin ( <i>Delphinus delphis</i> )	Protected
Spotted and striped dolphins ( <i>Stenella</i> spp.)	Protected
Bottlenose dolphin ( <i>Tursiops truncatus</i> )	Protected

### Seals

Harbor seal ( <i>Phoca vitulina</i> )	Protected
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Gray seal ( <i>Halichoerus grypus</i> )	Protected
Harp seal ( <i>Phoca groenlandica</i> )	Protected

Sea Turtles

Leatherback turtle ( <i>Dermochelys coriacea</i> )	Endangered
Kemp's ridley turtle ( <i>Lepidochelys kempii</i> )	Endangered
Green turtle ( <i>Chelonia mydas</i> ) <sup>2</sup>	Endangered
Hawksbill turtle ( <i>Eretmochelys imbricata</i> )	Endangered
Loggerhead turtle ( <i>Caretta caretta</i> )	Threatened

Fish

Shortnose sturgeon ( <i>Acipenser brevirostrum</i> )	Endangered
Atlantic salmon ( <i>Salmo salar</i> ) <sup>3</sup>	Endangered

NOAA Fisheries has developed a list of species of concern that include: 1) species for which there are concerns regarding danger of extinction or risk of becoming endangered but for which insufficient information is available to indicate a need to list; 2) species for which an ESA biological status review has determined that listing is not warranted but for which significant concerns or uncertainties remain; 3) species that are undergoing formal status reviews. The objectives of the Species of Concern designation are to:

- Identify species potentially at risk;
- Increase public awareness about those species;
- Identify data deficiencies and uncertainties in species' status and threats;
- Stimulate cooperative research efforts to obtain the information necessary to evaluate species status and threats; and
- Foster voluntary efforts to conserve the species before listing becomes warranted.

Species of concern in New England include:

- Dusky shark (*Carcharhinus obscurus*)
- Sand tiger shark (*Odontaspis Taurus*)
- Barndoor skate (*Raja laevis*)
- Thorny skate (*Raja radiata*)
- Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)
- Atlantic salmon (*Salmo salar*)
- Rainbow smelt (*Osmerus mordax*)
- Cusk (*Brosme brosme*)
- Atlantic wolfish (*Anarhichas lupus*)
- Atlantic halibut (*Higgoglossus hippoglossus*)
- Atlantic white marlin (*Tetrapturus albidus*)

<sup>2</sup> The breeding populations of green turtles in Florida and on the Pacific coast of Mexico are listed as endangered, the remainder of the population is listed as threatened.

<sup>3</sup> The Gulf of Maine distinct population segment (DPS) of Atlantic salmon is endangered, all other Atlantic salmon is considered a species of concern.

## 7.4 PROTECTED SPECIES INTERACTIONS WITH EXISTING FISHERIES

Although all of the protected species listed above may be found in the general geographical area covered by the Herring FMP not all are affected by the fishery. Some species may inhabit areas other than those in which the fishery is prosecuted, prefer a different depth or temperature zone, or may migrate through the area at times when the fishery is not in operation. In addition, certain protected species may not be vulnerable to capture or entanglement with the gear used in the fishery.

Atlantic herring occur in large schools, inhabiting coastal and continental shelf waters from Virginia to Labrador, Canada, and support a commercial fishery. Landings exceeded 150 million pounds throughout the late 1880s and early 1900s, and again in the late 1940s and 1950s. Today, landings are lower, ranging from 80 to 100 million pounds; the majority of which is taken from the Gulf of Maine. Otter trawls, both single and pair, and purse seines are used in the majority of catches in the Atlantic herring fishery.

### 7.4.1 Marine Mammals

Marine mammal interactions have been recorded in the primary fisheries (utilizing otter trawls and purse seines) that target Atlantic herring, including the Northeast mid-water trawl (including pair trawl) fishery and the Gulf of Maine Atlantic herring purse seine fishery. Marine mammal stocks of greatest concern that interact with this fishery are the western North Atlantic long-finned and short-finned pilot whales, western North Atlantic white-sided dolphin, and Gulf of Maine/Bay of Fundy harbor porpoise. The MMPA 2004 List of Fisheries (LOF) (69 FR 48408) classifies fisheries by the level of serious injury and mortality of marine mammals incidental to each fishery (Table 5).

Subsequent sections discuss documented interactions with the primary species of concern, e.g., pilot whales, white-sided dolphins, and harbor porpoises. These bycatch reports do not represent a complete list, but rather available records. It should be noted that without adequate observer programs for these fisheries; actual numbers of interactions are difficult to obtain. Until very recently, the level of observer coverage has been minimal despite the 1999 re-categorization of the herring mid-water trawl fishery to Category II on the Marine Mammal Protection Act's (MMPA's) List of Fisheries. This change was to have permitted observers to collect data to more accurately document interactions. Category II fisheries have an occasional likelihood of causing incidental mortality and/or serious injury to marine mammals. The recent 2004 ramping up of observer coverage could provide additional information on protected species interactions in herring mid-water gear, whether vessels are engaged in domestic or foreign fishing.

**Table 5.** Commercial Fisheries Taking Atlantic Herring in the Atlantic Ocean (source: LOF 2004).<sup>4</sup>

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<sup>4</sup> Excerpt for List of Fisheries for 2004, Federal Register 69 (153 August 2004): 48407-48423.

<b>Fishery Description</b>	<b>Marine Mammal Species Incidentally Killed/Injured</b>
<b>CATEGORY II</b>	
Northeast mid-water trawl (including pair trawl)	Harbor seal, Long-finned pilot whale, Short-finned pilot whale, White-sided dolphin
<b>CATEGORY III</b>	
Gulf of Maine Atlantic herring purse seine	Harbor porpoise, Harbor seal, Gray seal

#### 7.4.1.1 Mid-Water Trawl

##### ***Pilot Whale***

Interactions between both short-finned and long-finned pilot whales and the Northeast mid-water trawl (including pair trawl) fishery have been documented. These two species are difficult to distinguish at sea as separate species and, therefore, abundance estimates, PBR, and bycatch estimates are combined into one listing for pilot whales. There were no domestic mid-water trawl trips observed in 1997-1998, 3 trips observed in 1999 (1 single; 2 paired), 13 trips in 2000 (12 single; 1 paired), and no trips in 2001. There were no marine mammal takes observed from the domestic mid-water trawl fishing trips during 1997-2001. A USA joint venture (JV) mid-water (pelagic) trawl fishery was conducted on Georges Bank from August - December 2001. A Total Allowable Level of Foreign Fishing (TALFF) was also granted during the same time period. Ten vessels (3 foreign and 7 American), fishing both single and paired mid-water trawls, participated in the 2001 Atlantic herring JV fishery. Two out of the three foreign vessels also participated in the 2001 TALFF and fished with paired mid-water trawls. NMFS maintained 74% observer coverage (243 hauls) of the JV transfers and 100% observer coverage (114 hauls) of the foreign vessels granted a TALFF. Eight pilot whales were incidentally captured in a single mid-water trawl during JV fishing operations. Three pilot whales were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF). The total mortality attributed to the Atlantic herring mid-water trawl fishery in 2001 was 11 animals.

##### ***White-sided Dolphin***

There were no domestic mid-water trawl trips observed in 1997-1998, 3 trips in 1999 (1 single; 2 paired), 13 trips in 2000 (12 single; 1 paired), and no trips in 2001. There were no marine mammal takes observed from the domestic mid-water trawl fishing trips during the period 1997-2001. A USA joint venture (JV) mid-water (pelagic) trawl fishery was conducted on Georges Bank from August -December 2001. A total allowable landings of foreign fishery (TALFF) was also granted during the same time period. Ten vessels (3 foreign and 7 American), fishing both single and paired mid-water trawls, participated in the 2001 Atlantic herring JV fishery. Two out of the three foreign vessels also participated in the 2001 TALFF and fished with paired mid-water trawls. The NMFS maintained 74% observer coverage (243 hauls) on the JV transfers and 100% observer coverage (114 hauls) on the foreign vessels granted a TALFF. No white-sided dolphins were incidentally captured in the mid-water trawl during JV fishing operations. Two white-sided dolphins were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF). The total mortality attributed to the Atlantic herring mid-water trawl fishery in 2001 was 2 animals.

#### 7.4.1.2 Purse Seine

##### ***Harbor Porpoise***

Harbor porpoises are listed on the MMPA 2004 List of Fisheries (LOF) as interacting with the Gulf of Maine Atlantic herring purse seine fishery. However, no interactions are documented in the most recent stock assessment report for the Gulf of Maine/Bay of Fundy harbor porpoise stock.

#### **7.4.2 Sea Turtles**

Interactions with sea turtles may occur when fishing effort overlaps with sea turtle distribution. Interactions could occur in the summer and fall, as turtles can be found in northeastern waters from June to November. Juvenile and immature Kemp's ridleys and loggerheads utilize nearshore and inshore waters north of Cape Hatteras during the warmer months and can be found as far north as the waters in and around Cape Cod Bay. Sea turtles are likely to be present off the Virginia, Maryland and New Jersey coasts by April or May, but do not arrive in great concentrations in New York and northwards until mid-June. Although uncommon north of Cape Hatteras, immature green sea turtles also use northern inshore waters during the summer and may be found as far north as Nantucket Sound. Leatherbacks migrate north in the spring to productive foraging grounds off Nova Scotia. With the decline of water temperatures in late fall, sea turtles migrate south to warmer waters. When water temperatures are greater than approximately 11°C, sea turtles may be present in some areas where the Atlantic herring fishery occurs.

There are not data available that can be used to estimate the number of threatened or endangered sea turtles that might be taken in herring gear. Nevertheless, based on observed takes from sea sampling data from other fisheries for gear types that may be used in the herring fishery, NMFS believes that it would be reasonable to expect, as a precaution, six loggerhead sea turtles to be taken by the proposed fishery (three of these takes would be lethal) and one green sea turtle, Kemp's ridley sea turtle and leatherback sea turtle to be taken by the proposed fishery. Based on the information available on the distribution and abundance of these sea turtle species in the actions area, NMFS does not believe the death, capture or injury of these small numbers of sea turtles would appreciably diminish the viability of sea turtle populations in the action area. Further, NMFS does not believe it would be reasonable to expect that the death, capture, harm or harassment of these numbers of sea turtles would appreciably reduce the likelihood of survival and recovery of these species in the wild (excerpted from NMFS, 1999).

Based on information collected in similar fisheries, the major gear types used in the herring fishery appear to have little or no interactions with sea turtles, although it must be acknowledged there has been an extremely low level of observer coverage in this fishery to date. In addition, there appears to be little spatial/temporal overlap in the distribution of Atlantic herring and sea turtles.

#### **7.4.3 Seabirds**



Like marine mammals and sea turtles, seabirds are vulnerable to entanglement in commercial fishing gear. Along with commercial fishing, human activities such as coastal development, habitat degradation and destruction, and the presence of organochlorine contaminants are considered to be major threats to some seabird populations.

The otter trawl and the purse seine are the primary commercial gears used in the Atlantic herring fishery, accounting for the vast majority of the landings. These gears do not appear to be a significant source of incidental seabird takes.

## **7.5 HERRING AS A FORAGE SPECIES**

Atlantic herring is one of many important forage species in the Northeast Atlantic Ocean ecosystem. While available information to quantify the importance of herring as a forage species is not available at this time, there is a substantial amount of literature that describes the role that herring plays in the ecosystem and estimates the amount of herring consumed by various fish, marine mammal, and seabird species.

Observational and empirical evidence suggests that there are four major groups of predators (marine mammals, large pelagic fishes, seabirds, and medium demersal) that feed on Atlantic herring in the Gulf of Maine-Georges Bank region. Many marine mammal populations in the region have increased dramatically in the last 20 years (NMFS 2002). Observations on the larger marine mammals such as humpback and fin whales suggest that these large predators have changed their diets to incorporate a larger proportion of herring during the 1990s and 2000s, instead of a diet that was dominated by sand lance in the 1980s (Read and Brownstein 2003). Smaller marine mammals such as harbor porpoise and harbor seals are also relying on Atlantic herring, based on diet studies from captured or stranded animals (Gannon et al. 1998; Williams 1999). Seabirds such as Northern gannets, shearwaters, and herring gulls are also likely preying routinely on herring (Powers and Backus 1987).

Read and Brownstein (2003) used survey-based estimates of abundance for eight species of marine mammals between 1991 and 1997 to estimate the total annual consumption of Atlantic herring by these species (Table 6). Their estimates of marine mammal consumption ranged from about 94,000 to 190,000 mt of herring per year. Their results show that minke whales, harbor porpoises, and white-sided dolphins are major predators on Atlantic herring because of high proportions of herring (34-51%) in their diets, whereas fin and humpback whales consume large quantities of herring to sustain their large body mass. Despite a three-fold increase in the harbor seal population in the Gulf of Maine between 1981 and 1997, herring only make up 13% of their diet. Consequently, the mean consumption estimate for harbor seals is below 5,000 mt a year.

Read and Brownstein's (2003) mean (or "best") estimate of Atlantic herring consumed annually by marine mammals during 1991-1997 was about 140,000 mt, with a range of 93,000-200,000 mt. Adding these estimates to the most current (1997) estimate of 100,000 mt of Atlantic herring consumed by fish and elasmobranch predators reported by Overholtz et al. (2000) produces a total mean estimate of 240,000 mt, with a range of 193,000-300,000 mt. During the 1990s, the total amount of herring consumed by all predators could have been as high as 400-450,000 mt.

**Table 6.** Annual Consumption Estimates (Metric Tons) of Atlantic Herring by Marine Mammal Predators (source: Read and Brownstein, 2003)

<b>Marine Mammal Predators</b>	
<b>Species</b>	<b>Estimated Annual Consumption, 1991-1997</b>
<b>Fin Whale</b>	16,081-62,362
<b>Minke Whale</b>	11,648-22,108
<b>Humpback Whale</b>	31,046-35,507
<b>Pilot Whale</b>	149-512
<b>Harbor Porpoise</b>	20,863-27,655
<b>White-sided Dolphin</b>	7,852-35,591
<b>Harbor Seal</b>	4,853
<b>Gray Seal</b>	1,310

## **7.6 POPULATION STATUS REVIEW OF RELEVANT PROTECTED SPECIES**

### **7.6.1 Marine Mammals**

Five marine mammal species are known to become entangled in gear used by the Atlantic herring fishery, namely, harbor porpoise, pilot whale, white-sided dolphin, harbor seal and gray seal. Both short and long-finned pilot whales are classified as strategic stocks under the MMPA. The status of these and other marine mammal populations inhabiting the northwest Atlantic Ocean has been discussed in great detail in the annual U.S. Atlantic Marine Mammal Stock Assessment Report. The reports present information on stock definition, geographic range, population size, productivity rates, potential biological removal levels (PBR – the number of human-caused deaths the stock can withstand annually and still reach and maintain an optimum population level), and fishery-specific mortality estimates and also compares the PBR to estimated human-caused mortality for each stock. To access the stock assessment report, see the NMFS website at [http://www.nmfs.noaa.gov/prot\\_res/PR2/Stock\\_Assessment\\_Program/sars.html](http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html).

#### *7.6.1.1 Harbor Porpoise*

The Gulf of Maine harbor porpoise was proposed to be listed as threatened under the ESA on January 7, 1993 (NMFS, 1993), but NMFS determined this listing was not warranted (NMFS, 1999). NMFS removed this stock from the ESA candidate species list in 2001. The PBR for the harbor porpoise is 747 animals (NMFS, 2002). The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR level, which means the human-induced mortality is not approaching a zero mortality and serious injury rate. This is not a

strategic stock because average annual fishery-related mortality and serious injury has not exceeded the PBR level in recent years.

Harbor porpoises range from Labrador to North Carolina. The southern-most stock of harbor porpoise is referred to as the Gulf of Maine/Bay of Fundy stock and generally spends its winters in the Mid-Atlantic region. Harbor porpoises are generally found in coastal and inshore waters, but will also travel to deeper, offshore waters. The status of the harbor porpoise stock in U.S. waters relative to the optimum sustainable population is unknown. There are insufficient data to determine population trends for this species because harbor porpoises are widely dispersed in small groups, spend little time at the surface, and distribution varies unpredictably from year to year depending on environmental conditions (NMFS, 2002).

Shipboard line transect sighting surveys have been conducted to estimate population size of the harbor porpoise stock. The best estimate of abundance for the Gulf of Maine/Bay of Fundy harbor porpoise stock is 89,700. The minimum population estimate is 74,695 individuals (NMFS, 2002).

#### *7.6.1.2 Pilot Whale*

The two species of pilot whales in the Atlantic, long-finned and short-finned pilot whales, are difficult to distinguish to the species level at sea. The species tend to overlap from New Jersey to Cape Hatteras, North Carolina. Sightings north of this overlapping area are likely long-finned pilot whales, while sightings south of this area are more likely short-finned pilot whales.

Both long-finned and short-finned pilot whale abundance may have been affected by reduction in foreign fishing, curtailment of the Newfoundland drive fishery for pilot whales in 1971, and increased abundance of herring, mackerel, and squid stocks. The total number of long-finned and short-finned pilot whales off the eastern U.S. is unknown. Because long-finned and short-finned pilot whales are difficult to identify at sea, seasonal abundance estimates were reported for *Globicephala* species as a whole. The best abundance estimate for pilot whales (*Globicephala* sp.) is 14,524 and the minimum population estimate is 11,343 individuals.

#### ***Long-finned pilot whale***

The status of long-finned pilot whales, *Globicephala melas*, relative to their optimum sustainable population is unknown, and there are insufficient data to determine a population trend for this species. Long-finned pilot whales are not listed under the ESA, but are considered a strategic stock because the 1996-2000 estimated average annual fishery-related mortality exceeds the PBR level (108) for this species.

Long-finned pilot whales range from North Carolina north to Iceland and Greenland and east to North Africa. Off the northeast U.S. coast, pilot whales are distributed principally along the continental shelf edge in the winter and early spring. In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters until late autumn. Pilot whales generally prefer areas of high relief or submerged banks, and also areas associated with the Gulf Stream north wall and thermal fronts along the continental shelf edge. Stock structure of the long-finned pilot whale is uncertain, although it has been proposed that two populations exist

(a warm-water population and a cold-water population) related to sea surface temperature (Fullard et al., 2000).

### ***Short-finned pilot whale***

The status of short-finned pilot whales, *Globicephala macrorhynchus*, relative to their optimum sustainable population, is unknown, and there are insufficient data to determine a population trend for this species. Short-finned pilot whales are not listed under the ESA, but are considered a strategic stock because the 1996-2000 estimated average annual fishery-related mortality exceeds the PBR level (108) for this species.

Short-finned pilot whales range worldwide in tropical to warm temperate waters with North Carolina considered the northern extent of their range in U.S. waters. Sightings within U.S. waters are primarily within the Gulf Stream and along the continental shelf and continental slope in the northern Gulf of Mexico. No information is available on stock structure for this species.

## **7.6.2 Sea Turtles**

All sea turtles that occur in U.S. waters are listed as either endangered or threatened under the ESA. The Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*) are listed as endangered. The loggerhead (*Caretta caretta*) and green turtle (*Chelonia mydas*) are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific coast of Mexico, which are listed as endangered. All five of these species inhabit the waters of the U.S. Atlantic and Gulf of Mexico.

NOAA Fisheries recognizes five loggerhead subgroups within the western Atlantic including two primary subpopulations: 1) a northern nesting subpopulation that occurs from North Carolina to northeast Florida, about 29°N (approximately 7,500 nests in 1998); 2) a south Florida nesting subpopulation, occurring from 29°N on the east coast to Sarasota, Florida on the west coast (mean of 73,751 nests each year). The status of the northern population based on the number of loggerhead nests has been classified as stable or declining (TEWG, 2000). Data from all beaches within the south Florida subpopulation where nesting activity has been recorded indicate substantial increases when data are compared over the last 25 years. However, an analysis limited to nesting data from the statewide sea turtle Index Nesting Beach Survey program from 1989 to 2002, a period encompassing index surveys that are more consistent and more accurate than surveys in previous years, has shown no detectable trend (Blair Witherington, Florida Fish and Wildlife Conservation Commission (FFWCC, pers. comm., 2002).

The Kemp's ridley is one of the most endangered of the world's sea turtle species. The only major nesting site for Ridelys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico. Estimates of the adult female nesting population reached a low of 300 in 1985. Conservation efforts by Mexican and U.S. agencies have aided this species by eliminating egg harvest, protecting eggs and hatchlings, and reducing at-sea mortality through fishing regulations. From 1985 to 1999, the number of nests observed at Rancho Nuevo, and nearby beaches increased at a mean rate of 11.3% per year (TEWG, 1998). Current totals exceed 8,000 nests per year, allowing cautious optimism that the population is on its way to recovery.

Recent population estimates for green sea turtle in the western Atlantic area are not available. However, the pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of index beaches in 1989.

Leatherback populations in the eastern Atlantic (*i.e.*, off Africa) and Caribbean appear to be stable, but there is conflicting information for some sites (Spotila, pers. comm.) and it is certain that some nesting populations (*e.g.*, St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS and USFWS, 1995). Data collected in southeast Florida clearly indicate increasing numbers of nests for the past twenty years (9.1-11.5% increase), although it is critical to note that there was also an increase in the survey area in Florida over time (NOAA Fisheries SEFSC, 2001).

## **7.7 EXISTING AND PROPOSED FEDERAL REGULATIONS/ACTIONS PERTAINING TO RELEVANT PROTECTED SPECIES**

### **7.7.1 Marine Mammals**

#### *7.7.1.1 Harbor Porpoise*

On December 1, 1998, NMFS published a final rule to implement the Harbor Porpoise Take Reduction Plan for the Gulf of Maine and the Mid-Atlantic coastal waters. The Northeast sink gillnet and Mid-Atlantic coastal gillnet fisheries are the two fisheries regulated by the HPTRP (63 FR 66464, December 2, 1998; also defines fishery boundaries). Among other measures, the HPTRP uses time/area closures in combination with acoustical devices (*e.g.*, pingers) in Northeast waters, and time/area closures along with gear modifications for both small mesh (greater than 5 inches (12.7 cm) to less than 7 inches (17.78 cm)) and large mesh (greater than or equal to 7 inches (17.78 cm) to 18 inches (45.72 cm)) gillnets in Mid-Atlantic waters. Although the HPTRP predominately impacts spiny dogfish and monkfish fisheries due to high rates of porpoise bycatch, other gillnet fisheries are also managed under the HPTRP.

Copies of the final rule are available from the Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910-3226. Additional information regarding the rule and its changes can also be accessed via the Internet at <http://www.nero.nmfs.gov/porptrp/>.

#### *7.7.1.2 Pilot Whale*

There are no take reduction measures currently in place for pilot whales in the Atlantic Ocean. However, NMFS plans to convene two new take reduction teams in 2005 and 2006 to address incidental takes of pilot whales in Atlantic pelagic longline and trawl fisheries. The Pelagic Longline TRT will convene in June of 2005 and the Trawl TRT will follow in 2006.

### **7.7.2 Sea Turtles**

Under the ESA, and its implementing regulations, taking sea turtles – even incidentally – is prohibited, with exceptions identified in 50 CFR 223.206. The incidental take of endangered species may only legally be authorized by an incidental take statement or an incidental take permit issued pursuant to section 7 or 10 of the ESA.

Existing NMFS regulations specify procedures that NMFS may use to determine that unauthorized takings of sea turtles are occurring during fishing activities, and to impose additional restrictions to conserve sea turtles and to prevent unauthorized takings (50 CFR 223.206(d)(4)). Restrictions may be effective for a period of up to 30 days and may be renewed for additional periods of up to 30 days each.

### **7.7.3 Seabirds**

Under the Migratory Bird Treaty Act it is unlawful “by any means or in any manner, to pursue, hunt, take, capture, [or] kill” any migratory birds except as permitted by regulation (16 U.S.C. 703). The regulations at 50 CFR 21.11 prohibit the take of migratory birds except under a valid permit or as permitted in the implementing regulations. The US Fish and Wildlife Service’s Policy on Waterbird Bycatch states “It is the policy of the U.S. Fish and Wildlife Service that the Migratory Bird Treaty Act of 1918, as amended, legally mandates the protection and conservation of migratory birds. Avian conservation is of significant concern to many in the United States. Substantial numbers of waterbirds (especially seabirds, but also waterfowl, shorebirds, and other related wading species) are killed annually in fisheries, making waterbird bycatch a serious conservation issue and a violation of the underlying tenets of the MBTA. The goal of the U.S. Fish and Wildlife Service is the elimination of waterbird bycatch in fisheries. The Service will actively expand partnerships with regional, national, and international organizations, States, tribes, industry, and environmental groups to meet this goal. The Service, in cooperation with interested parties, will aggressively promote public awareness of waterbird bycatch issues, and gather the scientific information to develop and provide guidelines for management, regulation, and compliance.”

## **7.8 POTENTIAL IMPACTS TO ATLANTIC COASTAL STATE AND INTERSTATE FISHERIES**

Regulations developed under the future trawl take reduction plan for pilot whales have the potential to impact trawl fisheries that target Atlantic herring.

## **7.9 IDENTIFICATION OF CURRENT DATA GAPS AND RESEARCH NEEDS**

### **7.9.1 Marine Mammal Research Needs**

- Abundance estimates capable of distinguishing short-finned from long-finned pilot whales are needed to achieve more accurate status assessments for this species and to improve the ability to monitor them.

### **7.9.2 Sea Turtle Research Needs**

- In order to better understand sea turtle populations and the impacts of incidental take in Atlantic herring fisheries, in-water abundance estimates of sea turtles are needed to achieve more accurate status assessments for these species and improve our ability to monitor them.

### **7.9.3 Sea Bird Research Needs**

- An analysis of existing bird bycatch data for this fishery should be conducted and summarized for the plan.

DRAFT

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