

ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR ATLANTIC HERRING
(Clupea herengus)

2014 FISHING YEAR



Prepared by the Plan Review Team

Approved by the Atlantic Herring Management
Board May 2015

I. Status of Fishery Management Plan

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 to suggest there are at least two separate biological stocks. 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 quantitative data on their relative size is lacking. Intermixing among these aggregations outside of the spawning season has led to difficulties in accurately assessing the status of individual stocks. Currently, ASMFC's Atlantic Herring FMP has been revised with two amendments and subsequent addenda since the original plan was approved in 1993.

<u>Date of FMP Approval</u>	November 1993
<u>Amendments</u>	Amendment 1 (February 1999) Amendment 2 (March 2006)
<u>Addenda</u>	Addendum I to Amendment 1 (July 2000) Technical Addendum #1A to Amendment I (October 2001) Addendum II to Amendment I (February 2002) Technical Addendum 1 to Amendment 2 (August 2006) Addendum I to Amendment 2 (March 2009) Addendum II (December 2010) Addendum V (October 2012) Addendum VI (August 2013)
<u>Management Unit</u>	US waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the Exclusive Economic Zone (East Coast of Maine), and from US/Canadian border to the southern end of the species range (Cape Hatteras, NC).
<u>States With Declared Interest</u>	Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey
<u>Active Boards/Committees</u>	Atlantic Herring Section, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, Plan Development and Plan Review Team

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.

Draft Amendment 3 (initiated 2014)

The Section initiated Draft Amendment 3 to review efficacy of the spawning program, consider changes to the fixed gear set-aside provision, and propose a requirement for fish holds to be empty of fish prior to a trip departure. The Section will consider approval of the draft amendment in 2015.

II. Status of the Atlantic Sea Herring Stock

The most recent completed assessment was 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.**

Stock Definition

The U.S. Atlantic herring coastal stock complex includes two distinct spawning stocks that occupy discrete areas in the Gulf of Maine and on Georges Bank/Nantucket Shoals in the summer and fall. Fish belonging to these two components, and to smaller spawning populations within each component, migrate to continental shelf waters south of Cape Cod after spawning, then move northward in the spring to summer feeding grounds north and east of the Cape before eventually returning to their natal spawning grounds. Tagging studies suggest that fish from the New Brunswick, Canada weir fishery may be part of the GOM/GB complex, based on evidence of mixing.

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 2**). SSB generally declined during 1997-2010, but increased in 2011 to an estimated 518,000 mt (1.1 billion lbs). Total biomass 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. Maximum sustainable yield (MSY) reference points were estimated to be $FMSY = 0.27$, $SSBMSY = 157,000$ mt ($\frac{1}{2} SSBMSY = 78,500$), and $MSY = 53,000$ mt.

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.

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.

III. Status of the Fishery in 2014

The Atlantic herring resource occurs in waters off Canada and the United States, and fisheries exist in both countries. The U.S. Atlantic herring fishery is controlled by annual catch limits (ACL) set by NOAA Fisheries. Specifications are set every three years and adjusted annually to account for over- and underages from the previous fishing season with final data. The ACL is allocated as sub-quotas distributed among the four management areas. Once 92% of the sub-quota for an area is reached, the fishery will close in that area. The stockwide fishery will close when 95% of the total ACL is projected to be reached (Addendum VI). Following a closure, 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 to quota-based closures, the "days out" and spawning closure programs provide additional measures to regulate catch of the resource.

The domestic Atlantic herring fishery is predominantly commercial; recreational catch accounts for less than 1%. Over the time series from 1965 to 2014, annual landings by the United States Atlantic herring fleet generally increased and averaged about 58,511 mt (129.0 million lbs). Landings reached the lowest level in 1983, with 23,254 mt (51.3 million lbs) and peaked in 2006 with 119,343 mt (263.1 million lbs) (**Figure 3**). Average landings were 78,394 mt (172.8 million lbs) since the FMP was implemented in 1993, and 86,342 mt (190.4 million lbs) a year in the past decade. The average landings from the past decade (2005-2014) was 89,038 mt (196.3 million lbs). In 2014, landings totaled 104,088 mt (229.5 million lbs) (GARFO), with the majority taken by trawl and purse seine gears.

State Fisheries

The sea herring fishery was predominantly located in Area 1A (inshore Gulf of Maine). Based on preliminary data provided in state compliance reports, Maine and Massachusetts accounted for 89.7% of the commercial Atlantic herring landings (source: state compliance reports and may include preliminary data) (**Table 1**).

Table 1. Percentage of state landings to coastwide in 2014. Source: State compliance reports.

State	% of Coastwide Landings (excluding confidential data)
ME	52.4
NH	confidential
MA	37.2
RI	8.2
CT	0.0
NY	0.1
NJ	2.0

Quota-Based Closures

The Area 1A fishery closed on October 26, 2014 when 92% of the sub-quota was reached. According to the [Atlantic Herring Weekly Report](#) (GARFO), the fishery caught 101.2% of the 33,031 mt adjusted sub-quota. Area 1B, which has the lowest sub-quota at 2,878 mt, was harvested at 164.46%. Areas 2 (Southern New England) and 3 (Georges Bank) were harvested at 68.2% and 94.5%, respectively.

“Days Out” Program

The Area 1A sub-quota was seasonally split with trimesters: 0% was allocated to Trimester 1 (January 1 – May 31), 72.8% to Trimester 2 (June 1 – September 30), and 27.2% to Trimester 3 (October 1 – December 31). The Section set five landing days for Trimester 2, which was adjusted to seven landing days effective July 7. In Trimester 3, the Section set four landing days to slow the catch rate and extend the season.

Spawning Closure Program

The spawning closures for 2014 are listed in **Table 2**.

Table 2. Spawning area closures effective in 2014.

Spawning Area	Boundaries	Closure Dates (inclusive)
Eastern Maine	Maine coast	August 15 through September 11
	43° 48' N	
	44° 25' N	
	North along the US/Canada border	
Western Maine	43° 30' N	September 24 through October 21
	43° 30' N	
	43° 48' N	
	North to Maine coast at 68° 20' W	
Massachusetts-New Hampshire	All waters bounded by MA, NH, and ME coasts 43° 30' N and 70° 00' W	September 21 through October 18

IV. Status of Assessment Advice

There were no research recommendations from the previous assessment, and so 15 new recommendations were developed during the 2012 assessment. The new recommendations are listed below. They are also included in the prioritized research recommendations in Section XI of this report.

New Research Recommendations from the 54th Northeast Region Stock Assessment for Atlantic Herring (2012)

- a. More extensive stock composition sampling including all stocks (i.e. Scotian Shelf).
- b. Develop (simple) methods to partition stocks in mixed stock fisheries.
- c. More extensive monitoring of spawning components.
- d. Analyze diet composition of archived mammal stomachs. Improve size selectivity of mammal prey. Also sea birds.
- e. Consider alternative sampling methods such as HabCam.
- f. Research depth preferences of herring.
- g. Simulation study to evaluate ways in which various time series can be evaluated and folded into model.
- h. Evaluate use of Length-based models (Stock Synthesis and Chen model)
- i. Develop indices at age from shrimp survey samples
- j. Evaluate prey field to determine what other prey species are available to the predators that could explain some of the annual trends in consumption.
- k. Develop statistical comparison of consumption estimates and biomass from model M.
- l. Consider information on consumption from other sources (i.e. striped bass in other areas) and predators inshore of the survey.
- m. Investigate why small herring are not found in the stomachs of predators in the NEFSC food habits database.
- n. Develop an industry-based LPUE or some other abundance index (Industry Based Survey).
- o. Develop objective criteria for inclusion of novel data streams (consumption, acoustic, larval, etc) and how can this be applied

V. Status of Research and Monitoring

Under Amendment 1, states are not required to conduct fishery independent surveys for Atlantic herring. However, state survey programs designed to catch other species may encounter herring regularly, so some states do collect biological information on sea herring. A summary of these surveys results follow.

Spawning Monitoring: Addendum V to Amendment 2 (2012) required states to collected 100 samples for spawning analysis, an increase from 50 samples, of sea herring during the spawning season in order to detect spawning events for the closure of spawning areas. This requirement only pertains to states bordering spawning areas: Maine, New Hampshire, and Massachusetts. New Hampshire does not analyze sea herring spawning, but its samples are included in Maine's program.

Maine and New Hampshire: ME and NH jointly operate an inshore bottom trawl survey in the fall that is designed for catching groundfish, but regularly encounters sea herring. From 2003 to 2014, the number of herring per tow has been generally increasing, with variance between years. In 2014, the ME/NH fall survey encountered about 1,800 fish/tow, an increase from about 1,300 fish/tow observed in 2013. A majority of the length samples from 2014 were between 10 and 14 cm in length. Due to limited staff resources, the data has not been analyzed for 2011 or 2012. In 2012, Maine processed 87 samples from Area 1A and collected biological data in addition to spawning condition.

Maine Department of Marine Resources also conducts commercial portside catch sampling as part of an ACCSP grant to examine bycatch. In 2014, approximately 170 samples, ranging from 50-100 individual fish, were taken over the calendar year, and have been processed for length, weight, sex, and maturity.

New Hampshire also conducts the juvenile finfish seine survey conducted in Great Bay and tributaries and other coastal harbors and the Maine-New Hampshire inshore trawl survey. 66 Atlantic herring were observed during the months of July, August, and September of 2014. Preliminary data indicate 1,091 Atlantic herring (ranging between 9 and 28 cm) were captured during the spring inshore trawl survey, while 1,243 Atlantic herring (ranging between 6 and 29 cm) were captured during the fall survey in 2014.

Massachusetts Division of Marine Fisheries (MA DMF) also conducts portside sampling of MA's fishery (including mid-water trawl fleet) and four Small-Mesh Bottom Trawl (SMBT) herring vessels out of Rhode Island through the River Herring Bycatch Avoidance in Small-Mesh Fisheries Study, which is funded through the National Fish and Wildlife Foundation. Sampling program began in October 2010.

Marine Fisheries conducts gonad somatic index (GSI) sampling of commercial landings from Area 1A during the spawning season. In 2014, *Marine Fisheries* sampled six trips from August 19 to September 16. Based upon these samples, it was determined that the default closure (9/21-10/18) would accurately protect Atlantic herring spawning activities in the area. Further sampling of commercial catches immediately after the area re-opened found that herring were no longer in spawning condition, and a subsequent closure was not necessary. In addition to sampling Area 1A spawning fish, *Marine Fisheries* conducted five GSI samples on landings from Georges Bank, starting on August 2. While there are currently no regulations that limit harvest of spawning herring on Georges Bank, collection of spawning data from these offshore areas is a priority.

Marine Fisheries continued portside sampling of the Atlantic herring fishery through the River Herring Bycatch Avoidance programs funded by both The Nature Conservancy and the Atlantic Herring Research Set-Aside. Portside sampling and River Herring Bycatch Avoidance programs were conducted with both the midwater trawl fishery operating out of Massachusetts ports and the small-mesh bottom trawl fishery operating out of Rhode Island ports.

Rhode Island Division of Fish & Wildlife (RI DFW) conducts a Seasonal Trawl Survey to develop abundance indices for sea herring. Fishery-independent monitoring for 2014 suggested a decrease in the relative biomass and abundance of Atlantic herring in Rhode Island waters in the spring component of the RIDFW seasonal trawl survey. Atlantic herring are rarely observed in the fall component of the RIDFW seasonal trawl survey, but are not uncommon in the spring. An average of 1.00 kg/tow of Atlantic herring was observed in 2013 during the spring component of the RIDFW seasonal trawl survey, lower than the 0.02 kg/tow observed during 2011. Similarly, the Atlantic herring abundance index derived from the spring data decreased from 19.4 fish/tow in 2013 to 0.8 fish/tow in 2014. These results indicate the previous years' herring biomass did not move back into state waters.

Connecticut Department of Energy and Environmental Protection (CT DEEP) monitors sea herring through the Long Island Sound Trawl Survey (LISTS), which is conducted each spring and fall since 1984. In 2014, the spring abundance index was 1.44 fish/tow, which is 27% below the full time series average, but an increase from 0.73 fish/tow observed in 2013. Few herring are caught in the fall survey, and most Atlantic herring taken in LISTS spring survey are greater than 20 cm fork length.

New York has *de minimis* status and does not conduct directed monitoring of Atlantic herring. Western Long Island Juvenile Striped Bass Survey and Peconic Estuary Small Mesh Trawl Survey encounter juvenile sea herring with great variance year to year, but does not routinely summarize the data. However, the information can be prepared at the request of management.

VI. Management Measures and Issues

Section 5.1.1.1 of Amendment 2 to the Interstate Fishery Management Plan for Atlantic Sea Herring lists the following state regulatory requirements:

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.

Spawning sampling provisions and comprehensive regulations were updated through Addendum V to Amendment 2 (2012). Addendum VI to Amendment 2 (2013) was implemented to complement measures contained in the New England Fishery Management Council’s Framework Adjustment 2. The addendum establishes:

1. Seasonal splitting of annual catch limit sub-components for Areas 1B, 2, and 3;
2. Up to 10% carryover of a sub-ACL consistent with the provisions laid out in the New England Fishery Management Council’s Framework Adjustment 2;
3. Establishment of triggers that close the directed fishery in a management area when 92% of a sub-ACL is projected to be reached. The stock-wide fishery closes when 95% of the total ACL is projected to be reached. A 2,000 pound bycatch allowance will continue for the remainder of the season; and
4. Directed fishery closure triggers to be set for sub-ACLs using the specification process.

VII. State Compliance

Each jurisdiction is required to submit a compliance report for the previous fishing season by February 1 of each year. The standard components and plan-specific requirements for the Atlantic Herring FMP are listed in Table 3.

- I. Introduction: Summary of the year that highlights significant changes in monitoring, harvest, or regulations.
- II. Request for *de minimis* status, where applicable.
- III. Previous calendar year’s fishery and management program.
- IV. Planned management programs for the current calendar year.
- V. Plan-specific requirements (see Section VI of this report)
- VI. Law Enforcement Reporting Requirements

Table 3. Completion of state compliance reports for the 2014 fishing year.

Section	ME	NH	MA	RI	CT	NY	NJ
I	✓	✓	✓	✓	✓	✓	✓
II	NA	NA	NA	NA	NA	DM	NA
III	✓	✓	✓	✓	✓	DM	✓
IV	✓	✓	✓	✓	✓	DM	✓
V	✓	✓	✓	✓	✓	DM	✓
VI	NA	NA	NA	NA	NA	NA	✓
✓ Completed sections DM = requests <i>de minimis</i> status. NA (does not apply) refers to restrictions that would not apply to a state.							

Request for *De minimis* Status

Amendment 1 to the FMP establishes the definition and criteria for *de minimis* status. A state with approved *de minimis* status has been determined to not have significant contributions to a coastwide conservation program required by an FMP or amendment. States may apply for *de minimis* status if, for the last two years, their combined commercial landings by weight constitute

less than 1% of coastwide commercial landings for the same two-year period. *De minimis* states are still required to implement management measures to address regulatory requirements 2, 3, and 4 under the FMP's Section 5.1.1.1 (see Section VI of this report).

New York has requested and met the requirements for *de minimis* status. Its landings have averaged 0.06% of the coastwide landings since 1991. New York landed 82,480 lbs in 2013 and 116,982 lbs in 2014.

VIII. PRT Recommendations

The Plan Review Team recommends the following for the Atlantic Herring Section's consideration:

1. All states who submitted reports meet the regulatory measures in the FMP.
2. The state of New York meets the criteria for *de minimis* status.

IX. Law Enforcement Report

There were no law enforcement concerns in 2014.

X. Future Compliance Issues

None.

XI. Research and Monitoring Recommendations

Fishery-Dependent Priorities

High

- Develop (simple) methods to partition stocks in mixed stock fisheries.
- Investigate bycatch and discards in the directed herring fishery through both at sea and portside sampling.
- Continue commercial catch sampling of Atlantic herring fisheries according to ACCSP protocols

Fishery-Independent Priorities

High

- Conduct more extensive stock composition sampling including all stocks (i.e., Scotian Shelf).
- Expand monitoring of spawning components.

Low

- 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.

- Consider alternative sampling methods such as HabCam.

Modeling / Quantitative Priorities

High

- Evaluate use of length based models (Stock Synthesis and Chen model).
- Develop statistical comparison of consumption estimates and biomass from model M.

Moderate

- Develop indices at age from shrimp survey samples.
- Conduct simulation studies to evaluate ways in which various time series can be evaluated and folded into the assessment model.
- Develop new approaches to estimating recruitment (i.e., juvenile abundance) from fishery-independent data.
- Examine the possible effects of density dependence (e.g., reduced growth rates at high population size) on parameter estimates used in assessments.

Low

- Develop an industry based LPUE or some other abundance index (Industry Based Survey).
- 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.
- Investigate the M rate assumed for all ages, the use of CPUE tuning indices, and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring.
- Develop objective criteria for inclusion of novel data streams (consumption, acoustic, larval, etc.) and how this can be applied.

Life History, Biological, and Habitat Priorities

High

- Consider information on consumption from other sources (i.e. striped bass in other areas) and predators inshore of the current surveys.

Moderate

- Continue 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.
- Analyze diet composition of archived mammal and sea bird stomachs. Improve knowledge on prey size selectivity of mammals and sea birds.
- Evaluate prey field to determine what other prey species are available to predators that could explain some of the annual trends in herring consumption.
- Investigate why small herring are not found in the stomachs of predators in the NEFSC food habits database.

Low

- Research depth preferences of herring.

Management, Law Enforcement, and Socioeconomic Priorities

High

- Evaluate the current herring spawning closure design in terms of areas covered, closure periods, catch-at-age within (before fishing prohibition in 2007) and outside of spawning areas to determine minimal spawning regulations (Maine DMR).
- Continue to organize annual US-Canadian workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

Moderate

- Develop a strategy for assessing individual spawning components to better manage heavily exploited portion(s) of the stock complex, particularly the Gulf of Maine inshore spawning component.
- Develop socioeconomic analyses appropriate to the determination of optimum yield.

Low

- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry.

Atlantic Sea Herring Research Priorities Identified as Being Met

- Evaluate the merit of acoustic surveys and other techniques to achieve sub stock complex monitoring. Gulf of Maine Research Institute.

Figures

Figure 1. Map of Atlantic herring management areas with boundaries current to Addendum V (October 2012). Note that the three spawning areas are within Area 1A, the inshore region of Gulf of Maine.

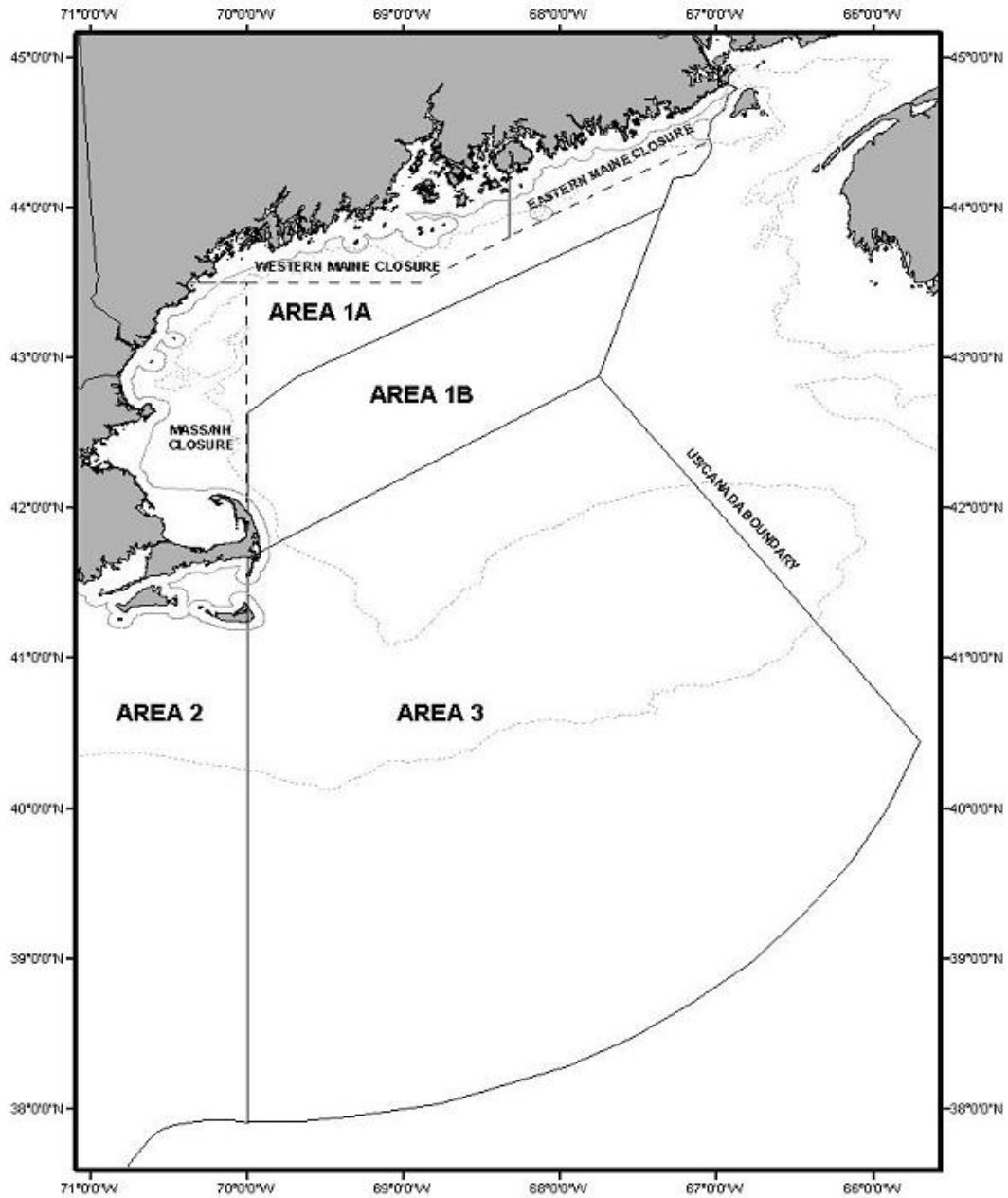


Figure 2. Total and spawning stock biomass and thresholds of Atlantic herring from 1965 to 2011. Total biomass is based on January 1 estimates.

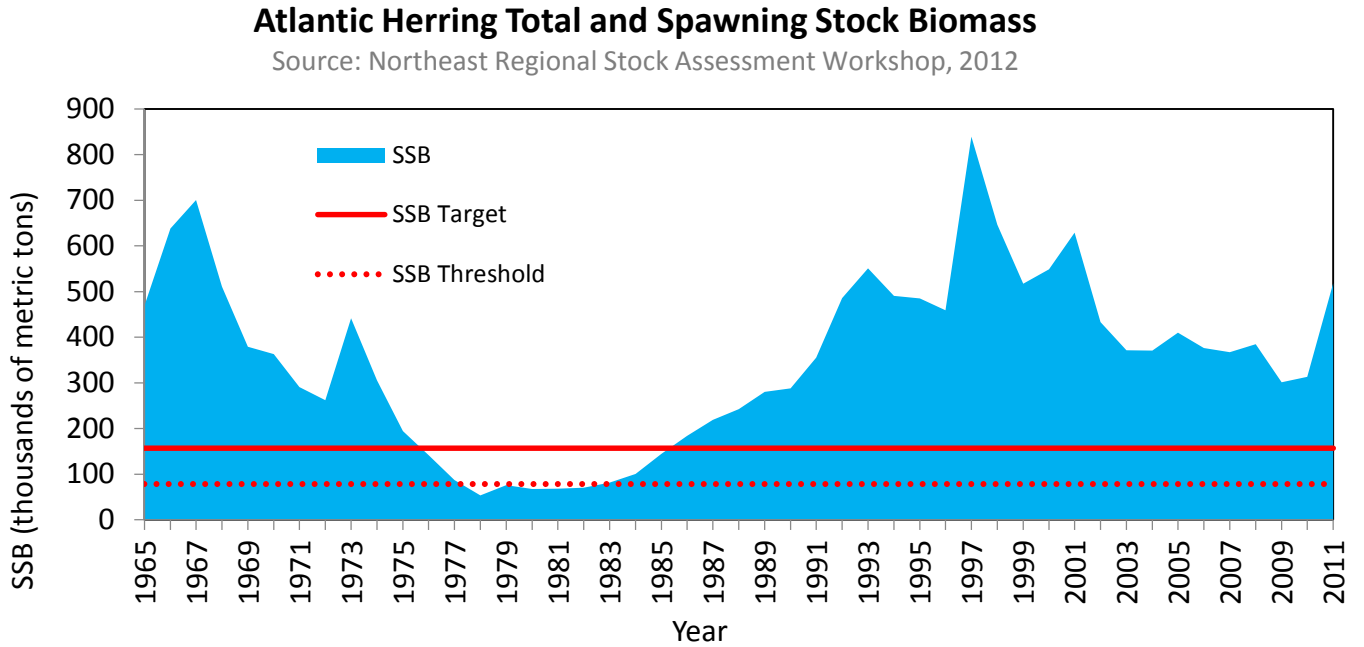


Figure 3. Commercial Atlantic herring landings by the U.S. fleet from 1965-2014.

