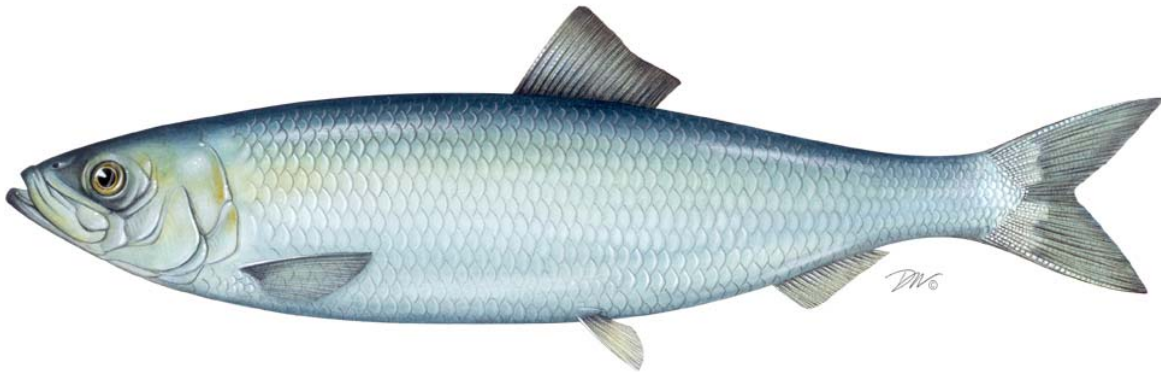


**2008 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR
ATLANTIC SEA HERRING (*Clupea harengus harengus*)**

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Prepared by

The Atlantic Sea Herring Plan Review Team

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Board Approved: November 2009

**2008 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR
ATLANTIC SEA HERRING (*Clupea harengus harengus*)**

I. Status of Fishery Management Plan

<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 Amnd. I) (July 2000) Technical Addendum #1a (to Amnd. I) (October 2001) Addendum II (to Amnd. I) (February 2002) Technical Addendum 1 (to Amnd. II) (August 2006)
<u>Management Unit:</u>	US waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the EEZ, 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

The Atlantic States Marine Fisheries Commission's (ASMFC) Amendment 1 to the Atlantic Herring Fishery Management Plan (FMP) was approved in 1999 establishing three management goals and eleven management objectives for the U.S. Atlantic herring (*Clupea h. harengus*) resource. Amendments I and II were developed in conjunction with the New England Fishery Management Council's (NEFMC) federal management plan. The goals and objectives can only be reached through the successful implementation of both the interstate and federal management plans. Management measures in both plans are designed to complement each other to minimize regulatory differences in fisheries conducted in state and federal waters. The management scheme relies on an overall total allowable catch (TAC) with effort control measures to avoid overfishing the resource. TACs are developed for specific management areas to reflect the current state of knowledge concerning migratory behavior and mixing rates of the various sub-components of Atlantic herring. State effort controls include specific days out of the fishery to slow catch rates and extend the fishing season.

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 the Council's FMP, the Commission's Atlantic Herring Section adopted the same overfishing definition and biological reference points as the Council, which were created under guidelines stipulated in the revised Magnuson-Stevens Fishery Conservation and Management Act prior to the 2006 re-authorization. Both FMPs provide a process for determining the annual specifications for the fishery and by management area. Both plans contain institutional frameworks for developing and implementing future management action involving the Commission, the New England and Mid-Atlantic Councils, and (possibly)

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Canada; state and federal spawning closures/restrictions; and recommend measures intended to prevent damage to herring spawning habitat and egg beds.

In 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 1st. Because National Marine Fisheries Service disapproved the spawning closures for the federal waters of Management Area 1A (inshore Gulf of Maine), the Commission 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).

The Commission approved Technical Addendum #1a (2001) to change the delineation of the Eastern Maine spawning boundary because the spawning aggregations were not adequately protected in 2000.

Addendum II was developed in conjunction with the Council's Framework Adjustment I to allocate the Management Area 1A Total Allowable Catch (TAC) on a seasonal basis. Addendum II also specifies the procedures for allocating the annual Internal Waters Processing (IWP) quota (more detail given in section IX).

Federal Amendment 1 was published in the Federal Register on March 12, 2007. Significant provisions include: changes to management area boundaries; authorization of a research set aside program; a provision allowing the establishment of harvest specs for up to three years; vessel monitoring system requirements; new permit specifications; a 5% bycatch set aside for each area; midwater trawl prohibition in area 1A from June 1 – September 30; and a 500 mt Area 1A set aside for west of Cutler fixed gear fishermen.

Regardless of coordinated development between the ASMFC (Amendment 2) and NMFS (Amendment 1) there remain some inconsistencies. The east of Cutler exemption in *section 4.3.2.4* of Amendment 2 was not adopted in federal Amendment 1 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 ASMFC's Amendment 2. It is unlikely that there are mid-water trawl vessels lacking federal permits.

Despite these minor inconsistencies, the essential management components are consistent between the federal Amendment 1 and ASMFC's Amendment 2. These provisions include identical management area boundaries, joint TAC specifications setting process between the New England Fishery Management Council and Atlantic States Marine Fisheries Commission and closure of an area when 95% of TAC is harvested leaving 5% as a bycatch allowance.

In November 2007, the NEFMC initiated an Amendment to improve catch/bycatch monitoring and address annual catch limits and accountability measures to ensure compliance with the reauthorized Magnuson Stevens Act. Scoping meetings for Amendment 4 were held during the

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summer of 2008. The NEFMC is working to complete the Draft Amendment 4 for public comment.

In February 2009, the ASMFC Atlantic Herring Section approved Addendum I to Amendment 2 to the Interstate FMP for Sea Herring which addresses effort in Area 1A. Addendum I 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 Jan. – 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 90 or 95% of a 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.

II. Status of the Stock

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. Herring deposit eggs on gravel bottom in relatively shallow, tidally-mixed coastal waters and offshore banks.

Data from the NMFS winter, summer, and autumn trawl surveys show the coastal stock complex has grown rapidly since the mid 1980's (ranging from Cape Hatteras, North Carolina to New Brunswick, Canada). Total stock biomass at the beginning of 1997 was estimated to be about 2.9 million metric tons (mt). This increase is due largely to the recovery of the Georges Bank/Nantucket Shoals components of the stock complex, which supported a large foreign fishery during the 1960's and early 1970's, but collapsed in the mid-1970's as a result of over-exploitation. Since the 1980's the spring and autumn trawl surveys increased significantly, and although variable, has remained high since that time. The surveys indicate the relative abundance to be high.

The NMFS offshore hydroacoustic surveys have shown an increasing biomass from 1999-2001. The 2002 estimate is significantly lower than the previous three years because the survey encountered "spent" Atlantic herring, indicating that spawning occurred earlier than the previous years. In 2003 and 2004, herring were intermittently available during spawning surveys in September and October. Herring were in various stages of maturity. The time series of offshore hydroacoustic surveys from 1999-2004 cannot be utilized at this time to estimate biomass/abundance or evaluate recent trends.

In addition to the NMFS hydroacoustic surveys, there is also a complimentary inshore hydroacoustic survey conducted by Maine DMR and the Gulf of Maine Aquarium (now the Gulf of Maine Research Institute, GMRI). The inshore also indicated an increasing trend from 1999-2001, but experienced a drop in 2002. The timing of the spawning also impacted the 2002 biomass estimates for the inshore survey. The increasing biomass over the last several years is

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attributed to two large year classes, 1994 and 1998. The GMRI herring acoustic survey recently (March 2006) underwent an independent peer review and served as a formal assessment of the accuracy and precision of the survey to determine the viability of using the data in regional stock assessments.

Historical assessment information indicates that the Gulf of Maine stock was much smaller than the Georges Bank/Nantucket Shoals stock during the 1960's and 1970's. Analysis of NMFS fall trawl survey data gives some indication as to the relative size of each component. An examination of the fall trawl survey data by the 27th SAW (NEFSC 1998) resulted in estimates of minimum population size for each of the three areas for the time periods 1988-97 and 1993-97. Coastal Maine accounted for 27% of the population during 1988-97, and 26% in the more recent time period. Nantucket Shoals accounted for 63% of the population from 1988-97 and 57% during 1993-97. Georges Bank accounted for 10% of the biomass in 1988-97 and 17% in the recent period, a reflection of the increased amount of spawning on Georges Bank during the last five years. These data indicate that the Gulf of Maine spawning stock accounts for about 25% of the total spawning stock biomass and the Georges Bank-Nantucket Shoals stock for the remaining 75%. According to the 2006 TRAC assessment, the inshore component of the resource is estimated to represent 18% of the total stock biomass (range 10%-30%).

Overall, the Atlantic herring stock complex appears to have recovered to high levels and stabilized. The resource appears to have redistributed throughout much of its historical range and sampling suggests that the age structure of the stock has expanded, both of which are positive signs of a healthy, recovered stock.

The Atlantic herring stock is not overfished and overfishing is not occurring. Fishing mortality rates have remained well below F_{msy} (0.27) for over a decade with a high of 0.20 in 2001 and a low of 0.14 in 2008. Stock biomass (2+) increased steadily from about 105,000 mt in 1982 to 652,000 mt in 2008. Biomass increases in the late 1990s were due to improved recruitment, especially from two very large year classes, 1994 and 1998. Weights-at-age in the population declined in the late 1980s but have remained steady since 1995. Recruitment markedly improved in the late 1980s with several moderate year classes and three very large year classes (1994 cohort: 7.2 billion; 1998 cohort: 5.5 billion; and the 2002 cohort: 4.8 billion). Recruitment from the 1999-2000 and 2003 year classes all appear weaker than the long-term (1967-2005) average of 2.3 billion fish.

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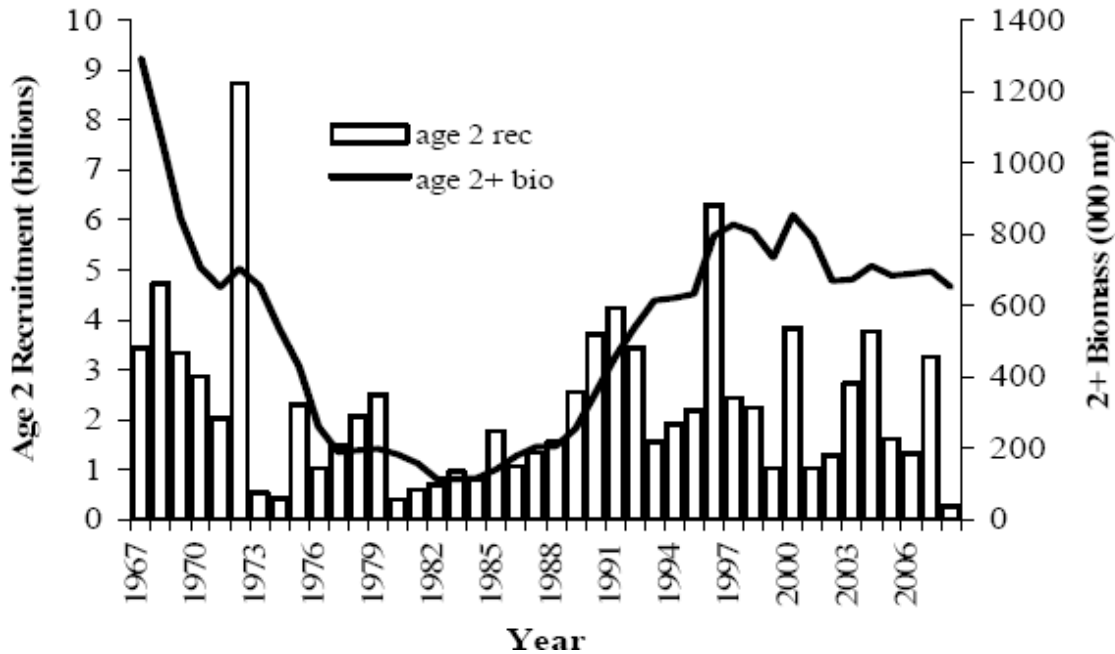


Figure 1. Age 2+ Biomass and Age 2 Abundance of the Atlantic Herring from 1965 to 2008. Source: TRAC 2009

III. Status of the Fishery

The following three paragraphs summarize the fishery prior to 2009. They are taken verbatim from the 2009 Transboundary Assessment Committee report summary.

Combined Canada/USA landings. Combined Canada/USA landings averaged 90,000 mt during 1978-1994 (Figure 1). Landings increased during 1995-2001, averaging 133,000 mt, and peaking at 145,000 mt in 2001. Landings declined slightly during 2002-2005, and averaged 109,000 mt. During 1978-2005, the USA accounted for about 76% of the total landings, but during the most recent decade, this percentage increased to about 85%.

Canadian landings. Landings by Canada averaged about 27,000 mt during 1978-1994, declined to an average of 19,000 mt during 1995-2001, and declined further to 14,000 mt during 2002-2005. Landing from 2006-2008 average 16,800 mt although landings in 2007 peaked at 31,000 mt. Canadian landing have been dominated by the New Brunswick weir fishery.

USA landings. Landings by the United States averaged about 62,300 mt during 1978-1994, increased to an average of 103,000 mt during 1995-2001, and declined to an average of 95,000 mt during 2002-2005. Landings since 2005 have averaged 89,000 mt. During 1978-1982, USA landings were about equally split between the weir fisheries and purse seines. During 1983-1992, most USA landings were taken by purse seines but subsequently single mid-water and paired mid-water trawling have dominated the landings, with purse seining accounting for only about 10-15% of the total USA landings during 2000-2005. Since 2005 purse seining has

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increased while pair and single midwater trawling has decreased with pair trawling accounting for 56%, single midwater trawling 12% and purse seine 26%.

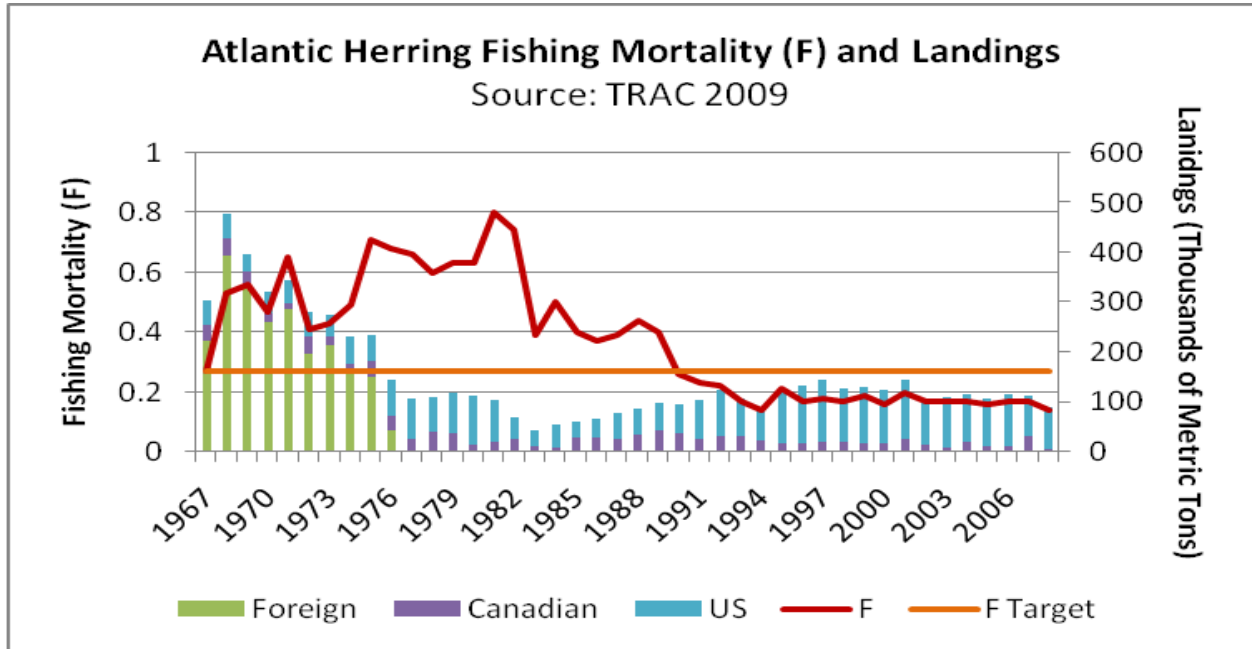


Figure 2. Fishing Mortality for the Atlantic Herring Stock Complex (1967-2008). $F_{target} = 0.27$

Table 1. Landings, 2+ biomass (thousands mt), Recruits (billions), F, and Exploitation Rate. Source: TRAC 2009.

Landings, 2+ Biomass (thousands mt); Recruits (millions)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avg ¹	Mm ¹	Max ¹
<i>Canada Landed</i>	18.6	17.1	24.8	13.4	9.0	20.6	12.6	12.9	30.9	6.4	23.1	6.4	44.1
<i>USA Landed</i>	110.6	108.8	120.0	93.2	100.8	94.4	93.3	103.1	81.7	83.6	80.6	33.2	123.6
<i>Total Landed</i>	129.1	125.9	144.8	106.6	109.8	115.0	105.9	116.0	112.6	90.0	103.7	44.6	144.8
<i>2+ Biomass</i>	735	854	790	670	674	711	684	690	697	652	529	112	1,294
<i>Age 2 Recruits</i>	1032	3828	1033	1275	2739	3775	1616	1318	3252	265	2268	265	8758
<i>Fishing Mortality</i>	0.19	0.16	0.20	0.17	0.17	0.17	0.16	0.17	0.17	0.14	0.37	0.14	0.80
<i>Exploitation Rate</i>	0.16	0.13	0.16	0.14	0.14	0.14	0.13	0.14	0.14	0.12	0.28	0.12	0.50

¹ 1978-2008 for landings (thousands mt)

1967-2008 for 2+ biomass (thousands mt), recruitment (millions) and F(2+)

The majority of harvest in 2007 was taken by commercial fishermen. Commercial landings totaled 72,961 mt in 2008 while recreational harvest (A + B1) accounted for only 40 metric tons in 2007¹.

¹ Recreational landings were not listed on the MRFSS website due to high PSE's of the data. The 2007 recreational landings are from a query done for the 2007 FMP Review.

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Maine (38.1%) and Massachusetts (54.6%) accounted for approximately 92% of commercial landings in 2008. Rhode Island and New Jersey landed 2.6% and 3.8% respectively and all other states landed less than 1%.

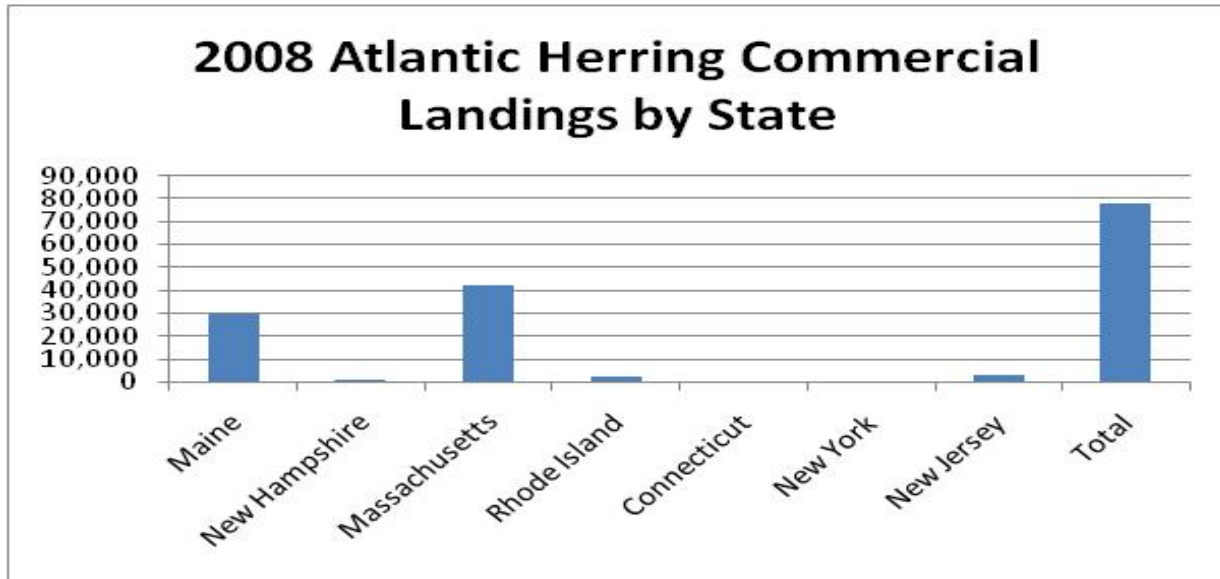


Figure 2. 2008 herring landings by state. Source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD.

IV. Status of Assessment Advice

In February 2003, two stock assessments for the Atlantic herring complex were presented at the Transboundary Resource Assessment Committee (TRAC) meeting in St. Andrews, New Brunswick. The TRAC provides a forum for U.S and Canadian scientists to jointly peer review the results and interpretations of conclusions from new and revised assessment methodologies for the Atlantic herring complex. The TRAC reviewed two approaches to assess the stock status, a virtual populations analysis (used in previous herring assessments) and a forward projection model (FPM). The two models produced different estimates of current stock biomass, in part because of disparate model assumptions, uncertainties in input data sets, and weightings given to different data sets. While it was determined that the stock complex is not overfished and overfishing is not occurring (Figure 2), the TRAC could not reach consensus on the most appropriate model to assess this transboundary resource.

In attempt to gain some resolution on these discrepancies, the NEFMC referred the issue to its Scientific and Statistical Committee (SSC) for guidance on how to proceed with the development of the amendment. The SSC determined the current estimate of maximum sustainable yield in both the Commission and Council Herring FMPs (317,000 mt) to be too high and unlikely to be sustainable given historical landings and stock status data. The Committee advised the Council to exercise caution when setting the annual total allowable catch (TAC), specifically giving

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consideration to the risk to individual stock components when setting area-specific TACs. The SSC provided some guidance on resolving the discrepancies between the two assessments prior to the next peer review, discussed below.

Most recently, the Transboundary Resources Assessment Committee met in 2009. The Gulf of Maine/Georges Bank Atlantic herring stock assessment previously conducted in 2006 was updated through 2008. A forward projecting age structured model was used to estimate abundance, spawning biomass, total age 2+ biomass and fishing mortality. A revised landings at age time series and updated survey indices at age (NMFS spring and autumn survey indices) were employed in a similar model formulation as accepted at the 2006 benchmark assessment. Findings of the 2009 TRAC are:

- Combined Canada and USA herring landings increased from 106,000 mt in 2005 to 116,000 mt in 2006, then declined to 90,000 mt in 2008.
- Stock biomass (2+, January 1) increased steadily from about 111,600 mt in 1982 to almost 830,000 mt in 1997, fluctuated without trend since then, and was estimated to be 652,000 mt at the beginning of 2008. This is below B_{msy} (670,600 mt).
- Recruitment at Age 2 from the 2004 and 2006 year classes appear weaker than the long-term (1967-2005) average of 2.3 billion fish. The 2005 year class abundance estimate is above average abundance at 3.3 billion fish.
- Fishing mortality (Age 2+) declined to 0.14 in 1993 and has remained stable at about 0.16 from 2002 onwards (Figure 1). Estimated fishing mortality in 2008 was 0.14. This is below F_{msy} (0.27)
-

V. Status of Research and Monitoring

Under Amendment 1, states are not required to conduct fishery independent surveys for Atlantic herring.

VI. Management Measures and Issues

Section 5.1.1.1 of Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sea Herring list state regulatory requirements as

1. Each jurisdiction must enact spawning area restrictions that are at least as restrictive or more than those in Section 4.2.1.
2. Each jurisdiction shall prohibit the landing of herring from a management area or subarea when the TAC has been attained in that area or sub-area (*Section 4.2.8.2*);
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 4.2.8.2*);

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4. Each jurisdiction shall prohibit the landing of herring to an Internal Waters Processing (IWP) operation, which were harvested from an area or sub-area closed to directed herring fishing (*Section 4.2.15*);
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 4.2.15*); 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. Each state's required Atlantic herring regulations and management program must be approved by the Section. States may not implement any regulatory changes concerning Atlantic herring, nor any management program changes that affect their responsibilities under this Amendment, without first having those changes approved by the Section.

VII. State Compliance

Table 2 State Compliance Matrix

✓ refers to whether the report addressed the compliance requirements listed in Section VI.

dm the state of New York requests *de minimis* status.

dna (does not apply) refers to restrictions that would not apply to a state.

Report Content^a	ME	NH	MA	RI	CT	NY	NJ
1	✓	✓	✓	✓	<i>dna</i>	<i>dm</i>	✓
2	✓	✓	✓	✓	✓	<i>dm</i>	✓
3	✓	✓	✓	✓	✓	<i>dm</i>	✓
4	✓	✓	✓	✓	✓	<i>dm</i>	✓
5	✓	✓	✓	✓	<i>dna</i>	<i>dm</i>	✓
6	✓	<i>dna</i>	<i>dna</i>	✓	<i>dna</i>	<i>dm</i>	✓

All states who submitted reports met all compliance requirements for 2008.

De minimis

Amendment 1 to the FMP allows states to 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. New York has requested and met the requirements for *de minimis* status.

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VIII. PRT Recommendations

The Plan Review Team recommends the following:

1. All states who submitted reports meet or exceed the regulatory measures in the FMP.

IX. Law Enforcement Report

During 2008, Atlantic Herring enforcement efforts were adequate and the plan was enforceable as written. Maine has the bulk of the fishery and has ongoing major gear conflict between lobster fisherman and mid-water trawl boats. Maine also states that late reporting has been a problem. All other states report similar gear conflict problems when mid-water trawling occurs in the area of lobstering.

It is important that regulations on herring be enforceable at dockside eliminating the need for time consuming at sea enforcement. There are potential jurisdictional problems with Federal water enforcement of the Atlantic herring plan. Currently the law enforcement committee is assessing the enforceability of regulations that may need to be enforced in Federal waters. This at sea enforcement in an area of Federal waters presents several challenges to individual states even with the provisions of Magnuson allowing for limited enforcement of certain regulations at sea. The LEC is also looking at how large trip limits are monitored to ensure that quotas are not being exceeded. Monitoring large volume trips is difficult with existing resources.

X. Future Compliance Issues

None.

XI. Research and Monitoring Recommendations

High Priority

- 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.
- 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.
- 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.
- Study the ecological role of Atlantic herring (predator/prey relationships) throughout the management range (Gulf of Maine and George's Bank). Re-evaluate Atlantic herring natural mortality by age and the response to changing predator population sizes through an ecosystem based assessment.

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- Continue commercial catch sampling of Atlantic herring fishery to ACCSP/ME DMR protocols.
- Organize annual US-Canada workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.
- Examine the root causes of the discrepancy between Forward Projection and ADAPT assessments.
- Investigate bycatch and discards in the directed herring fishery.

Medium Priority

- Conduct an otolith methods workshop to address aging differences between DFO, NMFS and ME DMR readers after age 5.
- Investigate possible density-dependence reduced growth rates affecting both the entire complex and inshore subcomponent.
- Investigate/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.
- Reevaluate the stock component makeup of the Coastal Stock Complex regarding the influences of the Canadian herring population that is persecuted by the New Brunswick fixed gear fishery and the Southwest Nova Scotia 4wx stock component.

Low Priority

- Develop socio-economic analyses appropriate to the determination of optimum yield.
- Consider potential discards if fishing mortality increases in the future.
- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry.