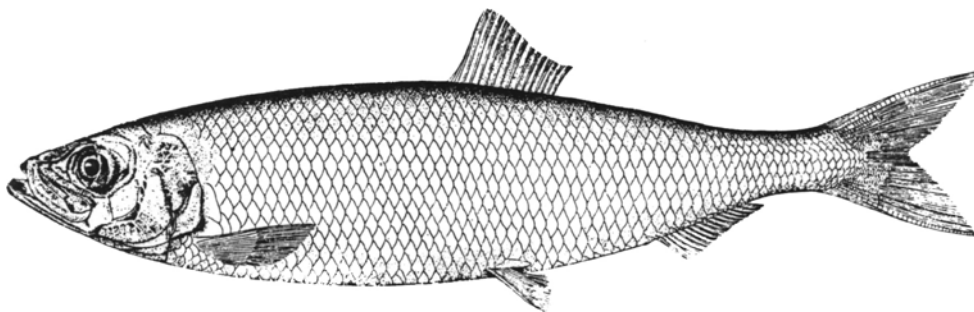


**2005 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR
ATLANTIC SEA HERRING
(*Clupea harengus harengus*)**



Prepared by

The Atlantic Sea Herring Plan Review Team

Ruth Christiansen, Chair, Atlantic States Marine Fisheries Commission
David Libby, Maine Department of Marine Resources
Clare McBane, New Hampshire Fish & Game
William Overholtz, Ph.D. National Marine Fisheries Service

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**2005 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR
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I. Status of Fishery Management Plan

<u>Date of FMP Approval:</u>	November 1993
<u>Amendments:</u>	Amendment I (February 1999) Amendment II (March 2006)
<u>Addenda:</u>	Addendum I (July 2000) Technical Addendum #1a (October 2001) Addendum II (February 2002)
<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 I to the Atlantic Herring Fishery Management Plan (FMP) was approved in 1999 and established 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. Effort controls include specific days out of the fishery to slow catch rates and extend the fishing season.

Amendment I 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 I 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. 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) Canada; state and

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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 I. 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.

In July 2003, the Section initiated the development of Amendment 2 to the Interstate Fishery Management Plan in response to the 2003 TRAC and to maintain complementary management programs in state and federal waters. Amendment II redefines the management areas and addresses maximum sustainable yield, the distribution of the area TACs, spawning area restrictions, internal waters processing, effort controls, and several other complementary issues included in the New England Council's Amendment I. Amendment II will be implemented at the start of the 2007 fishing year.

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

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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 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.

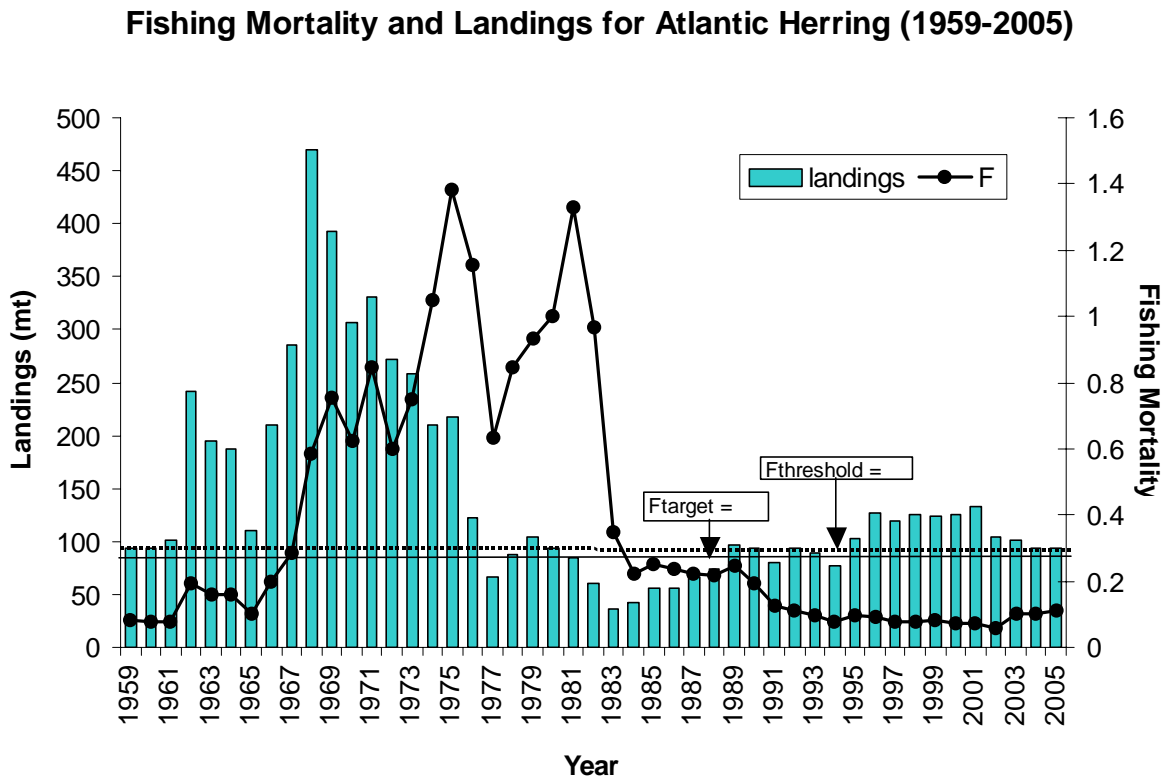
Historical assessment information indicates that the Gulf of Maine stock was much smaller than the Georges Bank/Nantucket Shoals stock during the 1960's and 1970's. Analysis of NMFS fall trawl survey data gives some indication as to the relative size of each component. An examination of the fall trawl 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. Figure 1 shows fishing mortality v. landings from 1959 to 2005. Fishing mortality rates have remained steady at approximately $F=0.11$ since 2002. Figure 2 shows age 2+ biomass from 1965 to 2002. Stock biomass (2+) increased steadily from about 105,000 mt in 1982 to nearly 1.3 and was estimated to be 1.0 million mt at the beginning of 2005. Biomass increases in the late 1990s were due to improved recruitment, especially from two very large year classes, 1994 and 1998 (Figure 2). Weights-at-age in the population declined in the late 1980s but have remained steady since 1995.

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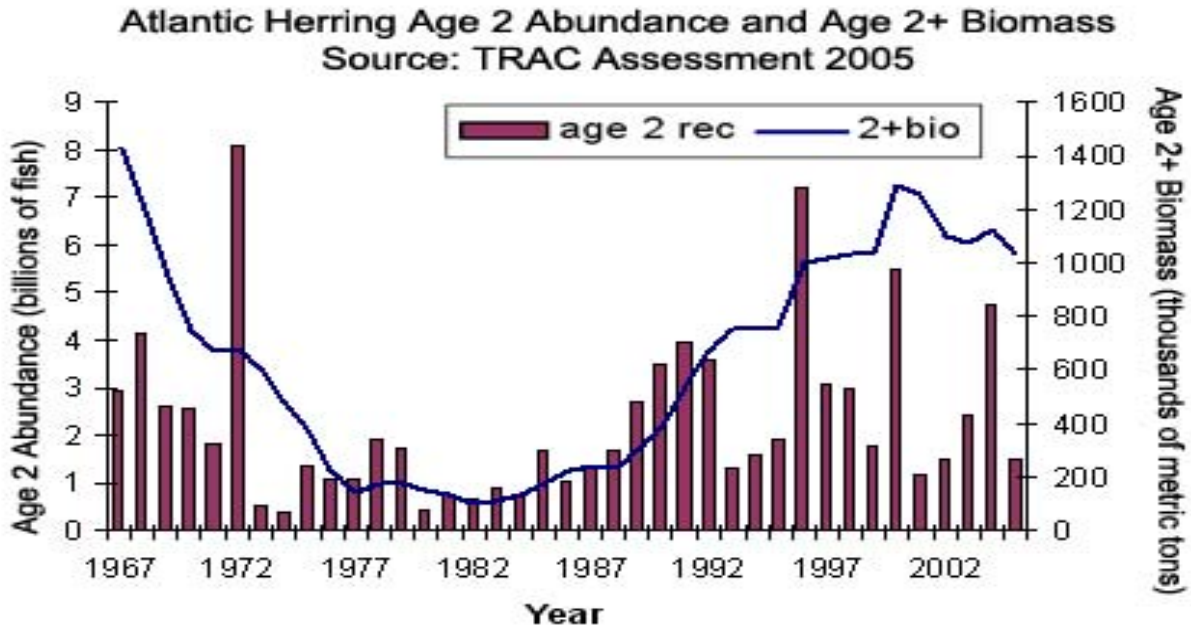
Recruitment (at age 2) markedly improved in the late 1980s with several moderate year classes and three very large year classes (1994 cohort: 7.2 billion; 1998 cohort: 5.5 billion; and the 2002 cohort: 4.8 billion). Recruitment from the 1999-2000 and 2003 year classes all appear weaker than the long-term (1967-2005) average of 2.3 billion fish.

Figure 1. Fishing Mortality and Landings for the Atlantic Herring Stock Complex (1959-2005).



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Figure 2. Age 2+ Biomass and Age 2 Abundance of the Atlantic Herring from 1965 to 2005.



III. Status of the Fishery

The preliminary catch data reports 96,915 metric tons (mt) of Atlantic herring caught during the 2005 fishing year (Table 1). This amount is about is slightly greater than the previous year, but less than the 2003 fishing year. Management Area 1A accounted for approximately 64% (61,570 mt) of the overall landings.

The predominant gear types in the Atlantic herring fishery are purse seines and mid-water trawls (mobile gear) and to a much lesser extent stop seines and weirs (fixed gear). Both types of mid-water trawler gear (single and pair) accounted for the bulk of the catches at 64% (Figure 3). Of the states, Massachusetts had the highest landings (55%), followed by Maine (44%) (Figure 4).

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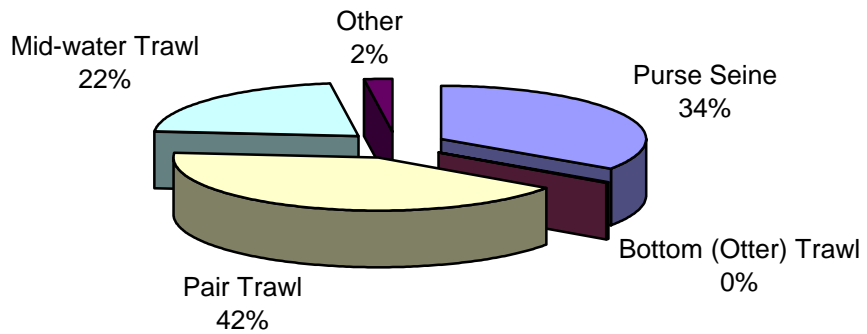
Table 1. Atlantic Herring Catch (mt) by Management Area and Month, 1999 – 2005

1999	Month												
MGMT AREA	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1A	805	120	93	3,945	4,995	8,432	13,371	11,731	10,759	6,057	9,863	5,414	75,585
1B	311		41		181	57		35	113	731	106	57	1,632
2X	7,335	9,488	4,504	559	15	8	79	158	0	1	4	560	22,712
3X		143	272	1,007	160	1,460	289	96	1,297	994			5,718
TOTAL	8,451	9,751	4,910	5,512	5,352	9,956	13,738	12,020	12,169	7,783	9,973	6,031	105,647
2000													
MGMT AREA	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1A	3	99	76	1,525	7,398	9,946	14,997	12,259	4,777	9,081	631		60,793
1B		0	127	82	128	234	489	73	209	0	6,126		7,468
2X	9,340	9,838	2,358	203	19	0	0	2	23	2	860	4,552	27,198
3X	54		537	87	38		743	3,006	6,686	2,048		0	13,199
TOTAL	9,397	9,937	3,098	1,896	7,582	10,181	16,230	15,341	11,694	11,132	7,617	4,552	108,658
2001													
MGMT AREA	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1A	3	1,767	1,273	2,814	6,526	8,701	7,884	7,254	5,046	9,741	2,662	57	53,728
1B	18	1	68	45	195	110		1,302	2,192	237	6,198	6,336	16,704
2X	9,129	4,376	447	869	56	100	55	2	96	3	64	623	15,821
3X						755	7,675	7,807	12,146	6,328	314	53	35,079
TOTAL	9,150	6,144	1,788	3,728	6,778	9,666	15,615	16,366	19,480	16,310	9,237	7,069	121,332
2002													
MGMT AREA	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1A	1,653	1,223	933	3,087	249	9,755	13,269	7,453	7,801	5,897	8,621	103	60,044
1B	1,701	753	355	126	1,062	412	665	159	293	31	14	1,766	7,335
2X	5,232	4,237	593	79	187	0	1	1	138	1	125	445	11,038
3X	589	0		43	805	792	3,211	2,041	3,953	2,739	4		14,177
TOTAL	9,175	6,212	1,881	3,335	2,302	10,959	17,146	9,653	12,185	8,668	8,764	2,314	92,594
2003													
MGMT AREA	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1A	185	11	14	260	4,151	8,998	6,581	11,714	12,559	7,653	7,326		59,451
1B	0			122	9	194	689	178	71	1	540	3,113	4,918
2X	4,647	3,083	1,901	377	353	0	1	2	419	37	277	4,939	16,036
3X			12	149	122	673	9,977	3,967	1,719	3,592	13	2	20,227
TOTAL	4,855	3,112	1,928	909	4,636	9,865	17,248	15,862	14,768	11,283	8,157	8,055	100,676
2004													

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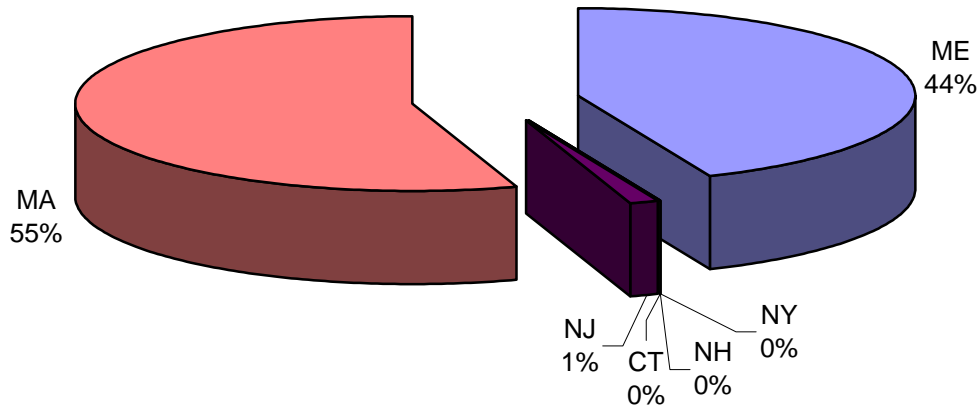
MGMT AREA	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
TOTAL													93,722
2005													
MGMT AREA	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1A													61,570
1B													7,873
2X													14,423
3X													13,029
TOTAL													96,915

Figure 3. 2005 Landings of Atlantic Herring by Gear Type



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Figure 4. Percentage of 2005 Herring Landings by State



Note: Figure 4 represents where the herring are landed, not necessarily where they are caught.

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 and 3), 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 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.

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Most recently, the Transboundary Resources Assessment Committee met in May 2006 at the Northeast Fisheries Science Center in Woods Hole, Massachusetts. The purpose of this meeting was to review and incorporate any new information from survey indices and the fisheries, revisit the model formulation issues and recommend a suitable approach upon which to base management advice for Atlantic herring. The major findings from this benchmark stock assessment were:

- Combined Canada and USA herring landings increased from 106,000 mt in 2002 to 110,000 mt in 2003, increased further to 115,000 mt in 2004, and declined to 105,000 mt in 2005.
- Stock biomass (2+) increased from about 105,000 mt in 1982 to about 1.3 million mt in 2000. Subsequently, biomass has declined slightly and was 1.0 million mt in 2005.
- Recruitment at age 2 increased in the late 1980s with several moderate year classes. In the past decade, three very large year classes have been produced (the 1994, 1998, and 2002 cohorts).
- Fishing mortality (age 2+) declined from peak values above 0.70 in the 1970s to an average of 0.30 during the mid-late 1980s. Fishing mortality declined to 0.15 in 1991 and has remained at about 0.1 since 2002.
- Assuming that fishing mortality in 2006 is equal to that in 2005 ($F=0.11$) produces a catch in 2006 of 105,000 mt (the same catch as in 2005). The resulting SSB in 2007 would be 952,000 mt, a decline of about 6%. Assuming average recruitment in 2006 through 2008, continuing to fish at $F=0.11$ in 2007 would generate a catch in 2007 of 99,000 mt and SSB in 2008 would be 901,000 mt.
- The relative proportion of the inshore component of the overall herring stock complex was 18% based on the average proportion from three different data sources (commercial acoustic survey biomass estimates; morphometric studies; and NEFSC autumn survey swept biomass estimates).

V. Status of Research and Monitoring

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

VI. Status of Management Measures and Issues

Spawning Closures

The state of Maine prohibited landings and transfers at sea from the Eastern Maine Spawning Area to protect spawning herring in stages V or VI from September 1st to September 29th, 2003. During the closure, there was a tolerance for 20% (by number) of the catch to be spawn herring, which was monitored by taking commercial fishery samples and identifying the spawning stage. The same regulations were implemented for the Western Maine Spawning Area during September 1st through September 29th, 2003. In Maine, New Hampshire, and Massachusetts, landings and transfers at sea were prohibited from the New Hampshire/Massachusetts Spawning Area between September 21st and October 19th, 2003. Maine and Massachusetts allow 20% of the catch to be spawn herring, whereas New Hampshire has a no tolerance provision. In

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previous years, the Law Enforcement Committee's Report indicated enforcement difficulty determining the gonad stages that may be landed under the spawning tolerance provision.

The Atlantic Herring Section approved Amendment II to the Interstate Fishery Management Plan for Atlantic Herring in January 2006. One of the major issues addressed by Amendment II regards spawning restrictions in the Atlantic herring fishery. Based on discussions between affected states, it became evident that the original language did not clearly reflect the decision made by the Section in January 2006. Contention focused on use of the word 'spawn' in the provision; some states interpreted this language to mean vessels could be in closure areas during restricted times as long as they were directing their fishing efforts on herring not in ICNAF gonadal stages V and VI. The Section met in May 2006 and agreed that the language in the Amendment needed to be corrected through a Technical Addendum.

For the 2006 fishing year, default spawning closure areas and dates as outlined in Amendment 1 to the Interstate FMP for Atlantic Herring will remain in effect.

Internal Water Processing

Amendment II to the Interstate FMP for Atlantic Herring prohibits Internal Water Processing Operations from processing herring caught in all state waters.

Cooperative Management

As a transboundary stock, both the U.S. and Canada should develop complementary management objectives for Atlantic herring. In addition, assessment biologists from both countries should continue to work together to provide the best scientific advice for the entire resource.

Days Out of the Fishery: Controlling Effort

Under Amendments I and II, effort controls are used to prevent the early closure of any management area. Landing restrictions have been used in Area 1 because the TAC has been harvested before the peak market demand abates in the autumn. The states, in the affected management area, determine when to start the landing restriction based on the catch rates in the first several months of the 2005 fishing year compared to previous years, as well as based on industry input. Maine, New Hampshire, and Massachusetts began the Area 1A days out provision on April 1st, 2003 with the landing prohibition in place every Saturday and Sunday until the end of the calendar year or until the Area 1A TAC was harvested, whichever came first. Maine implemented a landing restriction from 6 pm Friday to 6 pm Sunday. New Hampshire's and Massachusetts implemented a landing restriction beginning at 12:01 am Saturday and ending at midnight on Sunday. The states implemented different start times to account for different industry needs (i.e., travel time from the fishing grounds).

In 2003, Maine allowed vessels to offload herring caught prior to the start of the two-day landing restriction. Vessels fished on Friday, docked before 6 pm, and unloaded the catch after 6 pm. Landings were highest on the day the landing restriction went into effect because offloading was allowed. The increased landings indicates an increase in effort right before the landings restriction begins, which may invalidate the benefit of implementing an effort control measure.

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Additionally, offloading creates an advantage for larger vessels with refrigerated seawater (RSW) systems.

For the last two years, the Law Enforcement Report has indicated a problem with the interpretation of a "landing" prohibition. It is unclear if the regulations allow for unloading during a landing restriction and if it requires the boats to be specifically tied to the dock as opposed to a mooring in the harbor.

Law Enforcement Report

The Law Enforcement Committee noted general concern for adequate monitoring of bycatch mortality in the herring fisheries. The law enforcement report highlighted concern for the mortality of groundfish, dogfish, and marine mammals caught as bycatch in the herring fishery in the state of Maine.

VII. Annual State Compliance Reports

Atlantic herring compliance report checklist – Reports for 2005

✓ refers to whether the report addressed the four compliance requirements listed below

Report Content^a	ME	NH	MA	RI	CT	NY*	NJ
Date Rec'd	2/8/2006	1/24/2006	4/11/2006	4/10/2006	2/9/2006	2/15/2006	2/7/2006
1	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓	✓

*The state of New York maintains *de minimis* status.

^a Refers to *Section 5.1.3* of Atlantic Herring Amendment 1 as follows:

Reports on compliance should be submitted to the Commission by each jurisdiction annually, no later than February 1st each year. Each state must submit an annual report concerning its Atlantic herring fisheries and management program for the previous year. The compliance report shall cover (*Section 5.1.3*):

1. The previous calendar year’s fishery and management program including activity and results of monitoring, regulations that were in effect and harvest, including estimates of non-harvest losses;
2. The planned management program for the current calendar year summarizing regulations that will be in effect and monitoring programs that will be performed, highlighting any changes from the previous year;
3. A description of the operation and amount of fish mealed in conjunction with herring processing activities conducted in each jurisdiction; and
4. The amount of herring harvested by fixed gear fisheries operating in state waters.

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VIII. Recommendations of FMP Review Team

1. All of the states with a declared interest in the management of Atlantic herring have regulations in place that are in compliance with Amendment I, and subsequent addenda, to the Interstate Management Plan for Atlantic herring.
2. The PRT recommends no offloading during the days out landing prohibition because it increased the landings on Fridays, may have increased effort, creates an advantage for larger vessels with refrigerated seawater systems, and created enforcement difficulties.

Research and Monitoring Recommendations¹

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.
- 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.
- 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.
- Continue commercial catch sampling of Atlantic herring fishery (risk of becoming unfunded after the 2004-2005 season) according 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.

¹ The list of research and monitoring recommendations has been maintained from the May 2004 Atlantic Herring FMP review. .

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- Investigate possible density-dependence reduced growth rates affecting both the entire complex and inshore subcomponent.

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.