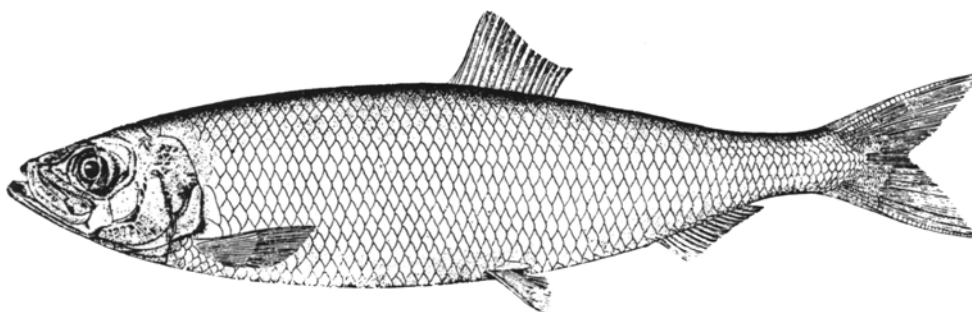


**2003 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR  
ATLANTIC SEA HERRING  
(*Clupea harengus harengus*)**



Prepared by:

**The Atlantic Sea Herring Plan Review Team:**

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*May 2004*

**2004 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 I (February 1999)
<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 1 to the Atlantic Herring Fishery Management Plan (FMP) was approved in 1998 and established three management goals and eleven management objectives for the U.S. Atlantic herring (*Clupea h. harengus*) resource. Amendment 1 was 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. The TACs were 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 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. 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 federal spawning closures/restrictions; and recommend measures intended to prevent damage to herring spawning habitat and egg beds.

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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 1<sup>st</sup>. 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 outline 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 1 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.

### **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-70'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. The 2003 hydroacoustic survey was not yet available when this report was produced. There is also a complimentary inshore hydroacoustic survey conducted by Maine DMR and the Gulf of Maine Aquarium. 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

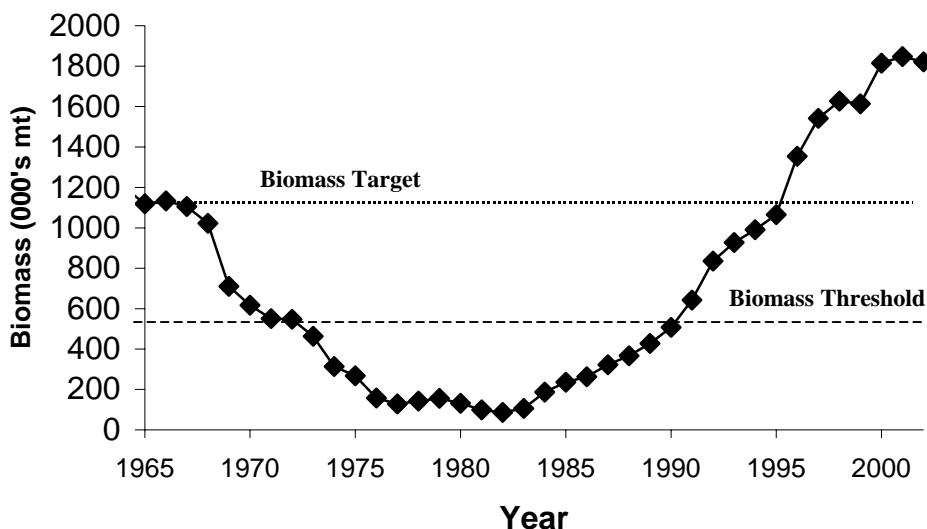
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to two large year classes, 1994 and 1998. The 2003 inshore hydroacoustic data was unavailable due to questions surrounding survey timing, coverage, and methodology. After a peer review of the survey occurs, scheduled for 2005, this hydroacoustic survey may be used as an index for the inshore spawning component.

There is limited information currently on the relative size of the two principal spawning stocks that make up the stock complex. Historical assessment information indicates, however, that the Gulf of Maine stock was much smaller than the Georges Bank/Nantucket Shoals stock during the 1960's and 1970's. With the recovery of the Georges Bank/Nantucket stock in recent years, the same situation may prevail today. 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 27<sup>th</sup> 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%.

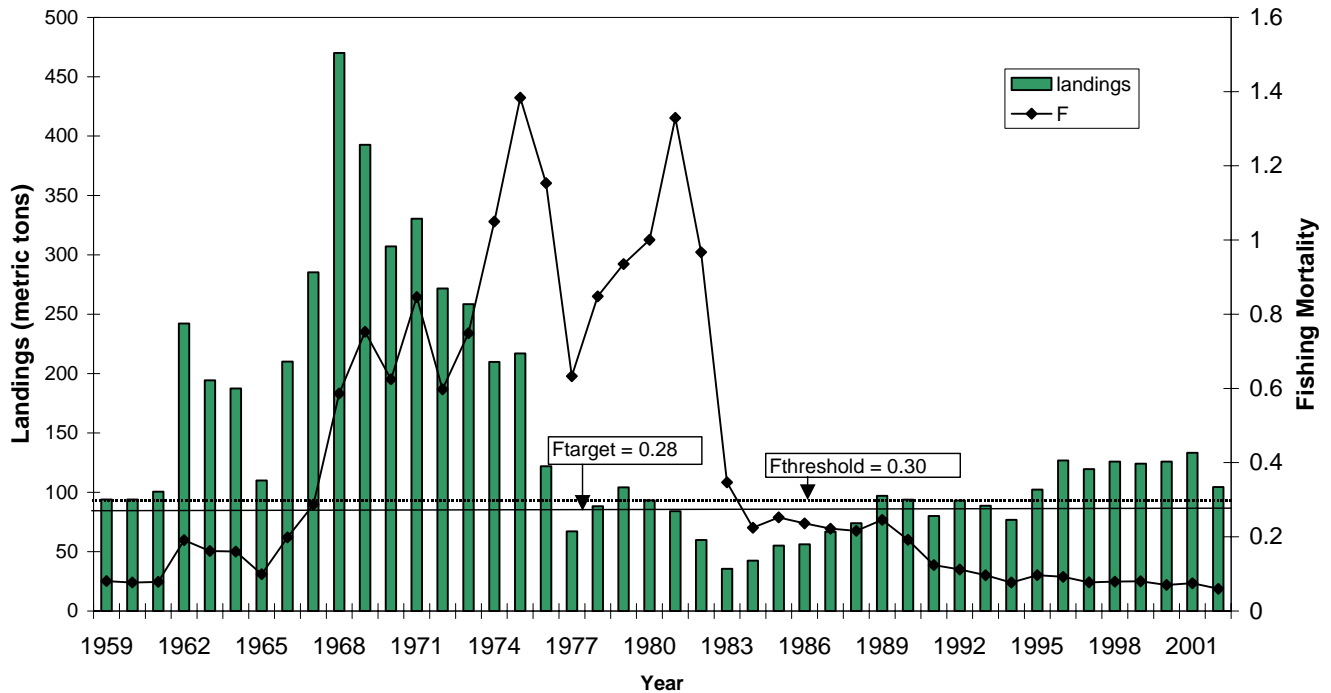
Currently, the stock complex biomass is stable and increasing over time. It may increase in size even further in the near future under current exploitation and recruitment patterns. Figures 1 and 2 show total biomass from 1965 to 2002 and fishing mortality v. landings from 1959 to 2002. Currently, there are not estimates of biomass or fishing mortality in 2003. These estimates will be updated in the next peer reviewed stock assessment.

**Figure 1. Total Biomass of the Atlantic Herring Complex from 1965 to 2002. Amendment 1 Biomass Target =  $B_{MSY}$  or 1.1 million mt; Biomass Threshold =  $\frac{1}{2} B_{MSY}$  or ~ 500,000 mt. Biomass estimates are based on outputs from the FPM model.**



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**Figure 2. Fishing Mortality and Landings for the Atlantic Herring Stock Complex (1959-2002).**



**III. Status of the Fishery**

The preliminary catch data reports 100,676 metric tons (mt) of Atlantic herring caught during the 2003 fishing year (Table 1). This amount is about 8,082 mt greater than the previous year. Management Area 1A accounted for approximately 59% (59,451 mt) of the overall landings, which is about the same as previous years. Compared to 2002, the 2003 Area 2 and 3 landings increased from about 11,000 mt to 16,000 mt and 14,000 mt to 20,000 mt, respectively. Landings from Area 1B are about 2,600 mt less than in 2002.

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). Within Management Area 1A, purse seines accounted for approximately 30% of the catches, but only accounted for 18% of the catches for the entire stock complex (Figures 3 and 4). Both types of mid-water trawler gear (single and pair) accounted for the bulk of the catches in Area 1A (70%) and total complex (81%). Of the states, Maine had the highest landings (47%), followed by Massachusetts (38%), Rhode Island (7%), and New Hampshire (8%) (Figure 5). Massachusetts landed a greater percentage of the total catch in 2003, about 10% more compared to 2002.

Under a provision of the Magnuson Fishery Conservation and Management Act, the sale of Atlantic herring to foreign processing ships operating in state internal waters have been conducted through the issuance of Internal Waters Processing (IWP) permits. These IWP sales continue to provide an alternative market opportunity for U.S. fishermen. While Amendment I

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**Table 1. Atlantic Herring Catch (mt) by Management Area and Month, 1999 – 2003\***

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

\*2003 data are preliminary.

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Figure 4. 2003 Landings of Atlantic Herring by Gear Type

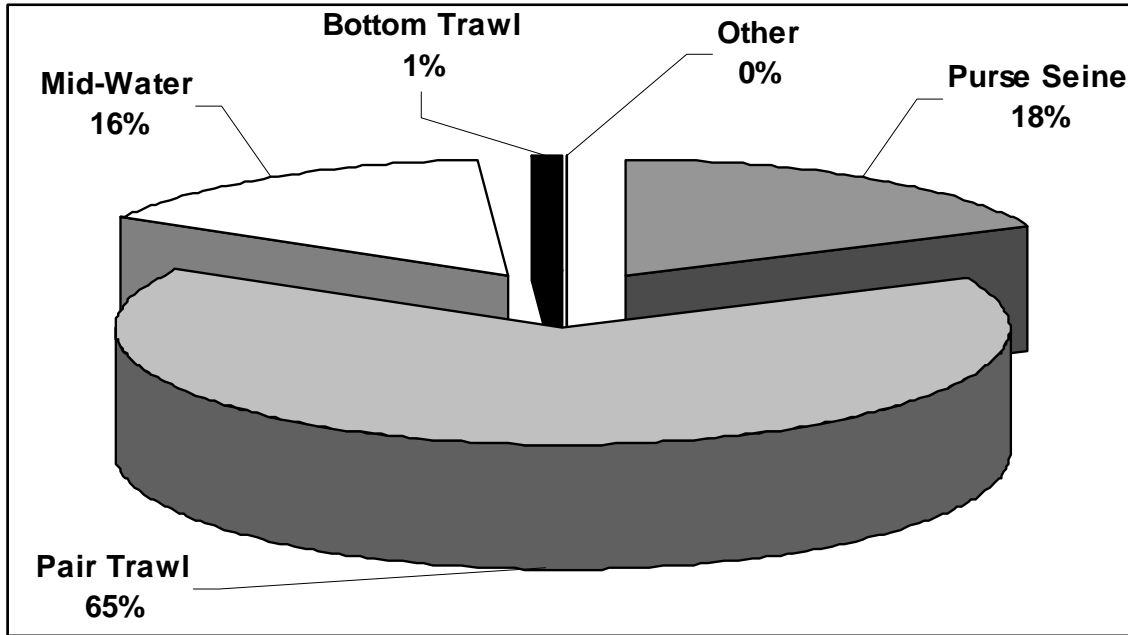
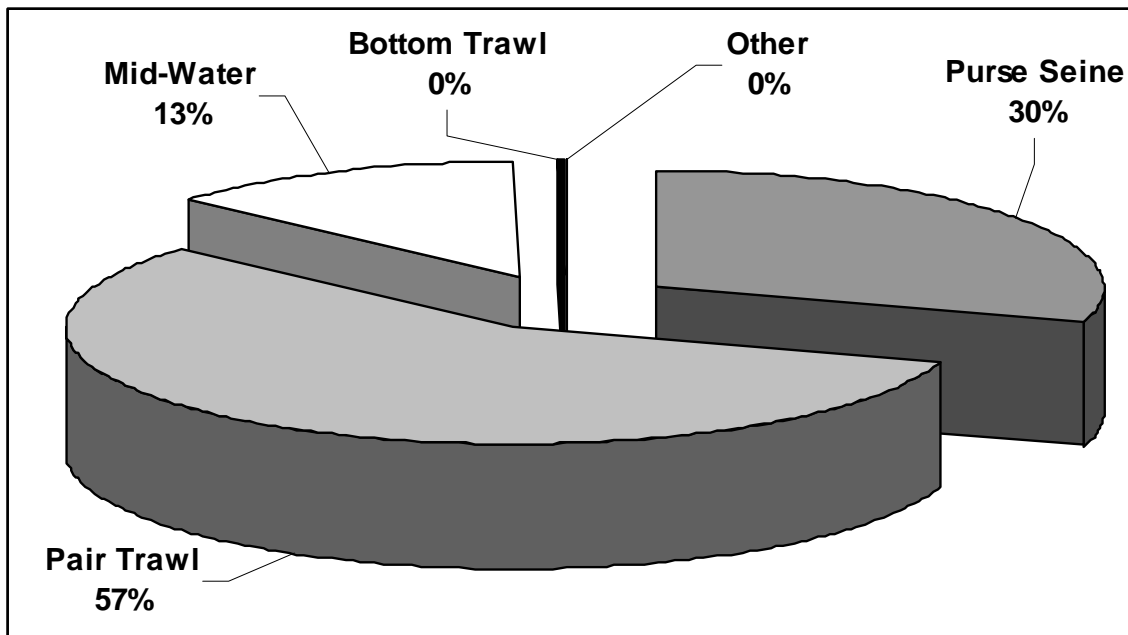
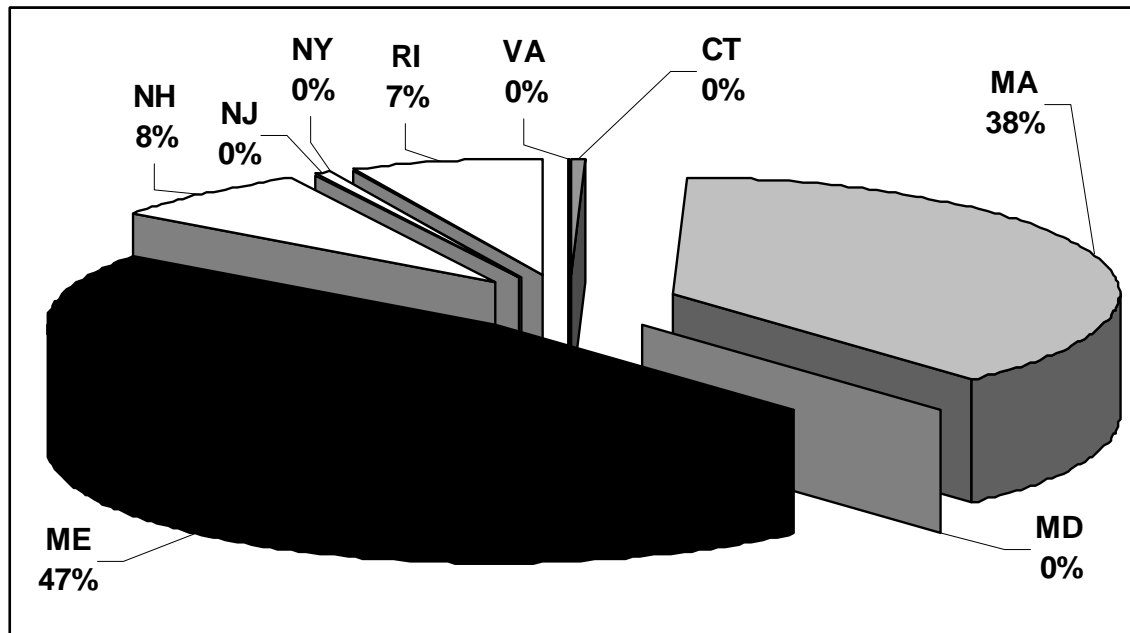


Figure 5. 2003 Landings of Atlantic Herring by Gear in Management Area 1A



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**Figure 6. Percentage of 2003 Herring Landings by State**



*Note: Figure 3 represents where the herring are landed, not necessarily where they are caught.*

and the subsequent addenda do not limit the allocation of IWP quota to specific areas, the Section has generally restricted the operation to Areas 2 and 3. The Section agreed to limit the harvest of IWP quota to these areas to compliment the federal regulations and prevent further competition in Area 1. In 2003, the Section could have allocated up to 10,000 mt to IWP operations. Rhode Island received an allocation of 5,000 mt for the 2003 fishing year, all of which was restricted to Areas 2 and 3. The state of Rhode Island reports 181.5 mt of Atlantic herring caught by one IWP operation. For the current fishing year (2004), the Commission's Atlantic Herring Section did not allocate any of the 10,000 mt IWP quota, denying Rhode Island's request for 5,000 mt.

#### **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.



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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, which will occur no earlier than 2006.

### **V. Status of Research and Monitoring**

Under Amendment I, 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 1<sup>st</sup> to September 29<sup>th</sup>, 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 1<sup>st</sup> through September 29<sup>th</sup>, 2003. In Maine, New Hampshire, and Massachusetts, landings and transfers at sea were prohibited from the New Hampshire/Massachusetts Spawning Area between September 21<sup>st</sup> and October 19<sup>th</sup>, 2003. Maine and Massachusetts allow 20% of the catch to be spawn herring, whereas New Hampshire has a no tolerance provision. In previous years, the Law Enforcement Committee's Report indicated enforcement difficulty determining the gonad stages that may be landed under the spawning tolerance provision.

#### ***Internal Water Processing***

Addendum II outlines the procedures and process to apply for an allocation of the annual IWP quota. In the addendum, requests from the herring industry must be submitted to the state by May 1<sup>st</sup> and the states must submit the application to ASMFC by May 15<sup>th</sup>. The purpose of these deadlines is to allow the Section to consider the IWP demand when setting the annual specifications for the upcoming fishing year. The Section first considered the allocation of the 2004 IWP quota during the May 2003 meeting and again in the summer of 2003. The Section confirmed it would not allocate the 2004 IWP quota due to the increasing capacity of domestic shoreside plants to process herring and competition with domestic products in the market place. The Commission has received one application of 5,000 metric tons for the 2005 IWP quota. With most of the herring caught in US waters processed by the US domestic shoreside processing plants, the Commission is considering the practicality of allocating an IWP quota in the development of Amendment 2, but acknowledges there is a bycatch of herring from vessels directing their effort on mackerel. These herring are often delivered to the IWP operation in Rhode Island.

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### ***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 Amendment I, 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 2003 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 1<sup>st</sup>, 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). On November 19<sup>th</sup> 2003, ASMFC and NMFS closed the directed fishery in Area 1A.

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 (Figure 6). 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. Additionally, offloading creates an advantage for larger vessels with refrigerated seawater (RSW) systems.

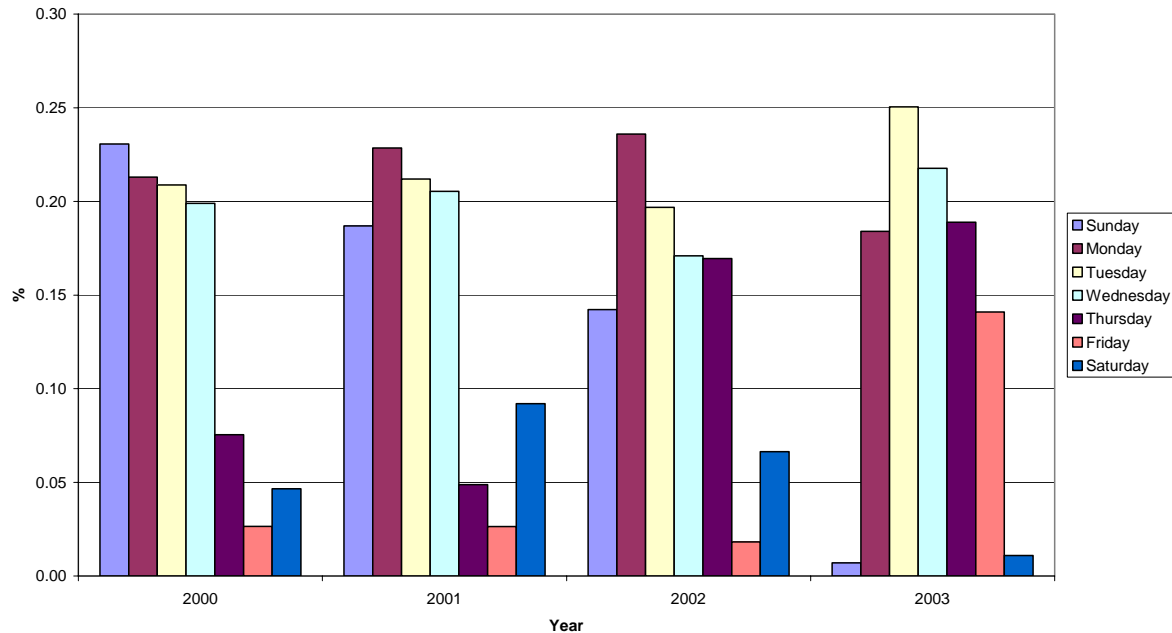
For the last two years, the Law Enforcement Report has indicated a problem with the interpretation of a "landing" prohibition. It is unclear if the regulations allow for unloading during a landing restriction and if it requires the boats to be specifically tied to the dock as opposed to a mooring in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

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**Figure 6. Percentage of Area 1A landings by day of the week**



**VII. Annual State Compliance Reports**

**Atlantic herring compliance report checklist – Reports for FY2003**

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

Report Content <sup>a</sup>	ME	NH	MA	RI	CT	NY*	NJ
<b>Date Rec'd</b>	1/15/2004	1/21/2004	<b>6/10/2004</b>	1/27/2004	1/30/2004	1/26/2004	1/27/2004
<b>1</b>	✓	✓	✓	✓	✓	✓	✓
<b>2</b>	✓	✓	✓	✓	✓	✓	✓
<b>3</b>	✓	✓	✓	✓	✓	✓	✓
<b>4</b>	✓	✓	✓	✓	✓	✓	✓

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

<sup>a</sup> 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 1<sup>st</sup> 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;

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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.

**VIII. Recommendations of FMP Review Team**

**Regulatory Recommendations**

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. The Plan Review Team could not evaluate the management program and practices for Massachusetts state waters because the Commission did not receive an annual state report.

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.

**Amendments**

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. The Amendment will address maximum sustainable yield, redefining the management areas, distribution of the area TACs, spawning area restrictions, internal water processing, and several other complementary issues included in the federal amendment. During May 2004, the Section decided a herring limited access program for state waters will not be considered in Amendment 2. The Commission's Atlantic Herring Plan Development Team is in the process of drafting the amendment for public comment. The Section will review a draft amendment in Fall 2004. To ensure the interstate and federal management plans are complementary, Amendment 2 will be implemented by the 2006 fishing year, the anticipated implementation date for the federal amendment.

**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.
- 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.

**2004 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR  
ATLANTIC SEA HERRING (*Clupea harengus harengus*)**

- 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.
- 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.