

# NEW ENGLAND FISHERY MANAGEMENT COUNCIL

## Herring PDT Report

May 1, 2003  
Holiday Inn, Mansfield, MA

The Herring Plan Development Team (PDT) met jointly with the ASMFC Herring Technical Committee (TC) on May 1, 2003 in Mansfield, MA to review the results of the recently-completed Transboundary Resource Assessment Committee (TRAC) Meeting and develop recommendations regarding the specifications for the 2004 fishing year (January 1 – December 31, 2004). At the May 20-22, 2003 meeting, the Council is scheduled to consider a rollover of the 2003 herring specifications through the 2004 fishing year and until the implementation of Amendment 2 to the Herring FMP, so the Herring PDT specifically considered this approach and developed related recommendations. This PDT Report includes the Herring PDT's recommendations regarding the 2004 annual specifications as well as updated fishery information to support those recommendations.

**PDT/TC Attendance:** Lori Steele (NEFMC Staff); Megan Gamble, Laura Lee (ASMFC Staff); Bill Overholtz, Drew Kitts, Phil Logan (NEFSC); Eric Dolin (NMFS); David Libby, Matt Cieri (ME DMR); Clare McBane (NH FW); Najih Lazar (RI FW); Madeleine Hall-Arber (MIT Sea Grant).

**Others Present:** David Borden (RI FW, ASMFC Herring Section Chair); Mary Beth Tooley (ECPA); Dave Ellenton (AP Chair); Dexter van Zile (National Fisherman).

### *TRAC Results*

Dr. Overholtz presented information and results from the TRAC Meeting (St. Andrews, NB, Feb. 10-14, 2003), highlighting important issues and differences between the US and Canadian assessments of the Atlantic herring resource, including the following:

- The inputs to both assessments (trawl and larval surveys, landings) were the same, with the notable exception that the Canadian assessment did not include results of the hydroacoustic surveys that the US has been conducting since 1998.
- The Canadian assessment utilized a virtual population analysis (VPA); the US assessment utilized a forward projection analysis (FPA). In general, the VPA works backwards through a population of fish based on the latest information about age structure, and the FPA projects forwards through a population based on more sources of information, including the acoustic surveys.
- The last US assessment (SAW 27, 1998) utilized a VPA and encountered problems associated with the retrospective pattern of the analysis, making it difficult to estimate biomass and fishing mortality. The VPA is not robust to recent problems that have been encountered with ageing herring. The FPA is considered a modern model that is more flexible, allowing for the utilization of additional information. Prior to conducting the FPA, a VPA was conducted through 2001, and similar problems were encountered. The results of

the VPA through 2001 were presented at the TRAC Meeting, but it was determined that the FPA may be a more appropriate way to proceed for the US assessment to model the dynamics of the herring complex.

- NMFS (offshore) and the Gulf of Maine Aquarium (inshore) have conducted acoustic surveys of herring abundance since 1998. Three surveys were conducted annually from 1999-2001, and one large survey was conducted in 2002. In 2002, 40-50% of the fish that were sampled were “spent,” suggesting that spawning occurred earlier last year, and the survey may have missed the fish when they were most concentrated. Echo-intensities were therefore lower in 2002, resulting in a lower total biomass estimate, but not affecting overall distribution (see Attachment). The low biomass from the acoustic survey in 2002 was key in the assessment because it was the terminal year.
- Based on the US assessment, fishing mortality was about 0.06 in 2002. Total biomass of Atlantic herring was about 1.8 million metric tons (mt), and spawning stock biomass (SSB) was about 1.7 million mt. Very strong year classes are apparent in 1994 and 1998. MSY estimates from the US assessment range from 222,000 mt – 243,000 mt (see Attachment). According to the Fox model,  $MSY = 222,000$  mt,  $B_{MSY} = 896,000$  mt, and  $F_{MSY} = 0.25$ .
- Projections from the US assessment indicate that fishing herring at  $F = 0.1$  would remove about 170,000 mt of herring in 2004 with very little change in total biomass. Fishing at  $F = 0.2$  would remove about 323,000 mt, resulting in a biomass decline of about 5% in 2005. Both of these levels of landings are significantly higher than annual removals since the late 1980s.
- The Canadian assessment did not provide reference points ( $MSY$ ,  $B_{MSY}$ ,  $F_{MSY}$ ). The VPA approach utilized catch-at-age information for the entire complex since 1967. Current  $F$  and  $B$  estimates from the Canadian assessment are quite different from the US assessment –  $F=0.2$  and  $B = 550,000$  mt. According to the Canadian assessment, fishing at  $F = 0.1$  would remove about 60,000 mt of herring in 2004 with no change in biomass. Fishing at  $F = 0.2$  would remove about 100,000 mt, resulting in a biomass decline of about 10% in 2005. This is inconsistent with the fact that removals have been around 100,000 or more for 15 years, and biomass levels have hit record highs during this time period. In addition, these kinds of declines in the population should be apparent in acoustic and other surveys, which they are not.

The PDT/TC discussed approaches for resolving the TRAC assessment results and moving forward with the development of Amendment 2. Ms. Steele noted that the Council is scheduling a meeting of its Scientific and Statistical Committee (SSC) in June to review the results from both assessments and provide guidance to the PDT for the development of Amendment 2. Ms. Gamble suggested that the TC could either base their advice on the guidance of the SSC, and/or add some state representatives to the SSC during the review of the TRAC results. The ASMFC’s Stock Assessment Committee also could review the results, but timing issues may prevent this approach (this Committee is not likely to meet again until August, well into the scheduled development of alternatives for Amendment 2). The ASMFC Herring Section will discuss this issue at the May 21, 2003 meeting.

### ***2002 Data***

The PDT/TC reviewed updated fishery data for the 2002 fishing year, presented by Matt Cieri and Drew Kitts. Data from Vessel Trip Reports (VTRs) are not yet complete but should be in time for the May 21 Committee/Advisory Panel meeting and May 22 Council meeting. In general, herring catches were lower in 2002 than they were in 2001 (see Attachment). Mr. Ellenton suggested that catches were lower last year due to higher water temperatures; the fish stayed closer to the bottom, affecting catchability. In addition, many vessels targeted more mackerel last year because it is more valuable.

In 2002, the total number of herring trips fell from about 2,200 to 1,700. Trips in Area 1A remained steady around 1,100 (see Attachment). A preliminary capacity analysis (data envelopment analysis) was presented to show lower-bound estimates of vessel capacity in the fishery. Ms. Tooley polled the members of the ECPA to estimate their boat capacity and suggested that it was much higher than the estimates from the data envelopment analysis. There are many ways to estimate capacity; the PDT will explore this issue further during the development of Amendment 2.

### ***2004 Specifications***

The PDT discussed the possible implications of rolling over the 2003 specifications through 2004 and until the implementation of Amendment 2. This approach would allow development of Amendment 2 alternatives to begin in June, to better ensure that the amendment can be implemented at or close to the start of the 2005 fishing year. Important considerations for the PDT/TC include whether or not maintaining the 2003 specifications would compromise the health of the herring resource and whether or not developments in the industry and markets would significantly alter the impacts of the specifications, which were analyzed in an Environmental Assessment (Final EA, December 2002).

The PDT discussed the current specification for Optimum Yield (OY) in the herring fishery, which is 250,000 mt. The MSY estimates from the US assessment at the TRAC Meeting range from 222,000 mt – 243,000 mt. The current specifications for the fishery include a 70,000 mt reserve for Area 2, to be released if the Area 2 TAC is caught and the fish in Area 2 are known to not include fish from the Gulf of Maine component of the population. One option to reduce the effective OY below the MSY levels from the US assessment is to not release the Area 2 TAC reserve if the Area 2 TAC were to be reached. Ms. Tooley noted that the industry generally views the Area 2 reserve fish as unavailable, and Mr. Ellenton expressed doubt that the fishery will catch the TAC in Area 2. Last year, landings from Area 2 were just more than 10,000 mt.

Mr. Dolin noted that specifications for the tilefish fishery were rolled over relatively recently without much difficulty. The key to this approach is ensuring that rolling over the specifications will not compromise the resource. The PDT/TC agreed that not releasing the TAC reserve and lowering the effective OY to 180,000 mt would be appropriate given uncertainty related to the results of the TRAC assessment. 180,000 mt is almost 20% lower than the lowest estimate of MSY from the US assessment. In addition, total catch was around 50% of this level in 2002. The PDT/TC agreed that this approach is not likely to compromise the health of the resource.

### *Consensus*

**The Herring PDT/TC agrees that rolling over the specifications for the 2004 fishing year and until the implementation of Amendment 2 will not compromise the status of the herring resource. The PDT recommends that the Council recommend that the Regional Administrator not release the TAC reserve in Area 2, making the effective OY 180,000 tons and taking a precautionary approach due to uncertainties related to the TRAC assessment results.**

It was noted that if the Council makes any changes to the specifications for the 2004 fishing year, the PDT will meet to review and analyze the proposed changes and prepare an EA and other required analyses. This would likely delay the development of Amendment 2 alternatives until mid-July.

### *Amendment 2 Development*

The PDT discussed plans for developing alternatives for Amendment 2. If the Council agrees to rollover the 2003 specifications through 2004 and until the implementation of Amendment 2, the PDT can meet at the end of May to begin work on Amendment 2 alternatives. The PDT agreed to meet on May 29 to develop recommendations on goals and objectives for Amendment 2 and to begin a dialogue with the Herring Committee and Advisory Panel regarding the details of alternatives to develop for consideration. At this meeting, the PDT will begin to outline management approaches for the Committee with qualitative analysis and provide recommendations regarding other adjustments to the Herring FMP that may be considered in this amendment. As an example, Dr. Cieri proposed consideration of TAC set-asides to fund cooperative research, including some of the hydroacoustic surveys.

The PDT also briefly discussed issues related to the coordination of mackerel and herring management. The New England Council has suggested to the Mid-Atlantic Council that closer coordination be achieved through increased cross-representation on both the NE Council's Herring Committee and the MA Council's Squid, Mackerel, and Butterfish Committee. Ms. Steele will follow-up with the PDT following the May Council meeting.

# Herring PDT/TC Report

## ATTACHMENT

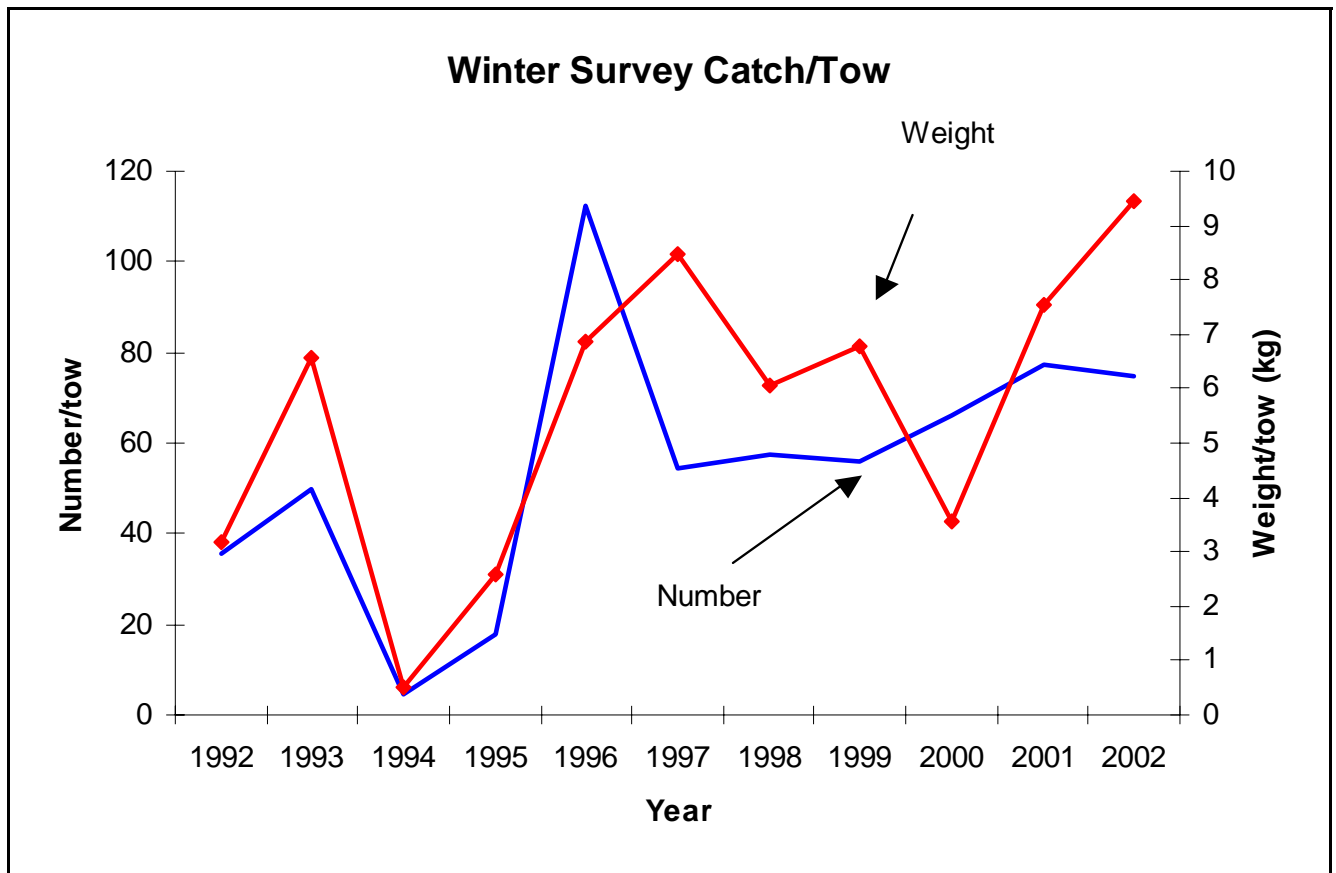
### UPDATED FISHERY DATA THROUGH 2002 FISHING YEAR (JANUARY 1, 2002 – DECEMBER 31, 2002)

#### 1.0 Stock Information

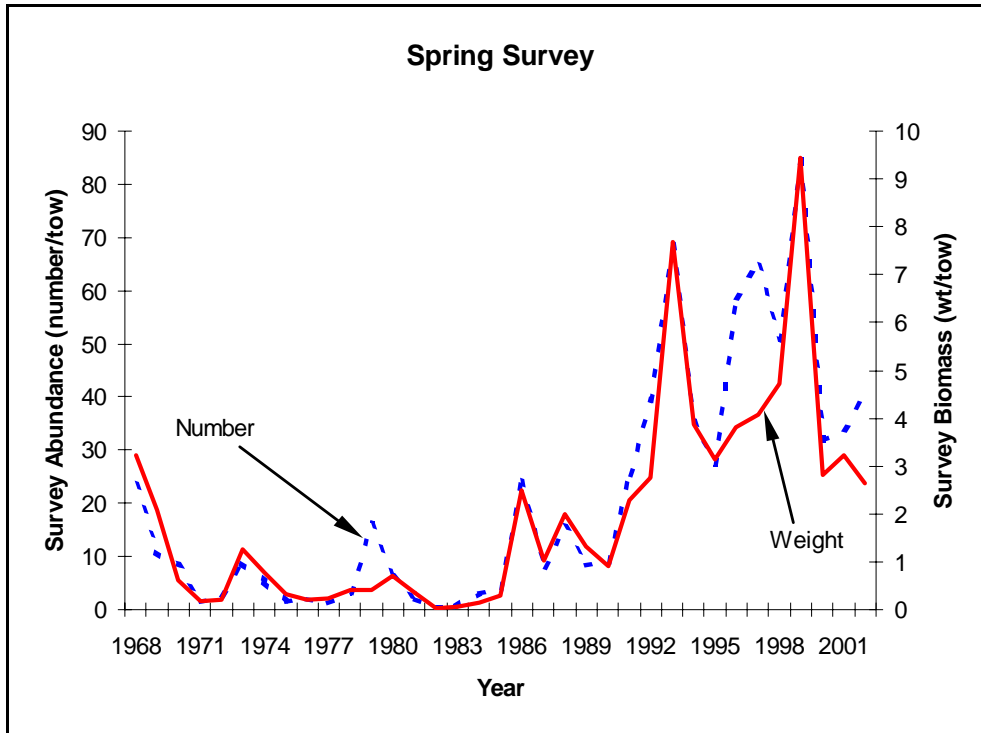
##### 1.1 Surveys

Figure 1 – Figure 3 illustrate trends in abundance and biomass of Atlantic herring from the Northeast Fisheries Science Center (NEFSC) winter, spring, and autumn trawl surveys.

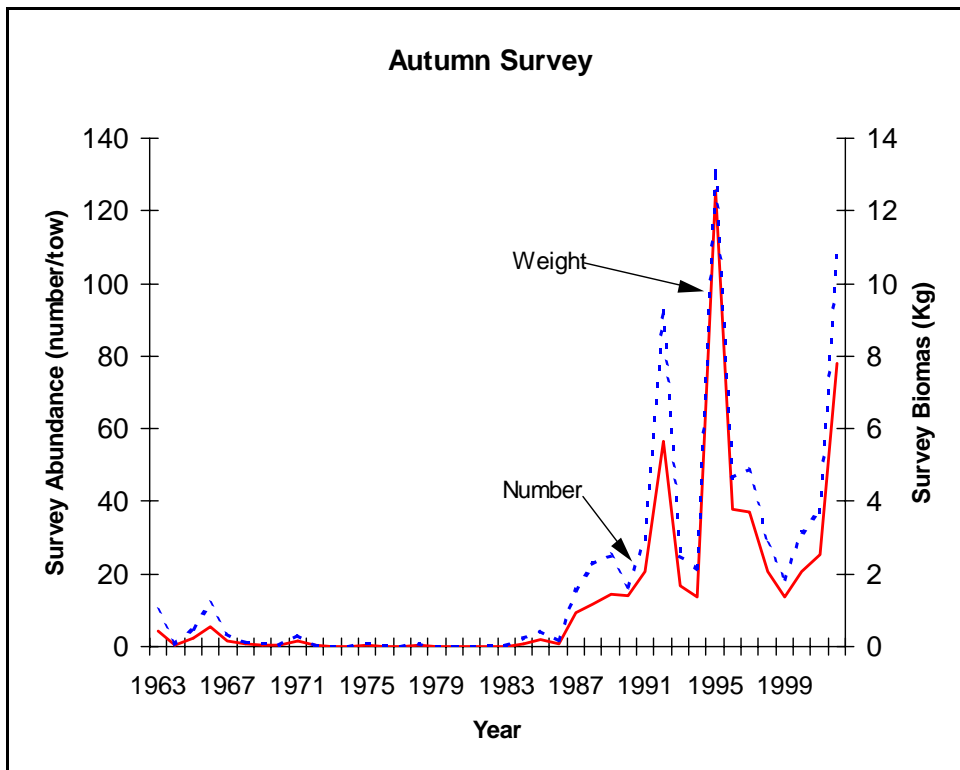
**Figure 1 Atlantic Herring Abundance and Biomass from the NEFSC Winter Trawl Survey**



**Figure 2 Atlantic Herring Abundance and Biomass from the NEFSC Spring Trawl Survey**



**Figure 3 Atlantic Herring Abundance and Biomass from the NEFSC Autumn Trawl Survey**



Offshore hydroacoustic surveys of Atlantic herring have been conducted by the National Marine Fisheries Service (NMFS) since 1999. From 1999-2001, three different surveys were conducted; in 2002, one larger survey was conducted. In 2002, 40-50% of the fish that were sampled during the survey were “spent,” suggesting that spawning occurred earlier last year, and the survey may have missed the fish when they were most concentrated. Echo-intensities were therefore lower in 2002, resulting in a lower total biomass estimate, but not affecting overall distribution (Table 1).

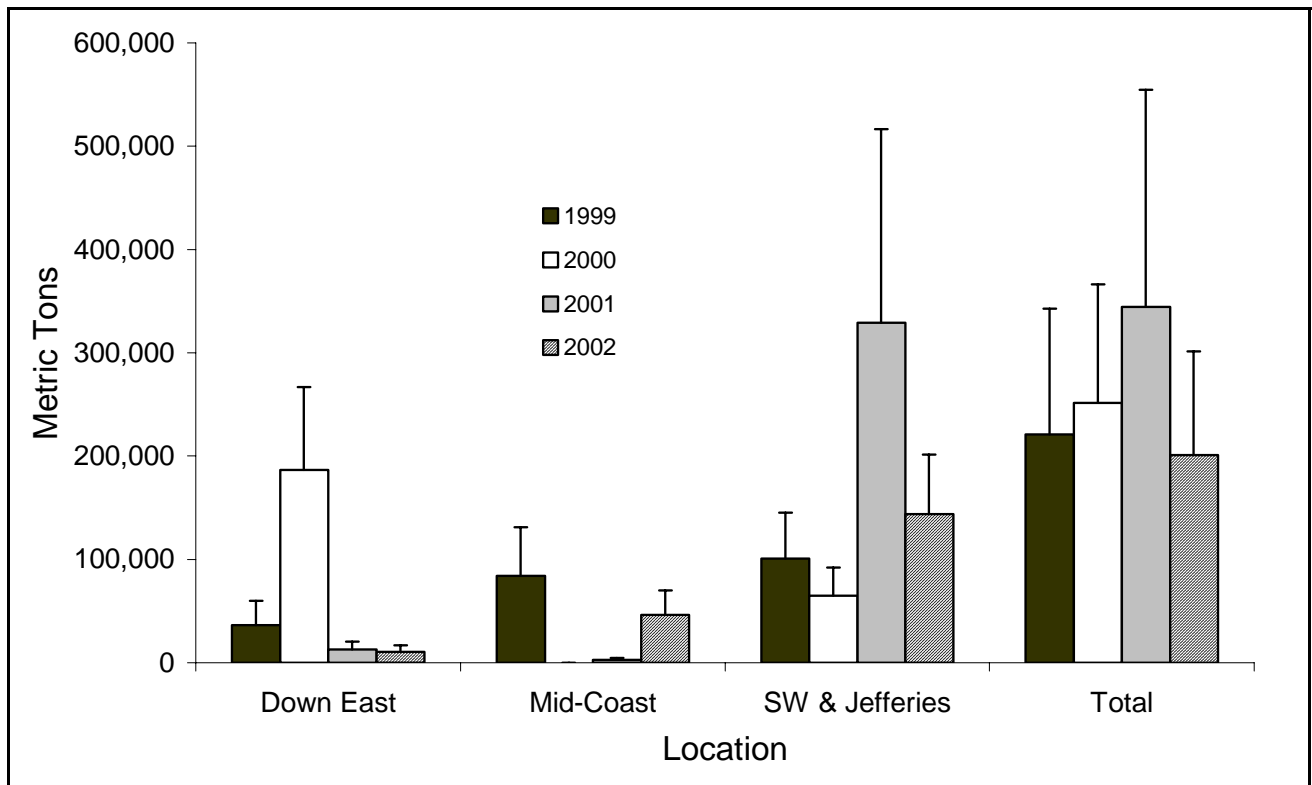
**Table 1 Geostatistical Estimates of Biomass, Coefficients of Variation (CV), CV inverse, Weighted Biomass (W), and Weighted CV (W) for Acoustic Surveys on Georges Bank from 1999-2002**

Year Survey Design	Biomass	CV	1/CV	W Biomass	W CV
<b>1999</b>					
Zigzag1	1.4173	18.74	0.0534		
Zigzag2	1.0409	20.86	0.0479	1.19E+06	10.712
Parallel	1.1467	9.79	0.1021		
<b>2000</b>					
Parallel	1.5025	11.49	0.087		
Zigzag	1.268	10	0.1	1.43E+06	7.222
S random	1.596	16.89	0.0592		
<b>2001</b>					
Parallel	2.1484	9.89	0.1011		
Zigzag	1.6172	10.8	0.0926	1.82E+06	6.604
S random	1.596	15.3	0.0654		
<b>2002</b>					
Parallel	0.7628	13.56		7.63E+05	13.56

Since 1999, Maine Department of Marine Resources (ME DMR), in partnership with the Gulf of Maine Aquarium, has been surveying the inshore spawning component in the Gulf of Maine during Autumn (September – November). This project is funded by the Northeast Consortium, and uses groundfish and herring vessels to conduct fishery independent hydroacoustic surveys. This survey compliments the offshore hydroacoustic survey conducted by NMFS.

2002 estimates of spawning herring biomass surveyed in the Gulf of Maine total approximately 201,000 metric tons (Figure 4). This value is considerably lower than estimates from prior years 344,000 metric tons in 2001, but well within the margin of standard error. Like the offshore survey conducted by NMFS, timing issues may have played a role in the reduction of fish seen this year. The average spawning stock biomass estimate using this method is approximately 250,000 mt.

**Figure 4 Estimates of Spawning Biomass of Atlantic Herring from Inshore Hydroacoustic Surveys**



**1.2 TRAC Assessment Meeting – Reference Points and Projections**

The Transboundary Resource Assessment Committee met in St. Andrew’s, New Brunswick from February 10-14, 2003 to assess the status of the Atlantic herring resource. No consensus was reached regarding stock status. See the PDT/TC Report and the DFO Stock Status Report for additional information. A U.S. Assessment Report is pending.

According to the U.S. Assessment results, maximum sustainable yield (MSY) for the Atlantic herring complex ranges from 222,000 to 243,000 metric tons (mt) (Table 2). Estimates of biomass that can sustain MSY ( $B_{MSY}$ ) range from 896,000 mt to 1,030,000 mt. The Canadian assessment did not provide any estimates of these reference points.

**Table 2 Estimates of Biological Reference Points for Atlantic Herring from the US Assessment Presented at the TRAC Meeting**

Model	MSY (mt)	$B_{MSY}$ (mt)	$F_{MSY}$
Fox	222,000	896,000	0.25
Shaefer	243,000	1,030,000	0.24



Short-term projections for Atlantic herring from the US and Canadian assessments are summarized in Table 3. Projections from the US assessment indicate that fishing herring at  $F = 0.1$  would remove about 170,000 mt of herring in 2004 with very little change in total biomass. Fishing at  $F = 0.2$  would remove about 323,000 mt, resulting in a biomass decline of about 5% in 2005. Both of these levels of landings are significantly higher than annual removals since the late 1980s. According to the Canadian assessment, fishing at  $F = 0.1$  would remove about 60,000 mt of herring in 2004 with no change in biomass. Fishing at  $F = 0.2$  would remove about 100,000 mt, resulting in a biomass decline of about 10% in 2005. However, removals of Atlantic herring have been around 100,000 or more for 15 years, and biomass levels have hit record highs during this time period. In addition, declines in the population like those predicted in the Canadian assessment should be apparent in acoustic and other surveys.

**Table 3 Projection Results for Atlantic Herring from the US and Canadian Assessments Presented at the TRAC Meeting**

<b>US ASSESSMENT</b>			
	<b>2004</b>		<b>2005</b>
	<b>2+ Biomass (mt)</b>	<b>Catch (mt)</b>	<b>2+ Biomass (mt)</b>
<b>F=0.1</b>	1.8 million	170,000t	1.79 million t
<b>F=0.2</b>	1.8 million	323,000t	1.64 million t
<b>CANADIAN ASSESSMENT</b>			
	<b>2004</b>		<b>2005</b>
	<b>3+ Biomass (mt)</b>	<b>Catch (mt)</b>	<b>3+ Biomass (mt)</b>
<b>F=0.1</b>	550,000t	60,000t	550,000t
<b>F=0.2</b>	550,000t	100,000t	500,000t

## 2.0 Fishery Information

### 2.1 2002 Herring Catch and Landings Statistics

Catch and landings for the Atlantic Herring fishery is monitored using two harvester reporting systems: Vessel Trip Reports (VTR), and Interactive Voice Reporting (IVR).

Harvesters report VTR data on a monthly basis. Because harvesters give precise location (coordinates or Loran) on a per trip basis, this reporting system allows for detailed catch information from specific areas. VTR data are useful for stock assessment and effort information. Because they are reported on a monthly basis, this system is not useful for quota monitoring.

The IVR call in system is also a harvester report. Harvesters report combined catches by Management Area on weekly schedule. While both trip level information and precise location are not reported, this system is useful for near real time quota monitoring. IVR data are not generally useful for stock assessment, or management questions that require information by sub-area or gear. Both IVR and VTR data incorporate landing to foreign vessels by domestic harvesters (JV or IWP but not TALFF).

The Catch at Age Matrix is then developed by applying the commercial harvest data (from VTR) to samples of fish taken from the commercial fleet using a program called BIOSTAT. This matrix is developed for each area by month. The results by area are then summed fishery wide from which they can be utilized in an age structured population model, or analyzed for other fishery dependent statistics.

## **VTR**

As reported by the Maine Department of Marine Resources, 91,026 metric tons (mt), (preliminary as of May 2003) of herring were caught during the 2002 fishing year (Table 4). This amount is about a 27,000 mt decrease from the previous year. Management Area 1A (58,754 mt) accounted for approximately 64 % of the over all landings and saw an increase in harvest levels compared to the previous years. Area 3 saw the biggest decline in catch (20,447 mt).

Within Area 1A, purse seines accounted for approximately 32% of the catches, but only accounted for 21 % of the catches for the entire stock complex (Figure 5 and Figure 6). Both types of mid-water trawler gear (single and pair) accounted for the bulk of the catches in 1A and total complex. Of all of the states (Figure 7), Maine had the highest landings (53%), followed by Massachusetts (27%), Rhode Island (12%), and New Hampshire (6%).

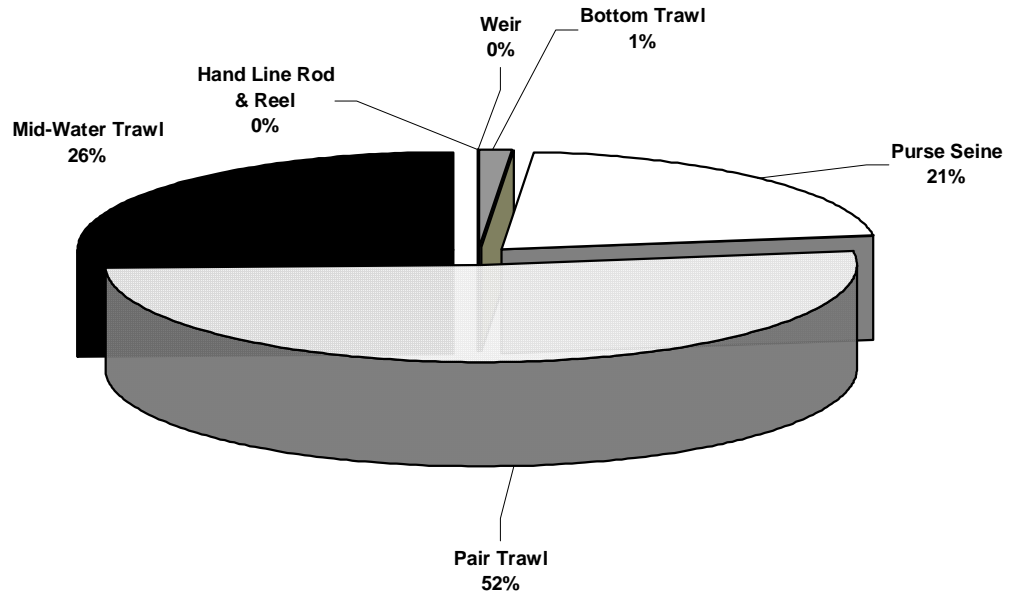
## **IVR**

The 2002 season was the third year of mandatory IVR reporting for the Atlantic herring fleet. A total of 96 vessels had a Category 1 permit in 2002, of those vessels, 42 reported using the IVR system. Although IVR reporting compliance among herring permit holders was less than 50%, dedicated herring vessels (about 26 in number) had a compliance level approaching 100%. The total catch in 2002 reached 91,831 mt, a 24% decrease from 2001 (Table 5). The Area 1A harvest accounted for approximately 65% of the total catch followed by Area 3 with 16% and Area 2 with 12% of the total. The most notable decrease in catch was in Area 3 that went from 37,174 mt in 2001 to 14,540 mt, a 61% reduction. Based on IVR data, discards accounted for 234 lbs (.11 mt) of the yearly harvest.

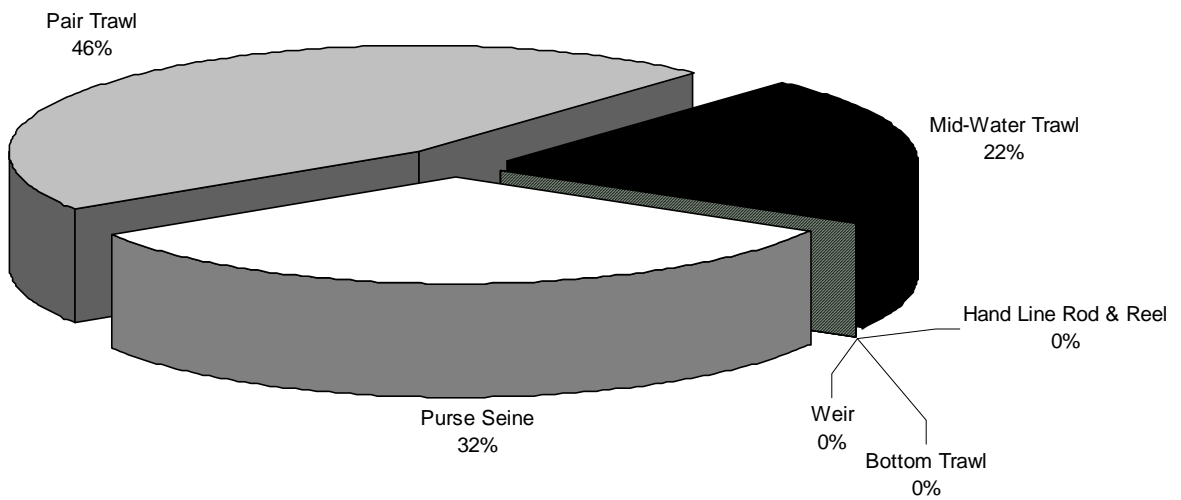
**Table 4 Herring Catch (mt) - Management Area by Month, 1997 - 2001**

<b>2002*</b>														
Mgt Area	1	2	3	4	5	6	7	8	9	10	11	12	Total	TAC
1A	1,653	1,223	786	3,087	44	9,019	13,760	7,727	7,380	5,953	8,018	103	<b>58,754</b>	<b>60,000</b>
1B	1,701	753	473	126	1,030	369	643	159	259	32		1,800	<b>7,343</b>	<b>10,000</b>
2	5,387	3,951	664	107	187	0	1	1	138	1	125	303	<b>10,866</b>	<b>50,000</b>
3	589	0	29	5	879	412	2,837	2,555	3,056	3,697	4		<b>14,063</b>	<b>50,000</b>
<b>Total</b>	<b>9,330</b>	<b>5,927</b>	<b>1,953</b>	<b>3,325</b>	<b>2,141</b>	<b>9,799</b>	<b>17,240</b>	<b>10,441</b>	<b>10,834</b>	<b>9,682</b>	<b>8,147</b>	<b>2,207</b>	<b>91,026</b>	<b>170,000</b>
* uncompleted catch data														
<b>2001*</b>														
Mgt Area	1	2	3	4	5	6	7	8	9	10	11	12	Total	
1A	3	1,716	1,292	2,476	6,596	8,605	6,978	7,920	4,682	8,954	3,888	57	<b>53,167</b>	
1B	18	1	68	45	195	110		1,266	1,302	1,128	4,382	6,447	<b>14,963</b>	
2	8,582	4,900	430	828	56	100	0	2	96	3	64	327	<b>15,388</b>	
3						755	7,636	7,826	10,701	7,310	193	89	<b>34,510</b>	
<b>Total</b>	<b>8,604</b>	<b>6,617</b>	<b>1,789</b>	<b>3,349</b>	<b>6,847</b>	<b>9,571</b>	<b>14,614</b>	<b>17,015</b>	<b>16,781</b>	<b>17,394</b>	<b>8,527</b>	<b>6,920</b>	<b>118,028</b>	
<b>2000</b>														
Mgt Area	1	2	3	4	5	6	7	8	9	10	11	12	Total	
1A	3	3	76	1,339	7,076	10,390	14,355	12,818	4,334	8,525	812	0	<b>59,730</b>	
1B		87	127		76	234	276	73	166	0	5,836	110	<b>6,985</b>	
2	7,802	7,902	2,391	212	18	1	0	2	23	2	860	4,364	<b>23,578</b>	
3	125		537	87	38		418	3,107	5,893	2,679			<b>12,884</b>	
<b>Total</b>	<b>7,929</b>	<b>7,992</b>	<b>3,132</b>	<b>1,638</b>	<b>7,208</b>	<b>10,624</b>	<b>15,049</b>	<b>16,001</b>	<b>10,415</b>	<b>11,207</b>	<b>7,508</b>	<b>4,474</b>	<b>103,178</b>	
<b>1999</b>														
Mgt Area	1	2	3	4	5	6	7	8	9	10	11	12	Total	
1A	628	120	93	3,264	4,975	8,055	12,939	9,415	9,497	5,907	8,644	5,110	<b>68,648</b>	
1B	272		41		181	57		35	113	731	106	57	<b>1,593</b>	
2	7,179	7,516	2,928	511	9	4	34	136	0	1	4	555	<b>18,878</b>	
3		143	272	999	154	1,460	290	92	1,280	994			<b>5,685</b>	
<b>Total</b>	<b>8,080</b>	<b>7,779</b>	<b>3,334</b>	<b>4,775</b>	<b>5,320</b>	<b>9,575</b>	<b>13,263</b>	<b>9,678</b>	<b>10,890</b>	<b>7,633</b>	<b>8,754</b>	<b>5,722</b>	<b>94,803</b>	
<b>1998</b>														
Mgt Area	1	2	3	4	5	6	7	8	9	10	11	12	Total	
1A		193		2,705	3,831	4,014	7,200	4,092	5,101	5,973	6,004	4,473	<b>43,586</b>	
1B				392		166	154	112	186	535	1,399	871	<b>3,815</b>	
2	5,965	6,568	2,167	160	187	202	161		237	246	222	126	<b>16,242</b>	
3				523	487	3,630	3,988	3,845	3,267	1,610	465	144	<b>17,959</b>	
<b>Total</b>	<b>5,965</b>	<b>6,761</b>	<b>2,167</b>	<b>3,779</b>	<b>4,505</b>	<b>8,012</b>	<b>11,503</b>	<b>8,049</b>	<b>8,792</b>	<b>8,364</b>	<b>8,091</b>	<b>5,614</b>	<b>81,601</b>	
<b>1997</b>														
Mgt Area	1	2	3	4	5	6	7	8	9	10	11	12	Total	
1A		6		2,801	3,302	5,885	10,311	12,530	12,841	11,647	7,303	983	<b>67,608</b>	
1B				118	295	500	556	1,091	3	94	316		<b>2,972</b>	
2	7,229	4,713	3,841	615	5					500	102	4,443	<b>21,448</b>	
3			34		839	948	2,581		213	778			<b>5,393</b>	
<b>Total</b>	<b>7,229</b>	<b>4,719</b>	<b>3,875</b>	<b>3,534</b>	<b>4,441</b>	<b>7,333</b>	<b>13,448</b>	<b>13,621</b>	<b>13,057</b>	<b>13,018</b>	<b>7,721</b>	<b>5,426</b>	<b>97,422</b>	

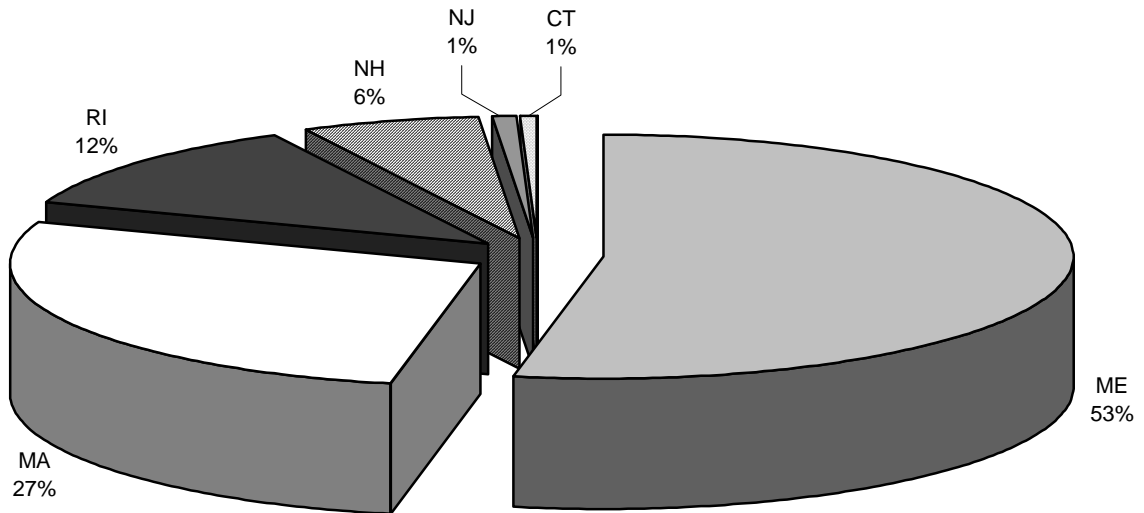
**Figure 5 2002 Landings of Atlantic Herring by Gear Type**



**Figure 6 2002 Landings of Atlantic Herring by Gear Type in Management Area 1A**



**Figure 7 Percentage of 2002 Herring Landings by State**



**Table 5 2002 Total IVR Catch of Herring by Management Area**

	<b>Landings</b>	<b>TAC</b>	<b>%</b>
<b>Area 1A</b>	59,263	60,000	99
<b>Area 1B</b>	7,355	10,000	74
<b>Area 2</b>	10,673	50,000	21
<b>Area 3</b>	14,540	50,000	29
<b>Total</b>	91,831	170,000	

**Catch At Age**

Examination of the catch at age matrix reveals interesting trends within the data. Strong year classes are noticeable particularly for 1994, 1996, and 1998 (Table 6). The 1994 and 1998 year classes seem particularly strong complex wide. Overall, the age structure of this complex has shifted to older individuals over the past years. This trend may be attributable to many factors including the abundance of older age classes due to increased recruitment and low fishing mortality, and industry trends towards landing larger fish.

**Table 6 Herring Catch at Age in Weight and Numbers**

<b>Weight (mt) Harvested at age</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>Total</b>
<b>1998</b>	0	10,589	9,016	38,530	8,090	4,790	5,776	3,141	1,197	397	76	<b>81,601</b>
<b>1999</b>	20	6,065	25,751	9,651	29,594	12,698	6,203	3,832	886	103	0	<b>94,803</b>
<b>2000</b>	0	14,093	4,688	15,947	24,270	30,445	8,762	3,278	638	250	87	<b>102,459</b>
<b>2001</b>	5	4,544	38,144	6,775	15,035	21,531	25,152	5,604	1,081	131	24	<b>118,028</b>
<b>2002</b>	289	5,454	9,998	31,558	12,293	11,313	12,709	6,547	778	87	0	<b>91,026</b>
<b>Numbers (X 1000) Harvested at age</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>Total</b>
<b>1998</b>	0	240,609	109,839	321,663	56,069	29,267	31,640	16,064	5,764	1,618	281	<b>812,814</b>
<b>1999</b>	667	103,606	285,314	82,967	216,579	79,553	35,158	19,554	4,527	357	0	<b>828,282</b>
<b>2000</b>	0	195,108	41,892	121,107	155,341	175,833	44,078	15,388	2,832	1,037	319	<b>752,937</b>
<b>2001</b>	117	74,760	379,858	51,299	98,063	127,478	135,847	26,771	5,153	484	91	<b>899,921</b>
<b>2002</b>	11,888	93,418	100,940	247,386	80,615	67,731	70,482	32,992	3,628	416	47	<b>709,543</b>

## 2.2 Economic Factors

This section summarizes the economic aspects of the herring fishery, including vessel, dealer and processor activities, as well as revenues from and utilization of herring.

In 2002, the gear type that brought the largest amount of herring to market was the mid-water pair trawl at 46,924. This is an 18% drop from 2001 levels. Fourteen vessels pair trawled in 2002 which is one more than 2001 levels. Single vessel mid-water trawling accounted for 23,310 metric ton, which is 37% lower than 2001 landings. Purse seine landings totaled 19,571 metric tons; a 5% decline from 2001. Bottom trawl gear accounted for 1,199 metric tons. Landings by weirs in 2002 were 1 metric ton.

Most herring sold in 2002 was taken from Area 1A (58,545 mt). Area 1B landings (7,415 mt) were about half of what they were in 2001. The Area 2 landings were 10,868 metric tons (down from 15,389 in 2001). Area 3 landings were 14,203 metric tons, down from 43,511 mt in 2001. Table 7 shows the landings of the various gears used in 2002 and the activities of each in the management areas.

Table 8 differs from Table 7 in that instead of listing herring landings by gear used, each vessel was assigned a principal gear based on the gear that landed the most herring. Since some vessels used multiple gears to catch herring, this principal gear designation was necessary to describe herring fishery activity by vessel. For example, some vessels which primarily used mid-water trawl gear landed herring with other gears; the actual gear used is shown in Table 7, while Table 8 lists all landings under the primary gear used by the vessel.

The Herring FMP distinguishes between vessels catching herring incidentally while pursuing other species and those targeting herring by defining vessels that average less than 2,000 pounds of herring caught per trip (in all areas) as incidental herring vessels. Table 9 provides the same information as Table 8 except it excludes the incidental herring vessels. In 2002 there were 37 vessels, defined as directed herring vessels, which sold 90,921 metric tons of herring.

Since Area 1A is the area in which the TAC is most likely to be reached, it is important to summarize the activity of vessels targeting herring in Area 1A. Table 10 provides information for the 27 vessels that averaged more than 2,000 pounds per trip in Area 1A in 2002. Those vessels landed 58,472 mt of herring from Area 1A.

Fluctuations in the ex-vessel price for herring are minor and the average price was \$0.065 per pound in 2002. At this price the total value of herring sold in 2002 was \$13,046,301.

The landings summarized in Table 7 through Table 10 are based on data provided by the State of Maine (for herring landings in all Northeast states). Most of the Maine data is from federal logbooks. Table 11 compares the value of herring to the value of all landed species, expressed as a percentage of revenues, by principal herring gear as well as average crew sizes on herring trips. Since the data provided by the State of Maine does not include information on non-herring landings or crew size, this information must be drawn from logbooks. Table 11 was constructed by only using information where the herring landings provided by the State of Maine closely matched the herring landings in the federal logbooks.

The total number of vessels landing herring in 2002, Table 8, declined to 140 which is 6 less than in 2001. However, the pair trawl fleet gained 1 vessel, the mid-water trawl fleet gained 5 vessels, and the purse seine fleet gained 1 vessel. The number of bottom trawl vessels catching herring dropped by 16 vessels.

**Table 7 Metric Tons of Herring Sold by Gear and Management Area in 2002**

	<b>1A</b>	<b>1B</b>	<b>2</b>	<b>3</b>	<b>Total</b>
<b>Mid-water pair trawl</b>	26,941	5,320	5,984	8,679	46,924
<b>Mid-water trawl</b>	12,599	1,452	3,760	5,499	23,310
<b>Purse Seine</b>	18,929	642	0	0	19,571
<b>Bottom trawl</b>	73	1	1,113	12	1,199
<b>Weir</b>	0	0	1	0	1
<b>Other</b>	3	0	8	10	21
<b>Total</b>	58,546	7,416	10,868	14,203	91,026

**Table 8 Number of Vessels, Herring Trips, and Herring Sold (mt) by Management Area and Principal Herring Gear for 2002**

		<b>1A</b>	<b>1B</b>	<b>2</b>	<b>3</b>	<b>Total</b>
<b>Mid-water Pair Trawl 13 vessels</b>	<b>Number of trips</b>	414	76	60	103	653
	<b>Landings (mt)</b>	29,196	5,771	6,107	8,739	49,813
<b>Mid-water Trawl 14 vessels</b>	<b>Number of trips</b>	161	12	22	26	221
	<b>Landings (mt)</b>	9,874	1,001	3,703	5,449	20,027
<b>Purse Seine 6 vessels</b>	<b>Number of trips</b>	324	7	0	0	331
	<b>Landings (mt)</b>	18,929	642	0	0	19,571
<b>Bottom Trawl 64 vessels</b>	<b>Number of trips</b>	294	6	186	10	496
	<b>Landings (mt)</b>	545	1	1,048	12	1,606
<b>Weir</b>	<b>Landings (mt)</b>	0	0	1	0	1
<b>Other Gear 43 vessels</b>	<b>Number of trips</b>	32	0	237	1	270
	<b>Landings (mt)</b>	1	0	8	<1	9
<b>Total 140 vessels</b>	<b>Number of trips</b>	1225	101	505	140	0
	<b>Landings (mt)</b>	58,545	7,415	10,867	14,201	0

**Table 9 Number of Vessels, Herring Trips, and Herring Sold (mt) by Management Area and Principal Herring Gear for Vessels Averaging more than 2,000 pounds of Herring per Trip in All Areas During 2002**

		<b>1A</b>	<b>1B</b>	<b>2</b>	<b>3</b>	<b>Total</b>
<b>Mid-water Pair Trawl 13 vessels</b>	<b>Number of trips</b>	414	76	60	103	653
	<b>Landings (mt)</b>	29,195	5,772	6,107	8,739	49,813
<b>Mid-water Trawl 10 vessels</b>	<b>Number of trips</b>	134	12	22	26	194
	<b>Landings (mt)</b>	9,854	1,001	3,703	5,449	20,007
<b>Purse Seine 6 vessels</b>	<b>Number of trips</b>	324	7	0	0	331
	<b>Landings (mt)</b>	18,929	642	0	0	19,571
<b>Bottom Trawl 8 vessels</b>	<b>Number of trips</b>	25	0	39	3	67
	<b>Landings (mt)</b>	494	0	1,029	7	1,530
<b>Total 37 vessels</b>	<b>Number of trips</b>	897	95	121	132	1245
	<b>Landings (mt)</b>	58,472	7,415	10,839	14,195	90,921



**Table 10 Number of Vessels, Herring Trips, and Herring Sold (mt) by Management Area and Principal Herring Gear for Vessels Averaging more than 2,000 Pounds of Herring per Trip in Area 1A During 2002**

		1A	1B	2	3	Total
<b>Mid-water pair trawl</b> 13 vessels	<b>Number of trips</b>	414	76	60	103	653
	<b>Landings (mt)</b>	29,195	5,772	6,107	8,739	49,813
<b>Mid-water trawl</b> 6 vessels	<b>Number of trips</b>	134	11	19	26	190
	<b>Landings (mt)</b>	9,854	988	3,568	5,449	19,859
<b>Purse seine</b> 6 vessels	<b>Number of trips</b>	324	7	0	0	331
	<b>Landings (mt)</b>	18,929	642	0	0	19,571
<b>Bottom trawl</b> 2 vessels	<b>Number of trips</b>	25	0	4	1	30
	<b>Landings (mt)</b>	494	0	875	5	1,374
<b>Total</b> 27 vessels	<b>Number of trips</b>	897	94	83	130	1204
	<b>Landings (mt)</b>	58,472	7,402	10,550	14,193	90,617

**Table 11 Value of Herring Compared to Value of All Species (as a Percentage of Revenue) and Crew Size by Principal Herring Gear for 2000**

	Percent of Revenue from Herring	Average Crew Size on Herring Trips
<b>Mid-water pair trawl</b>	51%	4.1
<b>Mid-water trawl</b>	40%	3.0
<b>Purse seine</b>	88%	5.6
<b>Bottom trawl</b>	0.1%	5.0