E.6.4.2.3 Vessels and Domestic Harvesting Capacity

Logbook and weigh-out data were used to uniquely identify 279 vessels catching and selling herring in the Northeast Region in 1996. Because the weigh-out system lumps some vessel landings (mostly small vessels) into categories of landings by unknown and/or under-tonnage vessels, not all of the 104,000 metric tons landed in 1996 can be traced directly to a vessel. Information from the vessels that can be identified can be used to determine herring catch rates.

Table E.17 shows the identified herring vessels by principal herring gear type and tonnage class (tonnage class 1 (TC1) is gross tons less than 5, tonnage class 2 (TC2) is from 5 gross tons to less than 50, tonnage class 3 (TC3) is from 50 gross tons to less than 150, tonnage class 4 (TC4) is gross tons greater than or equal to 150.) Because some vessels caught herring with more than one gear type, a vessel is assigned a gear type based on the gear used to catch the majority of herring in 1996.

A geographic breakdown of these vessels would violate confidentiality rules for many groupings. For the groups with larger numbers of vessels, the number of vessels by principal state of landing, as declared on federal permit applications, is as follows. For mid-water trawl TC4 there are 5 from RI, 3 each from ME and MA, 1 each from DE and an unknown principal state. For bottom trawl TC2 there are 29 from NY, 24 from ME, 18 from MA, 15 from NH, 7 from NJ, and the rest from RI, CT, and MD. For bottom trawl TC3 there are 18 from NY, 12 from NJ, 9 from RI, 6 from MA, and the rest from CT, MD, ME, and NC. For bottom trawl TC4 there are 7 from RI, 5 from NY, 4 from NJ, and the rest from MA, ME, PA, and VA.

	Purse Seine		**Mid-Water Trawl**		**Bottom Otter Trawl**			**Other**				
Tonnage Class	TC2	TC4	TC3	TC4	TC1	TC2	TC3	TC4	TC1	TC2	TC3	TC4
Number of unique vessels	<3	3	5	13	<3	101	54	20	6	60	10	<3
Avg. GRT	<15	169	106	178	<5	25	93	194	3	19	73	<180
Avg. length	<45	75	68	91	42	44	68	89	27	39	65	<90
Avg. horse	<400	516	550	917	302	302	512	956	220	337	599	<800
Avg. year built	-	1975	1982	1981	1985	1975	1976	1983	1977	1977	1975	------
Vessels catching herring only	2	3	3	5	3	30	3	1	1	8		1

Table E.17 - Overview of vessels that landed herring, 1996 (NMFS/NEFSC, Harvest Capacity of Northeast Herring Vessels)

In order to describe the current degree of dependence by vessels on herring, the landings of 201 vessels that reported herring landings to the dealer weighout database in 1997 were examined. The data illustrates the degree of dependence on herring, and the different gear types that vessels use to fish for herring and for other species. The results differ slightly from those presented in the regulatory flexibility analysis (section 7.3) because different data sources are used. For that

reason, these tables should be viewed as indicators of activity rather than a precise description of all vessels in the fishery. Dependence is measured by the size of herring revenue relative to revenue from all species. Dependence classes are established where:

- dependence class 1 = 75% to 100% herring revenue
- dependence class 2 = 50% to 75% herring revenue
- dependence class 3 = 25% to 50% herring revenue
- dependence class 4 = greater than 0% to 25% herring revenue

In order to illustrate how dependence is distributed geographically and by vessel size, Table E.18 through Table E. 21 report dependence by home state and length class, where length class is:

- length class 1 = vessel length less than or equal to 50 feet (22 feet was the minimum)
- length class 2 = vessel length greater than 50 to 90 feet
- length class 3 = vessel length greater than 90 feet (126 feet was the maximum)

Also illustrated in Table E.18 through Table E. 21 are the principal gears (gear associated with the most revenue) used to catch herring and the principal gears used to catch other species. Herring gear is listed in the columns and non-herring gear is listed in the rows. Vessels are summarized by state of homeport and by the three length categories. When a vessel registered a different primary state of landing on its permit application than its homestate, that is noted in the columns.

Displaying numbers of vessels in this manner indicates the degree to which gear is switched between herring and non-herring fishing. For vessels highly dependent on herring, one would expect that the gear used for herring is the same gear used for other species (i.e., a herring purse seiner tends to always purse seine). For vessels less dependent on herring one might expect gear changes are made while targeting herring. This does not hold true, however, for bottom trawl vessels in dependency class 4 (0 percent to 25 percent herring revenue). Because such a low percentage of the total revenue for these vessels came from herring, it is unlikely they are using bottom trawls to target herring on a regular basis. This suggests that many of these vessels catch herring while targeting other species or are occasionally targeting herring without changing gears.

There were 21 vessels with herring landings reported either to Maine or in the logbook in 1997 but that had no landings recorded in the 1997 dealer data. Degree of dependence could not be calculated for these vessels. Six of these vessels were from Maine with 5 reporting using weirs and 1 using purse seine. Five of the vessels that could not be assigned to a dependence class were from MA, 5 from NY, and one vessel each from CT, NH, NJ, and VA. One vessel could not be associated with a home port. Most in this group of vessels that could not be assigned to a dependence class had less than 1 metric ton of herring landings in 1997. Besides the weir gear and a couple purse seiners, the gear used was mostly bottom otter trawl and sink gillnet.

Examination of the tables shows that only a few of the vessels (15) that reported landings in 1997 relied on herring revenue for more than 50 percent of landings revenue. Of the 14 vessels in

dependency class 1, seven listed Maine as homeport or principal state. Seven (some that listed Maine as principal state) list Massachusetts as the homeport. The limited number of vessels that rely on herring for most of their revenue matches well with 1997 landing statistics illustrated in Table E.14. The rapid rise in catch per number of vessels indicates that a small group of vessels lands most herring. Most likely, these are the same vessels that rely on herring for the majority of their income.

Dependence Class 1		**Principal Herring Gear**																	
		Purse Seine			**Mid-Water Trawl**			**Paired Mid-water Trawl**			**Bottom OtterTrawl**			**Sink gillnet**			**Other**		
Principal Non-Herring Gear	Home State	Length Categories																	
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Purse Seine	MA		3/ ME																
	ME	1	1																
Mid-Water Trawl	MA					1/RI	2/1 RI												
Paired Mid-Water Trawl	MA									1									
Bottom Otter Trawl	ME	1																	
	NY											1CT							
Longline	ME	1				1													
	MA					1RI													

Table E.18 - Dependency on herring revenue by gear type, dependence class 1 (75 to 100 percent of revenue), 1997

Dependence Class 2		Principal Herring Gear																	
		Purse Seine			Mid-Water Trawl			Paired Mid-water Trawl			Bottom Otter Trawl			Sink gillnet			Other		
Principal Non-Herring Gear	Home State	Length Categories																	
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Fish pot	ME		1																

Table E.19 - Dependency on herring revenue by gear type, dependence class 2 (50 to 75 percent of revenue), 1997

Dependence Class 3		Principal Herring Gear																	
		Purse Seine			Mid-Water Trawl			Paired Mid-water Trawl			Bottom Otter Trawl			Sink gillnet			Other		
Principal Non-Herring Gear	Home State	Length Categories																	
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Bottom Otter Trawl	MA				2ME								1RI						

Table E.20 - Dependency on herring revenue by gear type, dependence class 3 (25 to 50 percent of revenue), 1997

Dependence Class 4		Principal Herring Gear												
		Purse Seine	Mid-Water Trawl		Paired Mid-water		Bottom Otter Trawl			Sink gillnet			Other	
Principal Non-Herring Gear	Home State	Length Categories												
		2	2	3	2	3	1	2	3	1	2	3	1	2
Purse Seine	NJ							2NY						
Bottom Otter Trawl	DE							1ME						
	MA		1	2RI	1		14 4ME/3RI/2NH	17 3RI/3ME/1NH					1	
	ME	1					9 1NH	3					2	
	NC							2						
	NH						7	1						
	NJ						4	8/1MD						
	NY						16/1NJ	20/3NJ/1RI						
	PA							2NJ	1NJ					
	RI		1				1	4						
	VA							2NC						
	WV						1ME	1NY						
Sink Gillnet	MA						1			2	1			1
	NJ									1				
	NY									7				
	RI									1				
Longline	MA						6/4ME						2	
	ME						1			1			2	
	NH						1							
	NY									1			2	
Lobster/Fish pot	NJ						1			1			2	
	WV		1ME											
Drift Gillnet	NJ									3				
Scallop	PA							1NJ						

Table E. 21 - Dependency on herring revenue by gear type, dependency class 4 (0-25 percent of revenue), 1997

The landings in 1996 were examined to establish an estimate of the domestic harvesting capacity available for the herring fishery. Vessels that caught herring in 1996 were listed according to their catch. Actual catch levels out at around 20 vessels and 80,000 metric tons (total catch in 1996 was about 100,000 metric tons but not all landings could be traced to individual vessels). Then their catch was "annualized" by multiplying their average catch rate times the number of trips recorded by the most active vessel. The annualized catch levels out at around 50 vessels and 260,000 mt. In other words, if the 214 vessels that caught herring made the same number of trips as the most active vessel, and caught herring at the same rate as in 1996, the potential harvest is about 260,000 mt. Most of the harvest still would be taken by about fifty vessels. Figure E.15 illustrates this data.

Since the handling of herring requires certain specialized vessel characteristics, such as RSW systems, additional vessels were identified as likely to have these features but have not reported any herring landings. Vessels that caught mackerel or menhaden but no herring are shown in Table E.22 with their expected annualized herring catch should they enter this fishery.

	Number of Vessels	**Catch per Trip (mt)**	**Number of Trips**	**Annualized Catch (mt)**
Menhaden Purse Seine - Tonnage Class 3*	7	50	182	63,700
Menhaden Purse Seine - Tonnage Class 4	<3	83.5	182	15,197
Mackerel Mid-water Trawl - Tonnage Class 3	8	19	182	27,664
Mackerel Mid-water Trawl - Tonnage Class 4	7	56	182	71,344
Totals	<26			177,905

* Tonnage Class 3 = 50 to 150 GRT

Tonnage Class 4 = 150 GRT and greater

Table E.22 - Annualized catch of additional northeast vessels

Combining the results of these two analyses, the potential existing domestic capacity for Atlantic herring is approximately 438,000 mt. This exceeds current estimates of the MSY for the herring resource by 121,000 mt. This figure does not necessarily equate to the domestic annual harvest of herring (DAH), as this figure is developed by considering not only the capacity, but by estimating the extent to which domestic vessels will harvest the resource.

There are a number of assumptions that make this a rough estimate of potential capacity. The first group of vessels examined actually landed herring in 1996, demonstrating the capability to do so. Few of these vessels, however, possess the

refrigerated sea water (RSW) systems necessary to harvest herring offshore. They may have already maximized their ability to take herring from coastal areas, with the result they may be incapable of increasing the number of trips and landings. On the other hand, there are a number of vessels included in the first group that are not currently targeting herring who may be able to significantly increase their catch rates should they choose to do so. The high costs ($150,000 or more) necessary to convert to the herring fishery may limit the number of these vessels that enter the directed herring fishery. Any large scale shift of effort from other fisheries into the herring fishery will be dependent on the development of additional markets.

The second group of vessels—particularly the mackerel mid-water trawl vessels—are equipped for a relatively smooth transition into the herring fishery. They are, however, currently pursuing other fisheries—in the case of mackerel, for a higher priced product. The main deterrent to the entry of these vessels in the herring fishery is the low price of herring and limited markets available.

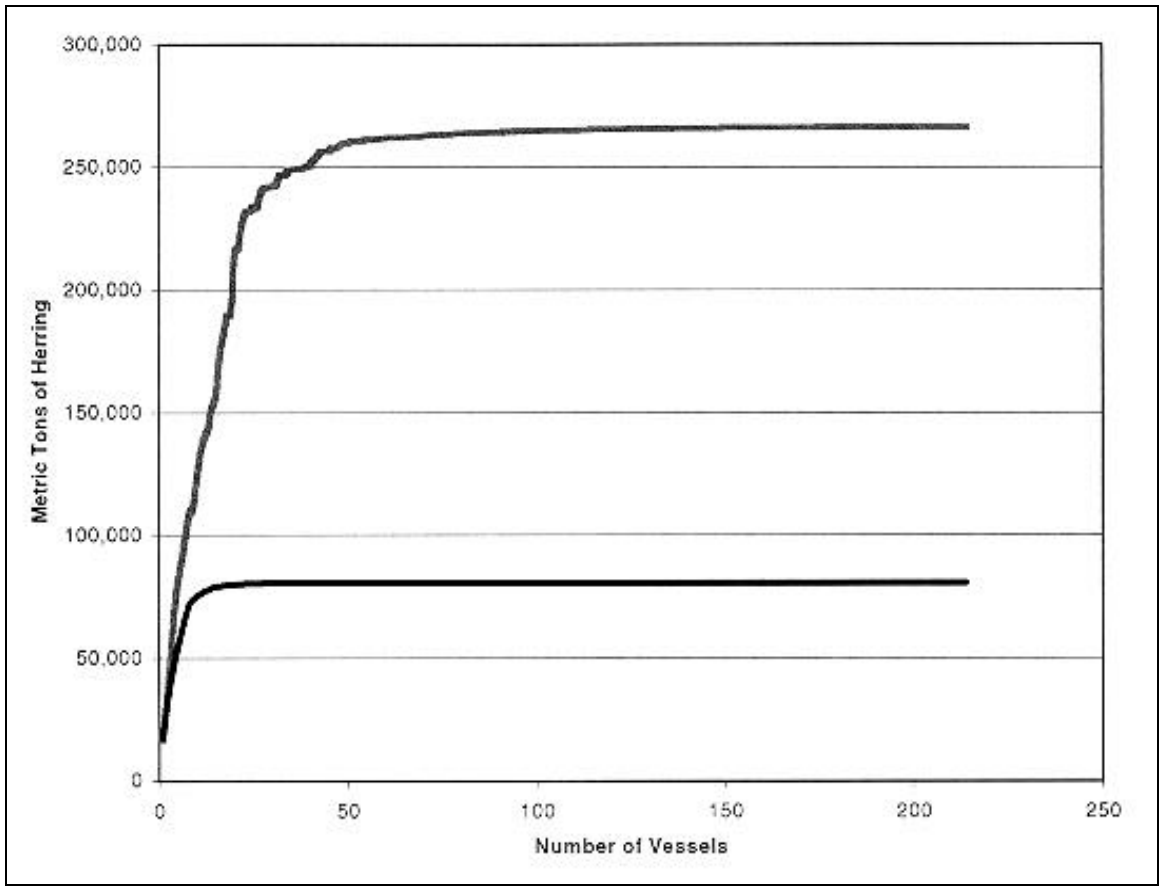

Figure E.15- Potential harvest of vessels that landed herring in 1996. Bottom line represents actual 1996 catch. Top line represents possible catch if all vessels fished the same number of trips as the vessel that made the most trips. (Source NMFS landings data)

E.6.4.2.4 Ports

In order to examine the importance of herring landings to different ports, data from the vessel logbook database and the Maine DMR database were examined. These data provide different (generally, higher) estimates of landings in various ports than the dealer weighout database. In some instances, state totals generated from these databases differ from the state totals in Table E.12.

The major states for herring landings are Maine, Massachusetts, and Rhode Island. Landings in other states were less than 1 percent of the total herring landings in 1996 and 1997, and less than 6 percent of total landings in 1995. Almost 30 percent of total herring landings in 1997 were made in Rockland, ME. The second highest landing port was Gloucester, MA, which accounted for almost all the landings in Massachusetts. The third ranking port was Portland, ME. No other port received more than 15 percent of the total landings. Landings in the state of Maine accounted for nearly 55 percent of the total landings in 1997. Rhode Island landings in 1997 were almost equally distributed among three different ports (Table E.23).

Because herring is a large volume fishery, the weight of herring landings tends to dominate the total weight of all fisheries landings in each of the ports. Rockland, ME and Portsmouth, RI are the two ports most dependent on herring landings and revenues. In both these ports, the landings of herring were more than 90 percent, by weight, of all landings, and the value of these landings was more than 50 percent of the value of all landings. Rockland in particular shows a growing dependence on herring revenues; in 1995, herring accounted for only 32% of landings revenues while in 1997 it had increased to 52.7% of revenues. Herring revenues accounted for about one-fifth of the landings revenues in Gloucester, MA in 1995 and 1996, but declined to about 10 percent in 1997 at the same time that the landed weight remained nearly constant. While herring revenues are important in individual ports, the value of these landings is a small part of the overall fisheries revenues for the three states (Table E.24).

Herring landings can be expected to increase in importance for most of these ports. Increased fishing restrictions in the Gulf of Maine for both groundfish and shrimp can be expected to result in reduced landings of these higher value species. In the near future, herring revenues may assume increased importance for all of these ports.

State	Port	Herring landings (mt)			Percent of total landings		
		1995	1996	1997	1995	1996	1997
Maine	Portland	16,072	17,682	13,988	22.6%	16.4%	14.4%
	Rockland	13,789	22,817	29,054	19.4%	21.2%	29.8%
	Belfast	3,212			4.5%		
	Cundys Harbor			1,645			1.7%
	Prospect Harbor			3,508			3.6%
	New Harbor			1,070			1.1%
	All Maine ports	35,500	58,249	53,321	49.9%	54.1%	54.7%
Massachusetts	Gloucester	14,449	22,382	21,437	20.3%	20.8%	22.0%
	New Bedford		2,081	1,634		1.9%	1.7%
	All Massachusetts Ports	18,979	26,979	23,072	26.7%	25.1%	23.7%
Rhode Island	Point Judith	9,922	5,568	8,181	13.9%	5.2%	8.4%
	Portsmouth	856	2,607	2,709	1.2%	2.4%	2.8%
	North Kingstown		12,748	8,306		11.8%	8.5%
	All Rhode Island Ports	13,054	22,094	20,481	18.4%	20.5%	21.0%
Total (mt)		71,139	107,574	97,422			

Table E.23 - Herring landings by major port, 1995 - 1997 (The other states that had herring landings (CT, NH, NJ, NY, NC, and VA) had less than 1% of total landings)

State	Port	Percent of weight of all species landed in port			Percent of value of all species landed in port		
		1995	1996	1997	1995	1996	1997
Maine	Portland	60.7%	55.2%	45.4%	5.3%	6.0%	4.3%
	Rockland	68.5%	95.7%	94.0%	32.0%	50.3%	52.7%
	All Maine ports	32.1%	51.2%	44.7%	1.7%	3.1%	2.6%
Massachusetts	Gloucester	52.2%	66.8%	60.1%	20.3%	20.8%	10.1%
	New Bedford		6.7%	5.5%		1.9%	0.2%
	All Massachusetts Ports	22.3%	25.1%	27.1%	26.7%	25.1%	1.5%
Rhode Island	Point Judith	13.9%	5.2%	26.1%	13.9%	5.2%	2.3%
	Portsmouth	1.2%	2.4%	96.4%	1.2%	2.4%	61.2%
	North Kingstown		11.8%	43.9%		11.8%	7.7%
	All Rhode Island Ports	18.4%	20.4%	34.3%	18.4%	20.5%	3.0%

Table E.24 - Herring landings as a percent of total landings and as a percent of total value of all landings in a port, 1995-1997

E.6.4.2.5 Other fisheries

Atlantic herring are also caught as an incidental catch in the coastal bottom trawl fishery and either landed as bait or discarded at sea. The incidental catch ratios reported by observers on bottom trawl trips are relatively low. Some whiting fishermen target herring for a limited number of trips each year. A review of data from the observer/sea sampler database provides estimates of the amount of bycatch in the shrimp fishery (Table E.25). Ratios vary depending on the area fished and time of year. An estimation of the total incidental catch based on these catch ratios is contained in section E.7.2.5.2.

Herring is also caught in the mackerel mid-water trawl fishery. A review of 1996 and 1997 vessel trip report data from vessels that reported both herring and mackerel catches shows that there are occasionally trips landing large amounts of both species. There is limited observer data on this mid-water trawl fishery to document the extent of discards of herring in this fishery. Vessels targeting herring also land some mackerel. Because mackerel is a higher value fish, it is unlikely there are significant discards of mackerel in the herring fishery.

Statistical Areas	January	February	March	April	May	December
0		.0037				
511		.0000				
512	.0000	.0012	.0052			
513	.0427	.0085	.0244	.0662	.0059	
514	.1436	.0204	.0243	.0502	.0020	.2482
521	3.2970	.0263	.1717			
538			.0661			
(blank)	.0412		.0029	.0639	.0050	.0705
Total	.0680	.0092	.0269	81	31	117
Observed Hauls	285	215	261			

Table E.25 - Herring bycatch ratios in the shrimp fishery (NMFS sea sampler/observer database)

Trips That Reported 10,000 lbs or more of Mackerel			Trips That Reported 10,000 lbs or more of Herring		
Herring	*Frequency*	*Cumulative %*	*Mackerel*	*Frequency*	*Cumulative %*
0	0	0%	0	0	0%
1000	2	5%	1000	3	6%
5000	1	8%	5000	10	26%
10000	3	15%	10000	4	34%
20000	1	18%	20000	7	48%
40000	7	36%	40000	5	58%
60000	6	51%	60000	6	70%
80000	7	69%	80000	4	78%
100000	5	82%	100000	4	86%
120000	5	95%	120000	0	86%
140000	0	95%	140000	0	86%
160000	0	95%	160000	2	90%
More	2	100%	More	5	100%

Table E.26. - Summary of trips landing herring and mackerel, 1996 (NMFS VTR)

Trips That Reported 10,000 lbs or more of Mackerel			Trips That Reported 10,000 lbs or more of Herring		
Herring	*Frequency*	*Cumulative %*	*Mackerel*	*Frequency*	*Cumulative %*
0	0	0%	0	0	0%
1000	2	6%	1000	4	12%
5000	0	6%	5000	1	15%
10000	5	22%	10000	4	26%
20000	2	28%	20000	4	38%
40000	9	56%	40000	5	53%
60000	4	69%	60000	7	74%
80000	3	78%	80000	1	76%
100000	4	91%	100000	2	82%
120000	0	91%	120000	2	88%
140000	0	91%	140000	0	88%
160000	1	94%	160000	1	91%
More	2	100%	More	3	100%

Table E.27 - Summary of trips landing herring and mackerel, 1997 (NMFS VTR)

E.6.4.2.6 Bycatch

The Sustainable Fisheries Act established National Standard 9, which requires that "conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch." "Bycatch" means fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic and regulatory discards. This definition differs from the traditional use of the term "bycatch", which many used to mean fish which are caught incidental to fishing for another species, whether or not those fish were retained for use. For commercial vessels, the current definition does not exclude fish that survive after being discarded. This section will summarize the limited information available on fish bycatch in the herring fisheries. Information on marine mammal and endangered species bycatch is discussed in section E.6.3.3.

At the request of the Council, the NEFSC analyzed data contained in the sea sampler/observer database to address four issues questions:

- Herring bycatch in all other fisheries
- Multispecies bycatch in the herring fisheries
- Marine mammal bycatch in the herring fishery
- Marine mammal bycatch in other midwater trawl fisheries.

The full NEFSC reply is contained in Appendix II. The NEFSC noted that the observer trips had not been examined to determine if they accurately characterized each fishery. The NEFSC identified only seven hauls using mid-water gear that targeted herring in 1995. The largest bycatch—none of which was retained—was spiny dogfish and silver hake. There was also a considerable discard of herring. Table E.28 summarizes this information.

In 1997, the Maine Department of Marine resources contracted for observer coverage of the herring fishery (Stevenson and Scully 1999). The complete report is in Appendix III. A total of 50 trips were made aboard eight different vessels. Trips were divided between purse seiners (23) and mid-water trawlers (27) either working singly (16) or in pairs (11), and were made to 21 different fishing locations, primarily in coastal Gulf of Maine waters. Table E.29 lists the bycatch species and quantities observed, by gear type. With the exception of spiny dogfish and mackerel, most bycatch was of small quantities on a number of different trips.

Most of the discards of spiny dogfish were observed in eleven haulbacks on six fishing trips. Five haulbacks using mid-water gear (including paired mid-water gear) averaged less than 80 pounds of dogfish per haulback, out of a total of 32 observed mid-water gear haulbacks. These catches were taken from a wide area, ranging from Seguin Island to Ipswich Bay. Six observed instances of observed dogfish incidental catch were using purse seine gear. One of these haulbacks contained 50,000 pounds of dogfish, a second contained 20,000 pounds, three other haulbacks averaged averaged about 1,500 pounds, and the final haulback consisted of only 50 pounds of dogfish. The large catches were made in August in the vicinity of Mt. Desert Rock. A total of 36 purse seine haulbacks were observed.

The review of the sea-sampling and observer database conducted by the NEFSC (see Appendix II) identified only one instance of dogfish discards. This is likely due to the limited observer coverage in the herring fishery. A review of dogfish discard mortality conducted during SAW 26 (NEFSC 1998c) focused on discards using bottom otter trawl and gillnet gear. While there was limited information available to base estimates of discard mortality, SAW 26 advised that estimates of 50% for discard mortality in bottom trawls, and 75% for discard mortality in gillnets, were reasonable. In the instances of purse seine incidental catches, the presence of large amounts of dogfish in the seine prevented the vessels from pumping herring. When the vessel operator recognizes this problem, the seine can be "slipped" and the catch released. Under these circumstances, the mortality of dogfish would be expected to be lower than the estimates for trawl or gillnet gear.

The majority of the mackerel bycatch was observed in the mid-water trawl fishery on Georges Bank or Cultivator Shoals. About 70,000 pounds of mackerel incidental catches were taken in June and July 1998. An additional 18,000 pounds was taken by mid-water trawlers in the winter fishery off Rhode Island. Most of the observed bycatch of bluefin tuna and all of the striped striped bass occurred in a series of mid-water trawl haulbacks made on the same day in the vicinity of the Great South Channel in October 1997. Two purse seine haulbacks also caught smaller amounts of bluefin tuna. In one instance, 11 bluefin tuna were released alive after being caught in a mid-water trawl net, apparently as it was being hauled back.

The Maine observer trips also recorded information on the quantity of herring discards, including the reasons for those discards, by gear type. These discards meet the current M-SFCMA definition of bycatch whether the herring survives or not. Based on these observed trips, the total amount of herring discarded for all gear types was nine percent of the herring caught. There was some variability across gear types, however, as discards in the trawl fisheries were less than one percent of the catch, while in the purse seine fishery it was 15.4 percent of the catch. The most common reason for discarding herring, and the greatest quantity discarded, was that the vessel was filled. Table E.30 summarizes these observations.

Within the purse seine fishery, herring released from the seine before pumping may survive. "Herring were caught, but not brought aboard, during 14 purse seine trips (16 sets) and 7 mid-water trawl trips (8 tows), or during 32% of all seine sets and 15% of all trawl tows" (Stevenson and Scully 1999). Herring discards by seiners reached 13% of the total catch. In some instances, herring also escaped because of problems with the gear. The most common reason why herring was discarded was because the vessel was too full to take any more on board. In one instance, 50,000 lbs of juvenile fish were released because they had no market value. Estimates of survival made at the time of release are not considered reliable because if herring suffer significant scale loss, long-term survival is unlikely (Stevenson and Scully 1999). Survival would seem to depend on the extent to which the seine is "dried up" before the herring are released. There are no studies available that document the survival rates of herring caught in purse seines, but Lockwood et al. (1983) estimated mortality of 50-90% for mackerel in a simulated purse seine experiment. To the extent herring released from a seine survive, this fishing method may reduce the mortality of bycatch as mandated by the Sustainable Fisheries Act. Discards only accounted for 1% of the trawl catch.

These limited observations do not cover all fishing seasons or all fishing areas and may not be truly representative of bycatch in the herring fishery. They are, however, comparable to a study of discard practices in the Irish Celtic Sea herring fishery during the 1994/1995 fishing season. The vessels in the study were paired mid-water trawlers of 21 to 25 meters in length. This study observed a discard rate for herring of 4.7%. As with observations in the Maine study, one of the major reasons for the discard of herring was due to market considerations. In the case of the Irish fishery, the primary reason for discards was due to a low roe content (Berrow et al. 1998). Bycatch of other species in this fishery was also small – 99.5% of the catch (by weight) was herring.

The NEFSC also examined its databases for information on herring bycatch in other fisheries. Because of more thorough observer coverage, the NEFSC was able to provide tables showing bycatch ratios for other gear types by month and statistical area. For bottom trawl gear, observed herring catches in other fisheries was less than ten percent of the amount of fish landed (on an annual basis) in all statistical areas except 539, 611, 612, 613, 615, and 625. In these areas, catch to landings ratios exceeded 15 percent on an annual basis, usually due to high ratios in several winter months. Observed catch to landings ratios also exceeded 10 percent in statistical areas 513 and 514 during the months of August and September. Bycatch ratios in the shrimp fishery are shown in Table E.25. The information provided by the NEFSC was used to estimate incidental catches of herring in other fisheries in order to evaluate the 5% TAC set-aside. This analysis is in section E.7.2.5.2.

Species	Discarded	Retained	Total
Bluefish	1	73	74
Atl. Herring	120,150	281,000	401,150
Lumpfish	5		5
Mackerel	10		10
Spiny Dogfish	253		253
Silver Hake	450		450
Illex Squid	17		17
Total	120,886	281,073	401,959

Table E.28 - Catch of other species for mid-water trawl gear targeting herring in 1995 (pounds) (NMFS Sea sampler/observer database)

Species	Seine	Trawl	Total
Atlantic Cod		19	19
Atlantic Mackerel	1,052	98,171	99,223
Atlantic Menhaden		50	50
Blue Shark, Round		310	310
Bluefin Tuna, Round	700	2,770	3,470
Blueback Herring		7,319	7,319
Bluefish	250	312	562
Butterfish		427	427
Harbor Seal		300	300
Longhorn Sculpin	2	8	10
Lumpfish	10	17	27
Mako Shark, round	25	199	224
Monkfish		37	37
Ocean Pout		16	16
Pollock		168	168
Porbeagle Shark		70	70
Scup		1	1
Sea Raven		4	4
Sea Robin		3	3
Illex squid	289	497	786
Silver Hake		2,224	2,224
Skate	2	1	3
Spiny Dogfish	75,050	3,837	78,887
Striped Bass		850	850
Thresher Shark		250	250
Torpedo ray		40	40
White Hake		11	11
Winter Flounder		1	1
Total	77,380	117,910	195,290

Table E.29 - Bycatch species (pounds) observed during observer trips funded by Maine DMR, 1997 (Maine DMR)

Gear Type		No market value	Gear damage prevented capture	Vessel filled	Pump clogged or other malfunc-tion	Not enough to pump	Gear Malfunc tion, fish escaped	Retained (trips without discards)	Total Catches (pounds)
Mid-water	Discards			19,360	4,000	22,520			45,880
	Retained			433,770	100,000	325,000		1,596,148	2,454,918
Pair trawl	Discards		100			4000			4,100
	Retained		140,000					1,845,000	1,985,000
Purse Seine	Discards	50,000	105,000	456,000	20,000	1,000	102,000		734,000
	Retained	40,000	235,000	1,425,000	200,000	400	230,000	1,139,000	3,269,400
Total	Discards	50,000	105,100	475,360	24,000	27,520	102,000		783,980
	Retained	40,000	375,000	1,858,770	300,000	325,400	230,000	4,580,148	7,709,318

Table E.30 - Observed herring catches (pounds), retained and discarded, on trips with herring discards, 1997 – 1998 (Stevenson and Scully 1999)

E.6.4.3 Herring Processing Sector

Herring fishermen sell their fish into both domestic and international markets. The vast majority of the catch, however, supports the domestic bait market and the sardine canneries. In recent years there has been little success in selling herring fillets into the international market for frozen fillets, though this has been an important product in the past.

Because of the large volume of herring that are landed, catches are offloaded via pumps that are either mounted shoreside or on the vessel. The herring is typically pumped into trucks that carry a combined mixture of herring and water, but are not cooled in any manner. For this reason, it is important the fish be landed soon after they are caught and transported as rapidly as possible. The typical truck is estimated to hold about 40,000 pounds (or just under 20 mt) of herring. Each boat may unload to a number of trucks that are owned by different herring dealers. Some small bait dealers may use smaller trucks or plastic containers to receive the herring. The herring are then shipped to the bait dealer, cannery, or processor that will use and sell the product. Some boats may unload herring at several different locations to a number of lobster cooperatives or other dealers. Small bottom trawl vessels that target herring at certain times of the year may sell herring directly to lobster or tuna boats, either at the dock or at-sea. When herring are plentiful, one of the key problems facing fishermen is to obtain, and retain, a ready market for their fish. The introduction of IWP's, discussed below, was in part a response to find an additional market for herring fishermen. Many fishermen do not leave the pier without knowing who will buy their fish and how much they should deliver.

E.6.4.3.1 Domestic Processors

The two major domestic processing markets for Atlantic herring are the sardine canneries and the bait market. At times, U. S. herring have also successfully competed in the foreign frozen fillet market to the European and foreign markets, but the last time this market was significant was in 1982. Herring are processed as canned products in five packing plants, sold as bait (either as whole fish or cuttings left over after canning), or sold whole to foreign processing ships (IWP operations), where they are frozen or brined for transport. There is currently no domestic market for whole fresh fish or fillets, and only limited international trade in these products (see section E.6.4.3.3). A few adult herring are smoked or pickled as specialty products and some are sold as food or pet food. No herring have been reduced to fish meal or oil in the U.S. since the closing of a reduction plant in Rockland, Maine in 1989, but some herring is shipped to Canada to be processed into these products.

The current primary use of herring is as bait for the lobster, tuna, and various long-line fisheries. The size of the bait market for herring is uncertain. Some herring landed in Maine is used for bait in Massachusetts and New Hampshire, and in the southern New England and mid-Atlantic region lobster and blue crab fisheries. The lack of a comprehensive dealer reporting system, as well as the transfer of bait directly over the side from harvesters to users, makes estimates of market size difficult. Reported bait landings varied between 10,000 and 15,000 mt during 1989-92. Reported bait landings of menhaden, which is substituted for herring when herring is not available, were roughly 7,000 mt in 1991. Maine

DMR (1997) estimated that 31,755 mt of the herring landed in Maine in 1996 was used for bait, an increase of more than 8,000 mt from the previous year. This only available estimate links the bait market to landings in a particular state. Most observers believe that at least 50,000 – 70,000 mt was used in the bait market in 1996 and 1997, with an estimated value of $15.6 million. Some observers believe that unreported landings and sales to this market may in fact be much higher. Especially in Maine, herring bait is critical to full and part time lobster fishermen (Dyer and Poggie, 1998). The increase in the number of lobster traps in the last four years, coupled with the lack of availability of an alternative bait, may help explain the rise in domestic herring landings. The demand for lobster bait in the summer and early fall mirrors the increased landings of herring during this same period. Comparisons of New England lobster landings with New England Atlantic herring landings for the period 1993 through 1997 reflect the link between these two fisheries (Figure E.16).

The Maine sardine industry dates back to the late nineteenth century. The first canneries were built when American importers, familiar with imported French sardines made from pilchards, began searching for a fish caught in the U. S. that could be similarly canned. Experiments with menhaden proved less than satisfactory. After much experimentation with herring, the industry developed a successful product marketed as sardines. In 1875, about two or three hundred cases were processed (Earll, p. 163). Prior to 1880, the industry was limited to Eastport, Maine, but it then began to expand to other cities in the vicinity. In 1950, 46 plants packed over 3.8 million cases worth $21.2 million. After 1950, the number of canneries declined until only five remained in 1997. The amount packed declined to under one million cases during the 1980's, but recently climbed over this mark for the first time since 1982. The amount of herring used by the canneries has remained stable at 30-35,000 mt for the past five years (Maine DMR, 1997).

An economic of the Maine sardine industry was conducted in 1982 (Hu et al. 1983). At the time of this review, 14 plants were operating in Maine, providing employment for 1,176 processing workers in 1980. The industry contributed $66 million to the Maine economy in 1980, about one third of the total estimated income contributed by the seafood processing industry to the state. Hu et al. found that the 14 existing plants were operating under extremely low profit margins—particularly the smaller plants (less than 50 employees and 50,000 to 100,000 cases packed annually). Small plants were pressured by increased costs for materials (particularly cans) and increased maintenance costs from operating older plants.

An updated economic study of the sardine industry was conducted in late 1997 (Reiling and Bennett 1998). Reiling and Bennett focused on the five remaining sardine-packing plants, owned by three separate companies. In 1996, more herring was packed by these three companies, and one company that closed, than in any year since 1981. 74% of the pack was sardines, the remainder herring steaks. As much as 40% of the herring purchased by sardine packers in 1996 was sold a lobster bait. The domestic market for sardines has remained unchanged for the past ten years. The report estimated that the packers could double their existing production given a steady supply of herring and increased market demand. Reiling and Bennett also estimated the economic impact of the canneries; this information is discussed in later sections.

The total production of six packing plants operating in Maine in 1996 was 1,022,621 standard cases (35,380 mt) with a wholesale value of $51.1 million (Table E.31). Of the total production of sardines, steaks, and kippers in 1996, 47% was supplied by domestic Maine landings. The remainder was trucked to Maine plants from other states (42%), mostly from Massachusetts, or from Canada (11%). In addition to canned product, the canneries are also participants in the bait market. Herring "cuttings", produced when large herring are canned as steaks, are sold to the bait market. In addition, some of the herring that arrives at the canneries is not suitable for canning and is diverted to the bait or other markets.

Maine canneries use both domestic and Canadian harvested herring. The movement of herring in both directions across the border has been an important factor in the Maine sardine industry since the industry began. In early years, the movement was primarily of fish caught in Canadian waters taken to canneries in downeast Maine. The application of customs duties was an issue, as the levying of tariffs made it uneconomical to use the Canadian fish in U. S. canneries. In the 1880's, a favorable decision by the U. S. Customs treated any fish carried across the border in vessels of less than five net tons as being “trucked” across the border and not subject to duties. In addition, the building of Canadian canneries resulted in herring moving across the border in both directions (Earll 1887). By the 1970’s, there were periods when most of the product used in U. S. canneries came from Canadian waters—in 1970, 70 percent of the sardines canned in Maine were caught in Canada (Hu et al. 1983). In years when the supply of juveniles is higher in New Brunswick, imports from Canada have accounted for 50% of the production by Maine plants (e.g. 1988 and 1990); at other times, Maine has exported a surplus to Canadian plants (most recently in 1980 and 1981) (NEFMC 1978; Maine DMR 1997). Herring is also trucked into Canada from other New England ports.

A limited amount of herring is processed as meal (usually waste cuttings from some other primary use), or sold to zoos and aquariums as animal feed. Preferred herring for zoo feed are fillet sized herring that are firm and high in fat content. The price for zoo feed can be as high as $0.17/lb. There have also been attempts to break into the food market with other value added products. The Gloucester Fishermen's Wives Association, for example, has developed several value added products (Dyer and Poggie 1998).

While the demand for herring has increased considerably in recent years as indicated by the rise in landings, this has not affected the ex-vessel price received by fisherman. The price has hovered in the range of $0.05 - $0.06 per pound. Of the two primary markets, the sardine canneries require a higher quality herring. Herring cannot be "feedy" or full of spawn for this fishery, and must be delivered to the canneries as fresh as possible. The canneries use herring caught by both mid-water trawlers and seiners. Part of the challenge facing herring fishermen is finding a market to sell their catch. Particularly in the bait market, it can be difficult to find a buyer when herring are abundant. Many boats do not leave the pier unless they know who they will sell their catch to, and how much is needed. Some in the industry report that in order to guarantee a place to sell their catch, vessels must agree to provide dealers with an occasional "truckload" of herring at no charge.

There is considerable interest in development of additional processing capacity in the herring fishery. One existing processor currently handles about 10,000- 15,000 mt annually and would like to increase to 40,000 – 50,000 mt. Other interests are considering developments that would add 150,000 –200,000 mt capacity to the industry. These developments hinge on finding additional markets for herring products. There may be an opportunity to enter the international food fish market, which will provide another outlet for herring fishermen. To be successful, a reliable source for high quality herring must be found and plants must have the flexibility to process the herring into different products (Dyer and Poggie, 1998).

Table E.31 – Maine canned herring products and packing plants

Year	Standard Cases	Wholesale Value($)	No. of Plants
1950	3,844,164	21,209,033,	46
1951	1,676,764	14,635,352	44
1952	3,530,876	21,507,970	48
1953	2,782,495	16,954,119	44
1954	2,934,933	18,152,815	43
1955	1,268,843	9,333,350	35
1956	2,231,441	16,692,008	39
1957	2,217,688	14,733,259	37
1958	2,099,959	15,873,963	33
1959	1,753,145	14,902,142	31
1960	1,997,618	16,699,987	31
1961	753,647	7,559,619	31
1962	2,144,372	19,931,333	31
1963	1,637,348	13,547,306	27
1964	865,751	7,583,821	23
1965	1,226,903	10,868,060	23
1966	1,332,544	12,261,590	23
1967	1,250,411	13,862,330	23
1968	1,730,306	19,296,978	22
1969	1,042,806	11,531,342	21
1970	806,501	11,226,817	21
1971	950,821	11,796,509	20
1972	1,561,535	23,877,119	18
1973	995,056	15,688,156	17
1974	1,434,801	23,954,640	16
1975	1,248,929	27,998,614	15
1976	1,209,074	29,591,481	15
1977	1,269,955	34,407,778	15
1978	1,301,965	41,167,963	15
1979	1,429,646	49,370,005	14
1980	1,109,883	41,370,210	14
1981	1,468,809	49,433,137	14
1982	1,014,336	40,573,440	13
1983	724,103	26,450,000	12

Table E. 29 (cont.)

Year	Standard Cases	Wholesale Value ($)	No. of Plants
1984	870,179	34,213,000	12
1985	983,651	37,800,000	11
1986	953,194	43,680,696	10
1987	882,178	40,414,536	10
1988	980,826[3]	44,137,170	9
1989	770,224	34,660,080	8
1990	815,758	37,340,886	8
1991	847,319	42,317,602	7
1992	948,792	47,439,600	6
1993	924,298	46,214,900	6
1994	934,686	46,734,300	6
1995	872,924	43,646,200	6
1996	1,022,621	51,131,050	6
1997	891,000	44,550,000	5

1. Data reported as standard cases of 100 cans beginning in 1990 when cans larger than 3¼ oz. were eliminated and value of $50 per case beginning in 1991.
2. Data prior to 1950 available from the Maine Department of Marine Resources.
3. Maine and Massachusetts – Massachusetts with one plant.

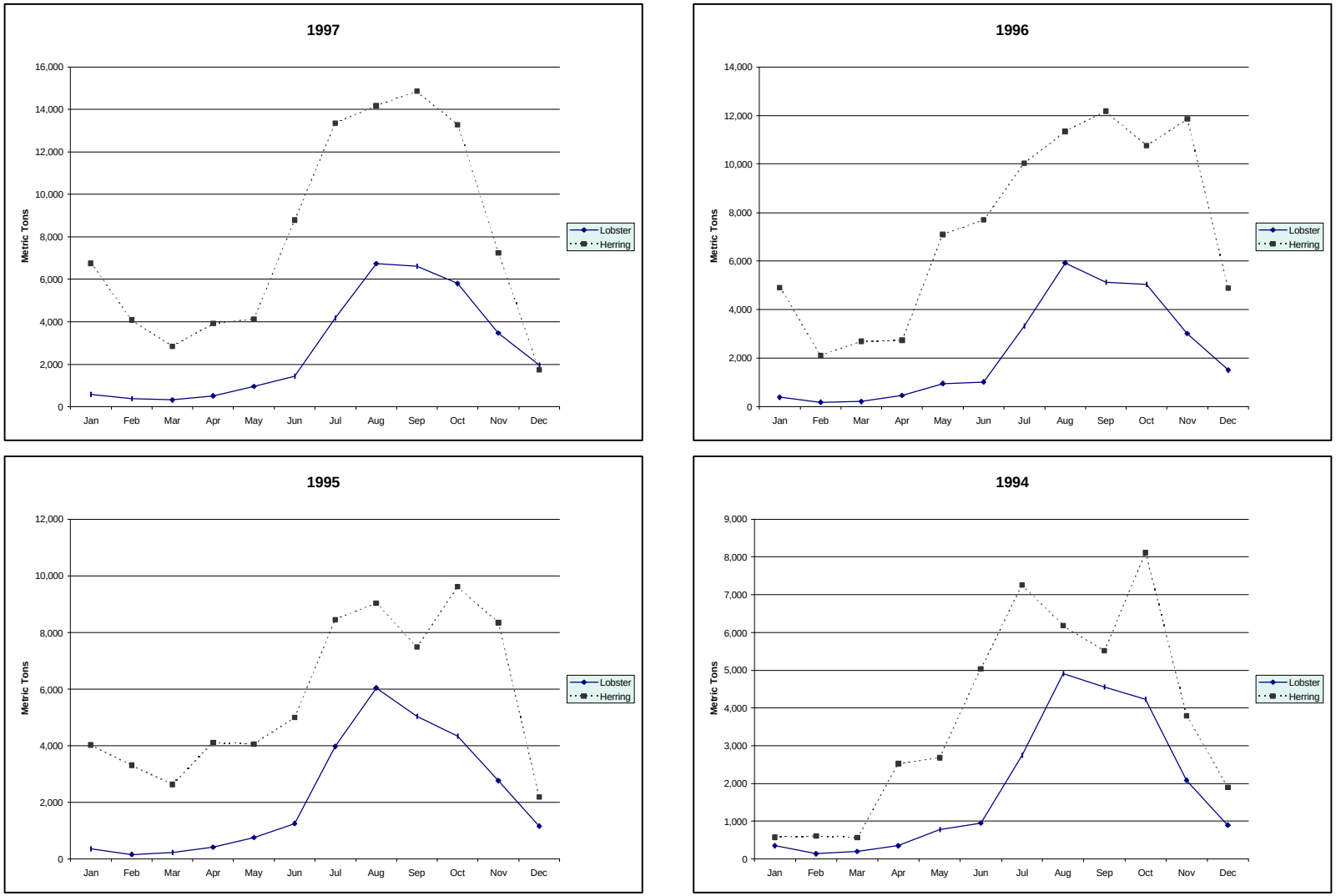

Figure E.16 – Comparison of New England lobster and herring landings, 1994-1997 (Source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division.)

U. S. GOM Catches Processed in Canada (mt)			Reported Herring Catches in SNE
Year	Truck	Boat	Truck
1987	4438	791	
1988	5933	186	
1989	4549	118	
1990	5180	42	
1991	5413	723	
1992	5042	1537	167
1993	1534	976	0
1994	2273	1547	183
1995	3280	2117	3316
1996	4489	3690	6359
1997	102	1280	5546

Table E.32 – Atlantic herring exports to Canada (Source: Maine DMR)

Year	From Canada (mt)	Total (mt)
1991	9,247	33,281
1992	11,742	35,335
1993	8,200	31,799
1994	7,054	32,874
1995	2,804	29,788
1996	3,777	35,380
1997	4,687	27,161

Table E.33 – Herring used by Maine sardine canneries (Source: Maine DMR)

E.6.4.3.1.1 Estimate of DAP

DAP is defined as the amount of the U.S. harvest that domestic processors will use, combined with the amount of the resource that will be sold as fresh fish. The ability to estimate DAP is complicated by poor information on the amount of herring being sold as bait (caught in both the US and Canada) and a lack of detailed information on plans of domestic processors. Improved reporting of vessel landings and dealer purchases after adoption of the plan should facilitate better estimates in the future. Information from various sources was used to estimate actual harvest and use of herring in 1994 through 1997.

	1994	**1995**	**1996**	**1997**
U.S. Landings	54,324 mt	76,135 mt	103,663 mt	98,083 mt
IWP	2,849	8,776	10,903	1,000 mt
Total amount processed (DAP)	51,475	67,359	92,760	97,083mt
Sardine canneries	32,874	29,788	35,380	27,162 mt (prelim. est.)
Other uses	18,601	37,571	57,380	69,921 mt
Trucked to Canada	2,456	6,596	10,848	5,546 mt
Boated to Canada	1,547	2,117	3,690	1,280 mt
Canadian herring processed in US canneries	7,054	2,804	3,777	4,687 mt
Canadian herring used as bait in U.S.	Unk	Unk	Unk	Unk

Table E.34 – Summary of recent herring processing estimates

This summary of historic processing performance can be used as a baseline for estimating DAP, but it does not indicate future developments. At various public hearings, sardine industry representatives have stated their canneries are operating at 66 to 80 percent of capacity. In 1996, roughly 35,000 mt of herring were processed by the canneries. For purposes of estimating DAP, the Council assumed 50,000 mt of herring (a 42 per cent increase over 1996) would meet the canneries needs for the foreseeable future. The bait industry is expected to stay at current levels. Reported use of bait is estimated at approximately 70,000 mt, but there are concerns that this number may actually under estimate the actual bait market. For this reason, the herring bait market is estimated at 100,000 mt. During development of the DEIS, various processors indicated an interest in increasing their processing by approximately 30,000 mt. Combining this information results in a DAP of 180,000 mt.

Even though it increases known processing performance by 80%, the Council's estimate of DAP

was questioned as being too low. Supporting this argument was the introduction of a new, moored processing vessel capable of harvesting 20,000 mt in Maine in October, 1998. The freezer/trawlers in the mackerel fishery are also capable of processing herring , should they choose to do so, which would increase processing capacity. While these developments were not explicitly considered when the Council developed its recommendation, all of this capacity fits into the Council's estimated increase of nearly 80,000 mt in DAP from 1997 performance.

E.6.4.3.2 Internal Waters Processing (IWP)

Internal waters processing operations for Atlantic herring began in Massachusetts in1985 (internal waters of a state are shoreward of the baseline used to delineate the territorial sea; they are not the waters between the baseline and the territorial sea limit). The first operation was conducted during the summer by Mayflower International of Gloucester in 1985 and 1986 using an East German processor. In 1985, 1,360 mt of the allocated 3,000 mt were taken, and the operation was considered a success. Unfortunately, 1986 was a disappointment. Only 127 mt of an allocated 2,500 mt (7,500 mt requested) were taken. Poor results were blamed on purse seine breakdowns and fish being unavailable in Massachusetts and adjacent waters.

During 1987 and 1988 there was a lull in IWP activity, with a small IWP harvest in Maine, but nothing in Massachusetts (Table E.36). This lull quickly changed to a frenzy as the demand for IWP permits and allocations grew dramatically from 1989 through 1991, with the emphasis (in Massachusetts) shifting from the summer/fall fishery to the winter/spring.

Three companies used 8,721 mt of 11,500 mt allocated by Massachusetts in 1988-89. An additional 3,500 mt was harvested in Maine during the summer of 1989. A total of 45,000 mt was requested by four applicants. The Commission's Atlantic Herring Section became involved in 1989 and allocated 10,000 mt for the Massachusetts winter fishery and 12,000 mt for Rhode Island (Table E.35). The Massachusetts allocation was taken during January-March 1990 by three companies using four Soviet processors, while only 2,000 mt was processed in Rhode Island.

In 1990-91 and 1991-92, Massachusetts IWP’s were unsuccessful since fish were unavailable. In 1991, there were IWP operations in four states. Reduced allocations in 1990-91 and 1991-92 (including a zero allocation in Maine in 1990) reflected concern for the Gulf of Maine herring resource. With the adoption of a single stock assessment in 1991 indicating that the stock complex was underutilized, IWP allocations increased substantially in subsequent years. IWP operations from 1992 to 1995 were confined to the Maine summer-fall fishery, except for a small operation in New Jersey in 1992 (Table E.35). In 1996, there were IWP operations in three states and in 1997 a single one in Rhode Island that processed 843 mt.

IWPs continue to be an important part of the processing sector. States coordinate the amount of herring allocated to IWPs through the Commission. Generally, the amount of herring allocated to IWPs has been greater than the actual amount taken (Table E.35 and Table E.36). Maine, Massachusetts, Rhode Island, New York, and New Jersey have allowed IWPs in recent years.

IWP landings in Maine peaked at 8,776 mt in 1995. In Massachusetts, IWP landings peaked at 9,673 mt in 1990. Quantities in other states have not exceeded 2,000 mt.

STATE	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
ME	Unk	0	3,500?	25,000	30,000	35,000	16,000	13,000[2]
MA	10,000	5,000	6,000	35,000	42,000	35,000	16,000[1]	8,000[3]
RI	12,000	2,400	3,000	15,000	18,000	15,000	21,600	42,000
NY			2,000	15,000	10,000	15,000	14,400	5,000
NJ			500	10,000		15,000		5,000
TOTAL IWP	22,000?	7,400	15,000?	100,000	100,000	115,000	68,000	73,000
AREA 2 (JVP)							20,000	20,000
AREA 3 (JVP)							20,000	20,000
TOTAL	22,000?	7,400	15,000?	100,000	100,000	115,000	108,000	73,000[4]

Table E.35 - Internal waters and joint venture processing allocations (mt) by state and fishing year, 1989 - 1996 (Source: Maine DMR)

1 = An initial allocation of 10,000 mt was made by MA with 6,000 mt held in reserve

2 = Maine allocated 6,750 mt for calendar year 1996

3 = MA allocated 4,000 mt to each of two companies, providing they diverted a portion of their production to shoreside processors

4 = Allocations for 1996-97 in areas 2 and 3 did not distinguish between IWP and JVP use

State	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
ME			300		3491		2918	3339	6647	2849	8776	3803
MA	1360	127			8748	9673	897					2937
RI						2000	740					4163
NY							1034					
NJ								772				
Total	1360	127	300		12239	11673	5589	4111	6647	2849	8776	10903

Table E.36 - Internal Waters Processing (IWP) landings (mt) by state, 1985-1996. (Source: Maine DMR)