

IMPINGEMENT OF ORGANISMS ON THE INTAKE SCREENS  
AT PILGRIM NUCLEAR POWER STATION  
JANUARY - DECEMBER 2010

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Entergy Nuclear  
Pilgrim Nuclear Power Station  
Plymouth, Massachusetts

by

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## **Introduction**

Pilgrim Nuclear Power Station (PNPS) is located on the northwestern shore of Cape Cod Bay (Figure 1) with a licensed capacity of 685 megawatts. The unit has two circulating water pumps with a capacity of approximately 345 cfs (155,500 gallons per minute) each and five service water pumps (2,500 gallons per minute each) with a combined capacity of 23 cfs. Water is drawn under a skimmer wall, through vertical bar racks spaced approximately three inches on center, and finally through vertical traveling screens of  $\frac{1}{2} \times \frac{1}{4}$  inch mesh (Figure 2). There are four vertical screens, two for each circulating water pump.

This report describes the monitoring of impinged organisms at Pilgrim Station based on screen wash samples taken from January to December 2010 and provides documentation of the environmental monitoring and reporting requirements of NPDES Permit No. MA0003557 (USEPA) and No. 359 (MA DEP).

## **Methods and Materials**

Three scheduled screen wash periods were monitored each week from January to December 2010. These included the 0830 wash on Monday, the 1630 wash on Wednesday, and the 0030 wash on Saturday. Each sampling period thus represented a separate, distinct eight-hour period. Prior to each sampling period, the time of the previous screen wash was obtained from a strip chart recorder located in the screen house or from the Control Room log to permit the actual sampling interval to be calculated. Whenever the screens were static upon arrival a 30-minute sample was collected, and if the screens were already operating then a 60-minute sample was obtained.

Low and high pressure spray nozzles directed at the screens washed impinged organisms and debris into a sluiceway which was sampled by inserting a collection basket made of stainless steel mesh. All fauna were identified and noted as being alive, dead, or injured. Fish were determined to be alive if they showed opercular movement and no obvious signs of injury. Fauna determined to be alive were measured for total length (mm), then released. Those determined to be dead or injured were preserved. In the lab, the weights (grams) and total lengths (mm) were recorded for up to 20 specimens of each species. The impingement rate was calculated by dividing the number of fish collected by the number of hours in the collection period. Counts made from all collections during a month were pooled and then extrapolated to estimate a monthly total (total number of fish in each month divided by the total collection hours in each month)  $\times 24$  hours  $\times$  number of days in the month. These monthly totals were summed to derive an annual total adjusted for number of collection hours.

If an impingement rate of 20 fish per hour was obtained for static washes, an additional one-hour sample was taken. If at least 20 fish were present in the extra 60-minute collection period the Operator and Shift Manager were immediately informed and advised to leave the screens operating until further notice. Additional follow-up sampling would be performed at approximately 4-hour intervals, as warranted by conditions until the impingement rate declined to less than 20 fish per hour. As these subsequent samples were taken communication typically

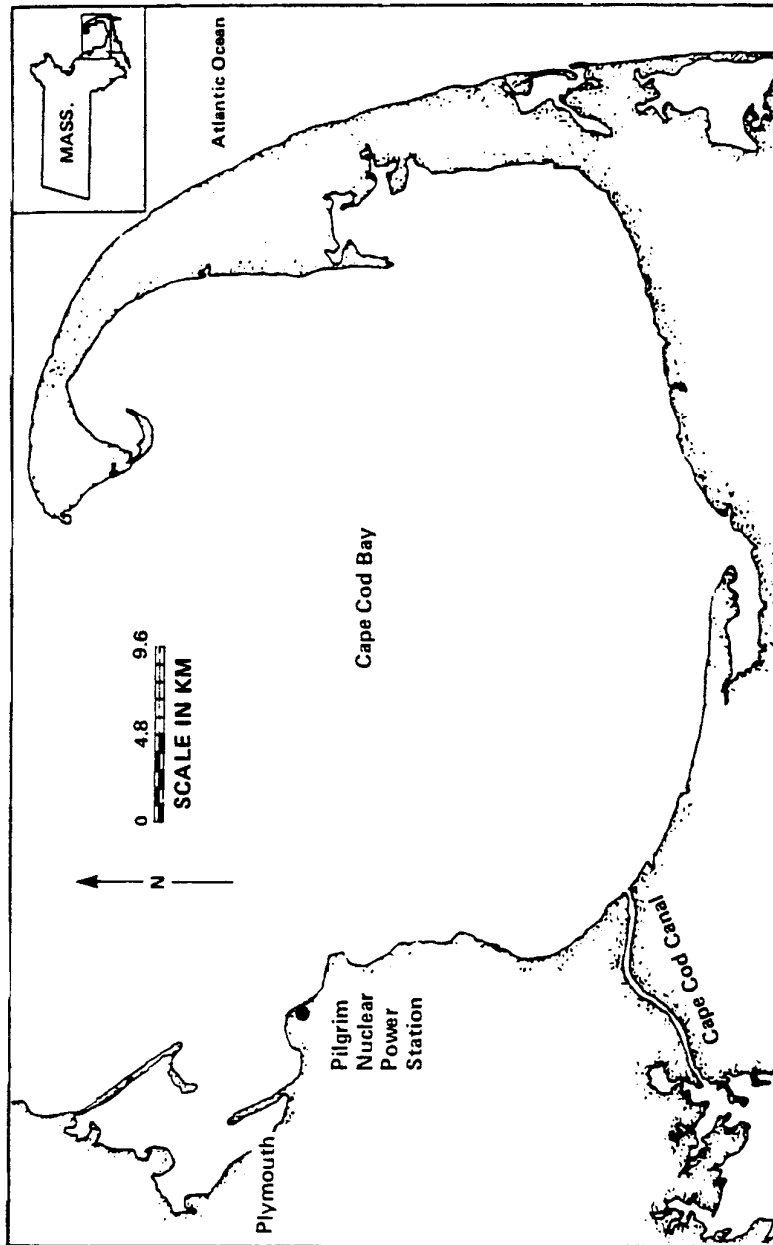


Figure 1. Location of Pilgrim Nuclear Power Station

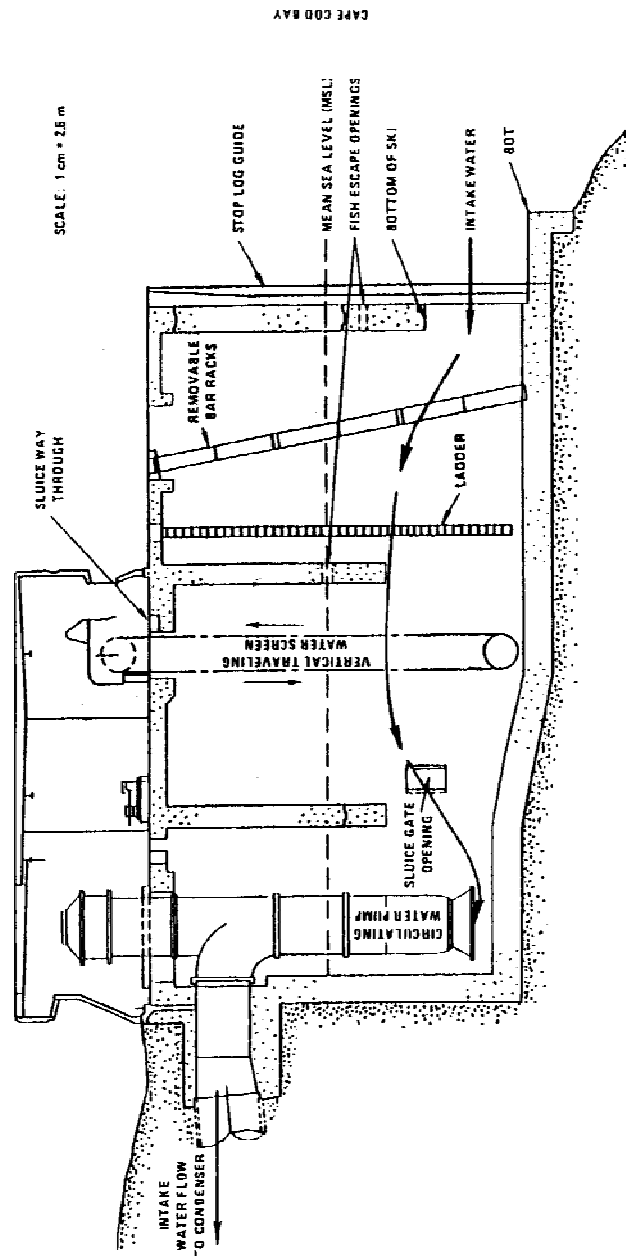


Figure 2. Cross-section of intake structure of Pilgrim Nuclear Power Station.

occurred in order to keep all appropriate individuals updated. A similar procedure was followed if 20 or more fish were found in an initial continuous wash sample, with additional monitoring occurring until the impingement rate was less than 20 fish per hour. As in the case of static wash samples all appropriate individuals were kept apprised as conditions changed.

## **Results and Discussion**

### **Fish**

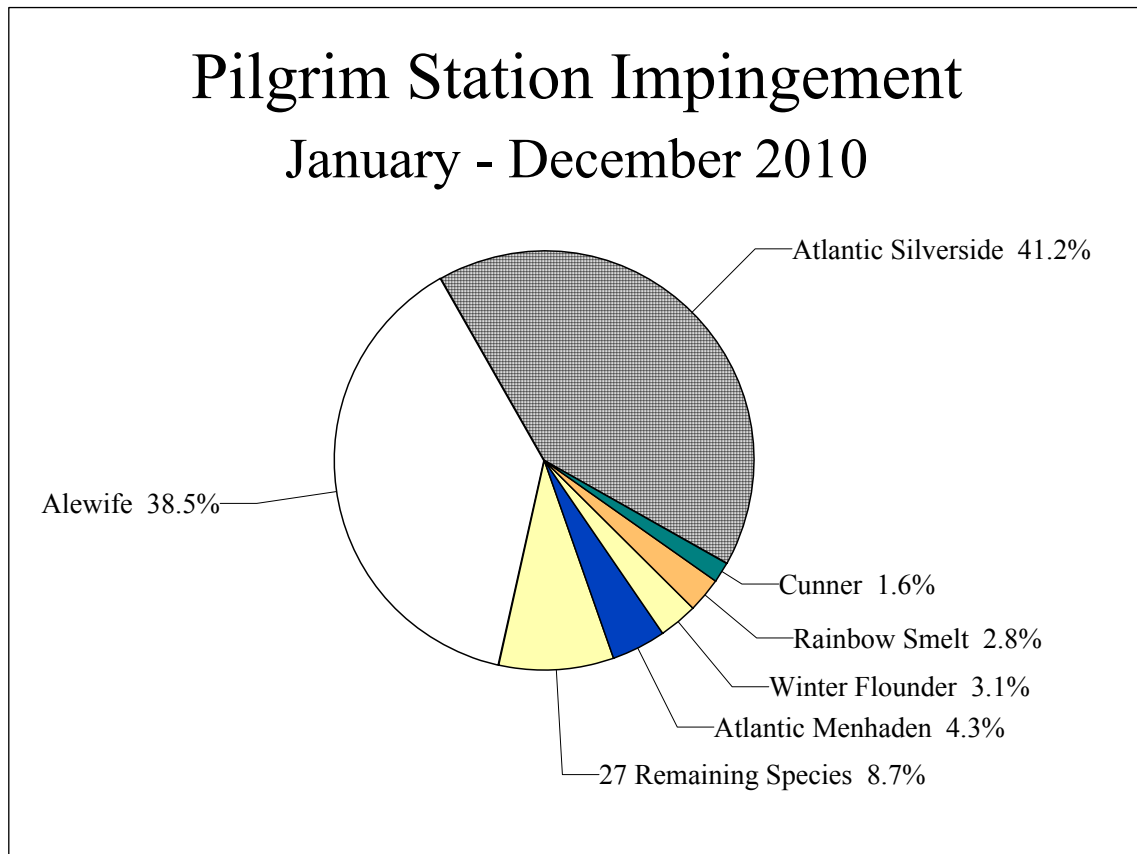
In 434.78 collection hours, an estimated total of 32,962 fish consisting of 33 species was collected during sampling completed from January - December 2010 (Table 1, Figure 3). Atlantic silversides (*Menidia menidia*), alewife (*Alosa pseudoharengus*), Atlantic menhaden, (*Brevoortia tyrannus*), winter flounder (*Pseudopleuronectes americanus*), rainbow smelt (*Osmerus mordax*), and cunner (*Tautoglabrus adspersus*), were the top six numerical dominants accounting for 41, 38, 4, 3, 3 and 2 %, respectively, of the annual total. The overall impingement rate of all fish combined in 2010 was 4.43 fish per hour, ranging from 16.7 in July down to 0.1 fish per hour in June (Table 1).

Atlantic silversides, historically one of the most numerous fish impinged at PNPS, ranked first with an estimated annual total of 13,576 fish. Silversides were represented in the catch every month but were most abundant in April (8,233 fish), when 61% of the annual total was collected (Table 1). Impinged silversides were all young-of-the-year and age 1 fish (see Conover and Murawski 1982) ranging in size from 63 to 152 mm with a mean length of 95 mm (Table 2).

Alewife ranked second in 2010 with an extrapolated total of 12,680 fish. They were impinged most often in July when 95% of the annual total was obtained (Table 1). The remaining individuals were found in March, April, May, August, and October through December. Impinged alewives were juvenile fish ranging in size from 64 to 172 mm with a mean length of 95 mm (Table 2).

Menhaden were impinged from July through December with 65% of the year's total being collected in August. Winter flounder were impinged every month except for June, September, and October; 63% were recorded from January through March. Smelt were most common in November, and March, 68% of the fish being impinged during those two months. Lastly, cunner were represented in the catch primarily during the cold months of November through February; 93% of the fish were taken during those months.

In 2010 there were two brief impingement incidents where the sampled impingement rate exceeded 20 fish per hour; one in April and one in July. The April sample, taken on the 12<sup>th</sup>, involved Atlantic silversides and spotted hake impinged at the rate of 25 fish per hour. The July sample, taken on the 28<sup>th</sup>, contained five species impinged at a combined rate of 236 fish per hour. Silversides accounted for 99.5% of the April catch and alewives accounted for 99.4% of the July catch. In both cases subsequent samples taken immediately following the first (3 and 0 fish per hour, respectively) indicated that the relatively high rates of impingement were of short duration.



**Figure 3. Percent of total for numerically dominant species of fish impinged on the Pilgrim Nuclear Power Station intake screens, January to December 2010.**

Annual extrapolated totals for all species impinged from 1980 to 2010 along with their respective 1980 to 2009 long-term means are shown in Table 3; results for the 14 typical dominants and total fish are also shown in Figure 4. The select 14 species typically account for greater than 90% of the annual total collected on the screens. The 2010 impingement total of 32,962 fish was 71% of the 30-year mean of 46,516 fish impinged. The below average value in 2010 was clearly due to reduced numbers of Atlantic menhaden which have typically ranked first or second over the 1980 to 2009 time period; in 2010 their annual total (1,403) amounted to only 5% of the time series mean of 25,691 fish. Overall among the remaining numerical dominants silversides, alewife, cunner, and lumpfish were above average in number in 2010. The alewife total, in particular, was seven times the time series mean. Grubby, smelt, tomcod, hakes, blueback herring, windowpane, tautog, and Atlantic herring were below average in number. Winter flounder numbers were near average (1005 in 2010 compared with a mean of 975).

Previous large impingement events, defined as those involving more than 1,000 fish, are documented in Table 4. The short-lived influx of alewives in July represented the only such event in 2010 and the first one occurring since September 2007. At PNPS menhaden and silversides have accounted for 15 of the 21 cases. These events often occur in the late summer and autumn when young fish are abundant, actively moving offshore for the winter and water temperatures are declining. As water temperatures drop, metabolism declines along with swimming ability.

Impingement rates (number of fish collected divided by number of collection hours) for each species and their respective estimated annual totals for 2010 are presented in Table 5. Alewife and silverside yielded the highest impingement rates (2.465 and 1.290 fish/hour, respectively). For all species combined, the impingement rates were 4.44 fish/hour and 32,962 fish/year, ranking 11<sup>th</sup> over the 31-year time series from 1980 to 2010 (Table 6). The average annual impingement total recorded from 1980 to 2009 was 46,448 fish per year, ranging from 1,112 (1984) to 302,883 (2005) fish per year.

Since 1980, 80 species of fish have been collected on the PNPS intake screens (Table 7). Nine species of fish (alewife, Atlantic silverside, Atlantic tomcod, blueback herring, cunner, grubby, hakes, rainbow smelt, and winter flounder) were collected every year from 1980 to 2010. Eight other species, Atlantic herring, Atlantic menhaden, lumpfish, northern pipefish, rock gunnel, tautog, threespine stickleback, and windowpane were present at least 90% of the time ( $\geq 28$  annual occurrences).

## **Invertebrates**

From January to December 2010, 12,454 invertebrates representing 13 taxa (Table 8) were estimated to have been impinged at Pilgrim Station yielding an impingement rate of 1.4 invertebrates per hour. Sevenspine bay shrimp (*Crangon septemspinosa*) ranked first and accounted for 51% of the annual estimated total. They were primarily impinged in January, February and April when 28, 35 and 24%, respectively, of the 6,368 estimated total was collected. Cancer crabs (*Cancer spp*) and green crabs (*Carcinus maenas*) ranked second and third in numerical order accounting for 18 and 8%, respectively, of the annual invertebrate total. Cancer crabs were present throughout the year and were most abundant in November when 22% of their total (2,301 crabs) was collected. Green crabs were also impinged every month and were most abundant in January when 28% of their annual total of 999 crabs was impinged. Seventeen American lobsters (*Homarus americanus*) were impinged during sampling periods in 2010 ranging in size from 12 to 143mm, yielding an annual estimated total of 350 animals. Among the seventeen lobsters collected three were of legal size ( $\geq 82$  mm) and the rest were less than 80 mm and likely juveniles.

Table 9 presents annual estimated totals for impinged invertebrates dating back to 1980. Based on the times series mean the bay shrimp total for 2010 was below average amounting to 89% of the mean. The green crab total was also below average amounting to 75% of the mean. In contrast, rock crab were impinged in above average numbers, 1.6 times the mean (2301 compared with 1447)..

## **Conclusions**

1. The average hourly impingement rate for 2010 at Pilgrim Station from January to December was 4.4 fish per hour for all fish combined. The estimated annual impingement total of 32,962 fish ranked 11<sup>th</sup> over the 31-year time series, 66% of all previous annual totals were lower.
2. Thirty-three species of fish were sampled in 437.28 collection hours in 2010.
3. Atlantic silversides, alewife, Atlantic menhaden, winter flounder, rainbow smelt, and cunner, were the numerical dominants accounting for 41, 38, 4, 3, 3 and 2 %, respectively, of the annual total.
4. In 2010 there were two brief impingement incidents where the sampled impingement rate exceeded 20 fish per hour; one in April and one in July. Silversides accounted for 99.5% of the April catch and alewives accounted for 99.4% of the July catch. In both cases subsequent samples indicated that the relatively high rates of impingement were of short duration.
5. The short-lived influx of alewives in July represented the only large impingement event (more than 1,000 fish) in 2010 and the first one that occurred since September 2007.
6. Invertebrates were impinged at a rate of 1.4 animals per hour. Sevenspine bay shrimp, cancer crabs and green crabs accounted for 51, 18, and 8% of the 2010 estimated annual total of 12,454 invertebrates.



**Literature Cited**

Conover, D.O. and S.A. Murawski. 1982. Offshore winter migration of the Atlantic silverside, *Menidia menidia*. Fishery Bulletin U.S. 80(1):145-150.

Witherell, D.B. and J. Burnett. 1993. Growth and maturation of winter flounder, *Pleuronectes americanus*, in Massachusetts. Fishery Bulletin U.S. 91(4):816-820.

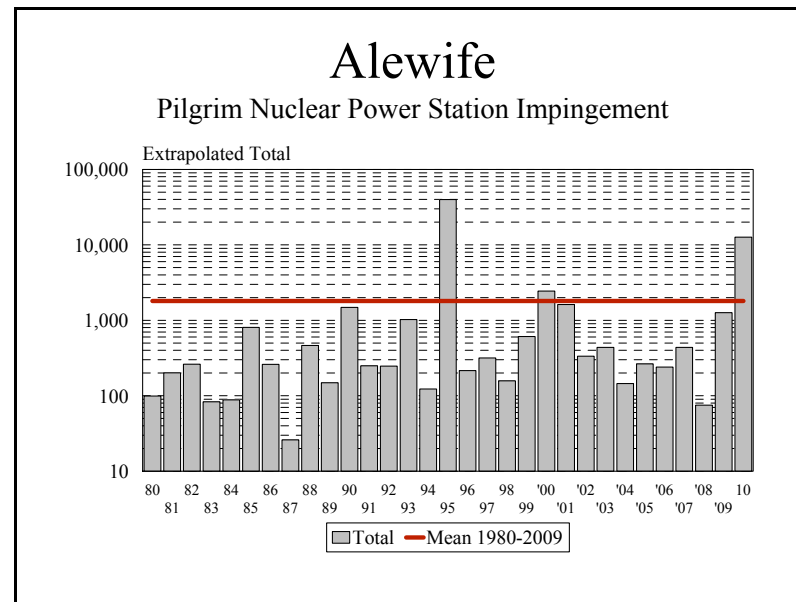
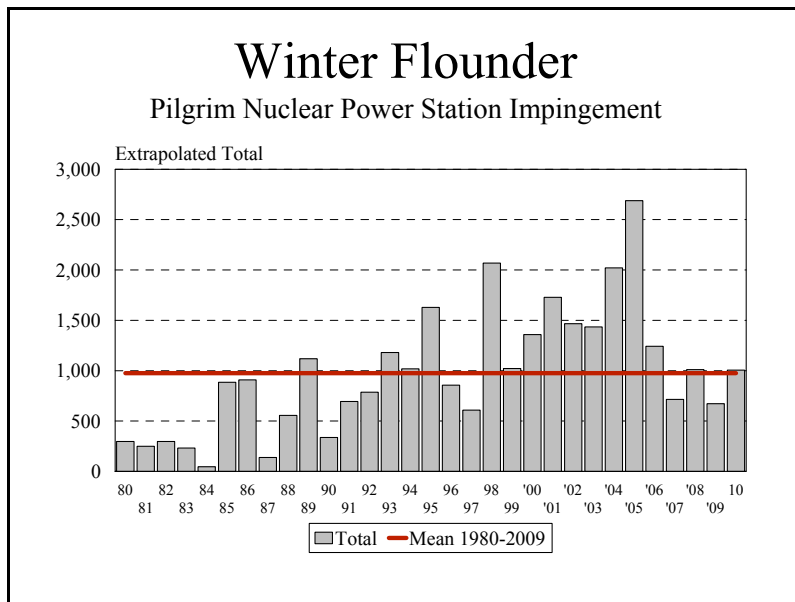
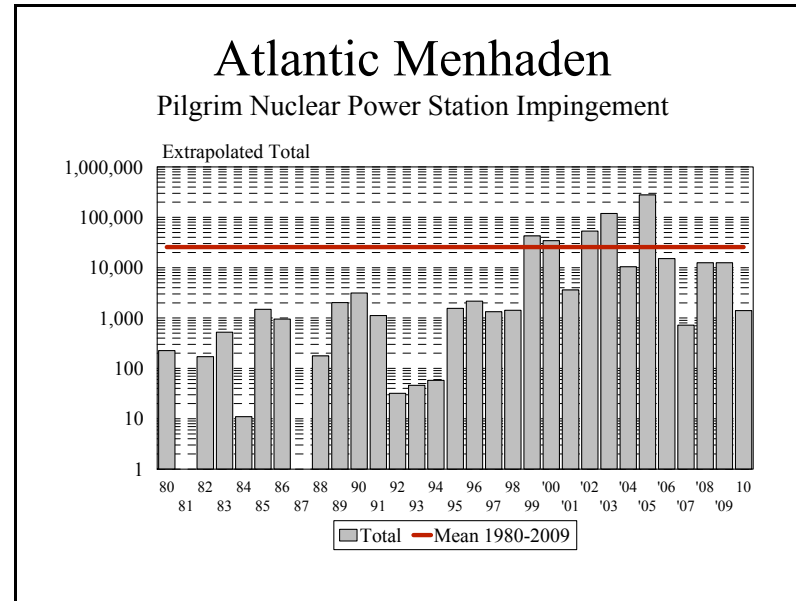
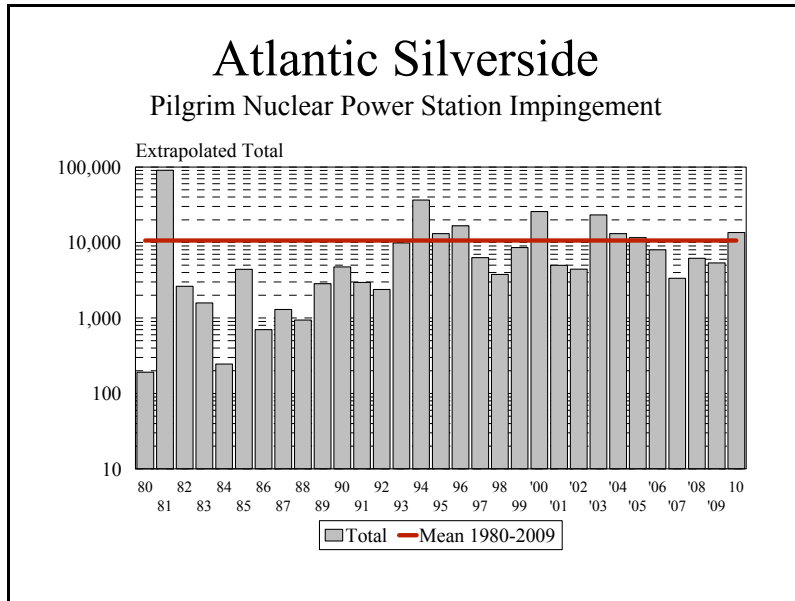


Figure 4. Extrapolated annual totals for typical numerical dominants impinged at Pilgrim Nuclear Power Station, 1980-2010.

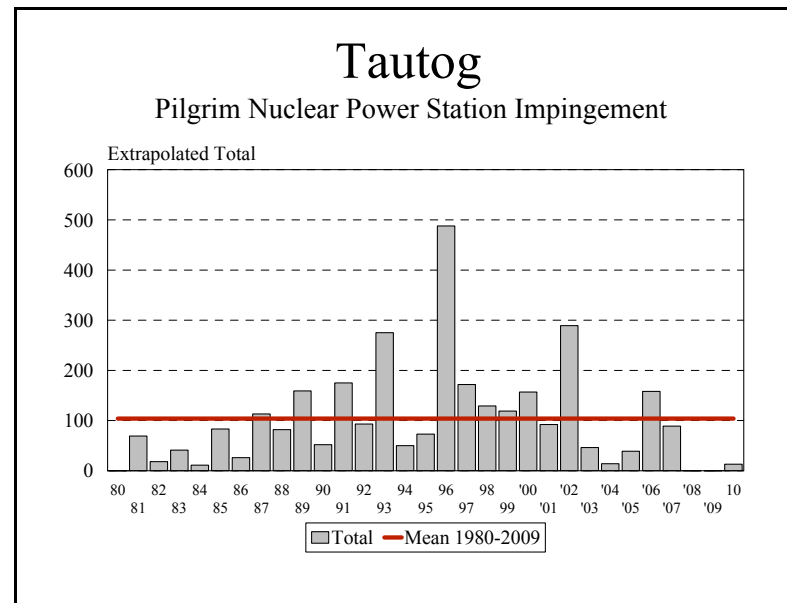
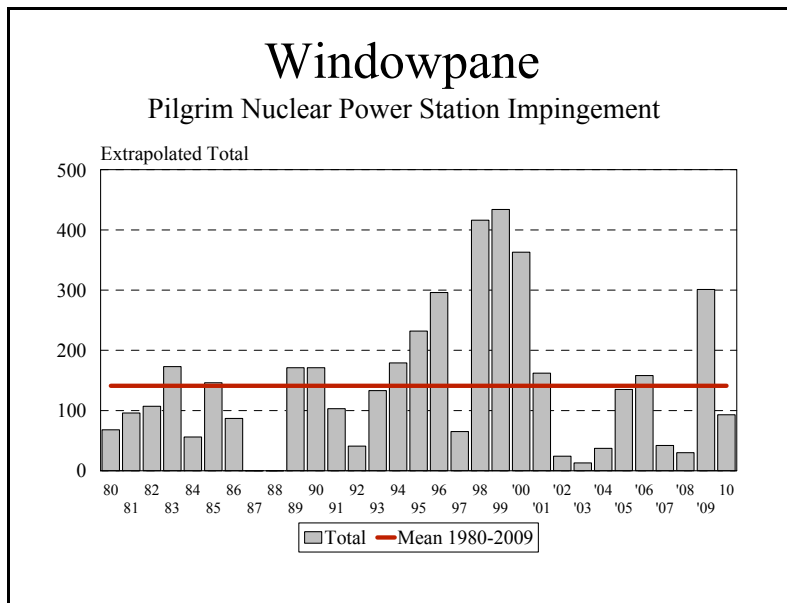
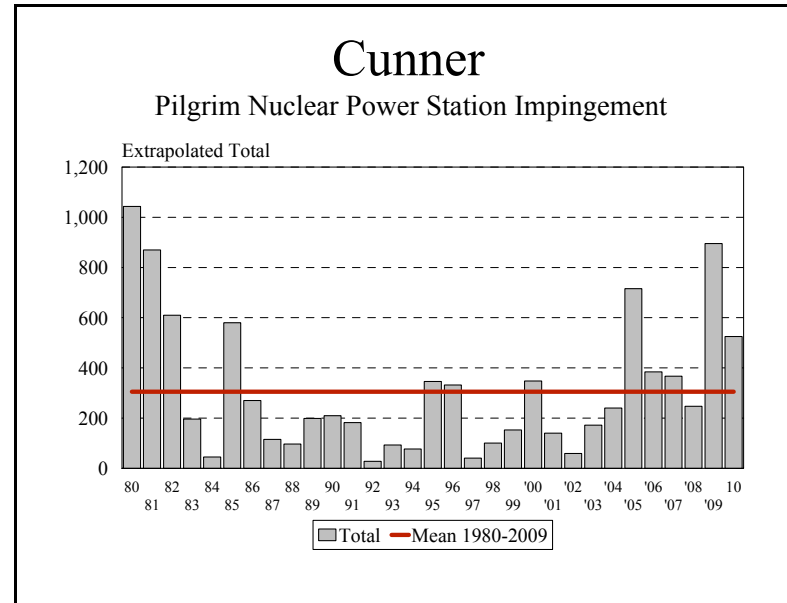
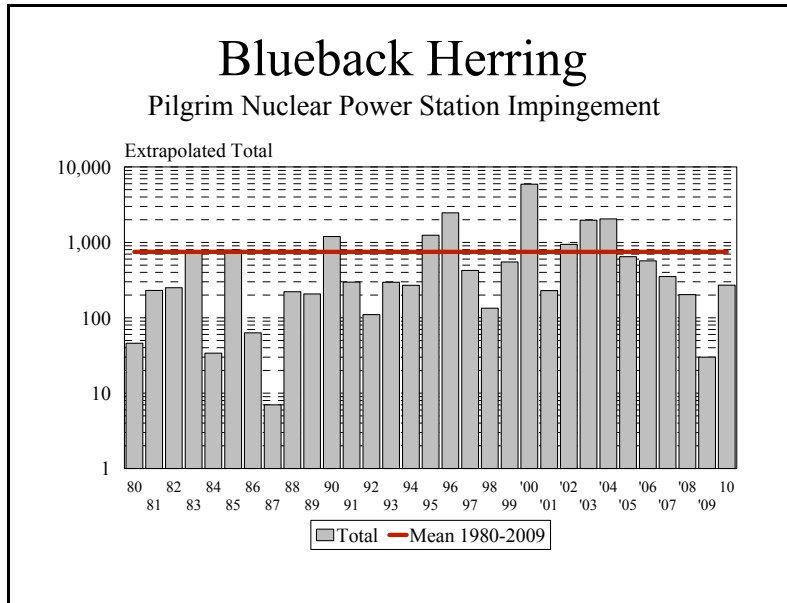


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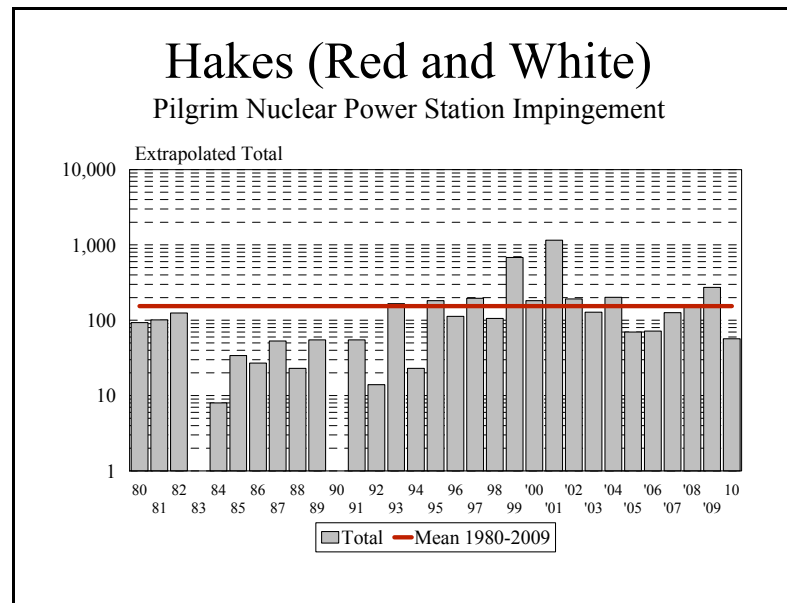
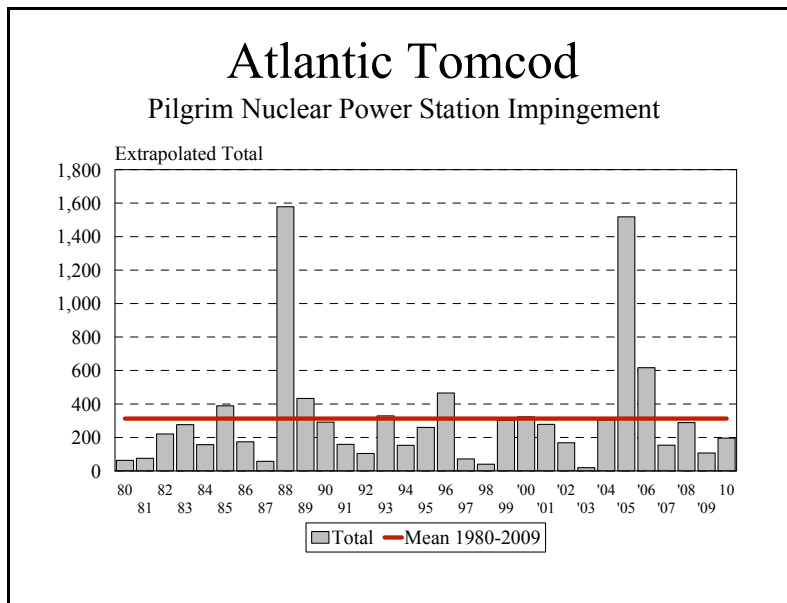
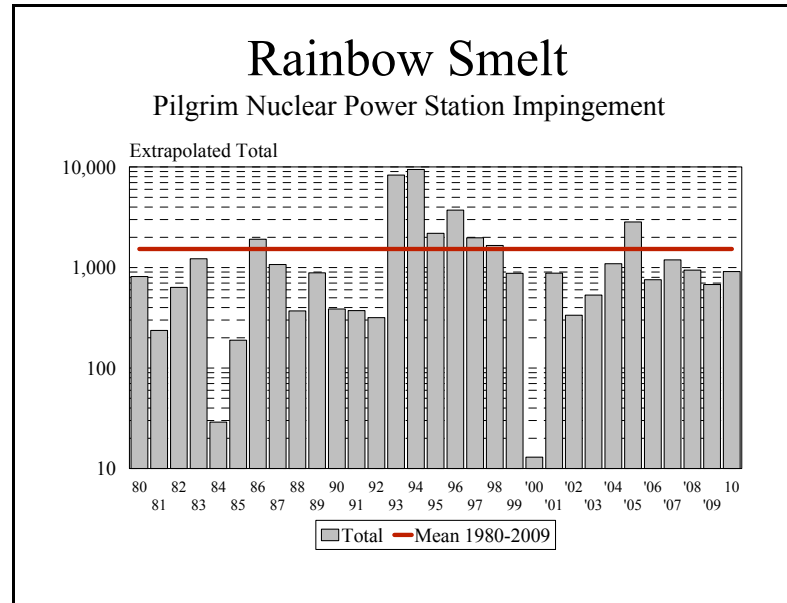
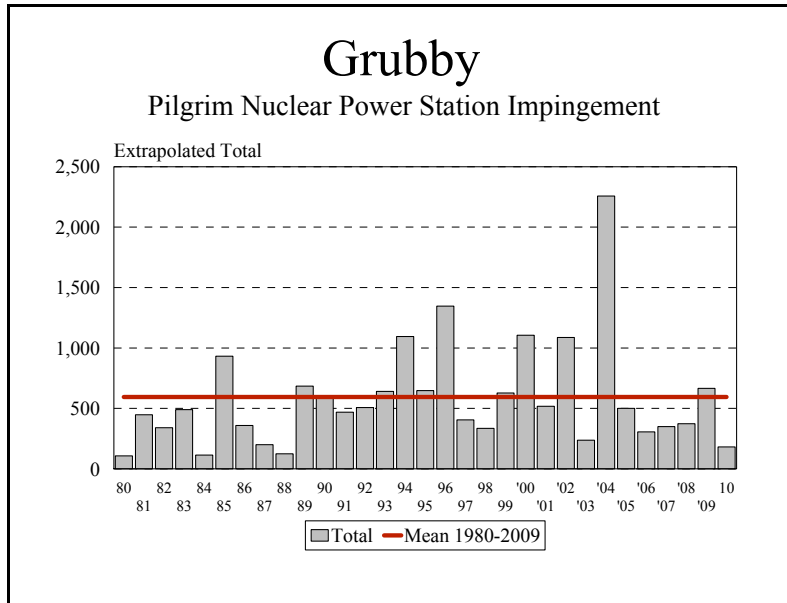


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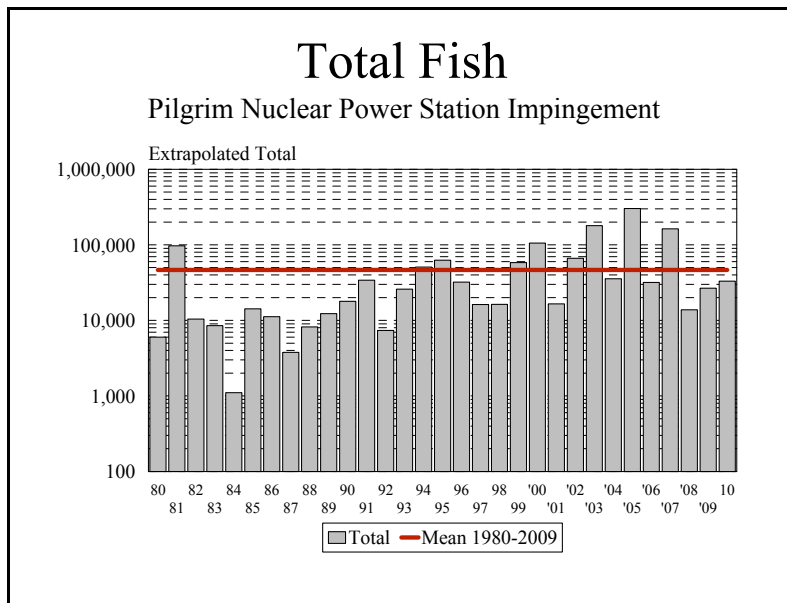
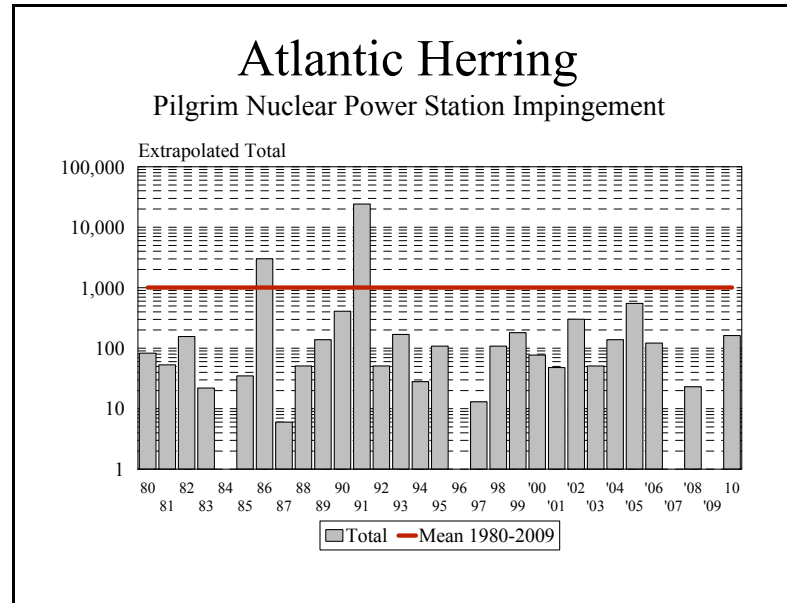
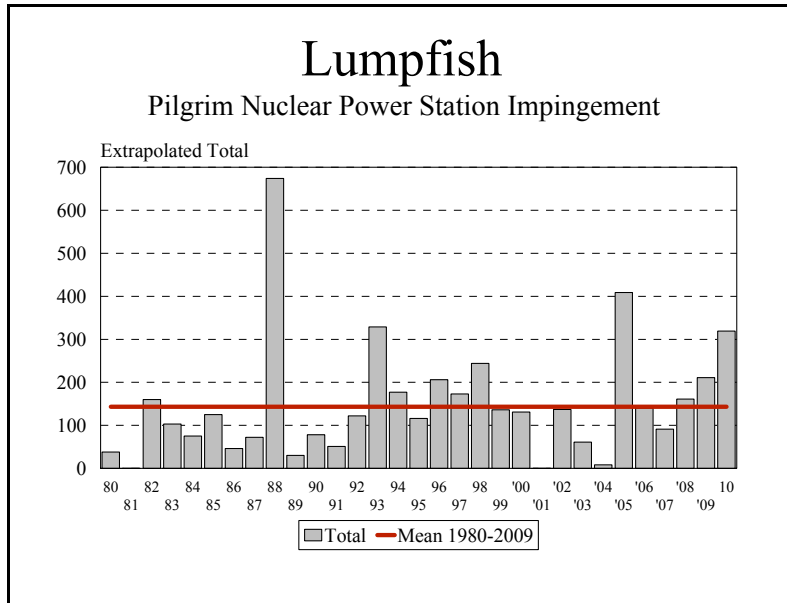


Figure 4. Continued.

**Table 1. Monthly extrapolated totals for all fishes collected from Pilgrim Station intake screens, January-December 2010.**

Common Name	Species	2010	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Summary												
Atlantic Silverside	<i>Menidia menidia</i>	13,576	784	379	2,755	8,233	148	24	12	14	25	17	613	572
Alewife	<i>Alosa pseudoharengus</i>	12,680	0	0	357	64	13	0	12,082	14	0	17	37	96
Atlantic Menhaden	<i>Brevoortia tyrannus</i>	1,403	0	0	0	0	0	0	183	916	146	17	109	32
Winter Flounder	<i>Pseudopleuronectes americanus</i>	1,005	196	148	292	22	37	0	35	70	0	0	109	96
Rainbow Smelt	<i>Osmerus mordax</i>	911	40	43	260	0	13	0	0	98	0	0	361	96
Cunner	<i>Tautoglabrus adspersus</i>	535	118	85	0	0	13	0	23	0	0	0	73	223
Lumpfish	<i>Cyclopterus lumpus</i>	319	0	0	33	0	0	0	0	0	0	0	0	286
Blueback Herring	<i>Alosa aestivalis</i>	271	0	0	0	22	13	0	0	14	0	17	109	96
Sand Lance	<i>Ammodytes sp.</i>	246	40	22	130	22	0	0	0	0	0	0	0	32
Atlantic Tomcod	<i>Microgadus tomcod</i>	196	0	0	0	22	37	0	0	0	0	0	73	64
Striped Killifish	<i>Fundulus majalis</i>	187	0	22	0	0	0	0	0	0	0	0	37	128
Grubby	<i>Myoxocephalus aeneus</i>	181	40	64	65	0	0	0	12	0	0	0	0	0
Atlantic Herring	<i>Clupea harengus</i>	162	0	0	98	64	0	0	0	0	0	0	0	0
Northern Pipefish	<i>Syngnathus fuscus</i>	131	0	0	0	22	0	0	0	0	0	0	109	0
American Shad	<i>Alosa sapidissima</i>	120	0	0	98	22	0	0	0	0	0	0	0	0
Atlantic Moonfish	<i>Selene setapinnis</i>	114	0	0	0	0	0	0	0	0	0	114	0	0
Little Skate	<i>Leucoraja erinacea</i>	112	0	0	0	0	25	24	35	28	0	0	0	0
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	112	79	0	33	0	0	0	0	0	0	0	0	0
Windowpane	<i>Scophthalmus aquosus</i>	93	0	0	0	43	13	0	0	0	0	0	37	0
Smallmouth Flounder	<i>Etropus microstomus</i>	90	0	0	33	43	0	0	0	14	0	0	0	0
Butterfish	<i>Peprilus triacanthus</i>	74	0	0	0	0	0	0	23	14	0	0	37	0
Spotted Hake	<i>Urophycis regia</i>	72	0	0	0	22	50	0	0	0	0	0	0	0
Radiated Shanny	<i>Ulvaria subbifurcata</i>	62	40	22	0	0	0	0	0	0	0	0	0	0
Red Hake	<i>Urophycis chuss</i>	57	0	0	0	0	13	0	12	0	0	0	0	32
Atlantic Cod	<i>Gadus morhua</i>	53	40	0	0	0	13	0	0	0	0	0	0	0
Rock Gunnel	<i>Pholis gunnellus</i>	43	0	0	0	43	0	0	0	0	0	0	0	0
Mummichog	<i>Fundulus heteroclitus</i>	32	0	0	0	0	0	0	0	0	0	0	0	32
Searobins	<i>Prionotus spp.</i>	32	0	0	0	0	0	0	0	0	0	0	0	32
Scup	<i>Stenotomus chrysops</i>	26	0	0	0	0	0	0	12	14	0	0	0	0
American Eel	<i>Anguilla rostrata</i>	25	0	0	0	0	0	0	0	0	25	0	0	0
White Perch	<i>Morone americana</i>	17	0	0	0	0	0	0	0	0	0	17	0	0
Tautog	<i>Tautoga onitis</i>	13	0	0	0	0	13	0	0	0	0	0	0	0
Striped Bass	<i>Morone saxatilis</i>	12	0	0	0	0	0	0	12	0	0	0	0	0
	<i>Number of Species</i>	33	9	8	11	13	13	2	11	10	3	6	12	14
	<i>Extrapolated Totals</i>	32,962	1,377	785	4,154	8,644	401	48	12,441	1,196	196	199	1,704	1,817
	<i>Number of "Collection Hours"</i>	437.28	19.00	31.97	22.96	34.02	60.63	30.88	65.09	53.66	29.78	45.88	19.98	23.43
	<i>Impingement Rate (fish per hour)</i>	4.43	1.84	1.16	5.57	11.99	0.53	0.06	16.72	1.60	0.27	0.26	2.35	2.43

**Table 2. Species, number, length and weight for all fish impinged at Pilgrim Station, January - December 2010.**

Common Name	Species	Number Collected		Length (mm)			Weight (g)			
		n	n	Mean	Min	Max	n	Mean	Min	Max
Little Skate	<i>Leucoraja erinacea</i>	8	8	457.9	384	552	0			
American Eel	<i>Anguilla rostrata</i>	1	1	305.0	305	305	1	28.64	28.64	28.64
Blueback Herring	<i>Alosa aestivalis</i>	10	10	141.7	55	295	3	3.28	1.65	4.77
Alewife	<i>Alosa pseudoharengus</i>	1,078	47	94.6	64	172	41	5.68	2.20	14.82
American Shad	<i>Alosa sapidissima</i>	4	4	114.0	75	150	2	3.65	1.92	5.37
Atlantic Menhaden	<i>Brevoortia tyrannus</i>	93	93	61.5	34	121	59	1.79	0.35	8.46
Atlantic Herring	<i>Clupea harengus</i>	6	6	140.3	124	160	6	13.61	8.23	22.87
Rainbow Smelt	<i>Osmerus mordax</i>	32	32	100.7	77	198	16	5.21	1.85	23.53
Atlantic Cod	<i>Gadus morhua</i>	2	2	256.5	63	450	1	1.99	1.99	1.99
Atlantic Tomcod	<i>Microgadus tomcod</i>	8	8	97.0	45	153	5	3.51	0.66	13.02
Red Hake	<i>Urophycis chuss</i>	3	3	76.3	62	87	2	2.43	1.77	3.08
Spotted Hake	<i>Urophycis regia</i>	5	5	88.8	64	120	3	3.22	1.41	5.58
Mummichog	<i>Fundulus heteroclitus</i>	1	1	87.0	87	87	0			
Striped Killifish	<i>Fundulus majalis</i>	6	6	73.8	60	102	1	3.08	3.08	3.08
Atlantic Silverside	<i>Menidia menidia</i>	564	305	95.0	63	152	154	3.78	0.84	12.86
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	3	3	59.0	44	68	0			
Northern Pipefish	<i>Syngnathus fuscus</i>	4	4	115.8	82	150	0			
Searobins	<i>Prionotus spp.</i>	1	1	212.0	212	212	0			
Grubby	<i>Myoxocephalus aeneus</i>	7	7	71.6	58	95	0			
Lumpfish	<i>Cyclopterus lumpus</i>	10	10	58.4	38	69	0			
White Perch	<i>Morone americana</i>	1	1	121.3	121.3	121.3	1	23.77	23.77	23.77
Striped Bass	<i>Morone saxatilis</i>	1	1	585.0	585	585	1	1282.00	1282.00	1282.00
Atlantic Moonfish	<i>Selene setapinnis</i>	7	7	49.6	46	55	0			
Scup	<i>Stenotomus chrysops</i>	2	2	37.5	32	43	1	0.28	0.28	0.28
Tautog	<i>Tautoga onitis</i>	1	1	320.0	320	320	1	670.00	670.00	670.00
Cunner	<i>Tautoglabrus adspersus</i>	19	19	78.3	40	160	3	39.46	10.12	70.94
Radiated Shanny	<i>Ulvaria subbifurcata</i>	2	2	100.5	76	125	0			
Rock Gunnel	<i>Pholis gunnellus</i>	2	2	138.0	113	163	0			
Sand Lance	<i>Ammodytes sp.</i>	8	8	152.9	110	195	1	7.06	7.06	7.06
Butterfish	<i>Peprilus triacanthus</i>	4	4	44.8	39	51	3	0.92	0.73	1.09
Smallmouth Flounder	<i>Etropus microstomus</i>	4	4	88.8	48	196	2	1.73	1.00	2.45
Windowpane	<i>Scophthalmus aquosus</i>	4	4	119.8	34	214	0			
Winter Flounder	<i>Pseudopleuronectes americanus</i>	39	39	90.2	44	310	4	1.36	0.95	1.78

**Table 3. Annual extrapolated totals for fish found on the Pilgrim Station intake screens, 1980-2010.**

Species	1980	1981	1982	1983	1984 <sup>1</sup>	1985	1986	1987 <sup>2</sup>	1988	1989	1990	1991	1992	1993	1994 <sup>3</sup>	1995 <sup>4</sup>
Alewife	99	201	262	83	88	807	261	26	464	149	1,480	250	247	1,021	123	39,884
American Eel	18	41	12	0	0	0	19	0	0	15	0	0	8	0	0	0
American Plaice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
American Sand Lance	0	0	12	11	0		0	0	0	0	9	0	0	0	0	0
American Shad	0	0	0	0	0	0	0	0	212	0	0	0	0	0	0	0
Atlantic Cod	12	122	11	0	0	0	33	0	23	0	0	24	10	47	42	58
Atlantic Herring	83	53	156	22	0	35	3,009	6	51	138	408	24,238	51	169	28	108
Atlantic Mackerel	0	49	0	12	0	0	0	0	24	29	13	0	0	0	12	0
Atlantic Menhaden	226	0	171	522	11	1,491	953	0	177	2,020	3,135	1,117	32	46	58	1,560
Atlantic Moonfish	0	0	0	10	8	0	0	0	0	43	0	0	14	0	0	21
Atlantic Seasnail	0	53	0	13	0	0	0	0	0	0	37	0	19	0	0	11
Atlantic Silverside	191	90,449	2,626	1,586	245	4,417	702	1,298	940	2,838	4,761	2,955	2,381	9,872	36,498	13,085
Atlantic Tomcod	63	76	221	276	157	389	174	57	1,578	433	291	159	104	329	153	260
Bay Anchovy	9	0	859	0	0	12	42	0	0	10	42	25	0	0	0	0
Bigeye	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0
Black Ruff	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0
Black Sea Bass	0	13	0	0	0	0	10	7	0	10	0	19	14	0	0	85
Black Spotted Stickleback	0	0	0	0	0	0	0	27	0	0	0	0	0	25	33	0
Blueback Herring	46	230	251	754	34	791	63	7	222	207	1,194	298	110	295	269	1,244
Bluefish	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
Butterfish	0	36	0	30	15	39	0	0	0	10	1,686	24	0	12	41	42
Crevalle Jack	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cunner	1,043	870	610	196	45	580	270	115	97	199	210	182	28	93	77	346
Dogfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flying Gurnard	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	22
Fourbeard Rockling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fourspine Stickleback	11	207	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fourspot Flounder	87	7	10	22	0	0	0	0	12	0	10	69	0	12	0	21
Gizzard Shad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Golden Redfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Goosefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grubby	107	448	340	490	114	932	359	200	124	684	585	468	507	640	1,094	648
Gulf Stream Flounder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haddock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hakes (Red and White)	93	101	125	0	8	34	27	53	23	55	0	55	14	166	23	182



**Table 3. (continued).**

	1980	1981	1982	1983	1984 <sup>1</sup>	1985	1986	1987 <sup>2</sup>	1988	1989	1990	1991	1992	1993	1994 <sup>3</sup>	1995 <sup>4</sup>
Hogchoker	0	0	7	0	0	0	10	0	0	0	0	8	0	0	0	0
Little Skate	0	7	12	45	15	32	11	29	120	84	0	78	92	147	48	35
Longhorn Sculpin	0	0	8	25	0	0	0	0	0	0	13	0	0	0	0	0
Lumpfish	38	0	160	103	75	125	46	72	674	30	78	51	122	329	177	116
Mummichog	0	0	21	0	0	0	0	0	97	0	28	12	0	11	35	20
Northern Kingfish	23	17		0	0	0	0	0	0	0	0	10	0	0	0	0
Northern Pipefish	144	79	122	177	8	213	0	0	24	176	28	30	28	116	230	180
Northern Puffer	144	1,327	177	94	78	36	51	0	120	388	47	141	42	12	0	43
Northern Searobin	69	20	70	60	17	69	13	27	0	51	13	23	0	48	80	68
Ocean Pout	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orange Filefish	9	0	0	0	0	0	0	0	0	11	23	0	0	0	0	0
Planehead Filefish	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0
Pollock	22	0	381	119	14	18	0	25	56	0	50	23	17	107	9	39
Radiated Shanny	30	0	45	0	0	65	70	30	0	36	9	20	43	66	141	85
Rainbow Smelt	814	236	634	1,224	29	189	1,909	1,070	370	886	387	372	317	8,302	9,464	2,191
Rock Gunnel	11	30	0	53	8	442	11	8	0	48	42	62	38	210	84	107
Round Scad	0	0	0	0	0	0	0	0	0	21	23	0	0	0	0	0
Sand Lance sp.	66	0	24	79	0	20	10	0	0	0	0	20	19	0	79	0
Sculpin sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scup	80	23	83	11	0	95	0	0	0	51	599	159	32	8	13	0
Sea Raven	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
Seaboard Goby	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Searobin sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shorthorn Sculpin	0	0	11	0	0	0	0	0	0	0	12	10	0	11	0	0
Silver Hake	57	35	0	22	0	24	49	26	0	10	9	23	9	32	27	11
Silver-rag	0	0	8	0	0	0	0	0	0	0	23	0	0	0	0	0
Smallmouth Flounder	0	0	0	0	0	0	16	0	0	0	5	0	0	0	0	0
Smooth Dogfish	0	0	0	0	0	0		0	56	11	12	10	0	0	0	0
Smooth Flounder	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0
Spiny Dogfish	8	23	0	28	0	0	0	0	12	7	19	10	0	8	0	0
Spot	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
Spotted Hake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Striped Bass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Striped Cusk Eel	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0
Striped Killifish	0	31	0	13	0	64	22	27	41	59	46	82	51	12	385	52

**Table 3. (continued).**

	1980	1981	1982	1983	1984 <sup>1</sup>	1985	1986	1987 <sup>2</sup>	1988	1989	1990	1991	1992	1993	1994 <sup>3</sup>	1995 <sup>4</sup>
Striped Searobins	0	0	0	0	9	0	0	0	0	0	10	30	0	12	0	12
Summer Flounder	12	0	20	0	0	0	0	0	0	7	0	0	0	0	22	0
Tautog	0	69	18	41	11	83	26	113	82	159	52	175	93	275	50	73
Threespine Stickleback	37	118	434	21	7	112	0	372	72	114	30	19	26	47	270	124
Weakfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weitzman's Pearlside	0	0	75	0	0	0	19	0	0	0	0	0	0	34	0	0
White Perch	0	42	0	0	5	81	0	0	0	0	0	29	88	0	24	21
Windowpane	68	96	107	173	56	146	87	0	0	171	171	103	41	133	179	232
Winter Flounder	297	249	297	232	47	884	908	138	556	1,119	336	694	787	1,181	1,018	1,628
Winter Skate	11	0	10	12	0	0	0	0	0	0	0	0	0	0	0	0
Yellowtail Flounder	0	0	0	0	0	0	51	50	0	0	0	0	0	27	0	0
Annual totals	4,028	95,358	8,406	6,559	1,104	12,243	9,241	3,783	6,227	10,290	15,935	32,077	5,398	23,890	50,786	62,614
Collection Time (hrs.)	687	574.8	687	763	1,042	465	806	527	525	618	919.5	930.3	774.0	673.5	737.4	607.7
Impingement Rate (fish/hour)	0.66	10.02	0.93	0.57	0.13	1.14	1.26	0.28	0.27	0.8	1.70	3.38	0.63	2.78	5.97	5.87

1 No CWS pumps were in operation April to August 1984.

2 No CWS pumps were in operation August 1987.

3 No CWS pumps were in operation 9 October - 14 November 1994.

4 No CWS pumps were in operation 30 March - 15 May 1995.

5 No CWS pumps were in operation 10 May - 10 June 1999.

6 No CWS pumps were in operation 28 April - 9 May 2001.

7 No CWS pumps were in operation 21 April - 11 May 2003.

8 No CWS pumps were in operation 20 April - 8 May 2005.

9 No CWS pumps were in operation 7 April - 20 April 2007.

**Table 3. (continued).**

Species	Mean															
	1996	1997	1998	1999 <sup>5</sup>	2000	2001 <sup>6</sup>	2002	2003 <sup>7</sup>	2004	2005 <sup>8</sup>	2006	2007 <sup>9</sup>	2008	2009	1980-2009	2010
Alewife	216	317	158	610	2,443	1,618	334	438	145	265	240	438	75	1,261	1,800	12,680
American Eel	0	0	0	0	13	0	0	0	0	0	0	15	0	0	5	25
American Plaice	0	0	0	0	0	0	0	36	0	0	0	0	0	0	1	0
American Sand Lance	0	0	0	0	16	0	0	0	0	0	0	0	0	0	2	0
American Shad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	120
Atlantic Cod	0	0	53	42	0	113	0	61	99	192	688	56	143	86	64	53
Atlantic Herring	0	13	108	181	77	48	301	51	138	549	122	0	23	0	1,006	162
Atlantic Mackerel	0	0	0	0	0	0	0	0	0	0	0	15	0	60	7	0
Atlantic Menhaden	2,168	1,329	1,423	42,686	64,354	3,599	53,304	119,041	10,431	277,601	15,189	154,832	721	12,528	25,691	1,403
Atlantic Moonfish	94	0	17	273	0	86	234	0	0	20	70	0	0	23	30	114
Atlantic Seasnail	0	0	0	0	0	13	0	10	8	0	0	0	16	0	6	0
Atlantic Silverside	16,615	6,303	6,773	8,577	25,665	4,987	4,430	23,149	13,107	11,590	7,993	3,362	6,167	5,349	10,630	13,576
Atlantic Tomcod	466	72	40	302	323	278	168	19	304	1,518	616	154	289	107	313	196
Bay Anchovy	0	23	0	0	0	8	148	60	0	0	0	28	23	23	44	0
Bigeye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black Ruff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black Sea Bass	0	0	0	15	0	57	0	38	147	188	82	0	30	0	24	0
Black Spotted Stickleback	0	50	0	0	0	0	0	0	0	34	0	0	0	0	6	0
Blueback Herring	2,462	424	134	550	5,919	229	943	1,968	2,046	646	570	352	203	30	750	271
Bluefish	0	0	17	0	0	0	47	0	0	0	0	0	0	0	3	0
Butterfish	44	1,581	42	188	0	170	0	0	31	78	29	85	28	186	147	74
Crevalle Jack	0	0	0	0	0	0	17	0	0	0	0	0	0	30	2	0
Cunner	332	41	101	153	348	140	59	172	240	716	384	367	247	895	305	525
Dogfish	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0
Flying Gurnard	0	0	0	0	0	27	0	0	0	0	0	0	0	0	2	0
Fourbeard Rockling	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0
Fourspine Stickleback	0	0	0	0	0	13	0	0	0	72	0	0	0	0	10	0
Fourspot Flounder	0	17	6	47	0	0	0	56	122	0	0	0	0	0	17	0
Gizzard Shad	0	0	0	0	27	0	0	0	0	0	0	0	0	0	1	0
Golden Redfish	0	0	0	0	0	0	17	0	0	0	0	0	0	0	1	0
Goosefish	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0
Grubby	1,347	405	335	628	1,105	517	1,087	237	2,257	501	306	349	374	666	595	181
Gulf Stream Flounder	0	0	0	0	27	0	0	0	0	0	0	0	0	0	1	0
Haddock	0	0	0	0	0	0	0	0	0	0	0	15	0	0	1	0
Hakes (Red and White)	113	196	106	682	182	1,158	192	128	202	70	72	126	159	273	154	57

**Table 3. (continued).**

Species	1996	1997	1998	1999 <sup>5</sup>	2000	2001 <sup>6</sup>	2002	2003 <sup>7</sup>	2004	2005 <sup>8</sup>	2006	2007 <sup>9</sup>	2008	2009	Mean 1980-2009	2010
Hogchoker	0	0	0	0	0	0	46	0	0	0	0	0	0	0	2	0
Little Skate	27	46	48	0	0	80	69	121	237	138	85	69	75	46	60	112
Longhorn Sculpin	13	0	21	15	261	0	0	0	0	0	0	0	0	0	12	0
Lumpfish	206	173	244	136	131	0	137	61	8	409	140	91	161	211	143	319
Mummichog	0	0	0	36	13	0	0	0	0	27	0	49	30	0	13	32
Northern Kingfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Northern Pipefish	143	55	0	187	92	28	110	99	14	509	119	15	46	120	103	131
Northern Puffer	0	105	0	0	0	0	0	11	0	0	35	18	0	0	96	0
Northern Searobin	0	0	6	31	319	57	0	10	51	58	50	0	30	120	45	0
Ocean Pout	0	0	0	0	0	0	0	26	14	0	0	0	16	0	2	0
Orange Filefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Planehead Filefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pollock	0	0	0	105	52	0	0	0	53	788	0	0	67	0	65	0
Radiated Shanny	29	0	63	26	13	67	31	59	14	16	0	15	31	31	35	62
Rainbow Smelt	3,728	1,978	1,656	875	13	879	335	532	1,092	2,840	756	1,191	943	677	1,530	911
Rock Gunnel	155	0	21	16	100	75	50	0	24	216	53	29	29	15	65	43
Round Scad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Sand Lance sp.	0	0	38	0	0	35	0	30,765	38	50	150	78	320	361	1,072	246
Sculpin sp.	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0
Scup	0	0	6	0	12	0	35	27	72	216	0	48	0	23	53	26
Sea Raven	0	0	0	0	0	0	0	19	0	23	0	0	0	0	2	0
Seaboard Goby	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
Searobin sp.	0	0	0	0	0	0	0	0	0	39	0	0	0	0	1	32
Shorthorn Sculpin	0	0	0	0	0	0	0	26	0	0	0	0	0	0	2	0
Silver Hake	26	138	21	83	165	114	0	97	0	0	0	0	0	23	33	0
Silver-rag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Smallmouth Flounder	0	0	11	10	0	0	0	0	0	72	31	0	23	61	8	90
Smooth Dogfish	0	0	0	0	0	0	0	26	16	0	0	0	81	0	7	0
Smooth Flounder	0	0	0	0	0	11	0	22	0	0	0	0	0	0	1	0
Spiny Dogfish	0	0	0	0	0	28	0	0	0	154	0	84	54	0	15	0
Spot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spotted Hake	0	0	21	0	0	0	0	0	0	0	0	0	0	0	1	72
Striped Bass	77	0	0	0	39	0	0	16	139	0	39	21	31	0	12	12
Striped Cusk Eel	0	0	19	0	0	0	0	0	0	0	12	0	16	0	2	0
Striped Killifish	29	0	44	52	309	64	613	488	121	223	37	144	100	120	108	187

**Table 3. (continued).**

Species	1996	1997	1998	1999 <sup>5</sup>	2000	2001 <sup>6</sup>	2002	2003 <sup>7</sup>	2004	2005 <sup>8</sup>	2006	2007 <sup>9</sup>	2008	2009	Mean 1980-2009	2010
Striped Searobins	0	83	0	61	0	0	0	0	0	0	83	21	0	0	11	0
Summer Flounder	0	0	10	0	0	0	0	0	41	0	0	0	23	0	5	0
Tautog	488	172	129	119	157	92	289	46	14	39	158	89	0	0	104	13
Threespine Stickleback	99	0	91	19	27	64	13	19	158	151	262	69	62	398	108	112
Weakfish	0	0	0	0	0	0	0	26	0	0	0	27	0	0	2	0
Weitzman's Pearlside	0	0	0	0	0	0	0	6	0	0	16	0	0	0	5	0
White Perch	206	34	43	122	24	21	72	15	86	28	21	27	145	60	40	17
Windowpane	296	65	416	434	363	162	24	13	37	135	158	42	30	301	141	93
Winter Flounder	857	608	2,069	1,021	1,358	1,729	1,466	1,435	2,021	2,688	1,242	715	1,010	672	975	1,005
Winter Skate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Yellowtail Flounder	0	0	0	32	0	0	0	16	37	24	0	0	0	0	8	0
Annual totals	30,236	14,228	14,301	58,314	103,986	16,567	64,583	179,445	33,564	302,883	29,808	163,036	11,821	24,756	46,516	32,952
Collection Time (hrs.)	416	455	575	375.5	507	430.1	494.4	714.1	638.3	440.5	432.3	468.0	388.2	249.1	597	436.3
Impingement Rate (fish/hour)	3.11	1.43	1.30	7.21	9.25	1.78	4.93	25.58	2.85	18.87	3.26	10.24	1.41	2.15	4.33	4.46

**Table 4. Dominant species and estimated number impinged during high impingement events at PNPS, 1973-2010.**

Date	Species	Estimated Number for all Species
August-September, 1973	Clupeids	1,600
August 5, 1976	Alewife	1,900
November 23-28, 1978	Atlantic menhaden	10,200
December 11-29, 1978	Rainbow smelt	6,200
March/April, 1979	Atlantic silverside	1,100
September 23-24, 1981	Atlantic silverside	6,000
July 22-25, 1991	Rainbow smelt	4,200
December 15-28, 1993	Atlantic silverside	5,100
November 26-28, 1994	Atlantic silverside	5,800
December 26-28, 1994	Atlantic silverside and Rainbow smelt	11,400
September 8-9, 1995	Alewife	13,100
September 17-18, 1999	Atlantic menhaden	4,910
November 17-20, 2000	Atlantic menhaden	19,900
August/September, 2002	Atlantic menhaden	33,300
November 1, 2003	Atlantic menhaden	2,500
November 12 - 17, 2003	Atlantic menhaden	63,900
November 19 - 21, 2003	Sand lance and Atlantic menhaden	17,900
November 29, 2003	Atlantic silverside	3,900
August 16 - 18, 2005	Atlantic menhaden	107,000
September 14-15, 2007	Atlantic menhaden	6,500
July 29, 2010	Alewife	1,061

**Table 5. Impingement rates, fish per hour and fish per year, for all fishes sampled from the Pilgrim Station intake screens, January-December 2010 (assuming 100% operation).**

Species	Fish Per Hour	Estimated Annual Rate	Dominant Month of Occurrence	Total Collected
Little Skate	0.018	112	July	8
American Eel	0.002	25	September	1
Blueback Herring	0.023	271	November	10
Alewife	2.465	12,680	July	1,078
American Shad	0.009	120	March	4
Atlantic Menhaden	0.213	1,403	August	93
Atlantic Herring	0.014	162	March	6
Rainbow Smelt	0.073	911	November	32
Atlantic Cod	0.005	53	January	2
Atlantic Tomcod	0.018	196	November	8
Red Hake	0.007	57	December	3
Spotted Hake	0.011	72	May	5
Mummichog	0.002	32	December	1
Striped Killifish	0.014	187	December	6
Atlantic Silverside	1.290	13,576	April	564
Threespine Stickleback	0.007	112	January	3
Northern Pipefish	0.009	131	November	4
Searobins	0.002	32	December	1
Grubby	0.016	181	March	7
Lumpfish	0.023	319	December	10
White Perch	0.002	17	October	1
Striped Bass	0.002	12	July	1
Atlantic Moonfish	0.016	114	October	7
Scup	0.005	26	August	2
Tautog	0.002	13	May	1
Cunner	0.043	535	December	19
Radiated Shanny	0.005	62	January	2
Rock Gunnel	0.005	43	April	2
Sand Lance	0.018	246	March	8
Butterfish	0.009	74	November	4
Smallmouth Flounder	0.009	90	April	4
Windowpane	0.009	93	April	4
Winter Flounder	0.089	1,005	March	39
<b>Annual Totals</b>	<b>4.44</b>	<b>32,962</b>		<b>1,940</b>

**Table 6. Hourly, daily, and estimated annual impingement rates for all species combined and annual dominants collected on the PNPS intake screens, 1980-2010.**

Year	Fish/Hour	Fish/Year	Dominant Species (Number/Year)
1980	0.66	4,030	Cunner (1,043)
1981	10.02	95,336	Atlantic silverside (90,449)
1982	0.93	8,411	Atlantic silverside (2,626)
1983	0.57	6,558	Atlantic silverside (1,586)
1984	0.13	1,112	Atlantic silverside (245)
1985	1.14	12,499	Atlantic silverside (4,417)
1986	1.26	9,259	Atlantic herring (3,009)
1987	0.28	3,155	Atlantic silverside (1,298)
1988	0.27	6,675	Atlantic tomcod (1,578)
1989	0.80	9,088	Atlantic silverside (2,838)
1990	1.70	15,939	Atlantic silverside (4,761)
1991	3.38	32,080	Atlantic herring (24,238)
1992	0.63	5,397	Atlantic silverside (2,381)
1993	2.78	24,105	Atlantic silverside (9,872)
1994	5.97	50,439	Atlantic silverside (36,498)



**Table 6. (continued).**

Year	Fish/Hour	Fish/Year	Dominant Species (Number/Year)
1995	5.87	62,616	Alewife (39,884)
1996	3.11	30,264	Atlantic silverside (16,615)
1997	1.43	14,230	Atlantic silverside (6,303)
1998	1.30	14,303	Atlantic silverside (6,773)
1999	7.21	58,318	Atlantic menhaden (42,686)
2000	9.25	103,968	Atlantic menhaden (34,354)
2001	1.78	15,636	Atlantic silverside (4,987)
2002	4.93	64,606	Atlantic menhaden (53,304)
2003	25.58	179,608	Atlantic menhaden (119,041)
2004	2.85	33,591	Atlantic silverside (13,107)
2005	18.84	302,883	Atlantic menhaden (277,607)
2006	3.26	29,711	Atlantic menhaden (15,189)
2007	10.24	163,036	Atlantic menhaden (154,832)
2008	1.41	11,821	Atlantic silverside (6,167)
2009	2.15	24,779	Atlantic menhaden (12,528)
<b>Mean</b>	<b>4.32</b>	<b>46,448</b>	
2010	4.44	33,457	Atlantic silverside (13,576)

**Table 7. Species collected on the Pilgrim Station intake screens, 1980-2010.**

Common Name	Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Alewife	<i>Alosa pseudoharengus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American Eel	<i>Anguilla rostrata</i>	x	x	x				x			x			x			
American Plaice	<i>Hippoglossoides platessoides</i>																
American Shad	<i>Alosa sapidissima</i>									x							
Atlantic Cod	<i>Gadus morhua</i>	x	x	x				x		x			x	x	x	x	x
Atlantic Herring	<i>Clupea harengus</i>	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Atlantic Mackerel	<i>Scomber scombrus</i>											x				x	
Atlantic Menhaden	<i>Brevoortia tyrannus</i>	x		x	x	x	x	x		x	x	x	x	x	x	x	x
Atlantic Moonfish	<i>Selene setapinnis</i>				x	x					x			x			x
Atlantic Seasnail	<i>Liparis atlanticus</i>		x		x	x						x		x			
Atlantic Silverside	<i>Menidia menidia</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Tomcod	<i>Microgadus tomcod</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bay Anchovy	<i>Anchoa mitchilli</i>	x		x			x	x			x	x					
Bigeye	<i>Priacanthus arenatus</i>										x						
Black Ruff	<i>Centrolophorus niger</i>											x					
Black Sea Bass	<i>Centropristis striata</i>		x					x	x		x		x	x			x
Black Spotted Stickleback	<i>Gasterosteus wheatlandi</i>								x						x	x	
Blueback Herring	<i>Alosa aestivalis</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bluefish	<i>Pomatomus saltatrix</i>			x													
Butterfish	<i>Peprilus triacanthus</i>		x	x	x	x	x					x			x	x	x
Creville Jack	<i>Caranx hippos</i>																
Cunner	<i>Tautoglabrus adspersus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dogfish	<i>see below</i>																
Flying Gurnard	<i>Dactylopterus volitans</i>						x										x
Fourbeard Rockling	<i>Enchelyopus cimbrius</i>																
Fourspine Stickleback	<i>Apeltes quadracus</i>	x	x														

**Table 7. (continued).**

Common Name	Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Fourspot Flounder	<i>Paralichthys oblongus</i>	x	x	x	x					x		x	x		x		
Gizzard Shad	<i>Dorosoma cepedianum</i>																
Golden Redfish	<i>Sebastes norvegicus</i>																
Goosefish	<i>Lophius americanus</i>																
Grubby	<i>Myoxocephalus aeneus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gulf Stream Flounder	<i>Citharichthys arctifrons</i>																
Haddock	<i>Melanogrammus aeglefinus</i>																
Hakes (red and white)	<i>Urophycis spp.</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hogchoker	<i>Trinectes maculatus</i>												x				
Little Skate	<i>Leucoraja erinacea</i>		x	x	x	x	x	x	x	x	x		x	x	x	x	x
Longhorn Sculpin	<i>Myoxocephalus octodecemspinosus</i>			x	x												
Lumpfish	<i>Cyclopterus lumpus</i>	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mummichog	<i>Fundulus heteroclitus</i>			x						x		x	x		x	x	x
Northern Kingfish	<i>Menticirrhus saxatilis</i>												x				
Northern Pipefish	<i>Syngnathus fuscus</i>	x	x	x	x	x	x	x		x	x	x		x	x	x	x
Northern Puffer	<i>Sphoeroides maculatus</i>											x	x	x	x		x
Northern Searobin	<i>Prionotus carolinus</i>	x	x	x	x	x	x		x		x	x	x		x	x	x
Ocean pout	<i>Zoarces americanus</i>																
Orange Filefish	<i>Aluterus schoepfii</i>											x					
Planehead Filefish	<i>Monacanthus hispidus</i>													x			
Pollock	<i>Pollachius virens</i>	x		x	x	x	x		x	x		x		x	x	x	x
Radiated Shanny	<i>Ulvaria subbifurcata</i>	x		x			x	x	x		x	x	x	x	x	x	x
Rainbow Smelt	<i>Osmerus mordax</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock Gunnel	<i>Pholis gunnellus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Round Scad	<i>Etrumeus teres</i>										x	x					
Sand Lance	<i>Ammodytes sp.</i>	x		x	x		x	x				x		x		x	

**Table 7. (continued).**

Common Name	Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Sculpin sp.	<i>Myoxocephalus spp.</i>											x	x		x		
Scup	<i>Stenotomus chrysops</i>	x	x	x	x		x				x	x	x	x	x	x	
Sea Raven	<i>Hemitripterus americanus</i>						x										
Seaboard Goby	<i>Gobiosoma ginsburgi</i>																
Searobin sp.	<i>Prionotus sp.</i>																
Shorthorn Sculpin	<i>Myoxocephalus scorpius</i>			x													
Silver Hake	<i>Merluccius bilinearis</i>	x	x		x		x	x	x		x						
Silver-rag	<i>Ariomma bondi</i>			x								x					
Smallmouth Flounder	<i>Etropus microstomus</i>							x			x	x					
Smooth Dogfish	<i>Mustelus canis</i>	x	x		x					x	x	x	x				
Smooth Flounder	<i>Pleuronectes putnami</i>																
Spiny Dogfish	<i>Squalus acanthus</i>											x	x		x		
Spot	<i>Leiostomus xanthurus</i>															x	
Spotted Hake	<i>Urophycis regia</i>																
Striped Bass	<i>Morone saxatilis</i>																
Striped Cusk Eel	<i>Ophidion marginatum</i>															x	
Striped Killifish	<i>Fundulus majalis</i>		x		x		x	x	x	x	x	x	x	x	x	x	x
Striped Searobins	<i>Prionotus evolans</i>					x						x			x		x
Summer Flounder	<i>Paralichthys dentatus</i>	x		x				x			x					x	
Tautog	<i>Tautoga onitis</i>		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Weakfish	<i>Cynoscion regalis</i>																
Weitzman's Pearlside	<i>Maurolicus weitmani</i>															x	
White Perch	<i>Morone americana</i>		x			x	x						x				
Windowpane	<i>Scophthalmus aquosus</i>	x	x	x	x	x	x	x			x	x	x	x	x	x	x
Winter Flounder	<i>Pleuronectes americanus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Winter Skate	<i>Leucoraja ocelata</i>	x		x	x				x								
Yellowtail Flounder	<i>Limanda ferruginea</i>							x	x						x		

**Table 7. (continued).**

Common Name	Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Alewife	<i>Alosa pseudoharengus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American Eel	<i>Anguilla rostrata</i>					x							x			x
American Plaice	<i>Hippoglossoides platessoides</i>								x							
American Shad	<i>Alosa sapidissima</i>															x
Atlantic Cod	<i>Gadus morhua</i>			x	x		x		x	x	x	x	x	x	x	x
Atlantic Herring	<i>Clupea harengus</i>		x	x	x	x	x	x	x	x	x	x	x	x		x
Atlantic Mackerel	<i>Scomber scombrus</i>												x		x	
Atlantic Menhaden	<i>Brevoortia tyrannus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Moonfish	<i>Selene setapinnis</i>	x			x		x				x	x			x	x
Atlantic Seasnail	<i>Liparis atlanticus</i>	x					x	x	x	x				x		
Atlantic Silverside	<i>Menidia menidia</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Tomcod	<i>Microgadus tomcod</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bay Anchovy	<i>Anchoa mitchilli</i>		x				x		x				x	x	x	
Bigeye	<i>Priacanthus arenatus</i>															
Black Ruff	<i>Centrolophorus niger</i>															
Black Sea Bass	<i>Centropristis striata</i>						x		x	x	x	x		x		
Black Spotted Stickleback	<i>Gasterosteus wheatlandi</i>		x								x					
Blueback Herring	<i>Alosa aestivalis</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bluefish	<i>Pomatomus saltatrix</i>			x												
Butterfish	<i>Peprilus triacanthus</i>	x	x	x	x		x			x	x	x	x	x	x	x
Crevalle Jack	<i>Caranx hippos</i>							x							x	
Cunner	<i>Tautoglabrus adspersus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dogfish	<i>see below</i>					x										
Flying Gurnard	<i>Dactylopterus volitans</i>						x									
Fourbeard Rockling	<i>Enchelyopus cimbrius</i>			x												
Fourspine Stickleback	<i>Apeltes quadracus</i>						x				x					

**Table 7. (continued).**

Common Name	Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Fourspot Flounder	<i>Paralichthys oblongus</i>	x	x	x	x				x	x						
Gizzard Shad	<i>Dorosoma cepedianum</i>					x										
Golden Redfish	<i>Sebastes norvegicus</i>							x								
Goosefish	<i>Lophius americanus</i>					x										
Grubby	<i>Myoxocephalus aeneus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gulf Stream Flounder	<i>Citharichthys arctifrons</i>					x										
Haddock	<i>Melanogrammus aeglefinus</i>												x			
Hakes	<i>Urophycis spp.</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Hogchoker	<i>Trinectes maculatus</i>															
Little Skate	<i>Leucoraja erinacea</i>	x	x	x			x	x	x	x	x	x	x	x	x	x
Longhorn Sculpin	<i>Myoxocephalus octodecemspinosus</i>	x		x	x	x										
Lumpfish	<i>Cyclopterus lumpus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mummichog	<i>Fundulus heteroclitus</i>				x	x					x		x	x		x
Northern Kingfish	<i>Menticirrhus saxatilis</i>															
Northern Pipefish	<i>Syngnathus fuscus</i>	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Northern Puffer	<i>Sphoeroides maculatus</i>		x						x			x	x			
Northern Searobin	<i>Prionotus carolinus</i>			x	x	x	x		x	x	x	x		x	x	
Ocean pout	<i>Zoarces americanus</i>								x	x				x		
Orange Filefish	<i>Aluterus schoepfii</i>															
Planehead Filefish	<i>Monacanthus hispidus</i>															
Pollock	<i>Pollachius virens</i>				x	x				x	x			x		
Radiated Shanny	<i>Ulvaria subbifurcata</i>	x		x	x	x	x	x	x	x	x		x	x	x	x
Rainbow Smelt	<i>Osmerus mordax</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock Gunnel	<i>Pholis gunnellus</i>	x		x	x	x	x	x		x	x	x	x	x	x	x
Round Scad	<i>Etrumeus teres</i>															
Sand Lance	<i>Ammodytes sp.</i>			x		x	x		x	x	x	x	x	x	x	x

**Table 7. (continued).**

Common Name	Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sculpin sp.	<i>Myoxocephalus spp.</i>					x										
Scup	<i>Stenotomus chrysops</i>			x		x			x	x	x		x		x	x
Sea Raven	<i>Hemitripterus americanus</i>										x					
Seaboard Goby	<i>Gobiosoma ginsburgi</i>							x								
Searobin sp.	<i>Prionotus sp.</i>										x					x
Shorthorn Sculpin	<i>Myoxocephalus scorpius</i>															
Silver Hake	<i>Merluccius bilinearis</i>								x						x	
Silver-rag	<i>Ariomma bondi</i>															
Smallmouth Flounder	<i>Etropus microstomus</i>			x	x						x	x		x	x	x
Smooth Dogfish	<i>Mustelus canis</i>								x	x				x		
Smooth Flounder	<i>Pleuronectes putnami</i>						x									
Spiny Dogfish	<i>Squalus acanthus</i>					x	x				x		x	x		
Spot	<i>Leiostomus xanthurus</i>															
Spotted Hake	<i>Urophycis regia</i>			x												x
Striped Bass	<i>Morone saxatilis</i>	x				x			x	x			x	x		x
Striped Cusk Eel	<i>Ophidion marginatum</i>			x								x		x		
Striped Killifish	<i>Fundulus majalis</i>	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Striped Searobins	<i>Prionotus evolans</i>		x		x							x				
Summer Flounder	<i>Paralichthys dentatus</i>			x					x	x			x	x		
Tautog	<i>Tautoga onitis</i>	x	x	x	x	x	x	x	x	x	x	x	x			x
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	x		x	x	x	x		x	x	x	x	x	x	x	x
Weakfish	<i>Cynoscion regalis</i>								x	x			x			
Weitzman's Pearlside	<i>Maurolicus weitmani</i>								x	x		x				
White Perch	<i>Morone americana</i>						x		x	x	x	x	x	x	x	x
Windowpane	<i>Scophthalmus aquosus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Winter Flounder	<i>Pleuronectes americanus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Winter Skate	<i>Leucoraja ocelata</i>															
Yellowtail Flounder	<i>Limanda ferruginea</i>				x				x	x	x					

**Table 8. Monthly extrapolated totals for invertebrates impinged on the PNPS intake screens, January - December 2010.**

Common Name	Species	2010												
		Summary	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ribbon worm	<i>Nemertean</i>	129	0	0	33	0	0	0	0	0	0	0	0	96
Nereis	<i>Nereis sp.</i>	916	0	673	163	43	0	0	0	0	0	0	37	0
Nephtys	<i>Nephtys sp.</i>	325	0	0	325	0	0	0	0	0	0	0	0	0
Squid	<i>Loligo pealeii</i>	455	0	0	0	0	111	234	23	70	0	17	0	0
Horseshoe Crab	<i>Limulus polyphemus</i>	61	0	0	0	0	25	24	12	0	0	0	0	0
Sevenspine Bay Shrimp	<i>Crangon septemspinosa</i>	6,368	1,763	2,250	649	1,503	62	0	0	0	0	109	32	
American Lobster	<i>Homarus americanus</i>	350	40	0	65	0	123	0	0	0	0	17	32	
Spider Crabs	<i>Libinia spp.</i>	25	0	0	0	0	0	0	0	0	25	0	0	
Cancer Crabs	<i>Cancer spp.</i>	2,301	235	337	130	106	234	210	69	14	121	244	96	
Blue Crabs	<i>Callinectes sapidus</i>	25	0	0	0	0	0	0	0	0	25	0	0	
Green Crabs	<i>Carcinus maenas</i>	999	275	22	33	64	62	24	46	14	49	65	128	
Lady Crabs	<i>Ovalipes ocellatus</i>	218	0	0	98	22	0	0	12	0	0	49	0	
Starfish	<i>Asterias spp.</i>	282	40	0	0	43	86	24	0	0	25	0	64	
	Number of Species	13	5	4	8	6	7	5	5	3	5	5	6	
	Extrapolated Totals	12,454	2,353	3,282	1,496	1,781	703	516	162	98	245	392	448	
	Number of "Collection Hours"	437	19	32	23	34	61	31	65	54	30	46	23	
	Impingement Rate (fish per hour)	1.41	3.68	5.29	2.61	2.70	1.04	0.71	0.35	0.28	0.34	0.70	1.07	



**Table 9. Extrapolated totals for invertebrates collected at Pilgrim Station from the intake screens, January - December, 1980 - 2010.**

Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	
American Lobster	<i>Homarus americanus</i>	7,482	3,828	4,596	6,044	0	5,483	112	0	46	323
Amphipod	<i>Amphipoda</i>	0	0	0	0	0	0	0	0	233	53
Arctic Lyre Crab	<i>Hyas coarctatus</i>	0	0	0	0	0	0	0	0	0	15
Barnacle	<i>Cirripedia</i>	0	0	0	0	0	0	0	0	0	0
Bloodworm	<i>Glycera sp.</i>	0	0	0	0	0	0	0	0	0	0
Blue Crab	<i>Callinectes sapidus</i>	0	0	0	7,494	0	0	11	0	0	0
Blue Mussel	<i>Mytilus edulis</i>	44,708	154,266	0	0	5,966	6,598	9,195	49,823	4,891	3,309
Brittle Star	<i>Ophiuroidea</i>	0	0	0	0	0	0	0	0	23	0
Cancer Crab	<i>Cancer spp.</i>	0	0	0	0	0	0	0	49	0	158
Caridean Shrimp	<i>Caridea</i>	0	0	0	0	0	0	0	0	0	446
Clam Worm	<i>Nereis spp.</i>	8,589	6,521	0	8,213	0	0	58	149	133	329
Common Periwinkle	<i>Littorina littorea</i>	0	0	0	0	0	0	9	30	24	0
Gammarid Shrimp	<i>Gammarus spp.</i>	0	0	0	0	0	0	0	0	0	0
Glass Shrimp	<i>Dichelopandulus leptocerus</i>	0	11,177	0	0	0	0	0	0	0	0
Green Crab	<i>Carcinus maenas</i>	4,582	3,828	4,279	4,664	1,750	4,490	447	220	311	362
Hermit Crab	<i>Paguridae</i>	0	0	0	0	0	0	0	0	24	0
Horseshoe Crab	<i>Limulus polyphemus</i>	3,610	4,167	3,962	11,906	993	4,617	842	88	718	721
Isopod	<i>Isopoda</i>	0	0	0	0	0	9,124	11	542	266	170
Japanese Shore Crab	<i>Hemigrapsus sanguineus</i>	0	0	0	0	0	0	0	0	0	0
Jellyfish	<i>Cnidaria</i>	0	744	0	940	0	0	0	0	0	0
Lady Crab	<i>Ovalipes ocellatus</i>	8,939	8,975	6,125	5,304	5,243	4,859	263	31	0	341
Mysid Shrimp	<i>Mysidacea</i>	0	0	0	0	0	0	0	0	0	0
Mantis Shrimp	<i>Squilla empusa</i>	0	0	6,736	0	0	0	0	0	7	0
Nephtys	<i>Nephtys spp.</i>	0	0	0	0	0	0	0	0	0	0
Nudibranch	<i>Nudibranchia</i>	0	0	0	0	0	0	236	2,767	2,684	246
Oligochaete worm	<i>Orbiniidae</i>	0	0	0	0	0	0	0	0	0	0
Penaeid Shrimp	<i>Penaeidae</i>	0	0	0	0	0	0	0	0	0	0
Polychaete worm	<i>Polychaeta</i>	0	0	11,207	0	0	7,159	99	5,004	5,530	638
Ribbon worm	<i>Nemertean</i>	0	10,427	8,975	0	0	0	74	1,558	348	90
Rock Crab	<i>Cancer irroratus</i>	3,891	5,352	2,836	4,210	3,142	6,701	446	2,767	1,725	1,215
Roundworm	<i>Nematoda</i>	0	0	0	0	6,711	0	0	0	79	0
Sea Anenome	<i>Actinaria</i>	9,771	0	0	0	0	0	59	0	196	0
Sea Urchin	<i>Echinoidea</i>	6,858	8,259	15,661	8,952	3,772	8,483	45	1,215	222	855
Sevenspine Bay Shrimp	<i>Crangon septemspinosa</i>	6,657	11,038	4,893	7,199	2,584	23,243	1,778	5,903	4,043	3,456
Softshell Clam	<i>Mya arenaria</i>	0	0	0	9,682	0	0	0	0	0	0
Spider Crab	<i>Libinia spp.</i>	0	0	0	0	0	0	11	0	0	0
Squid	<i>Loligo spp.</i>	7,988	16,567	13,473	3,881	4,506	5,327	240	39	328	660
Starfish	<i>Asterias spp.</i>	3,596	6,849	5,531	6,768	482	7,766	302	35	2,215	2,934
Tunicate	<i>Tunicata</i>	0	0	0	0	0	0	0	0	7	36
Twelve-scaled Worm	<i>Lepidodontus spp.</i>	0	0	0	0	0	0	0	0	0	0
Unidentified crab		0	0	10,463	0	0	0	0	0	0	0
<b>Total</b>		116,669	251,997	98,736	85,257	35,150	93,850	14,237	70,218	24,051	16,354

Table 9. (continued).

Species		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
American Lobster	<i>Homarus americanus</i>	410	631	1,050	1,554	993	619	986	383	429	606
Amphipod	<i>Amphipoda</i>	0	0	0	0	0	0	0	0	0	0
Arctic Lyre Crab	<i>Hyas coarctatus</i>	10	12	10	22	13	0	0	0	0	0
Barnacle	<i>Cirripedia</i>	0	10	0	0	0	0	0	0	0	0
Bloodworm	<i>Glycera sp.</i>	0	0	0	0	48	31	21	0	0	0
Blue Crab	<i>Callinectes sapidus</i>	12	0	0	0	0	0	0	0	0	0
Blue Mussel	<i>Mytilus edulis</i>	209	742	14	0	35	0	0	34	0	0
Brittle Star	<i>Ophiuroidea</i>	0	0	0	0	0	0	0	0	0	0
Cancer Crab	<i>Cancer spp.</i>	0	0	0	0	0	0	0	0	0	0
Caridean Shrimp	<i>Caridea</i>	0	0	0	0	9	0	0	0	0	0
Clam Worm	<i>Nereis spp.</i>	10	70	226	648	1,086	1,417	510	96	97	420
Common Periwinkle	<i>Littorina littorea</i>	0	0	0	0	0	0	0	0	0	0
Gammarid Shrimp	<i>Gammarus spp.</i>	14	0	0	0	0	0	0	0	0	0
Glass Shrimp	<i>Dichelopandulus leptocerus</i>	0	0	0	0	0	0	0	0	0	0
Green Crab	<i>Carcinus maenas</i>	272	597	622	1,013	1,643	1,395	1,358	906	550	950
Hermit Crab	<i>Paguridae</i>	9	32	0	0	0	0	0	0	0	0
Horseshoe Crab	<i>Limulus polyphemus</i>	340	421	1,128	1,616	519	183	190	131	71	37
Isopod	<i>Isopoda</i>	9	73	106	50	13	76	27	0	10	0
Japanese Shore Crab	<i>Hemigrapsus sanguineus</i>	0	0	0	0	0	0	0	0	0	0
Jellyfish	<i>Cnidaria</i>	0	0	0	0	0	0	0	0	0	0
Lady Crab	<i>Ovalipes ocellatus</i>	90	466	44	49	10	40	44	64	53	35
Mysid Shrimp	<i>Mysidacea</i>	0	0	0	0	33	0	0	0	0	0
Mantis Shrimp	<i>Squilla empusa</i>	0	0	0	0	0	0	13	55	0	15
Nephtys	<i>Nephtys spp.</i>	0	0	0	0	0	0	0	0	0	16
Nudibranch	<i>Nudibranchia</i>	0	0	0	0	0	0	0	312	0	26
Oligochaete worm	<i>Orbiniidae</i>	0	0	0	0	48	0	21	0	0	0
Penaeid Shrimp	<i>Penaeidae</i>	0	0	0	0	0	0	0	0	0	0
Polychaete worm	<i>Polychaeta</i>	0	0	25	100	0	0	40	0	0	26
Ribbon worm	<i>Nemertean</i>	45	10	42	155	18	64	0	27	0	78
Rock Crab	<i>Cancer irroratus</i>	565	893	215	1,207	813	1,607	1,337	244	113	360
Roundworm	<i>Nematoda</i>	0	0	0	34	0	0	0	0	0	0
Sea Anenome	<i>Actinaria</i>	0	0	58	0	0	0	19	0	0	0
Sea Urchin	<i>Echinoidea</i>	72	63	61	61	95	82	60	71	31	31
Sevenspine Bay Shrimp	<i>Crangon septemspinosa</i>	1,019	1,573	2,825	1,705	6,876	5,740	16,342	907	9,570	7,861
Softshell Clam	<i>Mya arenaria</i>	0	0	0	0	24	0	0	0	0	0
Spider Crab	<i>Libinia spp.</i>	0	0	0	0	0	0	0	0	0	0
Squid	<i>Loligo spp.</i>	605	296	445	360	760	2,270	309	343	1,145	1,013
Starfish	<i>Asterias spp.</i>	1,661	1,812	61	675	351	147	113	534	222	1,885
Tunicate	<i>Tunicata</i>	0	0	0	0	0	0	0	0	0	10
Twelve-scaled Worm	<i>Lepidodontus spp.</i>	0	0	0	0	0	0	0	0	0	0
Unidentified crab		0	0	0	0	0	0	0	0	0	0
	<b>Total</b>	5,352	7,702	6,934	9,249	13,390	13,671	21,389	4,107	12,290	13,371

Table 9. (continued).

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	1980-2009 Mean	2010
American Lobster <i>Homarus americanus</i>	631	112	145	321	140	1,025	278	519	54	0	1,293	350
Amphipod <i>Amphipoda</i>	0	0	0	0	0	0	0	0	0	0	10	0
Arctic Lyre Crab <i>Hyas coarctatus</i>	0	13	0	0	0	0	0	0	0	0	3	0
Barnacle <i>Cirripedia</i>	0	0	0	0	0	0	0	0	0	0	0	0
Bloodworm <i>Glycera sp.</i>	0	24	0	0	0	16	15	0	0	0	5	0
Blue Crab <i>Callinectes sapidus</i>	0	8	0	0	0	0	0	0	0	0	251	25
Blue Mussel <i>Mytilus edulis</i>	0	21	0	183	0	288	819	135	0	0	9,375	0
Brittle Star <i>Ophiuroidea</i>	0	0	0	0	0	0	0	0	0	0	1	0
Cancer Crab <i>Cancer spp.</i>	100	1,467	1,224	1,954	0	479	462	858	258	1,170	273	0
Caridean Shrimp <i>Caridea</i>	0	0	0	0	0	0	0	0	0	0	15	0
Clam Worm <i>Nereis spp.</i>	1,809	302	147	478	392	1,055	53	15	316	399	1,118	916
Common Periwinkle <i>Littorina littorea</i>	0	0	0	0	0	0	0	0	0	0	2	0
Gammarid Shrimp <i>Gammarus spp.</i>	0	0	0	0	0	0	0	0	0	0	0	0
Glass Shrimp <i>Dichelopandulus leptocerus</i>	0	0	0	0	0	0	0	0	0	0	373	0
Green Crab <i>Carcinus maenas</i>	2,277	1,378	569	426	111	68	265	314	177	279	1,337	999
Hermit Crab <i>Paguridae</i>	0	0	0	23	0	0	0	0	0	0	3	0
Horseshoe Crab <i>Limulus polyphemus</i>	26	0	0	0	0	22	57	14	0	0	1,213	61
Isopod <i>Isopoda</i>	0	16	0	0	0	0	0	0	0	0	350	0
Japanese Shore Crab <i>Hemigrapsus sanguineus</i>	0	0	47	36	21	0	60	0	0	35	7	0
Jellyfish <i>Cnidaria</i>	0	0	0	0	0	0	0	0	0	0	56	0
Lady Crab <i>Ovalipes ocellatus</i>	0	27	135	27	0	0	0	14	0	0	1,373	218
Mysid Shrimp <i>Mysidacea</i>	0	0	0	0	0	0	0	0	0	0	1	0
Mantis Shrimp <i>Squilla empusa</i>	0	0	0	0	0	0	0	0	0	0	228	0
Nephtys <i>Nephtys spp.</i>	0	0	0	0	0	11	23	667	0	0	24	325
Nudibranch <i>Nudibranchia</i>	0	8	0	0	0	0	0	0	0	0	209	0
Oligochaete worm <i>Orbiniidae</i>	0	0	0	0	0	0	0	0	0	0	2	0
Penaeid Shrimp <i>Penaeidae</i>	0	0	13	0	0	0	0	0	0	0	0	0
Polychaete worm <i>Polychaeta</i>	0	85	0	0	0	0	0	0	0	0	997	0
Ribbon worm <i>Nemertean</i>	0	0	0	0	0	0	0	0	123	93	738	129
Rock Crab <i>Cancer irroratus</i>	3,134	0	0	0	634	0	0	0	0	0	1,447	2,301
Roundworm <i>Nematoda</i>	0	0	0	0	8	0	0	0	0	0	228	0
Sea Anenome <i>Actinaria</i>	0	0	0	0	0	0	0	0	0	0	337	0
Sea Urchin <i>Echinoidea</i>	0	21	0	0	0	0	0	0	0	27	1,833	0
Sevenspine Bay Shrimp <i>Crangon septemspinosa</i>	26,959	7,030	7,165	7,925	15,622	9,283	1,728	1,544	3,575	7,505	7,118	6,368
Softshell Clam <i>Mya arenaria</i>	0	0	0	0	0	0	0	0	0	0	324	0
Spider Crab <i>Libinia spp.</i>	26	0	12	0	0	72	0	0	45	0	6	25
Squid <i>Loligo spp.</i>	1,961	903	878	545	36	64	850	468	299	62	2,221	455
Starfish <i>Asterias spp.</i>	0	1,206	274	61	26	45	51	76	36	97	1,527	282
Tunicate <i>Tunicata</i>	0	0	0	0	0	0	0	0	0	0	2	0
Twelve-scaled Worm <i>Lepidodontus spp.</i>	16	0	0	0	0	0	0	0	0	0	1	0
Unidentified crab	0	0	0	0	0	0	0	0	0	0	349	0
<b>Total</b>	<b>36,939</b>	<b>12,622</b>	<b>10,609</b>	<b>11,979</b>	<b>16,990</b>	<b>12,428</b>	<b>4,661</b>	<b>4,624</b>	<b>4,883</b>	<b>9,667</b>	<b>34,646</b>	<b>12,454</b>