IMPINGEMENT OF ORGANISMS ON THE INTAKE SCREENS

AT PILGRIM NUCLEAR POWER STATION

JANUARY - DECEMBER 2010

Submitted to

Entergy Nuclear
Pilgrim Nuclear Power Station
Plymouth, Massachusetts

by

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April 22, 2011

B/11 Encl

35 pages

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 ½ x ¼ 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) × 24 hours × 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

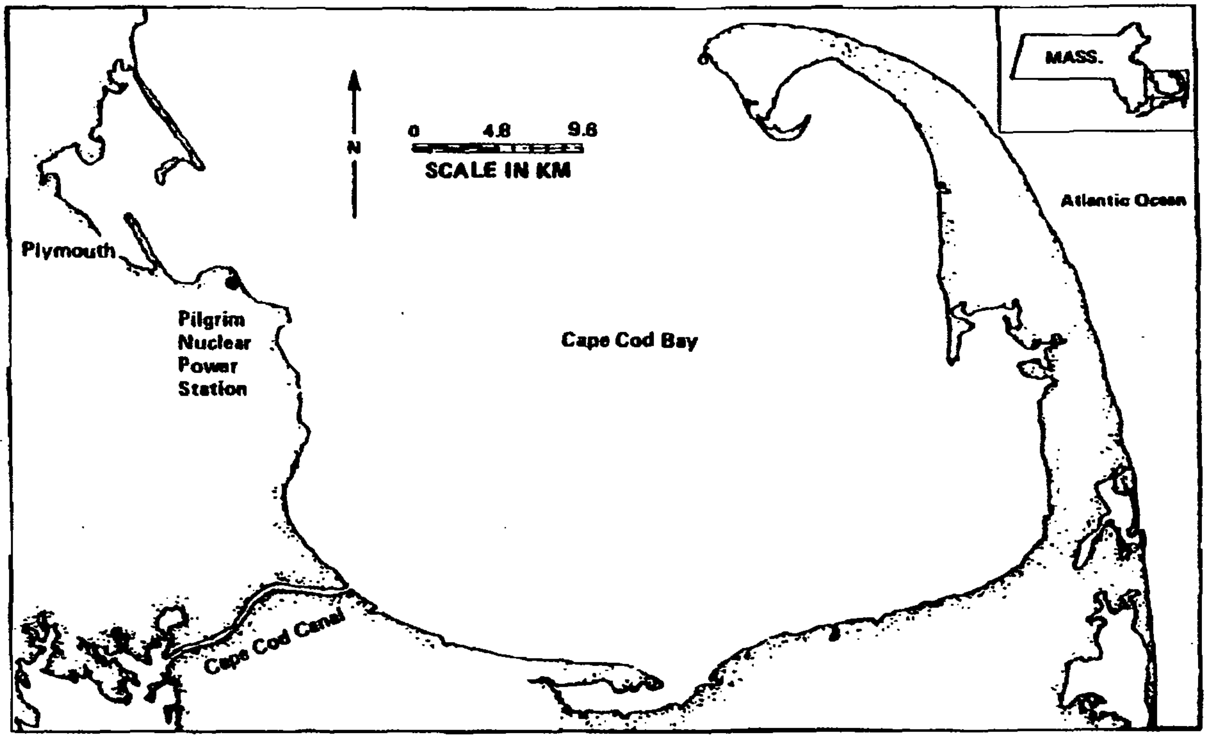

Figure 1. Location of Pilgrim Nuclear Power Station

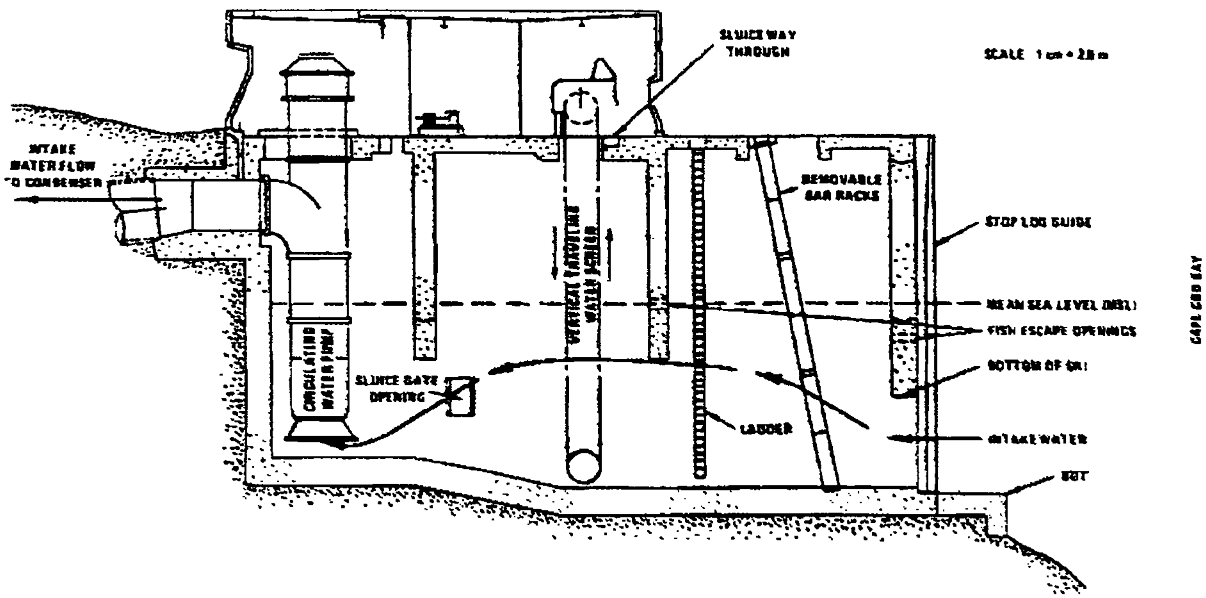

Figure 2. Cross-section of intake structure of Pilgrim Nuclear Power Station.

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 (*Tautogolabrus 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 12th, involved Atlantic silversides and spotted hake impinged at the rate of 25 fish per hour. The July sample, taken on the 28th, 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.

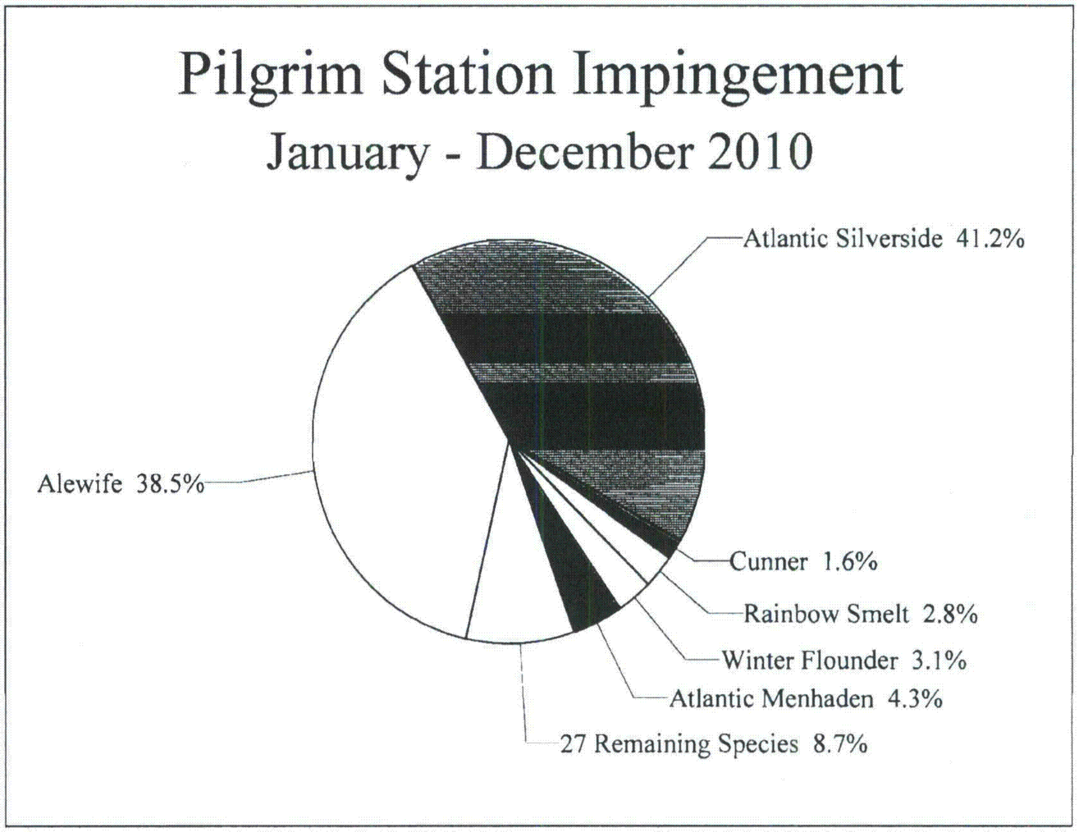

Figure 3. Percent of total for numerically dominant species of fish impinged on the Pilgrim Nuclear Power Station intake screens, January to December 2010.

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 11th 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 (≥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 (≥ 82 mm) and the rest were less that 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 11th 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.

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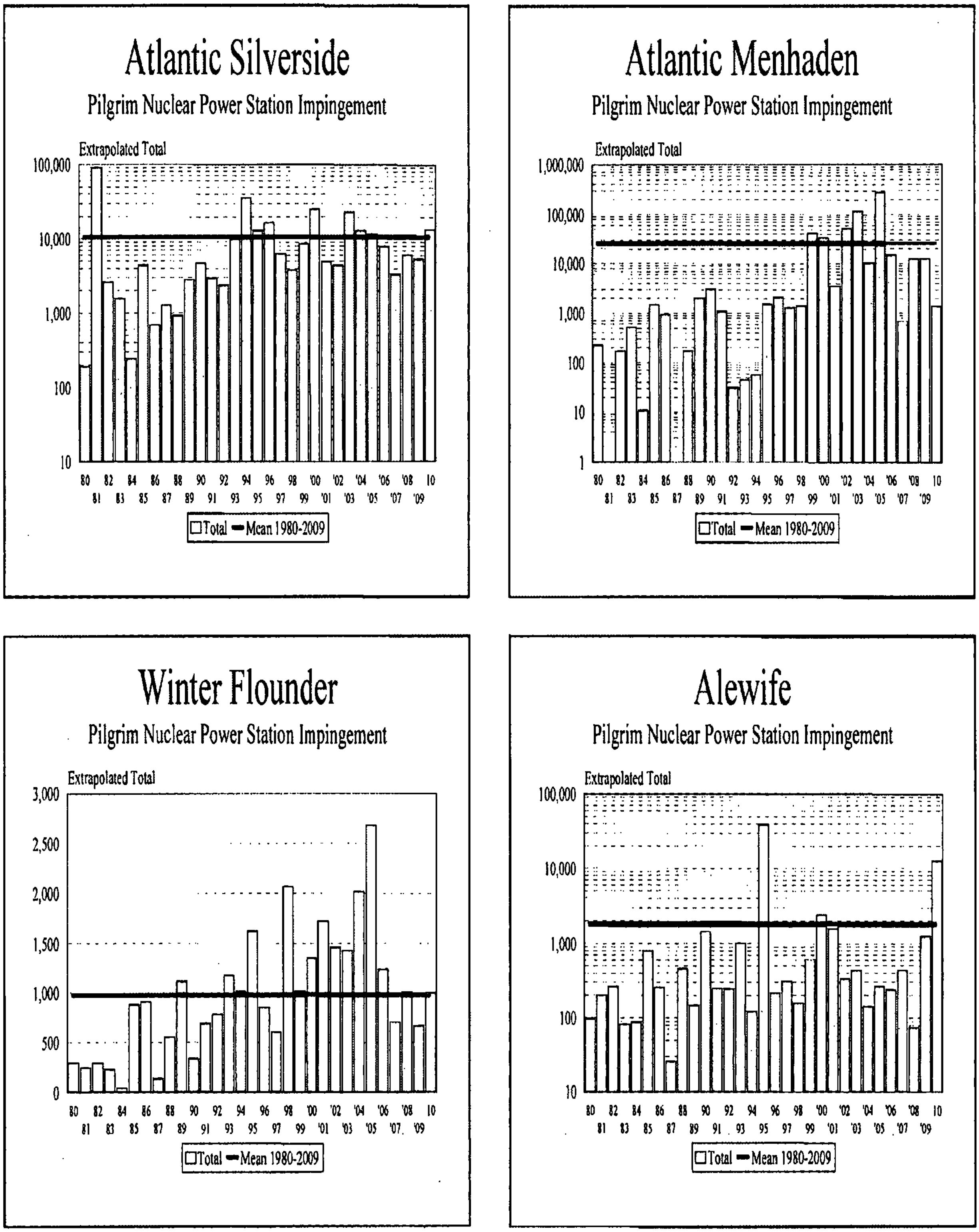
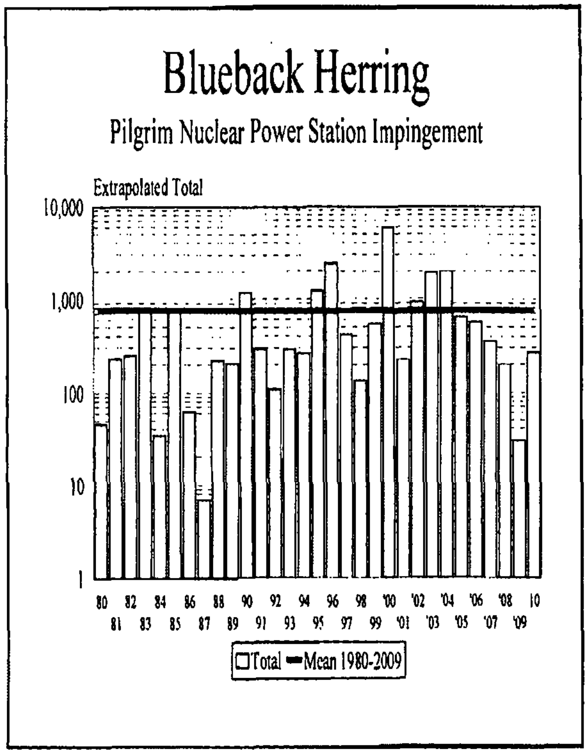
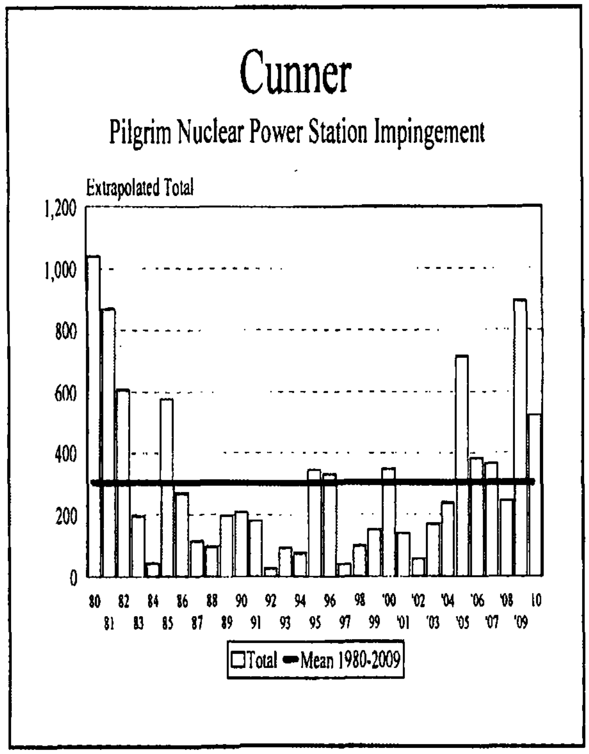
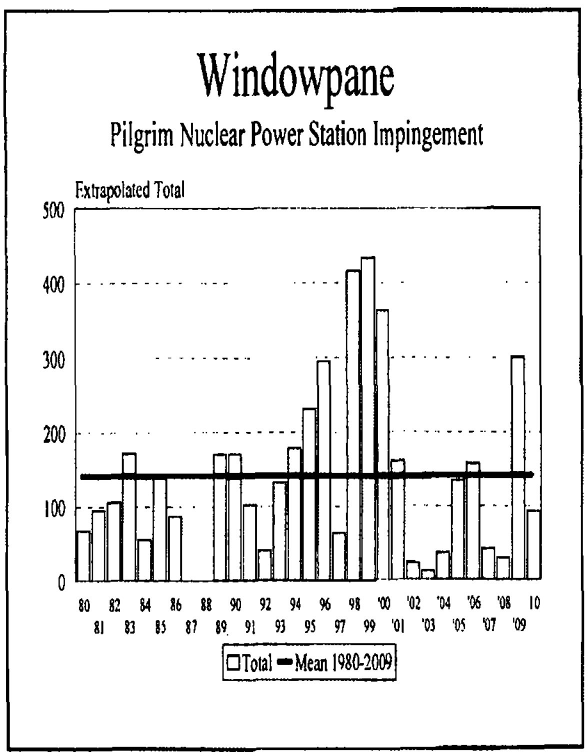
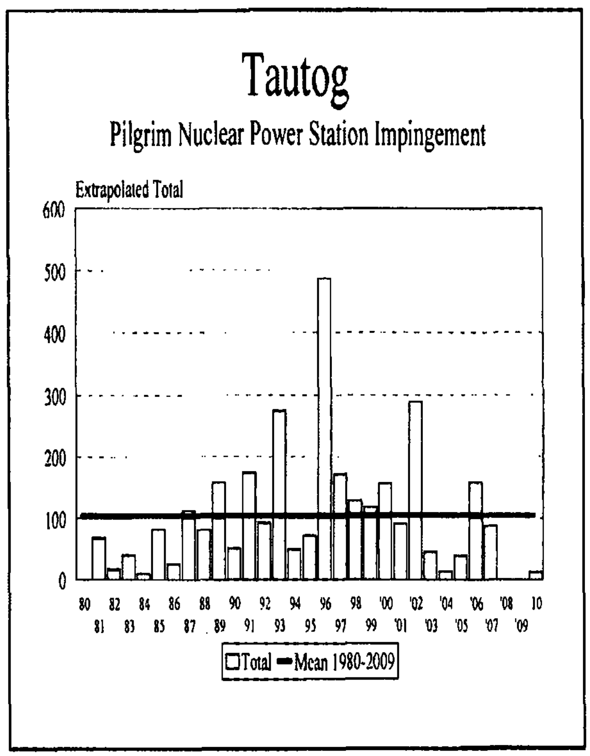


Figure 4. Extrapolated annual totals for typical numerical dominants impinged at Pilgrim Nuclear Power Station, 1980-2010.









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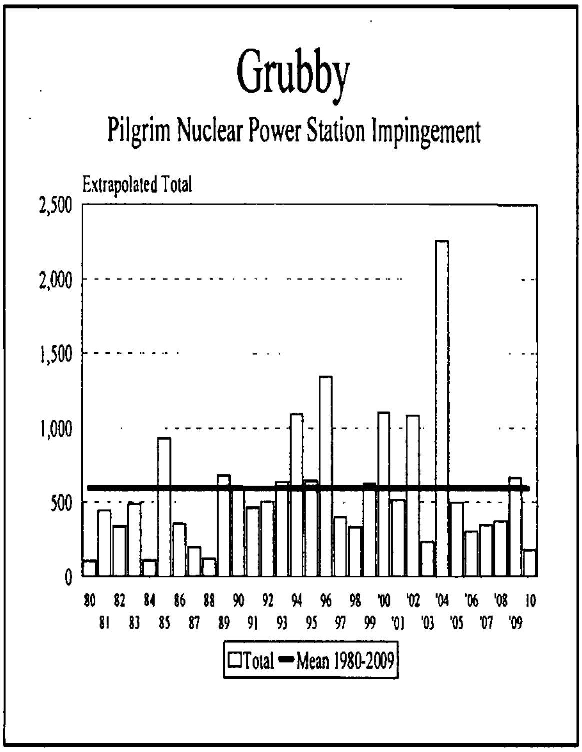

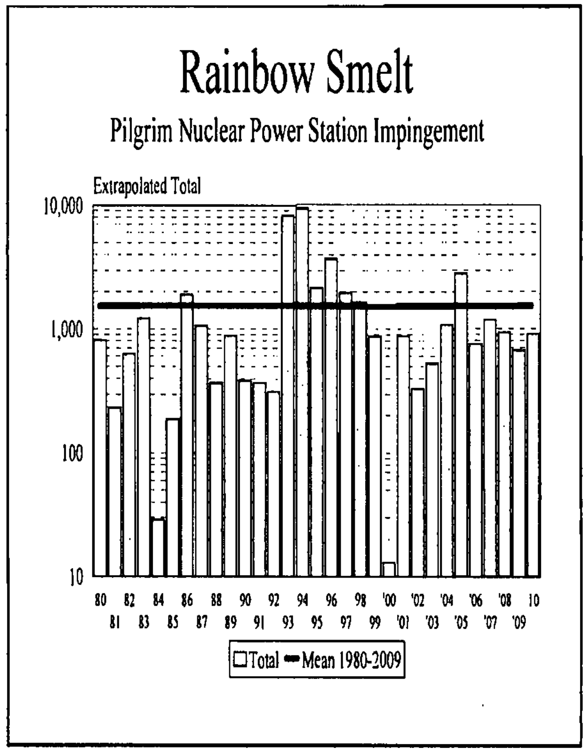

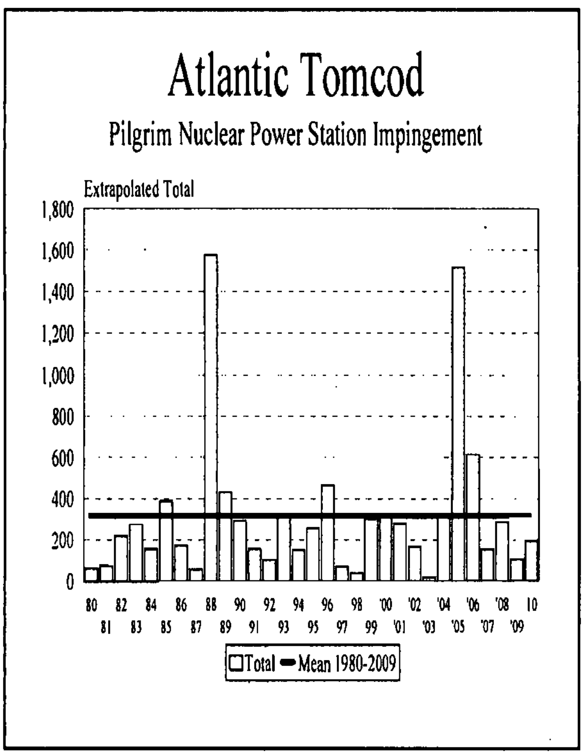

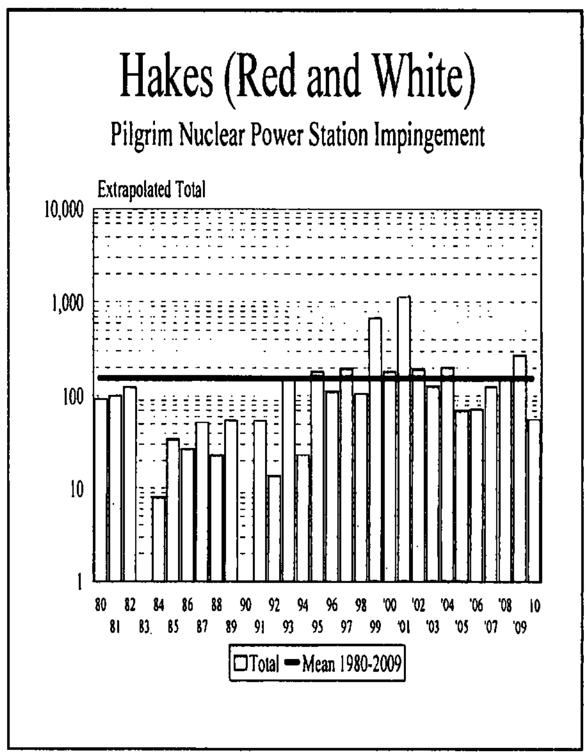

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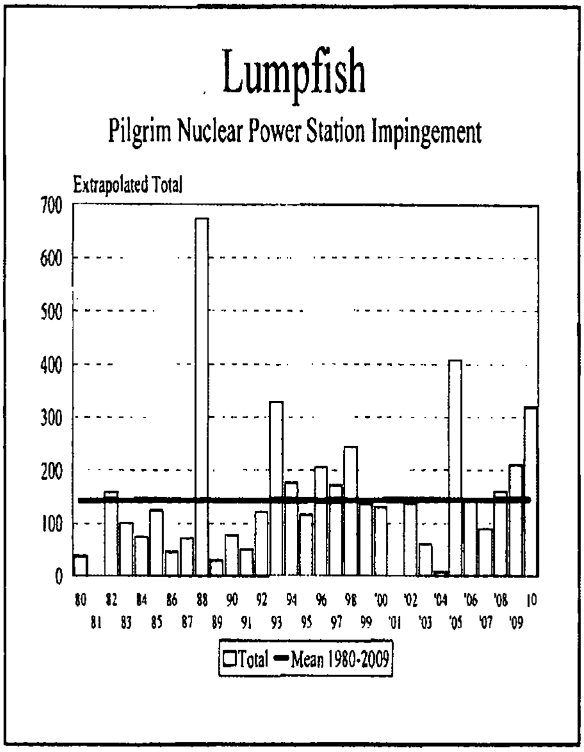

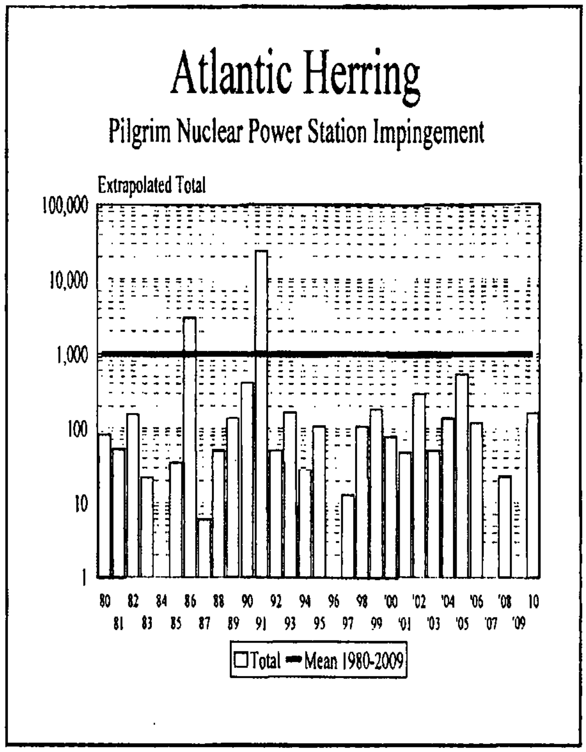

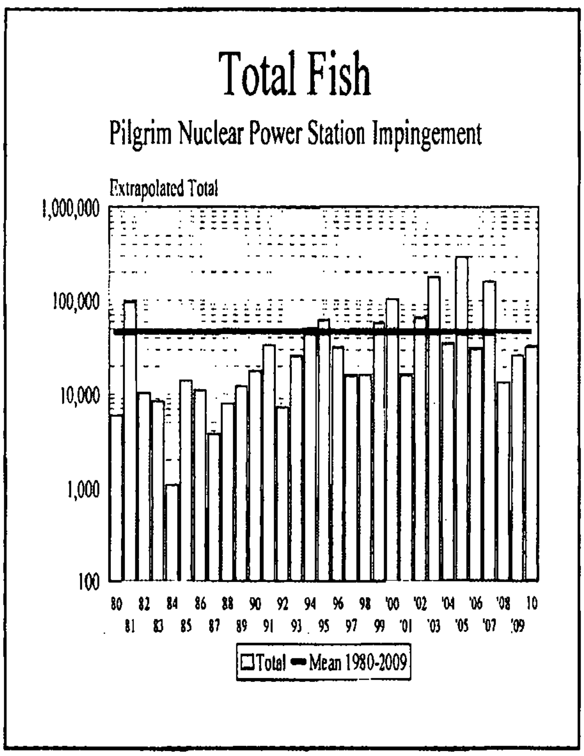

Figure 4. Continued.

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

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

		Number		Length (mm)				Weight (g)		
Common Name	Species	Collected	n	Mean	Min	Max	n	Mean	Min	Max
Little Skate	*Leucoraja erinacea*	8	8	457.9	384	552	0			
American Eel	*Anguilla rostrata*	1	1	305.0	305	305	1	28.64	28.64	28.64
Blueback Herring	*Alosa aestivalis*	10	10	141.7	55	295	3	3.28	1.65	4.77
Alewife	*Alosa pseudoharengus*	1,078	47	94.6	64	172	41	5.68	2.20	14.82
American Shad	*Alosa sapidissima*	4	4	114.0	75	150	2	3.65	1.92	5.37
Atlantic Menhaden	*Brevoortia tyrannus*	93	93	61.5	34	121	59	1.79	0.35	8.46
Atlantic Herring	*Clupea harengus*	6	6	140.3	124	160	6	13.61	8.23	22.87
Rainbow Smelt	*Osmerus mordax*	32	32	100.7	77	198	16	5.21	1.85	23.53
Atlantic Cod	*Gadus morhua*	2	2	256.5	63	450	1	1.99	1.99	1.99
Atlantic Tomcod	*Microgadus tomcod*	8	8	97.0	45	153	5	3.51	0.66	13.02
Red Hake	*Urophycis chuss*	3	3	76.3	62	87	2	2.43	1.77	3.08
Spotted Hake	*Urophycis regia*	5	5	88.8	64	120	3	3.22	1.41	5.58
Mummichog	*Fundulus heteroclitus*	1	1	87.0	87	87	0			
Striped Killifish	*Fundulus majalis*	6	6	73.8	60	102	1	3.08	3.08	3.08
Atlantic Silverside	*Menidia menidia*	564	305	95.0	63	152	154	3.78	0.84	12.86
Threespine Stickleback	*Gasterosteus aculeatus*	3	3	59.0	44	68	0			
Northern Pipefish	*Syngnathus fuscus*	4	4	115.8	82	150	0			
Searobins	*Prionotus spp.*	1	1	212.0	212	212	0			
Grubby	*Myoxocephalus aenaeus*	7	7	71.6	58	95	0			
Lumpfish	*Cyclopterus lumpus*	10	10	58.4	38	69	0			
White Perch	*Morone americana*	1	1	121.3	121.3	121.3	1	23.77	23.77	23.77
Striped Bass	*Morone saxatilis*	1	1	585.0	585	585	1	1282.00	1282.00	1282.00
Atlantic Moonfish	*Selene setapinnis*	7	7	49.6	46	55	0			
Scup	*Stenotomus chrysops*	2	2	37.5	32	43	1	0.28	0.28	0.28
Tautog	*Tautoga onitis*	1	1	320.0	320	320	1	670.00	670.00	670.00
Cunner	*Tautogolabrus adspersus*	19	19	78.3	40	160	3	39.46	10.12	70.94
Radiated Shanny	*Ulvaria subbifurcata*	2	2	100.5	76	125	0			
Rock Gunnel	*Pholis gunnellus*	2	2	138.0	113	163	0			
Sand Lance	*Ammodytes sp.*	8	8	152.9	110	195	1	7.06	7.06	7.06
Butterfish	*Peprilus triacanthus*	4	4	44.8	39	51	3	0.92	0.73	1.09
Smallmouth Flounder	*Etropus microstomus*	4	4	88.8	48	196	2	1.73	1.00	2.45
Windowpane	*Scophthalmus aquosus*	4	4	119.8	34	214	0			
Winter Flounder	*Pseudopleuronectes americanus*	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[1]	1985	1986	1987[2]	1988	1989	1990	1991	1992	1993	1994[3]	1995[4]
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[1]	1985	1986	1987[2]	1988	1989	1990	1991	1992	1993	1994[3]	1995[4]
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[1]	1985	1986	1987[2]	1988	1989	1990	1991	1992	1993	1994[3]	1995[4]
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
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	1996	1997	1998	1999[5]	2000	2001[6]	2002	2003[7]	2004	2005[8]	2006	2007[9]	2008	2009	Mean 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[5]	2000	2001[6]	2002	2003[7]	2004	2005[8]	2006	2007[9]	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[5]	2000	2001[6]	2002	2003[7]	2004	2005[8]	2006	2007[9]	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
Annual Totals	4.44	32,962		1,940

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)
Mean	**4.32**	**46,448**	
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	*Alosa pseudoharengus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American Eel	*Anguilla rostrata*	x	x	x				x			x			x			
American Plaice	*Hippoglossoides platessoides*																
American Shad	*Alosa sapidissima*									x							
Atlantic Cod	*Gadus morhua*	x	x	x				x		x			x	x	x	x	x
Atlantic Herring	*Clupea harengus*	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Atlantic Mackerel	*Scomber scombrus*											x				x	
Atlantic Menhaden	*Brevoortia tyrannus*	x		x	x	x	x	x		x	x	x	x	x	x	x	x
Atlantic Moonfish	*Selene setapinnis*				x	x					x			x			x
Atlantic Seasnail	*Liparis atlanticus*		x		x	x						x		x			
Atlantic Silverside	*Menidia menidia*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Tomcod	*Microgadus tomcod*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bay Anchovy	*Anchoa mitchilli*	x		x			x	x			x	x					
Bigeye	*Priacanthus arenatus*										x						
Black Ruff	*Centrolophorus niger*											x					
Black Sea Bass	*Centropristis striata*		x					x	x		x		x	x			x
Black Spotted Stickleback	*Gasterosteus wheatlandi*								x						x	x	
Blueback Herring	*Alosa aestivalis*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bluefish	*Pomatomus saltatrix*			x													
Butterfish	*Peprilus triacanthus*		x	x	x	x	x					x			x	x	x
Crevalle Jack	*Caranx hippos*																
Cunner	*Tautogolabrus adspersus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dogfish	*see below*																
Flying Gurnard	*Dactylopterus volitans*						x										x
Fourbeard Rockling	*Enchelyopus cimbrius*																
Fourspine Stickleback	*Apeltes quadracus*	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	*Paralichthys oblongus*	x	x	x	x					x		x	x		x		
Gizzard Shad	*Dorosoma cepedianum*																
Golden Redfish	*Sebastes norvegicus*																
Goosefish	*Lophius americanus*																
Grubby	*Myoxocephalus aenaeus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gulf Stream Flounder	*Citharichthys arctifrons*																
Haddock	*Melanogrammus aeglefinus*																
Hakes (red and white)	*Urophycis spp.*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hogchoker	*Trinectes maculatus*												x				
Little Skate	*Leucoraja erinacea*		x	x	x	x	x	x	x	x	x		x	x	x	x	x
Longhorn Sculpin	*Myoxocephalus octodecemspinosus*			x	x												
Lumpfish	*Cyclopterus lumpus*	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mummichog	*Fundulus heteroclitus*			x						x		x	x		x	x	x
Northern Kingfish	*Menticirrhus saxatilis*												x				
Northern Pipefish	*Syngnathus fuscus*	x	x	x	x	x	x	x		x	x	x		x	x	x	x
Northern Puffer	*Sphoeroides maculatus*											x	x	x	x		x
Northern Searobin	*Prionotus carolinus*	x	x	x	x	x	x		x		x	x	x		x	x	x
Ocean pout	*Zoarces americanus*																
Orange Filefish	*Aluterus schoepfii*											x					
Planehead Filefish	*Monacanthus hispidus*													x			
Pollock	*Pollachius virens*	x		x	x	x	x		x	x		x		x	x	x	x
Radiated Shanny	*Ulvaria subbifurcata*	x		x			x	x	x		x	x	x	x	x	x	x
Rainbow Smelt	*Osmerus mordax*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock Gunnel	*Pholis gunnellus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Round Scad	*Etrumeus teres*										x	x					
Sand Lance	*Ammodytes sp.*	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.	*Myoxocephalus spp.*											x	x		x		
Scup	*Stenotomus chrysops*	x	x	x	x		x				x	x	x	x	x	x	
Sea Raven	*Hemitripterus americanus*						x										
Seaboard Goby	*Gobiosoma ginsburgi*																
Searobin sp.	*Prionotus sp.*																
Shorthorn Sculpin	*Myxocephalus scorpius*			x													
Silver Hake	*Merluccius bilinearus*	x	x		x		x	x	x		x						
Silver-rag	*Ariomma bondi*			x								x					
Smallmouth Flounder	*Etropus microstomus*							x			x	x					
Smooth Dogfish	*Mustelus canis*	x	x		x					x	x	x	x				
Smooth Flounder	*Pleuronectes putnami*																
Spiny Dogfish	*Squalus acanthus*											x	x		x		
Spot	*Leiostomus xanthurus*														x		
Spotted Hake	*Urophycis regia*																
Striped Bass	*Morone saxatilis*																
Striped Cusk Eel	*Ophidion marginatum*														x		
Striped Killifish	*Fundulus majalis*		x		x		x	x	x	x	x	x	x	x	x	x	x
Striped Searobins	*Prionotus evolans*					x						x			x		x
Summer Flounder	*Paralichthys dentatus*	x		x				x			x					x	
Tautog	*Tautoga onitis*		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Threespine Stickleback	*Gasterosteus aculeatus*	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Weakfish	*Cynoscion regalis*																
Weitzman's Pearlside	*Maurolicus weitmani*														x		
White Perch	*Morone americana*		x			x	x						x				
Windowpane	*Scophthalmus aquosus*	x	x	x	x	x	x	x			x	x	x	x	x	x	x
Winter Flounder	*Pleuronectes americanus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Winter Skate	*Leucoraja ocelata*	x		x	x				x								
Yellowtail Flounder	*Limanda ferruginea*							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	*Alosa pseudoharengus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American Eel	*Anguilla rostrata*					x							x			x
American Plaice	*Hippoglossoides platessoides*								x							
American Shad	*Alosa sapidissima*															x
Atlantic Cod	*Gadus morhua*			x	x		x		x	x	x	x	x	x	x	x
Atlantic Herring	*Clupea harengus*		x	x	x	x	x	x	x	x	x	x	x	x		x
Atlantic Mackerel	*Scomber scombrus*												x		x	
Atlantic Menhaden	*Brevoortia tyrannus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Moonfish	*Selene setapinnis*	x			x		x				x	x			x	x
Atlantic Seasnail	*Liparis atlanticus*	x					x	x	x	x				x		
Atlantic Silverside	*Menidia menidia*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Tomcod	*Microgadus tomcod*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bay Anchovy	*Anchoa mitchilli*		x				x		x				x	x	x	
Bigeye	*Priacanthus arenatus*															
Black Ruff	*Centrolophorus niger*															
Black Sea Bass	*Centropristis striata*						x		x	x	x	x		x		
Black Spotted Stickleback	*Gasterosteus wheatlandi*		x								x					
Blueback Herring	*Alosa aestivalis*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bluefish	*Pomatomus saltatrix*			x												
Butterfish	*Peprilus triacanthus*	x	x	x	x		x			x	x	x	x	x	x	x
Crevalle Jack	*Caranx hippos*							x							x	
Cunner	*Tautogolabrus adspersus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dogfish	*see below*					x										
Flying Gurnard	*Dactylopterus volitans*						x									
Fourbeard Rockling	*Enchelyopus cimbrius*			x												
Fourspine Stickleback	*Apeltes quadracus*						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	*Paralichthys oblongus*	x	x	x	x				x	x						
Gizzard Shad	*Dorosoma cepedianum*					x										
Golden Redfish	*Sebastes norvegicus*							x								
Goosefish	*Lophius americanus*					x										
Grubby	*Myoxocephalus aenaeus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gulf Stream Flounder	*Citharichthys arctifrons*					x										
Haddock	*Melanogrammus aeglefinus*												x			
Hakes	*Urophycis spp.*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Hogchoker	*Trinectes maculatus*															
Little Skate	*Leucoraja erinacea*	x	x	x			x	x	x	x	x	x	x	x	x	x
Longhorn Sculpin	*Myoxocephalus octodecemspinosus*	x		x	x	x										
Lumpfish	*Cyclopterus lumpus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mummichog	*Fundulus heteroclitus*				x	x					x		x	x		x
Northern Kingfish	*Menticirrhus saxatilis*															
Northern Pipefish	*Syngnathus fuscus*	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Northern Puffer	*Sphoeroides maculatus*		x						x			x	x			
Northern Searobin	*Prionotus carolinus*			x	x	x	x		x	x	x	x		x	x	
Ocean pout	*Zoarces americanus*								x	x				x		
Orange Filefish	*Aluterus schoepfii*															
Planehead Filefish	*Monacanthus hispidus*															
Pollock	*Pollachius virens*				x	x				x	x			x		
Radiated Shanny	*Ulvaria subbifurcata*	x		x	x	x	x	x	x	x	x		x	x	x	x
Rainbow Smelt	*Osmerus mordax*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rock Gunnel	*Pholis gunnellus*	x		x	x	x	x	x		x	x	x	x	x	x	x
Round Scad	*Etrumeus teres*															
Sand Lance	*Ammodytes sp.*			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.	*Myoxocephalus spp.*					x										
Scup	*Stenotomus chrysops*			x		x			x	x	x		x		x	x
Sea Raven	*Hemitripterus americanus*										x					
Seaboard Goby	*Gobiosoma ginsburgi*							x								
Searobin sp.	*Prionotus sp.*										x					x
Shorthorn Sculpin	*Myxocephalus scorpius*															
Silver Hake	*Merluccius bilinearus*								x						x	
Silver-rag	*Ariomma bondi*															
Smallmouth Flounder	*Etropus microstomus*			x	x						x	x		x	x	x
Smooth Dogfish	*Mustelus canis*								x	x				x		
Smooth Flounder	*Pleuronectes putnami*						x									
Spiny Dogfish	*Squalus acanthus*					x	x				x		x	x		
Spot	*Leiostomus xanthurus*															
Spotted Hake	*Urophycis regia*			x												x
Striped Bass	*Morone saxatilis*	x				x			x	x			x	x		x
Striped Cusk Eel	*Ophidion marginatum*			x								x		x		
Striped Killifish	*Fundulus majalis*	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Striped Searobins	*Prionotus evolans*		x		x							x				
Summer Flounder	*Paralichthys dentatus*			x					x	x			x	x		
Tautog	*Tautoga onitis*	x	x	x	x	x	x	x	x	x	x	x	x			x
Threespine Stickleback	*Gasterosteus aculeatus*	x		x	x	x	x		x	x	x	x	x	x	x	x
Weakfish	*Cynoscion regalis*								x	x			x			
Weitzman's Pearlside	*Maurolicus weitmani*								x	x		x				
White Perch	*Morone americana*						x		x	x	x	x	x	x	x	x
Windowpane	*Scophthalmus aquosus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Winter Flounder	*Pleuronectes americanus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Winter Skate	*Leucoraja ocelata*															
Yellowtail Flounder	*Limanda ferruginea*				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	*Nemertean*	129	0	0	33	0	0	0	0	0	0	0	0	96
Nereis	*Nereis sp.*	916	0	673	163	43	0	0	0	0	0	0	37	0
Nephtys	*Nephtys sp.*	325	0	0	325	0	0	0	0	0	0	0	0	0
Squid	*Loligo pealeii*	455	0	0	0	0	111	234	23	70	0	17	0	0
Horseshoe Crab	*Limulus polyphemus*	61	0	0	0	0	25	24	12	0	0	0	0	0
Sevenspine Bay Shrimp	*Crangon septemspinosa*	6,368	1,763	2,250	649	1,503	62	0	0	0	0	0	109	32
American Lobster	*Homarus americanus*	350	40	0	65	0	123	0	0	0	0	17	73	32
Spider Crabs	*Libinia spp.*	25	0	0	0	0	0	0	0	0	25	0	0	0
Cancer Crabs	*Cancer spp.*	2,301	235	337	130	106	234	210	69	14	121	244	505	96
Blue Crabs	*Callinectes sapidus*	25	0	0	0	0	0	0	0	0	25	0	0	0
Green Crabs	*Carcinus maenas*	999	275	22	33	64	62	24	46	14	49	65	217	128
Lady Crabs	*Ovalipes ocellatus*	218	0	0	98	22	0	0	12	0	0	49	37	0
Starfish	*Asterias spp.*	282	40	0	0	43	86	24	0	0	25	0	0	64
	Number of Species	13	5	4	8	6	7	5	5	3	5	5	6	6
	Extrapolated Totals	12,454	2,353	3,282	1,496	1,781	703	516	162	98	245	392	978	448
	Number of "Collection Hours"	437	19	32	23	34	61	31	65	54	30	46	20	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	1.70	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	*Homarus americanus*	7,482	3,828	4,596	6,044	0	5,483	112	0	46	323
Amphipod	*Amphipoda*	0	0	0	0	0	0	0	0	233	53
Arctic Lyre Crab	*Hyas coarctatus*	0	0	0	0	0	0	0	0	0	15
Barnacle	*Cirripedia*	0	0	0	0	0	0	0	0	0	0
Bloodworm	*Glycera sp.*	0	0	0	0	0	0	0	0	0	0
Blue Crab	*Callinectes sapidus*	0	0	0	7,494	0	0	11	0	0	0
Blue Mussel	*Mytilus edulis*	44,708	154,266	0	0	5,966	6,598	9,195	49,823	4,891	3,309
Brittle Star	*Ophiuroidea*	0	0	0	0	0	0	0	0	23	0
Cancer Crab	*Cancer spp.*	0	0	0	0	0	0	0	49	0	158
Caridean Shrimp	*Caridea*	0	0	0	0	0	0	0	0	0	446
Clam Worm	*Nereis spp.*	8,589	6,521	0	8,213	0	0	58	149	133	329
Common Periwinkle	*Littorina littorea*	0	0	0	0	0	0	9	30	24	0
Gammarid Shrimp	*Gammarus* spp.	0	0	0	0	0	0	0	0	0	0
Glass Shrimp	*Dichelopandulus leptocerus*	0	11,177	0	0	0	0	0	0	0	0
Green Crab	*Carcinus maenas*	4,582	3,828	4,279	4,664	1,750	4,490	447	220	311	362
Hermit Crab	*Paguridae*	0	0	0	0	0	0	0	0	24	0
Horseshoe Crab	*Limulus polyphemus*	3,610	4,167	3,962	11,906	993	4,617	842	88	718	721
Isopod	*Isopoda*	0	0	0	0	0	9,124	11	542	266	170
Japanese Shore Crab	*Hemigraphus sanguineus*	0	0	0	0	0	0	0	0	0	0
Jellyfish	*Cnidaria*	0	744	0	940	0	0	0	0	0	0
Lady Crab	*Ovalipes ocellatus*	8,939	8,975	6,125	5,304	5,243	4,859	263	31	0	341
Mysid Shrimp	*Mysidacea*	0	0	0	0	0	0	0	0	0	0
Mantis Shrimp	*Squila empusa*	0	0	6,736	0	0	0	0	0	7	0
Nephtys	*Nephtys spp.*	0	0	0	0	0	0	0	0	0	0
Nudibranch	*Nudibranchia*	0	0	0	0	0	0	236	2,767	2,684	246
Oligochaete worm	*Orbiniidae*	0	0	0	0	0	0	0	0	0	0
Penaeid Shrmip	*Penaeidae*	0	0	0	0	0	0	0	0	0	0
Polychaete worm	*Polychaeta*	0	0	11,207	0	0	7,159	99	5,004	5,530	638
Ribbon worm	*Nemertean*	0	10,427	8,975	0	0	0	74	1,558	348	90
Rock Crab	*Cancer irroratus*	3,891	5,352	2,836	4,210	3,142	6,701	446	2,767	1,725	1,215
Roundworm	*Nematoda*	0	0	0	0	6,711	0	0	0	79	0
Sea Anenome	*Actinaria*	9,771	0	0	0	0	0	59	0	196	0
Sea Urchin	*Echinoidea*	6,858	8,259	15,661	8,952	3,772	8,483	45	1,215	222	855
Sevenspine Bay Shrimp	*Crangon septemspinosa*	6,657	11,038	4,893	7,199	2,584	23,243	1,778	5,903	4,043	3,456
Softshell Clam	*Mya arenaria*	0	0	0	9,682	0	0	0	0	0	0
Spider Crab	*Libinia spp.*	0	0	0	0	0	0	11	0	0	0
Squid	*Loligo spp.*	7,988	16,567	13,473	3,881	4,506	5,327	240	39	328	660
Starfish	*Asterias spp.*	3,596	6,849	5,531	6,768	482	7,766	302	35	2,215	2,934
Tunicate	*Tunicata*	0	0	0	0	0	0	0	0	7	36
Twelve-scaled Worm	*Lepidodontus spp.*	0	0	0	0	0	0	0	0	0	0
Unidentified crab		0	0	10,463	0	0	0	0	0	0	0
	Total	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	*Homarus americanus*	410	631	1,050	1,554	993	619	986	383	429	606
Amphipod	*Amphipoda*	0	0	0	0	0	0	0	0	0	0
Arctic Lyre Crab	*Hyas coarctatus*	10	12	10	22	13	0	0	0	0	0
Barnacle	*Cirripedia*	0	10	0	0	0	0	0	0	0	0
Bloodworm	*Glycera sp.*	0	0	0	0	48	31	21	0	0	0
Blue Crab	*Callinectes sapidus*	12	0	0	0	0	0	0	0	0	0
Blue Mussel	*Mytilus edulis*	209	742	14	0	35	0	0	34	0	0
Brittle Star	*Ophiuroidea*	0	0	0	0	0	0	0	0	0	0
Cancer Crab	*Cancer spp.*	0	0	0	0	0	0	0	0	0	0
Caridean Shrimp	*Caridea*	0	0	0	0	9	0	0	0	0	0
Clam Worm	*Nereis spp.*	10	70	226	648	1,086	1,417	510	96	97	420
Common Periwinkle	*Littorina littorea*	0	0	0	0	0	0	0	0	0	0
Gammarid Shrimp	*Gammarus* spp.	14	0	0	0	0	0	0	0	0	0
Glass Shrimp	*Dichelopandulus leptocerus*	0	0	0	0	0	0	0	0	0	0
Green Crab	*Carcinus maenas*	272	597	622	1,013	1,643	1,395	1,358	906	550	950
Hermit Crab	*Paguridae*	9	32	0	0	0	0	0	0	0	0
Horseshoe Crab	*Limulus polyphemus*	340	421	1,128	1,616	519	183	190	131	71	37
Isopod	*Isopoda*	9	73	106	50	13	76	27	0	10	0
Japanese Shore Crab	*Hemigraphus sanguineus*	0	0	0	0	0	0	0	0	0	0
Jellyfish	*Cnidaria*	0	0	0	0	0	0	0	0	0	0
Lady Crab	*Ovalipes ocellatus*	90	466	44	49	10	40	44	64	53	35
Mysid Shrimp	*Mysidacea*	0	0	0	0	33	0	0	0	0	0
Mantis Shrimp	*Squila empusa*	0	0	0	0	0	0	13	55	0	15
Nephtys	*Nephtys spp.*	0	0	0	0	0	0	0	0	0	16
Nudibranch	*Nudibranchia*	0	0	0	0	0	0	0	312	0	26
Oligochaete worm	*Orbiniidae*	0	0	0	0	48	0	21	0	0	0
Penacid Shrmip	*Penaeidae*	0	0	0	0	0	0	0	0	0	0
Polychaete worm	*Polychaeta*	0	0	25	100	0	0	40	0	0	26
Ribbon worm	*Nemertean*	45	10	42	155	18	64	0	27	0	78
Rock Crab	*Cancer irroratus*	565	893	215	1,207	813	1,607	1,337	244	113	360
Roundworm	*Nematoda*	0	0	0	34	0	0	0	0	0	0
Sea Anenome	*Actinaria*	0	0	58	0	0	0	19	0	0	0
Sea Urchin	*Echinoidea*	72	63	61	61	95	82	60	71	31	31
Sevenspine Bay Shrimp	*Crangon septemspinosa*	1,019	1,573	2,825	1,705	6,876	5,740	16,342	907	9,570	7,861
Softshell Clam	*Mya arenaria*	0	0	0	0	24	0	0	0	0	0
Spider Crab	*Libinia spp.*	0	0	0	0	0	0	0	0	0	0
Squid	*Loligo spp.*	605	296	445	360	760	2,270	309	343	1,145	1,013
Starfish	*Asterias spp.*	1,661	1,812	61	675	351	147	113	534	222	1,885
Tunicate	*Tunicata*	0	0	0	0	0	0	0	0	0	10
Twelve-scaled Worm	*Lepidodontus spp.*	0	0	0	0	0	0	0	0	0	0
Unidentified crab		0	0	0	0	0	0	0	0	0	0
	Total	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	*Homarus americanus*	631	112	145	321	140	1,025	278	519	54	0	1,293	350
Amphipod	*Amphipoda*	0	0	0	0	0	0	0	0	0	0	10	0
Arctic Lyre Crab	*Hyas coarctatus*	0	13	0	0	0	0	0	0	0	0	3	0
Barnacle	*Cirripedia*	0	0	0	0	0	0	0	0	0	0	0	0
Bloodworm	*Glycera sp.*	0	24	0	0	0	16	15	0	0	0	5	0
Blue Crab	*Callinectes sapidus*	0	8	0	0	0	0	0	0	0	0	251	25
Blue Mussel	*Mytilus edulis*	0	21	0	183	0	288	819	135	0	0	9,375	0
Brittle Star	*Ophiuroidea*	0	0	0	0	0	0	0	0	0	0	1	0
Cancer Crab	*Cancer spp.*	100	1,467	1,224	1,954	0	479	462	858	258	1,170	273	0
Caridean Shrimp	*Caridea*	0	0	0	0	0	0	0	0	0	0	15	0
Clam Worm	*Nereis spp.*	1,809	302	147	478	392	1,055	53	15	316	399	1,118	916
Common Periwinkle	*Littorina littorea*	0	0	0	0	0	0	0	0	0	0	2	0
Gammarid Shrimp	*Gammarus* spp.	0	0	0	0	0	0	0	0	0	0	0	0
Glass Shrimp	*Dichelopandulus leptocerus*	0	0	0	0	0	0	0	0	0	0	373	0
Green Crab	*Carcinus maenas*	2,277	1,378	569	426	111	68	265	314	177	279	1,337	999
Hermit Crab	*Paguridae*	0	0	0	23	0	0	0	0	0	0	3	0
Horseshoe Crab	*Limulus polyphemus*	26	0	0	0	0	22	57	14	0	0	1,213	61
Isopod	*Isopoda*	0	16	0	0	0	0	0	0	0	0	350	0
Japanese Shore Crab	*Hemigraphus sanguineus*	0	0	47	36	21	0	60	0	0	35	7	0
Jellyfish	*Cnidaria*	0	0	0	0	0	0	0	0	0	0	56	0
Lady Crab	*Ovalipes ocellatus*	0	27	135	27	0	0	0	14	0	0	1,373	218
Mysid Shrimp	*Mysidacea*	0	0	0	0	0	0	0	0	0	0	1	0
Mantis Shrimp	*Squila empusa*	0	0	0	0	0	0	0	0	0	0	228	0
Nephtys	*Nephtys spp.*	0	0	0	0	0	11	23	667	0	0	24	325
Nudibranch	*Nudibranchia*	0	8	0	0	0	0	0	0	0	0	209	0
Oligochacte worm	*Orbiniidae*	0	0	0	0	0	0	0	0	0	0	2	0
Penaeid Shrmip	*Penaeidae*	0	0	13	0	0	0	0	0	0	0	0	0
Polychaete worm	*Polychaeta*	0	85	0	0	0	0	0	0	0	0	997	0
Ribbon worm	*Nemertean*	0	0	0	0	0	0	0	0	123	93	738	129
Rock Crab	*Cancer irroratus*	3,134	0	0	0	634	0	0	0	0	0	1,447	2,301
Roundworm	*Nematoda*	0	0	0	0	8	0	0	0	0	0	228	0
Sea Anenome	*Actinaria*	0	0	0	0	0	0	0	0	0	0	337	0
Sea Urchin	*Echinoidea*	0	21	0	0	0	0	0	0	0	27	1,833	0
Sevenspine Bay Shrimp	*Crangon septemspinosa*	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	*Mya arenaria*	0	0	0	0	0	0	0	0	0	0	324	0
Spider Crab	*Libinia spp.*	26	0	12	0	0	72	0	0	45	0	6	25
Squid	*Loligo spp.*	1,961	903	878	545	36	64	850	468	299	62	2,221	455
Starfish	*Asterias spp.*	0	1,206	274	61	26	45	51	76	36	97	1,527	282
Tunicate	*Tunicata*	0	0	0	0	0	0	0	0	0	0	2	0
Twelve-scaled Worm	*Lepidodontus spp.*	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
	Total	36,939	12,622	10,609	11,979	16,990	12,428	4,661	4,624	4,883	9,667	34,646	12,454

ICHTHYOPLANKTON ENTRAINMENT MONITORING

AT PILGRIM NUCLEAR POWER STATION

JANUARY - DECEMBER 2010

Submitted to

Entergy Nuclear
Pilgrim Nuclear Power Station
Plymouth, Massachusetts

by

Normandeau Associates, Inc.
Falmouth, Massachusetts

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

April 27, 2011

C/11 Encl
323 pages

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B* Geometric mean monthly densities and 95% confidence limits per 100 m^3 of water for the dominant species of fish eggs and larvae entrained at PNPS, January-December 1981-2010.

*Available upon request.

SECTION I
SUMMARY

Sampling of entrained ichthyoplankton at PNPS in 2010 followed the revised protocol initiated in April 1994. In January, February, and October through December three samples were taken every other week each month, weather permitting, for a total of six per month. In March through September samples were taken three times every week in conjunction with the impingement monitoring study, except on March 1st and 3rd due to a severe storm and September 3rd due to Hurricane Earl moving up along the New England coast.

A total of 40 species of fish were represented in the January-December samples, slightly higher than the 35-year mean (39 species). Winter-early spring (January – April) samples were dominated by Gadidae-*Glyptocephalus*, Labridae-*Limanda*, windowpane, fourbeard rockling, and American plaice eggs along with sand lance, grubby, rock gunnel, and Atlantic seasnail larvae. Late spring-early summer collections, taken from May through July, were dominated by tautog-cunner-yellowtail flounder, fourspot flounder-windowpane, fourbeard rockling-hake-butterfish, and Atlantic mackerel eggs along with cunner, winter flounder, radiated shanny, tautog, fourbeard rockling, yellowtail flounder, and Atlantic menhaden larvae. Late summer-autumn collections (August – December) were dominated by the tautog-cunner-yellowtail, silver hake-scup-weakfish, fourspot flounder-windowpane, and fourbeard rockling-hake-butterfish egg groups, along with cunner, tautog, Atlantic menhaden, hake, fourbeard rockling, fourspot flounder, windowpane, and silver hake larvae.

Comparisons of ichthyoplankton densities over the 1975-2009 time series suggested that, in most cases, numbers in 2010 were consistent with those recorded since sampling began at PNPS in 1975. Species that appeared abundant in 2010 compared with past years included searobin and fourspot flounder-windowpane eggs and tautog larvae. In contrast, Atlantic mackerel eggs and larval seasnail, rock gunnel, and sand lance densities were relatively low.

Unusually high entrainment densities, based on historical results (defined under PNPS's sampling plan), were identified on 76 occasions in 2010 and involved six species of eggs and ten species of larvae. High abundance episodes were generally scattered among species and over time, and were of short duration.

Entrainment and impingement of winter flounder, cunner, Atlantic mackerel, Atlantic menhaden, Atlantic herring, and Atlantic cod were examined in some detail dating back to 1980

using equivalent adult (EA) procedures. These estimates were compared to commercial and recreational landings, and local stock size estimates where available. Equivalent adult estimates for winter flounder eggs and larvae entrained in 2010 were 6,293 age 3 adults compared with a 1980–2009 average of 13,629 assuming 100% entrainment mortality. When entrainment survival was included in the calculations, estimates decreased to 4,292 age 3 adults in 2010 compared to a time series average of 9,206. An additional 112 age 3 equivalent adults were estimated from the number of winter flounder impinged in 2010. The number of equivalent age 3 adults impinged declined to 88 when impingement survival was included in the calculations.

The EA estimate for cunner entrained in 2010 was 562,953 fish assuming 100% entrainment mortality. The 2010 cunner equivalent adult estimates decreased to 128,357 fish when entrainment survival was included in the calculations. An additional 442 equivalent adult cunner were impinged in 2010 that declined to 393 equivalent adults after adjustment for impingement survival. Atlantic mackerel equivalent adults attributable to entrainment in 2010 amounted to 316 age 1 fish or 114 age 3 fish based on two sets of survival values. Atlantic mackerel are swift swimmers and are not often impinged at PNPS. EA values for Atlantic menhaden were 1,004 age 2 fish in 2010 assuming 100% entrainment mortality, with an additional 355 age 2 equivalents estimated to have been impinged in 2010. The number of age 2 menhaden declined to 532 fish when adjusted for entrainment survival. Atlantic menhaden are sensitive to impingement and were assumed to have zero survival. Atlantic herring larvae entrained in 2010 were equivalent to 8,043 age 1 or 3,260 age 3 fish. Impingement, generally contributed little to herring equivalent adults at PNPS. Atlantic herring were assumed to have zero entrainment and impingement survival. Lastly, EA values for Atlantic cod were 664 age 2 fish, with an additional 36 equivalent age 2 Atlantic cod estimated to have been impinged in 2010 at PNPS. Atlantic cod were assumed to have zero entrainment survival. Equivalent age 2 cod declined to 32 when impingement survival was included in the calculations.

Twenty-seven lobster larvae were collected at PNPS during the January-December 2010 entrainment sampling period, resulting in an estimated total of 766,221 entrained larvae. The equivalent adult (82 mm CL) estimates for lobster larvae entrained in 2010 were 15 lobsters with an additional 238 equivalent adult lobsters attributed to impingement.

SECTION II
INTRODUCTION

This report summarizes the results of ichthyoplankton entrainment sampling conducted at the Pilgrim Nuclear Power Station (PNPS) from January through December 2010 by Normandeau Associates, Inc. for Entergy Nuclear under Contract No. 50014600, in compliance with environmental monitoring and reporting requirements of the PNPS NPDES Permit (U.S. Environmental Protection Agency and Massachusetts Department of Environmental Protection). Included here is a brief summary of the dominant taxa collected over the course of the year, a review of long-term trends for the dominant fish eggs and larvae, and an assessment of numbers entrained for six key species, winter flounder (*Pseudopleuronectes americanus*), cunner (*Tautogolabrus adspersus*), Atlantic mackerel (*Scomber scombrus*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic herring (*Clupea harengus*), and Atlantic cod (*Gadus morhua*).

SECTION III
METHODS AND MATERIALS

Monitoring

Entrainment sampling at PNPS, begun in 1974, was originally completed twice per month during January and February, October-December; weekly during March through September; in triplicate at low tide. The sampling regime was modified beginning in April 1994; the revised program exchanged replication for improved temporal coverage and has been followed every year since then. In January, February, and October through December during two alternate weeks each month single samples were taken on three separate occasions. Beginning with March and continuing through September single samples were taken three times every week. During autumn and winter months when sampling frequency was reduced, sampling was postponed during onshore storms due to heavy detrital loads. The delayed sample was taken during the subsequent week; six samples were ultimately taken each month.

To minimize costs, sampling was linked to the impingement monitoring program so that collections were made Monday morning, Wednesday afternoon, and Friday night regardless of tide (see Impingement Section). All sampling was completed with a 60-cm diameter plankton net streamed from rigging mounted approximately 30 meters from the headwall of the discharge canal (Figure 1). In instances where the net rigging mount failed, a temporary rigging was installed and sampling continued. Standard mesh was 0.333-mm except from late March through late May when 0.202-mm mesh was employed to improve retention of early-stage larval winter flounder. Sampling time in each case varied from 8 to 30 minutes depending on tide, higher tide requiring a longer interval due to lower discharge stream velocities. In most cases, a minimum quantity of 100 m^3 of water was sampled although at astronomically high tides it proved difficult to collect this amount even with long sampling intervals since the net would not inflate in the low current velocity near high tide. Exact filtration volumes were calculated using a General Oceanics Model 2030R digital flowmeter mounted in the mouth of the net. Near times of high water a 2030 R2 rotor was employed to improve sensitivity at low velocities.

All samples were preserved in 10% Formalin-seawater solutions and returned to the laboratory for microscopic examination. A detailed description of laboratory and analytical procedures appears in MRI (1988) and NAI (2008). As in past years, larval winter flounder were enumerated in four developmental stages as follows:

Stage 1 - from hatching until the yolk sac is fully absorbed (2.3-2.8 mm TL).

Stage 2 - from the end of stage 1 until a loop or coil forms in the gut (2.6-4 mm TL).

Stage 3 - from the end of stage 2 until the left eye migrates past the midline of the head during transformation (3.5-8 mm TL).

Stage 4 - from the end of stage 3 onward (7.3-8.2 mm TL).

Similarly larval cunner *(Tautogolabrus adspersus)* were enumerated in three developmental stages:

Stage 1 - from hatching until the yolk sac is fully absorbed (1.6-2.6 mm TL).

Stage 2 - from the end of stage 1 until dorsal fin rays become visible (1.8-6.0 mm TL).

Stage 3 - from the end of stage 2 onward (6.5-14.0 mm TL).

Samples were examined in their entirety for larval American lobster (*Homarus americanus*). When collected these were staged following Herrick (1911).

Unusual Entrainment Levels

When the Cape Cod Bay ichthyoplankton study was completed in 1976, provisions were added to the entrainment monitoring program to identify unusually high densities of fish eggs and larvae. Prior to 1994 "unusually abundant" was defined as any mean density, calculated over three replicates, which was found to be 50% greater than the highest mean density observed during the same month from 1975 through to the current year. Restricting comparisons to monthly periods damped the large seasonal variation so readily apparent with ichthyoplankton and allowed tracking densities as each species' season progressed. Starting with 1994 "unusually abundant" was redefined. On a month-by-month basis for each of the numerically dominant species all previous mean densities over three replicates (1974-1993) were examined and tested for normality following logarithmic transformation. Single sample densities obtained from 1994-2009 were added to the pool within each month. Where data sets (for example, mackerel eggs taken in June) fit the lognormal distribution, then "unusually large" was defined by exceeding the overall log mean density plus 2 or 2.58 standard deviations.[1] Log densities were back-transformed to make them easier to interpret thus providing geometric means. In cases where data sets did not fit the lognormal distribution (generally months when a species was frequently but not always absent, i.e., many zeros occurred), the mean and standard deviation was computed using the delta-distribution (see for example Pennington 1983). The same mean plus standard deviation guideline was applied.

The decision to rely on 2 standard deviations or 2.58 standard deviations was based on the relative importance of each species. The more critical criterion was applied to species of commercial, recreational, or biological interest, the less critical to the remaining species (i.e., relatively greater densities were necessary to flag a density as unusual). Species of commercial, recreational, or biological interest include Atlantic menhaden, Atlantic herring, Atlantic cod, tautog and cunner (the labrids; *Tautoga onitis* and *Tautogolabrus adspersus),* sand lance *(Ammodytes* sp.), Atlantic mackerel, windowpane (*Scophthalmus aquosus),* American plaice *(Hippoglossoides platessoides),* and winter flounder. Table 1 provides summary data for each species of egg and larva by month within these two categories showing the 2010 "unusually high" levels.

A scan of Table 1 will indicate that, in cases where the long-term mean amounts to 1 or 2 eggs or larvae per 100 m^3, the critical level is also quite small. This situation occurred during

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[1]Normal distribution curve theory states that 2.5% of the measurements in a normally distributed population exceed the mean plus 1.96 standard deviations (= s, we rounded to 2 for simplicity), 2.5% lie below the mean minus 1.96 standard deviations. Stated another way 95% of the population lies within that range and 97.5% lies below the mean plus 1.96s. Likewise 0.5% of measurements exceed the mean plus 2.58s, 99% lie within the range of the mean ± 2.58s, 99.5% lie above the mean + 2.58s.

months when a given species was obviously uncommon and many zeros were present in the data set with an inherent small standard deviation. The external reference distribution methodology of Box et al. (1975) was also employed. This procedure relies on a dotplot of all previous densities for a species within each month to produce a reference distribution. Densities exceeding either 97.5 or 99.5% of the reference set values were considered unusually high with this procedure.

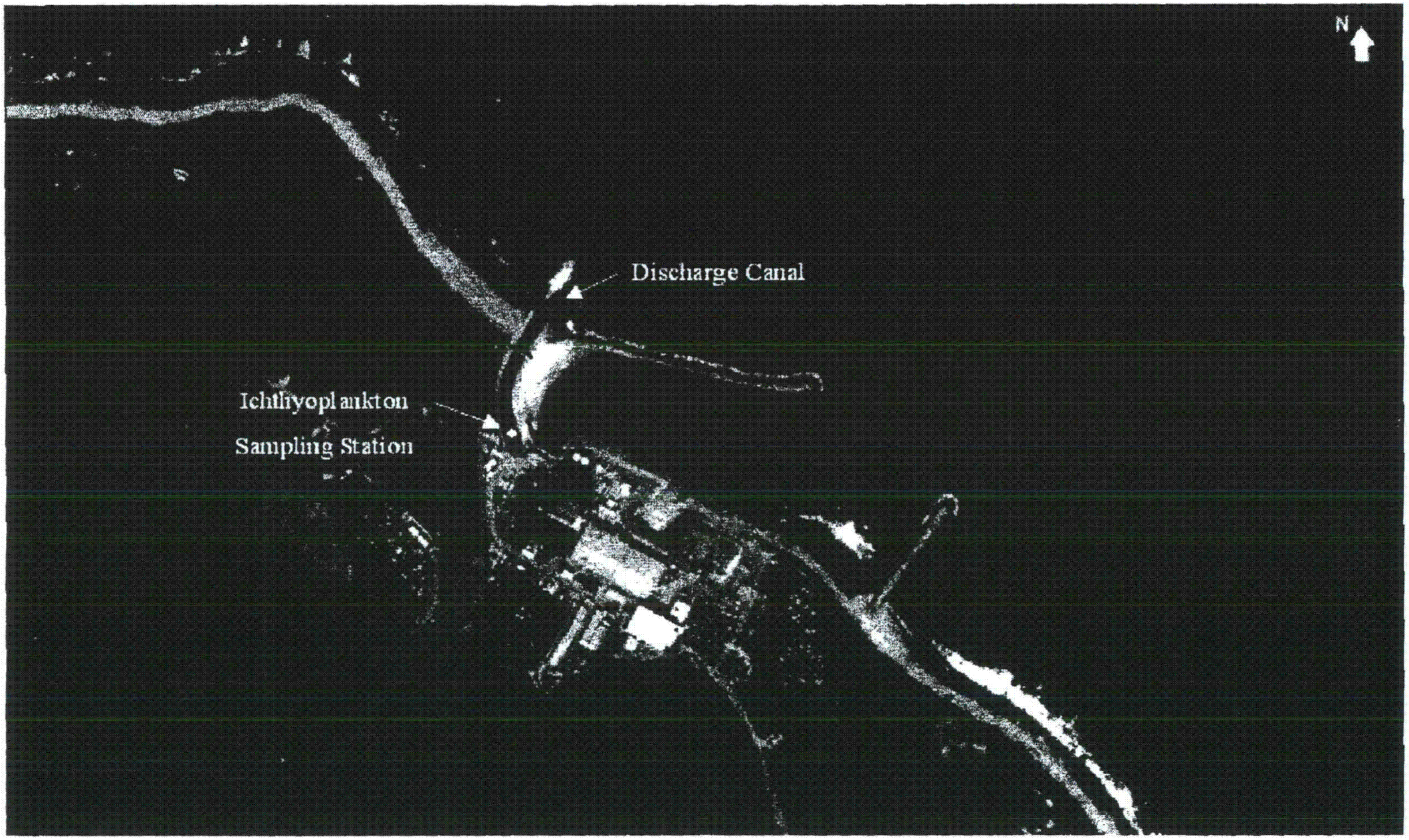


Figure 1. Aerial photograph of the entrainment sampling station in PNPS discharge canal.

Table 1. PNPS ichthyoplankton entrainment values for 2010 by species category and month used to determine unusually high densities. See text for details.

Densities per 100 m³ of water:	Long-term Mean[1]	Mean + 2 std.dev.	Mean + 2.58 std.dev.	Previous High (Year)
January				
LARVAE				
Atlantic herring[2]	0.2	1		3.7 (2006)
Sculpin	0.9		2	17.6 (2009)
Rock gunnel	4.0		7	78.1 (2002)
Sand lance[2]	5	11		337.0 (1996)
February				
LARVAE				
Atlantic herring[2]	0.5	0.7		5.8 (2002)
Sculpin	2		65	341.1 (2006)
Rock gunnel	5		177	133.0 (1999)
Sand lance[2]	16	29		372.9 (1995)
March				
EGGS				
American plaice[2]	2	3		19.0 (1977)
LARVAE				
Atlantic herring[2]	2	3		30.9 (2005)
Sculpin	17		608	369.9 (1997)
Seasnails	0.6		1	16.9 (2002)
Rock gunnel	10.7		723	882.2 (1997)
Sand lance[2]	12.5	388		2242.0 (2005)
Winter flounder[2]	0.4	0.7		16.2 (1997)
April				
EGGS				
American plaice[2]	3	32		70.3 (1978)
LARVAE				
Atlantic herring[2]	2	3		83.1 (2005)
Sculpin	15		391	386.2 (1985)
Seasnails	6		8	98.1 (1974)
Radiated shanny	5		7	83.9 (2002)
Rock gunnel	4		142	121.1 (1992)
Sand lance[2]	21	998		2590.6 (1994)
Winter flounder[2]	7	12		198.3 (1974)
May				
EGGS				
Gadidae-Glyptocephalus	2.6	3.1		63.5(2002)
Labrids[2]	36	3514		34050.0 (1974)
Atlantic mackerel[2]	18	4031		19203.0 (1995)
Windowpane[2]	9	147		603.9 (2008)
American plaice[2]	2	15		162.4 (2007)

Table 1 (continued).

Densities per 100 m³ of water:	Long-term Mean[1]	Mean + 2 std.dev.	Mean + 2.58 std.dev.	Previous High (Year)
May				
LARVAE				
Atlantic herring	0.7	1.1		15.2 (2005)
Fourbeard rockling	4.1		8	159.7 (2001)
Sculpin	3		4	78.3 (1997)
Seasnails	7		208	164.4 (1974)
Radiated shanny	7		236	266.9 (1998)
Sand lance[2]	37	59		639.1 (1996)
Atlantic mackerel	2	4		377.6 (1998)
Winter flounder[2]	9	123		573.8 (1998)
June				
EGGS				
Atlantic menhaden[2]	14	22		799.7 (1998)
Searobins	2		3	128.0 (1987)
Labrids[2]	958	21599		37282.0 (1995)
Atlantic mackerel[2]	63	3515		8193.2 (1990)
Windowpane[2]	27	261		355.5 (1998)
American plaice[2]	1	3		35.0 (1980)
LARVAE				
Atlantic menhaden[2]	6	10		495.9 (1981)
Fourbeard rockling	9		634	224.0 (1992)
Hake	0.3		1	50.6 (1998)
Cunner[2]	54	87		2215.6 (1998)
Radiated shanny	7		10	290.6 (2004)
Atlantic mackerel[2]	91	155		2700.0 (1981)
Winter flounder[2]	10	106		813.5 (1998)
July				
EGGS				
Atlantic menhaden[2]	2	4		59.1 (1978)
Labrids[2]	615	13349		12917.0 (1981)
Atlantic mackerel[2]	9	16		119.0 (1981)
Windowpane[2]	12	156		840.3 (2007)
LARVAE				
Atlantic menhaden[2]	6.9	9.3		212.8 (2005)
Fourbeard rockling	6		9	115.8 (1999)
Hake	0.7		1	301.8 (2009)
Tautog[2]	4.1	5.3		268.6 (1998)
Cunner[2]	7	318		2162.5 (1981)
Atlantic mackerel[2]	2	3		60.1 (1996)

Table 1 (continued).

Densities per 100 m³ of water:	Long-term Mean[1]	Mean + 2 std.dev.	Mean + 2.58 std.dev.	Previous High (Year)
August				
EGGS				
Searobins	4		6	89.2 (1995)
Labrids[2]	23	936		3500.0 (1984)
Windowpane[2]	15	136		261.3 (2006)
LARVE				
Atlantic menhaden[2]	3.6	5.3		760.2 (2008)
Fourbeard rockling	6		10	204.6 (1983)
Silver hake	1	2		157.3 (2009)
Hake	2		4	235.9 (2008)
Tautog[2]	3.2	4		89.6 (2008)
Cunner[2]	10	15		254.0 (1997)
September				
EGGS				
Atlantic menhaden[2]	42	112		73.2 (1993)
Labrids[2]	2	3		112.8 (1993)
Windowpane	11	159		539.6 (2005)
LARVAE				
Atlantic menhaden[2]	1.6	42.7		81.0 (1999)
Fourbeard rockling	4		6	68.6 (1993)
Silver hake[2]	1	2		46.2 (1999)
Hake	5		9	327.2 (1997)
Tautog[2]	1	2		32.1 (2009)
Cunner[2]	1	2		42.1 (1993)
October				
EGGS				
Atlantic menhaden[2]	2	6		163.6 (2002)
Windowpane[2]	1	2		40.2 (2000)
LARVAE				
Atlantic menhaden[2]	2.3	4		70.3 (1997)
Fourbeard rockling	1		16	67.9 (1994)
Hake	1		2	13.7 (1985)
November				
LARVAE				
Atlantic menhaden[2]	0.4	1		57.1 (1997)
Atlantic herring[2]	4	8		124.8 (1995)
December				
LARVAE				
Atlantic herring[2]	2	3		216.7 (1995)

[1]Geometric or Delta Mean.
[2]Species of commercial, recreational, or biological interest for which more critical unusual event level will be used.

SECTION IV
RESULTS

A. Ichthyoplankton Entrained - 2010

Estimated densities per 100 m^3 of water for each species listed by date, station, and replicate are presented for January-December 2010 in Appendix A (available upon request). The occurrence of eggs and larvae of each species by month appears in Table 2. Ichthyoplankton collections are summarized below within the three primary spawning seasons observed in Cape Cod Bay waters: winter-early spring, late spring-early summer, and late summer-autumn.

Winter-Early Spring (January-April)

Ichthyoplankton entrained during January through April generally represent winter-early spring spawning fishes. Many of these species employ a reproductive strategy that relies on demersal, adhesive eggs not normally entrained. As a result, more species are typically represented by larvae than by eggs during the early portion of the year. Over both life stages the number of species represented in the catch increased from 6 in January to 16 in April. Egg collections in winter-early spring were numerically dominated by the Gadidae-*Glyptocephalus* egg group, the Labridae-*Limanda* egg group, windowpane, fourbeard rockling (*Enchelyopus cimbrius*), and American plaice eggs. These species accounted for 40, 27, 11, 10, and 8% of the total egg catch during the period, respectively. Gadidae-*Glyptocephalus* eggs were entrained from January through April with respective monthly geometric mean densities of 0.4, 0.4, 4.0, and 0.3 eggs per 100 m^3 of water. Labridae-*Limanda* eggs were entrained in March and April with monthly geometric mean densities of 0.3 and 3.2 eggs per 100 m^3 of water, respectively. Windowpane eggs were entrained in March and April with corresponding monthly geometric mean densities of 0.1 and 1.5 eggs per 100 m^3 of water. Fourbeard rockling eggs were also entrained in March and April with corresponding monthly geometric mean densities of 0.03 and 1.4 eggs per 100 m^3 of water. Lastly, American plaice eggs were entrained in March and April with monthly geometric mean densities of 0.5 and 0.8 eggs per 100 m^3 of water, respectively.

In the winter-early spring, 16 species of larval fish were collected from the discharge canal. Sand lance, grubby (*Myoxocephalus aenaeus*), rock gunnel (*Pholis gunnellus*), and Atlantic seasnail (*Liparis atlanticus*) made up the majority of the larval fish collected from January to April, contributing respectively, 42, 21, 16, and 5% of the total collected. Sand lance were collected from January through April with monthly geometric mean densities of 0.04, 1.4, 3.5, and 15.1 larvae per 100 m^3 of water, respectively. Grubby were collected during February through April with corresponding monthly geometric mean densities of 0.3, 3.1, and 5.6 larvae per 100 m^3 of water. Rock gunnel were collected from January through April with respective monthly geometric mean densities of 0.4, 2.8, 3.2, and 0.1 larvae per 100 m^3 of water. Atlantic seasnail were collected during April with a monthly geometric mean density of 1.9 larvae per 100 m^3 of water.

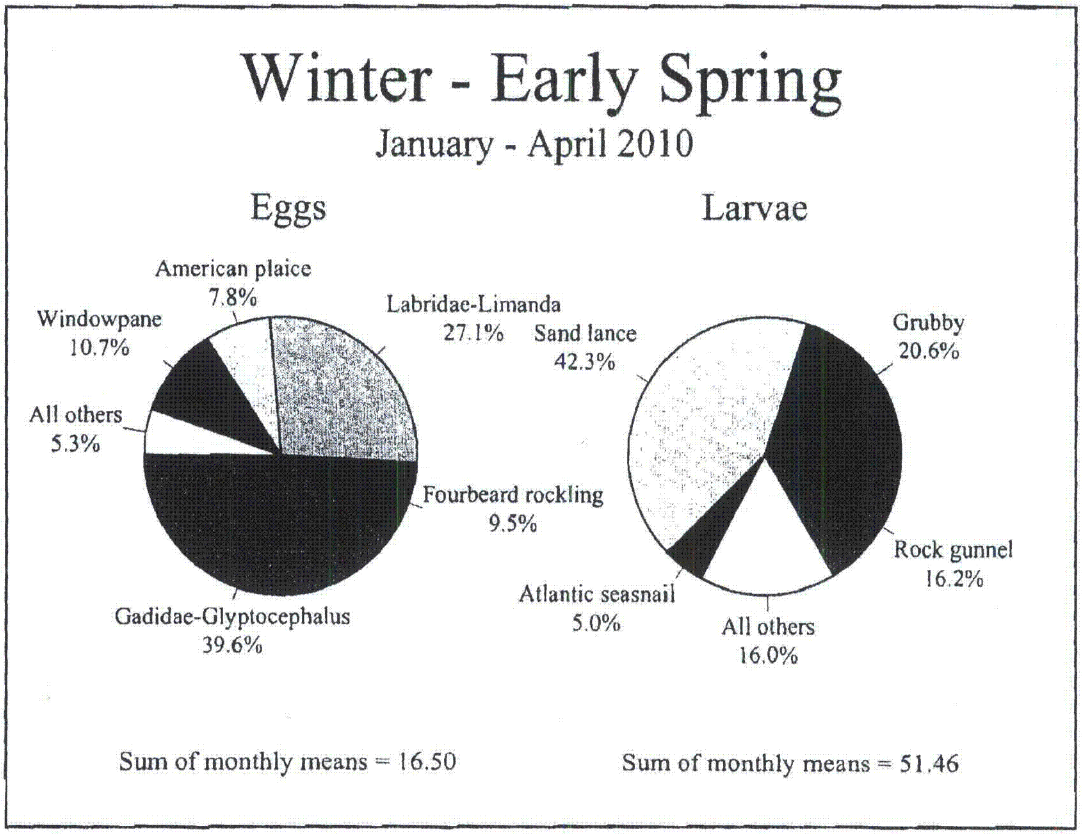


Figure 2: Dominant species of fish eggs and larvae found in PNPS ichthyoplankton samples during the winter-early spring season, 2010. Percent of total and summed monthly mean densities for all species are also shown.

Late Spring-Early Summer (May-July)

May through July represents the late spring-early summer ichthyoplankton season, typically the most active reproductive period among temperate fishes. Considering both eggs and larvae, 30 species were represented in the May-July collections, 23 species by eggs and 24 species by larvae. Numerically dominant eggs were the tautog-cunner-yellowtail flounder egg group (Labridae-*Limanda ferruginea*), the fourspot flounder-windowpane egg group (*Paralichthys oblongus-Scophthalmus aquosus*), the fourbeard rockling-hake-butterfish egg group (*Enchelyopus-Urophycis-Peprilus*) and Atlantic mackerel (Figure 3). Tautog-cunner-yellowtail flounder eggs accounted for 85.5% of the late spring-early summer egg catch, and peaked in June at a geometric mean density of 1616.6 eggs per 100 m^3 of water. Labrid egg measurement studies completed at PNPS suggested that the majority of labrid eggs collected near PNPS are cunner (Scherer 1984). Labrid eggs far exceed yellowtail eggs during the period when they are indistinguishable from each other. Fourspot-windowpane eggs accounted for 5.2% of the seasonal egg catch, and peaked in June with a geometric mean density of 74.9 eggs per 100 m^3 of water. Fourbeard rockling-hake-butterfish eggs accounted for 3.6% of the late spring-early summer egg catch, and peaked in June with a geometric mean density of 28.0 eggs per 100 m^3 of water. Atlantic mackerel eggs accounted for 2.7% of the seasonal egg catch and also peaked in June when they were collected at a mean density of 25.0 eggs per 100 m^3 of water.

Numerically dominant larvae during late spring-early summer collections were cunner, winter flounder, radiated shanny (*Ulvaria subbifurcata*), tautog, fourbeard rockling, yellowtail flounder, and Atlantic menhaden (Figure 3). Cunner accounted for 34.8% of the seasonal total, winter flounder for 13.0%, radiated shanny for 10.8%, tautog for 7.3%, fourbeard rockling for 7.0%, yellowtail flounder for 4.9%, and menhaden for 4.9%. Cunner larvae were observed in June and July with monthly geometric mean densities of 1.8 and 31.1 larvae per 100 m^3 of water, respectively. Winter flounder larvae were collected in May and June with monthly mean densities of 5.8 and 1.5 larvae per 100 m^3 of water. Radiated shanny were observed from May through July with corresponding monthly means of 5.3, 2.3, and 0.3 per 100 m^3 of water. Tautog larvae were collected from May through July with respective monthly mean densities of 0.6, 0.6, and 6.1 per 100 m^3 of water. Fourbeard rockling were most abundant in June with a monthly mean density of 2.0 per 100 m^3 of water. Yellowtail flounder larvae were most abundant in May with a monthly mean density of 2.0 per 100 m^3 of water. Lastly, Atlantic menhaden larvae were most abundant in July with a monthly geometric mean density of 3.1 per 100 m^3 of water.

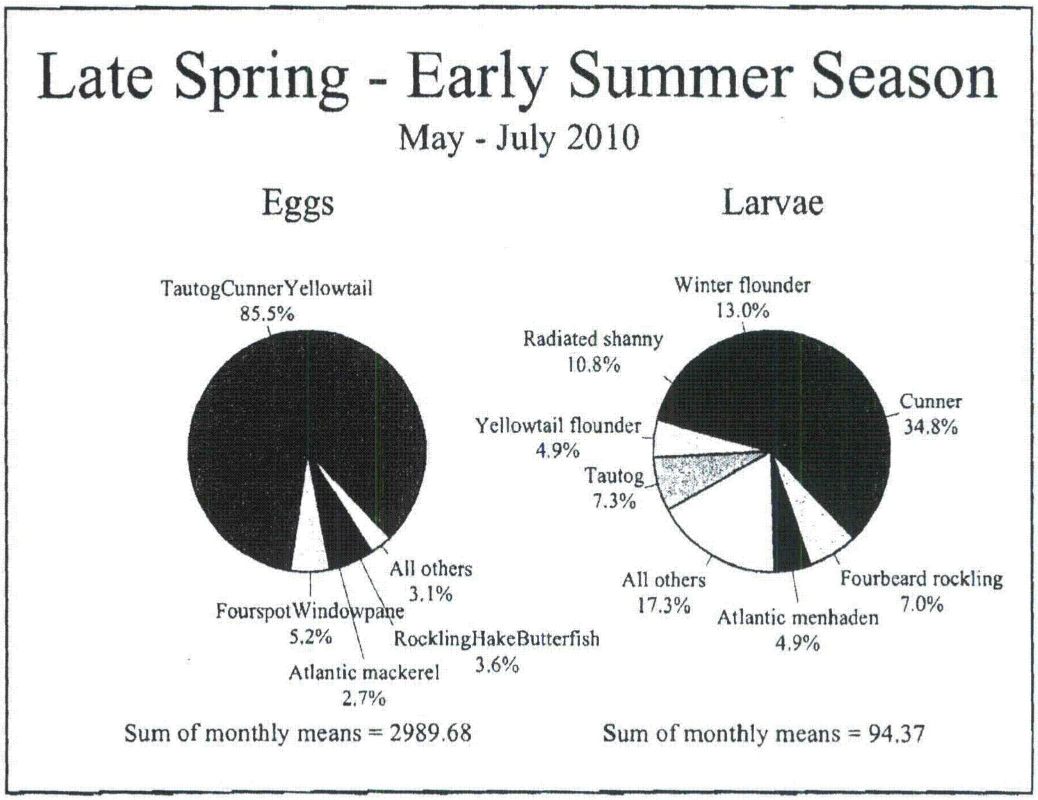


Figure 3. Dominant species of fish eggs and larvae found in PNPS ichthyoplankton samples during the late spring-early summer season, 2010. Percent of total and summed monthly mean densities for all species are also shown.

Late Summer - Autumn (August - December)

This season is typically marked by a decline in both overall ichthyoplankton density and in the number of species collected. Considering egg and larval stages combined, 27 species were collected during the August through December period; 21 species in August declined to 3 species in December. Numerically dominant eggs were the tautog-cunner-yellowtail, silver hake-scup-weakfish, fourspot flounder-windowpane, and fourbeard rockling-hake-butterfish egg groups. Seasonal percentages for these egg groups were 34%, 34%, 15%, and 12%, respectively (Figure 4). Tautog-cunner-yellowtail flounder eggs were present in August through October, the highest geometric mean density occurred in August at 28.9 eggs per 100 m^3 of water. Silver hake-scup-weakfish eggs were present from August through October and peaked in August at 19.2 eggs per 100 m^3 of water. Fourspot flounder-windowpane eggs occurred from August through October and peaked in August (13.8 egg per 100 m^3 of water). Lastly, fourbeard rockling-hake-butterfish eggs were collected from August through November and peaked in August (14.2 eggs per 100 m^3 of water). Larval dominants in the late summer-autumn season were cunner, tautog, Atlantic menhaden, hake, fourbeard rockling, fourspot flounder, windowpane, and silver hake (*Merluccius bilinearis*). Seasonal percentages for these species were 26, 13, 9, 8, 8, 6, 6, and 5%, respectively (Figure 4). Cunner were collected from August through October with corresponding geometric mean densities of 5.0, 0.3, and 0.1 larvae per 100 m^3 of water. Tautog were collected in August through October with geometric mean densities of 1.3, 2.8, and 0.1 larvae per 100 m^3 of water, respectively. Atlantic menhaden occurred from August through October at geometric mean densities of 0.4, 1.3, and 0.5 larvae per 100 m^3 of water. Hake were present from August through October at geometric mean densities of 1.8, 0.9, and 0.1 larvae per 100 m^3 of water. Fourbeard rockling occurred from August through November. Peak density occurred in August with a geometric mean of 1.7 larvae per 100 m^3. Fourspot flounder were collected from August through October. The peak density occurred in August at 1.1 larvae per 100 m^3 of water. Windowpane were present from August through October and peaked in September at 1.1 larvae per 100 m^3 of water, respectively. Lastly, silver hake were observed in August and September, and peaked in August at a mean density of 1.7 larvae per 100 m^3 of water.

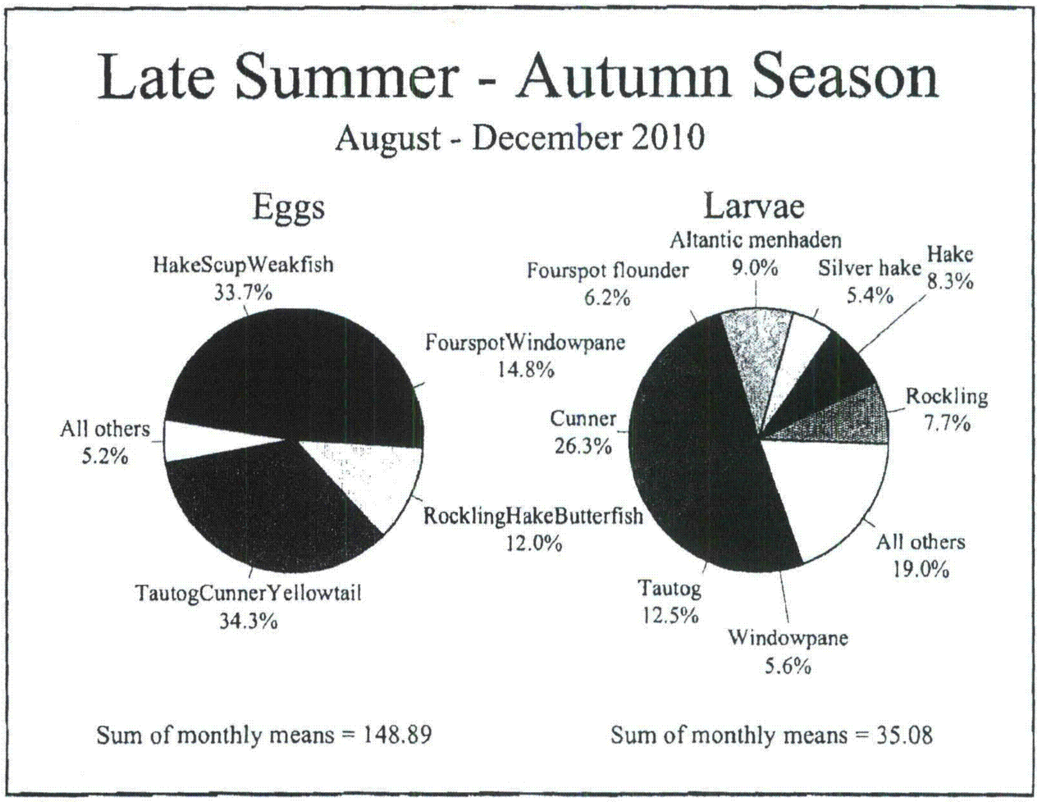


Figure 4. Dominant species of fish eggs and larvae found in PNPS ichthyoplankton samples during the late summer-autumn season, 2010. Percent of total and summed monthly mean densities for all species are also shown.

B. Unusual Entrainment Values

Ichthyoplankton densities reached the unusually high level, as defined under Methods, during the 2010 sampling season on 76 specific occasions and involved fourteen species (Table 3). These species were Atlantic herring, seasnail, winter flounder, radiated shanny, windowpane, Atlantic menhaden, searobins, American plaice, hake, Atlantic mackerel, fourbeard rockling, silver hake, and labrid species. Several species recorded unusually high densities either on several occasions or during more than a single month. In general, unusually high densities were sporadic and of short duration.

Atlantic herring larvae reached unusually high entrainment numbers on six occasions in 2010 (Table 3). The March 17th density (6.9 larvae per 100 m^3 of water) exceeded 94% of all previous March densities.

Seasnail larvae occurred at unusually high densities on two occasions in 2010 (Table 3), the April 23rd density (19.7 larvae per 100 m^3) exceeded 95% of all previous April densities.

Radiated shanny larvae were collected at unusually high densities on three occasions in 2010 (Table 3). The April 30th density of 10.3 larvae per 100 m^3 of water exceeded 95% of all previous April densities.

Winter flounder larvae attained an unusually high density once in 2010 on April 23rd (17.8 larvae per 100 m^3 of water) exceeding 95% of all previous April densities (Table 3).

Labrid eggs were observed at unusually high densities on four occasions in 2010 (Table 3). The May 31st density (4300.9 eggs per 100 m^3) and the September 10th density (28.6 eggs per 100 m^3) exceeded 97% of all previous May and September densities respectively.

Windowpane eggs reached unusually high entrainment numbers on five occasions in 2010 (Table 3). The May 24th density (458.7 eggs per 100 m^3) and the August 20th density (231.2 eggs per 100 m^3) exceeded 99% of all previous May and August values, respectively. The October 8th density (17.1 eggs per 100 m^3) exceeded 95% of all previous October values.

Atlantic menhaden eggs were recorded at unusually high densities on six occasions in 2010 (Table 3). The density of 266.4 eggs per 100 m^3 of water on June 25th exceeded 98% of all previous June densities. The July 5th and 7th densities (42.4 and 27.0 eggs per 100 m^3 of water) exceeded 99 and 98% respectively of all previous July densities.

Searobin eggs occurred at unusually high entrainment numbers on five occasions in 2010 (Table 3). The June 25th and 30th densities (17.0 and 13.6 eggs per 100 m^3 of water) correspondingly exceeded 99 and 98% of all previous June densities. The August 20th density of 26.0 eggs per 100 m^3 of water exceeded 98% of all previous August densities.

American plaice eggs were collected at unusually high densities twice in June 2010 (Table 3), with the June 7th density (19.9 eggs per 100 m^3) exceeding 99% of all previous June densities.

Hake larvae were attained at unusually high entrainment numbers on eight occasions in 2010 (Table 3). The June 4th density of 2.7 larvae per 100 m^3 of water surpassed 95% of all previous June densities. Additionally, the larval density collected on July 30th (4.6 larvae per 100 m^3) surpassed 92% of all previous July densities.

Atlantic mackerel eggs reached unusually high densities twice in July 2010 (Table 3). The July 2nd and 5th densities (29.1 and 22.4 eggs per 100 m^3, respectively) exceeded 97and 96% of all previous July densities.

Atlantic menhaden larvae occurred at unusually high densities three times in 2010 (Table 3). The July 7th density of 19.4 larvae per 100 m^3 of water exceeded 90% of all previous July densities.

Fourbeard rockling larvae were collected at unusually high numbers on two occasions in 2010 (Table 3). The August 6th larval density (20.8 larvae per 100 m^3) exceeded 95% of all previous August densities.

Tautog larvae were recorded at unusually high densities twenty times in 2010 (Table 3). The July 7th larval density (22.6 larvae per 100 m^3) exceeded 96% of all previous July densities. The larval densities collected on September 8th and 10th (12.6 and 22.2 larvae per 100 m^3, respectively) each surpassed 99% of all previous September densities. The September 15th and 22nd larval densities (8.7, and 9.1 larvae per 100 m^3, respectively) surpassed 96 and 97% of all previous September densities.

Silver hake larvae attained unusually high densities on three occasions in August 2010 (Table 3). Larval densities collected on August 20th, 25th, and 27th (8.2, 7.2, and 12.5 larvae per 100 m^3 respectively) each exceeded 95% of all previous August densities.

Lastly, cunner larvae appeared at unusually high densities four times in 2010 (Table 3). The August 6th density (118.9 larvae per 100 m^3) surpassed 98% of all previous August densities.

C. Multi-year Ichthyoplankton Comparisons

A master species list for ichthyoplankton collected from the PNPS discharge canal for the years 1975 through 2010 is provided in Table 4. A total of 40 species were represented in the 2010 collections, slightly above the 1975-2009 time series mean of 39 species.

Appendix B (available upon request) lists geometric mean monthly densities along with 95% confidence limits for each of the numerical dominants collected over the January-December period dating back to 1981. Geometric means are reported because they more accurately reflect the true population mean when the distribution of sample values are skewed to the right as is commonly the case with plankton data. Generally low values obtained for both eggs and larvae during April-June 1984 and 1987, as well as May-June 1999, were shaded because low through-plant water volumes during those months probably affected the measurement of ichthyoplankton densities (MRI 1994). Entrainment data collected from 1975-1980 remain in an outdated computer format requiring conversion before geometric mean densities can be generated. These years were therefore excluded from comparison. To help compare values over the 35-year period, egg data were plotted in Figure 5 for those species whose combined total represented 96% of the 2010 egg catch. For this figure, cod, haddock, pollock and witch flounder eggs were combined in the Gadidae-*Glyptocephalus* group; rockling, hake and butterfish made up the *Enchelyopus-Urophycis-Peprilus* group, and labrids and yellowtail flounder were combined in the Labridae-*Limanda* group. For each category shown, the highest monthly geometric means obtained from 1981 through 2009 were joined by solid lines as were the lowest geometric means, and the area between was shaded, indicating the range of these values. Monthly geometric mean values for 2010 were joined by a solid line. Alongside each plot is a bar graph showing annual abundance indices for each year. These were generated by integrating the area under each annual curve using trapezoidal integration[2]. One set of bars was based on geometric monthly means and the other, longer time series, on arithmetic monthly means (1975-2010). Appendix B and Figure 6 contain corresponding data for the 13 numerically dominant species of fish larvae, those accounting for 83% of the 2010 catch as well as total larvae (all species combined). As mentioned for eggs, low values obtained for both eggs and larvae during April through August 1984 and 1987 and May-June 1999 were flagged in these figures and omitted from the following discussion.

In many cases densities of fish eggs and larvae vary considerably from year to year. For example, over the 28-year geometric mean time series for Atlantic menhaden eggs, the highest annual abundance index (3,023 in 1993) divided by the lowest (10 in 1992) amounted to 292. In spite of such pronounced variation, no consistent upward or downward trend is apparent over the time series for many species including menhaden and windowpane eggs, sculpin and rock gunnel larvae. Following are noteworthy observations concerning the multi-year time series. Since densities of each ichthyoplankton species rise and fall to zero over the course of each representative occurrence season, interannual comparisons are often conveniently made within monthly periods.

Eggs

- Atlantic menhaden 2010 monthly mean egg densities were within the historical range that has been observed from 1981 to 2009, and showed the traditional peaks in egg densities

[2] Curve integration results in units of (Numbers x days) per 100 m^3 of water.

in late spring and late summer (Figure 5). The 2010 annual geometric mean abundance index (159) increased compared to the 2007 (98), 2008 (53), and 2009 (6) indices (Figure 5). The 2010 arithmetic mean index (1,104) also increased compare to the 2007 (462) through 2009 (9.6) indices, and is the highest since 1997. Atlantic menhaden eggs were collected at unusually high densities on six occasions in 2010 (See Section B above, Table 3).

- Gadidae-*Glyptocephalus* eggs were recorded at a new high in March 2010 at a monthly mean density of 4.04 eggs per 100m^3 of water (Figure 5). Egg group monthly mean densities showed the traditional seasonal characteristics in 2010 with peaks in early spring and early winter that have been observed from 1981 to 2009 (Figure 5). Atlantic cod eggs were typically collected in low numbers at PNPS during winter months from 1975-1987 (5 per 100 m^3 of water, for example). Following 1987 they became uncommon particularly during January and February. The gadidae-*Glyptocephalus* group showed a significant decline from 1975 to 1993 ($p<0.001$), based on a nonparametric sign test (Sprent 1989). This is consistent with the downward trend reported for Atlantic cod and witch flounder (*Glyptocephalus cynoglossus*) stocks for this time period, apparently resulting, at least in part, from overexploitation (NOAA 1998, NEFSC 1998). In 1998, the annual geometric mean index (163) reached the highest value since 1989 (195) and suggested that this decline had ended, at least locally, since the values for 1994 through 1997 (119, 114, 122, and 105, respectively), appeared stable at about two times the low value recorded in 1993 (51). From 2000-2003 the geometric mean indices increased (194, 237, 212, and 483, respectively), then decreased from 2004-2006 (334, 208, and 128, respectively) and increased in 2007 (172). The 2010 geometric mean index (253) increased from 2008 (140) and 2009 (212; Figure 5). Overall an upward trend was apparent in these eggs from 1999 through 2005, which is consistent with increases in the Gulf of Maine Atlantic cod spawning stock biomass from 1998 through 2004. The decline in eggs observed from 2006 through 2008 followed by the increases in 2009 and 2010 may reflect the decline observed in spawning stock biomass in 2005 followed by the increases in 2006 and 2007. The Gulf of Maine Atlantic cod stock is not considered overfished although overfishing is occurring (NEFSC 2008).

- Rockling, hake, and butterfish (grouped in their early developmental stages, *Enchelyopus-Urophycis-Peprilus*; MRI 1988) monthly mean egg densities reached a new December high in 2010 at a density of 0.12 eggs per $100m^3$ of water, but in general showed the traditional seasonal characteristics observed from 1981 to 2009 in 2010 (Figure 5). Rockling, hake, and butterfish eggs have been uncommon in recent years. Trend analysis using the longer-term arithmetic time series indicated that a significant downward trend occurred from 1978 through 1996 ($p = 0.05$) even with a moderate catch in 1995. The 1999 (4,715 and 2,366) and 2000 (7,946 and 4,301) indices suggested an upward trend might have begun, however in 2001 arithmetic and geometric mean indices declined (1,897 and 641, respectively). Although the arithmetic and geometric mean indices improved slightly in 2002 (1,980 and 1,199, respectively), they continued to decline in 2003 (1,915 and 585) and 2004 (953 and 438, respectively). The 2004 index values were the lowest recorded in the time series. The arithmetic and geometric mean indices increased from 2005 (1,340 and 611, respectively) through 2008 (8,709 and 2,987), and then declined in 2009 (3,019and 1,606, respectively). The 2010 arithmetic and geometric mean indices increased to 4,298 and 2,377; the geometric mean index was above the 1981-2009 time series average of 2,259 (Figure 5).

  Fourbeard rockling dominate within this egg grouping based on late-stage eggs as well as larval collections. Since they are a small bottom fish with little or no commercial value, stock size data are not available with which to compare trends. Hake on the other hand contribute to the commercial bottom fishery. The Gulf of Maine and northern Georges Bank white hake stock is considered to be overfished (NEFSC 2008). The northern red hake stock which includes the Gulf of Maine and northern Georges Bank areas is currently not considered overfished. The spring and fall total northern red hake stock biomass indices declined from 2003 through 2006 then increased through 2008 (NEFSC 2011). The low egg collections observed at PNPS from 2001 through 2005 followed by an increase through 2008 is consistent with the trend in the northern red hake stock biomass.

- Searobin (*Prionotus* spp.) egg monthly densities in 2010 showed the traditional late spring - early summer peak that has been observed from 1981 to 2009 (Figure 5). Searobin egg abundance has been low in recent years, a downward trend in egg abundance has occurred during the 1981 through 2010 time period. A Mann-Kendall trend test at a 95% significance level ($\alpha = 0.05$) using the geometric mean index supports this downward trend ($p = 0.003$). The 1981-2009 geometric mean abundance index time series shows an alternating, intermittent rise and fall in abundance between years since 1987. The arithmetic and geometric mean abundance indices increased in 1999 (258 and 123) and 2000 (452 and 290), declined in 2001 (108 and 62) and 2002 (57 and 33), and reached a time series low in 2003 of 1.8 and 1.5, respectively. The arithmetic and geometric mean abundance indices remained low from 2004 (36 and 21, respectively) through 2006 (17 and 8), and then gradually increased from 2007 (39 and 21, respectively) through 2009 (361 and 152). The 2010 indices continued to increase (694 and 319, respectively) and remained above the time series averages of 236 and 146, respectively. The 2010 indices are the highest values recorded since 1987 (Figure 5). Searobin eggs were recorded at unusually high densities on five occasions in 2010 (See Section B above, Table 3). The Massachusetts Division of Marine Fisheries (MADMF) resource survey trawls showed relatively high searobin abundance during the late 1970's through the mid-1980's followed by a sharp decline through the early 1990's (McBride et al. 1998). The decline in the 1990's appears to be reflected in the PNPS egg data.

- Labridae-*Limanda* egg monthly mean densities in 2010 showed the traditional late spring - early summer peak that has been observed from 1981 to 2009 (Figure 5). Labridae (tautog/cunner) eggs, believed to be composed primarily of cunner (Scherer 1984), appeared to be in a downward trend from the late 1970's through 1994 (Figure 5) although a sign test failed to confirm it using the conventional 95% significance level ($p = 0.055$). The arithmetic and geometric indices both showed an increase in density in 1995. The 1995 arithmetic index appeared exceptionally high and disproportionate to the geometric value due to a single high density in June (37,282 per 100 m^3 of water), which greatly skewed the arithmetic mean for that month. The arithmetic and geometric indices declined in 1997 but increased again in 1998. The 1998 arithmetic index was disproportionately high due to two high densities in June. The geometric indices declined in 1999 and 2000 (29,885 and 28,156 respectively) and increased in 2001 (40,559). In 2002 both the arithmetic and geometric indices declined (32,754 and 14,709 respectively); the arithmetic mean was the lowest recorded in the 1975-2009 time series.

The geometric indices increased in 2003 and 2004 (15,438 and 32,693 respectively), however in 2005 both the arithmetic and geometric indices declined (45,602 and 12,707 respectively). In 2006, the arithmetic index increased (55,672) compared to the 2005 index, however the geometric abundance index (11,534) continued to decline, to the lowest value in the 1981-2010 time series. The arithmetic and geometric indices increased in 2007 (82,258 and 34,322 respectively), declined slightly in 2008 (56,123 and 22,201) and then increased in 2009 (125,164 and 25,288 respectively). The 2010 arithmetic mean index (121,731) decline slightly and remained below the 1975-2009 time series average (127,440). The 2010 geometric index (70,236) increased to the highest value since 1989 and was above the 1981-2009 time series average of 40,009 (Figure 5). Labrid eggs were recorded at unusually high densities on four occasions in 2010 (See Section B above, Table 3).

The downward trend noted through 1994 was consistent with observations of finfish in the PNPS area as well as impingement collections at the Station (Lawton et al. 1995). Changes in sampling protocols at PNPS have negated the ability to monitor general cunner population trends beyond 1994, which in the past were sampled by gill net, trawl, and diver surveys. Numbers impinged appeared to systematically decline from 1980 through 1992 (annual totals dropped from 1,043 to as low as 28 in 1992), then increased in 1993 (93) and 1995 (346). They remained high in 1996 (332), which appeared to roughly parallel the egg abundance data. The impingement total for 1997 (41) and 1998 (101) represented a substantial drop relative to the preceding two years and appeared out of step with the ichthyoplankton collections. Cunner impingement dropped in 2002 (59), increased from 2003 (172) to 2005 (716), declined from 2006 (384) to 2008 (247), increased in 2009 (895) which was similar to the ichthyoplankton collections. Cunner impingement declined in 2010 (535; See Impingement Section), which appears out of step with the increase observed in the ichthyoplankton collections.

Early stage yellowtail flounder eggs are similar to and grouped with the labrids. Yellowtail flounder eggs are believed to account for all eggs of the Labridae-*Limanda* type collected in April since the labrids are not likely to spawn until May. Yellowtail flounder eggs were relatively abundant in April from 1999 through 2002, abundance then declined from 2003 through 2007, increased in 2008, declined slightly in 2009, and increased in 2010. The April geometric mean densities were 2.4 per 100 m^3 in 1999, 4.0 per 100 m^3 in 2001, 1.1 per 100 m^3 in 2003, 0.5 per 100 m^3 in 2005, 0.1 per m^3 in 2007, 1.3 per 100 m^3 in 2008, and 1.2 per 100 m^3 in 2009. The 2010 April yellowtail flounder eggs' geometric mean index was 2.5 per 100 m^3 of water. Spawning stock biomass of Cape Cod - Gulf of Maine yellowtail flounder decreased from 2,633 mt in 1990 to 949 mt in 1998, and then increased to 1,797 mt in 2002. The spawning stock biomass declined to 796 mt in 2005 and then increased to 1,922 mt in 2007. The Cape Cod - Gulf of Maine yellowtail flounder stock is currently considered overfished (NEFSC 2008). The decline seen in yellowtail flounder egg abundance at PNPS from 2003 through 2007 followed by an increase in 2008 reflects the overall trend observed throughout the Cape Cod - Gulf of Maine yellowtail flounder stock.

- Mackerel egg monthly mean densities in 2010 showed the traditional late spring peak abundance observed from 1981 to 2009 in June (Figure 5). Mackerel eggs typically display a sharp peak in their seasonal abundance curve often with one or two very high densities. For example, in May 1995 a single density of 19,203 eggs per 100 m^3 was recorded on May 26, dropping to 557 eggs per 100 m^3 on the 29th. The second highest density occurred on June 9th that year with 4,754 eggs per 100 m^3. Due to these brief sharp peaks, arithmetic and geometric indices are often quite far apart (Figure 5). Mackerel eggs were more abundant from 1988 to 1998 compared to the 1975 through 1987 period. A sign test using the arithmetic index time series supported this upward trend ($p < 0.006$). In 1999 and 2001, the numbers decreased significantly to 1,135 and 727, respectively. These decreases are likely due to the fact that the main seawater pumps were off for extended periods during the month of May both years, the peak season for mackerel eggs. In 2002, the geometric mean index increased to the second highest value in 10 years (11,850) but then declined in 2003 (3,411) and 2004 (661). The geometric mean index value increased slightly in 2005 (676) and then declined in 2006 (451) and 2007 (311), which was the lowest value in the time series. The geometric mean increased in 2008 (1,106) and 2009 (1,906), and then declined in 2010 (1,127; Figure 5). Entrainment of high densities of mackerel eggs during the 1990's was consistent with a dramatic rise in stock biomass attributable to reductions in foreign fishing and low commercial landings by U.S. fishermen (Overholtz 1993, NOAA 1998, NEFSC 1998). The northwest Atlantic mackerel spawning stock biomass declined from 1,359,003 mt in 1972 to 96,968 mt in 2008, and recruitment declined from an average of 2.1 billion age 1 fish from 1962-1984 to 566 million age 1 fish from 1985-2009 (TRAC 2010). The decline in mackerel egg densities observed at PNPS during the last eight years is consistent with the decline in northwest Atlantic mackerel productivity.

- The *Paralichthys-Scophthalmus* egg group was recorded at new March high in 2010 at a monthly mean density of 0.07 eggs per $100m^3$ of water. The traditional high monthly mean egg densities observed during late spring from 1981 to 2009 were seen in 2010 (Figure 5). Windowpane eggs are predominant within the *Paralichthys-Scophthalmus* egg group based on larval collections. The geometric mean indices increased from 1994 (2,216) through 2001 (6,377), declined in 2002 (1,396), increased in 2003 (1,973) and 2004 (2,843), and declined slightly in 2005 (2,074) and 2006 (2,038). In 2007 the geometric mean index increased to 7,294 and then decline to 2,792 in 2008. The geometric mean index increased in 2009 (4,496) and 2010 (5,140), and was above the 1981-2009 time series average of 3,061. The arithmetic mean index increased in 2007 (13,474) compared to the 2006 index (4,300) and then declined in 2008 (6,265). The arithmetic mean index increased in 2009 (7,800) and 2010 (9,000) and continued to be above the 1975-2009 time series average (5,213; Figure 5). Windowopane eggs were recorded at unusually high densities on five occasions in 2010 (See Section B above, Table 3).

  In general these eggs have not shown wide variations in number, at least compared with other species regularly entrained. Massachusetts Division of Marine Fisheries spring and fall trawl surveys suggest that stocks gradually increased from 1978 to 1995 but then decreased more or less steadily through 2004. A slight increase seems to have occurred from 2005 to 2007 (Matthew Camisa, MDMF, personal communication). Over that time series catch did not swing over a very wide range, the low being two fish per tow and the high 14 (average of spring and fall surveys). The Gulf of Maine-Georges Bank windowpane stock is considered to be overfished (NEFSC 2008).

- American plaice monthly mean egg densities in 2010 generally showed the traditional seasonal characteristics that have been observed from 1981 to 2009 (Figure 5). The highest geometric mean index value in the 1981-2010 time series occurred in 2004 (450). The index dramatically declined in 2005 (54), increased in 2006 (113) and 2007 (230), and then declined in 2008 (113). The arithmetic mean index followed a similar trend declining from 811 in 2004 to 186 in 2005, increasing to 206 in 2006 and 742 in 2007, and then declining to 296 in 2008. Both the geometric and arithmetic mean indices increased in 2009 (375 and 756, respectively) and then declined in 2010 (113 and 173, respectively) dropping below the time series averages (190 and 414, respectively; Figure 5). American plaice eggs were collected on two occasions at unusually high densities in 2010 (See Section B above, Table 3).

Plaice egg abundance at PNPS appears to generally follow trends in adult stock size. Entrainment was low in the mid 1980's when stock size was known to be low (NEFSC 1998, NEFSC 2008), increased from 1987 through 1992, and decreased slightly through 1996 although remained above the low of 1990; then rose again through 2001. Egg abundance has fluctuated from 2002 through 2007. Relatively strong egg production near PNPS may be accounted for by the strong year class produced in 1992 and a reduction in fully recruited fishing mortality from 1992 to 1999 (NEFSC 2001). Spawning stock biomass decreased from 10,648 mt in 2001 to 8,560 mt in 2004 and then increased to 15,569 mt in 2007. The Gulf of Maine – Georges Bank American plaice stock is currently not considered to be overfished although the spawning stock biomass is below the target level (28,600 mt; NEFSC 2008).

- Total eggs collected in 2010, all species pooled together (Figure 5), showed the characteristic temperate fish late spring-early summer peak observed during the 1981-2009 time series. The total egg geometric mean abundance index declined in 2005 (20,056) and 2006 (17,694), increased in 2007 (49,697), and then declined in 2008 (36,468). The geometric mean index increased in 2009 (57,933) and 2010 (96,590). The 2006 index was the lowest in the 1981-2010 time series. The 2005 arithmetic mean index (58,440) was the second lowest value in the 1975-2010 time series. The arithmetic mean index increased in 2006 (70,794) and 2007 (106,760), declined in 2008 (80,640), and then increased in 2009 (145,176) and 2010 (147,058; Figure 5). The 2010 geometric index was above the time series average (75,010) although the arithmetic index remained below the 1981-2009 series average (185,827). The low indices recorded in 2005 and

2006 may reflect to a large extent the below-average production of fourbeard rockling, cunner, yellowtail flounder, mackerel, and American plaice eggs. The increase recorded in 2010 may reflect above average production of searobins, labrid, and *Paralichthys-Scophthalmus* eggs.

Larvae

- Atlantic menhaden larvae monthly mean densities show the traditional seasonal characteristics in 2010 (Figure 6). Menhaden larval abundance was relatively high from 1996-1999, then noticeably dropped during 2000 and 2001, climbed slightly in 2002 and then dropped again in 2003 and 2004. The 2004 annual geometric mean abundance index (10) and arithmetic mean index (12) were the lowest values recorded in the time series. The geometric mean abundance index increased from 2005 (312) through 2008 (819), then declined in 2009 (320) and 2010 (194) dropping below the 1981-2009 time series average of 264. The arithmetic mean abundance index increased in 2005 (1,022) and 2006 (1,374), then declined slightly in 2007 (1,116), and increased in 2008 (4,048). The arithmetic mean index declined in 2009 (719) and 2010 (352) dropping below the 1975-2009 time series average of 606 (Figure 6). Atlantic menhaden larvae were collected in unusually high densities on three occasions in 2010 (See Section B above, Table 3).

  Atlantic menhaden are coastal migrants that travel in schools that can often be quite dense and are attracted to both intake and discharge currents at industrial facilities. The great variability in numbers of eggs taken at PNPS probably reflects not only numbers of adults in the surrounding waters but variability in the distance from PNPS at which spawning takes place. Spawning stock biomass increased from 1993 through 1995 (Cadrin and Vaughan 1997), which is consistent with the observed increase in egg and larval densities in 1997 and larval densities alone in 1997-1999. Currently the stock is believed to be healthy (ASMFC 2010) consistent with the relatively high numbers of larvae entrained during the last six years.
- Larval Atlantic herring 2010 monthly mean densities showed the traditional spring and early winter peaks that have been observed from 1981 to 2009 (Figure 6). Peak abundance of Atlantic herring larvae shift somewhat from year to year due to abiotic

factors like water temperature. For example, the major spawning for Atlantic herring in the Northwest Atlantic traditionally occurs from late August through November (Collette and Klein-MacPhee, 2002), but during unseasonably cold winters this spawning seasonality usually shifts later into December, as seen in 2003. Atlantic herring larvae were collected in unusually high densities on six occasions in 2010 (See Section B above, Table 3).

Atlantic herring larval abundance indices have proven valuable in management of herring stocks on Georges Bank, Nantucket Shoals, and in the Northwest Atlantic in general (Smith and Morse 1993). The Gulf of Maine-Georges Bank herring stock complex was seriously depleted by overseas fleets during the 1960's and 1970's to the point where no larval herring were found on Georges Bank for a decade (Anthony and Waring 1980, Smith and Morse 1993, Overholtz and Friedland 2002). The stock has increased more or less steadily since 1986 following reductions in fishing pressure to the point where they are abundant on Nantucket Shoals and in the Gulf of Maine-Georges Bank region. The estimated 2008 stock biomass (652,000 mt) is slightly below the B_{MSY} (670,600 mt) but the stock is not considered overfished (TRAC 2009). Larval collections at PNPS from 1994 through 2002 reflect the general increase in stock size, the geometric mean index for those seven years ranking among the top six. In 2003, however, the geometric mean index (32) fell relative to the 2002 index of 147, and represented a fourteen-year low dating back to 1989. The geometric and arithmetic mean indices increased in 2004 and 2005. The 2006 geometric mean index (148) was very similar to the 2005 index (147), however the 2006 arithmetic mean index (349) decreased compared to the 2005 index (602). In 2007 the geometric mean index declined to 9, representing a 1981-2010 time series low. The 2007 arithmetic mean index also declined to 13, representing the second lowest value in the 1975-2010 time series. The geometric and arithmetic mean indices increased in 2008 (72 and 145, respectively), were similar in 2009 (79 and 146), and increased slightly in 2010 to 93 and 185, respectively (Figure 6).

- Fourbeard rockling larval monthly mean densities showed the traditional seasonal characteristics in 2010 that have been observed from 1981 to 2009 (Figure 6). Larval densities were unusually high on two occasions in 2010 (See Section B above, Table 3). Fourbeard rockling larvae were relatively abundant in 1998 and 1999 due to the unusually high densities recorded in July of those years. The annual geometric mean index dropped sharply in 2000 (50), rebounded in 2001 (607), and then declined in 2002 and 2003. The 2003 geometric mean index (47) was a time series low and under one tenth the series average (479). In 2004, the geometric mean index increased (528) relative to the 2002 and 2003 indices. However, the geometric and arithmetic mean indices declined in 2005 (195 and 536, respectively) and 2006 (162 and 346). The 2007 geometric mean index remained essentially unchanged while the arithmetic mean index increased slightly (363). The geometric and arithmetic mean indices increased in 2008 (225 and 522, respectively) and 2009 (330 and 710). In 2010, both the geometric and arithmetic mean indices declined to 194 and 406 remaining below their respective time series averages of 459 and 1,324 (Figure 6). In spite of these swings in abundance, no consistent trend over the times series is evident. As mentioned above under eggs, the rockling is a small bottom fish with little or no commercial value and stock size data are unavailable with which to compare trends.

- Larval hake monthly mean densities in 2010 were within the historical range observed from 1981 to 2009 (Figure 6). Larval hake densities were unusually high on eight occasions in 2010 (See Section B above, Table 3). Larval hake abundance has been low since 1999. The arithmetic and geometric mean indices declined to time series lows in 2003 (16 and 9, respectively). The arithmetic and geometric mean indices increased slightly from 2005 (28 and 15) through 2007 (62 and 37), and then increased more noticeably in 2008 (1,332 and 217) and 2009 (1,549 and 226, respectively). In 2010 both the arithmetic and geometric mean indices declined (188 and 103 respectively), dropping below their respective time series averages of 789 and 200 (Figure 6). The Northeast Fisheries Center (NEFSC) autumn bottom trawl surveys biomass index suggests that the northern red hake stock biomass gradually increased from the 1970's though 2002, steady declined to 1.16 kg per tow in 2005, and then increased reaching 12.46 kg per tow in 2009. Commercial landings reached a historic low in 2005 of 150 mt. The MADMF fall survey biomass increased from a low of 447 mt in 1987 through the 1990's to a maximum of 3,842 mt in 2000, and then declined from 2002 through 2008. The MADMF fall survey biomass was 1,233 mt in 2009. The northern red hake stock is currently not considered overfished (NEFSC 2011). White hake NEFSC autumn bottom trawl survey biomass index declined during the 1990's reaching a near record low in 1999. The biomass then increased from 2000 to 2002 due to the strong 1998 year class and then declined to a very low level (Sosebee 2006). Spawning stock biomass was estimated to be 19,800 mt in 2007 which is below the spawning stock biomass maximum sustainable yield of 56,300 mt. The Georges Bank – Gulf of Maine white hake stock is currently considered as overfished (NEFSC 2008). Time series highs in larval hake abundance at PNPS in 1997 (994) and 1998 (932) may indicate production of strong year classes or simply reflect a localized spawning aggregation. The low larval hake abundance observed in the 2000 to 2007 indices may reflect the declines in biomass of both red and white hake stocks in the Gulf of Maine.

- Sculpin larval monthly mean densities followed historical characteristics with an early spring peak in 2010 (Figure 6). Sculpin abundance has remained relatively stable over the 36-year arithmetic mean time series (Figure 6). A slight increasing trend occurred from 1977 through 1988 and a secondary peak was observed in 1997 (arithmetic mean index = 5,058, geometric mean index = 2,249). After dropping in 1998 to 1,086, the geometric mean index increased in 1999 (1,668) and 2000 (1,528) before declining in 2001 (958). The sculpin geometric mean index rebounded in 2002 (2,428) to the third highest value since 1981 and the highest since 1988. The arithmetic mean and geometric mean indices then declined from 2003 to 2005. The arithmetic and geometric mean indices increased in 2006 (3,166 and 1,183) but then declined in 2007 (3,044 and 932) and 2008 (844 and 375). The 2008 geometric mean index was a time series low. The arithmetic and geometric mean indices increased in 2009 (1,949 and 843, respectively) and then declined in 2010 to 513 and 305 remaining below their respective time series averages of 2,446 and 1,266 (Figure 6). The major species within this genus entrained at PNPS is the grubby. Since these fish are small and have no commercial or recreational significance, no stock size data are available with which to compare the larval abundance patterns.
- Seasnail larvae monthly mean densities showed the traditional seasonal characteristics that have been observed from 1981 to 2009 (Figure 6). Seasnail larvae exceeded unusual density levels twice in 2010 although those values did not produce notably high monthly means (See Section B above, Table 3). Larval seasnail abundance has been low in since

1998. The arithmetic and geometric mean indices declined to time series lows of 30 and 27, respectively in 2003. The arithmetic mean index has remained at approximately 40% of the 1975-2009 time series average (579) since 2004, with an average index of 234 from 2004-2009. The geometric mean index has fluctuated continuously since the low in 2003 ranging from 233 in 2004 to 45 in 2007, and has remained below the 1981-2009 time series average (214) since 2005. The arithmetic and geometric mean indices increased slightly in 2010 to 200 and 92, respectively from 122 and 57 in 2009 (Figure 6). Since these fish typically reach a length of less than 6 inches and have no commercial or recreational significance, no stock size data are available with which to compare the larval abundance patterns.

- Tautog larval monthly mean densities reached a new September high in 2010 with a density of 2.8 larvae per 100m^3 of water. However in general, the monthly means densities showed the historical patterns that have been observed from 1981 to 2009 (Figure 6). Tautog larvae exceeded unusual high density levels on nine occasions in September corresponding to the new September high monthly mean density observed. Additionally tautog larvae exceeded unusual high density levels on eleven other occasions in 2010, although those densities did not produce notably high monthly means (See Section B above, Table 3). Larval tautog geometric mean abundance reached a five-year high in 2001 (268), followed by a decline in 2002 (73) and 2003 (64), and an increase in 2004 (172). Abundance decreased in 2005 (132) and 2006 (69), and increased from 2007 (79) through 2009 (722). The 2009 geometric mean index was the second highest value in the time series. The geometric mean index declined in 2010 to 337, but remained well above the 1981-2009 time series average of 174. The arithmetic mean indices show a similar increasing trend in 2008 (679) and 2009 (1,198) compared to the 2006 (189) and 2007 (137) values. The 2009 arithmetic mean index was also the second highest value in the time series. The arithmetic mean index declined in 2010 to 538, but continued to remain above the time series average of 346 (Figure 6). The arithmetic mean index (1975-2010) extends over a longer time period than the geometric mean index and historically shows peaks and ebbs from year to year with no apparent long-term trend. Tautog spawning stock biomass declined from 1982 to 2003 (NEFSC 1998, ASMFC 2006a). Recent data indicate that Massachusetts commercial landings decreased from 1993 to 2001 and recreational landings decreased from 1988-2004 (Stirratt 2002, ASMFC 2006a). Due to limited data, the Massachusetts tautog stock status is uncertain although it does not currently appear to be overfished. However coastwide tautog are considered overfished (ASMFC 2006a).

- Cunner larval monthly mean densities in 2010 showed the traditional seasonal characteristics that have been observed from 1981 to 2009. Cunner larvae exceeded unusual density levels on four occasions in 2010 although those values did not produce notably high monthly means (See Section B above, Table 3). No consistent long-term geometric mean index trends are apparent for this species. However, cunner larval abundance was low from 2002 through 2007. The geometric mean index declined from 1,697 in 2000 to 115 in 2003. The index increased slightly in 2004 (373), declined again in 2005 (350) and 2006 (259), and then increased from 2007 (294) to 2009 (1,229). The 2010 geometric mean index declined to 1,181 but remained above the 1981-2009 time series average of 1,020 (Figure 6). Arithmetic mean indices for cunner larvae over the time series (1975-2009) also show no apparent trends in entrainment collections, but rather fluctuate between a few years of relatively high abundance followed by years in which cunner larvae were less common. For instance, in 1981 the arithmetic mean index for cunner was 10,701 but then declined sharply to 437 in 1982 and climbed to 2,067 in 1983. The 2010 arithmetic mean index of 2,200 increased slightly compared to the 2009 index of 2,122 but remained below the 1975-2009 time series average of 2,461 (Figure 6). This general fluctuating pattern is repeated throughout the time series and likely reflects a localized, dynamic recruitment pattern for this temperate wrasse. Current stock size data for cunner are unavailable.
- Larval radiated shanny monthly densities in 2010 showed the historical characteristics that have been observed from 1981 to 2009 (Figure 6). Radiated shanny larvae occurred at unusually high densities on three occasions in 2010 although those values did not produce notably high monthly means (See Section B above, Table 3). Radiated shanny larval geometric mean abundance rebounded in 2000 (239) following a 12-year low in 1999 (73), and reached a seven year high in 2002 (651). The geometric mean index declined in 2005 (101) ending the 5-year increase in abundance, and remained low in 2006 (113) and 2007 (103). The geometric mean index increased in 2008 (456) and 2009

(700) and then declined in 2010 to 274, dropping below the 1981-2009 time series average of 384. The 2010 arithmetic mean index also decreased to 462 which was below the 1975-2009 time series average of 834 (Figure 6). Since this is a small, rather inconspicuous bottom fish, relatively little is known of its habits and data are not available concerning population trends.

- Rock gunnel larval monthly mean densities were collected at a new April low in 2010 with a density of 0.06 larvae per $100m^3$ of water. However in general, the monthly means densities showed the traditional patterns observed from 1981 to 2009 (Figure 6). Rock gunnel larvae were collected in above-average numbers from 2000 to 2002 but then declined in 2003 and have since remained relatively low. The 2010 geometric mean index (195) declined compared to the 2009 index (351) and continued to remain below the time series average (933). The arithmetic mean index has also shown a low relative abundance since 2003. The 2010 arithmetic mean index (408) was also below the 1975-2009 arithmetic mean index time series average of 1,725 (Figure 6). Overall, however, there was no obvious or statistically significant trend from 1975 to 2010, although there appeared to be intermittent highs in relative abundance followed by one or two-year declines with the abundance indices generally increasing over the 1981-2002 time period. The appearance of rock gunnel larvae from February through April, the three months when they typically are most abundant, fell below the time series mean for these months from 2003 through 2010 consistent with the overall annual indices. Since the rock gunnel is a small bottom fish with no commercial or recreational value, abundance data are not available with which to compare the entrainment estimates.
- Sand lance larval monthly mean densities reached a new November high in 2010 with a density of 0.08 larvae per $100m^3$ of water, and generally showed the traditional characteristics that have been observed from 1981 to 2009 (Figure 6). The geometric mean index increased nearly three-fold from 1994-2006 (mean index = 2,791) compared to 1981-1993 (mean index = 1,054) indicating a general increase in abundance that began in 1991 after a period of relatively low sand lance abundance from 1987-1990. Overall, the geometric mean index peaked in 1996 (6,156) and the arithmetic index peaked in 1994. The sand lance geometric mean index increased from 2004 (1,824) to 2006 (3,195). In 2007 the geometric mean index dropped 94% to 189, becoming the third

lowest value in the time series and the lowest value since 1988. The 2007 arithmetic mean index (397) also declined 95% from 2006 (7,998) and was the lowest value since 1989. The geometric mean and arithmetic mean indices increased in 2008 (2,911 and 7,223, respectively) and then declined in 2009 (728 and 1,696) and 2010 (633 and 1,0101) dropping below their respective time series averages of 1,856 and 3,854 (Figure 6).

Sand lance play an important role in community ecology since they are a major prey source for a number of finfish species including several of the dominant species discussed above: mackerel, cod, hake, plaice, and yellowtail flounder (Winters 1983). Adult sand lance are also a key prey species in the diet of several baleen whales such as humpback (*Megaptera novaeangliae*) and finback whales (*Balaenoptera physalis*) that migrate seasonally to or through Massachusetts and Cape Cod Bays and influence these seasonal migrations (Weinrich et al 1997; Hain et al 1995). Traditionally, other dominant prey sources for humpback whales have been Atlantic herring and Atlantic mackerel. However, as both these prey sources declined in abundance during the late 1970's and early 1980's, humpback whales began targeting sand lance as their main prey source for this region (Kenney et al 1996). Unfortunately, sand lance have little to no commercial or recreational value, and therefore abundance data are unavailable to compare to the entrainment estimates.

- Atlantic mackerel larval monthly mean densities in 2010 were within the historical range that has been observed from 1981 to 2009 (Figure 6). Peak larval abundance historically occurs in May and June with time series average geometric means of 0.63 and 8.4 per 100 m^3 of water, respectively. The 2010 May and June geometric means continued to be below these averages with densities of 0.0 per 100 m^3 of water in May and 0.59 in June. Mackerel larvae, like their eggs discussed above, typically display a sharp peak in their abundance curve often with one or two very high densities. Due to these brief sharp peaks, arithmetic and geometric indices are often quite far apart (Figure 6). The arithmetic mean index generally increased from 1975 until 1995 and then declined. Peaks in abundance occurred in 1981 (10,030) and 1995 (12,086). The 2008 arithmetic mean index (39) declined from the 2006 (565) and 2007 (387) values. The arithmetic mean increased slightly in 2009 (68) but then declined in 2010 (37) and continued to be below the time series average (1,601). The arithmetic mean index has been below the time series average since 1999. The mackerel larval geometric mean index increased in 2001 (159) from 2000 (131) but then declined in 2002 (70) and 2003 (36). A 5-year high occurred in 2004 when the geometric mean index reached 251, but then declined in 2005 (95). The geometric mean index increased slightly in 2006 (139), declined in 2007 (105) and 2008 (20), and then increased slightly in 2009 (30). In 2010 the geometric mean index decreased to 18, the fourth lowest value in the 1981-2010 time series, and was well below the 1981-2009 series average of 286 (Figure 6). The northwest Atlantic mackerel spawning stock biomass declined from 1,359,003 mt in 1972 to 96,968 mt in 2008, and recruitment declined from an average of 2.1 billion age 1 fish from 1962-1984 to an average of 566 million age 1 fish from 1985-2009 (TRAC 2010). The decline in mackerel larvae densities observed at PNPS since 1999 is consistent with the current decline in the northwest Atlantic mackerel spawning stock biomass.

- Winter flounder larvae, a species of considerable recreational and commercial interest and value, are typically among the numerically dominant members of the larval fish community around PNPS in May and the first part of June. Winter flounder larval monthly mean densities generally showed the traditional seasonal patterns that have been observed from 1981 to 2009 (Figure 6) although a single individual was collected in August in 2010. Winter flounder larvae were recorded at an unusually high density of 17.8 larvae per 100 m^3 of water in April 2010 which did not produce a notably high monthly mean (See Section B above, Table 3). The annual geometric mean curve area index reached a high of 2,307 in 2001. This high was followed by a decline in 2002 (575) and 2003 (195), a slight increase in 2004 (539), and then a decline from 2005 (492) through 2007 (172). The geometric mean index increased in 2008 (264) and 2009 (272), then declined in 2010 to 258 and remained below the 1981-2009 time series mean of 481. The arithmetic mean index increased in 2004 (3,047); declined in 2005 (2,009) and 2006 (429); and then increased from 2007 (480) through 2009 (1,422). The arithmetic mean index declined in 2010 (593) and was well below the 1975-2009 time series average of 1,162 (Figure 6). Overall these indices varied without trend over the time series.

  The Southern New England/Mid-Atlantic winter flounder stock, including offshore Cape Cod, continues to be overfished (NEFSC 2008, Mayo and Terceiro 2005).

The 2002 year class was estimated to be very small at only 4.4 million fish; it was followed by an average size year class (21.6 million) in 2003 (Mayo and Terceiro 2005). The 2006 year class was estimated to be the smallest on record (1981 to 2007) at 3.6 million fish and was followed by a small 2007 year class estimated to be 8.8 million fish The 2007 spawning stock biomass was estimated to be 3,368 mt (NEFSC 2008). The Gulf of Maine winter flounder stock appeared to be doing better than the Southern New England stock; this stock was considered to have been rebuilding since 1995 (NEFSC 2003, Mayo and Terceiro 2005) and was listed as not being overfished (Mayo and Terceiro 2005). However, in the most recent stock assessment a high degree of uncertainty in stock status determination exists although all models suggest that current spawning stock biomass is below the spawning stock biomass maximum sustainable yield value. The Gulf of Maine winter flounder stock is now considered to likely be overfished (NEFSC 2008). See additional information below.

- The total for all larvae combined in 2010 showed the traditional seasonal patterns that have been observed from 1981 to 2009 (Figure 6). The 2010 total larval arithmetic mean index (8,472) declined compared to the 2008 (24,825) and 2009 (23,411) indices and was well below the 1975-2009 time series average (21,179). The 2010 geometric mean index (5,521) also declined compared to the 2008 (11,264) and 2009 (11,773) indices and was considerably below the 1981-2009 time series average (11,147; Figure 6).

Figure 5. Geometric mean monthly densities per 100 m^3 of water in the PNPS discharge canal for the eight numerically dominant egg species and total eggs, 2010 (bold line). Solid lines encompassing shaded area show high and low values over the 1981-2009 period.

Brevoortia tyrannus

Gadidae-*Glyptocephalus*

Enchelyopus-Urophycis-Peprilus

Prionotus spp.

Labridae-*Limandas*

Scomber scombrus

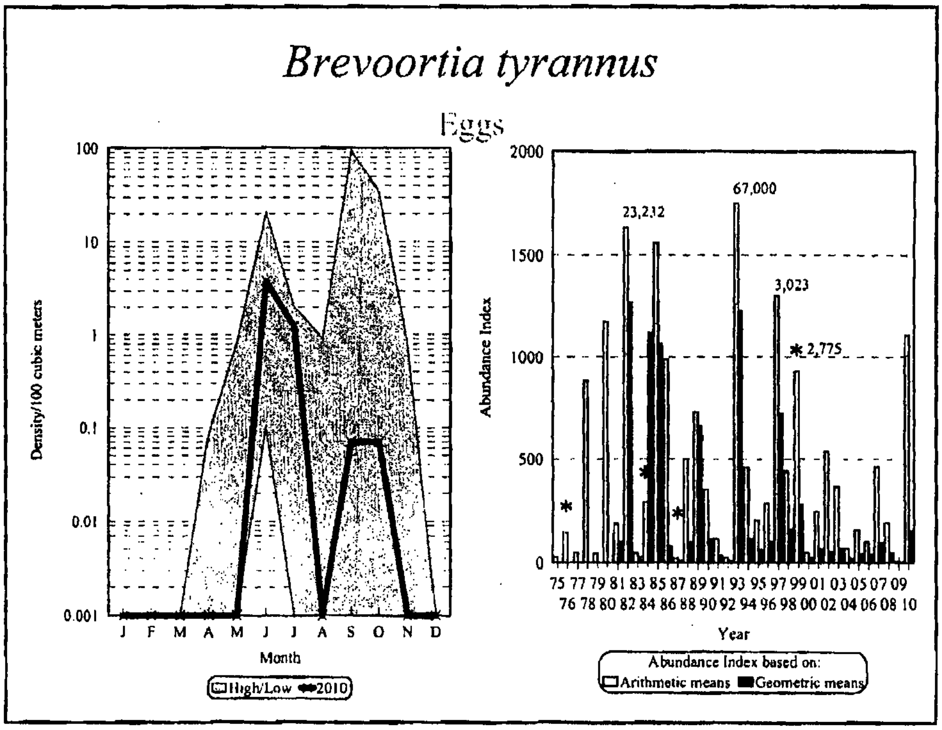
Paralichtys-Scopthalmus

Hippoglossoides platessoides

Total eggs

To the right are plotted integrated areas under the annual entrainment abundance curves for 1975-2010. An asterisk above 1984, 1987 and 1999 marks the three years when values may have been low due to low through-plant water volumes from April-August. An asterisk above 1976 indicates abundance value may be low due to absence of sampling during January – late April; see text for clarification. Light bars represent indices based on monthly means arithmetic means, solid bars (1981-2009) indices based on monthly geometric means.

Occasionally bars were rescaled to improve readability. The actual value in those cases is printed above the bar.



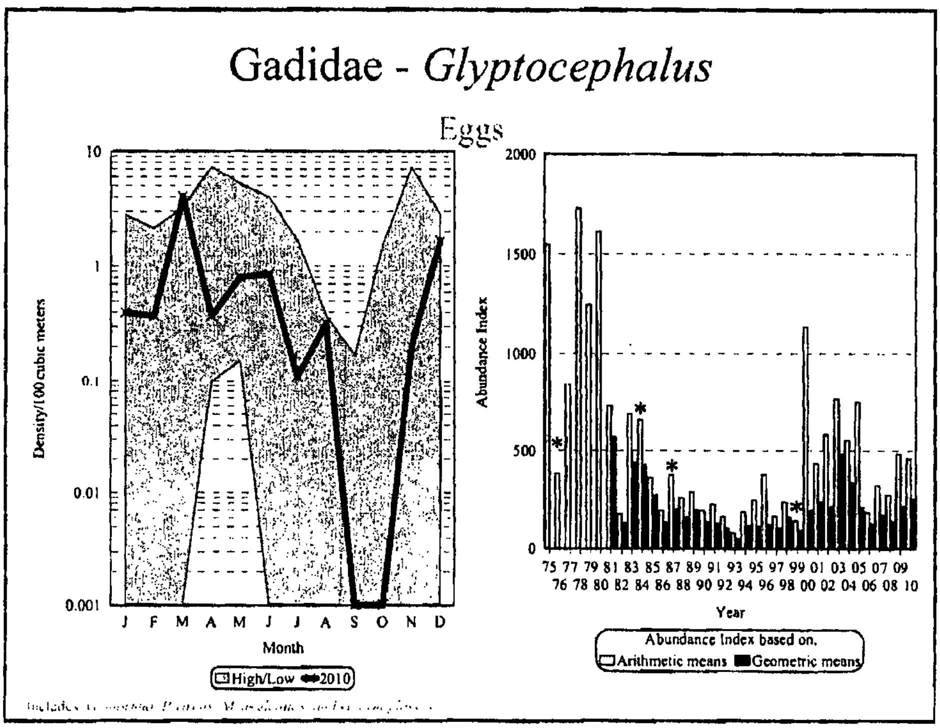
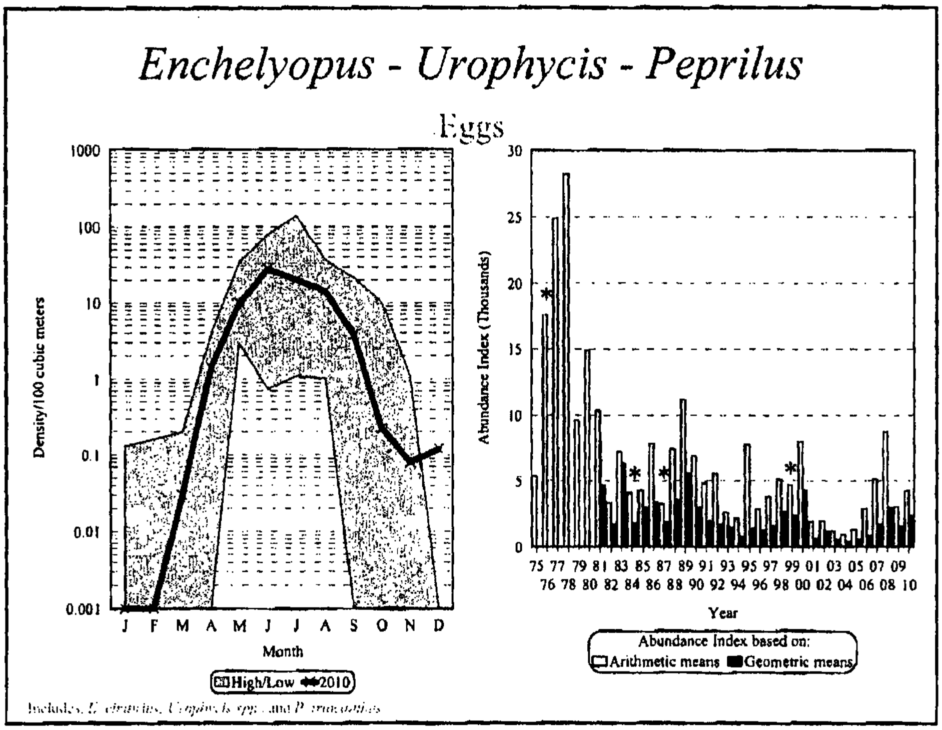


Figure 5 (continued).



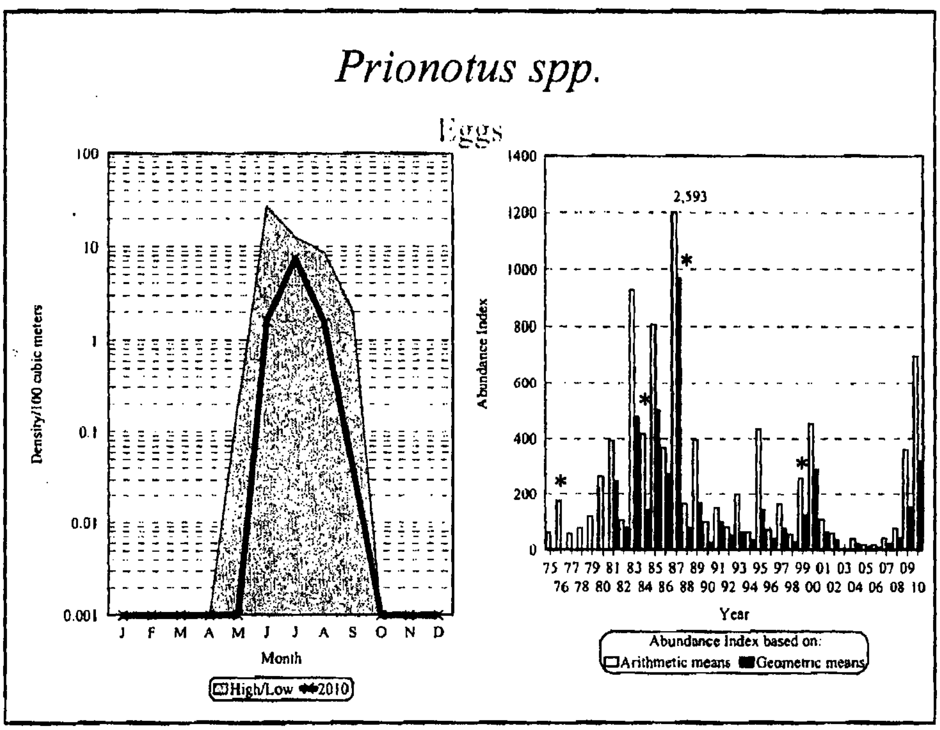
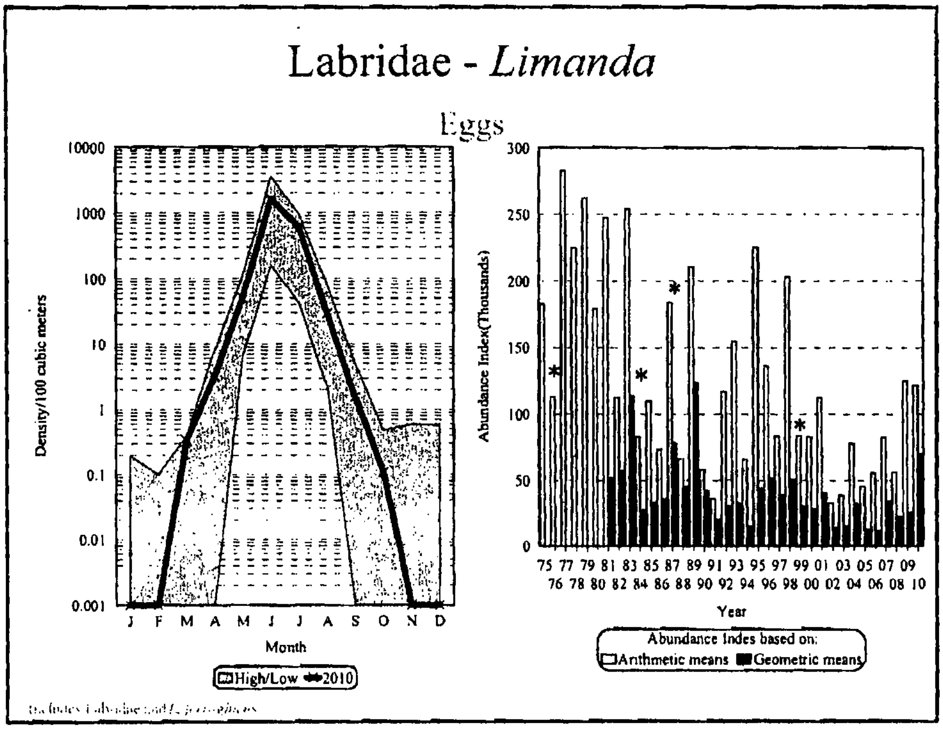


Figure 5 (continued).



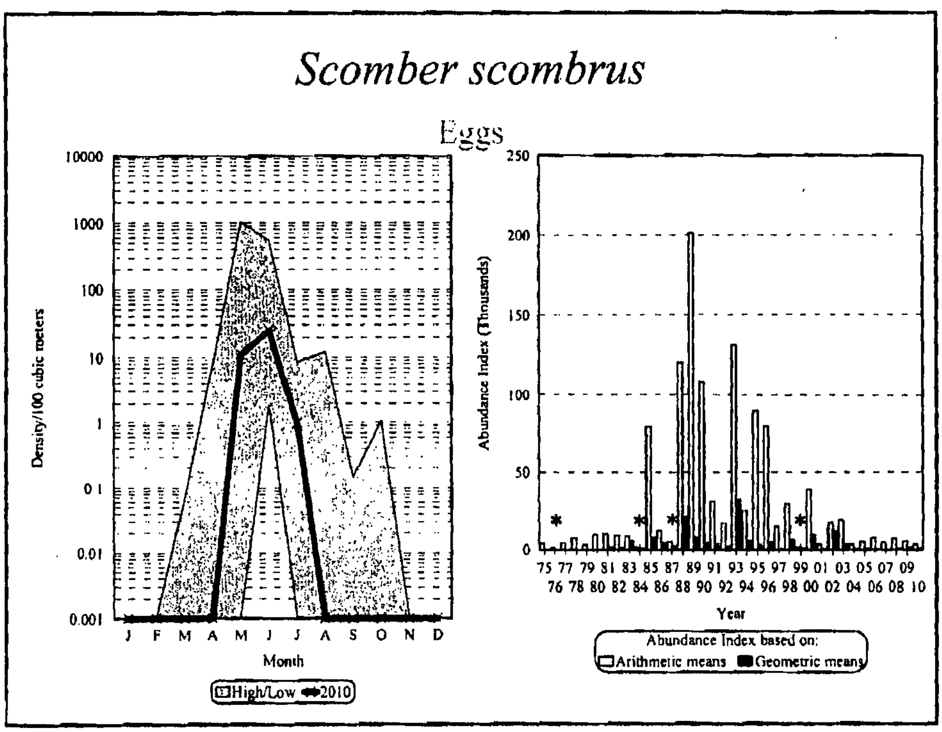
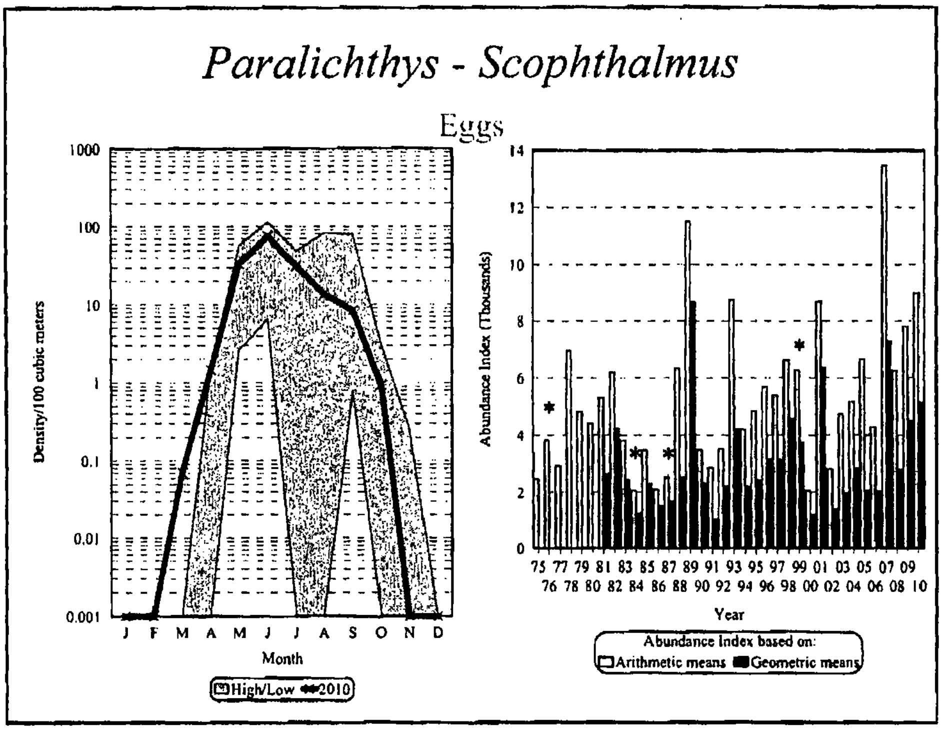


Figure 5 (continued).



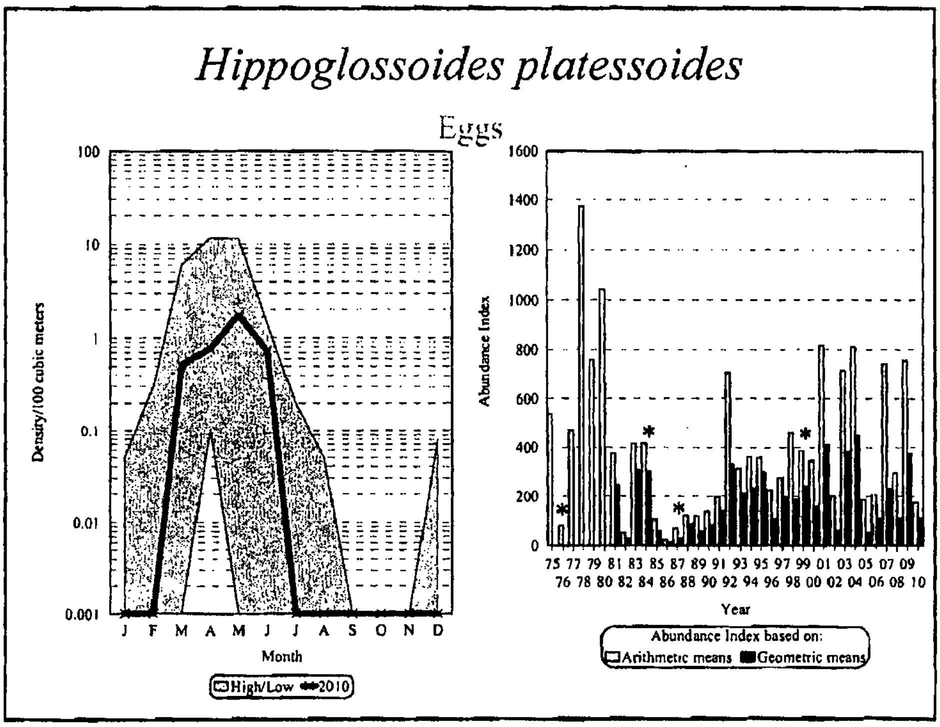


Figure 5 (continued).

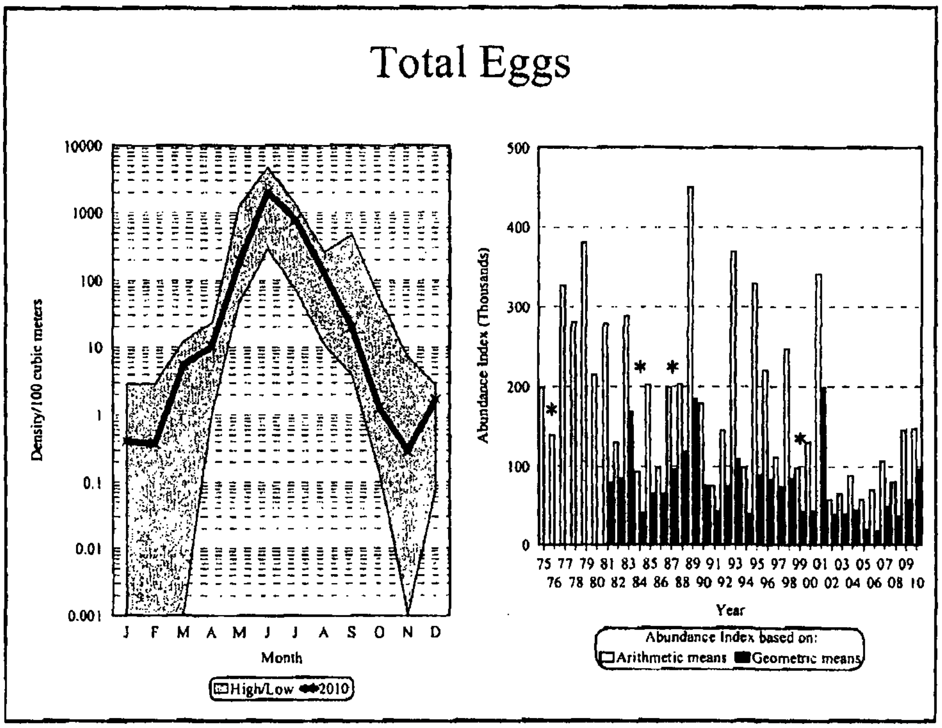


Figure 5 (continued).

Figure 6. Geometric mean monthly densities per 100 m^3 of water in the PNPS discharge canal for the thirteen numerically dominant larval species and total larvae, 2010 (bold line). Solid lines encompassing shaded area show high and low values over the 1981-2009 period.

Brevoortia tyrannus

Clupea harengus

Enchelyopus cimbrius

Urophycis species

Myoxocephalus species

Liparis species

Tautoga onitis

Tautogolabrus adspersus

Ulvaria subbifurcata

Pholis gunnellus

Ammodytes species

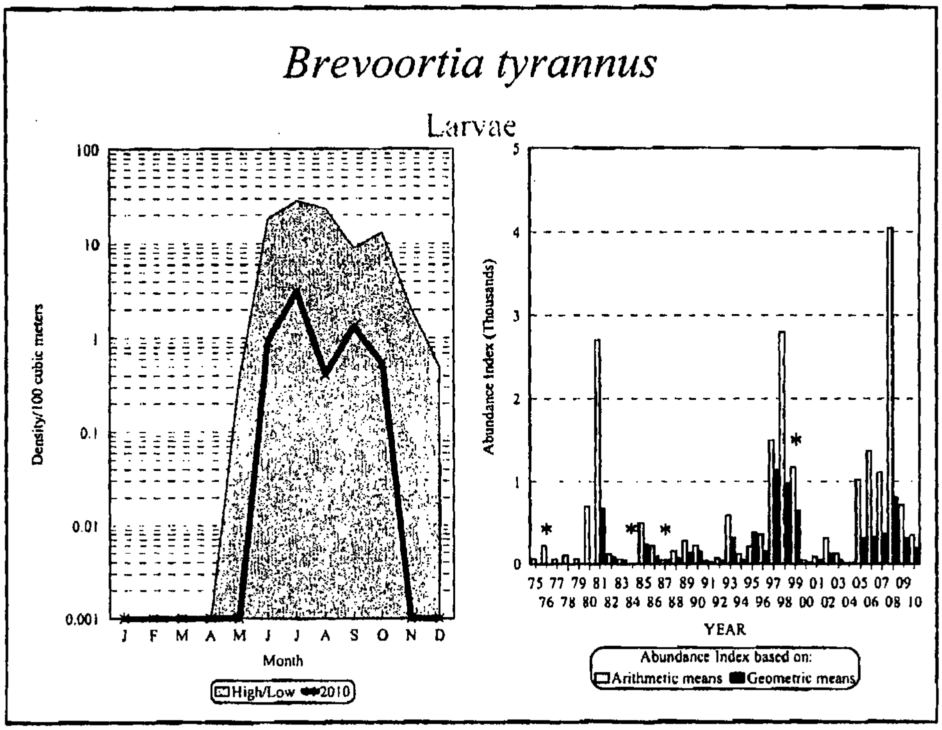
Scomber scombrus

Pleuronectes americanus

Total larvae

To the right are plotted integrated areas under the annual entrainment abundance curves for 1975-2009. An asterisk above 1984, 1987 and 1999 marks the three years when values may have been low due to low through-plant water volumes from April-August. An asterisk above 1976 indicates abundance value may be low due to absence of sampling during January – late April; see text for clarification. Light bars represent indices based on monthly means arithmetic means, solid bars (1981-2009) indices based on monthly geometric means.

Occasionally bars were rescaled to improve readability. The actual value in those cases is printed above the bar.



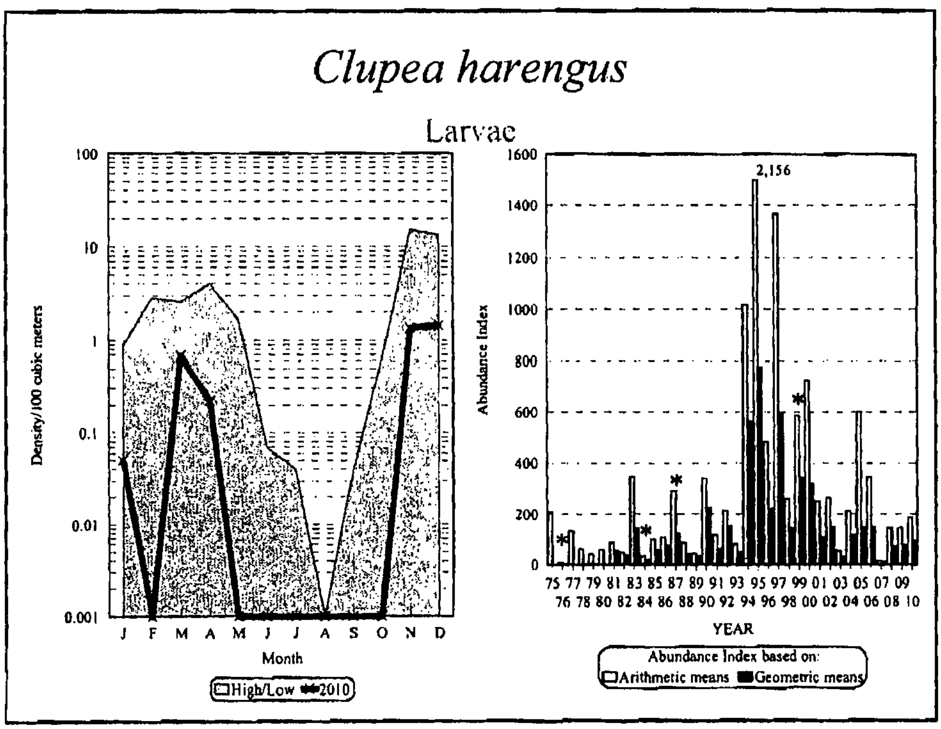
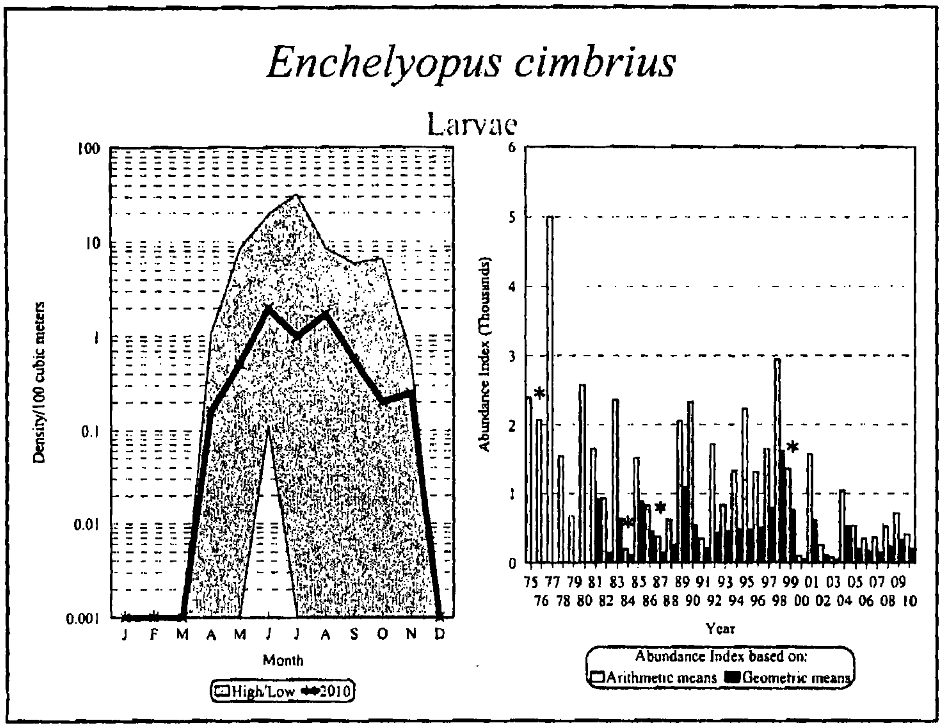
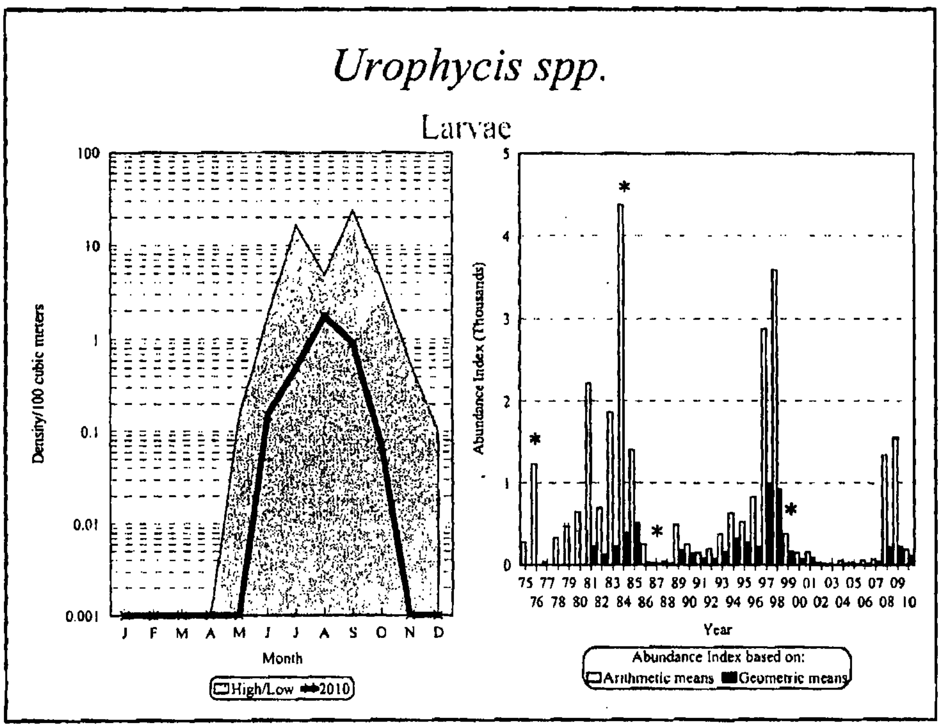


Figure 6 (continued).





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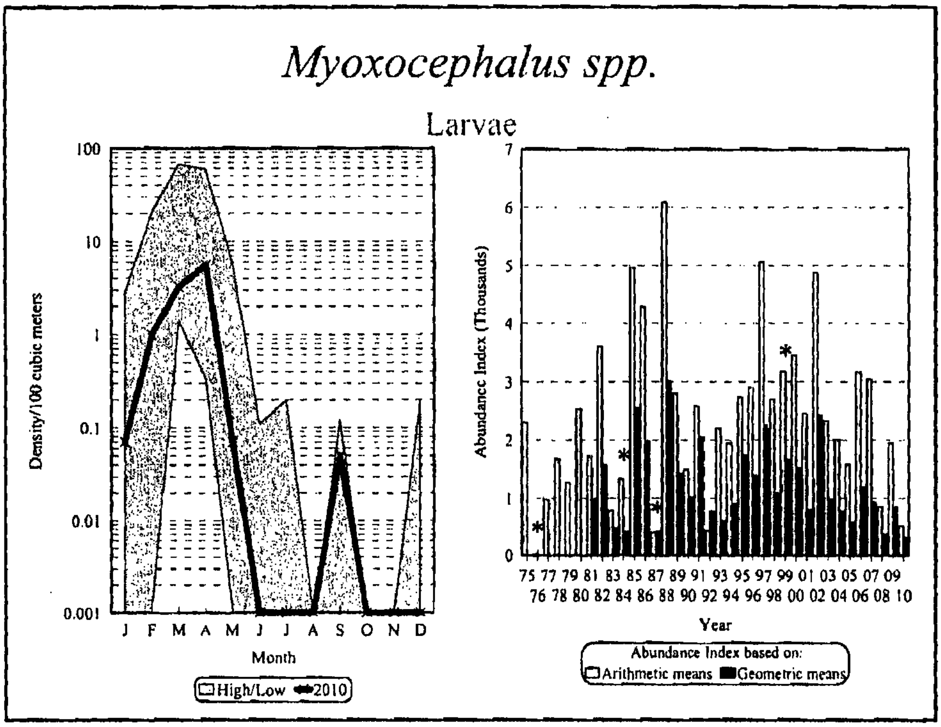

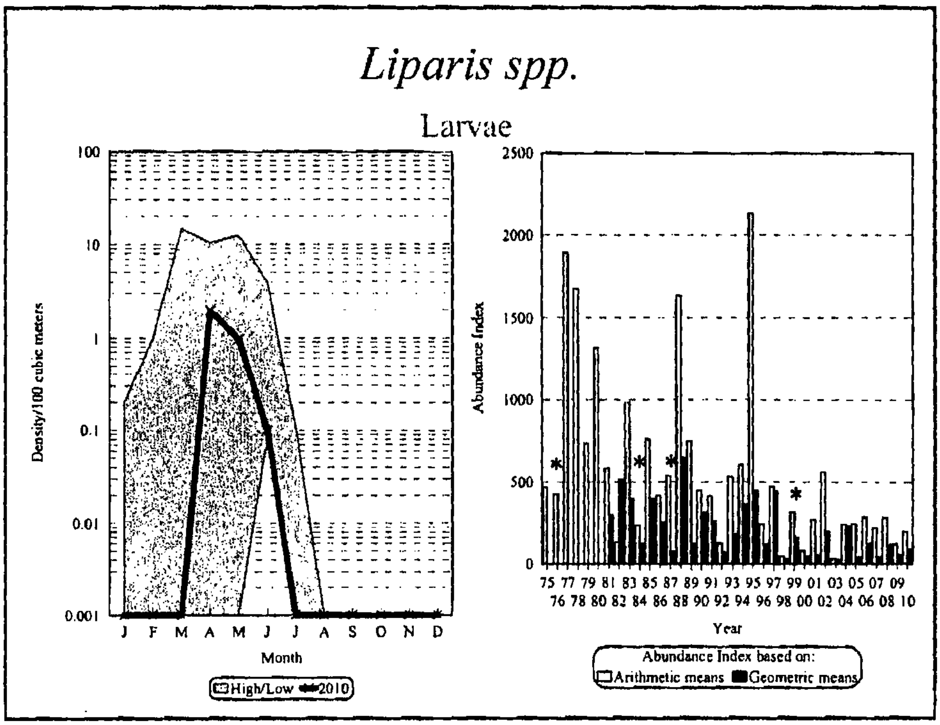

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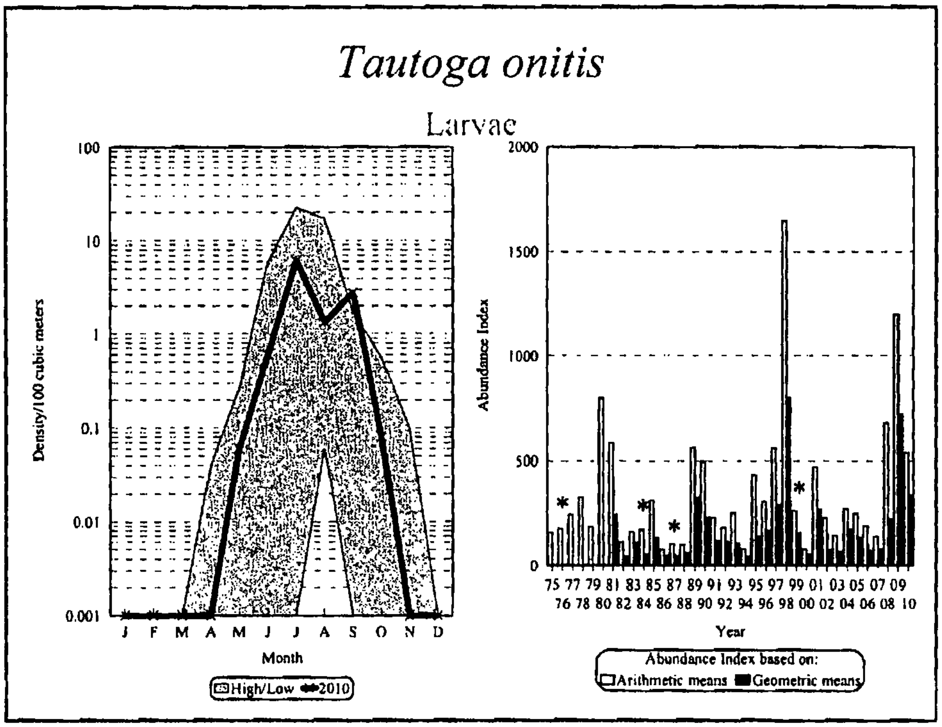

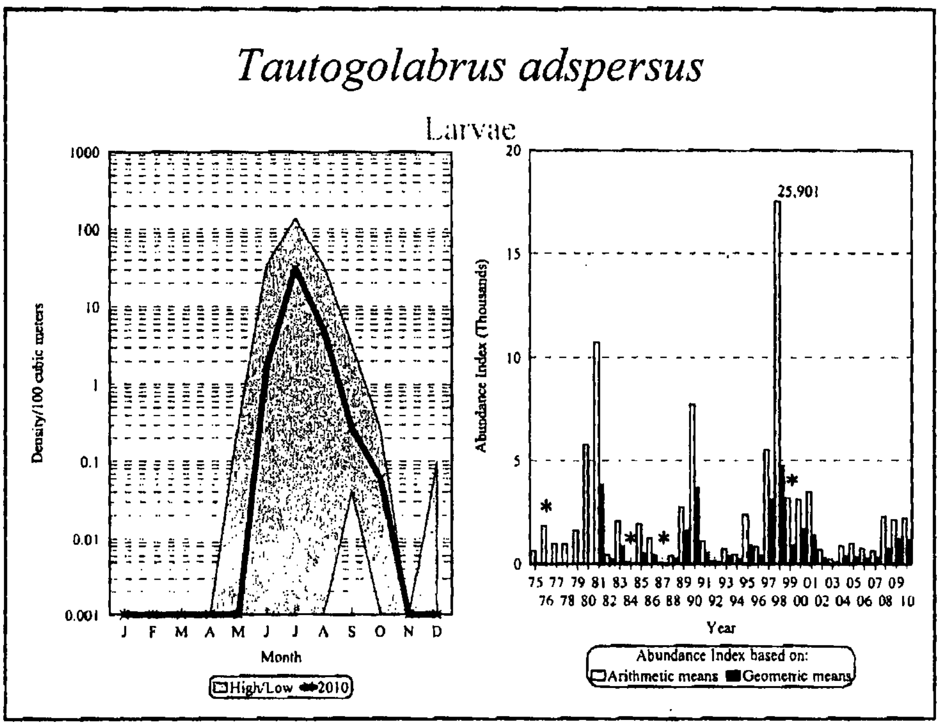

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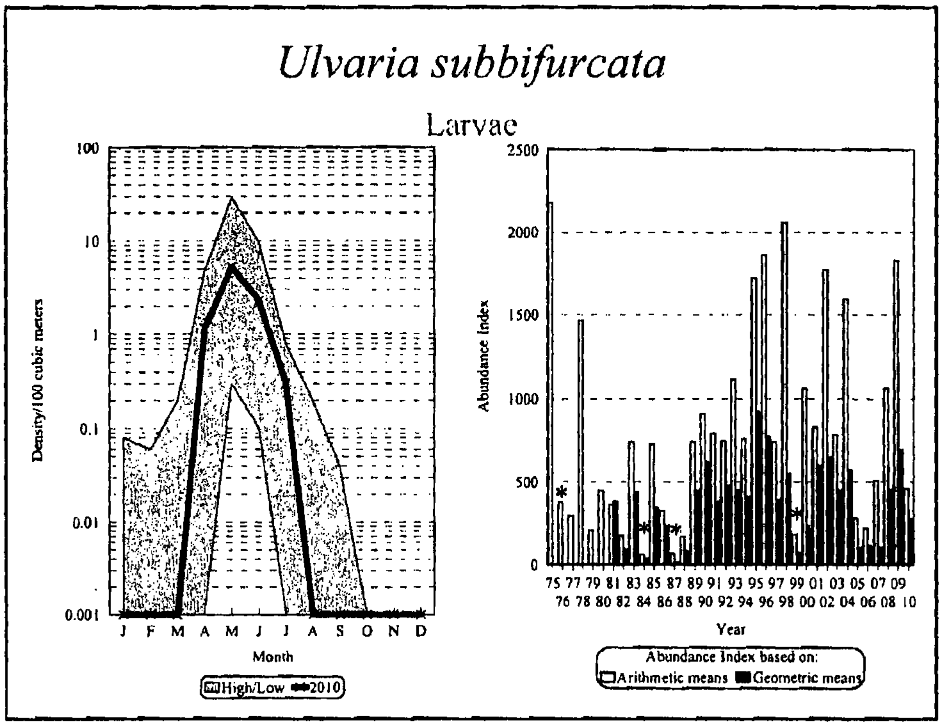

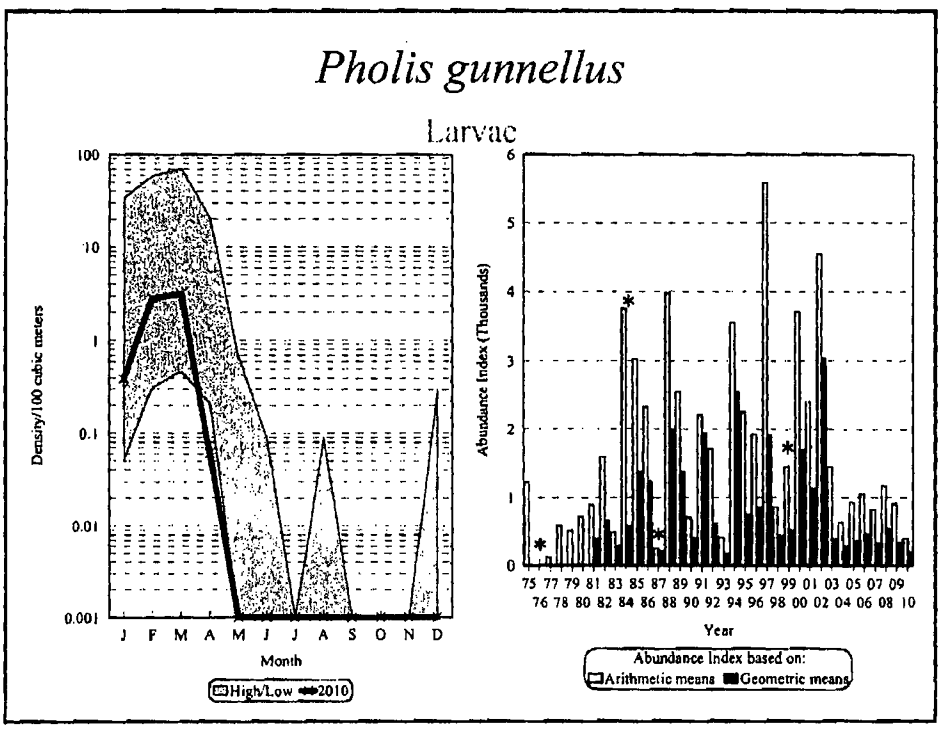

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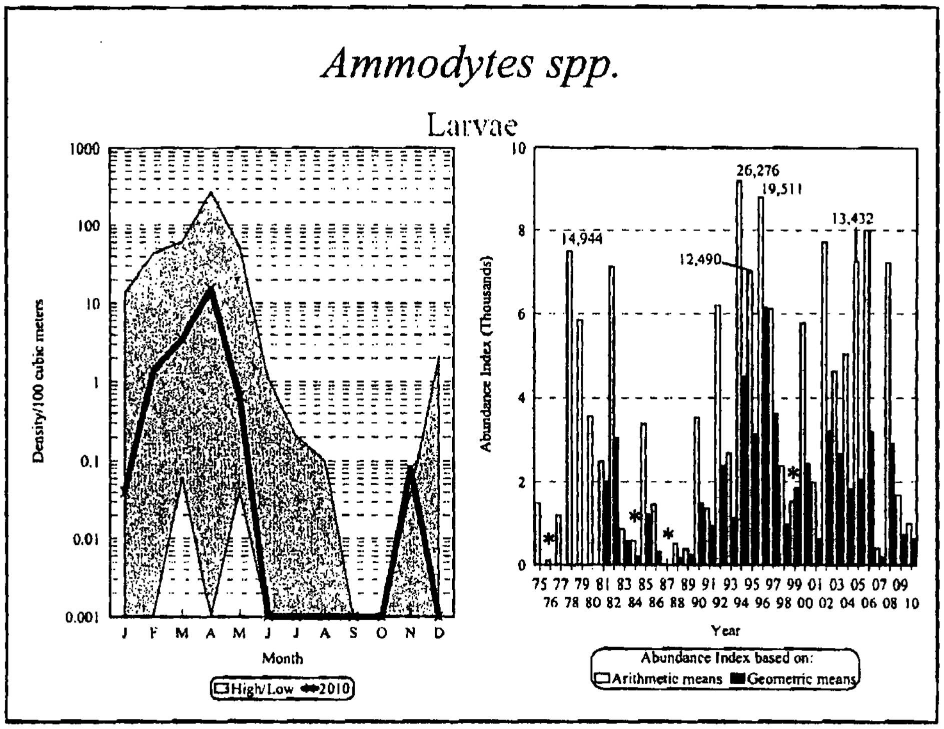

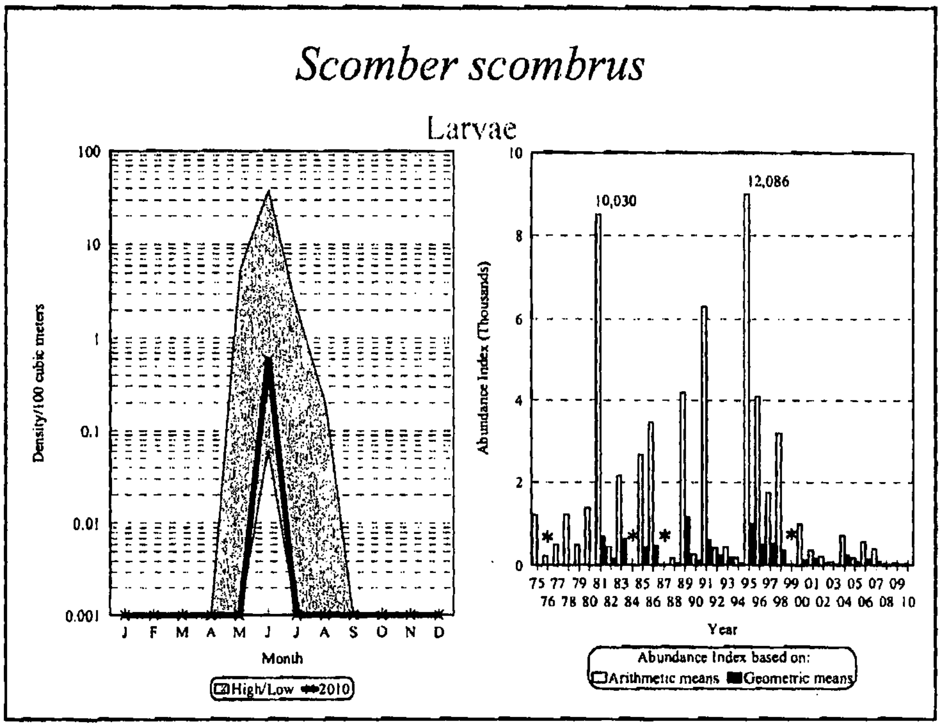

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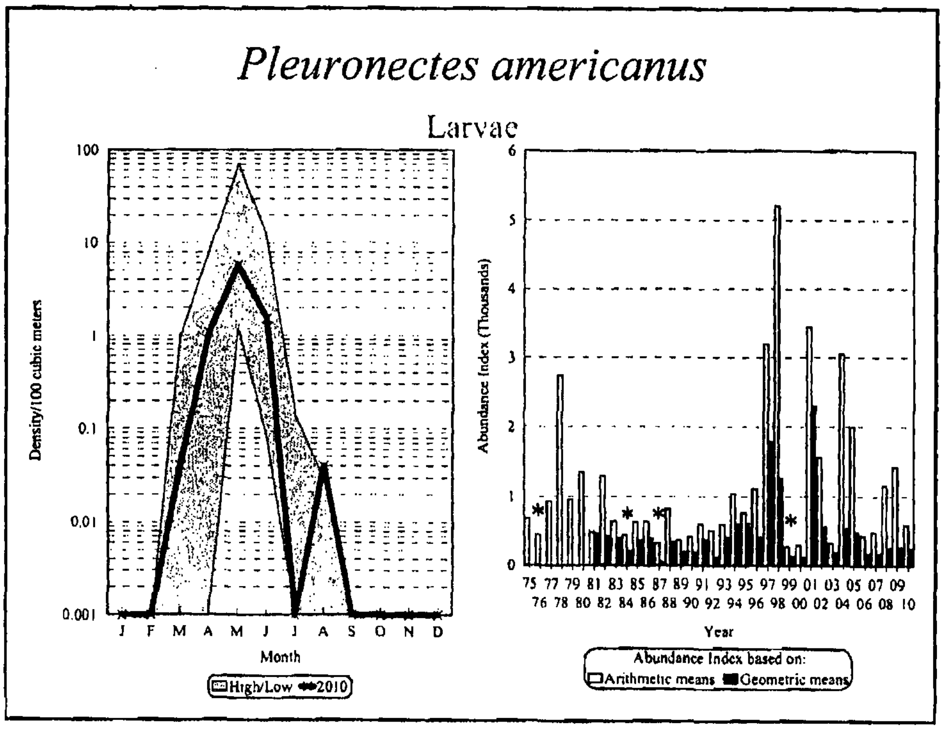

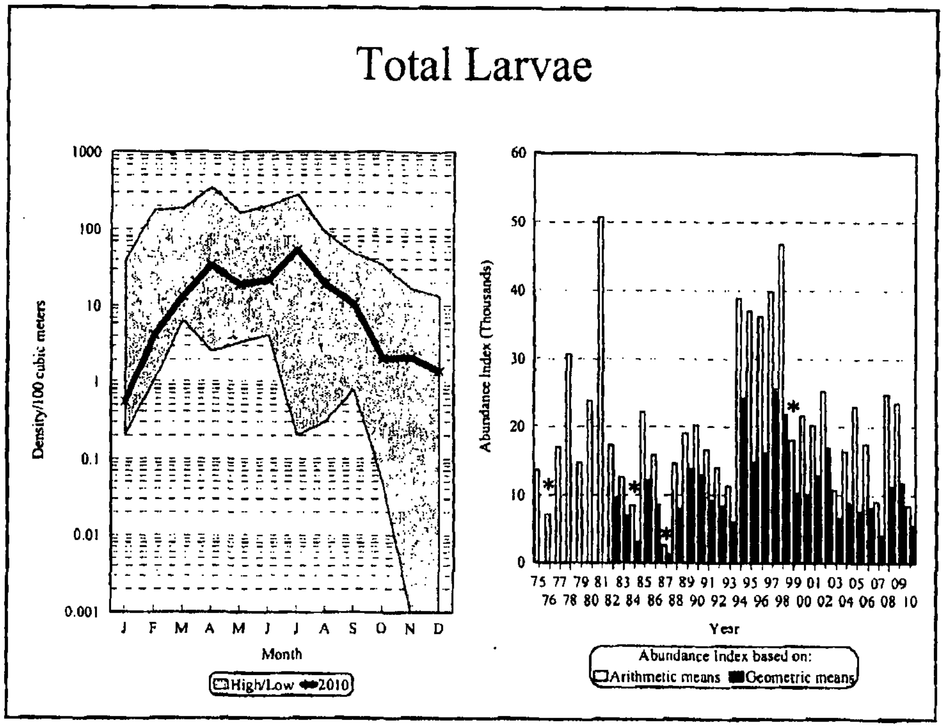

Figure 6 (continued).

Table 2. Species of fish eggs (E), larvae (L), and juveniles (J) obtained in ichthyoplankton collections from the Pilgrim Nuclear Power Station discharge canal, January-December 2010*.

Species		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2010 Species
Atlantic menhaden	*Brevoortia tyrannus*						E/L	E/L	L	E/L	E/L			E/L
Atlantic herring	*Clupea harengus*	L		L	L/J							L	L	L/J
Anchovy	*Anchoa spp.*								L	L				L/J
Bay anchovy	*A. mitchilli*						E	E						E
Fourbeard rockling	*Enchelyopus cimbrius*			E	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E	E/L
Atlantic cod	*Gadus morhua*	E	E/L	E	E/L	E	E/L		E			E	E	E/L
Haddock	*Melanogrammus aeglefinus*			E	E	E	E/L							E/L
Silver hake	*Merluccius bilinearis*					E	E/L	E/L	E/L	E/L	E/L			E/L
Atlantic tomcod	*Microgadus tomcod*								L					L
Pollock	*Pollachius virens*	L					E							E/L
Hake	*Urophycis spp.*				E	E/L	E/L	E/L	E/L	E/L	E/L			E/L
Striped cusk-eel	*Ophidion marginatum*								L					L
Goosefish	*Lophius americanus*					E	E							E
Silversides	*Menidia spp.*					L	L	L	L					L
Northern pipefish	*Syngnathus fuscus*						L	L	L	L	L			L
Searobins	*Prionotus spp.*						E	E	E	E/L				E/L
Northern searobin	*P. carolinus*									L				L
Striped searobin	*P. evolans*								L	L				L
Grubby	*Myoxocephalus aenaeus*		L	E/L	L	L				L				E/L
Longhorn sculpin	*M. octodecemspinosus*	L	L											L
Shorthorn sculpin	*M. scorpius*		L	L										L
Seasnail	*Liparis atlanticus*				L	L	L							L
Black sea bass	*Centropristis striata*						L	L	L	L	L			L
Scup	*Stenotomus chrysops*						E/L	E/L						E/L
Wrasses	*Labridae*			E	E	E	E	E	E	E	E			E
Tautog	*Tautoga onitis*					E/L	E/L	E/L	E/L	E/L	E/L			E/L
Cunner	*Tautogolabrus adspersus*						E/L	E/L	E/L	E/L	E/L			E/L
Radiated shanny	*Ulvaria subbifurcata*				L	L	L	L						L
Rock gunnel	*Pholis gunnellus*	L	L	L	L									L
Wrymouth	*Cryptacanthodes maculatus*			L										L
Sand lance	*Ammodytes sp.*	L	L	L	L/J	L/J						L		L/J
Seaboard Goby	*Gobiosoma ginsburgi*				L	E								E/L
Atlantic mackerel	*Scomber scombrus*					E	E/L	E						E/L
Butterfish	*Peprilus triacanthus*							E/L	E/L	E/L				E/L
Smallmouth flounder	*Etropus microstomus*					E	E	E	E	E/L	E/L			E/L
Windowpane	*Scophthalmus aquosus*			E	E	E/L	E/L	E/L	E/L	E/L	E/L			E/L
Summer flounder	*Paralichthys dentatus*									J	L			L/J
Fourspot flounder	*P. oblongus*						E/L	E/L	E/L	E/L	E/L			E/L
Witch Flounder	*Glyptocephalus cynoglossus*			E		E	E/L	E	E	L				E/L
American plaice	*Hippoglossoides platessoides*			E	E/L	E/L	E/L							E/L
Winter flounder	*Pseudopleuronectes americanus*			E/L	E/L	E/L	L		L					E/L
Yellowtail flounder	*Limanda ferrugineus*				E/L	E/L	E/L	E/L	E/L					E/L
Hogchoker	*Trinectes maculatus*									L				L
Number of species		6	6	14	16	20	27	20	21	19	12	4	3	**40**

*Occurrence of species in egg groups was based on spawning season and the presence of larvae in samples.

Table 3. Ichthyoplankton densities (number per 100 m^3 of water) for each sampling occasion during months when notably high densities were recorded, January -December, 2010. Densities marked by + were unusually high based on values in Table 1. Numbers in the last column indicate percent of all previous values during the month which were lower.

Atlantic Herring Larvae

March	5	0.0		
	8	0.0		
	10	0.0		
	12	1.8		
	15	0.0		
	17	6.9	+	94
	19	4.5	+	91
	22	4.1	+	90
	24	0.0		
	26	0.0		
	29	1.4		
	31	0.8		

Previous high: 30.9 (2005)
Notice level: 3.0

Seasnail Larvae

April	2	0.0		
	5	0.0		
	7	0.0		
	9	0.0		
	12	1.1		
	14	1.8		
	16	1.8		
	19	14.6	+	91
	21	0.0		
	23	19.7	+	95
	26	4.4		
	28	3.2		
	30	1.3		

Previous high: 98.1 (1974)
Notice level: 8.0

Radiated Shanny Larvae

April	2	0.0		
	5	0.0		
	7	0.0		
	9	0.0		
	12	1.1		
	14	1.8		
	16	1.8		
	19	0.0		
	21	6.8		
	23	1.3		
	26	4.4		
	28	0.7		
	30	10.3	+	95

Previous high: 83.9 (2002)
Notice level: 7.0

Winter Flounder Larvae

April	2	0.0		
	5	0.0		
	7	0.0		
	9	0.0		
	12	0.5		
	14	0.0		
	16	1.8		
	19	9.7		
	21	0.0		
	23	17.8	+	95
	26	0.0		
	28	6.5		
	30	0.0		

Previous high: 198.3 (1974)
Notice level: 12.0

Labrid Eggs

May	3	55.2		
	5	12.3		
	7	33.5		
	10	58.2		
	12	25.3		
	14	54.7		
	17	52.9		
	19	22.3		
	21	537.4		
	24	21.2		
	26	221.0		
	28	568.0		
	31	4300.9	+	97

Previous high: 34,050.0 (1974)
Notice level: 3514.0

Windowpane Eggs

May	3	7.8		
	5	28.5		
	7	48.8		
	10	14.8		
	12	4.2		
	14	47.1		
	17	0.0		
	19	7.1		
	21	94.4		
	24	458.7	+	99
	26	96.7		
	28	111.4		
	31	160.6	+	95

Previous high: 603.9 (2008)
Notice level: 147.0

Table 3. Continued.

Atlantic Menhaden Eggs

June	2	0.0		
	4	0.0		
	7	0.7		
	9	8.6		
	11	0.7		
	14	0.0		
	16	0.0		
	18	0.0		
	21	7.4		
	23	11.8		
	25	266.4	+	98
	28	13.2		
	30	124.0	+	96

Previous high: 799.7 (1998)
Notice level: 22.0

Searobin Eggs

June	2	0.0		
	4	0.0		
	7	0.0		
	9	1.3		
	11	2.0		
	14	0.0		
	16	0.0		
	18	0.0		
	21	1.9		
	23	1.1		
	25	17.0	+	99
	28	7.9	+	96
	30	13.6	+	98

Previous high: 128.0 (1987)
Notice level: 3.0

American Plaice Eggs

June	2	1.9		
	4	10.3	+	98
	7	19.9	+	99
	9	2.0		
	11	0.7		
	14	0.0		
	16	0.0		
	18	0.0		
	21	0.0		
	23	0.0		
	25	0.0		
	28	0.0		
	30	0.0		

Previous high: 35.0 (1980)
Notice level: 3.0

Hake Larvae

June	2	0.0		
	4	2.7	+	95
	7	0.0		
	9	0.0		
	11	0.0		
	14	0.0		
	16	0.0		
	18	0.0		
	21	0.0		
	23	0.0		
	25	0.0		
	28	0.0		
	30	0.0		

Previous high: 50.6 (1998)
Notice level: 1.0

Radiated Shanny Larvae

June	2	0.5		
	4	10.8	+	82
	7	7.1		
	9	1.3		
	11	5.9		
	14	1.2		
	16	1.1		
	18	1.2		
	21	0.9		
	23	0.0		
	25	1.3		
	28	19.4	+	89
	30	1.0		

Previous high: 290.6 (2004)
Notice level: 10.0

Atlantic Menhaden Eggs

July	2	11.6	+	96
	5	42.4	+	99
	7	27.0	+	98
	9	1.1		
	12	0.0		
	14	0.0		
	16	4.7	+	92
	19	0.0		
	21	0.0		
	24	0.0		
	26	0.0		
	28	0.0		
	30	0.0		

Previous high: 59.1 (1978)
Notice level: 4.0

Table 3. Continued.

Atlantic Mackerel Eggs

July	2	29.1	+	97
	5	22.4	+	96
	7	0.0		
	9	1.1		
	12	2.2		
	14	8.9		
	16	0.0		
	19	1.2		
	21	0.0		
	24	0.0		
	26	0.0		
	28	0.0		
	30	0.0		

Previous high: 119.0 (1981)
Notice level: 16.0

Atlantic Menhaden Larvae

July	2	2.9		
	5	11.2	+	86
	7	19.4	+	90
	9	3.3		
	12	2.2		
	14	6.7		
	16	2.4		
	19	1.2		
	21	2.5		
	24	0.7		
	26	0.0		
	28	3.5		
	30	3.7		

Previous high: 212.8 (2005)
Notice level: 9.3

Fourbeard Rockling Larvae

July	2	0.0		
	5	18.7	+	87
	7	0.0		
	9	0.0		
	12	0.0		
	14	5.5		
	16	2.4		
	19	0.0		
	21	0.0		
	24	0.0		
	26	0.0		
	28	1.8		
	30	1.9		

Previous high: 115.8 (1999)
Notice level: 9.0

Hake Larvae

July	2	0.0		
	5	0.0		
	7	0.0		
	9	2.2	+	88
	12	0.0		
	14	0.0		
	16	0.0		
	19	2.4	+	88
	21	0.0		
	24	0.0		
	26	0.0		
	28	0.0		
	30	4.6	+	92

Previous high: 301.8 (2009)
Notice level: 1.0

Tautog Larvae

July	2	17.5	+	94
	5	17.5	+	94
	7	22.6	+	96
	9	13.1	+	92
	12	6.6	+	83
	14	12.2	+	91
	16	4.7		
	19	2.4		
	21	8.6	+	86
	24	1.5		
	26	0.0		
	28	3.5		
	30	12.1	+	91

Previous high: 268.6 (1998)
Notice level: 5.3

Searobin Eggs

August	2	2.0		
	4	0.0		
	6	0.0		
	9	0.0		
	11	7.2	+	93
	13	4.4		
	16	2.7		
	18	3.9		
	20	26.0	+	98
	25	0.0		
	27	0.0		
	30	0.7		

Previous high: 89.2 (2005)
Notice level: 6.0

Table 3. Continued.

	Windowpane Eggs					Fourbeard Rockling Larvae			
August	2	11.7			August	2	2.6		
	4	13.2				4	5.4		
	6	4.9				6	20.8	+	95
	9	9.6				9	0.0		
	11	39.2				11	5.2		
	13	57.6				13	0.0		
	16	33.4				16	0.0		
	18	19.2				18	3.0		
	20	231.2	+	99		20	1.4		
	25	0.0				25	0.0		
	27	23.5				27	4.4		
	30	11.2				30	0.7		
	Previous high:	261.3 (2006)				Previous high:	204.6 (1983)		
	Notice level:	136.0				Notice level:	10.0		

	Silver Hake Larvae					Hake Larvae			
August	2	1.3			August	2	0.0		
	4	1.2				4	3.0		
	6	1.2				6	7.4	+	86
	9	0.0				9	1.3		
	11	1.3				11	7.2	+	86
	13	1.9				13	1.9		
	16	0.5				16	1.1		
	18	0.4				18	0.0		
	20	8.2	+	96		20	2.7		
	25	7.2	+	95		25	0.0		
	27	12.5	+	97		27	12.5	+	92
	30	0.0				30	0.7		
	Previous high:	157.3 (2009)				Previous high:	235.9 (2008)		
	Notice level:	2.0				Notice level:	4.0		

	Tautog Larvae					Cunner Larvae			
August	2	0.7			August	2	27.4	+	91
	4	5.4	+	86		4	26.4	+	90
	6	1.2				6	118.9	+	98
	9	0.6				9	9.0		
	11	3.9				11	0.0		
	13	4.4	+	84		13	5.6		
	16	0.5				16	1.1		
	18	0.0				18	0.9		
	20	4.1	+	83		20	5.5		
	25	0.0				25	3.6		
	27	2.2				27	2.2		
	30	0.0				30	0.0		
	Previous high:	89.6 (2008)				Previous high:	254.0 (1997)		
	Notice level:	4.0				Notice level:	15.0		

Table 3. Continued.

	Labrid Eggs			
September	1	4.1	+	81
	6	0.0		
	8	1.6		
	10	28.6	+	97
	13	2.6		
	15	2.2		
	17	4.1	+	81
	20	1.6		
	22	1.3		
	24	1.0		
	27	0.0		
	29	2.1		
	Previous high:		112.8 (1993)	
	Notice level:		3.0	

	Hake Larvae			
September	1	0.0		
	6	0.0		
	8	0.0		
	10	14.3	+	89
	13	3.6		
	15	0.7		
	17	1.4		
	20	1.6		
	22	1.3		
	24	0.0		
	27	4.2		
	29	0.0		
	Previous high:		327.2 (1997)	
	Notice level:		9.0	

	Tautog Larvae			
September	1	0.0		
	6	1.7		
	8	12.6	+	99
	10	22.2	+	99
	13	4.6	+	91
	15	8.7	+	96
	17	2.7	+	83
	20	1.6		
	22	9.1	+	97
	24	2.9	+	84
	27	5.3	+	93
	29	3.2	+	85
	Previous high:		32.1 (2009)	
	Notice level:		2.0	

	Cunner Larvae			
September	1	4.1	+	93
	6	0.0		
	8	1.6		
	10	0.0		
	13	0.5		
	15	0.0		
	17	0.0		
	20	0.0		
	22	0.0		
	24	0.0		
	27	0.0		
	29	0.0		
	Previous high:		42.1 (1993)	
	Notice level:		2.0	

	Windowpane Eggs			
October	8	17.1	+	95
	11	6.5	+	90
	14	0.6		
	18	0.7		
	20	0.0		
	22	0.0		
	Previous high:		40.2 (2000)	
	Notice level:		2.0	

	Atlantic Menhaden Larvae			
October	8	0.8		
	11	0.0		
	14	0.0		
	18	0.0		
	20	5.2	+	88
	22	3.3		
	Previous high:		70.3 (1997)	
	Notice level:		4.0	

	Atlantic Herring Larvae			
November	1	0.0		
	3	4.5		
	5	0.0		
	15	12.7	+	86
	17	0.0		
	19	1.3		
	Previous high:		124.8 (1995)	
	Notice level:		8.0	

	Atlantic Herring Larvae			
December	6	4.2	+	81
	8	8.3	+	86
	10	0.7		
	17	0.0		
	Previous high:		216.7 (1995)	
	Notice level:		3.0	

Table 4. Species of fish eggs (E), and larvae (L) collected in the PNPS discharge canal, 1975-2010. General periods of occurrence for eggs and larvae combined are shown along the right side; for the dominant species, periods of peak abundance are also shown in parentheses.

Species	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Anguilla rostrata	J[1]	J	J		J	J								J		J				J	J
Conger oceanicus																					
Alosa spp.		L	L	J	L						L					J					
Brevoortia tyrannus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Clupeas harengus	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Anchoa spp.	L		L	L	L		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
A. hepsetus																					
A. mitchilli			E	E	E		E	E/L			E	E			E	E	E	E	E		
Osmerus mordax	L	L	L	L	L		E/L	L	L		L	L	L	L	E/L			L	L	L	L
Brosme brosme	E/L	E/L	E/L		E/L	E/L	E	E	E												
Enchelyopus cimbrius	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Gadus morhua	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Melanogrammus aeglefinus	L	E/L	E/L	E/L	L				L		E			E		E					E
Merluccius bilinearis	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Microgadus tomcod			L	L		L	L	L	L	L	L	L	L	L	L	L		L	L	L	L
Pollachius virens	E/L	E/L	E	E/L	E/L	E/L	L			L	E/L	L	E/L	L	L	L	L	E/L	L	L	
Urophycis spp.	E/L	E/L	E/L	E/L	E	E/L	E/L	E/L	E/L	E	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Ophidion marginatum	L																				L
Lophius americanus	E/L	E	E/L	E/L	E/L	L	E/L	E/L	E/L	E/L	E/L	E	E	E	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Strongylura marina			L																		
Fundulus spp.		E	E																		
F. heteroclitus					E																
F. majalis					J													E			
Menidia spp.		L	L	L	L	E/L	E/L	E	E/L	L	L	L	L	L	L	L	L	L	L	L	L
M. menidia	E/L	E/L	E						L								E		E		
Syngnathus fuscus	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Sebastes norvegicus															L						
Prionotus spp.	E/L	E		E	E	E/L	E/L	E	E/L	E/L	E/L	E/L	E/L	E/L	E	E	E	E	E/L	E	E
Hemitripterus americanus																				L	L
Myoxocephalus spp.	L	L	L	L	L	L	L	L	E/L	L	E/L	L	L	L	E/L	L	E/L	L	L	L	L
M. aenaeus					L	L	L	L	L	L	L	L	L	L	L	L	E/L	L	L	L	L
M. octodecemspinosus						L	L	L	L	L	L	L	L	L	E/L	L	L	L	L	L	L
M. scorpius						L	L	L		L	L	L	L	L	L	L	L	L	L	L	L
Aspidophoroides monopterygius					L	L	L								L						
Cyclopterus lumpus		L	L				L	L	E		L		L	L	L	E/L		E/L	L	L	L
Liparis spp.	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L. atlanticus							L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Table 4 (continued).

Species	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
L. coheni							L	L	L	L	L	L	L	L	L	L	L	L	L	L	
Centropristis striata	L					L			L	L	L	L	L	L	L	L			L		L
Cynoscion regalis						L					L	L									
Stenotomus chrysops	L		L											L	E	L	L	L	L		L
Menticirrhus saxatilis	L				L																
Labridae	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Tautoga onitis	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Tautogolabrus adspersus	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Lumpenus lumpretaeformis	L						L			L	L	L		L	L	L				L	
Ulvaria subbifurcata	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Pholis gunnellus	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Cryptacanthodes maculatus				L	L		L	L	L	L	L	L			L	L	L	L	L	L	L
Ammodytes sp.	L	L	L	L	E/L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Gobiosoma ginsburgi	L		L					L						L						L	L
Scomber scombrus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Peprilus triacanthus	E/L	E/L	E/L	E	E	E/L	E/L	L	E/L	E/L	L		E	E/L	E/L	L	E/L		L	L	E/L
Etropus microstomus	L								L		E	E/L	E		E		E	E	E		E/L
Paralichthys dentatus	E/L								E/L		L		E/L	E		L			E/L	E	E/L
P. oblongus[3]		E/L	E/L		E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Scophthalmus aquosus[3]	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Glyptocephalus cynoglossus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Hippoglossoides platessoides	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Pleuronectes americanus	E/L	E/L	L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
P. putnami							L	E/L													L
Limanda ferrugineus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L
Trinectes maculatus			E	E			E	E				E		E	E/L	E/L	E				
Sphoeroides maculatus			L								L										
Number of Species[4]	**41**	**36**	**43**	**35**	**37**	**35**	**40**	**38**	**37**	**34**	**42**	**37**	**36**	**41**	**40**	**42**	**34**	**36**	**38**	**39**	**42**

[1] J = Juvenile

[2] Absent August and September; peaks = March-May and November-December.

[3] Although these eggs were not identified specifically, they were assumed to have occurred as shown based on the occurrence of larvae.

[4] For comparative purposes three species of Myoxocephalus were assumed for 1975-1978 and two species of Liparis for 1975-1980.

Table 4 (continued).

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Period of Occurrence
Anguilla rostrata	J	J	J		L	L	L	L		L	L	L		L		Feb - Sep
Conger oceanicus						L										Jul
Alosa spp.	L									L				L/J		May - Jul
Brevoortia tyrannus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L/J	E/L/J	E/L/J	E/L/J	E/L/J	E/L	Apr(Jun) - (Oct)Dec
Clupeas harengus	L	L	L	L	L	E/L	L	L	L	L/J	L/J	L/J	L	L/J	L/J	Jan - Dec[2]
Anchoa spp.	L	L	L	L			E/L	E	L		L	L	L/J	L/J	L	Jun - Sep
A. hepsetus											E					Jun - Sep
A. mitchilli	L		E	E/L	E/L				E	E	E	E	E	E	E	Jun - Sep
Osmerus mordax		L	L	E/L	L	E	L	L		L		L	L			Mar-Jul
Brosme brosme					E/L				E	E/L			E/L	E/L		Apr - Jul
Enchelyopus cimbrius	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	Apr(Jun) - (Sep)Dec
Gadus morhua	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L/J	E/L/J	E/L	E/L/J	E/L	Jan(Nov) - (Dec)Dec
Melanogrammus aeglefinus	E		L	E/L	E/L	E/L	E	E/L	E/L	E/L	E/L	E	E/L	E	E/L	Mar - Jul
Merluccius bilinearis	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E	E/L	E/L	E/L	E/L	E/L	E/L	May(May) - (Jun)Nov
Microgadus tomcod	L	L	L	L	L	L	L	L	L	L	L	L		L	L	Jan - Jun
Pollachius virens		E			L		E		L			L	E/L	E/L	E/L	Jan-Jun,Nov,Dec
Urophycis spp.	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	Apr(Aug) - (Sep)Nov
Ophidion marginatum		L	L	L	L						L	L	L	L	L	Aug - Sep
Lophius americanus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E	E	E		E	E/L	E/L	E	May - Oct
Strongylura marina																Jul
Fundulus spp.																Jul
F. heteroclitus																Jun
F. majalis																Oct
Menidia spp.	L		L	L	E/L	L	E/L	L	L	L	L/J	L	L	L	L	May - Sep
M. menidia					E/L											May - Sep
Syngnathus fuscus	L	L	L	L	L	L	L	L	L	L	E/L	L	L	L	L	Apr - Nov
Sebastes norvegicus						L								L		Jun(Jul)
Prionotus spp.	E	E/L	E/L	E/L	E/L	E	E/L	E/L	E	E/L	E	E/L	E/L	E/L	E/L	May(Jun) - (Aug)Sep
Hemitripterus americanus			L									L				Feb - Mar
Myoxocephalus spp.	L	L	L	L												Dec(Mar) - (Apr)Jul
M. aenaeus	L	L	L	L	L	L	L	L	L	L	L	L	L	L	E/L	Jan(Mar) - (Apr)Jul
M. octodecemspinosus	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Jan(Mar) - (Apr)May
M. scorpius	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Feb - Apr
Aspidophoroides monopterygius								L					L	L		Mar - Apr
Cyclopterus lumpus	L				L			L								Apr - Jul
Liparis spp.	L	L	L	L	L											Jan(Apr) - (Jun)Jul
L. atlanticus	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Mar(Apr) - (Jun)Jul

Table 4 (continued).

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Period of Occurrence
L. coheni		L	L	L	L	L	L	L			L					Jan(Feb) - (Mar)Apr
Centropristis striata		L	L	L	L	L	L	L	L	L	L	L	L	L	L	Jul - Oct
Cynoscion regalis							L	E/L	L					E/L		May - Sep
Stenotomus chrysops		L	L	E/L	E/L	L	L	E/L	L		E/L	E/L		E/L	E/L	Jun - Oct(Sep)
Menticirrhus saxatilis																Jul - Aug
Labridae	E	E	E	E/L	E	E/L	E	E	E	E	E	E	E	E	E	Mar(May) - (Aug)Nov
Tautoga onitis	L	L	L	L	E/L	E/L	L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	May(Jun) - (Aug)Oct
Tautogolabrus adspersus	L	L	L	L	E/L	E/L	L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	May(Jun) - (Aug)Oct
Lumpenus lumpretaeformis	L			L			L				L					Jan - Jun
Ulvaria subbifurcata	L	L	L	L	L	L	L	L	L	L	L	L	L/J	L	L	Feb(Apr) - (Jun)Oct
Pholis gunnellus	L	L	L	L	L	L	L	L	L	L	L	L	L/J	L/J	L	Jan(Feb) - (Apr)Jul
Cryptacanthodes maculatus	L	L	L				L	L	L	L	L	L		L	L	Feb - Apr
Ammodytes sp.	L	L	L	L	L	L	L	L	L	L	L	L	L/J	L/J	L/J	Jan(Mar) - (May)Dec
Gobiosoma ginsburgi				L	L	L	L	L	L		E			L	E/L	Jul - Sep
Scomber scombrus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	Apr(May) - (Jul)Sep
Peprilus triacanthus	L	L	E/L	L	E/L			E/L		E/L	E/L	E/L	E/L	E/L	E/L	May - Oct
Etropus microstomus	E/L	E/L	E/L	E/L			E/L		E	E	E	E	E/L	E/L	E/L	Jul - Oct
Paralichthys dentatus	L		L		L	E/L	E	E/L			E/L	E	L	E/L/J	L/J	May - Nov
P. oblongus[3]	E/L	E/L	E/L	L	E/L	E/L	L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	May - Oct
Scophthalmus aquosus[3]	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	Apr(May) - (Sep)Oct
Glyptocephalus cynoglossus	E/L	E/L	E/L			E/L	E	E/L	E/L	E	E/L	E/L	E/L	E/L	E/L	Mar(May) - (Jun)Nov
Hippoglossoides platessoides	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	Jan(Mar) - (Jun)Nov
Pleuronectes americanus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	Jan(Apr) - (Jun)Sep
P. putnami									L							Mar - Jun
Limanda ferrugineus	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	E/L	Feb(Apr) - (May)Nov
Trinectes maculatus				E/L			E	E/L						E/L	L	May - Sep
Sphoeroides maculatus					L											Jul - Aug
Number of Species[4]	37	37	40	38	41	37	42	43	39	38	40	42	39	45	40	

D. Entrainment and Impingement Effects - Specific

Estimated numbers of eggs and larvae entrained annually at PNPS were examined in some detail for six species of fish using the equivalent adult (EA) procedure (see Horst 1976, Goodyear 1978, Saila et al 1997, EPRI 2004, for example). Numbers impinged were also considered. This review dates back to 1980 so that, with the addition of 2010, 31 years of analyses are included. The adult equivalent methodology applies estimated survival rates to numbers of eggs and larvae entrained and numbers of fish impinged to obtain a number of adult fish which might have entered the local population had entrainment and impingement not occurred. The consequences, if any, of entrainment and impingement can then be considered if the size of the extant population is known or numbers can be compared with commercial or recreational landings.

Many assumptions are associated with the EA procedure. The fish population is assumed to be in equilibrium, therefore in her lifetime each female will replace herself plus one male. It was initially assumed that no eggs or larvae survive entrainment. In assessing potential entrainment values the assumption is also made that no density-dependent compensation occurs among non-entrained individuals, i.e. the approach assumes that non-entrained individuals do not benefit from reduced competition as a direct result of lower densities. The later two assumptions result in an overestimation of plant impacts. Additionally, survival has been demonstrated for some species of entrained fish eggs at PNPS such as the labrids (45%; MRI 1978a) and winter flounder (73%, n = 11; MRI 1982) and among larvae at other power plants (0-100% initial survival depending on species and size; Ecological Analysts 1981). LMS (2001) used induced-flow larval sampling tables to assess initial and latent survival among entrained winter flounder and other species. They determined that larval flounder mortality was high and statistically similar in both intake and discharge samples. In spite of high natural mortality they reported that survival increased with increasing larval length and decreasing through-plant temperature change.

Numbers of eggs and larvae entrained at Pilgrim Station were determined using a typical normal operation flow capacity of 461.28 million gallons per day (MGD) except when the station was out of service for refueling or other maintenance. During outage periods when one circulating seawater pump was in service sampling continued and flow prevailing at the time was used to calculate numbers entrained. Typically if both circulating seawater pumps were off entrainment sampling was discontinued as little if any entrainment occurred. In 1984 and 1987 an exception occurred since both circulating seawater pumps were shut down from April through August yet sampling continued using the salt service water system. Estimated numbers entrained for species present during those months are quite low as little entrainment was observed to occur (MRI 1994). Due to the extended outages those two years were omitted from 1980-2009 time series averages and ranges in the following six species reviews. During the more typical 1999 outage extending from May 9 to June 11 sampling was also conducted with only the salt service water pumps running with results similar to 1984 and 1987. Based on the very low numbers entrained when both seawater pumps were off entrainment sampling was not conducted during the portion of the 2001, 2003, 2005, 2007, and 2009 outage periods in which both circulating seawater pumps were shut down and entrained was assumed to be zero.

Since plankton densities are notorious for deviating from a normal distribution but do generally follow the lognormal, geometric mean densities more accurately reflect the true population mean. The geometric mean is always less than the arithmetic mean particularly for data which are skewed to the right such as plankton densities (see Figures 5 and 6). In calculating total entrainment values for the adult equivalent methodology we chose to use the larger arithmetic mean for all sampling dates proceeding April 1994 when three replicate samples were taken per sampling occasion to lend additional conservatism to the assessments. Beginning with April 1994 each individual sample density was utilized so that no averaging was necessary.

The six species selected for review were winter flounder, cunner, Atlantic mackerel, Atlantic menhaden, Atlantic herring, and Atlantic cod. Flounder were chosen because of their commercial and recreational value as well as their importance in PNPS ecology studies. Cunner were selected because they are abundant in entrainment samples and in the local nearshore area. Mackerel and menhaden were included because they are abundant among the ichthyoplankton entrained, both eggs and larvae being removed from the local population, and they are commercially and recreationally valuable. Atlantic herring and cod are not entrained in great numbers but they are valuable species in New England waters.

Winter Flounder

In 2010 an estimated total of 756,692 eggs and 10,181,766 winter flounder larvae were entrained by PNPS (Table 5). The number of larvae ranked in the middle of the range (37th percentile), 20th among the 31 totals recorded over the 1980 - 2010 time series. The average numbers entrained from 1980-2009 were 3,614,239 eggs and 21,822,298 larvae. Values ranged from 28,600 in 2002 to 32,717,500 in 1985 for eggs and 3,505,517 in 1999 to 86,850,000 in 1998 for larvae.

The annual larval entrainment estimates were converted to equivalent numbers of age 3 adults, the age at which flounder become sexually mature (Witherell and Burnett 1993, NOAA 1995). Four sets of survival values were used and the results averaged. The first set followed NEP (1978) using data from Pearcy (1962) and Saila (1976). Briefly, this consisted of dividing the total number of entrained larvae by 0.09 to estimate the number of eggs which hatched to produce that number of larvae. NEP (1978) did not specifically account for entrained winter flounder eggs. While they are demersal and adhesive, numbers of them are entrained each year. A survival rate of 0.058 for entrained winter flounder eggs was assumed based on Rose et al (1996) and assuming that the entrained eggs were 15 days from hatching. The number of newly hatched eggs derived from the number of eggs entrained was then added to the number of hatched eggs derived from the larvae entrained. The combined number of eggs was then multiplied in succession by 0.004536, an estimate of survival from a newly hatched egg to day 26; 0.2995, survival from day 27 to metamorphosis; 0.03546, survival of juveniles from 3 to 12 months; 0.3491, survival from 13 to 24 months; and finally 0.33, survival from 24 to 36 months.

The second approach followed larval stage-specific survival rates (S) derived from Niantic River data (Crecco and Howell 1990) as modified by Gibson (1993). These are as follows:

S (stage 1) = 0.236	S (age 0) = 0.0730
S (stage 2) = 0.108	S (age 1) = 0.250
S (stage 3) = 0.154	S (age 2) = 0.477
S (stage 4) = 0.623	

A survival rate of 0.058 was assumed for winter flounder eggs as indicated for the unstaged approach. All fish eggs or larvae are not entrained at the same point or age in a given life stage and it is assumed that the further along in development the greater the probability that an individual will survive to the next life stage. To account for this, the survival values for each life stage entrained were adjusted based on EPRI (2004). The adjusted survival value was applied only to the stage being entrained, not to subsequent stages as numbers were calculated to equivalent adults. The adjusted survival values were as follows:

Adjusted Eggs = 0.1096	
Adjusted S (stage 1) = 0.3819	Adjusted S (stage 3) = 0.2669
Adjusted S (stage 2) = 0.1949	Adjusted S (stage 4) = 0.7677

In using the stage-specific rates it is recognized that Dominion employs different morphological stage criteria than those used at PNPS (Dominion 2008). However a comparison of samples from both studies showed stages to be quite comparable until larvae approach metamorphosis, a size not often collected because these individuals begin to assume a benthic life style.

The third set of survival values obtained from PG&E (2001) was as follows:

Eggs = 0.75	
S (stage 1) = 0.1286	S (age 0) = 0.0927
S (stage 2) = 0.0328	S (age 1) = 0.3291
S (stage 3) = 0.0296	S (age 2) = 0.3654
S (stage 4) = 0.8377	

As above, survival values were adjusted based on EPRI (2004) and applied only to the stage being entrained. The values used were as follows:

Adjusted Eggs = 0.8571	
Adjusted S (stage 1) = 0.2279	Adjusted S (stage 3) = 0.0575
Adjusted S (stage 2) = 0.0635	Adjusted S (stage 4) = 0.9117

The fourth set of survival values obtained from EPA (2004), which were based on PG & E (2001), was as follows:

Eggs = 0.75	
S (stage 1) = 0.1287	S (age 0) = 0.0926
S (stage 2) = 0.0327	S (age 1) = 0.3307
S (stage 3) = 0.0296	S (age 2) = 0.3657
S (stage 4) = 0.8378	

As above, an adjustment was made to each survival value based on EPRI (2004) to account for the fact that entrained eggs and larvae are of mixed ages. The values used were as follows:

Adjusted Eggs = 0.8570	
Adjusted S (stage 1) = 0.2281	Adjusted S (stage 3) = 0.0575
Adjusted S (stage 2) = 0.0634	Adjusted S (stage 4) = 0.9117

Prior to calculating EA values numbers of eggs collected from 1980 - 1994 when 0.333-mm mesh was used on all sampling occasions were scaled upward by 1.24 to correct for mesh extrusion. While no direct mesh extrusion information is available for winter flounder eggs in the PNPS discharge stream, the value for similar sized cunner eggs was used. Numbers of stage 1 and 2 larvae collected prior to 1995 were likewise scaled upward by 1.62 to adjust for mesh extrusion (MRI 1995).

Numbers of age 3 fish were converted to weight based on 0.49 pounds per fish for the first three survival values. This was derived from the length-weight equation presented in NEFSC (1998) using mean length at age 3 for males (262 mm TL) and females (267 mm TL). Mean length at age was obtained using the gender specific, north of Cape Cod growth equations provided by Witherell and Burnett (1993). These relationships gave mean weights of 0.47 and 0.50 pounds for males and females, respectively; these were averaged. For the fourth set of survival values the number of age 3 fish were converted to weight based on 0.997 pounds per fish following EPA (2004).

The mean EA value for 2010 was 6,293 age 3 fish weighing 3,931 pounds. Comparable values for 1980 - 2009 ranged from 726 in 1999 to 72,476 in 1998 with an overall mean of 13,629 fish weighing 8,432 pounds (Figure 7, Table 5).

Winter flounder larvae have been shown to survive entrainment (MRI 1982, Ecological Analysts 1981, PG&E 2001). To account for this survival winter flounder eggs and larvae were adjusted based on the following: winter flounder eggs and stage 1 and stage 2 larvae were assumed to have zero entrainment survival, stage 3 larvae were assumed to have 48.9% survival, and stage 4 larvae were assumed to have 49.4% survival (PG&E 2001). Only the three life stage methods were used when calculating EA with entrainment survival since survival was specific to life stage. When entrainment survival was considered the mean EA value for 2010 declined to 4,292 age 3 adults weighing 2,683 pounds. The 1980 – 2009 time series mean also declined to 9,206 age 3 adults weighing 5,698 pounds (Figure 8, Table 6).

In addition to those entrained, small numbers of winter flounder were impinged on the intake screens each year (Table 7; also See Impingement Monitoring Section 3.3). Annual totals ranged from 232 in 1983 to 2,688 in 2005 and averaged 1,038 fish over the time series. The 2010 estimated total was below the average at 1,005. Based on annual mean length data, most impinged fish were young-of-the-year. Assuming all fish would have completed their first year, the average age 1 and age 2 survival rates from the first three entrainment EA procedures were applied. For the fourth method relying on EPA data, the ages of impinged fish were determined by length frequency distributions. The percent composition was multiplied by the total estimated number of fish impinged each month to partition the monthly total into age classes. The instantaneous mortality rate for juvenile winter flounder was obtained from EPA (2004) and adjusted to account for the higher probability that fish impinged later in any given year are more likely to survive to their first birthday. Mortality rate adjustments were made for each month that juvenile fish were impinged. This was done by dividing the EPA stage-specific instantaneous mortality rate by the respective stage duration in days to obtain a daily instantaneous rate. This daily instantaneous rate was multiplied by the number of days remaining until each fish's first birthday to derive the mortality rate expected to the end of year 1. That mortality rate was converted to the corresponding survival rate (1 – mortality rate) and multiplied by the number of age 0 fish impinged during each respective month. The monthly totals were then combined to obtain an estimated annual total number of equivalent age 1 fish. All impinged fish older than age 1 were conservatively assumed to survive to their next birthday. Annual survival values obtained from EPA (2004) were used to convert age 1 fish to age 3 fish.

Impinged winter flounder would be equivalent to an annual average of 117 age 3 adults (range = 26 to 261, 1980-2009) weighing 74 pounds (range = 17 to 152 pounds). The 2010 estimate amounted to 71 pounds, below the average. Some winter flounder typically survive impingement, particularly under continuous screen wash operation (see for example MRI 1982, 1984, 1997). To account for this survival the numbers of flounder impinged were adjusted assuming a 23.1% survival rate attributable to the fish return sluiceway and the low pressure spraywash (MRI 1984). When impingement survival was considered the annual average number of fish lost to impingement declined to 799 (range = 181 to 2,070) over the 1980 – 2009 time series. The 2010 estimated number of flounder lost to impingement was 788, which would be equivalent to 88 age 3 adults weighing 57 pounds. The 2010 EA value was below the time series average of 93 age 3 adults weighing 60 pounds (Figure 8, Table 8).

Winter flounder were commercially landed from NOAA statistical area 514 which covers Cape Cod Bay and Massachusetts Bay over the 1982 through 2009 period at an annual average of 992,793 pounds (s.e. = 202,551 pounds). The estimated average of 8,316 pounds of equivalent age 3 adults due to PNPS entrainment and impingement over the same time frame

(Tables 5 and 7) represents less than 0.9% of those landings. Area 514 commercial landings declined sharply after 1993 from 1,057,211 pounds that year to 16,788 pounds in 1995, 1,798 pounds in 1997, and only 221 pounds in 1999. Catch rebounded in 2000 to 40,000 pounds but dropped again each of the next three years to 4,742 pounds in 2003. Landings increased to 956,886 pounds in 2004 but decline to 286,927 pounds in 2007[3]. Area 514 commercial landings were 309,632 pounds in 2010 (David Sutherland, NOAA, personal communication).

Since the declines in the Gulf of Maine winter flounder stock occurred in the 1990's and revised management practices have evolved to reduce fishing mortality rates and hence landings, comparing equivalent adult values with landing data has been less realistic as an impact assessment screening tool. Also since survival rates used in the equivalent adult impact analysis were derived when winter flounder were far more abundant they are likely optimistic and result in considerable overestimates of equivalent adult values today.

Winter flounder also have considerable value as a recreational species. Based on NOAA records[4] an annual average of 1,253,187 fish weighing an average of about one pound each were landed from Massachusetts inland waters and within 3 miles of shore over the 1981-2009 time period. Over the course of the past two decades or so (1991-2009) recreational landings were well below 1980's levels due to stock declines and catch limits consistent with commercial landings; an annual average of 123,023 fish were reported landed in the state from inland waters and within 3 miles of shore over the fourteen-year period since 1996. Over the last five years these landings have averaged only 114,824 fish. Unfortunately, recreational landings are compiled by state within distance from shore areas (inland, <3 miles from shore, > 3 miles from shore) and the number of fish taken from a more appropriate area such as Cape Cod Bay are not available. Arbitrarily adding 20,000 pounds of recreationally-caught flounder to the depressed 1994-2009 Area 514 commercial landings would bring the respective totals for those sixteen years to an average of 221,914 pounds (s.e. = 67,622). The average PNPS EA entrainment and impingement values based on the four parameter sets for the same years (12,216 pounds) would amount to 6%. Clearly the decline in commercial landings after 1994 suggests that those values,

[3] Beginning in 2004 the landings data have been entered by dealers and in the majority of the entries the statistical area field has been null (000). Landings data from vessel trip reports have been used when available.

[4] Recreational landings data were obtained via the internet at http://remora.ssp.nmfs.gov/mrfss.

even when combined with the recreational landings, may no longer be a realistic comparison to equivalent adult values.

Stock assessment data available from the Massachusetts Division of Marine Fisheries for north of Cape Cod suggest that flounder abundance has varied without trend since 1978 with peaks in 1979, 1983, and 2000 (34 kg per tow). Similarly National Marine Fisheries Service stock assessment data vary without trend with peaks in 1981, 1983, 2000, and 2002 (Figure 9 and 10). If entrainment and impingement at PNPS were having an adverse environmental impact on winter flounder these fishery independent surveys would be expected to decline over time.

Massachusetts Division of Marine Fisheries (DMF) personnel made estimates of the number of adult winter flounder (>280 mm TL - age 3+) in a 267 km^2 (106 square mile) area in the vicinity of PNPS using the area swept by a commercial trawl each year from 1997-1999 (Lawton et al. 2000). Marine Research, Inc./Normandeau Associates, Inc. completed comparable Area Swept surveys from 2000 through 2010 (see Section 3.1 of this volume). While reliable estimates of local population size are difficult to make, they can provide more realistic numbers with which to compare EA values relative to commercial and recreational landings which are difficult if not impossible to pinpoint to the actual study area. Landings data typically represent numbers caught over a very large area or as displayed by the most recent commercial landings can be subject to stock management catch restrictions, changes in fishing effort, and data handling which make them less useful.

The Normandeau area swept estimate for 2010 equaled 255,008 adult flounder based on gear efficiency of 50% with confidence limits ranging from 250,574 to 259,442 fish. The area covered by the spring trawl survey was based on a simplistic hydrodynamic model used to predict spatial estimates of the origin of winter flounder larvae that are subject to entrainment at PNPS. Modeling work completed by the U.S. Geological Survey showed that the majority of particles released into the water column off Boston Harbor would be transported through Cape Cod Bay within a 15-day period. Considering that larval winter flounder can drift for 30 to 60 days depending on prevailing water temperature the size of the area-swept survey is likely very conservative. Regardless, the size of the area was not intended to represent the entire population potentially affected by PNPS. For example, the National Marine Fisheries Service manages the winter flounder resource as three stocks – Southern New England-Mid-Atlantic Bight, Georges Bank, and the Gulf of Maine. Although winter flounder appear to form localized spawning aggregations (Lobell 1939, Saila 1961, Grove 1982) they also move inshore and offshore during the course of the year and mixing occurs then (Perlmutter 1947, Howe and Coates 1975, Hanson and Courtenay 1996).

Comparing the average number of age 3 equivalent adults attributable to entrainment and impingement estimated for 1997 through 2007 with the corresponding area-swept estimates lagged by three years provided the percentages shown below. The average over the 1997-2007 time period was 11.0% and the current 2010 estimated number of equivalent adults of 6,405 amounts to 2.5% of the 2010 area swept estimate.

Since assuming that the spring trawl survey reflects all fish potentially influenced by PNPS is likely an over estimate, the area swept estimates were expanded to reflect all of Cape Cod Bay. The trawl surveys covered approximately 267 km^2 or 16.7% of the area of Cape Cod Bay (1600 km^2, Emberton 1981). It is important to note that the area of Cape Cod Bay amounts to only 1.7% of the area of the Gulf of Maine which represents the stock management unit. Based on Cape Cod Bay's area the average number of equivalent adults over the 1997-2007 time period represented less than 2.0% of the expected population and the current 2010 estimated number of equivalent adults of 6,405 amounts to 0.4% of the 2010 area swept Cape Cod Bay estimate.

Numbers of age 3 equivalent adult winter flounder estimated for entrainment and impingement at PNPS assuming 100% mortality compared with area-swept estimates for nearshore waters and all of Cape Cod Bay three years later.

Equivalent Age 3 Adults (Number of Fish) Entrainment and Impingement		Area-Swept Estimate 3 Years Later	Cape Cod Bay Estimate 3 Years Later	Percent Of Area-Swept Estimate	Percent Of Cape Cod Bay Estimate
1997	41,970	464,176	2,785,056	9.0	1.5
1998	72,710	400,812	2,404,872	18.1	3.0
1999	835	476,263	2,857,578	0.2	0.03
2000	3,629	262,604	1,575,624	1.4	0.2
2001	26,869	157,532	945,192	17.1	2.8
2002	18,557	126,117	756,702	14.7	2.4
2003	3,205	112,480	674,880	2.9	0.5
2004	46,801	184,432	1,106,592	25.4	4.2
2005	42,951	166,496	998,976	25.8	4.3
2006	7,605	172,404	1,034,424	4.4	0.7
2007	4,401	255,008	1,530,048	1.7	0.3
Mean	24,503	252,575	1,515,449	11.0	1.8

Recognizing that some entrained winter flounder larvae do survive, particularly the older more valuable individuals, and that many impinged winter flounder also survive, the following table reflects those adjustments. Entrainment survival was accounted for as described above. An impingement survival rate of 23.1% was based on studies completed after installation of low pressure sprays and the fish return sluiceway (MRI 1984).

Numbers of age 3 equivalent adult winter flounder estimated for entrainment and impingement compared with area-swept estimates for nearshore waters and all of Cape Cod Bay three years later. Numbers entrained and impinged were corrected for entrainment and impingement survival

Equivalent Age 3 Adults (Number of Fish) Entrainment and Impingement		Area-Swept Estimate 3 Years Later	Cape Cod Bay Estimate 3 Years Later	Percent Of Area-Swept Estimate	Percent Of Cape Cod Bay Estimate
1997	28,251	464,176	2,785,056	6.10	1.00
1998	49,110	400,812	2,404,872	12.30	2.00
1999	573	476,263	2,857,578	0.10	0.02
2000	2,450	262,604	1,575,624	0.90	0.20
2001	18,190	157,532	945,192	11.60	1.90
2002	12,593	126,117	756,702	10.00	1.70
2003	2,161	112,480	674,880	1.90	0.30
2004	31,502	184,432	1,106,592	17.10	2.80
2005	29,041	166,496	998,976	17.40	2.90
2006	5,132	172,404	1,034,424	2.98	0.50
2007	3,037	255,008	1,530,048	1.19	0.20
Mean	16,549	252,575	1,515,449	7.42	1.23

The average over this period of time after adjusting for survival was 7.4% using only the area-swept estimate, 1.2% based on Cape Cod Bay and the current 2010 estimated number of equivalent adults of 4,380 fish amounted to 1.7% of the current area-swept estimate.

The latest Groundfish Assessment Review Meeting (NEFSC 2008) concluded that the Gulf of Maine stock assessment is currently uncertain. The stock is "likely in an overfished condition and overfishing is probably occurring". In spite of the uncertainty spring abundance indices for the Gulf of Maine developed by NOAA's Northeast Fisheries Science Center (NEFSC) and the MDMF spring resource assessment for the northern winter flounder stock do not display a downward trend that would suggest an adverse environmental impact is occurring.

Cunner

As described above, cunner eggs are consistently among the most abundant fish eggs in PNPS entrainment samples and in the waters surrounding the Station (Scherer 1984). The breakwaters protecting the intake and discharge in particular provide considerable habitat for cunner, a temperate reef fish (Nitschke et al. 2002). Total numbers entrained ranged from

580,955,000 in 2002 to 6,576,000,000 in 1981 with a time series mean of 2,291,526,600 through 2009. For cunner larvae annual totals ranged from 2,792,000 in 1992 to 576,300,000 in 1981 with a time series average of 70,552,000. Totals for 2010 were 2,555,971,000 eggs and 37,470,000 larvae. The number of eggs was above the 1980-2009 average while larvae numbers were below the average (Table 9). The egg total ranked 12th overall and was in the 63th percentile. Larvae ranked 15th overall, in the 53rd percentile and 53% of the times series mean.

Two methods were used to estimate equivalent adult values for cunner. The first method followed Goodyear (1978) by converting numbers of eggs and larvae to numbers of fish at age of sexual maturity which occurs for approximately half the population at age 1 (P. Nitschke, University of Massachusetts, Amherst, personal communication). Assuming all labrid eggs were cunner eggs in PNPS entrainment samples (Scherer 1984), cunner larva/egg ratios were determined from PNPS samples to provide an estimate of survival from spawned egg to entrained larva. Mesh correction values were first applied to both eggs and larvae. Presented in MRI (1998) these were 1.24 for eggs taken from 1980-1995, 1.14 for eggs taken in 1995, and 1.10 for eggs taken in 1997. The mean of 1995 and 1997 values was used for 1998 through 2010 except in early-season cases where cunner eggs occurred in 0.202-mm mesh samples. Larval cunner mesh values applied were 1.16 for stage 1 and 1.28 for stage 2, irrespective of year. From 1980 to 2010 the larva/egg ratio ranged from 0.001284 to 0.128812 and averaged 0.027885; 1984, 1987, and 1999 were excluded because of extended circulating seawater pump shutdown during the cunner spawning season. Average lifetime fecundity was calculated from fish collected in the PNPS area by Nitschke (1997) and Nitschke et al. (2001a, b). He provided numbers of eggs produced at age in the second order form:

$$\text{Log } F = [2.891 \log A] - [1.355 \log A^2] + 3.149 \text{ where}$$

F = fecundity at age A

Age-specific instantaneous mortality necessary for calculation of average lifetime fecundity was calculated from fish trap collections made from 1992 - 1997 (Brian Kelly, Massachusetts Division of Marine Fisheries, personal communication, MRI 1998). Average instantaneous mortality rates for the PNPS area collections from 1992 through 1997 using this approach were as follows:

Age 3 = 0.286	Age 7 = 0.653
Age 4 = 0.342	Age 8 = 1.463

Age 5 = 0.645 Age 9 = 0.728
Age 6 = 1.260

Utilizing data from Serchuk and Cole (1974) for age 1 through 5 cunner collected with assorted gear, a survival rate of S = 0.605 was obtained (Z = 0.5025) which appears comparable to the PNPS values. Age 1 and 2 fish appeared less abundant in the PNPS collections than age 3 fish (MRI 1998), suggesting they were not fully recruited to the trap collections, perhaps due to their small size or behavior. Fish older than age 10 were rarely taken both because they are uncommon and because they can exceed the maximum size susceptible to the fish traps. In the absence of additional information an overall mean value of Z = 0.831 was substituted for age 2 and age 10.

Based on the PNPS area fecundity study (Nitschke 1997, Nitschke et al. 2001), 50% of age 1 females were assumed to be mature; complete recruitment was assumed by age 2. Following Goodyear (1978), an average lifetime fecundity of 17,226 eggs per female at age 1 was calculated. Utilizing the survival estimate for eggs to larvae assuming most eggs were recently spawned and average lifetime fecundity, a survival estimate for larvae to adult of 4.116E-3 was obtained. Numbers of eggs were converted to larvae based on the larva/egg ratio and then numbers of larvae were converted to adults.

The second method to estimate cunner equivalent adult values relied on early life stage survival rates obtained from EPA (2004). These were S = 0.031 for eggs, S = 0.055 for larvae, and S = 0.055 for juveniles. The survival values for each entrained life stage were adjusted following EPRI (2004) to account for the fact that entrained eggs and larvae are of mixed ages. The resulting values were: adjusted S = 0.0592 for eggs and adjusted S = 0.1043 for larvae.

An estimated 562,953 cunner were potentially lost to entrainment effects in 2010. The 1980 – 2009 average was 687,677 ranging from 134,565 in 2003 to 3,810,945 in 1981 (Figure 11, Table 9). The high value recorded in 1981, attributable to high egg and exceptionally high larval densities skewed the mean EA value. As mentioned for winter flounder, estimates made in 1984 and to a lesser extent those made in 1987 and 1999 were low due to reduced flow during outage periods.

Cunner eggs were assumed to have an entrainment survival rate of 90% based on data collected during the entrainment survival study conducted at PNPS in 2007 (NAI unpublished data). Cunner larvae were assumed to have 100% entrainment survival at discharge temperatures between 25 and 30°C and 48% entrainment survival at discharge temperatures between 30 and 35°C (EPRI 2000). When entrainment survival was accounted for the number of age 1 adults potentially lost to entrainment in 2010 decreased to 128,357 fish (6,582 pounds). The 2010 value was lower than the 1980 – 2009 average of 150,213 fish (range = 12,613 to 888,528; Figure 12, Table 10).

In addition to numbers of eggs and larvae entrained, cunner were impinged on the PNPS intake screens (See Impingement Monitoring Section 3.3). Annual estimated totals ranged from 28 in 1992 to 1,043 in 1980 with a time series average of 300 fish. A total of 535 fish were impinged in 2010 the seventh highest value overall. The number of equivalent adult cunner potentially lost to impingement was calculated by two methods. The first method made no equivalent adult adjustment to the number impinged since cunner mature as early as age 1. The second method estimated the age of the impinged cunner by annual length frequency distributions. The percent composition for each 10-mm length class was multiplied by the total estimated number of fish impinged each month to partition each monthly total into age classes. The instantaneous mortality rate for the cunner age classes were obtained from EPA (2004) and were adjusted as above in winter flounder to account for the higher probability that fish impinged later in any given year are more likely to survive to their first birthday. Mortality rate adjustments were made for each month that juvenile fish were impinged. The mortality rate was converted to the corresponding survival rate and multiplied by the number of age 0 fish impinged during each respective month. The monthly totals were then combined to obtain an estimated annual total number of equivalent age 1 fish. All impinged fish older than age 1 were considered adults. These methods produced 442 equivalent adult cunner in 2010 which is above the 1980-2009 mean of 266 fish (range = 25 to 708; Table 11). Cunner often survive being impinged at PNPS (MRI 1984). Cunner impingement survival, attributable to the fish return sluiceway and the low pressure spraywash system, was assumed to be 10.7% (MRI 1984). When impingement survival is considered the number of equivalent adult cunner potentially lost in 2010 declined to 393 fish (29 pounds) and the time series average to 226 (17 pounds; Figure 12, Table 12).

Cunner have no commercial value and little recreational importance (although many may be taken unintentionally by shore fishermen) so that current landing records are not available. To shed some light on their abundance in the PNPS area, calculations were performed to estimate the number of adult cunner which would be necessary to produce the number of eggs found there. The PNPS area was defined by Cape Cod Bay sampling stations 2,3,4,7,8 (MRI 1978b), the half-tide volume of which was estimated by planimetry from NOAA chart 1208 at 22,541,000 100 m^3 units. Labrid egg densities were obtained at those stations on a weekly basis in 1975 and they were integrated over time (April-December) using the mean density of the five stations. The integrated values were multiplied by 1.40 to account for extrusion through the 0.505-mm mesh used in that survey (MRI unpublished data), then by the sector volume. Based on the 0.333/0.202-mm mesh data collected from the PNPS discharge stream from 1994 through 1997, additional upward scaling might be appropriate; however specific data for towed samples with 0.202-mm mesh are not available and an estimated value was not applied. Omitting this step likely led to an underestimate of the number of eggs produced and therefore to an underestimate of the number of adults spawning in the area. The resulting value was divided by 2.2, the estimated incubation time in days for cunner eggs (Johansen 1925), then divided by 17,226 the average life time fecundity value described. Lastly the resulting value was multiplied by 2 assuming an even sex ratio. These calculations resulted in an estimated production of 6.899E12 eggs by an estimated 364,090,000 adult fish. The potential loss of 563,394 adults in 2010 due to PNPS operation represents 0.2% of the estimated spawning stock. The annual mean of 687,943 fish attributable to entrainment and impingement, including all years, represents 0.2% of the stock estimate.

In earlier studies MDMF personnel chose cunner as an indicator species for PNPS impact investigations. Tagging studies were conducted during the 1994 and 1995 seasons to estimate the size of the cunner population in the immediate PNPS area. Minimum tagging size and therefore the minimum size fish enumerated was 90 mm TL. Estimates were highly localized since individual cunner have a very small home range measured on the order of 100 m^2 or less (Pottle and Green 1979). Very young cunner may spend their first year within a single square meter (Tupper and Boutilier 1995, 1997). Estimated population size for the outer breakwater and intake areas combined were 7,408 and 9,300 for the two respective years. Combining upper 95% confidence limits for breakwater and intake produced totals of 10,037 and 11,696 fish, respectively. Since the upper confidence limit total is only 0.003% of the egg based population estimate, it is clear that eggs must arrive at PNPS from areas beyond the immediate vicinity of the Station. A hydrodynamic modeling study completed by Eric Adams of MIT predicted that 90% of the cunner eggs and larvae entrained at PNPS come from within about 5.5 miles of PNPS to the north down to White Horse Beach, about one mile to the south of PNPS. This area extends further to the north than the area 2, 3, 4, 7, 8 used in the above egg estimates and would presumably provide an even greater adult population estimate. The number of eggs entrained indicated that cunner must be very abundant in these waters.

Atlantic Mackerel

Numbers of mackerel eggs entrained at PNPS ranged from 6,182,000 in 1999 to 4,674,000,000 in 1989 with an average of 767,204,000. Totals for larval mackerel ranged from 311,000 in 1999 to 320,135,600 in 1981 with an average of 38,197,000. Corresponding values for 2010 were 72,370,028 for eggs and 779,129 for larvae (Table 13). The current egg total ranked 26th in the 11th percentile and the larval total ranked 27th in the 7th percentile. Values amounted to 9 and 2% of the respective time series means.

Two methods were used to determine equivalent adult Atlantic mackerel. The first method followed the procedures outlined by Vaughan and Saila (1976) to derive a survival rate for spawned mackerel eggs to age 1 fish. This procedure utilizes the Leslie matrix algorithm to estimate early survival from proportion mature, fecundity, and survival within each age class assuming a stable population. Fecundity for Atlantic mackerel was obtained from Griswold and Silverman (1992) and Neja (1992). Age-specific instantaneous natural mortality ($M = 0.20$) was obtained from Overholtz (2000a) and NOAA (1995). A low fishing mortality rate of $F = 0.02$ was used consistent with the current low exploitation rate (NEFSC 2000). A maximum age of 14 and maturity schedules were obtained from NEFSC (1996). Since two fecundity profiles provide two egg to age 1 survival values: 2.2820E-6 for Griswold and Silverman, 2.1692E-6 for Neja, the values were averaged (2.22559E-6).

To account for the fact that all eggs entrained were not recently spawned and the Vaughan and Saila estimate begins at time of spawning an estimate of daily mortality was derived from Pepin (1991). Based on an average late-spring summer water temperature of 15 C daily mortality was estimated to be $M_e = 0.074$. At 15 C mackerel eggs require approximately 4 days to hatch assuming an average diameter of 1.15 mm (Colton and Marak 1969, Pepin 1991). Entrained eggs were therefore assumed to average one day old with a corresponding mortality rate of $M = 0.446$ (survival rate $S = 0.640$). The number of entrained eggs was therefore divided by 0.640 to estimate the equivalent number of newly spawned eggs entrained.

To back calculate from entrained larvae to spawned eggs so the spawned egg to age 1 survival rate could be applied the observed average ratio of eggs to larvae for PNPS of 0.0712 (1980-2009) was used. In calculating the average larva/egg ratio 1981, 1984, 1987, and 1999 were omitted, 1981 because larvae were more abundant then eggs, 1984, 1987, and 1999 because both circulating seawater pumps were off for all or an important portion of the mackerel egg and larval seasons during maintenance outages. A mesh adjustment factor of 1.12 was applied to the egg data obtained with 0.333-mm mesh nets based on mesh comparison collections completed from 1994 through 1997 (MRI 1998). No mesh adjustment was justified for larvae. Numbers of entrained larvae were divided by 0.0712 then by the age adjustment factor of 0.640 and the back calculated total was then added to the age-adjusted egg total. The age 0 survival rate of 2.2256E-6 was then applied to the combined egg total to derive the number of age 1 fish.

According to NOAA (1995, 1998) and Overholtz (2000a) stock biomass consists of fish age 1 and older while fish completely recruit to the spawning stock by age 3. Therefore, juvenile and adult equivalent values are shown for both respective age groups (Figure 13, Table 13). Age 3 individuals were estimated using an instantaneous mortality rate of M = 0.52 for age 1 fish and M = 0.37 for age 2 fish (Overholtz et al. 1988). These values provided annual survival rates of S = 0.595 and 0.691, respectively. Numbers of age 1 and 3 mackerel were expressed on a weight basis using 0.2 and 0.7 pounds per fish, respectively (Clayton et al. 1978).

The second method to estimate Atlantic mackerel equivalent adult values followed the life stage method. The survival values obtained from EPA (2004) were S = 0.092 for eggs, S = 0.005 for larvae, and S = 0.005 for juveniles, S = 0.595 for age 1, and S = 0.538 for age 2. The survival values were adjusted following EPRI (2004) to account for the mixed ages of entrained eggs and larvae. The resulting values were: adjusted S = 0.1679 for eggs and adjusted S = 0.0099 for larvae. The adjusted survival values were applied only to the stage being entrained, not to subsequent stages as numbers were calculated to equivalent adults.

PNPS equivalent age 1 juvenile mackerel lost to entrainment for 2010 amounted to 316 age 1 fish weighing 82 pounds or 114 age 3 fish weighing 95 pounds. Corresponding age 1 values over the 1980 through 2009 time series ranged from 39 (1999) to 21,128 (1989) fish with an average of 4,818. Age 3 values ranged from 14 to 7,646 with an annual average of 1,748 individuals. Converting numbers of fish to weight resulted in an estimated average annual value through 2009 of 1,242 pounds or 1,174 pounds, respectively. Due to the insufficient species and life stage specific data on upper lethal temperatures and exposure limits for Atlantic mackerel, all eggs and larvae were assumed to die following entrainment.

The number of eggs and larvae entrained in 2010 and therefore the number of equivalent juveniles and equivalent adults was well below average, amounting to 6.5% of the time series mean (Table 13). This follows 2001 through 2009 when numbers ranged from only about 6 to 23% of the time series average. The below average totals suggest that mackerel egg and larval production in the waters near PNPS was not particularly high during the last ten years. The Transboundary Resources Assessment Committee (TRAC) status report for Atlantic mackerel in the northwest Atlantic was completed in 2010. The estimated spawning stock biomass has declined from 1.36 million mt in 1972 to 96,968 mt in 2008. Stock recruitment has also declined in recent years from an average of 2.1 billion age 1 fish during 1962 through 1984 to an average of 566 million age 1 fish from 1985 through 2009. The assessment time series average is 1.3 billion age 1 fish (TRAC 2010). Atlantic mackerel recruitment is strongly dependent on copepod nauplii production through species that contribute to the larval mackerel diet. Strong mackerel year-classes such as 1999 were characterized by remarkably high prey copepod nauplii availability (Castonguay et al. 2008).

Atlantic mackerel are swift swimmers and not often impinged at PNPS. They occurred during only eight years from 1980 to 2010 with an average of 8 individuals annually. For simplicity all impinged mackerel were considered adult fish using the Vaughan and Saila approach and therefore included with the EA totals. Following the life stage method, the age of impinged mackerel was determined from annual length frequency distributions. The percent composition was multiplied by the total estimated number of fish impinged each month to partition each year's monthly total into age classes. Based on length data all impinged fish were young of the year. The instantaneous mortality rates for mackerel age classes were obtained from EPA (2004) and were adjusted described for winter flounder to account for the higher probability that fish impinged later in any given year are more likely to survive to their first birthday. Mortality rate adjustments were made for each month that juvenile fish were impinged. The mortality rate was converted to the corresponding survival rate and multiplied by the number of age 0 fish impinged during each respective month. The monthly totals were then combined to obtain an estimated annual total number of equivalent age 1 fish. All impinged fish older than age 1 were conservatively assumed to survive to their next birthday. Annual survival rates obtained from EPA (2004) were used to convert age 1 fish to age 3 fish. Atlantic mackerel impinged were assumed to have 0% survival since no site specific data were available (MRI 1984).

According to NOAA statistical records, an annual average of 227,887 pounds (s.e. = 60,174) of mackerel were taken commercially from statistical area 514 over the years 1982-2009. For PNPS the loss of an average of 1,242 pounds of age 1 fish (1980-2009) amounts to 0.5% of those landings and the loss of an average of 1,174 pounds of age 3 fish, less than 0.5%. In addition to commercial landings, mackerel have considerable recreational value. For example, over the years 1981-2009 an average of 1,065,194 fish (s.e. = 149,259) were landed in Massachusetts by fishermen working inland waters and within three miles of shore. These fish had an average weight of about one pound. Unfortunately these landings are available only by state and therefore the portion attributable to Cape Cod Bay is not known. Arbitrarily adding 200,000, 1 pound fish to the Area 514 commercial landings brings the average harvest total to 427,887 pounds. The mean PNPS age 1 estimate amounts to 0.3% of those landings and the mean age 3 equivalent adult total to 0.3% of the landings.

Calculations performed to estimate the number of adult cunner which would be necessary to produce the number of eggs found in the PNPS area were also completed for Atlantic mackerel. Mackerel eggs occurred at Cape Cod Bay stations 2, 3, 4, 7, and 8 from early May through early July in 1975. Integration over time using the mean density of the five stations produced an estimate of 1.3529E12 eggs. This total included a mesh correction factor of 1.95 to account for extrusion through 0.505-mm mesh (MRI unpublished data). The resulting value was divided by 4, the estimated incubation time in days for mackerel eggs (Sette 1950), then divided by 319,978, an estimate of mean annual fecundity per female for age 3 fish from Griswold and Silverman (1992) and Neja (1992). Lastly the resulting value was multiplied by 2 assuming an even sex ratio. These calculations resulted in an estimated production of 3.382E11 eggs by an estimated 2,114,052 adult fish. The annual mean equivalent (1980-2009) of 1,748 age 3 fish (Table 13) due to PNPS entrainment represents less than 0.1% of that value.

Atlantic Menhaden

Total numbers of Atlantic menhaden eggs entrained at PNPS dating back to 1980 ranged from 393,000 in 1992 to 947,800,000 in 1993, with an overall average of 56,887,000.

Corresponding totals for menhaden larvae ranged from 176,000 in 2004 to 48,300,000 in 1997 averaging 13,158,000 over the 1980 - 2009 time series. Totals for 2010 amounted to 21,379,962 eggs and 5,751,886 larvae. The current year's egg total ranked 6th, in the 80th percentile, and represented 38% of the time series mean. The larval total ranked at 15th, in the 50th percentile and represented 44% of the time series mean (Table 15).

Numbers of eggs and larvae entrained each year at PNPS were converted to numbers of equivalent adults using two methods. The first method followed Vaughan and Saila (1976). This procedure requires an estimate of the ratio of larvae to eggs plus fecundity and mortality for each age class. To provide an estimate of survival from spawned egg to entrained larva (Se) the ratio of larvae to eggs at PNPS was calculated. In some years, such as 2009, more larvae were entrained then eggs so that estimates were not obtained for all cases. Estimates ranging from 0.005 to 0.987 were obtained in 1980, 1982, 1985, 1986, 1988-1991, 1993, 1994, 1997, 1998, 2001-2004, and 2010. A geometric mean of 0.216 was obtained over those 17 estimates. In the Mount Hope Bay section of Narragansett Bay from 1973-1991 a geometric mean ratio of 0.066 was obtained providing a second estimate based on extensive data. An average of the two estimates, 0.141 was used to approximate survival from egg to larva.

Since Se is defined as survival from spawned egg to entrained larva, an adjustment to the average larva/egg ratio was necessary. To derive this estimate, collected menhaden eggs were estimated to average one day old, one-quarter their incubation period at 15°C, assuming that spawning takes place nearby. A 4-day incubation period was obtained from Pepin (1991) who related incubation duration to water temperature and egg diameter. A mean diameter of 1.6 mm was obtained from Colton and Marak (1969). Pepin (1991) also related daily egg mortality to water temperature ($M_e = 0.030e^{0.18T}$). Assuming an average spring-early summer water temperature of 15°C, menhaden eggs would experience a daily mortality rate of Me = 0.4464. The mean egg/larva ratio of 0.141, equivalent to an instantaneous mortality rate of 1.959 was added to 0.4464 to derive the mortality rate from spawned egg to entrained larva of Ze = 2.4055 (Se = 0.0902).

The procedure of Vaughan and Saila (1976) using the Leslie matrix algorithm provided an estimate of survival from spawned egg to age 1 of 5.419E-05. Fecundity for ages 3 through 5 was obtained from Dietrich (1979). All females were assumed to spawn first at age 3 based on Ahrenholz et al. (1987) who reported that all age 2 fish mature by the fourth quarter. Since fall spawning does occur but is uncommon in Cape Cod Bay (Scherer 1984), we assumed initial spawning at age 3. Dietrich's (1979) age 5 fecundity was assumed for ages 6 through 9 as well since direct counts were not available. Instantaneous natural mortality rates (M) were obtained from ASFMC (2004); these were 0.98, 0.56, and 0.55 for ages 1, 2, and 3-9, respectively. Fishing mortality (F) of 0.14 for age 1 and 0.79 for older individuals was also used (ASFMC 2004). To account for the fact that all eggs entrained were not recently spawned and the Vaughan and Saila estimate begins at time of spawning the estimate of daily mortality rate for menhaden eggs described above was used. Numbers of entrained larvae were back calculated to spawned eggs using Se and that total added to the number of entrained eggs. These parameters provided an estimate of 5,266 age 1 individuals potentially lost as a result of egg and larvae entrainment in 2010. Since menhaden enter the fishery at age 2 (Durbin et al. 1983), the annual natural mortality rate of M = 0.98 and F = 0.14 (S = 0.326) was applied to the age 1 value. Age 2 natural mortality (M = 0.56) and fishing mortality (F = 0.79) rates were then applied to the numbers of age 2 fish to estimate the number of age 3 adults potential lost to the population. A wet weight of 0.6 pound for age 2 individuals (ASFMC 2006a) was used to calculate weight.

The second method to estimate equivalent adults utilized life stage survival values from EPA (2004): S = 0.301 for eggs, S = 0.011 for larvae, S = 0.002 for age 0 juveniles, S = 0.583 for age 1, and S = 0.212 for age 2. The survival values were adjusted following EPRI (2004) to account for the fact that entrained eggs and larvae are of mixed ages (adjusted S = 0.4630 for eggs and adjusted S = 0.0226 for larvae). A weight of 0.235 pounds for age 2 individuals (EPA 2004) was used to calculate weight.

The two EA methods provided an average estimate of 1,004 age 2 fish (550 pounds) potentially lost to the fishery in 2010. Corresponding age 2 values for the 1980-2009 time series ranged from 30 fish (16 pounds) in 2004 to 17,414 fish (9,295 pounds) in 1993 with an average value of 2,688 fish (1,390 pounds). For 2010 the average estimated number of age 3 adults lost to the population was 253 adults. Corresponding age 3 values for the 1980-2009 time series ranged from 8 to 4,365 with an average value of 669 (Figure 14, Table 15). Some Atlantic menhaden eggs and larvae survive entrainment. To reflect this survival Atlantic menhaden eggs were assumed to survive at the rate of 80% based on the data collected during the PNPS entrainment survival study conducted in 2007 (NAI unpublished data). Atlantic menhaden larvae were assumed to survive at the rate of 55% at temperatures between 25 and 30°C and 24%

at temperatures between 30 and 35°C (EPRI 2000). When survival was incorporated into the equivalent adult calculations the number of age 2 fish potentially lost to entrainment in 2010 decreased to 532 fish (248 pounds) and age 3 fish decreased to 135. The 2010 age 2 value was below the 1980 – 2009 average of 1,256 age 2 fish (Figure 15, Table 16).

In addition to numbers entrained 1,403 young menhaden were estimated to have been impinged in 2010 (See Impingement Monitoring Section 3.3). That compares with an average of 26,451 annually from 1980-2009 and a range from 0 in 1981 and 1987 to 277,601 in 2005. Since menhaden are sensitive to impingement and handling in general (see for example Tatham et al. 1977, MRI 1984) all were assumed to have died. Method 1 assumed conservatively that 50% would have survived to the end of their first year had they not been impinged and 32.6% would then survive to age 2. Method 2 determined the age of the impinged menhaden by annual length frequency distributions. The percent composition for each 110-mm length class was multiplied by the total estimated number of menhaden impinged each month to partition the monthly total into age classes. The instantaneous mortality rate for each age class was obtained from EPA (2004) and was adjusted as described for winter flounder to account for the higher probability that fish impinged later in any given year are more likely to survive to their next birthday. Mortality rate adjustments were made for each month that juvenile fish were impinged. The mortality rate was converted to the corresponding survival rate and multiplied by the number of age 0 fish impinged during each respective month. The monthly totals were then combined to obtain an estimated annual total number of equivalent age 1 fish. All impinged fish older than age 1 were conservatively assumed to survive to their next birthday. Annual survival rates obtained from EPA (2004) were used to convert age 1 fish to age 2 and 3 fish. Based on these calculations an additional 355 fish might have been lost to the fishery and 81 adults might have been lost to the spawning stock from impingement in 2010. This compares with a time series average of 7,223 age 2 and 1,634 age 3 fish potentially lost to impingement. Combined potential entrainment and impingement EA values totaled 1,359 age 2 (675 pounds) and 334 age 3 fish in 2010 which compared with average of 9,911 age 2 (3,874 pounds) and 2,303 age 3 fish over the 1980-2009 time series.

The Atlantic menhaden resource has supported one of the largest fisheries in the United States since colonial times and is believed to consist of a single population based on tagging studies (Dryfoos et al. 1973, Nicholson 1978, ASMFC 2004). The menhaden fishery has two components, a reduction fishery that produces fishmeal and fish oil and the bait fishery. As bait, menhaden are collected in pound nets, trawls, haul seines, purse seines and gill nets. Obtaining data from the bait fishery is difficult to achieve but the bulk of the bait landings in New England are used by the lobster fishery. Bait landings along the New England coast averaged approximately 11.9 million pounds from 1985-2009 representing 15% of the average coastwide bait landings and 2% of the total coastwide landings (ASMFC 2010, ASMFC 2006b). The potential loss of an average of 3,874 pounds of menhaden to entrainment and impingement at PNPS represents 0.03% of the average 1985-2009 New England menhaden bait landings and 0.005% of the average 1985-2009 total coastwide bait landings.

Numbers of menhaden eggs were revisited from 1975 when ichthyoplankton sampling was completed throughout Cape Cod Bay (see for example Scherer 1984). At that time menhaden eggs were found from late May into July and again in October. To determine an approximation of the number of menhaden that might have spawned in the Bay that year mean densities were integrated over time. The integrated total was multiplied by 2.0 to adjust for extrusion through the 0.505-mm mesh used in those studies (MRI unpublished), then divided by 3 an estimate of the incubation period for menhaden eggs. This value was then divided by the average lifetime fecundity (456,481 eggs) and assuming an even sex ratio, multiplied by 2 to account for males. The resulting value was then multiplied by the volume of Cape Cod Bay (4.5E10 m^3; Collings et al. 1981). This procedure produced an estimate of 3.4 million adults spawning in the Bay at that time. To be conservative that number was divided in half assuming that eggs were present in only half the volume of Cape Cod Bay. Using this rough approximation and assuming that numbers of menhaden spawning in the Bay in 1975 were similar to current levels the average loss of 2,303 age 3 menhaden (1980-2009) would amount to 0.1% of the estimated spawning stock in Cape Cod Bay.

MRI completed estimates of the number of menhaden eggs and larvae passing through the Cape Cod Canal during the 1999 spawning season (TRC 2000). Estimates were based on ichthyoplankton sampling completed in the Canal near the eastern end as well as a near-canal station in Buzzard's Bay and in Cape Cod Bay. The seasonal total passing through the Canal amounted to 520 million eggs and 258 million larvae. The number of menhaden eggs and larvae entrained by PNPS in 1999 amounted to 2.8 and 4.6% of those estimates, respectively.

Atlantic Herring

Since Atlantic herring spawn demersal, adhesive eggs primarily on offshore banks, they are not subject to entrainment at PNPS. Larval entrainment at the station ranged from 341,371 in 2007 to 43,248,000 in 1995 and averaged 6,558,300 over the 1980-2009 period. For the 2010 season the number entrained was estimated to be 3,737,447 larvae (Table 18). Since they are relatively large, no mesh adjustment factor was applied to the estimated values.

Two methods were used to determine equivalent adult Atlantic herring from the numbers entrained. The first method followed the Vaughan and Saila procedure to derive an estimate of survival from spawned egg to age 1. For this estimate fecundity was obtained from Messieh (1976); age-specific mortality of M = 0.2 was obtained from NOAA (1998) and NEFSC (1998). A maximum age of 11 was assumed following (NEFSC 1998) and fishing mortality was set at F = 0.2 beginning at age 1. These values provided an estimated survival rate of 5.1004E-5 for a spawned herring egg to age 1. To estimate the number of eggs which must have been spawned to produce the number of larvae entrained, individuals were assumed to average 45 days of age. This was based on their relatively long larval period (see for example Jones et al. 1978, Folkvord et al. 1997) and the fact that spawning occurs on offshore banks. Over that 45-day period larvae were assumed to experience a mortality rate of 5.75% per day. This value equals the median summarized from various authors by Dragesund (1970). A mortality rate of 50% was assumed among spawned eggs (Lough et al. 1985). The mortality rate among eggs coupled with a 5.75% daily mortality rate over 45 days provided a mortality rate of Se = 0.034804 from spawned egg to entrained larva. The number of entrained larvae was divided by the egg to larva mortality rate and multiplied by 5.1004E-5 to provide an estimate of age 1 herring potentially lost to entrainment. Based on an annual survival rate of 0.67 (M = 0.20, F = 0.20, see above), age 3 fish, the age at which 50% of herring recruit to the spawning stock (NOAA 1995, Overholtz 2000b), were calculated. Age 1 juveniles (sardines) were assumed to weigh 0.03 pounds and age 3 adults 0.4 pounds.

The second method to estimate equivalent adults relied on life stage data from EPA (2004): S = 0.038 for larvae and juvenile stages, and S = 0.619 for age 1 and age 2 fish. The larval survival value was adjusted following EPRI (2004) to account for the mixed ages of entrained larvae (adjusted S = 0.0739). Age 1 (sardines) juveniles were assumed to weigh 0.03 pounds and age 3 adults 0.3 pounds.

The two methods used to calculate equivalent adult herring produced an average of 8,043 age 1 (249 pounds) and 3,260 age 3 herring (1,105 pounds) that would have been lost due to entrainment in 2010. The 2010 values were below the long term average for age 1 (14,113) and age 3 (5,721) equivalents (Figure 16, Table 18). Atlantic herring larvae were assumed have 0% survival due to insufficient species specific data on upper lethal temperatures and exposure limits.

In addition to being entrained Atlantic herring are also impinged at PNPS (see Impingement section), at an annual average of 1,077 fish from 1980-2009 ranging from 0 in 1996, 2007, and 2009 to 24,238 in 1991 (Table 19). Over the time series fish were most often impinged from late winter to spring although a relatively large number was impinged in July 1991. While some adults appeared in the catch from time to time, the majority of fish were small, ranging in length from 25 to 75 mm total length. Using the Vaughan and Saila approach impinged fish were converted to equivalent age 3 adults using the annual mortality rate given above, assuming that young fish would complete their first year. Using EPA life stage data impinged herring were converted to equivalent age 3 fish using an adjusted juvenile stage survival value (adjusted S = 0.0739) to account for the mixed ages of impinged juveniles. The calculations then used the survival values for age 1 and 2 fish above. Based on these two methods impingement would add an annual average of 638 age 3 fish to the potential number of fish lost. Since Atlantic herring are generally fragile like other members of the herring family 100% impingement mortality was assumed.

Atlantic herring have long been an important component of the commercial fishery off the northeast coast of the United States (see for example Matthiessen 2004) They were severely overfished by distant-water fleets during the 1960's and 1970's to the point where no larval herring were found on Georges Bank for a decade (Overholtz and Friedland 2002). They have since recovered and are currently abundant on Nantucket Shoals and in the Gulf of Maine-Georges Bank region. Although likely to increase, landings remain low. For example, while 1.1 million pounds were landed from Statistical Area 514 in 1997, none were reported for that area from 1999 through 2003[5], and 14.6 million pounds were landed in 2008. Spawning stock biomass in the northeast was estimated at 400,000 metric tons (0.9 billion pounds) of adult fish

[5] NOAA cautions that landings reported by water codes such as 514 may be unreliable as codes can be assigned after the fact and not necessarily based on observations or fisherman reports.

in 2008 (TRAC 2009). If spawning stock biomass in the 514 statistical area equals only one percent of the northeast stock, then the 2010 equivalent adult value resulting from entrainment and impingement at PNPS (1,121 pounds) would amount to about 0.01%. The combined time series average of 2,156 pounds would amount to about 0.02%.

Atlantic Cod

Estimated numbers of Atlantic cod eggs entrained at PNPS dating back to 1980 ranged from 1,268,748 in 1993 to 20,388,850 in 1980 averaging 6,332,831 over the 30-year time series from 1980-2009. For cod larvae corresponding estimates ranged from 119,436 in 1989 to 4,215,642 in 2001, averaging 1,206,309 over the time series. Corresponding estimates for 2010 amounted to 8,707,496 eggs and 754,858 larvae. These values ranked 8th and 18th, respectively in the 77th and 43rd percentiles indicating that eggs were above average and larvae were below average in abundance in 2010 (Table 20).

Two methods were used to calculate equivalent adult Atlantic cod. The first method used the Vaughan and Saila procedure to convert the numbers of eggs and larvae to equivalent age 2 fish, the age at which 50% of the stock reaches maturity and the age at which they enter the fishery. To calculate age 0 survival using the Vaughan and Saila procedure fecundity at age was obtained by averaging values from May (1967) and Kjesbu et al.(1996). A natural mortality rate of M= 0.20 was obtained from NOAA (1998) along with a fishing mortality rate of F = 0.2 beginning at age 2. A maximum age of 6 was assumed based on their high exploitation rate (Serchuk et al 1994). Using these variables an age 0 survival rate of 1.5506E-6 was obtained.

Survival from spawned egg to entrained larva (Se) was estimated by averaging three values:

- The average larva/egg ratio obtained at PNPS from 1980-2010 following adjustment for the average age of entrained eggs; this equaled 0.0964. To derive this estimate, cod eggs were assumed to average 6 days old, half their incubation period at 5C. A 12-day incubation period was obtained from Pepin (1991) who related incubation duration to water temperature and egg diameter. A mean diameter of 1.5 mm was obtained from Colton and Marak (1969). Pepin (1991) also related daily egg mortality to water temperature. Assuming an average winter water temperature of 5C cod eggs would experience a daily instantaneous mortality rate of Me = 0.074 or 0.443 over six days. The observed geometric mean egg/larva ratio at PNPS from 1980-2010 of 0.1502, equivalent to an instantaneous mortality rate of 1.8959 was added to 0.443 to derive the mortality rate from spawned egg to entrained larva of Ze = 2.3389 (Se = 0.0964).

- The second estimate relied on daily mortality rates given for the closely related pollock by Saila et al (1997; 0.0068). They estimated egg mortality for pollock eggs from spawning to hatch to be Ze = 0.922 and larval mortality at Z = 1.358 per mm of growth. Assuming cod larvae entrained at PNPS average 6 mm in length and that they hatch at 3 mm (Colton and Marak 1969), they would be expected to experience a mortality rate of Z = 4.074. Combined these estimates equal 2.4184 = Z corresponding to a survival rate from spawned egg to entrained larva of S = 0.0068.
- The third value (Se = 0.0077) was derived as follows. Larvae entrained at PNPS were assumed to average 10 days old. Eggs were assumed to require 20 days to hatch with a daily mortality rate of 10% per day (Serchuk et al. 1994). Larval mortality from hatch to day 10 was assumed to be 4% per day (Serchuk et al. 1994) providing a survival rate of 0.0077 from spawned egg to entrained larva.

The average of those three values, Se = 0.0370, was used to estimate the number of eggs necessary to yield the number of entrained larvae at PNPS. The average Se value was then applied to the number of larvae entrained each year, the result added to the number of eggs entrained and the value of age 0 survival applied to the total to provide the estimated equivalent adult values. Numbers of equivalent adults were converted to weight in pounds using an estimate of 0.5 pounds per fish.

The second method to estimate equivalent adults followed the life stage method. Survival values were obtained from EPA (2004): S = 0.008 for eggs, S = 0.003 for larvae, S = 0.400 for juveniles, and S = 0.670 for age 1. The survival values were adjusted following EPRI (2004) to account for the mixed ages of entrained eggs and larvae (adjusted S = 0.0152 for eggs and adjusted S = 0.0059 for larvae). A weight of 0.245 pound for age 2 individuals (EPA 2004) was used to calculate weight.

The average number of age 2 fish potentially lost due to entrainment was 664 in 2010. This was below the 1980 - 2009 mean of 1,011 age 2 fish. The 2010 average weight of 167 pounds was also below the overall mean of 254 pounds (Figure 17, Table 20). Atlantic cod eggs and larvae were all assumed to die following entrainment since species specific data on upper lethal temperatures and exposure limits were not available.

In addition to the numbers entrained 53 Atlantic cod were estimated to have been impinged on the PNPS intake screens in 2010. That compares with an average of 68 annually from 1980-2009 ranging from 0 to 688 in 2006; no cod were impinged during 10 years (see impingement section). The number of equivalent adult Atlantic cod potentially lost to impingement was calculated by two methods. Based on size the majority of impinged cod were young fish ranging in size from 50 to 100 mm total length. The first method assumed all impinged fish were age 1 and calculated survival from a natural mortality rate of M= 0.20 obtained from NOAA (1998). The second method used annual length frequency distributions to estimate the age of impinged cod. The percent composition for each 10-mm length class was multiplied by the total estimated number of fish impinged each month to partition each monthly total into age classes. The instantaneous mortality rate for the Atlantic cod age classes were obtained from EPA (2004) and were adjusted as above in winter flounder to account for the higher probability that fish impinged later in any given year are more likely to survive to their first birthday (January 1st). Mortality rate adjustments were made for each month that juvenile fish were impinged. The mortality rate was converted to the corresponding survival rate and multiplied by the number of fish impinged during each respective month. The monthly totals were then combined to obtain an estimated annual total number of equivalent age 2 fish. The number of impinged fish would account for an additional 36 equivalent age-2 adults in 2010 and an average of 41 additional adults over the 1980-2009 time series. These totals were considered low relative to any recent landings information for the Cape Cod Bay area. For reference Area 514 landings averaged 1,636,863 pounds (s.e. = 543,890) from 1995-2009 and Massachusetts inland and near shore (< 3 miles) recreational landings averaged 452,550 pounds (s.e. = 129,450) over the same period. Atlantic cod impingement survival was assumed to be 10.7% attributable to the fish return sluiceway and the low pressure spraywash (MRI 1984). When impingement survival is considered the number of equivalent adult cod potentially lost in 2010 declined to 32 fish (13 pounds). The 1980 – 2009 time series mean also declined to 37 age 2 adults weighing 15 pounds (Figure 18, Table 22).

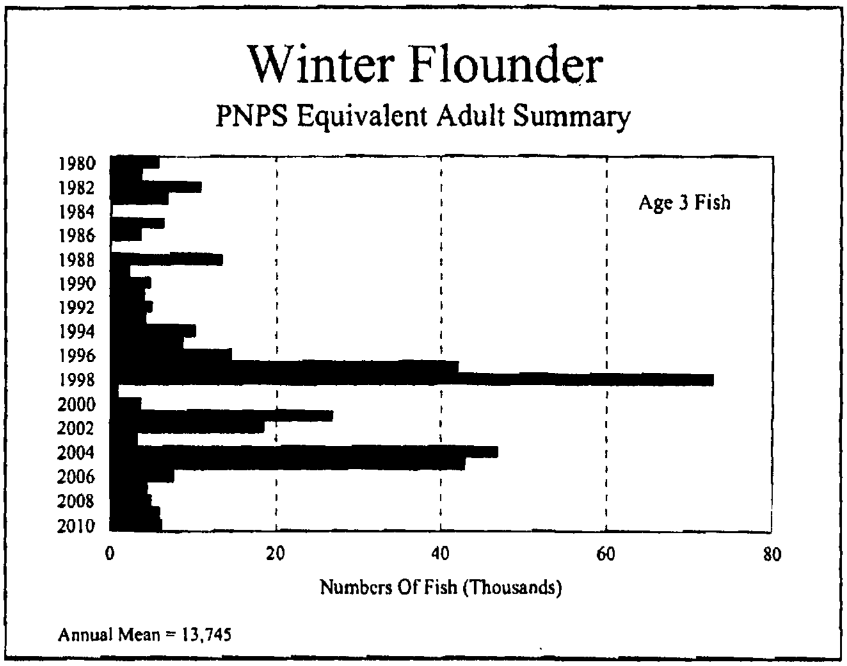

Figure 7. Numbers of equivalent adult winter flounder estimated from entrainment and impingement data at PNPS, 1980-2010.

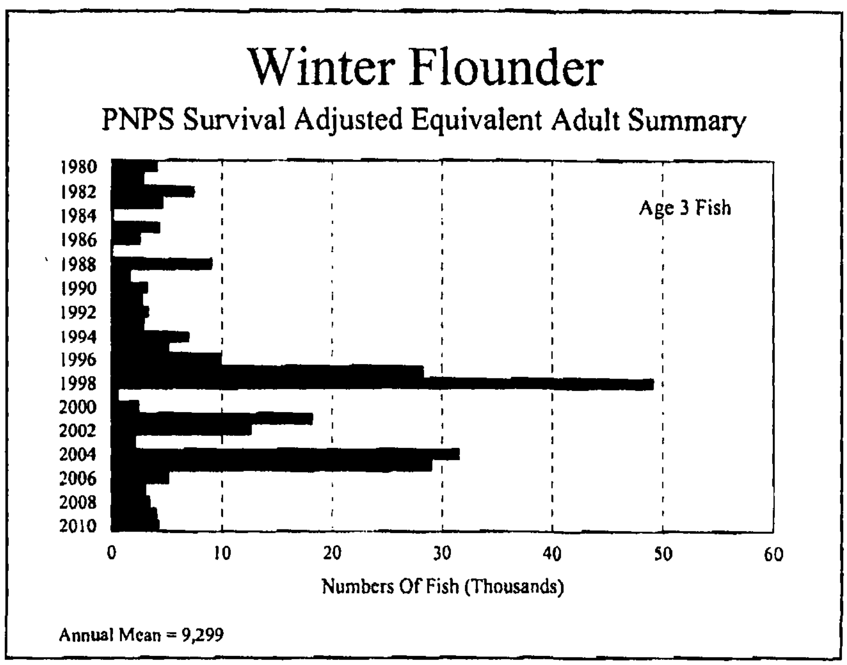

Figure 8. Numbers of equivalent adult winter flounder estimated from survival adjusted entrainment and impingement data at PNPS, 1980-2010.

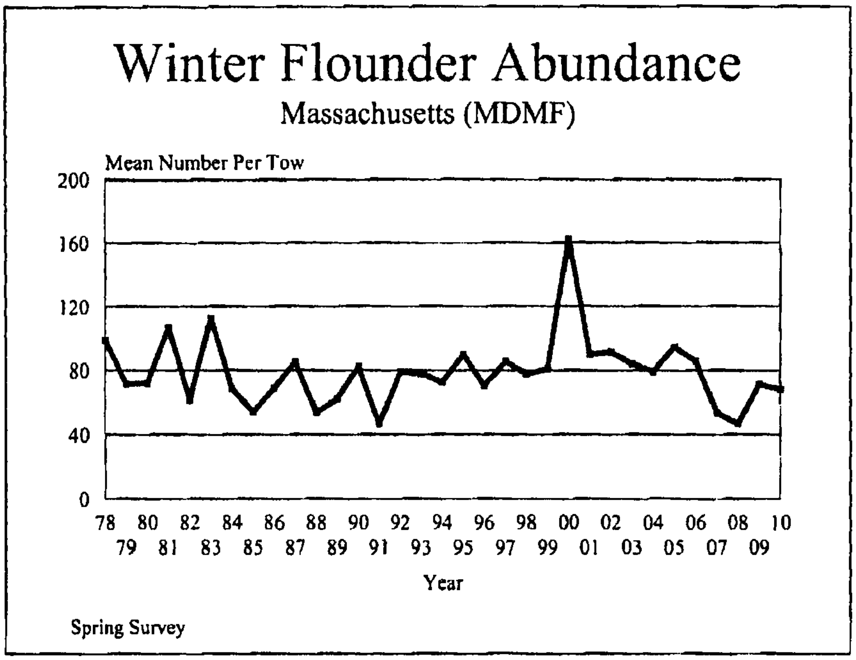

Figure 9. Massachusetts Division of Marine Fisheries spring winter flounder northern stock abundance data (mean catch per tow) from 1978-2010.

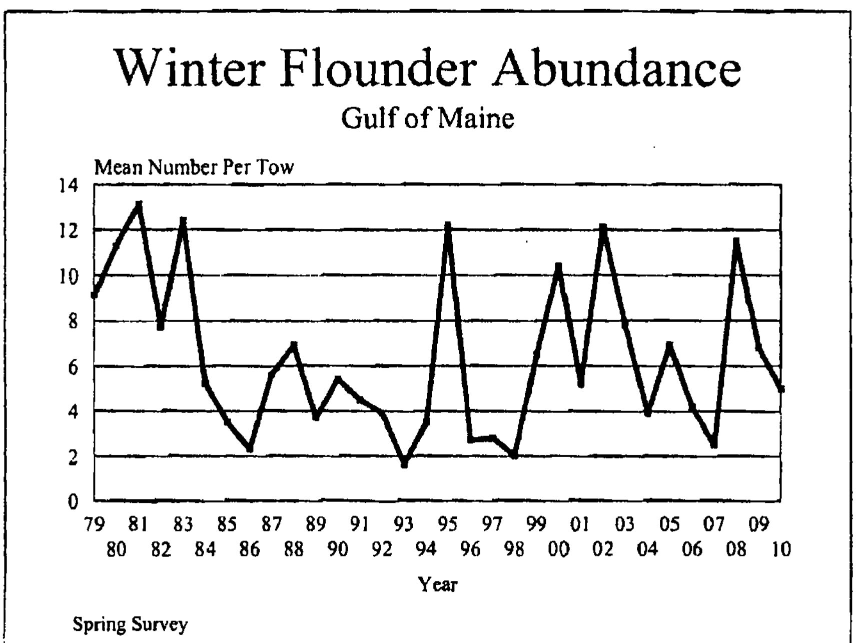

Figure 10. NMFS spring survey winter flounder mean catch per tow in the Gulf of Maine from 1979-2010.

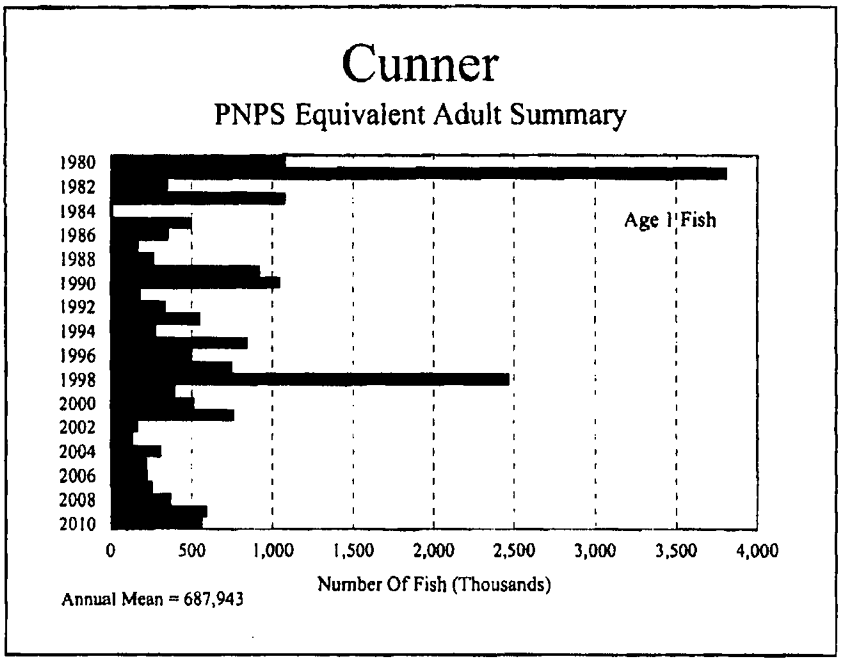

Figure 11. Numbers of equivalent adult cunner estimated from entrainment and impingement data at PNPS, 1980-2010.

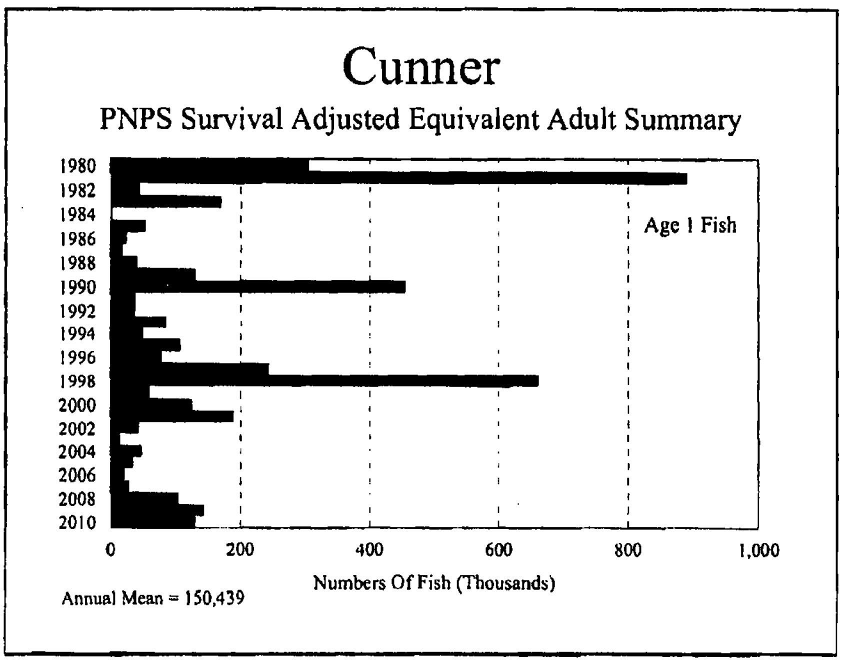

Figure 12. Numbers of equivalent adult cunner estimated from survival adjusted entrainment and impingement data at PNPS, 1980-2010.

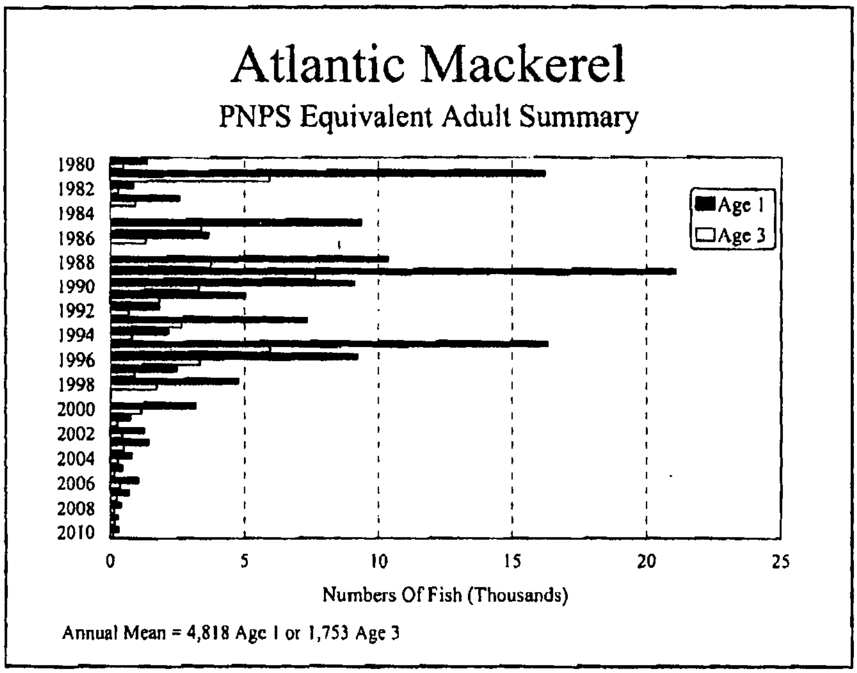

Figure 13. Numbers of equivalent adult Atlantic mackerel estimated from entrainment and impingement data at PNPS, 1980-2010.

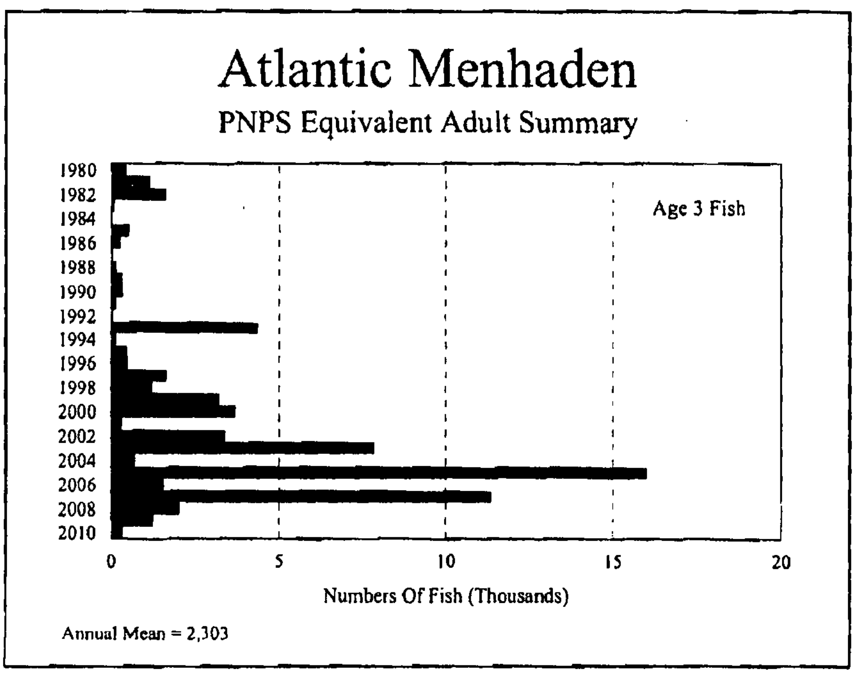

Figure 14. Numbers of equivalent adult Atlantic menhaden estimated from to entrainment and impingement data at PNPS, 1980-2010.

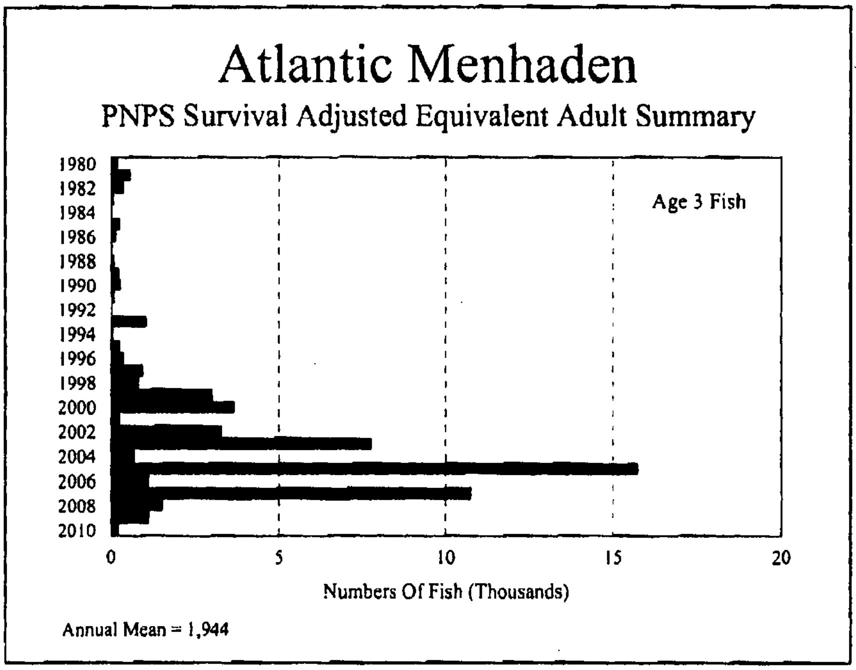

Figure 15. Numbers of equivalent adult Atlantic menhaden estimated from survival adjusted entrainment and impingement data at PNPS, 1980-2010.

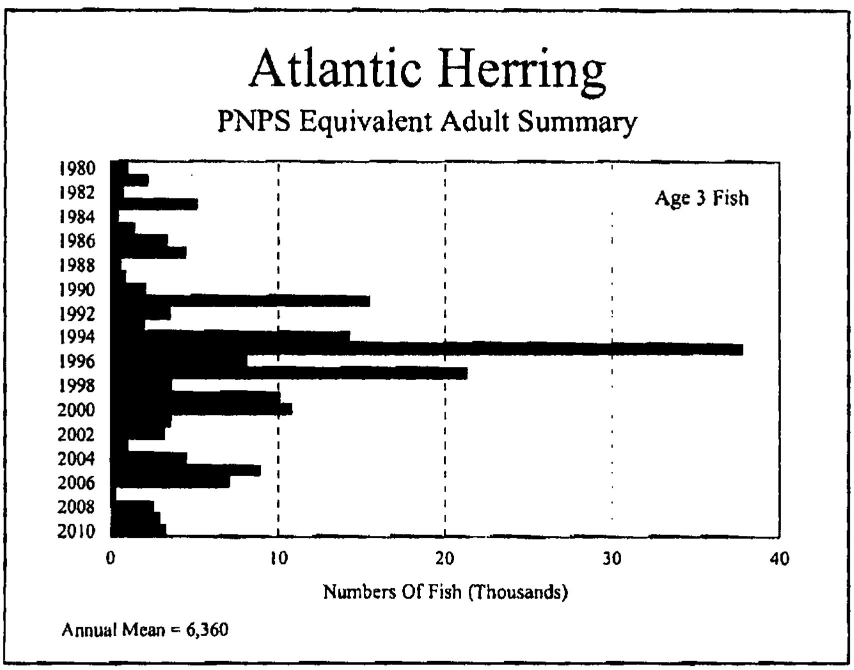

Figure 16. Numbers of equivalent adult Atlantic herring estimated from entrainment and impingement data at PNPS, 1980-2010.

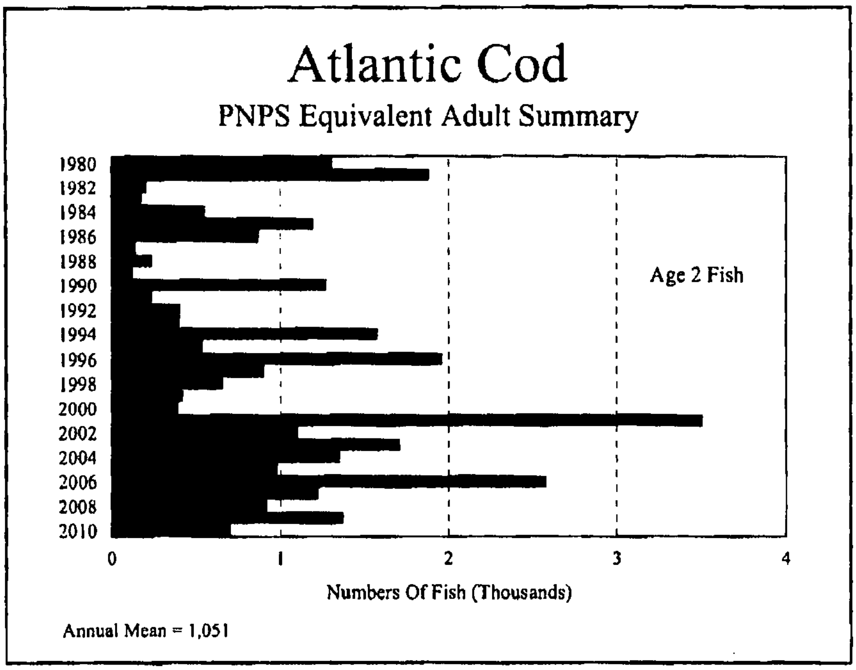

Figure 17. Numbers of equivalent adult Atlantic cod estimated from entrainment and impingement data at PNPS, 1980-2010.

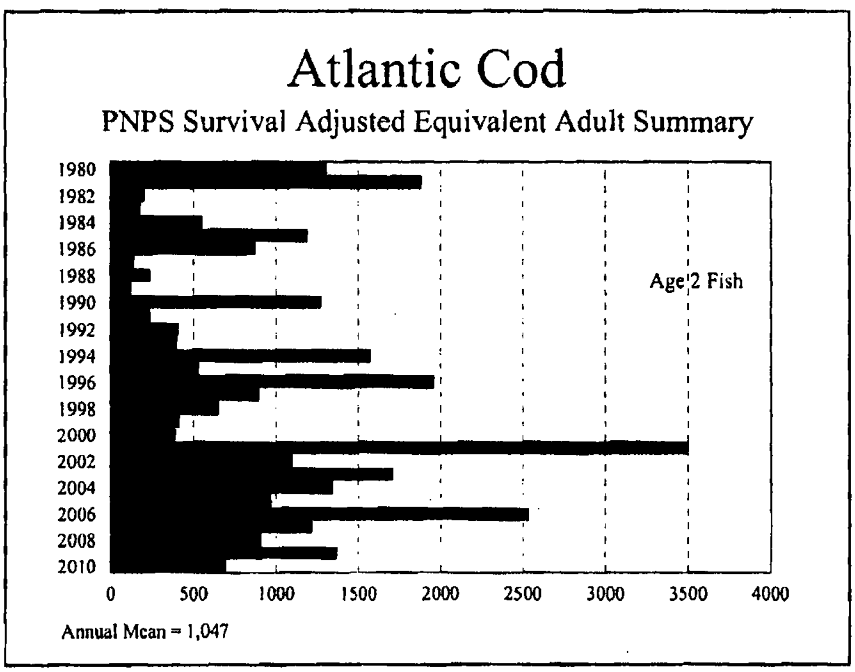

Figure 18. Numbers of equivalent adult Atlantic cod estimated from survival adjusted entrainment and impingement data at PNPS, 1980-2010.

Table 5. Numbers of winter flounder eggs and larvae entrained at PNPS annually by stage, 1980 - 2010. Numbers and weight of equivalent age 3 adults calculated by four methods are also shown. Estimates based on normal operation flow.

Year	Number Of Eggs Entrained	Number Of Larvae Entrained: Stage 1	Stage 2	Stage 3	Stage 4	Total	Equivalent Age 3 Adults: General Number	General Weight (lbs)	Staged Suite 1 Number	Staged Suite 1 Weight (lbs)	Staged Suite 2 Number	Staged Suite 2 Weight (lbs)	Staged Suite 3 Number	Staged Suite 3 Weight (lbs)	Average Number	Average Weight (lbs)
1980	3,513,717	8,694,456	12,714,822	7,317,129	0	28,726,407	1,773	860	12,969	6,290	4,173	2,024	4,190	4,177	5,776	3,338
1981	9,674,954	7,606,942	19,133,121	3,073,126	43,304	29,856,494	1,844	894	8,138	3,947	2,451	1,189	2,460	2,453	3,723	2,121
1982	7,001,776	2,706,834	6,724,795	11,583,134	425,011	21,439,774	1,324	642	20,811	10,093	10,669	5,174	10,712	10,680	10,879	6,647
1983	1,305,735	1,933,453	2,246,172	7,558,534	260,350	11,998,508	740	359	13,116	6,361	6,749	3,273	6,776	6,756	6,845	4,187
1984	341,424	166,925	0	164,036	15,729	346,690	21	10	349	111	249	121	250	249	217	123
1985	32,717,535	1,039,001	2,312,789	8,025,452	130,786	11,508,028	720	349	12,980	6,295	5,714	2,771	5,736	5,719	6,288	3,784
1986	5,118,035	5,397,403	5,783,669	3,963,747	77,005	15,221,823	940	456	7,392	3,585	3,029	1,469	3,041	3,031	3,600	2,135
1987	20,782,324	0	5,613	23,555	0	3,534,685	218	107	84	53	34	16	34	34	92	53
1988	3,494,771	1,995,968	1,656,376	15,079,960	511,009	19,243,314	1,188	576	25,590	12,411	13,327	6,464	13,380	13,340	13,371	8,198
1989	6,423,987	1,668,823	5,755,240	2,224,675	39,114	9,687,851	599	291	4,491	2,178	1,703	826	1,709	1,704	2,126	1,250
1990	48,501	643,683	1,155,404	6,846,718	33,002	8,678,807	535	260	10,341	5,015	4,033	1,956	4,049	4,037	4,740	2,817
1991	1,217,178	3,471,022	3,908,488	5,188,056	37,717	12,605,283	778	377	8,520	4,132	3,246	1,574	3,259	3,249	3,951	2,333
1992	4,124,308	873,660	876,914	7,034,690	26,192	8,811,456	545	264	10,540	5,112	4,065	1,972	4,081	4,069	4,808	2,854
1993	3,078,941	1,595,700	3,540,750	4,934,952	88,617	10,160,019	627	304	8,374	4,061	3,619	1,755	3,633	3,622	4,063	2,436
1994	2,530,707	1,034,617	6,433,716	13,060,373	172,606	20,701,312	1,277	620	21,147	10,256	8,884	4,309	8,920	8,893	10,057	6,019
1995	2,766,716	1,632,907	2,820,023	8,826,496	375,857	13,655,283	843	409	15,810	7,668	8,615	4,178	8,649	8,623	8,479	5,220
1996	4,896,687	504,810	5,818,499	11,329,855	995,127	18,648,292	1,151	558	24,027	11,653	16,305	7,908	16,370	16,321	14,463	9,110
1997	3,609,393	2,225,634	9,537,788	41,484,016	2,126,280	55,373,718	3,416	1,657	75,896	36,810	44,059	21,369	44,235	44,103	41,902	25,984
1998	1,035,001	3,111,891	20,282,772	58,546,916	4,904,482	86,846,061	5,356	2,597	120,935	58,653	81,643	39,597	81,970	81,724	72,476	45,643
1999	1,409,453	2,030,743	496,056	977,373	1,345	3,505,517	216	106	1,578	447	553	268	555	553	726	344
2000	1,693,672	33,482	170,475	5,391,088	0	5,595,045	346	168	7,836	3,800	2,899	1,406	2,911	2,902	3,498	2,069
2001	330,283	4,638,546	13,093,697	37,019,304	263,144	55,014,691	3,393	1,645	57,636	27,953	22,791	11,054	22,882	22,813	26,675	15,866
2002	28,637	1,389,319	6,911,151	14,802,848	1,232,865	24,336,183	1,501	728	30,840	14,957	20,602	9,992	20,684	20,622	18,407	11,575
2003	1,977,333	700,749	480,190	3,040,299	154,185	4,245,138	270	131	5,538	2,686	3,211	1,557	3,224	3,214	3,061	1,897
2004	246,468	159,859	10,431,901	49,597,823	2,044,822	62,234,406	3,838	1,861	87,163	42,274	47,596	23,084	47,786	47,643	46,596	28,716
2005	243,151	158,986	7,470,964	20,441,584	4,277,092	32,348,626	1,995	968	59,396	28,807	54,575	26,469	54,794	54,629	42,690	27,718
2006	758,001	0	1,394,121	6,306,024	488,047	8,188,192	505	245	12,618	6,120	8,371	4,060	8,405	8,379	7,475	4,701
2007	125,635	703,347	3,928,911	3,769,052	236,079	8,637,389	533	259	7,698	3,734	4,494	2,180	4,511	4,498	4,309	2,667
2008	1,192,616	1,197,418	6,579,471	3,934,150	261,747	11,972,786	739	358	8,559	4,151	4,892	2,372	4,911	4,896	4,775	2,945
2009	635,509	72,902	4,136,179	7,462,932	111,928	11,783,940	727	353	12,228	5,931	5,218	2,531	5,239	5,223	5,853	3,509
Mean[1]	3,614,239	2,043,648	5,921,231	13,172,154	689,918	21,822,298	1,347	653	24,720	11,978	14,196	6,885	14,253	14,210	13,629	8,432
s.e.	1,168,682	413,097	995,080	2,820,350	234,065	3,783,986	233	113	5,465	2,653	3,672	1,781	3,687	3,676	3,235	2,039
Minimum[1]	28,637	0	170,475	977,373	0	3,505,517	216	106	1,578	447	553	268	555	553	726	344
Maximum[1]	32,717,535	8,694,456	20,282,772	58,546,916	4,904,482	86,846,061	5,356	2,597	120,935	58,653	81,643	39,597	81,970	81,724	72,476	45,643
2010	756,692	731,634	3,813,055	5,248,385	388,692	10,181,766	628	305	10,842	5,259	6,837	3,316	6,865	6,844	6,293	3,931

Notes: See text for details

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Mesh factor = 1.24 applied to eggs prior to 1995.

Mesh factor = 1.62 applied to Stages 1 and 2 prior to 1995.

Larval densities recorded in 1984, 1987, and 1999 are believed to be low relative to densities in surrounding waters, see text for details.

Weights for General, Staged Suite 1, and Staged Suite 2 are based on 0.485 pounds per fish. Weights for Staged Suite 3 are based on 0.997 pounds per fish.

Table 6. Numbers of winter flounder eggs and larvae entrained adjusted for survival at PNPS by stage, 1980 - 2010. Numbers and weights of equivalent age 3 adults calculated by three methods are also shown. Estimates based on normal operation flow.

Year	Number Of Adjusted Eggs Entrained	Number Of Adjusted Larvae Entrained, Stage 1	Stage 2	Stage 3	Stage 4	Total	Equivalent Age 3 Adults: Staged Suite 1 Number	Staged Suite 1 Weight (lbs)	Staged Suite 2 Number	Staged Suite 2 Weight (lbs)	Staged Suite 3 Number	Staged Suite 3 Weight (lbs)	Average Number	Average Weight (lbs)
1980	3,513,717	8,694,456	12,714,822	3,739,053	0	25,148,331	7,790	3,778	2,252	1,092	2,261	2,254	4,101	2,375
1981	9,674,954	7,606,942	19,133,121	1,570,367	21,916	28,332,347	5,819	2,822	1,427	692	1,432	1,428	2,893	1,647
1982	7,001,776	2,706,834	6,724,795	5,918,981	215,098	15,565,709	11,210	5,437	5,495	2,665	5,516	5,500	7,407	4,534
1983	1,305,735	1,933,453	2,246,172	3,862,411	131,763	8,173,798	6,907	3,350	3,458	1,677	3,471	3,461	4,612	2,829
1984	341,424	166,925	0	83,822	7,960	258,707	181	111	127	62	127	127	145	100
1985	32,717,535	1,039,001	2,312,789	4,101,006	66,191	7,518,987	6,867	3,330	2,950	1,431	2,962	2,953	4,260	2,571
1986	5,118,035	5,397,403	5,783,669	2,025,475	38,972	13,245,519	4,332	2,101	1,601	776	1,608	1,603	2,514	1,493
1987	20,782,324	0	5,613	12,037	0	17,650	67	53	27	13	35	35	43	34
1988	3,494,771	1,995,968	1,656,376	7,705,859	258,622	11,616,826	13,229	6,416	6,803	3,299	6,830	6,809	8,954	5,508
1989	6,423,987	1,668,823	5,755,240	1,136,809	19,795	8,580,667	2,787	1,352	922	447	926	923	1,545	907
1990	48,501	643,683	1,155,404	3,498,673	16,702	5,314,462	5,386	2,612	2,070	1,004	2,078	2,072	3,178	1,896
1991	1,217,178	3,471,022	3,908,488	2,651,096	19,088	10,049,695	4,724	2,291	1,694	822	1,701	1,696	2,706	1,603
1992	4,124,308	873,660	876,914	3,594,727	13,256	5,358,557	5,474	2,655	2,086	1,012	2,094	2,088	3,218	1,918
1993	3,078,941	1,595,700	3,540,750	2,521,761	44,849	7,703,060	4,589	2,226	1,878	911	1,886	1,880	2,784	1,672
1994	2,530,707	1,034,617	6,433,716	6,673,851	87,356	14,229,540	11,333	5,497	4,589	2,226	4,607	4,593	6,843	4,105
1995	2,766,716	1,632,907	2,820,023	422,339	190,221	5,065,491	8,322	4,036	4,411	2,139	2,224	2,218	4,986	2,798
1996	4,896,687	504,810	5,818,499	5,789,556	503,634	12,616,499	12,722	6,170	8,335	4,042	8,368	8,343	9,808	6,185
1997	3,609,393	2,225,634	9,537,788	21,198,332	1,076,110	34,037,864	39,514	19,164	22,494	10,910	22,584	22,516	28,197	17,530
1998	1,035,001	3,111,891	20,282,772	29,917,474	2,482,158	55,794,295	63,306	30,703	41,653	20,202	41,819	41,694	48,926	30,866
1999	1,409,453	2,030,743	496,056	499,438	681	3,026,918	881	447	289	140	292	291	487	293
2000	1,693,672	33,482	170,475	2,754,846	0	2,958,803	4,020	1,950	1,484	720	1,490	1,485	2,331	1,385
2001	330,283	4,638,546	13,093,697	18,916,864	133,177	36,782,285	30,564	14,824	11,750	5,699	11,797	11,762	18,037	10,761
2002	28,637	1,389,319	6,911,151	7,564,255	623,953	16,488,678	16,292	7,902	10,527	5,106	10,569	10,537	12,463	7,848
2003	1,977,333	700,749	480,190	1,553,593	78,033	2,812,564	2,877	1,395	1,639	795	1,646	1,641	2,054	1,277
2004	246,468	159,859	10,431,901	25,344,488	1,034,884	36,971,132	45,307	21,974	24,309	11,790	24,407	24,333	31,341	19,366
2005	243,151	158,986	7,470,964	10,445,649	2,164,636	20,240,236	30,809	14,942	27,739	13,453	27,850	27,767	28,799	18,721
2006	758,001	0	1,394,121	3,222,378	247,001	4,863,500	6,544	3,174	4,266	2,069	4,283	4,270	5,031	3,171
2007	125,635	703,347	3,928,911	1,925,985	119,479	6,677,723	4,251	2,062	2,319	1,125	2,328	2,321	2,966	1,836
2008	1,192,616	1,197,418	6,579,471	2,010,351	132,470	9,919,710	4,911	2,382	2,545	1,234	2,555	2,547	3,337	2,054
2009	635,509	72,902	4,136,179	3,813,558	56,647	8,079,285	6,576	3,189	2,697	1,308	2,707	2,699	3,993	2,399
Mean[1]	3,614,239	2,043,648	5,921,231	6,584,971	349,168	14,899,017	13,119	6,364	7,274	3,528	7,225	7,203	9,206	5,698
s.e.	1,168,682	413,097	995,080	1,456,841	118,460	2,441,007	2,837	1,376	1,870	907	1,884	1,878	2,179	1,377
Minimum[1]	28,637	0	170,475	422,339	0	2,812,564	881	447	289	140	292	291	487	293
Maximum[1]	32,717,535	8,694,456	20,282,772	29,917,474	2,482,158	55,794,295	63,306	30,703	41,653	20,202	41,819	41,694	48,926	30,866
2010	756,692	731,634	3,813,055	2,681,925	196,717	7,423,331	5,845	2,835	3,508	1,702	3,522	3,512	4,292	2,683

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Mesh factor = 1.24 applied to eggs prior to 1995.

Mesh factor = 1.62 applied to Stages 1 and 2 prior to 1995.

Larval densities recorded in 1984, 1987, and 1999 are believed to be low relative to densities in surrounding waters, see text for details.

Weights for Staged Suite 1 and Staged Suite 2 are based on 0.485 pounds per fish. Weights for Staged Suite 3 are based on 0.997 pounds per fish.

Winter flounder eggs, and stage 1 and stage 2 larvae were assumed to have zero survival.

Winter flounder stage 3 larvae were assumed to have 48.90% survival, and stage 4 larvae were assumed to have 49.39% survival.

Table 7. Numbers of winter flounder impinged at PNPS annually, 1980 - 2010. Numbers and weights of equivalent age 3 adults calculated by three methods are also shown.

Year	Estimated Annual Number Impinged	Equivalent Age 3 Adults							
		General		Staged		Staged Suite 3		Average	
		Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
1980	297	34	16	36	17	59	59	43	31
1981	249	29	14	30	15	57	57	39	28
1982	297	34	16	36	17	128	128	66	54
1983	232	27	13	28	14	24	24	26	17
1984	47	5	2	6	3	6	6	6	4
1985	884	102	49	106	51	120	120	109	74
1986	908	105	51	109	53	62	62	92	55
1987	138	16	8	17	8	16	16	16	11
1988	556	64	31	67	32	44	44	58	36
1989	1,119	129	63	134	65	105	105	123	77
1990	336	39	19	40	19	36	36	38	25
1991	694	80	39	83	40	86	86	83	55
1992	787	91	44	94	46	142	142	109	77
1993	1,181	136	66	141	68	115	115	131	83
1994	1,018	117	57	122	59	116	116	118	77
1995	1,628	188	91	195	95	223	222	202	136
1996	857	99	48	103	50	137	137	113	78
1997	608	70	34	73	35	62	62	68	44
1998	2,069	238	115	248	120	217	216	234	151
1999	1,021	118	57	122	59	87	87	109	68
2000	1,358	156	76	163	79	74	74	131	76
2001	1,729	199	97	207	100	177	176	194	124
2002	1,466	169	82	176	85	104	104	150	90
2003	1,435	165	80	172	83	94	94	144	86
2004	2,021	233	113	242	117	141	141	205	124
2005	2,688	310	150	322	156	151	151	261	152
2006	1,242	143	69	149	72	99	99	130	80
2007	715	82	40	86	42	107	107	92	63
2008	1,010	116	56	121	59	144	144	127	86
2009	672	77	38	80	39	39	39	66	38
Mean[1]	1,038	120	58	124	60	105	105	117	74
s.e.	114	13	6	14	7	10	10	11	7
Minimum[1]	232	27	13	28	14	24	24	26	17
Maximum[1]	2,688	310	150	322	156	223	222	261	152
2010	1,005	116	56	120	58	100	100	112	71

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Weights for General and Staged methods are based on 0.485 pounds per fish.

Weights for Staged Suite 3 are based on 0.997 pounds per fish.

Table 8. Numbers of winter flounder impinged adjusted for survival at PNPS, 1980 - 2010. Numbers and weights of equivalent age 3 adults calculated by three methods are also shown.

		Equivalent Age 3 Adults							
Year	Adjusted	General		Staged		Staged Suite 3		Average	
	Number Impinged	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
1980	231	27	13	28	13	46	46	33	24
1981	194	22	11	23	11	45	45	30	22
1982	232	27	13	28	13	100	100	52	42
1983	181	21	10	22	11	20	20	21	14
1984	37	4	2	4	2	5	5	5	3
1985	684	79	38	82	40	94	94	85	57
1986	701	81	39	84	41	48	48	71	43
1987	108	12	6	13	6	13	13	13	8
1988	431	50	24	52	25	36	36	46	28
1989	865	100	48	104	50	82	82	95	60
1990	261	30	15	31	15	27	27	29	19
1991	540	62	30	65	31	68	68	65	43
1992	609	70	34	73	35	110	110	84	60
1993	912	105	51	109	53	90	90	101	65
1994	789	91	44	94	46	91	91	92	60
1995	1,258	145	70	151	73	173	172	156	105
1996	663	76	37	79	39	108	108	88	61
1997	473	54	26	57	27	50	50	54	35
1998	1,595	184	89	191	93	169	168	181	117
1999	788	91	44	94	46	69	69	85	53
2000	1,047	121	58	125	61	105	105	117	75
2001	1,334	154	75	160	77	138	138	150	97
2002	1,131	130	63	135	66	118	118	128	82
2003	1,000	115	56	120	58	83	83	106	66
2004	1,559	180	87	187	91	112	112	159	96
2005	2,070	238	116	248	120	229	228	238	155
2006	959	110	54	115	56	78	78	101	62
2007	553	64	31	66	32	84	84	71	49
2008	779	90	44	93	45	113	113	99	67
2009	526	61	29	63	31	32	32	52	31
Mean[1]	799	92	45	96	46	90	90	93	60
s.e.	87	10	5	10	5	9	9	10	6
Minimum[1]	37	4	2	4	2	5	5	5	3
Maximum[1]	2,070	238	116	248	120	229	228	238	155
2010	788	91	44	94	46	80	80	88	57

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Impingement survival was assumed to be 23.1% attributable to the fish return sluiceway and low pressure spraywash.

Weights for General and Staged methods are based on 0.485 pounds per fish.

Weights for Life Stage are based on 0.997 pounds per fish.

Table 9. Numbers of cunner eggs and larvae entrained at PNPS annually, 1980 - 2010. Numbers and weights of equivalent age 1 adults calculated by two methods are also shown. Estimates based on normal operation flow.

Year	Total Number Entrained		Equivalent Age 1 Adults					
			Method 1		Method 2		Average	
	Eggs	Larvae	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
1980	3,257,891,776	120,991,540	882,027	105,843	1,278,287	3,835	1,080,157	54,839
1981	6,576,294,915	576,322,566	3,163,174	379,581	4,486,298	13,459	3,824,736	196,520
1982	2,010,779,150	10,136,561	275,664	33,080	418,548	1,256	347,106	17,168
1983	5,895,329,347	42,488,978	861,381	103,366	1,300,417	3,901	1,080,899	53,633
1984	56,209,029	43,701	6,708	805	10,325	31	8,516	418
1985	2,021,886,071	39,882,271	400,807	48,097	591,259	1,774	496,033	24,935
1986	1,493,653,289	26,913,778	285,480	34,258	422,159	1,266	353,819	17,762
1987	1,122,803,794	239,840	131,360	15,763	202,605	608	166,983	8,186
1988	1,539,089,318	7,376,502	209,407	25,129	318,171	955	263,789	13,042
1989	4,469,416,004	52,188,130	736,212	88,345	1,100,532	3,302	918,372	45,823
1990	1,336,048,112	172,098,797	871,690	104,603	1,227,175	3,682	1,049,433	54,142
1991	675,000,390	16,735,627	148,052	17,766	217,024	651	182,538	9,209
1992	2,174,661,078	2,791,875	264,110	31,693	405,766	1,217	334,938	16,455
1993	3,235,317,207	15,250,109	439,129	52,695	667,358	2,002	553,243	27,349
1994	1,558,253,667	9,986,072	222,498	26,700	336,583	1,010	279,541	13,855
1995	4,116,491,874	47,130,178	674,176	80,901	1,008,252	3,025	841,214	41,963
1996	2,807,124,109	17,418,813	398,444	47,813	603,064	1,809	500,754	24,811
1997	1,718,289,720	99,634,994	614,351	73,722	879,788	2,639	747,070	38,181
1998	4,341,664,826	370,217,451	2,045,563	245,468	2,902,906	8,709	2,474,234	127,088
1999	1,098,618,436	46,550,682	321,377	38,565	464,063	1,392	392,720	19,979
2000	1,349,685,330	63,093,975	419,409	50,329	604,006	1,812	511,708	26,071
2001	2,744,377,803	71,295,038	615,484	73,858	901,031	2,703	758,258	38,281
2002	580,954,607	15,566,804	132,267	15,872	193,461	580	162,864	8,226
2003	759,226,058	4,557,281	107,124	12,855	162,224	487	134,674	6,671
2004	1,452,433,321	19,052,802	247,963	29,756	369,655	1,109	308,809	15,432
2005	816,334,983	19,546,053	176,164	21,140	258,484	775	217,324	10,958
2006	1,033,954,109	14,140,211	178,922	21,471	266,460	799	222,691	11,135
2007	1,384,419,011	10,574,648	204,766	24,572	308,806	926	256,786	12,749
2008	1,102,923,951	42,052,473	303,148	36,378	439,018	1,317	371,083	18,847
2009	2,612,626,136	41,475,460	476,027	56,885	706,275	2,119	590,159	29,502
Mean[1]	2,291,526,593	70,552,488	559,815	67,169	815,610	2,447	687,677	34,808
s.e.	295,611,260	23,293,720	121,147	14,538	171,424	514	146,278	7,526
Minimum[1]	580,954,607	2,791,875	107,124	12,855	162,224	487	134,674	6,671
Maximum[1]	6,576,294,915	576,322,566	3,163,174	379,581	4,486,298	13,459	3,824,736	196,520
2010	2,555,970,632	37,470,155	452,772	54,333	673,133	2,019	562,953	28,176

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Mesh adjustment factors incorporated as necessary.

Egg and larval densities recorded in 1984, 1987, and 1999 are believed to be low relative to densities in waters, see text for details.

Method 1 weight based on 0.12 pound per fish. Method 2 weight based on 0.003 pounds per fish.

Table 10. Numbers of cunner eggs and larvae entrained adjusted for survival at PNPS, 1980 - 2010. Numbers and weights of equivalent age 1 adults calculated by two methods are also shown. Estimates based on normal operation flow.

Year	Total Adjusted Number Entrained		Equivalent Age 1 Adults					
			Method 1		Method 2		Average	
	Eggs	Larvae	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
1980	316,015,502	52,188,454	253,988	30,479	356,162	1,068	305,075	15,774
1981	637,900,607	161,201,665	745,260	89,431	1,039,511	3,119	892,386	46,275
1982	195,045,578	2,812,358	34,355	4,123	51,097	153	42,726	2,138
1983	571,846,947	17,344,339	138,610	16,633	202,031	606	170,321	8,620
1984	5,452,276	22,725	728	87	1,108	3	918	45
1985	196,122,949	4,643,473	42,105	5,053	61,799	185	51,952	2,619
1986	144,884,369	375,307	18,384	2,206	28,120	84	23,252	1,145
1987	108,911,968	83,969	12,995	1,559	20,001	60	16,498	810
1988	149,291,664	3,615,463	32,387	3,886	47,506	143	39,947	2,014
1989	433,533,352	13,205,564	105,319	12,638	153,489	460	129,404	6,549
1990	129,596,667	88,510,263	383,578	46,029	531,214	1,594	457,396	23,812
1991	65,475,038	5,508,754	30,539	3,665	43,351	130	36,945	1,897
1992	210,942,125	1,033,522	28,794	3,455	43,737	131	36,266	1,793
1993	313,825,769	7,779,515	68,828	8,259	100,893	303	84,860	4,281
1994	151,150,606	5,145,732	38,974	4,677	56,622	170	47,798	2,423
1995	399,299,712	9,399,794	85,498	10,260	125,511	377	105,504	5,318
1996	272,291,039	7,595,788	63,241	7,589	92,395	277	77,818	3,933
1997	166,674,103	44,337,878	203,962	24,475	284,340	853	244,151	12,664
1998	421,141,488	121,472,847	554,674	66,561	772,648	2,318	663,661	34,439
1999	106,565,988	8,822,383	49,107	5,893	69,733	209	59,420	3,051
2000	130,919,477	21,257,305	103,710	12,445	145,466	436	124,588	6,441
2001	266,204,647	30,182,136	156,577	18,789	220,934	663	188,756	9,726
2002	56,352,597	6,871,478	35,154	4,218	49,537	149	42,345	2,184
2003	73,644,928	352,711	10,019	1,202	15,223	46	12,621	624
2004	140,886,032	5,152,826	37,812	4,537	54,823	164	46,318	2,351
2005	79,184,493	4,120,844	26,352	3,162	37,842	114	32,097	1,638
2006	100,293,549	919,390	15,473	1,857	23,251	70	19,362	963
2007	134,288,644	1,382,286	21,347	2,562	32,001	96	26,674	1,329
2008	106,983,623	17,505,914	85,311	10,237	119,646	359	102,478	5,298
2009	253,424,735	21,194,144	117,670	13,999	167,059	501	141,857	7,250
Mean[1]	222,278,080	23,711,862	124,537	14,940	175,926	528	150,213	7,734
s.e.	28,674,292	7,327,778	32,509	3,901	45,162	135	38,835	2,018
Minimum[1]	56,352,597	352,711	10,019	1,202	15,223	46	12,621	624
Maximum[1]	637,900,607	161,201,665	745,260	89,431	1,039,511	3,119	892,386	46,275
2010	247,929,151	18,529,225	105,936	12,712	150,779	452	128,357	6,582

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Mesh adjustment factors incorporated as necessary.

Egg and larval densities recorded in 1984, 1987, and 1999 are believed to be low relative to densities in surrounding waters, see text for details.

Method 1 weight based on 0.12 pound per fish. Method 2 weight based on 0.003 pounds per fish.

Cunner eggs were assumed to have 90% survival. Cunner larvae were assumed to have 100% survival at temperatures between 25 and 30°C and 48% survival at temperatures between 30 and 35°C.

Table 11. Numbers of cunner impinged at PNPS annually, 1980 - 2010. Numbers and weights of equivalent age 1+ adults calculated by two methods are also shown. Estimates based on normal operation flow.

Year	Total Number Impinged	Equivalent Age 1+ Adults					
		Method 1		Method 2		Average	
		Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
1980	1,043	1,043	125	373	1	708	63
1981	870	870	104	508	2	689	53
1982	610	610	73	446	1	528	37
1983	196	196	24	187	1	192	12
1984	45	45	5	32	0	38	3
1985	580	580	70	537	2	559	36
1986	270	270	32	271	1	271	17
1987	115	115	14	80	0	98	7
1988	97	97	12	56	0	77	6
1989	199	199	24	133	0	166	12
1990	210	210	25	213	1	212	13
1991	182	182	22	179	1	181	11
1992	28	28	3	22	0	25	2
1993	93	93	11	83	0	88	6
1994	77	77	9	77	0	77	5
1995	346	346	42	201	1	274	21
1996	332	332	40	256	1	294	20
1997	41	41	5	32	0	37	3
1998	101	101	12	101	0	101	6
1999	153	153	18	119	0	136	9
2000	348	348	42	228	1	288	21
2001	140	140	17	77	0	109	9
2002	59	59	7	31	0	45	4
2003	172	172	21	49	0	111	10
2004	240	240	29	169	1	204	15
2005	716	716	86	485	1	600	44
2006	384	384	46	156	0	270	23
2007	367	367	44	226	1	296	22
2008	247	247	30	210	1	229	15
2009	895	895	107	501	2	698	54
Mean[1]	321	321	39	212	1	266	20
s.e.	52	52	6	30	0	40	3
Minimum[1]	28	28	3	22	0	25	2
Maximum[1]	1,043	1,043	125	537	2	708	63
2010	535	535	64	348	1	442	33

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Method 1 weight based on 0.12 pound per fish. Method 2 weight based on 0.003 pounds per fish.

Table 12. Numbers of cunner impinged adjusted for survival at PNPS, 1980 - 2010. Numbers and weights of equivalent age 1 adults calculated by two methods are also shown. Estimates based on normal operation flow.

Year	Adjusted Number Impinged	Equivalent Age 1 Adults: Method 1 Number	Method 1 Weight (lbs)	Method 2 Number	Method 2 Weight (lbs)	Average Number	Average Weight (lbs)
1980	931	931	112	507	2	719	57
1981	777	777	93	431	1	604	47
1982	545	545	65	348	1	447	33
1983	175	175	21	97	0	136	11
1984	40	40	5	29	0	35	2
1985	518	518	62	354	1	436	32
1986	241	241	29	175	1	208	15
1987	103	103	12	58	0	81	6
1988	87	87	10	50	0	69	5
1989	177	177	21	96	0	137	11
1990	188	188	23	126	0	157	11
1991	162	162	19	124	0	143	10
1992	25	25	3	15	0	20	2
1993	83	83	10	55	0	69	5
1994	69	69	8	47	0	58	4
1995	309	309	37	183	1	246	19
1996	297	297	36	177	1	237	18
1997	37	37	4	25	0	31	2
1998	90	90	11	59	0	75	5
1999	136	136	16	105	0	121	8
2000	310	310	37	188	1	249	19
2001	125	125	15	90	0	108	8
2002	53	53	6	28	0	41	3
2003	154	154	18	44	0	99	9
2004	214	214	26	151	0	183	13
2005	639	639	77	433	1	536	39
2006	343	343	41	151	0	247	21
2007	328	328	39	202	1	265	20
2008	221	221	27	83	0	152	13
2009	799	799	96	281	1	540	48
Mean[1]	287	287	34	165	0	226	17
s.e.	47	47	6	26	0	36	3
Minimum[1]	25	25	3	15	0	20	2
Maximum[1]	931	931	112	507	2	719	57
2010	478	478	57	308	1	393	29

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Cunner impinged were assumed to have a 10.7% survival attributable to the fish return sluiceway and the low pressure spraywash.

Method 1 weight based on 0.12 pound per fish. Method 2 weight based on 0.003 pounds per fish.

Table 13. Numbers of Atlantic mackerel eggs and larvae entrained at PNPS annually, 1980 - 2010. Numbers and weights of equivalent age 1 and age 3 fish calculated by two methods are also shown. Estimates based on normal operation flow.

Year	Total Number Entrained		Equivalent Age 1 Juveniles and Age 3 Adults											
			Method 1				Method 2				Average			
			Age 1 Juveniles		Age 3 Adult		Age 1 Juveniles		Age 3 Adult		Age 1 Juveniles		Age 3 Adult	
	Eggs	Larvae	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
1980	81,599,432	22,293,108	1,373	275	564	395	1,447	447	463	296	1,410	361	513	345
1981	183,959,791	320,135,596	16,275	3,255	6,691	4,684	16,643	5,143	5,323	3,401	16,459	4,199	6,007	4,043
1982	108,234,931	9,388,143	835	167	343	240	918	284	294	188	877	225	318	214
1983	148,616,621	41,333,673	2,536	507	1,042	730	2,671	825	854	546	2,603	666	948	638
1984	570,854	2,480	2	0	1	1	3	1	1	1	2	1	1	1
1985	1,867,648,438	45,711,343	8,727	1,745	3,588	2,512	10,079	3,114	3,223	2,060	9,403	2,430	3,406	2,286
1986	219,488,066	58,333,520	3,612	722	1,485	1,040	3,811	1,177	1,219	779	3,711	950	1,352	909
1987	2,397,224	107,727	14	3	6	4	15	5	5	3	14	4	5	4
1988	2,663,608,568	3,401,489	9,429	1,886	3,877	2,714	11,310	3,495	3,617	2,311	10,369	2,690	3.747	2,512
1989	4,673.915,938	65,562,469	19,455	3,891	7,999	5,599	22,801	7,046	7,292	4,660	21,128	5,468	7,646	5,130
1990	2,313,416,455	4,627,282	8,271	1,654	3,401	2,380	9.906	3,061	3,168	2,024	9,088	2,358	3,284	2,202
1991	479,761,865	66,009,482	4,892	978	2,011	1,408	5,280	1,631	1,689	1,079	5,086	1,305	1,850	1,243
1992	377,610,764	8,086,393	1,708	342	702	492	1,980	612	633	405	1,844	477	668	448
1993	1,801,378,418	8,325,789	6,671	1,334	2,743	1,920	7,948	2,456	2,542	1,624	7,309	1,895	2,642	1,772
1994	520,917,221	3,419,299	1,978	396	813	569	2,348	726	751	480	2,163	561	782	525
1995	1,767,609,278	197,689,693	15,802	3,160	6,497	4,548	17,196	5,314	5,500	3,514	16,499	4,237	5,998	4,031
1996	1,507,370,682	70,947,053	8,707	1,741	3,580	2,506	9,823	3,035	3,142	2,007	9,265	2,388	3,361	2,257
1997	316,969,390	25,778,062	2,361	472	971	680	2,604	805	833	532	2,483	638	902	606
1998	530,017,006	56,622,648	4,609	922	1,895	1,326	5,025	1,553	1,607	1,027	4,817	1,237	1,751	1,177
1999	6,182,166	311,394	37	7	15	11	41	13	13	8	39	10	14	10
2000	619,863,003	16,496,664	2,961	592	1,218	852	3,411	1,054	1,091	697	3,186	823	1,154	775
2001	134,385,477	4,839,176	704	141	289	203	802	248	257	164	753	194	273	183
2002	280,852,511	3,704,444	1,158	232	476	333	1,358	420	434	278	1,258	326	455	305
2003	310,982,536	4,924,563	1,322	264	544	380	1.545	477	494	316	1.433	371	519	348
2004	70,143,355	10,894,804	776	155	319	223	834	258	267	170	805	206	293	197
2005	86,441,242	2,782,044	436	87	179	126	500	154	160	102	468	121	170	114
2006	154,562,772	9,370,507	995	199	409	286	1,111	343	355	227	1,053	271	382	257
2007	97,050,673	6,522,372	656	131	270	189	729	225	233	149	693	178	251	169
2008	98,816,053	609,492	373	75	154	107	444	137	142	91	408	106	148	99
2009	60,306,471	1,407,741	278	55	114	80	322	100	103	66	299	77	108	73
Mean[1]	767,203,897	38,197,437	4,533	907	1,864	1,305	5,103	1,577	1,632	1,043	4,818	1,242	1,748	1,174
s.e.	204,855,181	12,952,531	1,006	201	414	290	1,129	349	361	231	1,067	275	387	260
Minimum[1]	6,182,166	311,394	37	7	15	11	41	13	13	8	39	10	14	10
Maximum[1]	4,673,915,938	320,135,596	19,455	3,891	7,999	5,599	22,801	7,046	7,292	4,660	21,128	5,468	7,646	5,130
2010	72,370,028	779,129	290	58	119	120	341	105	109	70	316	82	114	95

Notes: See text for details.

[1] The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Mesh adjustment factors incorporated as necessary.

Egg and larval densities recorded in 1984, 1987, and 1999 are believed to be low relative to densities in surrounding waters, see text for details.

Method 1 weight based on 0.2 pound per fish for Age 1 and 0.7 pound per fish for Age 3. Method 2 weight based on 0.309 pounds per fish for Age 1 and 0.639 pound per fish for Age 3.

Atlantic mackerel eggs and larvae entrained were assumed to have zero survival.

Table 14. Numbers of Atlantic mackerel impinged at PNPS annually, 1980 - 2010. Numbers and weights of equivalent age 3 adults calculated by two methods are also shown.

Year	Estimated Annual Number Impinged	Equivalent Age 3 Adults: Method 1 Number	Method 1 Weight (lbs)	Method 2 Number	Method 2 Weight (lbs)	Average Number	Average Weight (lbs)
1980	0	0	0	0	0	0	0
1981	49	49	34	0	0	25	17
1982	0	0	0	0	0	0	0
1983	12	12	8	0	0	6	4
1984	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0
1988	24	24	17	0	0	12	8
1989	29	29	20	0	0	15	10
1990	13	13	9	0	0	7	5
1991	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0
1994	12	12	8	0	0	6	4
1995	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	15	15	11	0	0	8	5
2008	0	0	0	0	0	0	0
2009	60	60	42	60	38	60	40
Mean[1]	8	8	5	2	1	5	3
s.e.	3	3	2	2	1	2	2
Minimum[1]	0	0	0	0	0	0	0
Maximum[1]	60	60	42	60	38	60	40
2010	0	0	0	0	0	0	0

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Method 1 weight based on 0.7 pound per fish. Method 2 weight based on 0.639 pound per fish.

Atlantic mackerel impinged were assumed to have zero survival.

Table 15. Numbers of Atlantic menhaden eggs and larvae entrained at PNPS annually, 1980-2010. Numbers and weights of equivalent age 2 and 3 fish calculated by two methods are also shown. Estimates based on normal operation flow.

			Equivalent Age 2 and Age 3 Adults								
			Method 1			Method 2			Average		
Year	Total Number Entrained		Age 2		Age 3	Age 2		Age 3	Age 2		Age 3
	Eggs	Larvae	Number	Weight (lbs)	Number	Number	Weight (lbs)	Number	Number	Weight (lbs)	Number
1980	16,468,408	12,060,791	2,819	1,691	731	430	101	91	1,625	896	411
1981	3,473,080	40,076,799	7,950	4,770	2,061	1,106	260	235	4,528	2,515	1,148
1982	365,091,471	1,845,849	10,450	6,270	2,709	2,361	555	501	6,405	3,412	1,605
1983	869,580	1,227,190	265	159	69	39	9	8	152	84	38
1984	300,943	0	131	79	34	2	0	0	67	40	17
1985	41,131,470	9,190,654	2,938	1,763	761	509	120	108	1,723	941	435
1986	21,112,802	3,654,854	1,300	780	337	232	55	49	766	417	193
1987	135,755	731,741	314	189	82	21	5	4	168	97	43
1988	9,273,771	2,713,857	788	473	204	132	31	28	460	252	116
1989	11,212,165	4,411,807	1,174	705	304	190	45	40	682	375	172
1990	7,057,041	3,263,718	835	501	216	133	31	28	484	266	122
1991	5,744,115	512,319	259	155	67	50	12	11	155	84	39
1992	392,533	1,117,881	230	138	60	33	8	7	131	73	33
1993	947,815,345	11,833,443	28,508	17,105	7,389	6,320	1,485	1,341	17,414	9,295	4,365
1994	10,221,752	2,361,834	745	447	193	129	30	27	437	239	110
1995	3,280,481	12,419,886	2,525	1,515	654	357	84	76	1,441	799	365
1996	4,861,265	8,660,874	1,832	1,099	475	265	62	56	1,048	581	266
1997	48,899,715	48,283,152	10,814	6,488	2,803	1,615	380	343	6,215	3,434	1,573
1998	44,730,447	33,280,806	7,758	4,655	2,011	1,183	278	251	4,471	2,467	1,131
1999	10,385,304	18,939,526	4,185	2,511	1,085	578	136	123	2,381	1,323	604
2000	882,086	809,127	183	110	47	27	6	6	105	58	27
2001	4,025,648	1,251,898	357	214	92	59	14	13	208	114	53
2002	14,464,446	5,164,308	1,412	847	366	231	54	49	822	451	208
2003	6,122,068	4,059,959	965	579	250	149	35	32	557	307	141
2004	613,682	176,011	51	31	13	9	2	2	30	16	8
2005	1,402,677	17,566,121	3,481	2,089	902	484	114	103	1,983	1,101	503
2006	1,681,187	22,066,458	4,371	2,623	1,133	607	143	129	2,489	1,383	631
2007	8,328,758	17,482,918	3,657	2,194	948	14,572	3,424	3,093	9,114	2,809	2,020
2008	3,085,175	69,472,958	13,701	8,221	3,551	2,019	474	475	7,860	4,347	2,013
2009	203,077	14,512,115	2,850	1,659	739	394	93	84	1,579	876	400
Mean[1]	56,886,770	13,157,754	4,157	2,493	1,078	1,222	287	261	2,688	1,390	669
s.e.	35,425,186	3,129,038	1,133	680	294	548	129	116	724	371	179
Minimum[1]	203,077	176,011	51	31	13	9	2	2	30	16	8
Maximum[1]	947,815,345	69,472,958	28,508	17,105	7,389	14,572	3,424	3,093	17,414	9,295	4,365
2010	21,379,962	5,751,886	1,718	1,031	445	291	68	62	1,004	550	253

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.
Egg and larval densities recorded in 1984, 1987, and 1999 are believed to be low relative to densities in surrounding waters, see text for details.
Method 1 weight based on 0.6 pound per fish. Method 2 weight based on 0.235 pound per fish.

Table 16. Numbers of Atlantic menhaden eggs and larvae entrained adjusted for survival at PNPS annually, 1980-2010. Numbers and weights of equivalent age 2 and 3 fish calculated by two methods are also shown. Estimates based on normal operation flow.

			Equivalent Age 2 and Age 3 Adults								
			Method 1			Method 2			Average		
Year	Adjusted Number Entrained		Age 2		Age 3	Age 2		Age 3	Age 2		Age 3
	Eggs	Larvae	Number	Weight (lbs)	Number	Number	Weight (lbs)	Number	Number	Weight (lbs)	Number
1980	3,293,682	5,780,660	1,224	734	317	177	42	38	701	388	177
1981	694,616	19,776,470	3,895	2,337	1,010	539	127	114	2,217	1,232	562
1982	73,018,294	1,225,310	2,258	1,355	585	495	116	105	1,377	736	345
1983	173,916	808,723	163	98	42	23	5	5	93	52	24
1984	60,189	0	2	1	0	0	0	0	1	1	0
1985	8,226,294	4,253,143	1,061	637	275	167	39	35	614	338	155
1986	4,222,560	1,694,157	449	269	116	73	17	15	261	143	66
1987	27,151	469,555	93	56	24	13	3	3	53	29	13
1988	1,854,754	2,001,043	443	266	115	66	15	14	255	141	64
1989	2,242,433	2,451,756	542	325	141	80	19	17	311	172	79
1990	1,411,408	2,189,095	468	281	121	68	16	14	268	148	68
1991	1,148,823	230,543	77	46	20	14	3	3	45	25	11
1992	78,507	641,934	128	77	33	18	4	4	73	40	18
1993	189,563,069	8,077,164	6,821	4,092	1,768	1,418	333	301	4,120	2,213	1,035
1994	2,044,350	1,155,213	283	170	73	44	10	9	164	90	41
1995	656,096	5,932,286	1,181	708	306	165	39	35	673	374	170
1996	972,253	4,878,306	983	590	255	138	32	29	560	311	142
1997	9,779,943	29,172,650	5,988	3,593	1,552	851	200	181	3,419	1,896	866
1998	8,946,089	24,529,846	5,055	3,033	1,310	720	169	153	2,887	1,601	731
1999	2,077,061	13,174,086	2,639	1,584	684	369	87	78	1,504	835	381
2000	176,417	497,183	102	61	27	15	3	3	58	32	15
2001	805,130	762,485	172	103	45	26	6	5	99	55	25
2002	2,892,889	3,839,619	832	499	216	122	29	26	477	264	121
2003	1,224,414	2,238,968	473	284	123	68	16	14	270	150	69
2004	122,736	169,682	37	22	9	5	1	1	21	12	5
2005	280,535	7,904,754	1,557	934	404	216	51	46	886	492	225
2006	336,237	6,459,340	1,275	765	331	177	42	38	726	403	184
2007	1,665,752	9,867,163	1,092	655	283	10,953	2,574	2,325	6,022	1,615	1,304
2008	617,035	52,641,902	10,334	6,200	2,679	1,427	335	303	5,881	3,268	1,491
2009	40,615	10,869,225	2,131	1,241	552	294	69	62	1,181	655	299
Mean[1]	11,377,354	7,972,240	1,845	1,106	478	669	157	142	1,256	631	310
s.e.	7,085,037	2,165,964	465	279	121	388	91	82	321	152	77
Minimum[1]	40,615	169,682	37	22	9	5	1	1	21	12	5
Maximum[1]	189,563,069	52,641,902	10,334	6,200	2,679	10,953	2,574	2,325	6,022	3,268	1,491
2010	4,275,992	4,119,483	926	463	240	138	33	29	532	248	135

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages. Egg and larval densities recorded in 1984, 1987, and 1999 are believed to be low relative to densities in surrounding waters.
Method 1 weight based on 0.5 pound per fish. Method 2 weight based on 0.235 pound per fish.

Atlantic menhaden eggs were assumed to have 80% survival. Atlantic menhaden larvae were assumed to have 55% survival at temperatures between 25 and 30°C, and 24% survival at temperatures between 30 and 35°C.

Table 17. Numbers of Atlantic menhaden impinged at PNPS annually, 1980-2010. Numbers and weights of equivalent age 2 and 3 fish calculated by two methods are also shown.

Year	Estimated Annual Number Impinged	Equivalent Age 2 and Age 3 Adults: Method 1 Age 2 Number	Method 1 Age 2 Weight (lbs)	Method 1 Age 3 Number	Method 2 Age 2 Number	Method 2 Age 2 Weight (lbs)	Method 2 Age 3 Number	Average Age 2 Number	Average Age 2 Weight (lbs)	Average Age 3 Number
1980	226	37	22	10	104	25	22	71	23	16
1981	0	0	0	0	0	0	0	0	0	0
1982	171	28	17	7	102	24	22	65	20	14
1983	522	85	51	22	223	53	47	154	52	35
1984	11	2	1	0	5	1	1	3	1	1
1985	1,491	243	146	63	567	133	120	405	140	92
1986	953	155	93	40	406	95	86	281	94	63
1987	0	0	0	0	0	0	0	0	0	0
1988	177	29	17	7	73	17	16	51	17	12
1989	2,020	329	197	85	845	198	179	587	198	132
1990	3,135	511	307	132	1,249	293	265	880	300	199
1991	1,117	182	109	47	440	103	93	311	106	70
1992	32	5	3	1	22	5	5	13	4	3
1993	46	7	4	2	34	8	7	21	6	5
1994	58	9	5	2	20	5	4	14	5	3
1995	1,560	254	152	66	576	135	122	415	144	94
1996	2,168	353	212	92	1,590	374	338	972	293	215
1997	1,329	217	130	56	471	111	100	344	120	78
1998	1,423	232	139	60	501	118	106	367	128	83
1999	42,686	6,958	4,175	1,803	16,285	3,827	3,456	11,621	4,001	2,630
2000	34,354	5,600	3,360	1,451	27,432	6,446	5,822	16,516	4,903	3,637
2001	3,599	587	352	152	1,405	330	298	996	341	225
2002	53,304	8,689	5,213	2,252	19,070	4,481	4,048	13,879	4,847	3,150
2003	119,041	19,404	11,642	5,029	48,899	11,491	10,379	34,152	11,567	7,704
2004	10,341	1,686	1,012	437	4,208	989	893	2,947	1,000	665
2005	277,601	45,249	27,149	11,729	90,770	21,331	19,266	68,009	24,240	15,498
2006	15,189	2,476	1,486	642	5,675	1,334	1,205	4,076	1,410	924
2007	154,832	25,238	15,143	6,542	57,203	13,443	12,141	41,221	14,293	9,341
2008	721	118	71	30	319	75	68	218	73	49
2009	12,528	2,042	1,225	529	5,268	1,238	1,118	3,655	1,232	824
Mean[1]	26,451	4,312	2,587	1,117	10,134	2,382	2,151	7,223	2,484	1,634
s.e.	11,615	1,893	1,136	491	4,065	955	863	2,971	1,042	675
Minimum[1]	0	0	0	0	0	0	0	0	0	0
Maximum[1]	277,601	45,249	27,149	11,729	90,770	21,331	19,266	68,009	24,240	15,498
2010	1,403	229	137	59	481	113	102	355	125	81

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low numbers resulting from plant outages.

Method 1 weight based on 0.6 pound per fish. Method 2 weight based on 0.235 pound per fish.

Atlantic menhaden impinged were assumed to have zero survival.

Table 18. Numbers of Atlantic herring larvae entrained at PNPS annually, 1980-2010. Numbers and weights of equivalent age 1 and 3 fish calculated by two methods are also shown.

Year	Total Number of Larvae Entrained	Equivalent Age 1 Juveniles and Age 3 Adults											
		Method 1				Method 2				Average			
		Age 1		Age 3		Age 1		Age 3		Age 1		Age 3	
		Number	Weight(lbs)	Number	Weight(lbs)	Number	Weight(lbs)	Number	Weight(lbs)	Number	Weight(lbs)	Number	Weight(lbs)
1980	1,068,466	1,566	47	703	281	3,033	95	1,161	351	2,299	71	932	316
1981	2,471,492	3,622	109	1,626	650	7,015	220	2,686	811	5,319	164	2,156	731
1982	732,857	1,074	32	482	193	2,080	65	796	241	1,577	49	639	217
1983	5,880,315	8,618	259	3,869	1,548	16,691	524	6,391	1,930	12,654	391	5,130	1,739
1984	468,840	687	21	308	123	1,331	42	510	154	1,009	31	409	139
1985	1,580,435	2,316	69	1,040	416	4,486	141	1,718	519	3,401	105	1,379	467
1986	1,811,101	2,654	80	1,192	477	5,141	161	1,968	594	3,897	121	1,580	536
1987	5,142,045	7,536	226	3,383	1,353	14,595	458	5,588	1,688	11,066	342	4,486	1,520
1988	639,089	937	28	420	168	1,814	57	695	210	1,375	43	558	189
1989	911,487	1,336	40	600	240	2,587	81	991	299	1,962	61	795	270
1990	2,079,483	3,048	91	1,368	547	5,902	185	2,260	683	4,475	138	1,814	615
1991	1,280,273	1,876	56	842	337	3,634	114	1,391	420	2,755	85	1,117	379
1992	3,970,208	5,819	175	2,612	1,045	11,269	354	4,315	1,303	8,544	264	3,463	1,174
1993	2,098,952	3,076	92	1,381	552	5,958	187	2,281	689	4,517	140	1,831	621
1994	16,351,765	23,966	719	10,758	4,303	46,412	1,457	17,771	5,367	35,189	1,088	14,265	4,835
1995	43,247,883	63,385	1,902	28,454	11,381	122,754	3,854	47,002	14,194	93,070	2,878	37,728	12,788
1996	9,265,826	13,580	407	6,096	2,438	26,300	826	10,070	3,041	19,940	617	8,083	2,740
1997	24,445,056	35,827	1,075	16,083	6,433	69,384	2,179	26,567	8,023	52,606	1,627	21,325	7,228
1998	4,026,783	5,902	177	2,649	1,060	11,430	359	4,376	1,322	8,666	268	3,513	1,191
1999	11,379,446	16,678	500	7,487	2,995	32,299	1,014	12,367	3,735	24,489	757	9,927	3,365
2000	12,306,502	18,037	541	8,097	3,239	34,930	1,097	13,375	4,039	26,484	819	10,736	3,639
2001	4,062,977	5,955	179	2,673	1,069	11,532	362	4,416	1,334	8,744	270	3,544	1,201
2002	3,468,890	5,084	153	2,282	913	9,846	309	3,770	1,139	7,465	231	3,026	1,026
2003	1,096,632	1,607	48	721	288	3,113	98	1,192	360	2,360	73	956	324
2004	5,064,603	7,423	223	3,332	1,333	14,375	451	5,504	1,662	10,899	337	4,418	1,498
2005	9,860,824	14,452	434	6,488	2,595	27,989	879	10,717	3,236	21,220	656	8,602	2,916
2006	8,006,769	11,735	352	5,268	2,107	22,726	714	8,702	2,628	17,231	533	6,985	2,368
2007	341,371	500	15	225	90	969	30	371	112	734	23	298	101
2008	2,879,217	4,220	127	1,894	758	8,172	257	3,129	945	6,196	192	2,512	851
2009	3,303,704	4,842	145	2,174	869	9,377	294	3,590	1,084	7,110	220	2,882	977
Mean[1]	6,558,300	9,612	288	4,315	1,726	18,615	585	7,128	2,153	14,113	436	5,721	1,939
s.e.	1,715,780	2,515	75	1,129	452	4,870	153	1,865	563	3,692	114	1,497	507
Minimum[1]	341,371	500	15	225	90	969	30	371	112	734	23	298	101
Maximum[1]	43,247,883	63,385	1,902	28,454	11,381	122,754	3,854	47,002	14,194	93,070	2,878	37,728	12,788
2010	3,737,447	5,478	164	2,459	984	10,608	333	4,062	1,227	8,043	249	3,260	1,105

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low number resulting from the plant outage.

Outage periods in 1984 and 1987 may have affected entrainment estimates at the end of the spring larval herring period.

The outage in 1999 occurred after the larval herring season.

Method 1 weight conversion based on 0.03 for Age 1 and 0.4 pound per Age 3 fish. Method 2 weight conversion based on 0.0314 for Age 1 and 0.302 pound per Age 3 fish.

Atlantic herring entrained were assumed to have zero survival.

Table 19. Numbers of Atlantic herring impinged at PNPS annually 1980-2010. Numbers and weights of equivalent age 3 fish calculated by two methods are also shown.

	Estimated	Equivalent Age 3 Adults								
	Annual	Method 1			Method 2			Average		
Year	Number	Age 1	Age 3		Age 1	Age 3		Number	Weight(lbs)	
	Impinged	Weight(lbs)	Number	Weight(lbs)	Weight(lbs)	Number	Weight(lbs)	Age 3	Age 1	Age 3
1980	83	2	37	15	3	61	18	49	3	17
1981	53	2	24	10	2	39	12	32	2	11
1982	156	5	70	28	5	115	35	92	5	31
1983	22	1	10	4	1	16	5	13	1	4
1984	0	0	0	0	0	0	0	0	0	0
1985	35	1	16	6	1	26	8	21	1	7
1986	3,009	90	1,351	540	94	2,218	670	1,785	92	605
1987	6	0	3	1	0	4	1	4	0	1
1988	51	2	23	9	2	38	11	30	2	10
1989	138	4	62	25	4	102	31	82	4	28
1990	408	12	183	73	13	301	91	242	13	82
1991	24,238	727	10,880	4,352	761	17,867	5,396	14,373	744	4,874
1992	51	2	23	9	2	38	11	30	2	10
1993	169	5	76	30	5	125	38	100	5	34
1994	28	1	13	5	1	21	6	17	1	6
1995	108	3	48	19	3	80	24	64	3	22
1996	0	0	0	0	0	0	0	0	0	0
1997	13	0	6	2	0	10	3	8	0	3
1998	108	3	48	19	3	80	24	64	3	22
1999	181	5	81	32	6	133	40	107	6	36
2000	77	2	35	14	2	57	17	46	2	16
2001	48	1	22	9	2	35	11	29	1	10
2002	301	9	135	54	9	222	67	178	9	61
2003	51	2	23	9	2	38	11	30	2	10
2004	138	4	62	25	4	102	31	82	4	28
2005	549	16	246	98	17	405	122	325	17	110
2006	122	4	55	22	4	90	27	72	4	25
2007	0	0	0	0	0	0	0	0	0	0
2008	23	1	10	4	1	0	0	5	1	2
2009	0	0	0	0	0	0	0	0	0	0
Mean[1]	1,077	32	484	193	34	793	240	638	33	217
s.e.	864	26	388	155	27	637	192	513	27	174
Minimum[1]	0	0	0	0	0	0	0	0	0	0
Maximum[1]	24,238	727	10,880	4,352	761	17,867	5,396	14,373	744	4,874
2010	162	5	73	29	1	9	3	41	3	16

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low number resulting from the plant outage.

Method 1 weight conversion based on 0.03 for Age 1 and 0.4 pound per Age 3 fish.

Method 2 weight conversion based on 0.0314 for Age 1 and 0.302 pound per Age 3 fish.

Atlantic herring impinged were assumed to have zero survival.

Table 20. Numbers of Atlantic cod eggs and larvae entrained at PNPS annually, 1980-2010. Numbers and weights of equivalent age 2 fish calculated by two methods are also shown.

Year	Total Number Entrained		Equivalent Age 2 Adults					
			Method 1		Method 2		Average	
	Eggs	Larvae	Number	Weight (lbs)	Number	Weight (lbs)	Number	Weight (lbs)
1980	20,388,850	1,450,522	76	38	2,524	618	1,300	328
1981	11,620,588	2,173,076	89	45	3,554	871	1,822	458
1982	2,582,984	222,721	11	5	381	93	196	49
1983	9,349,728	142,136	17	8	336	82	176	45
1984	11,726,579	587,054	35	18	1,063	260	549	139
1985	5,071,151	1,441,442	56	28	2,326	570	1,191	299
1986	2,788,767	1,035,987	39	20	1,661	407	850	213
1987	5,623,282	122,579	11	6	260	64	136	35
1988	2,747,034	254,239	12	6	432	106	222	56
1989	3,395,726	119,436	8	4	228	56	118	30
1990	2,406,536	1,566,291	57	28	2,490	610	1,273	319
1991	3,668,649	239,746	13	6	421	103	217	55
1992	2,819,673	469,713	20	10	772	189	396	99
1993	1,268,748	446,489	17	8	717	176	367	92
1994	3,119,312	1,904,519	69	35	3,030	742	1,550	389
1995	2,549,370	602,594	24	12	978	239	501	126
1996	8,542,922	2,369,255	92	46	3,826	937	1,959	492
1997	1,800,711	1,101,118	40	20	1,752	429	896	225
1998	4,971,621	735,301	32	16	1,215	298	623	157
1999	1,932,894	464,125	18	9	753	184	385	97
2000	18,525,824	325,095	35	17	733	180	384	98
2001	6,869,977	4,215,642	153	77	6,707	1,643	3,430	860
2002	8,538,146	1,299,393	55	28	2,144	525	1,100	277
2003	10,087,198	2,000,121	81	41	3,264	800	1,673	420
2004	6,934,046	1,550,052	62	31	2,519	617	1,290	324
2005	14,954,283	950,164	52	26	1,673	410	862	218
2006	2,921,907	2,681,553	96	48	4,249	1,041	2,172	544
2007	6,308,949	1,419,048	57	28	2,306	565	1,181	297
2008	3,413,624	1,009,708	39	19	1,628	399	833	209
2009	7,740,045	1,587,158	64	32	2,587	634	1,325	333
Mean[1]	6,332,831	1,206,309	49	25	1,972	483	1,011	254
s.e.	949,001	176,303	6	3	279	68	143	36
Minimum[1]	1,268,748	119,436	8	4	228	56	118	30
Maximum[1]	20,388,850	4,215,642	153	77	6,707	1,643	3,430	860
2010	8,707,496	754,858	37	18	1,291	316	664	167

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low number resulting from the plant outage.

from plant outages.

Method 1 weight conversion based on 0.5 pounds per fish. Method 2 weight conversion based on 0.245 pounds per fish.

Atlantic cod eggs and larvae were assumed to have zero entrainment survival.

Table 21. Numbers of Atlantic cod impinged at PNPS annually, 1980-2010. Numbers and weights of equivalent age 2 fish calculated by two methods are also shown.

Year	Estimated Annual Number Impinged	Equivalent Age 2 Adults: Method 1 Number Age 2	Method 1 Weight (lbs) Age 2	Method 2 Number Age 2	Method 2 Weight (lbs) Age 2	Average Number Age 2	Average Weight (lbs) Age 2
1980	12	10	5	5	1	8	3
1981	100	82	41	38	9	60	25
1982	11	9	5	3	1	6	3
1983	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0
1986	33	27	14	13	3	20	8
1987	0	0	0	0	0	0	0
1988	23	19	10	7	2	13	6
1989	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0
1991	24	20	10	14	3	17	7
1992	10	8	4	6	1	7	3
1993	47	38	19	24	6	31	12
1994	42	34	17	16	4	25	10
1995	58	47	24	19	5	33	14
1996	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0
1998	53	43	22	16	4	30	13
1999	42	34	17	21	5	28	11
2000	0	0	0	0	0	0	0
2001	113	93	47	63	15	78	31
2002	0	0	0	0	0	0	0
2003	61	50	25	23	6	37	15
2004	99	81	41	42	10	62	25
2005	192	157	79	76	19	117	49
2006	688	563	282	246	60	405	171
2007	56	46	23	28	7	37	15
2008	143	117	59	43	11	80	35
2009	86	70	35	29	7	50	21
Mean[1]	68	55	28	26	6	41	17
s.e.	25	20	10	9	2	15	6
Minimum[1]	0	0	0	0	0	0	0
Maximum[1]	688	563	282	246	60	405	171
2010	53	43	22	29	7	36	14

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low number resulting from the plant outage.

Method 1 weight conversion based on 0.5 pounds per fish.

Method 2 weight conversion based on 0.245 pounds per fish.

Table 22. Numbers of Atlantic cod impinged adjusted for survival at PNPS, 1980-2010. Numbers of equivalent age 2 fish calculated by two methods are also shown.

		Equivalent Adults					
	Adjusted	Method 1		Method 2		Average	
Year	Number Impinged	Number Age 2	Weight (lbs) Age 2	Number Age 2	Weight (lbs) Age 2	Number Age 2	Weight (lbs) Age 2
1980	11	9	4	4	1	6	3
1981	89	89	45	34	8	62	26
1982	10	8	4	3	1	6	2
1983	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0
1986	29	24	12	16	4	20	8
1987	0	0	0	0	0	0	0
1988	21	17	8	7	2	12	5
1989	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0
1991	22	18	9	12	3	15	6
1992	9	7	4	6	1	7	3
1993	42	34	17	22	5	28	11
1994	37	31	15	14	3	22	9
1995	52	42	21	17	4	30	13
1996	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0
1998	47	39	19	14	3	26	11
1999	38	31	15	19	5	25	10
2000	0	0	0	0	0	0	0
2001	101	83	41	56	14	69	28
2002	0	0	0	0	0	0	0
2003	54	45	22	21	5	33	14
2004	88	72	36	37	9	55	23
2005	171	140	70	68	17	104	43
2006	614	503	251	220	54	361	153
2007	50	41	20	25	6	33	13
2008	128	105	53	38	9	72	31
2009	77	63	32	26	6	45	19
Mean[1]	60	50	25	24	6	37	15
s.e.	22	18	9	8	2	13	6
Minimum[1]	0	0	0	0	0	0	0
Maximum[1]	614	503	251	220	54	361	153
2010	47	38	19	25	6	32	13

Notes: See text for details.

[1]The mean, minimum, and maximum were calculated with 1984 and 1987 omitted due to the unusually low number resulting from the plant outage.

Method 1 weight conversion based on 0.5 pounds per fish.

Method 2 weight conversion based on 0.245 pounds per fish.

Atlantic cod were assumed to have 10.7% survival attributable to the fish return sluiceway and the low pressure spraywash.

E. American Lobster Larvae Entrainment

Twenty-seven American lobster larvae were found in the entrainment samples collected during 2010, resulting in an estimated total of 766,221 entrained larvae (Table 23). The number of larvae collected in 2010 was the fourth highest collected in a year dating back to 1974. The highest number of lobster larvae collected in a single year occurred in 2006 when 60 larvae were collected. A total of 212 lobster larvae have been collected at PNPS from 1974 - 2009 including the more intensive sampling directed specifically toward lobster larvae in 1976. The estimated total number of lobster larvae entrained in 2010 was above the 1980-2009 average of 271,766 (range = 0 to 1,973,143 in 2008, Table 23).

The annual larval entrainment estimates were converted to equivalent numbers of 82 mm carapace length (CL) adults, the age at which they enter the Massachusetts fishery (Dean et al, 2004, 2005, and Dean et al. 2006). Survival values were obtained from French McCay et al. (2003). To determine the individual instantaneous mortality rates (Z) for each of the four larval stages, the total larval stage instantaneous mortality rate ($Z_S = 4.116$; French McCay et al. 2003) was divided by the stage duration of 28 days (French McCay et al. 2003) to produce a daily instantaneous larval mortality rate of $Z_D = 0.147$. The daily mortality rate was then multiplied by the number of days in each larval stage interval at a water temperature of 19°C (Stage 1 = 3 days, Stage 2 = 4 days, Stage 3 = 6 days, and Stage 4 = 15 days; MacKenzie and Moring 1985). The larval stage mortality rates were then converted to survival rates ($S = e^{-Z}$) as follows:

S (stage I) = 0.6434	S (stage III) = 0.4140
S (stage II) = 0.5554	S (stage IV) = 0.1103

All lobster larvae are not entrained at the same point in a given life stage and it is assumed that the further along in development the greater their probability in reaching the next life stage. To account for this, the survival values of the life stage entrained were adjusted based on EPRI (2004). The adjusted survival values were as follows:

Adjusted S (stage I) = 0.7830	Adjusted S (stage III) = 0.5855
Adjusted S (stage II) = 0.7142	Adjusted S (stage IV) = 0.1986

Following Stage IV, when settlement to the bottom occurs, numbers were converted to equivalent adults by applying S = 0.2645 from the settlement to 7 mm CL interval and S = 0.0037 for the 7 to 82 mm CL interval (French McCay et al. 2003). This produced a total of 15 equivalent 82 mm lobsters potentially lost due to entrainment in 2010. The 2010 value is above the time series average of 8 (range = 0 to 47 in 2008) equivalent adult lobsters (Table 23).

In addition to those entrained, American lobster were impinged on the intake screens each year (also see the impingement section). Annual totals ranged from 0 in 1984 and 1987 to 1,559 in 1993 and averaged 480 lobsters over the time series. The 2010 estimated total was below the average at 350 lobsters (Table 23). Based on annual mean length data most impinged lobsters were juveniles. Survival values for 5 mm size class increments from 7 mm CL to 82 mm CL were obtained from French McCay et al. (2003) and adjusted to account for the higher probability that lobster impinged later in the size class increment are more likely to survive to the next increment. Impinged lobsters would be equivalent to an average of 283 equivalent adults (range = 0 to 1,065). The 2010 estimate amounted to 238 equivalent adult lobsters, which was below the average (Table 23).

A number of factors may be contributing to the increase in the number of lobster larvae observed at PNPS in recent years. The first is the addition of a nighttime sampling period to the entrainment monitoring protocol beginning in 1995. Adult female lobsters release larvae at night (Ennis et al.1975, Charmantier et al. 1991), so that more stage 1 individuals would be expected in the surrounding water at that time. Predation, dispersion, and mortality likely rapidly reduce their numbers during subsequent days. Since 1995, 84% of the lobster larvae captured were collected during the Friday evening sampling period. This represents 80% of the total larvae captured over the 37-year time period. In spite of the relatively high numbers obtained at night, numbers continue to show a recent increase when the Friday night sample is omitted as shown below.

The number of lobster larvae entrained from 1995 to 2010 with Friday night samples excluded. Equivalent 82 mm adults are also shown.

Year	Total Annual Number Entrained	Total Annual Equivalent Adults
1995	0	0
1996	0	0
1997	0	0
1998	0	0
1999	94,362	9
2000	0	0
2001	0	0
2002	0	0
2003	40,947	1
2004	39,725	1
2005	53,781	2
2006	29,946	1
2007	1,913,512	37
2008	462,728	18
2009	0	0
2010	316,938	6

There is no apparent direct relationship between prevailing winds or tides at sampling time and the number of lobster larvae entrained.

The second factor that may be contributing to the increase in lobster larvae is the establishment of a protection zone around Pilgrim Station extending seaward from the shorefront for a distance of approximately 1,000 feet on September 11, 2001. Within this zone no lobster harvesting is permitted; as a result there may be an increase in nearshore lobster reproductive activity and successful larval release.

The last factor that may be contributing to the increase in the number of lobster larvae observed at PNPS is an increase in lobster larvae abundance in Cape Cod Bay. Although larval lobster abundance data for Massachusetts waters are not currently available, there are data for early benthic phase lobsters (0 to 40 mm carapace length). The Massachusetts Division of Marine Fisheries coastal lobster project observed an increase in early benthic phase lobsters in Cape Cod Bay, Boston Harbor, and Salem Sound from 2001 to 2004 (MDMF 2005). The Gulf of Maine American lobster stock is currently at a record high (1981-2007; ASMFC 2009); except for lobsters in the southern Gulf of Maine (Statistical Area 514) which are considered to be in poor condition with low abundance, low recruitment, and a high exploitation rate. Lobster landings in Area 514 declined to a time series low of 5,392,509 lobsters in 2005 (ASMFC 2009). The increase in lobster larvae observed at PNPS is consistent with the increase seen in other coastal Massachusetts and Gulf of Maine areas.

Tabulation of previous lobster larvae collections, 1974 to 2010:

2010: **27 larvae:** 1 stage 1, May 24; 1 stage 1, May 31; 4 stage 1, June 4; 1 stage 1, June 7; 2 stage 1, June 11; 9 stage 1 & 1 stage 2, June 18; 2 stage 1, June 30; 3 stage 1, July 2; 2 stage 1, July 19; 1 stage 1, August 2;

2009: **11 larvae:** 8 stage 1, May 29; 1 stage 1, Jun 5; 1 stage 1, Jun 19; 1 stage 1, June 26.

2008: **44 larvae:** 1 stage 1, May 19; 1 stage 1, May 23; 1 stage 1, June 2; 13 stage 1, June 6; 3 stage 1 & 1 stage 2, June13; 6 stage 1 June 20; 1 stage 1 June 27; 5 stage 1, July 4 1 stage 1, July 7; 4 stage 1, July 11; 1 stage 1, July 25; 1 stage 1, July 28; 1 stage 1, August 15; 1 stage 1 & 1 stage 2, August 18; 1 stage 1, August 22; 1 stage 4, September 22.

2007: **19 larvae:** 3 stage 1, June 8; 13 stage 1, June 13; 1 stage 1, June 18; 1 stage 1, July 16; 1 stage 1, July 23.

2006: **60 larvae**: 13 stage 1, June 2; 26 stage 1, 1 stage 2, June 16; 4 stage 1, June 24; 15 stage 1, June 30; 1 stage 1 July 3.

2005: **32 larvae**: 8 stage 1, June 3; 1 stage 1, June 17; 5 stage 1, 1 stage 2, June 24; 9 stage 1, 1 stage 2, 2 stage 4, July 8; 2 stage 1, July 15; 1 unstaged July 18; 2 stage 1, August 5.

2004: **9 larvae**: 2 stage 1, June 4; 2 stage 1, June 11; 1 stage 1, July 5; 1 stage 1, July 23; 1 stage 1, August 13; 1 stage 3, 1 stage 4, September 3.

2003: **16 larvae**: 1 stage 2, June 2; 1 stage 3, June 6; 1stage 3, June 13; 7 stage 3, June 20; 5 stage 3, July 4; 1 stage 1, July 11.

2002: none found

2001: none found.

2000: none found.

1999: **8 larvae:** 4 stage 1, June 18; 1 stage 1, July 3; 1 stage 1, July 5; 1 stage 1, August 6; 1 stage 4, August 25.

1996-1998: none found.

1995: **1 larva** – stage 4-5, July 28.

1994: none found.

1993: **1 larva** –stage 4-5, July 21.

1991-1992: none found.

1990: **2 larvae** – 1 stage 1, June 26; 1 stage 4, August 23.

1983-1989: none found.

1982: **1 larva** – stage 1 on June 14.

1981: **1 larva** – stage 4 on June 29.

1980: none found.

1979: **1 larva** – stage 1 on July 14.

1978: none found.

1977: **3 larvae** – 1 stage 1, June 10; 2 stage 1, June 17.

1976: **2 larvae** – 1 stage 1, July 22; July 22; 1 stage 4-5, August 5.

1975: **1 larva** – stage 1, date unknown.

1974: none found.

Table 23. Numbers of American lobster entrained and impinged at PNPS annually, 1980-2010. Numbers of equivalent adults (82 mm) calculated by two methods are also shown.

Year	Entrainment		Impingement		Entrainment + Impingement	
	Total Larvae Entrained	Equivalents Adult (82 mm)	Total Lobsters Impinged	Equivalents Adult (82 mm)	Total Number	Equivalents Adult (82 mm)
1980	0	0	56	45	56	45
1981	39,013	8	200	174	39,213	182
1982	38,306	1	332	221	38,638	222
1983	0	0	93	74	93	74
1984	0	0	0	0	0	0
1985	0	0	420	216	420	216
1986	0	0	110	96	110	96
1987	0	0	0	0	0	0
1988	0	0	48	30	48	30
1989	0	0	326	187	326	187
1990	108,254	12	568	325	108,822	337
1991	0	0	579	327	579	327
1992	0	0	1,053	557	1,053	557
1993	40,936	8	1,559	771	42,495	779
1994	0	0	998	551	998	551
1995	34,389	7	622	348	35,011	355
1996	0	0	990	543	990	543
1997	0	0	387	206	387	206
1998	0	0	431	229	431	229
1999	258,377	10	608	283	258,985	293
2000	0	0	633	355	633	355
2001	0	0	114	94	114	94
2002	0	0	148	105	148	105
2003	604,079	35	321	260	604,400	295
2004	265,850	10	434	293	266,284	303
2005	1,382,946	45	1,493	1,065	1,384,439	1,110
2006	1,728,159	34	701	445	1,728,860	479
2007	1,392,550	27	532	311	1,393,082	338
2008	1,973,143	47	111	85	1,973,254	132
2009	286,979	6	542	280	287,521	286
Mean	271,766	8	480	283	272,246	291
s.e.	102,375	3	75	43	102,387	44
Minimum	0	0	0	0	0	0
Maximum	1,973,143	47	1,559	1,065	1,973,254	1,110
2010	766,221	15	350	238	766,571	253

SECTION V

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APPENDIX A*. Densities of fish eggs and larvae per 100 m^3 of water recorded in the PNPS discharge canal by species, date, and replicate, January-December 2010.

*Available upon request.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JANUARY 2010 :	4	6	8	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	-	0.83	-	0.83	0.83
TOTAL EGGS	-	0.83	-	0.83	0.83

No sample collection for Monday and Friday, due to snow covered rocks.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JANUARY 2010 :	4	6	8	MEANS ARITHM.	MEANS GEOM.
TOTAL LARVAE	-	0.00	-	0.00	0.00

No sample collection for Monday and Friday, due to snow covered rocks.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JANUARY 2010 :	11	13	15	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	1.09	-	0.00	0.54	0.44
TOTAL EGGS	1.09	-	0.00	0.54	0.44

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — JANUARY 2010 :	11	13	15	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	0.00	-	0.87	0.44	0.37
POLLACHIUS VIRENS	0.54	-	0.00	0.27	0.24
PHOLIS GUNNELLUS	0.00	-	0.87	0.44	0.37
AMMODYTES SP.	0.54	-	0.00	0.27	0.24
TOTAL LARVAE	1.09	-	1.74	1.41	1.37

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JANUARY 2010 :	18	20	22	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	-	1.73	-	1.73	1.73
TOTAL EGGS	-	1.73	-	1.73	1.73

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JANUARY 2010 :	18	20	22	MEANS ARITHM.	MEANS GEOM.
PHOLIS GUNNELLUS	-	1.73	-	1.73	1.73
TOTAL LARVAE	-	1.73	-	1.73	1.73

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JANUARY 2010 :	25	27	29	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	4.50	-	-	4.50	4.50
TOTAL EGGS	4.50	-	-	4.50	4.50

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JANUARY 2010 :	25	27	29	MEANS ARITHM.	MEANS GEOM.
MYOXOCEPHALUS OCTODECEMSPINOSUS	1.29	-	-	1.29	1.29
PHOLIS GUNNELLUS	9.00	-	-	9.00	9.00
TOTAL LARVAE	10.29	-	-	10.29	10.29

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — FEBRUARY 2010 :	1	3	5	MEANS ARITHM.	GEOM.
TOTAL EGGS	-	0.00	0.00	0.00	0.00

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- FEBRUARY 2010 :	1	3	5	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	-	2.71	0.00	1.36	0.93
PHOLIS GUNNELLUS	-	12.21	1.75	6.98	4.63
AMMODYTES SP.	-	4.07	1.75	2.91	2.67
TOTAL LARVAE	-	19.00	3.51	11.25	8.16

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- FEBRUARY 2010 :	8	10	12	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	0.42	-	-	0.42	0.42
TOTAL EGGS	0.42	-	-	0.42	0.42

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — FEBRUARY 2010 :	8	10	12	MEANS ARITHM.	MEANS GEOM.
PHOLIS GUNNELLUS	0.42	-	-	0.42	0.42
AMMODYTES SP.	0.42	-	-	0.42	0.42
TOTAL LARVAE	0.83	-	-	0.83	0.83

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- FEBRUARY 2010 :	15	17	19	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	0.00	0.00	0.46	0.15	0.13
GADUS MORHUA	0.00	2.12	2.29	1.47	1.17
TOTAL EGGS	0.00	2.12	2.75	1.62	1.27

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- FEBRUARY 2010 :	15	17	19	MEANS ARITHM.	MEANS GEOM.
MYOXOCEPHALUS AENAEUS	1.05	0.00	3.66	1.57	1.12
MYOXOCEPHALUS OCTODECEMSPINOSUS	3.15	0.00	0.00	1.05	0.61
MYOXOCEPHALUS SCORPIUS	4.20	2.12	1.83	2.72	2.54
PHOLIS GUNNELLUS	13.65	7.41	26.11	15.72	13.83
AMMODYTES SP.	8.40	2.12	3.21	4.57	3.85
TOTAL LARVAE	30.45	11.65	34.81	25.64	23.12

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — MARCH 2010 :	1	3	5	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	-	-	1.39	1.39	1.39
GADUS MORHUA	-	-	2.78	2.78	2.78
PSEUDOPLEURONECTES AMERICANUS	-	-	1.39	1.39	1.39
TOTAL EGGS	-	-	5.56	5.56	5.56

No Monday and Wednesday sampling, due to snow storm.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- MARCH 2010 :	8	10	12	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	2.34	16.94	6.15	8.48	6.25
GADUS MORHUA	1.17	18.20	17.21	12.19	7.16
MELANOGRAMMUS AEGLEFINUS	0.00	1.25	0.00	0.42	0.31
LABRIDAE-LIMANDA	0.59	0.00	0.00	0.20	0.17
HIPPOGLOSSOIDES PLATESSOIDES	1.17	2.51	1.84	1.84	1.76
TOTAL EGGS	5.27	38.90	25.20	23.12	17.29

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- MARCH 2010 :	8	10	12	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	0.00	0.00	1.84	0.61	0.42
MYOXOCEPHALUS AENAEUS	22.26	1.88	3.07	9.07	5.05
MYOXOCEPHALUS SCORPIUS	0.59	4.39	0.00	1.66	1.04
PHOLIS GUNNELLUS	26.95	5.65	8.60	13.73	10.94
CRYPTACANTHODES MACULATUS	0.00	0.00	0.61	0.20	0.17
AMMODYTES SP.	0.00	5.02	37.49	14.17	5.14
UNIDENTIFIED FRAGMENTS	1.76	0.00	1.84	1.20	0.99
TOTAL LARVAE	51.56	16.94	53.47	40.66	36.01

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — MARCH 2010 :	15	17	19	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	3.14	1.72	1.13	2.00	1.82
GADUS MORHUA	15.72	3.43	2.25	7.14	4.95
MELANOGRAMMUS AEGLEFINUS	0.00	0.86	0.00	0.29	0.23
MYOXOCEPHALUS AENAEUS	1.57	0.00	0.00	0.52	0.37
LABRIDAE	0.00	0.00	1.13	0.38	0.29
HIPPOGLOSSOIDES PLATESSOIDES	0.00	0.86	0.00	0.29	0.23
PSEUDOPLEURONECTES AMERICANUS	3.14	0.00	0.00	1.05	0.61
TOTAL EGGS	23.58	6.87	4.50	11.65	9.00

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — MARCH 2010 :	15	17	19	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	0.00	6.87	4.50	3.79	2.51
MYOXOCEPHALUS AENAEUS	0.00	0.00	5.63	1.88	0.88
PHOLIS GUNNELLUS	0.00	3.43	10.13	4.52	2.67
AMMODYTES SP.	17.29	14.60	41.64	24.51	21.90
TOTAL LARVAE	17.29	24.90	61.89	34.69	29.87

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- MARCH 2010 :	22	24	26	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	0.59	1.32	2.15	1.35	1.19
ENCHELYOPUS CIMBRIUS	0.00	0.66	0.00	0.22	0.18
GADUS MORHUA	1.76	3.29	2.15	2.40	2.32
LABRIDAE-LIMANDA	0.00	1.32	0.00	0.44	0.32
SCOPHTHALMUS AQUOSUS	0.59	0.00	0.00	0.20	0.17
GLYPTOCEPHALUS CYNOGLOSSUS	0.59	0.00	0.00	0.20	0.17
HIPPOGLOSSOIDES PLATESSOIDES	0.00	0.66	0.00	0.22	0.18
PSEUDOPLEURONECTES AMERICANUS	0.00	1.32	4.31	1.87	1.31
TOTAL EGGS	3.53	8.55	8.62	6.90	6.38

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- MARCH 2010 :	22	24	26	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	4.12	0.00	0.00	1.37	0.72
MYOXOCEPHALUS AENAEUS	4.71	6.58	2.15	4.48	4.06
PHOLIS GUNNELLUS	2.35	6.58	0.00	2.98	1.94
AMMODYTES SP.	14.12	0.00	0.00	4.71	1.47
TOTAL LARVAE	25.30	13.16	2.15	13.54	8.95

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — MARCH 2010 :	29	31	2	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	1.41	0.00	1.34	0.92	0.78
GADUS MORHUA	1.41	0.00	0.67	0.69	0.59
LABRIDAE-LIMANDA	0.00	0.00	6.04	2.01	0.92
LABRIDAE	0.00	0.00	0.67	0.22	0.19
SCOPHTHALMUS AQUOSUS	0.00	0.00	0.67	0.22	0.19
HIPPOGLOSSOIDES PLATESSOIDES	2.11	0.00	1.34	1.15	0.94
TOTAL EGGS	4.92	0.00	10.74	5.22	3.11

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — MARCH 2010 :	29	31	2	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	1.41	0.80	0.00	0.73	0.63
MYOXOCEPHALUS AENAEUS	18.29	21.51	12.75	17.52	17.12
PHOLIS GUNNELLUS	8.44	7.17	2.01	5.88	4.96
AMMODYTES SP.	3.52	3.19	2.01	2.91	2.83
P. AMERICANUS STAGE 2	0.00	0.80	0.00	0.27	0.22
UNIDENTIFIED FRAGMENTS	1.41	0.00	0.00	0.47	0.34
TOTAL LARVAE	33.06	33.47	16.77	27.77	26.48

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- APRIL 2010 :	5	7	9	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	0.00	0.58	4.36	1.65	1.04
LABRIDAE-LIMANDA	2.61	1.16	4.36	2.71	2.36
LABRIDAE	0.52	0.00	0.00	0.17	0.15
HIPPOGLOSSOIDES PLATESSOIDES	2.61	0.00	0.00	0.87	0.53
TOTAL EGGS	5.75	1.74	8.71	5.40	4.43

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — APRIL 2010 :	5	7	9	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	0.52	0.00	0.00	0.17	0.15
GADUS MORHUA	0.52	0.00	0.00	0.17	0.15
MYOXOCEPHALUS AENAEUS	3.14	5.80	13.07	7.34	6.19
LIPARIS ATLANTICUS	0.00	0.58	0.00	0.19	0.16
AMMODYTES SP.	7.84	17.39	52.28	25.84	19.25
AMMODYTES SP. (JUV.)	0.00	1.16	4.36	1.84	1.26
GOBIOSOMA GINSBURGI	0.00	0.00	4.36	1.45	0.75
HIPPOGLOSSOIDES PLATESSOIDES	0.00	0.58	0.00	0.19	0.16
LIMANDA FERRUGINEA	0.52	0.00	8.71	3.08	1.45
UNIDENTIFIED FRAGMENTS	0.00	1.74	0.00	0.58	0.40
TOTAL LARVAE	12.55	27.25	82.78	40.86	30.48

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — APRIL 2010 :	12	14	16	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	0.00	0.00	0.45	0.15	0.13
GADUS MORHUA	0.54	0.00	0.00	0.18	0.16
MELANOGRAMMUS AEGLEFINUS	0.54	0.00	0.00	0.18	0.16
UROPHYCIS SPP.	0.54	0.00	0.00	0.18	0.16
SCOPHTHALMUS AQUOSUS	0.00	13.54	0.00	4.51	1.44
HIPPOGLOSSOIDES PLATESSOIDES	5.42	3.61	0.45	3.16	2.07
LIMANDA FERRUGINEA	1.63	5.42	0.90	2.65	1.99
TOTAL EGGS	8.67	22.57	1.80	11.02	7.06

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- APRIL 2010 :	12	14	16	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	0.00	0.00	0.45	0.15	0.13
MYOXOCEPHALUS AENAEUS	4.34	17.15	10.35	10.62	9.17
LIPARIS ATLANTICUS	1.08	1.81	1.80	1.56	1.52
ULVARIA SUBBIFURCATA	0.00	3.61	0.00	1.20	0.66
AMMODYTES SP.	7.05	32.50	31.96	23.84	19.42
AMMODYTES SP. (JUV.)	0.00	0.00	2.70	0.90	0.55
P. AMERICANUS STAGE 1	0.00	0.00	0.45	0.15	0.13
P. AMERICANUS STAGE 2	0.54	0.00	0.90	0.48	0.43
P. AMERICANUS STAGE 3	0.00	0.00	0.45	0.15	0.13
LIMANDA FERRUGINEA	0.00	0.00	0.45	0.15	0.13
UNIDENTIFIED FRAGMENTS	0.00	1.81	0.90	0.90	0.75
TOTAL LARVAE	13.01	56.88	50.42	40.10	33.42

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — APRIL 2010 :	19	21	23	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	0.00	0.97	0.00	0.32	0.25
ENCHELYOPUS CIMBRIUS	2.43	7.79	6.97	5.73	5.09
SCOPHTHALMUS AQUOSUS	2.43	8.76	2.54	4.57	3.78
PSEUDOPLEURONECTES AMERICANUS	1.82	0.00	0.63	0.82	0.66
LIMANDA FERRUGINEA	0.61	18.49	4.44	7.84	3.68
TOTAL EGGS	7.29	36.01	14.58	19.29	15.64

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date in --- APRIL 2010 :	19	21	23	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	0.61	0.00	0.00	0.20	0.17
CLUPEA HARENGUS (JUV.)	1.21	0.00	0.63	0.62	0.54
ENCHELYOPUS CIMBRIUS	0.00	0.00	0.63	0.21	0.18
MYOXOCEPHALUS AENAEUS	15.18	0.00	15.85	10.34	5.48
LIPARIS ATLANTICUS	14.57	0.00	19.65	11.41	5.85
ULVARIA SUBBIFURCATA	0.00	6.81	1.27	2.69	1.61
PHOLIS GUNNELLUS	0.00	0.97	0.00	0.32	0.25
AMMODYTES SP.	33.39	21.41	17.11	23.97	23.04
AMMODYTES SP. (JUV.)	1.21	0.00	0.00	0.40	0.30
HIPPOGLOSSOIDES PLATESSOIDES	0.61	0.97	0.00	0.53	0.47
P. AMERICANUS STAGE 1	1.21	0.00	12.68	4.63	2.12
P. AMERICANUS STAGE 2	6.07	0.00	5.07	3.71	2.50
P. AMERICANUS STAGE 3	2.43	0.00	0.00	0.81	0.51
LIMANDA FERRUGINEA	1.82	0.00	3.17	1.66	1.27
UNIDENTIFIED FRAGMENTS	1.21	0.00	2.54	1.25	0.99
TOTAL LARVAE	79.53	30.17	78.60	62.77	57.35

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- APRIL 2010 :	26	28	30	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	2.62	8.40	2.57	4.53	3.83
LABRIDAE-LIMANDA	0.00	0.00	6.41	2.14	0.95
LABRIDAE	1.74	0.00	0.00	0.58	0.40
SCOPHTHALMUS AQUOSUS	0.87	1.94	3.85	2.22	1.87
HIPPOGLOSSOIDES PLATESSOIDES	1.74	0.00	1.28	1.01	0.84
LIMANDA FERRUGINEA	9.59	1.29	20.53	10.47	6.34
TOTAL EGGS	16.56	11.63	34.64	20.94	18.82

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — APRIL 2010 :	26	28	30	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	0.00	0.00	2.57	0.86	0.53
MYOXOCEPHALUS AENAEUS	2.62	5.81	1.28	3.24	2.69
LIPARIS ATLANTICUS	4.36	3.23	1.28	2.96	2.62
ULVARIA SUBBIFURCATA	4.36	0.65	10.26	5.09	3.07
AMMODYTES SP.	3.49	4.52	6.41	4.81	4.66
AMMODYTES SP. (JUV.)	0.00	1.94	0.00	0.65	0.43
P. AMERICANUS STAGE 1	0.00	0.65	0.00	0.22	0.18
P. AMERICANUS STAGE 2	0.00	1.94	0.00	0.65	0.43
P. AMERICANUS STAGE 3	0.00	3.88	0.00	1.29	0.70
LIMANDA FERRUGINEA	0.00	0.00	5.13	1.71	0.83
UNIDENTIFIED FRAGMENTS	0.00	1.29	0.00	0.43	0.32
TOTAL LARVAE	14.82	23.90	26.94	21.89	21.21

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- MAY 2010 :	3	5	7	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	1.41	0.95	0.00	0.79	0.68
ENCHELYOPUS-UROPHYCIS-PEPRILUS	7.78	0.95	6.70	5.14	3.67
ENCHELYOPUS CIMBRIUS	18.39	6.65	2.87	9.30	7.05
GADUS MORHUA	1.41	0.00	0.00	0.47	0.34
MERLUCCIUS BILINEARIS	1.41	0.00	0.00	0.47	0.34
LABRIDAE-LIMANDA	41.02	8.54	27.74	25.77	21.34
LABRIDAE	14.15	3.80	5.74	7.89	6.76
GOBIOSOMA GINSBURGI	22.63	0.00	0.00	7.54	1.87
SCOMBER SCOMBRUS	0.00	1.90	0.00	0.63	0.43
PARALICHTHYS-SCOPHTHALMUS	7.78	28.48	48.78	28.35	22.11
GLYPTOCEPHALUS CYNOGLOSSUS	1.41	0.95	0.00	0.79	0.68
HIPPOGLOSSOIDES PLATESSOIDES	0.00	2.85	1.91	1.59	1.24
TOTAL EGGS	117.41	55.07	93.73	88.74	84.63

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — MAY 2010 :	3	5	7	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	0.71	3.80	0.00	1.50	1.02
LIPARIS ATLANTICUS	0.71	1.90	1.91	1.51	1.37
ULVARIA SUBBIFURCATA	12.73	6.65	15.30	11.56	10.90
AMMODYTES SP.	2.12	0.95	0.96	1.34	1.24
AMMODYTES SP. (JUV.)	1.41	0.00	0.96	0.79	0.68
HIPPOGLOSSOIDES PLATESSOIDES	0.71	2.85	1.91	1.82	1.57
P. AMERICANUS STAGE 1	0.00	0.95	0.00	0.32	0.25
P. AMERICANUS STAGE 2	1.41	11.39	27.74	13.52	7.65
P. AMERICANUS STAGE 3	0.71	1.90	7.65	3.42	2.17
LIMANDA FERRUGINEA	0.71	20.89	19.13	13.57	6.56
UNIDENTIFIED FRAGMENTS	1.41	0.00	0.00	0.47	0.34
TOTAL LARVAE	22.63	51.27	75.56	49.82	44.43

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — MAY 2010 :	10	12	14	MEANS ARITHM.	MEANS GEOM.
GADIDAE-GLYPTOCEPHALUS	0.00	0.00	1.52	0.51	0.36
ENCHELYOPUS-UROPHYCIS-PEPRILUS	2.28	2.53	15.18	6.66	4.44
ENCHELYOPUS CIMBRIUS	3.42	1.68	4.56	3.22	2.97
GADUS MORHUA	0.00	0.84	0.00	0.28	0.23
MERLUCCIUS-STENOTOMUS-CYNOSCION	0.00	0.84	0.00	0.28	0.23
LABRIDAE-LIMANDA	41.05	16.85	47.07	34.99	31.93
LABRIDAE	17.10	8.42	7.59	11.04	10.30
SCOMBER SCOMBRUS	11.40	3.37	28.85	14.54	10.35
PARALICHTHYS-SCOPHTHALMUS	14.82	4.21	47.07	22.04	14.32
GLYPTOCEPHALUS CYNOGLOSSUS	1.14	0.00	0.00	0.38	0.29
HIPPOGLOSSOIDES PLATESSOIDES	1.14	10.11	1.52	4.26	2.60
PSEUDOPLEURONECTES AMERICANUS	2.28	0.00	0.00	0.76	0.49
TOTAL EGGS	94.65	48.86	153.36	98.95	89.17

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- MAY 2010 :	10	12	14	MEANS ARITHM.	MEANS GEOM.
MYOXOCEPHALUS AENAEUS	1.14	0.00	0.00	0.38	0.29
LIPARIS ATLANTICUS	19.39	2.53	0.00	7.30	3.16
ULVARIA SUBBIFURCATA	3.42	7.58	1.52	4.17	3.40
AMMODYTES SP.	0.00	1.68	0.00	0.56	0.39
AMMODYTES SP. (JUV.)	0.00	0.84	0.00	0.28	0.23
P. AMERICANUS STAGE 1	1.14	0.00	0.00	0.38	0.29
P. AMERICANUS STAGE 2	12.54	0.00	0.00	4.18	1.38
P. AMERICANUS STAGE 3	13.68	2.53	6.07	7.43	5.94
LIMANDA FERRUGINEA	3.42	0.84	0.00	1.42	1.01
TOTAL LARVAE	54.73	16.00	7.59	26.11	18.81

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — MAY 2010 :	17	19	21	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	15.76	7.97	12.79	12.18	11.71
ENCHELYOPUS CIMBRIUS	0.00	0.00	4.00	1.33	0.71
GADUS MORHUA	0.00	0.00	0.80	0.27	0.22
MERLUCCIUS-STENOTOMUS-CYNOSCION	0.00	0.00	1.60	0.53	0.37
LABRIDAE-LIMANDA	42.78	366.70	502.20	303.89	198.98
LABRIDAE	10.13	20.50	35.19	21.94	19.41
SCOMBER SCOMBRUS	41.65	19.36	37.59	32.87	31.18
PARALICHTHYS-SCOPHTHALMUS	0.00	122.99	94.36	72.45	21.78
GLYPTOCEPHALUS CYNOGLOSSUS	0.00	0.00	0.80	0.27	0.22
HIPPOGLOSSOIDES PLATESSOIDES	3.38	0.00	0.00	1.13	0.64
TOTAL EGGS	113.70	537.52	689.33	446.85	347.96

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — MAY 2010 :	17	19	21	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	0.00	4.56	0.00	1.52	0.77
LIPARIS ATLANTICUS	2.25	0.00	0.00	0.75	0.48
ULVARIA SUBBIFURCATA	10.13	5.69	0.00	5.28	3.21
AMMODYTES SP.	0.00	0.00	0.80	0.27	0.22
AMMODYTES SP. (JUV.)	0.00	0.00	0.80	0.27	0.22
SCOPHTHALMUS AQUOSUS	0.00	0.00	0.80	0.27	0.22
P. AMERICANUS STAGE 2	9.01	0.00	0.80	3.27	1.62
P. AMERICANUS STAGE 3	32.65	0.00	3.20	11.95	4.21
LIMANDA FERRUGINEA	2.25	0.00	0.80	1.02	0.80
TOTAL LARVAE	56.29	10.25	7.20	24.58	16.07

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — MAY 2010 :	24	26	28	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	8.08	0.00	17.48	8.52	4.52
ENCHELYOPUS CIMBRIUS	10.10	11.60	8.74	10.15	10.08
GADUS MORHUA	2.02	0.00	0.00	0.67	0.45
MERLUCCIUS-STENOTOMUS-CYNOSCION	4.04	3.32	3.28	3.54	3.53
MERLUCCIUS BILINEARIS	6.06	0.00	0.00	2.02	0.92
LOPHIUS AMERICANUS	0.00	0.00	2.18	0.73	0.47
LABRIDAE-LIMANDA	0.00	0.00	406.31	135.44	6.41
LABRIDAE	21.22	221.02	161.65	134.63	91.18
SCOMBER SCOMBRUS	106.09	14.37	30.58	50.35	35.99
ETROPUS MICROSTOMUS	1.01	0.00	0.00	0.34	0.26
PARALICHTHYS-SCOPHTHALMUS	458.73	96.70	111.41	222.28	170.33
HIPPOGLOSSOIDES PLATESSOIDES	1.01	7.74	2.18	3.64	2.58
TOTAL EGGS	618.38	354.73	743.81	572.31	546.44

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — MAY 2010 :	24	26	28	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	0.00	0.00	2.18	0.73	0.47
MENIDIA SPP.	0.00	0.00	1.09	0.36	0.28
TAUTOGA ONITIS	0.00	0.00	1.09	0.36	0.28
ULVARIA SUBBIFURCATA	12.13	0.00	22.94	11.69	5.80
HIPPOGLOSSOIDES PLATESSOIDES	0.00	0.00	2.18	0.73	0.47
P. AMERICANUS STAGE 2	0.00	0.00	7.65	2.55	1.05
P. AMERICANUS STAGE 3	0.00	0.00	25.12	8.37	1.97
P. AMERICANUS STAGE 4	0.00	0.00	2.18	0.73	0.47
LIMANDA FERRUGINEA	0.00	0.00	10.92	3.64	1.28
TOTAL LARVAE	12.13	0.00	75.36	29.16	9.01

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- MAY 2010 :	31	2	4	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	240.26	17.32	55.72	104.44	61.44
ENCHELYOPUS CIMBRIUS	4.76	6.26	5.41	5.47	5.44
GADUS MORHUA	0.00	0.00	4.33	1.44	0.75
MERLUCCIUS-STENOTOMUS-CYNOSCION	33.30	8.66	10.28	17.41	14.37
MERLUCCIUS BILINEARIS	5.95	0.96	2.16	3.02	2.31
UROPHYCIS SPP.	3.57	2.41	0.00	1.99	1.50
LOPHIUS AMERICANUS	15.46	3.37	0.54	6.46	3.04
LABRIDAE-LIMANDA	4129.58	404.22	2518.96	2350.92	1614.05
LABRIDAE	171.27	61.60	76.28	103.05	93.02
SCOMBER SCOMBRUS	818.30	110.68	10.82	313.27	99.33
ETROPUS MICROSTOMUS	3.57	0.96	0.00	1.51	1.08
PARALICHTHYS-SCOPHTHALMUS	160.57	128.00	87.10	125.23	121.42
GLYPTOCEPHALUS CYNOGLOSSUS	1.19	0.00	0.00	0.40	0.30
HIPPOGLOSSOIDES PLATESSOIDES	0.00	1.92	10.28	4.07	2.21
TOTAL EGGS	5587.78	746.37	2781.89	3038.68	2263.83

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — MAY 2010 :	31	2	4	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	5.95	0.00	3.25	3.06	2.09
MELANOGRAMMUS AEGLEFINUS	0.00	0.00	0.54	0.18	0.16
MERLUCCIUS BILINEARIS	0.00	0.00	4.33	1.44	0.75
UROPHYCIS SPP.	1.19	0.00	2.71	1.30	1.01
MENIDIA SPP.	0.00	0.48	0.54	0.34	0.32
LIPARIS ATLANTICUS	0.00	0.00	1.62	0.54	0.38
TAUTOGA ONITIS	0.00	0.00	1.08	0.36	0.28
ULVARIA SUBBIFURCATA	11.89	0.48	10.82	7.73	3.96
SCOMBER SCOMBRUS	4.76	0.00	7.03	3.93	2.59
SCOPHTHALMUS AQUOSUS	1.19	0.96	4.87	2.34	1.77
HIPPOGLOSSOIDES PLATESSOIDES	1.19	0.48	0.00	0.56	0.48
P. AMERICANUS STAGE 2	0.00	0.48	0.00	0.16	0.14
P. AMERICANUS STAGE 3	0.00	1.92	0.00	0.64	0.43
P. AMERICANUS STAGE 4	0.00	1.44	0.54	0.66	0.56
LIMANDA FERRUGINEA	2.38	0.00	5.41	2.60	1.79
TOTAL LARVAE	28.55	6.26	42.74	25.85	19.69

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — JUNE 2010 :	7	9	11	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	0.71	8.61	0.65	3.33	1.59
GADIDAE-GLYPTOCEPHALUS	1.42	0.00	0.00	0.47	0.34
ENCHELYOPUS-UROPHYCIS-PEPRILUS	9.96	39.76	3.27	17.66	10.90
ENCHELYOPUS CIMBRIUS	2.14	5.96	2.62	3.57	3.22
GADUS MORHUA	9.96	1.33	0.00	3.76	1.94
MERLUCCIUS-STENOTOMUS-CYNOSCION	5.69	39.10	9.82	18.20	12.98
MERLUCCIUS BILINEARIS	7.12	0.00	5.24	4.12	2.70
UROPHYCIS SPP.	1.42	0.66	3.93	2.00	1.55
PRIONOTUS SPP.	0.00	1.33	1.96	1.10	0.90
LABRIDAE-LIMANDA	8744.96	4219.67	1696.83	4887.15	3970.93
LABRIDAE	5.69	0.00	115.22	40.30	8.20
SCOMBER SCOMBRUS	11.39	64.28	32.73	36.13	28.83
ETROPUS MICROSTOMUS	0.00	0.00	1.31	0.44	0.32
PARALICHTHYS-SCOPHTHALMUS	81.13	216.02	66.77	121.31	105.38
GLYPTOCEPHALUS CYNOGLOSSUS	1.42	1.33	0.00	0.92	0.78
HIPPOGLOSSOIDES PLATESSOIDES	19.93	1.99	0.65	7.52	2.96
TOTAL EGGS	8902.95	4600.02	1941.01	5148.00	4299.73

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JUNE 2010 :	7	9	11	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	1.42	1.99	4.58	2.66	2.35
GADUS MORHUA	2.85	0.00	0.00	0.95	0.57
ULVARIA SUBBIFURCATA	7.12	1.33	5.89	4.78	3.82
SCOMBER SCOMBRUS	0.00	0.66	2.62	1.09	0.82
SCOPHTHALMUS AQUOSUS	1.42	2.65	1.31	1.79	1.70
GLYPTOCEPHALUS CYNOGLOSSUS	1.42	0.00	0.00	0.47	0.34
HIPPOGLOSSOIDES PLATESSOIDES	7.12	0.00	0.00	2.37	1.01
P. AMERICANUS STAGE 2	0.00	0.00	3.93	1.31	0.70
P. AMERICANUS STAGE 3	2.14	3.98	5.24	3.78	3.54
P. AMERICANUS STAGE 4	0.00	0.00	1.96	0.65	0.44
LIMANDA FERRUGINEA	1.42	0.00	0.00	0.47	0.34
UNIDENTIFIED FRAGMENTS	2.14	0.00	0.00	0.71	0.46
TOTAL LARVAE	27.04	10.60	25.53	21.06	19.42

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — JUNE 2010 :	14	16	18	MEANS ARITHM.	MEANS GEOM.
ANCHOA MITCHILLI	1.15	0.00	0.00	0.38	0.29
ENCHELYOPUS-UROPHYCIS-PEPRILUS	25.28	14.08	9.13	16.16	14.81
ENCHELYOPUS CIMBRIUS	4.02	2.17	1.83	2.67	2.51
MERLUCCIUS-STENOTOMUS-CYNOSCION	48.26	19.49	25.56	31.10	28.86
MERLUCCIUS BILINEARIS	6.32	0.00	3.65	3.32	2.24
UROPHYCIS SPP.	2.30	4.33	0.00	2.21	1.60
LABRIDAE-LIMANDA	1075.55	701.70	924.95	900.73	887.09
LABRIDAE	280.38	246.89	63.29	196.85	163.63
SCOMBER SCOMBRUS	44.24	9.75	15.82	23.27	18.97
ETROPUS MICROSTOMUS	1.15	0.00	0.00	0.38	0.29
PARALICHTHYS-SCOPHTHALMUS	68.95	167.84	0.00	78.93	21.77
GLYPTOCEPHALUS CYNOGLOSSUS	0.00	0.00	1.22	0.41	0.30
TOTAL EGGS	1557.59	1166.25	1045.44	1256.43	1238.36

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — JUNE 2010 :	14	16	18	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	0.00	2.17	3.04	1.74	1.34
ENCHELYOPUS CIMBRIUS	0.00	2.17	1.83	1.33	1.08
MENIDIA SPP.	0.57	0.00	1.83	0.80	0.64
SYNGNATHUS FUSCUS	0.57	0.00	0.61	0.39	0.36
LIPARIS ATLANTICUS	0.00	0.00	0.61	0.20	0.17
CENTROPRISTIS STRIATA	0.00	1.08	0.00	0.36	0.28
STENOTOMUS CHRYSOPS	0.00	2.17	1.22	1.13	0.91
T. ADSPERSUS STAGE 1	0.00	3.25	0.00	1.08	0.62
ULVARIA SUBBIFURCATA	1.15	1.08	1.22	1.15	1.15
PARALICHTHYS OBLONGUS	0.00	1.08	0.00	0.36	0.28
SCOPHTHALMUS AQUOSUS	0.00	0.00	0.61	0.20	0.17
P. AMERICANUS STAGE 3	1.72	0.00	1.83	1.18	0.97
P. AMERICANUS STAGE 4	1.15	1.08	0.61	0.95	0.91
TOTAL LARVAE	5.17	14.08	13.39	10.88	9.91

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JUNE 2010 :	21	23	25	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	7.40	11.82	266.44	95.22	28.56
ANCHOA MITCHILLI	0.00	2.25	0.00	0.75	0.48
GADIDAE-GLYPTOCEPHALUS	0.00	0.56	0.00	0.19	0.16
ENCHELYOPUS-UROPHYCIS-PEPRILUS	5.55	18.57	82.28	35.47	20.39
ENCHELYOPUS CIMBRIUS	0.92	1.69	3.92	2.18	1.83
MERLUCCIUS-STENOTOMUS-CYNOSCION	34.20	51.22	32.65	39.36	38.53
MERLUCCIUS BILINEARIS	5.55	5.63	3.92	5.03	4.96
UROPHYCIS SPP.	0.00	0.56	18.29	6.28	2.11
PRIONOTUS SPP.	1.85	1.13	16.98	6.65	3.28
LABRIDAE-LIMANDA	210.77	799.20	3719.72	1576.56	855.70
LABRIDAE	20.34	29.27	522.43	190.68	67.75
SCOMBER SCOMBRUS	10.17	11.26	27.43	16.28	14.64
ETROPUS MICROSTOMUS	0.00	0.00	2.61	0.87	0.53
PARALICHTHYS-SCOPHTHALMUS	59.16	69.23	113.63	80.67	77.49
LIMANDA FERRUGINEA	3.70	9.01	0.00	4.23	2.61
TOTAL EGGS	359.59	1011.38	4810.30	2060.43	1204.95

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — JUNE 2010 :	21	23	25	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	3.70	1.69	2.61	2.67	2.54
ENCHELYOPUS CIMBRIUS	38.83	5.07	1.31	15.07	6.36
GADUS MORHUA	0.00	0.56	0.00	0.19	0.16
MERLUCCIUS BILINEARIS	0.92	3.94	0.00	1.62	1.12
MENIDIA SPP.	0.00	0.56	1.31	0.62	0.53
SYNGNATHUS FUSCUS	0.92	2.81	1.96	1.90	1.72
CENTROPRISTIS STRIATA	0.92	0.00	0.00	0.31	0.24
STENOTOMUS CHRYSOPS	1.85	1.13	0.00	0.99	0.82
TAUTOGA ONITIS	2.77	1.69	0.00	1.49	1.16
T. ADSPERSUS STAGE 1	2.77	0.56	0.00	1.11	0.81
T. ADSPERSUS STAGE 2	20.34	9.01	0.00	9.78	4.98
ULVARIA SUBBIFURCATA	0.92	0.00	1.31	0.74	0.64
SCOPHTHALMUS AQUOSUS	9.24	5.63	0.00	4.96	3.08
GLYPTOCEPHALUS CYNOGLOSSUS	0.92	0.00	0.00	0.31	0.24
HIPPOGLOSSOIDES PLATESSOIDES	0.00	0.56	0.00	0.19	0.16
P. AMERICANUS STAGE 3	2.77	2.25	0.00	1.67	1.31
P. AMERICANUS STAGE 4	0.00	0.56	0.00	0.19	0.16
LIMANDA FERRUGINEA	4.62	0.56	0.00	1.73	1.06
UNIDENTIFIED FRAGMENTS	0.92	0.00	0.00	0.31	0.24
TOTAL LARVAE	92.44	36.58	8.49	45.84	30.62

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JUNE 2010 :	28	30	2	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	13.24	124.03	11.63	49.63	26.73
ANCHOA MITCHILLI	0.00	5.81	14.54	6.78	3.73
ENCHELYOPUS-UROPHYCIS-PEPRILUS	12.36	68.80	26.17	35.78	28.13
ENCHELYOPUS CIMBRIUS	2.65	1.94	1.45	2.01	1.95
MERLUCCIUS-STENOTOMUS-CYNOSCION	22.07	8.72	26.17	18.99	17.14
MERLUCCIUS BILINEARIS	10.59	0.00	2.91	4.50	2.56
POLLACHIUS VIRENS	0.88	0.00	0.00	0.29	0.23
UROPHYCIS SPP.	0.00	10.66	13.09	7.91	4.48
PRIONOTUS SPP.	7.94	13.57	15.99	12.50	11.99
LABRIDAE-LIMANDA	506.68	2496.01	4769.22	2590.64	1820.30
LABRIDAE	49.43	131.78	663.04	281.42	162.85
SCOMBER SCOMBRUS	11.48	3.88	29.08	14.81	10.90
ETROPUS MICROSTOMUS	0.88	3.88	1.45	2.07	1.71
PARALICHTHYS-SCOPHTHALMUS	107.69	89.14	129.41	108.75	107.50
GLYPTOCEPHALUS CYNOGLOSSUS	1.77	0.00	0.00	0.59	0.40
LIMANDA FERRUGINEA	5.30	0.00	0.00	1.77	0.85
TOTAL EGGS	752.96	2958.20	5704.16	3138.44	2333.44

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JUNE 2010 :	28	30	2	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	6.18	0.00	2.91	3.03	2.04
ENCHELYOPUS CIMBRIUS	0.88	0.00	0.00	0.29	0.23
GADUS MORHUA	0.88	0.00	0.00	0.29	0.23
MERLUCCIUS BILINEARIS	0.00	0.00	1.45	0.48	0.35
MENIDIA SPP.	0.00	1.94	4.36	2.10	1.51
SYNGNATHUS FUSCUS	0.00	0.97	0.00	0.32	0.25
TAUTOGA ONITIS	1.77	0.00	17.45	6.40	2.71
T. ADSPERSUS STAGE 1	0.88	0.00	2.91	1.26	0.94
T. ADSPERSUS STAGE 2	7.06	1.94	95.97	34.99	10.95
T. ADSPERSUS STAGE 3	0.00	0.00	45.07	15.02	2.58
ULVARIA SUBBIFURCATA	19.42	0.97	0.00	6.80	2.43
SCOMBER SCOMBRUS	0.00	0.00	2.91	0.97	0.58
SCOPHTHALMUS AQUOSUS	0.00	0.00	4.36	1.45	0.75
P. AMERICANUS STAGE 3	0.88	0.00	0.00	0.29	0.23
UNIDENTIFIED FRAGMENTS	2.65	1.94	0.00	1.53	1.20
TOTAL LARVAE	40.61	7.75	177.39	75.25	38.22

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — JULY 2010 :	5	7	9	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	42.38	26.95	1.09	23.48	10.76
ANCHOA MITCHILLI	12.47	8.62	3.28	8.12	7.06
ENCHELYOPUS-UROPHYCIS-PEPRILUS	95.98	36.65	7.64	46.76	29.96
ENCHELYOPUS CIMBRIUS	6.23	4.31	0.00	3.51	2.37
MERLUCCIUS-STENOTOMUS-CYNOSCION	3.74	0.00	2.18	1.97	1.47
UROPHYCIS SPP.	0.00	0.00	1.09	0.36	0.28
PRIONOTUS SPP.	33.66	78.70	5.46	39.27	24.36
LABRIDAE-LIMANDA	1027.14	1285.06	1039.48	1117.23	1111.20
LABRIDAE	309.14	491.60	26.21	275.65	158.51
SCOMBER SCOMBRUS	22.44	0.00	1.09	7.84	2.66
ETROPUS MICROSTOMUS	7.48	0.00	0.00	2.49	1.04
PARALICHTHYS-SCOPHTHALMUS	67.31	77.62	40.40	61.78	59.54
TOTAL EGGS	1627.97	2009.53	1127.93	1588.48	1545.28

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JULY 2010 :	5	7	9	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	11.22	19.41	3.28	11.30	8.93
ENCHELYOPUS CIMBRIUS	18.70	0.00	0.00	6.23	1.70
MERLUCCIUS BILINEARIS	0.00	0.00	1.09	0.36	0.28
UROPHYCIS SPP.	0.00	0.00	2.18	0.73	0.47
MENIDIA SPP.	0.00	1.08	0.00	0.36	0.28
STENOTOMUS CHRYSOPS	8.73	6.47	2.18	5.79	4.98
TAUTOGA ONITIS	17.45	22.64	13.10	17.73	17.30
T. ADSPERSUS STAGE 1	48.61	42.04	0.00	30.22	11.88
T. ADSPERSUS STAGE 2	58.59	9.16	40.40	36.05	27.89
T. ADSPERSUS STAGE 3	0.00	0.00	63.33	21.11	3.01
ULVARIA SUBBIFURCATA	1.25	0.00	2.18	1.14	0.93
PARALICHTHYS OBLONGUS	0.00	1.08	1.09	0.72	0.63
SCOPHTHALMUS AQUOSUS	0.00	3.23	8.74	3.99	2.45
LIMANDA FERRUGINEA	0.00	0.00	1.09	0.36	0.28
TOTAL LARVAE	164.54	105.11	138.67	136.11	133.86

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JULY 2010 :	12	14	16	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	0.00	0.00	4.73	1.58	0.79
ANCHOA MITCHILLI	11.04	12.18	0.00	7.74	4.41
ENCHELYOPUS-UROPHYCIS-PEPRILUS	34.23	14.40	14.19	20.94	19.12
ENCHELYOPUS CIMBRIUS	0.00	4.43	0.00	1.48	0.76
MERLUCCIUS-STENOTOMUS-CYNOSCION	13.25	13.29	26.01	17.52	16.61
MERLUCCIUS BILINEARIS	2.21	0.00	21.28	7.83	3.15
UROPHYCIS SPP.	3.31	0.00	7.09	3.47	2.27
PRIONOTUS SPP.	15.46	11.08	0.00	8.85	4.84
LABRIDAE-LIMANDA	477.02	4341.93	1286.40	2035.12	1386.33
LABRIDAE	79.50	212.67	61.48	117.88	101.30
SCOMBER SCOMBRUS	2.21	8.86	0.00	3.69	2.16
ETROPUS MICROSTOMUS	3.31	6.65	4.73	4.90	4.70
PARALICHTHYS-SCOPHTHALMUS	68.46	60.92	40.20	56.53	55.14
GLYPTOCEPHALUS CYNOGLOSSUS	0.00	0.00	2.36	0.79	0.50
TOTAL EGGS	710.01	4686.40	1468.49	2288.30	1696.91

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JULY 2010 :	12	14	16	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	2.21	6.65	2.36	3.74	3.26
ENCHELYOPUS CIMBRIUS	0.00	5.54	2.36	2.63	1.80
UROPHYCIS SPP.	1.10	0.00	0.00	0.37	0.28
MENIDIA SPP.	2.21	0.00	4.73	2.31	1.64
SYNGNATHUS FUSCUS	0.00	4.43	0.00	1.48	0.76
CENTROPRISTIS STRIATA	1.10	0.00	0.00	0.37	0.28
TAUTOGA ONITIS	6.63	12.18	4.73	7.85	7.25
T. ADSPERSUS STAGE 1	0.00	7.75	0.00	2.58	1.06
T. ADSPERSUS STAGE 2	8.83	38.77	4.73	17.44	11.74
T. ADSPERSUS STAGE 3	20.98	0.00	21.28	14.09	6.88
ULVARIA SUBBIFURCATA	0.00	0.00	2.36	0.79	0.50
PARALICHTHYS OBLONGUS	2.21	2.22	0.00	1.47	1.18
SCOPHTHALMUS AQUOSUS	2.21	7.75	0.00	3.32	2.04
LIMANDA FERRUGINEA	1.10	0.00	0.00	0.37	0.28
TOTAL LARVAE	48.59	85.29	42.56	58.81	56.08

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- JULY 2010 :	19	21	24	MEANS ARITHM.	MEANS GEOM.
ANCHOA MITCHILLI	0.00	3.70	0.00	1.23	0.68
ENCHELYOPUS-UROPHYCIS-PEPRILUS	5.87	18.52	45.21	23.20	17.00
ENCHELYOPUS CIMBRIUS	2.35	0.00	0.00	0.78	0.50
MERLUCCIUS-STENOTOMUS-CYNOSCION	8.22	28.39	64.49	33.70	24.69
MERLUCCIUS BILINEARIS	0.00	7.41	3.71	3.70	2.41
UROPHYCIS SPP.	3.52	13.58	2.96	6.69	5.21
PRIONOTUS SPP.	15.26	11.11	5.19	10.52	9.58
LABRIDAE-LIMANDA	112.68	387.62	515.89	338.73	282.44
LABRIDAE	133.80	93.82	26.68	84.77	69.45
SCOMBER SCOMBRUS	1.17	0.00	0.00	0.39	0.30
ETROPUS MICROSTOMUS	5.87	1.23	6.67	4.59	3.64
PARALICHTHYS-SCOPHTHALMUS	53.99	30.86	35.58	40.14	38.99
TOTAL EGGS	342.72	596.24	706.39	548.45	524.57

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JULY 2010 :	19	21	24	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	1.17	2.47	0.74	1.46	1.29
MERLUCCIUS BILINEARIS	1.17	0.00	0.74	0.64	0.56
UROPHYCIS SPP.	2.35	0.00	0.00	0.78	0.50
MENIDIA SPP.	0.00	3.70	0.74	1.48	1.02
SYNGNATHUS FUSCUS	0.00	0.00	0.74	0.25	0.20
TAUTOGA ONITIS	2.35	8.64	1.48	4.16	3.11
T. ADSPERSUS STAGE 2	9.39	13.58	15.57	12.84	12.57
T. ADSPERSUS STAGE 3	0.00	6.17	10.38	5.52	3.34
PEPRILUS TRIACANTHUS	0.00	0.00	0.74	0.25	0.20
PARALICHTHYS OBLONGUS	0.00	3.70	3.71	2.47	1.81
SCOPHTHALMUS AQUOSUS	4.69	2.47	0.00	2.39	1.70
LIMANDA FERRUGINEA	1.17	0.00	0.00	0.39	0.30
UNIDENTIFIED FRAGMENTS	2.35	0.00	1.48	1.28	1.03
TOTAL LARVAE	24.65	40.74	36.32	33.90	33.16

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — JULY 2010 :	26	28	30	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	6.12	5.27	12.98	8.12	7.48
ENCHELYOPUS CIMBRIUS	0.51	0.00	0.00	0.17	0.15
MERLUCCIUS-STENOTOMUS-CYNOSCION	39.75	10.53	34.29	28.19	24.31
MERLUCCIUS BILINEARIS	1.02	5.27	8.34	4.88	3.55
UROPHYCIS SPP.	1.53	5.27	9.27	5.35	4.21
PRIONOTUS SPP.	3.06	1.76	1.85	2.22	2.15
LABRIDAE-LIMANDA	191.61	115.88	242.83	183.44	175.35
LABRIDAE	10.19	10.53	35.22	18.65	15.58
ETROPUS MICROSTOMUS	4.08	0.00	5.56	3.21	2.22
PARALICHTHYS-SCOPHTHALMUS	0.00	21.07	21.32	14.13	6.90
TOTAL EGGS	257.85	175.57	371.65	268.36	256.25

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- JULY 2010 :	26	28	30	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	0.00	3.51	3.71	2.41	1.77
ENCHELYOPUS CIMBRIUS	0.00	1.76	1.85	1.20	0.99
MERLUCCIUS BILINEARIS	0.00	0.00	1.85	0.62	0.42
UROPHYCIS SPP.	0.00	0.00	4.63	1.54	0.78
MENIDIA SPP.	0.51	0.00	1.85	0.79	0.63
SYNGNATHUS FUSCUS	1.02	0.00	0.93	0.65	0.57
TAUTOGA ONITIS	0.00	3.51	12.05	5.19	2.89
T. ADSPERSUS STAGE 2	4.59	36.87	7.41	16.29	10.78
T. ADSPERSUS STAGE 3	3.57	14.05	10.19	9.27	7.99
PEPRILUS TRIACANTHUS	1.02	0.00	0.00	0.34	0.26
SCOPHTHALMUS AQUOSUS	0.00	1.76	2.78	1.51	1.18
UNIDENTIFIED FRAGMENTS	0.51	0.00	1.85	0.79	0.63
TOTAL LARVAE	11.21	61.45	49.12	40.59	32.35

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- AUGUST 2010 :	2	4	6	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	3.26	24.03	0.00	9.10	3.74
ENCHELYOPUS CIMBRIUS	1.30	1.20	0.00	0.84	0.72
MERLUCCIUS-STENOTOMUS-CYNOSCION	20.22	28.23	3.68	17.38	12.80
MERLUCCIUS BILINEARIS	9.78	5.41	4.90	6.70	6.38
UROPHYCIS SPP.	7.17	1.80	0.00	2.99	1.84
PRIONOTUS SPP.	1.96	0.00	0.00	0.65	0.44
LABRIDAE-LIMANDA	23.48	165.78	23.30	70.85	44.93
LABRIDAE	0.65	0.00	0.00	0.22	0.18
ETROPUS MICROSTOMUS	2.61	3.60	1.23	2.48	2.26
PARALICHTHYS-SCOPHTHALMUS	11.74	13.21	4.90	9.95	9.13
GLYPTOCEPHALUS CYNOGLOSSUS	0.00	0.00	1.23	0.41	0.31
TOTAL EGGS	82.18	243.27	39.23	121.56	92.22

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- AUGUST 2010 :	2	4	6	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	1.30	0.60	2.45	1.45	1.24
ENCHELYOPUS CIMBRIUS	2.61	5.41	20.84	9.62	6.65
MERLUCCIUS BILINEARIS	1.30	1.20	1.23	1.24	1.24
UROPHYCIS SPP.	0.00	3.00	7.36	3.45	2.22
MENIDIA SPP.	0.65	0.60	0.00	0.42	0.38
SYNGNATHUS FUSCUS	0.00	1.20	1.23	0.81	0.70
TAUTOGA ONITIS	0.65	5.41	1.23	2.43	1.63
T. ADSPERSUS STAGE 2	17.61	16.22	62.53	32.12	26.14
T. ADSPERSUS STAGE 3	9.78	10.21	56.40	25.46	17.79
PEPRILUS TRIACANTHUS	0.00	9.01	0.00	3.00	1.16
PARALICHTHYS OBLONGUS	0.65	2.40	0.00	1.02	0.78
SCOPHTHALMUS AQUOSUS	0.65	0.60	0.00	0.42	0.38
LIMANDA FERRUGINEA	0.00	0.00	2.45	0.82	0.51
TOTAL LARVAE	35.22	55.86	155.71	82.26	67.41

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- AUGUST 2010 :	9	11	13	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	0.64	83.67	6.88	30.40	7.17
ENCHELYOPUS CIMBRIUS	0.64	5.23	0.63	2.17	1.28
MERLUCCIUS-STENOTOMUS-CYNOSCION	0.64	47.72	10.63	19.66	6.88
MERLUCCIUS BILINEARIS	0.00	3.27	3.13	2.13	1.60
UROPHYCIS SPP.	9.62	49.02	18.14	25.60	20.45
PRIONOTUS SPP.	0.00	7.19	4.38	3.86	2.53
LABRIDAE-LIMANDA	0.00	75.83	525.49	200.44	33.33
LABRIDAE	3.21	9.15	27.53	13.29	9.31
ETROPUS MICROSTOMUS	7.70	36.61	14.39	19.56	15.94
PARALICHTHYS-SCOPHTHALMUS	9.62	39.22	57.55	35.46	27.90
TOTAL EGGS	32.06	356.90	668.74	352.57	197.06

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- AUGUST 2010 :	9	11	13	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	0.00	0.65	1.88	0.84	0.68
ANCHOA SPP.	0.00	0.00	0.63	0.21	0.18
ENCHELYOPUS CIMBRIUS	0.00	5.23	0.00	1.74	0.84
MERLUCCIUS BILINEARIS	0.00	1.31	1.88	1.06	0.88
UROPHYCIS SPP.	1.28	7.19	1.88	3.45	2.59
OPHIDION MARGINATUM	0.00	0.00	0.63	0.21	0.18
MENIDIA SPP.	0.00	0.00	8.13	2.71	1.09
SYNGNATHUS FUSCUS	0.00	1.31	1.25	0.85	0.73
CENTROPRISTIS STRIATA	0.00	0.00	0.63	0.21	0.18
TAUTOGA ONITIS	0.64	3.92	4.38	2.98	2.22
T. ADSPERSUS STAGE 2	0.00	0.00	0.63	0.21	0.18
T. ADSPERSUS STAGE 3	8.98	0.00	5.00	4.66	2.91
PEPRILUS TRIACANTHUS	0.00	0.00	5.00	1.67	0.82
PARALICHTHYS OBLONGUS	0.64	3.27	1.88	1.93	1.58
SCOPHTHALMUS AQUOSUS	0.00	0.65	1.25	0.63	0.55
P. AMERICANUS STAGE 3	0.00	0.65	0.00	0.22	0.18
UNIDENTIFIED FRAGMENTS	0.00	1.31	0.00	0.44	0.32
TOTAL LARVAE	11.54	25.49	35.03	24.02	21.76

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- AUGUST 2010 :	16	18	20	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	12.73	0.00	101.23	37.98	10.20
ENCHELYOPUS CIMBRIUS	1.06	1.71	2.74	1.84	1.71
MERLUCCIUS-STENOTOMUS-CYNOSCION	67.87	913.08	0.00	326.98	38.78
MERLUCCIUS BILINEARIS	15.91	92.76	23.25	43.97	32.50
UROPHYCIS SPP.	10.61	5.56	47.88	21.35	14.13
PRIONOTUS SPP.	2.65	3.85	25.99	10.83	6.42
LABRIDAE-LIMANDA	77.42	0.00	199.72	92.38	24.06
LABRIDAE	8.48	23.08	273.58	101.72	37.70
ETROPUS MICROSTOMUS	0.53	31.21	51.98	27.91	9.51
PARALICHTHYS-SCOPHTHALMUS	33.41	19.24	231.18	94.61	52.96
TOTAL EGGS	230.66	1090.48	957.54	759.56	622.18

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — AUGUST 2010 :	16	18	20	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	0.00	2.99	1.37	1.45	1.11
MERLUCCIUS BILINEARIS	0.53	0.43	8.21	3.06	1.23
MICROGADUS TOMCOD	0.00	2.99	0.00	1.00	0.59
UROPHYCIS SPP.	1.06	0.00	2.74	1.27	0.97
SYNGNATHUS FUSCUS	0.00	0.00	4.10	1.37	0.72
CENTROPRISTIS STRIATA	0.00	0.00	1.37	0.46	0.33
TAUTOGA ONITIS	0.53	0.00	4.10	1.54	0.98
T. ADSPERSUS STAGE 3	1.06	0.85	5.47	2.46	1.71
PEPRILUS TRIACANTHUS	1.59	0.43	0.00	0.67	0.55
PARALICHTHYS OBLONGUS	1.06	0.43	9.58	3.69	1.63
LIMANDA FERRUGINEA	0.00	0.00	1.37	0.46	0.33
TOTAL LARVAE	5.83	8.12	38.30	17.42	12.20

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — AUGUST 2010 :	23	25	27	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	-	21.45	3.68	12.56	8.88
GADUS MORHUA	-	0.00	0.74	0.37	0.32
MERLUCCIUS-STENOTOMUS-CYNOSCION	-	25.02	13.24	19.13	18.20
MERLUCCIUS BILINEARIS	-	3.57	11.03	7.30	6.28
UROPHYCIS SPP.	-	7.15	12.50	9.83	9.45
LABRIDAE-LIMANDA	-	28.59	46.33	37.46	36.40
LABRIDAE	-	0.00	1.47	0.74	0.57
ETROPUS MICROSTOMUS	-	3.57	1.47	2.52	2.29
PARALICHTHYS-SCOPHTHALMUS	-	0.00	23.53	11.77	3.95
GLYPTOCEPHALUS CYNOGLOSSUS	-	7.15	0.00	3.57	1.85
TOTAL EGGS	-	96.50	113.99	105.25	104.88

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- AUGUST 2010 :	23	25	27	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	-	0.00	4.41	2.21	1.33
MERLUCCIUS BILINEARIS	-	7.15	12.50	9.83	9.45
UROPHYCIS SPP.	-	0.00	12.50	6.25	2.67
PRIONOTUS EVOLANS	-	0.00	0.74	0.37	0.32
TAUTOGA ONITIS	-	0.00	2.21	1.10	0.79
T. ADSPERSUS STAGE 3	-	3.57	2.21	2.89	2.81
PARALICHTHYS OBLONGUS	-	0.00	1.47	0.74	0.57
SCOPHTHALMUS AQUOSUS	-	0.00	0.74	0.37	0.32
TOTAL LARVAE	-	10.72	36.77	23.75	19.86

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — AUGUST 2010 :	30	1	3	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	4.18	16.29	-	10.24	8.25
MERLUCCIUS BILINEARIS	4.88	0.00	-	2.44	1.42
PRIONOTUS SPP.	0.70	0.00	-	0.35	0.30
LABRIDAE-LIMANDA	0.00	4.07	-	2.04	1.25
LABRIDAE	9.06	0.00	-	4.53	2.17
ETROPUS MICROSTOMUS	0.70	0.00	-	0.35	0.30
PARALICHTHYS-SCOPHTHALMUS	11.15	20.37	-	15.76	15.07
TOTAL EGGS	30.66	40.74	-	35.70	35.34

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- AUGUST 2010 :	30	1	3	MEANS ARITHM.	MEANS GEOM.
ANCHOA SPP.	0.00	4.07	-	2.04	1.25
ENCHELYOPUS CIMBRIUS	0.70	0.00	-	0.35	0.30
UROPHYCIS SPP.	0.70	0.00	-	0.35	0.30
SYNGNATHUS FUSCUS	0.70	0.00	-	0.35	0.30
T. ADSPERSUS STAGE 3	0.00	4.07	-	2.04	1.25
PEPRILUS TRIACANTHUS	0.70	0.00	-	0.35	0.30
TOTAL LARVAE	2.79	8.15	-	5.47	4.77

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- SEPTEMBER 2010 :	6	8	10	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	1.73	0.00	0.00	0.58	0.40
ENCHELYOPUS-UROPHYCIS-PEPRILUS	5.20	0.52	22.24	9.32	3.93
ENCHELYOPUS CIMBRIUS	0.00	0.00	1.59	0.53	0.37
MERLUCCIUS-STENOTOMUS-CYNOSCION	0.00	0.00	100.08	33.36	3.66
MERLUCCIUS BILINEARIS	3.46	5.76	54.01	21.08	10.25
UROPHYCIS SPP.	0.00	0.00	11.12	3.71	1.30
LABRIDAE-LIMANDA	0.00	0.00	28.60	9.53	2.09
LABRIDAE	0.00	1.57	0.00	0.52	0.37
ETROPUS MICROSTOMUS	1.73	0.00	0.00	0.58	0.40
PARALICHTHYS-SCOPHTHALMUS	1.73	1.57	27.01	10.10	4.19
TOTAL EGGS	13.86	9.43	244.65	89.31	31.73

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — SEPTEMBER 2010 :	6	8	10	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	0.00	2.62	22.24	8.29	3.38
ANCHOA SPP.	0.00	0.00	1.59	0.53	0.37
MERLUCCIUS BILINEARIS	0.00	1.57	1.59	1.05	0.88
UROPHYCIS SPP.	0.00	0.00	14.30	4.77	1.48
SYNGNATHUS FUSCUS	0.00	1.05	1.59	0.88	0.74
PRIONOTUS SPP.	0.00	0.00	1.59	0.53	0.37
MYOXOCEPHALUS AENAEUS	0.00	1.05	0.00	0.35	0.27
CENTROPRISTIS STRIATA	0.00	0.00	3.18	1.06	0.61
TAUTOGA ONITIS	1.73	12.57	22.24	12.18	7.85
T. ADSPERSUS STAGE 2	0.00	0.52	0.00	0.17	0.15
T. ADSPERSUS STAGE 3	0.00	1.05	0.00	0.35	0.27
PEPRILUS TRIACANTHUS	0.00	0.00	3.18	1.06	0.61
PARALICHTHYS DENTATUS (JUV.)	0.00	0.52	0.00	0.17	0.15
PARALICHTHYS OBLONGUS	0.00	0.00	15.89	5.30	1.57
SCOPHTHALMUS AQUOSUS	0.00	0.00	12.71	4.24	1.39
TRINECTES MACULATUS	0.00	3.14	0.00	1.05	0.61
TOTAL LARVAE	1.73	24.09	100.08	41.97	16.10

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- SEPTEMBER 2010 :	13	15	17	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	1.02	4.34	1.37	2.24	1.83
ENCHELYOPUS CIMBRIUS	0.00	0.72	0.00	0.24	0.20
MERLUCCIUS-STENOTOMUS-CYNOSCION	4.60	5.78	4.12	4.83	4.78
MERLUCCIUS BILINEARIS	1.02	5.06	1.37	2.49	1.92
UROPHYCIS SPP.	0.51	0.00	0.00	0.17	0.15
LABRIDAE-LIMANDA	2.55	2.17	3.43	2.72	2.67
LABRIDAE	0.00	0.00	0.69	0.23	0.19
ETROPUS MICROSTOMUS	0.00	0.72	0.69	0.47	0.43
PARALICHTHYS-SCOPHTHALMUS	8.69	27.47	41.86	26.01	21.54
TOTAL EGGS	18.40	46.27	53.53	39.40	35.72

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — SEPTEMBER 2010 :	13	15	17	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	1.02	0.00	3.43	1.48	1.08
ENCHELYOPUS CIMBRIUS	1.53	0.72	1.37	1.21	1.15
MERLUCCIUS BILINEARIS	0.00	0.72	0.69	0.47	0.43
UROPHYCIS SPP.	3.58	0.72	1.37	1.89	1.53
SYNGNATHUS FUSCUS	0.51	0.72	0.69	0.64	0.63
PRIONOTUS EVOLANS	0.00	0.00	1.37	0.46	0.33
CENTROPRISTIS STRIATA	1.02	0.00	0.00	0.34	0.26
TAUTOGA ONITIS	4.60	8.68	2.74	5.34	4.78
T. ADSPERSUS STAGE 3	0.51	0.00	0.00	0.17	0.15
ETROPUS MICROSTOMUS	0.51	0.00	0.00	0.17	0.15
PARALICHTHYS OBLONGUS	2.04	1.45	1.37	1.62	1.59
SCOPHTHALMUS AQUOSUS	7.15	6.51	2.06	5.24	4.58
TOTAL LARVAE	22.48	19.52	15.10	19.03	18.78

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- SEPTEMBER 2010 :	20	22	24	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	4.70	5.84	8.70	6.41	6.20
ENCHELYOPUS CIMBRIUS	1.57	0.65	0.00	0.74	0.62
MERLUCCIUS-STENOTOMUS-CYNOSCION	0.00	11.03	11.60	7.54	4.33
MERLUCCIUS BILINEARIS	0.00	1.30	1.93	1.08	0.89
UROPHYCIS SPP.	3.13	1.95	0.00	1.69	1.30
LABRIDAE-LIMANDA	1.57	1.30	0.97	1.28	1.25
PARALICHTHYS-SCOPHTHALMUS	17.22	11.03	16.44	14.90	14.62
TOTAL EGGS	28.18	33.08	39.65	33.64	33.31

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- SEPTEMBER 2010 :	20	22	24	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	17.22	5.84	0.00	7.69	3.99
ENCHELYOPUS CIMBRIUS	0.00	3.24	0.97	1.40	1.03
MERLUCCIUS BILINEARIS	0.00	1.30	0.00	0.43	0.32
UROPHYCIS SPP.	1.57	1.30	0.00	0.95	0.81
PRIONOTUS CAROLINUS	0.00	0.00	0.97	0.32	0.25
CENTROPRISTIS STRIATA	0.00	0.00	1.93	0.64	0.43
TAUTOGA ONITIS	1.57	9.08	2.90	4.52	3.46
ETROPUS MICROSTOMUS	0.00	6.49	1.93	2.81	1.80
PARALICHTHYS OBLONGUS	1.57	0.00	1.93	1.17	0.96
SCOPHTHALMUS AQUOSUS	0.00	1.30	1.93	1.08	0.89
GLYPTOCEPHALUS CYNOGLOSSUS	0.00	0.00	0.97	0.32	0.25
TOTAL LARVAE	21.92	28.54	13.54	21.33	20.38

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- SEPTEMBER 2010 :	27	29	I	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	0.00	5.85	-	2.92	1.62
ENCHELYOPUS CIMBRIUS	0.00	1.60	-	0.80	0.61
MERLUCCIUS-STENOTOMUS-CYNOSCION	0.00	1.06	-	0.53	0.44
MERLUCCIUS BILINEARIS	7.37	3.19	-	5.28	4.85
LABRIDAE	0.00	2.13	-	1.06	0.77
PARALICHTHYS-SCOPHTHALMUS	13.70	9.04	-	11.37	11.13
TOTAL EGGS	21.07	22.87	-	21.97	21.95

No Friday sampling, Fall-Winter schedule begins.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — SEPTEMBER 2010 :	27	29	1	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	2.11	0.00	-	1.05	0.76
ENCHELYOPUS CIMBRIUS	0.00	4.79	-	2.39	1.41
MERLUCCIUS BILINEARIS	0.00	1.06	-	0.53	0.44
UROPHYCIS SPP.	4.21	0.00	-	2.11	1.28
SYNGNATHUS FUSCUS	0.00	0.53	-	0.27	0.24
PRIONOTUS EVOLANS	0.00	0.53	-	0.27	0.24
CENTROPRISTIS STRIATA	0.00	2.66	-	1.33	0.91
TAUTOGA ONITIS	5.27	3.19	-	4.23	4.10
PEPRILUS TRIACANTHUS	1.05	0.53	-	0.79	0.75
ETROPUS MICROSTOMUS	1.05	10.10	-	5.58	3.26
PARALICHTHYS OBLONGUS	0.00	1.06	-	0.53	0.44
SCOPHTHALMUS AQUOSUS	0.00	2.13	-	1.06	0.77
TOTAL LARVAE	13.70	26.59	-	20.14	19.08

No Friday sampling, Fall-Winter schedule begins.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- OCTOBER 2010 :	4	6	8	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	-	-	0.81	0.81	0.81
ENCHELYOPUS-UROPHYCIS-PEPRILUS	-	-	4.89	4.89	4.89
MERLUCCIUS-STENOTOMUS-CYNOSCION	-	-	4.89	4.89	4.89
MERLUCCIUS BILINEARIS	-	-	1.63	1.63	1.63
LABRIDAE-LIMANDA	-	-	1.63	1.63	1.63
PARALICHTHYS-SCOPHTHALMUS	-	-	17.10	17.10	17.10
TOTAL EGGS	-	-	30.94	30.94	30.94

No Monday and Wednesday sampling, due to high tide and storm.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In — OCTOBER 2010 :	4	6	8	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	-	-	0.81	0.81	0.81
UROPHYCIS SPP.	-	-	0.81	0.81	0.81
CENTROPRISTIS STRIATA	-	-	1.63	1.63	1.63
ETROPUS MICROSTOMUS	-	-	0.81	0.81	0.81
PARALICHTHYS OBLONGUS	-	-	0.81	0.81	0.81
SCOPHTHALMUS AQUOSUS	-	-	0.81	0.81	0.81
TOTAL LARVAE	-	-	5.70	5.70	5.70

No Monday and Wednesday sampling, due to high tide and storm.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- OCTOBER 2010 :	11	14	15	MEANS ARITHM.	MEANS GEOM.
MERLUCCIUS-STENOTOMUS-CYNOSCION	2.17	0.00	-	1.08	0.78
MERLUCCIUS BILINEARIS	6.50	0.00	-	3.25	1.74
ETROPUS MICROSTOMUS	1.08	0.00	-	0.54	0.44
PARALICHTHYS-SCOPHTHALMUS	6.50	0.60	-	3.55	1.97
TOTAL EGGS	16.24	0.60	-	8.42	3.11

Backwash in progress on Wed, Sample collected on Thursday. No friday sampling.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- OCTOBER 2010 :	11	14	15	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS CIMBRIUS	0.00	1.19	-	0.60	0.48
TAUTOGA ONITIS	1.08	0.00	-	0.54	0.44
PEPRILUS TRIACANTHUS	1.08	0.00	-	0.54	0.44
ETROPUS MICROSTOMUS	1.08	0.60	-	0.84	0.80
PARALICHTHYS OBLONGUS	1.08	0.00	-	0.54	0.44
SCOPHTHALMUS AQUOSUS	2.17	1.79	-	1.98	1.97
TOTAL LARVAE	6.50	3.57	-	5.03	4.82

Backwash in progress on Wed, Sample collected on Thursday. No friday sampling.

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — OCTOBER 2010 :	18	20	22	MEANS ARITHM.	MEANS GEOM.
PARALICHTHYS-SCOPHTHALMUS	0.69	0.00	0.00	0.23	0.19
TOTAL EGGS	0.69	0.00	0.00	0.23	0.19

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- OCTOBER 2010 :	18	20	22	MEANS ARITHM.	MEANS GEOM.
BREVOORTIA TYRANNUS	0.00	5.19	3.29	2.83	1.99
ENCHELYOPUS CIMBRIUS	0.00	0.00	1.32	0.44	0.32
SYNGNATHUS FUSCUS	0.00	0.00	0.66	0.22	0.18
T. ADSPERSUS STAGE 3	0.00	0.65	0.00	0.22	0.18
PARALICHTHYS DENTATUS	0.00	1.95	0.66	0.87	0.70
SCOPHTHALMUS AQUOSUS	0.00	1.30	0.66	0.65	0.56
UNIDENTIFIED FRAGMENTS	0.00	3.25	0.00	1.08	0.62
TOTAL LARVAE	0.00	12.34	6.59	6.31	3.66

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — NOVEMBER 2010 :	1	3	5	MEANS ARITHM.	MEANS GEOM.
TOTAL EGGS	0.00	0.00	0.00	0.00	0.00

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- NOVEMBER 2010 :	1	3	5	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	0.00	4.45	0.00	1.48	0.76
ENCHELYOPUS CIMBRIUS	0.00	0.64	0.00	0.21	0.18
UNIDENTIFIED CLUPEIFORMS	0.00	0.00	0.52	0.17	0.15
TOTAL LARVAE	0.00	5.08	0.52	1.87	1.10

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- NOVEMBER 2010 :	15	17	19	MEANS ARITHM.	MEANS GEOM.
ENCHELYOPUS-UROPHYCIS-PEPRILUS	0.00	0.55	0.00	0.18	0.16
GADUS MORHUA	2.00	0.00	0.00	0.67	0.44
TOTAL EGGS	2.00	0.55	0.00	0.85	0.67

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- NOVEMBER 2010 :	15	17	19	MEANS ARITHM.	MEANS GEOM.
CLUPEA HARENGUS	12.70	0.00	1.29	4.66	2.15
ENCHELYOPUS CIMBRIUS	1.34	0.00	0.00	0.45	0.33
AMMODYTES SP.	0.00	0.55	0.00	0.18	0.16
UNIDENTIFIED FRAGMENTS	1.34	0.00	0.00	0.45	0.33
UNIDENTIFIED CLUPEIFORMS	0.00	1.10	0.00	0.37	0.28
TOTAL LARVAE	15.37	1.65	1.29	6.10	3.20

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In --- DECEMBER 2010 :	6	8	10	MEANS ARITHM.	GEOM.
GADUS MORHUA	0.70	0.75	12.64	4.70	1.88
PARALICHTHYS-SCOPHTHALMUS	0.00	0.00	0.74	0.25	0.20
TOTAL EGGS	0.70	0.75	13.39	4.95	1.92

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- DECEMBER 2010 :	6	8	10	MEANS ARITHM.	GEOM.
CLUPEA HARENGUS	4.22	8.29	0.74	4.42	2.96
TOTAL LARVAE	4.22	8.29	0.74	4.42	2.96

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

EGGS

Date In — DECEMBER 2010 :	13	15	17	MEANS ARITHM.	MEANS GEOM.
GADUS MORHUA	-	-	2.20	2.20	2.20
TOTAL EGGS	-	-	2.20	2.20	2.20

DENSITIES IN NUMBER OF PLANKTON PER 100 CUBIC METERS OF WATER

LARVAE

Date In --- DECEMBER 2010 :	13	15	17	MEANS ARITHM.	MEANS GEOM.
TOTAL LARVAE	-	-	0.00	0.00	0.00

APPENDIX B*

Geometric mean monthly densities and 95% confidence limits per 100 m^3 of water for the dominant species of fish eggs and larvae entrained at PNPS, January-December 1981-2010.

Note the following:

When extra sampling series were required under the contingency sampling regime, results were included in calculating monthly mean densities.

Shaded columns for certain months in 1984, 1987, and 1999 delineate periods when sampling was conducted for all or part of a month with only salt service water pumps in operation. Densities recorded at those times were probably biased low due to low through-plant water flow (MRI 1994).

*Available upon request.

January

EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0	0	0
Enchelyopus-Urophycis-	0	0	0	0	0	0	0	0	0
Peprilus									
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Gadus morhua	2.8	0.5	0	0.3	0	0.5	0.09	0	0
	1.1-6	0.1-1		0-1.1		0-1.5	0-0.4		
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippogloissoides	0.05	0	0	0	0	0	0	0	0
platessoides	0-0.2								
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	2.9	0.05	0	0.3	0	0.5	0.09	0	0
	1.1-6	0.1-1		0-1.1		0-1.5	0-0.4		

January (continued)

EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0	0	0.1 0-0.5
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0.1 0-0.5	0	0
Gadus morhua	0.4 0-1.1	0	0	0	0	0.09 0-0.4	0	0	0.3 0-1
Pollachius virens	0	0	0	0	0	0	0	0.09 0-0.4	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0.1 0-0.5
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippogloissoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0.2 0-0.7	0	0.3 0-0.9	0	0	0
Total	0.4 0-1.1	0	0	0.2 0-0.7	0	0.3 0-1.1	0.1 0-1.1	0.09 0-0.4	0.7 0.2-1.3

January (continued)									
EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0.5 0-2	0.1 0-0.3	0	0	0	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Gadus morhua	0	3.0 0-27	0.6 0-1.7	1.3 0.04-4	1.7 0.2-5	0.7 0.2-1.4	2.1 0-19	0.4 0-1.6	0.05 0-0.2
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	0	3.0 0-27	1.4 0.4-3	1.5 0.2-4	1.7 0.2-5	0.7 0.2-1.4	2.1 0-19	0.4 0-1.6	0.05 0-0.2

January (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0
Gadidae-*Glyptocephalus*	0	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0
Enchelyopus cimbrius	0	0	0
Gadus morhua	0	0	0.4 0-1.0
Pollachius virens	0	0	0
Urophycis spp.	0	0	0
Prionotus spp.	0	0	0
Labridae-*Limanda*	0	0	0
Labridae	0	0.08 0-0.3	0
Scomber scombrus	0	0	0
Paralichthys-Scophthalmus	0	0	0
Hippoglossoides platessoides	0	0	0
Limanda ferruginea	0	0	0
Total	0	0.1 0-0.3	0.4 0-1.0

February									
EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Gadus morhua	1.0	0.08	0.2	1.2	0.4	0.4	0.1	0	0
	0.2-2.2	0-0.3	0-0.7	0.6-2.1	0-1	0-1	0-0.4		
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0	0	0.3	0.3	0	0	0	0.08	0
			0-0.8	0.1-0.6				0-0.3	
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	1.9	0.08	0.5	1.6	0.8	0.4	1.0	0.08	0.1
	0.1-7.1	0-0.3	0-1.4	0.8-2.9	0.3-1.6	0-1	0-0.4	0-0.3	0-0.4

February (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0.2 0-0.7
Gadus morhua	0	0	0.2 0-0.8	0	0	0	0.3 0-1.1	0.2 0-0.9	2.1 0.7-4.8
Pollachius virens	0	0	0	0	0	0	0	0.3 0-1.1	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippogloissoides	0	0	0	0	0	0	0	0	0.3 0-1.4
Limanda ferruginea	0	0	0	0.1 0-0.5	0	0	0	0	0
Total	0	0	0.2 0-0.8	0.1 0-0.5	0	0	0.3 0-1.1	0.7 0.5-1.1	2.9 1-6.1

February (continued)									
EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0.08 0-0.3	0	0	0	0	0	0.15 0-0.4	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0.03 0-0.1	0
Gadus morhua	0.2 0-0.5	0	0.9 0-5.8	1.5 0.4-3.7	1.1 0.2-2.5	0.5 0.1-1	1.0 0.2-2.5	0.3 0-0.9	0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	
Labridae	0	0	0	0.1 0-0.3	0	0	0	0	0.07 0-0.3
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippogloissoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	0.3 0-0.9	0	0.9 0-5.8	1.7 0.6-3.7	1.1 0.2-2.5	0.5 0.1-1	1.3 0.5-2.7	0.5 0-0.9	0.07 0-0.3

February (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0
Gadidae-*Glyptocephalus*	0	0.05 0-0.2	0.04 0-0.2
Enchelyopus-Urophycis-Peprilus	0	0	0
Enchelyopus cimbrius	0	0	0
Gadus morhua	0	0	0.35 0-1.0
Pollachius virens	0	0	0
Urophycis spp.	0	0	0
Prionotus spp.	0	0	0
Labridae-*Limanda*	0	0	0
Labridae	0	0	0
Scomber scombrus	0	0	0
Paralichthys-Scophthalmus	0	0	0
Hippogloissoides platessoides	0	0	0
Limanda ferruginea	0	0	0
Total	0	0.05 0-0.2	0.37 0-1.0

March

EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0.4 0-0.9	0.08 0-0.2	0	0	0.4 0-1	0.1 0-0.3	0.04 0-0.1
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0.08 0-0.2	0
Gadus morhua	0.9 0.2-2	0.3 0-0.8	2.9 1.1-5.9	1.7 0.8-2.9	0.2 0-0.5	0.3 0.1-0.6	0.3 0-0.8	0.2 0.01-0.4	0.04 0-0.1
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	1.7 0.4-4.3	0	6.0 3.3-10	2.7 1.4-4.7	0.2 0-0.5	0	0	0.09 0-0.2	0.07 0-0.2
Limanda ferruginea	0.03 0-0.1	0	0	0.07 0-0.2	0.04 0-0.1	0.03 0-0.1	0	0.06 0-0.2	0
Total	4.1 1.6-8.7	0.9 0.2-2.1	10.4 5.8-18	5.3 3.1-8.5	1.4 0.4-3.2	2.3 0.6-5.5	12.1 2-56	2.4 0.6-6.3	0.3 0.04-0.6

March (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0.05 0-0.2	0	0	0.2 0-0.5	0.06 0-0.2	0.1 0-0.3	0	0.1 0-0.4
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0.2 0-0.5	0	0	0.2 0-0.7	0
Gadus morhua	0	0.2 0-0.4	0	0.2 0-0.4	0.05 0-0.2	0.6 0-1.6	0.5 0.2-0.9	0	0.1 0-0.3
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0	0.2 0-0.5	0.07 0-0.2	0.04 0-0.1	0.3 0.01-0.7	0.1 0-0.4	0.3 0-0.7	0	0.2 0-0.5
Limanda ferruginea	0	0	0	0	0.2 0.01-0.5	0	0	0	0.1 0-0.3
Total	0	0.4 0.01-0.9	0.2 0-0.5	0.6 0-1.9	1.8 0.6-3.8	1.0 0.2-2.5	1.2 0.3-2.7	1.2 0-5	0.7 0.2-1.3

March (continued)									
EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0.3	0.3	0.2	0	0.4	0	0.6	0.2	0.05
	0.01-0.7	0-0.9	0-0.6		0.1-0.9		0.1-1.5	0-0.7	0-0.2
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0.1	0	0.05	0.05	0	0
				0-0.2		0-0.2	0-0.2		
Gadus morhua	0.1	0	0.3	0	0.7	0.05	0.07	0	0
	0-0.3		0.1-0.6		0.2-1.7	0-0.2	0-0.3		
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0.2	0	0	0	0	0
				0-1					
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Hippogloissoides platessoides	0.3	0	0.3	0	0.3	0	0.1	0.1	0
	0-0.7		0-1		0.7-0.6		0-0.2	0-0.2	
Limanda ferruginea	0	0	0.1	0	0.6	0	0	0	0
			0-0.4		0-2				
Total	0.8	0.3	1.0	0.2	2.3	0.2	0.8	0.3	0.05
	0.2-1.5	0-0.9	0.3-2.3	0-1	0.9-4.8	0-0.5	0.2-1.8	0-0.8	0-0.2

March (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0
Gadidae-*Glyptocephalus*	0	0	1.6 0.7-3.0
Enchelyopus-Urophycis-Peprilus	0	0	0
Enchelyopus cimbrius	0.05 0-0.2	0.04 0-0.1	0.03 0-0.1
Gadus morhua	0.2 0-0.7	0	2.4 1.0-4.9
Pollachius virens	0	0	0
Urophycis spp.	0	0	0
Prionotus spp.	0	0	0
Labridae-*Limanda*	0	0	0.2 0-0.7
Labridae	0.06 0-0.2	0	0.1 0-0.2
Scomber scombrus	0	0	0
Hippoglossoides platessoides	0.2 0-0.6	0.06 0-0.2	0.5 0.2-1.0
Limanda ferruginea	0		0
Total	0.6 0.1-1.4	0.2 0-0.7	5.4 2.4-11.1

April									
EGGS	1981	1982	1983	1984	1985	1986	1987[1]	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0		0	0
Gadidae-*Glyptocephalus*	0	0.03	0.4	0.5	0	0		0.06	0.06
		0-0.1	0.02-0.8	0-1.3				0-0.2	0-0.2
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0		0	0
Enchelyopus cimbrius	0.2	0.03	0.4	0.1	0.5	2.1		1.9	0.5
	0-0.5	0-0.1	0.01-0.8	0-0.4	0-1.4	0.5-5.4		0.4-5.2	0-1.3
Gadus morhua	0.3	0.07	0.4	1.4	1.0	0.1		1.1	0.4
	0-0.7	0-0.2	0.1-0.7	0.4-3.3	0.2-2.2	0-0.4		0.03-3.4	0-1
Pollachius virens	0	0	0	0	0.05	0		0	0
					0-0.2				
Urophycis spp.	0	0	0	0	0	0		0	0
Prionotus spp.	0	0	0	0	0	0		0	0
Labridae-*Limanda*	0	0	0	0	0	0		0	0.2
									0-0.9
Labridae	0	0	0	0	0	0		0	0
Scomber scombrus	0	0	0	0	0	0		0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0.2		0	0
						0-0.5			
Hippogloissoides platessoides	0.7	0.6	1.5	5.2	0.9	0.1		2.6	0.6
	0.2-1.4	0.03-1.4	0.6-2.8	2.9-8.9	0.1-2.3	0-0.4		1.1-5.4	0-1.8
Limanda ferruginea	0.7	0.03	1.8	1.0	1.7	0.3		1.3	0.5
	0.04-1.8	0-0.09	0.6-3.8	0.2-2.5	0.3-5	0-0.7		0.5-2.5	0-1.8
Total	4.6	1.0	5.8	10.3	6.3	5.4		11.5	1.9
	1.2-13	0.3-2.1	2.9-11	7.6-14	2.7-13	0.6-10		6.5-20	0.2-6.1

[1]No sampling.

April (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0.1 0-0.3	0.2 0-0.5	0	0.1 0-0.5	0	0	0.2 0-0.5	0.2 0-0.6
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	1.0 0-3.7	0.7 0.1-1.7	0.7 0.1-1.7	0.1 0-0.5	0.2 0-0.6	0	0.1 0-0.3	3.9 1.1-9.1	3.4 0.8-9.6
Gadus morhua	0.1 0-0.3	0.7 0.2-1.4	0.8 0.3-1.4	0.2 0-1.1	0.3 0-0.7	0.1 0-0.6	0.3 0.1-0.6	1.4 0.5-2.9	0.8 0.2-1.7
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0.06 0-0.2	0	0.2 0-0.5	0.6 0-2.3	0.3 0-1.1
Labridae	0	0	0	0	0	0	0	0.3 0-1.1	0.2 0-0.6
Scomber scombrus	0	0	0	0	0	0	0	0.06 0-0.2	0.04 0-0.1
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0.9 0.3-1.9	2.7 1.3-4.8	7.5 3-17	5.7 2.2-13	1.8 0.6-3.7	3.8 3-4.8	0.6 0.1-1.5	5.2 2.7-9.6	4.0 1-12
Limanda ferruginea	0.5 0.1-1	0.6 0.1-1.5	1.0 0.3-2.2	0	0.2 0-0.6	0.7 0-1.8	0	4.6 1.3-13	7.7 2.7-20
Total	4.1 1.9-8.2	7.7 4.7-12	14.7 6.2-33	6.1 2.4-14	3.9 1.9-7.3	7.6 4-14	2.7 0.8-6.6	20.6 9.1-45	23.2 9.9-53

April (continued)									
EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0.1	0	0	0	0	0
				0-0.2					
Gadidae-*Glyptocephalus*	0.7	0.9	0.8	0.3	4.6	1.5	0.6	0.5	0.7
	0.1-1.6	0.1-2.3	0.01-2.1	0-0.8	0.7-18	0.5-3.2	0-1.6	0.04-1.1	0-3.3
Enchelyopus-Urophycis-	0	1.0	0	0	0	0	0	0.1	0
Peprilus		0.1-2.6						0-0.3	
Enchelyopus cimbrius	1.6	0.1	0	0.7	0.3	0.6	0.2	0.1	0
	0.6-3.3	0-0.3		0.1-1.6	0-1.4	0.2-1.1	0-0.9	0-0.2	
Gadus morhua	0.2	0.1	1.2	0.4	1.3	4.4	0.6	0.1	0.2
	0-0.6	0-0.3	0.4-2.5	0-1	0-4.4	1.8-9.3	0-2.1	0-0.4	0-1.1
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0.7	4.0	1.7	0	0	0.1	0	0
		0-2.7	1.5-8.9	0.3-4.9			0-0.5		
Labridae	0	0	0	0.5	0	0	0	0	0
				0-1.7					
Scomber scombrus	0.1	0	0.1	4.3	0	0	0	0	0
	0-5		0-0.2	0.6-17					
Paralichthys-Scophthalmus	0.1	0.0.6	0.1	0.8	0	0	0	0	0
	0-0.4	0-0.2	0-0.2	0-2.5					
Hippoglossoides platessoides	5.3	1.0	11.8	0.5	5.7	8.7	0.7	0.8	0.7
	2.5-10.4	0-3.2	5.8-23	0-1.3	2.4-12	4-17	0-2.2	0.1-2.0	0-2.4
Limanda ferruginea	2.4	0.6	0	1.1	1.1	1.6	0.3	0.3	0.1
	0.8-5.3	0-1.8		0-3.2	0-3.6	0.6-3.2	0-0.7	0-0.7	0-0.5
Total	13.2	5.9	19.7	10.2	16.8	21.9	2.9	2.8	1.9
	7.5-22	1.5-18	9.7-39	2.2-38	7.5-36	12-39	0-8.3	1-6.0	0-9.2

April (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0
Gadidae-*Glyptocephalus*	0.04	0	0.1
	0-0.1		0-0.3
Enchelyopus-Urophycis-Peprilus	0.1	0	0
	0-0.3		
Enchelyopus cimbrius	0.4	0.2	1.4
	0-0.9	0-0.8	0.3-3.3
Gadus morhua	0.7	0.2	0.2
	0.2-1.5	0-0.8	0-0.7
Pollachius virens	0	0	0
Urophycis spp.	0	0	0.04
			0-0.1
Prionotus spp.	0	0	0
Labridae-*Limanda*	0.3	0	0.6
	0-1.1		0-1.6
Labridae	0.04	0	0.1
	0-0.1		0-0.4
Scomber scombrus	0.1	0	0
	0-0.2		
Paralichthys-Scophthalmus	0.1	0	0
	0-0.2		
Hippoglossoides platessoides	1.4	0.5	0.8
	0.2-4.1	0-2.2	0.1-1.8
Limanda ferruginea	1.0	1.2	2.5
	0.3-2.3	0.4-2.5	0.7-6.1
Total	4.8	3.3	10.3
	1.5-12.6	0.8-9.8	5.6-18.4

May

EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0.1
									0-0.3
Gadidae-*Glyptocephalus*	0.2	0.2	2.0	1.4	0.6	0.3	0.8	0.2	0.6
	0-0.6	0.02-0.4	0.6-4.7	0.6-2.5	0.2-1.2	0-0.9	0.1-2	0-0.4	0.1-1.3
Enchelyopus-Urophycis-	6.2	2.2	6.0	3.6	4.5	16.3	10.7	9.2	22.1
Peprilus	3.6-10	1.2-3.6	4.3-8.2	1.3-8.3	1.9-9	6.2-41	5.2-21	2.7-27	6.9-66
Enchelyopus cimbrius	5.2	0.6	3.3	2.2	6.7	13.5	11.2	18.6	8.7
	1.3-16	0.2-1.1	0.6-10	0.5-5.8	4.3-10	5.6-31	5.8-21	6.8-48	3.5-20
Gadus morhua	0.5	0.09	0.5	0.7	0.3	0.2	0.2	0.06	0.3
	0.1-1.1	0-0.2	0.1-0.9	0.3-1.4	0.1-0.6	0-0.4	0-0.6	0-0.2	0-0.6
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0.08	0	0.04	0	0.4	0.06	0.05	0	0.3
	0-0.3		0-0.1		0-0.9	0-0.2	0-0.2		0-1
Prionotus spp.	0	0	0	0	0.2	0	0.06	0	0
					0.1-0.4		0-0.2		
Labridae-*Limanda*	23.0	16.3	6.6	4.9	85.2	18.9	7.1	39.6	47.2
	10-50	7.1-36	1.3-24	2.2-9.7	19-365	6.7-51	2.7-17	13-115	8.3-250
Labridae	1.3	2.4	0.2	0.2	0.6	0.9	0.4	4.4	1.9
	0.1-3.7	1-3-4.2	0-0.4	0-0.6	0-1.5	0-2.6	0.01-1.1	1.6-10	0.5-4.9
Scomber scombrus	5.4	2.5	9.5	9.6	204.3	91.0	17.0	152.5	137.5
	0.8-22	0.5-7.1	1.1-51	3.9-21	64-644	56-149	6.9-40	18-1217	14-1322
Paralichthys-Scophthalmus	7.0	3.9	3.6	3.8	15.3	14.3	4.7	22.4	15.7
	2-20	1.4-8.7	0.8-11	1.5-8.4	10-24	6.4-30	1.7-11	6.3-74	6.9-34
Hippoglossoides	4.5	0.9	1.8	1.7	0.9	0.4	0.4	0.05	1.2
platessoides	2.6-7.4	0.3-1.6	0.9-3	0.8-3.1	0.5-1.6	0.01-0.8	0-1	0-0.2	0.3-2.7
Limanda ferruginea	3.7	1.5	1.0	1.1	2.5	0.4	1.3	4.6	2.5
	1.5-7.6	0.7-2.7	0.2-2.4	0.4-2.1	1.1-4.8	0.01-0.9	0.3-2.9	1.9-10	0.8-5.5
Total	108.0	107.1	66.3	48.4	757.8	230.1	86.7	473.7	616.6
	62-188	59-194	21-202	33-71	271-2111	150-353	57-131	129-1727	125-3021

May (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0.3	0	0	0	0.06	0.1	0	0.9
		0-0.9				0-0.2	0-0.3		0.02-2.4
Gadidae-*Glyptocephalus*	0.5	1.4	0.2	0	0.2	1.2	0.1	0.3	0.2
	0.2-1	0.3-3.7	0-0.6		0-0.7	0-4.2	0-0.2	0-0.7	0-0.5
Enchelyopus-Urophycis-	21	15.9	1.0	3.7	3.2	3.7	3.3	2.2	5.7
Peprilus	9-46	5.3-44	0.3-2.2	1.9-6.6	1.1-7.5	0-25	1.4-6.8	0.6-5.3	3.3-9.4
Enchelyopus cimbrius	10.7	18.9	3.1	1.8	5.9	9.9	2.7	3.5	3.6
	6.7-17	9-38	0.7-8.8	0.9-3.1	1.8-16	3.7-24	1-6	0.9-9.6	1.9-6
Gadus morhua	0.5	0.9	0.6	0	0.4	0.8	0.1	0	0
	0.1-1	0.3-1.9	0.1-1.5		0.1-1	0.2-1.8	0-0.4		
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0.1	0	0
							0-0.2		
Prionotus spp.	0	0	0.05	0	0	0	0	0	0
			0-0.2						
Labridae-*Limanda*	20.9	36.7	16.9	110.0	10.0	25.0	24.2	19.5	51.1
	7.3-57	6.6-187	3.8-66	12-928	2-40	2.4-197	4.9-107	5.8-61	8.6-281
Labridae	0.6	5.3	2.4	2.8	0.6	2.7	4.6	1.8	1.3
	0-1.5	1.4-16	0.7-5.5	0.5-8.2	0-2.1	0.1-11	0.6-19	0.4-4.4	0-8.4
Scomber scombrus	50.4	75.0	22.5	1042.1	67.4	73.2	201.4	21.3	196.0
	8.7-271	12-451	5.8-80	157-6890	16-269	6.5-733	23-1699	3.2-117	43-887
Paralichthys-Scophthalmus	6.7	10.3	12.0	34.2	2.6	16.2	11.4	8.8	23.3
	2.8-15	5.8-18	4.8-28	7.6-143	0.8-6.1	2.7-79	3.1-36	3.8-19	13-42
Hippoglossoides	1.2	1.7	3.2	0.7	4.2	5.8	1.3	1.3	1.1
platessoides	0.5-2.2	0.7-3.1	0.9-8.2	0-2.5	2-8	2.9-11	0.5-2.5	0.4-2.8	0.2-2.7
Limanda ferruginea	0.7	1.2	0.8	0.5	4.8	3.5	0.5	2.6	2.0
	0.3-1.2	0.4-2.6	0.1-2	0-1.5	2.5-8.6	0.6-12	0.02-1.1	1.1-5	0.4-5.1
Total	278.6	298.5	131.1	1301.9	139.4	240.2	336.1	91.3	579.6
	99-784	91-969	63-272	211-7999	44-441	43-1315	53-2119	28-289	174-1921

<u>May</u> (continued)

EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0.3	0.03	0	0	0	0	0.5
			0-0.8	0-0.8					0-1.6
Gadidae-*Glyptocephalus*	0.4	0.8	0.1	1.6	1.1	0.5	0.5	0.2	1.1
	0-1.3	0.1-2.2	0-0.3	0.2-4.5	0.3-2.5	0.1-0.9	0-1.6	0-0.7	0.4-2.2
Enchelyopus-Urophycis-	16.0	7.3	1.7	6.5	3.9	2.2	1.6	2.2	7
Peprilus	6.6-37	3.2-15	0-6.4	3..3-12.2	1-11	1-4.2	0.5-3.4	0.6-5.6	3.6-13.1
Enchelyopus cimbrius	3.0	0.6	5.3	0.2	3.3	1.4	2.5	1.0	2.9
	0.8-7.9	0-1.4	0.7-22	0-0.7	1.1-8.1	0.3-3.3	0.5-7.1	0.1-2.7	1.1-6.1
Gadus morhua	0.1	0.04	0.4	0.06	0.3	0.4	0.3	0.3	1.9
	0-0.4	0-0.1	0-1.2	0.0.2	0-1.3	0-1	0-0.9	0-0.6	0.8-3.7
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0.1	0.1	0.1	0	0	0.1
				0-0.4	0-0.4	0-0.4			0-0.3
Prionotus spp.	0	0.1	0	0	0	0	0	0	0
		0-0.5							
Labridae-*Limanda*	31.8	80.7	44.4	29.6	7.2	27.9	24.8	37.5	16.6
	13-77	22-282	7.8-234	11-75	1.5-25	7.6-97	7.4-78.1	9.5-140	6.4-41.1
Labridae	0	0	0	0.06	0.7	2.2	0.2	0	1.8
				0-0.2	0-2.1	0.4-6.3	0-0.7		0.5-4.2
Scomber scombrus	34.9	197.6	141.3	371.2	60.1	15.6	6	8.6	7.2
	17-72	44-870	45-436	224-616	13-281	4.2-52	1.0-23.3	1.0-44.1	1.9-22.2
Paralichthys-Scophthalmus	8.0	22.4	30.0	19.8	5.6	15.1	4.9	8.7	11.4
	3-20	7.8-61	15-57	12-31	2.1-13	5.5-39	1.8-11.4	3.3-21.0	4.3-27.9
Hippoglossoides	1.9	3.4	2.4	1.3	5.9	5.9	0.9	2.8	6.6
platessoides	0.3-5.4	1.3-7.4	0.4-7.4	0.1-3.8	1.4-19	2.2-14	0-3.2	1.2-5.8	2.4-15.8
Limanda ferruginea	0.2	0	1.9	2.5	0.5	0	0	0.1	0.5
	0-0.7		0.3-5.3	0.6-6.4	0-1.6			0-0.3	0.1-1.1
Total	116.0	712.6	394.1	514.4	129.4	141.9	56.9	89.4	66.8
	59-226	283-1790	138-1120	345-768	44-374	63-316	17.6-178.6	26.5-295.7	22.4-196.0

May (continued)

EGGS	2008	2009	2010
Brevoortia tyrannus	0.2	0	0
	0-0.7		
Gadidae-*Glyptocephalus*	0.2	1.3	0.2
	0-0.5	0.3-3.0	0-0.6
Enchelyopus-Urophycis-	12.9	5.1	5.7
Peprilus	6.2-26.0	1.3-14.7	2.7-11.1
Enchelyopus cimbrius	2.5	3.8	4.0
	0.7-6.2	1.1-9.7	1.8-8.1
Gadus morhua	0.4	3.3	0.3
	0-1.4	0.6-10.6	0-0.7
Pollachius virens	0	0	0
Urophycis spp.	0.2	0	0
	0-0.6		
Prionotus spp.	0	0	0
Labridae-*Limanda*	65.5	85.5	31.5
	24.3-173.4	11.7-590.1	7.8-118.5
Labridae	2.1	18.5	19.3
	0.2-6.9	5.7-55.6	8.6-42.2
Scomber scombrus	33.7	56.3	10.9
	7.6-138.6	12.7-238.3	3.6-30.2
Paralichthys-Scophthalmus	20.1	58.2	33.7
	7.4-52.0	16.4-200.3	11.0-99.3
Hippoglossoides	1.7	11.6	1.7
platessoides	0.4-4.3	3.6-33.3	0.7-3.5
Limanda ferruginea	0	0	0
Total	190.2	309.1	195.1
	73.5-489.7	49.0-1922	102.5-370.8

June

EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	1.3	1.4	0.4	2.1	0.4	0.8	0.3	1.8	21.1
	0.7-2.1	0.3-3.4	0-0.9	0.2-7.3	0-1.3	0-2.4	0-0.9	0.2-5.9	16-28
Gadidae-*Glyptocephalus*	1.6	0.3	0.3	1.0	0.7	0.7	0.2	1.1	0.2
	0.8-2.8	0.04-0.7	0.1-0.7	0.1-2.8	0.2-1.3	0.1-1.4	0-0.7	0.4-2.2	0-0.6
Enchelyopus-Urophycis-	32.3	6.7	23.7	7.9	13.7	14.0	8.8	21.9	26.9
Peprilus	18-57	3.9-11	13-41	3.7-16	7.3-25	4-44	2.7-25	11-43	19-38
Enchelyopus cimbrius	11.8	6.7	7.0	1.5	5.5	22.7	16.0	28.3	26.7
	7.9-17	4.6-9.6	3-15	0.3-3.8	2.2-12	6.2-77	7.6-32	15-52	17-42
Gadus morhua	1.7	0.2	0.4	0.6	0.2	0.05	0.3	0.2	0
	0.9-2.8	0.01-0.4	0-1.0	0.2-1.3	0-0.4	0-0.2	0-1.1	0-0.5	
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	3.8	1.4	1.7	0.6	2.7	2.3	1.5	2.2	26.9
	1.9-7.1	0.7-2.3	0.6-3.3	0.1-1.4	1.3-4.8	0.6-5.9	0-5.9	1.1-3.9	20-35
Prionotus spp.	0.5	0.3	0.8	0.3	3.5	2.7	27.0	0.8	1.8
	0.2-1	0.04-0.7	0.2-1.6	0-0.8	1.5-7.2	1.6-4.3	6.4-105	0.1-0.3	0.6-3.9
Labridae-*Limanda*	892.7	1187.9	2641.3	482.3	376.6	900.3	2261.4	704.6	2941.8
	459-1734	745-1893	932-7480	168-1378	169-838	431-1879	746-6849	419-1184	1807-4789
Labridae	58.7	143.8	100.5	1.2	61.2	41.7	41.0	147.7	674.3
	33-105	115-180	50-201	0.2-2.7	30-123	17-98	11-145	114-192	461-986
Scomber scombrus	46.6	15.0	77.3	14.6	47.8	43.4	66.9	542.9	114.6
	25-86	3.2-60	35-169	5.2-38	18-126	8.5-207	27-164	155-1901	25-513
Paralichthys-Scophthalmus	30.7	30.8	29.2	6.4	27.5	22.8	36.0	37.1	114.6
	18-52	20-48	15-56	2.7-14	12-60	16-33	18-70	22-62	73-179
Hippogloissoides	1.2	0	0.5	0.06	0	0	0.5	0.07	0
platessoides	0.6-1.8		0.1-1.1	0-0.2			0-1.7	0-0.2	
Limanda ferruginea	1.6	0.7	0.8	0.6	0.7	0.3	2.4	1.4	2.5
	0.5-3.3	0-2.0	0.09-2	0-1.8	0-2.1	0-1.1	0.3-7.4	0.3-3.2	0.7-6.5
Total	1432.7	1565.7	4035.4	645.9	575.4	1555.9	2734.6	2659.4	4653.7
	813-2524	1040-2357	1930-8435	268-1553	264-1254	867-2792	1003-7453	1563-4524	2825-7665

June (continued)

EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.5	0.7	0.3	1.5	2.8	0.7	3.2	20.3	7.3
	0.1-1.1	0-2.3	0-0.8	0.5-3.3	0.5-8.2	0-2.1	0.7-9.1	6.2-62	2.4-20
Gadidae-*Glyptocephalus*	0.7	0.1	0.1	0.4	0.3	0.2	0	0	0.5
	0.1-1.7	0-0.4	0-0.4	0.01-0.9	0-0.6	0-0.6			0-1.1
Enchelyopus-Urophycis-	9.8	3.6	2.5	7.9	3.4	7.1	4.1	7.7	13.6
Peprilus	3.5-25	1-9	0.7-6.3	3.1-18	1-8.8	1.8-23	1.1-11	2.4-21	7.9-23
Enchelyopus cimbrius	8.9	2.2	2.3	3.4	5.6	8.5	1.6	9.7	7.3
	3.1-23	0.04-9	0.6-6	1.1-8.4	2.3-12	2.3-27	0.3-4	4.9-18	3-16
Gadus morhua	0.5	0	0.2	0.2	1.0	0.02	0.8	0	0.08
	0.2-0.8		0-0.4	0-0.6	0.4-1.9	0-0.5	0.1-1.9		0-0.2
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	1.6	0.6	0.4	0.1	0	0.7	1.2	7.4	1.4
	0.1-5.2	0-1.7	0.1-0.9	0-0.3		0.1-1.6	0.3-2.7	2.7-18	0-4.6
Prionotus spp.	0.2	1.5	0.1	0	0	0.8	0.5	1.2	0.04
	0-0.5	0-5.3	0-0.3			0.2-1.8	0.1-1.1	0.3-2.6	0-0.1
Labridae-*Limanda*	794.6	448.6	453.8	596.5	218.9	1102.0	779.1	918.1	1292.0
	492-1283	362-556	261-829	191-1858	87-547	304-3987	330-1839	439-1919	564-2956
Labridae	14.3	54.5	32.6	39.6	6.7	77.4	112.9	186.5	4.8
	3.1-56	6.3-420	11-97	17-91	2.2-18	28-211	34-365	68-511	0.4-23
Scomber scombrus	83.3	44.2	58.8	19.4	107.6	24.6	18.4	14.3	11.0
	11-589	0.4-1466	12-282	3.7-88	38-304	2.2-205	3.1-91	1.8-83	3.7-30
Paralichthys-Scophthalmus	17.8	14.4	18.4	47.6	14.2	35.7	37.7	43.2	41.8
	6.7-45	3.2-55	10-33	34-67	6.1-31	20-64	16-87	20-92	24-71
Hippogloissoides	0.7	0	0	0.5	1.2	0.1	1.4	0.4	0.5
platessoides	0.1-1.8			0.02-1.3	0.4-2.6	0-0.4	0.1-4.1	0.1-0.8	0-1.4
Limanda ferruginea	0	0.3	0	0.6	0.4	0.4	0.5	0.4	0.3
		0-1.4		0.1-1.3	0.04-0.9	0-2.1	0-1.5	0-1.2	0-1
Total	1448.7	867.4	924.4	1622.5	638.2	2246.0	1548.4	2062.0	1585.0
	645-3250	367-2051	528-1618	886-2972	326-1250	787-6409	732-3275	1282-3317	716-3506

<u>June</u> (continued)

EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	8.0	0.7	1.5	0.7	1.4	0.2	0.6	1.2	2.5
	1.7-29	0-1.7	0.1-4.7	0-2.2	0-5.3	0-0.6	0-1.9	0.2-3.3	0.4-7.7
Gadidae-*Glyptocephalus*	0	0	0.03	0.5	0.7	0.3	0.04	0.3	0
			0-0.1	0-1.4	0.2-1.3	0-1	0-0.1	0-0.8	
Enchelyopus-Urophycis-Peprilus	9.3	10.3	4.8	19.5	4.6	3.7	3.9	7.6	8.7
	3.4-23	4.9-21	2.5-8.6	11-35	1.9-9.9	1.3-8.6	2.0-7.1	2.7-19.0	3.6-19.5
Enchelyopus cimbrius	2.4	2.3	2.2	0.5	0.8	2.8	2.1	2.9	4.1
	0.3-7.7	0.7-5.4	0.8-4.8	0-2	0.2-1.8	0.4-9.3	0.4-5.7	0.4-9.6	1.3-10.3
Gadus morhua	0	0	0.3	0	0.9	0	0.1	0.1	0.3
			0.04-0.7		0-0.2		0-0.2	0-0.3	0-1.0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	1.4	10.7	0.1	0.7	0.8	0	0.3	0.5	0.3
	0.1-3.9	3.6-29	0-0.5	0.1-1.6	0-2.5		0-0.7	0-1.3	0-0.9
Prionotus spp.	1.5	1.9	0.5	0.6	0	0.2	0	0.1	0.1
	0.2-4.4	0.4-4.8	0-1.3	0.1-1.3		0-0.7		0-0.4	0-0.4
Labridae-*Limanda*	491.2	438.9	808.6	390.0	376.0	730.4	157.8	264.7	681.8
	86-2782	182-1054	335-1952	178-854	143-985	338-1579	49-499	56.1-1236	291-1593
Labridae	32.1	0	50.1	5.2	6.2	4.8	1.5	1.3	25.4
	4.4-201		24-105	1.3-16	1.6-18	0.7-18	0-6.9	0-5.6	5.2-110.3
Scomber scombrus	1.9	13.0	21.3	9.1	50.7	5.9	16.2	6.2	3
	0.2-6.2	4.3-36	7.2-60	1.9-34	9-267	1-24	3-73.1	0.5-34.6	0.5-34.6
Paralichthys-Scophthalmus	22.3	39.3	51.3	15.4	28.0	26.7	8.6	12.4	93.2
	5.5-83	22-71	31-84	5.6-40	9.3-81	13-54	2.9-22.4	4.9-29.5	49.1-176.1
Hippoglossoides platessoides	0.07	0.02	1.2	0.2	0.1	0.2	0.04	0.05	0.3
	0-0.3	0-0.6	0.4-2.5	0-0.5	0-0.4	0-0.5	0-0.1	0-0.2	0-0.9
Limanda ferruginea	0.2	0	1.0	6.5	0	0	0	0.5	0.4
	0.7		0.1-2.8	1-27				0-2.9	0-1.4
Total	616.2	649.6	1073.2	599.8	964.0	943.1	289.6	335.1	928.0
	106-3563	313-1346	487-2364	328-1095	485-1916	507-1755	117-717	72-1556	406-2117

June (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0.1	0.1	3.8
	0-0.3	0-0.3	0.7-12.4
Gadidae-*Glyptocephalus*	0.1	0.7	0.1
	0-0.3	0-2.1	0-0.3
Enchelyopus-Urophycis-	20.9	2.5	23.1
Peprilus	7.6-55.3	0.8-5.9	12.4-42.3
Enchelyopus cimbrius	1.9	2.0	2.9
	1.1-3.0	0.7-4.4	2.1-3.9
Gadus morhua	0.4	0.2	0.4
	0-0.9	0-0.6	0-1.1
Pollachius virens	0	0	0.04
			0-0.1
Urophycis spp.	0.8	0.5	2.1
	0.1-1.9	0-1.5	0.8-4.5
Prionotus spp.	0.4	0.8	1.6
	0-1.0	0.2-1.9	0.4-3.9
Labridae-*Limanda*	249.4	249.3	1547.5
	134.4-462	39.2-1556	857-2795
Labridae	37.3	31.5	68.6
	9.9-133	7.3-126.4	26.3-176.4
Scomber scombrus	2.3	6.0	25.0
	0.5-6.5	1.3-20.6	12.0-51.2
Paralichthys-Scophthalmus	39.0	30.7	75.0
	20.2-74.6	9.1-98.9	36.9-151.3
Hippogloissoides	0.3	0.2	0.7
platessoides	0-0.7	0-0.5	0-2.0
Limanda ferruginea	0	0	0.5
			0-1.3
Total	444.4	337.4	2039.6
	247-799	51.8-2170	1206-3394

July									
EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	2.0	0.7	0.6	0	0	0	0	1.5	0.08
	0.4-5.4	0.1-1.7	0.1-1.2					0.1-4.8	0-0.3
Gadidae-*Glyptocephalus*	0.2	0.5	0.8	0.4	0.03	0	0	0.2	0.2
	0-0.4	0.09-1.1	0.1-1.7	0.06-0.7	0-0.1			0-0.4	0-0.6
Enchelyopus-Urophycis-	36.7	6.4	73.7	5.0	11.9	10.3	2.4	11.2	8.6
Peprilus	16-83	2.3-16	29-188	3.2-7.5	8-16	6.5-16	1-5	5.2-23	4.2-17
Enchelyopus cimbrius	2.6	3.5	10.0	0.05	1.3	0.3	0.2	1.2	3.1
	1-5.5	1.4-7.4	3.9-24	0-0.2	0.7-2.1	0-0.9	0-0.5	0.6-2.2	1.0-7.3
Gadus morhua	0	0.2	0.3	0.3	0	0	0	0	0
		0-0.4	0-0.7	0-0.6					
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	31.1	1.6	54.2	0.5	5.8	3.7	1.3	2.1	15.5
	11-82	0.5-3.7	35-84	0.1-0.9	3.9-8.5	1.6-7.7	0.4-2.9	0.9-4.1	12-21
Prionotus spp.	4.4	0.2	12.6	0.06	3.6	3.1	3.6	0.6	1.9
	2.8-6.7	0-0.4	5-30	0-0.2	2.4-5.2	1.7-5.4	1.3-8.1	0.1-1.4	0.5-4.7
Labridae-*Limanda*	630.3	481.4	862.1	312.5	513.4	177.6	230.9	488.2	272.0
	141-2807	245-944	580-1280	204-477	196-1341	82-385	64-826	311-765	94-784
Labridae	57.8	21.5	84.9	4.3	23.1	19.1	3.1	69.4	39.1
	10-314	11-42	58-124	1.6-9.9	11-48	10-36	0.6-9.5	38-125	12-123
Scomber scombrus	8.5	0.2	4.0	0.3	0.06	0.6	0.06	5.6	2.0
	1.1-42	0-0.6	0.6-14	0.01-0.6	0-0.2	0.1-1.4	0-0.2	3.2-10	0.02-7.6
Paralichthys-	27.2	11.7	23.2	1.5	10.6	6.5	1.1	0	30.2
Scophthalmus	9.9-72	5.9-22	13-41	0.9-2.3	6.9-16	3.8-11	0.2-2.9		16-56
Hippogloissoides	0	0	0.04	0.05	0	0	0	0	0
platessoides			0-0.1	0-0.2					
Limanda ferruginea	0.4	0	0	0.1	0	0	0	0.1	0.3
	0-1.5			0-0.5				0-0.4	0-0.7
Total	986.1	576.5	1317.6	337.4	670.5	293.3	297.3	651.7	490.3
	238-4068	312-1065	932-1862	226-504	301-1491	165-520	104-843	425-1000	221-1086

July (continued)

EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.1	0	0	1.3	0.06	0.04	0	0.9	1.0
	0-0.4			0.5-2.6	0-0.2	0-0.1		0-3.4	0.02-2.7
Gadidae-*Glyptocephalus*	0.3	0.08	0.07	0.05	0	0	0	0	0.2
	0.04-0.7	0-0.2	0-0.2	0-0.2					0-0.6
Enchelyopus-Urophycis-	19.8	3.0	12.3	5.3	0.9	5.6	4.5	5.7	10.2
Peprilus	11-35	1.8-4.7	6.2-24	1.8-13	0.1-2.3	1.9-14	1.9-9.2	1.6-16	4.9-21
Enchelyopus cimbrius	8.7	0.5	0	1.7	0.5	0.4	0.07	1.2	6.9
	2.8-24	0.02-1.1		0.6-3.3	0-1.4	0-1.3	0-0.2	0-3.7	2.7-16
Gadus morhua	0.04	0	0	0	0.2	0	0.03	0	0
	0-0.1				0-0.6		0-0.1		
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	8.7	0.5	0.06	0.9	0.04	1.1	1.0	4.3	10.9
	4.3-17	0.1-1.1	0-0.2	0.1-2.6	0-0.2	0.2-2.7	0-2.9	0.7-16	4.2-26
Prionotus spp.	0	0.4	0.4	0.4	0.7	2.2	0.2	0.7	0.4
		0.1-0.7	0-1	0.1-0.8	0.2-1.6	0.6-5.6	0-0.6	0-2.1	0-1.1
Labridae-*Limanda*	451.0	99.3	418.6	240.8	210.1	187.9	705.4	115.7	238.8
	279-728	45-218	52-3351	73-794	81-545	92-381	343-1450	38-351	61-930
Labridae	83.3	2.6	14.6	60.0	34.9	28.6	39.7	12.7	29.9
	48-144	1.2-4.9	1-119	25-144	10-118	11-74	23-70	3.8-38	4.2-182
Scomber scombrus	1.6	0.2	0.1	0.2	0.5	0.3	0	0	1.2
	0.4-3.8	0.03-0.4	0-0.4	0-0.5	0-1.3	0-1			0.3-2.7
Paralichthys-Scophthalmus	31.3	3.8	12.8	17.7	29.5	12.7	21.6	19.8	20.6
	24-41	1.3-8.7	6.5-24	8.8-35	17-51	7-22	11-41	8.6-44	8.2-49
Hippoglossoides platessoides	0	0	0	0.05	0.1	0	0	0	0.1
				0-0.2	0-0.4				0-0.4
Limanda ferruginea	0.2	0.2	0.3	0	0	0.04	0.1	1.7	0
	0-0.6	0-0.4	0-0.9			0-0.1	0-0.4	0-8.6	
Total	712.5	130.5	1242.0	388.6	431.8	361.3	841.2	213.7	427.8
	481-1055	69-246	384-4010	140-1074	211-884	213-612	434-1629	91-501	97-1869

July (continued)									
EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0.6	0.1	0.4	0	0.4	0	0.4	0.03	0.13
	0-2.2	0-0.3	0-1.3		0-1.1		0-1.5	0-0.1	0-0.5
Gadidae-*Glyptocephalus*	0	0.1	0	0.03	0	0	0	0	0
		0-0.3		0-0.1					
Enchelyopus-Urophycis-	18	9.4	4.7	6.4	1.3	1.0	1.2	1.07	4.4
Peprilus	9.9-32	3-26	2.5-8.5	3.1-12	0.4-2.8	0.2-2.6	0.3-2.7	0.4-2.1	1.2-12.5
Enchelyopus cimbrius	2.5	0.3	1.5	0.1	0.05	0	0	0.34	0.04
	1-5.2	0-0.7	0.2-4.1	0-0.4	0-0.2			0-1.2	0-0.1
Gadus morhua	0	0	0.2	0	0	0.1	0	0	0
			0-0.5			0-0.2			
Polluchius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	5.8	27.6	2.2	0.2	0	0.1	0.1	0.5	0.9
	1.7-16	7.2-99	0.7-5	0-0.5		0-0.2	0-0.4	0-1.5	0-2.7
Prionotus spp.	1.2	4	1.2	0.2	0	0.4	0.3	0	0.3
	0.4-2.6	1.7-8.2	0.4-2.4	0-0.5		0-1	0-0.8		0-0.7
Labridae-*Limanda*	368.9	0	380.5	40.1	95.0	283.0	201.3	49.3	337.5
	153-889		166-872	9.3-162	32-281	71-1120	62-649	23.7-101.4	131.9-860.9
Labridae	36.6	150.6	17.9	0.7	0.5	2.9	0	1.2	9.0
	14-95	26-841	8.3-37	0-2.5	0-1.8	0.5-9.4		0.1-3.5	2.5-27.5
Scomber scombrus	0.3	1.0	1.2	0.1	0.04	0	0	0	0
	0-1	0.2-2.2	0.3-2.8	0-0.4	0-0.1				
Paralichthys-	42.9	0.3	49.4	5.2	3.0	9.2	5.1	7.1	36.8
Scophthalmus	21-85	0-1.3	32-77	2.2-11	1.2-6.3	3.1-25	1.3-15.1	3.5-13.8	14.3-92.0
Hippogloissoides	0.2	0	0.2	0	0	0	0	0	0
platessoides	0-0.9		0-0.5						
Limanda ferruginea	0	0	0.1	0.3	0	0	0	0.1	0
			0-0.2	0-0.8				0-0.2	
Total	547.3		558.3	95.6	106.4	298.7	214.3	69.42	419.8
	256-1170		281-1107	36-249	37-306	74-1190	66-688	34.6-138.2	172.7-1019

July (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0.6	0.1	1.2
	0-1.6	0-.3	0-4.4
Gadidae-*Glyptocephalus*	0.1	0	0
	0-0.2		
Enchelyopus-Urophycis-	26.6	17.5	16.8
Peprilus	8.4-80.0	9.4-31.7	9.2-29.9
Enchelyopus cimbrius	3.2	2.11	0.8
	1.4-6.2	0.7-4.7	0.1-2.0
Gadus morhua	0.1	0	0
	0-0.4		
Pollachius virens	0	0	0
Urophycis spp.	7.5	6.7	2.5
	2.9-17.7	3.2-13.3	0.9-5.3
Prionotus spp.	0.5	3.5	7.5
	0-1.1	1.6-6.8	2.9-17.2
Labridae-*Limanda*	281.9	393.2	526.2
	85.9-919.8	86.1-1782.9	261.3-1058.7
Labridae	31.5	28.4	65.4
	11.9-81.1	6.6-112.3	29.5-144.0
Scomber scombrus	0.3	0.2	1.0
	0-0.9	0-.5	0-2.8
Paralichthys-	16.4	25.6	31.2
Scophthalmus	6.6-38.6	16.9-38.4	14.3-66.9
Hippoglossoides platessoides	0	0	0
Limanda ferruginea	0.04	0	0
	0-0.1		
Total	449.9	1107.7	770.9
	140-1441	598.5-2049.4	421.2-1410.4

August									
EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0.2	0	0	0	0	0	0	0
		0-0.4							
Gadidae-*Glyptocephalus*	0	0	0.03	0	0.04	0	0	0	0
			0-0.1		0-0.1				
Enchelyopus-Urophycis-	11.7	3.7	3.5	4.4	9.4	13.3	1.2	7.4	24.4
Peprilus	6.0-22	1.2-9	2.2-5.3	1.7-9.8	5.4-16	8.2-21	0.3-2.6	1.7-25	11-51
Enchelyopus cimbrius	1.3	1.9	0.7	0.2	3.3	1.0	0.2	2.9	1.4
	0.6-2.4	0.8-3.5	0.3-1.3	0-0.5	1.8-5.5	0.2-2.4	0-0.5	1.2-5.9	0.5-2.9
Gadus morhua	0	0	0	0	0	0	0	0	0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	4.9	4.4	3.9	8.2	12.1	5.2	2.0	5.1	11.5
	2.3-10	1.6-9.9	2.1-6.9	3.2-19	8.8-17	3-9	1-3.4	1.9-12	6.1-21
Prionotus spp.	3.1	0.5	2.0	2.3	8.7	3.1	1.0	0.8	1.7
	1.1-7.1	0.3-0.9	0.9-3.6	0.5-5.8	3.4-20	1.7-5.3	0.4-1.9	0.1-2	0.3-4.4
Labridae-*Limanda*	2.1	12.2	11.9	75.2	8.5	5.5	1.8	16.1	65.2
	0.6-4.9	2.4-50	9-16	15-360	5.9-12	3-9	0.5-4.4	36-63	26-160
Labridae	2.5	3.0	3.1	4.0	7.1	3.9	0.9	3.2	14.7
	1.2-4.8	0.8-7.9	1.5-5.9	1.1-11	4.1-12	1.9-7.4	0.1-2.2	1-8	6.7-31
Scomber scombrus	0	0	0	0	0	0.05	0	0.08	0.06
						0-0.2		0-0.3	0-0.2
Paralichthys-	15.3	12.0	4.8	12.2	16.9	4.4	1.0	12.2	81.9
Scophthalmus	7.5-30	7.3-19	2.1-9.8	8.2-18	9.6-29	3.3-5.9	0.2-2.4	5.3-27	54-125
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0.1	0.02	0	0.2	0	0	0.1	0	0.1
	0-0.2	0-0.08		0-1			0-0.6		0-0.4
Total	58.2	53.1	41.6	204.0	80.8	43.7	11.0	57.5	261.4
	38-89	20-136	35-50	67-617	60-108	33-58	6.7-18	20-166	152-449

August (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.05	0	0.04	0.9	0	0.4	0	0	0.4
	0-0.2		0-0.1	0.2-2.2		0-1.4			0-1.2
Gadidae-*Glyptocephalus*	0.06	0.05	0	0	0	0	0	0	0
	0-0.2	0-0.2							
Enchelyopus-Urophycis-	0.6	5.6	18.5	0.9	1.4	1.3	8.5	1.2	6.1
Peprilus	0.2-1.3	1.4-17	7.2-45	0.1-2.1	0.3-3.7	0.2-3.8	3.2-21	0.3-2.8	2.4-14
Enchelyopus cimbrius	2.2	4.0	2.8	3.5	2.1	1.1	0.7	0.3	2.6
	1-4	0.7-14	0.5-8.5	2.1-5.6	0.7-4.8	0.2-2.8	0.01-2	0-0.6	0.8-6.1
Gadus morhua	0.2	0	0	0	0	0	0	0	0
	0-0.5								
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	2.9	4.2	8.7	2.0	2.5	3.6	13.0	0.9	7.7
	1.3-5.6	1-13	1.7-35	1.2-3.3	0.8-5.8	0.8-11	5.2-31	0.2-2.1	3.2-17
Prionotus spp.	0.6	1.3	1.0	0.4	0.4	1.7	0.5	0.2	0.4
	0.1-1.3	0.5-2.5	0.3-2.0	0-1	0.1-0.7	0.2-5	0-1.3	0-0.6	0-1
Labridae-*Limanda*	4.0	11.2	18.0	15.5	6.6	12.5	15.7	4.0	20.7
	1.1-11	5.3-23	4.3-67	5.3-42	2.6-15	3.8-37	6.1-39	1.1-11	7-58
Labridae	1.9	5.6	25.5	4.3	2.2	2.1	3.6	0.6	7.3
	0.7-3.8	2.2-13	8.3-75	1.9-8.7	0.6-5.4	0.2-6.9	1.1-9.3	0-1.5	2.6-18
Scomber scombrus	0	0	0.2	0	0	0	0.2	0	0.07
			0-0.4				0-0.7		0-0.3
Paralichthys-	18.3	0	15.9	17.7	18.0	8.0	31.5	6.2	38.0
Scophthalmus	13-25		7.9-31	9.2-34	6.6-47	4.3-14	17-59	1.8-17	24-60
Hippoglossoides	0	0	0.05	0	0	0	0.04	0	0
platessoides			0-0.2				0-0.2		
Limanda ferruginea	0.05	0.3	0.05	0.06	0	0	0	0	0.07
	0-0.2	0.1-0.7	0-0.2	0-0.2					0-0.2
Total	37.9	68.6	131.2	62.2	33.4	51.0	113.9	18.9	127.6
	26-55	28-165	48-355	36-107	11-100	23-111	69-188	9.4-37	74-221

August (continued)									
EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0.07	0	0	0	0.04	0	0.03	0	0
	0-0.3				0-0.1		0.09		
Gadidae-*Glyptocephalus*	0	0	0	0.1	0	0	0	0	0
				0-0.3					
Enchelyopus-Urophycis-	5.6	1.6	2.8	1.8	1.66	0.9	1.5	10.3	7.8
Peprilus	1.9-14	0.3-4.2	1-6	0.7-3.4	0.2-4.9	0.2-2.3	0.7-2.9	2.8-32.6	2.8-19.5
Enchelyopus cimbrius	1.6	0	0.2	0	0.2	0	0	0	0.2
	0.5-3.4		0-0.4		0-0.8				0-0.4
Gadus morhua	0	0	0	0	0	0	0	0	0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	8.4	5.4	1.7	0.5	0.2	0.1	0.9	1.2	1.8
	3.4-19	1.7-14	0.01-6	0.1-1.2	0-0.6	0-0.3	0.2-2	0-4.3	0.4-4.5
Prionotus spp.	1.0	1.5	0.4	0.3	0.05	0.1	0	0.2	0.1
	0.2-2.3	0.6-2.9	0.02-0.8	0-0.9	0-0.2	0-0.2		0-0.6	0-0.3
Labridae-*Limanda*	7.1	0	8.5	1.7	14.9	12.0	24.8	19.8	41.1
	1.9-22		2.8-23	0.4-4.2	5.6-37	3-42	8.6-68.8	6.5-56.7	16.1-102.6
Labridae	2.5	4.3	0.3	0.4	0	0.1	0.1	1.2	1.7
	0.7-5.9	1.2-12	0-1.1	0-1.8		0-0.4	0-0.3	0.2-3.0	0.5-3.7
Scomber scombrus	0	0	0	0.05	0.08	0	0	0	0
				0-0.2	0-0.3				
Paralichthys-	36.9	18.7	13.9	2.4	9.1	12.2	12.8	29.66	26.7
Scophthalmus	19-72	6.8-49	6.1-31	0.5-6.8	4.9-16	5.3-27	5.5-28.4	10.2-83.0	13.3-52.8
Hippogloissoides	0	0	0.04	0	0.05	0	0	0	0
platessoides			0-0.1		0-0.2				
Limanda ferruginea	0.09	0	0.2	0	0	0	0	0.2	0
	0-0.2		0-0.9					0-0.5	
Total	92.5		38.0	14.0	30.6	27.6	47.4	71.2	115.3
	44-191		16-91	6.3-30	14-64	9.8-75	19-114	21.8-227.5	60.3-219.7

August (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0.9 0-3.1	0	0
Gadidae-*Glyptocephalus*	0.3 0-0.8	0	0
Enchelyopus-Urophycis-Peprilus	7.2 2.4-18.9	1.3 0-4.3	6.1 1.5-19.6
Enchelyopus cimbrius	0.9 0.3-1.8	0.7 0-2.5	0.9 0.3-1.7
Gadus morhua	0	0	0.05 0-0.2
Pollachius virens	0	0	0
Urophycis spp.	5.6 1.8-14.4	6.2 2.5-13.8	7.2 2.7-17.4
Prionotus spp.	0.5 0-1.2	0.6 0-2.3	1.5 0.3-4.1
Labridae-*Limanda*	45.1 12.0-162.5	10.9 3.1-33.9	24.8 5.6-100.9
Labridae	6.9 2.3-18.0	1.9 0-8.5	4.1 0.7-14.7
Scomber scombrus	0	0	0
Paralichthys-Scophthalmus	10.6 4.5-23.8	19.4 11.4-32.6	13.8 4.5-38.9
Hippogloissoides platessoides	0	0	0
Limanda ferruginea	0	0	0
Total	82.8 23-289	105.0 57.4-191.4	126.0 36.7-426.9

September									
EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	39.1	0	0	0	1.7	0.05	0	0.4
		2.8-429				0-7.6	0-0.2		0-1.1
Gadidae-*Glyptocephalus*	0.04	0.04	0.06	0	0	0	0	0	0
	0-0.1	0-0.1	0-0.2						
Enchelyopus-Urophycis-	0.3	8.9	6.3	5.9	1.5	1.2	1.4	2.1	0.4
Peprilus	0.1-0.7	2.9-24	1.5-21	1.4-19	0.7-2.6	0.5-2.3	0.6-2.5	0.6-4.9	0.1-0.7
Enchelyopus cimbrius	0.04	1.6	3.4	4.2	2.4	1.9	1.4	1.4	2.3
	0-0.1	0.4-3.8	0.9-9.4	0.8-14	0.6-6.2	1-31	0.5-2.8	0.5-2.8	1.5-3.3
Gadus morhua	0	0	0	0	0	0	0	0	0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0.7	5.8	3.9	11.5	5.8	3.5	1.5	0.9	1.0
	0.4-1.2	2.5-12	1.5-8.4	3.8-31	3-11	1.8-6.5	0.8-2.6	0.2-2.1	0.3-2.2
Prionotus spp.	0	1.5	0.2	2.1	0.4	0	0	0.3	0
		0.6-2.8	0-0.5	0.4-5.6	0.1-0.7			0-0.8	
Labridae-*Limanda*	0	1.8	0.8	1.04	0.4	0.09	1.0	1.4	0.5
		0.04-6.5	0-2.2	0.3-2.3	0-1	0-0.3	0.3-2	0.2-3.5	0.1-1
Labridae	0.04	0.8	0.3	0.6	0.1	0.04	0.4	0.5	0.4
	0-0.2	0.1-2	0-0.7	0.1-1.3	0-0.4	0-0.1	0.1-0.7	0.02-1.1	0-1
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-	4.6	80.4	16.1	27.5	4.4	0.9	12.3	11.1	41.0
Scophthalmus	2.9-7.1	57-112	9-28	19-39	2.4-7.7	0.4-1.6	7.6-20	3.1-35	22-74
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0.2	0	0
							0-0.4		
Total	7.3	469.2	40.7	85.8	17.2	20.3	21.2	19.4	47.3
	4.5-12	199-1107	20-82	56-132	10-29	10-41	14-32	6.8-52	27-84

September (continued)

EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	1.5	0.3	0	95.4	0.3	0.5	0.2	1.4	0.5
	0-5.7	0-1.4		17-513	0-0.8	0-1.8	0-0.5	0.03-4.8	0-1.5
Gadidae-*Glyptocephalus*	0	0	0	0.05	0	0.08	0	0	0
				0-0.2		0-0.3			
Enchelyopus-Urophycis-	0.2	1.9	0.4	6.5	0	2.5	0.7	1.7	2.6
Peprilus	0-0.6	0.6-4.3	0.02-0.9	1.5-21		0.8-6.1	0-2	0.4-4.2	1.1-5.2
Enchelyopus cimbrius	0.4	1.4	1.7	3.1	1.1	0.9	0.3	0.9	1.7
	0-1.1	0.3-3.4	0.9-2.7	1.1-7	0-3.7	0.3-1.8	0-0.7	0.1-2.3	0.8-3.2
Gadus morhua	0	0	0	0.03	0	0	0	0	0
				0-0.9					
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0.4	0.7	1.9	4.1	0.3	0.8	0.9	1.1	2.0
	0-1	0.1-1.9	0.9-3.4	1.2-11	0-0.8	0.04-2	0.2-2	0.1-2.9	0.5-5
Prionotus spp.	0	0.05	0.1	1.2	0	0	0	0.3	0
		0-0.2	0-0.3	0.2-3.2				0-1.2	
Labridae-*Limanda*	0.05	0.2	1.0	3.1	0.4	0.2	0.5	1.5	0.6
	0-0.2	0-0.5	0.3-2	0.9-7.9	0-1.4	0-0.6	0.02-1.2	0.3-3.7	0-1.9
Labridae	0	0.09	0.3	2.0	0.09	0.5	0.3	1.2	0.3
		0-0.2	0-0.6	0.4-5.4	0-0.3	0-2.3	0-0.9	0.2-2.9	0-0.8
Scomber scombrus	0.1	0	0	0.04	0	0	0	0	0
	0-0.4			0-0.1					
Paralichthys-	3.1	5.0	13.3	19.9	7.6	6.4	2.6	21.3	16.7
Scophthalmus	1.2-6.7	2.2-10	7.7-22	6.5-57	3.2-17	3.1-13	0.4-8	11-40	7.2-37
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0.3	0
								0-0.8	
Total	7.7	10.2	23.6	201.8	10.9	17.5	5.4	41.6	26.6
	2.6-20	3.9-25	16-34	41-978	4.3-26	8.5-35	1.4-16	23-76	11-63

September (continued)

EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0.6	0.04	0.2	0.2	0.05	0	0.5	0.04	0.06
	0.03-1.5	0-0.2	0-0.7	0-0.6	0-0.2		0-1.7	0-0.1	0-0.2
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0.1	0	0
							0-0.4		
Enchelyopus-Urophycis-	1.25	0.1	0.4	1.2	1.2	1.0	4.8	1.6	15.0
Peprilus	0.1-3.8	0-0.3	0-1.3	0.2-3	0.3-2.6	0.1-2.5	1.3-13.2	0.6-4.0	6.4-33.4
Enchelyopus cimbrius	0.5	0.04	0	0.05	0.6	0	0.2	0.04	0.2
	0-1.6	0-0.2		0-0.2	0.2-1.3		0-0.5	0-0.1	0-0.6
Gadus morhua	0	0	0	0	0	0	0	0	0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0.9	0.7	0.1	0.3	0.4	0	0.5	0.2	2.8
	0.1-2.4	0.1-1.5	0-0.2	0-0.8	0-1.2		0-1.9	0-0.8	0.4-8.8
Prionotus spp.	0.3	0	0	0	0	0	0.07	0	0.2
	0-0.8						0-0.2		0-0.7
Labridae-*Limanda*	0	0	0.5	0.2	2.2	2.3	2.3	0.9	3.8
			0-1.2	0-0.4	0.9-4.5	0.4-6.7	0.6-5.7	0-2.9	1.3-9.0
Labridae	0	0.05	0.04	0	0.05	0	0.2	0.1	0
		0-0.2	0-0.2		0-0.2		0-0.6	0-0.3	
Scomber scombrus	0	0	0.2	0	0	0.1	0	0	0
			0-0.6			0-0.5			
Paralichthys-	7.9	3.1	42.7	0.8	12	19.5	24.5	5.5	47.1
Scophthalmus	5.3-11	1.2-6.5	25-72	0.1-1.7	4.8-28	8.7-42	7.6-74.7	1.9-13.8	26.2-83.9
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	14.9		46.5	3.9	17.8	27.9	38.4	8.4	88.3
	8.4-26		29-75	1.7-7.9	6.7-45	13-57	12-114	2.5-24.6	45.1-171.8

September (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0.1
			0-0.2
Gadidae-*Glyptocephalus*	0	0	0
Enchelyopus-Urophycis-	4.3	1.8	3.1
Peprilus	1.5-9.9	.4-4.5	1.3-6.1
Enchelyopus cimbrius	0.3	0.2	0.3
	0-0.9	0-.5	0-0.6
Gadus morhua	0	0	0
Pollachius virens	0	0	0
Urophycis spp.	1.1	0.9	0.4
	0.2-2.7	.01-2.4	0-1.2
Prionotus spp.	0	0.1	0.04
		0-.3	0-0.1
Labridae-*Limanda*	1.4	1.9	1.1
	0.3-3.2	.3-5.3	0.3-2.6
Labridae	0.4	0.1	0.4
	0-1.3	0-.3	0-1.0
Scomber scombrus	0	0	0
Paralichthys-	2.7	8.5	8.3
Scophthalmus	0.9-6.4	3.3-20.1	3.8-17.0
Hippoglossoides platessoides	0	0	0
Limanda ferruginea	0	0	0
Total	14.0	16.6	19.7
	4.9-37.0	6.6-40.0	8.4-44.4

October									
EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0.2	0	0	34.5	0.2	0	0	0
		0-0.5			5-202	0-0.8			
Gadidae-*Glyptocephalus*	0.1	0.08	0	1.5	0.7	0	0	0	0.3
	0-0.6	0-0.3		0.3-3.8	0-2.2				0-0.9
Enchelyopus-Urophycis-	1.5	0.2	0.7	0.2	2.9	0.08	0.2	0.1	0.2
Peprilus	0.1-4.6	0-0.5	0.2-1.5	0-0.7	0-18	0-0.3	0-0.4	0-0.4	0-0.9
Enchelyopus cimbrius	0.9	0.2	1.0	0.4	6.8	0.1	1.3	1.9	1.1
	0-3.3	0-0.8	0.3-2	0-1.1	2.9-15	0-0.6	0.2-3.7	0-8.6	0-3.6
Gadus morhua	0	0	0	0.1	0	0	0	0	0.09
				0-0.4					0-0.4
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0.4	0	0.5	0.1	0.5	0.09	0	0.1	0.1
	0-1.4		0-1.5	0-0.4	0-2.4	0-0.4		0-0.4	0-0.5
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0.2	0	0	0	0	0	0	0.1	0
	0-0.5							0-0.4	
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-	1.7	1.0	3.1	0.6	0.5	0	0.2	0.3	0.5
Scophthalmus	0-7.7	0-2.9	0.4-12	0-1.8	0-1.9		0-0.4	0-0.9	0.1-1.2
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0.09	0	0	0	0	0	0
			0-0.4						
Total	4.1	1.7	6.3	4.4	52.0	0.5	2.2	2.4	2.7
	0.3-19	0.4-4.3	2-17	2.6-7.1	11-232	0-1.5	0.8-4.8	0-13	1-6

October (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.9	0	0	0	0.7	0.5	0	1.2	1.0
	0-3.2				0-2.9	0-1.7		0-4.3	0-4.8
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0	0	0
Enchelyopus-Urophycis-	0	0.1	0	2.7	0	0	0.08	1.2	1.5
Peprilus		0-0.4		0-17			0-0.3	0-5.2	0.03-4.8
Enchelyopus cimbrius	0.2	0.8	0.3	1.7	0	0.1	0	0.2	0.2
	0-0.7	0.3-1.6	0-1.2	0-9.8		0-0.4		0-0.7	0-0.7
Gadus morhua	0	0	0	0	0	0	0	0	0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0.2	0.1	0	0	0	0.1
				0-0.7	0-0.4				0-0.5
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0.2	0	0.1	0.4	0	0	0	0.2	0.5
	0-0.7		0-0.5	0-1				0-0.8	0-1.6
Labridae	0	0	0.1	0	0	0	0	0	0
			0-0.5						
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-	0.1	0.2	0.1	0.9	0.2	0.9	0	2.7	0.4
Scophthalmus	0-0.5	0-0.6	0-0.5	0-3.2	0-0.6	0-2.7		0-15	0-1.2
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	1.8	1.4	1.0	5.4	3.3	1.3	0.1	5.5	3.3
	0.5-4.1	0.8-2	0-4.1	0.01-40	1.2-7.7	0-4.5	0-0.5	0.6-25	0.1-16

October (continued)

EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0.5	0.4	0.5	0	0.2	0
				0-2.9	0-1.3	0-3.5		0-0.7	
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0	0	0
Enchelyopus-Urophycis-	0	0.5	0.2	0.2	0.5	0.3	0.2	0.3	0.7
Peprilus		0-2	0-0.6	0-0.7	0-1.5	0-0.9	0-0.4	0-0.7	0-2.3
Enchelyopus cimbrius	0	0	0	0.2	0.2	0	0	0	0.1
				0-0.6	0-0.8				0-0.5
Gadus morhua	0	0	0	0	0	0	0	0	0
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0.1	0	0.1	0.06	0	0	0	0.2
		0-0.3		0-0.4	0-0.2				0-0.7
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0.2	0	0.4	0.1	0	0.1	0
			0-0.7		0-1.1	0-0.4		0-0.6	
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-	0.5	1.1	1.3	0.1	2.05	1.2	0.05	0.5	0.7
Scophthalmus	0-2	0-6.7	0-7.9	0-0.4	0-9.1	0-5	0-0.2	0-1.4	0-3.0
Hippogloissoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	0.9		3.0	1.4	3.2	1.9	0.3	1.2	1.7
	0-3.2		0.1-13	0-5.5	0.2-14	0-9.9	0-0.7	0.1-3.4	0-6.0

October (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0.1 0-0.2
Gadidae-*Glyptocephalus*	0	0	0
Enchelyopus-Urophycis-Peprilus	0.7 0-2.1	0.7 0-2.1	0.2 0-0.9
Enchelyopus cimbrius	0	0.1 0-.4	0
Gadus morhua	0	0	0
Pollachius virens	0	0	0
Urophycis spp.	0.3 0-1.3	0.1 0-.3	0
Prionotus spp.	0	0	0
Labridae-*Limanda*	0	0	0.1 0-0.4
Labridae	0	0	0
Scomber scombrus	0	0	0
Paralichthys-Scophthalmus	0.2 0-0.7	0.6 0-1.5	0.9 0-3.4
Hippoglossoides platessoides	0	0	0
Limanda ferruginea	0	0	0
Total	1.1 0-4.3	1.4 .04-4.4	1.3 0-5.4

November									
EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	6.0 1.8-20	0	0	0	0	0.2 0-0.6	0.7 0.04-1.8	0	2.0 1.4-2.7
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0.9 0-0.4	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0.2 0-0.6	0	0
Gadus morhua	1.2 0.5-2.9	0.3 0-1.5	2.6 1.4-4.4	2.1 0.2-6.8	3.3 1.5-6.5	0.5 0-1.5	0.2 0-0.7	0	0.4 0-1.1
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0.1 0-0.4
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	7.3 2.8-19	0.3 0-1.5	2.6 1.4-4.4	2.1 0.2-6.8	4.5 2.1-8.6	0.6 0-2	1.3 0.3-3.1	0	2.4 1.3-4.1

November (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.8 0-2.6	0	0	0	0	0	0	0	0.07 0-0.2
Gadidae-*Glyptocephalus*	0.2 0-0.9	0	0	0	0	0	0	0.1 0-0.4	0.2 0-0.6
Enchelyopus-Urophycis-Peprilus	0	0.1 0-0.4	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0.2 0-0.7	0	0	0.08 0-0.3	0	0	0	0
Gadus morhua	0	0.1 0-0.4	0.1 0-0.5	0.1 0-0.4	0.6 0-1.9	0.2 0-0.9	1.6 0-7	0.6 0-2.7	0.2 0-0.5
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0.2 0-1	0.1 0-0.6	0.2 0-0.7	0	0.1 0-0.5	0.1 0-0.4	0.1 0-0.4
Labridae	0	0	0	0	0	0	0.1 0-0.4	0	0.07 0-0.2
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0.08 0-0.3	0	0.3 0-1.1	0	0
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0.4 0-1.5	0	0	0	0	0	0
Total	1.1 0.1-3.1	0.3 0-1.3	0.6 0-2.6	0.2 0-0.8	1.3 0.4-2.7	0.2 0-0.9	1.9 0-8.6	0.9 0-3.4	0.6 0.1-1.5

November (continued)									
EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0.1 0-0.4	0	0	0	0	0.2 0-0.6	0
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Gadus morhua	0.2 0-0.5	0.4 0-1.3	0.2 0-0.6	1.1 0-3.7	2.8 0.7-7.8	0.3 0-0.9	0.1 0-0.5	0.2 0-0.6	0.2 0-0.6
Pollachius virens	0	0	0	0.2 0-0.9	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0.1 0-0.5	0	0	0.08 0-0.3	0.2 0-0.8	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippogloissoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	0.3 0-0.9	0.4 0-1.3	0.4 0.03-0.9	1.2 0-4.5	3.0 0.7-8.5	0.3 0-0.9	0.1 0-0.5	0.3 0-1.1	0.2 0-0.6

November (continued)

EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0
Gadidae-*Glyptocephalus*	0	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0.1 0-0.3
Enchelyopus cimbrius	0	0	0
Gadus morhua	0.4 0-1.2	0.1 0-0.4	0.2 0-0.9
Pollachius virens	0	0	0
Urophycis spp.	0	0	0
Prionotus spp.	0	0	0
Labridae-*Limanda*	0	0	0
Labridae	0	0	0
Scomber scombrus	0	0	0
Paralichthys-Scophthalmus	0	0	0
Hippogloissoides platessoides	0	0	0
Limanda ferruginea	0	0	0
Total	0.4 0-1.2	0.1 0-0.4	0.3 0-1.1

December									
EGGS	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Gadus morhua	2.4 1.7-3.1	1.1 0.3-2.4	1.3 0.1-3.9	0.7 0.1-1.9	1.2 0.6-2.2	1.2 0.3-2.7	2.5 0-14	0.1 0-0.4	1.1 0-3.8
Pollachius virens	0	0	0	-	-	-	0.3 0-0.8	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0.05 0-0.2	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	2.4 1.7-3.2	1.2 0.4-2.5	1.7 0.5-3.9	0.7 0.1-1.9	1.2 0.6-2.2	1.4 0.3-3.6	2.7 0-16	0.2 0-0.7	1.1 0-3.8

December (continued)									
EGGS	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0	0	0	0	0.07 0-0.2	0	0.4 0-1.2
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Gadus morhua	0	0.4 0-1.2	0.8 0-3	0.1 0-0.4	0.2 0-0.6	0.08 0-0.3	0.2 0-0.8	0	0.2 0-0.6
Pollachius virens	0	0	0.1 0-0.6	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0.1 0-0.4	0
Labridae	0	0	0	0	0.1 0-0.5	0	0	0	0.6 0-2.3
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0	0	0	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0.08 0-0.3	0	0	0
Total	0.08 0-0.3	0.4 0-1.2	1.1 0-3.6	0.1 0-0.4	0.5 0.1-1	0.2 0-0.7	0.3 0-0.9	0.1 0-0.4	1.3 0.2-3.5

December (continued)

EGGS	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Gadidae-*Glyptocephalus*	0	0	0.3 0-1.7	0.1 0-0.4	0	0	0	0.04 0-0.2	0
Enchelyopus-Urophycis-Peprilus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Gadus morhua	1.1 0-4	1.8 0-22	1.8 0-9.3	1.6 0.1-4.9	0.8 0-2.3	0.2 0-0.4	0.2 0-0.6	0.4 0-1.0	0.8 0-4.7
Pollachius virens	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
Prionotus spp.	0	0	0	0	0	0	0	0	0
Labridae-*Limanda*	0	0	0	0	0	0	0	0	0
Labridae	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Paralichthys-Scophthalmus	0	0	0	0	0	0	0	0	0
Hippoglossoides platessoides	0	0	0.08 0-0.3	0	0	0	0	0	0
Limanda ferruginea	0	0	0	0	0	0	0	0	0
Total	1.1 0-4	1.8 0-22	2.8 0.1-12	1.6 0.1-5.1	0.8 0-2.3	0.2 0-0.4	0.2 0-0.6	0.4 0-1.1	0.8 0-4.7

December (continued)			
EGGS	2008	2009	2010
Brevoortia tyrannus	0	0	0
Gadidae-*Glyptocephalus*	0.24 0-0.8	0	0
Enchelyopus-Urophycis-Peprilus	0	0	0
Enchelyopus cimbrius	0	0	0
Gadus morhua	0.2 0-0.6	0.7 0-2.1	1.7 0-6.5
Pollachius virens	0	0	0
Urophycis spp.	0	0	0
Prionotus spp.	0	0	0
Labridae-*Limanda*	0	0	0
Labridae	0	0	0
Scomber scombrus	0	0	0
Paralichthys-Scophthalmus	0	0	0.1 0-0.4
Hippoglossoides platessoides	0	0	0
Limanda ferruginea	0	0	0
Total	0.4 0-1.2	0.7 0-2.1	1.7 0-6.7

January									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0.1 0-0.4	0.08 0-0.3	0.9 0.1-2.1	0	0	0.08 0-0.3	0.7 0-2.1	0	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0	0.08 0-0.3	0	0	0.1 0-0.4	0	0.09 0-0.4	0.09 0-0.4	0
M. octodecemspinosus	0	0.2 0-0.5	2.3 0.3-7.5	0.2 0-0.6	1.2 0.5-2.3	0.4 0-1.4	0.1 0-0.6	0.2 0-0.6	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0.1 0-0.4	0	0.05 0-0.2	0	0.09 0-0.3	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0.05 0-0.2	0.08 0-0.3	1.9 0.5-4.3	0.2 0-0.8	0.2 0-0.4	0.8 0-2.6	0.4 0.02-1	0.4 0-1.1	0.1 0-0.4
Ammodytes sp.	1.0 0-3.6	0.5 0-1.3	0.7 0.2-1.4	0	13.4 1.9-70	0.9 0-2.9	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	1.1 0-4.1	1.0 0.3-2.1	7.5 4.2-13	0.6 0-1.9	15.5 2.6-75	2.3 0.1-9.4	1.3 0.1-4	0.8 0.1-2	0.2 0-0.7

January (continued)									
LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0.2 0-0.6	0.5 0-1.3	0.1 0-0.4	0.3 0-0.8	0	0.09 0-0.4	0.4 0-1.1	0.07 0-0.3	0.2 0-0.9
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0	0	0	0.2 0-0.7	0	0	0	0.4 0-1.3	0.2 0-0.7
M. octodecemspinosus	0	0.2 0-0.6	0.1 0-0.4	0.1 0-0.4	0	0	0	0.9 0.1-2.3	0
M. scorpius	0	0.2 0-0.6	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0.2 0-0.8	0	0	0	0	0
L. coheni	0	0	0.1 0-0.5	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0.1 0-0.6	1.6 0.3-4.4	0.1 0-0.4	0.5 0-2.2	0.2 0-0.7	1.6 0.1-5.2	0.07 0-0.3	1.0 0.1-2.6	0.5 0-1.7
Ammodytes sp.	0.09 0-0.3	0.07 0-0.3	0	3.3 0.5-12	1.9 0.5-4.7	1.3 0-4.2	2.5 0-40	1.2 0.1-3.4	0.1 0-0.5
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pscudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	0.6 0.2-1.1	2.8 0.9-6.4	0.5 0-1.3	4.2 0.5-17	2.2 0.7-5.2	3.8 1.3-9.2	3.0 0-44	3.4 0.7-10	1.3 0.3-2.9

January (continued)

LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0.5 0-1.4	0.1 0-0.4	0.2 0-0.7	0.5 0-1.5	0.1 0-0.5	0.3 0-1.3	0.1 0-0.4	0.3 0-1.5	0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0	0	0	0.3 0-0.7	0.1 0-0.4	0	0.1 0-0.4	0	0.5 0-1.4
M. octodecemspinosus	2.8 0.5-8.6	1.4 0.4-3.2	0	0.5 0.2-0.8	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0.2 0-0.9	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0.08 0-0.3	0	0	0	0	0
Pholis gunnellus	4.9 1-17	2.7 0-13	1.7 0.2-5.3	34 13-86	0.2 0-0.8	0.08 0-0.3	0.5 0-1.5	0.7 0-1.9	1.1 0.1-2.9
Ammodytes sp.	0.8 0-2.6	0	0.8 0-2.6	1.0 0-5.5	0	0.7 0-2.1	0.3 0-1.6	1.1 0-6.0	0.2 0-0.5
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	11.0 4.5-26	4.8 1-16	3.7 1.4-8.4	38.2 15-96	1.4 0.4-3	1.4 0.1-4.3	1.2 0-3.9	2.3 0-10.7	1.4 0.1-4.1

January (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	0	0	0
Clupea harengus	0.2 0-0.8	0	0.05 0-0.2
Enchelyopus cimbrius	0	0	0
Urophycis spp.	0	0	0
M. aenaeus	0.1 0-0.5	0	0
M. octodecemspinosus	0.2 0-0.7	0.4 0-1.5	0.1 0-0.3
M. scorpius	0	0	0
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	0	0	0
Tautogolabrus adspersus	0	0	0
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	0.8 0-3.5	0.2 0-0.6	0.4 0-1.2
Ammodytes sp.	1.7 0-9.0	0.1 0-0.4	0.04 0-.1
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0
Total	2.9 0-14.2	0.7 0-2.2	0.5 0-1.5

February									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0	0.2	0.08	0.4	0.4	0.1	0	0
			0-0.8	0-0.3	0.1-0.7	0-1.1	0-0.5		
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0.1	0.08	1.4	0.4	3.7	0.6	8.4	3.2	0.3
	0-0.4	0-0.3	0.4-3.2	0.1-0.9	0.7-12	0-2	6.5-11	0-18	0-0.9
M. octodecemspinosus	1.0	0	0.2	0.5	0.7	0.4	0.2	0.4	0
	0-3.6		0-0.6	0.2-0.8	0.1-1.7	0-1.1	0-0.7	0-1.2	
M. scorpius	0	0	0	0	2.5	0	2.3	12.7	1.1
					0.3-8.6		0.3-7.5	1.3-82	0.04-3.4
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0.3	0	0.4	0	0	0.1	1.0
			0-0.8		0.1-0.9			0-0.4	0.2-2.4
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0.06	0	0	0	0	0	0	0	0
	0-0.2								
Pholis gunnellus	1.3	0.4	3.1	6.7	10.6	4.7	4.6	4.0	8.4
	0-4.8	0-1.3	0.9-7.8	2.9-14	2-44	2.3-8.7	3.7-5.7	0.3-19	3.2-20
Ammodytes sp.	8.9	1.4	0.3	0.6	9.7	0.08	0	0.4	0
	4.4-17	0-6.1	0-1	0.2-1.2	1.5-45	0-0.3		0-1	
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	11.6	2.1	6.3	8.9	21.6	7.6	18.3	19.4	10.9
	4.5-28	0.2-7.2	3.1-12	4.1-18	3-126	4.9-12	17-20	2.3-124	4.4-25

February (continued)

LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0.1	0.4	0.7	0.2	0	0.09	0.4	0
		0-0.4	0-1.6	0-3.3	0-0.5		0-0.4	0-1.8	
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0.1	8.6	0.1	2.2	0.6	4.4	0.3	7.4	7.5
	0-0.5	6-12	0-0.4	0-11	0-1.8	0.9-15	0-1.4	0.2-60	0-81
M. octodecemspinosus	0	0.2	0.1	0.2	0.6	0.09	0.3	0.7	0.3
		0-0.6	0-0.4	0-0.8	0-1.6	0-0.4	0-0.7	0-2.5	0-1.2
M. scorpius	0	12.2	1.9	0.9	0.3	1.8	2.5	8.5	0.5
		2.8-46	0.4-5.1	0-3.1	0-0.8	0.2-6	0-15	2.6-24	0-1.7
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0.07	0.1	0	0.1	0	0	0	0
		0-0.3	0-0.4		0-0.3				
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	1.1	45.7	1.8	2.0	1.5	6.4	3.7	4.8	6.8
	0-4.2	38-55	0.5-4.4	0-7.9	0.01-5.3	0.9-28	0.5-13	0-36	0.8-33
Ammodytes sp.	0.5	0.6	4.5	5.9	18.9	29.6	2.7	7.1	0.8
	0-2.4	0.2-1.2	0-30	0.2-39	12-29	5.9-134	0.1-12	0.6-41	0-3
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	1.5	74.5	11.1	8.5	22.9	48.3	9.5	550.4	24.4
	0-6.7	54-103	2.5-41	0.3-69	13-40	13-178	1.4-46	42-61	4.6-113

February (continued)									
LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0.2	0	0.2	2.9	0.05	0	0	0.2	0
	0-0.6		0-1	1-6.5	0-0.2			0-0.6	
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	1.2	3.2	3.3	16.8	0.5	0	1.9	6.4	3.2
	0.1-3.1	0.1-16	0.4-12	5-52	0-1.6		0-9.8	1.2-24.0	0.6-9.7
M. octodecemspinosus	0.2	3.2	1.3	8.9	0.6	0	0.1	2.6	3.7
	0-0.6	0-20	0-5.8	1.7-36	0-1.9		0-0.2	0.6-7.1	0.5-14.3
M. scorpius	0.7	2.2	0.8	1.2	0.3	0	0.3	4.0	0
	0-2	0.1-8.7	0-2.9	0.2-3.1	0-1.1		0-1.5	0.5-15.3	
L. atlanticus	0	0	0	0	0	0	0.1	0.3	0
							0-0.4	0-1.0	
L. coheni	0.1	0	0.1	0	0	0	0	0.1	0
	0-0.4		0-0.5					0-0.3	
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	1.5	15.2	19.4	59.1	2.5	0.3	2.9	4.2	2.6
	0-5.7	3.6-57	4.5-75	29-118	0.3-8.7	0-1.1	0.2-11.1	0.9-13.5	0.2-9.8
Ammodytes sp.	0.9	11.8	5.0	43.7	1.0	0.4	2.6	3.7	0.9
	0.1-2.2	0.5-111	0.8-19	16-115	0.1-2.7	0-1	0.6-7.0	0.5-13.5	0.02-2.4
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	4.2	41.9	40.0	179.7	4.1	1.0	7.8	13.2	28.9
	0.6-15	7.6-213	15-107	98-326	0.5-17	0.3-2.1	1.2-34	0.9-103.3	9.5-84.5

February (continued)

LARVAE	2008	2009	2010
Brevoortia tyrannus	0	0	0
Clupea harengus	0.2 0-0.6	0	0
Enchelyopus cimbrius	0	0	0
Urophycis spp.	0	0	0
M. aenaeus	1.6 0.2-4.7	1.4 0-5.1	0.3 0-0.9
M. octodecemspinosus	1.5 0.2-4.1	1.1 0.2-2.6	0.2 0-0.7
M. scorpius	0.4 0-1.3	1.2 0-5.3	0.5 0-1.5
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	0	0	0
Tautogolabrus adspersus	0	0	0
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	2.0 0.1-7.1	2.0 0-8.2	2.8 0.4-9.7
Ammodytes sp.	1.6 0-5.7	5.5 0.6-24.7	1.4 0.3-3.5
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0
Total	5.5 0.8-22.7	9.8 1.2-51.0	4.1 0.6-15.6

March									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	1.7	0.2	2.6	0.3	0.8	0.1	0	0.5	0.2
	0.7-3.3	0-0.6	0.9-5.8	0.01-0.7	0.3-1.7	0-0.3		0-1.5	0.03-0.4
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	18.9	17.1	4.6	8.4	14.2	34.0	2.7	59.8	18.6
	8.6-40	7.6-37	2.1-9	3.3-19	6.7-29	18-64	1.1-55	32-11	7.7-43
M. octodecemspinosus	1.2	0.5	0.06	0	0.5	0.8	0.1	0.2	1.0
	0.5-2.4	0-1.7	0-0.2		0.2-1	0.4-1.3	0-0.4	0-0.5	0.3-1.9
M. scorpius	0.1	0.8	0	2.0	1.0	3.5	0.1	7.1	6.5
	0-0.3	0.1-1.9		0.4-5.6	0.3-1.9	2-6	0-0.4	3.5-14	1.9-18
L. atlanticus	0.03	0	0.6	0	0.04	0.2	0	0.08	0.04
	0-0.1		0-1.8		0-0.2	0-0.6		0-0.2	0-0.1
L. coheni	0.4	0.08	0.3	0.03	0.4	0.3	0.06	0.3	0.4
	0.1-0.7	0-0.3	0-0.7	0-0.1	0.1-0.8	0.03-0.6	0-0.2	0.04-0.7	0.04-0.9
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0.04	0	0	0.03	0	0.2	0	0	0
	0-0.1			0-0.9		0-0.5			
Pholis gunnellus	10.4	14.8	3.7	16.3	24.5	30.3	2.4	57.6	32.3
	3.5-28	7.6-28	1.4-8.4	4.5-53	8.3-69	14-66	0.9-52	25-129	12-83
Ammodytes sp.	30.0	59.0	3.3	0.7	4.1	5.1	0.06	1.3	3.0
	20-45	12-283	0.9-8.8	0.3-1.3	1.1-11	2.3-10	0-0.2	0.4-2.8	1.7-4.8
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes	0.5	1.0	0.6	0.1	0.2	0.7	0	0	0
americanus	0.1-1.1	0-3.6	0-1.7	0-0.3	0-0.5	0.1-1.7			
Total	84.8	124.9	14.6	30.2	55.7	86.7	6.4	137.6	70.6
	58-125	48-322	5.6-36	9.8-89	26-118	47-159	3.3-12	71-266	29-168

March (continued)

LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0.5	1.1	0.5	1.5	1.0	0.4	0.7	0.8
		0.1-1.1	0.3-2.4	0.1-1	0.7-2.9	0.1-2.6	0.1-0.9	0-3.2	0.2-1.8
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	1.6	33.8	3.3	7.2	5.5	13.6	13.9	38.5	17.2
	0.1-5.4	23-49	1.1-7.6	1.9-22	1.2-18	8.5-21	5-36	7.9-175	8.3-35
M. octodecemspinosus	0	0	0.7	0.2	1.2	0.1	0.3	0.6	0.08
			0.1-1.5	0-0.4	0.1-3.1	0-0.5	0-0.9	0-2.3	0-0.2
M. scorpius	6.9	1.3	4.1	2.5	2.5	5.4	6.2	0.8	0.9
	1.6-23	0.7-2.2	1.2-11	0.7-6.2	1.1-4.9	2.1-12	1.7-18	0-2.5	0.3-1.8
L. atlanticus	0	0.05	0	0	0.05	0	0	0	0.2
		0-0.2			0-0.2				0-0.5
L. coheni	0.1	0.09	0	0.5	0.06	0	0	0	0
	0-0.4	0-0.2		0-1.2	0-0.2				
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0.05	0	0	0	0	0	0	0
		0-0.2							
Pholis gunnellus	2.8	14.3	5.9	2.0	71.1	8.2	16.1	51.5	6.7
	0.7-7.5	8-26	1.6-17	0.4-5.3	40-126	2.6-23	6-41	11-228	3-14
Ammodytes sp.	0.8	3.4	21.4	4.7	61.3	26.2	45.0	42.6	8.5
	0-2.8	1.6-6.3	8.3-53	1.4-12	17-217	11-63	16-126	12-151	3.5-19
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes	0	0.05	0	0	0	0	0	0.5	0.3
americanus		0-0.2						0-2.2	0-0.7
Total	14.9	59.3	52.7	16.6	188.9	74.0	108.7	147	38.9
	6.9-31	48-84	25-110	5.4-47	82-432	42-131	47-249	30-695	19-78

March (continued)									
LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	1.3 0.5-2.5	1.1 0.2-2.7	0.3 0.04-0.6	1.1 0.2-2.7	0.2 0-0.5	0.4 0-0.9	1.1 0.02-3.3	0.5 0-1.5	0.03 0-0.1
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	32.3 15-67	10.8 3.1-33	16.1 5-48	55.8 30-104	17.2 6.3-45	9.8 3.7-24	9.8 3.5-25	16.3 6.5-39.3	8.8 1.9-32.0
M. octodecemspinosus	0.8 0-2.4	0.8 0.1-2.1	0.2 0-0.6	2.3 0.2-8.3	1.6 0.4-4.1	0.3 0-0.9	0	0.5 0.1-1.1	1.3 0.1-3.7
M. scorpius	3.1 0.2-13	2.5 0.8-5.8	1.8 0.5-4.3	0.9 0-2.6	2.5 0.9-5.5	0.6 0.1-1.4	0.7 0.3-1.3	5.3 2.5-10.4	1.6 0.3-4.3
L. atlanticus	0.3 0-0.9	0.1 0-0.3	0.1 0-0.3	0.7 0-2.1	0	0	0.2 0-0.6	0.3 0-0.6	0
L. coheni	0.5 0-1.1	0.04 0-0.2	0	0.07 0-0.2	0.08 0-0.3	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0.04 0-0.1
Pholis gunnellus	9.9 3.3-27	24.1 7.1-77	14.3 5.1-37	9.4 2.9-27	7.6 1.9-25	6.1 2.3-14	6.4 2.8-13.5	5.4 2-12.7	3.6 1.1-9.5
Ammodytes sp.	18.9 5.6-59	24.7 8-72	2.4 0.6-6.2	55.9 19-163	7.9 3.4-17	9.8 3.5-25	36.4 8.4-148	34.3 12.2-93	2.7 0.9-6.4
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0.3 0-1.2	0	0	0	0	0
Total	94.6 38-234	113.4 49-257	36.0 11-110	161.6 73-355	49.7 19-131	38.2 17-84	67.8 19-237	88.1 42.5-181.4	17.4 4.4-61.8

March (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	0	0	0
Clupea harengus	0.7	0.4	0.7
	0.1-1.7	0.1-0.8	0.1-1.6
Enchelyopus cimbrius	0	0	0
Urophycis spp.	0	0	0
M. aenaeus	38.6	11.8	3.1
	17.9-82.3	4.4-29.6	1.1-7.0
M. octodecemspinosus	1.5	0.2	0
	0.5-3.3	0-0.5	
M. scorpius	1.9	1.1	0.2
	0.4-5.2	0.4-2.3	0-0.5
L. atlanticus	0.3	0	0
	0-1.2		
L. coheni	0	0	0
Tautoga onitis	0	0	0
Tautogolabrus adspersus	0	0	0
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	13.9	5.7	3.2
	5.8-31.6	2.3-12.8	1.3-6.4
Ammodytes sp.	44.8	8.0	3.5
	17.1-114.9	3.3-17.7	1.1-8.6
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0.04
			0-0.1
Total	134.8	32.7	13.2
	70-257	13.0-80.6	5.7-29.0

April									
LARVAE	1981	1982	1983	1984	1985	1986	1987[1]	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0		0	0
Clupea harengus	0	0.8	1.1	0	0.1	0.3		0.7	0.2
		0.4-1.4	0.2-2.4		0-0.3	0-0.7		0.1-1.6	0-0.6
Enchelyopus cimbrius	0	0	0.04	0	0	0		0.06	0
			0-0.1					0-0.2	
Urophycis spp.	0	0	0	0	0	0		0	0
M. aenaeus	10.0	47.8	4.7	1.3	58.7	24.9		14.2	19.1
	4.3-22	21-108	2.1-9.2	0.03-4.3	28-124	8-74		4.9-38	11-33
M. octodecemspinosus	0.3	0.1	0	0	0	0.3		0	0
	0-0.6	0-0.3				0-0.8			
M. scorpius	0.06	0.1	0	0	0.1	0.2		0.2	0.4
	0-0.2	0-0.4			0-03	0-0.5		0-0.7	0.1-0.8
L. atlanticus	0.6	0	5.1	0	3.1	4.5		4.1	1.9
	0.1-1.3		1.5-13		1-7	1.7-10		0.4-18	0.2-6.4
L. coheni	0	0.7	0	0	0.3	0.1		0.07	0
		0.3-1.2			0-0.7	0-0.4		0-0.3	
Tautoga onitis	0	0	0	0	0	0		0	0
Tautogolabrus adspersus	0	0	0	0	0	0		0	0
Ulvaria subbifurcata	2.5	0.05	2.7	0	2.0	1.3		0.5	0.3
	0.5-6.9	0-0.2	1.2-5.3		0.4-5.4	0.4-3		0-1.5	0-0.7
Pholis gunnellus	1.6	21	1.2	1.4	9.9	4.8		2.7	4.1
	0.4-3.9	9.4-45	0.1-3.6	0.1-4.4	2.5-33	1.9-11		1.2-5.4	1.1-12
Ammodytes sp.	24.8	28.6	9.7	0	12.6	3.8		2.8	2.0
	14-42	15-54	4.3-21		5.6-27	0.2-18		0.2-11	0.7-4.2
Scomber scombrus	0	0	0	0	0	0		0	0
Pseudopleuronectes	1.3	2.6	2	0	2.5	5.2		1.2	1.2
americanus	0.4-2.8	1-5.6	0.6-4.5		1-5.3	1.8-13		0-3.9	0.1-3.7
Total	57.3	112.7	36.9	3.4	136.9	69.7		32.7	40.1
	40-82	55-230	21-66	0.7-10	82-229	28-168		13-83	23-71

[1]No sampling

April (continued)

LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0.2	0.2	1.1	0.1	4.0	2.3	2.5	0.3	1.1
	0-0.6	0-0.5	0.5-1.9	0-0.5	1.8-7.9	0.4-7.2	0.6-6.5	0-0.7	0.5-1.8
Enchelyopus cimbrius	0.06	0	0	0	0	0	0	0.2	1.1
	0-0.2							0-0.6	0-3.2
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	22.2	11.3	12.9	5.4	11.4	31.1	19.0	14.1	8.7
	12-41	8.4-15	8.9-19	0.3-32	4.7-26	12-77	9-39	6.3-30	3.9-18
M. octodecemspinosus	0.2	0.06	0.1	0	1.0	0.3	0.2	0.06	0.1
	0-0.5	0-0.2	0-0.4		0.5-1.8	0-1.2	0-0.5	0-0.2	0-0.5
M. scorpius	0.5	0.1	0.9	0	0.6	1.0	0.4	0	0.07
	0.1-1.1	0-0.3	0.2-2		0.1-1.5	0.2-2.2	0-1		0-0.2
L. atlanticus	3.0	1.4	0.3	0	0.8	4.4	0.7	4.6	0.5
	1.9-4.5	0.4-2.9	0-0.7		0-2.9	1.7-9.8	0-1.8	1.2-13	0.1-1.1
L. coheni	0.05	0	0	0	0	0	0	0.08	0
	0-0.2							0-0.3	
Tautoga onitis	0	0	0	0	0	0	0	0	0.04
									0-0.1
T. adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0.5	2.0	0.5	0	0	0	0.09	0.1	0.7
	0-1.2	0.5-5	0-1.2				0-0.3	0-0.5	0.1-1.6
Pholis gunnellus	9.6	3.5	11.9	1.4	10.6	8.9	7.0	5.3	0.8
	3.8-22	1.7-6.6	4.3-31	0.01-4.9	5.9-18	1-48	2.2-19	2.2-12	0.3-1.6
Ammodytes sp.	33.3	26.1	34.9	11.2	274.4	44.2	154.2	52.1	18.7
	13-84	13-50	21-58	1-73	130-580	14-131	48-489	29-92	6.2-53
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes	0.8	1.0	0.1	0.3	0.9	2.2	0.2	8.2	1.8
americanus	0.1-1.7	0.3-1.9	0-0.3	0-0.8	0.2-2	0.1-8	0-0.5	2.9-21	0.5-4.5
Total	109.0	55.2	99.7	20.2	349.1	114.3	216.2	118.6	53.4
	64-185	35-87	78-128	2.8-116	182-668	44-293	77-607	85-166	32-90

April (continued)

LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia. tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	3.7 1.4-8	1.0 0.2-2.5	1.5 0.2-4.2	0.2 0-0.4	0.7 0-0.3	1.6 0.6-3.3	1.3 0-6.2	2.5 0.5-7.2	0.08 0-0.3
Enchelypus. cimbrius	0	0.05 0-0.2	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	13.1 7-24	18.4 7.8-42	8.1 2.4-23	9.9 4.4-21	8.4 2.5-24	12.5 5-30	5.1 0.6-22	3.6 1.6-7.1	1.2 0-7.3
M. octodecemspinosus	0	0.05 0-0.2	0.1 0-0.3	0	0.2 0-1	0.2 0-0.6	0	0	0
M. scorpius	0.06 0-0.2	0.1 0-0.3	0.1 0-0.4	0	0.4 0-1.4	0.5 0-1.2	0.5 0.01-1.2	0.3 0-1.1	0.1 0-0.3
L. atlanticus	3.7 1.2-9.1	0.9 0.2-2	1.4 0.2-3.8	10.5 4.8-22	0	0.4 0-1.1	0.2 0-0.4	1.5 0.8-2.6	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
T. adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0.04 0-0.1	4.8 1.5-13	0	0.2 0-0.5	0	0.9 0.1-2.3	0
Pholis gunnellus	1.1 0.3-2.4	7.9 3.2-18	2.1 0.5-5.7	0.2 0-0.6	3.0 0.8-7.7	2.9 0.9-7.1	2.4 0.1-9.6	5 2-11.2	0.4 0-1.4
Ammodytes sp.	38.9 16-90	29.8 13-67	10.3 2-41	5.4 1.7-14	71.5 18-276	45.7 17-119	27.1 2.9-202	64.7 25.3-163.1	1.2 0-5.1
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	2.5 1-5.2	0.8 0.2-1.7	1.4 0.3-3.7	3.3 1-8.2	0.2 0-0.8	0.3 0-0.8	0.1 0-0.2	0.1 0-0.2	0.1 0-0.4
Total	79.4 41-155	69.9 34-140	36.5 12-106	74.5 47-118	103.0 40-266	78.6 35-177	45.1 5.5-327	98.2 47-204.2	2.6 0-15.6

April (continued)

LARVAE	2008	2009	2010
Brevoortia tyrannus	0	0	0
Clupea harengus	0.7 0.04-1.7	1.2 0-4.4	0.2 0-0.6
Enchelyopus cimbrius	0	0	0.2 0-0.5
Urophycis spp.	0	0	0
M. aenaeus	4.4 1.8-9.3	10.3 1.6-48.9	5.6 2.7-10.7
M. octodecemspinosus	0.2 0-0.5	0	0
M. scorpius	0.3 0-0.6	0	0
L. atlanticus	1.4 0.6-2.9	0.1 0-0.4	2.0 0.6-4.6
L. coheni	0	0	0
Tautoga onitis	0	0	0
Tautogolabrus adspersus	0	0	0
Ulvaria subbifurcata	1.0 0.2-2.5	0	1.1 0.2-2.8
Pholis gunnellus	1.4 0.7-2.3	3.6 0.3-16.1	0.06 0-0.2
Ammodytes sp.	44.5 19.3-100.8	7.9 1.0-30.9	15.1 8.3-26.5
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0.5 0.05-1.2	0	1.1 0.04-3.2
Total	71.1 36.3-138.5	24.1 3.3-144.9	33.6 21.4-52.4

May

LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0.1 0-0.3	0.03 0-0.1	0.05 0-0.2	0	0.06 0-0.2	0	0.06 0-0.2	0.2 0-0.5
Enchelyopus cimbrius	0.7 0.2-1.5	0.03 0-0.08	0.2 0-0.5	0	1.3 0.4-2.9	1.8 0.3-5.3	0.2 0-0.5	1.7 0.2-5.3	0.6 0-1.9
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0.2 0-0.4	1.8 0.8-3.5	2.4 0.5-7.1	0.9 0.2-2.1	1.0 0.3-2	0.3 0.01-0.8	0.1 0-0.3	0.9 0.04-2.4	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	8.0 3.5-17	1.0 0.3-2.2	6.2 2.1-16	2.0 0.8-4	7.4 3.5-15	1.8 1-3	2.0 0.1-7	12.6 5.2-29	0
L. coheni	0	0.1 0-0.3	0	0	0	0	0	0	0
Tautoga onitis	0	0.05 0-0.1	0	0	0.03 0-0.1	0	0	0	0
Tautogolabrus adspersus	0.03 0-0.1	0	0	0	0	0.1 0-0.4	0	0	0.05 0-0.2
Ulvaria subbifurcata	9.3 6.4-13	1.9 0.7-3.7	11.1 5.3-22	0.6 0.1-1.2	7.0 3.3-14	4.4 2.4-7.5	0.3 0-0.8	1.7 0.5-4	12.3 6.5-23
Pholis gunnellus	0	0.1 0-0.3	0.2 0.01-0.3	0.6 0.2-1.2	0.08 0-0.2	0.06 0-0.2	0	0.7 0.2-1.4	0.4 0.03-1
Ammodytes sp.	1.4 0.6-2.6	9.1 4-20	3.9 1.6-8.6	5.7 1.7-15	0.4 0.1-0.8	0.7 0.1-1.7	0.04 0-0.2	0.9 0-2.7	2.7 1.1-5.7
Scomber scombrus	0.4 0-1.2	0.07 0-0.2	0	0	0.2 0-0.6	0.1 0-0.3	0.05 0-0.2	0	0.3 0-0.7
Pseudopleuronectes americanus	12.6 3.9-37	8.0 2.9-20	10.0 4.7-20	4.8 1.8-11	7.6 4.1-14	6.5 4.4-9.4	1.6 0.1-5.2	9.4 3.2-25	5.1 2.8-8.8
Total	45.9 26-82	39.7 25-62	37.7 18-76	20.5 9.5-43	45.2 33-63	22.4 18-28	3.3 0.5-11	38.0 19-75	49.5 38-64

May (continued)									
LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0.05 0-0.2
Clupea harengus	1.7 0.6-3.6	0.2 0-0.5	1.5 0.4-3.5	0	0.8 0.2-1.8	0	0.4 0-1.3	0	0.1 0-0.3
Enchelyopus cimbrius	0	1.8 0.8-3.3	0	0.2 0-0.6	0.05 0-0.2	2.4 0.2-8.3	1.4 0.2-3.8	5.0 1.4-14	4.7 1.9-10
Urophycis spp.	0	0	0	0	0	0	0	0	0.2 0-0.6
M. aenaeus	1.9 0.5-4.4	0	0.7 0-2	0.5 0.1-1.1	5.6 1.8-15	0.9 0-4.3	2.1 0.5-5.3	2.2 1.1-3.9	0.3 0-0.8
M. octodecemspinosus	0	0	0.1 0-0.4	0	0.06 0-0.2	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	4.9 2.5-8.8	4.7 3.3-6.7	1.5 0.4-3.6	3.7 1.2-9.1	8.4 3.6-18	9.0 3.4-22	1.3 0.4-2.9	8.1 2.5-22	1.0 0.3-2
L. coheni	0	0	0	0.2 0-0.6	0	0	0	0	0
Tautoga onitis	0	0.04 0-0.1	0	0	0	0	0	0	0.05 0-0.2
Tautogolabrus adspersus	0	0.1 0-0.5	0	0	0	0.06 0-0.2	0	0	0.2 0-0.6
Ulvaria subbifurcata	17.1 8.8-33	9.3 3.7-22	13.5 6.2-28	11.3 2.4-44	6.4 3-13	29.5 9.3-90	19.5 10-37	10.4 5.6-19	13.0 3.6-42
Pholis gunnellus	0.4 0.1-0.8	0.1 0-0.3	0.5 0-1.2	0.08 0-0.3	0.7 0.1-1.7	0.1 0-0.5	0.2 0-0.7	0.2 0-0.6	0
Ammodytes sp.	14.2 7.1-27	0.6 0.1-1.2	17.5 3.7-72	10.9 4.6-24	53.3 23-124	2.3 0.1-8.6	18.7 6.1-54	15.6 6.3-37	2.8 0.5-8.5
Scomber scombrus	0.04 0-0.1	1.2 0-4.7	0	0.4 0.01-0.9	0	0.3 0-1.1	1.3 0-4.7	0.7 0-2.3	2.8 1-5
Pseudopleuronectes americanus	5.6 2.2-13	10.3 4.3-23	3.5 0.6-12	9.6 5.7-16	16.8 7.6-36	17.3 11-27	7.3 3.1-16	45.3 20.2-100	27.9 9.4-79
Total	68.9 51-92	50.8 37-70	72.4 32-163	54.5 30-99	136.7 86-216	94.0 53-166	97.6 70-136	127.7 80-203	111.0 51-240

May (continued)									
LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0.4
									0-1.7
Clupea harengus	0.3	0.2	0.5	0	0.3	0.2	1.0	0	0.0
	0-1.1	0-0.8	0-1.8		0-1.2	0-0.5	0.2-2.4		0-0.1
Enchelyopus cimbrius	0.3	0.06	8.5	0.3	0.6	0.6	0.3	0.1	0.8
	0-1.1	0-0.2	2-29	0-8	0.04-1.5	0-1.5	0-0.9	0-0.2	0.1-1.8
Urophycis spp.	0	0	0	0	0	0	0	0	0.04
									0-0.1
M. aenaeus	0.5	0.6	0.3	0.2	0.4	1.3	0.2	0.1	0.8
	0-1.5	0-1.6	0-1.6	0-0.5	0-1.2	0.3-3	0-0.5	0-0.2	0.2-1.6
M. octodecemspinosus	0	0	0	0	0.05	0	0	0	0
					0-0.2				
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	1.1	0.4	4.0	3.5	0.5	4.1	0.7	1.8	1.2
	0.2-2.8	0-1.2	1-12	1.3-8	0-1.3	1.8-8.2	0.1-1.9	0.7-3.8	0.4-2.6
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0.3	0	0	0.05	0	0	0.06
			0-0.9			0-0.2			0-0.2
Tautogolabrus adspersus	0	0	0.3	0	0	0	0	0.04	0.1
			0-1.5					0-0.1	0-0.4
Ulvaria subbifurcata	1.0	5.3	16.2	14.6	11.1	14.9	1.3	2.4	1.9
	0-3.9	1-19	9-29	5.1-39	6.3-19	5.8-36	0.3-3.0	0.9-5.0	0.8-3.6
Pholis gunnellus	0.07	0.05	0.2	0	0	0.03	0.1	0.05	0.15
	0-0.2	0-0.2	0-0.5			0-0.1	0-0.3	0-0.2	0-0.4
Ammodytes sp.	1.3	5.0	2.1	0.8	6.4	3.2	1.4	1.1	0.6
	0-6.4	1-17	0-13	0.1-2.1	1.9-18	1.6-6	0.1-4.0	0.3-2.3	0.1-1.4
Scomber scombrus	0	0	3.3	0.5	0.1	0.09	0.05	0.2	0.1
			0.6-11	0.02-1.2	0-0.4	0-0.2	0-0.2	0-0.8	0-0.3
Pseudopleuronectes	1.2	1.2	71.0	13.2	3.2	11.3	5.7	5.1	3.9
americanus	0-4.2	0.2-3.5	25-197	5.3-31	1.1-7.6	2.5-43	1.5-17	2-11.3	1.3-9.5
Total	7.4	53.2	164.4	50.9	29.2	70.3	16.6	16.2	12.4
	1.7-25	32-89	81-334	25-101	18-47	33-147	6.1-43	8.1-31.2	4.3-34.0

May (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	0	0	0
Clupea harengus	0.08	0.1	0
	0-0.2	0-0.4	
Enchelyopus cimbrius	0.6	0.4	0.5
	0-1.7	0-1.5	0-1.3
Urophycis spp.	0	0.2	0
		0-0.6	
M. aenaeus	0	0.3	0.1
		0-0.8	0-0.2
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	1.9	1.6	1.0
	0.5-4.5	0.1-5.0	0.1-2.5
L. coheni	0	0	0
Tautoga onitis	0	0	0.1
			0-0.2
Tautogolabrus adspersus	0	0.2	0
		0-0.6	
Ulvaria subbifurcata	11.7	20.2	5.3
	4.4-29.0	4.2-85.9	2.2-11.2
Pholis gunnellus	0.04	0	0
	0-0.1		
Ammodytes sp.	2.4	2.4	0.7
	0.05-8.4	0.3-5.1	0.1-1.4
Scomber scombrus	0.4	0.1	0
	0-1.2	0-0.3	
Pseudopleuronectes	4.8	6.6	5.8
americanus	0.9-16.9	0.5-38.6	1.7-16.3
Total	42.7	36.8	19.0
	18.6-96.1	6.0-203.2	7.9-43.8

June

LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	18.1	0.2	0.2	0	4.7	2.6	1.0	0.3	3.0
	8.6-37	0-0.5	0-0.5		1-15	0.5-7.7	0-3.3	0-0.6	0.8-7.9
Clupea harengus	0	0	0	0	0.05	0	0	0	0
					0-0.2				
Enchelyopus cimbrius	19.6	0.5	7.1	0.1	15.9	12.6	1.5	1.0	16.3
	12-33	0.1-1.1	3-16	0-0.3	6.5-37	6.3-24	0-6	0.4-19	7.3-35
Urophycis spp.	0.4	0	0.4	0	0	0.6	0	0	0.2
	0.1-0.8		0.03-0.8			0-1.7			0-0.6
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0.7	0.3	0.5	2.1	1.4	1.5	0.4	3.9	0.7
	0.3-1.4	0-0.7	0.03-1.2	0.5-5.5	0.8-2.2	0.4-3.3	0-1.6	1.9-7.3	0.1-1.8
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	3.5	1.0	0.4	0	1.7	0.7	0.9	0.3	6.0
	1.7-6.6	0.1-2.6	0.1-0.8		0.3-4.6	0.2-1.6	0-2.9	0.04-0.5	2.5-13
Tautogolabrus adspersus	34.4	3.3	3.2	0	8.4	12.8	0.4	0.6	35.8
	15-79	1.2-7.3	0.6-9.8		1.2-38	3.4-43	0-1.2	0.1-1.3	15-85
Ulvaria subbifurcata	0.5	0.9	0.6	0.6	2.3	1.9	0.1	0.5	2.1
	0.2-1	0.3-1.8	0.2-1.2	0.1-1.4	1-4.7	1-3.3	0-0.4	0-1.5	0.7-4.7
Pholis gunnellus	0.03	0	0	0.06	0	0	0	0	0
	0-0.1			0-0.2					
Ammodytes sp.	0.02	0	0.06	0.06	0	0	0	0	0.09
	0-0.06		0-0.2	0-0.2					0-0.3
Scomber scombrus	15.6	4.8	20.6	0.06	13.2	15.3	0.3	1.7	37.8
	6.1-38	1.6-12	7.6-53	0-0.2	2.5-56	1.9-90	0-0.7	0.5-4.2	8.4-160
Pseudopleuronectes	1.0	2.3	0.3	1.9	1.7	0.7	0.2	0.3	0.4
americanus	0.5-1.8	1-4.4	0-0.6	0.4-5.1	0.8-3	0.1-1.7	0-0.6	0-0.8	0-1
Total	181.6	16.9	47.1	5.9	69.2	87.3	4.1	14.5	204.9
	98-336	6.8-40	20-110	2.2-14	21-219	34-220	0.6-16	9-23	121-346

June (continued)

LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.6	0.4	0.5	0	0.5	6.3	0.9	3.4	1.6
	0.1-1.4	0-1.5	0.03-1.2		0-1.5	1.9-18	0.2-2.1	1.2-7.9	0.3-4.3
Clupea harengus	0	0	0	0.07	0	0	0	0	0
				0-0.3					
Enchelyopus cimbrius	8.1	1.3	8.9	10.0	3.6	9.9	10.7	11.9	10.5
	2-26	0.1-3.9	2.7-26	7.2-14	1.7-6.6	2.2-36	3-33	4.5-29	4.1-25
Urophycis spp.	0	0	0	0	0	0.08	0.2	0.7	1.8
						0-0.3	0-0.4	0.2-1.5	0.3-4.7
M. aenaeus	0.08	0	0	0	0	0	0	0	0.1
	0-0.3								0.3
M. octodecemspinosus.	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	2.3	2.4	0.4	1.6	2.6	1.3	2.0	0.8	0.08
	0.9-4.8	0-13	0.1-0.8	0.1-5.2	1.1-5.2	0.1-3.5	0.3-6.3	0.2-1.8	0-0.2
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	1.3	1.0	2.1	0.6	0	1.5	0.8	0.9	1.1
	0.2-3.3	0-3.8	0.8-4.4	0.03-1.4		0-5	0.1-1.9	0.3-1.9	0.4-2.2
Tautogolabrus adspersus	2.0	4.9	1.1	0.3	0.2	0	1.9	9.9	13.8
	0.2-6.7	0-44	0.4-22	0.1-0.7	0-0.6		0.4-5	3.9-23	2.8-57
Ulvaria subbifurcata	2.7	1.2	1.2	3.4	6.3	0.7	9.7	2.2	3.9
	1.3-4.8	0.1-3.3	0.5-2.2	1.9-5.7	2.6-14	0-2	3.2-26	0.4-6.7	1-11
Pholis gunnellus	0	0	0	0	0	0	0	0.07	0
								0-0.2	
Ammodytes sp.	0.4	0	0	1.1	0.4	0	0.06	0.2	0.1
	0.1-0.9			0.1-3.1	0-0.9		0-0.2	0-0.6	0-0.4
Scomber scombrus	2.4	19.0	7.0	5.5	1.2	30.5	13.8	16.1	8.1
	0.5-6.4	0-626	2.9-15	2.1-13	0.2-3.3	3.4-223	4.1-42	5-48	1.9-27
Pseudopleuronectes	0.08	1.1	0.4	3.7	2.3	0.8	6.5	4.9	11.6
americanus	0-0.3	0-4.1	0.1-0.9	1.5-7.8	0.6-5.5	0.1-1.8	1.6-21	1.2-15	3.6-33
Total	36.8	31.8	23.8	45.2	33.8	59.7	89.4	98.1	150.4
	17-79	0.5-732	8-70	31-66	25-45	8.2-399	33-238	53-180	62-363

June (continued)									
LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	1.0	0.2	0.1	0.3	0.1	0.1	0.8	2.0	6.3
	0.1-2.7	0-0.8	0-0.2	0-1.1	0-0.2	0-0.3	0.1-1.8	0.1-7.4	2.1-16.2
Clupea harengus	0	0	0	0	0.03	0.07	0	0	0
					0-0.1	0-0.3			
Enchelyopus cimbrius	1.9	0.5	3.6	2.5	0.7	15.7	3.7	3.8	3.2
	0.3-5.4	0-1.4	1.9-6.2	0.7-6.3	0.1-1.8	5.7-40	1.2-9.0	1.1-10.2	1.1-7.4
Urophycis spp.	0	0.6	0.4	0.3	0.3	0.4	0	0.2	0.1
		0-2.1	0.1-0.8	0-0.9	0-0.9	0-1.3		0-0.7	0-0.3
M. aenaeus	0	0	0	0	0	0	0.1	0	0
							0-0.2		
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0.05	0	0	0	0	0
				0-0.2					
L. atlanticus	0.1	0	0.3	0.2	0.1	0.5	0.3	0.1	0.3
	0-0.4		0.03-0.7	0-0.5	0-0.3	0.04-1.1	0-0.9	0-0.4	0-0.6
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	1.4	0.4	1.6	0.6	0	1.9	1.9	1.0	0.5
	0.3-3.4	0-1.1	0.1-5.1	0.02-1.4		0.7-4	0.6-4.4	0-2.9	0-1.2
Tautogolabrus adspersus	6.3	3.4	6.3	1.8	0.4	7.0	4.3	5.2	5.4
	0.6-33	0.6-11	1.3-22	0.6-3.8	0-1.3	2.1-20	0.7-16	1.2-16.4	1.6-14.5
Ulvaria subbifurcata	0.7	1.4	3.1	1.6	3.6	3.5	2.0	0.4	1.4
	0-2.4	0.1-4.4	1.1-7.2	0.2-5	0.8-11	0.8-10	0.3-5.8	0-1.3	0-6.1
Pholis gunnellus	0	0	0	0	0.1	0	0	0	0
					0-0.3				
Ammodytes sp.	0	0	0.1	0	0.6	0	0.3	0	0
			0-0.3		0-1.8		0-0.8		
Scomber scombrus	0.3	4.3	1.7	1.4	0.9	7.6	2.5	4.3	3.3
	0-0.8	0.4-18	0.2-4.8	0.2-3.8	0.1-2.5	2-24	0.7-6	1.0-13.1	0.7-10.2
Pseudopleuronectes	0.8	4.3	3.2	2.2	3.0	6.0	10.3	0.8	1.6
americanus	0-2.3	0.4-18	1.4-6.4	0.3-7	1.1-6.7	2.3-14	2.3-37	0.1-1.8	0.3-4.3
Total	15.6	29.9	47.7	24.2	17.0	107.8	75.4	25.2	46.1
	3.2-64	12-71	28-79	13-46	18-35	52-221	43-132	7.4-81.0	23.3-90.5

June (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	0.4	0.04	0.9
	0-1.0	0-0.1	0.3-1.9
Clupea harengus	0	0.04	0
		0-0.1	
Enchelyopus cimbrius	2.3	2.7	2.0
	0.5-6.3	0.7-7.1	0.7-4.1
Urophycis spp.	0.4	0.1	0.2
	0-1.5	0-0.3	0-0.4
M. aenaeus	0	0	0
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	0	0.2	0.1
		0-0.4	0-0.3
L. coheni	0	0	0
Tautoga onitis	0.4	0.04	0.6
	0-1.4	0-0.1	0.01-1.5
Tautogolabrus adspersus	1.7	0.4	1.8
	0-6.4	0-1.2	0.2-5.5
Ulvaria subbifurcata	2.2	2.7	2.3
	0.1-6.0	0.4-8.8	0.9-4.6
Pholis gunnellus	0	0.05	0
		0-0.2	
Ammodytes sp.	0.3	0.04	0
	0-0.7	0-0.1	
Scomber scombrus	0.2	0.7	0.6
	0-0.5	0-1.9	0.1-1.4
Pseudopleuronectes	3.3	2.3	1.5
americanus	1.1-7.9	0.4-7.0	0.7-2.8
Total	21.0	14.1	21.8
	7.3-56.9	4.3-42.4	12.4-37.8

July

LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	3.8	0	0.8	0	0.3	0.1	0.09	1.2	1.4
	0.8-12		0.3-1.5		0.04-0.7	0-0.3	0-0.2	0.1-3.2	0.4-3
Clupea harengus	0	0	0	0	0.03	0	0	0	0
					0-0.1				
Enchelyopus cimbrius	6.3	1.0	3.4	0.6	1.6	0.09	0	1.1	0.6
	2.8-13	0.5-1.8	1.1-8.5	0.2-1.2	0.5-3.5	0-0.2		0.2-2.5	0-1.6
Urophycis spp.	2.1	0	2.3	0	0.04	0	0	0.06	0
	0.4-6		0.7-5.3		0-0.1			0-0.2	
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0.03	0	0	0	0
					0-0.1				
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	3.4	0.3	1.5	0	0.5	0.4	0	1.2	1.6
	1.6-6.3	0.01-0.6	0.4-3.3		0.1-1	0.1-0.9		0.3-2.9	0.4-3.9
Tautogolabrus adspersus	83.5	0.9	21.2	0.05	4.4	0.4	0	5.1	6.4
	18-384	0.3-1.7	9.8-45	0-0.2	2-8.5	0.05-0.8		2.6-9.6	3.6-11
Ulvaria subbifurcata	0.1	0.09	0	0	0	0	0	0	0
	0-0.4	0-0.3							
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	2.1	0	0.6	0.05	0.7	0.3	0	0	0.08
	0.2-7.3		0.09-1.4	0-0.2	0.2-1.5	0-0.7			0-0.3
Pseudopleuronectes americanus	0	0.05	0.08	0	0	0	0	0	0
		0-0.2	0-0.2						
Total	126	3.4	39.5	1.1	10.4	1.4	0.2	11.7	18.7
	33-475	2.4-4.7	20-78	0.6-1.8	5.6-19	0.6-2.7	0-0.6	6.4-21	14-24

July (continued)									
LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	1.9	0	0.5	0.04	0.3	1.0	1.4	11.1	28.1
	0.8-3.6		0.2-0.9	0-0.2	0.01-0.6	0.4-1.8	0.4-3.1	3.5-32	10-75
Clupea harengus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0	0	0.3	0.6	2.4	1.9	0.8	3.4	32.3
			0-0.9	0.01-1.6	0.9-5.1	0.5-4.4	0.1-1.8	1.4-7	13-78
Urophycis spp.	0.7	0.04	0	0	0	0.8	0.2	1.1	16.6
	0.2-1.4	0-0.1				0-3.2	0-0.6	0-5.9	4.4-57
M. aenaeus	0	0	0	0.2	0	0	0	0	0
				0-0.6					
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0.05	0	0.1	0	0
					0-0.2		0-0.3		
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	2.6	0	0.6	0	0.4	0.7	1.6	4.5	22.5
	0.8-6.3		0.1-1.3		0-1	0.3-1.2	0.8-2.7	1.2-13	9-54
Tautogolabrus adspersus	106.4	0	0.4	0.7	2.3	4.5	6.9	56.1	135.6
	53-214		0.09-0.7	0.07-1.8	0.9-4.7	2.7-7.3	3.6-13	24-132	39-471
Ulvaria subbifurcata	0.2	0	0.4	0.05	0.8	0	0.5	0.1	0.5
	0.01-0.4		0.08-0.8	0-0.2	0.03-2.1		0-1.4	0-0.3	0-1.3
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0.2	0	0	0	0	0
				0-0.5					
Scomber scombrus	1.2	0	0.6	0.3	0.6	1.6	1.6	0.5	0.9
	0.2-2.9		0.1-1.4	0-0.8	0-1.8	0.1-5.1	0.3-4.2	0-1.5	0.1-2.3
Pseudopleuronectes	0	0	0	0.1	0	0.06	0.1	0.1	0.08
americanus				0-0.4		0-0.2	0-0.3	0-0.3	0-0.3
Total	146.7	1.1	3.8	4.4	11.0	18.3	16.9	104.0	282.2
	80-270	0.5-2.1	1.7-7.7	3-6.2	5.3-22	9-36	9-31	52-206	79-1007

July (continued)

LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	4.5	0.2	0.6	1.4	0.5	0.1	9.0	5.4	3.2
	2-9.2	0-0.6	0.2-1.2	0.3-3.3	0.04-1.2	0-0.2	2.4-28.2	2.8-9.6	0.8-8.7
Clupea harengus	0	0.04	0	0.1	0	0	0	0	0
		0-0.1		0-0.3					
Enchelyopus cimbrius	18.5	0.5	3.2	0.2	0.1	0.5	0.8	0.1	0.1
	8.6-39	0.02-1.1	0.8-8.8	0-0.7	0-0.4	0-1.2	0-2.5	0-0.4	0-0.3
Urophycis spp.	3.1	0	0.6	0.04	0	0.3	0	0.03	0
	0.9-8		0-1.8	0-0.1		0-0.9		0-0.1	
M. aenaeus	0	0.04	0	0	0	0	0	0	0
		0-0.2							
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0.06	0	0
							0-0.2		
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	1.2	0.2	5.0	1.6	1.3	0.8	0.8	0.2	0.8
	0.3-2.7	0.01-0.5	3.3-7.5	0.4-3.9	0.2-3.6	0.2-1.7	0.01-2.1	0.02-0.5	0.1-1.9
Tautogolabrus adspersus	22.2	15.4	33.6	7.2	2.3	2.5	6.2	2.1	1.0
	11-43	5.9-38	16-69	2.9-16	1.1-4	0.7-6.1	2.7-12.8	0.9-4.0	0.3-2.0
Ulvaria subbifurcata	0.7	0.1	0.4	0.2	0.2	0.2	0.03	0	0
	0-2.4	0-0.4	0-1	0-0.4	0-0.4	0-0.6	0-0.1		
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0.2	0	0.3	0.4	0.1	0.5	0	0	0
	0-0.5		0-0.6	0-1.5	0-0.4	0.1-1.1			
Pseudopleuronectes americanus	0	0	0	0	0	0.04	0.06	0	0
						0-0.1	0-0.2		
Total	70.0		66.5	26.5	6.4	4.8	27.1	11.1	9.0
	45-109		39-112	15-46	3.2-12	1.5-13	11-64.0	6.8-18.0	3.8-20.0

July (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	1.1	6.3	3.1
	0.4-2.0	2.8-13.1	1.5-6.0
Clupea harengus	0	0	0
Enchelyopus cimbrius	3.1	2.6	1.0
	1.2-6.4	0.9-5.6	0.1-2.7
Urophycis spp.	1.4	2.2	0.5
	0.5-2.9	0-9.2	0-1.2
M. aenaeus	0	0	0
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	1.2	5.2	6.1
	0.5-2.3	2.2-11.3	2.9-11.8
Tautogolabrus adspersus	16.5	31	31.1
	6.8-37.9	16.2-58.7	18.4-52.1
Ulvaria subbifurcata	0.04	0	0.3
	0-0.1		0-0.8
Pholis gunnellus	0	0	0
Ammodytes sp.	0	0	0
Scomber scombrus	0.05	0.2	0
	0-0.2	0-0.4	
Pseudopleuronectes americanus	0.04	0	0
	0-0.1		
Total	27.9	185.2	53.6
	12-62.7	86.5-395.1	33.3-85.9

August									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0.1	0.2	0.2	0	0.05	0	0	0.5	0
	0-0.3	0-0.4	0-0.5		0-0.2			0-1.5	
Clupea harengus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	1.7	1.6	5.3	0.6	0.8	0	0	2.1	8.7
	0.6-3.7	0.5-3.6	1.1-18	0-1.5	0.1-1.9			0.3-6.3	3.6-20
Urophycis spp.	1.2	0.5	0.4	0.4	1.4	0	0.05	0.3	3.2
	0.3-2.9	0.1-0.9	0.06-0.9	0-1	0.3-3.8		0-0.2	0-0.9	0.8-9
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0.9	0.06	0.7	1.0	0.6	0.3	0.2	0.4	2.3
	0.3-1.9	0-0.2	0.2-1.5	0-3	0.1-1.2	0.01-0.7	0-0.6	0-0.9	1-4.5
Tautogolabrus adspersus	3.2	2.8	3.5	0.6	3.6	0.2	0	2.4	9.3
	1.6-5.9	1--6.1	1.1-9	0-1.6	1.9-6.4	0-0.4		0.9-5.4	6.4-13
Ulvaria subbifurcata	0	0	0.05	0	0	0	0	0	0
			0-0.2						
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0.04	0	0	0	0	0	0	0
		0-0.1							
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0.05	0	0	0	0	0
				0-0.2					
Total	12.0	7.8	15.0	2.9	10.2	1.2	0.3	6.3	38.5
	6.6-21	4.2-14	5.1-41	0.7-7.6	5.7-18	0.6-1.9	0-0.8	2-17	23-65

August (continued)									
LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.3	0	0.05	0.3	0	0	0.1	7.5	0.7
	0-0.8		0-0.2	0-0.8			0-0.3	1.9-24	0.09-1.6
Clupea harengus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	2.2	1.7	1.0	0.3	2.6	0.9	2.7	1.2	2.2
	0.4-6.2	0.7-32	0.4-1.8	0-0.9	0.6-6.8	0-2.7	0.8-6.5	0.2-3.1	0.8-4.8
Urophycis spp.	1.3	0.6	1.0	0.3	0.7	3.6	3.4	4.0	3.9
	0.4-3	0.06-1.6	0.04-2.7	0-0.7	0.1-1.7	0.2-16	0.7-10.6	1.1-11	1.3-9.5
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	3.4	1.0	0.4	1.6	0.4	2.2	1.9	3.1	0.7
	1.3-7.5	0.4-1.8	0-1.1	0.1-5	0.1-0.9	0.3-6.6	0.6-4.2	0.8-8.5	0.1-1.7
Tautogolabrus adspersus	10.0	9.9	1.1	8.5	4.8	10.2	3.5	34.3	3.3
	2.3-36	5.6-17	0.4-1.9	4.1-17	2-10	3.9-25	1.1-8.8	12-97	1.3-6.9
Ulvaria subbifurcata	0	0	0.05	0	0	0.2	0	0	0
			0-0.2			0-0.7			
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0.1	0	0	0
						0-0.3			
Scomber scombrus	0.1	0	0.08	0	0	0.2	0	0	0
	0-0.3		0-0.3			0-1			
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	26.7	18.5	5.2	13.1	9.4	31.6	22.4	89.2	20.9
	10-67	14-25	2.7-9.4	5.7-28	3.4-23	13-77	11-43	45-175	9.7-44

August (continued)

LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0.9 0.3-1.8	0.1 0-0.3	0.2 0-0.5	1.5 0.1-4.6	0.4 0-1	0	0.3 0-0.9	2.1 0.2-7.4	0.35 0-0.8
Clupea harengus	0	0	0	0.04 0-0.1	0	0	0.09 0-0.3	0	0
Enchelyopus cimbrius	1.6 0.4-3.7	0.4 0-1	2.7 0.7-7	0.6 0.04-1.5	0	0.5 0-1.4	1.4 0.4-3.4	0.4 0-1.2	0.3 0-0.7
Urophycis spp.	0.7 0.08-1.6	0.3 0-0.6	1.7 0.9-2.8	0.1 0-0.4	0.2 0-0.7	0	0.5 0.03-1.1	0.4 0-1.1	0.6 0.1-1.3
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	1.0 0.3-2	0.8 0.3-1.5	1.5 0.4-3.3	0.1 0-0.3	0.2 0-0.5	1.5 0.5-3.3	0.7 0.2-1.6	0.5 0-1.5	0.5 0.1-1.1
Tautogolabrus adspersus	1.3 0.5-2.7	2.3 0.8-5.3	4.8 1.8-11	0.6 0-1.8	0.3 0-0.7	2.6 0.8-6.3	0.8 0.2-1.5	1.1 0.1-3.1	3.0 1.5-5.2
Ulvaria subbifurcata	0	0	0	0.04 0-0.1	0	0.1 0-0.3	0	0	0
Pholis gunnellus	0	0	0	0.09 0-0.3	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0.01 0-0.2	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0.1 0-0.2	0.03 0-0.1	0	0
Total	10.8 5.3-21		17.6 9.8-31	6.2 2.8-13	1.9 0.8-3.7	9.1 4.6-17	6.1 2.8-12.3	6.9 2.1-18.9	6.8 3.6-12.1

August (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	23.5 5.0-99.9	2.2 0.6-5.2	0.4 0-0.9
Clupea harengus	0	0	0
Enchelyopus cimbrius	0.7 0.1-1.6	4.9 1.6-12.2	1.7 0.4-4.2
Urophycis spp.	4.8 0.6-20.6	3.7 1.5	1.8 0.5-4.0
M. aenaeus	0	0	0
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	4.8 1.0-15.9	17.4 10.2-29.2	1.3 0.5-2.7
Tautogolabrus adspersus	6.5 1.6-20.8	8.1 3.9-15.9	5.0 1.4-14.2
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	0	0	0
Ammodytes sp.	0	0	0
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0.04 0-0.1
Total	50.1 11.1-216	69.0 40.9-115.8	19.0 7.9-44.4

September									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0.04 0-0.2	1.7 0.7-3.5	0	0	0	0.1 0.01-0.3	0	0.1 0-0.3	0
Clupea harengus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	0.5 0.09-1.1	1.6 0.5-3.3	6.0 2-15	3.0 1.6-5.3	3.1 1.5-5.7	0.3 0.03-0.6	1.6 0.8-2.8	1.7 0.3-4.5	2.1 1.1-3.6
Urophycis spp.	2.0 0.3-5.7	1.9 0.4-4.7	4.5 2.4-8	12.3 3.9-35	10.9 3.6-30	0.2 0-0.5	0.3 0.03-0.7	0.4 0.1-0.9	1.3 0.5-2.5
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0.07 0-0.3	0	1.0 0.5-1.5	0.8 0.2-1.8	1.4 0.2-3.6	0.2 0-0.5	0.2 0-0.5	0.04 0-0.1	0.7 0.3-1.3
Tautogolabrus adspersus	0.1 0-0.3	0.2 0-0.4	0.2 0-0.5	0.2 0-0.4	0.4 0.1-0.8	0.04 0-0.1	0.3 0.04-0.5	0.06 0-0.2	0.5 0.1-0.9
Ulvaria subbifurcata	0	0.04 0-0.1	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	5.3 2.1-12	8.3 3.9-17	19.6 11-34	27.3 12-61	21.5 9-48	2.3 1-4.4	3.9 2.1-6.7	3.4 1.4-7.2	8.8 7-11

September (continued)

LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.2	0	0	7.7	0.2	0	0.6	1.9	0.4
	0-0.5			3.9-15	0-0.7		0-1.7	0.7-3.8	0.04-0.9
Clupea harengus	0	0	0	0	0	0	0	0	0
Enchelyopus cimbrius	1.0	1.6	1.7	3.2	0.9	0.2	0.5	2.7	1.7
	0-3.3	0.4-3.7	0.6-3.8	1-7.8	0-3.1	0-0.4	0.04-1	1.2-5.3	0.6-3.4
Urophycis spp.	0.9	1.7	1.0	4.3	7.8	3.6	2.6	24.3	7.2
	0.01-2.5	0.6-3.8	0.1-2.7	2.5-7.1	2.5-21	1-10	0.6-7.5	7.8-72	1.6-25
M. aenaeus	0	0	0	0	0	0	0	0	0
M..octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0.1	1.7	0.3	1.1	0.5	0.05	1.2	0.4	1.6
	0-0.4	0.4-4.1	0-0.6	0.5-1.9	0-1.6	0-0.2	0.2-2.9	0-9	0.5-3.5
Tautogolabrus adspersus	0.5	2.8	0.3	3.2	0.5	0.4	1.2	0.3	0.5
	0-1.3	0.6-7.8	0-0.9	1.3-6.8	0-1.3	0-1.2	0.2-2.9	0-0.9	0.02-1.1
Ulvaria subbifurcata	0	0	0	0.03	0	0	0	0	0
				0-0.1					
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	4.2	10.5	4.1	28.3	15.2	9.1	7.2	48.4	18.7
	1.3-11	4-25	1.4-9.9	17-47	6.6-33	3.8-20	2.1-20	24-95	5.8-56

September (continued)									
LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	9.0	0.08	0.04	0.3	0.6	0.1	0	1.0	0.2
	3.3-22	0-0.2	0-0.2	0-0.7	0-1.7	0-0.3		0.2-2.4	0-0.4
Clupea harengus	0	0	0	0	0.04	0	0	0	0
					0-0.1				
Enchelyopus cimbrius	1.2	0	0.6	0.1	0.05	0	0.09	0.6	0.6
	0.1-3.3		0.09-1.5	0-0.3	0-0.2		0-0.3	0-1.4	0-2.1
Urophycis spp.	1.2	0.4	0.2	0.04	0.07	0	0	0.2	0.5
	0-3.9	0-0.5-0.8	0-0.4	0-0.1	0-0.2			0-0.5	0-1.1
M. aenaeus	0	0	0	0	0	0	0.1	0	0
							0-0.3		
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	1.4	1.4	0.3	0	0.5	1.2	0.9	0.3	0.7
	0.5-2.8	0.5-2.8	0-0.9		0.1-1.1	0.3-2.9	0.3-1.8	0-0.9	0.1-1.7
Tautogolabrus adspersus	0.1	0.1	0.6	0.04	0.5	0.1	0.2	0.1	0.1
	0-0.3	0.0.3	0.03-1.4	0-0.1	0.04-1.3	0-0.2	0-0.6	0-0.3	0-0.3
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	22.1		2.5	0.8	3.1	1.7	2.1	3.7	9.5
	9.6-50		0.9-5.7	0.3-1.5	1.2-6.8	0.5-3.7	0.8-4.5	1.4-8.3	4.0-20.9

September (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	1.8 0.2-4.9	1.6 0.2-4.4	1.3 0.3-3.3
Clupea harengus	0	0	0
Enchelyopus cimbrius	0.3 0.1-0.6	0.2 0-.5	0.6 0.1-1.2
Urophycis spp.	0.5 0-1.3	1.1 0.2-2.7	0.9 0.2-2.0
M. aenaeus	0	0	0.05 0-0.2
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	0.7 0.2-1.6	0.9 0.1-2.5	2.8 1.2-5.7
Tautogolabrus adspersus	0.1 0-0.4	0.1 0-0.3	0.3 0-0.8
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	0	0	0
Ammodytes sp.	0	0	0
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0
Total	11.0 4.1-27.4	9.0 3.7-20.4	10.4 4.6-22.5

October									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0.4 0-1.1	0	0	0.4 0-1.4	0.1 0-0.4	0.2 0-0.5	0	0
Clupea harengus	0	0	0	0	0	0.3 0-0.8	0.05 0-0.2	0	0
Enchelyopus cimbrius	0.8 0-2.5	0	0.3 0-0.8	0.06 0-0.2	6.2 2.3-15	0	1.3 0.4-2.8	0.6 0-2	6.7 3.3-13
Urophycis spp.	1.5 0.01-5.2	1.1 0-4	0	0.4 0-1.2	4.3 0.5-18	0.1 0-0.4	0.2 0-0.4	0	1.1 0.01-3.3
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0.2 0-0.5	0	0	0	0	0.2 0-0.6	0	0
Tautogolabrus adspersus	0	0.07 0-0.3	0	0	0	0	0.06 0-0.2	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	2.1 0-8.6	1.7 0.07-5.9	0.9 0.2-1.9	0.9 0.1-2.2	11.9 3.7-34	0.5 0-1.7	3.2 1.6-5.9	0.9 0-2.6	9.9 4.9-19

October (continued)

LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	1.2	0	0	2.0	0.7	5.2	2.0	13.2	0.5
	0.1-3.5			0-8	0-1.8	0.4-26	0.1-7.1	1.2-89	0-1.6
Clupea harengus	0	0	0.1	0	0	0	0	0.6	0
			0-0.5					0-3.5	
Enchelyopus cimbrius	6.1	0.3	2.1	0.4	6.3	0.1	0.6	1.4	0
	1.4-20	0-1	0.9-3.9	0-1.4	0-54	0-0.4	0-1.7	0-6.6	
Urophycis spp.	1.5	0	0.3	0.4	2.1	0.9	0.8	2.5	0
	0.2-4		0-1.2	0-1.4	0-9.2	0-3	0-2.4	0.4-8.1	
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0.2	0.1	0.1	0	0.2	0.6	0
			0-0.9	0-0.4	0-0.4		0-0.7	0-1.6	
Tautogolabrus adspersus	0	0	0	0.1	0	0.1	0	0	0
				0-0.4		0-0.4			
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	11.6	0.3	3.4	2.8	10.8	13.0	4.1	34.0	2.0
	4.9-26	0-1	1.7-6.1	0.2-11	0.7-79	5.4-30	0.6-15	11-104	0.03-7.8

October (continued)									
LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	4.7 0.8-17	0	0	0	0	0	0	0.2 0-0.7	0
Clupea harengus	0	0.5 0-1.4	0	0	0	0.1 0-0.3	0.07 0-0.2	0.3 0-1.3	0
Enchelyopus cimbrius	1.0 0-5.2	0	1.1 0-3.8	0	0.04 0-0.1	0.1 0-0.3	0	0.3 0-0.7	0.1 0-0.3
Urophycis spp.	0.4 0-1.7	0.6 0-1.8	0	0	0	0	0	0	0.04 0-0.1
M. aenaeus	0	0	0	0	0	0	0	0	
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0.1 0-0.5	0	0	0	0.3 0-1.2	0.1 0-0.6	0	0.2 0-0.9	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0.1 0-0.4
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	13.9 7.3-26		4.1 1-12	0.06 0-0.2	0.4 0-1.3	1.0 0-3.2	0.1 0-0.2	1.5 0.1-4.5	0.8 0.2-1.9

October (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	0	0.3 0-0.6	0.5 0-1.7
Clupea harengus	0.2 0-0.7	0	0
Enchelyopus cimbrius	0.3 0-0.6	0	0.2 0-0.6
Urophycis spp.	0	0.2 0-0.5	0.1 0-0.2
M. aenaeus	0	0	0
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	0	0	0.1 0-0.3
Tautogolabrus adspersus	0	0	0.1 0-0.2
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	0	0	0
Ammodytes sp.	0	0	0
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0
Total	1.2 0.4-2.7	0.7 0.1-1.7	2.1 0.3-6.1

November									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0	0.5 0.04-1	0	2.1 0.7-5	0	0.4 0-1.1	0	0
Clupea harengus	0	0	0	0.2 0-0.8	0	0.5 0-1.7	0.8 0-2.9	0	0.4 0-1.2
Enchelyopus cimbrius	0.2 0-1.7	0	0.09 0-0.4	0	0.1 0-0.4	0	0.3 0-0.8	0	0.6 0-1.6
Urophycis spp.	0.2 0-1.7	0	0	0	0.2 0-0.7	0	0	0	0.09 0-0.4
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	0.4 0-4	0	0.7 0-2	0.5 0.05-1.3	2.5 0.6-6.5	0.5 0-1.7	2.4 0.8-5.6	0	1.3 0.8-1.9

November (continued)

LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0.7 0-2.2	0.3 0-1.5	0.2 0-0.9	0.5 0.07-1.1	0	0	0	0	0.5 0-1.2
Clupea harengus	4.6 1.3-13	0	0	0	11.4 1.4-64	15.3 1.3-117	2.8 0.6-8.1	12.5 1.6-69	1.5 0-5.8
Enchelyopus cimbrius	0.4 0-0.9	0	0	0.1 0-0.6	0.08 0-0.3	0.1 0-0.5	0.2 0-0.5	0.1 0-0.5	0.2 0-0.6
Urophycis spp.	0.2 0-0.8	0	0	0	0.06 0-0.2	0	0	0	0.6 0-1.7
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0.1 0-0.5	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	5.3 1.2-17	0.6 0-23	0.2 0-1	0.7 0.04-1.8	11.5 1.4-65	16.9 1.7-118	3.0 0.6-8.8	14.2 2.7-61	5.3 1.9-13

November (continued)

LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	1.1	0	0.8	0.09	0.1	0	0	0	0.1
	0-4.6		0-2.5	0-0.4	0-0.5				0-0.3
Clupea harengus	3.7	4.7	0.4	0.3	0	0.5	0.7	0.5	0
	0.4-15	0-31	0-2.1	0-1.6		0-1.2	0-4.4	0-1.6	
Enchelyopus cimbrius	0.1	0	0.2	0	0	0	0	0.1	0
	0-0.4		0-0.5					0-0.2	
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0	0	0
Ammodytes sp.	0	0	0	0	0	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0.06	0	0	0	0	0
				0-0.2					
Total	6.6		2.2	0.5	0.5	0.5	0.7	0.8	0.1
	2-19		0.5-6	0-1.9	0.1-1.2	0-1.4	0-4.4	0-2.3	0-0.3

November (continued)

LARVAE	2008	2009	2010
Brevoortia tyrannus	0.1 0-0.3	0	0
Clupea harengus	0.2 0-0.7	0.6 0-1.7	1.4 0-6.4
Enchelyopus cimbrius	0.1 0-0.4	0	0.3 0-0.8
Urophycis spp.	0	0	0
M. aenaeus	0	0	0
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	0	0	0
Tautogolabrus adspersus	0	0	0
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	0	0	0
Ammodytes sp.	0	0	0.1 0-0.3
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0
Total	0.6 0-1.7	0.6 0-1.8	2.1 0.1-8.0

December									
LARVAE	1981	1982	1983	1984	1985	1986	1987	1988	1989
Brevoortia tyrannus	0	0.2 0-0.5	0	0	0	0	0	0	0
Clupea harengus	0.2 0-0.6	0	1.9 0-8.8	0	1.0 0.02-3.1	0.1 0-0.4	4.6 1.1-14	0.1 0-0.4	0.1 0-0.4
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0	0	0	0.1 0-0.4	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0	0	0	0	0.1 0-0.4	0	0
Ammodytes sp.	0	2.1 0-9.3	0.1 0-0.6	0	0.1 0-0.4	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	0.2 0-0.6	2.8 0.2-11	2.3 0.08-9.1	0.2 0-0.6	1.8 0.3-5.4	0.1 0-0.4	4.9 1.4-14	0.1 0-0.4	0.1 0-0.4

December (continued)									
LARVAE	1990	1991	1992	1993	1994	1995	1996	1997	1998
Brevoortia tyrannus	0	0	0	0	0	0	0	0.5 0-1.4	0
Clupea harengus	1.2 0.8-1.6	1.0 0-4	1.3 0.3-2.9	0	1.2 0-5.5	13.3 1.9-70	0.6 0.02-1.5	9.9 1.3-51	2.0 0.5-4.9
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0	0	0	0	0	0	0	0	0
M. aenaeus	0	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0.09 0-0.4	0	0.04 0-0.1	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0	0	0.3 0-1	0	0	0	0	0	0.05 0-0.2
Ammodytes sp.	0	0	0.2 0-1.1	0	0	0	0.04 0-0.1	0	0.4 0-1.4
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	1.2 0.8-1.6	1.0 0-4	2.0 0.5-4.9	0.2 0-0.7	1.5 0-6	13.3 1.9-70	0.6 0.02-1.6	10.5 1.4-55	3.4 1.3-7.3

December (continued)									
LARVAE	1999	2000	2001	2002	2003	2004	2005	2006	2007
Brevoortia tyrannus	0	0	0	0	0	0	0	0	0
Clupea harengus	3.2 0.4-12	0.5 0-3	1.0 0-2.9	0	0.5 0.04-1.1	1.6 0.3-4.3	0.6 0-2.1	1.1 0.2-2.5	0.2 0-1.0
Enchelyopus cimbrius	0	0	0	0	0	0	0	0	0
Urophycis spp.	0.1 0-0.5	0	0	0	0	0	0	0	0
M. aenaeus	0.2 0-1	0	0	0	0	0	0	0	0
M. octodecemspinosus	0	0	0	0	0	0	0.1 0-0.4	0	0
M. scorpius	0	0	0	0	0	0	0	0	0
L. atlanticus	0	0	0	0	0	0	0	0	0
L. coheni	0	0	0	0	0	0	0	0	0
Tautoga onitis	0	0	0	0	0	0	0	0	0
Tautogolabrus adspersus	0	0	0	0	0	0	0	0	0
Ulvaria subbifurcata	0	0	0	0	0	0	0	0	0
Pholis gunnellus	0.2 0-0.6	0	0.2 0-3.7	0	0	0	0.1 0-0.2	0.1 0-0.2	0
Ammodytes sp.	0.2 0-1.2	0	0	0	0.4 0-1.5	0	0	0	0
Scomber scombrus	0	0	0	0	0	0	0	0	0
Pseudopleuronectes americanus	0	0	0	0	0	0	0	0	0
Total	4.8 1.1-15		1.1 0-3.7	0	0.8 0-2.3	1.7 0.3-4.4	0.9 0-2.7	1.2 0.3-2.8	0.4 0-1.5

December (continued)			
LARVAE	2008	2009	2010
Brevoortia tyrannus	0	0	0
Clupea harengus	0.2 0-0.6	0.5 0-1.5	1.4 0-5.9
Enchelyopus cimbrius	0	0	0
Urophycis spp.	0	0	0
M. aenaeus	0	0	0
M. octodecemspinosus	0	0	0
M. scorpius	0	0	0
L. atlanticus	0	0	0
L. coheni	0	0	0
Tautoga onitis	0	0	0
Tautogolabrus adspersus	0	0	0
Ulvaria subbifurcata	0	0	0
Pholis gunnellus	0	0	0
Ammodytes sp.	0.2 0-0.9	0.1 0-0.3	0
Scomber scombrus	0	0	0
Pseudopleuronectes americanus	0	0	0
Total	0.5 0-1.7	0.7 0-1.9	1.4 0-5.9