FISHERIES DATA REPORT

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1.0 INTRODUCTION

The waters of Nantucket Sound support a diverse fish community. Both commercial and recreational fishing are conducted in the Sound. During the summer months, a temperature gradient forms off the east coast of Cape Cod that demarcates the cold-water fishes to the north and warmer water fishes to the south. This gradient, however, is variable and will oscillate north and south along a 20-40 mile section of the Cape Cod Coast. Due to its geographic location and the temperature gradient observed along Cape Cod, Nantucket Sound serves as a migratory pathway for many warm water species that pass through the Sound moving into Cape Cod Bay and Massachusetts Bay. The area also serves as a northern border for several summer migrants including scup, northern fluke and black sea bass.

Both federal and state agencies monitor fishery resources within Nantucket Sound. The National Marine Fisheries Service (NMFS) monitors commercial and recreational fishing activities in all coastal states throughout the U.S. The Commonwealth of Massachusetts also monitors the fishery resources in its coastal waters. For the purposes of this report, fisheries information was gathered from several different sources to better characterize the fishery resources in Nantucket Sound. Commercial landings reported by fishermen to NMFS are presented in Section 2.0 for finfish, shellfish and lobster. Commercial information monitored by the Massachusetts Division of Marine Fisheries (MDMF) is presented in Section 3.0 for various fisheries including the fish weir fishery, gill net and fish pot fisheries. Recreational fishery information from the NMFS Marine Recreational Fisheries Statistical Surveys is presented in Section 4.0. Section 5.0 presents results from the MDMF independent fisheries monitoring program. MDMF conducts bi-annual research trawls for all coastal waters including Nantucket Sound and the information gathered is independent of commercial fisheries monitoring. Data from those trawls located in the vicinity of the Proposed and alternative wind farm locations are discussed in detail in Section 5.0. A likelihood-of-occurrence analysis using the MDMF research trawl data is presented in Section 6.0.

2.0 NMFS COMMERCIAL LANDINGS DATA

Data on commercial fisheries have long been collected by the National Marine Fisheries Service (NMFS). In the Northeast prior to 1994, fishery statistics were collected through a voluntary reporting system. Fish landings and price information were collected by NMFS port agents at the point of initial sale of the catch through dealer reports or “weigh out receipts”. This voluntary “weigh out” reporting was replaced in June 1994 with a mandatory reporting system. The mandatory reporting system continues today and involves fishermen submitting logbooks of their catch. NMFS refers to these data as vessel trip reports. The system is used in all fisheries that are subject to federal fishery management plans except for American lobster and Atlantic herring fisheries.

Commercial landings data for the Nantucket Sound region were received from NMFS from 1990 through 2001. The data from 1990 through 1993 are from weigh out reports and those from 1994 through 2001 are from vessel trip reports. For the purposes of this report weigh out data from 1990 through 1993 have not been directly compared to the vessel trip report data from 1994 through 2001 because the data were collected using different methods (dealer weigh out versus fishermen logbook). Additionally, the 1990 to 1993 data represent a larger sampling area than the 1994 through 2001 data. For reporting purposes, NMFS divides the coast of the U.S. into statistical sampling areas and sub-areas. Nantucket Sound is located in statistical area 538. Statistical area 538 also includes Buzzards Bay and the New Bedford region. Statistical area 538 is subdivided into several sub-areas. The sub-area directly relevant to Nantucket Sound is Area 075. The 1990 through 1993 data are from statistical area 538 whereas the 1994 through 2001 data are from sub-area 075. A map depicting NMFS statistical area 075 is included in Attachment A.

Over the four-year period from 1990 through 1993, total commercial landings in statistical area 538 ranged from a high of 335 million pounds in 1990 to a low of 258 million pounds in 1992 (Figure 1a). The dollar value of these landings increased from 1990 to 1993 from $400 million to $458 million (Figure 1b).

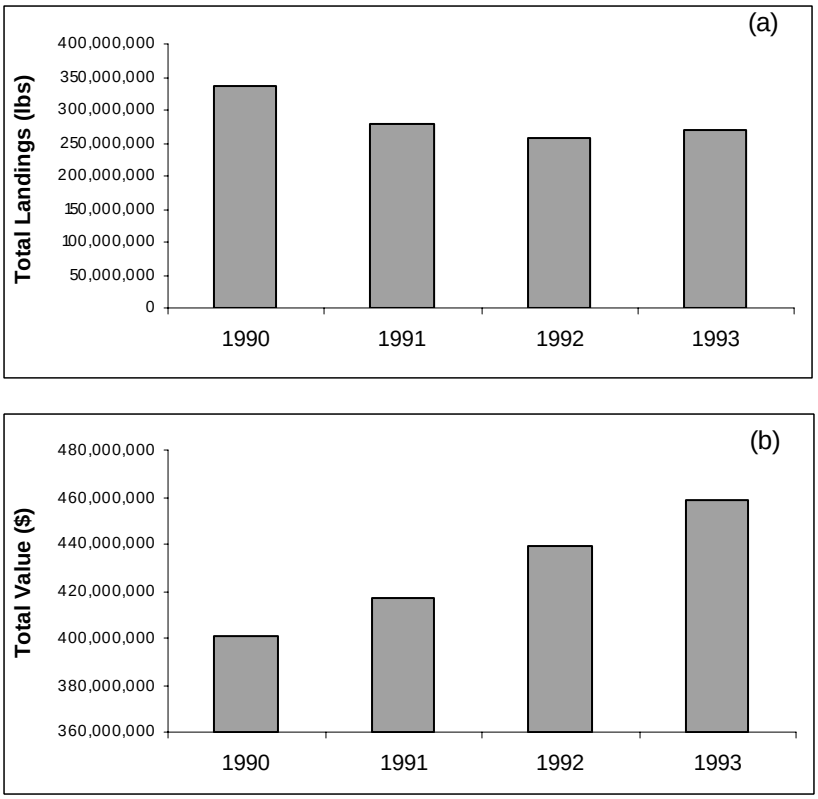


Figure 1. (a) Total commercial landings from 1990 through 1993 as reported from dealer weigh outs for NMFS statistical area 538. (b) Total value of commercial catch from 1990 through 1993 as reported from dealer weigh outs from NMFS statistical area 538 (Source: NMFS Weigh Out Data, Area 538)

For Nantucket Sound (sub-area 075), total landings appear to have increased from 1994 through 2000, with a subsequent decrease in 2001 (Figure 2). It is important to note, however, that this trend may simply be an artifact of the mandatory reporting requirements that began in 1994 for the vessel trip reports. As the reporting system became more common, the accuracy with which the fishermen reported and are continuing to report their catches may have improved. Vessel trip report data are presented annually by month and species in Tables 1 through 8 in Attachment A.

2.1 Finfish Landings

The commercial data presented in Figures 1 and 2 include all finfish species, shellfish species, lobster and other invertebrates such as squid, shrimp and crabs. Figures 3a and 3b present the total landings for finfish species only in statistical area 538 and sub-area 075, respectively. Squid (both *Loligo* and *Illex*) are important commercial fisheries in this region and are included in the finfish landings.

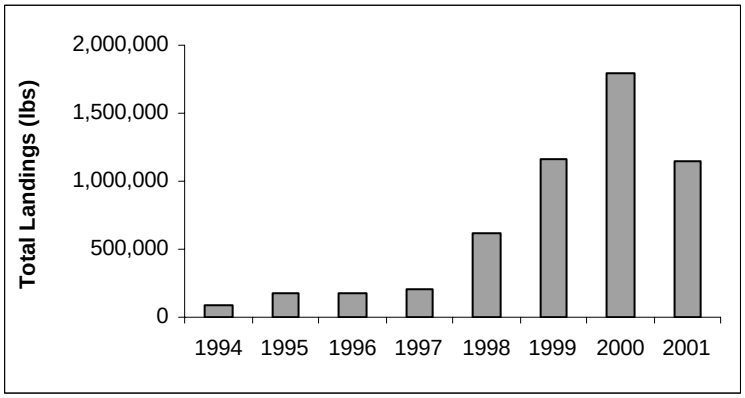


Figure 2. Total commercial landings from 1994 through 2001 as reported from vessel trip reports for NMFS statistical sub-area 075 (Source: NMFS Vessel Trip Report Data, Sub-area 075)

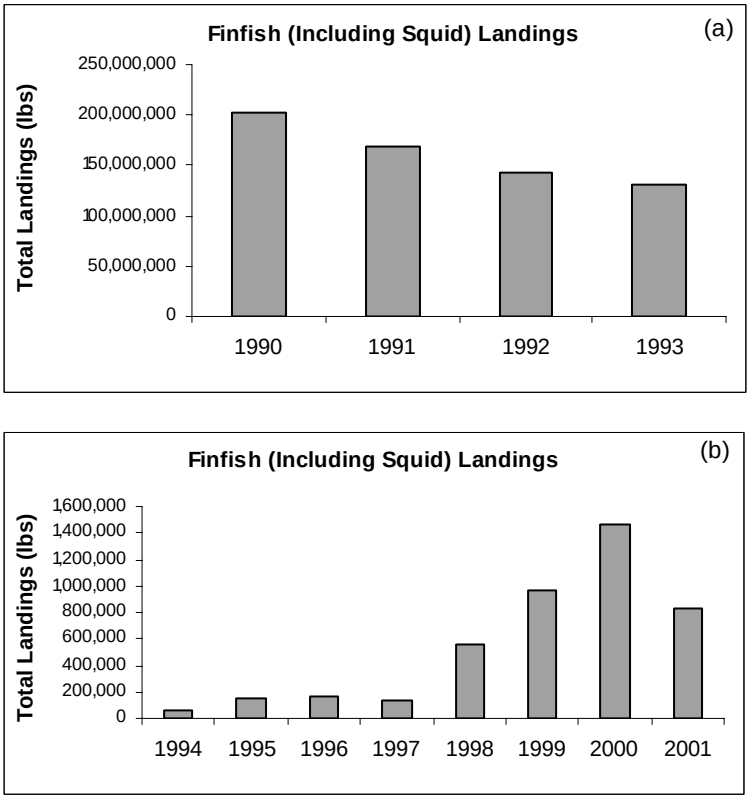


Figure 3. (a) Total finfish landings from 1990 through 1993 for NMFS statistical area 538. (b) Total finfish landings from 1994 through 2001 for NMFS statistical sub-area 075 (Source: NMFS Weigh Out Data for Area 538 and Vessel Trip Report Data for Sub-area 075)

In general, both the 1990 through 1993 finfish landings and the 1994 through 2001 finfish landings parallel the total commercial landings. Finfish landings from 1990 through 1993 totaled approximately 644 million pounds, or 56% of the total landings for statistical area 538. The largest landings of finfish occur in 1990. Approximately 201 million pounds of finfish were harvested from the region in 1990, which is 60% of the total landings for that year. The lowest finfish landings were reported in 1993 with approximately 131 million pounds harvested, or 49% of the total landings for 1993.

For Nantucket Sound (sub-area 075), vessel trip report data suggest that approximately 4.3 million pounds of finfish were harvested from 1994 through 2001. Eighty percent of the total landings reported by the fishermen were from commercial finfish species. Similar to the overall total landings for sub-area 075, finfish landings appear highest in 2000 (1.4 million pounds) and lowest in 1994 (63 thousand pounds). Again, it is important to note that mandatory reporting by the fishermen began in 1994 and the steady increase in the total finfish species harvested, may be a function of better reporting practices through time.

Gear types used to harvest finfish species include otter trawls, gill nets, pound nets, seines, various types of pots/traps as well as hand lines. Finfish landings reported for the specific gear types are presented in Table 1 for the period 1990 through 1993 for Area 538 and the period from 1994 through 2001 for sub-area 075, Nantucket Sound. For both areas (538 and 075), the greatest landings were from otter trawls (approximately 343 million pounds and 2.1 million pounds, respectively). Hand lines and fish pot/traps also harvested significant catches for Area 538. In Nantucket Sound (sub-area 075) fish weirs and fish pots harvested a large fraction of the total finfish.

Table 1. Finfish landings by gear type for weigh out data (NMFS statistical area 538) and vessel trip report data (NMFS statistical sub-area 075)

1990-1993 Weigh Out Data Gear Types Reported	Finfish Landings (lbs) Statistical area 538	1994-2001 Vessel Trip Report Data Gear Types Reported	Finfish Landings (lbs) Statistical sub-area 075
Otter trawl, bottom - fish	342,981,834	Otter trawl, fish	2,147,199
Handline	104,686,868	Fish Weir	930,942
Fish pots/traps	67,356,796	Fish pot	509,321
Otter trawl, midwater paired	52,781,040	Hand line/rod & reel	381,618
other pound net	48,725,118	Fish Trap	233,512
Bottom longline	10,385,726	Otter trawl , beam	36,345
Other troll line	7,328,074	Scottish Seine	27,390
Gill net	2,586,532	Otter trawl, shrimp	21,319
Fish pound net	1,616,186	Other pots	11,227
Dip net	1,440,400	Conch pot	7,077
Eel pots/traps	1,363,102	Crab pot	3,993
Pelagic longline	860,080	Lobster pot	2,533
Beach/haul seine	722,800	Mixed pots	1,056
other rakes	572,000	Otter trawl, scallop	549
Spears	472,160	Other gear	299
Sea scallop dredge	138,398		
Conch pots/traps	77,428		
Handline, auto jig	4,160		

Source: NMFS Weigh Out Data for Area 538 and Vessel Trip Report Data for Sub-area 075.

The finfish species harvested in any given year in statistical area 538 and sub-area 075 were similar; however, the total numbers of any given species harvested did not vary by year. In the larger statistical area 538, the top species harvested from 1990 through 1993 included *Loligo* squid, scup, summer flounder, winter flounder, Atlantic mackerel, tautog, various skates, bluefish, black sea bass and spiny dogfish. Striped bass landings from 1990 through 1993 were very similar to those of spiny dogfish (Figure 4a). For Nantucket Sound (i.e., statistical subarea 075), the top species harvested from 1994 through 2001 included *Loligo* squid, Atlantic mackerel, black sea bass, summer flounder, scup, unidentified squid species, *Illex* squid, menhaden, butterfish, tautog, winter flounder and bluefish (Figure 4b).

In both Area 538 and sub-area 075, *Loligo* squid were the top species landed. Landings of *Loligo* squid from 1990 through 1993 were approximately 233 million pounds in Area 538. Landings from 1994 through 2001 in Nantucket Sound (sub-area 075) totaled approximately 1.6 million pounds. *Illex* squid and unspecified species of

squid ranked among the top species in sub-area 075, but were not among the top species in area 538. Total landings of *Illex* squid in area 538 from 1990 through 1993 were reported at approximately 22 thousand pounds. Unspecified squid species were reported at approximately 706 thousand pounds.

Menhaden and butterfish also ranked as top species in Nantucket Sound (sub-area 075). Although not ranked within the top ten species of the larger statistical area 538, butterfish landings were approximately 1.9 million pounds from 1990 through 1993 in sub-area 075. Menhaden, however, was not reported during 1990 through 1993. Annual trends for individual species harvested in Nantucket Sound (sub-area 075) from 1994 through 2001are presented in Attachment A.

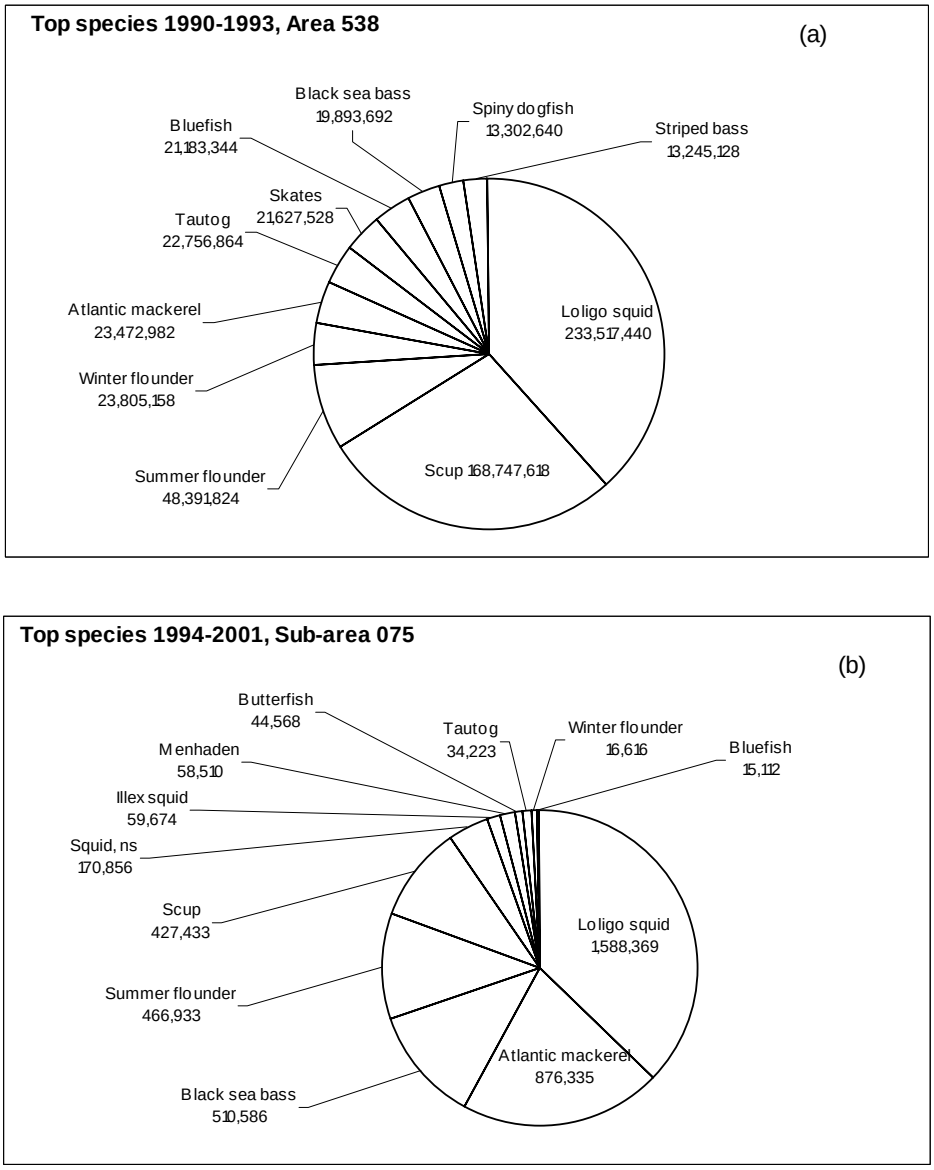


Figure 4. (a) Top finfish species from 1990 through 1993 for NMFS statistical area 538. (b) Top finfish species from 1994 through 2001 for NMFS statistical sub-area 075 (Source: NMFS Weigh Out Data for Area 538 and Vessel Trip Report Data for Sub-area 075)

2.2 Lobster Landings

Nantucket Sound does not appear to support a major lobster fishery. Lobster landings in Area 538 constituted 7.5% of the total commercial landings from 1990 through 1993. For Nantucket Sound (sub-area 075), lobster

landings constituted less than 0.5 % of the total commercial landings from 1994 through 2001. Figure 5 presents the lobster landings by year for statistical area 538 (Figure 5a) and sub-area 075 (Figure 5b).

Within area 538, total lobster landings ranged from 21 million pounds in 1990 to 25 million pounds in 1991 (Figure 5). In 1992, the lowest landings were observed (approximately 14 million pounds) but landings increased to greater than 23 million pounds in 1993. Vessel trip report data from Nantucket Sound (sub-area 075), suggested very low lobster landings in 1995 and 1996 (35 and 27 pounds, respectively). The highest landings were observed in 1998, 1007 pounds, or 34% of the lobster landings in Nantucket Sound (sub-area 075) over the 1994 through 2001 time period.

The most common gear type used by commercial fishermen to harvest lobster is the lobster pot/trap. (Table 2) Ninety-seven percent (approximately 83 million pounds) of the lobster landings from Area 538 were harvested using lobster pots/traps. Otter trawls harvested approximately 2.9% of the lobster from area 538. From Nantucket Sound (sub-area 075), 78% of the lobster landings were from lobster pots, 4% were from fish pots, and 12% were from mixed pots (most likely lobster, fish, conch or crab pots). Six percent of the lobster landings were reported from otter trawls in Nantucket Sound.

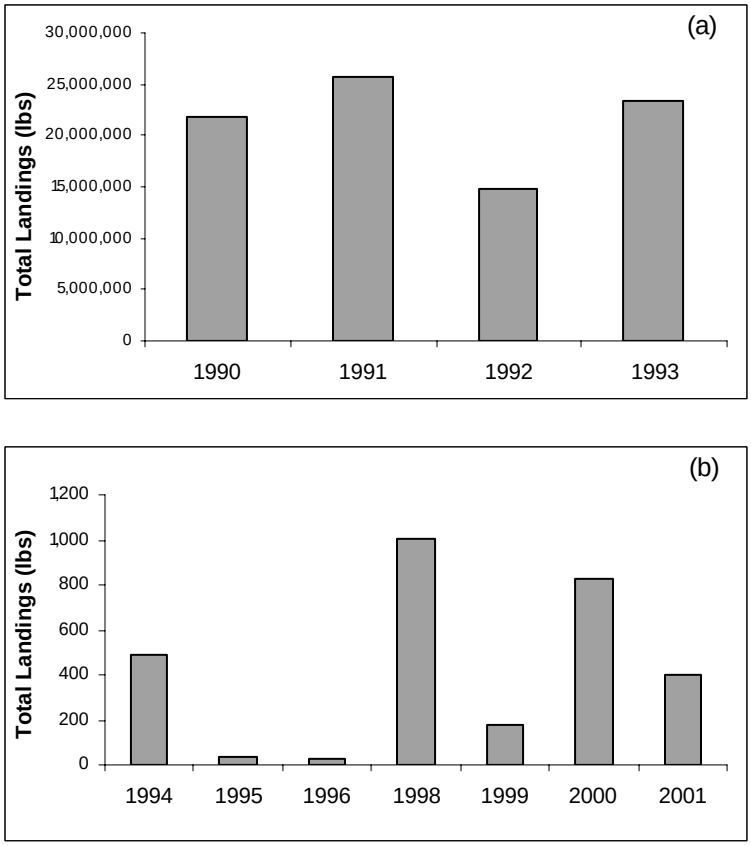


Figure 5. (a) Total lobster landings from 1990 through 1993 for NMFS statistical area 538. (b) Total lobster landings from 1994 through 2001 for NMFS statistical sub-area 075 (Source: NMFS Weigh Out Data for Area 538 and Vessel Trip Report Data for Sub-area 075)

Table 2. Gear type used for harvesting of lobster from NMFS statistical area 538 from 1990 through 1993 and sub-area 075 from 1994 through 2001.

Gear Type	Area 538 Total Lobster Landings (lbs)	Gear Type	Sub-area 075 Total Lobster Landings (lbs)
Lobster pot/trap	83,218,174	Lobster pot	2322
Otter trawl, bottom - fish	2,528,422	Mixed pots	364
Sea scallop dredge	4,368	Otter trawl, bottom - fish	175
		Fish pot	106

Source: NMFS Weigh Out Data for Area 538 and Vessel Trip Report Data for Sub-area 075

2.3 Shellfish Landings

Shellfish reported by NMFS are represented by several species including mussels, quahogs, scallops, clams, and conch. Conch is the generic classification for the various whelks found in the Southern New England waters, including the knobbed whelk, channeled whelk, and lightning whelk. Shellfish landings for Area 538 totaled approximately 413 million pounds from 1990 through 1993. Total shellfish landings ranged from 85.9 million pounds in 1991 to 114 million pounds in 1993 (Figure 6a). Approximately 1 million pounds of shellfish were harvested from Nantucket Sound (sub-area 075) from 1994 through 2001. The lowest shellfish landings (approximately 10 thousand pounds) were reported in 1996 while the highest shellfish landings for Nantucket Sound were reported in 2000 (approximately 327 thousand pounds; Figure 6b).

For statistical area 538, mussels, conch and quahog were the predominant species harvested (Figure 7). In 1990, 1991, and 1992 mussels constituted 39%, 28%, and 17% of the total shellfish harvest, respectively. The various species of conch comprised 31%, 26% and 40% of the landings for 1990 through 1992 and quahog landings were16%, 26% and 20% of the total catch. In 1993, ocean quahog was the most common shellfish, constituting 34% of the total shellfish catch. General “quahog” represented 22% of the total landings and the various conch species made up 17% of the total catch.

For Nantucket Sound (sub-area 075), the various conch species constituted more than 90% of the total shellfish landings in any given year from 1994 through 2001 (Table 3). In 1999 and 2001 small landings of clams, quahogs and sea scallops were reported in addition to the conch species.

The most common gear type for harvesting shellfish from statistical area 538 and sub-area 075 was conch pots/traps (Table 4). Sixty-eight percent of the shellfish landings in Nantucket Sound (sub-area 075) were harvested from conch pots/traps. Shellfish were also harvested from fish pots/traps (17%), otter trawls (10%), quahog/clam dredge (3%) and crab pots (1.6%). In Area 538, shellfish landings from conch pots/traps comprised approximately 29% of the total shellfish landings. Shellfish harvested from rakes, quahog/clam dredges, mussel dredge, scallop dredge, hand gear, and otter trawls comprised approximately 25%, 18%, 16%, 6%, 3% and 1% of the total shellfish landings, respectively.

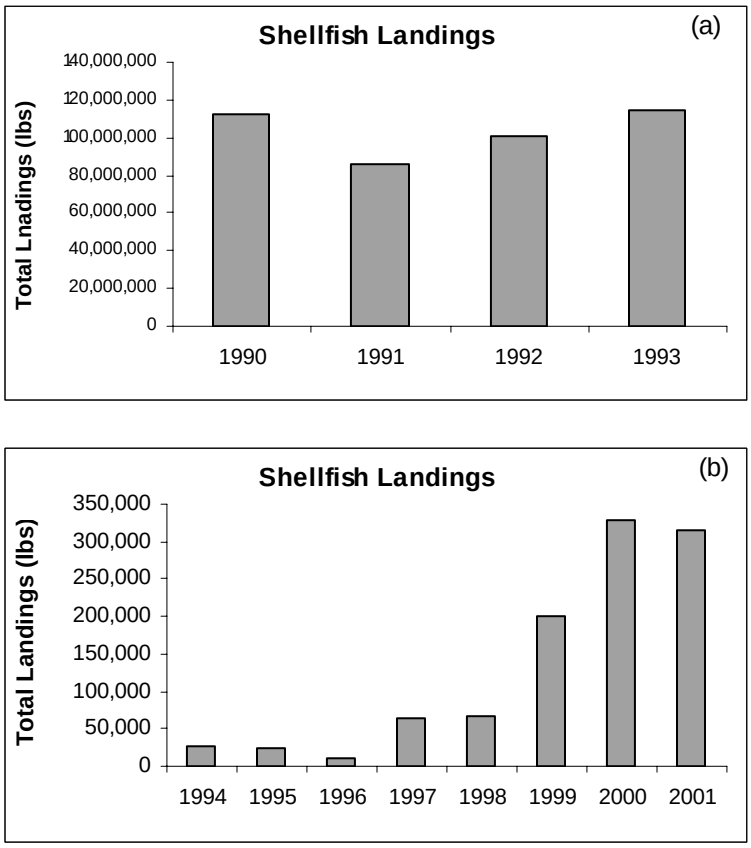


Figure 6. (a) Total shellfish landings from 1990 through for NMFS statistical area 538 (b) Total shellfish landings from 1994 through 2001 for statistical sub-area 075 (Source: NMFS Weigh Out Data for Area 538 and Vessel trip Report Data for Sub-area 075)

Table 3. Total landings of shellfish species in NMFS statistical sub-area 075, Nantucket Sound, from 1994 through 2001 (Source: NMFS Vessel Trip Report Data for Sub-area 075)

	1994		1995		1996		1997	
Species	pounds landed	% total	pounds landed	% total	pounds landed	% total	pounds landed	% total
Whelk, channeled	25,247	90.94	17,709	70.15	9,523	89.60	41,881	64.09
Whelk, knobbed	1,544	5.56	6,734	26.68	325	3.06	1,115	1.71
Whelk, lightning	315	1.13			780	7.34		
Whelk, not specified	655	2.36	800	3.17			22,350	34.20
Whelk, channeled	58,427	85.86	191,277	95.66	248,468	75.76	273,925	86.85
Whelk, knobbed	1,297	1.91	1,591	0.80	4,934	1.50	4,873	1.55
Whelk, lightning								
Whelk, not specified	8,327	12.24	6,353	3.18	74,553	22.73	1,767	0.56
Clam, not specified							32,900	10.43
Clam, not specified - bushel							295	0.094
Clam, quahog - bushel							292	0.093
Ocean quahog							150	0.048
Sea scallop			725	0.36			1,200	0.380

Table 4. Gear type used for harvesting of shellfish from statistical area 538 from 1990 through 1993 and sub-area 075 from 1994 through 2001

Gear Type	Area 538 Total Shellfish Landings (lbs)	Gear Type	Sub-area 075 Total Shellfish Landings (lbs)
Conch pots/traps	121,278,300	Conch pot	704,816
Other rakes	104,894,842	Fish pot	176,887
Surf clam/ocean quahog dredge	75,981,152	Fish otter trawl	107,093
Mussel dredge	64,447,500	Ocean quahog/surf clam dredge	34,797
Bay scallop dredge	25,110,644	Crab pot	16,577
Hand	11,093,680	Scallop otter trawl	84
Otter trawl, bottom - fish	3,829,878	Hand line/rod & reel	55
Clam tongs/grabs	2,927,366	Mixed pots	23
Sea scallop dredge	1,035,112		
Other tongs/grabs	946,400		
Oyster dredge	875,238		
Oyster rakes	568,854		
Dip net	353,028		
Forks	260,260		
Oyster tongs/grabs	207,532		
Fish pots/traps	20,124		

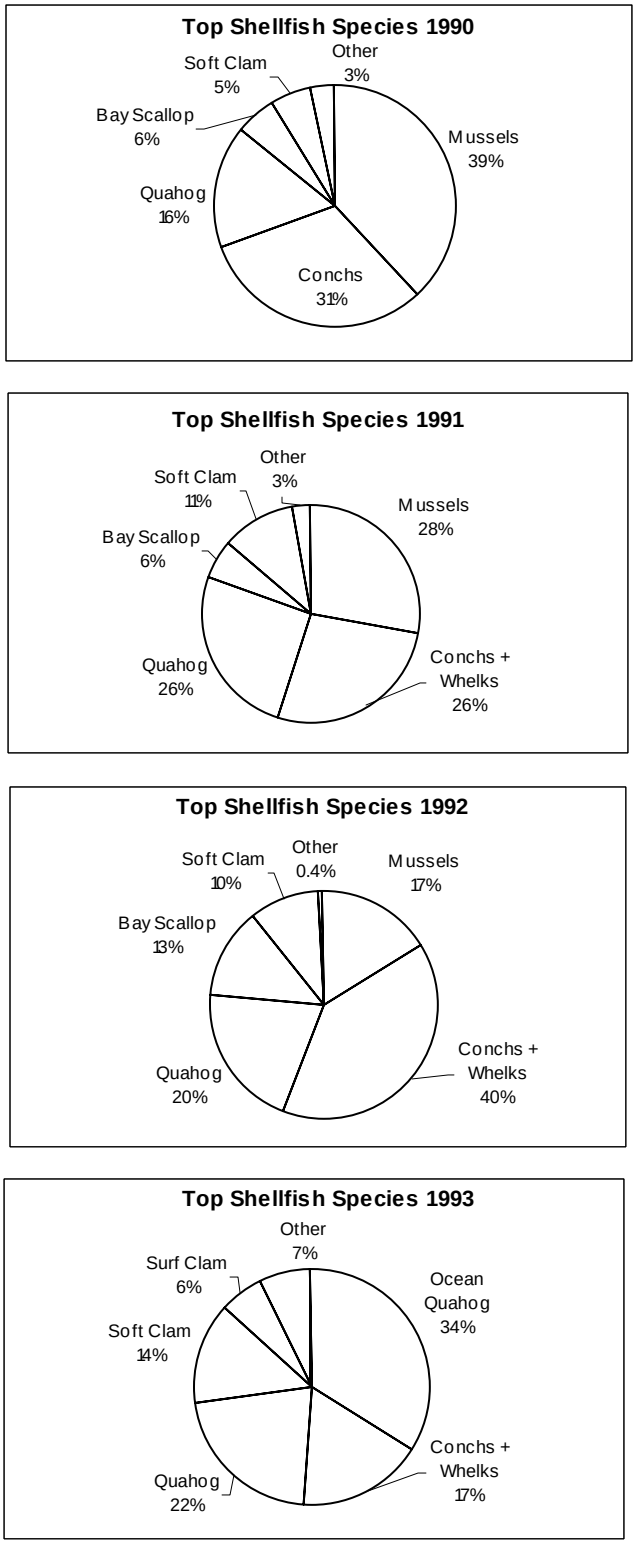


Figure 7. Top shellfish species landed from NMFS statistical area 538 from 1990 through 1993 (Source: NMFS Weigh Out Data for Area 538)

3.0 MDMF COMMERCIAL LANDINGS DATA

The mission of the Massachusetts Division of Marine Fisheries is to "manage the Commonwealth's living marine resources and the harvesting of those resources by the commercial and recreational fisheries, while maintaining a diverse number of self-sustaining fish populations at healthy levels of abundance in balance with the ecosystem." The Management Information Systems and Fisheries Statistics Project through the MDMF maintains a commercial database for lobster, shellfish and other "regulated" fisheries throughout Massachusetts. This program collects, analyzes and distributes fisheries information such as catch statistics and effort estimations, which are collected from catch reports submitted by licensed fisherman. MDMF is a partner in the Atlantic Coast Cooperative Statistics Program (ACCSP). The ACCSP develops and implements uniform fisheries data collection so that the information will meet the needs of fisheries managers, scientists, etc.

For the purposes of reporting commercial fishery information, MDMF also defines statistical areas for the waters along the Massachusetts coast. Nantucket Sound is considered statistical reporting area 10. MDMF Area 10 appears to be identical to the NMFS sub-area 075. A map depicting MDMF Area 10 is included in Attachment B. Information for Area 10 from 1990 to 2000 are summarized in this section. The information was subdivided by specific fishery type: lobster, shellfish, striped bass, gill net fishery, fish pot fishery and fish weir fishery. MDMF does not archive trawl data. MDMF believes these data should be similar to that submitted by the Nantucket Sound fishermen to NMFS in the form of the vessel trip reports (Vin Malkoski, Personal communication).

3.1 Finfish Landings

The data received from MDMF allowed the finfish landings in Nantucket Sound to be evaluated from the gill net data, fish pot data and fish weir data. Additionally, striped bass landings by commercial fishermen were also reported and used to evaluate finfish in Area 10. Table 5 presents the number of licenses issued in Area 10 by year and fishery. This information suggests that few fishermen use fish weirs in Nantucket Sound. The number of licenses issued for fish weirs ranged from 3 to 5 from 1992 to 2000. The information also suggests that few fishermen appear to participate in the gill net fishery in Nantucket Sound. In 1992, 1995 and 1999 only 1 license was issued for gillnets in Area 10. In 1993, 3 licenses were issued for gillnets in the area. The fish pot fishery is further sub-divided by species for the purposes of reporting. The number of licenses issued to harvest scup from fish pots appears to have declined through the years. In 1994, 49 licenses were issued to harvest scup from pots in statistical area 10. By 2000, this number had decreased to 21 licenses.

Table 5. Number of licenses issued in MDMF Area 10 by year and fishery

Fishery	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	total
Fish Weir			4	4	4	3	4	4	5	4	4	36
Gillnet	0	0	1	3	0	1	0	0	0	1	0	6
Sea Bass (Fish Pot)	35	38	27	22	27	29	28	20	18	25	25	294
Conch (Fish Pot)	NA	NA	42	47	47	47	40	27	21	33	24	328
Scup (Fish Pot)	NA	NA	NA	NA	49	47	44	31	26	28	21	246

NA = data not available; state did not require catch reports for those fisheries during those years

The number of licenses issued for collection of sea bass from fish pots in Nantucket Sound (Area 10) has varied over the years from a high of 38 licenses in 1991 to a low of 18 licenses in 1998. The number of licenses for collecting conch from fish pots appears to have decreased through the years. Forty-seven licenses for conch were issued from 1993 through 1995. Since that time, the number of licenses has decreased, and in 2000 only 24 licenses were issued to harvest conch from fish pots.

The fish species collected using fish weirs, gill nets and fish pots are presented in Table 6. Fish weirs appeared to collect more diverse finfish species including albacore tuna, bluefish, bonita, butterfish, various flounders,

mackerels, menhaden, scup, seabass, squid, tautog and weakfish. Finfish collected in gill nets included cod, haddock, hake, summer flounder, winter flounder, witch flounder, yellowtail flounder, pollock, monkfish, Atlantic mackerel, bluefish, cusk, tautog, dogfish and skates. The fish pot fishery targets demersal species such as scup, sea bass and conch. No other species are reported for fish pots.

Table 6. Species collected from the gill net fishery, fish weir fishery and fish pot fishery in MDMF Area 10, Nantucket Sound, from 1990 through 2000

Fish Weir	Gillnet	Fish pot
Albacore	Atlantic Mackerel	Conch
Amberjack	Bluefish	Scup
Atlantic Herring	Cod	Sea bass
Atlantic mackerel	Cusk	
Bluefish	Dogfish	
Bonito	Flounder - not specified	
Butterfish	Haddock	
Flounder - not specified	Hake	
Herring - not specified	Monkfish	
King mackerel	Pollock	
Menhaden	Skates	
Scup	Summer flounder	
Sea bass - not specified	Tautog	
Spanish mackerel	Winter flounder	
Squid	Witch flounder	
Summer flounder	Yellowtail flounder	
Tautog		
Weakfish		
Winter flounder		
Witch flounder		

Fish Weir Fishery: Total landings from the fish weir fishery in Area 10, Nantucket Sound, from 1990 through 2000 are estimated at 11.3 million pounds (mean = 1.03 million lbs/yr). Total fish landings from fish weirs were highest in 1990 (1.4 million lbs) and lowest in 1995 (679 thousand lbs; Figure 8). Atlantic mackerel, squid and scup are the most common species harvested from fish weirs. Ten-year total landings for Atlantic mackerel, squid and scup in Area 10 are reported at 4.7 million pounds (mean = 432,901 lbs/yr), 4.3 million pounds (mean = 386,450 lbs/yr), and 1.1 million pounds (mean = 103,587 lbs/yr) respectively. The annual landing trends for these species are shown in Figure 9. Atlantic mackerel landings reached a high of 876 thousand pounds in 1997 and have declined to between 430-530 thousand pounds from 1998 to 2000. Scup landings peaked in 1992 (334 thousand pounds) declining to very low landings in 1996 through 1998. Squid landings have shown a general downward trend from 1990 through 2000. In 1990-1991 squid landings were greater than 700 thousand pounds whereas landings since 1995 were below 125 thousand pounds. Individual species landings by year are presented for fish weirs in Table 1 of Attachment B.

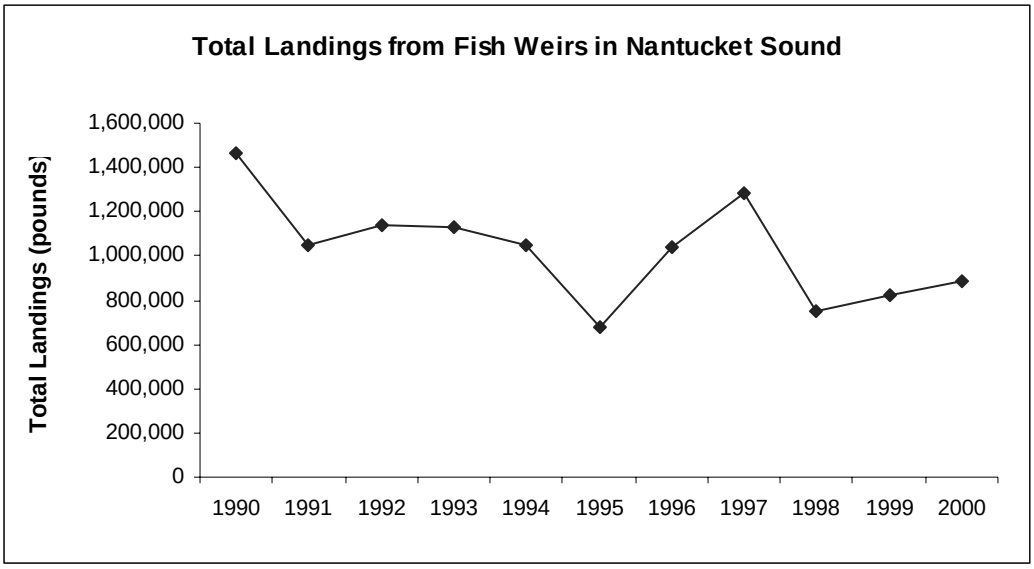


Figure 8. Total landings from the fish weir fishery in MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990-2000)

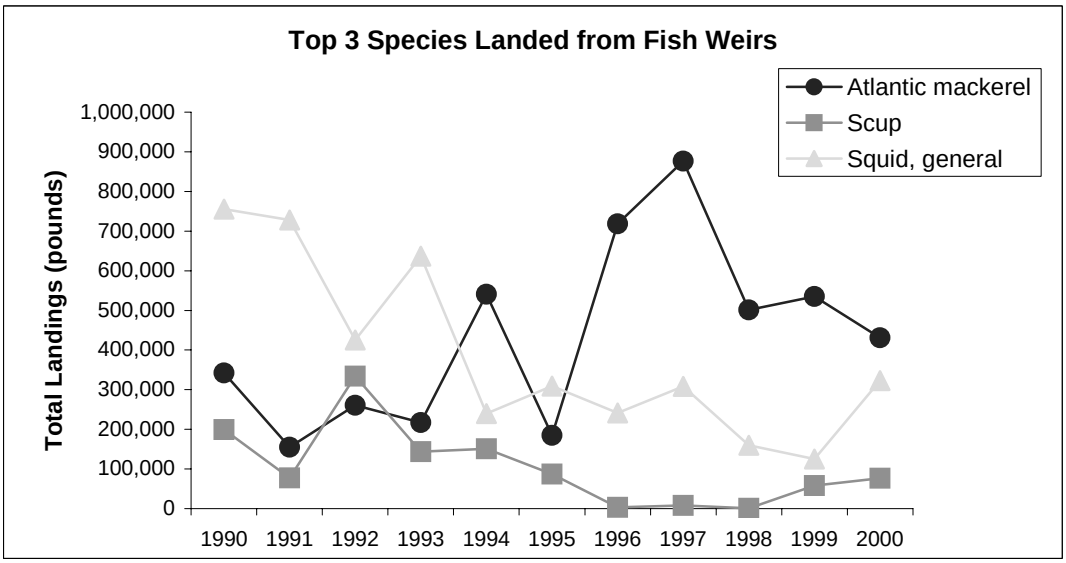


Figure 9. Most common species landed from fish weirs in MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990-2000)

Gill Net Fishery: Gill nets were fished from January through June and then again in August in years 1992, 1993, 1995, 1999. There was no gill net fishing in 1990, 1991, 1994, 1996, 1997, 1998, or 2000 in Area 10. Total landings from the gill net fishery in Nantucket Sound from these four years totaled approximately 192 thousand pounds (Table 7). Only one species was collected in the gill nets in 1992. That species, Atlantic mackerel, totaled approximately 2 thousand pounds. In 1993 and 1995 the diversity of fish collected via gillnets increased to 5 and 7 species, respectively. The greatest species diversity was observed in 1999 when 15 different fish species were collected. On an annual basis, total landings from gill nets were greatest in 1995 (165 thousand pounds) due to the large landings of dogfish (approximately 158 thousand pounds). Individual species landed by year for the gill net fishery in Nantucket Sound are presented in Table 2, Attachment B.

Table 7. Gill net landings by species and year for MDMF Area 10, Nantucket Sound

	1992	1993	1995	1999	Total
Dogfish	0	1,850	158,807	803	161,460
Monkfish	0	21	601	13,778	14,400
Mackerel, Atlantic	2,375	3,392	0	538	6,305
Flounder, Yellowtail	0	0	3,656	1	3,657
Pollock	0	0	0	2,414	2,414
Flounder, Winter	0	0	2,302	2	2,304
Cod, General	0	0	230	715	945
Skate, General	0	0	0	371	371
Bluefish	0	205	0	3	208
Flounder, Summer	0	0	0	112	112
Flounder, Unclass	0	0	0	43	43
Tautog	0	9	25	0	34
Hake, General	0	0	0	13	13
Cusk	0	0	0	8	8
Haddock, General	0	0	0	6	6
Flounder, Witch	0	0	0	1	1
Total	2,375	5,477	165,621	18,808	192,281

Fish Pot Fishery: The fish pot fishery in Nantucket Sound is open from April through December. Conch are only reported from 1992 to 2000 because fishermen were not required to file reports for catches of conch prior to this date. Reports were not required for scup from 1990 to 1993. Figure 10 presents the total annual landings of conch, sea bass and scup from fish pots in Nantucket Sound.

Total conch landings from fish pots from 1992 through 2000 are approximately 10.3 million pounds for Area 10. Annually, conch landings have generally decreased from a high of approximately 2 million pounds in 1992 to a low of 478 thousand pounds in 1998. Since 1998, landings have increased slightly to 939 thousand pounds in 1999 and 979 thousand pounds in 2000. Seasonally, conch landings are generally highest in July and August, averaging more than 200 thousand pounds during those months from 1992 to 2000 (Figure 11). Attachment B (Table 3) presents conch landings by month and year for the fish pot fishery in Nantucket Sound.

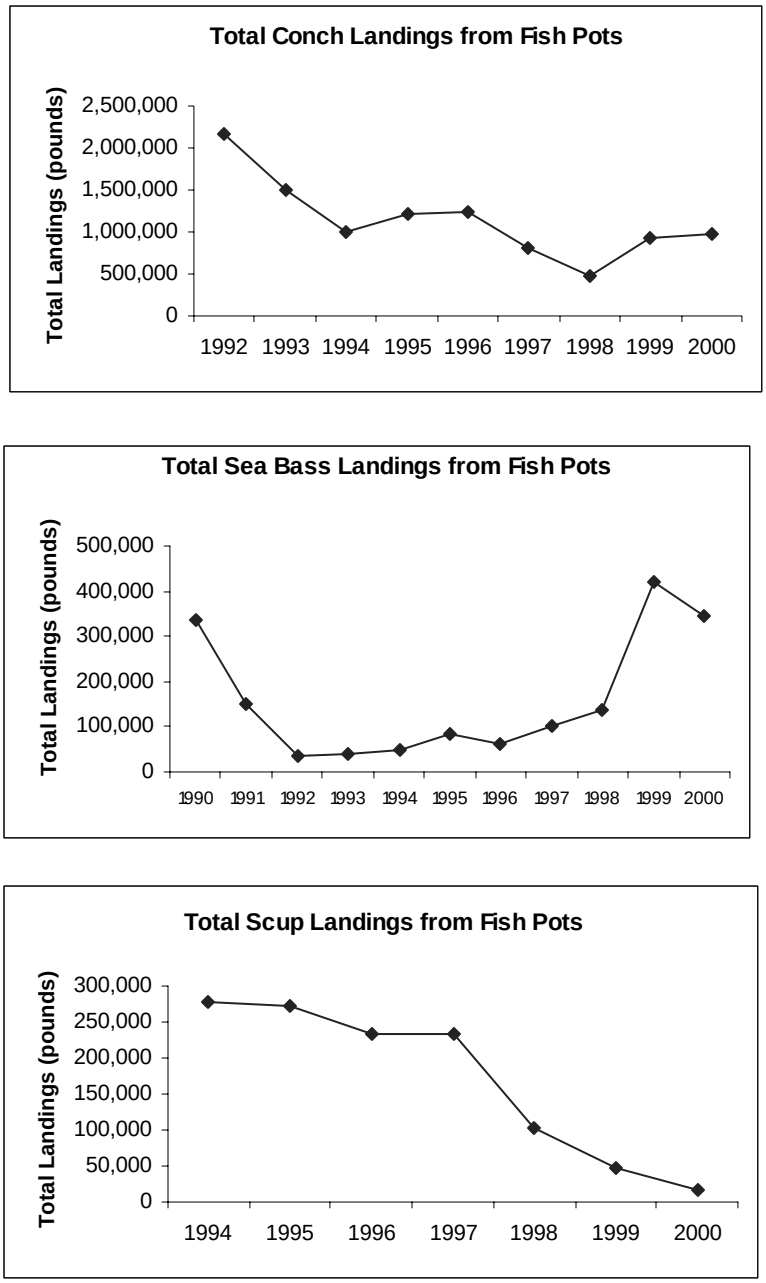


Figure 10. Trends in annual landings of conch, sea bass and scup from fish pots in MDMF Area 10, Nantucket Sound (Source: MDMF Commercial Data 1990-2000)

Total sea bass landings from fish pots from 1990 through 2000 are approximately 1.8 million pounds. From 1990 to 1992 annual sea bass landings dropped substantially from 336 thousand pounds to 40 thousand pounds. Since 1992, annual landings have increased steadily up until 1998 with a large peak of approximately 419 thousand pounds in 1999. Landings then dropped in 2000. Seasonally, sea bass landings are highest in May and June for the 1990 through 2000 period, averaging over 61 thousand pounds in May and over 50 thousand pounds in June (Figure 11). Attachment B (Table 4) presents sea bass landings by month and year for the fish pot fishery in Nantucket Sound.

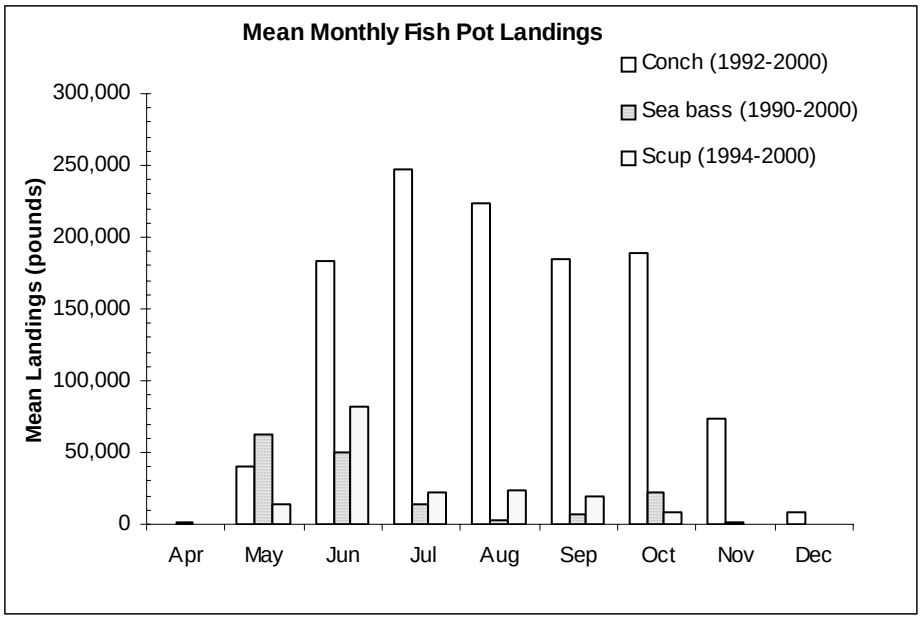


Figure 11. Mean monthly commercial fish pot landings for conch, sea bass and scup from MDMF Area 10, Nantucket Sound (Source: MDMF Commercial Data 1990-2000)

Total scup landings from fish pots from 1994 through 2000 are approximately 1.2 million pounds. Annual landings of scup have declined from 1994 to 2000. Scup landings in 1994 were approximately 277 thousand pounds and declined to 17 thousand pounds in 2000. Seasonally, scup landings are highest in June, averaging over 80 thousand pounds from 1994 to 2000 (Figure 11). Scup landings by month and year are presented in Table 5, Attachment B.

Striped Bass Fishery: The Commonwealth of Massachusetts is one of the largest recreational striped bass fisheries in the country. All Atlantic states that harvest these fish are required to characterize their commercial and recreational landings. The commercial fishery for striped bass in Nantucket Sound is a hook and line fishery. The commercial fishermen report what they keep, the legal and sublegal fish released, and the fish sold to seafood wholesalers. Analysis of the striped bass fishery for this report are based on those fish sold to market for the period of 1990 through 2000. Striped bass landings that were retained, released and sold to market are presented in Attachment B by month and year.

The commercial season for striped bass occurs from July through September. Seasonally, striped bass landed and sold to market were greatest during the month of July (mean = 17,614 pounds landed; Figure 12). By September, much fewer striped bass were landed and sold to market (mean = 1,210 pounds). Total striped bass landings sold to market for Nantucket Sound from 1990 through 2000 were approximately 320 thousand pounds. Figure 13 presents the annual landings for striped bass in Area 10, Nantucket Sound. From 1990 to 1994 total landings did not exceed 15 thousand pounds. From 1995 through 1998 striped bass landing increased steadily to a high of 80 thousand pounds. Landings decreased to below 50 thousand pounds in 1999 and 2000.

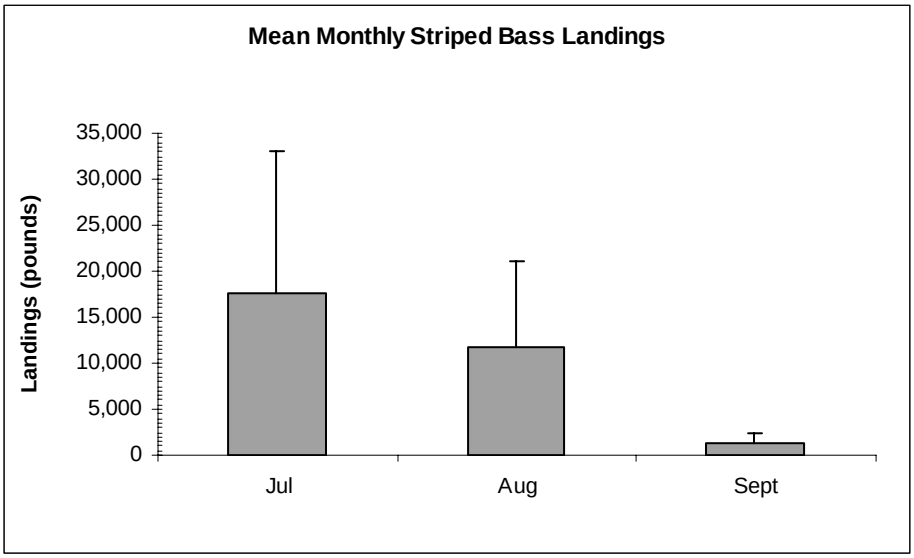


Figure 12. Mean monthly striped bass landings sold to market from MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990 – 2000)

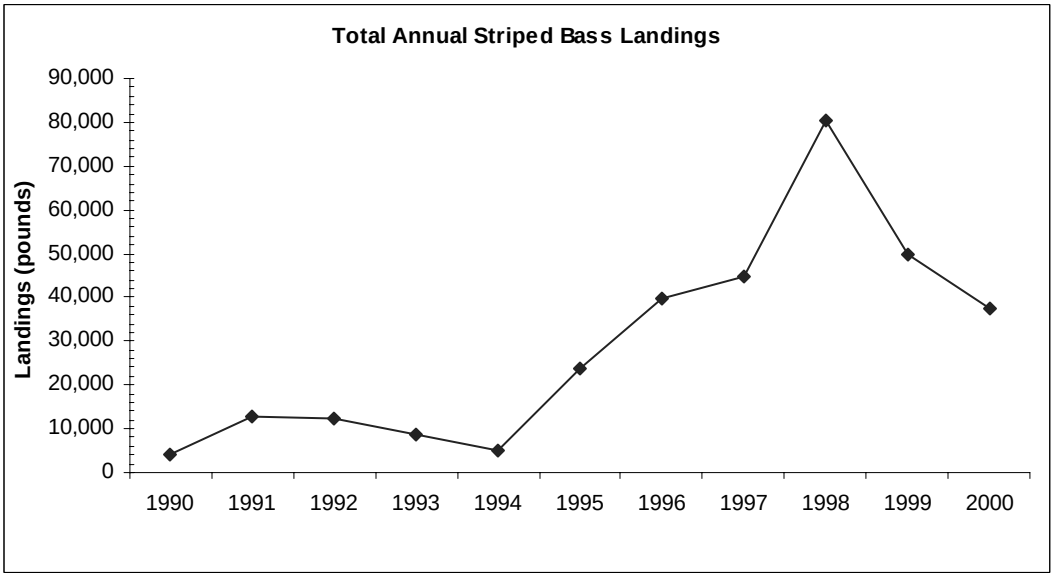


Figure 13. Total annual striped bass landings sold to market from MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990 – 2000)

3.2 Shellfish Landings

Shellfish species harvested from Area 10, Nantucket Sound, from 1990 through 2000 included bay scallops (weights logged as either with and without shells), ocean quahogs, mixed quahog species, littlenecks, mussels, sea clams, sea scallops, soft shell calms, and conch. The total annual landings for shellfish in Nantucket Sound from 1990 through 2000 are presented in Figure 14. Approximately 24.7 million pounds of shellfish were harvested from Area 10, Nantucket Sound from 1990 through 2000. From 1990 to 1992 shellfish landings increased from approximately 50 thousand pounds to just over 5 million pounds in 1992. Landings declined in 1993, but then increased to a 10 year high of 7.9 million pounds in 1994. Since 1994, shellfish landings have decreased to lows of 64 thousand pounds in 1999 and 78 thousand pounds in 2000.

Table 8 presents total landings for shellfish species for 1990 through 2000. Sea clams appear to be the most common species harvested over the ten-year period in Area 10, Nantucket Sound. Sea clam landings constitute 52% of the shellfish landings from 1990 through 2000 (Figure 15). Landings for individual shellfish species by year are presented in Table 6, Attachment B.

Mussels were the second most common species of shellfish harvested, constituting 35% of the shellfish landings from Nantucket Sound. The various species of conch harvested from Nantucket Sound from 1990 through 2000 accounted for 13% of the total landings. The various quahogs (ocean quahogs, mixed quahogs and littlenecks), bay scallops (with and without shells), sea scallops and soft shell clams accounted for less than 1% of the total shellfish landings from 1990 through 2000.

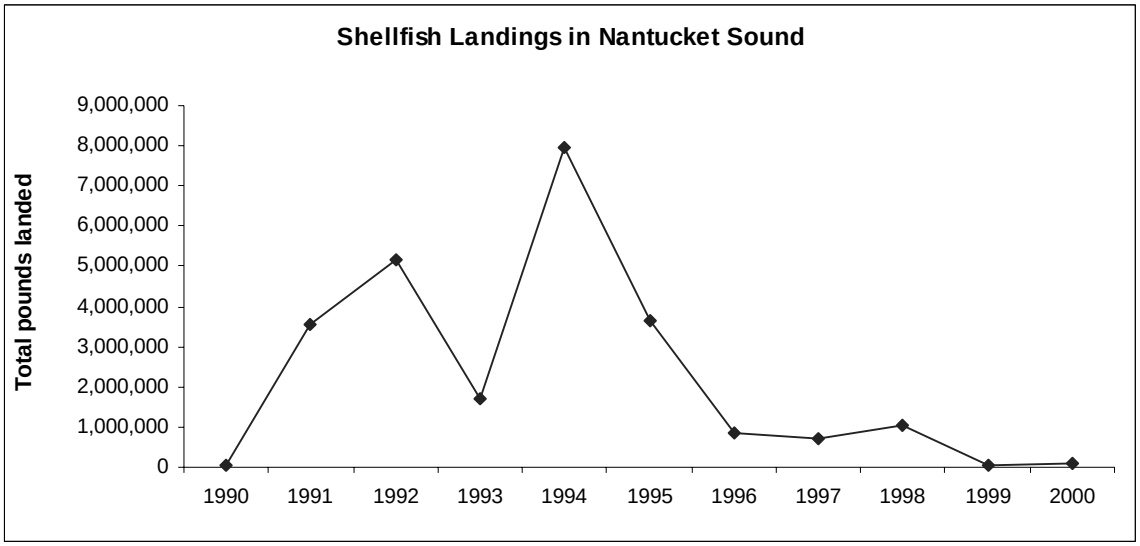


Figure 14. Total annual landings of shellfish from MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990-2000)

Table 8. Total landings of shellfish species from Area 10, Nantucket Sound, from 1990 through 2000

Shellfish Species harvested	Total lbs Landed (1990 - 2000)
Sea Clam	12,816,980
Mussel	8,548,273
Conch	3,229,377
Ocean Quahogs	66,560
Soft Shell Clam	42,285
Bay Scallop (w/ shells)	28,068
Bay Scallop (no shells)	17,813
Mixed Quahogs	3,985
Sea Scallops (no shells)	413
Littlenecks	200

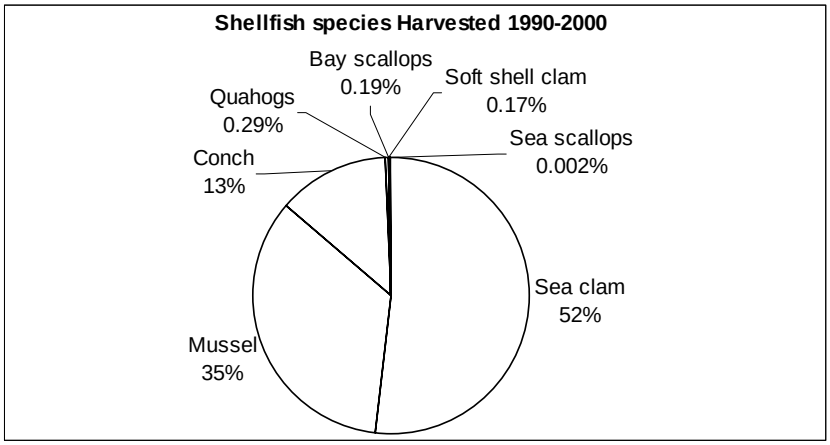


Figure 15. Percent of total landings of for various shellfish species harvested from MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990 – 2000)

3.3 Lobster Landings

The season for commercial lobstering with pots in Massachusetts' waters is open year long. While some specific areas are permanently closed or only open seasonally, all of Nantucket Sound is open year long for lobstering and commercial landings have been reported at least once for each month of the year from 1990 through 2000. The total annual landings for lobster in Nantucket Sound from 1990 through 2000 are presented in Figure 16. Approximately 345 thousand pounds of lobster were harvested from Nantucket Sound from 1990 through 2000. From 1990 to 1993 lobster landings increased from 8 thousand pounds to approximately 50 thousand pounds. Landings fluctuated from a low of 28 thousand pounds to a high of approximately 48 thousand pounds between 1994 and 1999, but declined to below 20 thousand pounds in 2000, the lowest landings observed since 1992.

Seasonally, lobster landings are highest during the summer months (Figure 17). Landings increase substantially in June, peaking in July (mean = 12,201 pounds). From August through December, landings decline steadily. In addition to lobster, the lobster pot fishery also includes a crab by-catch. Total landings of various crab species collected from lobster pots is estimated at 498 pounds from 1990 through 2000. Similar to lobster landings, the majority of the crab by-catch occurs in July. Lobster landings by month and year are presented in Attachment B.

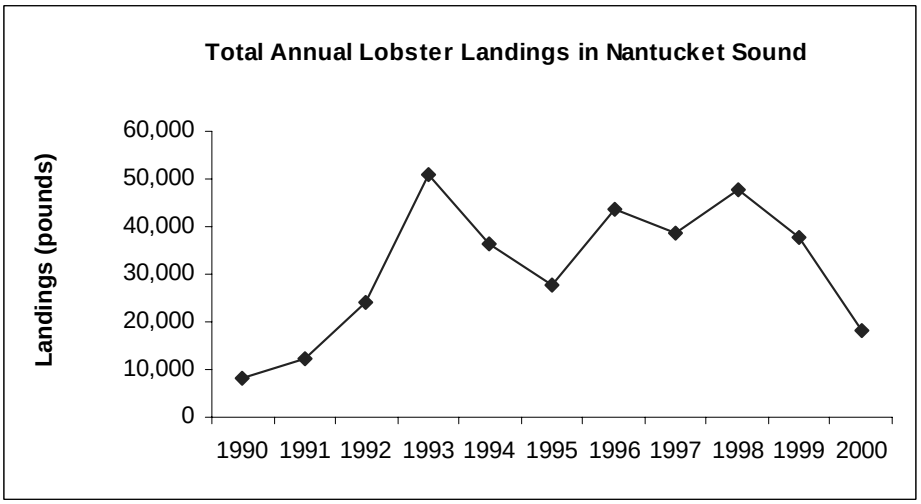


Figure 16. Total annual lobster landings from MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990 – 2000)

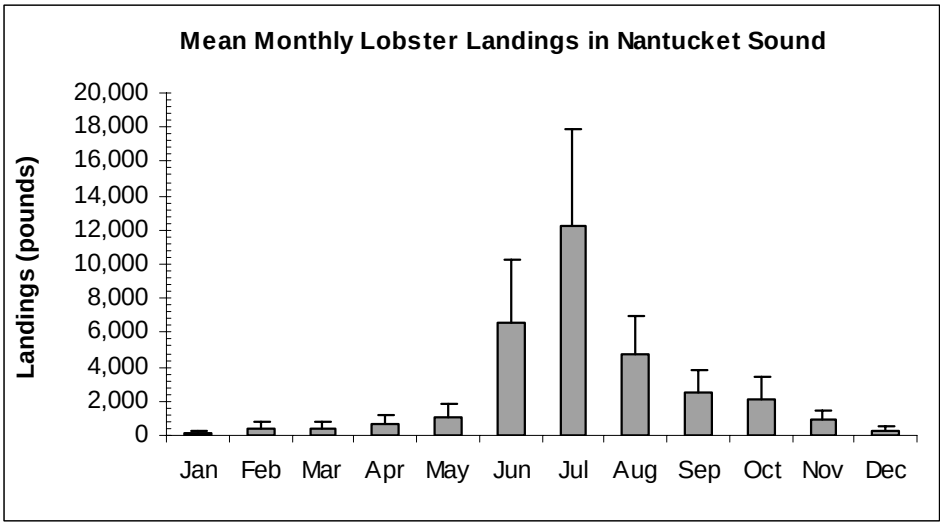


Figure 17. Mean monthly lobster landings from MDMF Area 10, Nantucket Sound, from 1990 through 2000 (Source: MDMF Commercial Data 1990 – 2000)

4.0 NMFS RECREATIONAL DATA

Until 1979, data on marine recreational fisheries were not collected on a regular basis. In 1981, NMFS developed a Marine Recreational Fisheries Statistics Survey (MRFSS) to establish a database, which could be used for evaluating the impacts of recreational fishing on marine resources throughout the country. Fisheries managers need information on catch composition, numbers, and weight of fish that are harvested by recreational fishermen, the numbers of individuals participating in the various types of recreational fisheries (i.e., hook and line, charter boat, etc.) as well as the number of trips they make, and social and economic information about the anglers themselves.

For the purposes of this report, recreational data compiled from the MRFSS were received from the NMFS Marine Recreational Fisheries for 1990 through 2001. Data from three counties surrounding Nantucket Sound (Dukes, Barnstable, and Nantucket) were obtained. It is important to note that the recreational fishery information summarized below cannot be directly related to Nantucket Sound. From the surveys, there is no way to determine the exact fishing location of the anglers that responded to the survey. Therefore, although survey information was gathered from the three counties surrounding Nantucket Sound, it can only be assumed that some portion of the anglers interviewed from these counties were truly fishing in Nantucket Sound and not in other areas such as those offshore of the islands, farther out on the Cape, or in Cape Cod Bay.

Information that was summarized from all the recreational statistics data included fishing effort by mode, fishing effort by hours fished as reported by individual anglers, type of gear used by individual anglers, number of fish reported by anglers, as well as the number of fish observed by interviewers during surveys, and the fish species observed by interviewers during surveys. The recreational fishing data are presented as 2-month intervals referred to as waves. NMFS waves are as follows:

- Wave 1: January and February
- Wave 2: March and April
- Wave 3: May and June
- Wave 4: July and August
- Wave 5: September and October
- Wave 6: November and December

For New England, no surveys were conducted during January and February (Wave 1). Sampling efforts during January and February since 1980 were generally limited to the Pacific coast, Gulf coast states and the Atlantic coast of Florida. Historically, only about 5 percent of the annual recreational catch on the Atlantic and Gulf coasts is taken during Wave 1 (January - February). Furthermore, the costs to sample these months were very high because of low fishing activity, particularly in the North and Mid-Atlantic subregions. Therefore, in Jan/Feb of 1981 the MRFSS was not conducted in any region. In 1982, Jan/Feb data collection resumed on the Pacific and Gulf Coasts and also on the Atlantic Coast of Florida. With a few exceptions (GA 1985-1989, SC 1988, NC 1988-1992), the MRFSS has not been conducted in Jan/Feb on the Atlantic Coast north of Florida since 1980.[1]

The total number of surveys used to summarize recreational fishing in the three counties surrounding Nantucket Sound is shown in Table 9.

To evaluate recreational fishing effort in Nantucket Sound, data from three distinct modes of fishing were compiled and summarized. These fishing modes included fishing from shore, fishing from a charter or party boat and fishing from a private or rental boat. Fishing from shore is comprised of any pier, dock or structure built over the water, any rock wall built out into the water or parallel to the shore to restrain currents or protect a harbor, a breakwater device, bridges, causeways, beaches or banks. Fishing effort from shore may not provide much pertinent information to the recreational fishing that occurs on the Proposed and alternative sites in Nantucket Sound, but will be important in addressing concerns of anglers fishing near the proposed cable landfall areas.

Table 9. Number of surveys reported from Dukes, Barnstable and Nantucket counties

Year	Number of surveys
1990	2916
1991	2479
1992	2503
1993	3105
1994	3063
1995	3446
1996	2589
1997	2562
1998	2710
1999	2627
2000	2184
2001	2474

A head or party boat is defined as a boat on which fishing space and privileges are provided for a fee. The vessel is operated by a licensed captain and crew. A charter boat is also operated by a licensed captain and crew, however, the anglers are part of a pre-formed group that "charters" the boat, captain and crew for a specific price and time. A private boat is that belonging to an individual. A rental boat is rented and operated by the renter. No captain or crew is provided for private or rental boats.

For the past 11 years, the use of private boats or rental boats appears to be the most common mode of recreational fishing (Figure 18). A total of 3,446 individuals reported using private/rental boats when engaged in fishing activities in 1995 alone. Anglers reporting the use of private/rental boats from 1990 to 2001 comprised 46% of all anglers surveyed. Anglers reporting the use of party/charter boats was much lower than private boats (13.6%). The number of anglers reporting that they used charter/party boats ranged from a low of 274 individuals in 1999 to highs of 452 and 451 individuals in 1990 and 1994, respectively. Fishing from shore is more common than the use of charter/party boats as well. The number of anglers reporting fishing from shore activities ranged from 841 to 1,389 individuals between 1990 and 2001. From 1990 through 2001, approximately 40% of the anglers

[1] http://www.st.nmfs.gov/st1/recreational/the_mrfss.html

surveyed described their mode of fishing to be from shore. Attachment C (Table 1) presents the number of anglers reporting the various modes of fishing by year and wave.

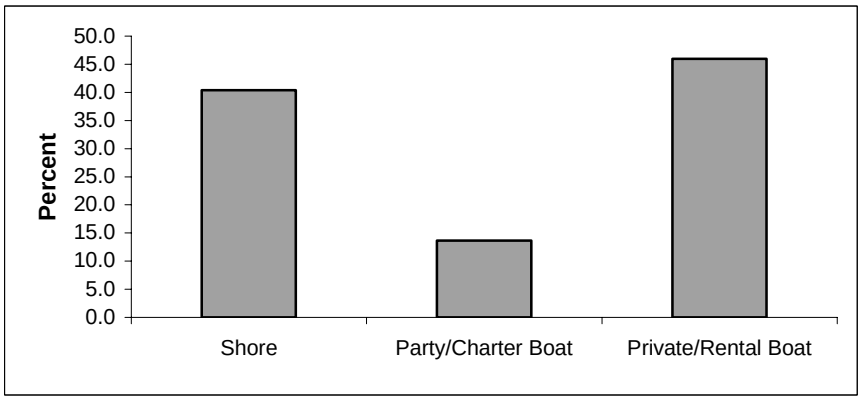


Figure 18. Percent of anglers reporting mode of fishing as shore, party/charter boat, or private/rental boat from surveys conducted from 1990 through 2001 in Dukes, Barnstable and Nantucket counties (Source: MRFSS Data 1990 – 2001)

The average length of time individual anglers spent fishing over the 11-year period does not vary greatly among years (Figure 19). Average time individual anglers spent fishing ranged from a low of 2.8 hours in 1993 to a high of 3.8 hours in 1997. The total number of hours reported from all surveys is presented in Figure 20. From 1990 through 2001, surveys suggest that anglers spent anywhere from eight thousand hours per year to just over eleven thousand hours per year participating in recreational fishing activities in the Dukes, Nantucket and Barnstable regions.

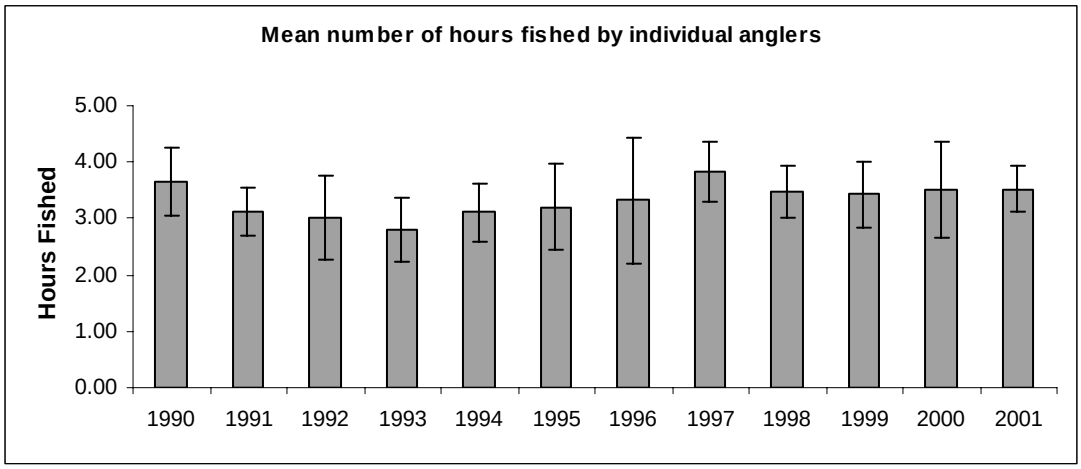


Figure 19. Mean number of hours fished by individual anglers calculated from all surveys conducted in Dukes, Barnstable and Nantucket counties (Source: MRFSS Data 1990 – 2001)

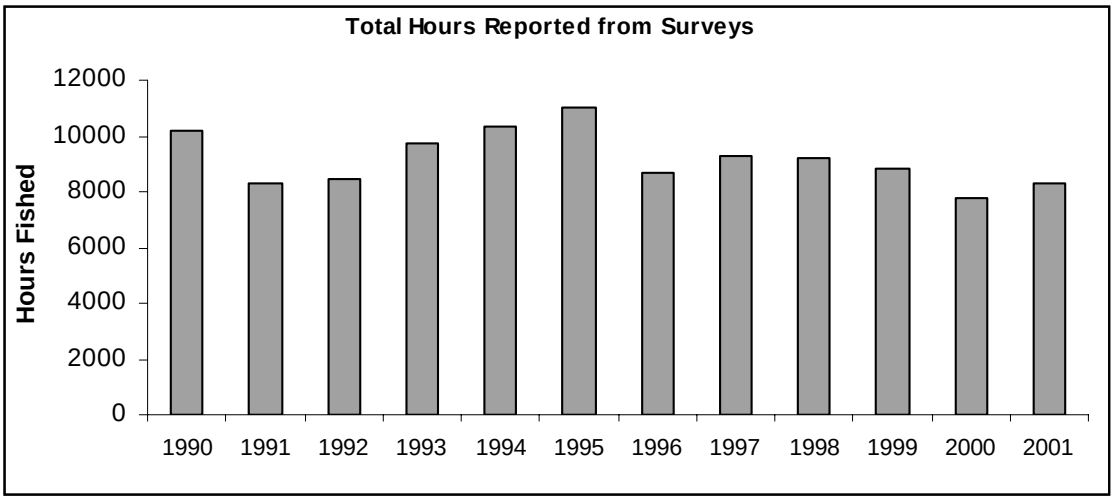


Figure 20. Total number of hours anglers engaged in recreational fishing in any given year as reported from surveys from Dukes, Barnstable and Nantucket counties (Source: MRFSS Data 1990 – 2001)

The mean number of hours calculated by wave across all years from 1990 through 2001 is shown in Figure 21. As expected, the number of hours fished is longer during the summer months. The mean number of hours fished is greatest during wave 4 (July and August) followed by wave 5 (September and October). Fishing effort by hours fished presented by year and wave is presented in Attachment C (Table 2).

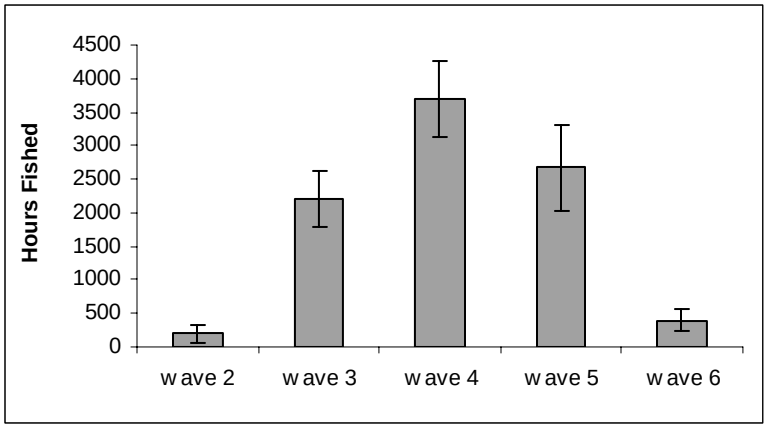


Figure 21. Mean number of hours fished by wave as reported from surveys from 1990 through 2001 from Dukes, Barnstable and Nantucket counties (Source: MRFSS 1990 – 2001)

The fishing gear used by individual anglers included hook and line, dip/A frame net, cast net, gill net, seine, trawl, trap, spear, hand, or other. By far, the majority (99.6%) of anglers used hook and line for recreational fishing. Spear fishing and use of a dip net ranked second in terms of gear used (0.09%). Some type of fish trap use was reported in only 18 of 32,658 surveys from 1990 through 2001. Gill nets and trawls were reported one time each over the 11-year period. Attachment C (Table 3) presents the gear used by recreational anglers by year and wave.

The number of fish reported by anglers and the number of fish observed by interviewers are reported in Attachment C (Table 4) by fishing mode, year and wave. In general, the number of fish reported by anglers during interviews increased from 1990 through 2001 (Figure 22). However, it is important to note, that if an angler is surveyed multiple times over the years, he/she may become more familiar with survey questions and may provide more detailed information on the catch. Survey interviewers observed approximately 10% of the catches reported by anglers fishing from shore, fishing from party/charter boats, or fishing from private/rental boats from 1990 through 2001. The greatest numbers of fish were reported from anglers using private/rental boats (Figure 22). Anglers fishing from shore reported the lowest numbers of fish.

The species of fish observed by the interviewers from 1990 through 2001 by fishing mode is presented in Attachment C (Table 5). The top five species observed for the common fishing modes are presented in Figure 23. In general, the most common species observed by interviewers surveying anglers fishing from shore are bluefish, Atlantic mackerel, scup, striped bass and winter flounder. The most common species observed by interviewers surveying anglers from party/charter boats include scup, bluefish, striped bass, menhaden and tautog. Bluefish, summer flounder, Atlantic mackerel, scup and striped bass are the most common fish observed by interviewers surveying anglers who are fishing from private/rental boats.

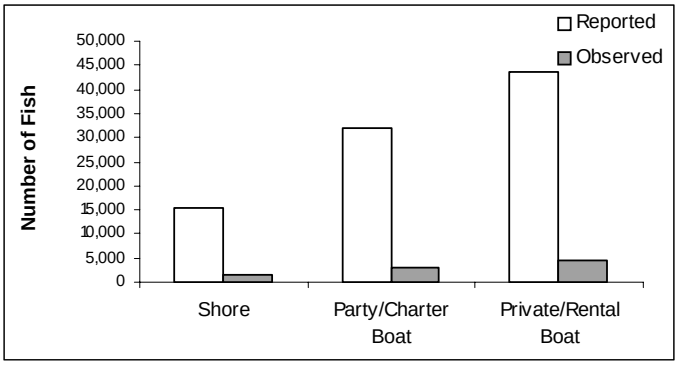


Figure 22. Total number of fish reported by anglers fishing by different modes from 1990 through 2001 in Dukes, Barnstable and Nantucket counties (Source: MRFSS 1990 – 2001)

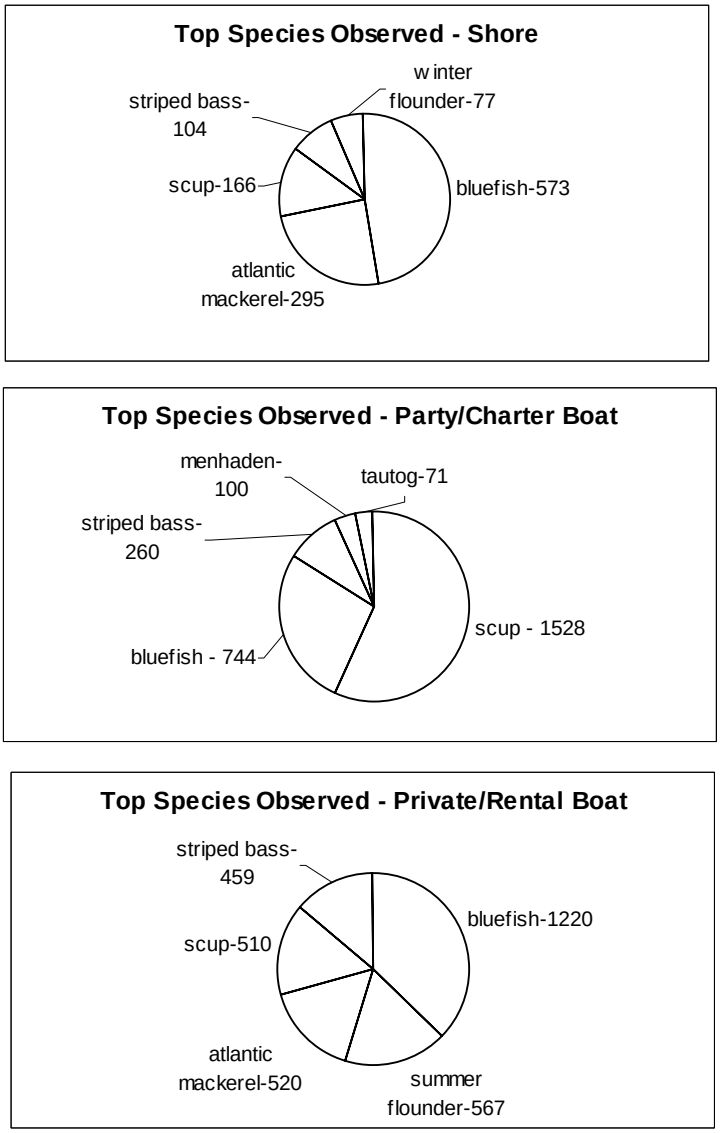


Figure 23. Top 5 species observed by interviewers surveying anglers from shore, party/charter boats or private/rental boats from Dukes, Barnstable and Nantucket counties (Source: MRFSS 1990 – 2001)

5.0 MDMF RESEARCH TRAWL DATA

The MDMF has conducted bi-annual bottom trawl surveys within Massachusetts' territorial waters (including both state and federal waters in Nantucket Sound) during the spring and fall since 1978. Spring surveys are conducted in May and fall surveys are conducted in September. The objective of this sampling is to obtain fishery independent data on the distribution, relative abundance, and size composition of finfish, and specific crustacean and mollusks that are collected in otter trawls.

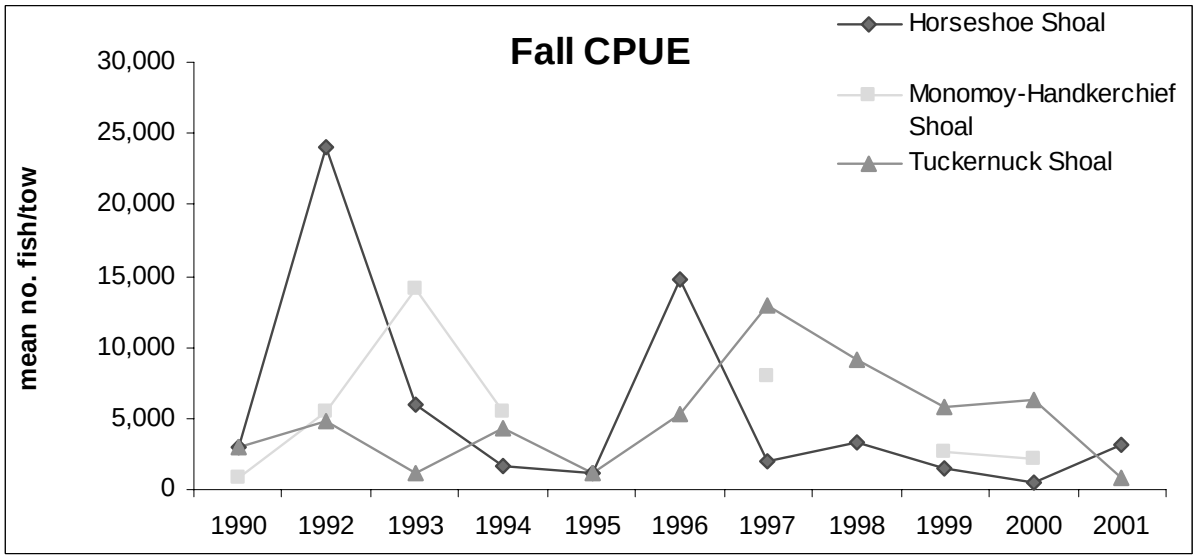
The bi-annual sampling is based on a stratified random sampling design using depth strata and a 1 square nautical mile grid system. The coastal waters are subdivided into geographical zones or strata. No stratum is assigned less than two sampling stations so that an estimate of sampling error can be made. On average, 95 stations are sampled on each spring and fall cruise. The MDMF uses the NOAA R/V *Gloria Michelle* to conduct the sampling. Trawls consist of 20-minute tows at a speed of 2.5 knots. A ¾ size North Atlantic type, two seam otter trawl is used for all surveys. The net contains a 6.4 mm cod end liner to retain smaller juveniles.

For this report, data from all trawl locations in Nantucket Sound was acquired from MDMF. All trawl locations were plotted on a map containing the outline of the Proposed and alternative wind farm locations, Horseshoe Shoal, Monomoy-Handkerchief Shoal and Tuckernuck Shoal. All trawl locations that resided within a particular site were assigned to that site and used in the analysis. Those trawls residing on the border or slightly outside a particular site were also included. Data from all other regions of Nantucket Sound were not analyzed.

Data from 1990 through 2002 were used to calculate Catch Per Unit Effort (CPUE) for each site during the fall and spring seasons. For the fall season, tows were conducted within the Horseshoe Shoal and Tuckernuck Shoal sites for all years from 1990 through 2001. Tows were not conducted within the Monomoy-Handkerchief Shoal site during the fall of 1995, 1996, 1998 and 2001. Figure 24 presents annual CPUE for the fall and spring for the Proposed and alternative sites in Nantucket Sound. The total number of fish/tow for each tow conducted at the Proposed and alternative sites from 1990 through 2001 for the fall survey and from 1990 through 2002 for the spring survey is presented in Attachment D.

In the fall of 1992, 1996 and 2001 CPUE was greater at Horseshoe Shoal than at the other two sites. In 1990 and 1995, CPUE was similar at Horseshoe Shoal and Tuckernuck Shoal. From 1997 through 2000, CPUE at the Tuckernuck Shoal was greater than at the other sites. Monomoy-Handkerchief Shoal showed the highest CPUE in 1993 and 1994. For the spring surveys, CPUE was lower at the Proposed (Horseshoe Shoal) and alternative sites (Monomy-Handkerchief Shoal and Tuckernuck Shoal) than during fall surveys. Only tows conducted at Tuckernuck Shoal in 1999 have comparable CPUE to those calculated from the fall surveys.

An Analysis of Variance (ANOVA) was used to determine if the CPUE was significantly different between the Proposed and alternative sites in Nantucket Sound for the fall and spring seasons. Data from 1990 through 2001 for the fall were combined and an ANOVA run. The mean CPUE by site across years for the fall survey is presented in Figure 25. Results of the ANOVA suggest that during the fall, CPUE is not significantly different among Horseshoe Shoal, Monomoy-Handkerchief Shoal or Tuckernuck Shoal ($p > 0.05$). Similarly, spring data from 1990 through 2002 were combined and an ANOVA run. The mean CPUE across all years for the spring survey is also graphically presented in Figure 25. Again, results of the ANOVA suggest that the CPUE is not significantly different ($p > 0.05$) among the 3 sites during the spring.



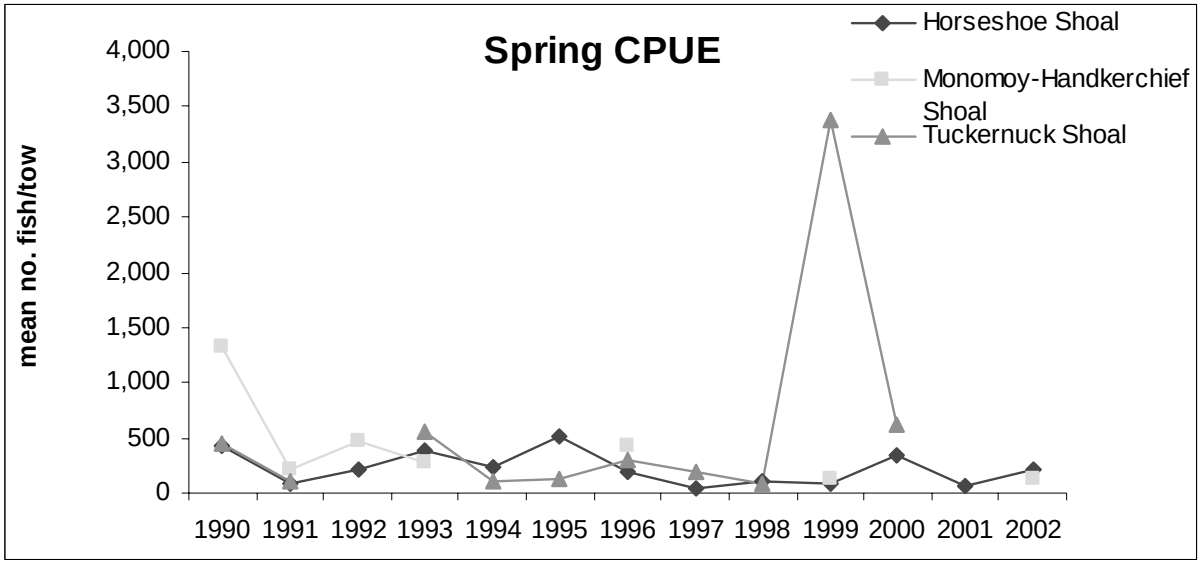


Figure 24. (a). CPUE for Horseshoe Shoal, Monomoy-Handkerchief Shoal and Tuckernuck Shoal from 1990 through 2001 for the fall trawl surveys; and (b) CPUE for Horseshoe Shoal, Monomoy-Handkerchief Shoal and Tuckernuck Shoal from 1990 through 2002 for the spring surveys

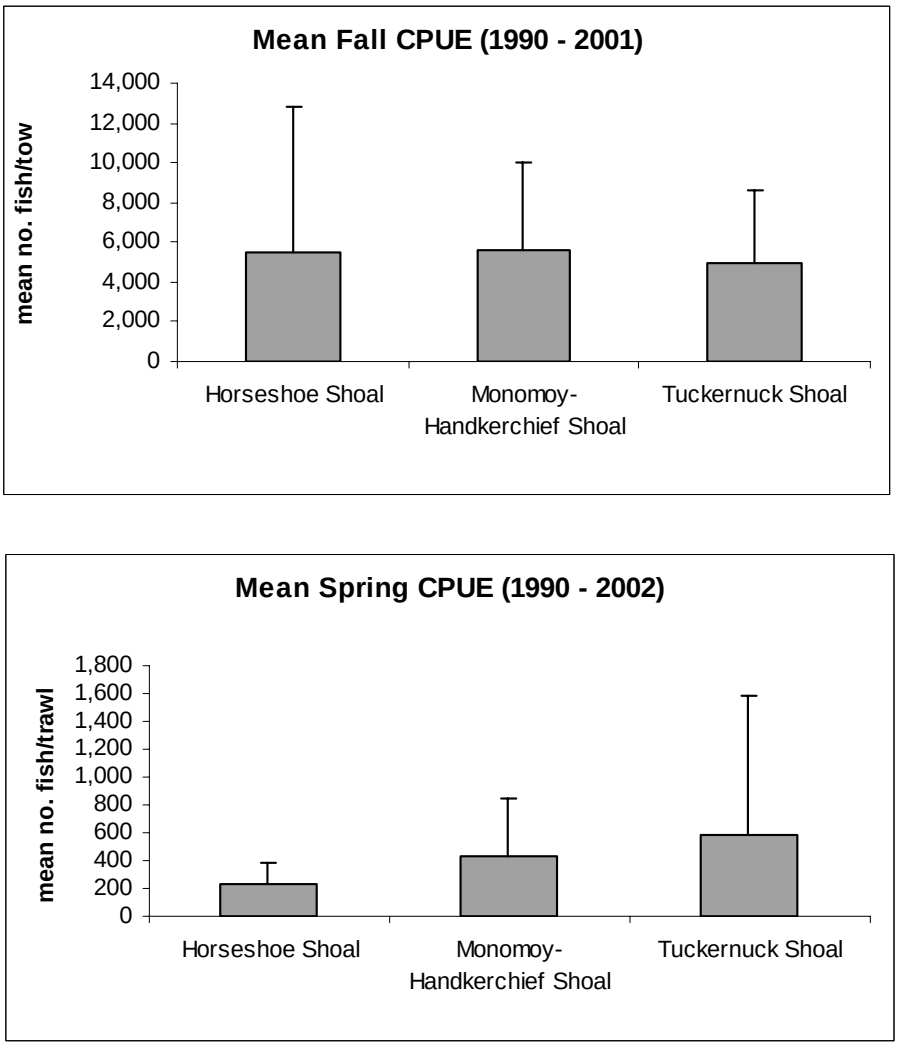


Figure 25. Mean CPUE across years for Horseshoe Shoal, Monomoy-Handkerchief Shoal and Tuckernuck Shoal for the fall and spring trawl surveys

Although the trawl data from MDMF were used to calculate CPUE and compare CPUE between the proposed and alternative sites in Nantucket Sound, it is important to point out some of the limitations of the data when interpreting the results. Although the sampling design (and gear) is consistent throughout all years, the sampling efficiency of the otter trawls is estimated at approximately 50% (Vin Malkoski, MDMF, personal communication). The timing of the surveys (one month in the spring and one month in the fall) can not adequately represent the abundance and distribution of finfish over the year. Although no specific species are targeted during these surveys, otter trawls are not particularly efficient at sampling the more pelagic and mid-water column species such as Atlantic mackerel, sharks, bluefish or tuna. Therefore any analysis evaluating species occurrence may not represent accurate abundance and distribution for these pelagic species. That being said, because no long-term fish monitoring data are available, the MDMF trawl data from all trawl locations within the boundaries of the proposed and alternative sites in Nantucket Sound were evaluated to provide some estimate of finfish resources at the Proposed and alternative sites. Decisions should not be based solely on these data and results of analyses using this information should be combined with other data sources (biological and physical) to draw conclusions and make recommendations.

6.0 LIKELIHOOD-OF-OCCURRENCE ANALYSIS

Because intensive, site-specific evaluations of the fish populations at the proposed and alternative sites in Nantucket Sound do not exist, the MDMF bi-annual trawl data were used to conduct a likelihood of occurrence analysis. The trawl data consisted of the number of individuals of each species caught during a series of trawls taken near the Proposed site (Horseshoe Shoal) and alternative sites (Monomoy-Handkerchief Shoal, and Tuckernuck Shoal) in Nantucket Sound. The individual trawling events spanned 25 years from 1978 to 2002. Trawl events (at most one per season) were divided between the spring (May) and fall (September) seasons. Except for four years (Monomoy-Handkerchief Shoal: 1995, 1998, and 2001; Tuckernuck Shoal: 2002), there was at least a single trawl event in the spring or fall near each of the three sites in Nantucket Sound. The total number of trawls for each site and season is listed in Table 10. All analyses assumed equal effort (e.g., length of tow, size of mesh) for each trawl event.

Table 10. Total number of trawls taken near each site by season

Season	Horseshoe Shoal	Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total
Spring	25	18	21	64
Fall	23	17	22	62
Total	48	35	43	126

6.1 Statistical Methods

The statistical analysis of trawl data was conducted by site and season, by region and season, annually by site, and annually by region. The intent of the analysis was to estimate a categorical likelihood of occurrence of each species, ranging from very common to not observed during either the spring or fall at each of the three sites in Nantucket Sound. First, a category for the *local likelihood of occurrence* was estimated using the presence/absence (P/A) data of each species using only the trawl data collected closest to a given site for each season (i.e., spring or fall). The proportion of occurrence was defined as the number of trawls for which a species was caught divided by the total number of trawls taken. Second, a category for the *regional likelihood of occurrence* was estimated using the P/A of each species in trawl data from all three sites for each season. Finally, the local and regional estimates of the likelihood of occurrence were combined with the relationship of the count data across time to produce a category for the *final likelihood of occurrence.* The final estimate was a reduction or increase in the occurrence category obtained from the P/A analysis based on species counts across time. Two measures of potential increase or decrease in counts across time were evaluated: (1) a significant slope (α=0.1) from a simple linear regression of counts across time and (2) the proportion of counts in the first 10 years greater than the median count from all years compared to the proportion of counts in the last 10 years greater than the median count.

The same general rules of proportion of occurrence based on the P/A data were used for the regional and local estimate of the category for the *likelihood of occurrence* (Table 11). For the local analysis, species were considered very common if they were caught greater than 75% of the time for a given season. Species caught between 50% and 75% of the time were considered variably common. Species caught between 25% and 50% of the time were considered less

Table 11. Rules and color codes for each category of the likelihood of occurrence

Code	Category	Local Analysis	Regional Analysis	Regional Analysis, Alternate Rule
0	Not Observed	Species not caught at the site	Species not caught at any of the sites	Species caught 0% of the time
1	Very Rare	Species were caught between 0 and 10% of the time	Species were caught between 0 and 10% of the time at no more than 2 sites and 0 times at least 1 site	Species caught between 0% and 10% of the time
2	Rare	Species were caught between 10% and 25% of the time	Species were caught between 10% and 25% of the time at 1 or more sites and greater than 0 and less than 25% at all sites	Species caught between 10% and 20% of the time
3	Variably Rare	NA	Species are caught between 10% and 25% of the time at no more than one site and less than 50% at all sites	Species caught between 20% and 40% of the time
4	Less Common	Species were caught between 25% and 50% of the time	Species are caught between 25% and 50% of the time at 2 sites and less than 75% at all sites	Species caught between 40% and 60% of the time
5	Variably Common	Species were caught between 50% and 75% of the time	Species are caught greater than 25% of the time at all sites and greater than 50% of the time at 2 or more sites	Species caught between 60% and 70% of the time
6	Very Common	Species were caught greater than 75% of the time	Species are caught greater than 75% of the time at 2 or more sites and greater than 50% of the time all sites.	Species caught between 70% and 100% of the time

common. Species caught between 10% and 25% of the time were considered rare. Species caught greater than 0 and less than 10% of the time were considered very rare. The last category of occurrence was for those species not observed at all for a given site and season. Note that in the local analysis, there is no category defined as "Variably Rare". The "Variably Rare" category's percentages of occurrence overlap completely with the "Rare" category's percentages of occurrence when considering only a single site.

For both the regional and local occurrence categories, the percentages of 75%, 50%, 25% and 10% were a subjective criterion applied to indicate the frequency of occurrence of a species. The regional analysis used the same percentage values, however, the number of sites which met each criterion varied. If the criteria didn't match exactly (for example, a species was caught greater than 75% of the time at 1 site and less than 10% at 2 sites), then the regional percentage caught would be evaluated using the regional alternate rule definitions. The alternate rules do not impose as much symmetry between sites as the original definitions and are therefore a less desirable classification scheme.

The count data were used to amend the P/A analysis of occurrence by either decreasing the occurrence category by one level or increasing it depending on whether or not the population appeared to be declining or increasing. The first indicator of a population increase or decline was a significant slope from a simple linear regression of count against time. The direction of the slope either positive or negative would dictate an increase or decrease in the category level. However, a linear decay or increase is not a very normal response for highly variable populations. Instead, the regression analysis is conducted using the average catch over a five year period to reduce some of the variability. Despite this smoothing, most of these species still displayed peaks and troughs in numbers caught over time. Thus, many significant linear regressions were not expected since the response across five 5-year periods is still highly variable. As an additional indicator of potential concern of either an increase or decrease in the local and regional populations, the proportion of counts within a 5 year block that the catch goes above the 25 year median catch was evaluated. If there was no change in numbers caught, this proportion would be expected to be roughly 0.5 for each block. However, it is known that there is Binomial noise that is different for each block of years. Thus, only a comparison between the average response of the first two 5 year blocks with

the average response of the last two 5 year blocks was conducted. Proportions were determined to be different if the absolute value of the difference was greater than one standard deviation of the proportions across all 5 time blocks. This is not a statistical test, but only an indicator of potential concern of an increase or decrease in the local and regional populations.

The combined analysis to produce a category for the *final likelihood of occurrence* uses both the P/A results and the determination of whether or not the population is increasing or decreasing based on the count data. The combined analysis was conducted on both the regional and local data separately. If a species had either a significant slope ($\alpha = 0.1$) or an indication that the proportion of counts greater than the median catch were different using only the local data, the local estimate of occurrence was increased or decreased by one classification level depending on the direction of change. Likewise, the regional occurrence category was either increased or decreased based only on the regional count data response. Categories were not increased above the highest category (very common) or decreased below the very rare category. For all cases for which no change was indicated by the count data, the P/A based category of occurrence was used as the final category of occurrence.

For those species caught in both the spring and fall, an annual occurrence category was determined by taking the average of the spring and fall final occurrence category codes and rounding up to the nearest category. The effect of this algorithm was to decrease the highest ranked category by one level if the absolute difference between the fall and spring categories was equal to three. A difference less than this would give an annual occurrence category equivalent to the greater of the two occurrence categories. Absolute differences of four or five result in an annual occurrence category two levels lower than the greater of the spring and fall occurrence categories.

6.2 Results

A total of 77 species were observed in the bi-annual research trawl dataset from all three sites over the 25 year sampling period. Note that the blue mussel was not observed at all during this time period although it remains in the data giving a total of 78 species tracked. Based only on the P/A data for the spring and fall trawls, two species (longfin squid and the spider crab unclassified) were classified as locally very common at all three sites and in both seasons (Table 12). The distribution of locally common and rare species based on the P/A data is not the same for all three sites (Figure 26). Monomoy-Handkerchief Shoal has fewer observed species in both the spring and fall seasons than either of the other sites. Tuckernuck Shoal has more observed species during the spring than the fall. The distribution of the number of species observed at Horseshoe Shoal remains about the same during both seasons even though the community changes. There were 18 species that were generally common (i.e., very common, common and less common) at one or more sites through out the year (Table 13). Tuckernuck Shoal had the least number of species that were generally common through out the year.

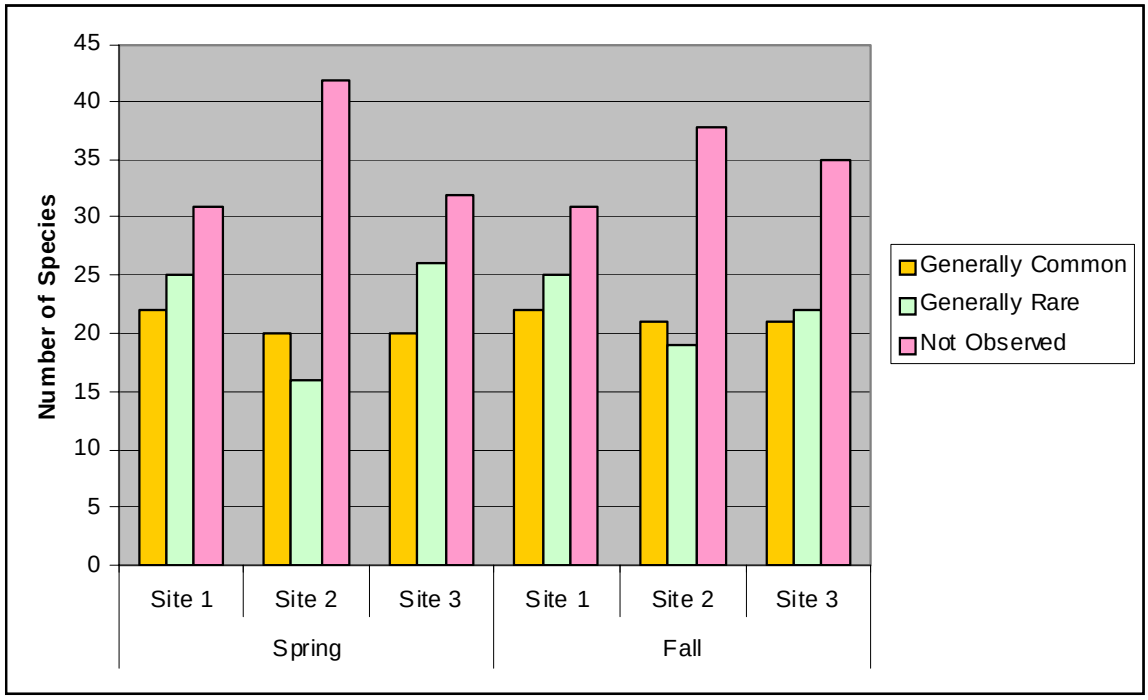


Figure 26. Distribution of the 78 species local occurrence categories by site and season using only the presence/absence data. Generally common species include those species designated in categories 4, 5, and 6; generally rare species includes categories 1, 2, and 3, and species not observed are in category 0. (Site 1 = Horseshoe Shoal, Site 2 = Monomoy-Handkerchief Shoal, Site 3 = Tuckernuck Shoal)

Table 12. Local estimate of the category for the likelihood of occurrence by season based only on the presence/absence data

Spring Horseshoe Shoal	Spring Monomoy-Handkerchief Shoal	Spring Tuckernuck Shoal
Very Common		
Channeled Whelk	Atlantic Rock Crab	Atlantic Rock Crab
Lady Crab	Little Skate	Channeled Whelk
Little Skate	Longfin Squid	Lady Crab
Longfin Squid	Spider Crab Uncl	Little Skate
Northern Searobin	Windowpane	Longfin Squid
Spider Crab Uncl	Winter Flounder	Northern Searobin
Summer Flounder	Winter Skate	Spider Crab Uncl
Windowpane		Summer Flounder
Winter Flounder		Windowpane
Winter Skate		Winter Flounder
		Winter Skate
Variably Common		
Atlantic Cod	Channeled Whelk	Moon Snail Shark Eye And Baby- Ear
Atlantic Rock Crab	Longhorn Sculpin	
Black Sea Bass	Northern Searobin	
Less Common		
Butterfish	American Lobster	Alewife
Cunner	Atlantic Cod	American Lobster
Fourspot Flounder	Black Sea Bass	Atlantic Cod
Horseshoe Crab	Butterfish	Butterfish
Knobbed Whelk	Knobbed Whelk	Longhorn Sculpin
Longhorn Sculpin	Lady Crab	Scup
Moon Snail Shark Eye And Baby- Ear	Red Hake	Smallmouth Flounder
Scup	Scup	White Hake
Tautog	Summer Flounder	
	Tautog	
Rare		
Alewife	Alewife	Atlantic Herring
American Lobster	Atlantic Mackerel	Black Sea Bass
Northern Sand Lance	Cunner	Cunner
Rock Gunnel	Fourspot Flounder	Fourspot Flounder
Sea Raven	Horseshoe Crab	Horseshoe Crab
Smallmouth Flounder	Moon Snail Shark Eye And Baby- Ear	Knobbed Whelk
Smooth Dogfish	Sea Raven	Northern Pipefish
Spiny Dogfish	Silver Hake	Northern Sand Lance
	Spiny Dogfish	Red Hake
		Rock Gunnel
		Silver Hake
		Smooth Dogfish
		Spiny Dogfish
		Spotted Hake
Very Rare		
American Shad	Gulf Stream Flounder	American Shad
Atlantic Herring	Jonah Crab	Atlantic Menhaden
Atlantic Mackerel	Longfin Squid Egg Mops	Atlantic Surfclam
Atlantic Surfclam	Ocean Pout	Blueback Herring
Bay Anchovy	Smooth Dogfish	Bluefish
Bay Scallop	Snakeblenny	Longfin Squid Egg Mops
Very Rare (continued)		
Blueback Herring	Striped Searobin	Northern Shortfin Squid
Gulf Stream Flounder		Pollock
Longfin Squid Egg Mops		Rainbow Smelt
Northern Moonsnail		Sea Raven
Northern Pipefish		Striped Bass
Pollock		Tautog
Red Hake		

Spring Horseshoe Shoal	Spring Monomoy-Handkerchief Shoal	Spring Tuckernuck Shoal
Silver Hake Spotted Hake Striped Searobin White Hake		
Not Observed Atlantic Menhaden Atlantic Moonfish Banded Rudderfish Bigeye Blue Mussel Blue Runner Bluefish Bluespotted Cornetfish Flying Gurnard Guaguanche Inshore Lizardfish Jonah Crab Mackerel Scad Northern Horsemussel Northern Kingfish Northern Puffer Northern Sennet Northern Shortfin Squid Ocean Pout Planehead Filefish Rainbow Smelt Rough Scad Roughtail Stingray Sand Tiger Scrawled Filefish Short Bigeye Snakeblenny Snakefish Snowy Grouper Striped Anchovy Striped Bass	 American Shad Atlantic Herring Atlantic Menhaden Atlantic Moonfish Atlantic Surfclam Banded Rudderfish Bay Anchovy Bay Scallop Bigeye Blue Mussel Blue Runner Blueback Herring Bluefish Bluespotted Cornetfish Flying Gurnard Guaguanche Inshore Lizardfish Mackerel Scad Northern Horsemussel Northern Kingfish Northern Moonsnail Northern Pipefish Northern Puffer Northern Sand Lance Northern Sennet Northern Shortfin Squid Planehead Filefish Pollock Rainbow Smelt Rock Gunnel Rough Scad Roughtail Stingray Sand Tiger Scrawled Filefish Short Bigeye Smallmouth Flounder Snakefish Snowy Grouper	 Atlantic Mackerel Atlantic Moonfish Banded Rudderfish Bay Anchovy Bay Scallop Bigeye Blue Mussel Blue Runner Bluespotted Cornetfish Flying Gurnard Guaguanche Gulf Stream Flounder Inshore Lizardfish Jonah Crab Mackerel Scad Northern Horsemussel Northern Kingfish Northern Moonsnail Northern Puffer Northern Sennet Ocean Pout Planehead Filefish Rough Scad Roughtail Stingray Sand Tiger Scrawled Filefish Short Bigeye Snakeblenny Snakefish Snowy Grouper Striped Anchovy Striped Searobin
Not Observed (continued)	 Spotted Hake Striped Anchovy Striped Bass White Hake	

Table 12 (Continued)

Fall Horseshoe Shoal	Fall Monomoy-Handkerchief Shoal	Fall Tuckernuck Shoal
Very Common		
Black Sea Bass	Black Sea Bass	Black Sea Bass
Butterfish	Butterfish	Butterfish
Knobbed Whelk	Channeled Whelk	Lady Crab
Lady Crab	Lady Crab	Little Skate
Longfin Squid	Little Skate	Longfin Squid
Northern Searobin	Longfin Squid	Scup
Scup	Northern Searobin	Smooth Dogfish
Smooth Dogfish	Scup	Spider Crab Uncl
Spider Crab Uncl	Smooth Dogfish	
Summer Flounder	Spider Crab Uncl	
	Summer Flounder	
Variably Common		
Channeled Whelk	Atlantic Rock Crab	Atlantic Rock Crab
Winter Skate	Bluefish	Channeled Whelk
	Knobbed Whelk	Knobbed Whelk
	Windowpane	Northern Searobin
	Winter Skate	Summer Flounder
		Winter Skate
Less Common		
Atlantic Rock Crab	Horseshoe Crab	Atlantic Moonfish
Bluefish	Northern Kingfish	Bluefish
Cunner	Striped Searobin	Mackerel Scad
Little Skate	Tautog	Northern Pipefish
Northern Kingfish	Winter Flounder	Smallmouth Flounder
Northern Pipefish		Striped Searobin
Northern Puffer		Windowpane
Smallmouth Flounder		
Tautog		
Windowpane		
Rare		
Bay Anchovy	American Lobster	Blue Runner
Bluespotted Cornetfish	Atlantic Moonfish	Fourspot Flounder
Horseshoe Crab	Bay Anchovy	Gulf Stream Flounder
Inshore Lizardfish	Bay Scallop	Horseshoe Crab
Mackerel Scad	Cunner	Moon Snail Shark Eye And Baby- Ear
Moon Snail Shark Eye And Baby- Ear	Mackerel Scad	Northern Kingfish
Planehead Filefish	Northern Pipefish	Northern Puffer
Striped Anchovy	Smallmouth Flounder	Northern Sand Lance
Striped Searobin	White Hake	Red Hake
Winter Flounder		Rough Scad
		Snowy Grouper
		Striped Anchovy
		White Hake
		Winter Flounder
Very Rare		
Atlantic Surfclam	Bigeye	Atlantic Herring
Banded Rudderfish	Gulf Stream Flounder	Bay Anchovy
Bigeye	Longfin Squid Egg Mops	Cunner
Blueback Herring	Moon Snail Shark Eye And Baby- Ear	Guaguanche
Very Rare (continued)		
Flying Gurnard	Northern Horsemussel	Northern Sennet
Fourspot Flounder	Northern Puffer	Planehead Filefish
Gulf Stream Flounder	Northern Sand Lance	Rock Gunnel
Red Hake	Planehead Filefish	Silver Hake
Rock Gunnel	Spotted Hake	
Roughtail Stingray	Striped Anchovy	
Sand Tiger		

Fall Horseshoe Shoal	Fall Monomoy-Handkerchief Shoal	Fall Tuckernuck Shoal
Scrawled Filefish		
Sea Raven		
Short Bigeye		
Snakefish		
Not Observed		
Alewife	Alewife	Alewife
American Lobster	American Shad	American Lobster
American Shad	Atlantic Cod	American Shad
Atlantic Cod	Atlantic Herring	Atlantic Cod
Atlantic Herring	Atlantic Mackerel	Atlantic Mackerel
Atlantic Mackerel	Atlantic Menhaden	Atlantic Menhaden
Atlantic Menhaden	Atlantic Surfclam	Atlantic Surfclam
Atlantic Moonfish	Banded Rudderfish	Banded Rudderfish
Bay Scallop	Blue Mussel	Bay Scallop
Blue Mussel	Blue Runner	Bigeye
Blue Runner	Blueback Herring	Blue Mussel
Guaguanche	Bluespotted Cornetfish	Blueback Herring
Jonah Crab	Flying Gurnard	Bluespotted Cornetfish
Longfin Squid Egg Mops	Fourspot Flounder	Flying Gurnard
Longhorn Sculpin	Guaguanche	Inshore Lizardfish
Northern Horsemussel	Inshore Lizardfish	Jonah Crab
Northern Moonsnail	Jonah Crab	Longfin Squid Egg Mops
Northern Sand Lance	Longhorn Sculpin	Longhorn Sculpin
Northern Sennet	Northern Moonsnail	Northern Horsemussel
Northern Shortfin Squid	Northern Sennet	Northern Moonsnail
Ocean Pout	Northern Shortfin Squid	Northern Shortfin Squid
Pollock	Ocean Pout	Ocean Pout
Rainbow Smelt	Pollock	Pollock
Rough Scad	Rainbow Smelt	Rainbow Smelt
Silver Hake	Red Hake	Roughtail Stingray
Snakeblenny	Rock Gunnel	Sand Tiger
Snowy Grouper	Rough Scad	Scrawled Filefish
Spiny Dogfish	Roughtail Stingray	Sea Raven
Spotted Hake	Sand Tiger	Short Bigeye
Striped Bass	Scrawled Filefish	Snakeblenny
White Hake	Sea Raven	Snakefish
	Short Bigeye	Spiny Dogfish
	Silver Hake	Spotted Hake
	Snakeblenny	Striped Bass
	Snakefish	Tautog
	Snowy Grouper	
	Spiny Dogfish	
	Striped Bass	

Table 13. Species considered generally common based on the presence/absence data at one or more sites through out the year. Cell numbers represent the occurrence category defined in Table 11.

Species	Horseshoe Shoal		Monomoy-Handkerchief Shoal		Tuckernuck Shoal	
	Spring	Fall	Spring	Fall	Spring	Fall
Atlantic Rock Crab	5	4	6	5	6	5
Black Sea Bass	5	6	4	6	2	6
Butterfish	4	6	4	6	4	6
Channeled Whelk	6	5	5	6	6	5
Cunner	4	4	2	2	2	1
Knobbed Whelk	4	6	4	5	2	5
Lady Crab	6	6	4	6	6	6
Little Skate	6	4	6	6	6	6
Longfin Squid	6	6	6	6	6	6
Northern Searobin	6	6	5	6	6	5
Scup	4	6	4	6	4	6
Smallmouth Flounder	2	4	0	2	4	4
Spider Crab Uncl	6	6	6	6	6	6
Summer Flounder	6	6	4	6	6	5
Tautog	4	4	4	4	1	0
Windowpane	6	4	6	5	6	4
Winter Flounder	6	2	6	4	6	2
Winter Skate	6	5	6	5	6	5

The regional analysis by season was based on the sum of the number of times that a species was caught at each site (Table 14). Only five species had asymmetric occurrence distributions and required the alternative rules to determine the regional occurrence category. There were 16 species that were generally common regionally through out the year based only on the P/A data, and 26 species that were generally rare (i.e., very rare or rare; Table 15). The remaining 38 species were not observed at all during at least one of the seasons.

Based on the count data, five species were potentially increasing in population during the spring and eight species were potentially increasing in the fall at one or more of the sites (Table 16). Atlantic rock crab does not display a linear increase in catch, yet it does appear that a potential increase is occurring based on the average of the first two 5-year periods' proportion of counts greater than the median catch of 4 and the average of the last two 5-year periods (Figure 27). Likewise, the Channeled whelk does not display a linear decline in catch, yet does indicate a potential decrease is occurring based on the average of the first two 5-year periods' proportion of counts greater than the median of 4 and the average of the last two 5-year periods (Figure 28). Of those species potentially increasing during the spring, only two were potentially increasing regionally. In the fall, four species were potentially increasing locally and five species were potentially increasing regionally. Twelve species were potentially decreasing in population locally during the spring and 11 in the fall. Fourteen species were potentially decreasing regionally in the spring while only eight species were potentially decreasing regionally in the fall. Horseshoe Shoal had the greatest number of species that were potentially declining in the spring and the least in the fall.

A species category of the likelihood of occurrence was either increased or decreased by one level depending on whether or not the population was potentially increasing or decreasing, respectively. Local occurrence categories based on the P/A data were adjusted independently of the regional count data results. For example, the Atlantic rock crab was increased from variably common to very common at Horseshoe Shoal during the spring because of the potential increase in catch indicated by the greater number of observations above the median catch in the last two 5-year periods (Figure 27). The Channeled whelk was decreased from very common to variably common at Horseshoe Shoal during the spring (Figure 28). Likewise, the regional occurrence categories were adjusted based only on the regional count data response. The combined estimate of the likelihood of occurrence category based

on both the presence/absence and count data by site and season is presented in Table 17. The sorting from common to rare based on each site's spring occurrence categories allows one to quickly determine which species were not observed during a particular season at a given site.

The final adjustment to the category of the likelihood of occurrence was to average the spring and fall category classes for those species occurring in both seasons (Table 18). Analyzing the number of species in each category, it appears that Monomoy-Handkerchief Shoal has the fewest species compared to Horseshoe Shoal or Tuckernuck Shoal (Figure 29). Horseshoe Shoal and Monomoy-Handkerchief Shoal have the most species declining in the spring and Monomoy-Handkerchief Shoal and Tuckernuck Shoal have the most declining in the fall (Figure 30).

Table 14. Number of trawls species were observed by site and resulting regional estimate of the occurrence category by season based only on the presence/absence data. Shaded cells indicate when the alternate rules for occurrence category were used.

Species	Horseshoe Shoal	Spring Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls
Very Common					
Spider Crab Uncl	25	17	21	63	0.98
Winter Flounder	25	18	20	63	0.98
Little Skate	24	17	21	62	0.97
Longfin Squid	25	16	19	60	0.94
Windowpane	23	17	20	60	0.94
Winter Skate	22	15	16	53	0.83
Atlantic Rock Crab	18	16	18	52	0.81
Northern Searobin	21	12	19	52	0.81
Channeled Whelk	21	11	17	49	0.77
Variably Common					
Summer Flounder	21	7	17	45	0.70
Lady Crab	20	5	16	41	0.64
Less Common					
Atlantic Cod	17	8	10	35	0.55
Longhorn Sculpin	10	11	7	28	0.44
Scup	11	8	8	27	0.42
Black Sea Bass	15	8	3	26	0.41
Variably Rare					
Moon Snail					
Shark Eye And Baby- Ear	9	3	12	24	0.38
Northern Kingfish	8	4	3	15	0.24
Butterfish	8	6	6	20	0.31
Knobbed Whelk	10	6	3	19	0.30

Species	Horseshoe Shoal	Fall Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls
Very Common					
Scup	23	17	22	62	1.00
Longfin Squid	23	17	22	62	1.00
Butterfish	23	17	21	61	0.98
Lady Crab	21	14	22	57	0.92
Black Sea Bass	22	16	19	57	0.92
Spider Crab Uncl	20	17	19	56	0.90
Smooth Dogfish	21	14	18	53	0.85
Northern Searobin	20	14	14	48	0.77
Summer Flounder	18	14	13	45	0.73
Variably Common					
Little Skate	11	14	18	43	0.69
Winter Skate	16	12	14	42	0.68
Knobbed Whelk	19	10	11	40	0.65
Channeled Whelk	15	13	12	40	0.65
Less Common					
Atlantic Rock Crab	8	11	12	31	0.50
Windowpane	7	11	9	27	0.44
Bluefish	7	9	10	26	0.42
Variably Rare					
Smallmouth Flounder	9	3	6	18	0.29
Northern Pipefish	8	1	8	17	0.27
Striped Searobin	5	4	7	16	0.26

Species	Horseshoe Shoal	Spring Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls
Tautog	11	7	1	19	0.30
American Lobster	5	7	5	17	0.27
Horseshoe Crab	11	4	2	17	0.27
Fourspot Flounder	7	4	2	13	0.20
Red Hake	2	7	4	13	0.20
Rare					
Alewife	3	4	5	12	0.19
Cunner	6	3	2	11	0.17
Silver Hake	2	4	4	10	0.16
Smooth Dogfish	5	1	4	10	0.16
Spiny Dogfish	5	2	3	10	0.16
Smallmouth Flounder	3	0	6	9	0.14
Sea Raven	5	2	1	8	0.13
Northern Sand Lance	3	0	4	7	0.11
White Hake	1	0	6	7	0.11
Northern Pipefish	1	0	4	5	0.08
Rock Gunnel	3	0	2	5	0.08
Longfin Squid Egg Mops	2	1	1	4	0.06
Very Rare					
Atlantic Mackerel	2	2	0	4	0.06
Spotted Hake	2	0	2	4	0.06
Gulf Stream Flounder	2	1	0	3	0.05
Pollock	2	0	1	3	0.05
Atlantic Herring	1	0	2	3	0.05
Striped Searobin	1	1	0	2	0.03
American Shad	1	0	1	2	0.03

Species	Horseshoe Shoal	Fall Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls
Horseshoe Crab	5	7	2	14	0.23
Horseshoe Crab	5	7	2	14	0.23
Mackerel Scad	3	2	7	12	0.19
Cunner	8	3	1	12	0.19
Tautog	7	4	0	11	0.18
Northern Puffer	7	1	3	11	0.18
Rare					
Winter Flounder	2	5	2	9	0.15
Striped Anchovy	4	1	4	9	0.15
Moon Snail Shark Eye And Baby- Ear	2	1	5	8	0.13
Atlantic Moonfish	0	2	6	8	0.13
Planehead Filefish	4	1	1	6	0.10
Bay Anchovy	3	2	1	6	0.10
Gulf Stream Flounder	1	1	2	4	0.06
Very Rare					
White Hake	0	2	2	4	0.06
Red Hake	1	0	2	3	0.05
Fourspot Flounder	1	0	2	3	0.05
Northern Sand Lance	0	1	2	3	0.05
Rock Gunnel	1	0	1	2	0.03
Bigeye	1	1	0	2	0.03
Inshore Lizardfish	2	0	0	2	0.03
Bluespotted Cornetfish	2	0	0	2	0.03
Snakefish	1	0	0	1	0.02
Short Bigeye	1	0	0	1	0.02
Sea Raven	1	0	0	1	0.02

Species	Horseshoe Shoal	Spring Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls
Atlantic Surfclam	1	0	1	2	0.03
Blueback Herring	1	0	1	2	0.03
Bay Anchovy	1	0	0	1	0.02
Bay Scallop	1	0	0	1	0.02
Northern Moonsnail	1	0	0	1	0.02
Jonah Crab	0	1	0	1	0.02
Ocean Pout	0	1	0	1	0.02
Snakeblenny	0	1	0	1	0.02
Atlantic Menhaden	0	0	1	1	0.02
Bluefish	0	0	1	1	0.02
Northern Shortfin Squid	0	0	1	1	0.02
Rainbow Smelt	0	0	1	1	0.02
Striped Bass	0	0	1	1	0.02
Not Observed					
Atlantic Moonfish	0	0	0	0	0.00
Banded Rudderfish	0	0	0	0	0.00
Bigeye	0	0	0	0	0.00
Blue Mussel	0	0	0	0	0.00
Blue Runner	0	0	0	0	0.00
Bluespotted Cornetfish	0	0	0	0	0.00
Flying Gurnard	0	0	0	0	0.00
Guaguanche	0	0	0	0	0.00
Inshore Lizardfish	0	0	0	0	0.00
Mackerel Scad	0	0	0	0	0.00
Northern Horsemussel	0	0	0	0	0.00
Northern Kingfish	0	0	0	0	0.00

Species	Horseshoe Shoal	Fall Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls
Scrawled Filefish	1	0	0	1	0.02
Sand Tiger	1	0	0	1	0.02
Roughtail Stingray	1	0	0	1	0.02
Flying Gurnard	1	0	0	1	0.02
Blueback Herring	1	0	0	1	0.02
Banded Rudderfish	1	0	0	1	0.02
Atlantic Surfclam	1	0	0	1	0.02
American Lobster	0	3	0	3	0.05
Bay Scallop	0	2	0	2	0.03
Spotted Hake	0	1	0	1	0.02
Northern Horsemussel	0	1	0	1	0.02
Longfin Squid Egg Mops	0	1	0	1	0.02
Snowy Grouper	0	0	2	2	0.03
Rough Scad	0	0	2	2	0.03
Blue Runner	0	0	2	2	0.03
Silver Hake	0	0	1	1	0.02
Northern Sennet	0	0	1	1	0.02
Guaguanche	0	0	1	1	0.02
Atlantic Herring	0	0	1	1	0.02
Not Observed					
Alewife	0	0	0	0	0.00
American Shad	0	0	0	0	0.00
Atlantic Cod	0	0	0	0	0.00
Atlantic Mackerel	0	0	0	0	0.00
Atlantic Menhaden	0	0	0	0	0.00
Blue Mussel	0	0	0	0	0.00

Species	Horseshoe Shoal	Spring Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls	Species	Horseshoe Shoal	Fall Monomoy-Handkerchief Shoal	Tuckernuck Shoal	Total	Proportion of Total Trawls
Northern Puffer	0	0	0	0	0.00	Jonah Crab	0	0	0	0	0.00
Northern Sennet	0	0	0	0	0.00	Longhorn Sculpin	0	0	0	0	0.00
Planehead Filefish	0	0	0	0	0.00	Northern Moonsnail	0	0	0	0	0.00
Rough Scad	0	0	0	0	0.00	Northern Shortfin Squid	0	0	0	0	0.00
Roughtail Stingray	0	0	0	0	0.00	Ocean Pout	0	0	0	0	0.00
Sand Tiger	0	0	0	0	0.00	Pollock	0	0	0	0	0.00
Scrawled Filefish	0	0	0	0	0.00	Rainbow Smelt	0	0	0	0	0.00
Short Bigeye	0	0	0	0	0.00	Snakeblenny	0	0	0	0	0.00
Snakefish	0	0	0	0	0.00	Spiny Dogfish	0	0	0	0	0.00
Snowy Grouper	0	0	0	0	0.00	Striped Bass	0	0	0	0	0.00
Striped Anchovy	0	0	0	0	0.00						

Table 15. Species considered generally common or rare regionally through out the year based on the presence/absence data. Numbers represent the occurrence category defined in Table 11.

Generally Common			Generally Rare		
Species	**Spring**	**Fall**	**Species**	**Spring**	**Fall**
Atlantic Rock Crab	6	4	American Lobster	3	1
Black Sea Bass	4	6	Atlantic Herring	1	1
Butterfish	3	6	Atlantic Surfclam	1	1
Channeled Whelk	6	5	Bay Anchovy	1	2
Knobbed Whelk	3	5	Bay Scallop	1	1
Lady Crab	5	6	Blueback Herring	1	1
Little Skate	6	5	Bluefish	1	4
Longfin Squid	6	6	Cunner	2	3
Northern Searobin	6	6	Fourspot Flounder	3	1
Scup	4	6	Gulf Stream Flounder	1	2
Spider Crab Uncl	6	6	Horseshoe Crab	3	3
Summer Flounder	5	6	Longfin Squid Egg Mops	2	1
Windowpane	6	4	Moon Snail Shark Eye And Baby- Ear	3	2
Winter Skate	6	5	Northern Pipefish	2	3
			Northern Sand Lance	2	1
			Red Hake	3	1
			Rock Gunnel	2	1
			Sea Raven	2	1
			Silver Hake	2	1
			Smallmouth Flounder	2	3
			Smooth Dogfish	2	6
			Spotted Hake	1	1
			Striped Searobin	1	3
			Tautog	3	3
			White Hake	2	1
			Winter Flounder	6	2

Table 16. Species indicated as potentially increasing or decreasing locally and regionally based on count data

Spring							
Horseshoe Shoal		**Monomoy-Handkerchief Shoal**		**Tuckernuck Shoal**		**Regional**	
Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing
Atlantic Cod Atlantic Rock Crab Lady Crab Pollock	Channeled Whelk Little Skate Northern Searobin Sea Raven Windowpane Winter Flounder Winter Skate		Black Sea Bass Channeled Whelk Cunner Northern Searobin Red Hake Sea Raven Tautog	Atlantic Rock Crab Silver Hake	Channeled Whelk Little Skate Moon Snail Shark Eye And Baby- Ear Northern Searobin Windowpane Winter Skate	Atlantic Cod Atlantic Rock Crab	Atlantic Surfclam Black Sea Bass Channeled Whelk Knobbed Whelk Little Skate Moon Snail Shark Eye And Baby- Ear Northern Searobin Red Hake Sea Raven Tautog Windowpane Winter Flounder Winter Skate
Fall							
Horseshoe Shoal		**Monomoy-Handkerchief Shoal**		**Tuckernuck Shoal**		**Regional**	
Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing
Cunner Summer Flounder	Black Sea Bass Channeled Whelk Knobbed Whelk Northern Searobin Smooth Dogfish Windowpane	Atlantic Moonfish Atlantic Rock Crab Summer Flounder	Black Sea Bass Bluefish Channeled Whelk Little Skate Northern Searobin Smooth Dogfish Spider Crab Uncl	Butterfish Scup Smallmouth Flounder Spider Crab Uncl Summer Flounder	Channeled Whelk Fourspot Flounder Knobbed Whelk Little Skate Longfin Squid Northern Searobin Smooth Dogfish	Cunner Northern Pipefish Scup Smallmouth Flounder Summer Flounder	Black Sea Bass Channeled Whelk Knobbed Whelk Little Skate Longfin Squid Northern Searobin Smooth Dogfish Windowpane

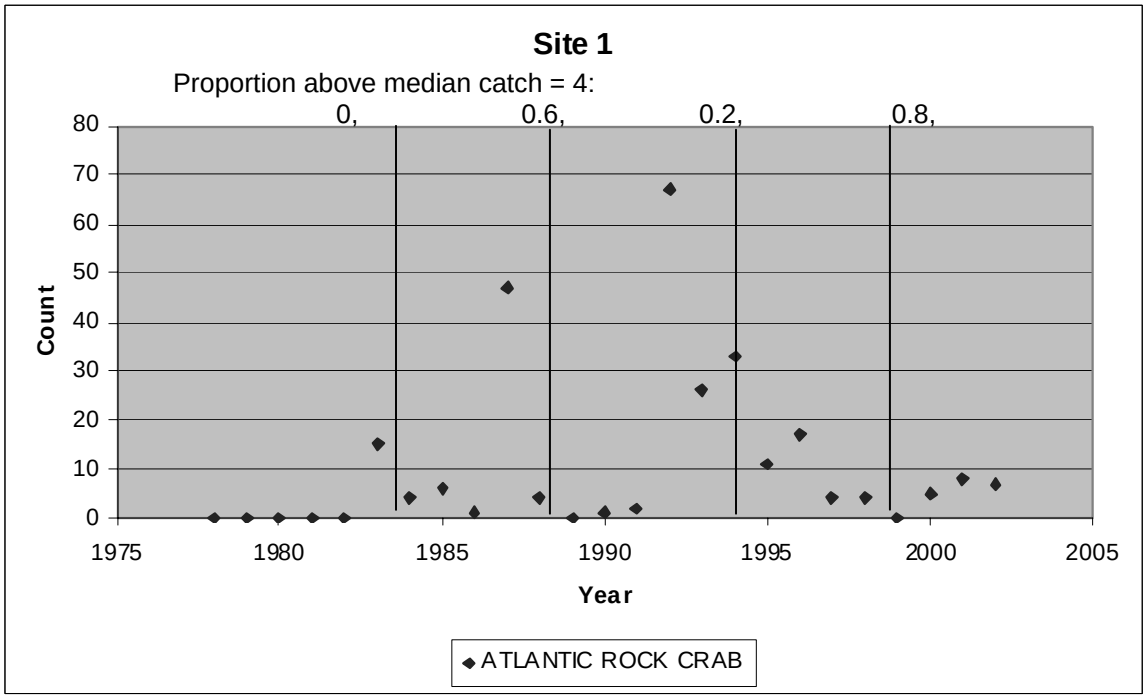


Figure 27. Catch data and proportion of each five year period during the Spring when the catch goes above the median catch for the Atlantic Rock Crab

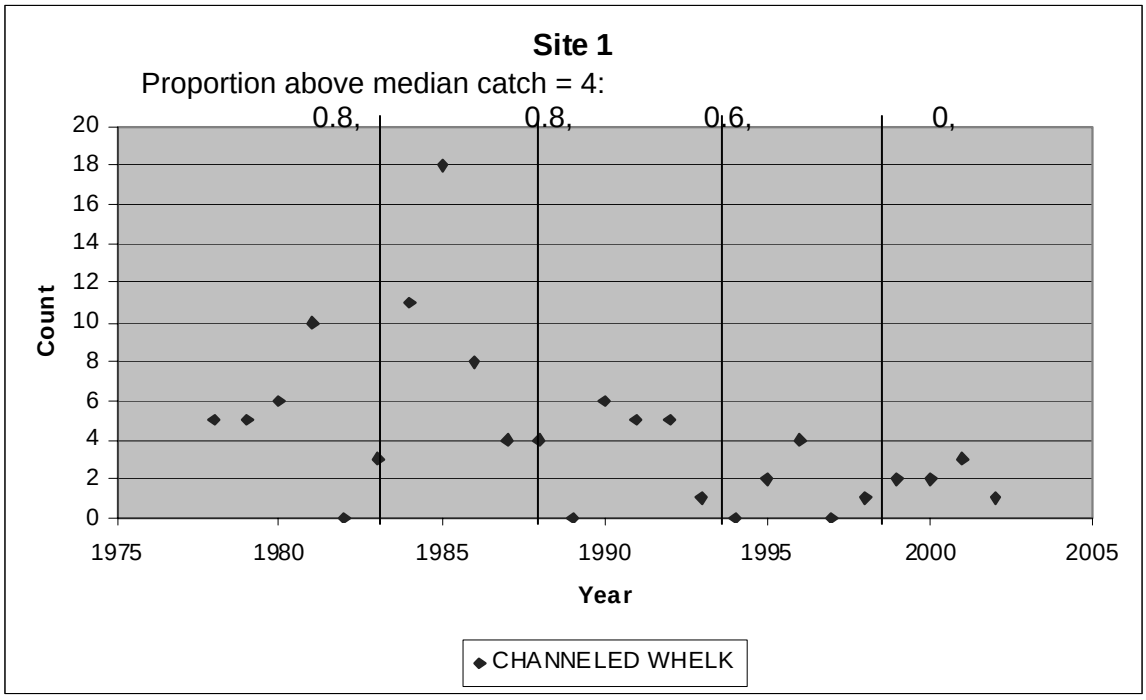


Figure 28. Catch data and proportion of each five year period during the Spring when the catch goes above the median catch for the Channeled whelk.

Table 17. Combined estimate of the likelihood of occurrence category based on both the presence/absence and count data by site and season. Species are sorted from common to rare based on each site's spring occurrence categories. Numbers represent the occurrence category as defined in Table 11.

Combined Analysis Horseshoe Shoal	Spring	Fall	Combined Analysis Monomoy-Handkerchief Shoal	Spring	Fall	Combined Analysis Tuckernuck Shoal	Spring	Fall
Lady Crab	6	6	Atlantic Rock Crab	6	6	Lady Crab	6	6
Longfin Squid	6	6	Longfin Squid	6	6	Spider Crab Uncl	6	6
Spider Crab Uncl	6	6	Little Skate	6	5	Summer Flounder	6	6
Summer Flounder	6	6	Spider Crab Uncl	6	5	Atlantic Rock Crab	6	5
Atlantic Rock Crab	6	4	Windowpane	6	5	Longfin Squid	6	5
Atlantic Cod	6	0	Winter Skate	6	5	Winter Flounder	6	3
Black Sea Bass	5	5	Winter Flounder	6	4	Little Skate	5	5
Northern Searobin	5	5	Longhorn Sculpin	5	0	Winter Skate	5	5
Winter Skate	5	5	Butterfish	4	6	Channeled Whelk	5	4
Channeled Whelk	5	4	Lady Crab	4	6	Northern Searobin	5	4
Little Skate	5	4	Scup	4	6	Windowpane	5	4
Windowpane	5	3	Summer Flounder	4	6	Butterfish	4	6
Winter Flounder	5	3	Channeled Whelk	4	5	Scup	4	6
Butterfish	4	6	Knobbed Whelk	4	5	Smallmouth Flounder	4	5
Scup	4	6	Northern Searobin	4	5	Moon Snail Shark Eye And Baby- Ear	4	3
Cunner	4	5	American Lobster	4	3	White Hake	4	3
Knobbed Whelk	4	5	Atlantic Cod	4	0	Silver Hake	4	1
Tautog	4	4	Black Sea Bass	3	5	Alewife	4	0
Horseshoe Crab	4	3	Horseshoe Crab	3	4	American Lobster	4	0
Moon Snail Shark Eye And Baby- Ear	4	3	Tautog	3	4	Atlantic Cod	4	0
Fourspot Flounder	4	1	Moon Snail Shark Eye And Baby- Ear	3	1	Longhorn Sculpin	4	0
Longhorn Sculpin	4	0	Alewife	3	0	Black Sea Bass	3	6
Smooth Dogfish	3	5	Atlantic Mackerel	3	0	Smooth Dogfish	3	5
Smallmouth Flounder	3	4	Fourspot Flounder	3	0	Knobbed Whelk	3	4
Rock Gunnel	3	1	Red Hake	3	0	Northern Pipefish	3	4
Alewife	3	0	Silver Hake	3	0	Horseshoe Crab	3	3
American Lobster	3	0	Spiny Dogfish	3	0	Northern Sand Lance	3	3
Northern Sand Lance	3	0	Smooth Dogfish	1	5	Red Hake	3	3
Pollock	3	0	Striped Searobin	1	4	Atlantic Herring	3	1
Spiny Dogfish	3	0	Cunner	1	3	Cunner	3	1
Northern Pipefish	1	4	Gulf Stream Flounder	1	1	Fourspot Flounder	3	1
Bay Anchovy	1	3	Longfin Squid Egg Mops	1	1	Rock Gunnel	3	1
Striped Searobin	1	3	Jonah Crab	1	0	Spiny Dogfish	3	0
Atlantic Surfclam	1	1	Ocean Pout	1	0	Spotted Hake	3	0
Blueback Herring	1	1	Sea Raven	1	0	Bluefish	1	4
Gulf Stream Flounder	1	1	Snakeblenny	1	0	American Shad	1	0
Red Hake	1	1	Atlantic Moonfish	0	4	Atlantic Menhaden	1	0
Sea Raven	1	1	Bluefish	0	4	Atlantic Surfclam	1	0
American Shad	1	0	Northern Kingfish	0	4	Blueback Herring	1	0
Atlantic Herring	1	0	Bay Anchovy	0	3	Longfin Squid Egg Mops	1	0
Atlantic Mackerel	1	0	Bay Scallop	0	3	Northern Shortfin Squid	1	0
Bay Scallop	1	0	Mackerel Scad	0	3	Pollock	1	0
Longfin Squid egg	1	0	Northern Pipefish	0	3	Rainbow Smelt	1	0

Combined Analysis Horseshoe Shoal	Spring	Fall	Combined Analysis Monomoy-Handkerchief Shoal	Spring	Fall	Combined Analysis Tuckernuck Shoal	Spring	Fall
Northern Moonsnail	1	0	Smallmouth Flounder	0	3	Sea Raven	1	0
Silver Hake	1	0	White Hake	0	3	Striped Bass	1	0
Spotted Hake	1	0	Bigeye	0	1	Tautog	1	0
White Hake	1	0	Northern Horsemussel	0	1	Atlantic Moonfish	0	4
Bluefish	0	4	Northern Puffer	0	1	Mackerel Scad	0	4
Northern Kingfish	0	4	Northern Sand Lance	0	1	Striped Searobin	0	4
Northern Puffer	0	4	Planehead Filefish	0	1	Blue Runner	0	3
Bluespotted Cornetfish	0	3	Spotted Hake	0	1	Gulf Stream Flounder	0	3
Inshore Lizardfish	0	3	Striped Anchovy	0	1	Northern Kingfish	0	3
Mackerel Scad	0	3	American Shad	0	0	Northern Puffer	0	3
Planehead Filefish	0	3	Atlantic Herring	0	0	Rough Scad	0	3
Striped Anchovy	0	3	Atlantic Menhaden	0	0	Snowy Grouper	0	3
Banded Rudderfish	0	1	Atlantic Surfclam	0	0	Striped Anchovy	0	3
Bigeye	0	1	Banded Rudderfish	0	0	Bay Anchovy	0	1
Flying Gurnard	0	1	Blue Mussel	0	0	Guaguanche	0	1
Roughtail Stingray	0	1	Blue Runner	0	0	Northern Sennet	0	1
Sand Tiger	0	1	Blueback Herring	0	0	Planehead Filefish	0	1
Scrawled Filefish	0	1	Bluespotted Cornetfish	0	0	Atlantic Mackerel	0	0
Short Bigeye	0	1	Flying Gurnard	0	0	Banded Rudderfish	0	0
Snakefish	0	1	Guaguanche	0	0	Bay Scallop	0	0
Atlantic Menhaden	0	0	Inshore Lizardfish	0	0	Bigeye	0	0
Atlantic Moonfish	0	0	Northern Moonsnail	0	0	Blue Mussel	0	0
Blue Mussel	0	0	Northern Sennet	0	0	Bluespotted Cornetfish	0	0
Blue Runner	0	0	Northern Shortfin Squid	0	0	Flying Gurnard	0	0
Guaguanche	0	0	Pollock	0	0	Inshore Lizardfish	0	0
Jonah Crab	0	0	Rainbow Smelt	0	0	Jonah Crab	0	0
Northern Horsemussel	0	0	Rock Gunnel	0	0	Northern Horsemussel	0	0
Northern Sennet	0	0	Rough Scad	0	0	Northern Moonsnail	0	0
Northern Shortfin Squid	0	0	Roughtail Stingray	0	0	Ocean Pout	0	0
Ocean Pout	0	0	Sand Tiger	0	0	Roughtail Stingray	0	0
Rainbow Smelt	0	0	Scrawled Filefish	0	0	Sand Tiger	0	0
Rough Scad	0	0	Short Bigeye	0	0	Scrawled Filefish	0	0
Snakeblenny	0	0	Snakefish	0	0	Short Bigeye	0	0
Snowy Grouper	0	0	Snowy Grouper	0	0	Snakeblenny	0	0
Striped Bass	0	0	Striped Bass	0	0	Snakefish	0	0

Table 18. Final category of occurrence for those species that were caught annually, spring only, fall only, and not at all

Horseshoe Shoal Annual Species	Monomoy-Handkerchief Shoal Annual Species	Tuckernuck Shoal Annual Species	Regional Annual Species
Very Common			
Lady Crab	Atlantic Rock Crab	Atlantic Rock Crab	Lady Crab
Longfin Squid	Little Skate	Lady Crab	Longfin Squid
Spider Crab Uncl	Longfin Squid	Longfin Squid	Spider Crab Uncl
Summer Flounder	Spider Crab Uncl	Spider Crab Uncl	Summer Flounder
	Windowpane	Summer Flounder	
	Winter Skate		
Variably Common			
Atlantic Rock Crab	Butterfish	Black Sea Bass	Atlantic Rock Crab
Black Sea Bass	Channeled Whelk	Butterfish	Butterfish
Butterfish	Knobbed Whelk	Channeled Whelk	Channeled Whelk
Channeled Whelk	Lady Crab	Little Skate	Little Skate
Cunner	Northern Searobin	Northern Searobin	Northern Searobin
Knobbed Whelk	Scup	Scup	Scup
Little Skate	Summer Flounder	Smallmouth Flounder	Winter Skate
Northern Searobin	Winter Flounder	Windowpane	
Scup		Winter Flounder	
Winter Skate		Winter Skate	
Less Common			
Horseshoe Crab	American Lobster	Knobbed Whelk	Black Sea Bass
Moon Snail Shark Eye And Baby-Ear	Black Sea Bass	Moon Snail Shark Eye And Baby- Ear	Smooth Dogfish
Smallmouth Flounder	Horseshoe Crab	Northern Pipefish	Windowpane
Smooth Dogfish	Tautog	Smooth Dogfish	Winter Flounder
Tautog		White Hake	
Windowpane			
Winter Flounder			
Variably Rare			
Fourspot Flounder	Smooth Dogfish	Bluefish	Bluefish
Northern Pipefish	Striped Searobin	Horseshoe Crab	Cunner
		Northern Sand Lance	Horseshoe Crab
		Red Hake	Knobbed Whelk
		Silver Hake	Northern Pipefish
			Smallmouth Flounder
			Tautog
Rare			
Bay Anchovy	Cunner	Atlantic Herring	American Lobster
	Moon Snail Shark Eye And Baby- Ear		
Rock Gunnel		Cunner	Bay Anchovy
Striped Searobin		Fourspot Flounder	Fourspot Flounder
		Rock Gunnel	Gulf Stream Flounder
			Longfin Squid Egg Mops
			Moon Snail Shark Eye And Baby- Ear
			Northern Sand Lance
			Red Hake
			Rock Gunnel
Rare (Continued)			
			Silver Hake
			Striped Searobin
			White Hake
Very Rare			
Atlantic Surfclam	Gulf Stream Flounder		Atlantic Herring
Blueback Herring	Longfin Squid Egg Mops		Atlantic Surfclam *
Gulf Stream Flounder			Bay Scallop
Red Hake			Blueback Herring
Sea Raven			Sea Raven
			Spotted Hake

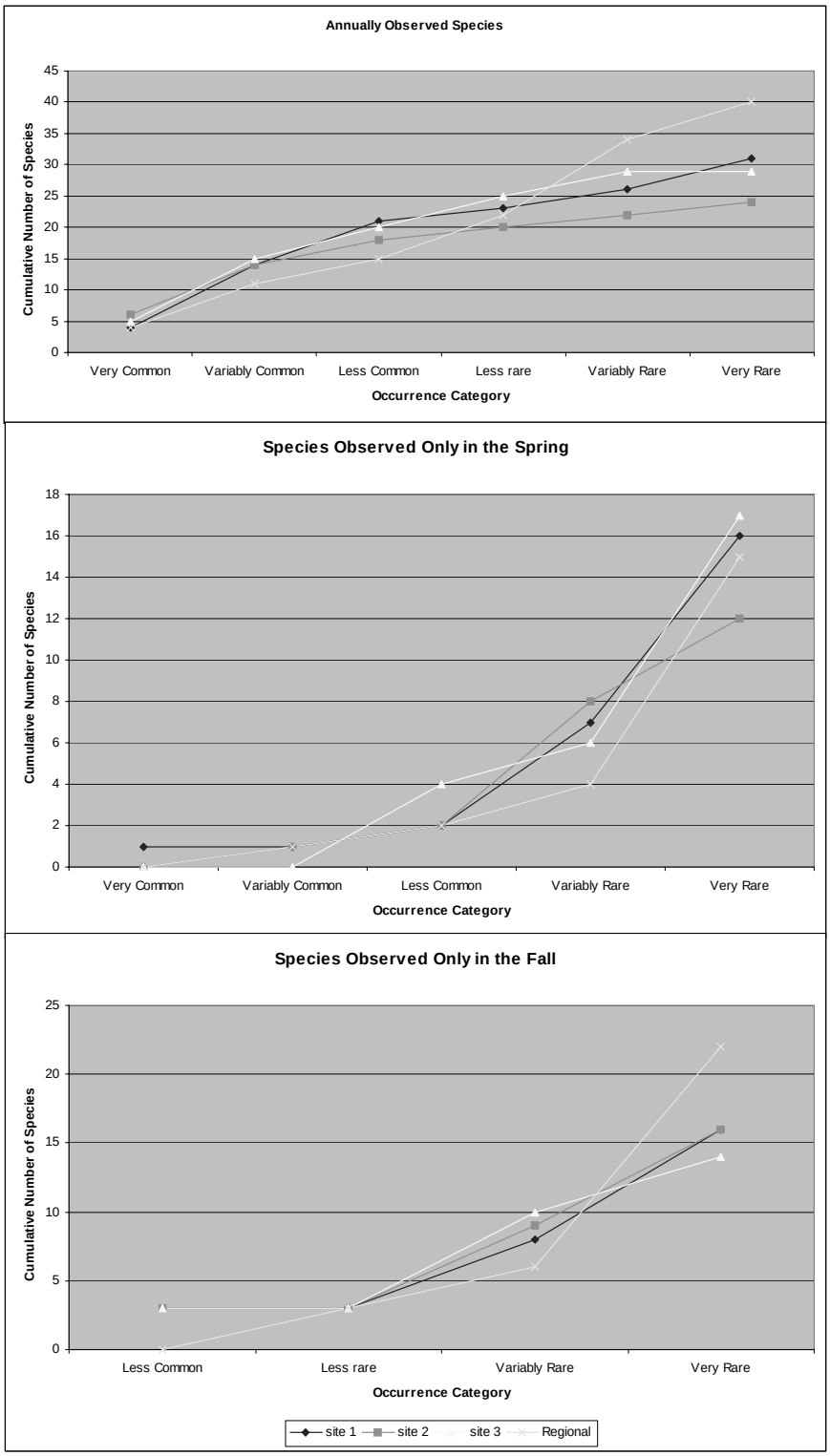
Table 18 (Continued)

Horseshoe Shoal Spring Only	Monomoy-Handkerchief Shoal Spring Only	Tuckernuck Shoal Spring Only	Regionally Spring Only
Very Common			
Atlantic Cod			
Variably Common			
	Longhorn Sculpin		Atlantic Cod
Less Common			
Longhorn Sculpin	Atlantic Cod	Alewife	Longhorn Sculpin
		American Lobster	
		Atlantic Cod	
		Longhorn Sculpin	
Rare			
Alewife	Alewife	Spiny Dogfish	Alewife
American Lobster	Atlantic Mackerel	Spotted Hake	Spiny Dogfish
Northern Sand Lance	Fourspot Flounder		
Pollock	Red Hake		
Spiny Dogfish	Silver Hake		
	Spiny Dogfish		
Very Rare			
American Shad	Jonah Crab	American Shad	American Shad
Atlantic Herring	Ocean Pout	Atlantic Menhaden	Atlantic Mackerel
Atlantic Mackerel	Sea Raven	Atlantic Surfclam	Atlantic Menhaden
Bay Scallop	Snakeblenny	Blueback Herring	Jonah Crab
Longfin Squid Egg Mops		Longfin Squid Egg Mops	Northern Moonsnail
Northern Moonsnail		Northern Shortfin Squid	Northern Shortfin Squid
Silver Hake		Pollock	Ocean Pout
Spotted Hake		Rainbow Smelt	Pollock
White Hake		Sea Raven	Rainbow Smelt
		Striped Bass	Snakeblenny
		Tautog	Striped Bass

Horseshoe Shoal Fall Only	Monomoy-Handkerchief Shoal Fall Only	Tuckernuck Shoal Fall Only	Regionally Fall Only
Less Common			
Bluefish	Atlantic Moonfish	Atlantic Moonfish	
Northern Kingfish	Bluefish	Mackerel Scad	
Northern Puffer	Northern Kingfish	Striped Searobin	
Variably Rare			
			Mackerel Scad
			Northern Kingfish
			Northern Puffer
Rare			
Bluespotted Cornetfish	Bay Anchovy	Blue Runner	Atlantic Moonfish
Inshore Lizardfish	Bay Scallop	Gulf Stream Flounder	Planehead Filefish
Mackerel Scad	Mackerel Scad	Northern Kingfish	Striped Anchovy
Planehead Filefish	Northern Pipefish	Northern Puffer	
Striped Anchovy	Smallmouth Flounder	Rough Scad	
	White Hake	Snowy Grouper	
		Striped Anchovy	
Very Rare			
Banded Rudderfish	Bigeye	Bay Anchovy	Banded Rudderfish
Bigeye	Northern Horsemussel	Guaguanche	Bigeye
Flying Gurnard	Northern Puffer	Northern Sennet	Blue Runner
Roughtail Stingray	Northern Sand Lance	Planehead Filefish	Bluespotted Cornetfish
Sand Tiger	Planehead Filefish		Flying Gurnard
Scrawled Filefish	Spotted Hake		Guaguanche
Short Bigeye	Striped Anchovy		Inshore Lizardfish
Snakefish			Northern Horsemussel
			Northern Sennet
			Rough Scad
			Roughtail Stingray
			Sand Tiger
			Scrawled Filefish
			Short Bigeye
			Snakefish
			Snowy Grouper

Table 18 (Continued)

Horseshoe Shoal Not Observed At All	Monomoy-Handkerchief Shoal Not Observed At All	Tuckernuck Shoal Not Observed At All	Regionally Not Observed At All
Atlantic Menhaden	American Shad	Atlantic Mackerel	Blue Mussel
Atlantic Moonfish	Atlantic Herring	Banded Rudderfish	
Blue Mussel	Atlantic Menhaden	Bay Scallop	
Blue Runner	Atlantic Surfclam	Bigeye	
Guaguanche	Banded Rudderfish	Blue Mussel	
Jonah Crab	Blue Mussel	Bluespotted Cornetfish	
Northern Horsemussel	Blue Runner	Flying Gurnard	
Northern Sennet	Blueback Herring	Inshore Lizardfish	
Northern Shortfin Squid	Bluespotted Cornetfish	Jonah Crab	
Ocean Pout	Flying Gurnard	Northern Horsemussel	
Rainbow Smelt	Guaguanche	Northern Moonsnail	
Rough Scad	Inshore Lizardfish	Ocean Pout	
Snakeblenny	Northern Moonsnail	Roughtail Stingray	
Snowy Grouper	Northern Sennet	Sand Tiger	
Striped Bass	Northern Shortfin Squid	Scrawled Filefish	
	Pollock	Short Bigeye	
	Rainbow Smelt	Snakeblenny	
	Rock Gunnel	Snakefish	
	Rough Scad		
	Roughtail Stingray		
	Sand Tiger		
	Scrawled Filefish		
	Short Bigeye		
	Snakefish		
	Snowy Grouper		
	Striped Bass		



A

B

C

Figure 29. The cumulative numbers of species observed annually (A) and during each season (B and C) by site and regionally based on the final category of the likelihood of occurrence (Site 1 = Horseshoe Shoal, Site 2 = Monomoy-Handkerchief Shoal, Site 3 = Tuckernuck Shoal)

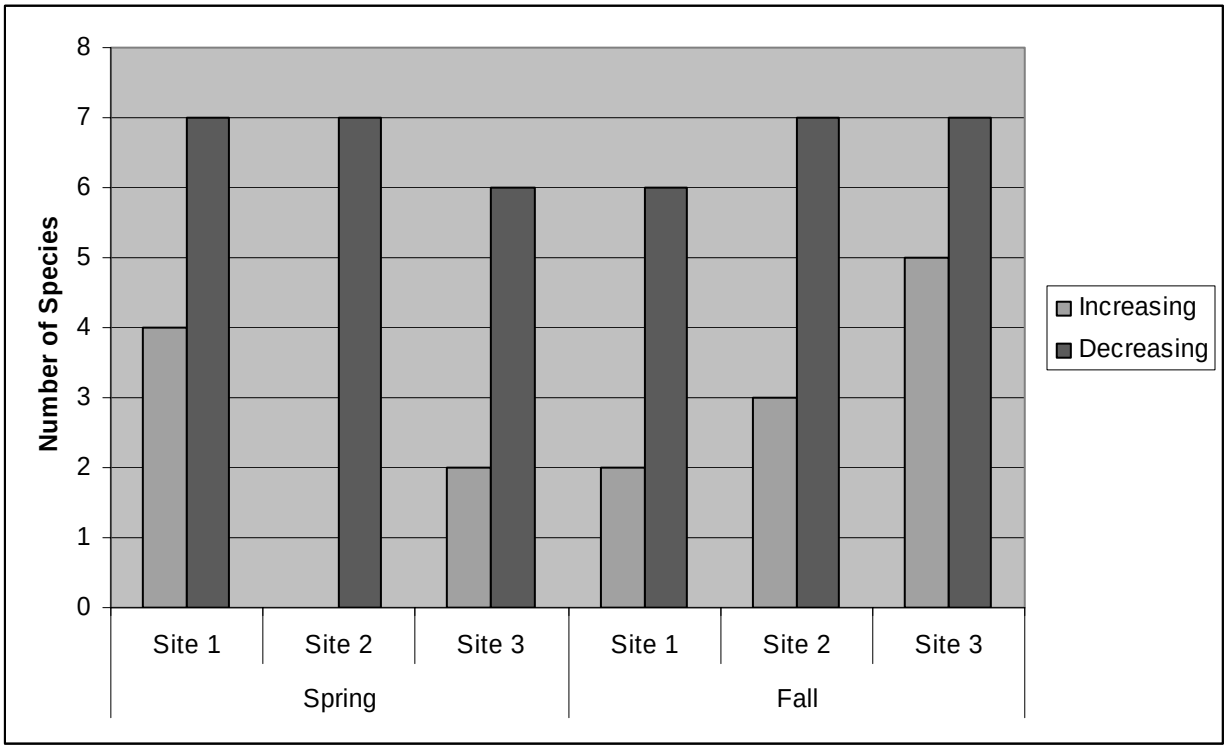


Figure 30. Number of species potentially increasing or decreasing by site and season (Site 1 = Horseshoe Shoal, Site 2 = Monomoy-Handkerchief Shoal, Site 3 = Tuckernuck Shoal)

ATTACHMENT A

NMFS Statistical Areas – RI, Cape Cod and Islands

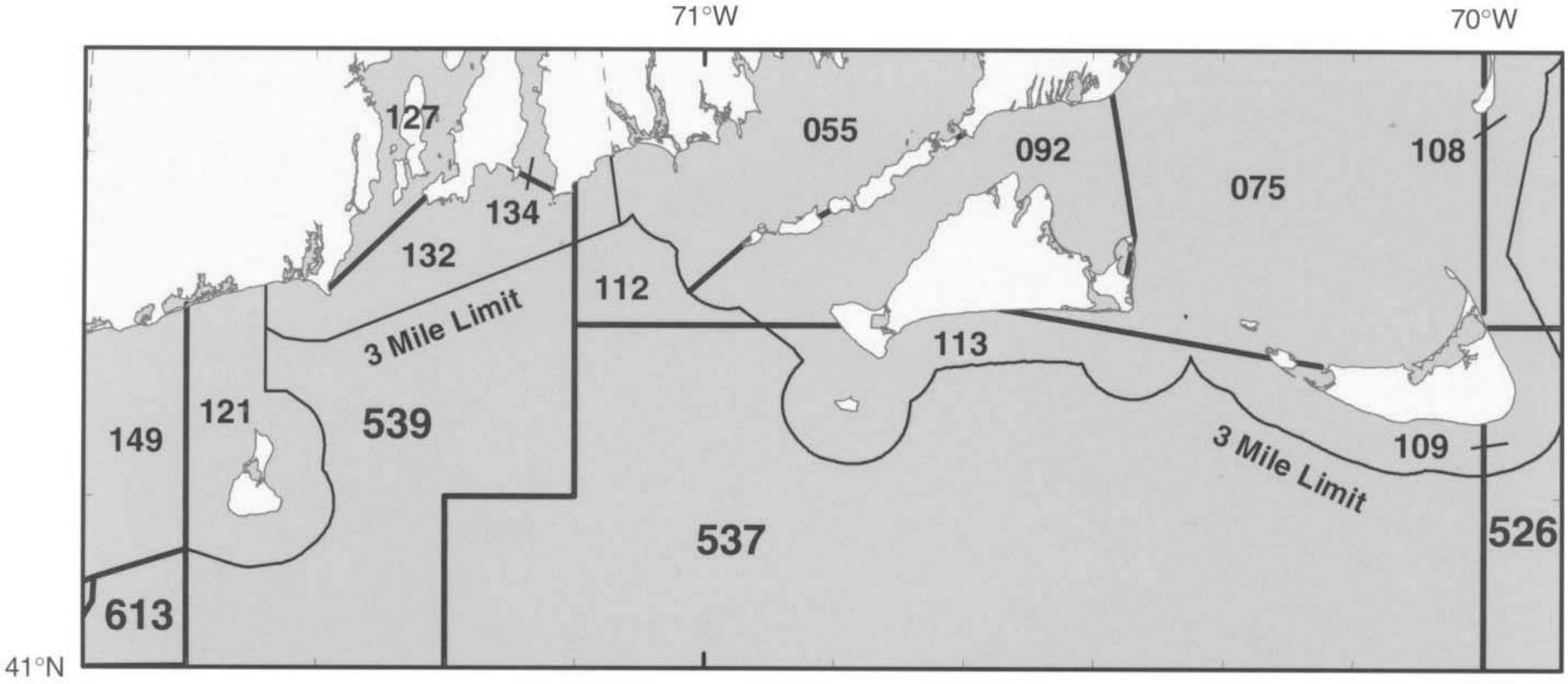


Chart 6. Rhode Island Sound, Cape Cod and Islands NEMFIS Area Codes

Table 1. 1994 commercial landings (pounds) for Area 075, Nantucket Sound

	May	July	August	September	October	November
American Lobster			315	177		
Bluefish		2	9			
Black Sea Bass					99	
Bonito			6			
Channeled Whelk		9,431	5,986	5,927	3,402	501
Summer Flounder		1,743	20,975	4,178	9	
King Whiting			100			
Knobbed Whelk			1,335	209		
Lightening Whelk			315			
Monkfish				18		
Scup	5,500		285	842	2,187	
Skate				52	35	
Spiny Dogfish					22	
Squid/Loligo	21,770					
Striped Bass		246				
Tautog					27	
Whelk, Unspecified Species			655			
White Hake			4,881			
Winter Flounder				12		
Grand Total	27,270	11,422	34,862	11,415	5,781	501

Table 2. 1995 commercial landings (pounds) for Area 075, Nantucket Sound

	March	April	May	June	July	August	September	October	November	December
American Lobster					35					
Bluefish				46	149	94	173	53		
Black Sea Bass			53	424	351	430	653	193		
Bonito					1		1			
Butterfish					1					
Channeled Whelk				5,137	7,718	760	3,216	365	323	190
Flounder, Unspecified Species			5							
Summer Flounder			275	13,409	11,320	8,861	3,576			
Horseshoe Crab				250	60					
King Whiting						20				
Knobbed Whelk				5,739	755	240				
Other Finfish			79	500						
Windowpane		5								
Scup		20	3,981	11,250	7,975	5,779	5,728	2,842		
Searobin			27	120	43	4		4		
Skate			12	65			13	31		
Squid/Loligo		1,500	36,435	31,165						
Squid, Unspecified Species				1						
Tautog		50	335	300	108	185	55	11		
Whelk, Unspecified Species					800					
Winter Flounder	200	50	185	192						
Grand Total	200	1,625	41,387	68,598	29,316	16,373	13,415	3,499	323	190

Table 3. 1996 commercial landings (pounds) for Area 075, Nantucket Sound

	April	May	June	July	August	September	October	November
American Lobster			27					
American Plaice Flounder		3						
Atlantic Mackerel		1,651						
Bluefish		328	7	9	106	3	2	
Black Sea Bass		54	478	199	658	292	104	
Butterfish		900		1				
Channeled Whelk			3,420	4,053	1,482		457	111
Cunner			1					
Summer Flounder		214	4,994	15,331	4,832	3	3	
Knobbed Whelk			25	300				
Lemon Shark				1				
Lightening Whelk				30	750			
Rock Crab			12					
Scup		1,046	3,729	2,138	10,525	8,708	4,396	
Searobin		12	72	38	76			
Skate		3	94			10	16	
Smooth Dogfish					8	2	6	
Spiny Dogfish						13	17	
Squid/Illex		950						
Squid/Loligo	300	90,521						
Squid, Unspecified Species	450	7,341	1,000					
Striped Bass			1					
Tautog		494	211	198	60	13	7	
White Hake					100			
Winter Flounder	105	394	1			1	3	
Grand Total	855	103,911	14,072	22,298	18,597	9,045	5,011	111

Table 4. 1997 commercial landings (pounds) for Area 075, Nantucket Sound

	April	May	June	July	August	September	October
Albacore Tuna				425			
American Plaice Flounder		1					
Atlantic Mackerel		1					
Bluefish			349	25	76	3	6
Black Sea Bass		109	193	257	712	561	107
Bluefin Tuna				375			
Butterfish		575					
Channeled Whelk			1,360	11,041	4,160	11,865	13,455
Cunner					11		
Summer Flounder		613	4,279	13,136	3,740	71	7
Horseshoe Crab				545			
Knobbed Whelk			210	850	55		
Monkfish			60	140			
Scup		3,573	12,039	2,104	3,262	3,581	2,409
Searobin		19	89	53	9		
Skate		1	7		300	5	2
Smooth Dogfish				7	1	3	
Squid/Loligo	1,250	77,263	6,500				
Striped Bass				1	1		
Tautog		185	201	141	84	44	32
Whelk/Conch, Unspecified Species				8,482	8,844	5,024	
White Hake				900			
Winter Flounder		69				1	
Grand Total	1,250	82,409	25,287	38,482	21,255	21,158	16,018

Table 5. 1998 commercial landings (pounds) for Area 075, Nantucket Sound

	January	March	April	May	June	July	August	September	October	November	December
American Lobster		76	853	78							
Atlantic Herring				500							
Atlantic Mackerel			5,570	223,740							
Bluefish				231	376	827	922	887	863		
Black Sea Bass				1,325	25,385	7,810	4,679	7,553	35,445	5,760	
Bonito							20		1		
Butterfish			20	10,844	10						
Channeled Whelk					7,210	11,898	8,674	11,303	9,549	9,427	366
Cod	180										
Common Pompano									30		
Cunner				5							
Summer Flounder			9	547	8,336	25,447	154	66	28		
Horseshoe Crab					50						
Jonah Crab								283			
King Whiting						1,735		5			
Knobbed Whelk					966	331					
Menhaden					30,000						
Monkfish				10	20						
Sandbar Shark							50				
Windowpane			40	300							
Scup				9,021	13,591	4,474	8,197	37,068	7,263	15	
Searobin				253	49	28	25		2		
Sea Trout, Unspecified Species									9		
Shark, Unspecified Species					31		45	46			
Shrimp (Pandalid)	742										
Silver Hake								20			
Skate				5	1	300	261	1	19		
Smooth Dogfish						5	1	4	1		
Spiny Dogfish									4		
Spotted Seatrout								42	15		
Gray Seatrout									20		
Squid/Loligo			13,206	39,205	164						
Squid, Unspecified Species			2,500	1,380	550						
Striped Bass				2	3	8	285	4			
Tautog			1,274	2,442	2,279	202	221	213	1,402	513	
Tuna, Unspecified Species								17	7		
Whelk/Conch, Unspecified Species					354	1,564	4,937	1,472			
White Hake					1,640						
Winter Flounder			400	2,518		1			325	86	
Grand Total	922	76	23,872	292,406	91,015	54,630	28,471	58,984	54,983	15,801	366

Table 6. 1999 commercial landings (pounds) for Area 075, Nantucket Sound

	April	May	June	July	August	September	October	November	December
American Lobster	53			56	72				
Atlantic Croaker						2	3		
Atlantic Mackerel	61,815	240,484							
Bluefish		102	47	167	87	23	40		
Black Sea Bass	22	53,886	38,536	15,752	9,208	17,428	36,734	669	
Blacktip Shark						1			
Butterfish	40	2,180							
Channeled Whelk		6,255	35,545	31,340	29,891	33,608	39,339	13,163	2,136
Cod				115					
Crab, Unspecified Species	40								
Cusk				15					
Summer Flounder	32	4,804	2,424	76,263	34,349	1			
Horseshoe Crab	50	20		703					
King Whiting				753		2,851			
Knobbed Whelk				761	830				
Menhaden		28,510							
Northern Puffer						1			
Windowpane	145								
Sea Scallop		400	325						
Scup/Porgy		23,416	19,414	7,469	8,767	8,610	6,946	481	
Searobin		118	211	51					
Silver Hake			100	300	100				
Skate		200	4		2	2	1		
Smooth Dogfish		2	5		2				
Spiny Dogfish							5		
Squid/Iisex	300	500							
Squid/Loligo	31,429	167,888	2,900						
Squid, Unspecified Species	1,706	33,657	2,228	209					
Striped Bass		2	4	1,505	372				
Tautog	728	3,160	61	277	276	506	471	58	
Whelk/Conch, Unspecified Species	23	19		3,914	2,397				
White Hake				2,277	1,919	3,138			
Winter Flounder	1,625		3	2					
Grand Total	98,008	565,603	101,807	141,929	88,272	66,171	83,539	14,371	2,136

Table 7. 2000 commercial landings (pounds) for Area 075, Nantucket Sound

	April	May	June	July	August	September	October	November
American Plaice Flounder		20	600					
American Lobster	365		273	187	2			
Atlantic Mackerel		209,509						
Blacktip Shark						1		
Bluefish	30	4,867	744	128	52	11	9	
Black Sea Bass	382	44,943	21,496	25,854	1,233	1,948	63,802	
Butterfish	5	3,072						
Channeled Whelk		11,904	57,253	47,081	58,373	28,388	41,241	4,228
Cod			1,500					
Summer Flounder	25	6,476	2,167	78,388	43,434	55		
Haddock			100					
Horseshoe Crab		50		465	150			
King Whiting							1,296	
Knobbed Whelk				3,376	1,558			
Monkfish							15	
Other Finfish							155	
Pollock			200					
Windowpane	215							
Scup	1,065	32,415	23,704	15,967	9,077	7,597	1,249	
Searobin		38	146	11	57			
Skate		60	2					
Smooth Dogfish		120	104	2	2	3		
Spanish Mackerel			4					
Spiny Dogfish			2			5	9	
Squid/Iilex		57,924						
Squid/Loligo	34,925	525,117	97,005					
Squid, Unspecified Species	4,510	112,874	2,400					
Striped Bass		16	51	26				
Tautog	2,938	5,053	149	322	92	178	2,294	
Gray Seatrout		5			1	1		
Whelk/Conch, Unspecified Species	30	1,693	18,365	26,686	16,757	11,022		
Winter Flounder	1,050	5,520					800	
Witch Flounder			1,800					
Yellowtail Flounder			500					
Grand Total	45,540	1,021,676	228,565	198,493	130,788	49,209	110,870	4,228

Table 8. 2001 commercial landings (pounds) for Area 075, Nantucket Sound

	March	April	May	June	July	August	September	October	November	December
American Plaice Flounder			5							
American Lobster	250	148								
Atlantic Herring		3,000	2,600							
Atlantic Mackerel		2,410	131,155							
Bluefish			2,619	395	8	231	6			
Black Sea Bass			34,444	6,501	22,303	1,857	354	18,206	1,144	
Butterfish		2,890	24,030							
Channeled Whelk			23,301	111,208	82,790	28,262	10,157	10,931	6,116	1,160
Clam, Quahog, Hard (Bushel)								157	135	
Clam, Quahog, Ocean							150			
Clam, Unspecified Species								9,200		23,700
Clam, Unspecified Species (Bushel)									295	
Crab, Unspecified Species		15			177					
Cunner										
Cusk					30					
Dogfish, Unspecified Species				2						
Dusky Shark										
Summer Flounder		102	1,741	78	24,851	45,586	1			
Horseshoe Crab					358	450	390	1,200		
King Whiting						175	1,665			
Knobbed Whelk				3,300	225	648	700			
Sculpins			100							
Scup/Porgy		100	43,589	16,863	8,717	6,843	1,445		171	
Searobin			89	154	33					
Sea Scallop			1,200							
Skate				3						
Smooth Dogfish				8	3	2	5			
Spotted Seatrout			20	10						
Squid/Loligo		155,218	254,588	20						
Squid, Unspecified Species			50							
Striped Bass			3	5		1	3			
Tautog		166	5,288	5	180	38		696		
Tilefish, Unspecified Species		3								
Whelk/Conch, Unspecified Species			25		974	768				
Winter Flounder		15	3,052	2						
Wolffish (Ocean Catfish)			4							
Grand Total	250	164,067	527,903	138,554	140,649	84,861	14,876	40,390	7,861	24,860

Table 9. Total commercial landings (pounds) and number of species landed by month and year

Month	1994		1995		1996		1997		1998		1999		2000		2001		Total Landings
	No. Species	Total Landings (lbs)	No. Species	Total Landings (lbs)	No. Species	Total Landings (lbs)	No. Species	Total Landings (lbs)	No. Species	Total Landings (lbs)	No. Species	Total Landings (lbs)	No. Species	Total Landings (lbs)	No. Species	Total Landings (lbs)	
January									2	922							922
February																	0
March			1	200					1	76					1	250	526
April			5	1,625	3	855	1	1,250	9	23,872	14	98,008	12	45,540	11	164,067	335,217
May	2	27,270	10	41,387	14	103,911	11	82,409	18	292,406	20	565,605	20	1,021,676	20	527,903	2,662,567
June			14	68,598	15	14,072	11	25,287	19	91,015	15	101,807	22	228,565	15	138,554	667,898
July	4	11,422	13	29,316	11	22,298	16	38,482	14	54,630	19	141,929	13	198,493	13	140,649	637,219
August	11	34,862	9	16,373	10	18,597	13	21,255	14	28,471	14	88,272	13	130,788	12	84,861	423,479
September	8	11,415	8	13,415	9	9,045	11	21,163	16	58,984	12	66,171	11	49,209	11	14,876	244,278
October	8	5,783	7	3,499	10	5,011	7	16,018	17	54,983	8	83,539	10	110,870	6	40,390	320,093
November	1	501	1	323	1	111			5	15,801	4	14,371	1	4,228	5	7,861	43,196
December			1	190					1	366	1	2,136			2	24,860	27,552
Grand Total		**91,253**		**174,926**		**173,900**		**205,864**		**621,526**		**1,161,838**		**1,789,369**		**1,144,271**	5,362,947

Table 10. Top 20 species landed (pounds) from Area 075, Nantucket Sound

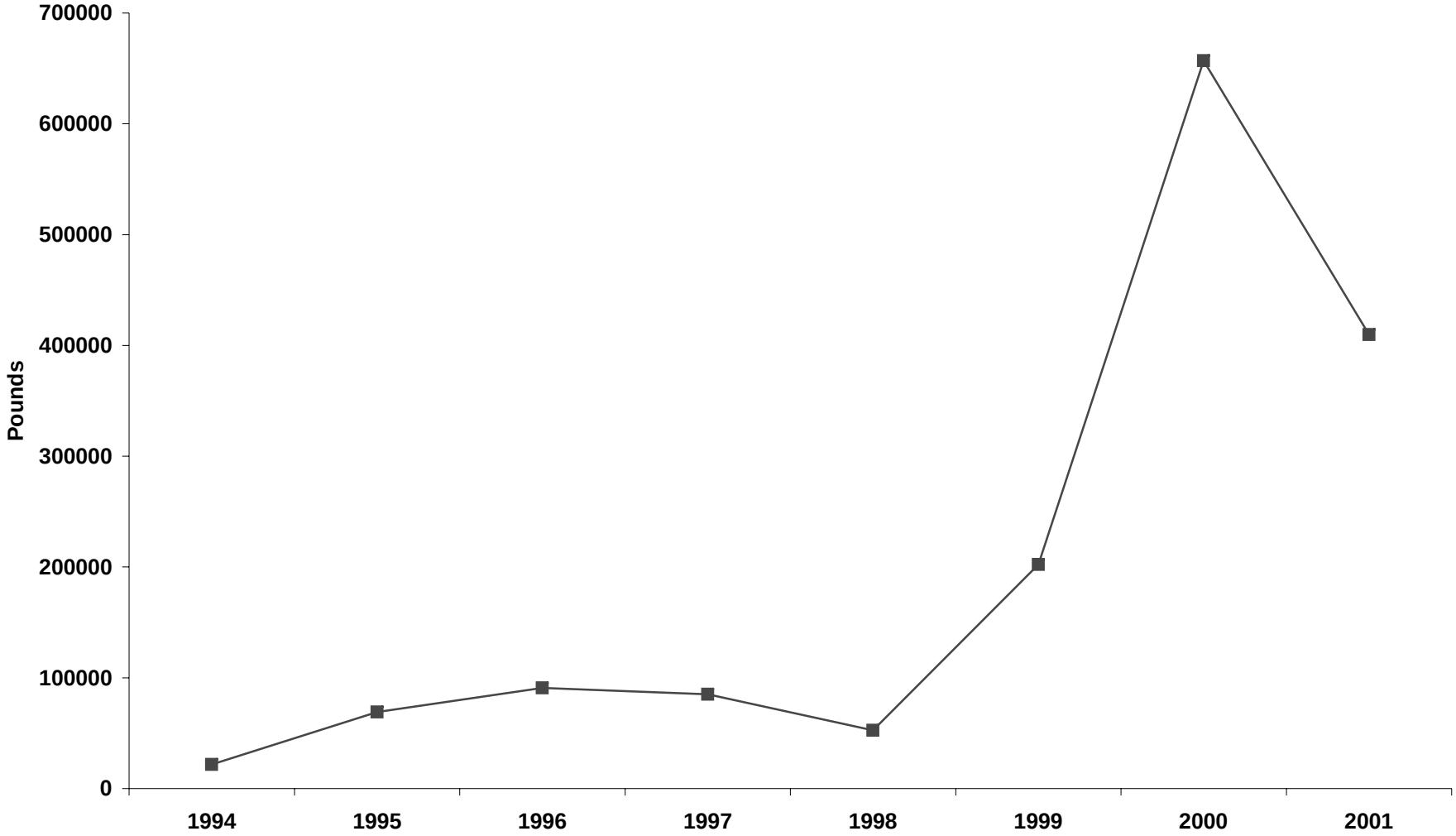
	1994	1995	1996	1997	1998	1999	2000	2001	Total
Squid/Loligo	21,770	69,100	90,821	85,013	52,575	202,217	657,047	409,826	1,588,369
Atlantic Mackerel			1,651	1	229,310	302,299	209,509	133,565	876,335
Channeled Whelk	25,247	17,709	9,523	41,881	58,427	191,277	248,468	273,925	866,457
Black Sea Bass	99	2,104	1,785	1,939	87,957	172,235	159,658	84,809	510,586
Summer Flounder	26,905	37,441	25,377	21,846	34,587	117,873	130,545	72,359	466,933
Scup	8,814	37,575	30,542	26,968	79,629	75,103	91,074	77,728	427,433
Squid, Unspecified Species		1	8,791		4,430	37,800	119,784	50	170,856
Whelk, Unspecified Species	655	800		22,350	8,327	6,353	74,553	1,767	114,805
Squid/Iilex			950			800	57,924		59,674
Menhaden					30,000	28,510			58,510
Butterfish		1	901	575	10,874	2,220	3,077	26,920	44,568
Tautog	27	1,044	983	687	8,546	5,537	11,026	6,373	34,223
Clam, Unspecified Species								32,900	32,900
Knobbed Whelk	1,544	6,734	325	1,115	1,297	1,591	4,934	4,873	22,413
Winter Flounder	14	627	504	70	3,330	1,632	7,370	3,069	16,616
Bluefish	11	515	455	459	4,106	466	5,841	3,259	15,112
White Hake	4,881		100	900	1,640	7,334			14,855
King Whiting	100	20			1,740	3,604	1,296	1,840	8,600
Atlantic Herring					500			5,600	6,100
American Lobster	492	35	27		1,007	181	827	398	2,967
Total	90,559	173,706	172,735	203,804	618,282	1,157,032	1,782,933	1,139,261	5,338,312

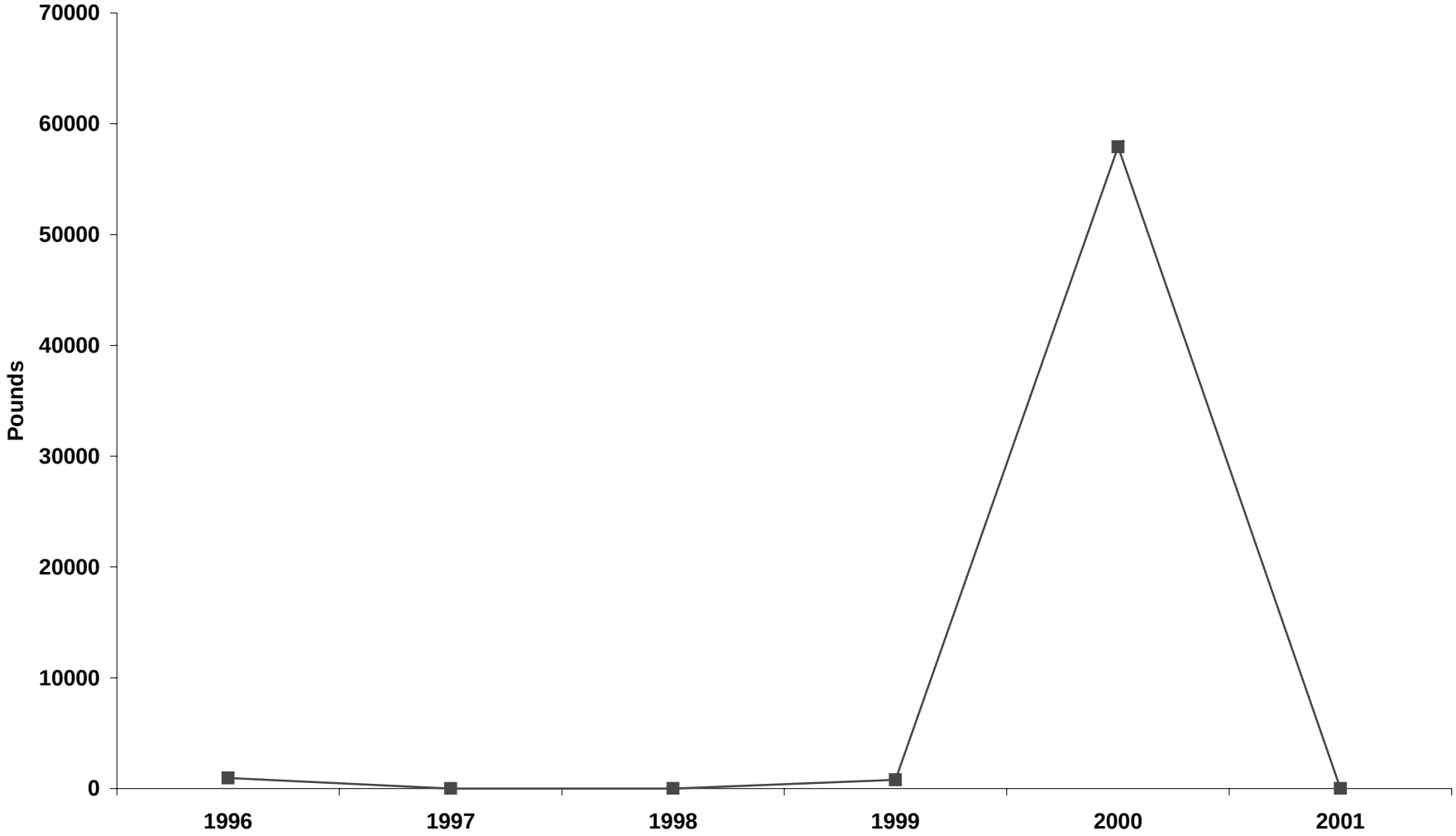
Table 11. Total Landings (pounds) for finfish and squid species and proportion of total catch for each species

1994			1995			1996			1997		
Species	Total	% of total annual catch	Species	Total	% of total annual catch	Species	Total	% of total annual catch	Species	Total	% of total annual catch
Summer flounder	26,905	42.71	Squid (all species)	69,101	46.27	Squid (all species)	100,562	61.61	Squid (all species)	85,013	60.74
Squid (all species)	21,770	34.56	Scup	37,575	25.16	Scup	30,542	18.71	Scup	26,968	19.27
Scup	8,814	13.99	Summer flounder	37,441	25.07	Summer flounder	25,377	15.55	Summer flounder	21,846	15.61
White hake	4,881	7.75	Black sea bass	2,104	1.41	Black sea bass	1,785	1.09	Black sea bass	1,939	1.39
Striped bass	246	0.390	Tautog	1,044	0.699	Atlantic mackerel	1,651	1.01	White hake	900	0.643
Whiting	100	0.159	Winter flounder	627	0.420	Tautog	983	0.602	Tautog	687	0.491
Black sea bass	99	0.157	Other finfish	579	0.388	Butterfish	901	0.552	Butterfish	575	0.411
Skate	87	0.138	Bluefish	515	0.345	Winter flounder	504	0.309	Bluefish	459	0.328
Tautog	27	0.043	Sea robins	198	0.133	Bluefish	455	0.279	Albacore tuna	425	0.304
Dogfish, spiny	22	0.035	Skate	121	0.081	Sea robins	198	0.121	Bluefin tuna	375	0.268
Monkfish	18	0.029	Whiting	20	0.013	Skate	123	0.075	Skate	315	0.225
Winter flounder	14	0.022	Flounder, not specified	5	0.003	White hake	100	0.061	Monkfish	200	0.143
Bluefish	11	0.017	Windowpane flounder	5	0.003	Dogfish, spiny	30	0.018	Sea robins	170	0.121
Bonito	6	0.010	Bonito	2	0.001	Dogfish, smooth	16	0.010	Winter flounder	70	0.050
			Butterfish	1	0.0007	American plaice	3	0.002	Cunner	11	0.008
						Cunner	1	0.0006	Dogfish, smooth	11	0.008
						Shark, lemon	1	0.0006	Striped bass	7	0.005
						Striped bass	1	0.0006	Atlantic mackerel	1	0.0007
									American plaice	1	0.0007

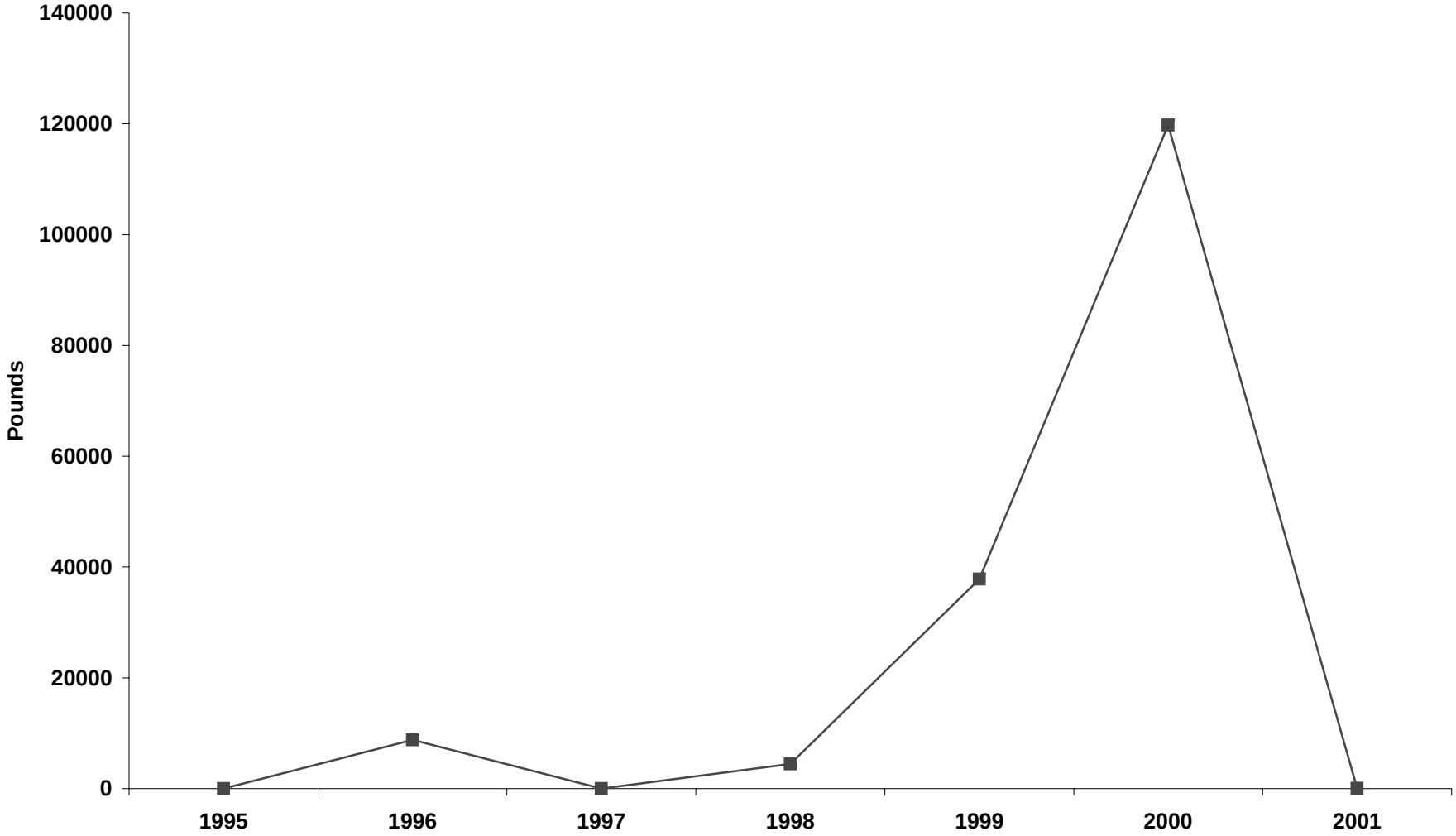
1998			1999			2000			2001		
Species	Total	% of total annual catch	Species	Total	% of total annual catch	Species	Total	% of total annual catch	Species	Total	% of total annual catch
Atlantic mackerel	229,310	41.53	Atlantic mackerel	302,299	31.46	Squid (all species)	834,755	57.18	Squid (all species)	409,876	49.63
Black sea bass	87,957	15.93	Squid (all species)	240,817	25.06	Atlantic mackerel	209,509	14.35	Atlantic mackerel	133,565	16.17
Scup	79,629	14.42	Black sea bass	172,235	17.92	Black sea bass	159,658	10.94	Black sea bass	84,809	10.27
Squid (all species)	57,005	10.32	Summer flounder	117,873	12.27	Summer flounder	130,545	8.94	Scup	77,728	9.41
Summer flounder	34,587	6.26	Scup	75,103	7.82	Scup	91,074	6.24	Summer flounder	72,359	8.76
Menhaden	30,000	5.43	Menhaden	28,510	2.97	Tautog	11,026	0.755	Butterfish	26,920	3.26
Butterfish	10,874	1.97	White hake	7,334	0.7632	Winter flounder	7,370	0.505	Tautog	6,373	0.772
Tautog	8,546	1.55	Tautog	5,537	0.5762	Bluefish	5,841	0.400	Atlantic herring	5,600	0.678
Bluefish	4,106	0.744	Whiting	3,604	0.3751	Butterfish	3,077	0.211	Bluefish	3,259	0.395
Winter flounder	3,330	0.603	Butterfish	2,220	0.2310	Witch flounder	1,800	0.123	Winter flounder	3,069	0.372
Whiting	1,740	0.315	Striped bass	1,883	0.1960	Cod	1,500	0.103	Whiting	1,840	0.223
White hake	1,640	0.297	Winter flounder	1,632	0.1698	Whiting	1,296	0.089	Sea robins	276	0.033
Shrimp	742	0.134	Silver hake	500	0.0520	American plaice	620	0.042	Sculpins	100	0.012
Skate	587	0.106	Bluefish	466	0.0485	Yellowtail flounder	500	0.034	Cusk	30	0.004
Atlantic herring	500	0.091	Sea robins	380	0.0395	Sea robins	252	0.017	Spotted seatrout	30	0.004
Sea robins	357	0.065	Skate	209	0.0218	Dogfish, smooth	231	0.016	Dogfish, smooth	18	0.002
Windowpane flounder	340	0.062	Windowpane flounder	145	0.0151	Windowpane flounder	215	0.015	Striped bass	12	0.001
Striped bass	302	0.055	Cod	115	0.012	Pollock	200	0.014	American plaice	5	0.0006
Cod	180	0.033	Cusk	15	0.002	Other finfish	155	0.011	Wolffish/Ocean catfish	4	0.0005
Shark, not specified	122	0.022	Dogfish, smooth	9	0.0009	Haddock	100	0.0068	Skate	3	0.0004
Spotted seatrout	57	0.010	Atlantic croaker	5	0.0005	Striped bass	93	0.0064	Tilefish	3	0.0004
Shark, sandbar	50	0.009	Dogfish, spiny	5	0.0005	Skate	62	0.0042	Dogfish, not specified	2	0.0002
Monkfish	30	0.005	Puffer, northern	1	0.0001	Dogfish, spiny	16	0.0011			
Pompano	30	0.005	Shark, blacktip	1	0.0001	Monkfish	15	0.0010			
Tuna, not specified	24	0.004				Gray seatrout	7	0.0005			
Bonito	21	0.004				Spanish mackerel	4	0.0003			
Gray seatrout	20	0.004				Shark, blacktip	1	7E-05			
Silver hake	20	0.004									
Dogfish, smooth	11	0.002									
Seatrout	9	0.002									
Cunner	5	0.0009									
Dogfish, spiny	4	0.0007									

Loligo Squid Landings: 1994-2001
Area 075, Nantucket Sound

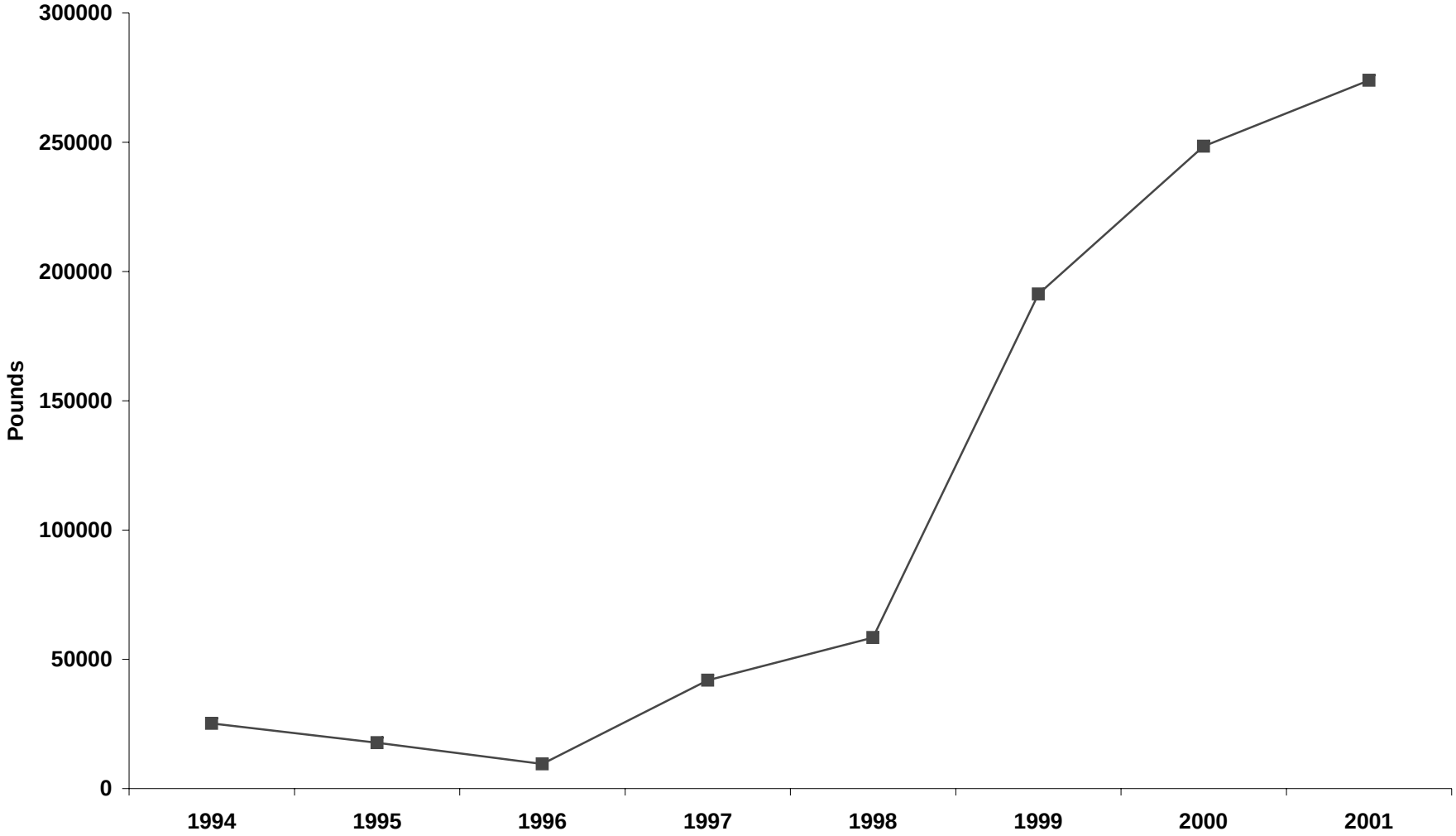


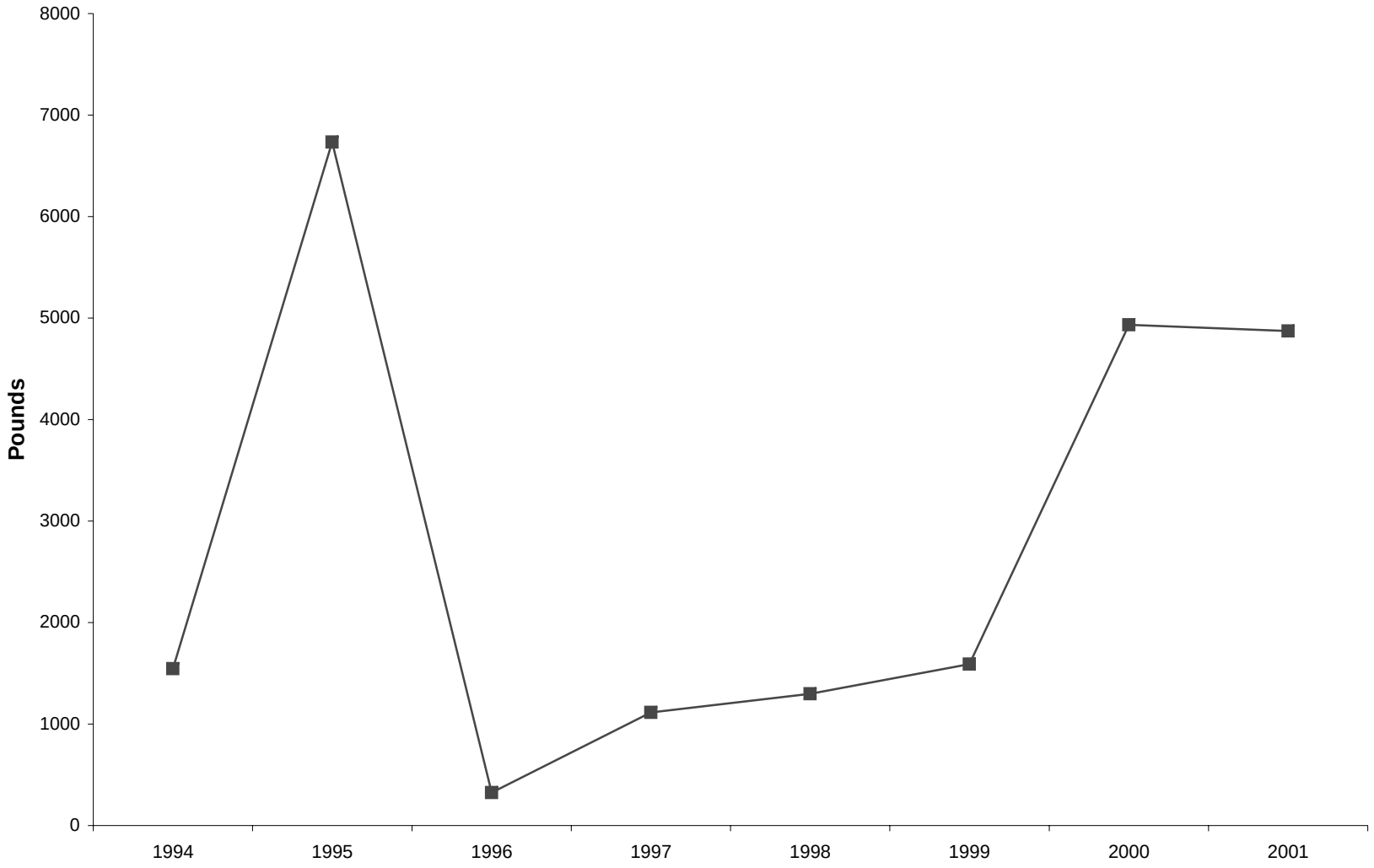

Illex Squid Landings: 1996-2001
Area 075, Nantucket Sound
Pounds
70000
60000
50000
40000
30000
20000
10000
0
1996
1997
1998
1999
2000
2001

Squid (not specified) Landings: 1995-2001
Area 075, Nantucket Sound

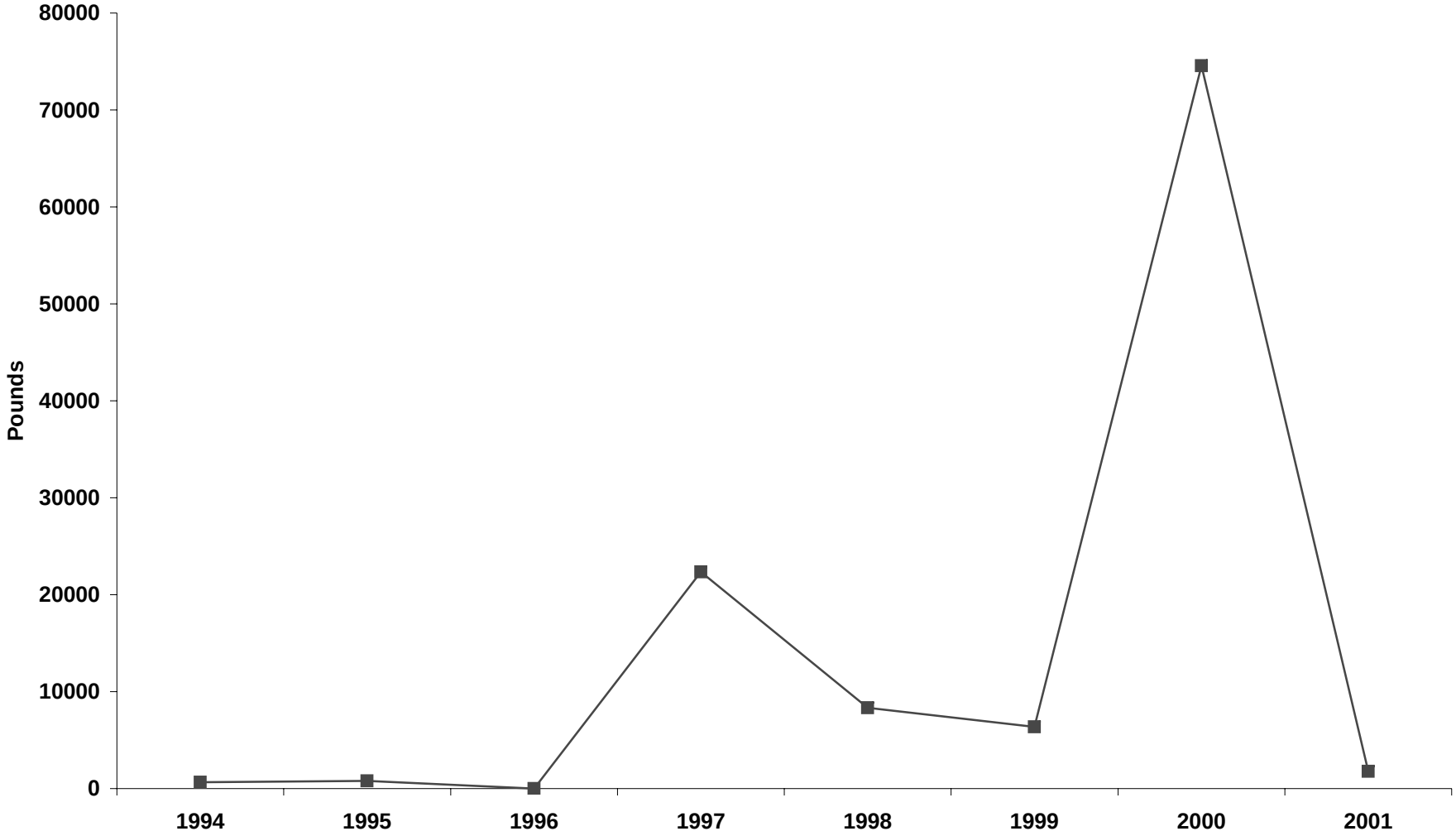


Channeled Whelk Landings: 1994-2001
Area 075, Nantucket Sound

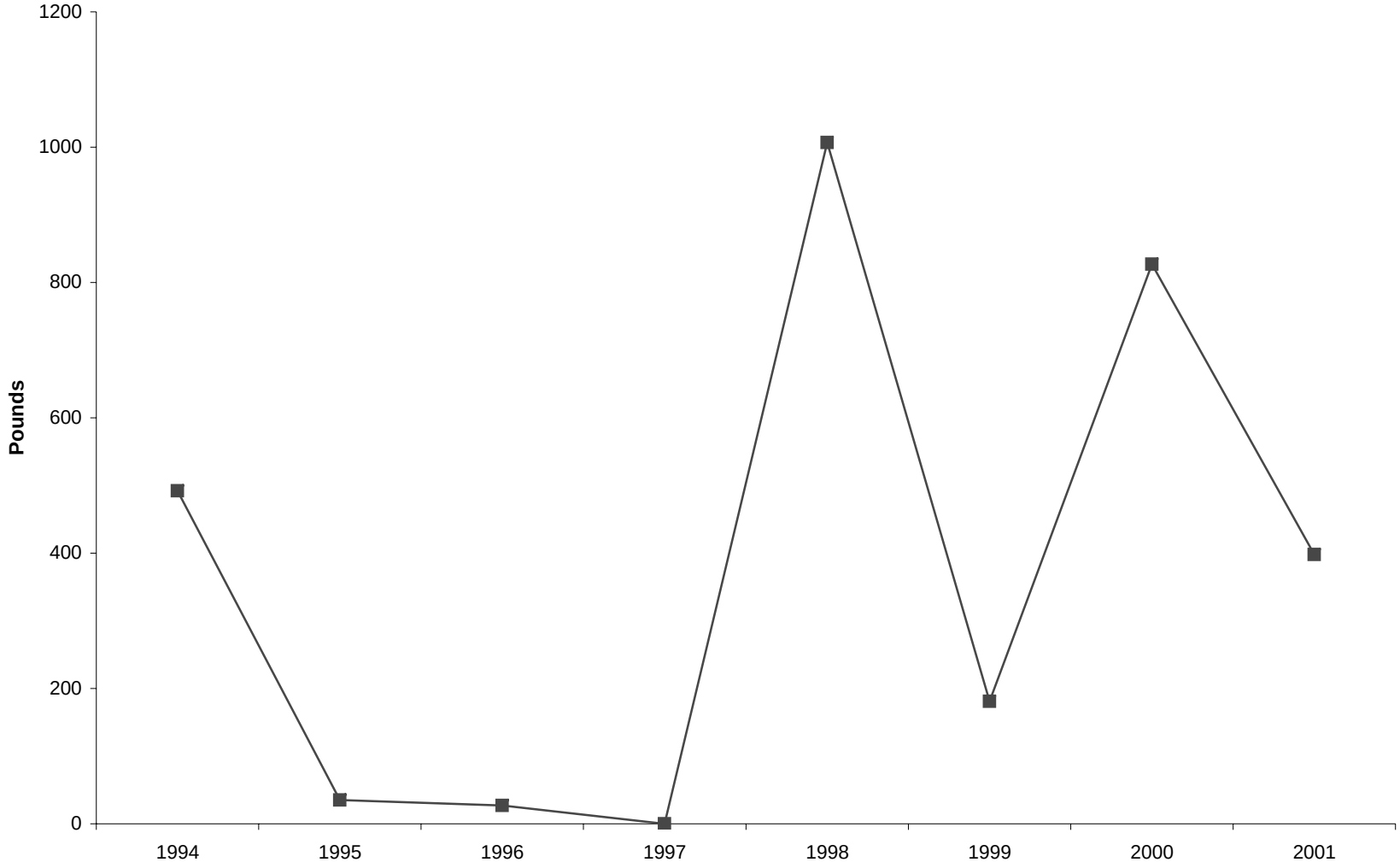



Knobbed Whelk Landings: 1994-2001
Area 075, Nantucket Sound
Pounds
8000
7000
6000
5000
4000
3000
2000
1000
0
1994
1995
1996
1997
1998
1999
2000
2001

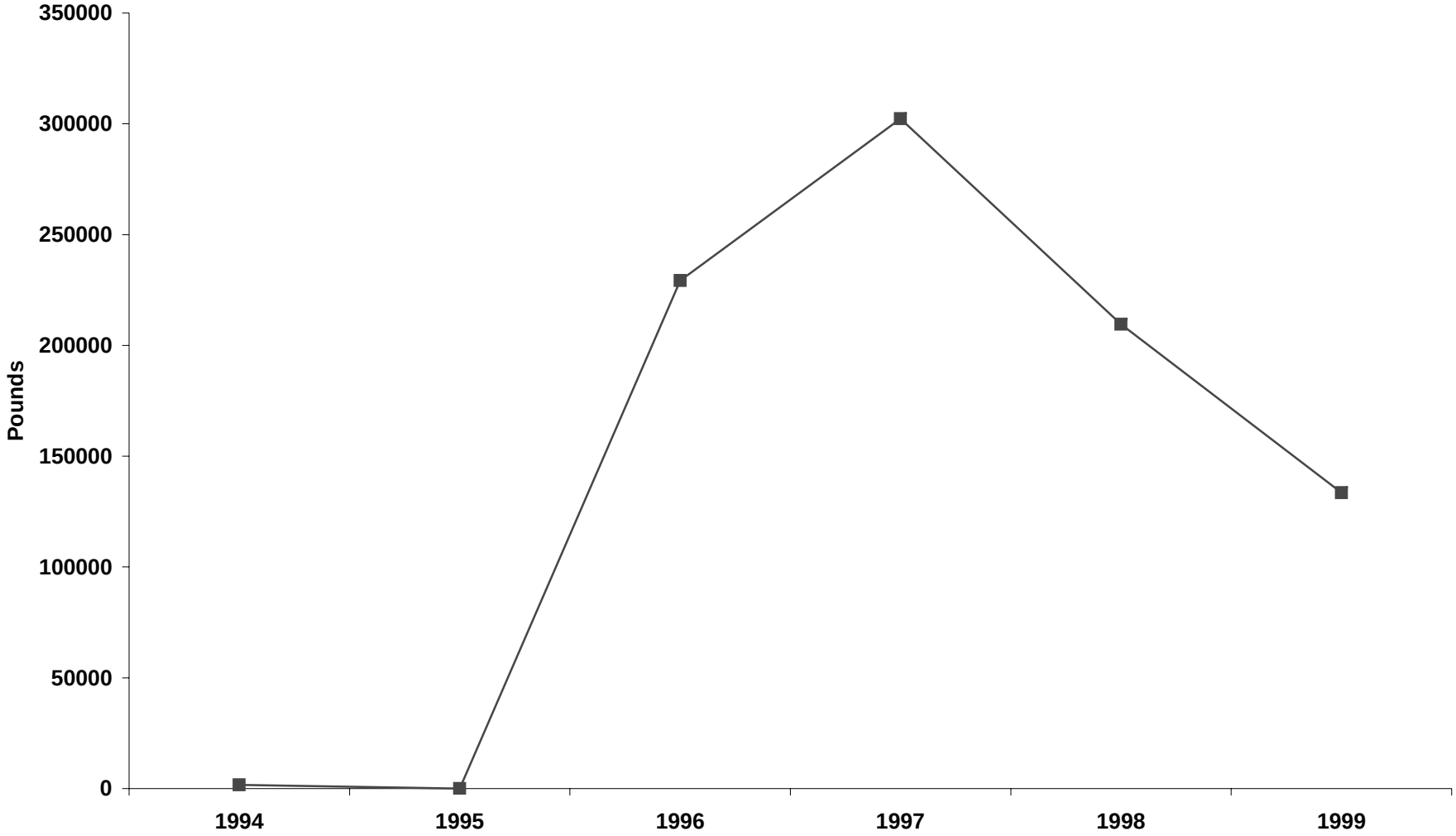
Whelk (not specified) Landings: 1994-2001
Area 075, Nantucket Sound



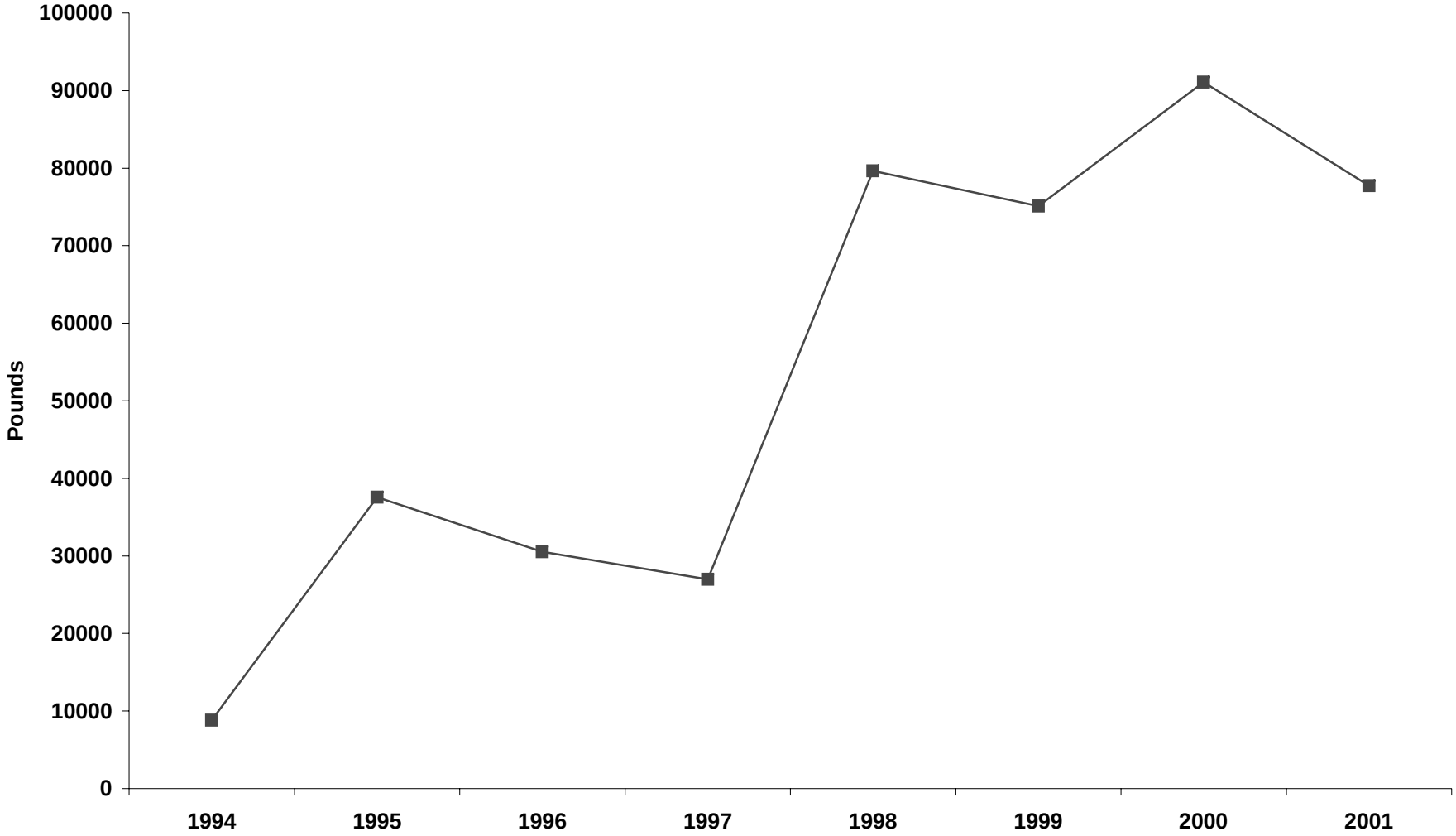
American Lobster Landings: 1994-2001
Area 075, Nantucket Sound



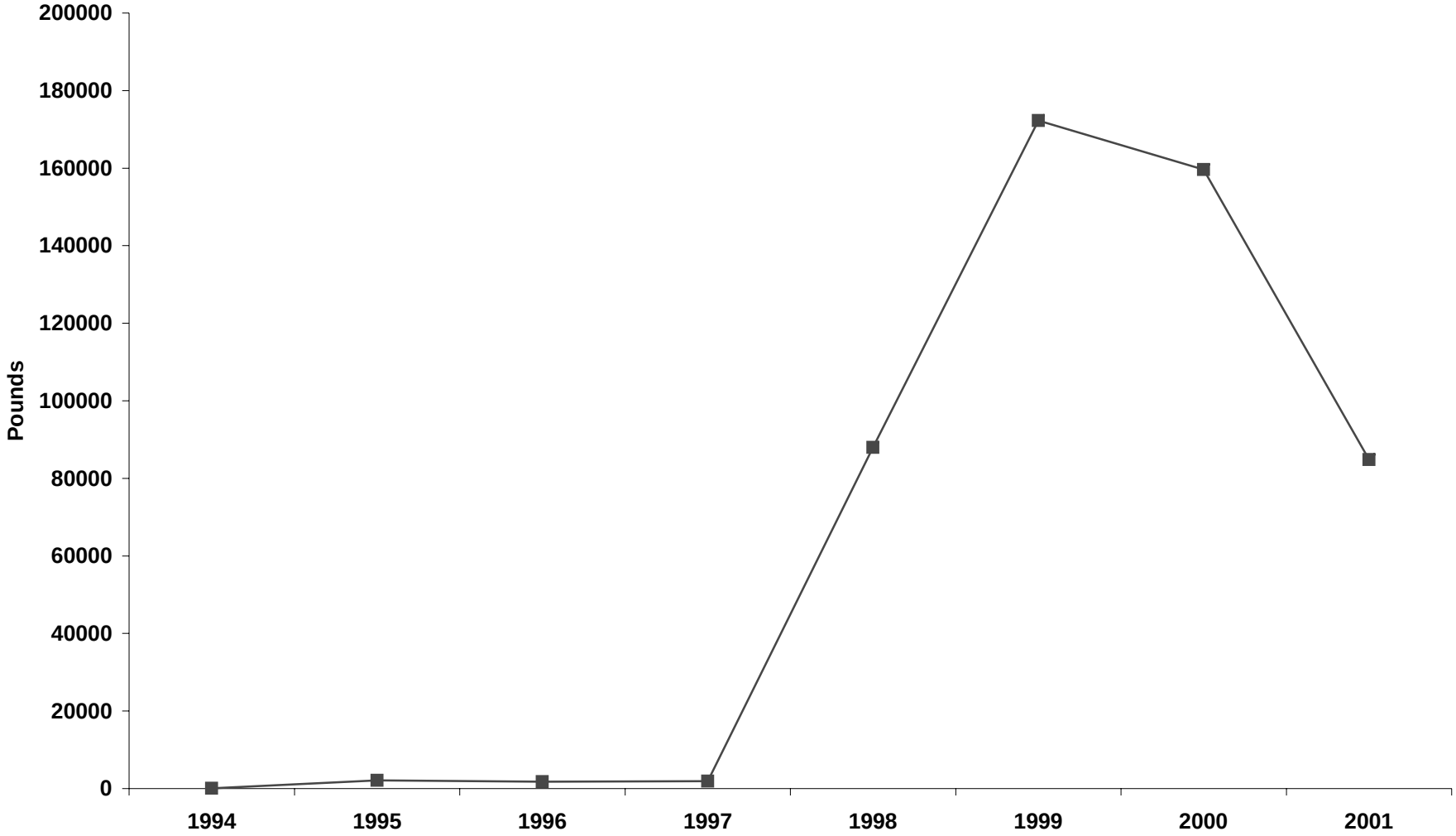
Atlantic Mackerel Landings: 1994-1999
Area 075, Nantucket Sound



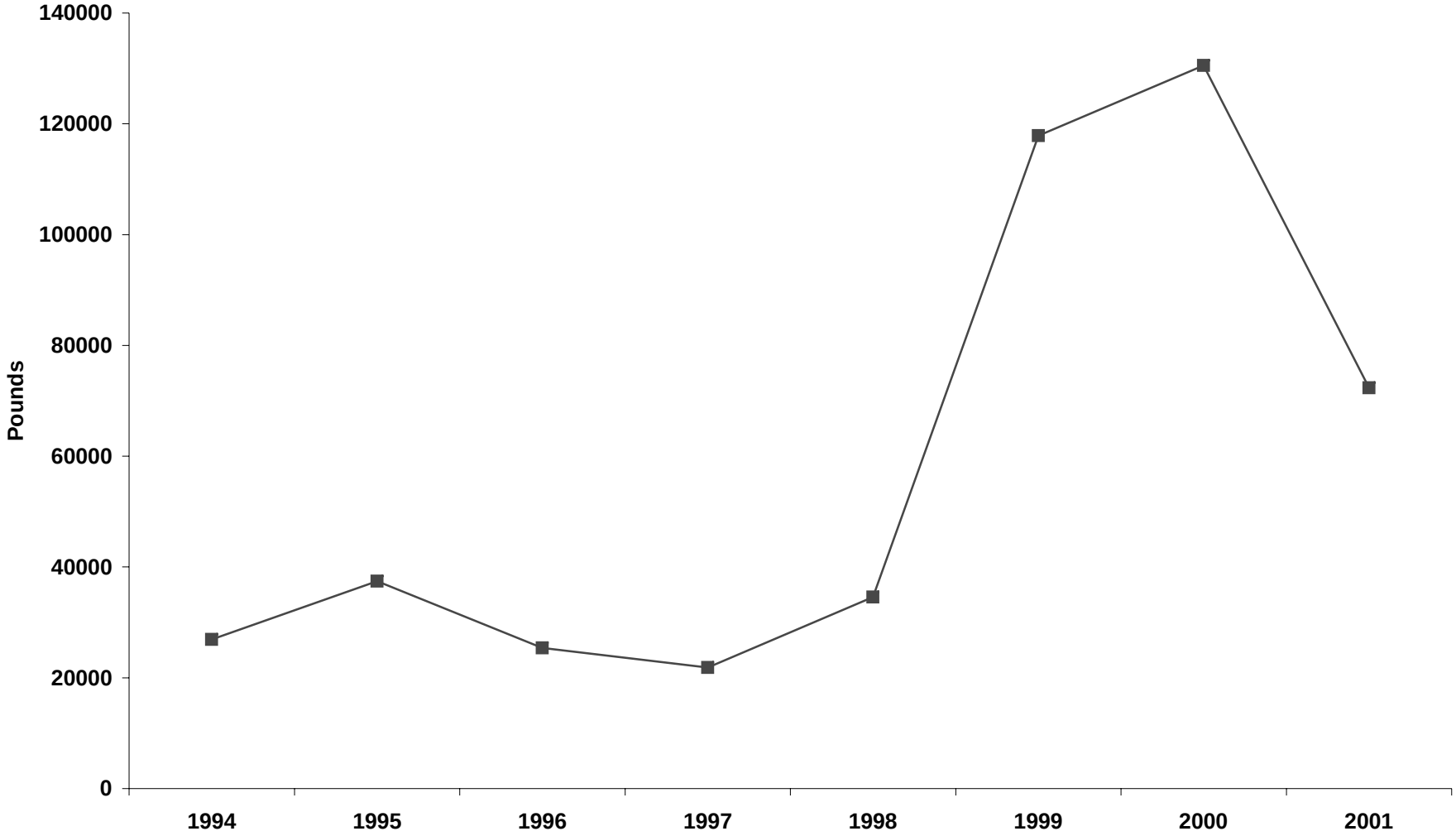
Scup Landings: 1994-2001
Area 075, Nantucket Sound



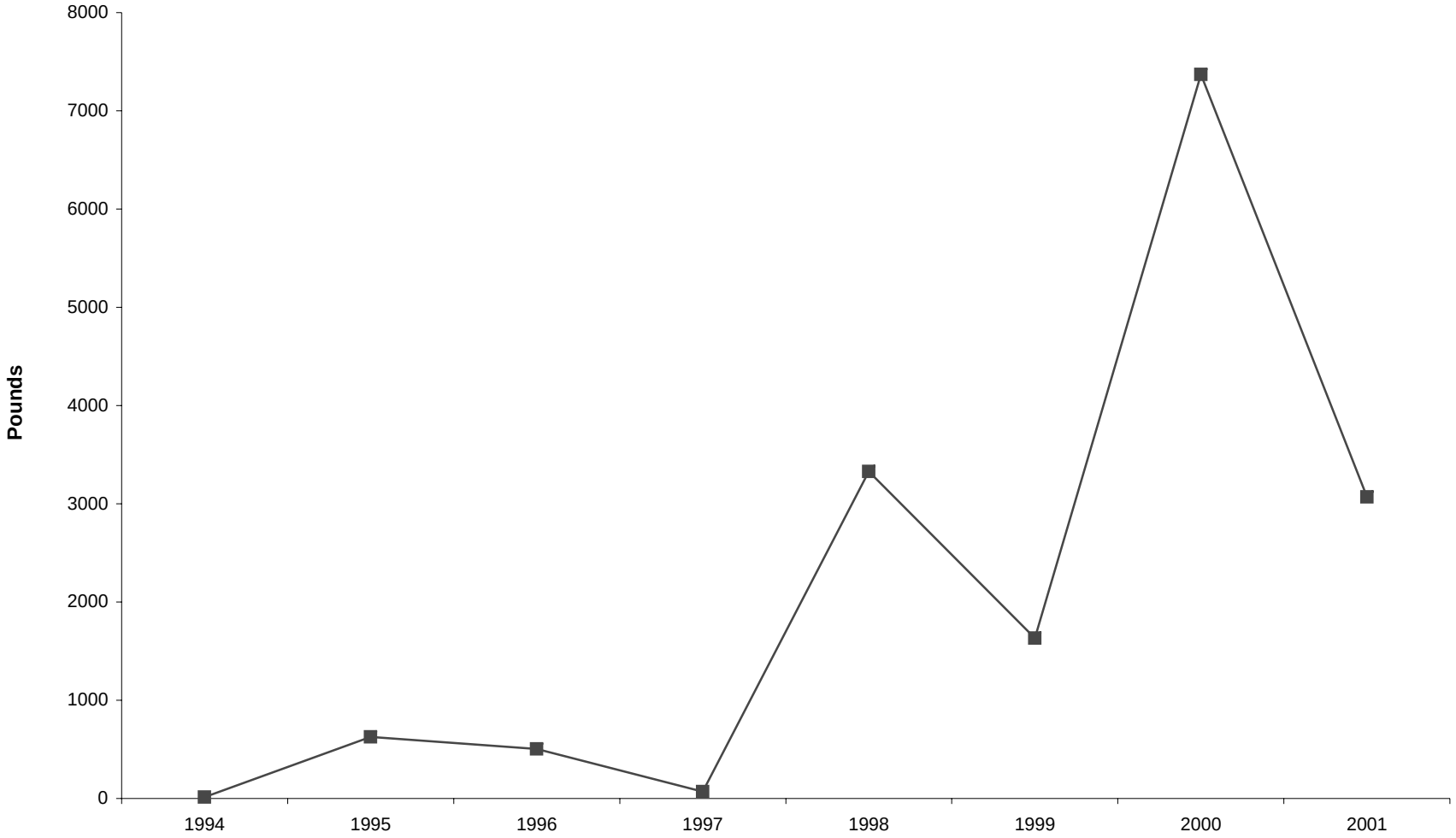
Black Sea Bass Landings: 1994-2001
Area 075, Nantucket Sound



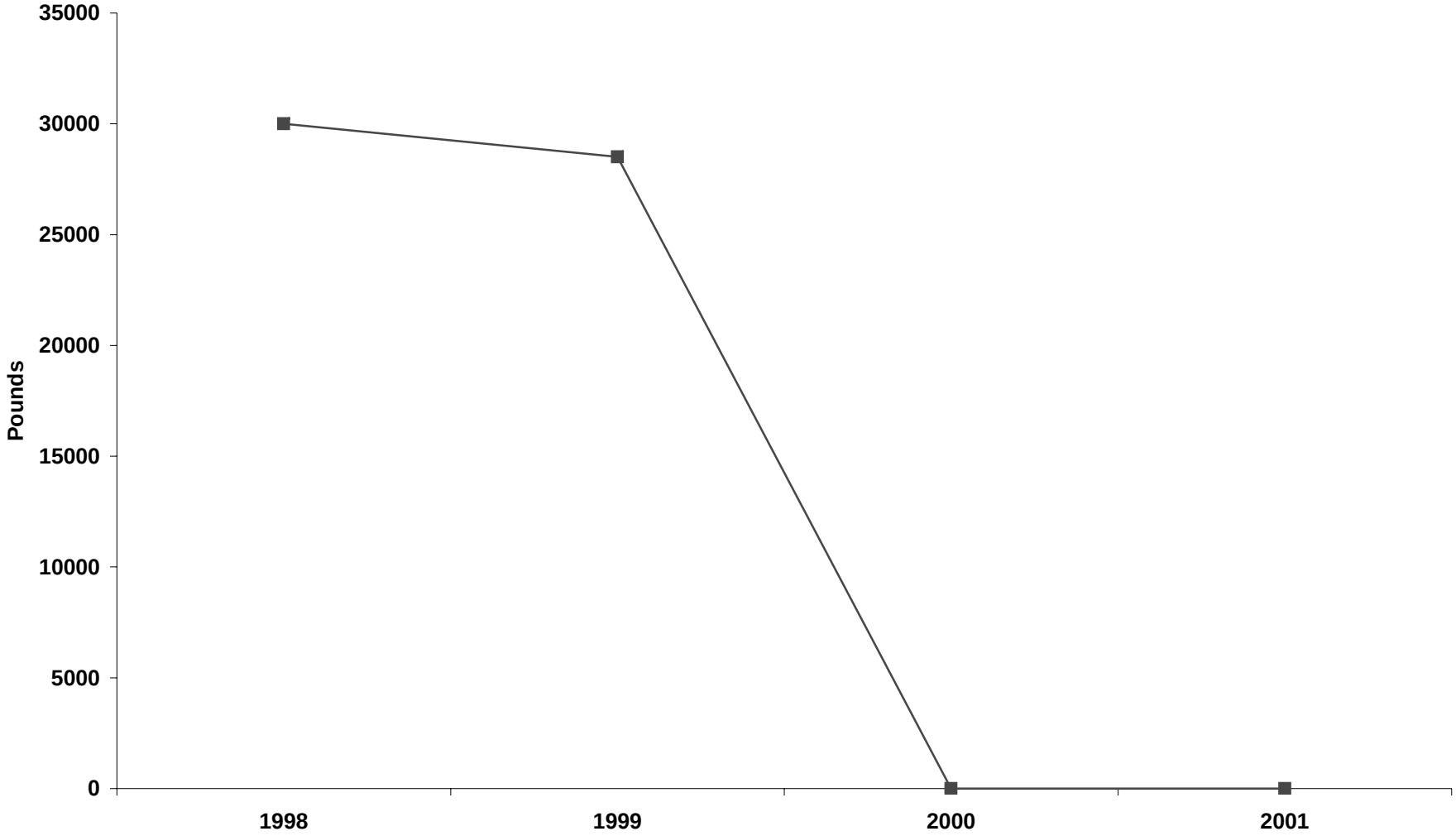
Summer Flounder Landings: 1994-2001
Area 075, Nantucket Sound



Winter Flounder Landings: 1994-2001
Area 075, Nantucket Sound



Menhaden Landings: 1998-2001
Area 075, Nantucket Sound



ATTACHMENT B

MA DMF Statistical Reporting Areas

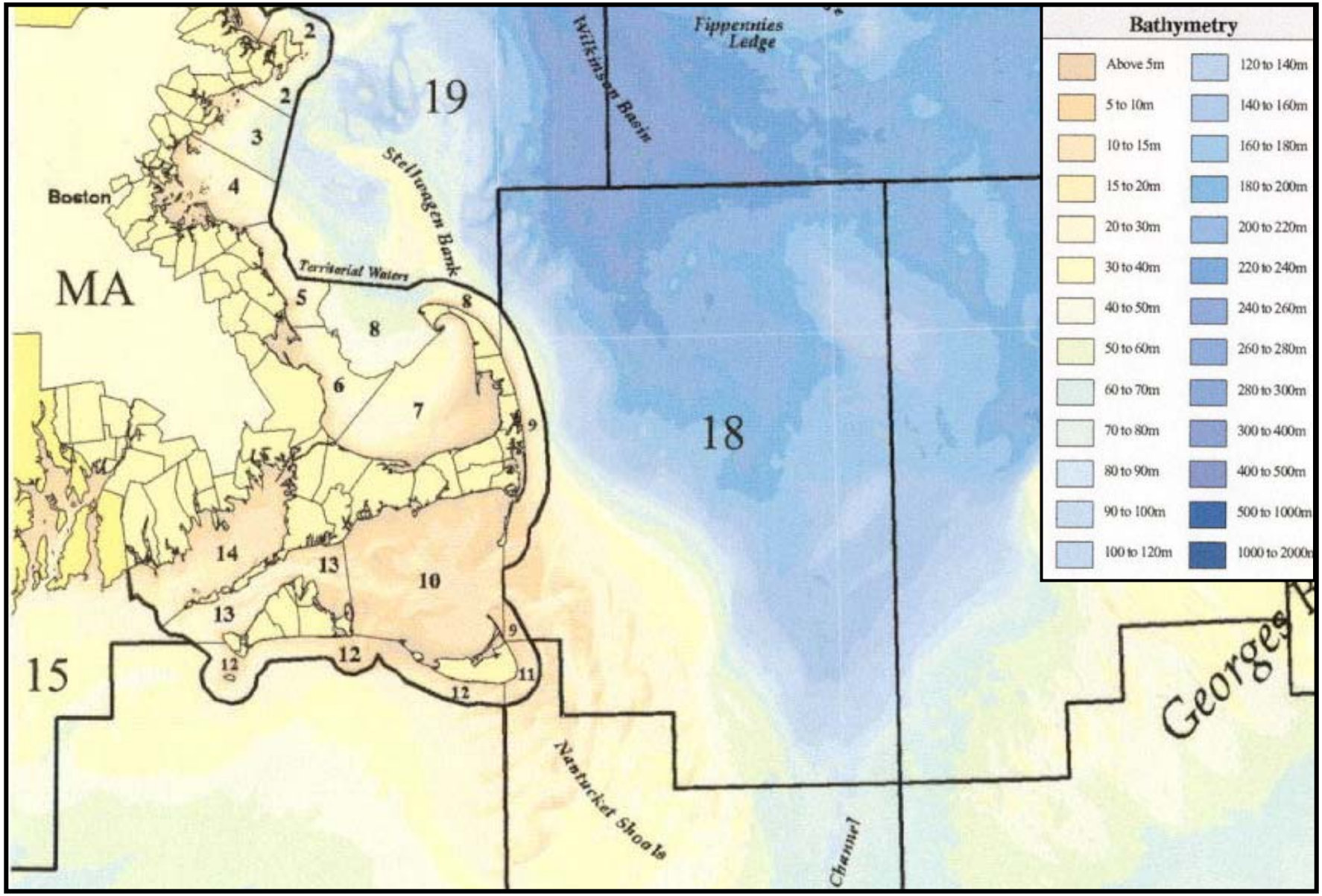


Table 1. Species landings (pounds) from fish weirs in Area 10, Nantucket Sound, from 1990 through 2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	Mean	Std. Dev.
Albacore	6,955	5,273	5,005	1,375	898	5,823	405	1,800	2,585	6,670	1,363	38,152	3,468	2,489
Amberjack	0	0	0	0	0	47	0	0	0	0	27	74	7	16
Atlantic herring	41,620	2,000	2,000	0	0	0	0	0	0	0	0	45,620	4,147	12,454
Atlantic mackerel	342,477	154,582	260,669	216,890	540,827	184,930	718,675	876,160	500,880	535,135	430,785	4,762,010	432,910	229,853
Bluefish	57,865	43,342	40,290	42,404	37,594	34,008	9,204	8,693	18,915	37,796	11,076	341,187	31,017	16,446
Bonito	3,802	2,886	62,852	83,880	57,190	38,953	13,167	24,647	21,278	29,403	356	338,414	30,765	27,357
Butterfish	22,823	7,023	2,801	1,147	1,915	5,229	17,990	46,053	5,899	5,293	12,464	128,637	11,694	13,299
Flounder, unclassified	0	68	40	0	0	81	41	35	100	0	0	365	33	37
Herring, unclassified	0	0	0	10	0	0	0	0	500	0	0	510	46	150
King mackerel	562	1,214	107	0	81	210	4	0	86	179	1,615	4,058	369	548
Menhaden	0	0	0	0	0	5,850	35,700	0	30,000	15,800	0	87,350	7,941	13,284
Scup	199,184	77,633	334,537	143,360	150,649	87,110	2,836	8,337	1,027	58,090	76,693	1,139,456	103,587	99,877
Sea bass, unclassified	2,681	361	160	12	197	141	5	1,796	11	912	14,630	20,906	1,901	4,310
Spanish mackerel	22,039	19,698	278	0	3,488	3,997	25	77	68	2,131	11,046	62,847	5,713	8,182
Squid, general	755,495	727,768	424,941	636,684	239,673	309,322	241,370	308,540	159,808	124,742	322,608	4,250,951	386,450	222,561
Summer flounder	1,123	4,235	2,611	2,759	9,714	86	982	4,370	1,360	3,899	3,924	35,063	3,188	2,622
Tautog	4,092	4,368	3,951	909	5,563	358	167	198	227	395	51	20,279	1,844	2,150
Weakfish	0	0	0	0	0	0	0	0	0	5	18	23	2	5
Winter flounder	0	0	0	0	86	0	0	0	1,980	25	0	2,091	190	594
Witch flounder	1,579	37	0	10	0	3,303	367	0	2,625	0	0	7,921	720	1,214
Total annual	1,462,297	1,050,488	1,140,242	1,129,440	1,047,875	679,448	1,040,938	1,280,706	747,349	820,475	886,656	11,285,914		
Mean	73,115	52,524	57,012	56,472	52,394	33,972	52,047	64,035	37,367	41,024	44,333			
Std. Dev.	181,659	163,319	125,879	148,328	130,294	78,533	165,822	203,100	114,767	120,149	116,271			

Table 2. Species landed (pounds) from gill nets in Area 10, Nantucket Sound, in 1992, 1993, 1995 and 1999

	1992	1993	1995	1999	Total
Dogfish	0	1,850	158,807	803	161,460
Monkfish	0	21	601	13,778	14,400
Mackeral, Atlantic	2,375	3,392	0	538	6,305
Flounder, Yellowtail	0	0	3,656	1	3,657
Pollock	0	0	0	2,414	2,414
Flounder, Winter	0	0	2,302	2	2,304
Cod, General	0	0	230	715	945
Skate, General	0	0	0	371	371
Bluefish	0	205	0	3	208
Flounder, Summer	0	0	0	112	112
Flounder, Unclassified	0	0	0	43	43
Tautog	0	9	25	0	34
Hake, General	0	0	0	13	13
Cusk	0	0	0	8	8
Haddock, General	0	0	0	6	6
Flounder, Witch	0	0	0	1	1
Total	2,375	5,477	165,621	18,808	192,281

Table 3. Conch landings (pounds) from fish pots in Area 10, Nantucket Sound, from 1992 through 2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	mean	stdev
Apr	0	117	0	0	0	0	2,361	56	44	2,578	286	778.992
May	105,668	58,674	20,983	33,170	28,303	21,524	17,920	30,953	47,705	364,900	40,544	27779.39
Jun	421,076	194,153	126,326	172,937	213,089	113,593	58,789	176,099	168,664	1,644,726	182,747	100946.4
Jul	541,539	336,715	216,246	246,990	262,562	111,894	96,129	167,510	251,371	2,230,956	247,884	133854.6
Aug	460,696	317,296	191,555	181,619	254,212	294,763	71,362	119,100	118,400	2,009,003	223,223	121935.7
Sep	326,173	259,534	173,610	210,473	200,109	125,333	74,127	150,071	138,949	1,658,379	184,264	75565.25
Oct	218,044	237,944	199,210	263,152	225,167	126,750	76,056	180,275	169,319	1,695,917	188,435	58354.4
Nov	81,704	96,403	67,708	91,703	62,168	23,462	60,998	94,785	82,259	661,190	73,466	23116.62
Dec	7,504	9,509	3,479	7,860	409	3,000	20,580	20,237	2,685	75,263	8,363	7421.861
Total	2,162,404	1,510,345	999,117	1,207,904	1,246,019	820,319	478,322	939,086	979,396	10,342,912		
mean	240,267	167,816	111,013	134,212	138,447	91,147	53,147	104,343	108,822			
stdev	204659.9	129947.5	88994.91	103017.8	112845.2	93765.85	31856.04	71274.58	83740.03			

Table 4. Sea bass landings (pounds) from fish pots in Area 10, Nantucket Sound, from 1990 through 2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	mean	stdev
Apr	4,746	946	765	0	0	9	0	20	0	25	1,573	8,084	735	1,433
May	157,150	79,855	10,569	12,965	18,944	31,738	22,357	30,301	16,999	165,854	133,447	680,179	61,834	61,386
Jun	113,394	50,505	16,748	21,294	21,937	16,804	22,939	36,303	53,647	119,268	82,866	555,705	50,519	38,271
Jul	21,233	8,145	3,720	2,841	2,622	22,448	4,521	7,836	9,312	24,561	44,690	151,929	13,812	13,117
Aug	8,647	1,562	1,031	587	467	1,199	1,685	3,464	5,119	11,771	90	35,622	3,238	3,802
Sep	9,720	3,911	741	729	906	1,627	4,712	8,135	14,287	27,253	2,265	74,286	6,753	8,081
Oct	18,679	3,370	2,446	1,907	2,882	8,691	6,013	15,875	33,004	68,283	78,061	239,211	21,746	27,176
Nov	3,037	344	368	185	580	1,030	1,095	2,000	4,245	2,815	489	16,188	1,472	1,359
Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	336,606	148,638	36,388	40,508	48,338	83,546	63,322	103,934	136,613	419,830	343,481	1,761,204		
mean	37,401	16,515	4,043	4,501	5,371	9,283	7,036	11,548	15,179	46,648	38,165			
stdev	56,971	28,656	5,780	7,515	8,639	11,719	9,106	13,376	17,740	59,480	49,579			

Table 5. Scup landings (pounds) from fish pots in Area 10, Nantucket Sound, from 1994 through 2000

	1994	1995	1996	1997	1998	1999	2000	Total	mean	stdev
Apr	0	0	0	0	0	0	250	250	36	94
May	8,986	26,668	15,264	10,319	10,314	21,646	250	93,447	13,350	8,746
Jun	151,869	143,227	95,308	123,148	40,471	24,296	0	578,319	82,617	60,932
Jul	35,888	39,763	33,834	23,192	9,783	486	14,232	157,178	22,454	14,837
Aug	37,619	26,174	44,530	37,400	17,806	0	3,054	166,583	23,798	17,531
Sep	26,528	26,968	33,859	27,494	16,956	0	0	131,805	18,829	13,778
Oct	16,618	9,716	10,659	12,774	6,313	120	0	56,200	8,029	6,272
Nov	99	419	3	0	39	136	0	696	99	151
Dec	0	0	0	0	0	0	0	0	0	0
Total	277,607	272,935	233,457	234,327	101,682	46,684	17,786	1,184,478		
mean	30,845	30,326	25,940	26,036	11,298	5,187	1,976			
stdev	47,782	44,772	30,920	38,773	12,921	10,105	4,702			

Table 6. Shellfish landings (pounds) in Area 10, Nantucket Sound, from 1990 through 2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL	Mean	stdev
Bay Scallop (no shells)	4,691	210	0	0	1,244	11,323	0	195	60	0	90	17,813	1,619	3,507
Bay Scallop (w/ shells)	0	5,589	162	58	423	5,790	9,830	108	1,627	538	3,943	28,068	2,552	3,294
Conch	52,174	2,186,847	65,556	315,600	63,858	164,226	70,704	54,946	126,476	56,425	72,565	3,229,377	293,580	632,800
Littlenecks	0	0	0	0	200	0	0	0	0	0	0	200	18	60
Mixed Quahogs	50	0	0	0	0	300	325	50	60	2,400	800	3,985	362	718
Mussel	100	115,283	0	0	3,538,150	3,476,550	767,980	646,635	550	1,925	1,100	8,548,273	777,116	1,377,793
Ocean Quahogs	0	0	0	66,560	0	0	0	0	0	0	0	66,560	6,051	20,069
Sea Clam	0	1,228,800	5,067,120	1,291,540	4,341,280	0	0	0	887,360	880	0	12,816,980	1,165,180	1,831,769
Sea Scallops (no shells)	0	0	0	0	0	50	51	0	0	0	312	413	38	93
Soft Shell Clam	0	0	19,023	8,450	0	0	0	614	11,750	2,448	0	42,285	3,844	6,443
Total	57,015	3,536,729	5,151,861	1,682,208	7,945,155	3,658,239	848,890	702,548	1,027,883	64,616	78,810	24,753,954		
Mean	5,702	353,673	515,186	168,221	794,516	365,824	84,889	70,255	102,788	6,462	7,881			
stdev	16394.69	749423.9	1599521	406775.7	1668557	1094190	241022.7	203251.1	278466.2	17584.02	22759.81			

Table 7. Lobster landings (pounds) in Area 10, Nantucket Sound, from 1990 through 2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	mean	stdev
Jan				294		85		50	41		21	491	98	112
Feb				91				674				765	383	412
Mar				577	1,167	322		136	68	125	49	2,443	349	405
Apr	302	99	50	423	893	915	786	983	1,537	1,144	614	7,744	704	458
May	309	568	186	653	1,263	785	1,457	1,010	2,282	2,359	568	11,439	1,040	737
Jun	1,736	2,644	2,449	10,141	8,106	4,518	8,178	6,969	12,331	10,913	4,414	72,398	6,582	3,668
Jul	3,024	5,705	9,372	21,340	14,393	11,179	16,910	13,767	19,181	12,112	7,230	134,214	12,201	5,673
Aug	1,663	1,545	4,570	8,406	4,828	6,431	7,833	5,120	4,065	5,356	2,897	52,713	4,792	2,234
Sep	535	780	2,925	4,600	2,006	1,328	3,921	3,808	2,689	3,127	1,181	26,899	2,445	1,375
Oct	390	546	2,239	2,380	2,273	922	2,984	4,910	3,343	1,847	1,006	22,840	2,076	1,354
Nov	119	391	1,676	1,462	554	1,151	1,261	1,238	1,608	670	372	10,502	955	549
Dec			620	372	729	160	192	12	390	90	13	2,577	286	259
Total	8,078	12,278	24,086	50,737	36,211	27,796	43,522	38,676	47,535	37,743	18,363	345,025		
mean	1,010	1,535	2,676	4,228	3,621	2,527	4,836	3,223	4,321	3,774	1,669			
stdev	1,029	1,870	2,895	6,357	4,458	3,493	5,389	4,071	5,998	4,379	2,297			

Table 8. Striped bass landings (pounds) in Area 10, Nantucket Sound, from 1990 through 2000

Consumed - personal consumption of permitee

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Jul	404	1,437	507	1,323	716	2,678	2,540	5,334	4,268	4,449	5,149
Aug	185	1,348	288	927	496	1,891	2,723	6,106	4,846	3,017	2,959
Sept	1,052	2,184	527	718	867	817	1,776	4,341	1,944	1,554	2,059
Oct						340	388	2,530	700	255	878

Released (legal) - catch and release by permitee

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Jul	431	924	1,068	571	430	616	1,662	6,819	4,688	5,290	5,848
Aug	283	556	2,086	668	610	435	1,347	9,585	4,268	2,574	2,598
Sept	0	961	1,469	1,327	676	946	2,765	5,029	3,127	2,288	2,221
Oct						423	694	1,542	1,133	349	1,105

Released (sublegal) catch and release by permitee

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Jul	9,797	13,290	15,757	15,857	9,819	20,434	18,999	24,203	31,208	27,461	23,386
Aug	3,647	10,390	4,070	7,076	3,905	11,551	17,317	17,802	12,486	18,040	23,630
Sept	5,156	5,702	5,948	7,573	2,897	4,024	9,415	4,331	3,351	6,415	7,289
Oct						1,187	5,554	1,982	4,173	2,675	2,522

Striped Bass sold to market

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	mean	stdev
Jul	2,082	7,432	11,540	7,918	4,865	11,468	22,454	25,696	57,136	24,608	18,548	193,749	17,614	15,416
Aug	708	5,320	997	798		9,616	17,336	19,280	23,388	22,919	16,940	117,302	11,730	9,300
Sept	1,466					2,726	65	15	90	2,349	1,762	8,473	1,210	1,152
Total	4,256	12,753	12,537	8,717	4,865	23,810	39,854	44,992	80,614	49,877	37,250	319,524		
mean	1,419	6,376	6,268	4,358	4,865	7,937	13,285	14,997	26,871	16,626	12,417			
stdev	688	1,493	7,455	5,035		4,607	11,731	13,366	28,682	12,392	9,262			

ATTACHMENT C

Table 1. Recreational fishing effort by mode based on interviews from Barnstable/Dukes/Nantucket Counties

Year	Wave	Shore	Party/Charter Boat	Private/Rental Boat	Total
1990	wave 2	4	0	30	34
	wave 3	177	103	263	543
	wave 4	358	241	761	1360
	wave 5	267	108	504	879
	wave 6	54	0	46	100
	total	860	452	1604	2916
1991	wave 2	81	0	40	121
	wave 3	122	47	230	399
	wave 4	345	208	459	1012
	wave 5	396	66	353	815
	wave 6	115	0	17	132
	total	1059	321	1099	2479
1992	wave 2	25	0	9	34
	wave 3	203	85	270	558
	wave 4	325	185	485	995
	wave 5	319	116	340	775
	wave 6	118	10	13	141
	total	990	396	1117	2503
1993	wave 2	59	0	2	61
	wave 3	285	87	326	698
	wave 4	452	210	740	1402
	wave 5	391	65	384	840
	wave 6	69	0	35	104
	total	1256	362	1487	3105
1994	wave 2	84	6	10	100
	wave 3	341	102	281	724
	wave 4	308	222	465	995
	wave 5	609	112	448	1169
	wave 6	47	9	19	75
	total	1389	451	1223	3063
1995	wave 2	93	0	2	95
	wave 3	318	88	431	837
	wave 4	337	239	941	1517
	wave 5	460	60	395	915
	wave 6	56	15	11	82
	total	1264	402	1780	3446
1996	wave 2	23	0	0	23
	wave 3	252	78	345	675
	wave 4	323	111	663	1097
	wave 5	387	83	297	767
	wave 6	12	18	8	38
	total	997	290	1313	2600
1997	wave 2	14	23	8	45
	wave 3	297	74	321	692
	wave 4	319	145	456	920
	wave 5	411	149	210	770
	wave 6	87	29	51	167
	total	1128	420	1046	2594
1998	wave 2	5	6	10	21
	wave 3	200	110	316	626
	wave 4	420	165	630	1215
	wave 5	201	86	316	603
	wave 6	170	42	40	252
	total	996	409	1312	2717
1999	wave 2	81	11	44	136
	wave 3	375	70	344	789
	wave 4	459	99	431	989
	wave 5	337	63	183	583
	wave 6	66	31	33	130
	total	1318	274	1035	2627
2000	wave 2	40	0	17	57
	wave 3	293	81	265	639
	wave 4	337	149	477	963
	wave 5	147	77	233	457
	wave 6	24	18	26	68
	total	841	325	1018	2184
2001	wave 2	79	26	42	147
	wave 3	253	97	215	565
	wave 4	375	103	570	1048
	wave 5	279	79	217	575
	wave 6	84	31	24	139
	total	1070	336	1068	2474
Grand Total		13168	4438	15102	32708

Table 2. Recreational fishing effort by hours fished based on interviews from Barnstable/Dukes/Nantucket Counties

Year	Wave	Total hours fished	Mean of hours fished	std dev
1990	wave 2	156	4.59	1.98
	wave 3	1970.5	3.63	1.83
	wave 4	4449	3.27	1.84
	wave 5	3351.1	3.81	2.16
	wave 6	299	2.99	1.7
	total	10225.6	3.66	0.61
1991	wave 2	345	2.85	1.9
	wave 3	1284	3.22	1.7
	wave 4	3214.5	3.18	1.83
	wave 5	3075	3.77	2.33
	wave 6	347	2.63	1.45
	total	8265.5	3.13	0.43
1992	wave 2	70	2.06	1.24
	wave 3	1958.5	3.54	1.94
	wave 4	3076.5	3.09	1.89
	wave 5	3026	3.91	2.26
	wave 6	357.5	2.54	1.85
	total	8488.5	3.03	0.74
1993	wave 2	117	1.92	1.03
	wave 3	2234	3.2	1.93
	wave 4	4436	3.16	1.96
	wave 5	2704	3.22	1.91
	wave 6	260.5	2.5	1.73
	total	9751.5	2.80	0.58
1994	wave 2	231.5	2.32	1.32
	wave 3	2571.3	3.55	4.13
	wave 4	3452	3.47	2.38
	wave 5	3860.5	3.3	2.69
	wave 6	217.5	2.9	1.95
	total	10332.8	3.11	0.51
1995	wave 2	197	2.07	1.26
	wave 3	2929	3.5	3.96
	wave 4	4642	3.06	1.82
	wave 5	2940	3.21	2.11
	wave 6	344	4.19	10.94
	total	11052	3.21	0.77
1996	wave 2	39	1.7	0.78
	wave 3	2323	3.44	2.17
	wave 4	3632	3.33	4.66
	wave 5	2478	3.24	2.15
	wave 6	185	4.87	4.67
	total	8657	3.32	1.12
1997	wave 2	213	4.72	3.94
	wave 3	2355	3.42	2.13
	wave 4	3233	3.53	2.37
	wave 5	2848	3.72	2.55
	wave 6	628	3.76	2.99
	total	9277	3.83	0.52
1998	wave 2	87	4.12	3.4
	wave 3	2094	3.35	2.16
	wave 4	4127	3.4	2.07
	wave 5	2186	3.62	2.14
	wave 6	720	2.86	2.29
	total	9214	3.47	0.46
1999	wave 2	371	2.73	1.86
	wave 3	2626	3.33	1.97
	wave 4	3368	3.4	1.97
	wave 5	1936	3.32	1.95
	wave 6	566	4.35	2.55
	total	8867	3.43	0.58
2000	wave 2	127	2.23	1.35
	wave 3	2270	3.57	2.07
	wave 4	3315.5	3.44	2.02
	wave 5	1723.5	3.77	2.09
	wave 6	311.5	4.58	2.95
	total	7747.5	3.52	0.85
2001	wave 2	492.5	3.35	2.65
	wave 3	1976	3.5	1.9
	wave 4	3287.5	3.14	1.7
	wave 5	1980	3.45	2.59
	wave 6	584	4.2	3.44
	total	8320	3.53	0.40
Grand Total		110198.4	3.334833	0.659737

Table 3. Gear used by recreational anglers based on interviews from Barnstable/Dukes/Nantucket Counties

Year	Wave	hook & line	dip/ A frame net	cast net	gill net	seine	trawl	trap	spear	hand	other
1990	wave 2	34									
	wave 3	541							2		
	wave 4	1359					1				
	wave 5	875	2	2							
	wave 6	100									
	total	2909	2	2			1		2		
1991	wave 2	118						2	1		
	wave 3	396						1	2		
	wave 4	1002	5			1		1	2	1	
	wave 5	815									
	wave 6	132									
	total	2463	5			1		4	5	1	
1992	wave 2	34									
	wave 3	556	2								
	wave 4	993							2		
	wave 5	767							8		
	wave 6	141									
	total	2491	2						10		
1993	wave 2	61									
	wave 3	693				2		1	2		
	wave 4	1394	1					3	1	3	
	wave 5	837			1	1		1			
	wave 6	104									
	total	3089	1		1	3		5	3	3	
1994	wave 2	100									
	wave 3	722	1						1		
	wave 4	990	1						2		2
	wave 5	1160		2		1		1		1	4
	wave 6	75									
	total	3047	2	2		1		1	3	1	6
1995	wave 2	95									
	wave 3	834	1	1							1
	wave 4	1512						2	1		2
	wave 5	915									
	wave 6	82									
	total	3438	1	1				2	1		3

Year	Wave	hook & line	dip/ A frame net	cast net	gill net	seine	trawl	trap	spear	hand	other
1996	wave 2	23									
	wave 3	674				1					
	wave 4	1091	1							1	
	wave 5	760									
	wave 6	38									
	total	2586	1	0	0	1	0	0	0	1	0
1997	wave 2	43									
	wave 3	673	4								
	wave 4	903	5						1		
	wave 5	758	4								4
	wave 6	167									
	total	2544	13						1		4
1998	wave 2	21									
	wave 3	624									
	wave 4	1208						1			1
	wave 5	599							4		
	wave 6	252									
	total	2704						1	4		1
1999	wave 2	136									
	wave 3	788	1								
	wave 4	987	1						1		
	wave 5	582	1								
	wave 6	130									
	total	2623	3						1		
2000	wave 2	56									1
	wave 3	638	1								
	wave 4	959						4			
	wave 5	456									1
	wave 6	68									
	total	2177	1					4			2
2001	wave 2	147									
	wave 3	564						1			
	wave 4	1048									
	wave 5	575									
	wave 6	139									
	total	2473						1			
TOTAL		32544	31	5	1	6	1	18	30	6	16

Table 4. Number of fish reported by fisherman and number of fish observed by interviewer based on interviews from Barnstable/Dukes/Nantucket Counties

		Shore		Party/Charter Boat		Private/Rental Boat		Total	
Year	Wave	Reported	Observed	Reported	Observed	Reported	Observed	Reported	Observed
1990	wave 2	2				6	16	8	16
	wave 3	159	29	93	87	264	100	516	216
	wave 4	444	55	252	220	800	113	1496	388
	wave 5	270	47	430	264	745	159	1445	470
	wave 6	174	92			108	6	282	98
	total	1049	223	775	571	1923	394	3747	1188
1991	wave 2	7	4			19	71	26	75
	wave 3	86	77	139	59	1572	222	1797	358
	wave 4	237	92	466	168	627	120	1330	380
	wave 5	349	106	228	61	786	146	1363	313
	wave 6	210	109			11	4	221	113
	total	889	388	833	288	3015	563	4737	1239
1992	wave 2					1	2	1	2
	wave 3	98	41	478	69	723	111	1299	221
	wave 4	210	41	419	381	488	111	1117	533
	wave 5	1190	74	613	129	1057	106	2860	309
	wave 6	760	64	57		1	14	818	78
	total	2258	220	1567	579	2270	344	6095	1143
1993	wave 2								
	wave 3	161	23	267	77	420	127	848	227
	wave 4	634	49	764	108	1148	212	2546	369
	wave 5	511	112	200	48	765	179	1476	339
	wave 6	78	57			102	74	180	131
	total	1384	241	1231	233	2435	592	5050	1066
1994	wave 2		2					0	2
	wave 3	267	57	231	136	444	127	942	320
	wave 4	266	37	524	193	924	163	1714	393
	wave 5	644	58	530	63	1051	125	2225	246
	wave 6	36		96	1	30	5	162	6
	total	1213	154	1381	393	2449	420	5043	967
1995	wave 2	3				12		15	0
	wave 3	288	31	453	44	1478	174	2219	249
	wave 4	179	21	816	168	1727	279	2722	468
	wave 5	1570	32	266	22	1210	82	3046	136
	wave 6	213		81	30	5		299	30
	total	2253	84	1616	264	4432	535	8301	883
1996	wave 2	22						22	0
	wave 3	227	24	1230	37	1222	174	2679	235
	wave 4	282	3	553	40	1670	103	2505	146
	wave 5	519	8	365	44	939	70	1823	122
	wave 6	2	13	276	10			278	23
	total	1052	48	2424	131	3831	347	7307	526
1997	wave 2			297	10			297	10
	wave 3	244	28	876	20	1374	83	2494	131
	wave 4	266	22	659	33	848	78	1773	133
	wave 5	414	21	1522	49	791	44	2727	114
	wave 6	100	13	185	40	813	13	1098	66
	total	1024	84	3539	152	3826	218	8389	454
1998	wave 2	2		218		4		224	0
	wave 3	252	17	1280	95	1929	91	3461	203
	wave 4	381	20	548	31	2077	127	3006	178

Table 4. Number of fish reported by fisherman and number of fish observed by interviewer based on interviews from Barnstable/Dukes/Nantucket Counties

		Shore		Party/Charter Boat		Private/Rental Boat		Total	
Year	Wave	Reported	Observed	Reported	Observed	Reported	Observed	Reported	Observed
	wave 5	358	7	1023	10	1129	48	2510	65
	wave 6	169	13	985	8	636	29	1790	50
	total	1162	57	4054	144	5775	295	10991	496
1999	wave 2	78		35		22	3	135	3
	wave 3	377	25	1683	2	3026	77	5086	104
	wave 4	351	15	882	17	1311	59	2544	91
	wave 5	155	2	1216		587	20	1958	22
	wave 6	267	4	135	8	1234	8	1636	20
	total	1228	46	3951	27	6180	167	11359	240
2000	wave 2	9				39		48	0
	wave 3	370	15	1863	19	1372	54	3605	88
	wave 4	340	22	1057	50	1587	139	2984	211
	wave 5	85	2	1732	14	489	40	2306	56
	wave 6	7		384		1		392	0
	total	811	39	5036	83	3488	233	9335	355
2001	wave 2	97	3	1233	1	9		1339	4
	wave 3	210	20	2028	27	1390	39	3628	86
	wave 4	354	21	743	77	1668	172	2765	270
	wave 5	399	19	842	36	755	19	1996	74
	wave 6	46		745		207	13	998	13
	total	1106	63	5591	141	4029	243	10726	447
TOTAL		15429	1647	31998	3006	43653	4351	91080	9004

Table 5. Numbers and species observed by interviewers from surveys conducted in Dukes/Barnstable/ Nantucket couunties

	Shore		Party/Charter		Private/Rental	
Year	Species Name	Total Number	Species Name	Total Number	Species Name	Total Number
1990	atlantic mackerel	72	scup	456	bluefish	171
	bluefish	68	bluefish	41	tautog	83
	scup	37	winter flounder	28	scup	51
	pollock	26	black sea bass	17	winter flounder	40
	summer flounder	7	tautog	16	summer flounder	15
	winter flounder	4	striped bass	4	black sea bass	9
	black sea bass	3	smooth dogfish shark	3	atlantic mackerel	8
	atlantic menhaden	2	atlantic cod	2	striped bass	7
	atlantic bonito	1	atlantic bonito	1	white perch	3
	smooth dogfish shark	1	fourspot flounder	1	northern searobin	2
	striped bass	1	ocean pout	1	american eel	1
	tautog	1	summer flounder	1	atlantic cod	1
					atlantic menhaden	1
					cunner	1
					searobins	1
1991	bluefish	185	scup	165	atlantic mackerel	162
	atlantic mackerel	89	bluefish	101	bluefish	160
	scup	22	tautog	9	scup	70
	windowpane	18	black sea bass	5	winter flounder	61
	pollock	12	striped bass	3	tautog	58
	atlantic bonito	11	cunner	2	summer flounder	21
	butterfish	9	northern searobin	1	atlantic cod	6
	winter flounder	9	searobins	1	striped bass	6
	atlantic herring	7	summer flounder	1	8850030102	5
	tautog	7			black sea bass	5
	cunner	5			pollock	4
	8850030102	4			albacore	2
	striped bass	3			atlantic bonito	2
	black sea bass	2			american eel	1
	summer flounder	2				
	atlantic menhaden	1				
	needlefish	1				
	spanish mackerel	1				
1992	atlantic mackerel	82	scup	429	scup	100
	bluefish	55	bluefish	83	bluefish	64
	scup	41	striped bass	21	winter flounder	43
	winter flounder	16	tautog	17	tautog	39
	summer flounder	8	black sea bass	11	atlantic mackerel	28
	albacore	4	northern searobin	11	summer flounder	20
	striped bass	4	atlantic mackerel	3	striped bass	15
	atlantic bonito	3	left-eye flounder	2	atlantic cod	13
	atlantic herring	2	summer flounder	2	black sea bass	11
	pollock	2			atlantic bonito	5
	northern searobin	1			atlantic silverside	2
	rainbow smelt	1			bluefin tuna	2
	searobin	1			haddock	1
					yellowtail flounder	1
1993	bluefish	52	bluefish	126	bluefish	215
	atlantic bonito	50	scup	51	atlantic bonito	100
	rainbow smelt	45	striped bass	18	winter flounder	81
	scup	21	tautog	16	scup	66

Table 5. Numbers and species observed by interviewers from surveys conducted in Dukes/Barnstable/ Nantucket couunties

	Shore		Party/Charter		Private/Rental	
Year	Species Name	Total Number	Species Name	Total Number	Species Name	Total Number
1993	winter flounder	20	atlantic cod	11	summer flounder	43
continued	atlantic silverside	15	atlantic bonito	4	tautog	40
	cunner	14	black sea bass	2	striped bass	24
	striped bass	5	ocean pout	2	atlantic cod	6
	tautog	5	winter flounder	2	black sea bass	6
	windowpane	5	summer flounder	1	spanish sardine	4
	pollock	2			windowpane	2
	summer flounder	2			atlantic menhaden	1
	atlantic tomcod	1			lamprey sea	1
	blueback herring	1			shortfin mako shark	1
	mummichog	1			spanish mackerel	1
	northern searobin	1			spiny dogfish shark	1
	winter skate	1				
1994	bluefish	55	scup	224	bluefish	107
	8845010100	18	bluefish	87	atlantic mackerel	88
	american sandlance	15	summer flounder	21	summer flounder	68
	scup	15	atlantic mackerel	18	striped bass	40
	atlantic mackerel	14	striped bass	17	winter flounder	35
	summer flounder	13	northern searobin	12	scup	29
	striped bass	6	tautog	6	atlantic bonito	20
	winter flounder	5	atlantic bonito	2	tautog	17
	albacore	2	atlantic cod	2	skipjack tuna	6
	atlantic bonito	2	black sea bass	1	atlantic cod	2
	cunner	2	blueback herring	1	bigeye tuna	2
	windowpane	2	shortfin mako shark	1	cunner	2
	atlantic menhaden	1	skipjack tuna	1	black sea bass	1
	blueback herring	1			chub mackerel	1
	pollock	1			striped searobin	1
	rainbow smelt	1			yellowfin tuna	1
	skipjack tuna	1				
1995	bluefish	66	bluefish	107	bluefish	169
	Atlantic bonito	5	scup	67	Atlantic mackerel	101
	white perch	3	striped bass	39	summer flounder	84
	winter flounder	3	finescale menhaden	29	striped bass	53
	striped bass	2	tautog	6	scup	43
	Atlantic herring	1	black sea bass	5	winter flounder	39
	cunner	1	Atlantic bonito	4	tautog	19
	scup	1	white perch	2	yellowfin tuna	7
	summer flounder	1	winter flounder	2	Atlantic bonito	6
	tautog	1	pollock	1	black sea bass	4
			summer flounder	1	Atlantic menhaden	3
			yellowfin tuna	1	bluefin tuna	2
					skipjack tuna	2
					bigeye tuna	1
					blueback herring	1
					cunner	1
1996	bluefish	14	bluefish	57	bluefish	79
	Atlantic mackerel	13	scup	30	Atlantic mackerel	60
	winter flounder	11	striped bass	25	winter flounder	54
	striped bass	3	finescale menhaden	7	scup	43
	Atlantic bonito	2	tautog	4	striped bass	43

Table 5. Numbers and species observed by interviewers from surveys conducted in Dukes/Barnstable/ Nantucket couunties

	Shore		Party/Charter		Private/Rental	
Year	Species Name	Total Number	Species Name	Total Number	Species Name	Total Number
1996 continued	summer flounder	2	pollock	3	summer flounder	28
	windowpane flounder	2	black sea bass	2	tautog	24
	tautog	1	summer flounder	2	Atlantic bonito	6
			Atlantic mackerel	1	cunner	2
					little skate	2
					smooth dogfish	2
					Atlantic herring	1
					black sea bass	1
					northern searobin	1
					shorthorn sculpin	1
1997	bluefish	26	finescale menhaden	49	bluefish	68
	striped bass	22	striped bass	36	striped bass	50
	Atlantic mackerel	12	scup	31	summer flounder	27
	summer flounder	10	bluefish	18	scup	22
	blueback herring	5	black sea bass	6	Atlantic mackerel	17
	scup	4	tautog	4	winter flounder	15
	windowpane flounder	4	Atlantic bonito	3	black sea bass	4
	winter flounder	1	summer flounder	3	tautog	4
			pollock	2	Atlantic bonito	3
					finescale menhaden	3
					spiny dogfish	2
					little skate	1
					sand lance	1
					skate	1
1998	striped bass	21	striped bass	47	summer flounder	103
	bluefish	12	pollock	39	striped bass	69
	Atlantic mackerel	11	bluefish	30	bluefish	56
	Atlantic croaker	2	finescale menhaden	7	Atlantic mackerel	29
	pollock	2	scup	7	winter flounder	11
	summer flounder	2	Atlantic mackerel	3	scup	10
	tautog	2	Atlantic herring	2	black sea bass	7
	American eel	1	black sea bass	2	tautog	6
	American shad	1	spiny dogfish	2	cunner	4
	scup	1	winter flounder	2		
	white perch	1	summer flounder	1		
	yellowtail flounder	1	tautog	1		
1999	bluefish	18	striped bass	10	summer flounder	47
	striped bass	7	finescale menhaden	8	striped bass	46
	winter flounder	5	scup	6	Atlantic mackerel	23
	cunner	3	bluefish	2	bluefish	18
	summer flounder	3	winter flounder	1	winter flounder	17
	Atlantic mackerel	2			scup	5
	white perch	2			tautog	5
	Atlantic bonito	1			black sea bass	4
	Atlantic tomcod	1			albacaore tuna	1
	longhorn sculpin	1			Atlantic bonito	1
	pollock	1				
	shark (NS)	1				
	tautog	1				
2000	striped bass	10	scup	35	summer flounder	83
	bluefish	7	striped bass	18	scup	44

Table 5. Numbers and species observed by interviewers from surveys conducted in Dukes/Barnstable/ Nantucket couunties

	Shore		Party/Charter		Private/Rental	
Year	Species Name	Total Number	Species Name	Total Number	Species Name	Total Number
2000 continued	scup	5	summer flounder	9	striped bass	40
	black sea bass	4	bluefish	7	bluefish	28
	rainbow smelt	4	atlantic cod	6	bluefin tuna	9
	summer flounder	3	black sea bass	6	black sea bass	8
	winter flounder	3	atlantic bonito	2	tautog	7
	northern searobin	2			winter flounder	7
	spanish mackerel	1			atlantic mackerel	4
					atlantic bonito	2
					whiteperch	1
2001	striped bass	20	bluefish	85	bluefish	85
	scup	19	scup	27	striped bass	66
	bluefish	15	striped bass	22	summer flounder	28
	alewife	3	summer flounder	5	scup	27
	spanish mackerel	3	atlantic cod	1	atlantic bonito	15
	8850030102	1	black sea bass	1	black sea bass	12
	black sea bass	1			tautog	4
	tautog	1			atlantic cod	3
					winter flounder	2
					cunner	1

ATTACHMENT D

Table 1. Total number of fish per tow for tows conducted at the 3 proposed sites from 1990 through 2001.

Season	Site	Year	Tow id	Total fish/tow
Fall	Site 1	1990	2	7660
Fall	Site 1	1990	5	584
Fall	Site 1	1990	7	696
Fall	Site 1	1992	3	13890
Fall	Site 1	1992	5	34093
Fall	Site 1	1993	7	5887
Fall	Site 1	1994	5	2089
Fall	Site 1	1994	6	2359
Fall	Site 1	1994	7	746
Fall	Site 1	1994	9	1140
Fall	Site 1	1995	5	960
Fall	Site 1	1995	7	1186
Fall	Site 1	1995	9	1418
Fall	Site 1	1996	2	14683
Fall	Site 1	1997	7	1908
Fall	Site 1	1997	8	2151
Fall	Site 1	1998	1	626
Fall	Site 1	1998	8	9306
Fall	Site 1	1998	9	848
Fall	Site 1	1998	10	2698
Fall	Site 1	1999	6	124
Fall	Site 1	1999	7	2910
Fall	Site 1	2000	5	541
Fall	Site 1	2001	3	2549
Fall	Site 1	2001	4	179
Fall	Site 1	2001	8	6931
Fall	Site 2	1990	1	1038
Fall	Site 2	1990	2	695
Fall	Site 2	1992	4	5519
Fall	Site 2	1993	1	14135
Fall	Site 2	1994	3	5484
Fall	Site 2	1997	1	3301
Fall	Site 2	1997	3	12534
Fall	Site 2	1999	2	901
Fall	Site 2	1999	3	4434
Fall	Site 2	2000	2	3154
Fall	Site 2	2000	4	1314
Fall	Site 3	1990	8	2968
Fall	Site 3	1992	8	1357
Fall	Site 3	1992	11	8414
Fall	Site 3	1993	6	1142
Fall	Site 3	1994	8	4370
Fall	Site 3	1995	8	1111
Fall	Site 3	1996	3	3589
Fall	Site 3	1996	4	6916
Fall	Site 3	1997	7	12900
Fall	Site 3	1998	10	12784
Fall	Site 3	1998	7	5402
Fall	Site 3	1999	4	5871
Fall	Site 3	2000	5	10336
Fall	Site 3	2000	8	6079
Fall	Site 3	2000	9	2398
Fall	Site 3	2001	8	763

Table 2. Summary of CPUE for sites Horseshoe Shoals, Monomoy and Tuckernuck

	Horseshoe Shoal			Handkerchief Shoal			Tuckernuck Shoal		
Fall	Number of Tows	Mean CPUE	Std. Dev	Number of Tows	Mean CPUE	Std. Dev	Number of Tows	Mean CPUE	Std. Dev
1990	3	2,980	4,053	2	867	243	1	2,968	na
1992	2	23,992	14,285	1	5,519	na	2	4,886	4,990
1993	1	5,887	na	1	14,135	na	1	1,142	na
1994	4	1,584	765	1	5,484	na	1	4,370	na
1995	3	1,188	229				1	1,111	na
1996	1	14,683	na				2	5,253	2,353
1997	2	2,030	172	2	7,918	6,529	1	12,900	na
1998	4	3,370	4,065				2	9,093	5,219
1999	2	1,517	1,970	2	2,668	2,498	1	5,871	na
2000	1	541	na	2	2,234	1,301	3	6,271	3,972
2001	3	3,220	3,425				1	763	na
11-year Mean $\pm$ Std. Dev		5544.5	7272.6		5546.2	4482.4		4966.1	3661.8

Table 3. Total number of fish per tow for tows conducted at the 3 proposed sites from 1990 through 2002.

Season	Site	Year	Tow	Total fish/tow
Spring	Site 1	1990	1	547
Spring	Site 1	1990	8	318
Spring	Site 1	1991	4	102
Spring	Site 1	1991	5	85
Spring	Site 1	1992	4	291
Spring	Site 1	1992	7	142
Spring	Site 1	1993	7	390
Spring	Site 1	1994	3	141
Spring	Site 1	1994	6	322
Spring	Site 1	1995	5	652
Spring	Site 1	1995	6	401
Spring	Site 1	1995	7	500
Spring	Site 1	1996	8	161
Spring	Site 1	1996	9	227
Spring	Site 1	1997	9	41
Spring	Site 1	1998	5	102
Spring	Site 1	1999	4	77
Spring	Site 1	1999	7	74
Spring	Site 1	2000	3	308
Spring	Site 1	2000	4	621
Spring	Site 1	2000	5	124
Spring	Site 1	2001	3	90
Spring	Site 1	2001	4	36
Spring	Site 1	2002	1	146
Spring	Site 1	2002	2	421
Spring	Site 1	2002	3	81
Spring	Site 2	1990	2	1321
Spring	Site 2	1991	1	212
Spring	Site 2	1992	3	461
Spring	Site 2	1993	4	386
Spring	Site 2	1993	5	183
Spring	Site 2	1996	4	438
Spring	Site 2	1999	3	125
Spring	Site 2	2002	5	130
Spring	Site 3	1990	11	456
Spring	Site 3	1991	8	105
Spring	Site 3	1993	9	1001
Spring	Site 3	1993	10	126
Spring	Site 3	1994	2	47
Spring	Site 3	1994	4	155
Spring	Site 3	1995	8	137
Spring	Site 3	1996	10	289
Spring	Site 3	1997	10	200
Spring	Site 3	1998	7	77
Spring	Site 3	1999	9	180
Spring	Site 3	1999	10	6580
Spring	Site 3	2000	5	612

Table 4. Summary of CPUE for sites Horseshoe Shoals, Monomoy and Tuckernuck

Spring	Horseshoe Shoal			Handkerchief Shoal			Tuckernuck Shoal		
	Number of Tows	Mean CPUE	Std. Dev	Number of Tows	Mean CPUE	Std. Dev	Number of Tows	Mean CPUE	Std. Dev
1990	2	433	162	1	1321	na	1	456	na
1991	2	94	12	1	212	na	1	105	na
1992	2	217	105	1	461	na			
1993	1	390	na	2	285	144	2	564	619
1994	2	232	128				2	101	76
1995	3	518	126				1	137	na
1996	2	194	47	1	438	na	1	289	na
1997	1	41	na				1	200	na
1998	1	102	na				1	77	na
1999	2	75.5	2.1	1	125	na	2	3380	4525
2000	3	351	251				1	612	na
2001	2	63	38						
2002	3	216	180	1	130	na			
13-year Mean $\pm$ Std. Dev		224.9	154.9		424.5	417.6		592.05	999.4