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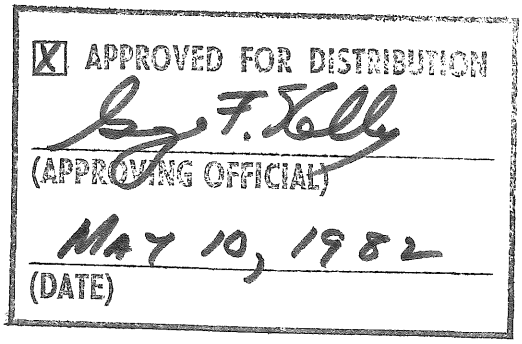
ABUNDANCE AND SIZE COMPOSITION OF FISH AND INVERTEBRATES FROM COASTAL OTTER TRAWL SURVEYS IN CAPE COD AND MASSACHUSETTS BAYS IN 1975-77

by

Fred E. Lux and George F. Kelly



National Marine Fisheries Service, NOAA
Northeast Fisheries Center
Woods Hole Laboratory
Woods Hole, Massachusetts 02543

INTRODUCTION

A fisheries-ecological study of Cape Cod and Massachusetts Bays was undertaken by the Northeast Fisheries Center in 1972 to better define fishery resources there in relation to actual and potential environmental impacts. A report on landings data and survey results from offshore surveys in the area (Lux and Kelly, 1978) followed by one on ichthyoplankton (Lux and Kelly, 1981) provided summaries of data on species present, the harvest, and extent of spawning there. The present paper reports catch data from otter trawl surveys in the shallow coastal waters of this area in 1975-77.

METHODS AND MATERIALS

The surveys were conducted in depths of 4-40 m (Figure 1). Eighteen stations were selected on trawlable bottoms for this purpose, two of which were in sheltered waters of Boston and Gloucester harbors, and eight cruises were made in the series (Table 1). For most cruises commercial fishing trawlers were chartered; for two cruises the Phalarope II, a National Marine Fisheries Service research vessel, was used.

The otter trawl for the surveys was a 1/2-35 Yankee trawl (footrope, 35 ft; headrope, 26 ft) fitted with a chain on the footrope and a 1/2" mesh cod end liner. One tow, 1/2 hour in duration, was made at each station sampled in a survey at a towing speed of 3 K. While the intent was to cover all 18 stations during each survey, weather, time limitations, and vessel breakdowns made this impractical (Table 1).

Catches of fish and invertebrates in each tow were separated by species, and the aggregate weight of each, to the nearest 0.1 kg, was recorded[1]. Measurements, to the nearest whole centimeter, were made of the entire sample or a representative subsample.

The common names of fish and invertebrates are used in this report; scientific names are given in an appendix.

RESULTS AND DISCUSSION

The survey catches per tow by species in mean numbers and pounds by season and area (i.e., Cape Cod Bay and Massachusetts Bay) are given in Tables 2-4. Spring data include the April surveys (Table 2); fall data include September-October surveys (Table 4). The principal fishes contributing to the biomass of catches were spiny dogfish, ocean pout, and winter flounder. The first two of these are seasonal in the area. No dogfish were caught in the spring, when the water still was cold. Ocean pout, on the other hand, were common in spring catches, and, except for a few small ones, were absent from shallow areas in summer and fall. The winter flounder was the species most consistently present in some abundance, and it is economically the most important bottom fish of the coastal waters there.

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[1] In 1975 weights were to the nearest pound and later were converted to kilograms; weights of less than 1/2 pound were not recorded in 1975.

The principal invertebrate in tows was the lobster, with the catch of these rising greatly in the summer (Table 3) as a result of large numbers of sublegal-sized ones being taken in the Duxbury-Hummarock area.

Information on the size of fish and invertebrates caught (Table 5)[2] indicates that many of them were small, showing that these coastal waters serve as nursery grounds for many species. Ichthyoplankton studies there show that many fish spawn in the vicinity (Lux and Kelly, 1981). A count of the number of kinds of fishes and invertebrates caught shows that 28 fishes and 5 invertebrates were recorded in spring, 28 and 8 in summer, and 32 and 8 in fall (Table 5).

Percentage size compositions for the more common fish and invertebrates (Figures 2-5) provide information on the relative abundance of juvenile and adult fish in the area in different seasons and on growth rate. In Figure 2, for example, large and small ocean pout are present in spring but only small ones remain in summer, the larger ones presumably having sought deeper, cooler water. The catch of these in the fall was too small to provide a size frequency (Table 5): however, all were small then also.

For some species, like smelt and sand lance, some measure of growth during the season is shown by the progression of modal lengths with the passage of time (Figure 3). For herring (Figure 3) the mode at 11 cm for summer-caught fish estimates the mean length in summer for fish hatched the previous fall.

The pollock caught were mostly 0-group "harbor pollock," many of which were caught at the stations in Gloucester and Boston harbors in August (Table 3, Figure 3). The pollock with a mode at 16 cm likely are from those hatched the previous fall. Winter flounder caught in the fall had a mode of small fish at 10 cm (Figure 4); this is about the length achieved by this species during its first year (Bigelow and Schroeder, 1953) and it is likely that these little fish were hatched the previous winter and spring.

Many of the haddock in catches were 0-group fish and were caught mostly in the summer (Figure 5). These had a modal length then of about 10 cm. Most scup caught were taken in the fall, and these were young of the previous spring and summer (Figure 5). Almost all of these were caught in Cape Cod Bay, and the 0-group fish among them may have resulted from eggs or larvae from Buzzards Bay which drifted to Cape Cod Bay through the Cape Cod Canal. The dozen young-of-the-year sea bass caught in Cape Cod Bay in fall 1976 (Table 4) also may have resulted from Buzzards Bay spawning, for no adult sea bass were taken in the surveys.

Longfin squid generally appear inshore in May and spawn there through the summer and early fall. Young-of-the-year of this species, from 1 to about 10 cm mantle length, were caught in some abundance in summer and fall

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[2] In Table 5, March and April surveys were summarized as all being spring, June and August surveys were summer, and September-October surveys were fall.

(Figure 5). A few egg masses, the eggs of which appeared viable, were picked up in the otter trawl in October, indicating that spawning continues well into fall. Few adult squid were caught in the surveys, nor, for that matter, were swift swimming fish like large pollock. We attribute this to the small size of the otter-trawl used and the slow towing speed.

In regard to the rock and jonah crabs, the individuals less than 5 cm in carapace width in the fall probably were young-of-the-year of these spring and summer spawners (Figure 5).

In these inshore surveys 39 species of finfish were recorded, which is considerably fewer than the 64 taken in offshore surveys of the area (Lux and Kelly, 1978). Six fishes found in inshore catches were not caught offshore: black sea bass, tautog, rock gunnel, grubby, summer flounder, and striped sea robin. The first four of these hug the coastline; the last two, while not just coastal, were very uncommon in all tows. Many of the fishes caught offshore but not in coastal tows are deepwater species, such as redfish and witch flounder, or fast-swimming ones, such as pollock and mackerel. The swift fishes were less likely to escape the larger trawl used in offshore surveys.

Fish of many species from the inshore catches were smaller than those reported from offshore (Lux and Kelly, 1978), further indicating the importance of coastal waters as nursery areas.

REFERENCES CITED

Bigelow, H. B., and W. C. Schroeder. 1953. Fishes of the Gulf of Maine. Fish. Bull. 53, 577 p.

Lux, F. E., and G. F. Kelly. 1978. Fisheries resources of the Cape Cod and Massachusetts Bay region. NMFS, Northeast Fisheries Center, Woods Hole Lab. Ref. No. 78-15.

Lux, F. E., and G. F. Kelly. 1981. Ichthyoplankton studies of Cape Cod and Massachusetts bays, 1976-77. NMFS, Northeast Fisheries Center, Woods Hole Lab. Ref. No. 81-43.

Table 1.--Cruise dates, vessels, and stations sampled in coastal otter trawl surveys of Cape Cod and Massachusetts bays in 1975-77.

Cruise dates	Vessel(s)	Stations sampled
April 18-29, 1975	Phalarope II	1-2, 5-12
Sept. 29-Oct. 16, 1975	David and Katy and Peggy Bell	1-18
April 19-23, 1976	Spirit of '76	1-18
August 16-20, 1976	Spirit of '76	1-18
October 13-15, 1976	Phalarope II	5-8, 10-11
March 14-18, 1977	Spirit of '76	1-11, 13-17
April 11-16, 1977	Spirit of '76	1-18
June 6-11, 1977	Spirit of '76	1-3, 5-10, 17-18

Table 2.--Mean numbers and weights per tow of fish and invertebrates in otter trawl catches in spring coastal surveys of Cape Cod and Massachusetts bays in 1975-77. (Numbers of tows are given in parentheses.)

	1975				1976				1977			
	Cape Cod Bay (8)		Massachusetts Bay (2)		Cape Cod Bay (10)		Massachusetts Bay (8)		Cape Cod Bay (10)		Massachusetts Bay (8)	
Species	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)
Little skate	1.8	1.3	6.0	3.9	3.2	2.6	1.8	1.6	1.1	0.4	1.4	1.0
Winter skate	0.5	0.9	-	-	0.6	1.7	1.9	2.1	0.1	0.3	-	-
Alewife	-	-	-	-	0.7	-	0.1	-	2.8	-	0.6	-
Atlantic herring	-	-	-	-	-	-	-	-	7.7	0.3	1.4	0.1
Rainbow smelt	1.9	0.1	1.0	-	31.7	0.3	38.4	1.0	9.6	0.1	10.8	0.4
Atlantic cod	0.3	0.5	2.0	3.4	1.1	0.1	4.3	2.6	0.8	0.5	3.2	1.6
Haddock	-	-	-	-	-	-	-	-	-	-	0.8	0.1
Silver hake	-	-	-	-	-	-	-	-	-	-	0.1	-
Pollock	0.1	-	-	-	0.4	-	-	-	-	-	0.3	-
Red hake	1.4	-	-	-	0.5	-	0.1	-	0.5	-	0.1	-
Ocean pout	7.6	11.7	13.0	16.4	13.3	16.9	12.0	17.6	15.1	18.1	4.8	5.6
Atlantic silverside	0.9	-	-	-	-	-	-	-	-	-	-	-
Northern pipefish	0.1	-	-	-	0.1	-	0.1	-	-	-	-	-
Tautog	-	-	0.5	0.4	0.2	0.5	-	-	-	-	-	-
Cunner	-	-	-	-	-	-	0.2	-	0.1	-	-	-
Rock gunnel	0.1	-	-	-	-	-	-	-	-	-	-	-
Atlantic wolffish	-	-	-	-	-	-	0.4	5.5	-	-	-	-
American sand lance	-	-	-	-	115.5	0.8	-	-	34.5	0.3	-	-
Sea raven	-	-	-	-	0.2	-	0.6	0.4	0.2	0.1	-	-
Grubby	-	-	-	-	-	-	-	-	0.3	-	-	-
Longhorn sculpin	2.2	0.9	4.5	1.4	2.0	0.7	2.9	1.2	4.5	1.4	3.1	0.5
Fourspot flounder	0.1	-	-	-	0.1	-	-	-	-	-	-	-
Windowpane	3.9	1.3	7.0	2.3	5.3	1.7	3.6	1.4	2.0	0.7	2.0	0.6
American plaice	-	-	-	-	-	-	0.2	-	-	-	0.4	-
Halibut	-	-	-	-	-	-	0.1	0.1	-	-	-	-
Yellowtail flounder	0.5	0.2	4.5	3.0	1.1	0.2	11.5	6.6	2.1	0.3	2.5	0.7
Winter flounder	11.8	5.4	17.0	6.4	17.5	9.6	90.0	27.8	25.9	7.5	33.2	17.7
Sea scallop	2.5	-	-	-	0.4	-	-	-	-	-	-	-
American lobster	0.4	0.2	1.5	0.7	-	-	3.3	1.2	0.3	-	2.8	0.9
Rock crab	-	-	1.0	-	0.3	-	1.3	0.2	0.2	-	2.0	0.3
Jonah crab	-	-	-	-	-	-	0.2	-	-	-	0.1	-
Green crab	-	-	-	-	-	-	2.0	0.1	-	-	-	-
Horseshoe crab	1.4	0.9	-	-	1.2	0.7	-	-	0.1	-	-	-
Totals	37.5	23.4	58.0	37.9	195.4	35.8	175.0	69.4	107.9	30.0	69.6	29.5

Table 3.--Mean numbers and weights per tow of fish and invertebrates in otter trawl catches of coastal surveys of Cape Cod and Massachusetts bays in March 1977, June 1977, and August 1976. (Numbers of tows are given in parentheses.)

	March 1977				June 1977				August 1976			
	Cape Cod Bay (10)		Massachusetts Bay (6)		Cape Cod Bay (9)		Massachusetts Bay (2)		Cape Cod Bay (10)		Massachusetts Bay (7)	
Species	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)
Spiny dogfish	-	-	-	-	7.2	31.0	-	-	117.2	199.4	-	-
Little skate	2.5	1.1	0.3	0.2	2.3	0.7	-	-	3.0	2.8	4.4	2.7
Winter skate	0.1	0.6	-	-	0.9	3.2	-	-	0.6	0.9	1.9	0.8
Thorny skate	-	-	-	-	-	-	-	-	-	-	0.1	0.2
Alewife	0.1	-	-	-	0.4	-	-	-	-	-	-	-
American shad	0.1	-	-	-	-	-	-	-	-	-	-	-
Atlantic herring	27.1	1.7	0.7	-	0.1	-	-	-	-	-	47.0	0.7
Rainbow smelt	8.8	0.2	7.0	0.3	1.1	-	-	-	0.4	-	34.1	1.3
Goosefish	-	-	-	-	-	-	-	-	0.6	5.8	0.1	0.1
Atlantic cod	1.1	1.4	1.6	0.2	0.2	0.2	4.0	2.5	-	-	25.4	9.4
Haddock	-	-	-	-	-	-	-	-	0.2	-	7.4	0.2
Silver hake	-	-	-	-	1.4	0.3	-	-	1.6	0.5	3.1	0.7
Pollock	0.2	-	1.7	0.1	-	-	17.0	2.2	-	-	109.7	8.1
Red hake	-	-	-	-	0.8	0.4	-	-	19.9	2.7	2.6	0.4
White hake	-	-	-	-	-	-	-	-	1.0	0.1	12.9	0.8
Ocean pout	10.5	8.7	2.2	2.9	0.6	0.1	1.0	0.8	6.4	0.6	0.4	-
Butterfish	-	-	-	-	-	-	-	-	-	-	0.1	-
Scup	-	-	-	-	0.6	-	-	-	-	-	-	-
Cunner	-	-	0.5	-	2.0	0.2	12.0	2.6	0.9	0.2	2.8	0.2
Rock gunnel	-	-	-	-	-	-	1.0	-	0.3	-	-	-
American sand lance	93.9	0.6	0.3	-	23.1	0.5	-	-	2.1	-	-	-
Sea raven	0.2	0.1	-	-	-	-	-	-	0.1	-	0.1	-
Longhorn sculpin	0.9	0.2	-	-	0.4	0.1	-	-	0.6	0.1	2.8	0.3
Shorthorn sculpin	-	-	-	-	0.1	-	-	-	-	-	-	-
Summer flounder	-	-	-	-	-	-	-	-	0.2	0.6	-	-
Fourspot flounder	-	-	-	-	-	-	-	-	0.9	0.1	-	-
Windowpane	1.0	0.2	0.5	0.1	1.2	0.4	-	-	2.2	0.5	3.7	0.6
American plaice	0.3	-	-	-	-	-	-	-	-	-	0.4	-
Yellowtail flounder	2.9	0.8	8.3	5.2	2.0	0.4	-	-	14.9	2.5	7.4	2.5
Winter flounder	10.8	1.9	47.7	23.3	68.0	23.6	35.0	12.9	114.6	22.6	107.1	28.8
Longfin squid	-	-	-	-	0.1	-	-	-	1571.9	8.1	6.9	-
Shortfin squid	-	-	-	-	-	-	-	-	-	-	0.3	0.1
Sea scallop	-	-	-	-	1.0	-	-	-	3.1	0.3	-	-
American lobster	0.2	0.1	0.5	0.1	9.0	2.5	7.0	1.9	33.7	7.4	61.2	14.9
Rock crab	0.7	-	3.0	0.1	2.4	0.2	2.8	2.5	6.4	0.6	8.3	0.7
Jonah crab	-	-	-	-	-	-	-	-	0.2	-	0.3	0.1
Calico crab	-	-	-	-	-	-	-	-	7.5	4.7	2.0	0.2
Horseshoe crab	-	-	-	-	-	-	-	-	2.0	2.4	-	-
Totals	161.4	17.6	74.3	32.5	124.9	63.8	79.8	25.4	1918.8	263.0	452.6	73.8

Table 4 .--Mean numbers and weights per tow of fish and invertebrates in otter trawl catches in fall coastal surveys of Cape Cod and Massachusetts bays in 1975-76. (Numbers of tows are given in parentheses.)

Species	1975				1976			
	Cape Cod Bay (10)		Massachusetts Bay (8)		Cape Cod Bay (5)		Massachusetts Bay (1)	
	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)
Spiny dogfish	14.6	27.2	-	-	54.4	163.3	-	-
Little skate	10.5	6.4	10.6	7.4	7.2	3.6	5.0	4.0
Winter skate	0.1	0.3	0.1	0.2	0.8	4.9	-	-
Thorny skate	-	-	0.1	-	-	-	-	-
Alewife	-	-	0.4	-	-	-	-	-
Rainbow smelt	-	-	71.1	0.9	-	-	-	-
Goosefish	0.5	4.0	0.6	2.0	0.4	2.0	-	-
Atlantic cod	0.1	-	0.2	-	-	-	-	-
Haddock	-	-	2.4	-	-	-	-	-
Silver hake	4.3	0.2	2.6	0.1	5.6	0.3	-	-
Red hake	2.9	0.2	8.8	0.3	29.6	7.6	-	-
White hake	-	-	0.9	-	-	-	-	-
Ocean pout	0.8	-	0.4	-	0.4	0.1	-	-
Atl. silverside	-	-	0.2	-	-	-	-	-
Butterfish	0.5	-	1.6	-	0.8	-	-	-
Northern sea robin	-	-	-	-	3.2	0.1	-	-
Striped sea robin	-	-	-	-	0.4	-	-	-
Northern pipefish	0.6	-	1.0	-	-	-	-	-
Black sea bass	-	-	-	-	2.4	-	-	-
Scup	10.0	0.1	0.1	-	6.0	0.1	-	-
Tautog	0.3	-	-	-	-	-	-	-
Cunner	3.5	-	1.6	-	1.6	0.2	-	-
Rock gunnel	0.2	-	-	-	-	-	-	-
Am. sand lance	-	-	-	-	10.4	0.1	-	-
Sea raven	0.1	0.1	0.2	0.2	0.4	0.1	-	-
Longhorn sculpin	0.1	-	0.1	0.1	-	-	-	-
Summer flounder	0.1	0.1	-	-	1.2	2.3	-	-
Fourspot flounder	4.8	0.7	0.5	0.1	1.2	0.3	-	-
Windowpane	5.6	0.8	16.4	3.5	8.4	2.2	4.0	1.0
American plaice	-	-	3.6	0.2	-	-	-	-
Yellowtail flounder	1.7	0.2	12.8	4.5	0.4	-	15.0	5.0
Winter flounder	29.3	3.3	118.0	37.4	89.6	34.8	17.0	7.6
Longfin squid	180.3	0.4	281.6	0.7	72.5	1.0	-	-
Shortfin squid	-	-	0.1	-	-	-	-	-
Sea scallop	36.2	1.3	-	-	0.4	0.1	-	-
American lobster	0.7	0.2	19.2	4.3	0.4	0.1	7.0	2.3
Rock crab	16.2	0.5	39.0	2.3	10.0	1.0	8.0	2.0
Jonah crab	-	-	1.2	-	-	-	3.0	0.2
Calico crab	3.6	0.1	0.5	0.1	5.2	0.4	2.0	0.2
Horseshoe crab	0.9	0.5	-	-	1.2	0.5	-	-
Totals	323.5	46.6	595.9	64.3	314.1	225.1	61.0	22.3

Table 5 .--Numbers measured, mean sizes,[1/] and size ranges of fish and invertebrates in otter trawl catches in coastal surveys of Cape Cod and Massachusetts bays in 1975-77.

	Spring			Summer			Fall		
Species	Number measured	Mean size(cm)	Size range(cm)	Number measured	Mean size(cm)	Size range(cm)	Number measured	Mean size(cm)	Size range(cm)
Fishes									
Spiny dogfish	-	-	-	348	79.8	53 - 102	215	79.7	53 - 102
Little skate	89	45.3	10 - 57	77	40.5	17 - 56	194	43.3	12 - 58
Thorny skate	-	-	-	1	50.0	-	1	25.0	-
Winter skate	25	51.8	30 - 87	27	50.4	30 - 101	4	80.2	71 - 99
Alewife	42	9.4	6 - 16	4	12.0	8 - 19	2	14.0	13 - 15
American shad	1	28.0	-	-	-	-	-	-	-
Atlantic herring	366	17.0	3 - 30	166	11.0	1 - 23	-	-	-
Rainbow smelt	667	12.0	5 - 23	132	15.9	4 - 21	10	15.0	11 - 17
Goosefish	-	-	-	3	69.7	31 - 94	11	72.1	29 - 91
Atlantic cod	97	28.5	3 - 80	97	32.0	22 - 58	2	7.0	-
Haddock	6	21.3	20 - 23	52	9.4	6 - 13	17	9.7	8 - 11
Silver hake	1	36.0	-	43	29.1	9 - 54	75	16.4	4 - 30
Pollock	11	16.4	8 - 21	513	16.9	12 - 41	-	-	-
Red hake	22	13.4	9 - 20	128	26.0	14 - 50	156	22.8	3 - 44
White hake	-	-	-	97	19.8	13 - 28	4	14.5	11 - 23
Ocean pout	523	58.0	6 - 81	31	27.5	15 - 40	11	15.6	13 - 35
Atlantic silverside	9	9.4	8 - 11	-	-	-	1	11.0	-
Northern pipefish	3	16.3	12 - 20	-	-	-	10	16.2	10 - 20
Black sea bass	-	-	-	-	-	-	9	8.8	-
Scup	-	-	-	3	18.3	17 - 20	116	8.7	6 - 11
Tautog	3	43.3	35 - 51	-	-	-	3	9.7	8 - 12
Cunner	6	7.7	4 - 14	-	-	-	48	8.2	3 - 23
Rock gunnel	1	12.0	-	2	15.5	15 - 16	2	9.0	6 - 12
Atlantic wolffish	3	112.3	108 - 118	-	-	-	-	-	-
American sand lance	610	12.5	9 - 19	125	16.4	8 - 20	26	14.0	13 - 16
Butterfish	-	-	-	1	9.0	-	77	4.5	2 - 9
Northern sea robin	-	-	-	-	-	-	8	13.5	12 - 16
Striped sea robin	-	-	-	-	-	-	1	13.0	-
Sea raven	8	21.2	11 - 33	2	18.5	17 - 20	3	29.0	22 - 39
Grubby	3	7.0	4 - 10	-	-	-	-	-	-
Longhorn sculpin	146	27.3	5 - 36	26	19.8	12 - 30	2	25.5	20 - 31
Shorthorn sculpin	-	-	-	1	32.0	-	-	-	-
Summer flounder	-	-	-	1	61.0	-	4	49.8	42 - 64
Fourspot flounder	2	17.5	17 - 18	5	22.2	20 - 28	52	22.8	9 - 36
Windowpane	165	28.1	10 - 36	53	24.1	7 - 33	179	24.3	7 - 39
American plaice	4	17.2	10 - 22	3	14.3	14 - 15	29	17.5	14 - 27
Atlantic halibut	1	38.0	-	-	-	-	-	-	-
Yellowtail flounder	208	31.9	9 - 50	130	24.7	12 - 53	133	30.4	17 - 47
Winter flounder	1521	27.6	5 - 55	1794	24.3	6 - 40	1074	23.4	4 - 46
Invertebrates									
Longfin squid	-	-	-	970	2.6	1 - 28	909	2.7	1 - 33
Shortfin squid	-	-	-	2	26.5	26 - 27	1	22.0	-
Sea scallop	19	5.9	4 - 10	18	8.4	4 - 10	208	7.6	4 - 15
American lobster	53	7.4	5 - 12	703	6.4	3 - 11	113	6.5	3 - 9
Rock crab	43	7.4	1 - 12	110	7.6	1 - 14	377	5.9	1 - 11
Jonah crab	3	8.3	6 - 12	4	7.2	4 - 11	13	8.6	7 - 10
Calico crab	-	-	-	81	6.5	4 - 9	55	5.4	2 - 9
Horseshoe crab	12	16.9	14 - 19	2	21.0	20 - 22	12	16.0	13 - 23
Number of species	33			36			40		

1/ Measurements used were as follows. Fish with unforked tails: total length, fish with forked tails: fork length, squid: mantle length, sea scallop: shell height, lobsters: carapace length from eye socket to rear margin of carapace at midline, crabs: carapace width.

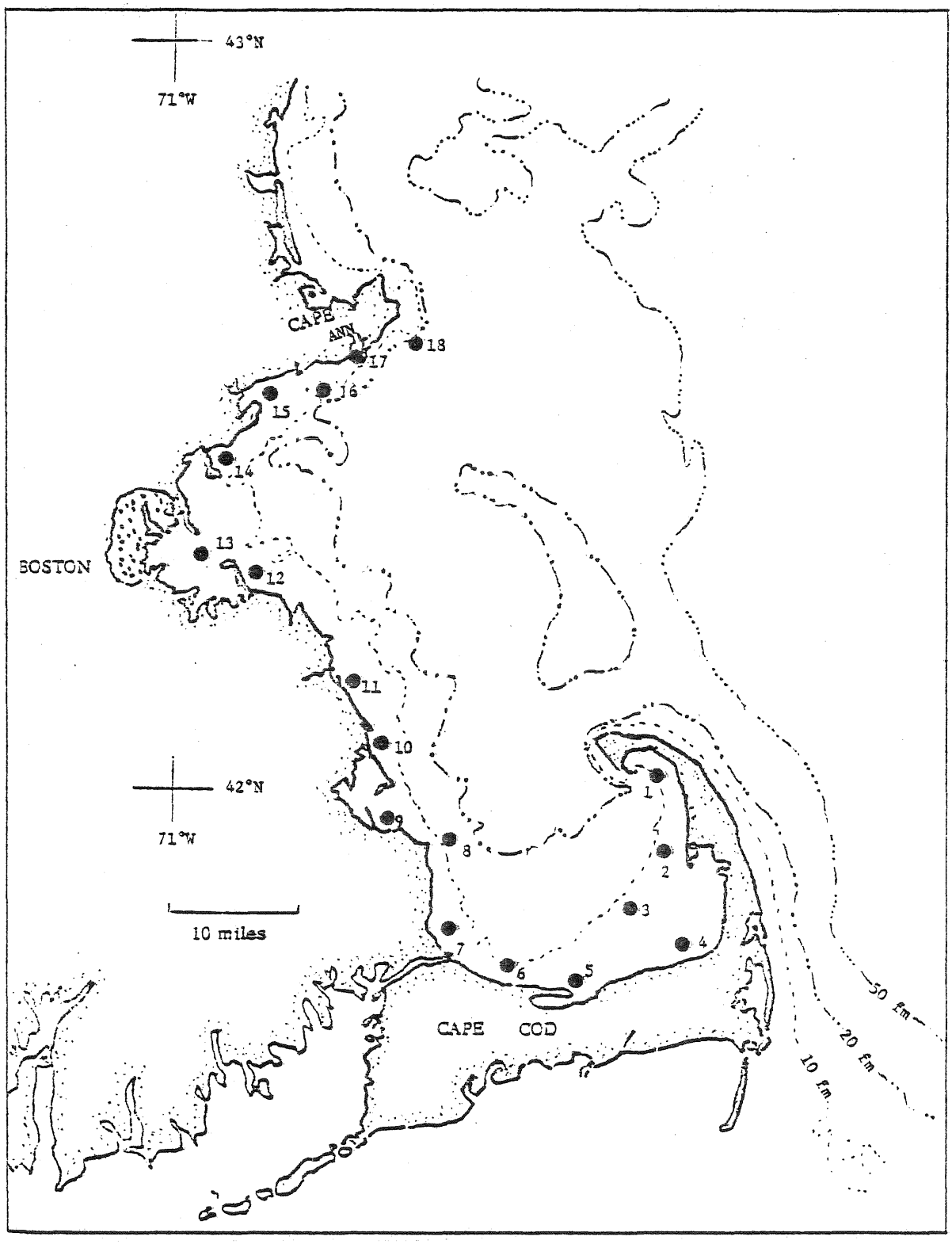

Figure 1.--Station locations for inshore otter trawl sampling in Cape Cod and Massachusetts bays in 1975-77.

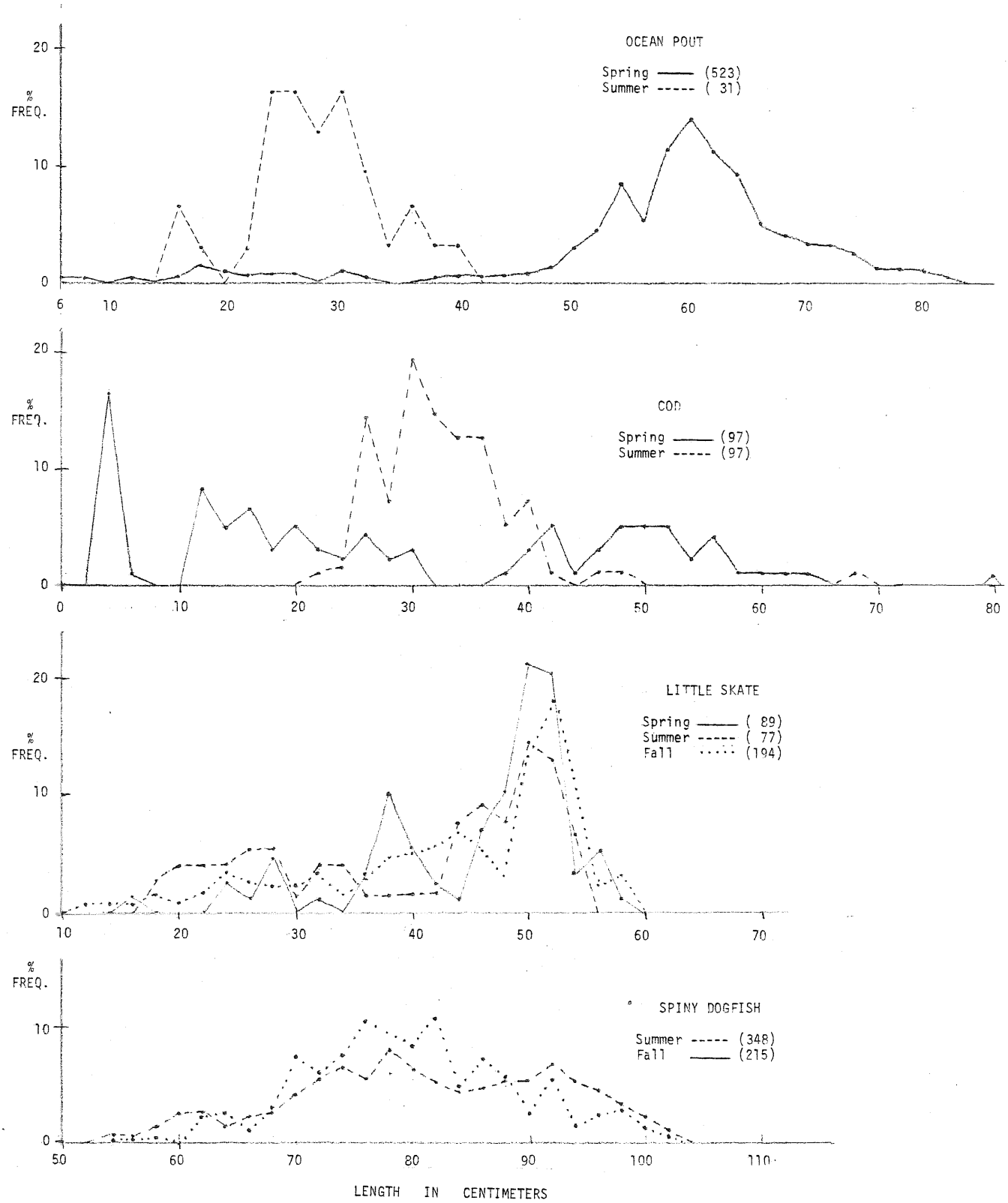

Figure 2.--Length frequency distributions for ocean pout, Atlantic cod, little skate, and spiny dogfish from inshore otter trawl catches in 1975-77. (Numbers of fish are given in parentheses.)

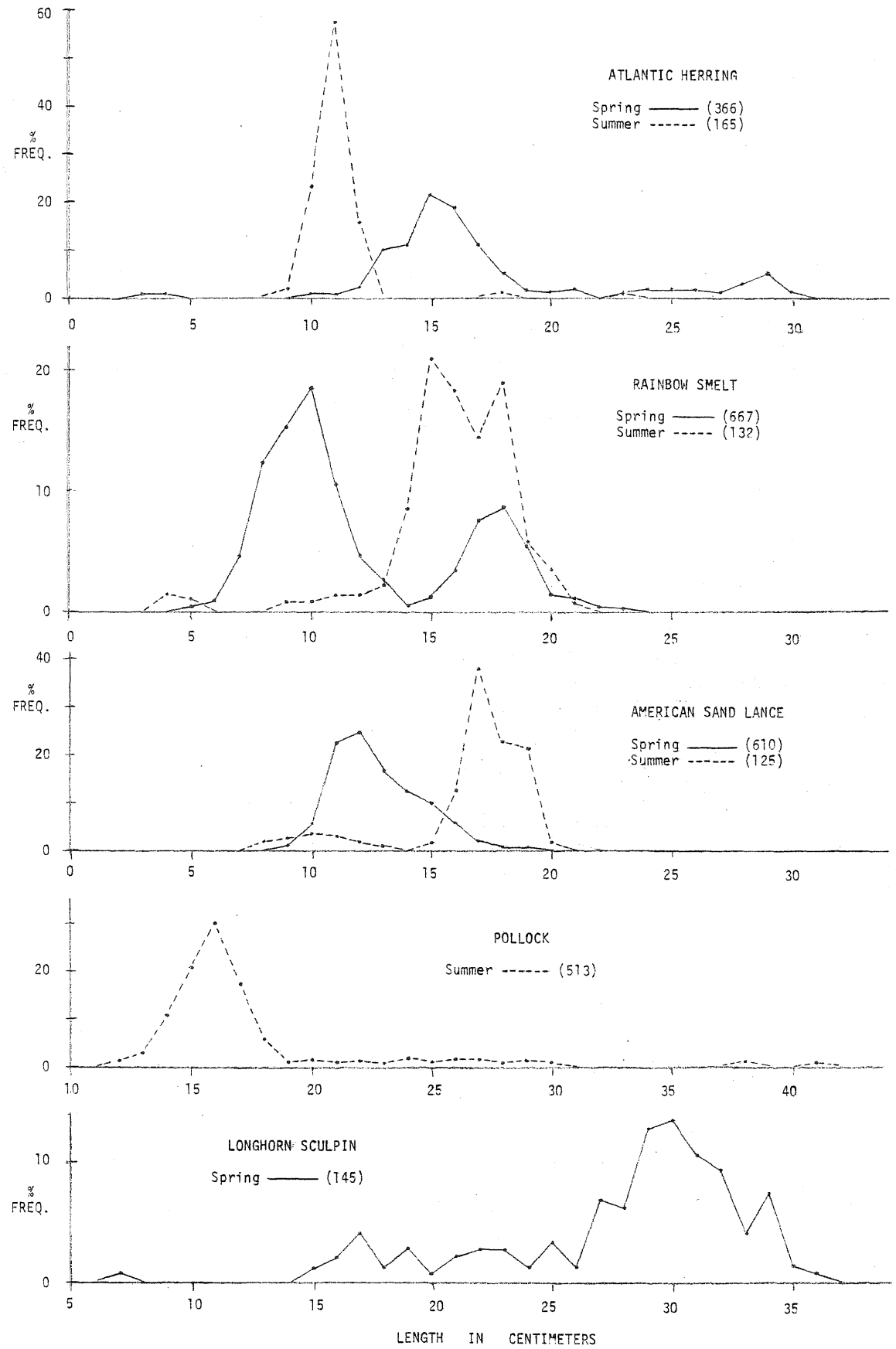

Figure 3.--Length frequency distributions for Atlantic herring, rainbow smelt, American sand lance, pollock, and longhorn sculpin from inshore otter trawl catches in 1975-77.

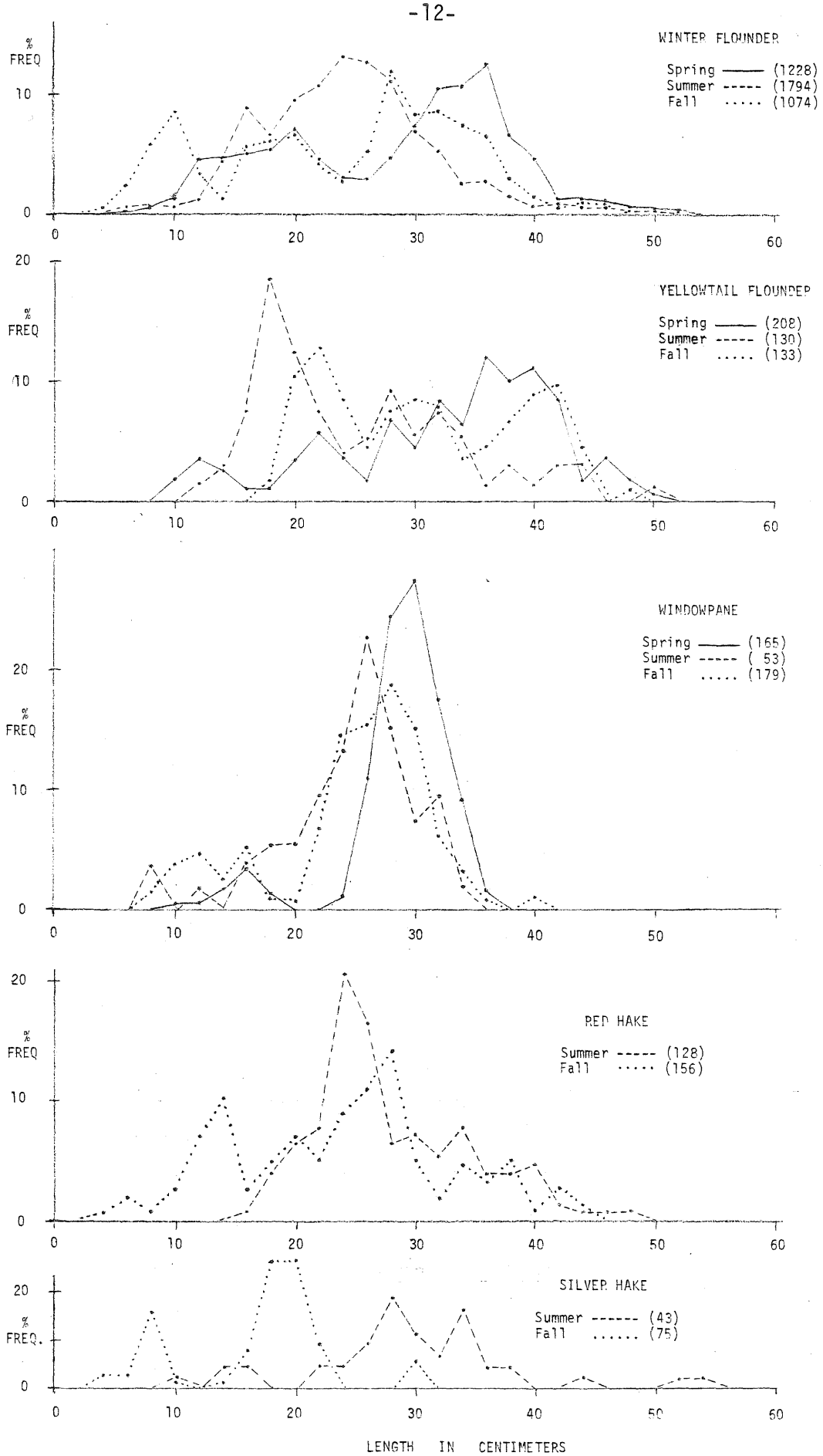

Figure 4.--Length frequency distributions for winter flounder, yellowtail flounder, windowpane, red hake, and silver hake from inshore trawl catches in 1975-77.

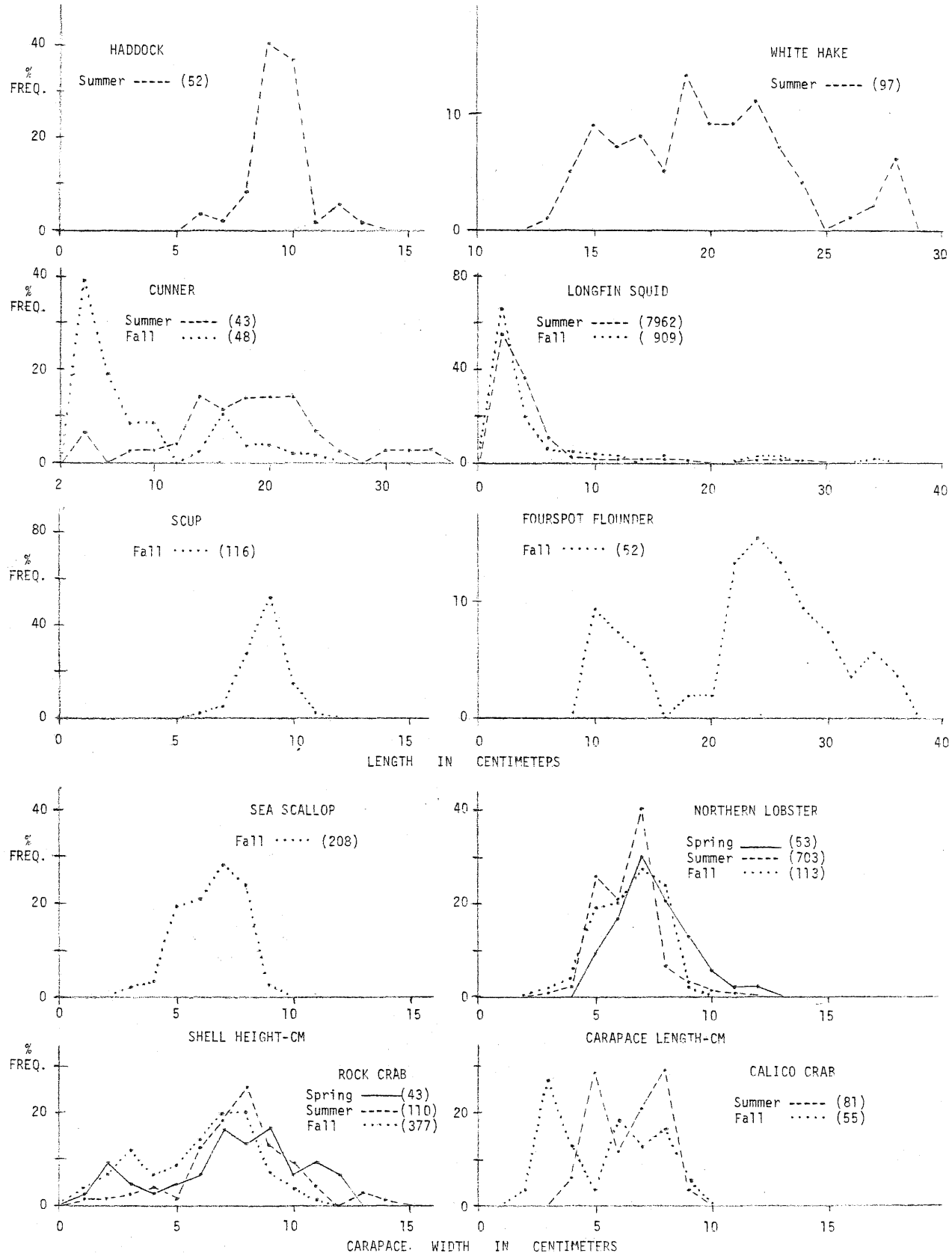

Figure 5.--Length frequency distributions for haddock, white hake, cunner, scup, fourspot flounder, longfin squid, sea scallops, northern lobster, rock crab, and jonah crab from inshore otter trawl catches in 1975-77.

Appendix.--List of fishes and invertebrates recorded in inshore surveys in 1975-77.

Fish

Spiny dogfish, *Squalus acanthias*
Little skate, *Raja erinacea*
Thorny skate, *Raja radiata*
Winter skate, *Raja ocellata*
Alewife, *Alosa pseudoharengus*
American shad, *Alosa sapidissima*
Atlantic herring, *Clupea harengus*
Rainbow smelt, *Osmerus mordax*
Goosefish, *Lophius americanus*
Atlantic cod, *Gadus morhua*
Haddock, *Melanogrammus aeglefinus*
Silver hake, *Merluccius bilinearis*
Pollock, *Pollachius virens*
Red hake, *Urophycis chuss*
White hake, *Urophycis tenuis*
Ocean pout, *Macrozoarces americanus*
Atlantic silverside, *Menidia menidia*
Northern pipefish, *Syngnathus fuscus*
Black sea bass, *Centropristis striata*
Scup, *Stenotomus chrysops*
Tautog, *Tautoga onitis*
Cunner, *Tautogolabrus adspersus*
Rock gunnel, *Pholis gunnellus*
Atlantic wolffish, *Anarhichas lupus*
American sand lance, *Ammodytes americanus*
Butterfish, *Peprilus triacanthus*
Northern sea robin, *Prionotus carolinus*
Striped sea robin, *Prionotus evolans*
Sea raven, *Hemitripterus americanus*
Grubby, *Myoxocephalus aenaeus*
Longhorn sculpin, *Myoxocephalus octodecemspinosus*
Shorthorn sculpin, *Myoxocephalus scorpius*
Summer flounder, *Paralichthys dentatus*
Fourspot flounder, *Paralichthys oblongus*
Windowpane, *Scophthalmus aquosus*
American plaice, *Hippoglossoides platessoides*
Atlantic halibut, *Hippoglossus hippoglossus*
Yellowtail flounder, *Limanda ferruginea*
Winter flounder, *Pseudopleuronectes americanus*

Invertebrates

Longfin squid, *Loligo pealei*
Shortfin squid, *Illex illecebrosus*
Sea scallop, *Placopecten magellanicus*
American lobster, *Homarus americanus*
Rock crab, *Cancer irroratus*
Jonah crab, *Cancer borealis*
Calico crab, *Ovalipes ocellatus*
Horseshoe crab, *Limulus polyphemus*