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ABUNDANCE OF GROUNDFISH AND INVERTEBRATES IN OTTER TRAWL SURVEYS OF OFFSHORE WATERS OF MASSACHUSETTS AND CAPE COD BAYS IN 1975-77

by

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INTRODUCTION

In 1972 an intensive study of groundfish of the area between Cape Ann and Cape Cod out to a depth of 100 m was undertaken by the Northeast Fisheries Center in relation to environmental impact problems in the area (Lux and Kelly, 1978). This area was identified, for study purposes only, as the "Massachusetts Bay Biome," and it included Massachusetts Bay, Cape Cod Bay, Stellwagen Bank, and a deeper water area which we called the "Outer Ground" (Figure 1). All available groundfish survey data for the Biome from 1949 through 1974 were summarized in a report by Lux and Kelly (1978), who also provided a description of this productive region and the fishery harvest therefrom. The surveys, made with large research vessels, did not cover coastal areas less than 25 m deep and were characterized as "offshore." To sample the shore fishes there, shallow water surveys to a few meters in depth, were undertaken with small, chartered otter trawlers in 1975-77 and reported on by Lux and Kelly (1982).

The offshore surveys in the Biome also were continued for the period 1975-77, with a greater number of stations sampled than previously. The results from these surveys form the basis of the present report.

METHODS AND MATERIALS

Methods of the 1975-77 offshore Biome surveys, which were conducted in spring and fall, were the same as those described by Lux and Kelly (1978). The NOAA Research Vessels Albatross IV and Delaware II were the ships used, and a 1/2-hour otter trawl tow was made at each sampled station. The number of stations sampled in a survey varied from 17 to 24 (Table 1). The stations were randomly selected, except for the string of nine stations nearest shore (Figure 2), which were sampled on each cruise. Otter trawls used were a No. 41 Yankee for spring surveys and a No. 36 Yankee in the fall. The trawls were fitted with 16-inch rubber rollers on the footrope and had a 1/2-inch mesh liner in the cod end to retain baby fish.

Catches were separated by species, and the aggregate weight of each species was recorded. Total or fork lengths of fish, carapace measurements of crustaceans, and mantle lengths of squid were recorded for the entire catch or representative samples. Common names of fish and invertebrates are used in the data presented here; scientific names are given in an appendix.

RESULTS AND DISCUSSION

The mean catches per tow by species in numbers and weights for each cruise show the species composition and variations in abundance by season and ground (Tables 2-9). Catch per tow in numbers varied little from season to season within a ground, but weight per tow was highest in fall surveys, despite the fact that a smaller trawl was used then.

There are 56 species of fish and eight of invertebrates in catches[1/]. The number of species was greatest in the fall in Cape Cod Bay, but the reverse of this was true on Stellwagen Bank and the Outer Ground; for Massachusetts Bay there was little difference with season (Tables 2-9). More tows in an area, however, generally means more species are caught, and this must be considered in making comparisons.

A comparison of catches in 1975-77 with those of 1963-74 (Lux and Kelly, 1978) indicated that the species composition was very similar in the two periods. There were, however, some noteworthy changes. Atlantic cod, for example, were generally fewer in catches in the later period while shortfin squid were considerably more abundant. One rather striking change was the appearance of large numbers of American sand lance in some of the 1975-77 surveys. This species was much less abundant in 1963-74.

The catches from surveys in more coastal waters of the area (Lux and Kelly, 1982) produced fewer species than offshore ones, although these also had fewer stations. In addition, the shallower waters had larger numbers of juvenile fish, pointing up the importance of shore areas as nursery grounds.

Size compositions of the principal trawl-caught species in the offshore Biome area were presented by Lux and Kelly (1978) for 1963-74 surveys and are not reported here for surveys of 1975-77. A comparison of the size data for major species for the two periods showed no marked differences.

REFERENCES CITED

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. 1982. Abundance and size composition of fish and invertebrates from coastal otter trawl surveys in Cape Cod and Massachusetts Bays in 1975-77. NMFS, Northeast Fisheries Center. Woods Hole Lab. Ref. Doc. No. 82-21.

[1/] Small amounts of northern shrimp, Pandalus borealis, occasionally were taken in samples, and aggregate weights only were recorded; these catches do not appear in the data of Tables 2-9.

Table 1.--Albatross IV and Delaware II groundfish surveys in 1975-77 and numbers of stations in each Biome ground.

Year	Month(s)	Cape Cod Bay	Massachusetts Bay	Stellwagen Bank	Outer Ground	All grounds
			Spring surveys			
1975	April-May	4	7	5	8	24
1976	April-May	5	7	5	6	23
1977	April-May	4	8	2	9	23
All years		13	22	12	23	70
			Fall surveys			
1975	October	5	8	3	8	24
1976	November	4	7	3	4	18
1977	Nov.-Dec.	5	7	1	4	17
All years		14	22	7	16	59

TABLE 2 .- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: CAPE COD BAY

SPECIES	SPRING 1975 TOWS: 4 NUMBER	WEIGHT	SPRING 1976 TOWS: 5 NUMBER	WEIGHT	SPRING 1977 TOWS: 4 NUMBER	WEIGHT	ALL SURVEYS SPRING TOWS: 13 NUMBER	WEIGHT
SPINY DOGFISH	.3	.3	.6	1.3	1.5	6.7	.8	2.7
LITTLE SKATE	.5	.0	.0	.0	.5	.2	.3	.1
THORNY SKATE	.0	.0	2.6	5.4	.8	.8	1.2	2.3
SMTHTAIL SKATE	.0	.0	.6	.1	1.0	3.5	.5	1.1
BLUEBK HERRING	1.3	.0	11.6	.7	.0	.0	4.8	.3
HICKORY SHAD	1.0	.1	.0	.0	.0	.0	.3	.0
ALEWIFE	175.8	18.5	42.0	3.4	.0	.0	70.2	7.0
AM SHAD	.0	.0	.2	.0	.0	.0	.1	.0
ATL HERRING	13.3	1.4	246.0	12.7	1.5	.3	99.2	5.4
GOOSEFISH	2.8	5.1	1.0	3.9	.5	12.6	1.4	6.9
4-BRD ROCKLING	9.5	.8	21.4	2.7	38.5	3.7	23.0	2.4
ATLANTIC COD	1.0	8.7	2.8	14.1	5.3	23.5	3.0	15.3
HADDOCK	.3	.0	1.0	.1	.0	.0	.5	.1
SILVER HAKE	176.5	8.8	33.6	4.3	44.5	3.1	80.9	5.3
RED HAKE	19.3	4.1	36.8	3.6	17.5	5.9	25.5	4.5
WHITE HAKE	2.8	1.1	.6	.5	3.5	2.3	2.2	1.3
OCEAN POUT	1.8	2.4	23.8	16.2	44.3	20.9	23.3	13.4
CUNNER	.5	.0	.0	.0	.5	.0	.3	.0
SNAKEBLENNY	.0	.0	.8	.0	.0	.0	.3	.0
DAUBED SHANNY	.0	.0	93.0	.8	13.3	.1	39.8	.3
RADIATD SHANNY	17.8	.0	.0	.0	.0	.0	5.5	.0
WRYMOUTH	.3	.5	.0	.0	.0	.0	.1	.1
AM SAND LANCE	.0	.0	.6	.0	.0	.0	.2	.0
SEA RAVEN	.3	.5	1.4	.5	1.3	1.4	1.0	.8
LH SCULPIN	.3	.0	1.6	.5	2.5	.4	1.5	.3
ALLIGATORFISH	.0	.0	.6	.0	4.3	.1	1.5	.0
4-SPOT FLOUNDR	4.0	.2	16.0	2.0	23.3	2.8	14.5	1.7
WINDOWPANE	.5	.0	1.8	.3	1.8	.2	1.4	.2
WITCH FLOUNDER	.5	.9	2.4	2.1	5.0	5.2	2.6	2.7
AM PLAICE	93.0	12.1	102.6	9.6	236.8	33.4	140.9	17.7
YT FLOUNDER	5.0	.8	25.8	5.8	33.8	7.6	21.8	4.8
WINTER FLDR	2.8	.0	17.8	3.6	65.8	10.3	27.9	4.6
SEA SCALLOP	.0	.0	.2	.0	.3	.0	.2	.0
NO LOBSTER	.0	.0	.2	.1	1.3	.4	.5	.1
JONAH CRAB	.0	.0	4.2	.6	1.0	.1	1.9	.2
ROCK CRAB	.3	.0	7.2	.6	11.8	1.2	6.5	.6
TOTAL, ALL SPP.	530.8	66.3	700.8	95.5	561.5	146.8	605.6	102.3

TABLE 3.- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: CAPE COD BAY

SPECIES	FALL 1975 TOWS: 5 NUMBER	WEIGHT	FALL 1976 TOWS: 4 NUMBER	WEIGHT	FALL 1977 TOWS: 5 NUMBER	WEIGHT	ALL SURVEYS FALL TOWS: 14 NUMBER	WEIGHT
SMOOTH DOGFISH	.0	.0	.0	.0	.2	.6	.1	.2
SPINY DOGFISH	66.4	187.9	6.8	124.8	4.4	14.2	27.2	107.8
ATL TORPEDO	.2	1.3	.0	.0	.0	.0	.1	.5
LITTLE SKATE	.0	.0	.0	.0	.4	.1	.1	.0
THORNY SKATE	1.8	10.8	.3	.7	2.4	8.6	1.6	7.1
SMTHTAIL SKATE	.0	.0	.0	.0	.2	.1	.1	.0
BLUEBK HERRING	2.4	.5	.3	.0	.0	.0	.9	.2
ALEWIFE	1.4	.4	.3	.0	12.2	2.0	4.9	.8
AM SHAD	.0	.0	2.0	.5	.2	.0	.6	.1
ATL HERRING	.2	.0	.0	.0	.2	.0	.1	.0
GOOSEFISH	1.2	13.2	.3	4.4	1.6	8.4	1.1	9.0
4-BRD ROCKLING	11.8	1.1	1.8	.2	6.6	.9	7.1	.8
ATLANTIC COD	1.0	2.0	.5	1.6	.6	4.7	.7	2.8
HADDOCK	.6	.0	.0	.0	.2	.1	.3	.0
SILVER HAKE	119.0	15.0	104.0	24.0	138.6	23.0	121.7	20.4
POLLOCK	.0	.0	.0	.0	.2	.2	.1	.1
RED HAKE	25.4	11.9	26.8	6.1	167.8	65.6	76.6	29.4
WHITE HAKE	6.2	1.7	3.5	1.9	52.8	22.0	22.1	9.0
OCEAN POUT	.0	.0	1.5	1.3	27.8	12.4	10.4	4.8
SCUP	.2	.0	.3	.0	1.6	.5	.7	.2
CUNNER	.0	.0	.0	.0	.2	.0	.1	.0
WRYMOUTH	.0	.0	.0	.0	.4	.2	.1	.1
AM SAND LANCE	22.0	.2	.0	.0	.0	.0	7.9	.1
ATL MACKEREL	.0	.0	.0	.0	.2	.1	.1	.0
BUTTERFISH	1.4	.0	42.8	1.7	5.4	.4	14.6	.6
REDFISH	.0	.0	.0	.0	.2	.1	.1	.0
NO SEAROBIN	.2	.0	.0	.0	.2	.1	.1	.0
SEAROBIN,UNCL	.0	.0	.3	.0	.0	.0	.1	.0
SEA RAVEN	.0	.0	.0	.0	.8	.5	.3	.2
LH SCULPIN	.0	.0	.0	.0	.6	.2	.2	.1
ALLIGATORFISH	.0	.0	.0	.0	.2	.0	.1	.0
SUMMER FLOUNDR	.0	.0	.0	.0	.2	.3	.1	.1
4-SPOT FLOUNDR	3.4	.6	2.8	.1	18.2	2.5	8.5	1.2
WINDOWPANE	.6	.2	.5	.1	3.0	.4	1.4	.2
WITCH FLOUNDER	.0	.0	.0	.0	.2	.1	.1	.0
AM PLAICE	72.0	8.1	25.8	4.5	87.2	9.4	64.2	7.5
YT FLOUNDER	1.4	.2	2.5	.5	24.8	5.9	10.1	2.3
WINTER FLDR	10.2	2.9	74.8	13.1	83.6	24.4	54.9	13.5
SEA SCALLOP	.6	.0	.0	.0	.0	.0	.2	.0
SHORTFIN SQUID	.0	.0	58.8	22.8	16.2	7.4	22.6	9.2
LONGFIN SQUID	25.0	1.0	97.0	.2	11.0	.1	40.6	.4
NO LOBSTER	.2	.2	1.0	.5	5.2	2.4	2.2	1.1
ROCK CRAB	.0	.0	.0	.0	1.2	.2	.4	.1
CRAB,UNCL	.6	.0	.0	.0	.0	.0	.2	.0
TOTAL,ALL SPP.	375.4	259.0	454.0	209.1	677.0	218.0	505.6	230.1

TABLE 4.- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: MASSACHUSETTS BAY

SPECIES	SPRING 1975 TOWS: 7 NUMBER	WEIGHT	SPRING 1976 TOWS: 7 NUMBER	WEIGHT	SPRING 1977 TOWS: 8 NUMBER	WEIGHT	ALL SURVEYS SPRING TOWS: 22 NUMBER	WEIGHT
ATL HAGFISH	.0	.0	.0	.0	.6	.1	.2	.0
SPINY DOGFISH	.0	.0	.1	.7	.4	2.1	.2	1.0
WINTER SKATE	.6	4.0	.0	.0	.0	.0	.2	1.3
THORNY SKATE	.4	.1	3.4	8.8	3.8	7.3	2.6	5.5
SMTHTAIL SKATE	.3	.1	.9	.1	.6	.2	.6	.2
BLUEBK HERRING	16.6	.8	2.0	.1	.0	.0	5.9	.3
ALEWIFE	33.4	3.1	11.4	1.2	1.1	.1	14.7	1.4
ATL HERRING	31.0	6.8	34.9	6.5	.4	.1	21.1	4.3
GOOSEFISH	4.6	3.7	2.1	6.5	.9	3.1	2.5	4.4
CUSK	.1	.6	.0	.0	.0	.0	.0	.2
4-BRD ROCKLING	6.3	.5	10.0	1.0	9.1	1.2	8.5	.9
ATLANTIC COD	20.6	24.2	16.4	26.1	7.6	23.6	14.5	24.6
HADDOCK	.4	.1	2.3	.4	1.0	.4	1.2	.3
SILVER HAKE	143.9	4.3	42.7	4.5	6.4	1.3	61.7	3.3
POLLOCK	.0	.0	.0	.0	.3	.0	.1	.0
RED HAKE	9.3	2.8	12.1	6.0	4.6	2.1	8.5	3.5
WHITE HAKE	9.9	3.1	6.0	1.8	1.0	.9	5.4	1.9
WOLF EELPOUT	.1	.0	.0	.0	.1	.0	.1	.0
OCEAN POUT	3.9	1.7	6.3	2.3	18.4	4.6	9.9	2.9
CUNNER	.1	.0	.6	.1	.3	.1	.3	.0
SNAKEBLENNY	2.3	.1	.6	.1	.4	.0	1.0	.0
DAUBED SHANNY	.0	.0	30.6	.2	33.8	.4	22.0	.2
RADIATD SHANNY	17.0	.1	.0	.0	.0	.0	5.4	.0
ATL WOLFFISH	.0	.0	.3	1.0	.0	.0	.1	.3
WRYMOUTH	.3	.3	.1	.0	.0	.0	.1	.1
AM SAND LANCE	.0	.0	3.3	.1	6.5	.1	3.4	.1
REDFISH	12.0	3.0	28.1	5.8	20.4	3.5	20.2	4.1
HOOKEAR SCULPN	.7	.0	.0	.0	.0	.0	.2	.0
SEA RAVEN	.0	.0	.4	.7	.4	.1	.3	.3
GRUBBY	.4	.0	.0	.0	.0	.0	.1	.0
LH SCULPIN	3.0	.3	.6	.2	.3	.1	1.2	.2
ALLIGATORFISH	.3	.0	.6	.0	2.5	.1	1.2	.0
4-SPOT FLOUNDR	.3	.0	2.4	.3	1.4	.1	1.4	.1
WINDOWPANE	.3	.0	.0	.0	.0	.0	.1	.0
WITCH FLOUNDER	14.1	1.9	28.0	9.2	75.0	23.1	40.7	11.9
AM PLAICE	142.9	19.6	421.9	49.1	309.4	37.6	292.2	35.5
YT FLOUNDER	15.9	2.3	15.4	4.7	3.1	1.7	11.1	2.8
WINTER FLDR	.0	.0	.3	.2	.0	.0	.1	.0
SEA SCALLOP	7.3	.4	.0	.0	3.0	.2	3.4	.2
NO LOBSTER	.1	.1	.4	.4	.6	.8	.4	.5
RED CRAB	.0	.0	.0	.0	.3	.0	.1	.0
JONAH CRAB	.0	.0	.1	.1	.0	.0	.0	.0
ROCK CRAB	.3	.0	.3	.0	.4	.0	.3	.0
TOTAL, ALL SPP.	498.6	84.1	684.7	138.2	513.8	115.2	563.4	112.6

TABLE 5.- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: MASSACHUSETTS BAY

SPECIES	FALL 1975 TOWS: 8 NUMBER	WEIGHT	FALL 1976 TOWS: 7 NUMBER	WEIGHT	FALL 1977 TOWS: 7 NUMBER	WEIGHT	ALL SURVEYS FALL TOWS: 22 NUMBER	WEIGHT
ATL HAGFISH	.0	.0	.6	.1	.0	.0	.2	.0
SPINY DOGFISH	2.6	6.6	3.4	7.7	.3	.8	2.1	5.1
LITTLE SKATE	.0	.0	.1	.0	.0	.0	.0	.0
THORNY SKATE	1.5	6.0	.9	17.2	7.4	14.3	3.2	12.2
BLUEBK HERRING	27.0	4.9	.0	.0	.0	.0	9.8	1.8
ALEWIFE	41.8	7.1	3.9	.7	1.9	.5	17.0	3.0
AM SHAD	1.3	.3	.0	.0	.0	.0	.5	.1
ATL HERRING	25.9	5.8	.0	.0	.1	.0	9.5	2.1
GOOSEFISH	.5	2.0	.3	.2	1.0	6.0	.6	2.7
CUSK	.0	.0	.0	.0	.1	1.5	.0	.5
4-BRD ROCKLING	2.9	.3	1.4	.2	1.1	.2	1.9	.3
ATLANTIC COD	13.5	20.0	9.4	21.9	29.4	29.0	17.3	23.6
HADDOCK	3.3	.5	2.1	.8	18.4	8.1	7.7	3.0
SILVER HAKE	135.5	20.0	90.7	10.8	51.4	13.3	94.5	14.9
POLLOCK	.0	.0	.4	3.6	9.4	52.6	3.1	17.9
RED HAKE	11.0	5.5	51.1	16.2	55.4	23.6	37.9	14.7
WHITE HAKE	3.6	2.0	18.0	12.7	19.6	12.1	13.3	8.6
OCEAN POUT	.3	.0	.4	.1	26.4	11.9	8.6	3.8
BLK SEA BASS	.0	.0	.1	.0	.0	.0	.0	.0
CUNNER	.0	.0	.1	.0	.9	.1	.3	.0
ATL WOLFFISH	.3	1.0	.1	.1	1.3	3.8	.5	1.6
AM SAND LANCE	83.5	.8	.0	.0	.0	.0	30.4	.3
ATL MACKEREL	7.4	1.9	.1	.1	.0	.0	2.7	.7
BUTTERFISH	.0	.0	1.9	.1	.6	.0	.8	.0
REDFISH	16.1	3.5	4.4	1.2	9.6	3.1	10.3	2.6
SEAROBIN, UNCL	.0	.0	.1	.0	.0	.0	.0	.0
HOOKEAR SCULPN	.0	.0	.4	.0	.3	.0	.2	.0
SEA RAVEN	.4	.5	1.1	.5	6.9	4.7	2.7	1.8
LH SCULPIN	.1	.0	1.3	.2	14.3	2.3	5.0	.8
ALLIGATORFISH	.0	.0	.1	.0	.0	.0	.0	.0
LUMPFISH	.0	.0	.0	.0	.1	.0	.0	.0
4-SPOT FLOUNDR	.0	.0	1.9	.5	2.1	.4	1.3	.3
WINDOWPANE	.0	.0	.3	.1	1.3	.2	.5	.1
WITCH FLOUNDER	14.3	3.5	14.0	3.9	46.0	21.4	24.3	9.3
AM PLAICE	170.6	24.3	154.3	22.1	90.7	14.3	140.0	20.4
YT FLOUNDER	1.5	.2	3.7	1.6	25.0	6.4	9.7	2.6
WINTER FLDR	.0	.0	1.9	1.2	12.1	7.7	4.5	2.8
SEA SCALLOP	2.0	.1	1.9	.2	48.4	2.0	16.7	.7
SHORTFIN SQUID	4.0	1.6	59.7	14.3	5.0	2.2	22.0	5.8
LONGFIN SQUID	66.1	1.0	98.6	1.9	6.3	.4	57.4	1.1
NO LOBSTER	.4	.9	2.1	1.6	14.3	8.0	5.4	3.4
RED CRAB	.0	.0	.0	.0	.3	.1	.1	.0
ROCK CRAB	.0	.0	.0	.0	.1	.0	.0	.0
CRAB, UNCL	.1	.0	.0	.0	.0	.0	.0	.0
TOTAL, ALL SPP.	637.3	120.3	531.1	142.0	507.7	251.2	562.3	168.8

TABLE 6.- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: STELLWAGEN BANK

SPECIES	SPRING 1975 TOWS: 5 NUMBER	WEIGHT	SPRING 1976 TOWS: 5 NUMBER	WEIGHT	SPRING 1977 TOWS: 2 NUMBER	WEIGHT	ALL SURVEYS SPRING TOWS: 12 NUMBER	WEIGHT
ATL HAGFISH	.0	.0	.2	.0	.0	.0	.1	.0
SPINY DOGFISH	.8	.8	.0	.0	65.5	210.4	11.3	35.4
LITTLE SKATE	1.2	1.6	1.2	1.0	.0	.0	1.0	1.1
WINTER SKATE	4.4	6.0	.6	2.8	.0	.0	2.1	3.7
THORNY SKATE	1.0	2.4	5.2	12.2	1.0	1.1	2.8	6.3
SMTHTAIL SKATE	.0	.0	2.0	1.1	.0	.0	.8	.5
BLUEBK HERRING	.4	.0	.0	.0	.0	.0	.2	.0
ALEWIFE	6.8	.8	.2	.1	.0	.0	2.9	.4
ATL HERRING	12.2	2.0	4.8	1.1	57.5	12.6	16.7	3.4
GOOSEFISH	.8	1.3	3.6	9.8	1.5	7.3	2.1	5.8
CUSK	.8	.1	.0	.0	.0	.0	.3	.0
4-BRD ROCKLING	.0	.0	3.6	.3	.0	.0	1.5	.1
ATLANTIC COD	6.6	15.0	4.4	7.6	79.0	84.2	17.8	23.4
HADDOCK	.8	.5	7.0	5.1	95.0	74.2	19.1	14.7
SILVER HAKE	44.2	1.4	70.6	2.5	.5	.1	47.9	1.6
POLLOCK	.4	2.0	.4	.1	.0	.0	.3	.9
RED HAKE	4.2	.8	2.4	.3	.0	.0	2.8	.4
WHITE HAKE	5.2	.9	7.0	2.1	.0	.0	5.1	1.3
FAWN CUSKEEL	.0	.0	5.2	.0	.0	.0	2.2	.0
WOLF EELPOUT	.0	.0	.2	.0	.0	.0	.1	.0
OCEAN POUT	.8	1.1	3.0	3.4	6.5	10.0	2.7	3.6
SOFT POUT	.2	.0	.0	.0	.0	.0	.1	.0
CUNNER	.2	.0	.0	.0	.0	.0	.1	.0
SNAKEBLENNY	.2	.0	.0	.0	.0	.0	.1	.0
DAUBED SHANNY	.0	.0	.6	.0	.0	.0	.3	.0
RADIATD SHANNY	21.2	.0	.0	.0	.0	.0	8.8	.0
ATL WOLFFISH	.6	5.0	1.0	6.7	.0	.0	.7	4.9
WRYMOUTH	.0	.0	.2	.4	.0	.0	.1	.1
AM SAND LANCE	.0	.0	17.8	.3	10718.5	216.3	1793.8	36.2
REDFISH	1.2	.3	48.2	8.5	5.0	.8	21.4	3.8
HOOKEAR SCULPN	.8	.0	.0	.0	.0	.0	.3	.0
SEA RAVEN	.0	.0	.6	.2	2.0	1.6	.6	.3
LH SCULPIN	4.6	.5	2.0	.2	1.0	.1	2.9	.3
MOUST SCULPIN	.0	.0	.8	.0	.0	.0	.3	.0
ALLIGATORFISH	1.0	.0	.2	.0	.0	.0	.5	.0
4-SPOT FLOUNDR	1.2	.1	.6	.0	.0	.0	.8	.0
WINDOWPANE	.2	.0	.2	.0	.0	.0	.2	.0
WITCH FLOUNDER	3.2	1.2	28.2	15.0	.0	.0	13.1	6.8
AM PLAICE	75.4	10.5	114.0	18.3	4.0	1.1	79.6	12.2
ATL HALIBUT	.0	.0	.2	.9	.0	.0	.1	.4
YT FLOUNDER	11.4	1.2	18.0	4.7	1.0	.5	12.4	2.5
WINTER FLDR	1.8	.7	.8	.8	.0	.0	1.1	.6
SEA SCALLOP	1.6	.3	1.8	.1	.0	.0	1.4	.2
NO LOBSTER	.0	.0	1.2	2.1	.0	.0	.5	.9
ROCK CRAB	.0	.0	.2	.0	.0	.0	.1	.0
TOTAL, ALL SPP.	215.4	56.3	358.2	107.7	11038.0	620.4	2078.6	171.7

TABLE 7.- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: STELLWAGEN BANK

SPECIES	FALL 1975 TOWS: 3 NUMBER	WEIGHT	FALL 1976 TOWS: 3 NUMBER	WEIGHT	FALL 1977 TOWS: 1 NUMBER	WEIGHT	ALL SURVEYS FALL TOWS: 7 NUMBER	WEIGHT
SPINY DOGFISH	34.0	67.2	39.3	636.3	8.0	14.5	32.6	303.6
THORNY SKATE	.3	.6	.0	.0	2.0	2.5	.4	.6
BLUEBK HERRING	5.3	1.2	.0	.0	.0	.0	2.3	.5
ALEWIFE	20.3	3.3	2.7	.5	61.0	12.0	18.6	3.4
AM SHAD	.3	.2	.0	.0	.0	.0	.1	.1
ATL HERRING	38.0	8.9	.0	.0	.0	.0	16.3	3.8
GOOSEFISH	1.0	14.1	.7	7.8	1.0	5.0	.9	10.1
CUSK	.0	.0	.0	.0	2.0	6.0	.3	.9
4-BRD ROCKLING	.0	.0	.3	.0	.0	.0	.1	.0
ATLANTIC COD	133.7	82.9	14.7	20.6	30.0	42.5	67.9	50.4
HADDOCK	45.0	33.1	54.7	17.5	100.0	54.0	57.0	29.4
SILVER HAKE	99.7	31.0	35.3	13.0	9.0	7.0	59.1	19.8
POLLOCK	38.0	13.6	.3	.2	2.0	10.7	16.7	7.5
RED HAKE	1.7	.6	5.3	2.0	17.0	7.5	5.4	2.2
WHITE HAKE	.0	.0	2.0	1.4	10.0	23.5	2.3	3.9
OCEAN POUT	2.7	1.7	.3	.3	21.0	12.3	4.3	2.6
BLK SEA BASS	.0	.0	.3	.4	.0	.0	.1	.2
CUNNER	1.3	.3	.0	.0	1.0	.5	.7	.2
ATL WOLFFISH	.7	1.2	.0	.0	1.0	2.5	.4	.9
AM SAND LANCE	4238.3	43.7	.7	.0	.0	.0	1816.7	18.7
ATL MACKEREL	1.3	.6	.0	.0	.0	.0	.6	.3
BUTTERFISH	.0	.0	35.7	1.4	8.0	.5	16.4	.7
REDFISH	.3	.0	.0	.0	591.0	114.0	84.6	16.3
SEA RAVEN	.3	.8	.0	.0	1.0	.7	.3	.4
LH SCULPIN	.3	.2	.3	.1	3.0	.7	.7	.2
WITCH FLOUNDER	.3	.2	.0	.0	18.0	22.5	2.7	3.3
AM PLAICE	32.0	4.8	26.3	5.0	113.0	33.0	41.1	8.9
YT FLOUNDER	8.0	3.8	32.0	6.2	.0	.0	17.1	4.3
WINTER FLDR	.7	1.2	2.0	1.0	.0	.0	1.1	.9
SHORTFIN SQUID	.7	.2	9.0	2.9	2.0	.6	4.4	1.4
LONGFIN SQUID	25.3	.6	139.3	3.3	3.0	.2	71.0	1.7
NO LOBSTER	.0	.0	.0	.0	1.0	.6	.1	.1
ROCK CRAB	.0	.0	.3	.0	.0	.0	.1	.0
TOTAL, ALL SPP.	4729.6	315.7	401.7	720.1	1005.0	373.3	2342.7	497.2

TABLE 8.- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: OUTER GROUNDS

SPECIES	SPRING 1975 TOWS: 8 NUMBER	WEIGHT	SPRING 1976 TOWS: 6 NUMBER	WEIGHT	SPRING 1977 TOWS: 9 NUMBER	WEIGHT	ALL SURVEYS SPRING TOWS: 23 NUMBER	WEIGHT
ATL HAGFISH	3.5	.1	1.2	.1	.4	.0	1.7	.1
SPINY DOGFISH	.0	.0	.5	2.0	18.4	56.6	7.3	22.7
WINTER SKATE	.0	.0	.3	1.8	.0	.0	.1	.5
THORNY SKATE	.3	1.0	1.7	.8	.9	2.1	.9	1.4
SMTHTAIL SKATE	.1	.2	.5	.3	1.1	.5	.6	.3
BLUEBK HERRING	.3	.0	.0	.0	.0	.0	.1	.0
ALEWIFE	4.8	.7	1.2	.1	.8	.1	2.3	.3
ATL HERRING	.0	.0	6.5	6.6	.4	.1	1.9	1.7
GOOSEFISH	.5	3.1	.7	1.9	.3	1.1	.5	2.0
CUSK	.0	.0	.2	.8	.4	1.9	.2	1.0
4-BRD ROCKLING	.3	.0	.0	.0	2.3	.1	1.0	.0
ATLANTIC COD	9.3	14.7	11.2	25.8	8.0	17.0	9.3	18.5
HADDOCK	32.6	26.1	133.7	59.9	23.2	8.2	55.3	27.9
SILVER HAKE	191.4	3.9	61.8	9.1	13.7	1.8	88.0	4.4
POLLOCK	.0	.0	5.3	6.1	.7	1.7	1.7	2.3
RED HAKE	7.9	2.3	17.7	4.8	4.9	.8	9.3	2.4
WHITE HAKE	.0	.0	5.0	.8	1.8	.8	2.0	.5
OCEAN POUT	1.5	1.3	2.7	4.7	1.7	1.0	1.9	2.1
DAUBED SHANNY	.0	.0	.8	.0	1.9	.1	1.0	.0
RADIATD SHANNY	3.9	.0	.0	.0	.0	.0	1.3	.0
ATL WOLFFISH	.5	2.2	1.5	4.6	1.3	2.0	1.1	2.8
AM SAND LANCE	.0	.0	.2	.0	.0	.0	.0	.0
BLKBY ROSEFISH	.0	.0	2.8	.3	.0	.0	.7	.1
REDFISH	1.5	.4	.0	.0	107.9	23.3	42.7	9.2
HOOKEAR SCULPN	.0	.0	.0	.0	2.7	.0	1.0	.0
SEA RAVEN	.3	.1	1.2	.3	2.6	1.5	1.4	.7
LH SCULPIN	.5	.0	1.3	.1	.8	.2	.8	.1
MOUST SCULPIN	.1	.0	.0	.0	.8	.0	.3	.0
ALLIGATORFISH	5.9	.0	2.3	.0	.2	.0	2.7	.0
LUMPFISH	.1	.6	.0	.0	.0	.0	.0	.2
SPNY LUMPSUCKR	.0	.0	.2	.0	.0	.0	.0	.0
4-SPOT FLOUNDR	.0	.0	1.3	.1	.2	.0	.4	.1
WITCH FLOUNDER	3.0	.5	.5	.7	2.0	.9	2.0	.7
AM PLAICE	5.0	1.6	9.8	3.4	57.9	11.2	27.0	5.9
ATL HALIBUT	.0	.0	.3	1.2	.1	2.2	.1	1.2
YT FLOUNDER	.1	.0	1.8	.2	.8	.4	.8	.2
WINTER FLDR	.1	.1	.2	.3	.8	.2	.4	.2
LONGFIN SQUID	.0	.0	.3	.0	.0	.0	.1	.0
NO LOBSTER	.1	.4	.0	.0	.1	.1	.1	.2
RED CRAB	.0	.0	.0	.0	.1	.0	.0	.0
ROCK CRAB	.0	.0	.3	.0	.0	.0	.1	.0
TOTAL, ALL SPP.	273.4	59.3	275.0	137.0	259.2	135.9	268.3	109.5

TABLE 9.- - MEAN NUMBERS AND KILOGRAMS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN OFFSHORE BIOME TRAWL SURVEYS.

AREA: OUTER GROUNDS

SPECIES	FALL 1975 TOWS: 8 NUMBER	WEIGHT	FALL 1976 TOWS: 4 NUMBER	WEIGHT	FALL 1977 TOWS: 4 NUMBER	WEIGHT	ALL SURVEYS FALL TOWS: 16 NUMBER	WEIGHT
ATL HAGFISH	.0	.0	.0	.0	.3	.0	.1	.0
SPINY DOGFISH	3.4	7.7	7.5	70.0	.3	.5	3.6	21.5
CLEARNSE SKATE	.0	.0	.0	.0	.3	.1	.1	.0
THORNY SKATE	.5	1.8	.5	.1	1.3	1.8	.7	1.4
SMTHTAIL SKATE	.0	.0	.3	.0	.0	.0	.1	.0
SLDR SNIPE EEL	.3	.6	.0	.0	.0	.0	.1	.3
ALEWIFE	.3	.0	.3	.1	1.8	.4	.6	.1
LANTRNFSH, UNCL	.1	.0	.0	.0	.0	.0	.1	.0
GOOSEFISH	.1	.9	.0	.0	2.0	9.1	.6	2.7
CUSK	.1	.2	.0	.0	.3	.9	.1	.3
ATLANTIC COD	19.6	27.1	7.3	14.2	14.5	19.8	15.3	22.0
HADDOCK	16.0	16.5	35.0	61.7	87.5	84.7	38.6	44.8
SILVER HAKE	8.8	1.0	4.0	.5	23.0	1.0	11.1	.9
POLLOCK	2.3	6.4	2.5	12.8	29.0	175.9	9.0	50.4
RED HAKE	4.9	2.3	1.0	.3	3.5	2.0	3.6	1.7
WHITE HAKE	1.1	2.8	1.0	1.4	7.3	10.1	2.6	4.3
OCEAN POUT	.1	.1	.0	.0	2.8	2.1	.8	.6
DAUBED SHANNY	.1	.0	.0	.0	.0	.0	.1	.0
ATL WOLFFISH	1.3	1.1	.3	.5	.3	.1	.8	.7
BUTTERFISH	.0	.0	.3	.0	.3	.0	.1	.0
REDFISH	8.6	1.1	.5	.1	26.0	5.3	10.9	1.9
HOOKEAR SCULPN	.6	.0	.3	.0	.5	.0	.5	.0
SEA RAVEN	.4	.2	.5	.3	1.3	.8	.6	.4
LH SCULPIN	1.1	.1	.5	.1	1.0	.2	.9	.1
ALLIGATORFISH	.0	.0	.3	.0	.0	.0	.1	.0
WITCH FLOUNDER	.9	.3	.3	.4	4.8	3.1	1.7	1.1
AM PLAICE	10.4	2.7	.8	.3	47.5	11.0	17.3	4.2
ATL HALIBUT	.0	.0	.3	1.1	.3	1.1	.1	.6
YT FLOUNDER	.0	.0	.3	.1	.0	.0	.1	.0
SEA SCALLOP	.1	.0	.0	.0	.0	.0	.1	.0
SHORTFIN SQUID	3.8	1.8	102.0	16.5	3.8	1.4	28.3	5.4
LONGFIN SQUID	.3	.0	140.0	4.7	25.3	1.0	41.4	1.7
NO LOBSTER	.0	.0	.0	.0	1.5	1.0	.4	.3
RED CRAB	.0	.0	.0	.0	.8	.1	.2	.0
TOTAL, ALL SPP.	85.0	74.6	305.3	185.2	286.5	334.7	190.5	167.3

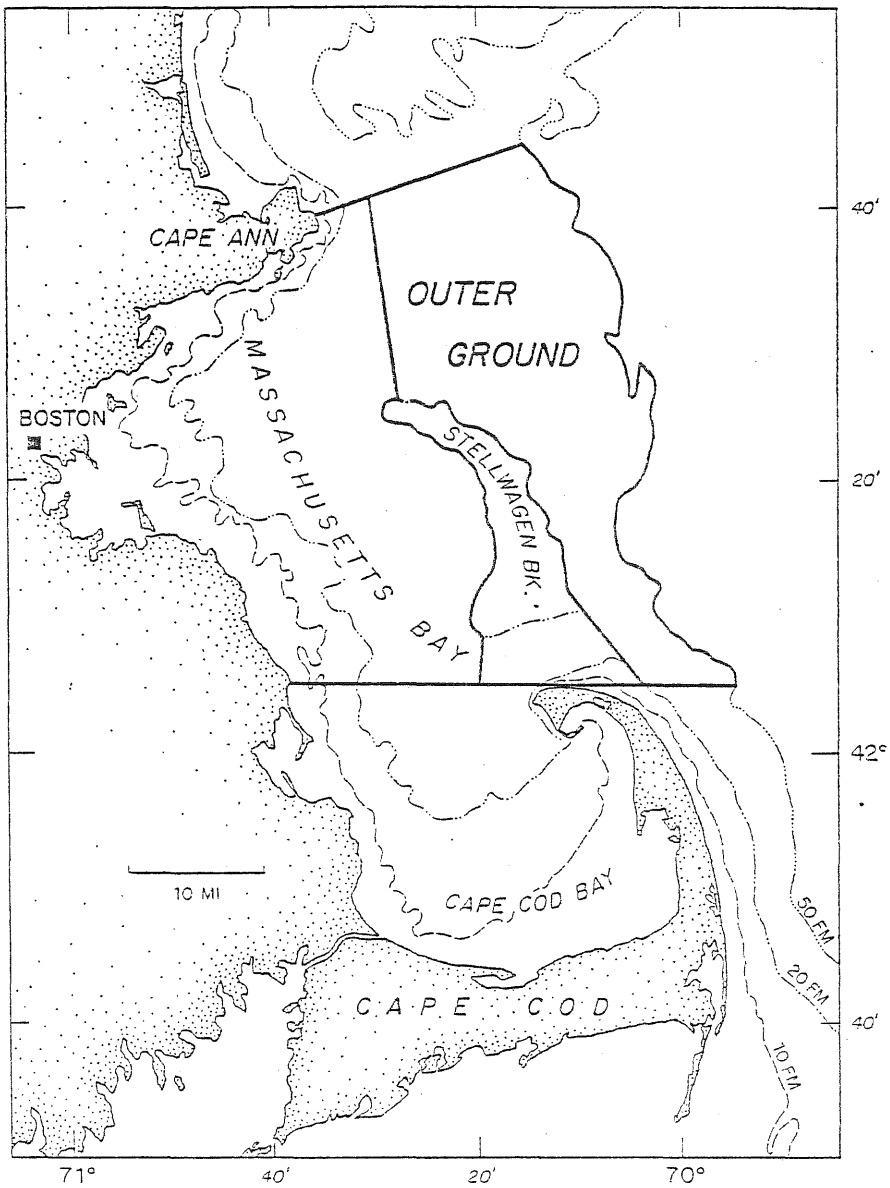

Figure 1.--The Biome area and the four strata used for summarizing the results of groundfish surveys there.

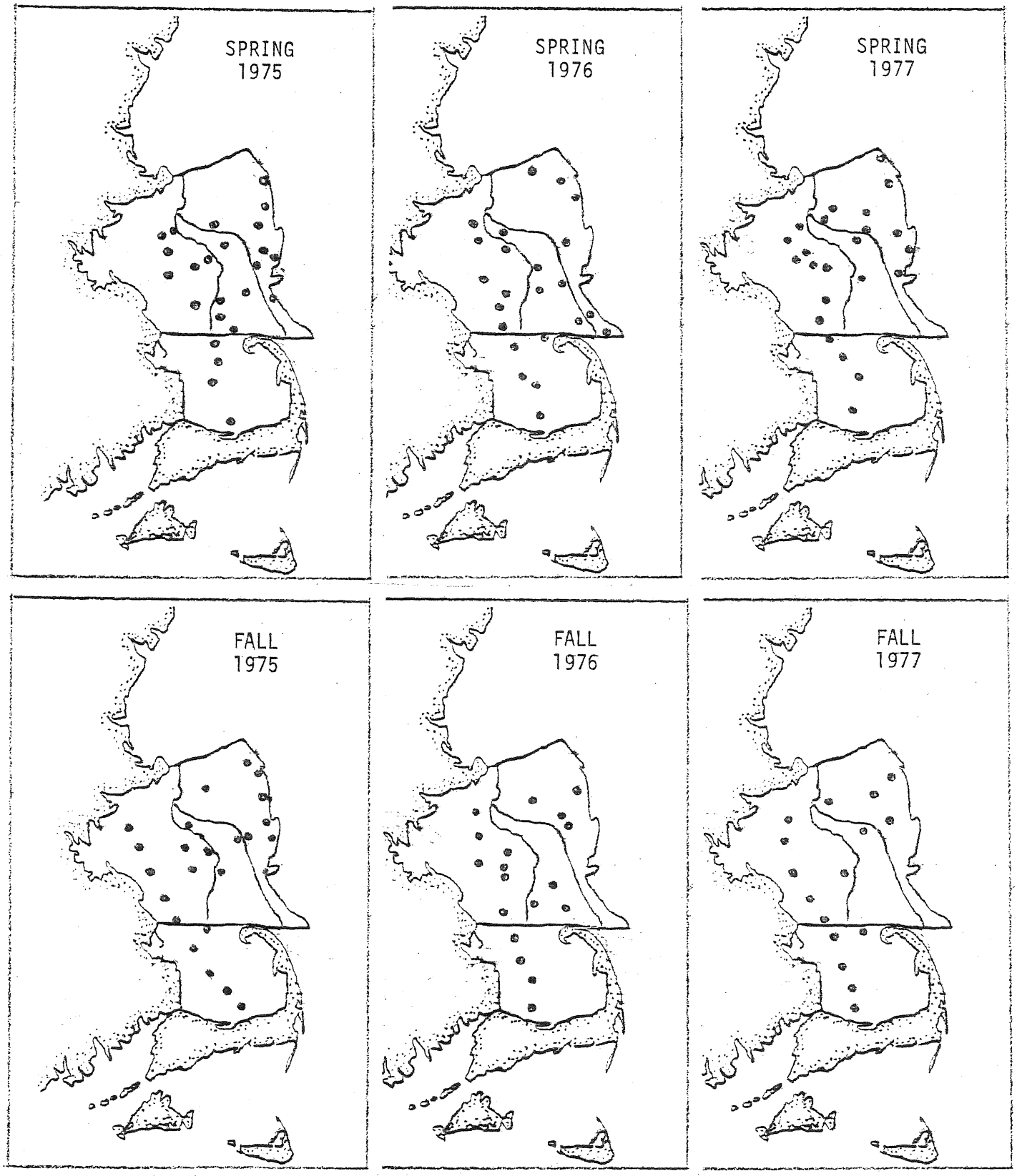

Figure 2.--Approximate trawl station locations in each of the four sampling strata in 1975-77 offshore Biome surveys.

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

Fishes

Atlantic hagfish, *Myxine glutinosa*
Spiny dogfish, *Squalus acanthias*
Smooth dogfish, *Mustelus canis*
Atlantic torpedo, *Torpedo nobiliana*
Clearnose skate, *Raja eglanteria*
Little skate, *Raja erinacea*
Winter skate, *Raja ocellata*
Thorny skate, *Raja radiata*
Smoothtail skate, *Raja senta*
Slender snipe eel, *Nemichthys scolopaceus*
Blueback herring, *Alosa aestivalis*
Hickory shad, *Alosa mediocris*
Alewife, *Alosa pseudoharengus*
American shad, *Alosa sapidissima*
Lanternfish, Unidentified Myctophidae
Goosefish, *Lophius americanus*
Cusk, *Brosme brosme*
Fourbeard rockling, *Enchelyopus cimbrius*
Atlantic cod, *Gadus morhua*
Haddock, *Melanogrammus aeglefinus*
Silver hake, *Merluccius bilinearis*
Pollock, *Pollachius virens*
Red hake, *Urophycis chuss*
White hake, *Urophycis tenuis*
Fawn cusk-eel, *Lepophidium cervinum*
Wolf eelpout, *Lycodapus fierasfer*
Ocean pout, *Macrozoarces americanus*
Soft pout, *Melanostigma atlanticum*
Black sea bass, *Centropristis striata*
Scup, *Stenotomus chrysops*
Cunner, *Tautogolabrus adspersus*
Snakeblenny, *Lumpenus lumpretaeformis*
Daubed shanny, *Lumpenus maculatus*
Radiated shanny, *Ulvaria subbifurcata*
Wolffish, *Anarhichas lupus*
Wrymouth, *Cryptacanthodes maculatus*
American sand lance, *Ammodytes americanus*
Atlantic mackerel, *Scomber scombrus*
Butterfish, *Peprilus triacanthus*
Redfish, *Sebastes marinus*
Northern searobin, *Prionotus carolinus*
Hookear sculpin, *Artediellus atlanticus*
Grubby, *Myoxocephalus aenaeus*
Longhorn sculpin, *Myoxocephalus octodecimspinosus*
Moustache sculpin, *Triglops murrayi*

Appendix-- cont'd

Fishes

Alligatorfish, *Aspidophoroides monopterygius*
Lumpfish, *Cyclopterus lumpus*
Spiny lumpsucker, *Eumicrotremus spinosus*
Summer flounder, *Paralichthys dentatus*
Fourspot flounder, *Paralichthys oblongus*
Windowpane, *Scophthalmus aquosus*
Witch flounder, *Glyptocephalus cynoglossus*
American plaice, *Hippoglossoides platessoides*
Atlantic halibut, *Hippoglossus hippoglossus*
Yellowtail flounder, *Limanda ferruginea*
Winter flounder, *Pseudopleuronectes americanus*

Invertebrates

Shortfin squid, *Illex illecebrosus*
Longfin squid, *Loligo pealei*
Sea scallop, *Placopecten magellanicus*
Northern lobster, *Homarus americanus*
Jonah crab, *Cancer borealis*
Rock crab, *Cancer irroratus*
Red crab, *Geryon quinquedens*