

ENVIRONMENTAL ASSESSMENT REPORT 5-78

Fisheries Resources of the Cape Cod and Massachusetts Bay Region

by

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Note: This report does not constitute a publication and is for information only. All data herein are considered to be provisional.

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1. INTRODUCTION

1.1 The Biome program

The Massachusetts Bay Biome program has provided for an inshore fisheries-ecological study at the Northeast Fisheries Center of the National Marine Fisheries Service (NMFS). The 'Biome' is defined, for study purposes only, as the coastal zone between Cape Cod and Cape Ann and extending from the tidal zone to about the 100 m (55 fm) curve. This encompasses Cape Cod Bay, Massachusetts Bay, Stellwagen Bank, and an outer area seaward of Stellwagen (Figures 1 and 2). The shore area here is densely populated, particularly in Massachusetts Bay, and is one where man's impact on the marine environment is considerable. Harbors, oil terminals, dredge and fill operations, nuclear and fossil fuel power plants, ocean dumping, agriculture, and industrial and domestic wastes all contribute toward upsetting natural stability in the coastal zone.

Despite these impacts, the area is rich in living marine resources which attract both commercial and recreational fishermen. In addition, it supports extensive recreational activities other than fishing, including boating, swimming, whale watching, and the enjoyment of the many aesthetic resources of the coastal zone such as tidal marshes, dunes, beaches, rocky shores, and tidal flats. The aim of the Biome Program is to assemble a description of the marine environment in this area, including a catalog of living marine resources and of natural and man-made forces of environmental impact. As an initial step in this effort, the present report provides data on the total fisheries resources of the Massachusetts and Cape Cod Bay region.

1.2 Sources of fisheries data

Data presently available for this purpose are primarily from two sources: 1) catch information from various otter trawl surveys by NMFS and predecessor agencies, and 2) statistics of the landings by commercial fishermen. Additional data come from the very incomplete reports that exist on the recreational fisheries for finfish and shellfish.

Data from numerous publications also have contributed to knowledge of fish and fisheries in the study area. Information on the marine resources of four harbor and estuarine areas in the Biome, and based on surveys by the Massachusetts Division of Marine Fisheries, is available in published reports (Fiske, Watson, and Coates, 1966; Jerome, Chesmore, and Anderson, 1966; 1967; 1969). These reports provide historical background on the fisheries as well as data on species composition and harvest.

Some of the other State of Massachusetts reports on fisheries for mollusks, alewife, crabs, and lobsters include those of Belding (1909); (1921); (1930); (1931); Wheeler (1948); Posgay (1953); Turner (1954); and Wheeler and Hughes (1957). Fishes of the Gulf of Maine (Bigelow and Schroeder, 1953) is, of course, the most complete work on fishes of the area, and it contains life history sketches of the fishes listed in the present report as well as an extensive bibliography of publications on fishes.

The NMFS otter trawl survey information for the area dates back to 1949. From 1949 to 1962 surveys were made using R/V ALBATROSS III, R/V DELAWARE, and F/V CAP'N BILL III. From 1963 to the present time, more comprehensive and more frequent surveys were made using R/V ALBATROSS IV. Currently, surveys are made in the spring and the fall of each year under the NMFS "MARMAP" program. Since fall 1972 extra trawl stations have been

sampled in the Biome during these surveys to increase sample coverage there.

This present report covers trawl surveys up through 1974; a subsequent report will deal with later surveys, which include additional inshore stations using small, chartered vessels.

The principal sources of commercial landings data for this report are from NMFS summaries for Statistical Area 514, which encompasses the Biome (Figure 1). These landings, based on vessel interviews and catch weighouts, primarily are those made by otter trawlers and other larger vessels fishing the area. In addition, the State of Massachusetts (Division of Marine Fisheries) obtains through annual canvasses the landings of shellfish and lobsters by smaller boats and shore fishermen. These landings are reported here also.

Records of the recreational catch of fish and invertebrates are sketchy, at best. They are based on questionnaires and estimates, since there is no mechanism for routine collection of statistics, such as exists for the commercial catch. The recreational harvest is large, however, and its impact on the economy is considerable. We have, therefore, put together here an estimate of the recreational catch, based on what data there are, for a recent year in order to provide some idea of its magnitude.

The common names of fish and invertebrates are used throughout this report. The scientific names, which follow those given by Bailey, et al. (1970), are given in an appendix.

2. OTTER TRAWL SURVEY DATA

2.1 Survey strata

In order to show the differences in species composition within the Biome, this area was divided into four subhabitats, or strata, on the basis

of recognized fishing grounds, water depth, bottom topography, and bottom sediments. These are: Cape Cod Bay, Massachusetts Bay, Stellwagen Bank, and, what is here called, the Outer Ground (Figure 2). Brief descriptions of each of these strata follow.

Cape Cod Bay is shallow (maximum depth 58 m), has largely sandy shores, sand and silt bottom sediments, and a generally smooth bottom. Massachusetts Bay is relatively deep (maximum depth 100 m), has generally rocky shores, and bottom sediments ranging from rocks, cobbles, and gravels to sands and silts. There are many areas of rocky and uneven bottom. Stellwagen is a shoal bank (depths of 20-55 m) and with largely sand bottom sediments. Stellwagen Bank serves as a partial barrier to block the free exchange of deep water from the Gulf of Maine to Massachusetts and Cape Cod Bays, although there are deeper channels to the north and south of Stellwagen that permit less restricted water movement (Bumpus, 1974).

The term "Outer Ground" is applied, in this report, to the deeper water Biome stratum to the east and north of Stellwagen Bank and extending out to the 50 fm (90 m) depth curve (Figure 2). It includes within its northern part some small, deeper holes, however, the deepest being one of about 180 m. And it also contains some small hummocks and shoals of only 50 to 60 m depth, such as Tillies Bank (Rich, 1930). In general, though, it is considerably deeper than the other Biome strata and has sediments ranging from boulders and cobbles to sands and silts.

2.2 Survey methods

Usually, a 1/2-hour bottom otter trawl tow was made at each sampled station, and the survey catch data have been presented here in terms of mean catch per 1/2-hour tow. The bottom otter trawl, of course, is designed primarily to catch demersal fish and it samples poorly, or misses entirely,

many species, particularly those of pelagic habit. For example, the tunas and pelagic sharks are almost never caught in trawls, and fishes like the herrings and mackerel are not very well sampled. In addition, the roller gear on the footrope, which is necessary when trawling on the rough bottom frequently encountered, reduces the catch of benthic invertebrates and bottom tending fishes like flounders. Also, survey stations were not attempted in waters shoaler than 15 fm in the series of cruises presented here because of bottom obstructions and other difficulties of sampling close-in areas with a large vessel. Some of the common shallower water species therefore were not recorded in catches, at least in proportion to their abundance. The smelt, cunner, tautog, silverside, tomcod, and American eel are examples.

The trawl used in the 1949-62 surveys was a No. 41 Yankee with footrope roller gear and, in most cases, with a 1/2-inch mesh cod end liner; Knake (1956) gives trawl sizes and riggings. In the 1963-74 series a No. 36 Yankee trawl with roller gear and a 1/2-inch mesh cod end liner was used for all surveys except in spring 1973-74 (Grosslein, 1969). In these latter two surveys a No. 41 trawl was used.

Since the data collected in the 1949-62 surveys are incomplete with respect to the total fish catch, they are summarized here rather briefly; the more extensive data for 1963-74 are treated in greater detail.

2.3 Surveys in 1949-62

Eight of the surveys in this period, four in the summer and four in the fall, covered stations in the Biome. Data from these surveys are reported here. The fish catch from each trawl station was identified to species, and the numbers of each species were counted. They were not weighed. Length measurements routinely were recorded only for species

of greatest commercial importance, such as haddock, cod, and silver hake. Standard measuring technique was to measure total length for fish with unforked tails and fork length for fish with forked tails. In general, catches of invertebrates were not recorded.

Catches in numbers per tow for the four Biome strata show the species caught and provide a rough index of relative abundance in trawl catches (Table 1). Forty-six species were recorded. While the number of tows is too few to provide accurate estimates of species composition in each stratum, some differences may be noted. Cod, for example, were caught mostly in Massachusetts Bay and on Stellwagen. Redfish, a relatively deep water species, were most abundant on the Outer Ground.

Mean lengths and length ranges for all available measurements combined provide estimates of sizes of the fish caught (Table 2). In many cases not enough measurements were made to show size distribution, however. The size compositions of those species for which some numbers were measured are presented in Figure 3. These compositions show that in many species the age groups sampled ranged from young-of-the-year through spawning adults. In haddock and cod, for examples, the fish less than 15 cm long generally are young-of-the-year and those from 15 to about 40 cm long are juveniles. For these species the Biome area clearly serves as a spawning and nursery area, as well as an adult habitat.

2.4 Surveys in 1963-74

This series of surveys includes 26 cruises with R/V ALBATROSS IV, conducted in the various years in winter, spring, summer, and fall (Table 3). In more recent years the surveys were made only in spring and fall. Sampling coverage of Massachusetts and Cape Cod Bays was poor before fall 1972, when extra stations were added in these areas (Table 3).

In this survey series the fish from each tow were measured and the aggregate weight of each species was obtained to the nearest pound (Grosslein, 1969). In the later surveys of this series, measurements and weights of the larger invertebrates caught in the trawl (lobsters, squids, sea scallops, and crabs) also were recorded; the aggregate weight of shrimp (Pandalus borealis), but not the number or individual measurements, was recorded as well.

The catches by species and Biome stratum in mean numbers and pounds per tow for each survey are given in Tables 4-17. Tables 4-5 are for Cape Cod Bay; Tables 6-9, for Massachusetts Bay; Tables 10-13, for Stellwagen; and Tables 14-17, for the Outer Ground. In these surveys aggregate weights of less than one pound were not recorded, and this accounts for the absence of weight in some cases in Tables 4-17. This occurs particularly for fishes that are small, such as sand lance, alligatorfish, smelt, shannies, pipefish, silverside, and a number of other species, where small numbers totaled less than a pound. It also occurs in cases where only small individuals of a species, such as young-of-the-year cod, haddock, or the flounders, were caught and the total weight was well under a pound.

The data of these tables, along with Table 18, provide basic information on species composition, relative abundance, and trends in abundance. With the more extensive sampling in this survey series, clearer ground to ground and season to season variations in species composition can be noted. Cod, for example, were taken in some numbers in all Biome strata, but they were least abundant in Cape Cod Bay and most abundant on Stellwagen and the Outer Ground. Haddock were relatively abundant only on Stellwagen and Outer Ground. The hakes and dogfish were taken during the warmer months when, as is known (Bigelow and Schroeder, 1953; Edwards, 1965), these species move inshore. Butterfish, also a warm water species, were caught

in some quantity, only in Cape Cod Bay, the Biome stratum where summer warming is greatest. Of the flatfishes, American plaice and witch flounder were found on all grounds but were most common in Massachusetts Bay. For the yellowtail and winter flounders the survey data show significant abundance only in Cape Cod Bay and on Stellwagen Bank. The winter flounder frequents shallow, coastal waters, however, and the survey tows in Massachusetts Bay were not shoal enough to reflect its true abundance there. It is, in fact, one of the most common species of all New England coastal waters. The yellowtail is a deeper water species, but there are known areas of commercial abundance of this species in Massachusetts Bay that were not sampled in the current survey series because of the near-shore operational difficulties mentioned earlier.

Goosefish were common only in Massachusetts and Cape Cod Bays. Redfish, a deep water species, were most consistently found on the Outer Ground. Ocean pout were taken primarily during the colder months when they move inshore.

Certain species and species groups made up a large part of the total weight of the trawl catches. Fishes of the family Gadidae (cod, haddock, pollock, cusk, rockling, and the hakes) generally predominated (Tables 4-17). The flatfishes, particularly American plaice, witch flounder, yellowtail, and winter flounder, were another important group. The spiny dogfish formed a large part of the catch biomass in summer and fall surveys. Other species and groups, such as redfish, goosefish, and the skates, also were a big part of the catch on some grounds.

The number of finfish species caught on each ground varied from 42 in Cape Cod Bay (where tows were fewest in number) to 49 in Massachusetts Bay (Table 18). For all strata combined, 64 species of finfish and eight of invertebrates were recorded. During the 1963-74 survey series a much greater number of otter trawl tows was made and fish identification was more complete. These, essentially, are the reasons why nearly 20 more fish species were recorded in 1963-74 than in 1949-62.

The fall research surveys provide the best body of data for following abundance trends (Tables 4-17). Comparisons of the long-term trends in abundance from fall surveys for principal species in the Stellwagen Bank and Outer Ground strata, where sampling was most consistent, are summarized in Table 19. These data show the notable drop in catch for most species between 1963-68 and 1969-74. Relative abundance of haddock, one of the species most heavily fished, was in 1969-74 only about one-tenth to one-third that of 1963-68. Silver hake, also, dropped sharply in abundance over this period. The abundance levels of cod, pollock, witch flounder, and yellowtail were slightly to moderately lower in the latter period. American plaice abundance changed little. Spiny dogfish also declined in the period. This species was fished by foreign vessels in some years. Additional mortality probably stemmed from the general increase in fishing effort. Like other sharks, dogfish have low fecundity and so are particularly vulnerable to heavy fishing.

Other studies, based on ALBATROSS IV survey data, have shown similar declines in finfish abundance in the Gulf of Maine area as a whole (Clark and Brown, 1977). These declines were accompanied by an estimated six-fold increase in fishing effort over the entire New England area, primarily by foreign vessels (Brown, et al., 1976)

Some of the data in Tables 4-17 suggest that abundance of certain species has increased in the later years of the period covered. This appears to be true of Cape Cod Bay and Massachusetts Bay where catches of alewife and squid show some increases (Tables 5 and 9). These are prey species, to a considerable extent (Mauer and Bowman, 1975), and the reduction of predator fish through the heavy fishing of recent years may be partly responsible for their increase. White hake also appears generally to have increased in abundance. There is no clear explanation for this, but increased survival of young through reduction of predator populations may have been a factor.

The numbers of fish and larger invertebrates measured, mean sizes, and size ranges for individuals measured for each ground during the surveys of 1963-74 are given in Table 18. These data provide a condensed picture of the ground to ground species composition, animal sizes, and species diversity in the area. For most species, small individuals were caught as well as large ones, further demonstrating the importance of the area as a nursery ground for juvenile fish.

The entire area is, of course, a well known spawning and nursery ground for many species of fish (Bigelow and Schroeder, 1953). Planktonic stages of eggs, larvae, and juveniles have been recorded there for at least 35 fishes (Bigelow, 1926; Fish, 1929; Colton and St. Onge, 1974; Anderson and McGrath, 1976; Anderson, 1977). Larval lobsters^{1/} and crabs also are components of the coastal plankton, in addition to many other invertebrates (Bigelow, 1926). Data on the water circulation pattern presented by Bigelow (1926) suggested to him that many fish eggs and larvae drift into the Massachusetts Bay area from coastal waters farther north; this may, in part, explain the richness of the area in ichthyoplankton.

^{1/} Personal communication from G. C. Matthiessen, Marine Research Inc., Falmouth, MA 02540.

The size compositions for the 30 most common fishes of Table 18 are presented in Figures 4 and 5, for each Biome stratum. The numbers of fish measured for each of these graphs are given in Table 18. Graphs are presented only for species where there were sufficient numbers to show size composition. For example, in Figure 4, winter skate were common only in the Stellwagen stratum and thus were graphed only for this stratum. Similar cases may be seen for other species.

Aside from providing further information on abundance by species from stratum to stratum, the graphs show something about comparative fish size in the different strata. In haddock, for example, the smaller fish were more common in Massachusetts Bay and on Stellwagen Bank, and the larger fish were more common on the Outer Ground, where the water is deeper. A similar pattern is shown for winter flounder. The smallest fish were caught in the shoaler waters of Cape Cod Bay and bigger ones on the Outer Ground. This depth distribution pattern within a species is not uncommon; data from Bigelow and Schroeder (1953) indicate that many fishes go through juvenile stages in estuarine and/or coastal waters and move farther offshore as adults.

A comparison of size frequency data from 1949-62 surveys (Figure 3) with those from 1963-74 surveys (Figures 4 and 5), indicates that there were no marked differences in the two periods. Neither was there a discernible difference in size of fish during the period of declining abundance in 1963-74 (Tables 4-17). It is probable, however, that the data, while adequate to show overall size composition, are inadequate to show year to year variations in fish size because of small sample sizes in individual years.

3. CATCH DATA

3.1 Commercial Catch

Most of the available catch information for the Cape Cod-Massachusetts Bay area is for commercial landings. The reported commercial landings in 1964-74 by U.S. fishermen from Area 514 are given in Table 20. As earlier indicated, Area 514 covers the Biome area in addition to some areas slightly to the north and farther offshore (Figure 1). However, it is safe to say that the vast bulk of landings in Area 514 come from within the boundaries of the Biome area, as previously defined here. The catch by foreign vessels in Area 514 was always less than 10% of that caught by U.S. vessels; at present it is nil. Since statistics for the foreign fleet are reported only for the Gulf of Maine as a whole, there is no finer breakdown by area.

The data of Table 20 principally are from the catches of vessels fishing at least a mile or more from shore. Much of this catch is obtained with otter trawls; however, a variety of gears are used. Most demersal fish are caught with otter trawls. Purse seines are used for menhaden and, to a considerable extent, for herring, alewife, mackerel, and tuna. Scallops are taken with dredges. A mixture of other gears (pound nets, floating trap nets, gill nets, hand lines, line trawls, angling rods, harpoons) account for smaller amounts of fish. Some gears, such as pound nets and floating traps, have all but vanished with the declines in catches.

The inshore lobster catch, taken with baited traps, is not included in Table 20, but is discussed separately below.

The catches show the wide diversity of species utilized by the commercial industry, as well as the large quantities of fishes caught in this area.

The landings averaged about 31,000 metric tons (nearly 70 million pounds) per year in the period covered.

Trends in abundance of certain species, as shown by catch, also may be noted. The haddock landings dropped sharply, coinciding with information from surveys presented in the previous section. The silver hake catch also has declined over this period. Menhaden catches, on the other hand, have risen in recent years, possibly in part because of the warmer summers. Being caught with purse seines, the abundance of this species is not reflected in otter trawl survey data.

The landings of herring and mackerel, also pelagic and with highly variable recruitment, have fluctuated considerably over the period covered with no clear sign of a trend in the Biome area, although assessment reports for the Gulf of Maine as a whole indicate that abundance has declined to a considerable extent in recent years (ICNAF, 1976).

The landings of lobsters by trap fishermen in the Biome area in 1967-74 were estimated from landings by county, given in annual summaries assembled by the Massachusetts Division of Marine Fisheries from reports filed by fishermen (Table 21). These may be considered minimum estimates of the total trap catch. Most of the lobster landings were from the area between the low tide line and three miles or so from shore. The bulk of them come from Massachusetts Bay. As the data show, the catches and ex-vessel values of lobsters are large, and the fishery is number one in value for the Biome. The catch has not changed much from the mean for this period of 1,300 metric tons; however, the value has about doubled. About 6 percent of the catch is taken on family licenses and cannot be sold. This portion therefore may be classed as recreational catch. The Massachusetts reports show that catch per trap has decreased for lobsters, while number of traps has increased.

Some additional catches of lobsters are made by otter trawlers of the area, but these do not appear in landings records. The data of Table 21 therefore underestimate the actual lobster catch.

In addition to the above fisheries, there are small to modest commercial fisheries for other marine organisms, some intertidal and others sub-tidal. Estimated landings of these for 1974 in the Biome area, based on an annual canvass by the Massachusetts Division of Marine Fisheries, are given in Table 22. Most are shellfish, and they are harvested with a variety of gears, but particularly clam rakes, from shore or from skiffs. The investment in gear is small, and the number of fishermen, mostly part time, is large.

These coastal shellfish areas are under the jurisdiction of the towns that embrace them; the shellfishing regulations, and the degree of catch reporting, vary from town to town.

The total catch of just under 3,000 metric tons given in Table 22 probably greatly underestimates the actual commercial landings because of the difficulties of gathering data in these diverse and widely scattered fisheries. In addition, it greatly underestimates the potential catch, since most of the rich and extensive coastal area of Massachusetts Bay is closed to shellfishing because of pollution. The landings of Table 22 therefore are largely from Cape Cod Bay.

Special permits are issued to some clam diggers to harvest soft clams in polluted areas. These clams are purified in clean running water at a state-run depuration plant at Newburyport, Massachusetts. In 1974, 237 metric tons of Table 22 soft clam total were depurated clams. The total depurated has been growing because of the high demand for soft clams.

In addition to the commercial fisheries listed in the above tables, there probably are other small ones for which the landings go unrecorded. As an example, fishermen indicated that they harvested 1,500 gallons of mummichogs for bait in 1965 from intertidal marsh creeks in the North River area (Fiske, Watson, and Coates, 1966). It is likely that some amounts of these are caught in other areas also and go unrecorded.

3.2 Recreational Catch

The recreational catch is considered here to be that taken by anglers, clam diggers, and other fishermen for sport and/or for home consumption. Accurate figures on this catch simply are not available at present, but there are some pieces of information that provide an indication of the scope of the recreational fisheries. For angling itself, a saltwater angling survey conducted for 1974¹ gave an estimated catch in Massachusetts of 15 million fish weighing 14 thousand metric tons. If one assumes that one-third of this amount came from the Biome, a figure which probably is conservative given the length of the Biome shoreline and observed fishing intensity, this would mean that an estimated 4.7 thousand tons were caught there by anglers in 1974.

The principal angler-caught species in the Biome are winter flounder, cod, striped bass, bluefish, pollock, mackerel, and bluefin tuna. Other species and species groups taken are tautog, hakes, eels, haddock, smelt, and cunner. Some of the angler catch is sold commercially, particularly striped bass, bluefish, and tuna, and this catch appears in commercial landings since sales records are filled out for most of these landings.

¹Deuel, D. G., and J. E. Ridgely. (Unpublished MS). Participation in marine recreational fishing, northeastern United States, 1973-74. Phase II.

Much of the tuna listed in Table 20 was angler-caught in some years; in 1974, for example, about 50% of the commercial tuna were reported taken with rod and reel.

Some of the other species that are sold by anglers are listed in footnote 3 of Table 20. In 1974, a good year for bluefish and striped bass, the reported commercial catches of these two species in Statistical Area 514 were 52 and 54 metric tons, respectively. It is likely that most of these catches were by anglers.

Another recreational fishery that is actively pursued by many thousands of coastal residents is that for shellfish. The recreational catches, by species, of shellfish taken on family permits in the coastal area of the Biome in 1974, estimated from two reports to the Massachusetts Division of Marine Fisheries, are given in Table 23. This catch of 275 metric tons came mostly from Cape Cod Bay. This is because much of Massachusetts Bay is closed to shellfishing as a result of high pollution levels there.

It is difficult to determine the accuracy of these recreational shellfish catch figures, since accuracy probably varies from town to town. They do, however, provide some idea of the magnitude of the recreational fishery. About 12,000 family shellfishing permits were issued for 1974 in the towns reporting.

4. SUMMATION

The foregoing data from otter trawl surveys and catch reports give one an appreciation of the extent of fisheries resources in the Biome. The information on harvest provides first estimates of the segment presently being utilized by man. A total of 70 species of fish and 17 of invertebrates are reported from the combined data. At least 33 fishes and 13 invertebrates

are included in commercial and recreational catches. Of the fishes, clupeids, gadids, and pleuronectids have made up most of the catch.

The estimated total harvest in the Biome in 1974,¹ using all of the commercial and recreational catch estimates given in the text, above, and in Tables 20-23 was 49,494 metric tons (109 million pounds) live weight (Table 24). The estimated value of this to fishermen was on the order of 15 million dollars. As mentioned, these figures probably underestimate the actual harvest because of the difficulties in gathering catch data from the many diverse and scattered fisheries. They also underestimate the potential harvest of the area that might be realized under management through the Fishery Conservation and Management Act of 1976.

The total commercial catch considerably exceeds that by recreational fishermen (Table 24). This is not surprising considering that commercial fishermen fish more of the year, cover a much larger area, use efficient gear designed for the mass capture of fish, and have much greater experience than recreational fishermen.

In addition to the fish landed, otter trawlers discard considerable quantities of undersized and/or unwanted fish. Since many of these are discarded dead, their weight should be added to the landed catch in order to estimate total removals by the fishery. We have no reliable estimate of discard tonnage, which varies with area, season, year, time of day, etc. Going by interviews with fishermen and our own experience aboard otter trawlers, however, we estimate that it is at least 25% of the landed otter trawl portion of the catch in Table 20. This would make discards about

¹ The year 1974 was used to summarize total harvest because this was the only year for which we had estimates of catch from all of the various fisheries.

4,000 tons in Subarea 514 in 1974. If we add 4,000 tons to the total for 1974 (Table 24), we have an overall estimate of removals of 53,494 tons (118 million pounds).

The dollar values given in Table 24 are those received by fishermen for their catches, in the case of commercial landings. The values we have assigned to recreational catches are based on these commercial values. The values are minimal ones. Retail values of commercially sold catches are more than twice as great; values to recreational fishermen of their catches may be greater still.

As we have indicated earlier, the extent of the fisheries resources in the Biome is rather imprecisely documented here because of the incomplete nature of the catch data and the sampling limitations of trawl surveys. Also, of course, the report does not deal with the vast number and variety of organisms in the food chain, planktonic and benthic, which, although not harvested, are vital to the ecosystem, but which must await a much more detailed study.

The above data as they stand, however, show that despite the impacts of man on the coastal zone of the Biome over a span of 300 years, an annual fisheries production of more than 100 million pounds still is possible. With the growing public awareness of the threat to marine ecosystems posed by pollution, and physical deterioration of habitats, one can be somewhat optimistic that environmental damage will be more effectively limited in the future. This, along with sound habitat management, could lead to even greater yields of fish and shellfish from these waters.

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Appendix.--Index of common and scientific names of plants, invertebrates, and fishes recorded in surveys and in commercial landings in the Biome area, 1949-74.

PLANTS

moss, Irish, Chondrus crispus

INVERTEBRATES

clam, hardshell, Mercenaria mercenaria
razor, Ensis directus
softshell, Mya arenaria
surf, Spisula solidissima
crab, jonah, Cancer borealis
red, Geryon quinquedens
rock, Cancer irroratus
lobster, American, Homarus americanus
mussel, blue, Mytilus edulis
oyster, American, Ostrea virginica
scallop, bay, Aequipecten irradians
sea, Placopecten magellanicus
shrimp, northern, Pandalus borealis
squid, longfin, Loligo pealei
shortfin, Illex illecebrosus
worm, sand, Nereis virens
blood, Glycera dibranchiata

FISHES

alewife, Alosa pseudoharengus
alligatorfish, Aspidophoroides monopterygius
argentine, Atlantic, Argentina silus
bass, black sea, Centropristis striata
striped, Morone saxatilis
bluefish, Pomatomus saltatrix
butterfish, Peprilus triacanthus
cod, Atlantic, Gadus morhua
cunner, Tautoglabrus adspersus
cusk, Brosme brosme
dogfish, smooth, Mustelus canis
spiny, Squalus acanthias
eel, American, Anguilla rostrata
conger, Conger oceanicus
eelpout, wolf, Lycenchelys verrilli
flounder, fourspot, Paralichthys oblongus
Gulf Stream, Citharichthys arctifrons
summer, Paralichthys dentatus
winter, Pseudopleuronectes americanus
witch, Glyptocephalus cynoglossus
yellowtail, Limanda ferruginea
goosefish, American, Lophius americanus
haddock, Melanogrammus aeglefinus
hagfish, Atlantic, Myxine glutinosa

hake, offshore, Merluccius albidus
 red, Urophycis chuss
 silver, Merluccius bilinearis
 white, Urophycis tenuis
 halibut, Atlantic, Hippoglossus hippoglossus
 herring, Atlantic, Clupea harengus
 blueback, Alosa aestivalis
 round, Etrumeus teres
 killifish, striped, Fundulus majalis
 lance, American sand, Ammodytes americanus
 lumpfish, Cyclopterus lumpus
 lump sucker, spiny, Eumicrotremus spinosus
 mackerel, Atlantic, Scomber scombrus
 menhaden, Atlantic, Brevoortia tyrannus
 mummichog, Fundulus heteroclitus
 pearlsides, common, Maurolicus mulleri
 pipefish, northern, Syngnathus fuscus
 plaice, American, Hippoglossoides platessoides
 pollock, Pollachius virens
 pout, ocean, Macrozoarces americanus
 raven, sea, Hemitripterus americanus
 redfish, Sebastes marinus
 rockling, fourbeard, Enchelyopus cimbrius
 rosefish, blackbelly, Helicolenus dactylopterus
 sculpin, Arctic hookear, Artediellus uncinatus
 little, Myoxocephalus aeneus
 longhorn, Myoxocephalus octodecemspinosus
 moustache, Triglops murrayi
 shorthorn, Myoxocephalus scorpius
 scup, Stenotomus chrysops
 searobin, northern, Prionotus carolinus
 seasnail, Liparis atlanticus
 shad, American, Alosa sapidissima
 shanny, daubed, Lumpenus maculatus
 radiated, Ulvaria subbifurcata
 silverside, Atlantic, Menidia menidia
 skate, barndoor, Raja laevis
 clearnose, Raja eglanteria
 little, Raja erinacea
 smooth tail, Raja senta
 thorny, Raja radiata
 winter, Raja ocellata
 smelt, rainbow, Osmerus mordax
 snakeblenny, Lumpenus lumpretaeformis
 stickleback, fourspine, Apeltes quadracus
 ninespine, Pungitius pungitius
 threespine, Gasterosteus aculeatus
 twospine, Gasterosteus wheatlandi
 tautog, Tautoga onitis
 tomcod, Atlantic, Microgadus tomcod
 torpedo, Atlantic, Torpedo nobiliana
 tuna, bluefin, Thunnus thynnus
 windowpane, Scophthalmus aquosus
 wolffish, Atlantic, Anarhichas lupus
 wrymouth, Cryptacanthodes maculatus

Table 1.-- Mean numbers of fish caught per ½-hour otter trawl tow in the Cape Cod-Cape Ann Biome in summer and fall groundfish surveys in 1949-1962, combined.

Species	Mean number caught per tow							
	Cape Cod Bay		Massachusetts Bay		Stellwagen Bank		Outer Ground	
	Summer	Fall	Summer	Fall	Summer	Fall	Summer	Fall
Smooth dogfish	-	0.2	-	-	-	0.8	-	-
Spiny dogfish	11.5	51.5	322.0	4.3	47.1	551.5	0.2	146.1
Little skate	4.0	0.8	-	0.3	0.2	0.6	0.8	0.4
Barndoor skate	-	-	-	-	0.3	0.4	-	2.9
Winter skate	13.5	-	20.3	-	3.2	7.3	2.6	-
Thorny skate	-	0.2	0.7	0.6	3.2	1.0	0.2	2.5
Smooth skate	1.0	-	-	-	0.4	0.1	0.2	-
Conger eel	-	-	-	-	0.1	0.1	-	-
Blueback herring	0.5	-	-	-	0.1	23.6	-	1.6
Alewife	4.0	9.0	35.7	6.7	0.2	7.4	1.2	2.3
American shad	-	-	-	1.8	0.1	0.6	-	0.3
Atlantic herring	96.5	0.5	-	5.2	45.9	65.5	8.4	9.3
Round herring	-	-	-	-	-	-	-	-
Goosefish	7.0	0.2	5.0	1.3	2.2	0.8	2.4	0.4
Cusk	-	1.0	1.3	1.0	-	-	0.2	-
Fourbeard rockling	3.5	4.2	0.3	-	-	-	-	-
Atlantic cod	3.5	0.2	25.3	6.3	35.7	28.3	2.6	3.6
Haddock	139.0	-	41.3	23.4	124.0	170.1	50.2	44.6
Silver hake	216.5	241.7	177.0	67.9	137.2	45.0	48.4	46.1
Pollock	-	-	-	0.7	0.5	7.3	0.4	1.6
Red hake	110.5	58.5	8.3	8.7	32.9	17.0	32.4	17.0
White hake	7.0	6.8	0.7	11.4	0.7	0.5	-	6.6
Ocean pout	140.0	1.5	-	1.0	31.6	8.2	0.6	1.3
Cunner	-	-	-	-	-	0.4	-	-
Daubed shanny	-	-	-	0.1	-	-	-	0.1
Atlantic wolffish	-	-	-	0.1	0.3	0.1	-	0.1
Wrymouth	0.5	0.8	-	-	-	-	-	-
American sand lance	-	-	-	-	0.5	0.6	-	-
Atlantic mackerel	-	-	-	-	-	2.0	-	0.2
Butterfish	-	0.8	15.3	0.7	0.6	24.0	-	21.4
Redfish	1.0	-	1.3	1.5	5.8	3.8	219.4	28.1
Northern searobin	-	-	-	-	-	0.1	-	-
Hookear sculpin	-	-	-	-	-	0.2	-	-
Longhorn sculpin	36.5	2.8	6.7	0.2	11.4	6.0	5.0	2.3
Mailed sculpin	-	-	-	-	-	0.1	0.2	-
Sea raven	1.0	-	-	0.2	1.9	0.5	0.4	1.5
Alligator fish	-	-	-	-	0.1	0.1	-	-
Gulfstream flounder	-	-	-	-	-	0.1	0.2	-
Summer flounder	-	-	-	0.2	-	-	-	-
Fourspot flounder	-	1.2	-	-	-	0.2	1.8	-
Windowpane	-	-	1.3	-	-	0.1	-	-
Witch flounder	0.5	-	-	6.0	1.8	0.1	0.2	1.1
American plaice	35.0	17.0	0.7	45.8	18.7	10.3	3.0	20.2
Atlantic halibut	-	-	-	-	0.1	0.1	-	-
Yellowtail flounder	10.5	-	30.3	0.3	17.0	8.9	25.0	2.2
Winter flounder	-	-	1.0	1.5	2.7	3.0	0.6	0.7
Total--all species	843.0	398.9	694.5	197.2	526.5	996.8	406.6	364.5
Number of tows	2	4	3	6	17	31	5	10
Number of species	22	19	19	26	31	40	25	27

Table 2.--Mean lengths (cm) and length ranges of fish measured from summer and fall otter trawl surveys in 1949-62 from all Biome grounds.

Species	Summer Surveys			Fall Surveys		
	Number measured	Mean length	Length range	Number measured	Mean length	Length range
Spiny dogfish	118	61.6	40-93	253	76.6	42-99
Barndoor skate	4	61.0	53-76	-	-	-
Winter skate	39	76.3	45-94	64	64.4	39-94
Thorny skate	39	35.0	14-79	27	32.7	15-80
Blueback herring	-	-	-	250	24.8	20-29
Alewife	-	-	-	185	25.3	16-31
American shad	1	47.0	-	12	32.8	26-42
Atlantic herring	84	25.6	15-33	760	20.7	13-38
Goosefish	4	66.5	50-86	3	40.0	34-47
Cusk	-	-	-	4	26.0	20-29
Fourbeard rockling	-	-	-	13	21.5	4-32
Atlantic cod	551	28.6	8-99	206	40.8	11-113
Haddock	2,220	27.2	7-97	3,040	30.3	9-77
Silver hake	978	23.6	10-57	1,480	30.4	4-63
Pollock	9	81.5	71-91	139	66.8	27-93
Red hake	288	34.9	14-50	508	37.5	18-54
White hake	4	31.0	25-62	128	39.8	19-75
Ocean pout	48	40.0	18-84	18	46.2	15-66
Cunner	-	-	-	12	31.2	25-39
Daubed shanny	-	-	-	1	7.0	-
Atl. wolffish	5	26.8	14-60	3	41.3	8-72
Wrymouth	-	-	-	2	20.5	18-23
Am. sandlance	9	20.9	18-24	3	14.3	13-16
Atl. mackerel	-	-	-	64	20.1	16-44
Butterfish	11	12.3	11-21	508	13.3	8-22
Redfish	174	18.6	6-34	270	18.5	7-33
Longhorn sculpin	50	21.2	11-33	72	28.2	15-44
Sea raven	22	17.0	11-27	18	27.6	16-57
Summer flounder	-	-	-	1	28.0	-
Fourspot flounder	-	-	-	8	38.1	30-52
Windowpane	-	-	-	1	37.0	-
Witch flounder	31	35.5	9-56	21	33.6	17-58
Am. plaice	292	21.6	10-47	271	23.1	7-44
Atl. halibut	1	51.0	-	2	35.5	35-36
Yellowtail flounder	349	27.0	9-54	243	27.8	12-50
Winter flounder	42	29.3	16-49	63	39.6	22-54

Table 3 .--ALBATROSS IV groundfish surveys in 1963-74 and numbers of stations in each Biome ground.

Year	Month	Cape Cod Bay	Massachusetts Bay	Stellwagen Bank	Outer Ground
<u>Winter Surveys</u>					
1964	January	-	1	4	2
1965	February	-	1	2	1
1966	January	-	-	2	2
<u>Spring Surveys</u>					
1968	April	-	2	-	2
1969	April	-	-	-	5
1970	March	1	-	2	2
1971	April	-	1	-	4
1972	April	-	1	2	2
1973	Apr.-May	2	4	3	4
1974	Apr.-May	4	6	1	7
<u>Summer Surveys</u>					
1963	July	-	-	3	3
1964	August	-	-	3	1
1965	July	-	1	2	1
1969	August	-	1	-	3
<u>Fall Surveys</u>					
1963	November	-	1	4	2
1964	November	-	1	1	2
1965	October	-	1	1	2
1966	October	-	1	-	3
1967	November	-	-	2	3
1968	November	-	-	1	3
1969	November	-	-	2	3
1970	November	-	-	3	2
1971	November	1	1	1	2
1972	Nov.-Dec.	4	8	2	5
1973	November	2	3	3	9
1974	October	4	8	2	5
Totals		18	42	46	80

TABLE 4 . . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: CAPE COD BAY		SURVEY 703		SURVEY 733		SURVEY 744	
SEASON: SPRING		SPRING 1970		SPRING 1973		SPRING 1974	
		TOWS: 1		TOWS: 2		TOWS: 4	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
015	SPINY DOGFISH	.0	.0	.5	3.5	.0	.0
028	THORNY SKATE	4.0	30.0	7.5	42.0	2.8	31.5
027	SMILTAIL SKATE	.0	.0	.5	.0	.0	.0
033	ALEWIFE	.0	.0	1.0	.0	1.3	.3
032	ATL HERRING	.0	.0	.0	.0	4.0	1.3
045	RAINBOW SMELT	.0	.0	2.5	.0	.0	.0
197	GOOSEFISH	.0	.0	1.5	17.0	.8	10.3
083	4-BRD ROCKLING	.0	.0	15.0	6.0	11.5	1.3
073	ATLANTIC COD	1.0	32.0	7.0	88.0	3.5	32.3
074	HADDACK	.0	.0	.0	.0	.3	.0
072	SILVER HAKE	.0	.0	14.0	1.0	70.0	3.5
069	OFFSHORE HAKE	.0	.0	.0	.0	.3	.3
077	RED HAKE	.0	.0	21.0	5.5	23.3	4.0
076	WHITE HAKE	.0	.0	.0	.0	2.3	1.3
193	OCEAN BUT	8.0	16.0	23.0	55.0	7.5	8.0
182	SNAKEBLENNY	.0	.0	10.0	.5	.3	.0
183	DAUBED SHANNY	6.0	.0	113.0	1.0	36.0	.0
191	WRYMOUTH	1.0	3.0	.0	.0	.0	.0
155	REDFISH	.0	.0	.0	.0	.5	.0
164	SEA RAVEN	.0	.0	.5	1.5	.0	.0
163	LH SCULPIN	6.0	3.0	5.0	2.5	.5	.3
165	ALLIGATORFISH	.0	.0	5.5	.0	1.5	.8
104	4-SPOT FLounder	.0	.0	2.5	.5	2.5	.3
108	WINDOWPANE	22.0	13.0	11.0	3.5	5.8	.5
107	WITCH FLounder	1.0	2.0	6.0	13.0	1.5	3.5
102	AM PLAICE	15.0	12.0	209.5	26.0	71.8	15.3
105	YT FLounder	6.0	3.0	22.5	13.0	26.5	17.0
106	WINTER FLDR	2.0	1.0	68.0	25.0	4.3	3.0
301	NØ LØBSTER	.0	.0	.0	.0	.3	.5
312	JØNAH CRAB	.0	.0	.5	.0	.0	.0
313	RØCK CRAB	.0	.0	3.0	.5	.0	.0
305	SHRIMP, UNCL	.0	18.0	.0	.0	.0	.0
	TØTAL, ALL SPP.	72.0	133.0	550.5	305.0	278.5	134.8

TABLE 5 . . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: CAPE COD BAY SEASON: FALL		SURVEY 716 FALL 1971 TOWS: 1		SURVEY 728 FALL 1972 TOWS: 4		SURVEY 738 FALL 1973 TOWS: 2		SURVEY 748 FALL 1974 TOWS: 4	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
013	SMOOTH DOGFISH	.0	.0	.0	.0	.0	.0	.3	2.5
015	SPINY DOGFISH	2.0	14.0	2.0	8.3	39.0	220.5	86.8	503.0
026	LITTLE SKATE	.0	.0	2.3	3.3	.0	.0	.0	.0
028	THORNY SKATE	1.0	23.0	.5	4.3	.0	.0	.3	4.8
034	BLUEBK HERRING	.0	.0	.0	.0	.0	.0	49.5	17.8
033	ALEWIFE	.0	.0	49.0	6.8	51.5	9.5	107.8	33.0
035	AM SHAD	.0	.0	2.3	.8	1.0	.5	.0	3.3
032	ATL HERRING	2.0	.0	6.5	3.0	.5	.0	25.0	7.5
045	RAINBOW SMELT	.0	.0	1.8	.0	.0	.0	.0	.0
197	GØØSEFISH	.0	.0	.3	5.3	1.0	21.0	1.5	30.0
083	4-BRD ROCKLING	15.0	.0	2.5	.3	.5	.0	1.3	.3
073	ATLANTIC CØD	18.0	1.0	6.8	32.8	11.0	112.5	.3	.0
074	HADDØCK	.0	.0	.0	.0	.5	.0	.0	.0
072	SILVER HAKE	35.0	5.0	71.3	14.8	33.0	12.5	145.5	27.0
075	PØLLØCK	.0	.0	5.5	61.3	.0	.0	.0	.0
077	RED HAKE	20.0	27.0	3.0	.5	6.0	7.5	4.5	7.0
076	WHITE HAKE	2.0	.0	3.5	2.5	8.5	17.0	3.8	8.3
193	OCEAN PØUT	.0	.0	3.3	7.0	3.0	7.0	.0	.0
113	ATL SILVERSIDE	.0	.0	4.0	.0	.0	.0	.0	.0
115	3-SP STICKLEBK	1.0	.0	.0	.0	.0	.0	.0	.0
116	NØ PIPEFISH	.0	.0	.0	.0	.5	.0	.0	.0
135	BLUEFISH	.0	.0	.0	.0	.0	.0	1.0	.3
143	SCUP	.0	.0	.3	.3	.0	.0	2.5	.8
182	SNAKEBLENNY	2.0	.0	.0	.0	.0	.0	.0	.0
183	DAUBED SHANNY	.0	.0	.5	.0	.0	.0	.0	.0
191	WRYMØUTH	.0	.0	.3	.3	.0	.0	.0	.0
121	ATL MACKEREL	.0	.0	.0	.0	14.0	14.0	.0	.0
131	BUTTERFISH	.0	.0	7.0	.8	18.0	3.0	454.8	42.3
164	SEA RAVEN	.0	.0	.0	.0	.5	1.0	.0	.0
163	LH SCULPIN	1.0	.0	1.8	.8	.5	.5	.3	.0
165	ALLIGATØRFISH	1.0	.0	.0	.0	.0	.0	.0	.0
104	4-SPØT FLØUNDR	.0	.0	.0	.0	.5	.0	.3	.0
108	WINDØWPANE	.0	.0	5.8	2.5	1.5	1.0	1.0	.5
107	WITCH FLØUNDR	1.0	4.0	.3	.0	.0	.0	.0	.0
102	AM PLAICE	103.0	21.0	64.8	11.0	13.5	4.0	7.3	3.0
105	YT FLØUNDR	.0	.0	13.3	5.8	5.5	4.0	.3	.3
106	WINTER FLDR	.0	.0	12.8	8.3	50.0	50.5	8.8	8.3
502	SHØRTFIN SQUID	2.0	1.0	.3	.3	.5	.0	3.0	2.3
503	LØNGFIN SQUID	1.0	.0	.0	.0	14.5	3.0	496.3	51.5
301	NØ LØBSTER	.0	.0	.3	.3	.0	.0	.0	.0
305	SHRIMP,UNCL	.0	3.0	.0	.3	.0	.0	.0	.0
	TOTAL, ALL SPP.	213.0	99.0	271.3	180.8	275.0	489.0	1404.8	751.3

TABLE 6. - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: MASS. BAY SEASON: WINTER		SURVEY 001 WINTER 1964 TOWS: 1		SURVEY 002 WINTER 1965 TOWS: 1	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS
026	LITTLE SKATE	.0	.0	2.0	2.0
028	THORNY SKATE	1.0	.0	1.0	.0
033	ALEWIFE	8.0	2.0	.0	.0
032	ATL HERRING	1.0	.0	.0	.0
197	GOOSEFISH	2.0	8.0	.0	.0
073	ATLANTIC COD	25.0	101.0	.0	.0
074	HADDOCK	15.0	40.0	1.0	1.0
072	SILVER HAKE	101.0	1.0	1.0	.0
075	POLLACK	1.0	1.0	1.0	.0
077	RED HAKE	13.0	1.0	1.0	1.0
076	WHITE HAKE	5.0	1.0	1.0	1.0
190	WOLF EELPOUT	5.0	.0	.0	.0
193	OCEAN POUT	4.0	10.0	.0	.0
113	ATL SILVERSIDE	4.0	.0	.0	.0
182	SNAKEBLenny	8.0	.0	.0	.0
155	REDFISH	696.0	324.0	.0	.0
164	SEA RAVEN	1.0	2.0	.0	.0
163	LH SCULPIN	4.0	1.0	4.0	1.0
165	ALLIGATORFISH	.0	.0	1.0	.0
108	WINDOWPANE	1.0	1.0	6.0	.0
107	WITCH FLBUNDER	8.0	.0	6.0	5.0
102	AM PLAICE	290.0	154.0	148.0	32.0
106	WINTER FLDR	2.0	2.0	.0	.0
000	MISCELLANEOUS	.0	.0	.0	2.0
	TOTAL, ALL SPP.	1195.0	649.0	173.0	45.0

TABLE 7 . . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: MASS. BAY SEASON: SPRING		SURVEY 803 SPRING 1968 TOWS: 2		SURVEY 711 SPRING 1971 TOWS: 1		SURVEY 722 SPRING 1972 TOWS: 1		SURVEY 733 SPRING 1973 TOWS: 4		SURVEY 744 SPRING 1974 TOWS: 6	
CODE	SPECIES	NUMBER	POUNDS								
026	LITTLE SKATE	.0	.0	2.0	1.0	.0	.0	.0	.0	.0	.0
023	WINTER SKATE	.0	.0	.0	.0	2.0	8.0	.3	.8	.0	.0
028	THORNY SKATE	1.0	3.0	1.0	2.0	6.0	91.0	3.3	7.8	1.5	1.0
034	BLUEBK HERRING	.0	.0	.0	.0	.0	.0	.5	.3	.0	.0
033	ALEWIFE	.5	.0	.0	.0	1.0	.0	18.3	2.3	12.2	1.2
032	ATL HERRING	.5	.5	.0	.0	.0	.0	174.5	66.0	13.8	4.2
197	GOOSEFISH	.5	13.5	.0	.0	.0	.0	3.3	57.0	2.0	9.3
083	4-BRD ROCKLING	.5	.0	.0	.0	.0	.0	16.5	2.0	9.0	1.0
073	ATLANTIC COD	4.0	23.5	1.0	.0	.0	.0	17.8	131.5	30.8	73.8
074	HADDUCK	3.0	11.0	.0	.0	.0	.0	.5	3.3	12.2	3.0
072	SILVER HAKE	.0	.0	4.0	.0	18.0	.0	17.8	3.0	408.8	20.3
075	POLLACK	.0	.0	.0	.0	.0	.0	2.0	10.5	.2	.0
077	RED HAKE	.0	.0	.0	.0	2.0	2.0	6.8	1.0	8.0	3.7
076	WHITE HAKE	.0	.0	.0	.0	13.0	7.0	2.0	1.0	4.2	2.5
190	WOLF EELPOUT	.0	.0	.0	.0	.0	.0	.0	.0	1.7	.0
193	OCEAN POUT	.0	.0	.0	.0	.0	.0	8.8	5.5	13.0	8.8
176	CUNNER	.0	.0	.0	.0	.0	.0	.3	.0	.3	.2
182	SNAKEBLenny	.0	.0	.0	.0	.0	.0	3.5	.8	8.7	.8
183	DAUBED SHANNY	.0	.0	6.0	.0	.0	.0	288.8	1.8	59.0	.0
184	RADIATD SHANNY	.0	.0	.0	.0	.0	.0	.0	.0	.2	.0
192	ATL WOLFFISH	.0	.0	.0	.0	.0	.0	.8	1.0	.2	.7
191	WRYMOUTH	.5	.0	.0	.0	.0	.0	.0	.0	.7	1.5
155	REDFISH	5.0	3.0	.0	.0	.0	.0	4.8	5.5	4.5	.8
164	SEA RAVEN	.5	1.5	.0	.0	.0	.0	1.0	2.3	.8	1.5
163	LH SCULPIN	.5	.0	.0	.0	1.0	.0	2.0	.5	.8	.7
161	MOUST SCULPIN	.5	.0	.0	.0	.0	.0	.0	.0	.2	.0
165	ALLIGATORFISH	.0	.0	.0	.0	.0	.0	1.8	.0	2.7	.0
104	4-SPOT FLOUNDR	.0	.0	.0	.0	.0	.0	.5	.0	.5	.0
108	WINDOWPANE	.0	.0	.0	.0	.0	.0	.3	.3	.0	.0
107	WITCH FLOUNDR	10.5	10.0	1.0	1.0	.0	.0	17.0	20.3	10.5	7.0
102	AM PLAICE	63.0	22.0	41.0	12.0	34.0	6.0	293.0	48.8	290.8	57.7
101	ATL HALIBUT	.0	.0	.0	.0	.0	.0	.0	.0	.2	2.0
105	YT FLOUNDR	1.0	.0	1.0	2.0	.0	.0	7.0	4.3	7.0	6.7
106	WINTER FLDR	.5	.5	.0	.0	.0	.0	.8	1.0	.5	1.3
401	SEA SCALLOP	.0	.0	.0	.0	.0	.0	.5	.5	4.7	.8
301	NO LOBSTER	.0	.0	.0	.0	.0	.0	.5	1.5	.5	.5
305	SHRIMP, UNCL	.0	18.0	.0	2.0	.0	6.0	.0	5.3	.0	7.5
	TOTAL, ALL SPP.	92.0	106.5	57.0	20.0	77.0	120.0	894.3	385.3	910.0	218.5

TABLE 8 . - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: MASS. BAY SEASON: SUMMER		SURVEY 510 SUMMER 1965 TOWS: 1		SURVEY 908 SUMMER 1969 TOWS: 1	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS
015	SPINY DOGFISH	108.0	585.0	11.0	33.0
028	THORNY SKATE	.0	.0	3.0	59.0
033	ALEWIFE	6.0	.0	.0	.0
035	AM SHAD	2.0	2.0	.0	.0
032	ATL HERRING	324.0	232.0	2.0	1.0
083	4-BRD ROCKLING	.0	.0	2.0	.0
073	ATLANTIC COD	6.0	29.0	1.0	1.0
074	HADDUCK	2.0	6.0	.0	.0
072	SILVER HAKE	2.0	.0	1.0	1.0
191	WRYMOUTH	.0	.0	7.0	12.0
121	ATL MACKEREL	.0	.0	1.0	.0
155	REDFISH	77.0	32.0	184.0	141.0
107	WITCH FLUNDER	1.0	.0	3.0	4.0
102	AM PLAICE	97.0	37.0	54.0	29.0
501	SQUID, UNCL	24.0	7.0	.0	.0
305	SHRIMP, UNCL	.0	.0	.0	30.0
	TOTAL, ALL SPP.	649.0	930.0	269.0	311.0

TABLE 9 . - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: MASS. BAY SEASON: FALL		SURVEY 007 FALL 1963 TOWS: 1		SURVEY 013 FALL 1964 TOWS: 1		SURVEY 014 FALL 1965 TOWS: 1		SURVEY 614 FALL 1966 TOWS: 1		SURVEY 716 FALL 1971 TOWS: 1	
CODE	SPECIES	NUMBER	POUNDS								
015	SPINY DOGFISH	41.0	216.0	10.0	43.0	2.0	17.0	18.0	95.0	7.0	40.0
022	BARNDORR SKATE	1.0	11.0	.0	.0	.0	.0	.0	.0	.0	.0
023	WINTER SKATE	11.0	182.0	.0	.0	.0	.0	.0	.0	.0	.0
028	THORNY SKATE	.0	.0	1.0	.0	7.0	70.0	2.0	25.0	2.0	44.0
033	ALEWIFE	.0	.0	.0	.0	.0	.0	.0	.0	10.0	3.0
035	AM SHAD	.0	.0	1.0	.0	.0	.0	.0	.0	1.0	1.0
032	ATL HERRING	9.0	6.0	.0	.0	3.0	3.0	12.0	9.0	237.0	118.0
197	GOOSEFISH	4.0	45.0	.0	.0	1.0	21.0	1.0	20.0	.0	.0
083	4-BRD ROCKLING	1.0	.0	.0	.0	1.0	1.0	4.0	1.0	2.0	1.0
073	ATLANTIC COD	.0	.0	5.0	31.0	.0	.0	1.0	2.0	34.0	154.0
074	HADDOCK	3.0	5.0	3.0	18.0	.0	.0	.0	.0	.0	.0
072	SILVER HAKE	534.0	134.0	132.0	101.0	.0	.0	9.0	4.0	228.0	93.0
075	POLLACK	.0	.0	.0	.0	.0	.0	1.0	1.0	1.0	21.0
077	RED HAKE	26.0	27.0	7.0	8.0	.0	.0	.0	.0	4.0	5.0
076	WHITE HAKE	.0	.0	2.0	11.0	.0	.0	8.0	42.0	17.0	25.0
183	DAUBED SHANNY	.0	.0	2.0	.0	.0	.0	4.0	.0	8.0	1.0
184	RADIATD SHANNY	.0	.0	.0	.0	3.0	.0	.0	.0	.0	.0
191	WRYMOUTH	.0	.0	.0	.0	2.0	5.0	1.0	2.0	.0	.0
121	ATL MACKEREL	1.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
155	REDFISH	10.0	4.0	74.0	26.0	28.0	9.0	5.0	2.0	3.0	2.0
163	LH SCULPIN	.0	.0	.0	.0	.0	.0	1.0	1.0	.0	.0
107	WITCH FLUNDER	93.0	20.0	9.0	6.0	17.0	9.0	6.0	4.0	.0	.0
102	AM PLAICE	426.0	181.0	67.0	26.0	170.0	75.0	246.0	42.0	61.0	10.0
401	SEA SCALLOP	.0	.0	.0	.0	.0	.0	.0	.0	1.0	1.0
502	SHORTFIN SQUID	.0	.0	.0	.0	.0	.0	.0	.0	14.0	10.0
503	LONGFIN SQUID	.0	.0	.0	.0	.0	.0	.0	.0	17.0	3.0
305	SHRIMP, UNCL	.0	.0	.0	.0	.0	.0	.0	.0	.0	14.0
000	MISCELLANEOUS	.0	.0	.0	4.0	.0	.0	.0	.0	.0	.0
	TOTAL, ALL SPP.	1160.0	831.0	313.0	274.0	234.0	210.0	319.0	250.0	647.0	546.0

TABLE 9. . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.
(CONTINUED)

AREA: MASS. BAY SEASON: FALL		SURVEY 728 FALL 1972 TOWS: 8		SURVEY 738 FALL 1973 TOWS: 3		SURVEY 748 FALL 1974 TOWS: 8	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
015	SPINY DOGFISH	2.3	10.6	12.7	83.7	10.9	51.0
021	ATL TORPEDO	.0	.0	.0	.0	.1	4.8
028	THORNY SKATE	2.4	7.1	.7	6.3	1.6	20.6
027	SMHTAIL SKATE	.0	.0	.0	.0	.1	.1
034	BLUEBK HERRING	.1	.0	.0	.0	.1	.0
033	ALEWIFE	.3	.0	8.7	1.3	31.5	9.9
035	AM SHAD	.0	.0	.0	.0	2.0	.9
036	ATL MENHADEN	.0	.0	.0	.0	.8	.5
032	ATL HERRING	.1	.0	.0	.0	1.6	.6
220	LANTRNFSH,UNCL	.0	.0	.0	.0	.3	.0
197	GOOSEFISH	.1	1.6	2.3	34.7	2.0	10.0
084	CUSK	.0	.0	.0	.0	.1	.6
083	4-BRD ROCKLING	1.1	.1	3.7	.3	7.0	1.3
073	ATLANTIC COD	28.0	51.4	18.0	32.3	10.0	30.4
074	HADDOCK	.4	.3	3.7	.3	2.6	1.5
072	SILVER HAKE	95.0	22.0	94.3	13.0	499.6	29.6
075	POLLACK	14.9	12.3	20.0	292.0	.3	2.1
077	RED HAKE	13.5	6.0	4.3	3.0	13.9	12.6
076	WHITE HAKE	12.9	9.8	21.7	19.7	6.1	14.6
193	OCEAN POUT	.5	.4	1.3	.7	.0	.0
116	NO PIPEFISH	.0	.0	.0	.0	.1	.0
143	SCUP	.0	.0	.0	.0	.3	.0
176	CUNNER	.5	.0	.3	.3	.3	.0
183	DAUBED SHANNY	8.3	.0	.0	.0	.6	.0
192	ATL WOLFFISH	.3	.5	.3	1.0	.0	.0
121	ATL MACKEREL	.0	.0	.3	.3	.5	.4
131	BUTTERFISH	.0	.0	.7	.0	.0	.0
155	REDFISH	12.3	3.1	4.0	.7	7.4	2.3
171	NO SEAROBIN	.0	.0	.0	.0	.4	.0
159	HOOKEAR SCULPN	.0	.0	.0	.0	.3	.0
164	SEA RAVEN	1.5	2.6	1.3	.3	.4	1.3
163	LH SCULPIN	2.4	.4	2.3	.7	.4	.1
161	MOUT SCULPIN	.4	.0	.3	.0	.0	.0
165	ALLIGATORFISH	.3	.0	.0	.0	.0	.0
104	4-SPOT FLOUNDR	.1	.0	.0	.0	.4	.0
108	WINDOWPANE	1.8	.9	.0	.0	.1	.0
107	WITCH FLOUNDER	4.5	8.1	2.0	.7	15.5	4.8
102	AM PLAICE	70.1	10.1	133.7	19.7	134.9	38.9
105	YT FLOUNDER	5.0	1.6	2.7	2.7	.0	.0
106	WINTER FLDR	.4	.5	.0	.0	.0	.0
401	SEA SCALLOP	3.0	.3	.0	.0	2.3	.3
502	SHORTFIN SQUID	.1	.1	.7	.7	2.3	2.0
503	LONGFIN SQUID	.0	.0	.3	.0	61.6	3.6
301	NO LOBSTER	.9	1.4	1.0	1.3	.0	.0
305	SHRIMP,UNCL	.0	7.5	.0	5.3	.0	3.6
	TOTAL, ALL SPP.	283.1	158.6	341.3	521.0	818.1	248.3

TABLE 10 . . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: STELLWAGEN SEASON: WINTER		SURVEY 001 WINTER 1964 TOWS: 4		SURVEY 002 WINTER 1965 TOWS: 2		SURVEY 601 WINTER 1966 TOWS: 2	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
026	LITTLE SKATE	1.3	1.8	.5	.5	1.0	2.5
023	WINTER SKATE	19.0	111.3	.0	.0	2.5	30.0
028	THORNY SKATE	.0	.0	4.0	7.0	3.0	8.5
027	SMTHTAIL SKATE	.0	.0	.0	.0	1.0	1.0
020	SKATE, UNCL	.3	.0	.0	.0	.0	.0
033	ALEWIFE	.8	.0	.0	.0	.0	.0
032	ATL HERRING	.8	.0	.0	.0	.0	.0
197	GOOSEFISH	1.0	11.3	.0	.0	.0	.0
084	CUSK	.0	.0	.0	.0	.5	5.5
073	ATLANTIC COD	20.8	60.2	36.5	104.5	12.0	28.0
074	HADDOCK	5.0	2.5	93.5	60.0	18.5	30.5
072	SILVER HAKE	3.0	.5	.0	.0	.0	.0
075	POLLACK	1.0	.0	1.5	1.5	2.5	2.0
077	RED HAKE	12.5	.3	.0	.0	.0	.0
076	WHITE HAKE	.0	.0	1.5	.5	.5	.0
193	OCEAN BUT	3.0	10.3	11.0	25.0	2.0	5.0
113	ATL SILVERSIDE	2.5	.0	.0	.0	.0	.0
183	DAUBED SHANNY	.0	.0	.0	.0	.5	.0
192	ATL WOLFFISH	.0	.0	.5	6.0	1.0	6.0
156	BLKBY ROSEFISH ^{1/}	.0	.0	59.0	3.0	.0	.0
155	REDFISH	1.8	1.0	.0	.0	14.0	1.0
164	SEA RAVEN	1.0	1.5	1.5	2.0	2.0	6.0
163	LH SCULPIN	6.5	2.0	11.5	4.0	13.5	2.0
161	MOUST SCULPIN	.0	.0	.0	.0	3.5	.0
165	ALLIGATORFISH	.3	.0	.0	.0	.0	.0
168	LUMPFISH	.0	.0	.0	.0	.5	.0
108	WINDOWPANE	12.0	6.8	.0	.0	.0	.0
107	WITCH FLounder	.3	.5	.0	.0	.0	.0
102	AM PLAICE	6.0	3.0	41.0	13.5	47.0	9.0
105	YT FLounder	74.8	37.5	10.0	10.5	8.0	3.5
106	WINTER FLDR	7.0	15.3	1.5	1.5	.5	1.0
100	FLounder, UNCL	.0	.0	.0	.0	.5	.0
000	MISCELLANEOUS	.0	.0	.0	.0	.0	.5
TOTAL, ALL SPP.		180.3	265.5	273.5	239.5	134.5	142.0

^{1/} It is likely that these fish were redfish rather than blackbelly rosefish. We base this opinion on distribution records and size of the fish.

TABLE 11. - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: STELLWAGEN SEASON: SPRING		SURVEY 703 SPRING 1970 TOWS: 2		SURVEY 722 SPRING 1972 TOWS: 2		SURVEY 733 SPRING 1973 TOWS: 3		SURVEY 744 SPRING 1974 TOWS: 1	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
001	ATL HAGFISH	.0	.0	.0	.0	.3	.0	.0	.0
015	SPINY DOGFISH	.0	.0	.0	.0	1.0	6.7	3.0	24.0
023	WINTER SKATE	.5	3.0	4.5	15.0	.0	.0	.0	.0
028	THORNY SKATE	2.0	6.5	.0	.0	8.3	23.7	2.0	20.0
027	SMTHTAIL SKATE	.0	.0	.0	.0	2.7	3.3	1.0	2.0
034	BLUEBK HERRING	.0	.0	.0	.0	.7	.0	.0	.0
033	ALEWIFE	.0	.0	.0	.0	3.7	1.3	4.0	1.0
032	ATL HERRING	.0	.0	2.5	1.0	93.3	51.3	.0	.0
197	GOOSEFISH	.0	.0	.0	.0	.7	15.7	2.0	1.0
083	4-BRD ROCKLING	.5	.0	.0	.0	.0	.0	31.0	6.0
073	ATLANTIC COD	7.5	31.0	6.0	39.5	83.7	401.0	2.0	45.0
074	HADDOCK	.0	.0	.5	.0	4.7	3.3	.0	.0
072	SILVER HAKE	.0	.0	.0	.0	.3	.3	203.0	12.0
075	POLLACK	.0	.0	1.0	.0	3.7	1.7	.0	.0
077	RED HAKE	.0	.0	.0	.0	4.7	4.0	1.0	.0
076	WHITE HAKE	.0	.0	.0	.0	.7	.7	5.0	4.0
190	WBLF EELPOUT	.0	.0	.0	.0	.0	.0	30.0	.0
193	OCEAN POUT	6.0	12.0	5.0	25.5	5.0	8.0	.0	.0
176	CUNNER	.0	.0	.0	.0	.3	.0	.0	.0
182	SNAKEBLenny	.0	.0	.0	.0	.7	.0	.0	.0
183	DAUBED SHANNY	.5	.0	.0	.0	1.0	.0	2.0	.0
192	ATL WOLFFISH	3.5	70.5	1.5	36.0	3.7	63.7	.0	.0
181	AM SAND LANCE	.0	.0	1.0	.0	.0	.0	.0	.0
155	REDFISH	.0	.0	.0	.0	20.0	39.7	1.0	.0
164	SEA RAVEN	1.5	7.5	.0	.0	.3	.3	.0	.0
163	LH SCULPIN	6.0	1.5	.0	.0	2.0	1.3	.0	.0
161	MOUST SCULPIN	2.0	.0	.0	.0	4.7	.0	.0	.0
165	ALLIGATORFISH	.0	.0	.0	.0	.3	.0	.0	.0
168	LUMPFISH	.0	.0	.5	.0	.0	.0	.0	.0
104	4-SPOT FLOUNDR	.0	.0	.0	.0	.3	.0	.0	.0
108	WINDGWANE	2.0	1.0	.0	.0	.0	.0	.0	.0
107	WITCH FLOUNDER	.0	.0	.0	.0	2.0	4.7	66.0	19.0
102	AM PLAICE	9.0	7.5	.0	.0	84.7	19.0	330.0	87.0
101	ATL HALIBUT	.0	.0	.0	.0	.3	2.3	.0	.0
105	YT FLOUNDER	11.0	8.5	5.5	2.5	10.0	4.3	10.0	12.0
401	SEA SCALLOP	1.0	1.0	.0	.0	.0	.0	18.0	3.0
301	NO LOBSTER	.0	.0	.0	.0	1.0	2.0	.0	.0
305	SHRIMP UNCL	.0	.5	.0	.0	.0	.0	.0	30.0
TOTAL ALL SPP.		53.0	150.5	28.0	119.5	344.7	658.3	711.0	266.0

TABLE 12. - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: STELLWAGEN SEASON: SUMMER		SURVEY 005 SUMMER 1963 TOWS: 3		SURVEY 210 SUMMER 1964 TOWS: 3		SURVEY 510 SUMMER 1965 TOWS: 2	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
015	SPINY DOGFISH	8.3	49.3	123.7	348.3	24.0	127.5
026	LITTLE SKATE	1.3	3.0	.0	.0	.5	1.0
023	WINTER SKATE	10.3	85.0	.3	.7	.0	.0
028	THORNY SKATE	.0	.0	1.0	14.3	.0	.0
034	BLUEBK HERRING	.0	.0	33.0	15.3	8.0	2.5
033	ALEWIFE	5.7	3.7	.0	.0	3.5	1.5
035	AM SHAD	.0	.0	2.0	2.7	.5	1.0
032	ATL HERRING	209.3	126.7	.0	.0	4.0	2.5
197	GOOSEFISH	.3	7.0	.3	7.0	.5	12.0
073	ATLANTIC COD	21.3	55.7	28.3	31.3	8.0	27.5
074	HADDØCK	93.3	133.3	767.3	376.3	62.5	42.0
072	SILVER HAKE	92.7	49.3	52.0	19.3	1.0	.5
075	PØLLØCK	1.0	.7	.7	5.0	.0	.0
077	RED HAKE	1.0	.3	.0	.0	.0	.0
076	WHITE HAKE	.0	.0	.3	2.3	.0	.0
193	OCEAN PØUT	.0	.0	.0	.0	4.5	24.0
183	DAUBED SHANNY	.0	.0	.0	.0	.5	.0
192	ATL WØLFFISH	.0	.0	.0	.0	.5	13.5
131	BUTTERFISH	.0	.0	1.0	.3	.0	.0
164	SEA RAVEN	.3	.3	.7	2.3	.0	.0
163	LH SCULPIN	2.3	1.0	.0	.0	.0	.0
102	AM PLAICE	3.0	1.3	45.3	21.0	26.0	6.5
101	ATL HALIBUT	2.0	2.7	2.0	13.7	1.0	13.5
105	YT FLØUNDER	4.3	4.0	1.0	1.3	9.0	10.5
106	WINTER FLDR	16.7	20.0	1.7	4.0	1.0	1.5
501	SQUID, UNCL	.0	.0	19.3	7.3	148.0	33.5
000	MISCELLANEOUS	.0	.0	.0	.0	.0	.5
	TOTAL, ALL SPP.	473.3	543.3	1080.0	872.7	303.0	321.5

TABLE 13. - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: STELLWAGEN SEASON: FALL		SURVEY 007 FALL 1963 TOWS: 4		SURVEY 013 FALL 1964 TOWS: 1		SURVEY 014 FALL 1965 TOWS: 1		SURVEY 721 FALL 1967 TOWS: 2		SURVEY 817 FALL 1968 TOWS: 1	
CODE	SPECIES	NUMBER	POUNDS								
015	SPINY DOGFISH	25.8	117.3	6.0	29.0	61.0	296.0	85.0	431.0	21.0	94.0
026	LITTLE SKATE	3.5	5.8	.0	.0	.0	.0	.0	.0	.0	.0
023	WINTER SKATE	18.5	123.8	3.0	17.0	7.0	42.0	.0	.0	.0	.0
034	BLUEBK HERRING	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
033	ALEWIFE	1.3	.5	.0	.0	.0	.0	10.0	4.5	1.0	.0
035	AM SHAD	.0	.0	.0	.0	.0	.0	12.0	23.0	.0	.0
036	ATL MENHADEN	.0	.0	.0	.0	.0	.0	.5	.5	.0	.0
032	ATL HERRING	1.3	.5	.0	.0	5.0	2.0	.0	.0	.0	.0
031	ROUND HERRING	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
197	GOOSEFISH	.0	.0	1.0	6.0	1.0	27.0	1.0	13.0	.0	.0
073	ATLANTIC COD	26.3	44.8	12.0	33.0	49.0	232.0	9.5	28.0	4.0	10.0
074	HADDACK	111.0	44.3	203.0	112.0	255.0	276.0	32.0	69.0	18.0	52.0
072	SILVER HAKE	24.0	17.3	28.0	71.0	4.0	3.0	62.0	40.5	7.0	21.0
075	POLLACK	1.0	16.8	1.0	12.0	3.0	31.0	.0	.0	1.0	1.0
077	RED HAKE	12.3	4.8	5.0	5.0	.0	.0	.0	.0	4.0	2.0
076	WHITE HAKE	.3	.3	.0	.0	.0	.0	4.5	1.5	.0	.0
193	OCEAN POUT	1.8	2.8	.0	.0	.0	.0	.0	.0	.0	.0
176	CUNNER	.3	.5	.0	.0	.0	.0	.0	.0	.0	.0
192	ATL WOLFFISH	.3	.3	.0	.0	1.0	14.0	.0	.0	1.0	6.0
181	AM SAND LANCE	.0	.0	.0	.0	1.0	.0	.0	.0	.0	.0
131	BUTTERFISH	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
155	REDFISH	.3	.0	.0	.0	.0	.0	57.5	26.0	.0	.0
164	SEA RAVEN	1.8	1.0	.0	.0	2.0	2.0	.0	.0	.0	.0
163	LH SCULPIN	15.0	3.3	4.0	4.0	.0	.0	.0	.0	1.0	.0
162	SH SCULPIN	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
165	ALLIGATORFISH	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
104	4-SPOT FLOUNDR	1.5	.5	.0	.0	.0	.0	.0	.0	.0	.0
108	WINDOWPANE	1.3	.8	3.0	1.0	.0	.0	.0	.0	.0	.0
107	WITCH FLOUNDER	.0	.0	.0	.0	.0	.0	5.0	6.0	.0	.0
102	AM PLAICE	9.0	4.8	7.0	4.0	.0	.0	178.0	42.0	.0	.0
101	ATL HALIBUT	.3	1.5	1.0	4.0	.0	.0	.0	.0	.0	.0
105	YT FLOUNDER	36.3	39.5	54.0	39.0	10.0	5.0	.0	.0	8.0	3.0
106	WINTER FLDR	1.3	3.5	.0	.0	53.0	140.0	.0	.0	.0	.0
502	SHORTFIN SQUID	.0	.0	.0	.0	.0	.0	20.5	12.5	.0	.0
503	LONGFIN SQUID	.0	.0	.0	.0	.0	.0	68.5	4.5	2.0	.0
000	MISCELLANEOUS	.0	.0	.0	.0	.0	.0	.0	.5	.0	.0
	TOTAL, ALL SPP.	294.5	434.0	328.0	337.0	452.0	1070.0	547.0	702.5	68.0	189.0

TABLE 13 . - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.
(CONTINUED)

AREA: STELLWAGEN SEASON: FALL		SURVEY 911 FALL 1969 TOWS: 2		SURVEY 706 FALL 1970 TOWS: 3		SURVEY 716 FALL 1971 TOWS: 1		SURVEY 728 FALL 1972 TOWS: 2		SURVEY 738 FALL 1973 TOWS: 3	
CODE	SPECIES	NUMBER	POUNDS								
001	ATL HAGFISH	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
015	SPINY DOGFISH	31.5	161.0	9.3	43.0	1.0	5.0	12.5	65.0	.7	3.3
026	LITTLE SKATE	.0	.0	.0	.0	.0	.0	.5	1.0	.0	.0
023	WINTER SKATE	.0	.0	.7	1.0	.0	.0	12.0	46.0	.0	.0
028	THORNY SKATE	3.0	27.0	.0	.0	3.0	55.0	6.0	9.5	.3	1.0
027	SMHTAIL SKATE	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
033	ALEWIFE	7.5	3.0	.3	.0	.0	.0	.0	.0	.0	.0
035	AM SHAD	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
032	ATL HERRING	.0	.0	.0	.0	3.0	2.0	.0	.0	.7	.7
197	GOOSEFISH	.0	.0	.0	.0	2.0	15.0	.5	1.0	.3	3.3
084	CUSK	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
083	4-BRD ROCKLING	.0	.0	.0	.0	1.0	.0	12.5	1.5	.0	.0
073	ATLANTIC COD	10.5	50.0	38.0	35.7	44.0	.0	157.0	129.0	28.0	10.0
074	HADDUCK	2.0	10.5	1.7	8.7	.0	.0	3.0	1.5	9.7	2.0
072	SILVER HAKE	23.0	10.5	.3	.0	204.0	19.0	53.5	13.5	5.7	4.3
075	POLLACK	.0	.0	.0	.0	.0	.0	.0	.0	3.7	35.3
077	RED HAKE	.5	.0	.0	.0	7.0	8.0	76.0	60.0	.7	.7
076	WHITE HAKE	20.0	28.5	.0	.0	16.0	19.0	5.5	10.5	1.0	1.7
193	OCEAN POUT	1.0	1.0	.0	.0	.0	.0	35.0	27.0	.0	.0
115	3-SP STICKLEBK	.0	.0	.0	.0	1.0	.0	.0	.0	.0	.0
182	SNAKEBLenny	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
183	DAUBED SHANNY	.0	.0	.0	.0	2.0	.0	1.5	.0	.0	.0
192	ATL WOLFFISH	.0	.0	.0	.0	.0	.0	2.0	15.0	2.3	1.3
121	ATL MACKEREL	.0	.0	1.0	.7	.0	.0	.0	.0	.0	.0
155	REDFISH	417.5	89.5	.0	.0	6.0	2.0	.5	.0	4.0	3.7
171	NO SEAROBIN	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
159	HOOKEAR SCULPN	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
164	SEA RAVEN	.5	.0	.3	1.7	.0	.0	10.5	9.0	1.0	.7
163	LH SCULPIN	6.0	2.5	1.7	.0	.0	.0	45.0	10.0	4.7	1.7
161	MOUT SCULPIN	3.5	.0	.0	.0	.0	.0	5.0	.5	.0	.0
165	ALLIGATORFISH	1.5	.0	.0	.0	.0	.0	4.0	.0	.0	.0
104	4-SPOT FLounder	.0	.0	.0	.0	.0	.0	2.0	1.0	.3	.0
107	WITCH FLounder	11.0	17.5	.0	.0	43.0	.0	.5	1.5	.7	1.3
102	AM PLAICE	84.0	26.5	.0	.0	198.0	41.0	40.5	6.0	11.3	3.0
105	YT FLounder	9.0	12.0	7.3	4.0	.0	.0	82.5	40.0	11.0	10.0
106	WINTER FLDR	1.0	2.0	1.7	7.0	.0	.0	5.5	10.0	.7	1.3
401	SEA SCALLOP	.0	.0	1.0	.0	3.0	.0	.5	.0	.0	.0
502	SHORTFIN SQUID	3.0	1.5	.0	.0	.0	.0	1.0	1.0	.3	.7
503	LONGFIN SQUID	.5	.0	38.3	3.3	.0	.0	.5	.0	.3	.0
313	ROCK CRAB	.0	.0	.0	.0	.0	.0	3.0	.0	.0	.0
305	SHRIMP, UNCL	.0	9.0	.0	.0	.0	45.0	.0	.0	.0	.0
	TOTAL, ALL SPP.	638.5	452.0	101.7	105.0	534.0	211.0	580.0	459.5	87.3	86.0

TABLE 13. - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.
(CONTINUED)

AREA: STELLWAGEN
SEASON: FALL

SURVEY 748
FALL 1974
TOWS: 2

CODE	SPECIES	NUMBER	POUNDS
015	SPINY DOGFISH	18.0	91.5
028	THORNY SKATE	3.5	16.0
032	ATL HERRING	1.0	.5
230	COM PEARLSIDES	1.5	.0
197	GOOSEFISH	1.0	5.5
083	4-BRD ROCKLING	10.5	2.5
073	ATLANTIC COD	37.0	32.0
074	HADDOCK	38.5	30.5
072	SILVER HAKE	17.0	8.0
075	POLLACK	2.5	19.0
077	RED HAKE	7.0	7.5
076	WHITE HAKE	7.5	23.0
193	OCEAN POUT	1.5	1.5
192	ATL WOLFFISH	.5	.5
155	REDFISH	43.5	19.5
159	HOOKEAR SCULPN	2.0	.0
163	LH SCULPIN	7.0	2.0
161	MOUT SCULPIN	2.0	.0
107	WITCH FLOUNDER	10.0	8.0
102	AM PLAICE	97.0	30.0
106	WINTER FLDR	1.5	1.5
401	SEA SCALLOP	1.5	.0
305	SHRIMP, UNCL	.0	10.0
	TOTAL, ALL SPP.	311.5	309.0

TABLE 14. - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: OUTER GROUND SEASON: WINTER		SURVEY 001 WINTER 1964 TOWS: 2		SURVEY 002 WINTER 1965 TOWS: 1		SURVEY 601 WINTER 1966 TOWS: 2	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
015	SPINY DOGFISH	.0	.0	1.0	6.0	.0	.0
026	LITTLE SKATE	.0	.0	1.0	1.0	.5	1.0
023	WINTER SKATE	1.0	3.0	.0	.0	.5	5.0
028	THORNY SKATE	.5	.0	2.0	1.0	4.0	47.5
027	SMHTAIL SKATE	.0	.0	.0	.0	.5	1.0
033	ALEWIFE	1.5	.5	.0	.0	.0	.0
197	GOOSEFISH	2.0	22.5	1.0	22.0	.5	7.5
084	CUSK	.5	2.0	.0	.0	.0	.0
073	ATLANTIC COD	22.0	78.5	11.0	13.0	15.0	60.0
074	HADDOCK	229.5	310.0	44.0	38.0	31.0	56.0
072	SILVER HAKE	3.5	.0	.0	.0	.0	.0
075	POLLACK	2.5	6.0	2.0	13.0	1.0	.5
077	RED HAKE	5.5	.0	.0	.0	2.0	.5
193	OCEAN POUT	4.5	5.5	.0	.0	.5	.5
113	ATL SILVERSIDE	.5	.0	.0	.0	.0	.0
182	SNAKEBLenny	.0	.0	.0	.0	.5	.0
183	DAUBED SHANNY	.0	.0	.0	.0	.5	.0
192	ATL WOLFFISH	2.0	21.0	2.0	14.0	2.0	5.0
155	REDFISH	82.0	17.0	9.0	.0	75.0	17.5
164	SEA RAVEN	1.5	1.5	1.0	6.0	1.5	.5
163	LH SCULPIN	1.0	.5	7.0	.0	9.0	3.5
161	MOUT SCULPIN	1.0	.0	1.0	.0	.0	.0
165	ALLIGATORFISH	.5	.0	.0	.0	.5	.0
107	WITCH FLounder	.0	.0	.0	.0	25.5	26.0
102	AM PLAICE	33.5	27.5	13.0	4.0	22.0	10.0
101	ATL HALIBUT	.0	.0	1.0	3.0	.0	.0
105	YT FLounder	.0	.0	.0	.0	4.5	2.0
000	MISCELLANEOUS	.0	.0	.0	1.0	.0	.0
	TOTAL, ALL SPP.	395.0	495.5	96.0	122.0	196.5	244.0

TABLE 15. - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: OUTER GROUND SEASON: SPRING		SURVEY 803 SPRING 1968 TOWS: 2		SURVEY 902 SPRING 1969 TOWS: 5		SURVEY 703 SPRING 1970 TOWS: 2		SURVEY 711 SPRING 1971 TOWS: 4		SURVEY 722 SPRING 1972 TOWS: 2	
CODE	SPECIES	NUMBER	POUNDS								
015	SPINY DOGFISH	.0	.0	.6	3.8	.0	.0	.0	.0	.0	.0
023	WINTER SKATE	.0	.0	.0	.0	.5	8.0	.0	.0	.0	.0
028	THORNY SKATE	3.5	6.0	.0	.0	2.5	4.0	1.0	.8	1.5	4.5
027	SPYTAIL SKATE	.0	.0	.0	.0	2.5	2.0	.0	.0	.0	.0
033	ALEWIFE	.0	.0	.8	.0	.0	.0	.0	.0	.0	.0
032	ATL HERRING	.0	.0	.8	.4	1.5	1.0	.3	.0	.0	.0
197	GOOSEFISH	.5	3.5	.2	1.8	.0	.0	.5	5.5	.0	.0
084	CUSK	.0	.0	.6	3.4	.5	.0	.3	.3	.0	.0
073	ATLANTIC COD	22.0	112.5	6.8	57.6	13.5	130.5	4.5	46.8	6.0	41.5
074	HADDUCK	2.5	2.5	9.6	38.8	.0	.0	4.5	26.3	1.0	.0
072	SILVER HAKE	.0	.0	.0	.0	.5	.0	.0	.0	2.5	.0
075	POLLACK	1.0	15.0	1.4	5.6	2.5	.5	.0	.0	2.0	2.5
077	RED HAKE	.0	.0	.0	.0	.0	.0	.3	.3	.0	.0
076	WHITE HAKE	.0	.0	.0	.0	.0	.0	.0	.0	.5	.0
190	WOLF EELPOUT	.0	.0	.2	.2	.0	.0	.0	.0	.0	.0
193	OCEAN POUT	.5	.5	.6	2.8	6.0	10.5	.0	.0	2.5	.0
183	DAUBED SHANNY	.0	.0	.0	.0	1.0	.0	2.5	.0	.5	.0
192	ATL WOLFFISH	2.0	26.0	1.0	16.0	5.0	15.0	1.5	7.0	17.0	9.0
155	REDFISH	1.0	.0	6.8	1.4	1.0	.0	64.0	25.3	32.0	1.0
159	HOOKEAR SCULPIN	.5	.0	.0	.0	.0	.0	.0	.0	12.5	.0
164	SEA RAVEN	3.5	10.0	.0	.0	.5	.0	.3	.0	4.5	2.5
163	LH SCULPIN	5.0	2.5	.0	.0	1.5	.0	.5	.0	1.0	.0
161	MUST SCULPIN	4.5	.0	.4	.0	9.5	.0	.0	.0	5.0	.0
165	ALLIGATORFISH	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
109	GSTR FLOUNDER	.0	.0	.0	.0	.0	.0	.0	.0	4.0	.0
107	WITCH FLOUNDER	.5	1.5	.2	.4	1.0	.5	1.3	2.3	1.5	2.5
102	AM PLAICE	2.0	.0	6.6	2.8	3.0	.5	6.8	3.8	5.0	1.0
101	ATL HALIBUT	.0	.0	.2	2.0	.5	4.0	.0	.0	.5	1.0
105	YT FLOUNDER	.0	.0	.0	.0	3.0	.5	.0	.0	.5	.0
106	WINTER FLDR	1.5	5.0	.0	.0	1.5	12.5	.0	.0	.0	.0
305	SHRIMP, UNCL	.0	.0	.0	.0	.0	.0	.0	.3	.0	.0
	TOTAL, ALL SPP.	51.0	185.0	36.8	137.0	57.5	189.5	88.0	118.3	100.0	65.5

TABLE 15. - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.
(CONTINUED)

AREA: OUTER GROUND SEASON: SPRING		SURVEY 733 SPRING 1973 TOWS: 4		SURVEY 744 SPRING 1974 TOWS: 7	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS
001	ATL HAGFISH	.3	.0	.6	.0
024	CLEARNSE SKATE	.0	.0	.7	.1
026	LITTLE SKATE	.0	.0	.1	.0
028	THORNY SKATE	1.8	2.3	.7	1.1
027	SMHTAIL SKATE	.8	.8	.0	.0
034	BLUEBK HERRING	.3	.0	.0	.0
033	ALEWIFE	5.8	.8	.3	.0
035	AM SHAD	.3	.0	.0	.0
032	ATL HERRING	.3	.3	.9	.1
197	GOOSEFISH	.8	6.5	.9	6.4
084	CUSK	.3	1.0	.6	.9
083	4-BRD ROCKLING	1.5	.0	1.4	.0
073	ATLANTIC COD	17.5	40.0	18.7	36.6
074	HADDCK	13.0	22.0	13.0	7.3
072	SILVER HAKE	6.5	1.3	30.3	1.7
075	POLLCK	6.8	4.3	3.0	9.6
077	RED HAKE	1.8	.5	2.6	1.0
076	WHITE HAKE	7.0	4.8	1.3	.9
193	OCEAN POUT	2.3	4.3	2.9	2.4
182	SNAKEBLENNY	2.3	.0	.0	.0
183	DAUBED SHANNY	.0	.0	6.4	.0
192	ATL WOLFFISH	1.0	3.3	6.0	11.3
155	REDFISH	9.8	1.0	9.3	.9
159	HOBKEAR SCULPN	.0	.0	6.1	.0
164	SEA RAVEN	1.0	1.3	1.1	2.0
163	LH SCULPIN	1.0	.3	1.9	.4
161	MOUST SCULPIN	.5	.0	1.0	.0
160	SCULPIN, UNCL	.0	.0	.1	.0
165	ALLIGATORFISH	.5	.0	1.4	.0
104	4-SPBT FLBUNDR	.3	.3	.6	.0
107	WITCH FLBUNDER	7.3	10.5	3.4	3.0
102	AM PLAICE	19.5	5.0	28.0	7.7
101	ATL HALIBUT	.0	.0	.1	.3
105	YT FLBUNDER	.0	.0	.9	1.0
401	SEA SCALLOP	.0	.0	.0	5.1
301	NO LOBSTER	.0	.0	.1	.1
310	RED CRAB	.0	.0	.4	.0
305	SHRIMP, UNCL	.0	.0	.0	2.3
	TOTAL, ALL SPP.	109.5	110.0	144.9	102.3

TABLE 16 . - - MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: OUTER GROUND SEASON: SUMMER		SURVEY 005 SUMMER 1963 TOWS: 3		SURVEY 210 SUMMER 1964 TOWS: 1		SURVEY 510 SUMMER 1965 TOWS: 1		SURVEY 908 SUMMER 1969 TOWS: 3	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS	NUMBER	POUNDS
001	ATL HAGFISH	.0	.0	1.0	.0	.0	.0	.0	.0
015	SPINY DOGFISH	18.0	57.3	4.0	13.0	3.0	19.0	1.3	5.0
023	WINTER SKATE	.0	.0	.0	.0	1.0	.0	.0	.0
028	THORNY SKATE	3.7	4.0	1.0	2.0	.0	.0	.7	1.7
027	SMTHTAIL SKATE	.3	.3	.0	.0	.0	.0	.7	1.0
032	ATL HERRING	10.3	4.0	.0	.0	.0	.0	6.0	4.7
197	GOOSEFISH	.3	1.7	.0	.0	.0	.0	1.3	19.7
073	ATLANTIC COD	1.7	13.0	5.0	41.0	4.0	19.0	22.7	228.3
074	HADDACK	14.0	16.7	35.0	19.0	132.0	90.0	6.3	27.7
072	SILVER HAKE	5.7	3.0	1.0	.0	1.0	.0	8.7	8.0
075	POLLACK	.3	6.3	.0	.0	.0	.0	.3	5.3
077	RED HAKE	37.0	25.0	.0	.0	.0	.0	3.3	4.3
076	WHITE HAKE	.0	.0	.0	.0	.0	.0	1.7	7.3
193	OCEAN POUT	.0	.0	1.0	.0	.0	.0	3.0	2.7
182	SNAKEBLenny	1.0	.0	.0	.0	.0	.0	.0	.0
183	DAUBED SHANNY	.0	.0	2.0	.0	.0	.0	7.7	.0
192	ATL WOLFFISH	.0	.0	.0	.0	.0	.0	4.0	2.7
155	REDFISH	5.7	1.3	209.0	39.0	.0	.0	51.0	9.3
159	HOOKEAR SCULPN	.0	.0	.0	.0	.0	.0	4.7	.0
164	SEA RAVEN	.3	1.3	2.0	3.0	.0	.0	3.3	2.0
163	LH SCULPIN	1.0	.0	3.0	.0	.0	.0	2.7	1.3
161	MOUT SCULPIN	.0	.0	.0	.0	.0	.0	10.0	.3
107	WITCH FLUNDER	2.0	5.0	7.0	5.0	.0	.0	.3	.3
102	AM PLAICE	48.0	18.0	29.0	15.0	.0	.0	24.7	7.3
105	YT FLUNDER	5.3	3.3	3.0	2.0	.0	.0	.0	.0
106	WINTER FLDR	.0	.0	1.0	3.0	1.0	2.0	.0	.0
502	SHORTFIN SQUID	.0	.0	.0	.0	.0	.0	18.0	5.7
501	SQUID, UNCL	.0	.0	5.0	2.0	12.0	2.0	.0	.0
301	NO LOBSTER	.0	.0	.0	.0	.0	.0	.3	.3
000	MISCELLANEOUS	.0	.0	.0	.0	.0	1.0	.0	.0
	TOTAL, ALL SPP.	154.7	160.3	309.0	144.0	154.0	133.0	182.7	345.0

TABLE 17. . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.

AREA: OUTER GROUND SEASON: FALL		SURVEY 007 FALL 1963 TOWS: 2		SURVEY 013 FALL 1964 TOWS: 2		SURVEY 014 FALL 1965 TOWS: 2		SURVEY 614 FALL 1966 TOWS: 3		SURVEY 721 FALL 1967 TOWS: 3	
CODE	SPECIES	NUMBER	POUNDS								
001	ATL HAGFISH	.0	.0	.0	.0	.0	.0	1.3	.0	.0	.0
015	SPINY DOGFISH	111.5	421.0	16.5	65.5	121.5	398.5	11.7	35.7	6.0	34.3
026	LITTLE SKATE	.5	1.0	.0	.0	.0	.0	.0	.0	.0	.0
023	WINTER SKATE	.5	5.0	.0	.0	.0	.0	.0	.0	.0	.0
028	THORNY SKATE	.0	.0	2.0	44.0	.5	.5	2.0	5.0	1.0	1.3
027	SMTHTAIL SKATE	.0	.0	.0	.0	.0	.0	.7	.7	.0	.0
033	ALEWIFE	.5	.0	.0	.0	.0	.0	.0	.0	1.0	.3
035	AM SHAD	.5	.0	.0	.0	.0	.0	.0	.0	.3	.3
032	ATL HERRING	11.0	5.0	.0	.0	.5	.0	2.0	1.0	.3	.3
197	GOOSEFISH	1.5	15.0	.5	.0	1.0	11.5	.0	.0	.0	.0
084	CUSK	.0	.0	.5	1.5	1.0	12.0	2.0	2.7	.0	.0
083	4-BRD ROCKLING	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0
073	ATLANTIC COD	7.0	20.5	2.0	7.0	21.5	61.0	22.3	175.7	6.3	43.7
074	HADDUCK	299.5	352.5	11.5	13.0	55.0	120.0	22.7	52.7	28.0	63.3
072	SILVER HAKE	85.0	14.5	12.5	6.5	.0	.0	.0	.0	1.7	1.3
075	POLLACK	11.5	122.5	1.0	6.0	2.0	12.0	.3	.7	.7	4.0
077	RED HAKE	12.0	5.0	5.0	7.0	.0	.0	.3	.0	1.0	1.3
076	WHITE HAKE	2.0	8.5	3.0	5.0	.0	.0	.3	2.3	.3	1.7
193	OCEAN POUT	.5	1.5	.0	.0	3.0	.5	1.0	.3	.0	.0
176	CUNNER	.0	.0	.0	.0	.0	.0	.3	.0	.0	.0
183	DAUBED SHANNY	.0	.0	.0	.0	.0	.0	3.7	.0	.0	.0
184	RADIATD SHANNY	.0	.0	.0	.0	.5	.0	.0	.0	.0	.0
192	ATL WOLFFISH	.0	.0	.0	.0	6.0	7.5	10.3	10.3	2.7	2.0
131	BUTTERFISH	1.0	.5	.0	.0	.0	.0	.0	.0	.0	.0
155	REDFISH	5.0	.0	12.5	4.5	180.0	17.0	296.0	29.0	17.3	2.7
159	HOBKEAR SCULPN	.0	.0	.0	.0	1.5	.0	4.3	.0	.0	.0
164	SEA RAVEN	1.5	2.0	1.0	.0	.0	.0	3.3	4.3	2.0	1.7
163	LH SCULPIN	3.0	.5	.0	.0	4.0	1.0	4.0	1.7	3.3	.7
161	MOUST SCULPIN	.0	.0	.0	.0	.5	.0	13.3	.0	1.3	.0
165	ALLIGATORFISH	.0	.0	.0	.0	.0	.0	.3	.0	.0	.0
168	LUMPFISH	.0	.0	.0	.0	.0	.0	.3	2.3	.3	.7
107	WITCH FLOUNDER	.0	.0	4.5	4.0	.5	1.0	1.7	3.3	4.0	5.7
102	AM PLAICE	28.5	8.0	23.5	8.0	16.5	6.0	18.7	6.0	29.3	8.0
101	ATL HALIBUT	2.0	12.5	.0	.0	.0	.0	.0	.0	.0	.0
105	YT FLOUNDER	7.5	3.0	.0	.0	.0	.0	.0	.0	.0	.0
106	WINTER FLDR	1.0	2.0	.0	.0	.0	.0	.0	.0	.0	.0
502	SHORTFIN SQUID	.0	.0	.0	.0	.0	.0	.0	.0	.3	.0
501	SQUID, UNCL	.0	.0	.0	.0	24.5	12.0	2.0	.7	.0	.0
000	MISCELLANEOUS	.0	.0	.0	2.0	.0	.0	.0	1.0	.0	.0
	TOTAL, ALL SPP.	593.0	1000.5	96.5	174.0	440.0	660.5	425.0	335.3	107.3	173.3

TABLE 17. . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.
(CONTINUED)

AREA: OUTER GROUND SEASON: FALL		SURVEY 817 FALL 1968 TOWS: 3		SURVEY 911 FALL 1969 TOWS: 3		SURVEY 706 FALL 1970 TOWS: 2		SURVEY 716 FALL 1971 TOWS: 2		SURVEY 728 FALL 1972 TOWS: 5	
CODE	SPECIES	NUMBER	POUNDS								
015	SPINY DOGFISH	92.0	364.0	8.0	38.3	103.5	426.0	52.0	178.0	2.0	11.8
023	WINTER SKATE	.0	.0	.0	.0	.0	.0	.0	.0	.2	.8
028	THORNY SKATE	.3	.7	4.0	18.7	2.0	10.0	.0	.0	.0	.0
027	SMHTAIL SKATE	.3	.7	.0	.0	.0	.0	.0	.0	.0	.0
034	BLUEBK HERRING	.0	.0	.7	.0	.0	.0	.0	.0	.0	.0
033	ALEWIFE	.0	.0	2.0	.3	.0	.0	.0	.0	.8	.0
032	ATL HERRING	.0	.0	.0	.0	.0	.0	.0	.0	.2	.0
046	ATL ARGENTINE	.0	.0	.0	.0	.0	.0	.0	.0	.2	.0
220	LANTRNFISH,UNCL	.0	.0	.0	.0	.0	.0	.0	.0	.4	.0
197	G00SEFISH	.3	3.3	.0	.0	.0	.0	.5	8.5	.0	.0
084	CUSK	2.0	14.0	.0	.0	.0	.0	1.0	6.0	.0	.0
073	ATLANTIC C0D	10.3	79.0	8.3	84.3	15.5	65.5	24.0	164.5	3.8	6.6
074	HADD0CK	26.7	104.0	23.3	101.0	4.5	30.5	5.5	17.0	.2	.0
072	SILVER HAKE	1.0	.0	4.7	1.7	.0	.0	4.5	3.0	2.0	.2
075	P0LL0CK	.7	5.7	1.3	15.0	1.5	1.5	.5	7.0	11.4	166.0
077	RED HAKE	.0	.0	8.3	7.3	.0	.0	1.5	2.0	5.2	3.6
076	WHITE HAKE	.7	3.0	9.3	13.7	3.5	10.0	3.5	16.5	4.4	11.8
193	0CEAN P0UT	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
183	DAUBED SHANNY	.0	.0	.3	.0	.0	.0	.5	.0	1.0	.0
192	ATL W0LFFISH	1.7	10.0	.0	.0	1.0	12.5	2.5	7.5	1.8	1.6
121	ATL MACKEREL	.0	.0	1.0	.3	.0	.0	.0	.0	.2	.0
155	REDFISH	25.7	3.7	.0	.0	3.5	2.5	7.5	1.0	11.8	2.6
159	H00KEAR SCULPN	.0	.0	.0	.0	.0	.0	8.0	.0	.4	.0
164	SEA RAVEN	.0	.0	.0	.0	.0	.0	.0	.0	.8	.8
163	LH SCULPIN	1.0	.3	2.7	.3	.0	.0	1.0	.5	.2	.0
161	M0UST SCULPIN	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
165	ALLIGAT0RFISH	.0	.0	.0	.0	.0	.0	.5	.0	.0	.0
108	WIND0WPAPE	.0	.0	.0	.0	.0	.0	.0	.0	1.6	.2
107	WITCH FL0UNDER	.3	1.0	.3	.7	.5	.5	4.0	5.5	.4	.8
102	AM PLAICE	6.3	3.0	36.3	16.0	5.0	1.5	10.0	3.0	4.0	.8
105	YT FL0UNDER	.0	.0	.7	.0	.0	.0	5.5	3.5	.0	.0
106	WINTER FLDR	.0	.0	.3	.3	2.5	9.0	.0	.0	.0	.0
401	SEA SCALL0P	.0	.0	.0	.0	.0	.0	6.0	.0	.0	.0
502	SH0RTFIN SQUID	3.0	2.0	.3	.3	2.5	1.5	2.0	1.0	.0	.0
503	L0NGFIN SQUID	1.3	.3	11.0	1.7	2.5	.0	11.5	.5	.6	.0
301	N0 L0BSTER	.0	.0	.3	.7	.0	.0	.0	.0	.2	.6
305	SHRIMP,UNCL	.0	.3	.0	.0	.0	.0	.0	4.5	.0	.8
	T0TAL,ALL SPP.	173.7	595.0	123.3	300.7	148.0	571.0	153.0	429.5	53.8	209.0

TABLE 17 . . . MEAN NUMBERS AND POUNDS PER TOW OF FISH AND INVERTEBRATES CAUGHT IN ALBATROSS IV OTTER TRAWL SURVEYS.
(CONTINUED)

AREA: BUTER GROUND SEASON: FALL		SURVEY 738 FALL 1973 TOWS: 9		SURVEY 748 FALL 1974 TOWS: 5	
CODE	SPECIES	NUMBER	POUNDS	NUMBER	POUNDS
001	ATL HAGFISH	1.6	.2	.0	.0
015	SPINY DOGFISH	9.0	38.0	34.6	156.2
028	THORNY SKATE	2.2	4.0	1.8	5.6
033	ALEWIFE	.2	.0	2.2	1.0
032	ATL HERRING	.2	.0	.2	.0
230	COM PEARLSIDES	.0	.0	18.4	.0
220	LANTRNFISH, UNCL	.0	.0	3.8	.0
197	GOOSEFISH	.6	4.6	.0	.0
084	CUSK	.3	5.1	.4	3.2
083	4-BRD ROCKLING	.4	.0	.2	.0
073	ATLANTIC COD	24.4	25.2	35.2	124.2
074	HADDOCK	13.1	26.4	17.2	36.4
072	SILVER HAKE	31.3	7.8	80.8	12.4
075	POLLACK	3.0	15.8	28.4	89.0
077	RED HAKE	1.8	.7	.2	.0
076	WHITE HAKE	5.1	22.1	4.0	21.6
193	OCEAN POUT	.9	.4	.6	.0
183	DAUBED SHANNY	.2	.0	.0	.0
192	ATL WOLFFISH	6.9	6.4	5.8	9.4
155	REDFISH	18.9	2.0	90.8	28.0
159	HOOKEAR SCULPN	5.3	.0	2.8	.0
164	SEA RAVEN	1.4	3.2	.8	.2
163	LF SCULPIN	2.4	.7	.2	.0
161	MOUT SCULPIN	4.4	.0	.2	.0
165	ALLIGATORFISH	1.6	.0	.0	.0
104	4-SPOT FLounder	.2	.0	.0	.0
107	WITCH FLounder	.4	.4	1.0	2.0
102	AM PLAICE	21.0	5.4	19.8	8.8
106	WINTER FLDR	.1	.0	.0	.0
502	SHORTFIN SQUID	1.8	1.3	18.6	13.6
503	LONGFIN SQUID	3.1	.2	6.6	.0
305	SHRIMP, UNCL	.0	4.3	.0	7.4
	TOTAL, ALL SPP.	162.1	174.4	374.6	519.0

Table 18.--Numbers of animals, mean sizes in centimeters, and size ranges for fishes and invertebrates¹ measured for each Biome ground during 1963-74 groundfish surveys.

Species	Cape Cod Bay			Massachusetts Bay			Stellwagen Bank			Outer Ground		
	number of fish	mean length	length range	number of fish	mean length	length range	number of fish	mean length	length range	number of fish	mean length	length range
Hagfish	-	-	-	-	-	-	2	40.5	31-49	24	43.7	31-55
Smooth dogfish	1	96.0	-	-	-	-	-	-	-	-	-	-
Spiny dogfish	436	80.6	54-105	197	79.9	50-95	966	74.0	46-107	1,496	74.1	48-99
Clearnose skate	-	-	-	-	-	-	-	-	-	5	25.9	9-44
Little skate	9	45.3	22-52	4	39.5	31-46	28	49.3	27-59	4	33.5	7-55
Barndoor skate	-	-	-	1	94.0	-	-	-	-	-	-	-
Winter skate	-	-	-	14	87.5	52-110	234	66.8	35-105	7	67.5	42-95
Thorny skate	35	63.2	17-100	48	53.6	10-109	77	46.4	12-105	110	43.8	12-106
Smoothtail skate	1	17.0	-	-	-	-	12	45.2	16-54	15	46.3	23-58
Blueback herring	198	23.2	20-28	2	14.5	13-16	118	24.2	15-28	3	20.2	17-22
Alewife	737	20.2	6-31	172	16.2	5-31	84	24.5	11-38	58	18.8	9-29
American shad	24	24.1	21-27	4	36.0	29-41	32	37.1	19-46	2	23.5	15-31
Atl. menhaden	-	-	-	-	-	-	1	31.0	-	-	-	-
Atl. herring	145	24.2	9-33	1,370	26.9	13-33	941	27.5	12-34	98	26.3	19-36
Round herring	-	-	-	-	-	-	1	16.0	-	-	-	-
Rainbow smelt	33	10.7	7-18	-	-	-	-	-	-	-	-	-
Argentine	-	-	-	-	-	-	-	-	-	1	7.0	-
Pearlsides	-	-	-	-	-	-	3	5.0	-	92	5.5	5-6
Goosefish	15	71.8	14-106	34	60.7	17-95	21	65.2	23-91	37	62.0	22-110
Cusk	-	-	-	-	-	-	2	56.5	32-81	33	55.6	15-97
Fourbeard rockling	107	23.4	11-37	131	21.4	11-33	79	23.4	11-36	22	20.4	9-34
Atlantic cod	97	52.2	7-120	337	45.2	8-120	1,465	33.9	5-132	1,200	48.0	5-130
Haddock	2	16.5	13-20	105	28.1	13-71	4,071	26.9	6-69	2,291	35.1	6-86
Silver hake	1,276	19.9	4-45	3,554	17.6	5-63	1,320	24.4	3-69	1,218	19.0	4-60
Offshore hake	1	50.0	-	-	-	-	-	-	-	-	-	-
Pollock	22	68.9	26-98	13	44.1	21-101	55	46.2	19-104	345	52.5	17-109
Red hake	197	25.7	6-59	128	28.9	9-59	302	29.3	7-62	270	33.3	7-59
White hake	57	39.4	11-66	79	33.4	15-111	107	38.7	18-80	188	49.2	13-120
Wolf eelpout	-	-	-	15	13.5	12-15	30	12.9	10-30	1	33.0	-
Ocean pout	103	53.9	16-73	117	36.4	10-70	166	48.5	12-92	92	41.7	11-78
Atl. silverside	16	9.2	8-12	4	10.0	10-11	10	8.9	8-10	1	9.0	-
Stickleback	1	5.0	-	-	-	-	1	5.0	-	-	-	-
No. pipefish	1	17.0	-	-	-	-	-	-	-	-	-	-
Bluefish	4	17.0	13-19	-	-	-	-	-	-	-	-	-
Scup	11	16.8	9-24	-	-	-	-	-	-	-	-	-
Cunner	-	-	-	3	20.8	12-27	2	28.5	24-34	1	19.0	-
Snakeblenny	23	31.3	19-46	74	35.2	8-44	3	38.8	36-42	13	11.5	7-32
Daubed shanny	378	10.8	7-15	1,529	9.8	5-16	13	10.0	7-16	104	9.6	7-14
Radiated shanny	-	-	-	4	10.0	8-12	-	-	-	1	9.0	-
Wolfish	-	-	-	4	45.0	33-58	40	73.1	23-112	290	34.0	5-106
Wrymouth	2	67.5	53-81	15	67.2	27-91	-	-	-	-	-	-
Sand lance	-	-	-	-	-	-	5	19.5	17-22	-	-	-
Atl. mackerel	28	35.3	30-41	2	17.5	13-22	3	33.5	30-36	4	22.0	20-26
Butterfish	1,883	12.7	8-28	-	-	-	4	17.5	15-19	2	16.5	9-24
Redfish	2	12.5	12-13	1,133	23.5	11-40	1,153	20.8	6-42	3,281	16.1	4-36
No. searobin	-	-	-	-	-	-	1	7.0	-	-	-	-
Hookear sculpin	-	-	-	-	-	-	5	7.5	7-8	179	5.5	2-7
Sea raven	2	35.5	32-39	11	34.0	14-47	53	28.1	15-53	92	27.5	12-56
Longhorn sculpin	28	25.4	17-32	24	23.8	14-32	301	20.9	5-32	148	21.6	5-32
Shorthorn sculpin	-	-	-	-	-	-	1	13.0	-	-	-	-
Moustache sculpin	-	-	-	2	9.5	8-11	46	11.6	7-17	169	10.9	5-14
Alligatorfish	18	15.6	7-33	24	10.1	6-19	14	9.9	4-14	31	9.9	6-14
Lumpfish	-	-	-	-	-	-	2	3.5	3-4	2	39.5	39-40
Gulfstream flounder	-	-	-	-	-	-	-	-	-	8	7.0	5-10
Fourspot flounder	17	20.6	11-34	5	16.3	14-18	12	26.3	14-36	7	24.4	17-34
Windupane	97	23.7	12-35	8	23.7	16-31	60	28.9	14-35	8	20.5	11-40
Witch flounder	21	47.0	18-63	296	29.0	6-57	171	24.0	4-60	179	39.8	5-61
American plaice	1,145	19.5	4-51	4,677	21.1	4-48	2,073	22.0	4-54	1,472	23.6	5-58
Atlantic halibut	-	-	-	1	79.0	-	17	54.0	30-79	9	52.2	16-92
Yellowtail flounder	222	28.6	11-52	73	33.0	21-47	897	29.3	10-58	69	27.5	11-50
Winter flounder	341	26.7	8-45	9	37.1	23-50	170	39.9	23-61	17	45.4	27-57
Sea scallop	-	-	-	31	8.7	5-11	30	8.9	5-17	12	5.3	4-6
Longfin squid	2,015	8.4	1-25	17	13.0	10-16	257	9.4	5-18	129	8.8	3-21
Shortfin squid	16	23.9	20-29	14	21.9	18-28	50	23.4	18-28	183	21.9	14-30
Rock crab	6	7.2	4-10	-	-	-	6	5.8	3-9	-	-	-
Jonah crab	1	3.0	-	-	-	-	-	-	-	-	-	-
Red crab	-	-	-	-	-	-	-	-	-	3	4.8	4-6
American lobster	2	11.5	-	5	12.7	9-18	3	12.8	11-14	4	12.0	9-16

¹For invertebrates the following measurements were used: sea scallop, shell height; squid, mantle length; crabs, carapace width; lobster, carapace length.

Table 19.--Comparison of mean pounds per tow of principal species and all species combined in ALBATROSS IV fall surveys in 1963-68 and 1969-74 for the Stellwagen and Outer Ground strata.

Species	Mean pounds per tow		Catch ratio
	1963-68	1969-74	1969-74/1963-68
<u>Stellwagen Bank</u>			
Spiny dogfish	194.5	59.5	0.31
Cod	56.7	43.0	0.76
Haddock	83.9	9.0	0.11
Silver hake	27.2	7.4	0.27
Pollock	12.4	11.1	0.90
American plaice	11.9	13.5	1.13
Yellowtail flounder	22.8	11.2	0.49
Total--all species	526.4	248.1	0.47
<u>Outer ground</u>			
Spiny dogfish	204.8	96.3	0.47
Thorny skate	7.3	5.4	0.74
Cod	71.5	61.3	0.86
Haddock	108.7	31.4	0.29
Redfish	9.9	6.8	0.69
Witch flounder	2.7	1.2	0.44
American plaice	6.3	5.9	0.94
Total--all species	465.4	312.0	0.67

Table 20.-- Reported commercial landings of fish and shellfish from Subarea 514 in 1964-74 in metric tons, live weight, (1 ton = 2,205 lbs). Source: National Marine Fisheries Service Statistics.

Species	Year										
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Alewife	1,814	2,874	2,770	2,316	-	-	479	36	-	250	55
Atl. Menhaden	-	-	t ^{1/}	-	-	-	408	2,702	5,121	18,792	19,057
Atl. herring	730	1,799	2,785	1,510	9,825	3,674	11,862	16,728	16,989	1,790	4,882
Goosefish	13	11	71	112	103	70	43	35	100	171	256
Cusk	155	193	141	72	92	47	158	310	283	484	507
Atlantic cod	1,812	2,107	1,910	2,248	2,517	3,237	3,756	3,481	2,953	2,907	3,063
Haddock	2,882	2,813	2,881	2,104	1,852	982	623	426	325	216	203
Silver hake	14,508	5,708	5,386	4,452	6,805	3,787	2,238	2,497	2,144	3,470	2,634
Pollock	824	1,182	377	447	507	282	498	688	1,787	1,726	1,775
Red hake	136	187	213	88	81	124	231	197	292	191	295
White hake	318	156	115	53	76	101	189	276	314	472	550
Atl. mackerel	995	745	1,112	1,979	1,494	2,613	1,795	1,153	887	252	154
Tunas ^{2/}	457	916	157	162	53	60	90	226	257	542	276
Redfish	372	332	194	88	110	86	834	457	102	140	91
Witch flounder	375	402	380	380	418	458	540	485	341	350	213
American plaice	487	560	451	567	507	678	490	287	172	205	436
Yellowtail fldr.	1,273	1,026	1,135	850	971	789	688	900	863	1,028	1,176
Winter flounder	1,036	625	704	748	829	915	932	1,039	929	972	755
Other finfish ^{3/}	5,509	3,836	3,944	3,889	3,240	3,850	2,586	2,105	1,899	2,873	2,627
Sea scallops	848	228	8	34	112	448	418	1,549	718	792	177
Squid	89	73	6	41	63	40	50	287	32	41	62
No. Shrimp	5	8	10	10	52	631	2,194	1,064	851	1,242	978
Total	34,638	25,781	24,750	22,150	29,707	22,872	31,102	36,928	37,369	38,906	40,222

^{1/} Less than 1 ton.

^{2/} Largely bluefin tuna.

^{3/} Includes small amounts of Am. eel, Am. shad, Am. goosefish, Atl. halibut, Atl. wolffish, black sea bass, bluefish, butterfish, ocean pout, scup, sharks, skates, striped bass, summer flounder, and tautog, in addition to other fish for which species was not recorded.

Table 21.--Reported landings of lobsters from the coastal area of the Biome in 1967-74¹. Source: Massachusetts Division of Marine Fisheries, Massachusetts Coastal Lobster Fishery Statistics, Technical Series 3-10.

Year	Metric tons live weight	Dollar value to fishermen
1967	1,125	2,319,783
1968	1,296	2,443,642
1969	1,263	2,577,936
1970	1,302	2,929,822
1971	1,308	3,175,864
1972	1,529	4,141,488
1973	1,254	3,784,653
1974	1,391	4,833,062

¹About 94% of the lobster catch is taken on commercial licenses. The other 6% is taken on family licenses and cannot be sold. This latter portion is therefore considered to be recreational catch.

Table 22.--Reported commercial landings in 1974 of Irish moss, sandworms, shellfish, and crabs from coastal areas of the Biome. Source: Massachusetts Division of Marine Fisheries canvass by towns.

Species	Metric tons live weight	Dollar value to fishermen
Irish moss ¹	998	88,000
Sandworm	25	68,340
Soft clam ²	725	363,216
Hard clam	844	247,030
Surf clam	37	5,160
Razor clam	1	810
American oyster	84	52,780
Blue mussel	168	11,130
Bay scallop	8	4,200
Rock crab	<u>14</u>	<u>4,340</u>
Total	2,904	845,006

¹Wet weight

²Includes soft clams taken from polluted areas and purified in the State of Massachusetts depuration plant at Newburyport, Massachusetts.

Table 23.--The estimated recreational catch and value¹ of coastal shellfish from the Biome area in 1974. Source: Massachusetts Division of Marine Fisheries.

Species	Metric tons live weight	Estimated dollar value
Soft clam	89	44,589
Hard clam	63	18,459
Surf clam	81	11,259
Razor clam	2	1,276
American oyster	5	3,140
Blue mussel	12	792
Bay scallop	<u>23</u>	<u>12,075</u>
Total	275	91,590

¹Value was arrived at by using the value per ton of commercial shellfish from Table 22.

Table 24.--Total estimated commercial and recreational harvests, and their estimated values to fishermen, in the Biome area in 1974.

Fishery category	Metric tons live weight	Estimated dollar value
Commercial finfish etc. (Table 20)	40,222	6,404,320 ¹
Commercial lobster (Table 21)	1,308	4,543,078
Commercial shellfish (Table 22)	2,906	845,006
Total commercial	<u>44,436</u>	<u>11,792,404</u>
Recreational finfish (text)	4,700	3,109,050 ²
Recreational lobster (Table 21)	83	289,984
Recreational shellfish (Table 23)	275	91,590
Total recreational	<u>5,058</u>	<u>3,490,624</u>
Grand total	<u>49,494</u>	<u>15,283,028</u>

¹The value to fishermen of commercial fish was taken from the values by species given in National Marine Fisheries Service statistics for all of Massachusetts in 1974 (Anonymous, 1975).

²The value to fishermen of recreational finfish was computed at \$0.30 per pound. This figure was chosen arbitrarily in order to put some reasonable total value on recreational fisheries. It is approximately the average price paid to commercial fishermen for food fishes in 1974.

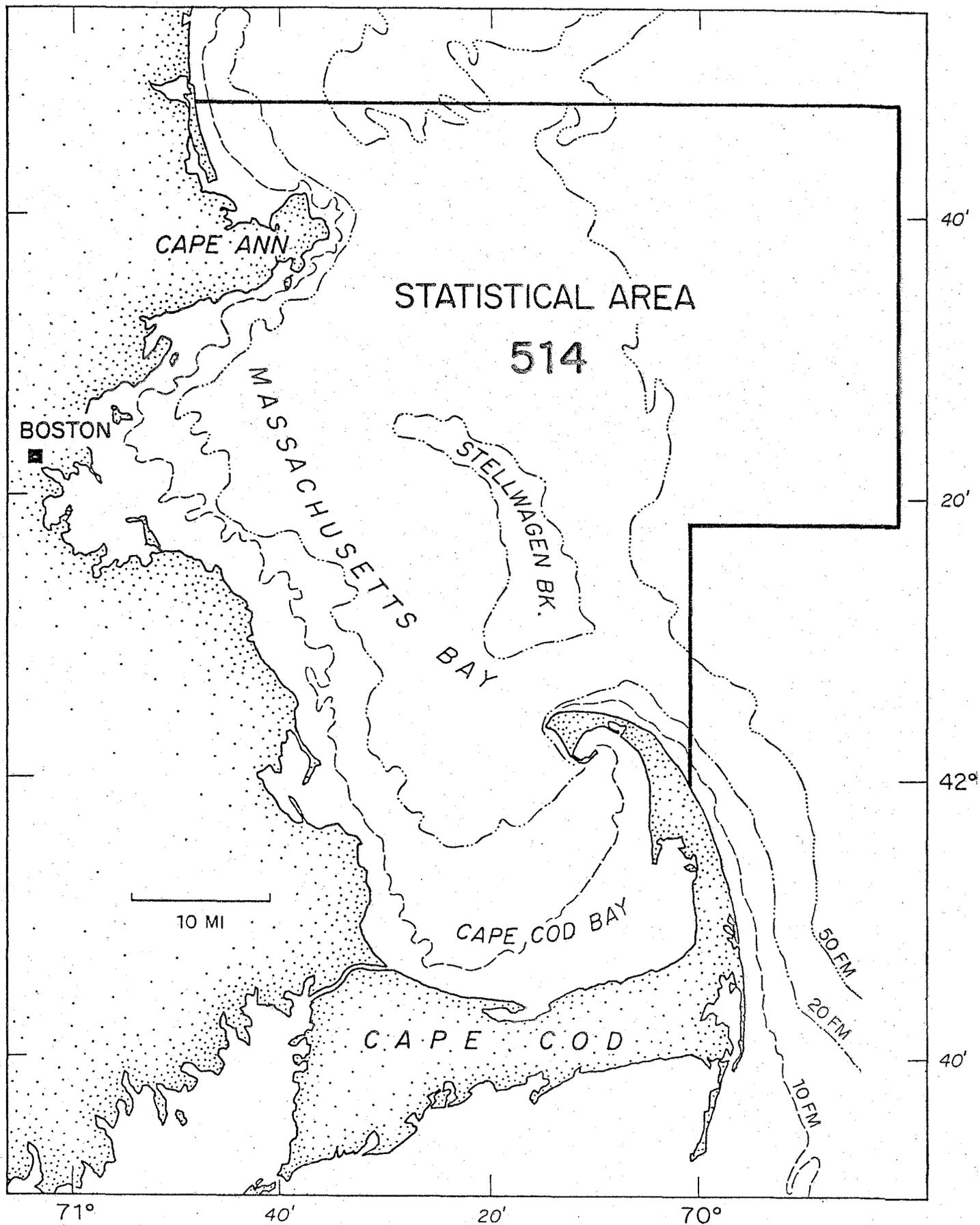


Figure 1.--The Biome area and its relationship to Statistical Area 514.

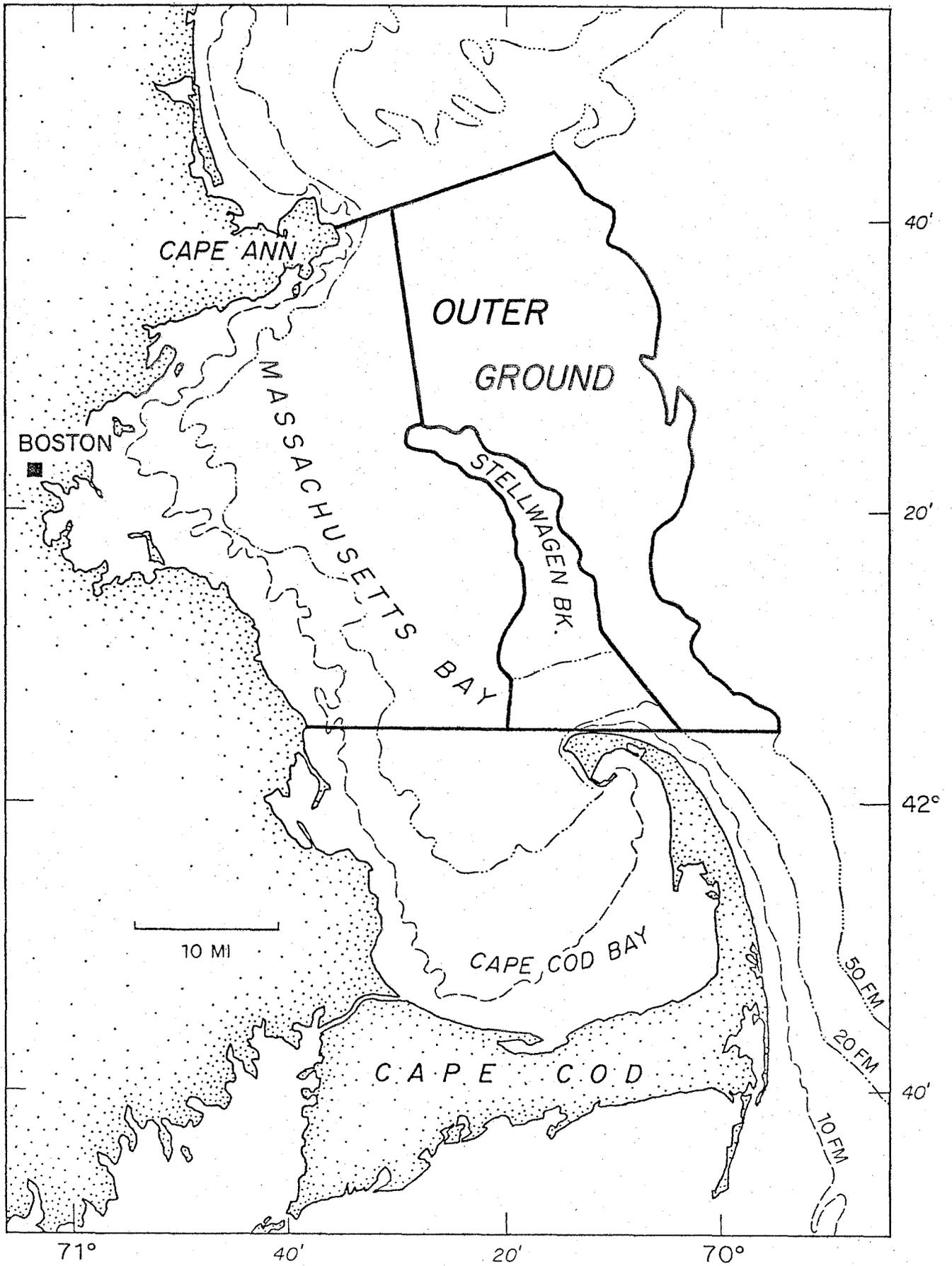


Figure 2.--Strata of the Biome area used for summarizing the results of groundfish surveys.

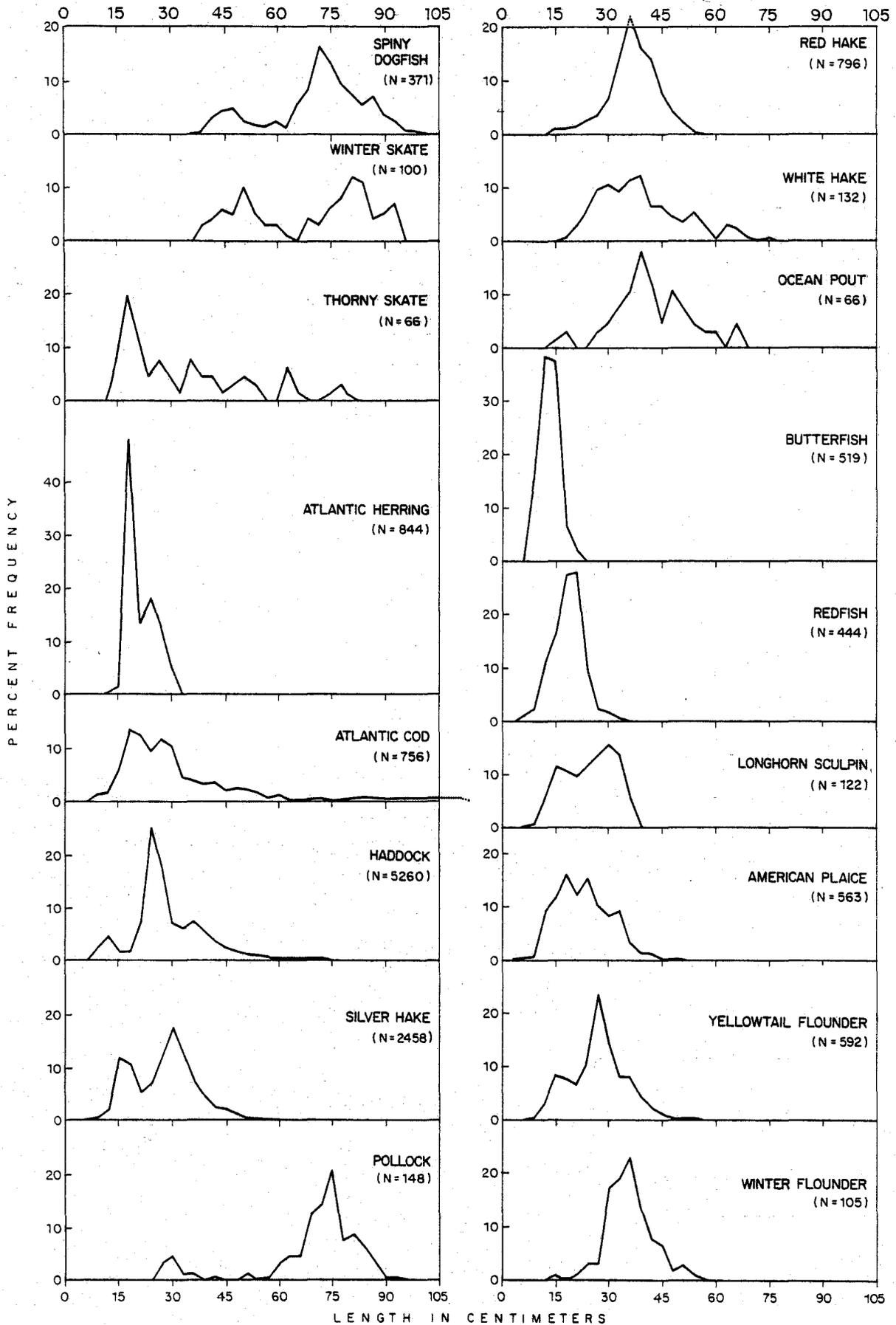


Figure 3.--Length-frequency distributions of principal fish species caught during otter trawl surveys in 1949-62.

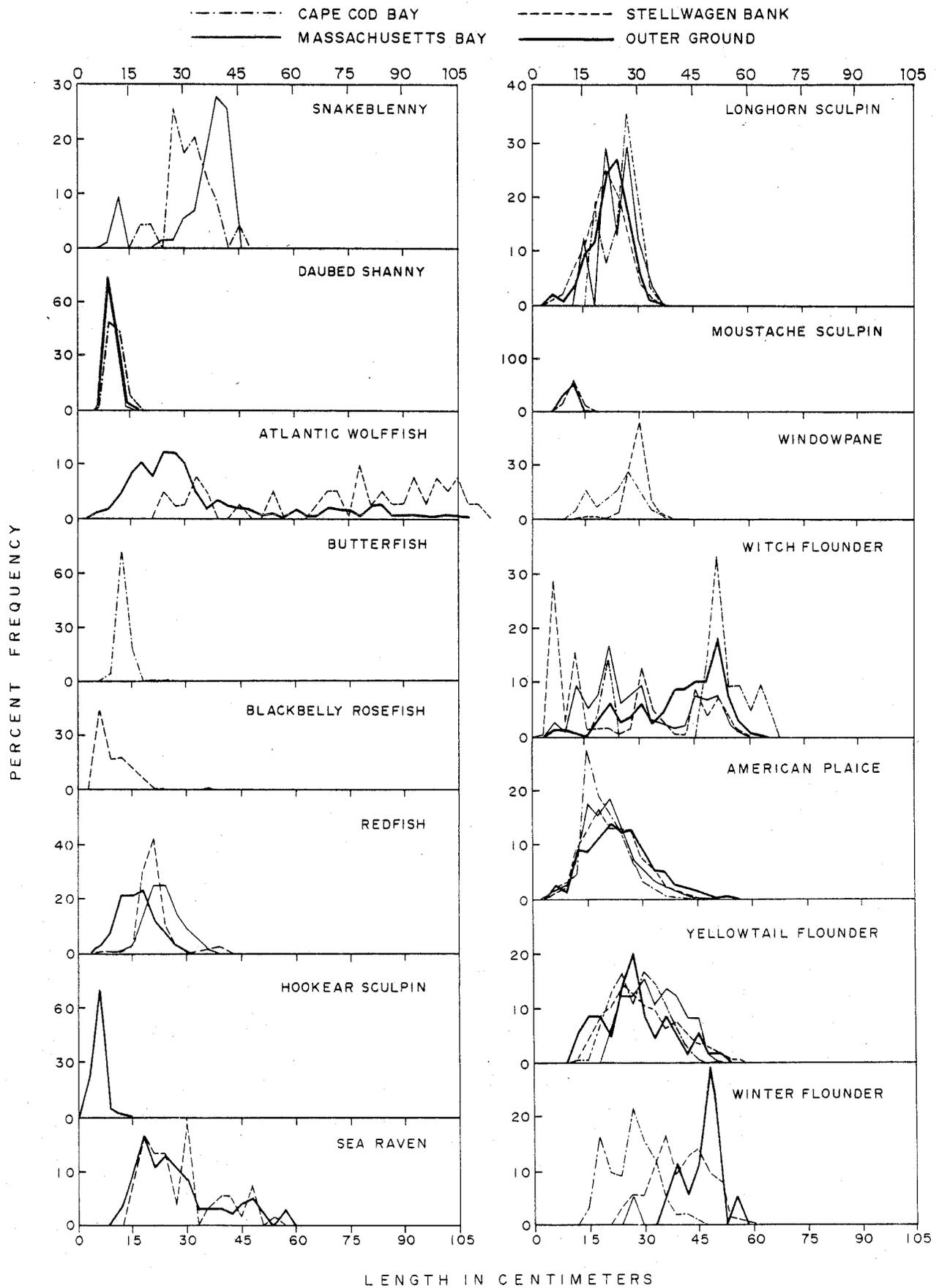


Figure 5.--Length-frequency distributions of flounders and miscellaneous species, for each Biome stratum, from otter trawl surveys in 1963-74.