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The Distribution and Size Composition of Finfish, American Lobster, and Long-Finned Squid in Long Island Sound Based on the Connecticut Fisheries Division Bottom Trawl Survey, 1984–1994

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ABSTRACT

The distribution, abundance, and length composition of marine finfish, lobster, and squid in Long Island Sound were examined relative to season and physical features of the Sound, using Connecticut Department of Environmental Protection trawl survey data collected from 1984 to 1994. The following are presented: seasonal distribution maps for 59 species, abundance indices for 41 species, and length frequencies for 26 species. In addition, a broader view of habitat utilization in the Sound was examined by mapping aggregated catches (total catch per tow, demersal catch per tow, and pelagic catch per tow) and by comparing species richness and mean aggregate catch/tow by analysis of variance (ANOVA) among eight habitat types defined by depth interval and bottom type. For many individual species, seasonal migration patterns and preference for particular areas within Long Island Sound were evident. The aggregate distribution maps show that overall abundance was lower in the eastern Sound than the central and western portions. Demersal and pelagic temporal abundance show opposite trends—demersals were abundant in spring and declined through summer and fall, whereas pelagic abundance was low in spring and increased into fall. The analysis of habitat types revealed significant differences for both species richness and mean catch per tow. Generally, species richness was highest in habitats within the central area of the Sound and lowest in eastern habitats. The aggregate mean catch was highest in the western and central habitats, and declined eastward.

Introduction

Long Island Sound (the Sound) supports commercial and recreational fisheries valued at over one billion dollars annually to the economies of Connecticut and New York. In Connecticut alone, 350,000 anglers make over one million fishing trips per year, primarily for bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), summer flounder (*Paralichthys dentatus*), striped bass (*Morone saxatilis*), tautog (*Tautoga onitis*), and winter flounder (*Pseudopleuronectes americanus*),[1] while Connecticut commercial fisheries harvest more than three million pounds of finfish, lobster, and squid from the Sound annually.[2]

Effective management of exploited species in the Sound requires understanding their distribution and size composition. In particular, this type of information is needed to identify essential habitat as required under the Magnuson-Stevens Act, develop habitat descriptions required in Atlantic States Marine Fisheries Commission Fishery Management Plans, provide habitat utilization information to state and federal environmental agencies responsible for habitat conservation, and evaluate the effectiveness of minimum trawl codend mesh requirements, particularly where they include bycatch thresholds.

Although the distributions of many species in the mid-Atlantic and Gulf of Maine ocean waters have been analyzed using commercial fishery data (Chang, 1990) and research trawl surveys (Bowman, 1981; Grosslein and Azarovitz, 1982; Almeida et al., 1984; Wigley and

* Note: the authors shared equally in the preparation of this report.

1 MacLeod, R. E. 1995. Marine Angler Survey, Job 1. *In* A Study of Marine Recreational Fisheries in Connecticut. Final report, CT DEP/Fisheries Division, P.O. Box 719, Old Lyme, CT 06371. 80 p.

2 CT DEP. Marine Fisheries Information System. P.O. Box 719, Old Lyme, CT 06371.

Gabriel, 1991), similar information is lacking for major estuaries, including the Sound. Information describing fishes occurring in the Sound is available from several sources, but descriptions of their distributions are limited seasonally and spatially. One of the first studies was conducted by Richards (1963), who characterized the demersal finfish assemblage in central Long Island Sound based on sampling with a modified shrimp trawl. Although the temporal coverage of this study was comprehensive (from June 1955 to July 1957), sampling was only conducted at two sites. Thompson et al. (1978) provided a thorough description of finfish species that occur in the Sound, based on a wide number of collections and literature citations; however, the spatial distribution and length composition of finfish within the Sound was not described. Since 1976, the Northeast Utilities Environmental Lab has monitored finfish abundance, but these data are limited to Niantic Bay and surrounding waters in eastern Long Island Sound. And finally, in 1991 the Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) began sampling finfish in the Sound, but sampling has only been conducted from July through September at 14 sites (Schimmel et al., 1994).

The purpose of this report is to describe the seasonal and spatial distribution and size composition of finfish, lobster, and squid in the Sound by summarizing and interpreting Connecticut Department of Environmental Protection (CTDEP) Trawl Survey (Survey) data. The Survey provides a unique opportunity to examine the distribution of finfish, lobster, and squid. Initiated in 1984, the Survey employs a stratified-random sampling design to monitor the relative abundance of finfish in the Sound. The sampling area includes all trawlable waters deeper than 5 m from New London, Connecticut, in the eastern Sound to Hempstead Harbor, New York, in the west, with sampling conducted from April through November in most years. In addition, the sampling gear employed is a small mesh otter trawl, which probably catches and retains a wider range of species and size groups than any other sampling gear. Although excessive by-catch of target and non-target species in otter trawls has concerned U.S. fishermen, managers, and conservationists alike since the gear was introduced in 1905 (Smolowitz, 1983), these same properties make otter trawls well suited for depicting species distributions and abundance when they are used in an overall fishery resource monitoring program. Summarizing the results of the Large Marine Ecosystems Monitoring Workshop held at Cornell University in 1991, Sherman and Laughlin (1992) cited trawl surveys as a proven method for monitoring both commercially important and noncommercial fish species.

Although the otter trawl is an effective sampling gear, the analysis of fish distributions and size compositions presented in this report must be viewed with the selectivity of the Survey trawl gear in mind. The catch composition is affected by a variety of factors including trawl design, mesh size, associated gear, and towing speed (Sissenwine and Bowman, 1978; Byrne et al., 1981; Byrne and Fogarty, 1985; Rose and Walters, 1990).

One way to examine the efficiency of a sampling gear, and to assess what portion of a population is sampled, is to examine the length frequency of captured fish. Generally, length frequencies exhibit increasing abundance up to some size, and then decreasing abundance with further increases in length. The size at greatest abundance indicates full recruitment to the gear, while decreasing abundance after this size indicates a decline in abundance of older, larger fish in the population. However, as mentioned above, a trawl does not sample all species equally, or capture all of the fish in its path. Large fish may evade capture by out-swimming the trawl, which causes their numbers to be underestimated. This is undoubtedly true of tunas, large sharks, and perhaps large bluefish and striped bass. Since the trawl is towed along the bottom, fish may also avoid the net by swimming above the headrope. In addition, rocky reef areas cannot be sampled with the type of trawl used in the Survey. This is particularly important when considering the distributions of structure-oriented species such as scup, black sea bass, and tautog. Despite these problems, catch and length frequencies from the Survey data provide valuable insight into most populations of finfish.

This report is organized into several sections. The first section, Description of Long Island Sound, provides information about the physical characteristics of the Sound that is useful for interpreting species distributions. Included are average seasonal bottom temperatures and salinities, and maps of the Sound's major geological features, bathymetry, and bottom sediment types. The Methods section describes the CTDEP Survey methodology and the methods used to analyze the Survey data. The Results and Discussion section is divided into two parts. Part I presents observations on distributions of individual species based on distribution maps, either by season or month, for 59 species of finfish, lobster, and squid; abundance indices for 41 species; and monthly length frequencies of 26 species. (Note that the figures referred to for each species appear in separate sections at the end of the report, titled Distribution Maps, Indices of Abundance, and Length Frequencies.) Part II presents a broader view of habitat utilization in the Sound by mapping aggregated catches and by comparing species richness and mean aggregate catch/tow among eight habitat types defined by depth interval and bottom type. And finally, appendices contain catch information for 25 rarely occurring species and the total catch by year of each species taken in the Survey.

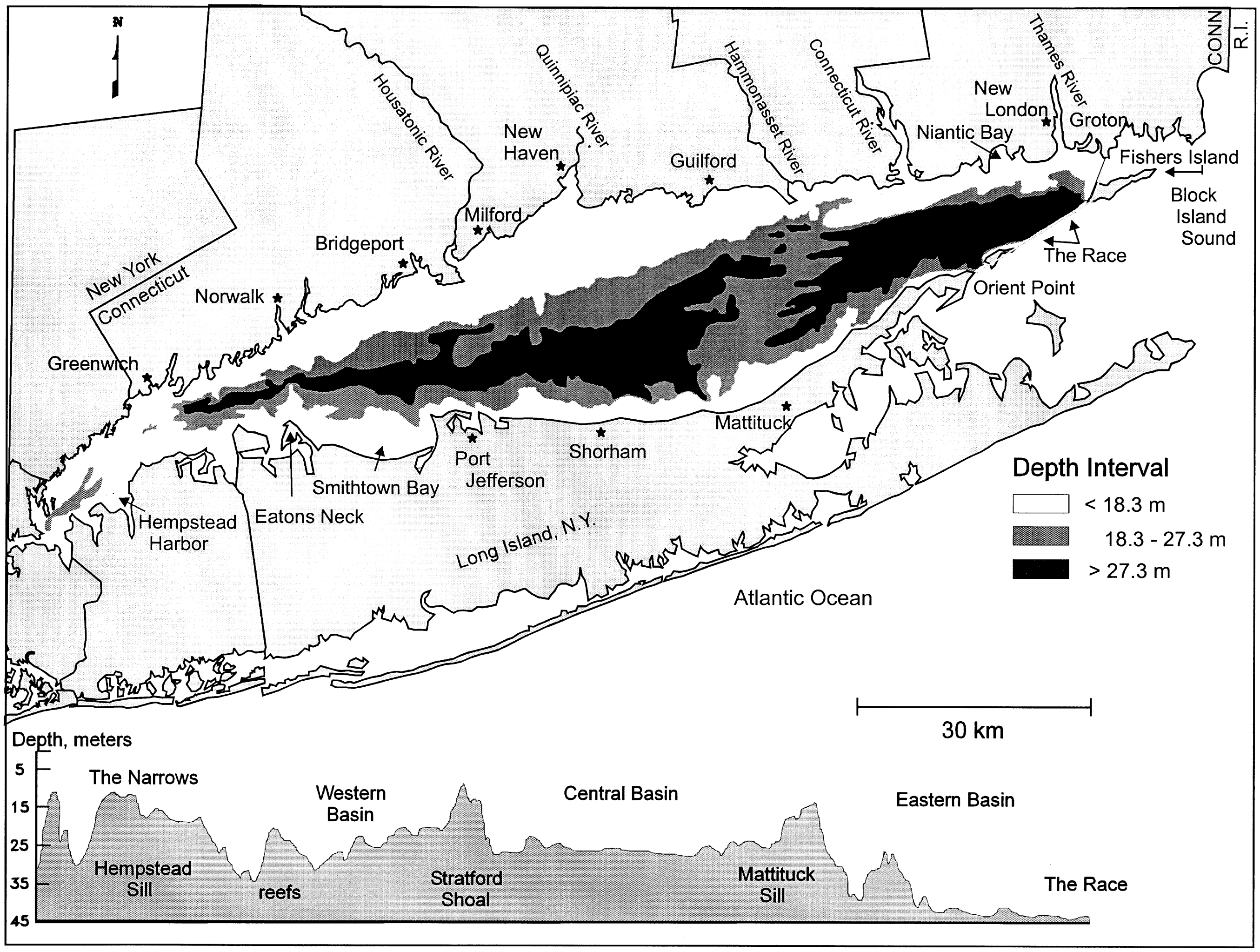

Figure 1
Long Island Sound depth contours and major bathymetric features. The 18.3 m (60 ft) and 27.4 m (90 ft) depth contours of Long Island Sound are adapted from Williams (1981). The bathymetric profile along the mainstem of the Sound showing major bathymetric and geological features is adapted from Welsh (1993).

Description of Long Island Sound

Overview

Long Island Sound is a 337,000 ha estuary (Wolfe et al., 1991) located between Connecticut and Long Island, New York, with exchange to the Atlantic Ocean through Block Island Sound to the east and through the New York Bight via a tidal strait, the East River, to the west (Fig. 1). The Sound is 182 km long and 32 km at its widest point (Lewis and Stone, 1991), with a total volume of 64×10^9 m^3 (Wolfe et al., 1991).

Shaped by glaciers, the Connecticut shore of the Sound is comprised of numerous embayments, marshes, small islands, and rocky reefs interspersed with sand deposits (Williams, 1981). All the major rivers that flow into the Sound—the Housatonic, Quinnipiac, Connecticut, and Thames Rivers—are on the Connecticut side of the Sound. The Long Island shore of the Sound west of Port Jefferson, New York, is irregular in shape with several narrow bays terminating inland along the Harbor Hill Moraine. In contrast, Long Island's shore east of Port Jefferson is characterized by steep coastal bluffs associated with the Roanoke Point Moraine, and adjacent shoal areas (< 9 m depth) comprised of unconsolidated coarse sediments (primarily sand and gravel) that extend 0.9–3.7 km into the Sound.

Bathymetry

There are three major basins in the Sound: the Eastern, Central, and Western (Fig. 1). The Eastern Basin is the deepest, with depths up to 90 m at its eastern boundary. Depths increase rapidly from both the Connecticut and Long Island shoal areas to between 35 and 60 m in most areas. Along the Connecticut shore of the Eastern Basin a 3–6 km wide band of shallow water (<18 m) contains numerous rock ledges and reefs.

Although the Eastern Basin is very narrow at the eastern end, considerable exchange of ocean water occurs with Block Island Sound through the deep channels of the Race. The flow of deeper water from the Eastern Basin into the Central Basin is moderated by the Mattituck Sill, a relatively shallow (averaging about 21 m), submarine ridge crossing the Sound at about longitude 72°30'W.

The Central Basin, located in the widest portion of the Sound, is the largest of the three basins. Depths increase gradually from the Connecticut shore to 30–40 m in the deepest area of the basin, whereas depths increase quickly from the narrow shoals along Long Island, often to more than 30 m deep within 5 km from shore. Reefs and islands are common within 3–4 km of the Connecticut shore, but are uncommon along the Long Island coastline.

Reef and island structures continue along the Connecticut shore into the Western Basin. Stratford Shoal, a reef mid-Sound between the Central and Western Basins, limits the exchange of water with the Western Basin. Unlike the Eastern and Central Basins, depths in the Western Basin increase gradually from both shores, resulting in proportionally more shallow (<18 m) habitat off Long Island. Deep water (>27 m) is limited to a channel approximately 3 km wide along the Sound's main axis that extends westward into the Narrows. The mid-Sound reefs and channels of the Narrows mark the limit of the Western Basin.

Further west in the Narrows is the Hempstead Sill, a shallow (<18 m) area separating the deeper portions of the eastern and western Narrows. West of the Sill, depths range from 12 to 33 m, and reefs and islands are common features.

Table 1

Long Island Sound average monthly temperature and salinity.[1] Table values are the monthly means of readings taken at seven stations along the longitudinal axis of the Sound from 1991–94. Surface readings were taken at 2 m below the surface, and bottom readings were taken at 5 m off bottom.

	Temperature (°C)		Salinity (‰)	
Month	Surface	Bottom	Surface	Bottom
January	3.6	3.7	27.6	27.8
February	1.6	1.7	27.1	27.5
March	2.1	1.8	25.5	27.0
April	4.9	3.7	26.1	26.4
May	9.6	7.4	25.8	26.4
June	14.4	11.7	26.0	27.0
July	20.4	16.4	26.9	27.7
August	22.0	19.4	27.4	28.2
September	21.9	21.3	27.2	28.3
October	18.3	18.4	28.2	28.4
November	13.3	13.4	28.3	28.6
December	8.3	8.4	27.9	28.1

[1] Olsen, C., and N. Kaputa. Long Island Sound water quality monitoring program. CTDEP, Bureau of Water Management, 719 Elm Street, Hartford, CT 06371, unpubl. data.

Bottom Sediments

Reid et al. (1979) described three sediment types in the Sound: sand (<5% silt/clay), transition (5–50% silt/clay), and mud (>50% silt/clay) (Fig. 2). Sand substrate is common in shallow water (<18 m) along the Long Island coast, but only occurs sporadically along the Connecticut coast. A lobe of sand extending from the mouth of the Connecticut River to the Mattituck Sill contains the only sand bottom in depths greater than 18 m. Much of the sand bottom over the Mattituck Sill consists of large sand wave formations that can be several meters high. While transitional substrate predominates in the eastern half of the Sound, which includes the eastern portion of the Central Basin, Mattituck Sill, and Eastern Basin, mud is the major bottom type in the western half, viz. the remainder of the Central Basin, Western Basin, and the Narrows. However, transitional substrate is found in several areas in the western half of the Sound: south of New Haven and Milford, in a band that encircles the mud bottom in the Western Basin, and near Greenwich, Connecticut, in the Narrows.

Temperature and Salinity

Temperatures in Long Island Sound are determined by marked seasonal changes typical of temperate climates, and the relative positions of the Labrador Current and Gulf Stream (Thompson et al., 1978). In winter, when the Gulf Stream lies further east, the cold Labrador Current flowing from the north envelopes the New England coast. In summer the Gulf Stream flows closer to New England, and a continuous zone of warm surface water extends from Florida to Cape Cod.

The bottom temperature of the Sound reaches a minimum in February and maximum in September (Table 1). Individual measurements recorded along the main axis of the Sound from 1991 to 1994 ranged from –0.7°C in March 1994 to 23.0°C in September 1993. Except for the Eastern Basin, where exchange with Block Island Sound waters moderates seasonal temperature change by 1–4°C, bottom temperatures along the main axis of the Sound are similar at any given time during the year.

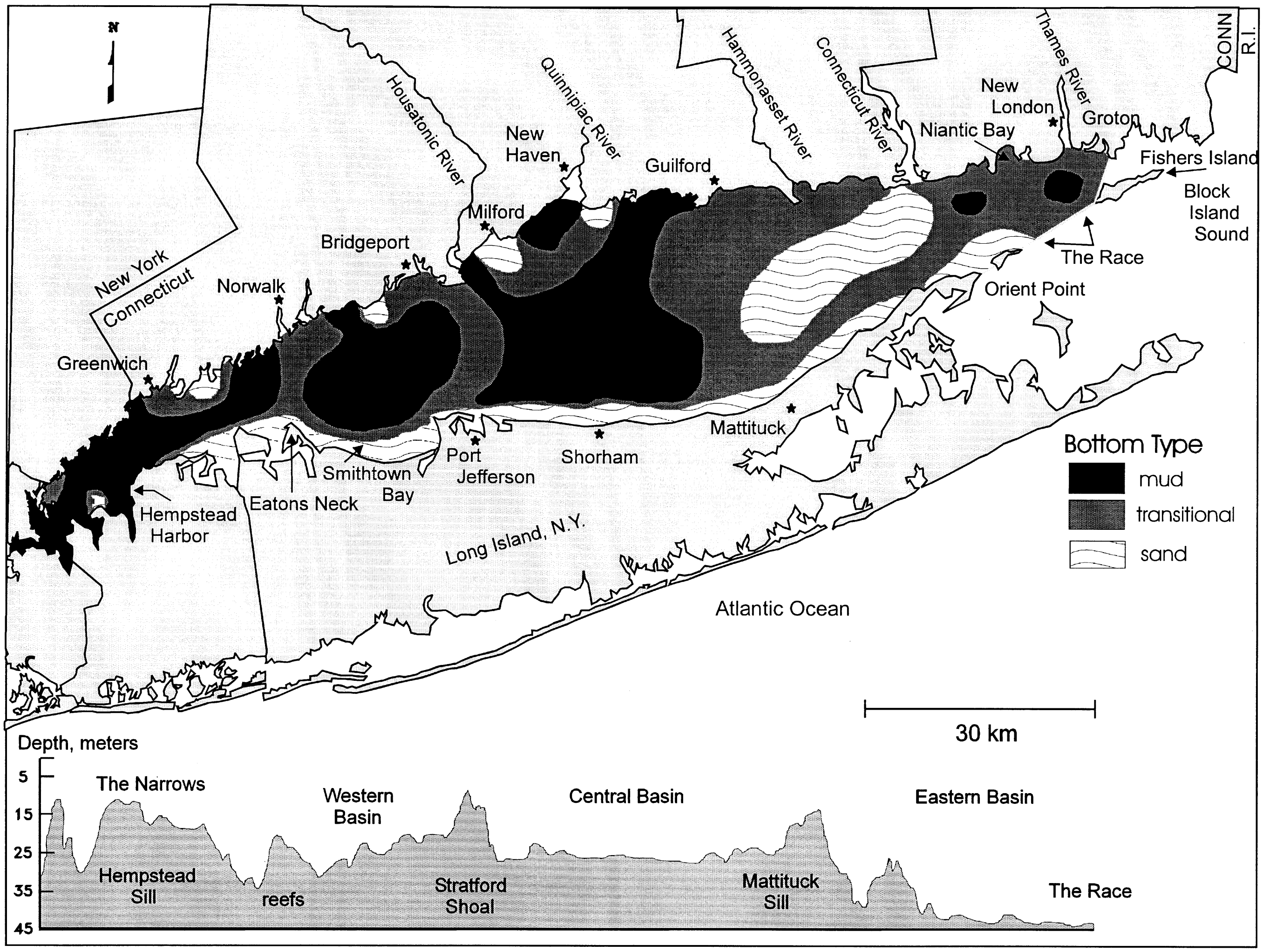

Figure 2

Long Island Sound sediment map and major bathymetric features. The sediment map is adapted from the work of Reid et al. (1979). The bathymetric profile along the mainstem of the Sound showing major bathymetric and geological features is adapted from Welsh (1993).

Bottom salinity peaks in October and November and reaches a minimum in the spring months (Table 1). Reid et al. (1979) reported the bottom water salinity gradient in the Sound ranged from 30–32‰ in the Eastern Basin to 26–28‰ west of Stratford Shoal during September, whereas April bottom salinities were generally 2‰ lower. Similar values were recorded from 1991 to 1994 by the CTDEP Bureau of Water Management.

Methods

Data Collection: The Connecticut Trawl Survey

The Trawl Survey (Survey) is conducted from longitude 72°03'W (Groton, Connecticut) to longitude 73°43'W (Hempstead Harbor, New York). The sampling area includes Connecticut and New York waters from 5 to 46 m depth over mud, sand, and transitional sediment types. Obstructed ground, such as rocky reef habitats, are not sampled.

The Survey is based on a stratified-random sampling design. The sampling area is divided into 1.85 × 3.7 km (1 × 2 n.mi.) sites (Fig. 3), with each site designated as one of 12 strata defined by depth interval (<9.1 m, 9.1–18.2 m, 18.3–27.3 m, or >27.3 m), and bottom type (mud, sand, or transitional sediments) as identified by Reid et al. (1979). For each sampling cruise, sites are selected randomly from within strata. Sampling intensity is one site per 68 sq km (20 sq. n.mi.), with a minimum of two sites sampled per stratum (Table 2). Discrete stratum areas smaller than a sample site are not sampled.

Sampling is conducted in monthly cruises of 40 sites each. From 1984 to 1990, cruises were conducted from

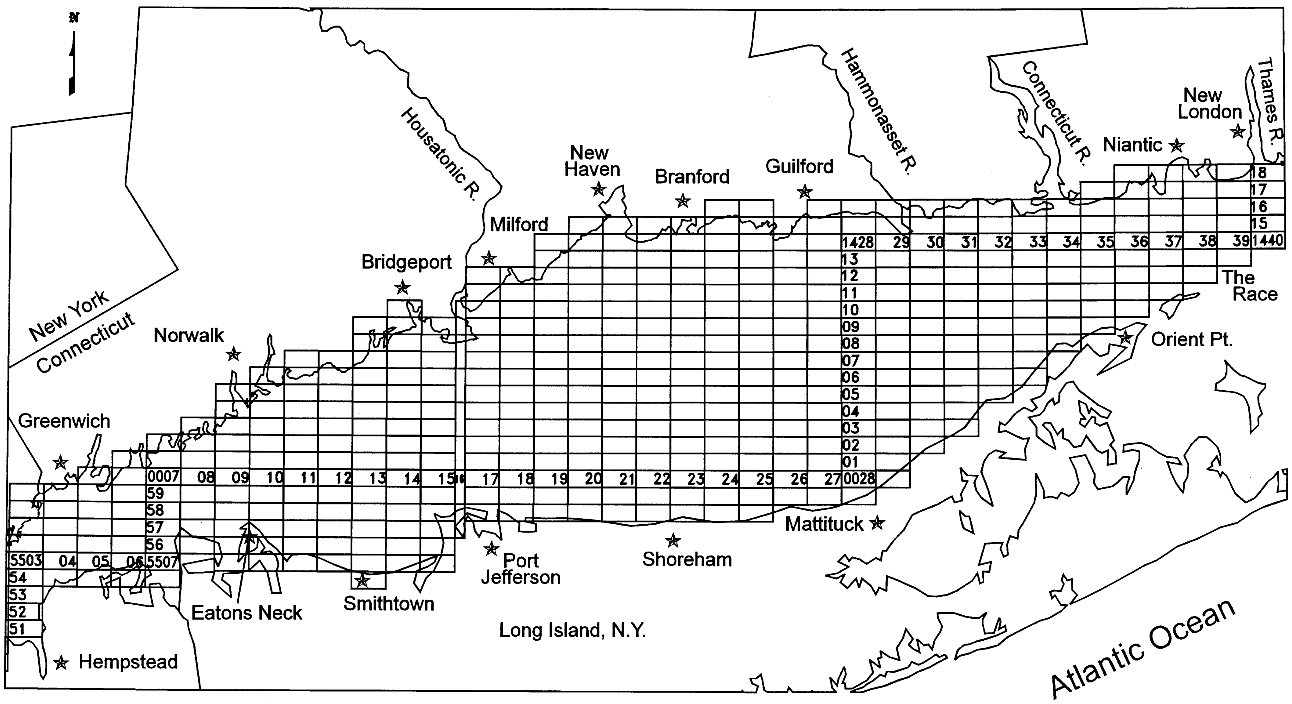

Figure 3

Connecticut DEP trawl survey site grid. Each sampling site is 1.85 × 3.7 km (1 × 2 n.mi.). A four digit number identifies the site: the first two digits are the row number (corresponding to minutes of latitude) and the last two digits are the column number. Examples: site 1428 near Guilford and 0028 near Mattituck. (Note: The sites in column 16 are approximately 1.85 × 3.7 km. The grid was drawn on the Eastern and Western Long Island Sound 80,000:1 nautical charts, which overlap by the area in column 16.)

Table 2

Number of sites scheduled for each sampling cruise. The number of sites to be sampled in each stratum was obtained by dividing the total stratum area by 68 sq km (20 sq n.mi.). A minimum of two sites per stratum were scheduled. The total stratum area (sq km) is given in parenthesis.

Depth interval (m)	Bottom type			
	Mud	Transitional	Sand	Total
0 – 9.0	2	3	2	7
	(135.9)	(227.6)	(45.5)	(409.0)
9.1–18.2	3	5	2	10
	(300.2)	(361.1)	(99.3)	(760.6)
18.3–27.3	5	5	2	12
	(382.3)	(346.7)	(86.9)	(815.9)
27.4+	5	4	2	11
	(379.6)	(209.5)	(122.9)	(712.0)
Total	15	17	8	40
	(1,197.9)	(1,146.9)	(354.6)	(2,699.4)

April through November. In 1991, the survey was modified to a spring (April–June) and fall (September–October) sampling schedule, but the 40 site per month schedule was retained. Beginning in 1993 a third cruise of 40 sites, conducted from late September through early October, was added to the fall period.

To reduce the day-night difference in catchability of some species (Sissenwine and Bowman, 1978), sampling is conducted between one half hour before sunrise and one half hour after sunset, and with few exceptions between 0700 and 1600 hours. At each site, a 14 m chain sweep otter trawl (Table 3) is towed for 30 min at 7 km/h (3.5 kts) with a 5:1 scope (tow wire to depth). A 12.8 m fiberglass research vessel was used until September 1990, when it was replaced by a 15.2 m aluminum vessel. On both vessels the trawl was deployed with split main winches and a net reel. To minimize potential catchability differences between the vessels, calibration cruises were conducted to standardize vessel speed, gear deployment, and net handling. Additional cruises demonstrated no significant differences of overall catch.[3]

After each tow is completed, the catch is sorted by species and enumerated. Subsamples of selected finfish

[3] Simpson, D. G., K. Gottschall, and M. Johnson. 1992. Job 4 *in* A Study of Marine Recreational Fisheries in Connecticut, Annual report. CT DEP Fisheries Division, P.O. Box 719, Old Lyme, CT 06371, 75 p.

species (Table 4) are measured to the centimeter total length or fork length (ex: measurements from 100 to 109 mm are recorded as 10 cm). Lobsters are measured to 0.1 mm carapace length and squid to the centimeter mantle length. A minimum of 30 individuals per species are measured; however, for large catches with a wide range of lengths, larger subsamples are taken. To estimate the length frequency of the catch, the individuals not measured are counted, and then the proportion of fish in each centimeter length interval of the subsample is multiplied by the total number of fish in the catch, to estimate the total numbers at length. Lengths are keypunched into the database as the midpoint of the interval (e.g. 10 cm is keypunched as 10.5 cm), along with the corresponding total numbers at length.

When a species' catch is dominated by many small individuals that can be easily separated by length from larger fish, the small fish are subsampled while all the large fish are measured. Fish not measured in a size group are counted, and the proportion of fish in each centimeter length interval of the subsample is multiplied by the total number of fish in the size group to estimate total numbers at length. The length frequency of the large individuals is then appended to complete the length frequency. This procedure is often used with catches of bluefish, scup, and weakfish (*Cynoscion regalis*), which are usually dominated by young-of-year (YOY).

Over the 11 years of sampling, there were changes in the list of species measured (Table 4). Seven species important to recreational fishermen were measured from all tows: bluefish, scup, striped bass, summer flounder, tautog, weakfish, and winter flounder. Beginning in 1987, other species were added or removed from the list depending upon research needs and available personnel.

Table 3

Specifications for the Wilcox 14 m high-rise trawl net (two seam) and associated gear.

Component	Description
Headrope	9.1 m long, 13 mm combination wire rope
Footrope	14.0 m long, 13 mm combination wire rope
Sweep	Combination type, 9.5 mm chain in belly, 7.9 mm chain in wing
Floats	7 floats, plastic, 203 mm dia.
Wings	102 mm mesh, #21 twisted nylon
Belly	102 mm mesh, #21 twisted nylon
Tail piece	76 mm mesh, #21 twisted nylon
Codend	51 mm mesh, #54 braided nylon
Ground wires	18.2 m long, 6×7 wire, 9.5 mm dia.
Bridle wires	Top legs: 27.4 m long, 6×9 wire, 6.4 mm dia. Bottom legs: 27.4 m long, rubber disc type, 38 mm dia.
Doors	Steel "V" type, 1.2 m. l × 0.8 m. h, 91 kg

Preparation of Distribution Maps

Catches were plotted using the latitude and longitude of the center of the Survey site boxes. The number of fish taken in each tow is represented by either an "x" for zero catches or a circle for positive catches, with identical catches plotted over each other. The circle diameter is proportional to the number of fish caught, and is scaled to the largest catch observed. However, for many species one or more catches were much larger than the majority of catches. This produced maps with mostly indistinguishable, small circles punctuated with a few large ones. In these cases, a smaller catch was used for the scalar to provide the best resolution for the majority of catches. One scalar was used for all seasonal maps of a species unless the species was plotted by length or age group, in which case a scalar was determined for each group.

For each species, the Survey catch data was aggregated over eleven years and divided into four seasonal periods: spring (April–June), summer (July–August), fall (September–October), and November (the last month sampled in the Survey, and a transitional period between the fall and winter finfish assemblages). These periods were chosen because they best illustrated the species' seasonal distributions. Monthly plots were attempted, but for most species they provided little additional detail, and seasonal distribution patterns were often less discernable. Distribution maps were prepared for a species if more than 10 individuals were caught over the time series. If 10 or fewer individuals of a species were taken, a list of dates and sites where individuals were caught was compiled in an appendix.

Additional maps were prepared for winter flounder, an important recreational and commercial species. The high abundance of winter flounder in Survey catches allowed an evaluation of distributional patterns by size group and month. Of interest were the migration patterns of different sized fish, and the abundance and distributions of legal (30.5+ cm for the recreational and commercial fisheries in Connecticut waters) and sublegal fish. For each month, maps were prepared for three size groups: <20 cm, 20–29 cm, and 30+ cm.

Four other important commercial and recreational species, American shad (*Alosa sapidissima*), bluefish, scup, and weakfish, were mapped by season and age group because catches of small fish comprised a high percentage of the total catch, obscuring the distribution of larger, older fish. Distinct modes and discontinuities in monthly Survey length frequencies, generally corresponding to literature length-at-age values, were used

Table 4

Sampling protocol for length data, 1984–94. Finfish were measured to total length (TL) or fork length (FL) if the caudal fin was forked. Starting in 1984, seven species—bluefish, scup, striped bass, summer flounder, tautog, weakfish, and winter flounder—were scheduled for measurement from all samples. During the 11 year period, other species were added or removed from the list as priorities and resources changed. (Note: some months were not sampled due to vessel availability, therefore they are not included. See Table 6 for months and number of tows actually sampled.)

Species	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Alewife (FL)	91,93–94	89–94	91–94	89–90		89–94	91–94	89–90
American lobster (CL)	86–91,93–94	85–94	85–94	85–90	85–90	85–94	85–94	85–90
American shad (FL)	89–91,93–94	91–94	89–94		89–90	91–94	89–94	
Atlantic croaker (FL)	93–94	93–94	93–94			93–94	93–94	
Atlantic herring (FL)	89–91,93–94	91–94	89–94		89–90	91–94	89–94	
Atlantic mackerel (FL)	91,93–94	89–94	91–94	89–90		89–94	91–94	89–90
Atlantic sturgeon (FL,TL)	89–91,93–94	89–94	89–94	89–90	89–90	89–94	89–94	89–90
Bigeye scad (FL)	94	94	94			94	94	
Black sea bass (FL)	89–91,93–94	89–94	89–94	89–90	89–90	89–94	89–94	89–90
Blueback herring (FL)	91,93–94	89–94	91–94	89–90		89–94	91–94	89–90
Bluefish (FL)	86–91,93–94	84–94	84–94	84–90	84–90	84–94	84–94	84–90
Butterfish (FL)	87–90,93–94	87–88,92–94	87–90,92–94	87–88	87–90	87–88,92–94	87–90,92–94	87–88
Crevalle jack (FL)	93–94	93–94	93–94			93–94	93–94	
Fourspot flounder (TL)	89–90		89–90		89–90		89–90	
Hickory shad (FL)	91–94	91–94	91–94			91–94	91–94	91–90
Little skate (TL)	89–90		89–90		89–90		89–90	
Long–finned squid (ML)	87–88,93–94	87–90,92–94	87–88,92–94	87–90	87–88	87–90,92–94	87–88,92–94	87–90
Moonfish (FL)	93–94	93–94	93–94			93–94	93–94	
Northern kingfish (TL)	93–94	93–94	93–94			93–94	93–94	
Red hake (TL)	89–90		89–90		89–90		89–90	
Rough scad (saurel) (FL)	93–94	93–94	93–94			93–94	93–94	
Round herring (FL)	92–94	92–94	92–94			92–94	92–94	
Scup (porgy) (FL)	86–91,93–94	84–94	84–94	84–90	84–90	84–94	84–94	84–90
Silver hake (TL)		89–90		89–90		89–90		89–90
Smallmouth flounder (TL)	92–94	92–94	92–94			92–94	92–94	
Smooth dogfish (FL)		89–90		89–90		89–90		89–90
Spanish mackerel (FL)	91–94	91–94	91–94			91–94	91–94	
Spot (FL)	93–94	93–94	93–94			93–94	93–94	
Striped bass (FL)	86–91,93–94	84–94	84–94	84–90	84–90	84–94	84–94	84–90
Striped searobin (TL)	89–90		89–90		89–90		89–90	
Summer flounder (TL)	86–91,93–94	84–94	84–90	84–90	84–94	84–94	84–94	84–90
Tautog (blackfish) (TL)	86–91,93–94	84–94	84–94	84–90	84–90	84–94	84–94	84–90
Tomcod (TL)	91–94	91–94	91–94			91–94	91–94	
Weakfish (TL)	86–91,93–94	84–94	84–94	84–90	84–90	84–94	84–94	84–90
Windowpane flounder (TL)	94	89–90,94	94	89–90		89–90,94	94	89–90
Winter flounder (TL)	86–91,93–94	84–94	84–94	84–90	84–90	84–94	84–94	84–90

to separate each species into two age groups. American shad were separated into juveniles (<32 cm) and adults (32+ cm) in all months (Leim, 1924). Bluefish, scup, and weakfish were separated into YOY and age 1+ on a monthly basis. Young-of-year bluefish were defined as <14 cm in July (the month YOY first appeared), <24 cm in August, <28 cm in September, and <30 cm in October and November. These lengths are comparable to those reported by Richards (1976) and Chiarella and Conover (1990), who determined that most bluefish less than 30 cm taken in the fall are YOY. Using Survey length discontinuities and modes similar to those reported by Finklestein (1969) and Hamer (1979), YOY scup were defined as <9 cm in August (the month YOY first appeared), <11 cm in September, <12 cm October, and <13 cm in November. Shepherd and Grimes (1983) reported weakfish length at age one to be 20 cm; however, the discontinuities in the Survey length frequencies were used to separate age groups. Young-of-year weakfish were defined as <18 cm in August (the month YOY first appeared), <27 cm in September, and <30 cm in October and November.

In addition to species specific distributions, maps were prepared by season for the total number of finfish (all species combined) per tow, total demersal finfish, and total pelagic finfish. The list of demersal species consisted of Atlantic sturgeon (*Acipenser oxyrinchus*), Atlantic tomcod (*Microgadus tomcod*), black sea bass (*Centropristes striata*), cunner (*Tautogolabrus adspersus*), fourbeard rockling (*Enchelyopus cimbrius*), fourspot flounder (*Paralichthys oblongus*), goosefish (*Lophius americanus*), hogchoker (*Trinectes maculatus*), little skate (*Raja erinacea*), longhorn sculpin (*Myoxocephalus octodecemspinosus*), northern puffer (*Sphoeroides maculatus*), northern searobin (*Prionotus carolinus*), ocean pout (*Macrozoarces americanus*), oyster toadfish *(Opsanus tau)*, red hake (*Urophycis chuss*), rock gunnel (*Pholis gunnellus*), scup (*Stenotomus chrysops*), sea raven (*Hemitripterus americanus*), smallmouth flounder (*Etropus microstomus*), spotted hake (*Urophycis regia*), striped searobin (*Prionotus evolans*), summer flounder (*Paralichthys dentatus*), tautog (*Tautoga onitis*), windowpane flounder (*Scophthalmus aquosus*), winter flounder (*Pseudopleuronectes americanus*), winter skate *(Raja ocellata)*, and 20 other rarely occurring species (n<10/species). Pelagic species were all species not listed as demersal.

Preparation of Length Frequencies

Of the 36 species for which length data were collected (Table 4), length frequencies were plotted for species which occurred in two or more months of the Survey and ranged more than 15 cm in length. For each species, all length data collected from 1984 to 1994 were aggregated and plotted by month. Length intervals ranging from 1–4 cm were chosen and plotted on a log scale to accommodate length frequencies ranging from one to thousands.

For species that did not meet the criteria required for plotting, the number of fish measured and range in lengths was determined and reported in the text. To characterize length frequencies of species that were not scheduled for measurement, field sheets were reviewed for comments and occasional length data.

Indices of Abundance

The non-random distributions of fish populations are reflected in the skewed trawl survey catch frequencies, which typically contained many observations of low to moderate abundance and a few with very high abundance. Since an arithmetic mean tends to depart markedly from the median and mode as a consequence of even one or two unusually high catches, the geometric mean is used in this report to characterize average abundance. The geometric mean was calculated from log(e) transformed values ($\ln(x+1)$), which have a more symmetrical distribution and therefore a mean that is more consistent with other measures of central tendency: the median and the mode. Log(e) means were retransformed to original units ($\exp(\bar{x})-1$) to give the geometric mean.

Percent occurrence, or the proportion of samples within which a species is present, is also used to describe the distribution of species in the Sound. Together, the geometric mean abundance and percent occurrence are used to describe distributions of 41 species represented by 100 or more individuals over the 1984–94 period.

To calculate the indices, catch data were aggregated over the time series (1984–94), and the geometric mean and percent occurrence were calculated by the following sampling strata: month, month and bottom type, and month and depth interval. The extra fall cruises of 1993 and 1994 were dropped from the calculations because they spanned September and October.

The percent occurrence and geometric mean catch/tow were calculated by month, month and bottom type, and month and depth interval. The results are displayed graphically for 41 species. The percent occurrence of a species, or the percentage of tows where at least one individual was caught, is used to describe how commonly a species was encountered in the Survey. It is also used to indicate when a species might have first arrived in the Sound, or became available to the Survey sampling gear. Reference to "abundance" is based on the geometric mean catch/tow. Reference to "depth" is based on the Survey depth strata in which fish were caught and is rounded to the nearest meter for brevity (e.g. the 9.1–18.2 m stratum is referred to as 9–18 m).

Observations of species distributions, seasonal trends in abundance, and preferences for strata (depth and bottom type), are inferred directly from the distribution maps, abundance indices, and length frequencies.

Habitat Utilization: Species Richness and Aggregate Counts/Tow

Species richness, defined as the mean number of finfish species caught per tow over the time series, and the mean aggregate count per tow, defined as the mean of the log(e) transformed, total number of finfish per tow, were used to compare habitat utilization of different areas within the Sound. The Sound was divided into 14 plots, or habitats, comprised of contiguous sampling sites with similar depth interval (0–18.3 m or 18.3+ m) and bottom type (mud, transitional, or sand) (Fig. 4). Using spring and fall data, species richness and the log(e) mean aggregate counts per tow were calculated for each area and then

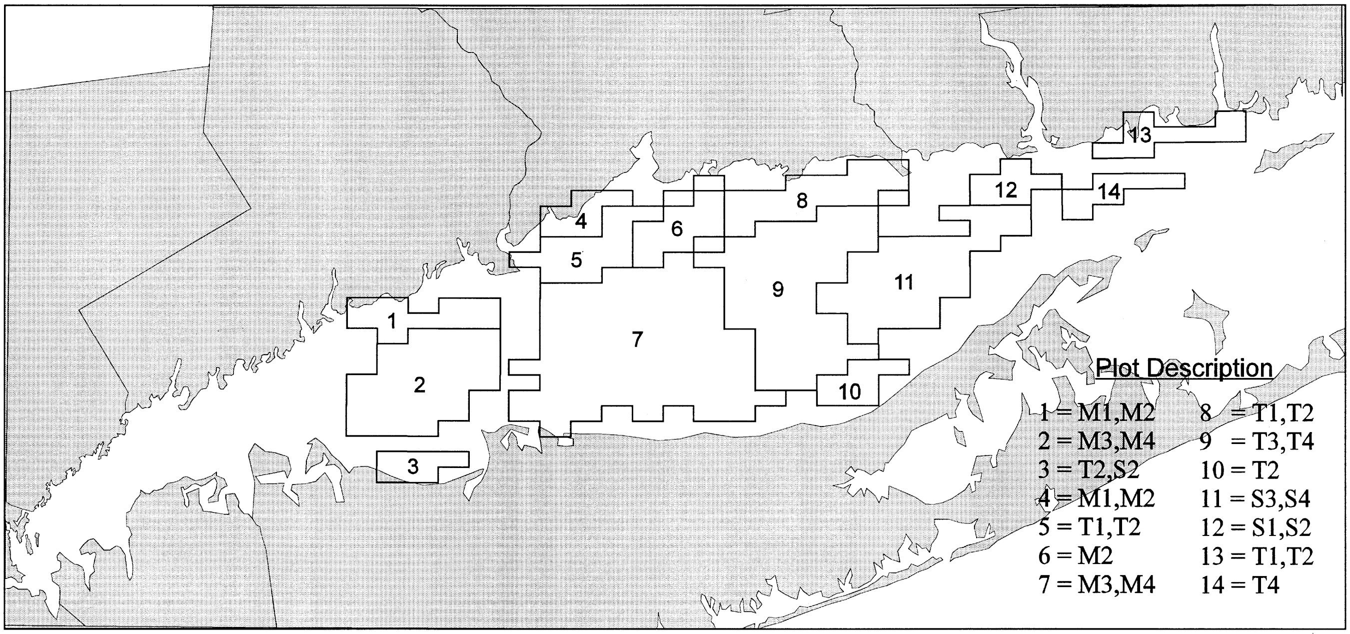

Figure 4

Fourteen plots representing habitat types in Long Island Sound. Habitat plots are comprised of contiguous Survey sampling sites that have in common one or two types of strata defined by bottom type (M = mud, S = sand, T = transitional) and depth interval (1 = 0–9.1 m, 2 = 9.1–18.2 m, 3 = 18.3–27.3 m, 4 = 27.4+ m). Note: refer to Fig. 1 (Long Island Sound depth contours and major bathymetric features) and Fig. 2 (Long Island Sound sediment map and major bathymetric features) to locate the features of Long Island Sound mentioned in the Discussion.

compared by ANOVA using SAS Proc GLM (p=0.05) (SAS, 1990). Spring and fall data were used because only these two seasons were sampled every year. The model was run with season nested within year, year randomized, and the means adjusted with LSMeans.

Results and Discussion

Part I: Species Distributions, Abundance, and Length Composition

From 1984 to 1994, 83 species of finfish (Table 5) were identified from 2,859 tows (Table 6). Distribution maps were plotted for 59 species by season. Additional maps were plotted for winter flounder by size group and month; bluefish, scup, and weakfish by age 0 and age 1+ groups by season; and American shad juveniles and adults by season. Maps were also plotted for long-finned squid and American lobster, two commercially important invertebrates commonly taken in trawl catches.

For 25 rarely occurring species (n<10 individuals over the time series), the following catch information is provided in Appendix I: date and number captured, site number, depth interval, and bottom type. Also, American sand lance and American silversides are included in Appendix I because they were not counted until 1992 and were relatively uncommon in Survey catches. Although bay anchovy were frequently caught, they were not counted and therefore could not be included in this report.

Alewife (*Alosa pseudoharengus*) (Figs. DM-1, IN-1, LF-1) Alewives taken in the Survey ranged from 7 to 32 cm (Fig. LF-1). The majority were juveniles (<25 cm; NMFS, 1989), comprising 97–100% of the catch in each month.

Alewives exhibited a seasonal inshore-offshore pattern (Fig. DM-1). In April, when abundance was highest (Fig. IN-1A), alewives were distributed primarily in depths greater than 18 m. Abundance was highest over mud bottom, with abundance over transitional and sand bottoms ranking second and third respectively (Fig. IN-1B). In May they were most abundant in depths less than 9 m along the Connecticut shore (generally, abundance varied inversely with depth), where many of the largest catches were recorded. In June alewives were distributed in all depths; however, abundance was still slightly higher in depths less than 9 m, and the largest catches were still recorded there.

During the summer period, alewives were distributed in all depths (primarily 27+ m in August), particularly south of Guilford on the Mattituck Sill and adjacent por-

Table 5

Marine Finfish Survey species list, 1984-94. Eighty-three species of finfish have been identified since 1984 (AFS, 1991). Also included are lobster and long-finned squid (Gosner, 1978).

Common name	Scientific name	Common name	Scientific name
Alewife	*Alosa pseudoharengus*	Northern pipefish	*Syngnathus fuscus*
American eel	*Anguilla rostrata*	Northern puffer	*Sphoeroides maculatus*
American lobster	*Homarus americanus*	Northern searobin	*Prionotus carolinus*
American sand lance	*Ammodytes americanus*	Northern sennet	*Sphyraena borealis*
American shad	*Alosa sapidissima*	Ocean pout	*Macrozoarces americanus*
Atlantic bonito	*Sarda sarda*	Orange filefish	*Alutera schoepfi*
Atlantic cod	*Gadus morhua*	Oyster toadfish	*Opsanus tau*
Atlantic croaker	*Micropogonias undulatus*	Planehead filefish	*Monacanthus hispidus*
Atlantic herring	*Clupea harengus*	Pollock	*Pollachius virens*
Atlantic mackerel	*Scomber scombrus*	Rainbow smelt	*Osmerus mordax*
Atlantic menhaden	*Brevoortia tyrannus*	Red cornetfish	*Fistularia petimba*
Atlantic salmon	*Salmo salar*	Red goatfish	*Mullus auratus*
Atlantic silversides	*Menidia menidia*	Red hake	*Urophycis chuss*
Atlantic sturgeon	*Acipenser oxyrinchus*	Rock gunnel	*Pholis gunnellus*
Banded rudderfish	*Seriola zonata*	Rough scad	*Trachurus lathami*
Bay anchovy	*Anchoa mitchelli*	Round herring	*Etrumeus teres*
Bigeye	*Priacanthus arenatus*	Sandbar shark	*Carcharhinus plumbeus*
Bigeye scad	*Selar crumenophthalmus*	Scup (porgy)	*Stenotomus chrysops*
Black sea bass	*Centropristis striata*	Sea lamprey	*Petromyzon marinus*
Blueback herring	*Alosa aestivalis*	Sea raven	*Hemitripterus americanus*
Bluefish	*Pomatomus saltatrix*	Seasnail	*Liparis atlanticus*
Butterfish	*Peprilus triacanthus*	Short bigeye	*Pristigenys alta*
Clearnose skate	*Raja eglanteria*	Silver hake	*Merluccius bilinearis*
Conger eel	*Conger oceanicus*	Smallmouth flounder	*Etropus microstomus*
Crevalle jack	*Caranx hippos*	Smooth dogfish	*Mustelus canis*
Cunner	*Tautogolabrus adspersus*	Spanish mackerel	*Scomberomorus maculatus*
Dwarf goatfish	*Upeneus parvus*	Spiny dogfish	*Squalus acanthius*
Fourbeard rockling	*Enchelyopus cimbrius*	Spot	*Leiostomus xanthurus*
Fourspot flounder	*Paralichthys oblongus*	Spotted hake	*Urophycis regia*
Goosefish	*Lophius americanus*	Striped bass	*Morone saxatilis*
Gray triggerfish	*Balistes capriscus*	Striped cusk eel	*Ophidion marginatum*
Grubby	*Myoxocephalus aeneus*	Striped searobin	*Prionotus evolans*
Hickory shad	*Alosa mediocris*	Summer flounder	*Paralichthys dentatus*
Hogchoker	*Trinectes maculatus*	Tautog (blackfish)	*Tautoga onitis*
Inshore lizardfish	*Synodus foetens*	Tomcod	*Microgadus tomcod*
Little skate	*Raja erinacea*	Weakfish	*Cynoscion regalis*
Long-finned squid	*Loligo pealei*	White perch	*Morone americana*
Longhorn sculpin	*Myoxocephalus octodecemspinosus*	Windowpane flounder	*Scophthalmus aquosus*
Lookdown	*Selene vomer*	Winter flounder	*Pseudopleuronectes americanus*
Lumpfish	*Cyclopterus lumpus*	Winter skate	*Raja ocellata*
Mackerel scad	*Decapterus macarellus*	Yellow jack	*Caranx bartholomaei*
Moonfish	*Selene setapinnis*	Yellowtail flounder	*Pleuronectes ferrugineus*
Northern kingfish	*Menticirrhus saxatilis*		

tions of the Central Basin. Distribution in fall was similar to May levels: alewives were again abundant along the Connecticut shore in depths less than 9 m from the mouth of the Housatonic River to the Hammonassett River (also, in October abundance again varied inversely with depth). November abundance was similar to May levels, and alewives were similarly distributed in near-shore areas on the Connecticut side of the Sound.

American lobster (*Homarus americanus*) (Figs. DM-2, IN-2, LF-2) Lobsters taken in the Survey ranged from 18 to 126 mm carapace length, with the distribution of lengths

Table 6

Number of samples taken by year and cruise. In 1984, 35 sites per month were scheduled for sampling from April through November; from 1985 to 1992, 40 sites per month were scheduled. Beginning in 1992, July, August, and November sampling was discontinued. In 1993 and 1994 an additional cruise, conducted from late September through early October, was added to the fall period.

	Year											
Cruise	84	85	86	87	88	89	90	91	92	93	94	Total
Apr	—	—	35	40	40	40	40	40	—	40	40	315
May	13	41	40	40	40	40	40	40	40	40	40	414
Jun	19	5	41	40	40	40	40	40	40	40	40	385
Jul	35	40	40	40	40	40	17	—	—	—	—	252
Aug	34	40	40	40	40	40	40	—	—	—	—	274
Sep	35	40	40	40	40	40	40	40	40	40	40	435
Sep/Oct	—	—	—	—	—	—	—	—	—	40	40	80
Oct	35	40	40	40	40	40	40	40	40	40	40	435
Nov	29	40	40	40	40	40	40	—	—	—	—	269
Total	200	246	316	320	320	320	297	200	160	240	240	2,859

similar in all seasons (Fig. LF-2). The percentage of juvenile lobsters (<55 mm; Briggs and Mushacke, 1979) ranged from 16.4% in November to 23.9% in October.

Although lobsters were found throughout the Sound during all seasons—percent occurrence ranged from 67.0% in April to 79.0% in July (Fig. IN-2D)—abundance was highest on mud bottom. Further, there were three areas with mud bottom in particular where lobsters were concentrated: the Western Basin, which contained the largest concentration of lobsters; the area between the Housatonic River and south of New Haven Harbor; and north of Shoreham, New York (Fig. DM-2[4]). In the Western Basin, abundance was generally highest in depths from 9 to 18 m. The area between the Housatonic River and New Haven is comprised of mud and transitional bottom, with depths generally less than 18 m. The third area north of Shorham is primarily mud bottom, with depths greater than 18 m. In addition to these three areas, lobsters were abundant on transitional bottom in Niantic Bay and the mouth of the Thames River during the spring and fall sampling periods.

American shad (*Alosa sapidissima*) (Figs. DM-3–DM-5, IN-3, LF-3) American shad caught in the Survey ranged from 8 to 52 cm, although about 99% were less than 27 cm (Fig. LF-3). From April through June, 95% ranged from 8 to 28 cm and corresponded to the lengths-at-age for ages one and two reported by Leim (1924). Adult shad (>32 cm; Leim, 1924) were most common in June. In August, 97% of the shad taken were age 1+ and ranged from 16–24 cm. The remaining 3% were adult shad that ranged from 40 to 53 cm. Young-of-year shad first appeared in Survey catches in September and ranged from 9 to 15 cm. From September to November, most shad were age 0+ and 1+ and ranged from 8 to 27 cm.

American shad, like alewives, exhibited a seasonal inshore/offshore pattern (Fig. DM-3). During the spring period, shad were most abundant in depths less than 18 m along the Connecticut shore from the Housatonic River to the Hammonassett River, whereas during the summer period shad were more abundant in depths greater than 9 m across the Sound from Connecticut to Long Island in the Central Basin and Mattituck Sill. During the fall period and November, shad distribution was similar to the spring months—abundance was again highest along the Connecticut shoreline. Both in the spring and fall periods, abundance generally increased with decreasing depth.

For the years where American shad were measured, distribution maps were prepared for juveniles (Fig. DM-4) and adults (Fig. DM-5). Juvenile distribution was similar to that described above. Adults displayed a similar pattern in spring, but after June very few were taken in the Survey.

Atlantic croaker (*Micropogonias undulatus*) (Fig. DM-6) Atlantic croaker were uncommon in Survey catches—only 44 individuals (Appendix II), ranging from 10 to 19 cm, were observed. Twenty-nine of the 44 Atlantic croaker taken were observed in September, which was also the month of first occurrence in the Survey. Fifteen Atlantic croaker were observed in October, none were taken in November. Most Atlantic croaker were taken in depths less

[4] Note: to find specific locations and bathymetric and geographical features on distribution maps, please refer to Figs. 1 and 2.

than 18 m along the Connecticut shoreline (39 of the 44 individuals were taken in depths less than 18 m), and none were observed east of the Mattituck Sill (Fig. DM-6).

Atlantic herring (*Clupea harengus*) (Figs. DM-7, IN-4, LF-4) Atlantic herring taken in the Survey ranged from 3 to 33 cm (Fig. LF-4). The percentage of adults (>22 cm; NMFS, 1989) was 81% and 94% in April and May respectively, but declined to 0% by October. Although Atlantic herring were not measured in November, observations recorded on field sheets indicated that most were adults.

Atlantic herring abundance in the Survey was highest during April and May (Fig. IN-4) when adults were most abundant in the Sound. In the spring sampling period they were widely distributed, but were especially abundant in the Western and Central Basins over mud bottom (Figs. DM-7 and IN-4B). Adult abundance declined through the spring months to very low abundance in the summer and fall periods, when most of the Atlantic herring taken in the Survey were juveniles. Although the Survey trawl did not effectively retain young-of-year, they were very abundant in the Sound during the summer months—in a separate sampling program, up to 80,000 per 15 minute tow were caught with an otter trawl equipped with a 6 mm codend liner.[5] During the fall period, most Atlantic herring were taken along the Connecticut side of the Sound in depths less than 18 m, especially south of Milford (Figs. DM-7 and IN-4F). Abundance increased in November when adult fish were again taken. During November, abundance increased slightly with decreasing depth, and the largest catches occurred in the Central Basin.

Atlantic mackerel (*Scomber scombrus*) (Figs. DM-8, IN-5, LF-5) Atlantic mackerel were observed in all months of the Survey (Fig. IN-5D), but were relatively uncommon (percent occurrence ranged from 0.3% in April to 7.6% in September) except in August (17.5% occurrence). While both juvenile and adult mackerel were taken, they were observed during different sampling periods and were distributed differently. Adults (>28 cm; NMFS, 1989), ranging in size from 36 to 47 cm (Fig. LF-5), were present from April through July and were widely distributed in the Sound (Fig. DM-8). In contrast, only juveniles (ranging from 13 to 23 cm) were present from August through November. They were most abundant in August and September in depths less than 18 m (Fig. IN-5C), primarily along the Connecticut coastline from Norwalk to the Housatonic River where the largest catches were made (>75/tow). Very few Atlantic mackerel were observed in October and November (1.6% and 1.9% occurrence respectively).

[5] Simpson, D. G., K. Gottschall, and M. Johnson. 1994. Job 5 *in*: A Study of Marine Recreational Fisheries in Connecticut, Annual report. CT DEP/Fisheries Division, P.O. Box 719, Old Lyme, CT 06371, 72 p.

Atlantic menhaden (*Brevoortia tyrannus*) (Figs. DM-9, IN-6) Menhaden first appeared in Survey catches in April (2.2% occurrence) and increased in abundance through fall (Figs. IN-6A and D). From April through August, catches of menhaden were highest near New Haven Harbor in depths less than 18 m (Figs. DM-9 and IN-6C). In September and October, catches were highest along the Connecticut shore from New Haven Harbor to Norwalk. By November they were concentrated farther east along the shore from Milford to Guilford, and from Guilford across the Sound towards Mattituck. The New Haven Harbor area had consistently high catches during all seasonal periods.

Although menhaden length data were not available, weights taken in the spring and fall periods from 1992 to 1994, in addition to observations recorded on field sheets, provided information about size composition. From April to June, the average weight per fish was 369 gm, or about 28 cm (length/weight relationship from Wilk et al., 1978), indicating many of these menhaden were adults (>22 cm; Lewis et al., 1987). From September through October, the mean weight was 132 gm (about 17 cm), indicating most were juveniles.

Atlantic sturgeon (*Acipenser oxyrinchus*) (Figs. DM-10, IN-7, LF-6) Atlantic sturgeon taken in the Survey ranged from 72 to 141 cm (Fig. LF-6), and were probably juveniles (size at 50% maturity = 200 cm; NMFS, 1995). Although Atlantic sturgeon were not often observed—percent occurrence ranged from 0% in April to 4.1% in October—they were taken in all months from May through November (Fig. IN-7D).

Most Atlantic sturgeon were found in the eastern half of the Sound, especially from the mouth of the Connecticut River on sand bottom in depths less than 9 m to deeper sand and transitional areas in the Eastern Basin and Mattituck Sill, and further south into a 27+ m mud area in the Central Basin (Fig. DM-10). Sturgeon were also taken in a 18–27 m transitional bottom area near Mattituck. The largest sturgeon concentrations were observed in September (the three largest catches of 15, 46, and 47 sturgeon occurred in three consecutive years during the same week in September) in two areas: south of Guilford on transitional bottom in depths greater than 27 m, and in the 27+ m mud area in the Central Basin. Overall, the greatest number of sturgeon were taken on transitional bottom in depths greater than 27 m (158 of the 208 sturgeon captured).

Bigeye scad (*Selar crumenophthalmus*) (Fig. DM-11) Bigeye scad were relatively uncommon in Survey catches, with 83 individuals taken since 1988 (Appendix II). In addition, 78 of the 83 scad were caught in 1988 and 1989, with 34 taken in a single tow in 1989 off Mattituck, New York, in depths between 18 and 27 m (Fig. DM-11).

Bigeye scad first appeared in Survey catches in July and were observed each month thereafter through November. They were most commonly found in the eastern half of the Sound, especially from Niantic Bay to the Thames River, and along the Mattituck Sill. Although only three bigeye scad, ranging from 13 to 15 cm, were measured, comments on field sheets indicated that all bigeye scad taken in the Survey were probably less than 16 cm.

Black sea bass (*Centropristis striata*) (Figs. DM-12, IN-8, LF-7) Black sea bass captured in the Survey ranged from 5 to 57 cm (Fig. LF-7). From May through August, most black sea bass taken in the Survey were adults (>19 cm; NMFS, 1995), whereas in October and November the majority of black sea bass were juveniles (84% and 57% respectively), many of which were YOY (<10 cm; Wenner et al., 1986).

Although black sea bass were not very abundant in the Survey, catch distributions exhibited distinct patterns. During May and June, when black sea bass were most commonly encountered (about 13.6% occurrence), they were mostly captured on the Mattituck Sill and along the Connecticut side of the Sound from Norwalk to Guilford (Fig. DM-12). In contrast, during the summer period sea bass were found almost exclusively among sand wave formations on the Mattituck Sill in depths between 18 and 27 m. During the fall period black sea bass were once again more dispersed; however, during September they were taken only in depths less than 27 m, whereas in October and November abundance was highest in depths greater than 27 m (Fig. IN-8C).

Blueback herring (*Alosa aestivalis*) (Figs. DM-13, IN-9, LF-8) Blueback herring were observed in every month of the Survey, ranging from 17.5% occurrence in April to 5.6% in November (Fig. IN-9). Ranging in length from 7 to 30 cm (Fig. LF-8), most bluebacks observed were juveniles (<25 cm; Johnson et al., 1978), with perhaps a few adults taken from May through October.

For most of the year, blueback herring were closely associated with the Connecticut shoreline (Fig. DM-13). During the spring period, bluebacks were mostly found in depths less than 18 m (Fig. IN-9C), with the largest concentrations along the Connecticut shore near major rivers. During the summer period bluebacks were more abundant in depths greater than 9 m, with the largest catches occurring in depths greater than 18 m in the Central Basin (the August indices may indicate a shift to shallow water, although they were very low). By fall blueback distribution was similar to the spring months—they were most abundant along the Connecticut shore in depths less than 9 m near the mouths of major rivers. The few bluebacks taken in November were caught primarily in depths less than 9 m, with only two bluebacks observed in depths greater than 18 m.

Bluefish (*Pomatomus saltatrix*) (Figs. DM-14–DM-16, IN-10–IN-12, LF-9) Bluefish first appeared in Survey catches in May (7% occurrence), but were relatively rare until June when they occurred in 28% of samples (Fig. IN-10D) and were taken throughout the Sound (Fig. DM-14). Bluefish taken in May ranged from 40 to 76 cm, whereas in June they ranged from 24 to 78 cm (Fig. LF-9).

Juveniles first appeared in Survey catches in July. They comprised 46% of the bluefish catch, but only appeared in 8.3% of samples (Fig. IN-11D). Juvenile abundance increased quickly during summer—by August they comprised 94% of the catch and occurred in 63.1% of samples. During the summer period juveniles were primarily distributed on the Connecticut side of the Sound from New Haven to Norwalk (Fig. DM-15), whereas adults appeared to be more abundant in the deeper portions of the Central and Western Basins (Figs. DM-16 and IN-12C).

When abundance peaked in September (Fig. IN-10A), bluefish were found throughout the Sound (93.3% occurrence), although about 93% of the bluefish taken were juveniles. Juvenile abundance was highest in depths between 9 and 27 m over mud bottom in several broad areas in the Sound: the Connecticut side from New Haven to Norwalk, across the Western Basin into Smithtown Bay, and across the Central Basin from New Haven to Mattituck. Adult abundance was also high in some of these areas, but in contrast with juveniles, abundance tended to generally increase with depth in September, and in October abundance was similar in depths greater than 9 m (Fig. IN-12C).

While juvenile abundance decreased rapidly after September (Fig. IN-12A), adult abundance increased to a peak in October before declining (Fig. IN-12A). By November, juveniles only comprised 60% of the bluefish catch, down from a high of 94% in September. The remaining bluefish in November were distributed throughout the Sound (Fig. DM-14).

Butterfish (*Peprilus triacanthus*) (Figs. DM-17, IN-13, LF-10) Butterfish, the most abundant species recorded in the Survey, were observed from April through November (Fig. IN-13). Abundance was relatively low until July, peaked at very high levels in August and September, and then declined through October and November. From July through October, butterfish occurred in 90% of trawls on average (Fig. IN-13D) and were encountered throughout the Sound (Fig. DM-17). The percent occurrence was high on all bottom types and depth intervals (Figs. IN-13C and F), but abundance was highest over mud and transitional bottoms in depths between 9 and 27 m (Figs. IN-13B and C).

Butterfish taken in the Survey ranged from 3 to 25 cm (Fig. LF-10). In May, 83% were adults, whereas only 9% were adults in September and October (>11 cm; NMFS, 1989). In November, the percentage of adults increased to 27%.

Clearnose skate (*Raja eglanteria*) (Fig. DM-18) Clearnose skate, a relatively rare species in the Sound (only 29 observed), were most often taken during September and October (Fig. DM-18). They were distributed primarily on the sand and transitional bottom of the Mattituck Sill and Eastern Basin. Only five clearnose skate were observed west of the Sill, four of which were in depths greater than 18 m on mud bottom.

Crevalle jack (*Caranx hippos*) (Fig. DM-19) Crevalle jack were uncommon in Survey catches; only 20 were observed. They first appeared in the Survey in September and most were taken during that month (16 individuals). Only three were taken in October and one in November (Fig. DM-19). They were most commonly found in depths less than 18 m (17 individuals), particularly along the Connecticut shoreline. Based on ten measurements and comments from field sheets, crevalle jack taken in the Survey ranged from 10–15 cm.

Cunner (*Tautogolabrus adspersus*) (Figs. DM-20, IN-14) Cunner were observed in all months of the Survey, ranging from 5% occurrence in October to 20% occurrence in May (Fig. IN-14D), with abundance generally highest from April through July (Fig. IN-14A). During all seasons, there were three areas of concentration: south of New Haven, the Connecticut side of the Western Basin, and off Eaton's Neck in the Western Basin (Fig. DM-20). The sites sampled in these areas were typically between 9 and 18 m deep. The first two areas were characterized by mud and transitional bottom types, whereas the sites sampled near Eaton's Neck, which consistently produced cunner, had transitional and sand bottom types and adjacent rocky structure.

Fourbeard rockling (*Enchelyopus cimbrius*) (Figs. DM-21, IN-15) Fourbeard rockling were observed from April through November, with percent occurrence ranging from 6% in October to 39% in June (Fig. IN-15D). Peak abundance occurred in June and declined through October (Fig. IN-15A). Although abundance varied, rockling distribution was similar during all seasons: most were found in depths greater than 18 m over mud bottom in the Central and Western Basins, very few were observed on the Mattituck Sill, and none were taken in the Eastern Basin (Fig. DM-21). Overall, fourbeard rockling were six times more abundant over mud compared to transitional sediments and were rarely caught on sand. Abundance tended to increase with depth (Figs. IN-15B and C).

Fourspot flounder (*Paralichthys oblongus*) (Figs. DM-22, IN-16, LF-11) Fourspot flounder sampled in the Survey ranged from 6 to 39 cm (Fig. LF-11). Adults (>22 cm; NMFS, 1989) comprised about 85% of fourspot flounder taken from April through June, 76% in August, and 16% in October.

Abundance increased rapidly during the spring period to a peak in June, and then quickly decreased through summer to a low level during the fall period that was similar to abundance in April (Fig. IN-16A). During May through November, the percent occurrence varied less than did abundance, ranging from 44% in September to 79% in June (Figs. IN-16A and D). Fourspot flounder were found throughout the Sound on all bottom types and depths, but were most abundant in the Central and Western Basins (Fig. DM-22). Preferences for depth and bottom type within these basins were most pronounced during the months of highest abundance—abundance generally increased with depth (Fig. 16C), and fourspot flouder were found mostly on mud bottom, with abundance over transitional and sand bottoms ranking second and third respectively (Fig. 16B).

Goosefish (*Lophius americanus*) (Fig. DM-23) Goosefish has been a relatively rare species in the Sound, with only 56 individuals observed in the Survey (Appendix II). Of the 46 goosefish taken during the spring period (one in April, 33 in May, and 13 in June), 44 were in depths greater than 18 m, and most were observed on mud and transitional sediments in the Central Basin (Fig. DM-23). Only seven goosefish were observed in the summer period, one in the fall, and five in November. Observations recorded on field sheets indicated that all goosefish taken in the Survey were juveniles (<41 cm; NMFS, 1989).

Grubby (*Myoxocephalus aeneus*) (Fig. DM-24) Grubby were uncommon in the Survey, with only 28 taken since 1984 (Appendix II). Most grubby were observed along the Connecticut side of the Sound, but they were also taken in a 9–18 m sand and rocky area near Eaton's Neck, New York (Fig. DM-24). Of the 28 grubby observed, 23 were taken in the spring period (11 in April, seven in May, and five in June); 25 were in depths less than 18 m and none were taken from depths greater than 27 m; and 12 each were on sand bottom and mud bottom, and four on transitional bottom.

Hickory shad (*Alosa mediocris*) (Figs. DM-25, IN-17, LF-12) Hickory shad taken in the Survey ranged in size from 18 to 37 cm (Fig. LF-12). They first appeared in catches in May and were observed every month thereafter (Fig. IN-17).

Although relatively uncommon in the Survey (<4% occurrence in all months), hickory shad appeared to exhibit a seasonal inshore/offshore pattern (Fig. DM-25). During the spring period they were primarily taken in depths less than 18 m, especially near the Housatonic

River and New Haven Harbor, whereas in summer most hickory shad were observed in depths greater than 18 m (Fig. IN-17C). In the fall period they were again taken in depths less than 18 m along the Connecticut shoreline. Although few hickory shad were taken in November (12 individuals), they appeared to be distributed throughout the Sound.

Hogchoker (*Trinectes maculatus*) (Figs. DM-26, IN-18) Hogchoker taken in the Survey exhibited a seasonal inshore/offshore pattern of distribution (Fig. DM-26). During April, a month of low abundance (Fig. IN-18A), hogchoker were distributed in all depths (Fig. IN-18C) in the Central and Western Basins. From May to June abundance was high in shallow water along the Connecticut shoreline from Norwalk to New Haven, and hogchoker were also found along the north shore of Long Island near Shoreham and Eaton's Neck. During July, when abundance was again low, hogchoker were still found along the Connecticut shore from Milford to New Haven, but they were rare along the Long Island shore, and none were observed in depths greater than 27 m.

Hogchoker abundance in deeper water increased from August through November, and by October they were concentrated along the Long Island side of the Western and Central Basins (Fig. DM-26) in depths greater than 18 m on mud and transitional bottom (Figs. IN-18B and C). Most of the largest catches occurred during October in this area. In November, a month of high abundance, they were most abundant in depths greater than 18 m on mud and transitional bottom, with none taken in depths less than 9 m.

Little skate (*Raja erinacea*) (Figs. DM-27, IN-19, LF-13) Little skate taken in the Survey ranged from 8 to 51 cm (Fig. LF-13). The percentage of adults (>39 cm; NMFS, 1995) ranged from 40% in April to 68% in August (Fig. LF-13).

When abundance was high during the spring period (Fig. IN-19A), little skate were most abundant on transitional and sand bottom (Fig. IN-19B) in the Eastern Basin and along the Mattituck Sill between Guilford, Connecticut, and Mattituck, New York (Fig. DM-27). Abundance decreased west of the Mattituck Sill where mud bottom is more common. However, little skate were abundant in some areas in the Central Basin where transitional and sand bottom exists, such as an area south of New Haven, and along the Long Island Shore near Shoreham, New York. In April little skate abundance was highest in depths less then 9 m and low in depths greater than 27 m (Fig. IN-19C). During June the reverse occurred—abundance was highest in depths greater than 27 m and low in depths less than 9 m. During the summer, a period of low abundance, little skate still occurred in the same areas as in the spring, but the largest catches occurred in the Eastern Basin.

Abundance increased during the fall months and November. When abundance peaked in November, skate were again concentrated on transitional bottom in depths between 9 and 27 m near Mattituck, and in depths less than 18 m near Guilford. In contrast with spring, large catches were not recorded over the large sand lobe that extends from the Eastern Basin onto the Mattituck Sill.

Long-finned squid (*Loligo pealei*) (Figs. DM-28, IN-20, LF-14) Long-finned squid taken in the Survey ranged from 2 to 40 cm mantle length (Fig. LF-14). The largest long-finned squid were present in May and June, when about 65% of long-finned squid were adults (>15 cm; NMFS, 1993). The percentage of juveniles increased through summer and peaked in September, when 98.8% of long-finned squid were less than 16 cm.

Long-finned squid were rarely observed in April (4% occurrence), but from May through November they were commonly taken throughout the Sound. The percent occurrence varied little during these months, ranging from 63% in July to 81% in September (Fig. IN-20D). Abundance remained stable through late spring and summer (Fig. IN-20A), and then increased dramatically in fall when small squid, ranging from about 2 to 12 cm, recruited to the trawl.

Although squid were commonly encountered throughout the Sound in late spring, they were most abundant east of Stratford Shoal, particularly in depths greater than 18 m on the transitional and sand bottom (Figs. IN-20B and C) of the Mattituck Sill and the adjacent portion of the Central Basin (Fig. DM-28). In addition, they were concentrated in Niantic Bay. In contrast, long-finned squid appeared to be more dispersed in summer. In fall, when small long-finned squid were abundant, they were distributed throughout the Sound, but were more abundant in the Central and Western Basins. During the fall generally, abundance tended to increase with depth and was highest over mud bottom, with abundance over transitional and sand bottoms ranking second and third respectively. Although the abundance of long-finned squid was very low in November, they were still commonly encountered throughout the Sound (65% occurrence). Abundance was similar over all bottom types but, as in the fall period, abundance tended to increase with depth.

Longhorn sculpin (*Myoxocephalus octodecemspinosus*) (Figs. DM-29, IN-21) During the spring period when they were most abundant, longhorn sculpin were found primarily on transitional and sand bottom in the Eastern Basin and on the Mattituck Sill (Fig. DM-29). Generally, abundance increased with depth (Fig. IN-21C) and most of the largest catches occurred in depths greater than 27 m in the Eastern Basin. Abundance of longhorn sculpins decreased rapidly after April, and none were taken from July through October. They reappeared in November, occurring in 8.2% of samples. Although only 28 longhorn sculpins were taken in November, the catch distribution contrasted with that of spring: catches were dispersed among all bottom types in the Central Basin and Mattituck Sill, with only two longhorn sculpins taken in the Eastern Basin. However, as in spring, abundance appeared to increase with depth.

Mackerel scad (*Decapterus macarellus*) (Fig. DM-30) Mackerel scad, a rarely occurring species in the Survey, were first recorded in 1990 (Appendix II). Of the 13 captured, all were caught during the fall period, and 12 were taken in the eastern half of the Sound (Fig. DM-30). None were taken in depths greater than 27 m. Although only two mackerel scad were measured, examination of field sheets indicated that all 13 taken were of similar size—about 12 cm.

Moonfish (*Selene setapinnis*) (Figs. DM-31, IN-22) Moonfish caught in the Survey ranged from 7 to 12 cm. They first appeared during August (5.8% occurrence), and were most abundant during the fall period (Figs. IN-22A and D). They were most abundant in depths less than 18 m (IN-22C) along the Connecticut shore from Norwalk to Guilford, and near Mattituck (Fig. DM-31). Abundance decreased in November when they were observed in only 5.9% of samples.

Northern kingfish (*Menticirrhus saxatilis*) (Fig. DM-32) Northern kingfish, an uncommon species in the Survey, were first observed in 1989 (Appendix II). From 1989 to 1994, 24 kingfish, ranging from 12 to 22 cm (based on 15 measurements), were taken during the fall period, and only one in November (Fig. DM-32). Most kingfish were taken over the Mattituck Sill, and 17 of the 25 kingfish were taken over sand bottom.

Northern pipefish (*Syngnathus fuscus*) (Fig. DM-33) Since 1984, only 33 pipefish were taken in the Survey. Although 20 were taken within a few miles of shore, they were in depths greater than 27 m. Six pipefish were observed in one tow in the Eastern Basin over transitional bottom in 27+ m, and 11 more were caught in one tow in similar depths in the Central Basin over mud bottom (Fig. DM-33).

Northern puffer (*Sphoeroides maculatus*) (Fig. DM-34) Northern puffer were relatively uncommon in the Survey. Of the 54 individuals observed since 1984, 28 were caught in 1993 (Appendix II). Only one puffer was taken during the spring period (in June), and four in summer (Fig. DM-34). During the fall period when they were most common (44 individuals), most puffers were taken in the Central Basin over all bottom types and depths (Fig. DM-34). Thirteen were caught in a single tow in less than 9 m off Shoreham, New York.

Northern searobin (*Prionotus carolinus*) (Figs. DM-35, IN-23) Northern searobin were rarely observed in April (6.3% occurrence), but became very common during May and June when they occurred in about 60% of samples (Fig. IN-23D). Although abundance declined quickly after peaking in June (Fig. IN-23A), northern searobin were still relatively common from July through November, occurring on average in about 23% of samples each month.

During the spring period northern searobin were most abundant on the Mattituck Sill, with the largest catches occurring near Mattituck (Fig. DM-35). They were also abundant in the deeper waters of the Central and Western Basins. Generally, abundance was highest in depths greater than 18 m, particularly in June, and was similar on transitional and sand bottom with slightly less abundance over mud bottom (Figs. IN-23B and C). During the summer period most northern searobin were distributed on the sand and transitional sediments of the Mattituck Sill with little preference of depth. In contrast, during the fall period and November they were more widely distributed, with some indication for increasing abundance with depth.

Ocean pout (*Macrozoarces americanus*) (Figs. DM-36, IN-24) The distribution of ocean pout was very restricted temporally and spatially. All but one ocean pout caught in the Survey were taken during the spring period, with 89% of the total catch taken during April and May. During these months ocean pout were concentrated in two areas: in the Western Basin between Eaton's Neck and Port Jefferson, New York; and a smaller concentration 85 km to the east in the Eastern Basin (Fig. DM-36). Both areas are generally deeper than 27 m, but the bottom type is different—the Western Basin area is primarily mud with some transitional bottom, whereas the bottom in the Eastern Basin area is entirely transitional. In general, abundance increased with depth (none were taken in depths less than 9 m), and ocean pout were most abundant on mud bottom in depths greater than 27 m (Figs. IN-24B and C).

Oyster toadfish (*Opsanus tau*) (Fig. DM-37) Oyster toadfish were rarely encountered in the Survey, with only 26 individuals taken since 1984 (Appendix II). Of these 26, 15 were taken in the spring period, two in summer, and nine in fall (Fig. DM-37); 17 were taken in depths less than 18 m and nine in depths greater than 18 m; and 11 were taken on mud bottom, 11 on transitional bottom, and four on sand.

Planehead filefish (*Monacanthus hispidus*) (Fig. DM-38) Athough relatively uncommon (98 taken since 1984), planehead filefish were observed in the Survey in most years (Appendix II). One filefish was observed in September, 30 in October, and 67 in November. During the fall period, most of the filefish were taken on transitional sediments along the Mattituck Sill and adjacent portions of the Central Basin, with 26 of the 31 filefish taken in depths greater than 18 m (Fig. DM-38). Although filefish were more widespread over mud and transitional sediments in November, they were still found primarily in depths greater than 18 m (50 of the 67 observed).

Pollock (*Pollachius virens*) (Fig. DM-39) Pollock were rarely observed in the Survey, and none have been recorded since 1989 (Appendix II). Of 24 pollock taken, 21 were caught in July and three in August (Fig. DM-39). They were observed in all depths over mud and transitional bottoms. Although pollock measurements are not available, examination of field data sheets indicates that all pollock taken in the Survey were juveniles (<37 cm; NMFS, 1989).

Rainbow smelt (*Osmerus mordax*) (Fig. DM-40) Although rainbow smelt were rarely observed in the Survey, seasonal and spatial patterns were evident. Of the 31 smelt caught, 30 were caught in April and one was caught in June (Fig. DM-40). Twelve were caught in depths less than 18 m over sand and transitional bottom near the mouth of the Connecticut River, and seven were caught in similar depths over mud bottom east of Norwalk where the Saugatuck and Mill Rivers enter the Sound. Overall, 26 of the 31 smelt were taken in depths less than 18 m. The remaining five smelt were caught in depths greater than 27 m.

Red hake (*Urophycis chuss*) (Figs. DM-41, IN-25, LF-15) Red hake caught in the Survey ranged from 7 to 53 cm (Fig. LF-15). The percentage of juvenile fish (<22 cm; NMFS, 1989) was highest in April (35%), and decreased thereafter through October (5%).

In most months red hake were found throughout the Sound (Fig. DM-41). However, they were most abundant in deeper water over mud bottom (generally, abundance increased with depth), particularly in June and July (Figs. IN-25B and C). During June, the month of peak abundance (Fig. IN-25A), red hake were most common over mud bottom in depths greater than 27 m in the Western and Central Basins. Although abundance dropped considerably in July, the largest catches observed in the Survey (>100/tow) occurred during this month in 27+ meter/mud strata in the Western Basin and north of Shoreham (the one exception was a catch in a 18–27 meter/mud site). Abundance continued to decline into fall, but in November abundance increased again to levels comparable to early spring.

Rock gunnel (*Pholis gunnellus*) (Figs. DM-42) Rock gunnel were rarely taken in the Survey, with only 37 observed since 1984 (Appendix II). Overall, 25 of the rock gunnels were observed during the spring period; 33 were taken in depths less than 18 m and four were in depths greater than 18 m; and 18 were taken on sand bottom, 13 on transitional bottom, and six on mud bottom. Although 18 of the 25 rock gunnels observed in spring were taken near the mouth of the Connecticut River (Fig. DM-42), this may be due to the large amounts of leafy debris and kelp in this area that often clogged the trawl net, thereby increasing the retention of very small fish.

Rough scad (*Trachurus lathami*) (Figs. DM-43, IN-26) Rough scad were generally first observed in August (only one was taken earlier in June), which was also the month of highest occurrence (17.5%) and abundance (Figs. IN-26A and D). The abundance of rough scad decreased after August and by November was observed in only 0.7% of samples. During August most rough scad were caught over the Mattituck Sill (Fig. DM-43), with the largest catches occurring over sand and transition bottoms. Rough scad were also frequently taken in Niantic Bay and south of Milford. In the fall period, rough scad were distributed farther west than during the summer period, with the largest catches made in depths less than 18 m along both shores of the Sound. Based on 115 measurements and comments on field sheets, rough scad taken in the Survey ranged from 12 to 16 cm.

Round herring (*Etrumeus teres*) (Fig. DM-44) Round herring were rarely taken in the Survey, with only 48 observed since 1984. In addition, 37 of the 48 were caught in the first two years of the Survey (Appendix II). They were observed in all seasonal periods, but the majority (39 of 48 fish) were taken in the fall period and November (Fig. DM-44). Forty-three were observed in depths between 18 and 27 m, whereas only four were taken in depths less than 9 m and only one was deeper than 27 m. Based on eight measurements and comments recorded on field sheets, round herring ranged from about 11–15 cm.

Scup (*Stenotomus chrysops*) (Figs. DM-45–DM-47, IN-27–IN-29, LF-16) Scup captured in the Survey ranged from 3–39 cm (Fig. LF-16). The length frequencies have modes at 11 cm and 18 cm in June, and 9 cm in November, that correspond to the modes and backcalculated lengths-at-age reported by Finklestein (1969) and Hamer (1970) for ages one and two in the spring and age zero in the fall respectively. Growth can be approximated by following the modes by month: age zero scup, which first recruited to the gear in August, increased from 4 cm in August to 9 cm in October; age one scup increased from 10 cm in July to 17 cm in November; and age two scup increased from 18 cm in July to 22 cm in October. Adult scup (>12 cm;

NMFS, 1989) comprised 77% of the sample population in May and 35% in June and July. As YOY recruited to the gear, the percentage of adult fish dropped to a low of 8% by October.

Scup were one of the most commonly observed species in the Survey (Fig. IN-27D). They were taken from April through November, but were not commonly observed until May (51.0% occurrence). From June through November, they occurred in 82.5% (November) to 96.3% of samples (September and October). Due to the large numbers of YOY scup that recruited to the trawl in summer and fall, the abundance and distributions of YOY and age 1+ scup were examined separately.

Although scup age 1+ were taken in the Survey in April (1.3% occurrence), they were most common from May (50.7% occurrence) through November (62.8% occurrence). Abundance increased through the spring period to a peak in July, and then declined through November (Figs. IN-29A and D).

During May and June, scup age 1+ were concentrated primarily on transitional and sand bottom at all depths (Figs. IN-29B and C) on the Mattituck Sill, and in Niantic Bay (Fig. DM-47). Additionally, some of the largest catches occurred south of Milford and near the Thames River. The distribution of age 1+ scup was similar during the summer period, except that the concentration over the Sill extended into the deeper, adjacent portions of the Central Basin. Most of the largest catches made in the summer period occurred in Niantic Bay.

During the fall period age 1+ scup were more dispersed. However, the areas where scup were abundant in spring, such as the Mattituck Sill, Niantic Bay, and south of Milford, still produced some of the largest catches. In contrast with spring, they appeared to be abundant along both the Connecticut and New York sides of the Western Basin. In November, when abundance dropped to early spring levels, most age 1+ scup were taken in depths greater than 18 m over transitional bottom south of Guilford.

Young-of-year scup first appeared in Survey catches in August (Fig. DM-46), occurring in 8% of samples (Fig. IN-28D). Abundance increased to very high levels in October and then dropped in November (Fig. IN-28A). Although YOY were distributed throughout the Sound in the fall period, they were most abundant on mud and transitional bottom (Figs. IN-28B and C), and there were several areas of concentration: Niantic Bay, along the Mattituck Sill, north of Shoreham, and throughout the Western Basin. As with age 1+ scup, the abundance of YOY in November was highest in depths greater than 18 m.

Sea raven (*Hemitripterus americanus*) (Figs. DM-48, IN-30) Sea ravens were most abundant in the Survey during April (Fig. IN-30A) when they occurred in 23.5% of samples (Fig. IN-30D). In April they were found primarily in the Eastern Basin and Mattituck Sill on transition and sand bottom (Fig. DM-48) in depths greater than 18 m (Fig. IN-30C). Generally, abundance was highest in depths over 18 m, but some of the largest catches occurred in depths less than 18 m in the Eastern Basin. Abundance decreased rapidly after April, and by July sea raven were absent from Survey catches.

Sea ravens were again observed in November. Although uncommon (6% occurrence), they appeared to be distributed differently than in April: they were still found primarily on transitional bottom, but were also found equally on mud and sand; abundance was highest in depths less than 9 m; most were taken in the Central Basin along the Connecticut shore; and only three were taken in the Eastern Basin.

Silver hake (*Merluccius bilinearis*) (Figs. DM-49, IN-31, LF-17) Silver hake sampled in the Survey ranged from 8 to 38 cm (Fig. LF-17). Adults (>19 cm; NMFS, 1989) made up 73% of the catches in May, declining to 37% in July and 16% in September.

Silver hake were commonly observed in all months, ranging from 27.6% occurrence in September to 72.2% in June (Fig. IN-31D). Abundance peaked in June, dropped in August and September, and increased again in October and November (Fig. IN-31A).

Silver hake were primarily distributed in the Central and Western Basins (Fig. DM-49). Generally, silver hake abundance was highest over mud bottom with abundance over transitional and sand bottoms ranking second and third respectively (Fig. IN-31B), and abundance tended to increase with depth (Fig. IN-31C). This pattern became more evident through spring as abundance increased, and was very pronounced in summer. During July, a month of high abundance, they were concentrated in depths greater than 27 m over mud bottom in the two basins. Eight of the nine largest samples observed in July occurred over mud bottom, and seven occurred in depths greater than 27 m (the other two were between 18 and 27 m). Although abundance was low in fall, the distribution of silver hake was similar to summer. In November, when abundance increased again, silver hake were distributed in all depths, although primarily in the northern half of the Central Basin.

Smallmouth flounder (*Etropus microstomus*) (Figs. DM-50, IN-32) Although taken in all months, smallmouth flounder were relatively uncommon in Survey catches, with percent occurrence ranging from 8.3% of samples in April to 1.6% in July (Fig. IN-32D). During most months, they were found primarily on the sand and transitional sediments of the Mattituck Sill (Fig. DM-50). Although only 18 smallmouth flounder were measured, examination of field sheets indicated that this sample, ranging from 7–13 cm, was representative of those taken in the Survey.

Smooth dogfish (*Mustelus canis*) (Figs. DM-51, IN-33, LF-18) Smooth dogfish caught in the Survey ranged from 27 to 130 cm (Fig. LF-18). In July, 83% of smooth dogfish were juveniles (<99 cm; Bigelow and Schroeder, 1953) and 42% were young-of-year (<39 cm; Bigelow and Schroeder, 1953). The percentage of juveniles decreased to 55% in September, but increased again to 85% in November.

Smooth dogfish were first observed in the Survey in May, occurring in 18.4% of samples (Fig. IN-33D). By June, a month of high abundance (Fig. IN-33A), they occurred in 54.3% of samples. They remained relatively common in Survey catches through November (30.5% occurrence).

During the spring period smooth dogfish were distributed throughout the Sound and were found on all bottom types and depths (Fig. DM-51). However, they were most abundant in the Central Basin in Connecticut waters, and the largest catches were consistently made in depths less than 9 m between New Haven and Guilford. Similarly, during the summer period smooth dogfish were found in all depths over all bottom types, but three areas of concentration were evident: the Central Basin on the Connecticut side, over the Mattituck Sill in depths greater than 18 m, and in the Eastern Basin in depths greater than 90 m. In addition, the largest catch (56 individuals) was made south of Stratford Shoal between the Western and Central Basins.

In September and October, smooth dogfish were found in many of the same areas where they were taken in summer, but more were found in deep water, especially during October (Fig. IN-33C). However, the largest catch of 127 individuals—again made south of Stratford Shoal between the Western and Central Basins—occurred in depths between 9 and 18 m over mud bottom. By November, when abundance decreased, smooth dogfish were not caught in depths less than 9 m, and most were found in depths greater than 27 m. As in summer and fall, the largest catch (114 individuals) was made south of Stratford Shoal, but this time it occurred in depths greater than 27 m over mud bottom.

Spanish mackerel (*Scomberomorus maculatus*) (Figs. DM-52, IN-34, LF-19) Spanish mackerel were first observed in the Survey in 1989 (Appendix II). They were relatively uncommon, occurring in 3.9% of samples in September, 1.6% in October, and 1.9% in November (Fig. IN-34D). They ranged in size from 8 to 54 cm; however, 96% were between 8 and 22 cm (Fig. LF-19). Most of the Spanish mackerel were taken in depths less than 18 m (Fig. IN-34C) in several nearshore areas: Smithtown Bay, near Shoreham, and between Norwalk and New Haven (Fig. DM-52).

Spiny dogfish (*Squalus acanthius*) (Figs. DM-53, IN-35) Spiny dogfish were relatively uncommon in Survey catches from spring through fall. During these seasons, they were most likely to be encountered during late spring (May and June) when they occurred in about 10% of samples (Fig. IN-35D). Only one spiny dogfish was caught in each April and August during the 11 years of the Survey. Although 211 dogfish were caught in July, 202 of these were caught in one tow in the Eastern Basin, an unusual occurrence.

Most spiny dogfish observed from spring through fall were found in the Eastern Basin in depths greater than 27 m over sand and transitional bottom (Fig. DM-53). Of 558 spiny dogfish caught from April to August, only eight were caught in depths less than 18 m. Spiny dogfish were also found in deep water across the Mattituck Sill into the Central Basin, but their occurrence decreased from east to west. One spiny dogfish was captured south of the Housatonic River; this was the farthest west that any were observed in spring and summer.

The abundance of spiny dogfish increased in late fall (Fig. IN-35A). By November they were commonly encountered (45.7% occurrence) and were more abundant and widely distributed than in any other month, occurring as far west as the Western Basin. Abundance was similar on mud and transition bottom, but less abundant on sand (Fig. IN-35B). Abundance generally increased with depth (Fig. IN-35C), but most spiny dogfish were taken in depths greater than 18 m (90% of the total catch), with the largest catches occurring in depths greater than 27 m.

Spot (*Leiostomus xanthurus*) (Figs. DM-54, IN-36) Spot captured in the Survey, ranging from 12 to 19 cm (based on 175 measurements), were age one or younger (<21.5 cm; Pacheco, 1962). They were observed as early as July (0.4% occurrence), but were most common during the fall period (about 8% occurrence) and November (8.6% occurrence) (Fig. IN-36D). They were found primarily in the Central and Western Basins, especially along the Long Island coastline from Mattituck to Shoreham and along the Connecticut shoreline from Norwalk to New Haven (Fig. DM-54).

Spotted hake (*Urophycis regia*) (Figs. DM-55, IN-37) Spotted hake were taken in every month of the Survey, with percent occurrence ranging from 1.9% in April to 21.6% in October (Fig. IN-37D). Spotted hake abundance was lowest in April, increased through October, and then declined slightly in November (Fig. IN-37A).

During spring and summer, spotted hake were found primarily in the Central and Western Basins (Fig. DM-55). However, in spring abundance was highest in depths less than 18 m, whereas during the summer period abundance increased in depths greater than 18 m, particularly over transitional bottom (Figs. IN-37B and C). When abundance was highest from September through November, the distribution of spotted hake changed: they were most abundant over the transitional and sand bottoms of the Mattituck Sill and adjacent portions of the Central Basin, and in the Eastern Basin (Fig. DM-55). During October, the month of peak abundance, spotted hake were most abundant in depths greater than 18 m. Spotted hake were also common in Smithtown Bay and near the mouth of the Connecticut River.

Striped bass (*Morone saxatilis*) (Figs. DM-56, IN-38, LF-20) Striped bass abundance in the Survey was highest in May and November and lowest during the summer period (Fig. IN-38A). Only three striped bass were observed during July, and none were taken in August. During all seasons they were most commonly taken along the Connecticut and Long Island coastlines in depths less than 18 m over all bottom types, especially near the mouths of the Connecticut and Housatonic Rivers (Figs. DM-56, IN-38B and C).

Striped bass taken in the Survey ranged from 11 to 126 cm (Fig. LF-20). During the months of highest abundance a wide range of sizes were observed, with striped bass ranging from 11 to 91 cm in May and 20 to 75 cm in November. From June through October striped bass were primarily larger than 45 cm, with none smaller than 34 cm. The three largest striped bass taken in the Survey—115, 117, and 126 cm—were caught during July in one tow south of the Connecticut River over sand bottom in depths less than 9 m.

Striped searobin (*Prionotus evolans*) (Figs. DM-57, IN-39, LF-21) Striped searobins taken in the Survey ranged from 5 to 45 cm (Fig. LF-21). In June, they ranged from 15 to 43 cm. In August, the length frequency was comprised of two groups: a smaller group not observed in June (probably YOY), ranging from 4 to 11 cm; and a larger group similar to the June length frequency, ranging from 20 to 45 cm. These two groups were also present in October, with the smaller group ranging from 8 to 18 cm and the larger group from 26 to 43 cm.

Striped searobins were rarely observed in April (0.3% occurrence), but became more common through late spring (Fig. IN-39D). Both abundance and percent occurrence remained high from June through November. Whereas striped searobins had been found throughout the Western and Central Basins, primarily on mud and transitional bottom (Fig. IN-39B), they were rare in the Eastern Basin (Fig. DM-57). In May, abundance decreased slightly with depth, whereas from June through November abundance generally increased with depth (Fig. IN-39C).

Searobin distribution within the Central and Western Basins changed seasonally. In the spring period (primarily June, since abundance was highest during this month) searobins were found throughout the Central and Western Basins, mainly in the deeper portions. During the summer period they were more concentrated in the Central Basin toward the Connecticut side of the Sound, with the largest catches east of New Haven. In fall they occurred throughout the Central and Western Basins, but appeared to be more abundant in the Western Basin and the adjacent, western portion of the Central Basin. In November searobin distribution resembled the spring period with one exception: the largest catches occurred along the Long Island shore in depths greater than 18 m from Port Jefferson to Mattituck.

Summer flounder (*Paralichthys dentatus*) (Figs. DM-58, IN-40, LF-22) Summer flounder taken in the Survey ranged from 12 to 76 cm (Fig. LF-22). The percentage of juvenile fish (<23 cm; NMFS 1989) decreased from 35% in April to 1.0% in August, but increased again to 13% in November.

Summer flounder were taken in all months of the Survey, with percent occurrence ranging from 17.1% of samples in November to 63.2% in September (Fig. IN-40D). Abundance peaked twice—in May and September—with highest abundance in September (Fig. IN-40A). In April, abundance was similar in all depths (Fig. IN-40C), but from late spring through the summer period abundance tended to increase with decreasing depth. During the spring and summer period, summer flounder were particularly abundant along the Connecticut shore from Guilford to New Haven, off the Connecticut River, in Niantic Bay, and near Mattituck, New York (Fig. DM-58). During the fall period, summer flounder were again distributed in all depths throughout the Sound, although in October abundance appeared to be lower in shallow water. By November, when abundance in the Survey was lowest, the remaining summer flounder were primarily taken in deeper water.

Tautog (*Tautoga onitis*) (Figs. DM-59, IN-41, LF-23) Tautog captured in the Survey ranged from 8 to 66 cm, with little variation in monthly size composition (Fig. LF-23). The majority of fish were adults, ranging from 86% of the catch in April to 97.5% in August (age at 50% maturity = age 3; Chenoweth, 1963; length at age 3 = 20.0 cm; Cooper, 1967).

Tautog were commonly observed in most months of the Survey, ranging from 15.4% occurrence in September to 50.2% in May (Fig. IN-41D). Tautog abundance in the Survey was highest from May through July, dropped in August, and then increased slightly in October and November (Fig. IN-41A).

From May through October tautog were most abundant in depths less than 18 m over all bottom types (Figs. IN-41B and C). During those months, tautog concentrations occurred in certain areas: several locations between New Haven and Norwalk, north of Hempstead, off of Eaton's Neck, and off Mattituck (Fig. DM-59).

All of these areas are typically less than 18 m deep and are adjacent to rocky structure. In contrast with May through October, tautog were more dispersed in November. They were found in all depths, although primarily in depths greater than 9 m, and were most abundant over mud bottom.

Tomcod (*Microgadus tomcod*) (Fig. DM-60) Tomcod were rarely taken in the Survey, with only 36 taken since 1984 (Appendix II). However, of the 36 observed, 32 were taken during April and May; 20 were taken near the Connecticut River (Fig. DM-60); six were taken near Eaton's Neck, including the only tomcod that were observed in November; and only six were observed in depths greater than 18 m. Although they were not consistently measured, most tomcod taken in the Survey ranged from 17 to 26 cm (based on 15 measurements and comments on field sheets).

Weakfish (*Cynoscion regalis*) (Figs. DM-61–DM-63, IN-42–IN-44, LF-24) Weakfish taken in the Survey ranged from 3 to 90 cm (Fig. LF-24). Most weakfish taken from May through July were adults (>24 cm; Shepherd and Grimes, 1984). Although one 5 cm weakfish was observed in June, YOY generally first appeared in Survey catches in August (<20 cm; Shepherd and Grimes, 1983) and comprised about 98% of the catch through October.

After first appearing in Survey catches in May (2.7% occurrence), weakfish abundance increased slightly thereafter through late spring and summer (Figs. IN-42A and D). Abundance increased dramatically through the fall period as YOY recruited to the Survey trawl, and then dropped in November.

Although few adult weakfish were taken in spring, most were taken along the Mattituck Sill and along both coastlines into the Western Basin (Fig. DM-63). They occurred in all of the Survey strata (Figs. IN-44E and F), but abundance tended to be highest over transitional bottom (Fig. IN-44B) in depths less than 18 m (Fig. IN-44C). During the summer and fall periods, weakfish were still distributed in the same areas as spring, but abundance tended to increase with depth, and abundance over mud bottom was proportionally higher compared to spring. In addition, during the fall period adult weakfish appeared to be more abundant along the Long Island side of the Central Basin, whereas in spring and summer more were distributed along the Connecticut side.

Young-of-year were more widely distributed than adults (Fig. DM-62). They were most abundant in the Central and Western Basins over mud bottom (Figs. DM-62 and IN-43B), with most of the largest catches occurring along the Long Island side of the Sound. Interestingly, in September abundance was highest in depths between 9 and 18 m and then decreased in deeper water, whereas in October abundance increased with increasing depth (Fig. IN-43). During both months abundance was lowest in depths less than 9 m.

Windowpane flounder (*Scophthalmus aquosus*) (Figs. DM-64, IN-45, LF-25) Windowpane flounder observed in the Survey ranged from 4 to 36 cm (Fig. LF-25). Adults (>14 cm; NMFS, 1989) comprised about 55% of the catch from April to June, 30% from July through October, and 60% in November.

Windowpane flounder was one of the most common species in the Survey, occurring throughout the Sound from April through November. Percent occurrence was high in all months, ranging from 87% of samples in September to 99% in April (Fig. IN-45D). Abundance peaked in May, declined to lowest abundance during September and October, and increased again in November (Fig. IN-45A). From April through July, and November, windowpane flounder were particularly abundant on transitional bottom south of Guilford, and on mud bottom in the Western Basin (Fig. DM-64).

Winter flounder (*Pseudopleuronectes americanus*) (Figs. DM-65–DM-71, IN-46–IN-49, LF-26) Winter flounder taken in the Survey ranged from 6 to 51 cm, with the largest fish observed during April and May (Fig. LF-26). After May, the length frequencies truncated each month through September—the largest fish measured in May was 51 cm, compared to 35 cm September. Larger winter flounder were again seen in November, when the largest fish measured was 44 cm. Juveniles (<25 cm; NMFS, 1989) comprised approximately 86% of the catch in April and May, 97% in August and September, and 84% in November.

Winter flounder was one of the most commonly taken species in all months of the Survey, ranging from 80.5% occurrence in October to 98.6% occurrence in May (Fig. IN-46D). Abundance, however, varied more than occurrence, ranging from 107.43 per tow in May to a low of 6.75 per tow in October. In general, abundance peaked in April and May, declined steadily through October, and increased again in November (Fig. IN-46A). They were generally more abundant on the mud bottom of the Central and Western Basins (Figs. DM-65, IN-46B), particularly during the months of highest abundance. Abundance increased with depth during the spring period, whereas during summer and fall abundance was similar in all depths (Fig. IN-46C). In November, abundance appeared to be highest in depths between 9 and 18 m, with a slight decrease in abundance in deeper water.

In addition to seasonal distribution maps of winter flounder, maps were prepared by month for three size groups to determine if winter flounder distribution and abundance changed monthly according to size. Of particular interest was the distribution and abundance of legal and sublegal size winter flounder (in Connecticut waters, the legal size for the recreational and commercial fisheries is 30.5+ cm). Group I was comprised of winter flounder less than 20 cm (Figs. DM-66 and DM-67), Group II winter flounder were 20 to 29 cm (Figs. DM-68 and DM-69), and Group III was 30 cm and larger (Figs. DM-70 and DM-71).

The overall seasonal pattern of abundance and occurrence was generally similar for the three size groups of winter flounder; however, there were some differences. Generally, abundance and occurrence peaked sometime in spring, declined thereafter through summer and fall, and then increased again in November. This pattern was slightly different for Groups I and II in two ways: Group I abundance peaked from April through May (Fig. IN-47A), whereas Group II peaked only in May (Fig. IN-48A); and, while the occurrence of both groups was high even during the fall period of low abundance, Group II were not as common as Group I (a low of 73.1% occurrence in October for Group I, and a low of 62.8% occurrence for Group II in September). Group III, however, differed more markedly from both Groups I and II: abundance of Group III peaked in April and declined rapidly through late spring to very low levels in summer and fall (Fig. IN-49A). The occurrence of Group III mirrored this trend, and decreased to a much lower percent occurrence than the other groups—Group III decreased from a high of about 89.8% in April to a low of 8.5% in September.

The abundance of the three groups of winter flounder also differed by bottom type. Group I abundance tended to be highest on mud bottom during all months (particularly during months of highest abundance), with abundance over transitional and sand bottoms ranking second and third respectively (Fig. IN-47B). Group II abundance by bottom type was similar to Group I during April, and perhaps May, but after May abundance on transitional sediments was very similar to that on mud bottom in most months (Fig. IN-48B). Group III was generally similar to Group II, but abundance on transitional bottom was similar to mud bottom even in May, and abundance on sand was relatively high as well (Fig. IN-48B).

Abundance by depth also varied among the three winter flounder groups. Group I abundance in April generally increased with depth (Fig. IN-47C). After April, abundance was always lowest in depths less than 9 m, while in depths greater than 9 m there may have been a slight, general decrease in abundance with increasing depth. Group II abundance increased with depth from April through July (Fig. IN-48C), but from August through November abundance was similar to Group I. Group III abundance was similar to Group II from April through July, but the trend was not quite as consistent (Fig. IN-49C). Although abundance increased with depth, abundance in depths less than 9 m was relatively high (this is also true in October and November). Also, in May abundance was similar in depths up to 27 m, while in depths greater than 27 m abundance was almost three times higher than in shallower water.

The differences in abundance by depth and bottom type observed between the three flounder groups was reflected in their distributions. Group I abundance was generally highest on mud bottom in the Central and Western Basins and on the adjacent transitional sediments of the Mattituck Sill, but the pattern of distribution changed noticeably during the spring period. In April abundance was highest in the central portions of the basins, whereas in May they were more dispersed within the basins and most of the largest catches were made near the Long Island side of the Sound from Smithtown Bay to Mattituck. Patterns were less discernable from June through November, but abundance appeared to remain relatively similar in both basins, and catches were consistently made in depths less than 18 m between Milford and New Haven.

The distribution of Group II winter flounder among the three basins appeared to be somewhat different from that of Group I. During the spring months, Group II winter flounder appeared to be more abundant in the Central Basin than in the Western Basin. The distribution of both groups within the basins appeared to be very similar in April, but different in May and June. In May many of the largest catches of Group II winter flounder were made in the same areas as Group I along the Long Island side of the Sound, but for Group II this was also true throughout much of the Central Basin. Also, in June Group II abundance in the Eastern Basin appeared to be higher than that of Group I, especially south of the Connecticut River, and they were still abundant south of Guilford. After June, Group II flounder remaining in the Sound were distributed in all three basins. In November, Group II flounder were distributed similarly to Group I along the Connecticut side of the Sound, particularly south of Guilford, and from New Haven Harbor to Milford. Within this stretch of the Connecticut coastline, however, Group I appeared to be more abundant off New Haven/Milford versus Guilford, whereas the reverse was true for Group II.

Similar to Group II, Group III winter flounder were more abundant in the Central Basin during April and May, and abundance was also relatively high across the Mattituck Sill into the Eastern Basin. From June through September, when abundance was very low, Group III flounder were observed sporadically throughout the Sound. When Group III abundance increased in late fall and November, they were most abundant in depths less than 18 m along the Connecticut coastline in the Eastern and Central Basins.

Winter skate (*Raja ocellata*) (Figs. DM-72, IN-50) Winter skate were most commonly taken during the spring period and late fall, occurring on average in 16.4% of samples during these periods (Fig. IN-50D). Abundance was highest during April, and decreased thereafter until August when none were recorded in the Survey (Fig. IN-50A). During the spring period, winter skate were most abundant on sand bottom in the Mattituck Sill and Eastern Basin (Figs. DM-72, IN-50B). Abundance was similar in most depths, with the exception of depths between 9 and 18 m, where abundance was lower (Fig. IN-50C). Winter skate abundance increased again in October and November, but they were not as concentrated on the Mattituck Sill and in the Eastern Basin as during the spring period.

Yellow jack (*Caranx bartholomaei*) (Fig. DM-73) Yellow jacks were relatively uncommon in the Survey, with 70 individuals taken since they were first observed in 1989 (Appendix II). They were most commonly taken in September and October, although a single tow in November produced almost half the total (30 individuals). Most yellow jacks were observed in depths less than 18 m along the Connecticut coast (67 were taken in depths less than 18 m), particularly in Niantic Bay where the largest catches occurred (11 and 30 individuals), and from the mouth of the Housatonic River to New Haven Harbor (Fig. DM-73). Although only three yellow jacks were measured, comments recorded on field sheets indicate that yellow jacks taken in the Survey were of similar size, i.e. 14 to 16 cm.

Part II: Habitat Utilization of Long Island Sound

As the distribution maps of individual species demonstrate, the occurrence and abundance of many species exhibit distinct seasonal patterns and habitat preferences in the Sound. But also of interest is whether the finfish assemblage as a whole exhibits patterns of utilization. To examine this issue, distribution maps were made of the aggregate catch/tow of all finfish, demersal finfish, and pelagic finfish. Further, species richness and the log mean of the aggregate finfish count/tow for eight habitats within the Sound were compared.

Distribution and Abundance of all Finfish, Pelagic Finfish, and Demersal Finfish (Figs. DM-74–DM-76, IN-51–IN-53) The aggregate abundance of finfish in the Survey generally increased from April through October, with two peaks in abundance: May (352 fish/tow) and October (513 fish/tow) (Fig. IN-51A). Aggregate abundance generally increased with depth in the spring and summer periods, whereas in fall and November abundance was highest between 9 and 27 m (Fig. IN-51C). Abundance tended to be highest over mud bottom during all months; however, abundance over transitional bottom was also high and was similar to abundance over mud bottom in some months (Fig. IN-51B). Abundance over sand bottom ranged from one-third to one-sixth that of mud bottom. Aggregate abundance was relatively low in the eastern portion of the Sound during all seasons, particularly over sandy substrate along the Mattituck Sill and the mouth of the Connecticut River (Fig. DM-74). During fall, fish were very abundant across the Western Basin, east towards New Haven, and over the transitional bottom extending from Guilford to Mattituck.

The abundance and distribution patterns of aggregate catch were generally a result of the different seasonal patterns exhibited by demersal and pelagic catches. The primary difference is that the seasonal trends of abundance were opposite: demersal abundance peaked in May and then declined through summer (Fig. IN-53A), whereas pelagic abundance was very low in spring, increased through summer, and peaked in October (Fig. IN-52A). This opposite seasonal trend was closely related to temperature, with demersals decreasing and pelagics increasing as water temperatures rose (Fig. 5A). The months of peak demersal and pelagic abundance (May and October respectively) coincided with the two months of peak aggregate abundance; therefore, the aggregate distribution in fall primarily reflected that of pelagic finfish (DM-75), whereas the aggregate distribution in spring primarily reflected that of demersal finfish (Fig. DM-76).

The fish assemblage in spring was dominated numerically by windowpane and winter flounders, and to a lesser extent by little skate (Table 7). Together these species accounted for 80% of demersals and 71% of all finfish taken during the spring. The most notable cold water pelagic species to inhabit the Sound, Atlantic herring, was occasionally taken in large numbers, but did not appear to be a major constituent of the cold water assemblage in the Sound every year. The pelagics were dispersed in all depths throughout the Sound (Figs. DM-75 and IN-52C), whereas demersal distribution, which generally reflected windowpane flounder, winter flounder, and little skate distributions, was primarily in deeper water (Figs. DM-76 and IN-53C).

As water temperatures warm, most cold water demersals move into deeper water and eventually out of the Sound, and are replaced by a variety of warm water pelagic migrants such as bluefish, butterfish, and weakfish, and by scup, a warm water demersal. Of the demersal species that migrate into the Sound, scup was the most abundant. By the summer period scup ranked with winter flounder as the most numerous demersal in the Survey, and by fall accounted for about 72% of the total demersal catch (Table 7), exceeding winter flounder and windowpane flounder abundance by an order of magnitude (Figs. IN-27A, IN-45A, and IN-46A). The appearance of YOY scup was the principal reason demersal abundance increased in fall instead of declin-

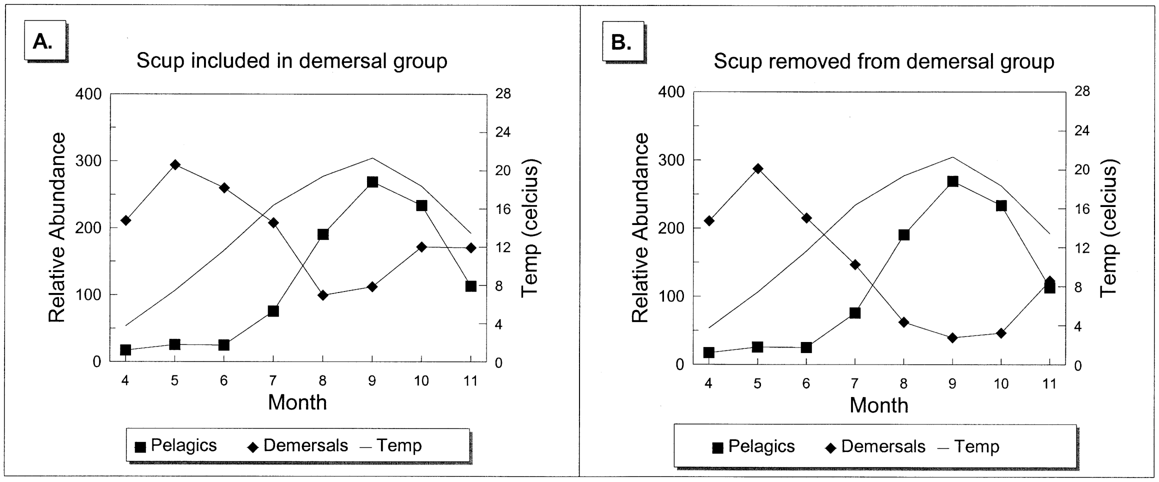

Figure 5

Monthly geometric mean catch/tow for demersals and pelagics plotted with bottom temperature (°C). A) Scup included with demersals, B) scup removed from demersals. Note: temperature values were obtained from Table 1.

ing further (Fig. IN-28A). After removing scup from the demersal group so as to examine the abundance of the original, more resident, cold water demersal assemblage, abundance declined to a low of 39 fish/tow in September, resulting in an inverse pattern of monthly demersal abundance versus pelagic migrant abundance (Fig. 5B).

During the fall period pelagic abundance was highest in depths between 9 and 27 m over mud substrates in the Western and Central Basins, with small catches consistently appearing over the sandy Mattituck Sill. By November, cooling water temperatures triggered emigration of most summer pelagics, with remnant concentrations scattered through the Central and Western Basins. Demersal abundance was generally greater in deeper areas during the summer and fall, with notable exceptions including frequent, large catches of age 1+ scup in Niantic Bay, and large catches of YOY scup in the shallow waters of Smithtown Bay and Shoreham, New York. Demersals were also more uniformly distributed among the three basins, whereas pelagics were seldom taken in quantity in the Eastern Basin during any season.

Measures of Habitat Utilization: Species Richness and Mean Aggregate Catch/tow To evaluate overall habitat utilization patterns in the Sound, Survey sites were grouped into 14 plots that comprise some of the major habitats based on depth, bottom type, and bathymetric features (Fig. 4). Species richness (mean number of finfish species per tow) and the log mean, aggregate finfish counts per tow were compared among plots by analysis of variance. Six of the 14 plots were dropped due to low sample size. The final comparison was made using plots 2, 5, 7, 8, 9, 11, 12, and 13.

Species richness was greatest within the Central Basin in plot 5 (13.22 species/tow), which is an area of shallow (<18 m) water over transitional sediments near the mouth of the Housatonic River, and plot 7 (12.73 species/tow), an area of deep water (>18 m) over mud substrate (Fig. 6, Table 8). Plots 12 and 13 had the lowest species richness (6.32 and 7.19 species/tow respectively). These two plots encompass the shallow, transitional strata along the eastern Connecticut shoreline from Niantic Bay to the mouth of the Thames River (plot 13), and the shallow sand area between the mouth of the Connecticut River and Long Sand Shoal (plot 12), which lies approximately two miles offshore. Plot 12 is routinely exposed to the large volume of fresh water outflow from the Connecticut River, which limits the average number of species occurring at any given time. Species that periodically appear in this area in large numbers include euryhaline species such as striped bass, tomcod, rainbow smelt, and summer flounder. Among species that occur in plot 13, scup is perhaps the predominant species. Other finfish utilizing this area with some frequency included summer flounder, blueback herring, and striped bass.

The deep sand habitat in plot 11 averaged 9.26 species per tow and was statistically distinct from any other area, ranking higher than plots 12 and 13, and lower than the other five plots (Fig 6, Table 8). This area is unique in the Sound, with large sand wave formations that are frequented most commonly by black sea bass and winter skate, and to a lesser extent by smooth dogfish, spiny dogfish, smallmouth flounder, little skate, and scup.

Table 7

Total counts of top 15 finfish species, by season and group (i.e. demersal and pelagic), 1984-94.

	Count	Percent		Count	Percent
Spring pelagic			**Spring demersal**		
Atlantic herring	32,935	50.8%	Winter flounder	206,993	46.4%
Silver hake	10,165	15.7%	Windowpane flounder	116,639	26.1%
Butterfish	9,934	15.3%	Little skate	37,132	8.3%
Alewife	3,183	4.9%	Red hake	22,564	5.1%
American shad	2,831	4.4%	Scup (porgy)	22,551	5.1%
Blueback herring	1,605	2.5%	Fourspot flounder	20,169	4.5%
Smooth dogfish	1,270	2.0%	Northern searobin	6,138	1.4%
American sand lance	1,028	1.6%	Tautog	3,864	0.9%
Atlantic menhaden	547	0.8%	Striped searobin	3,233	0.7%
Bluefish	352	0.5%	Fourbeard rockling	2,241	0.5%
Spiny dogfish	346	0.5%	Summer flounder	1,120	0.3%
Striped bass	263	0.4%	Cunner	835	0.2%
Weakfish	130	0.2%	Longhorn sculpin	816	0.2%
Hickory shad	83	0.1%	Winter skate	436	0.1%
Atlantic mackerel	61	0.1%	Hogchoker	435	0.1%
Summer pelagic			**Summer demersal**		
Butterfish	137,131	78.3%	Scup (porgy)	40,181	30.5%
Bluefish	17,046	9.7%	Winter flounder	40,003	30.4%
Silver hake	7,608	4.3%	Windowpane flounder	25,255	19.2%
American shad	4,821	2.8%	Red hake	5,983	4.5%
Atlantic herring	2,877	1.6%	Fourspot flounder	5,914	4.5%
Smooth dogfish	1,466	0.8%	Little skate	5,739	4.4%
Weakfish	1,283	0.7%	Striped searobin	4,066	3.1%
Blueback herring	934	0.5%	Tautog	1,479	1.1%
Atlantic menhaden	839	0.5%	Fourbeard rockling	849	0.6%
Alewife	269	0.2%	Summer flounder	671	0.5%
Atlantic mackerel	241	0.1%	Northern searobin	645	0.5%
Rough scad	236	0.1%	Cunner	315	0.2%
Spiny dogfish	212	0.1%	Hogchoker	306	0.2%
Moonfish	89	0.1%	Spotted hake	226	0.2%
Hickory shad	39	0.0%	Black sea bass	57	0.0%
			Fall demersal		
Fall pelagic			Scup (porgy)	178,655	71.8%
Butterfish	479,554	79.9%	Windowpane flounder	19,233	7.7%
Bluefish	67,775	11.3%	Winter flounder	18,284	7.4%
Weakfish	33,012	5.5%	Little skate	14,214	5.7%
American shad	6,320	1.1%	Striped searobin	8,303	3.3%
Atlantic menhaden	2,895	0.5%	Fourspot flounder	2,826	1.1%
Smooth dogfish	2,430	0.4%	Red hake	1,987	0.8%
Silver hake	2,255	0.4%	Summer flounder	1,526	0.6%
Blueback herring	1,790	0.3%	Spotted hake	881	0.4%
Atlantic herring	1,013	0.2%	Northern searobin	760	0.3%
Alewife	997	0.2%	Tautog	675	0.3%
Moonfish	596	0.1%	Hogchoker	626	0.3%
Rough scad	351	0.1%	Atlantic sturgeon	149	0.1%
Spanish mackerel	343	0.1%	Fourbeard rockling	115	0.0%
Atlantic mackerel	325	0.1%	Cunner	108	0.0%
Spot	255	0.0%	**November demersal**		
November pelagic			Windowpane flounder	21,471	28.2%
Butterfish	60,017	68.4%	Winter flounder	20,719	27.2%
Atlantic herring	17,883	20.4%	Scup (porgy)	12,963	17.0%
Weakfish	2,113	2.4%	Little skate	11,877	15.6%
Silver hake	1,481	1.7%	Striped searobin	2,802	3.7%
American shad	1,351	1.5%	Red hake	2,526	3.3%
Bluefish	1,227	1.4%	Fourspot flounder	2,482	3.3%
Atlantic menhaden	1,039	1.2%	Tautog	229	0.3%
Spiny dogfish	990	1.1%	Northern searobin	211	0.3%
Alewife	698	0.8%	Hogchoker	200	0.3%
Smooth dogfish	475	0.5%	Cunner	156	0.2%
Striped bass	183	0.2%	Spotted hake	141	0.2%
Blueback herring	136	0.2%	Summer flounder	88	0.1%
Spot	36	0.0%	Winter skate	71	0.1%
Yellow jack	31	0.0%	Planehead filefish	67	0.1%
Moonfish	30	0.0%			

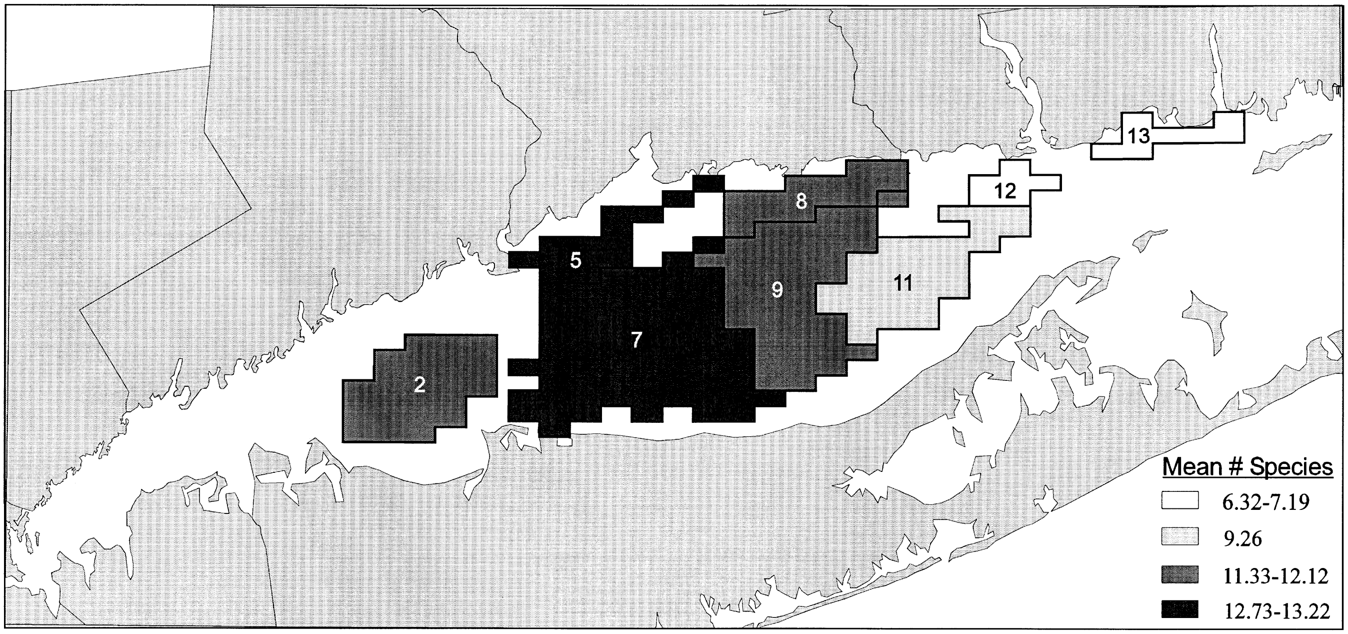

Figure 6

Comparison of species richness among eight habitats. Species richness, defined as the mean number of species caught/tow during spring and fall combined, was compared by ANOVA. Habitat types with similar means are grouped by shading. The range of means for each group is provided in the legend. Note: refer to Fig. 1 (Long Island Sound depth contours and major bathymetric features) and Fig. 2 (Long Island Sound sediment map and major bathymetric features) to locate the features of Long Island Sound mentioned in the Discussion.

Of the three remaining areas, plot 9 had greater species richness than plot 2, but neither plot could be statistically distinguished from plot 8 (Table 8). Therefore, for a simpler graphic presentation, these three plots are depicted as being similar. Plot 9, an area of transitional sediments in 18 to 30 m of water on the Mattituck Sill and the adjacent, eastern portion of the Central Basin, averaged 12.12 species per tow. Plot 8, an area of shallow (<18 m) transitional sediment habitat to the north of plot nine, averaged 11.8 species per tow. And plot 2, a mud habitat with depths between 18 and 37 m in the center of the Western Basin, averaged 11.33 species per tow. Plots 9 and 8 are both concentration areas for little skate. Plot 9 also supports concentrations of butterfish, northern searobin, red hake, spotted hake, scup, summer flounder, windowpane flounder, and winter flounder. During the fall, tropical visitors such as the planehead filefish are often found with greatest frequency in this area. Plot 8 supports concentrations of American shad moving along the Connecticut shoreline, and commonly attracts butterfish, red hake, scup, summer flounder, and windowpane flounder. Plot 2 in the Western Basin is a concentration area for fourbeard rockling, fourspot flounder, ocean pout, scup (in the fall), and windowpane flounder. Although not included in the evaluation of the eight habitats, American lobster occur in remarkable concentrations in plot 2 and are the dominant species collected in most samples.

Aggregate finfish abundance (log mean counts per tow) generally declined along a west to east gradient (Fig. 7). Plots 2, 5, 7, and 9 were similar, with retransformed means ranging from 544 fish per tow in plot 2 to 613 in plot 9 (Table 8). Plots 2, 7, and 9 represent the deep (>18 m) mud and transitional substrate habitats of the Sound, while plot 5 is a shallow transitional sediment habitat adjacent to the Housatonic River. Plot 8, a shallow transitional area toward the northeastern margin of the Central Basin, had an average of 436 fish per tow and was statistically distinct from all other plots. The sandy Mattituck Sill (plot 11) and shallow transitional habitat in the Eastern Basin (plot 13) had similar mean numbers per tow with 201 and 161 fish per tow, respectively. Finally, plot 12, shallow sand area adjacent to the Connecticut River, had the lowest mean abundance of fish (66) of the eight plots, due principally to the semidiurnal exposure to freshwater flow from the river, alternating with more typical Long Island Sound salinities (26–28‰).

Conclusions

Long Island Sound provides important habitat for a wide variety of species. Among these are resident populations of two economically important species, lobster

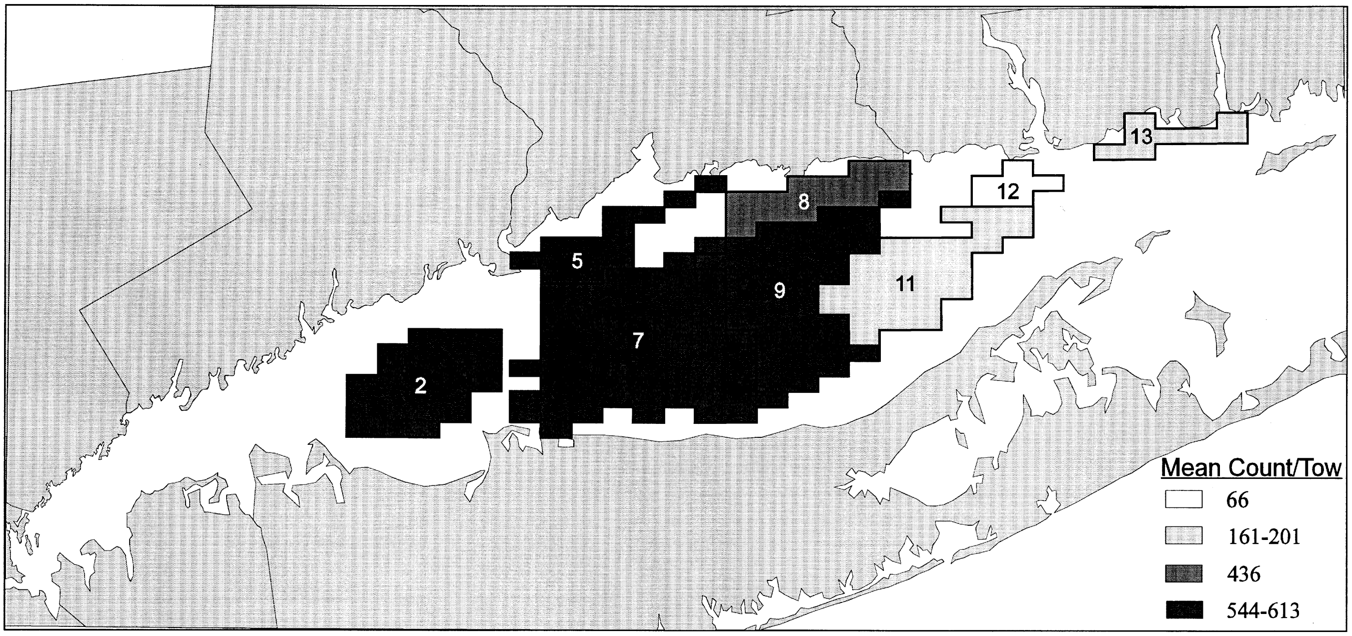

Figure 7

Comparison of aggregate count/tow among eight habitats. The mean aggregate count/tow was computed for each plot and compared by ANOVA. Habitat types with similar means are grouped by shading. The range of means for each group is provided in the legend. Note: refer to Fig. 1 (Long Island Sound depth contours and major bathymetric features) and Fig. 2 (Long Island Sound sediment map and major bathymetric features) to locate the features of Long Island Sound mentioned in the Discussion.

Table 8

Comparison of species richness and mean aggregate catch/tow among habitat types (plots) defined by depth and sediment types.

(A) Species richness: F=7.08 (df=175; 1,246 p=.0001)

	Plot							
Mean	5	7	9	8	2	11	13	12
	13.22	12.73	12.12	11.80	11.33	9.26	7.19	6.32

(B) Mean count/tow: F=9.01 (df=175; 1,246 p=.0001)

	Plot							
Mean	9	5	7	2	8	11	13	12
	613	595	572	544	436	201	161	66

Note: Means sharing the same underline are not significantly different from each other.

and tautog, which utilize the Sound through all their life history stages. The Sound provides spawning, feeding, and nursery habitat for many migratory species, including winter flounder, windowpane flounder, scup, squid, butterfish, and little skate. Offshore spawners, such as summer flounder and bluefish, also use the Sound as a summer feeding area and, in the case of bluefish, as a major nursery area. In all, at least 85 species of finfish, lobster, and squid utilize the Sound during some portion of their life history.

The transitional and mud areas of the Central and Western Basins appear to have particular value as estuarine habitat, attracting both greater numbers of species and greater numbers of individuals than other areas of the Sound. Within the Central Basin, the shallow transitional sediments adjacent to the Housatonic River attract a greater number of finfish and lobster than most other areas of the Sound. Tautog and lobster are attracted to this area because of the variety of nearby structure, whereas bluefish, summer flounder, and a number of anadromous species, including striped bass and American shad, appear to be attracted to the river mouth and surrounding waters.

The size frequencies presented for 26 species reveal a full range of sizes for species such as scup, bluefish, winter flounder, tautog, windowpane flounder, squid, and striped searobin, indicating that they utilize the Sound throughout their juvenile and adult life stages. Other species such as red hake and silver hake are juveniles or small adults, with larger individuals remaining in offshore waters outside of the Sound. Tropical and semitropical species, such as planehead and orange filefish, crevalle jack, yellow jack, moonfish, rough scad, and Spanish mackerel, appear principally in late summer and fall and are predominantly juveniles.

The size composition of some important commercial species targeted by the trawl fishery changes seasonally and spatially with implications for codend mesh regulations based on bycatch threshold triggers. These mesh regulations are designed to protect sublegal fish or nontargeted species by requiring a fisher to use a larger size mesh when the bycatch trigger, defined as a quantity of legal size fish, is reached. However, a mesh regulation may not provide the intended protection if it is based solely on a species-specific bycatch trigger. For example, most legal size winter flounder (>30 cm) emigrate from the Sound early in spring and are nearly absent in the Sound between June and October, whereas smaller winter flounder emigrate later, with many remaining in the Sound through summer and fall. Therefore, any mesh requirement based on a bycatch of market size winter flounder would seldom be triggered during summer and fall due to their low abundance. The fisher would continue to use the smaller mesh allowed below the bycatch trigger—thus retaining sublegal flounder—and the intended conservation would not occur. More generally, the high proportion of juvenile versus adult fish of many species, such as scup, weakfish, bluefish, butterfish, and squid, would result in substantial discarding unless mesh regulations are applied seasonally rather than on a species-specific basis with designated bycatch thresholds.

Acknowledgments

The Connecticut trawl survey is supported by Federal Aid to Sport Fish Restoration funds under project F54R: A Study of Marine Recreational Fisheries in Connecticut, and by the state of Connecticut. We thank the research vessel crew, Pete Simpson and Miles Peterle, for their many years of dedication during this project; Penny Howell for assistance with statistical analysis; Pete Aarrestad, Linda Gunn, Penny Howell, Rod MacLeod, and Tom Savoy for their comments in review of this report; Mark Alexander for guidance in data management and mapping; and the numerous seasonal resource assistants who contributed to the Survey effort. We also gratefully acknowledge the CT DEP Bureau of Water Management for providing monthly temperature and salinity data from the Long Island Sound Water Quality Monitoring Program.

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Distribution Maps

Figs. DM-1 through DM-74

Notes

In the Discussion section of the report, finfish distribution is described in reference to various coastal towns and bathymetric and geographical features of Long Island Sound. To locate these features on the distribution maps, the reader can use Fig. 1 (Long Island Sound depth contours and major bathymetric features) and Fig. 2 (Long Island Sound sediment map and major bathymetric features).

The number of fish taken in each tow is represented by either an "×" for zero catches or a circle for positive catches, with identical catches plotted over each other. The circle diameter is proportional to the number of fish caught and, for each set of maps, is scaled to one catch size (see Methods). Catches were plotted in the center of the site box.

The legend in the lower right corner of each map lists the number of tows plotted ("tows = "), the sum of fish taken ("sum = "), and the maximum and minimum catch "max = ", "min = "). In some cases "max = " is replaced by "max > ". This indicates that the largest catch resulted in poor circle size resolution for most catches. In these cases, "max >" is the catch used as the scalar, but the maximum catch (or catches) observed was greater than this value. If "max >" does not appear, then the scalar used is the largest of the "max =" catches listed on a set of maps.

Note that the number of tows conducted in each season is the same for all species (see Table 6 for the number of tows taken by year and month), with the exception of American shad and bluefish grouped by length (lengths were not available from all tows conducted).

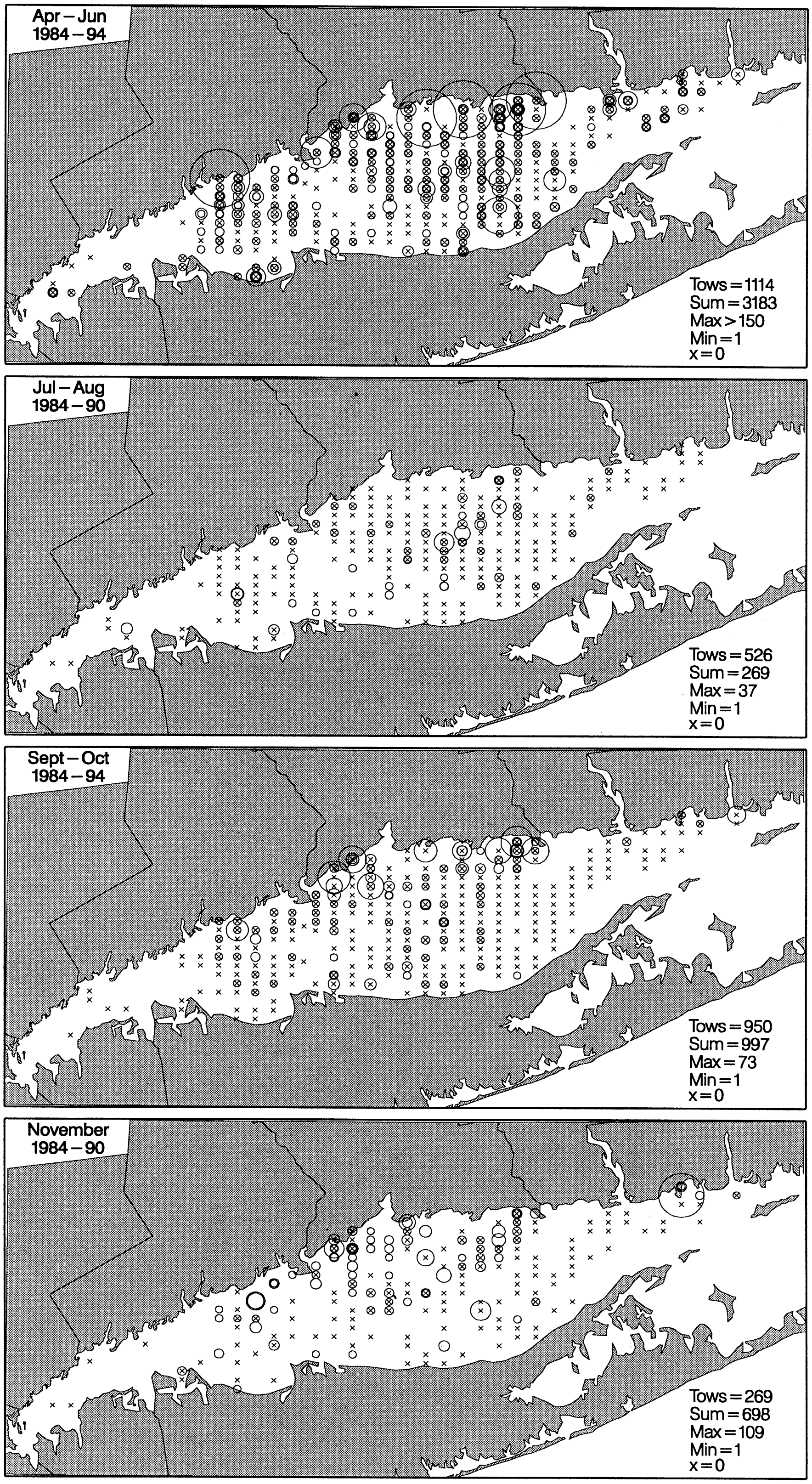


Figure DM-1

Alewife (*Alosa pseudoharengus*). Seasonal distribution maps based on 5,147 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 150 alewives.

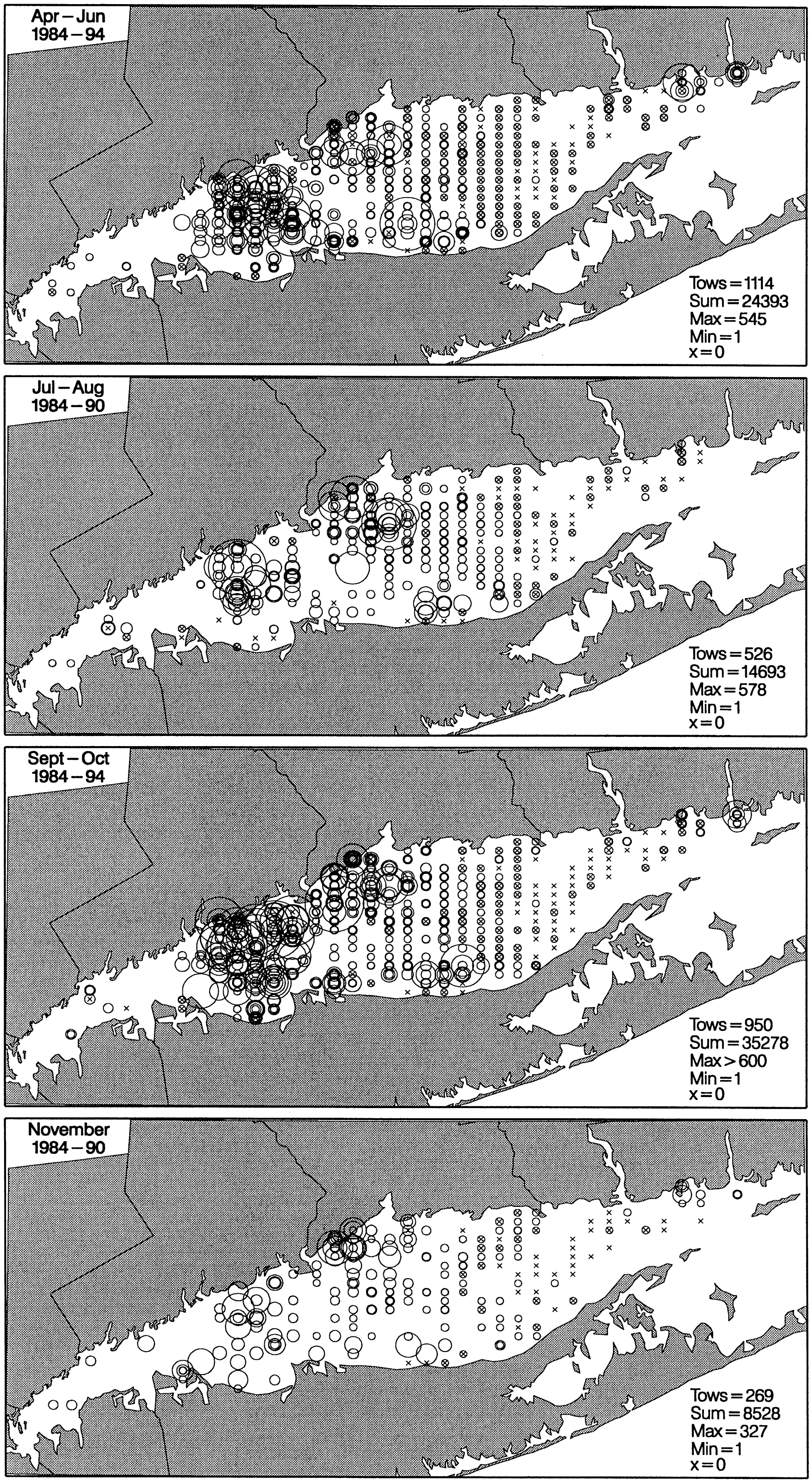


Figure DM-2

American lobster (*Homarus americanus*). Seasonal distribution maps based on 82,892 lobsters taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 600 lobsters.

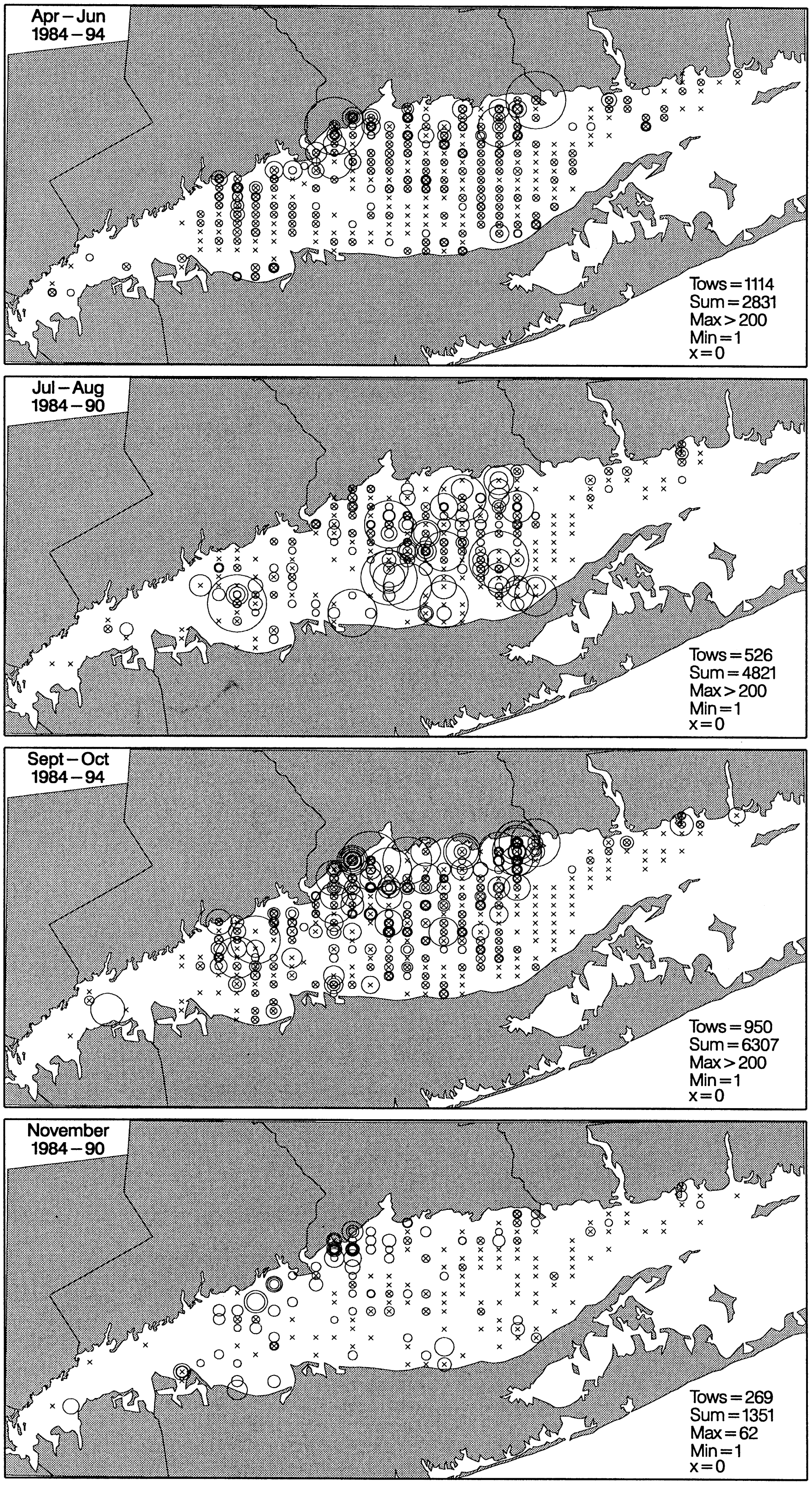


Figure DM-3

American shad (*Alosa sapidissima*). Seasonal distribution maps based on 15,310 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 200 shad.

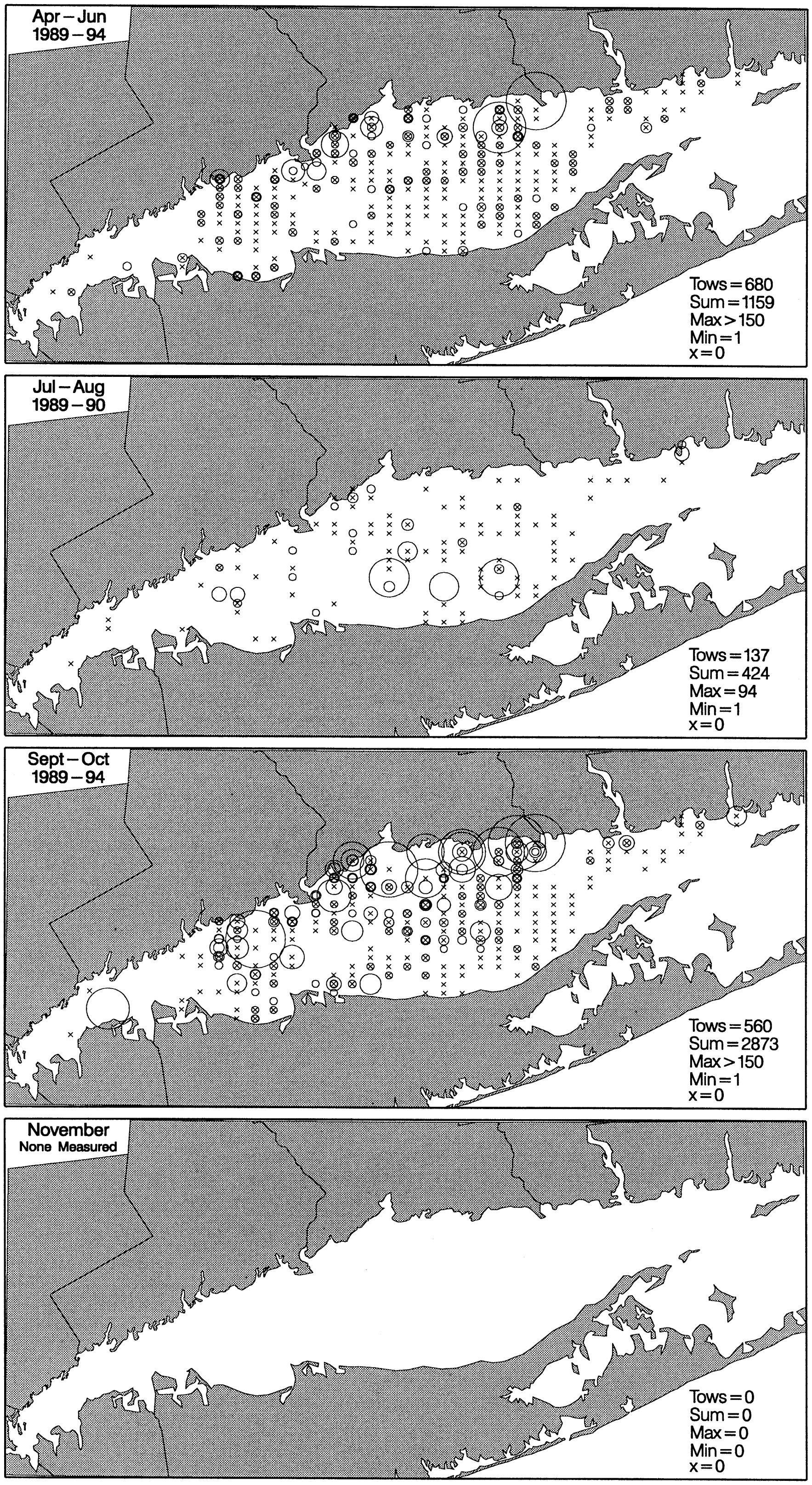


Figure DM-4

American shad (*Alosa sapidissima*), <33 cm. Seasonal distribution maps based on 4,456 fish taken in 1,377 tows between 1989 and 1994. The largest circle size represents a tow with a catch of greater than 150 shad.

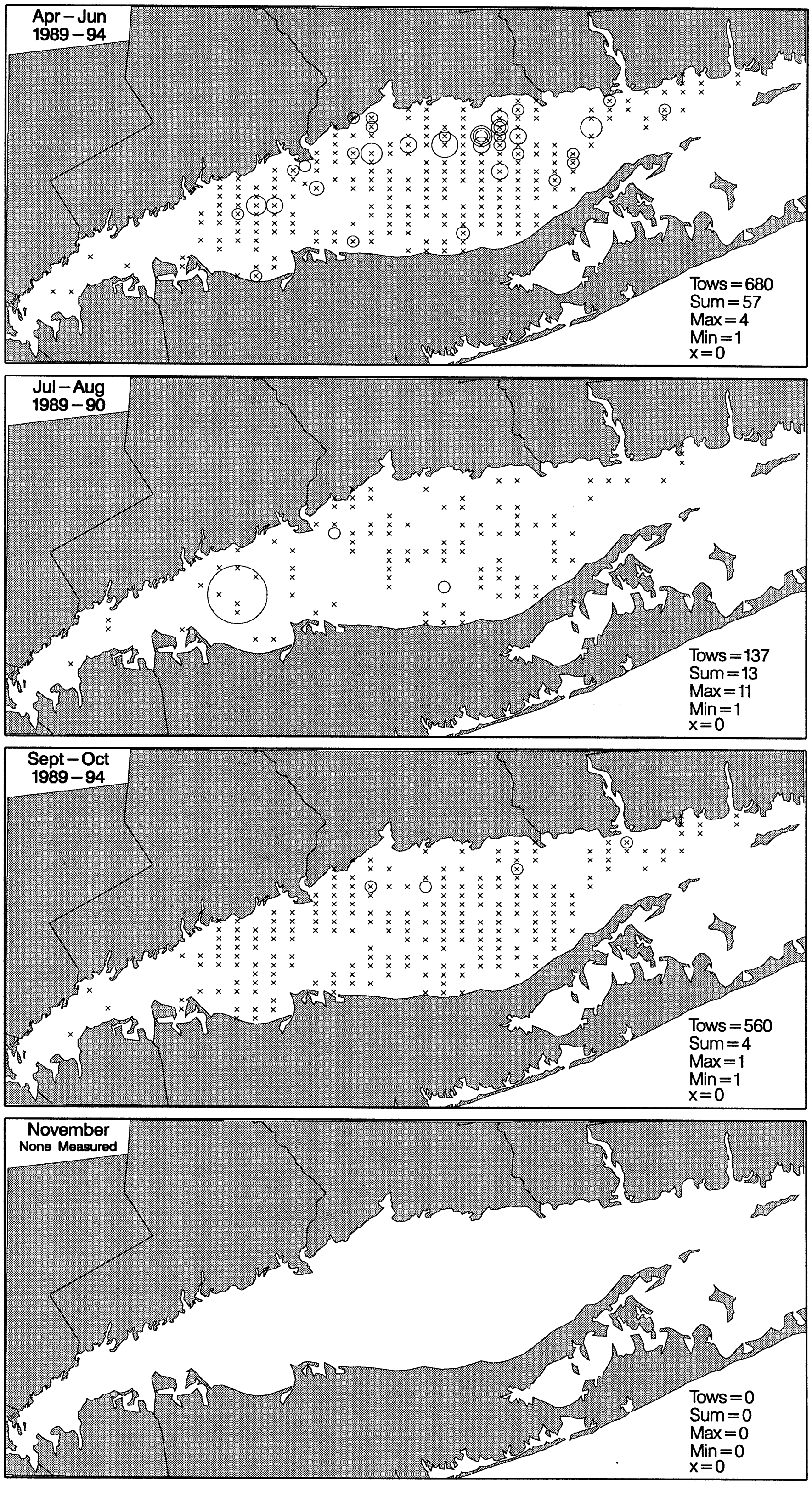


Figure DM-5

American shad (*Alosa sapidissima*), >32 cm. Seasonal distribution maps based on 74 fish taken in 1,377 tows between 1989 and 1994. The largest circle size represents a tow with a catch of 11 shad.

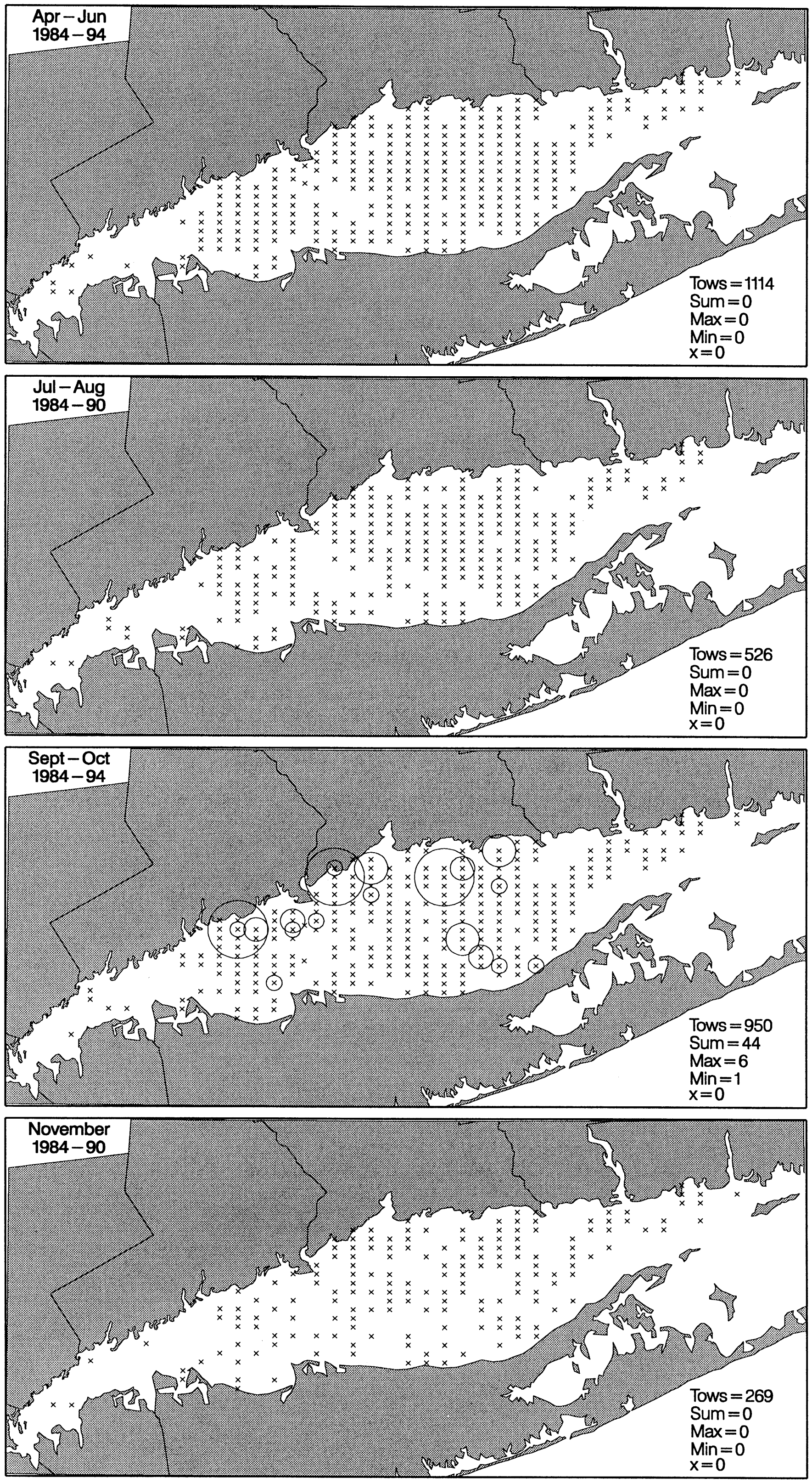


Figure DM-6
Atlantic croaker (*Micropogonias undulatus*). Seasonal distribution maps based on 44 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of six croakers.

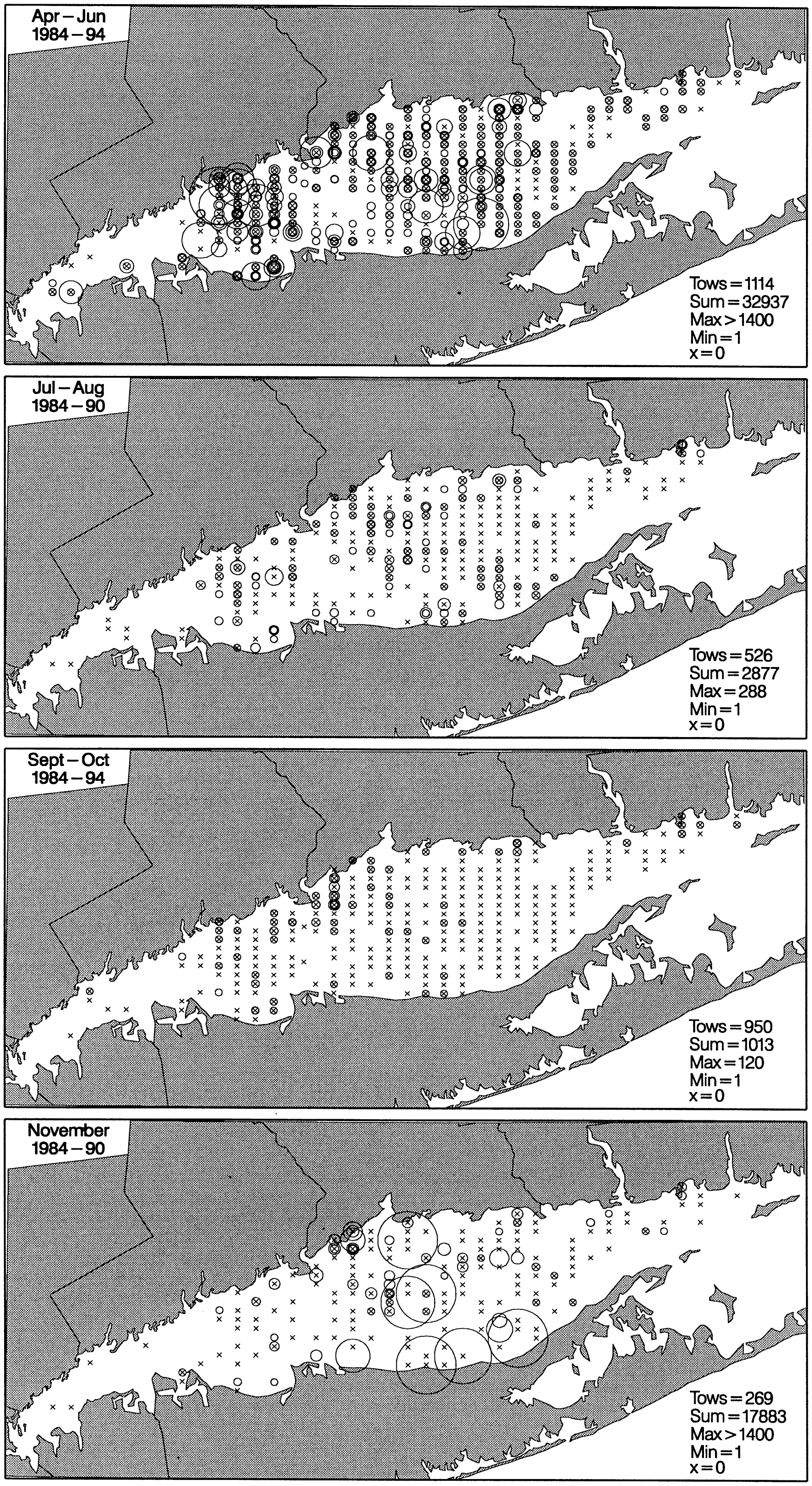


Figure DM-7

Atlantic herring (*Clupea harengus*). Seasonal distribution maps based on 54,710 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 1,400 Atlantic herring.

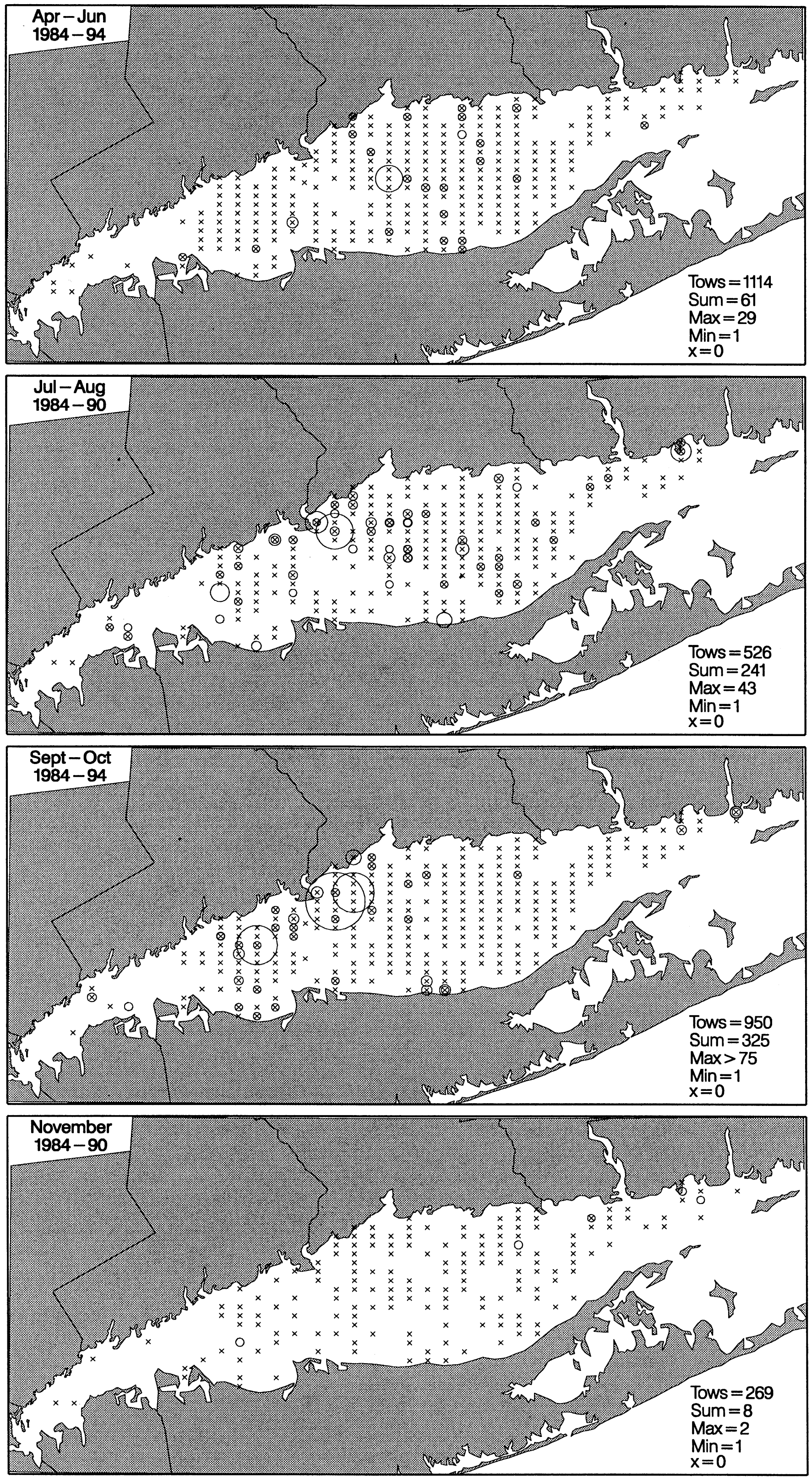


Figure DM-8

Atlantic mackerel (*Scomber scombrus*). Seasonal distribution maps based on 635 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 75 Atlantic mackerel.

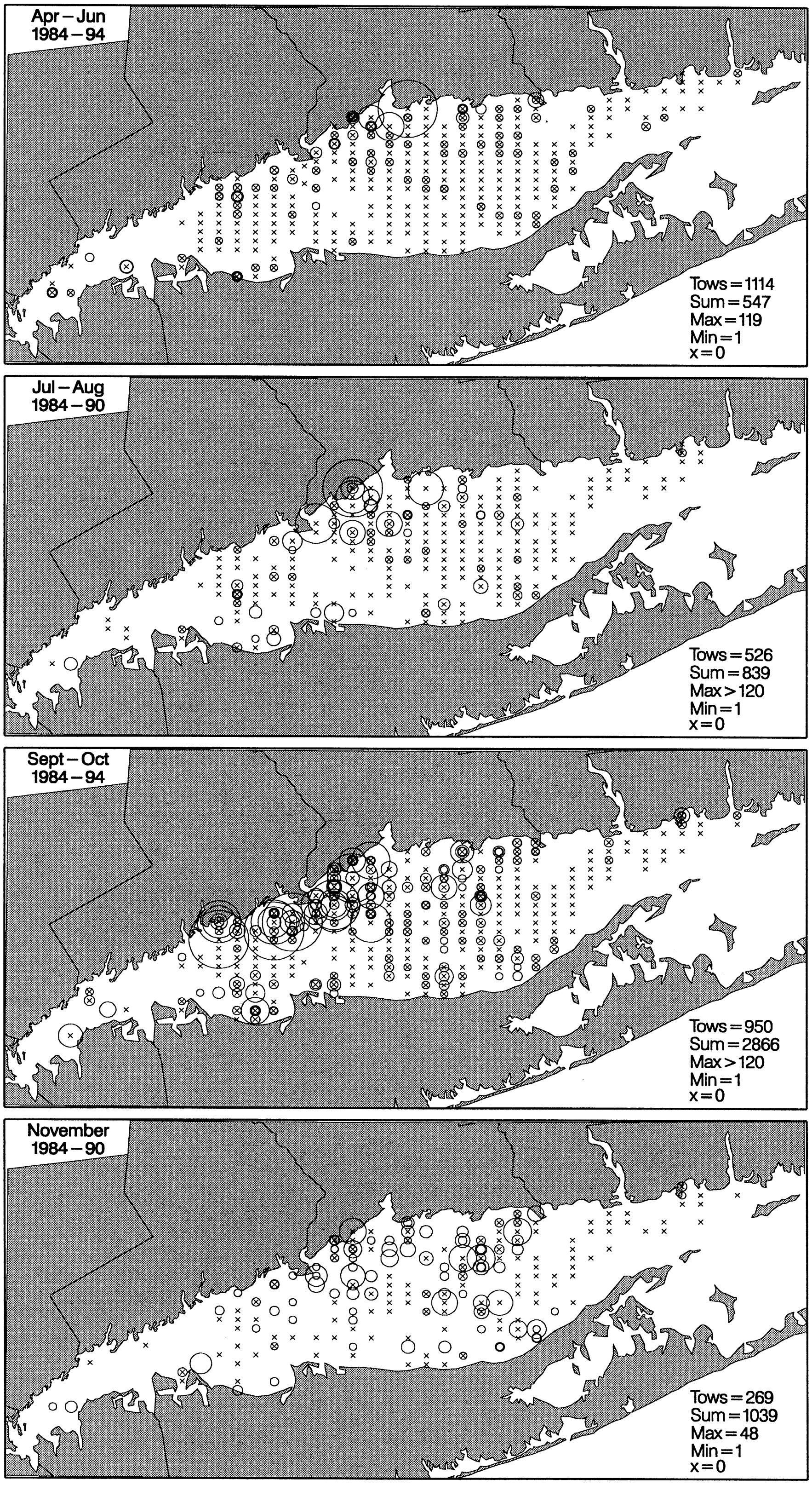


Figure DM-9

Atlantic menhaden (*Brevoortia tyrannus*). Seasonal distribution maps based on 5,291 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 120 Atlantic menhaden.

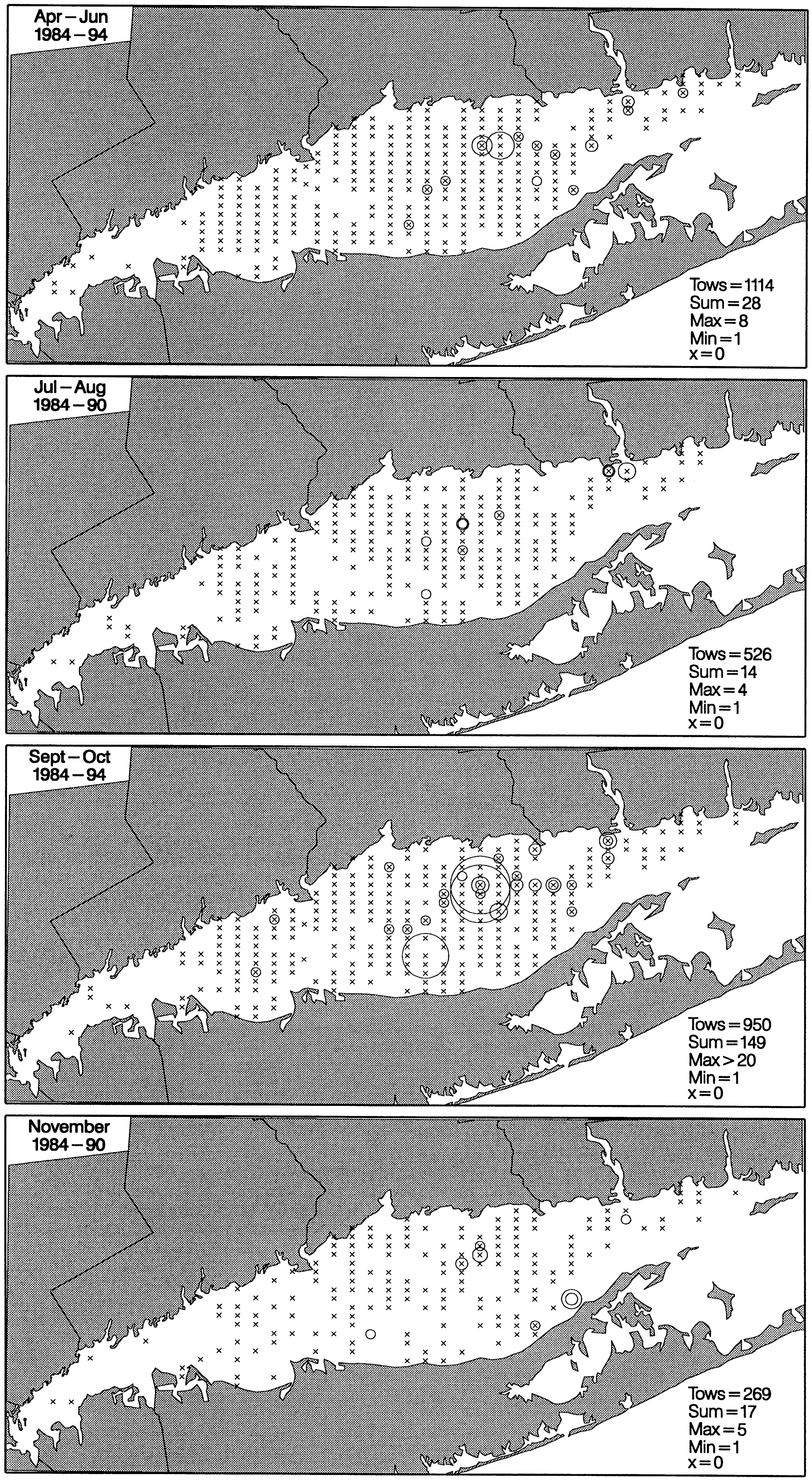


Figure DM-10
Atlantic sturgeon (*Acipenser oxyrinchus*). Seasonal distribution maps based on 208 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 20 Atlantic sturgeon.

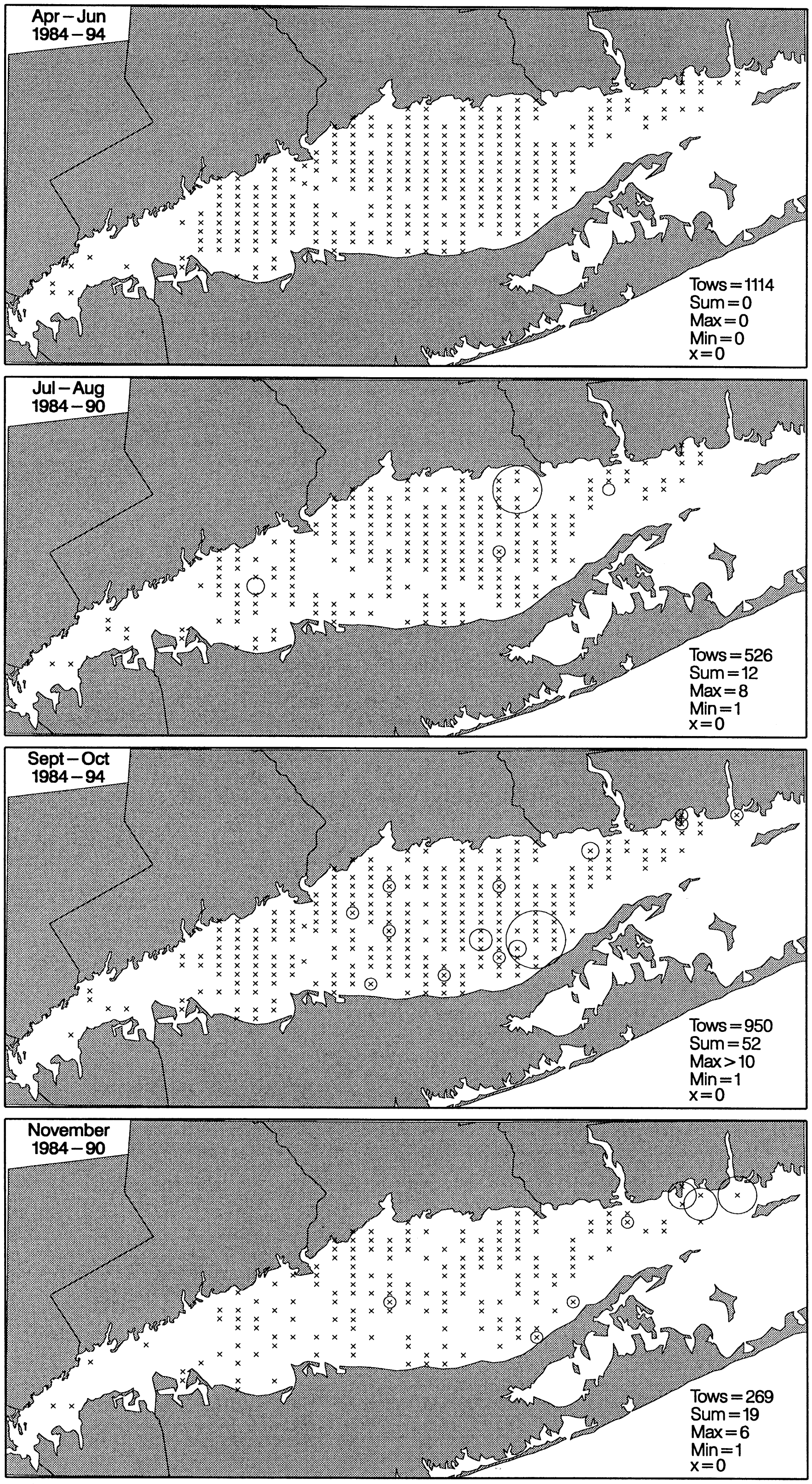


Figure DM-11

Bigeye scad (*Selar crumenophthalmus*). Seasonal distribution maps based on 83 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 10 bigeye scad.

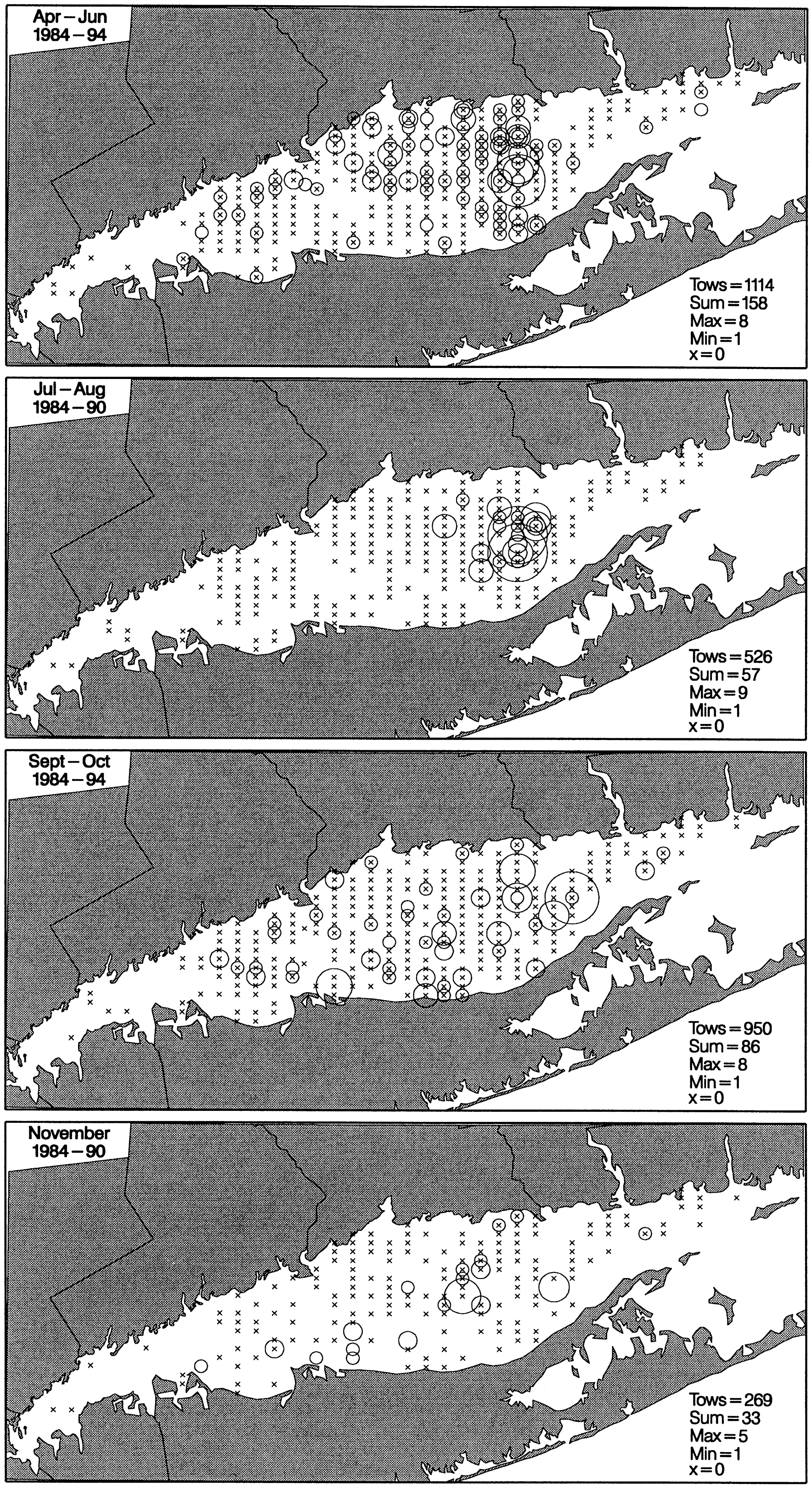


Figure DM-12

Black sea bass (*Centropristis striata*). Seasonal distribution maps based on 334 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of nine black sea bass.

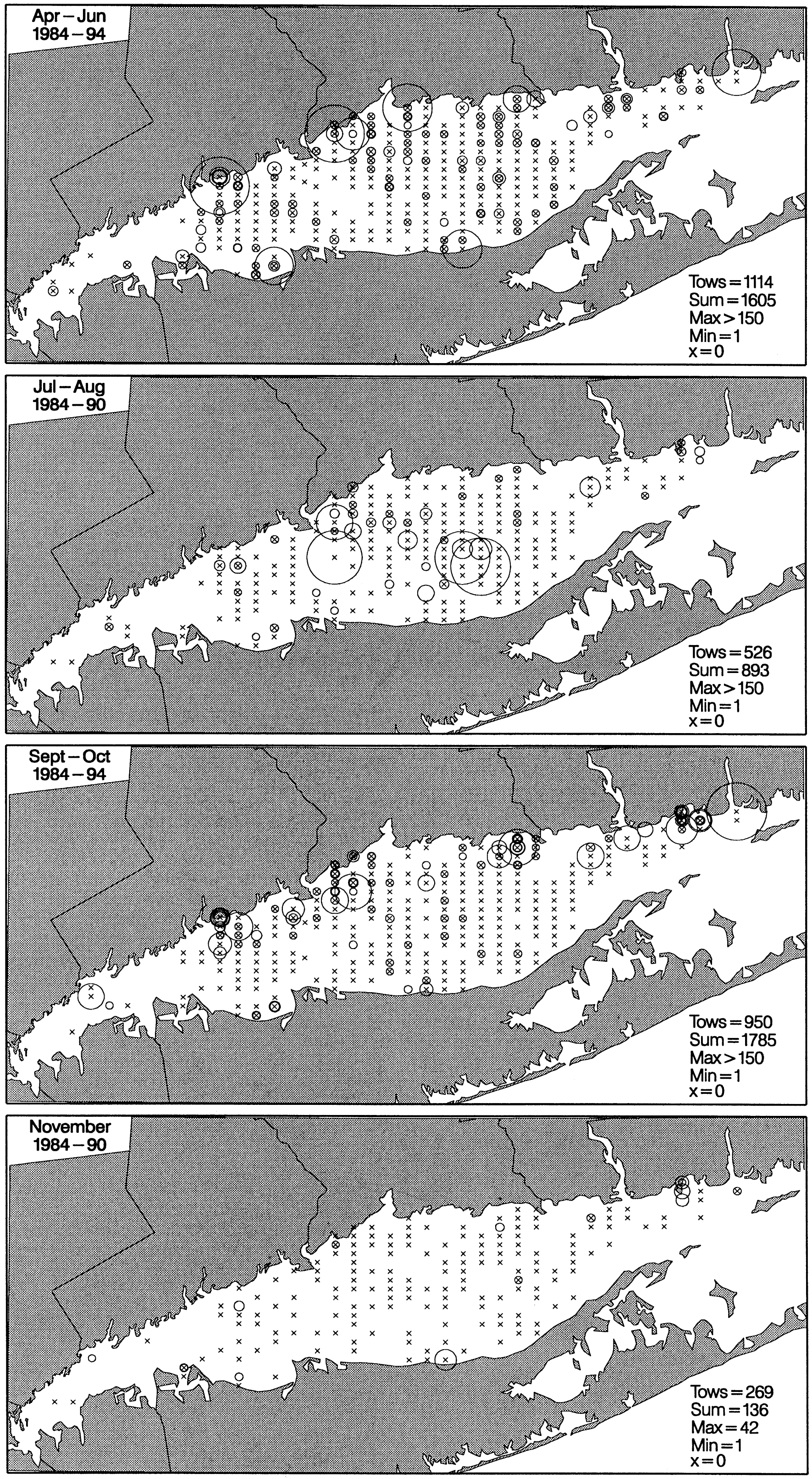


Figure DM-13

Blueback herring (*Alosa aestivalis*). Seasonal distribution maps based on 4,419 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 150 blueback herring.

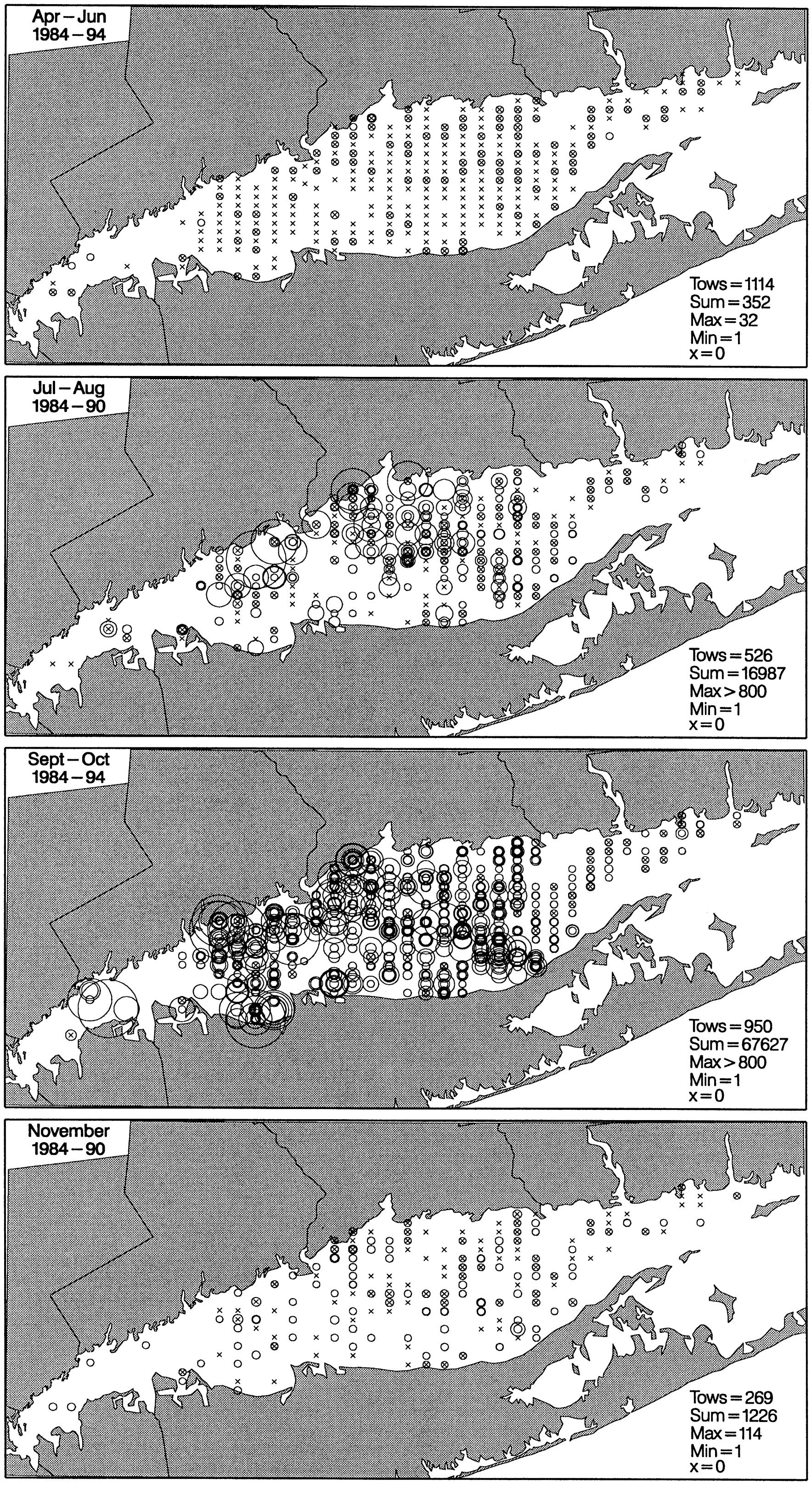


Figure DM-14

Bluefish (*Pomatomus saltatrix*). Seasonal distribution maps based on 86,192 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 800 bluefish.

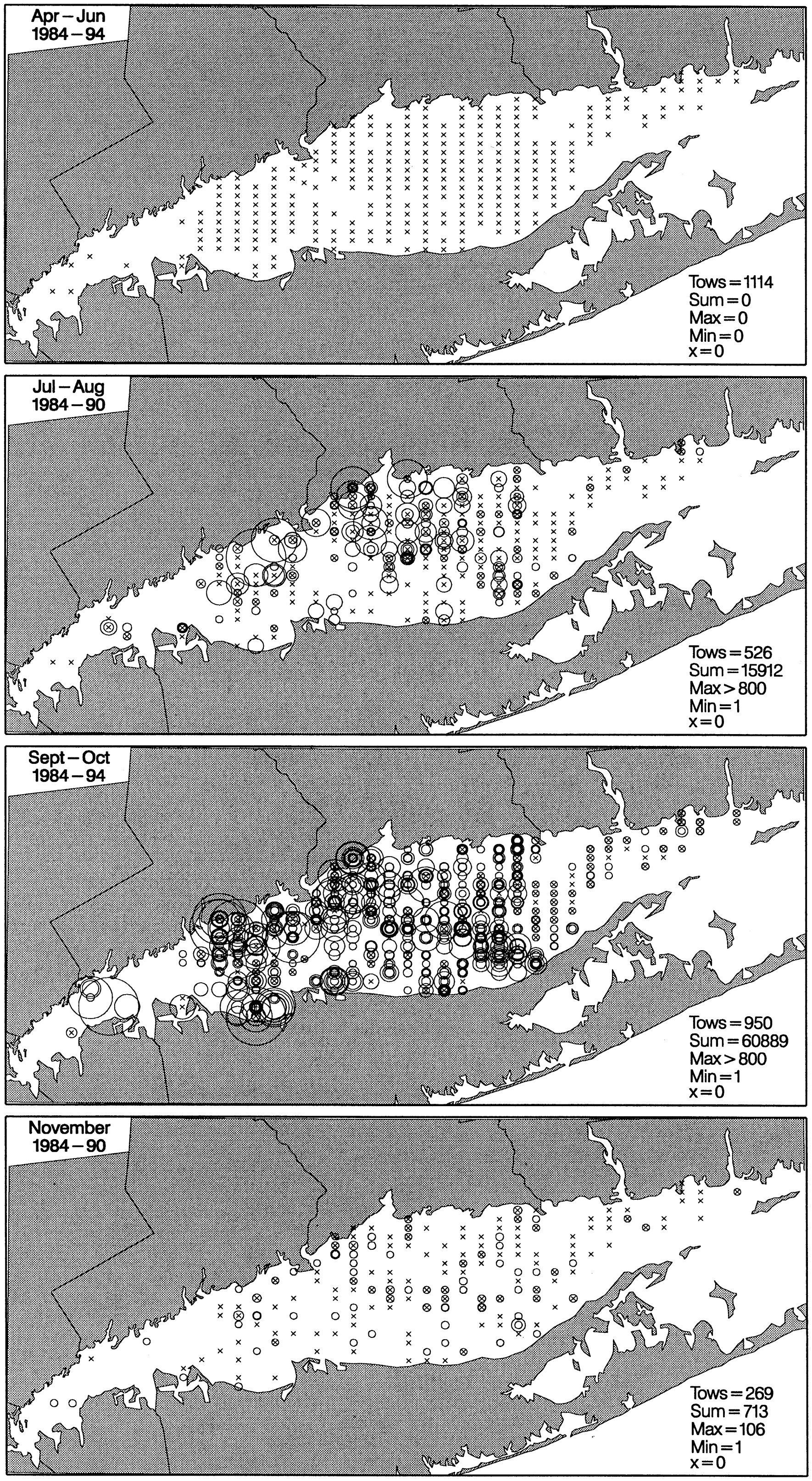


Figure DM-15

Bluefish (*Pomatomus saltatrix*), young-of-year. Seasonal distribution maps based on 77,514 young-of-year fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 800 bluefish.

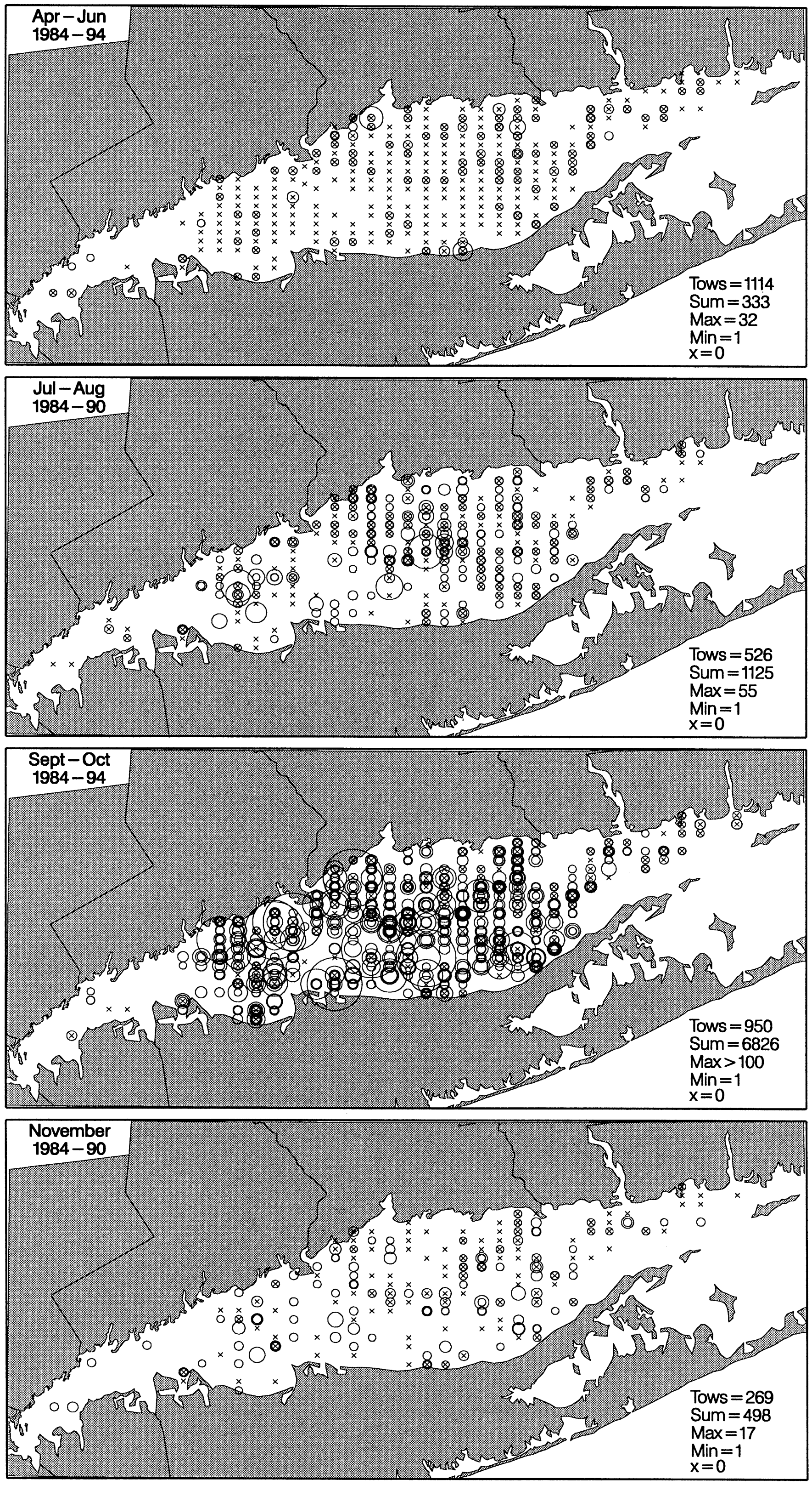


Figure DM-16

Bluefish (*Pomatomus saltatrix*), age 1+. Seasonal distribution maps based on 8,782 age 1+ fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 100 bluefish.

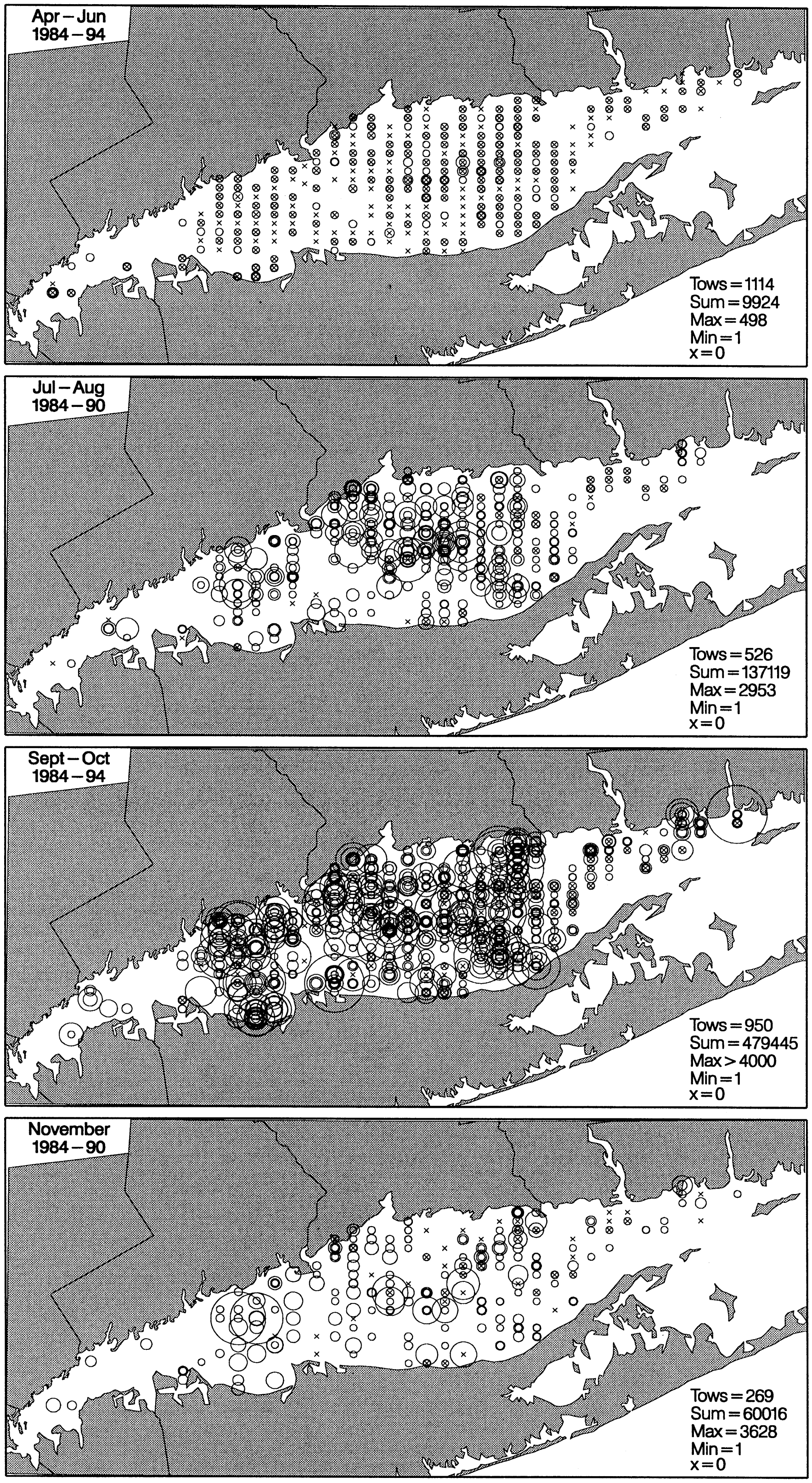


Figure DM-17

Butterfish (*Peprilus triacanthus*). Seasonal distribution maps based on 686,504 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 4,000 butterfish.

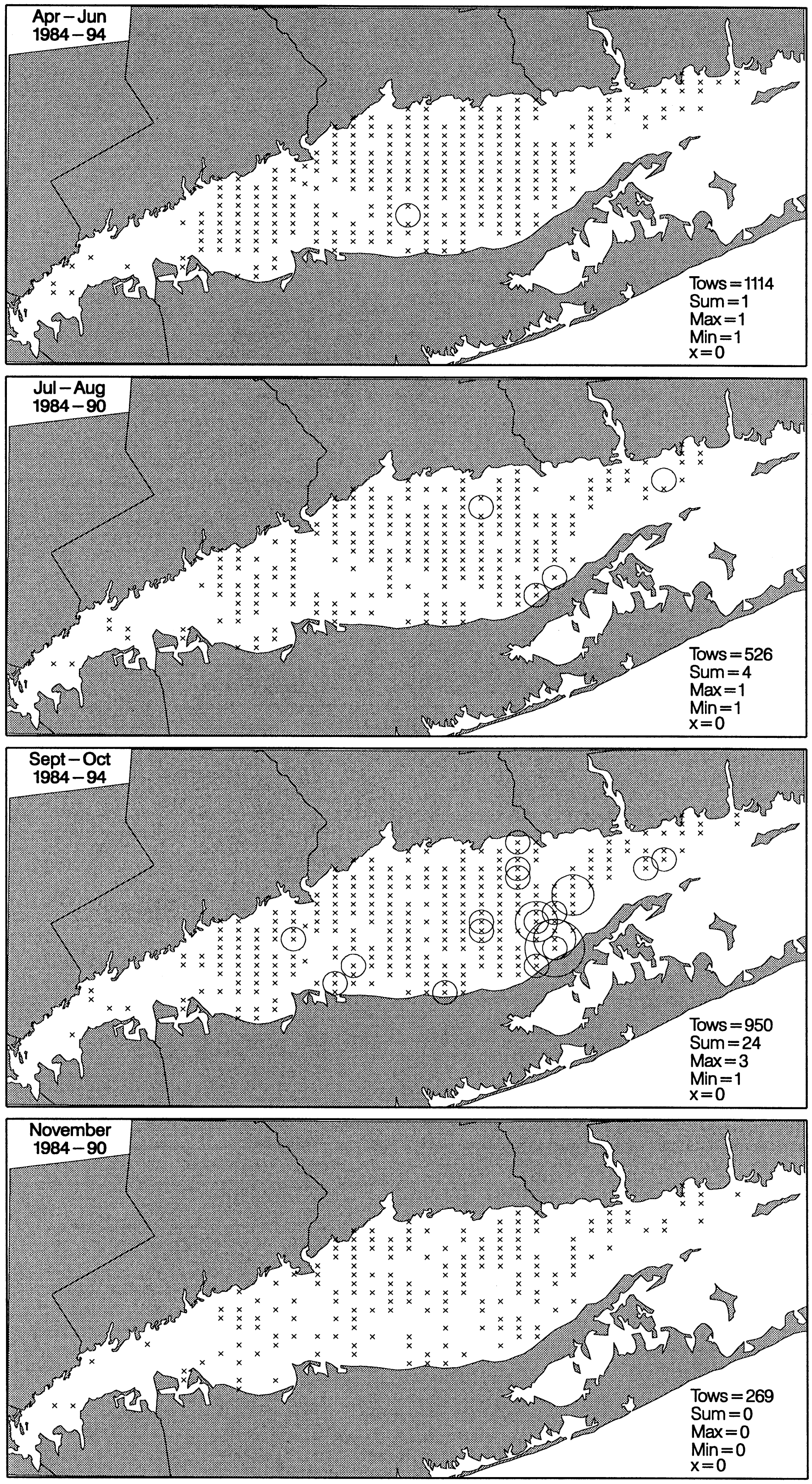


Figure DM-18

Clearnose skate (*Raja eglanteria*). Seasonal distribution maps based on 29 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of three clearnose skate.

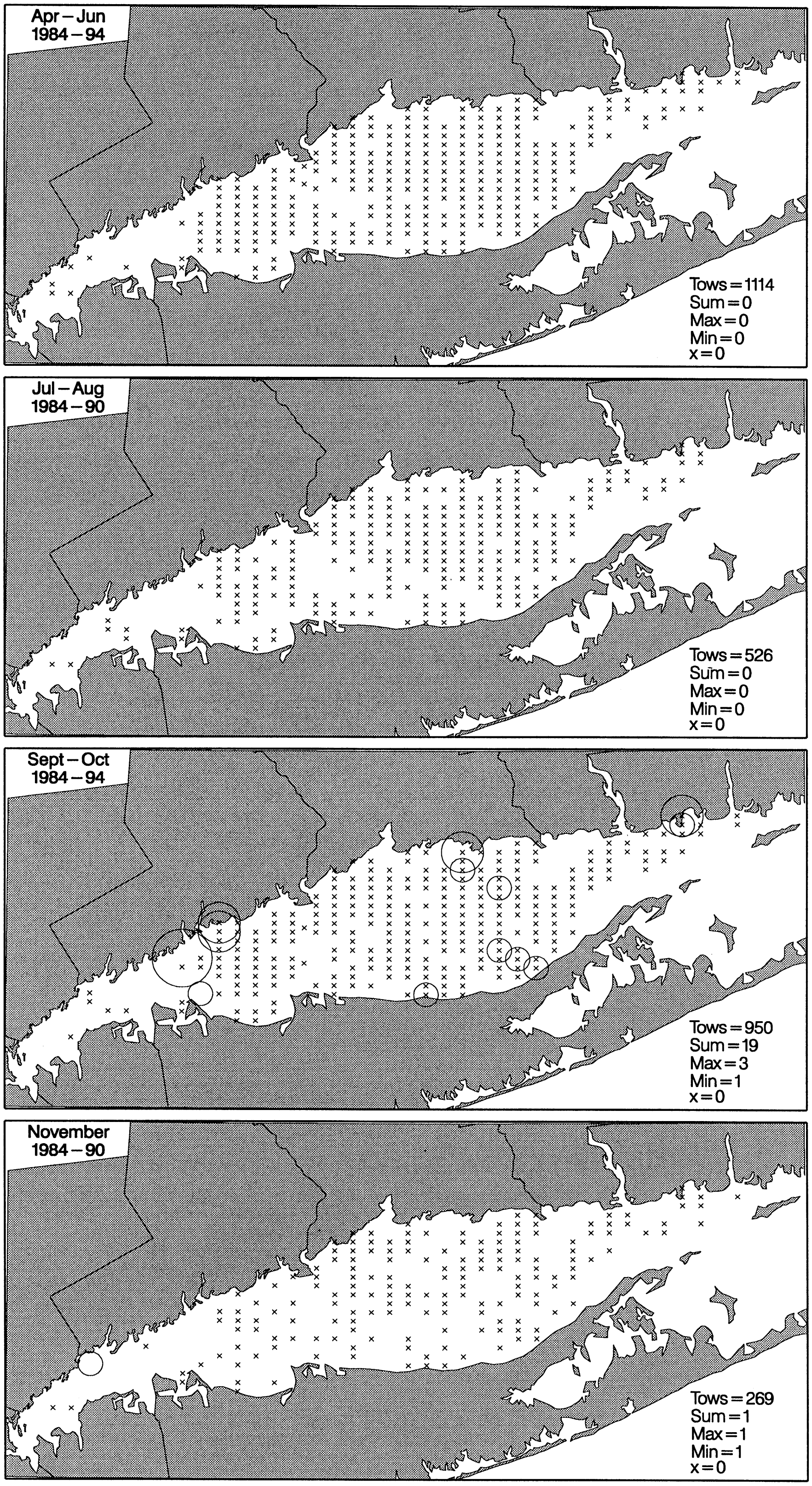


Figure DM-19

Crevalle jack (*Caranx hippos*). Seasonal distribution maps based on 20 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of three crevalle jacks.

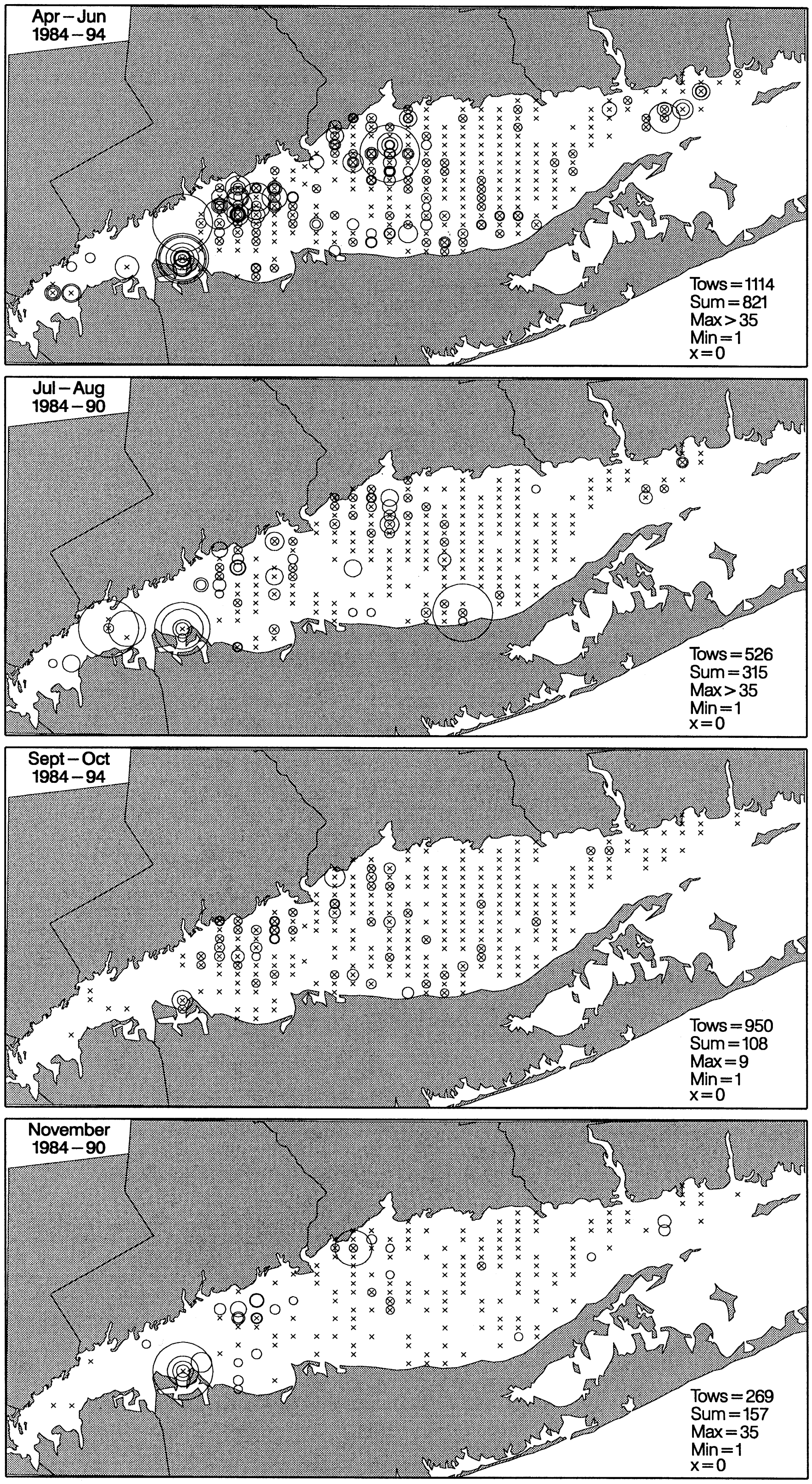


Figure DM-20

Cunner (*Tautogolabrus adspersus*). Seasonal distribution maps based on 1,401 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 35 cunner.

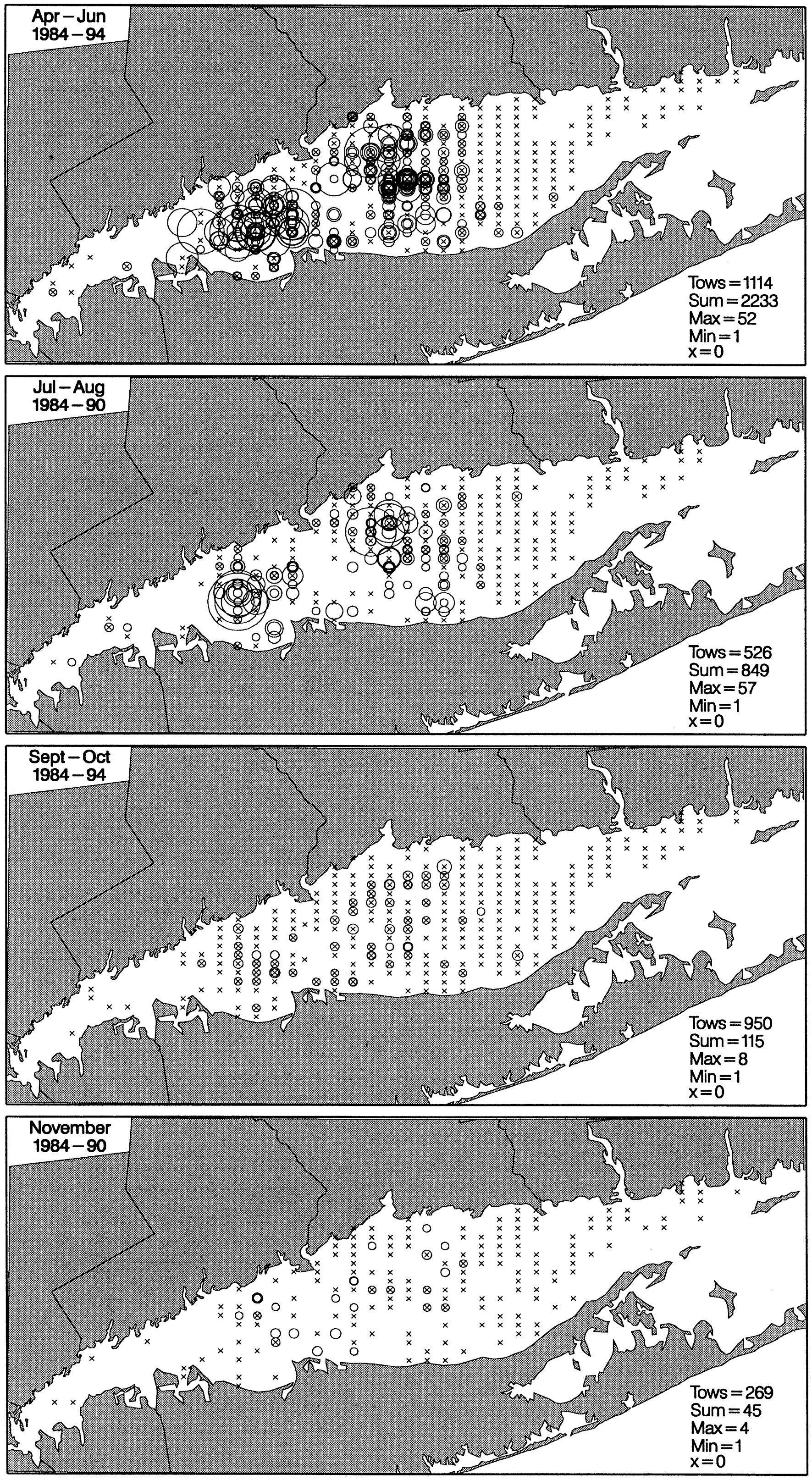


Figure DM-21

Fourbeard rockling (*Enchelyopus cimbrius*). Seasonal distribution maps based on 3,242 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 57 fourbeard rockling.

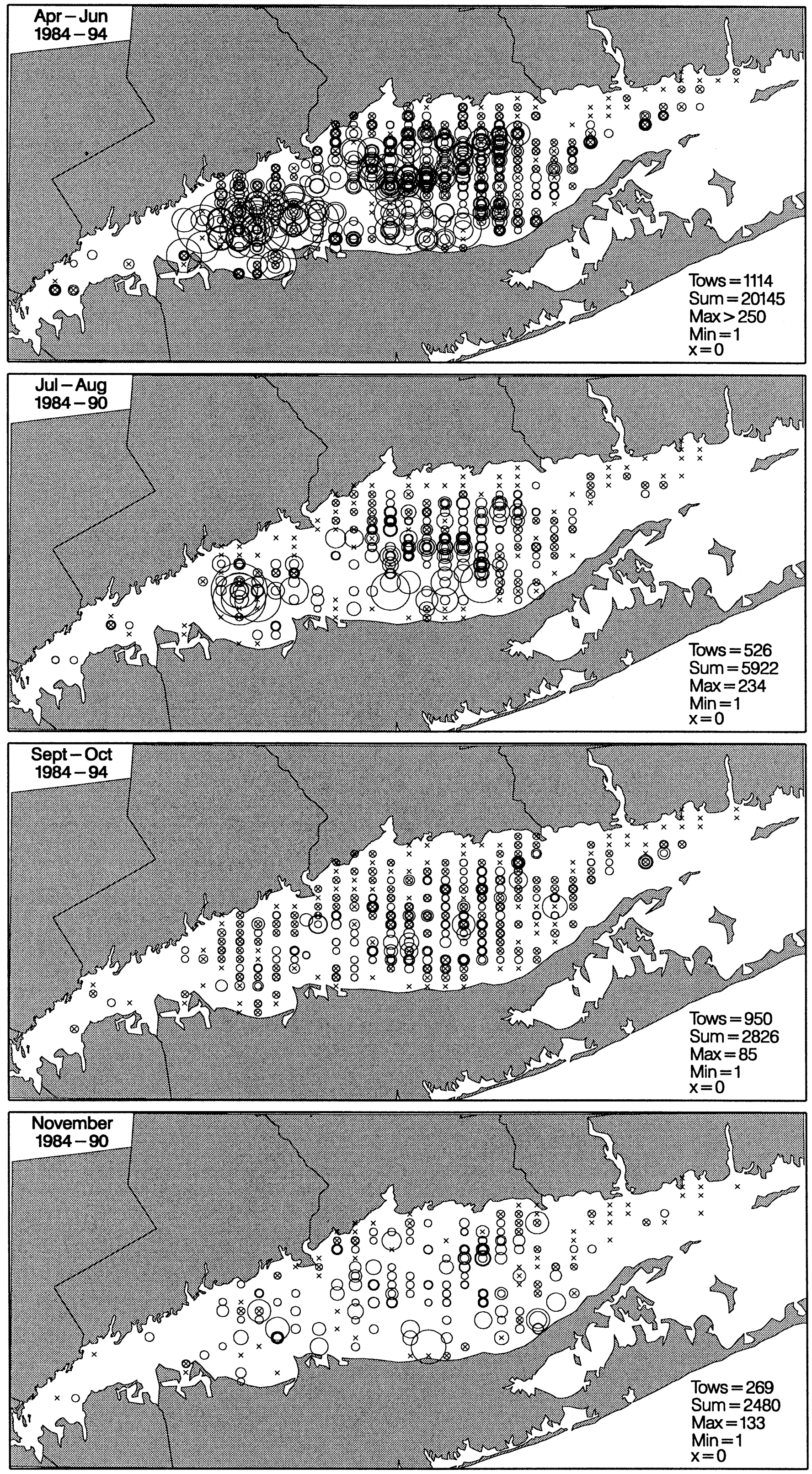


Figure DM-22

Fourspot flounder (*Paralichthys oblongus*). Seasonal distribution maps based on 31,373 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 250 fourspot flounder.

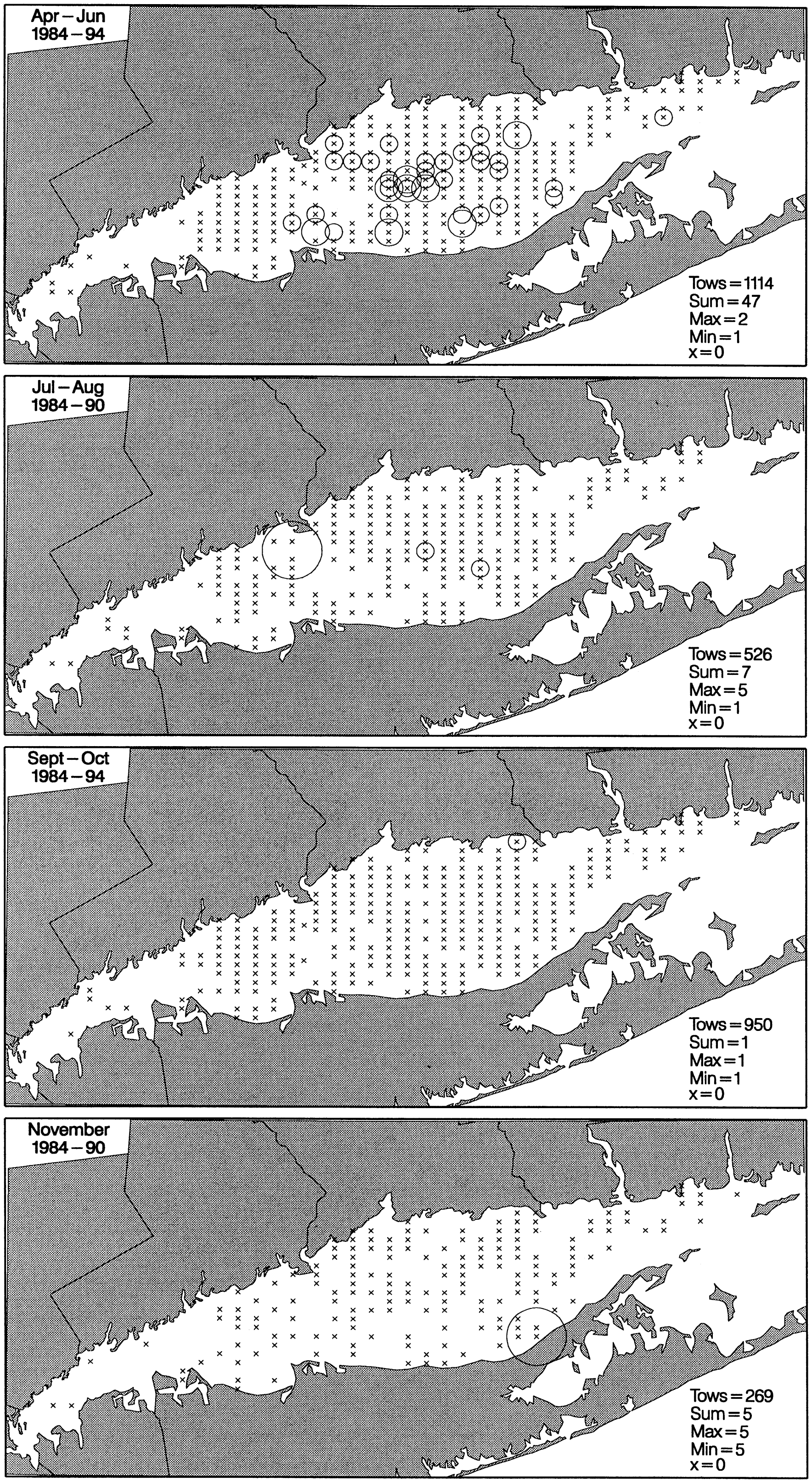


Figure DM-23

Goosefish (*Lophius americanus*). Seasonal distribution maps based on 60 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of five goosefish.

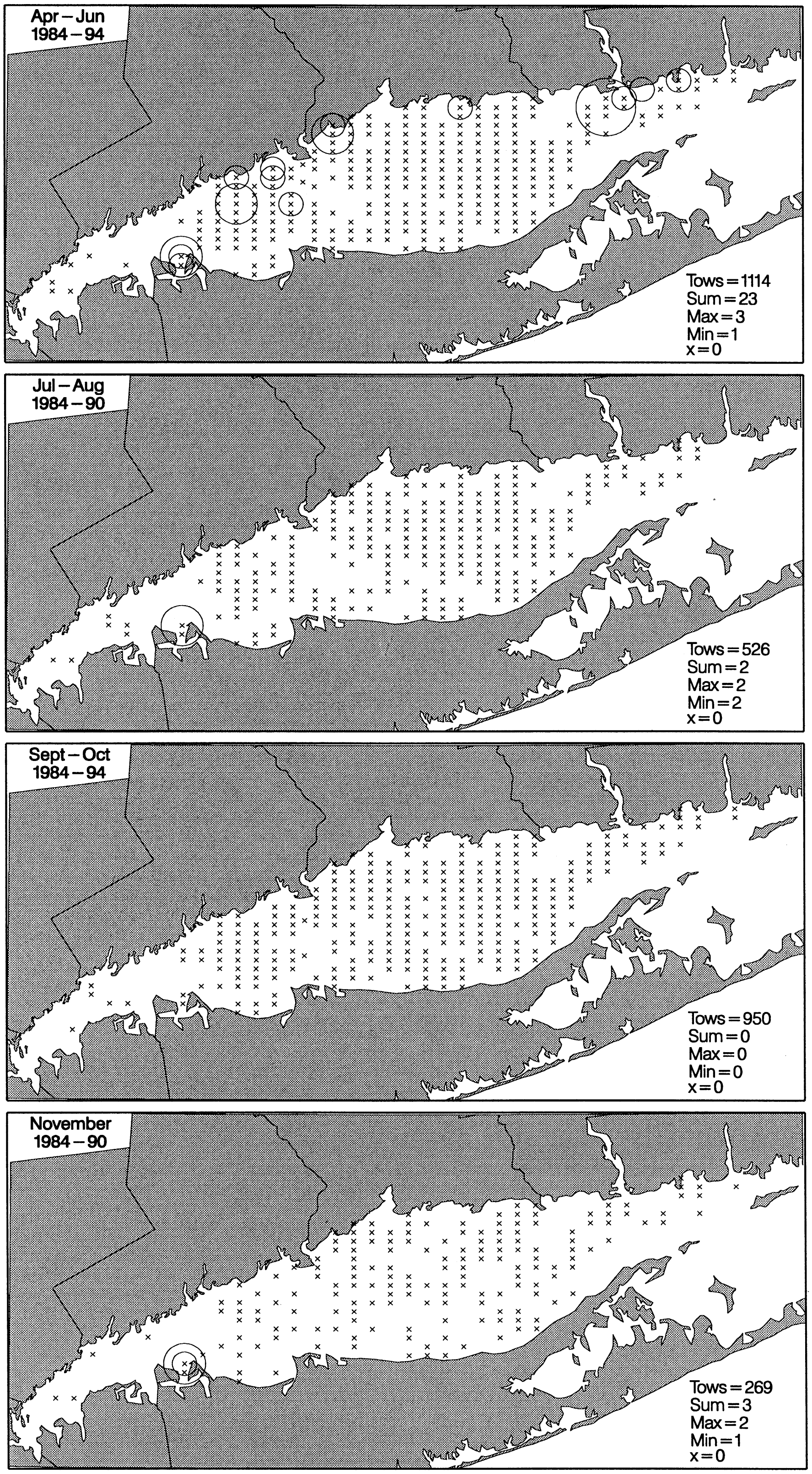


Figure DM-24

Grubby (*Myoxocephalus aeneus*). Seasonal distribution maps based on 28 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of three grubby.

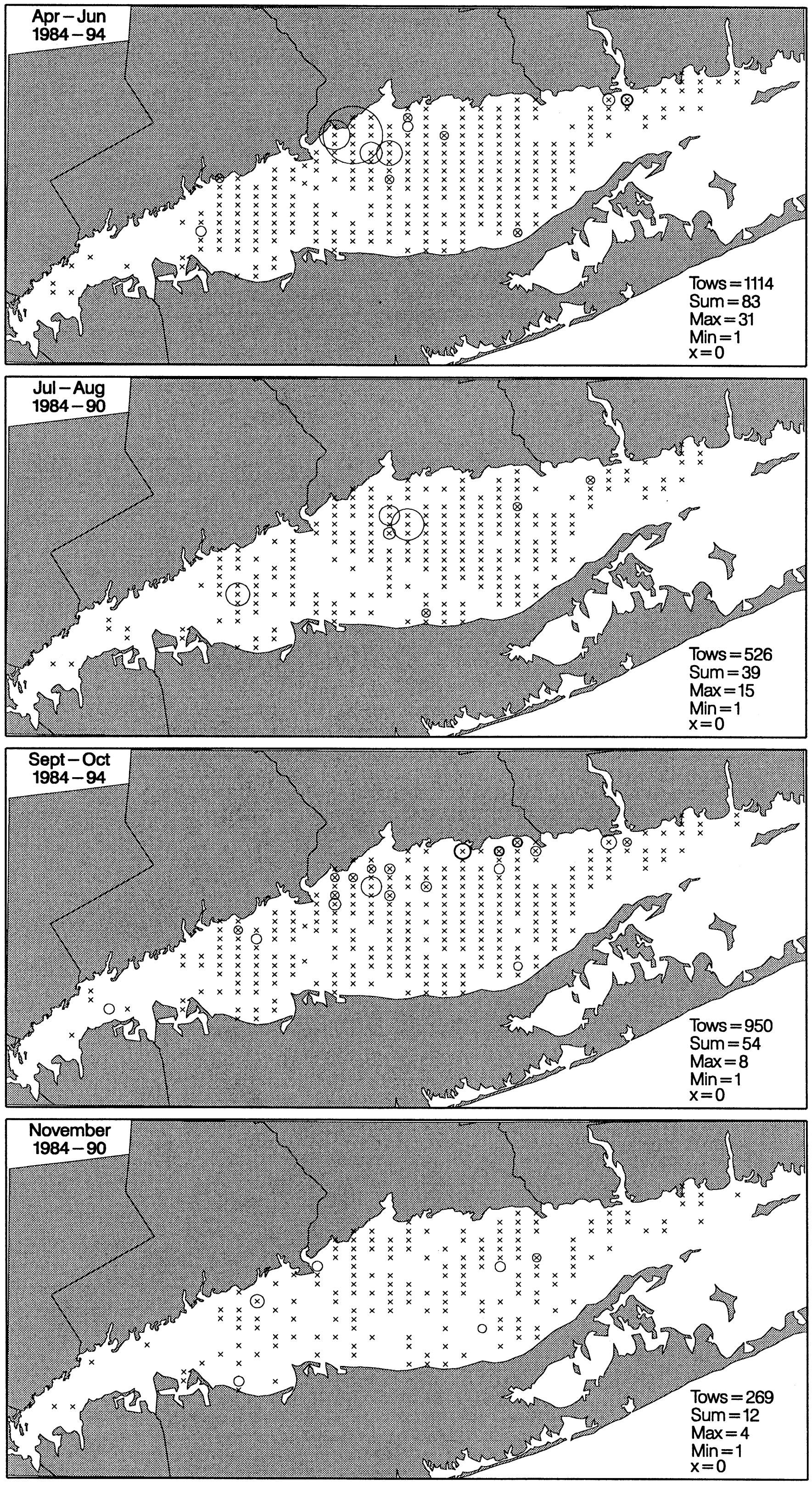


Figure DM-25

Hickory shad (*Alosa mediocris*). Seasonal distribution maps based on 188 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 31 hickory shad.

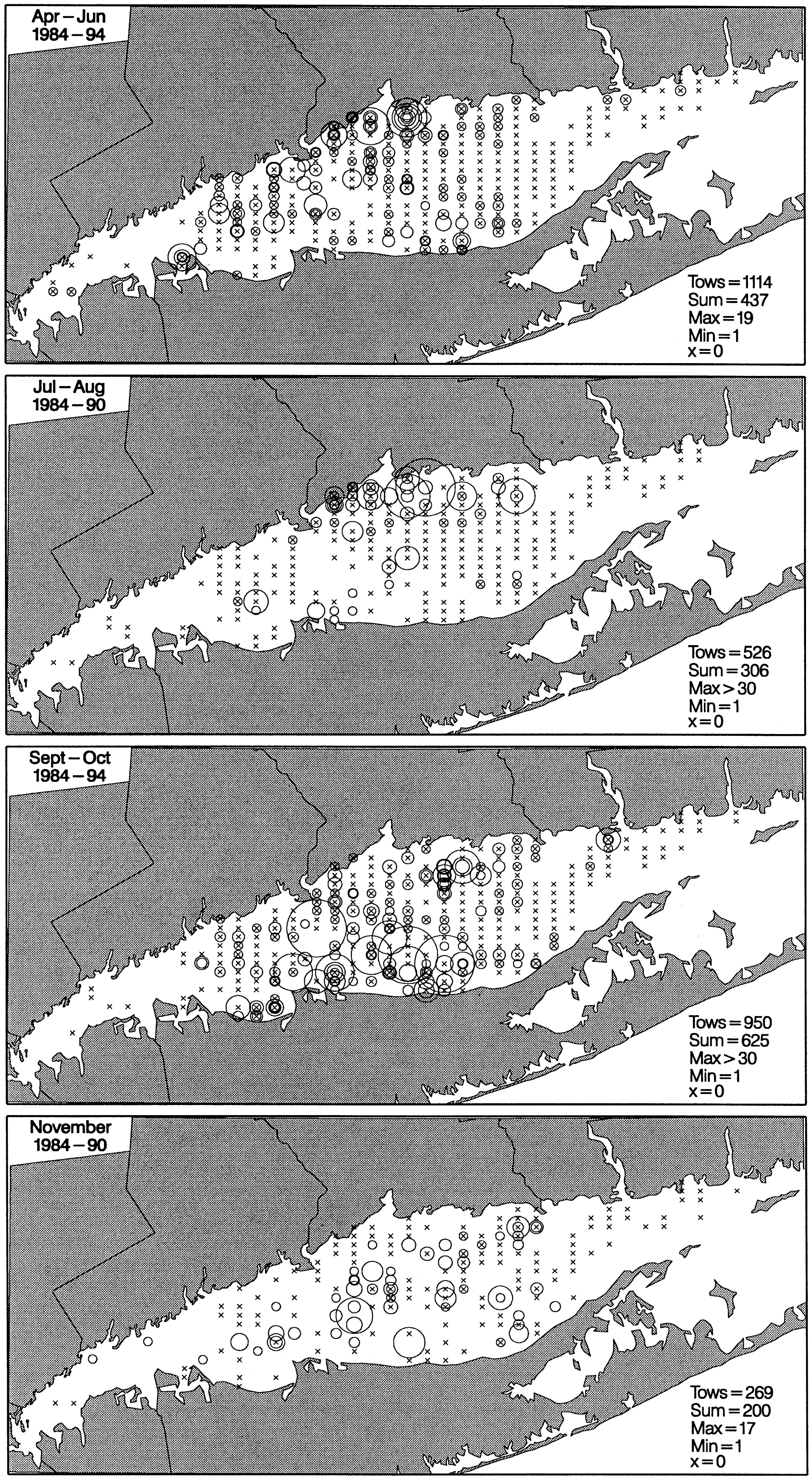


Figure DM-26

Hogchoker (*Trinectes maculatus*). Seasonal distribution maps based on 1,568 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 30 hogchoker.

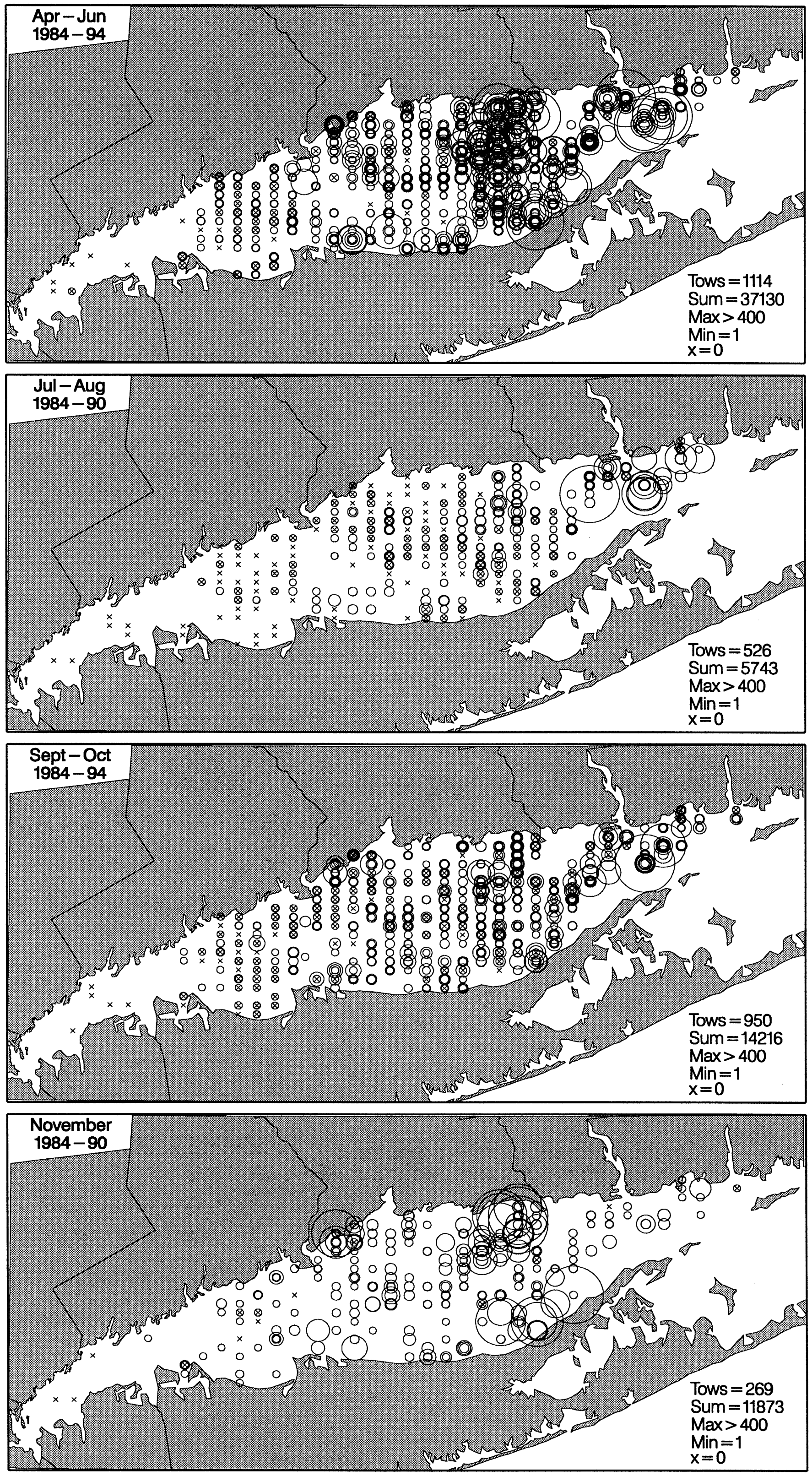


Figure DM-27
Little skate (*Raja erinacea*). Seasonal distribution maps based on 68,962 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 400 little skate.

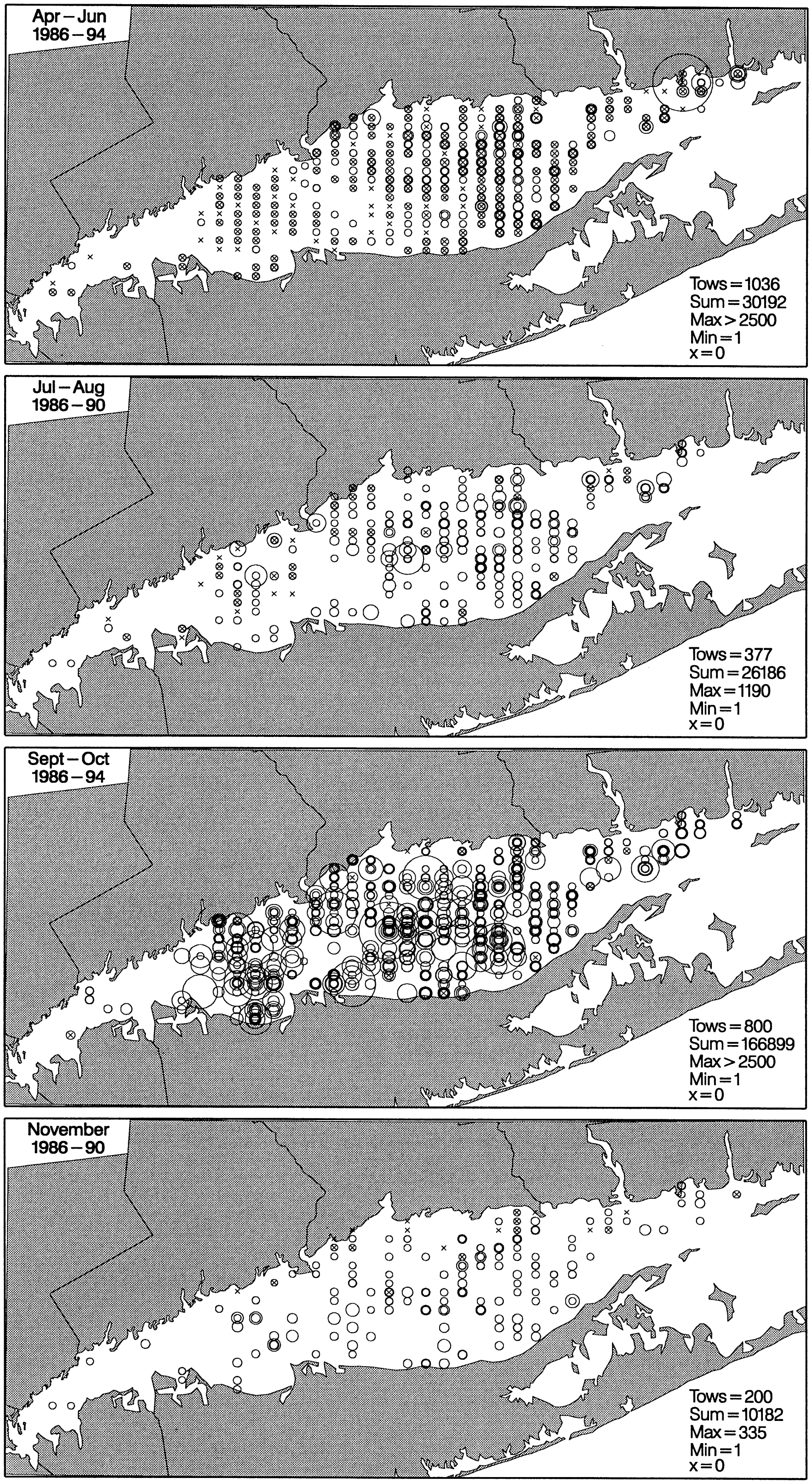


Figure DM-28
Long-finned squid (*Loligo pealei*). Seasonal distribution maps based on 233,459 squid taken in 2,413 tows between 1986 and 1994. The largest circle size represents a tow with a catch of greater than 2,500 long-finned squid.

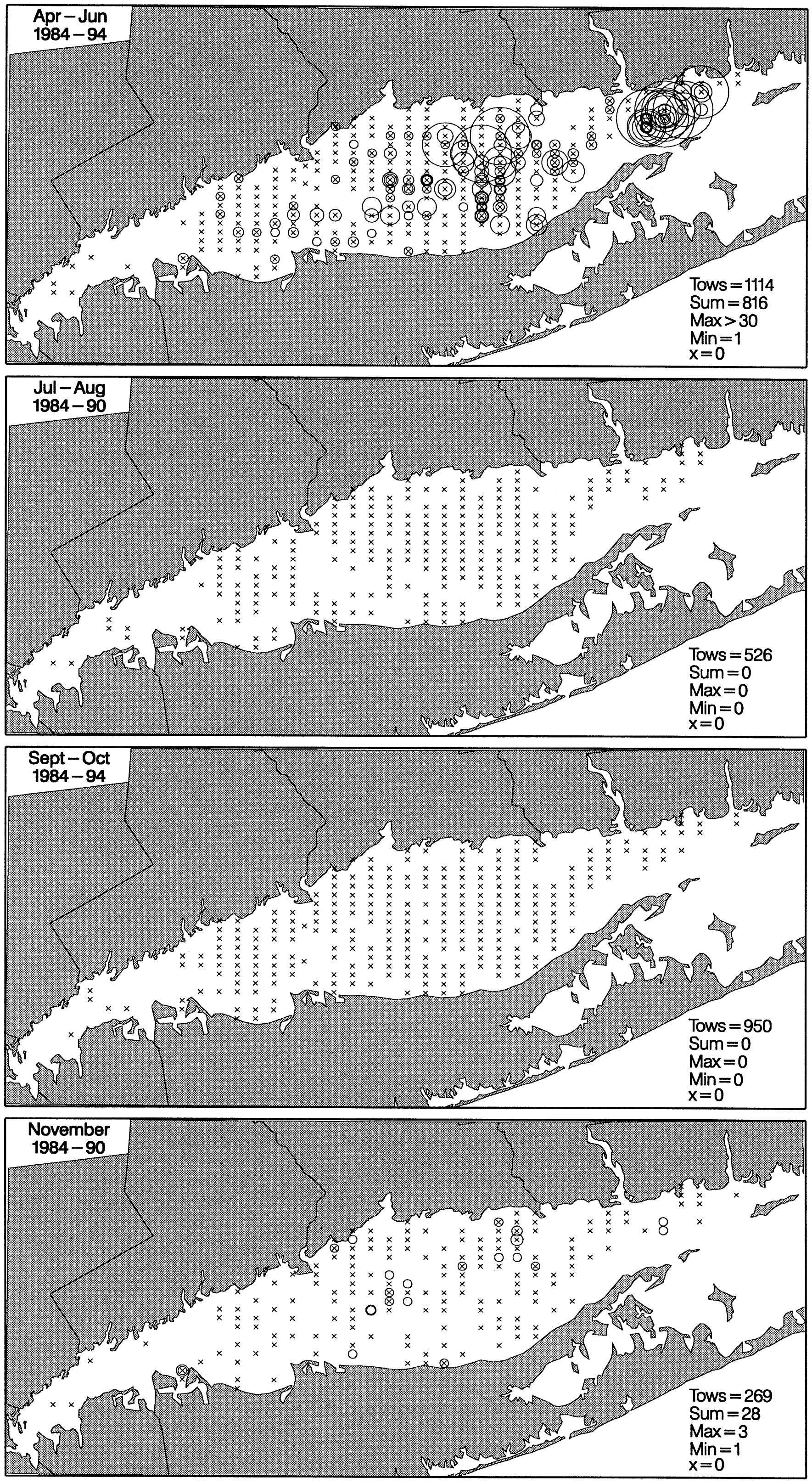


Figure DM-29

Longhorn sculpin (*Myoxocephalus octodecemspinosus*). Seasonal distribution maps based on 844 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 30 longhorn sculpin.

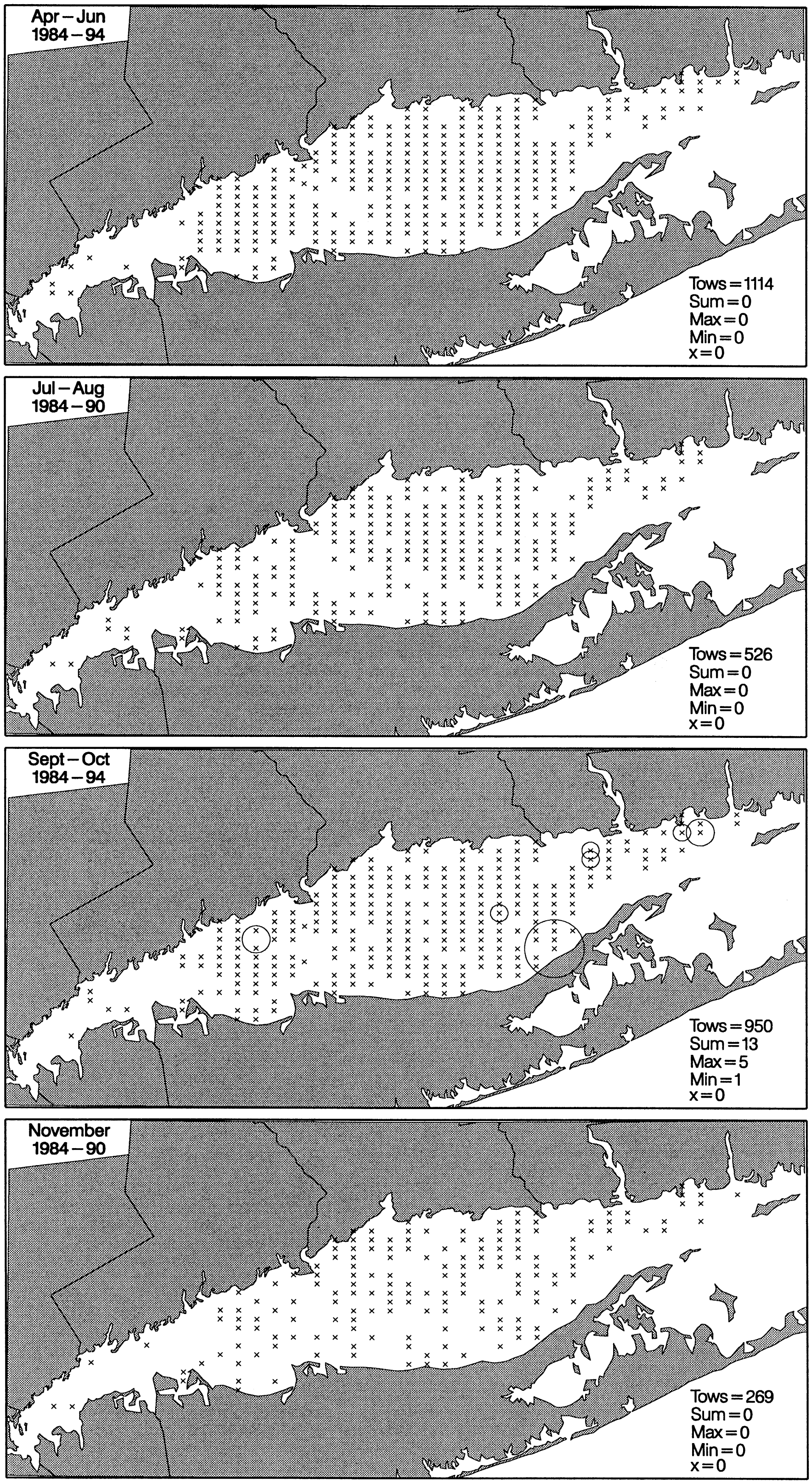


Figure DM-30

Mackerel scad (*Decapterus macarellus*). Seasonal distribution maps based on 13 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of five mackerel scad.

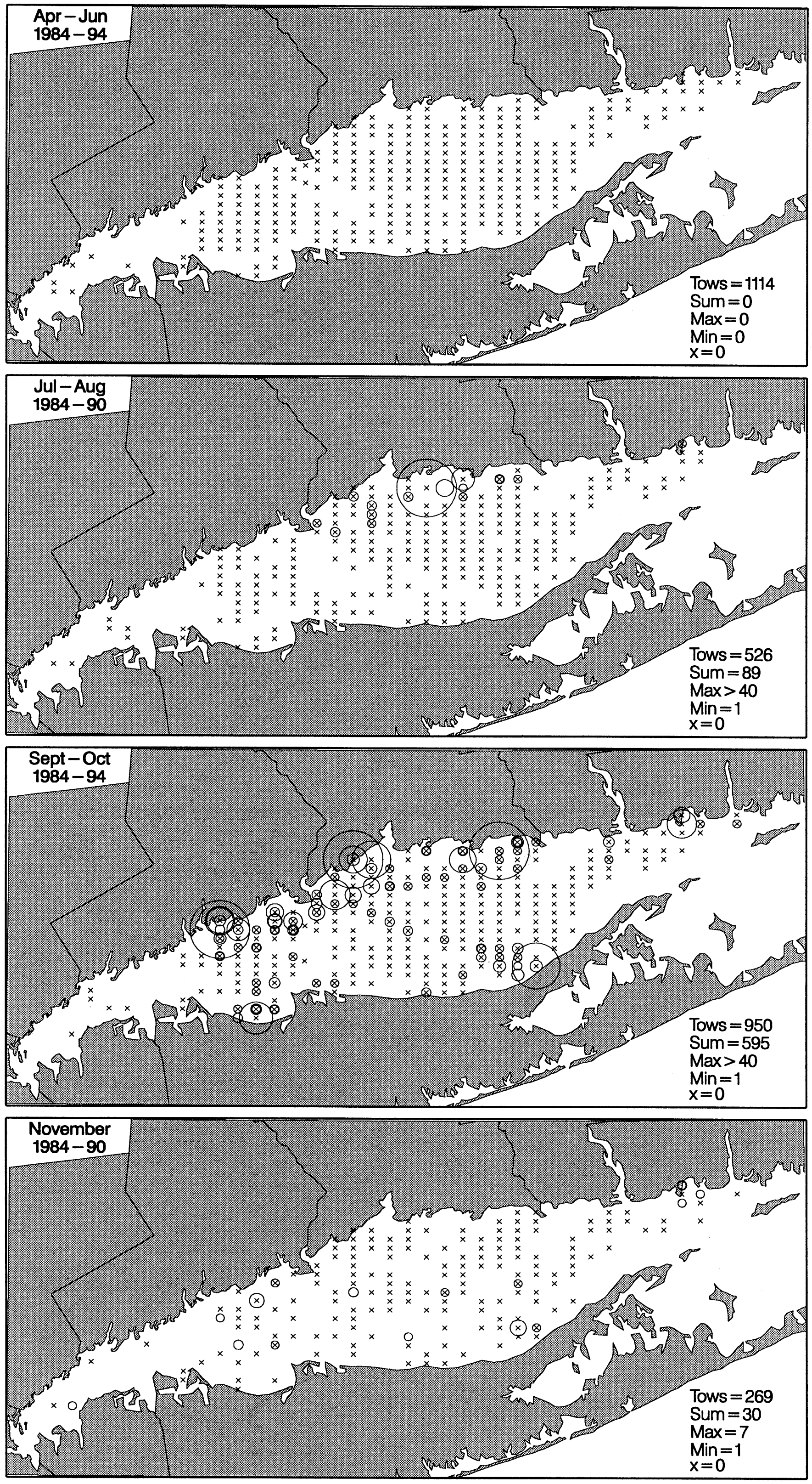


Figure DM-31

Moonfish (*Selene setapinnis*). Seasonal distribution maps based on 714 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 40 moonfish.

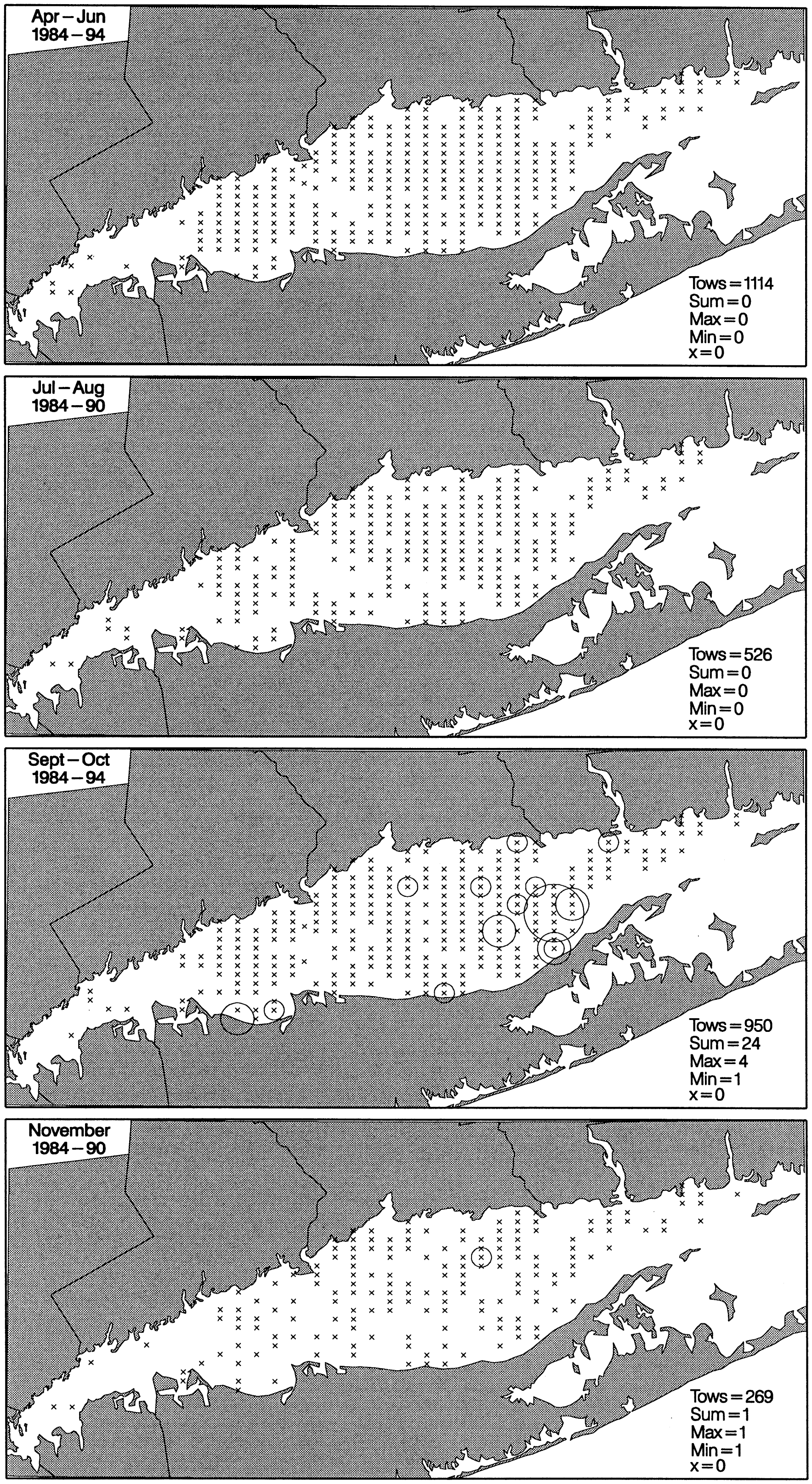


Figure DM-32

Northern kingfish (*Menticirrhus saxatilis*). Seasonal distribution maps based on 25 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of four northern kingfish.

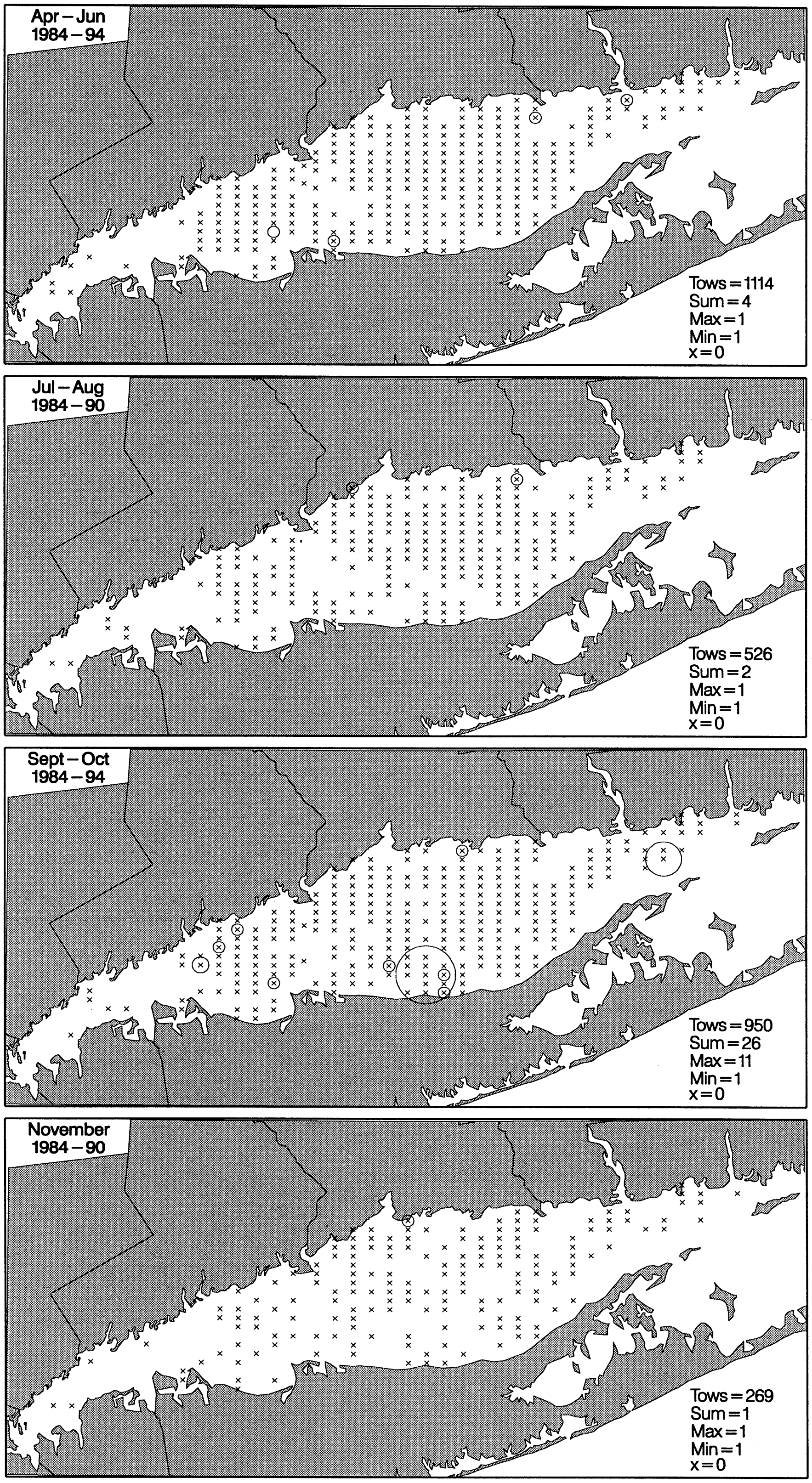


Figure DM-33

Northern pipefish (*Syngnathus fuscus*). Seasonal distribution maps based on 33 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 11 northern pipefish.

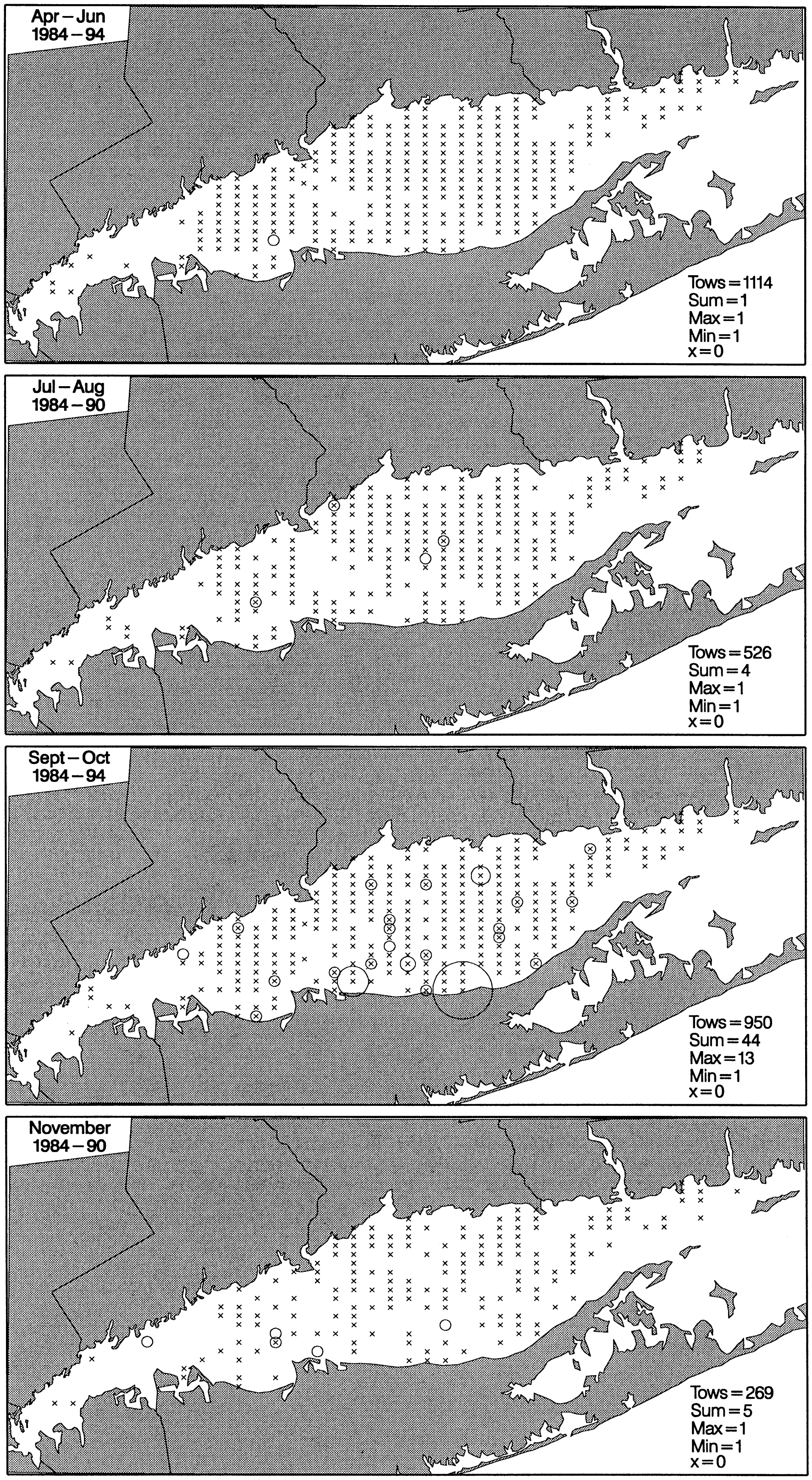


Figure DM-34

Northern puffer (*Sphoeroides maculatus*). Seasonal distribution maps based on 54 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 13 northern puffer.

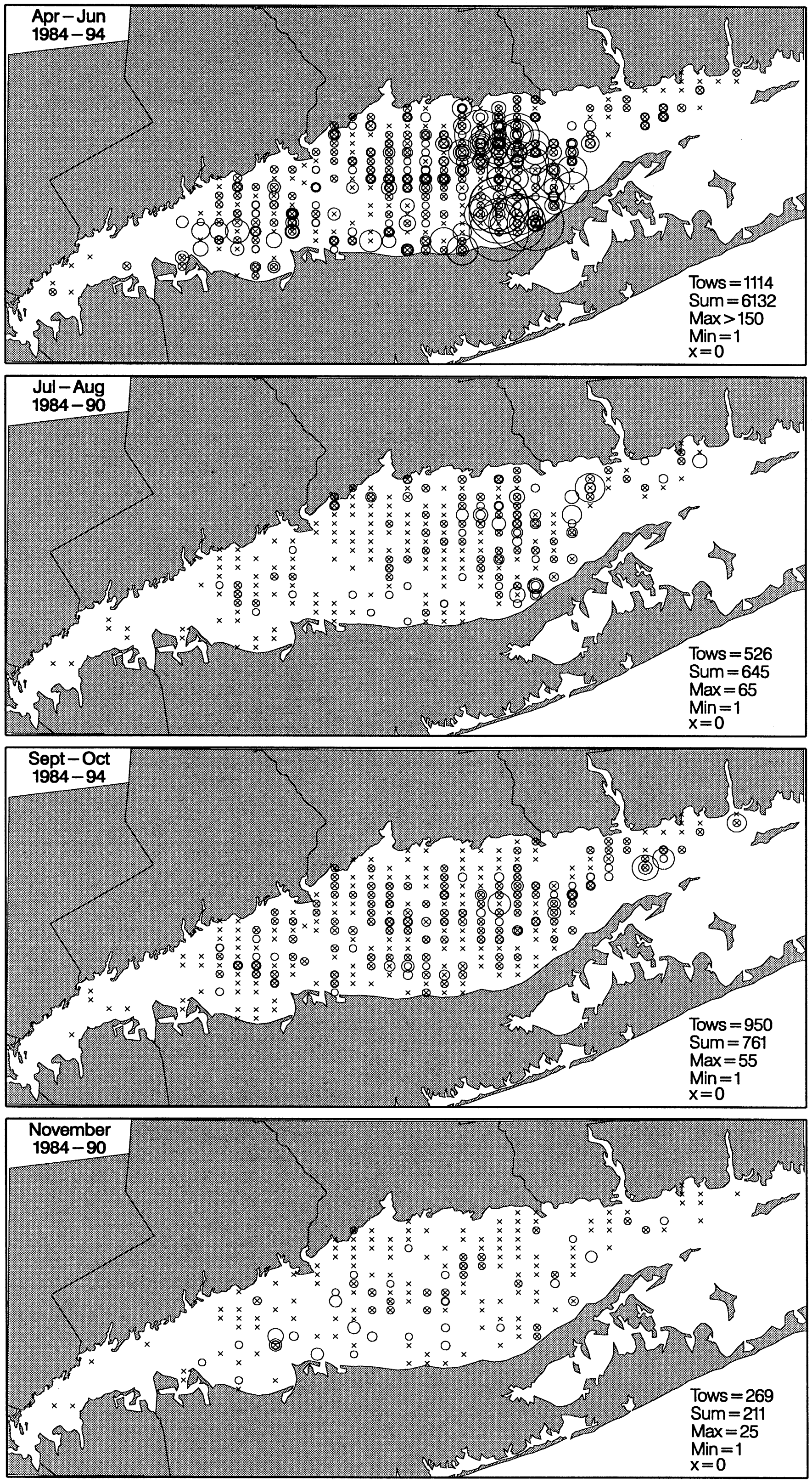


Figure DM-35

Northern searobin (*Prionotus carolinus*). Seasonal distribution maps based on 7,749 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 150 northern searobin.

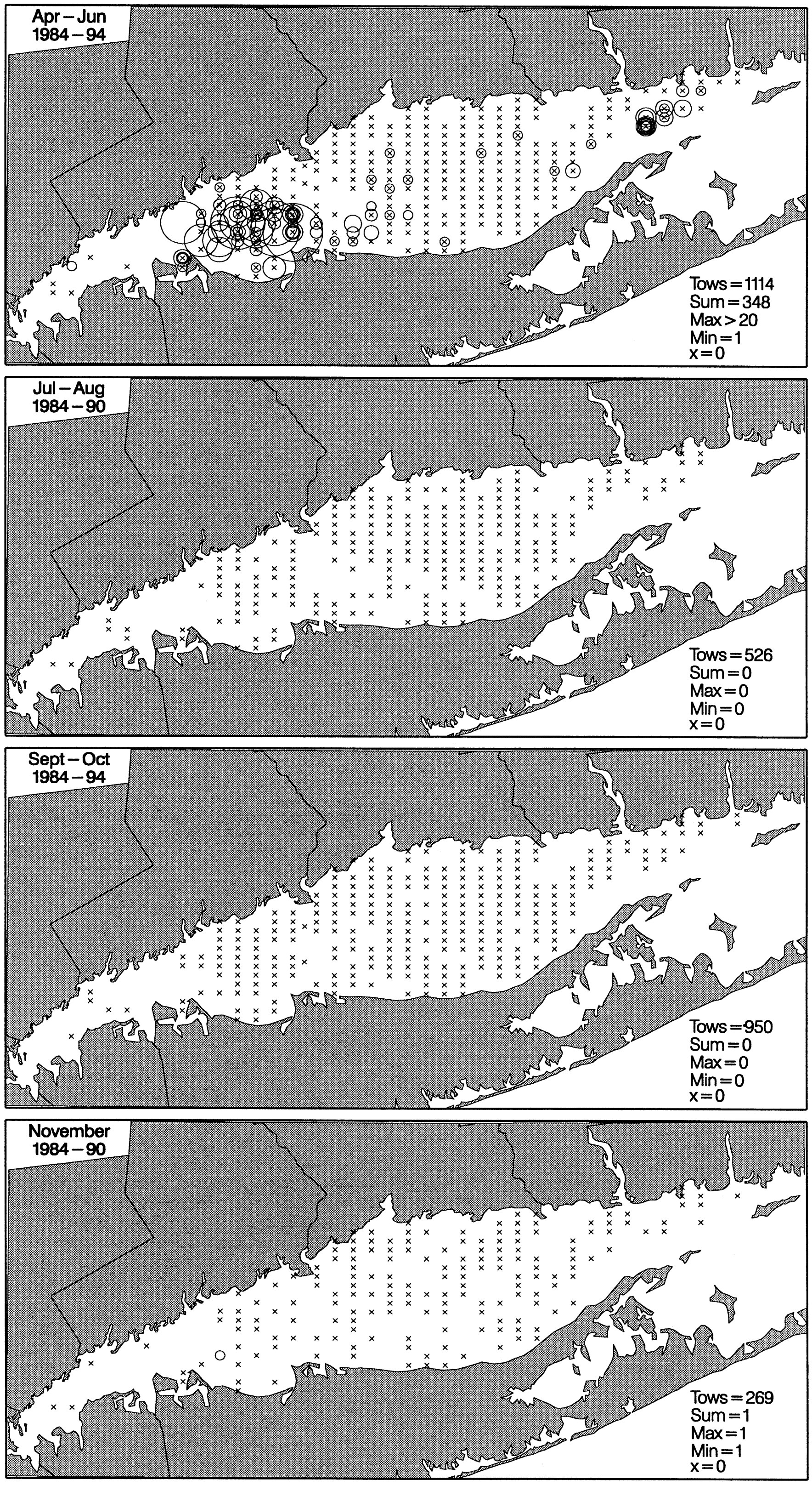


Figure DM-36

Ocean pout (*Macrozoarces americanus*). Seasonal distribution maps based on 349 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 20 ocean pout.

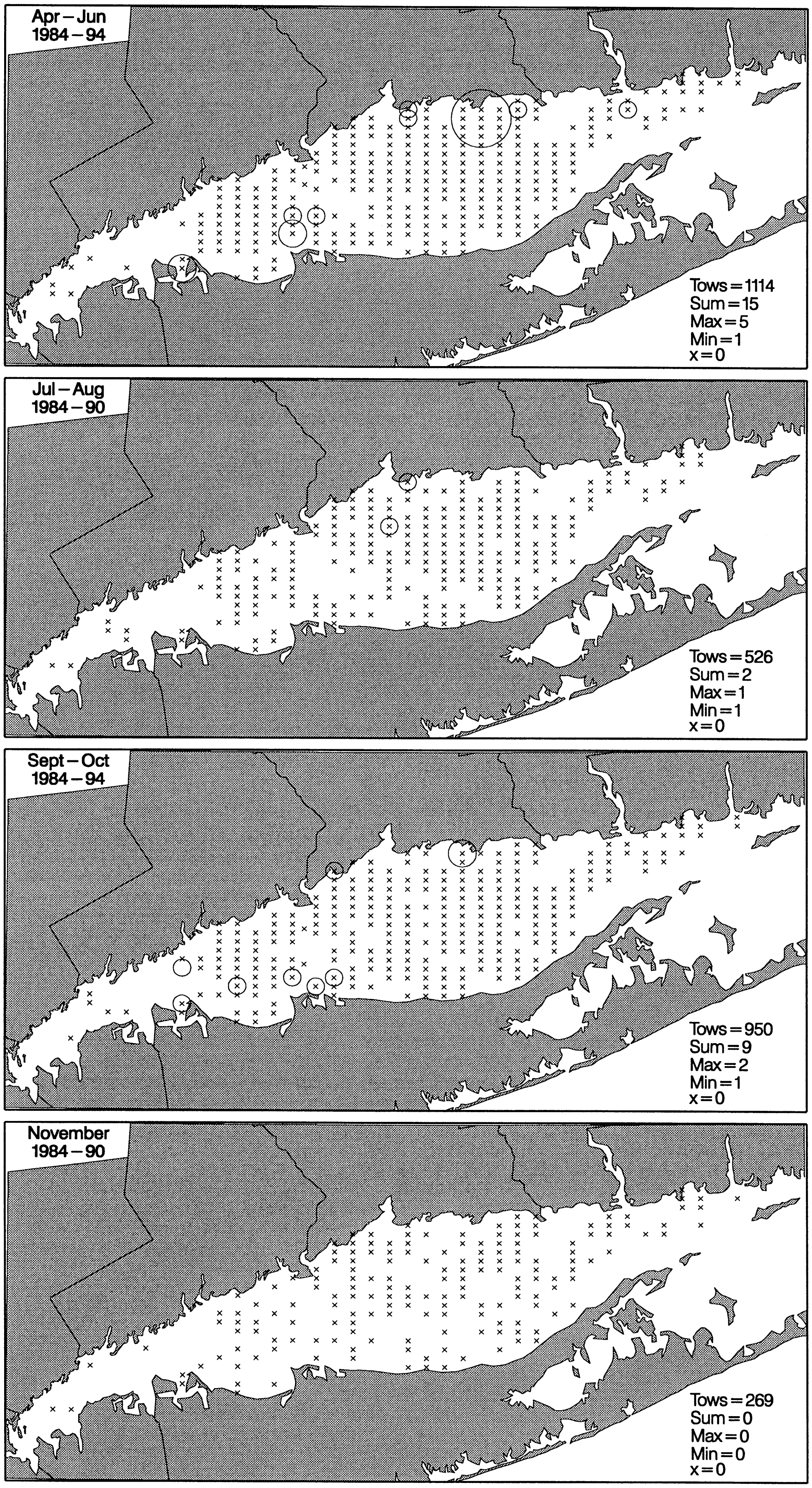


Figure DM-37

Oyster toadfish (*Opsanus tau*). Seasonal distribution maps based on 26 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of five oyster toadfish.

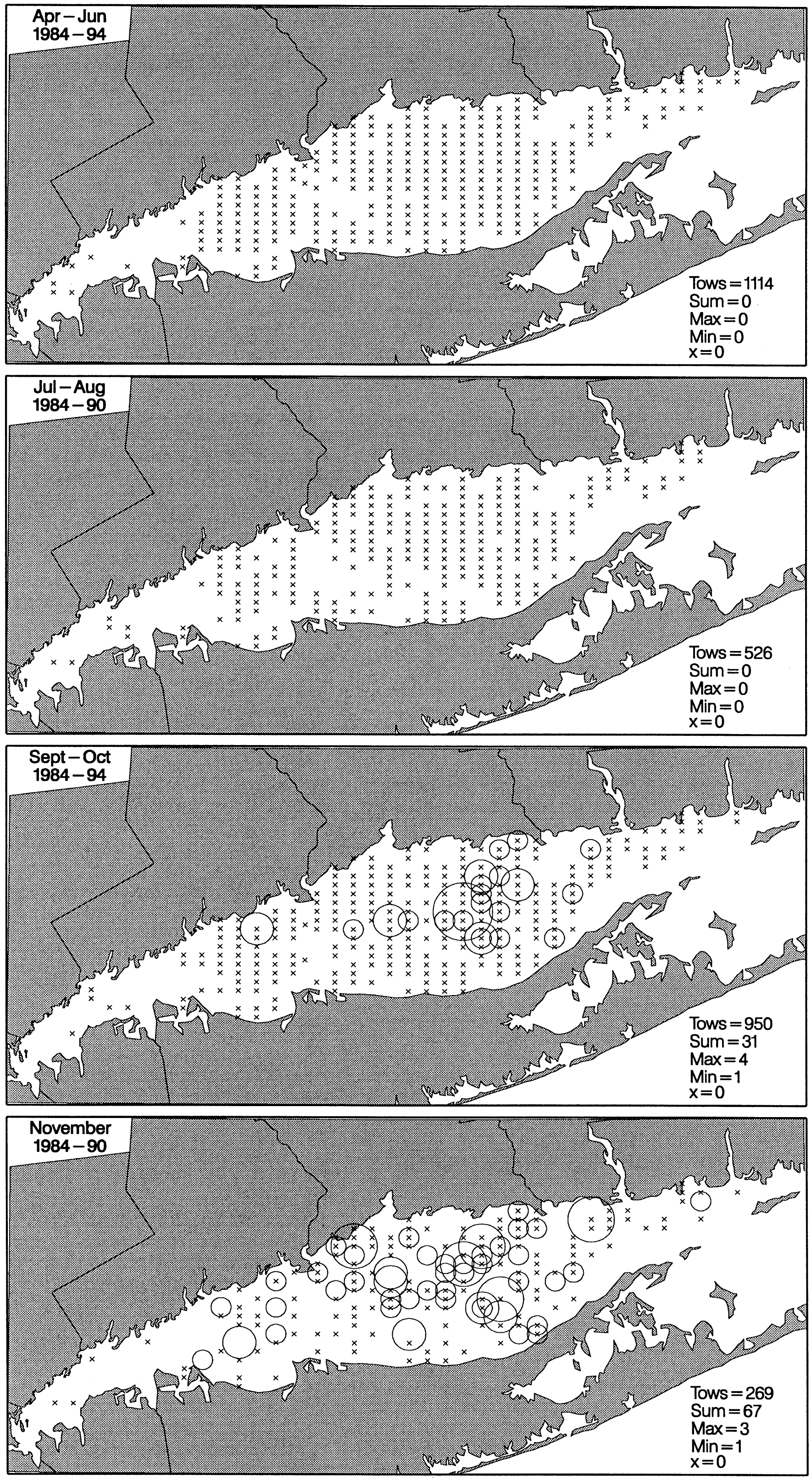


Figure DM-38

Planehead filefish (*Monacanthus hispidus*). Seasonal distribution maps based on 98 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of four planehead filefish.

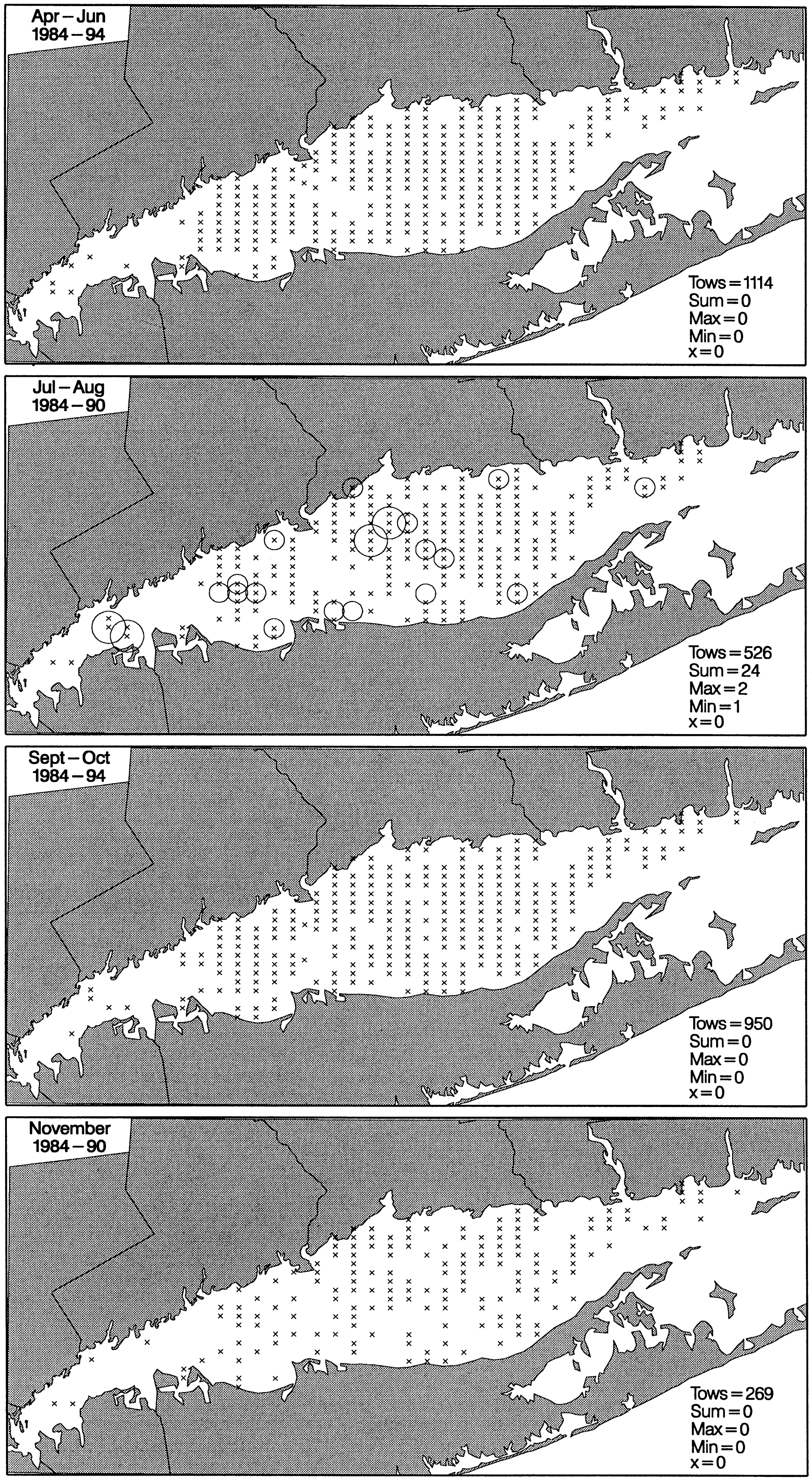


Figure DM-39

Pollock (*Pollachius virens*). Seasonal distribution maps based on 24 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of two pollock.

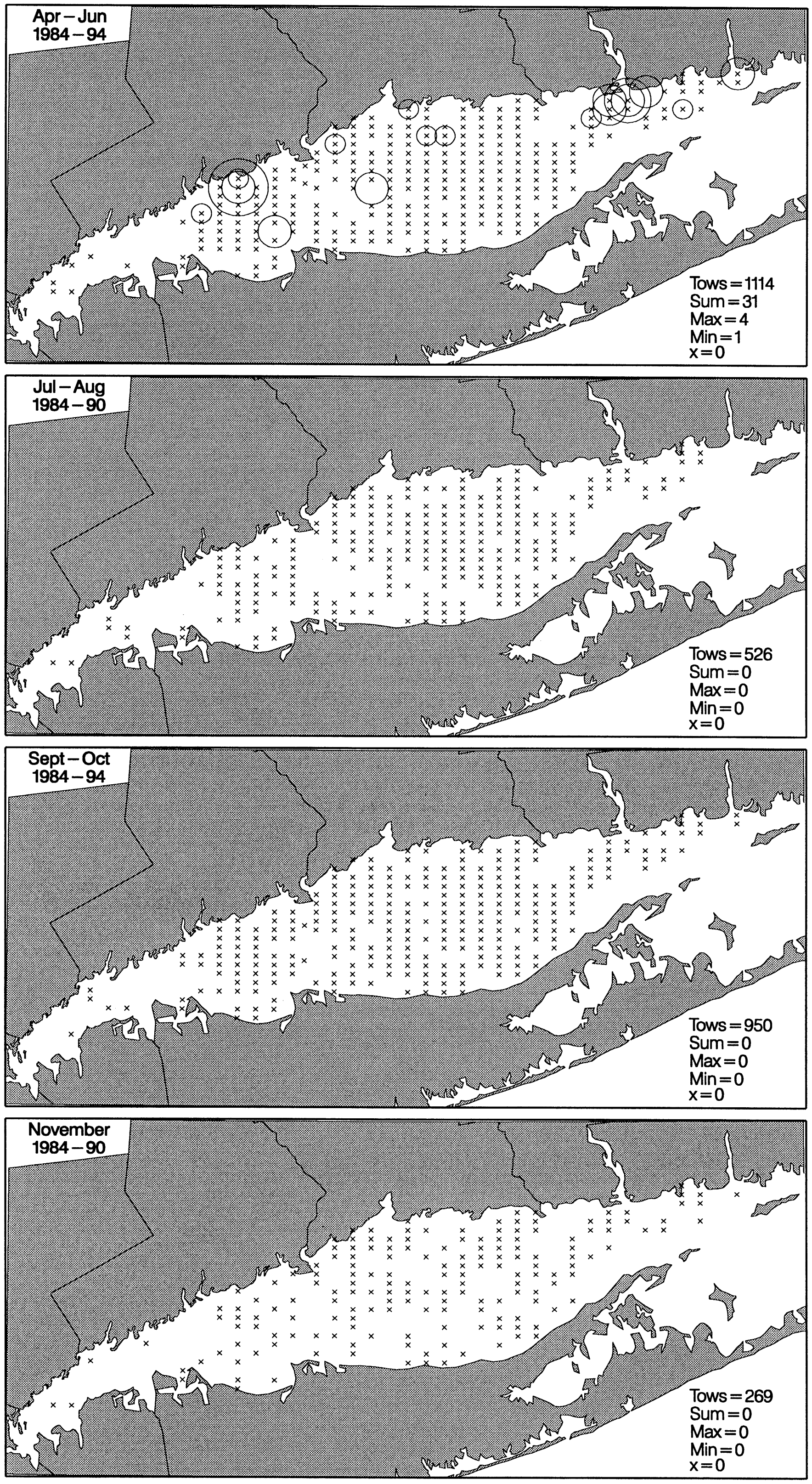


Figure DM-40
Rainbow smelt (*Osmerus mordax*). Seasonal distribution maps based on 31 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of four rainbow smelt.

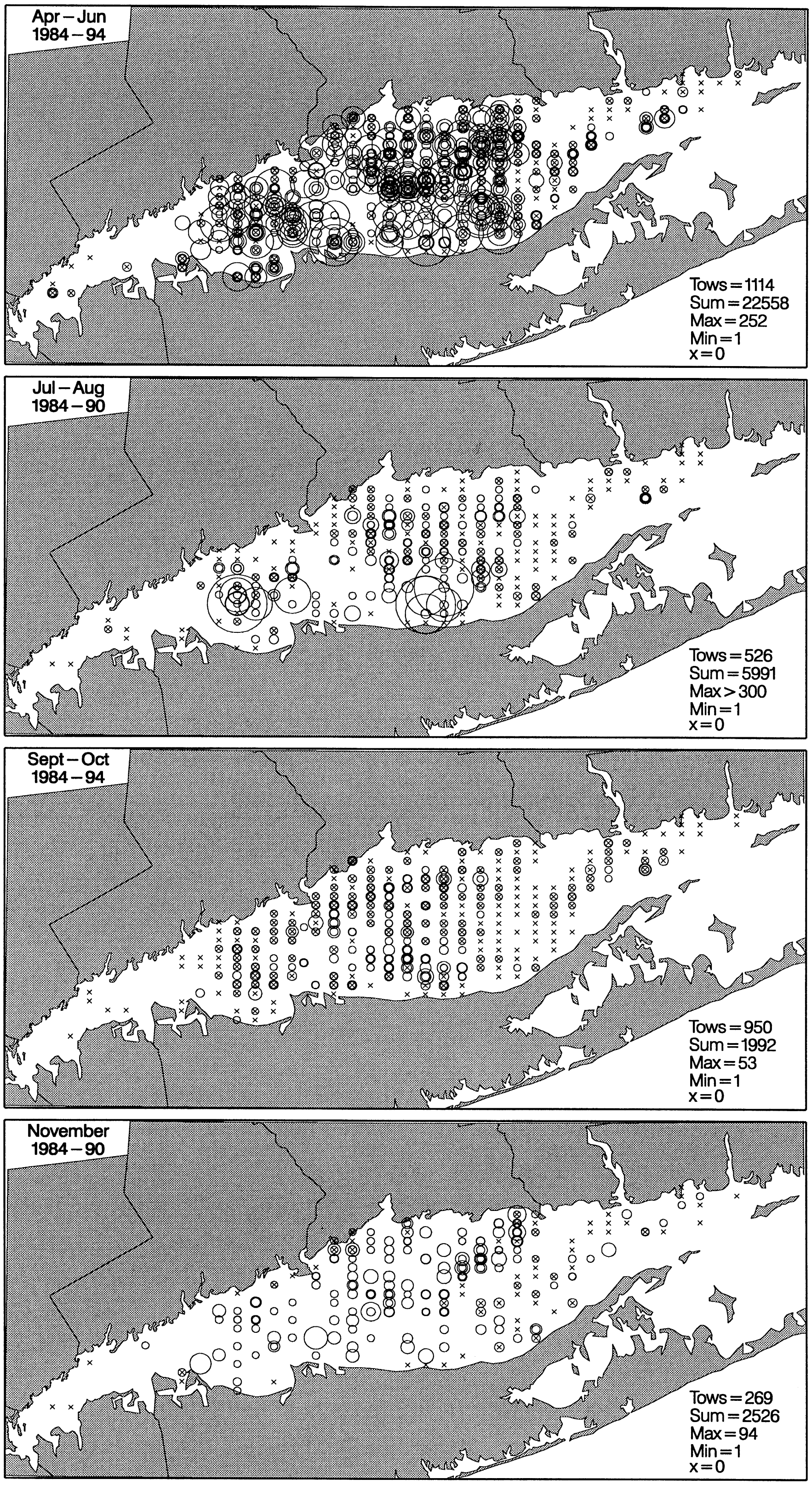


Figure DM-41

Red hake (*Urophycis chuss*). Seasonal distribution maps based on 33,067 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 300 red hake.

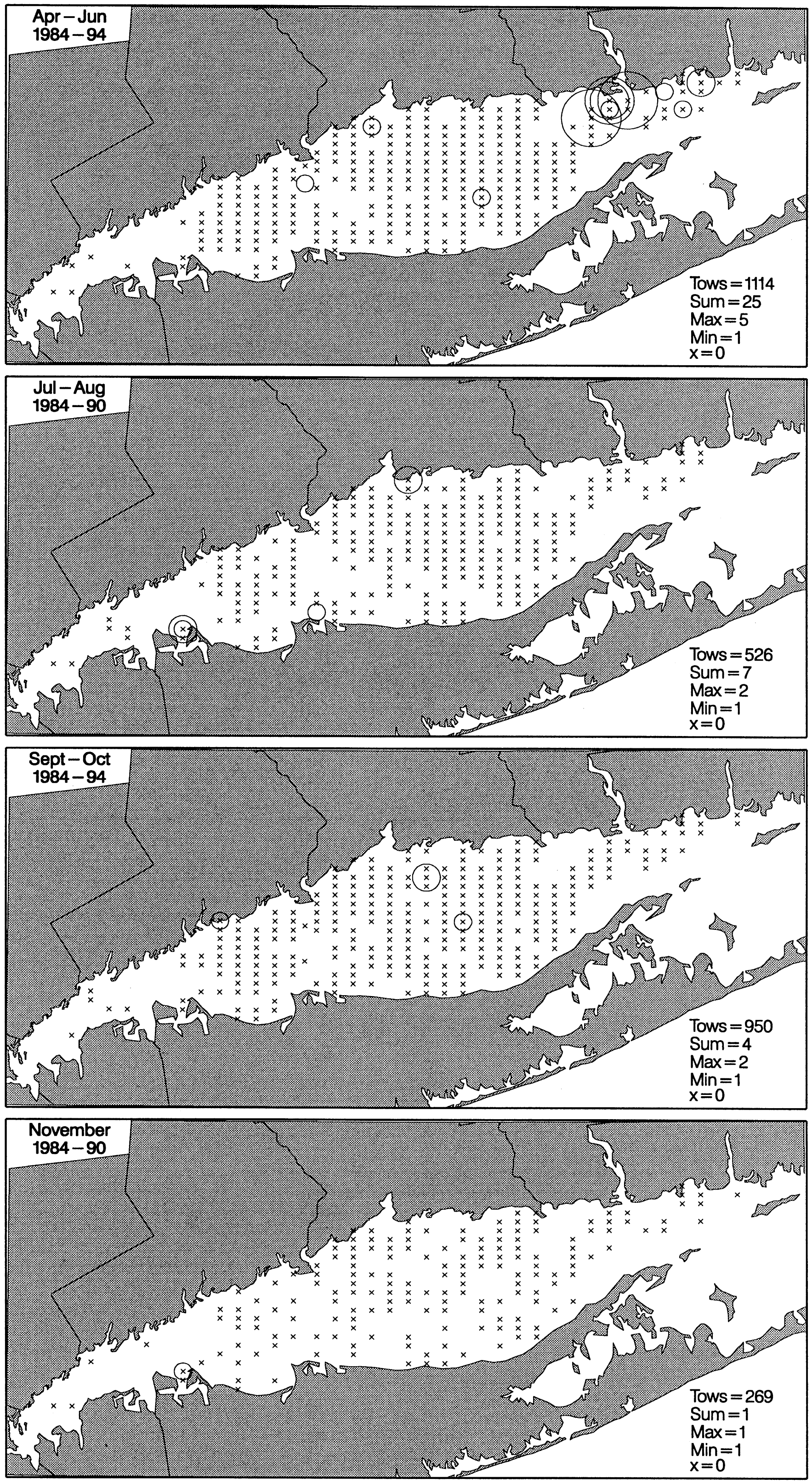


Figure DM-42

Rock gunnel (*Pholis gunnellus*). Seasonal distribution maps based on 37 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of five rock gunnel.

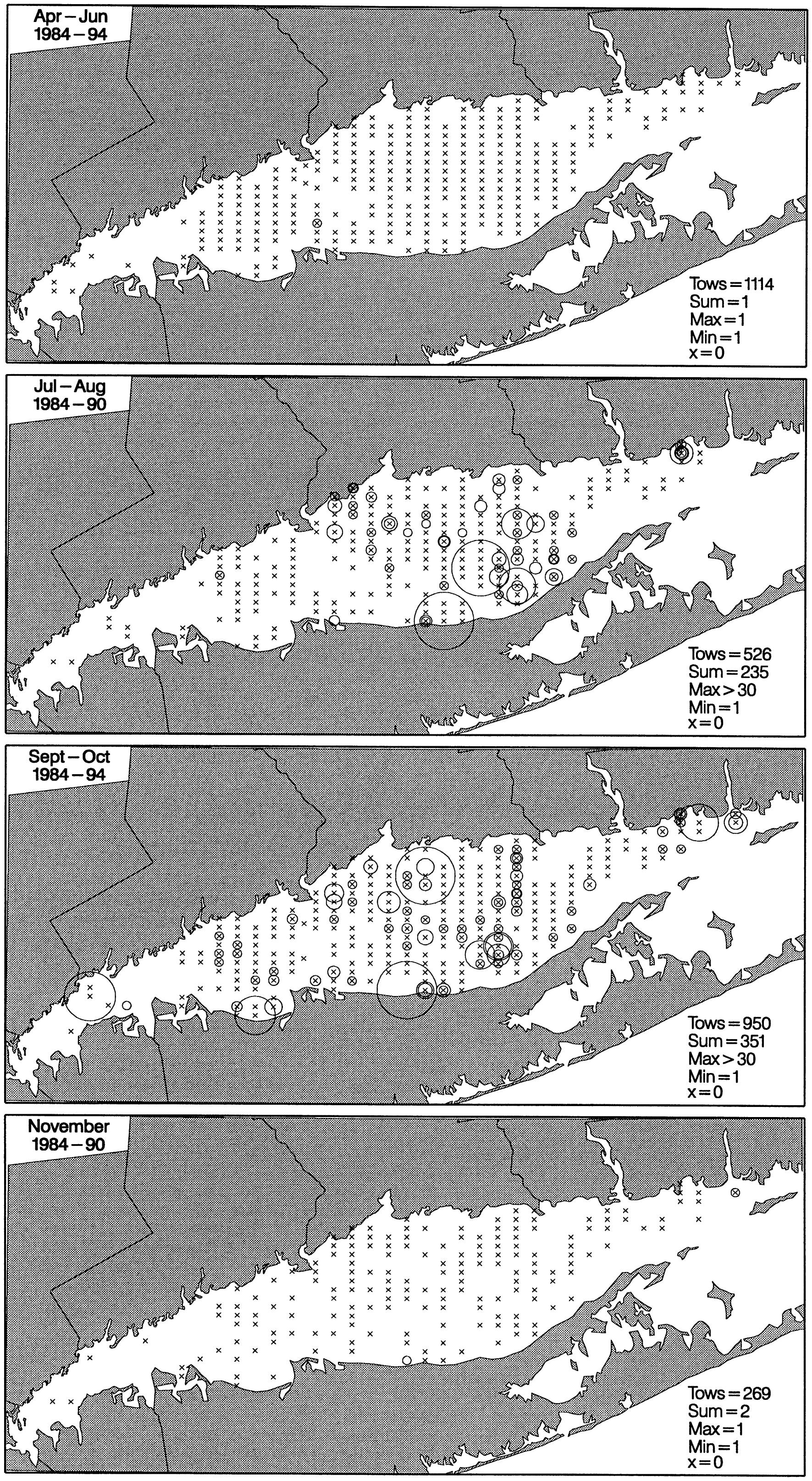


Figure DM-43

Rough scad (*Trachurus lathami*). Seasonal distribution maps based on 589 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 30 rough scad.

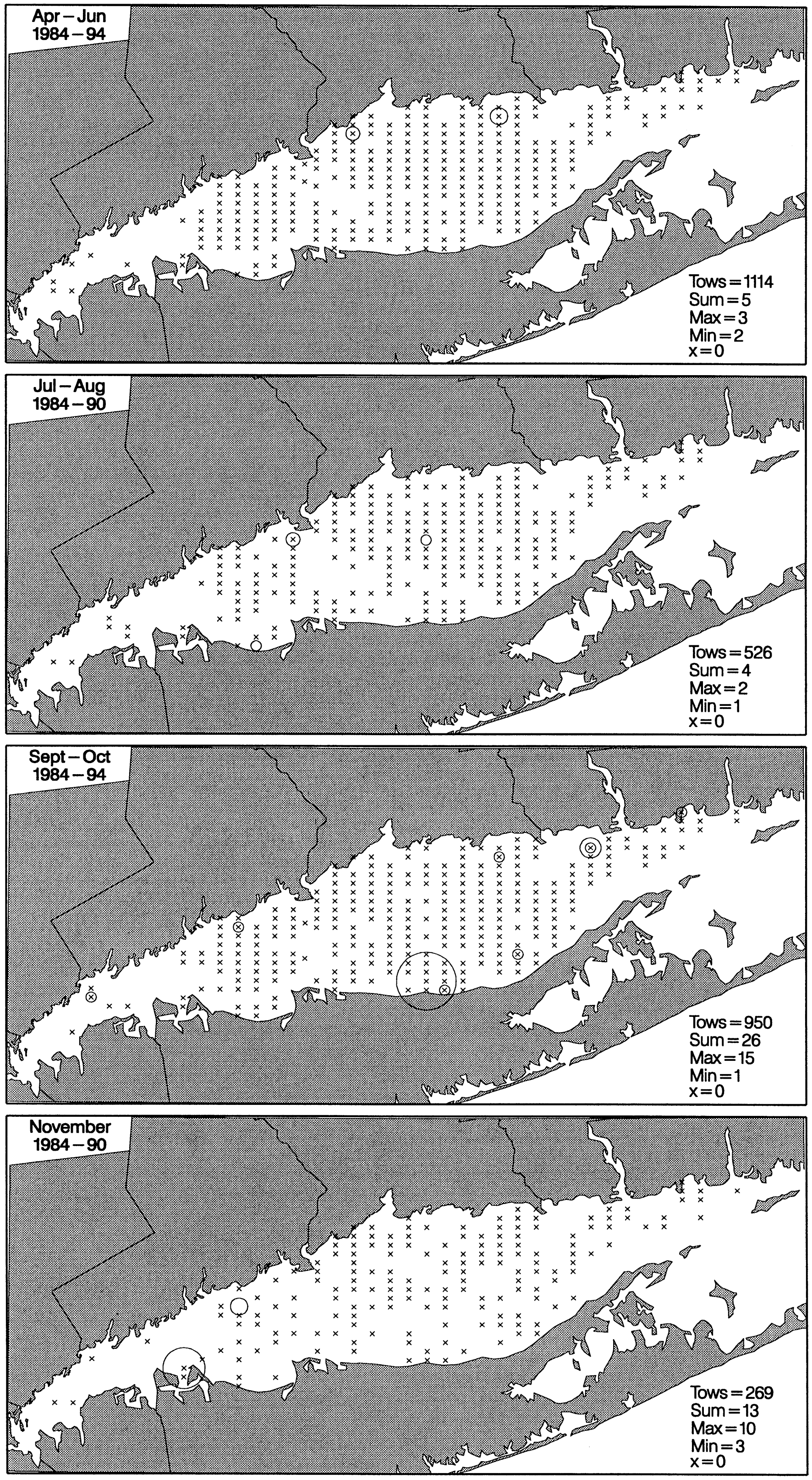


Figure DM-44

Round herring (*Etrumeus teres*). Seasonal distribution maps based on 48 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 15 round herring.

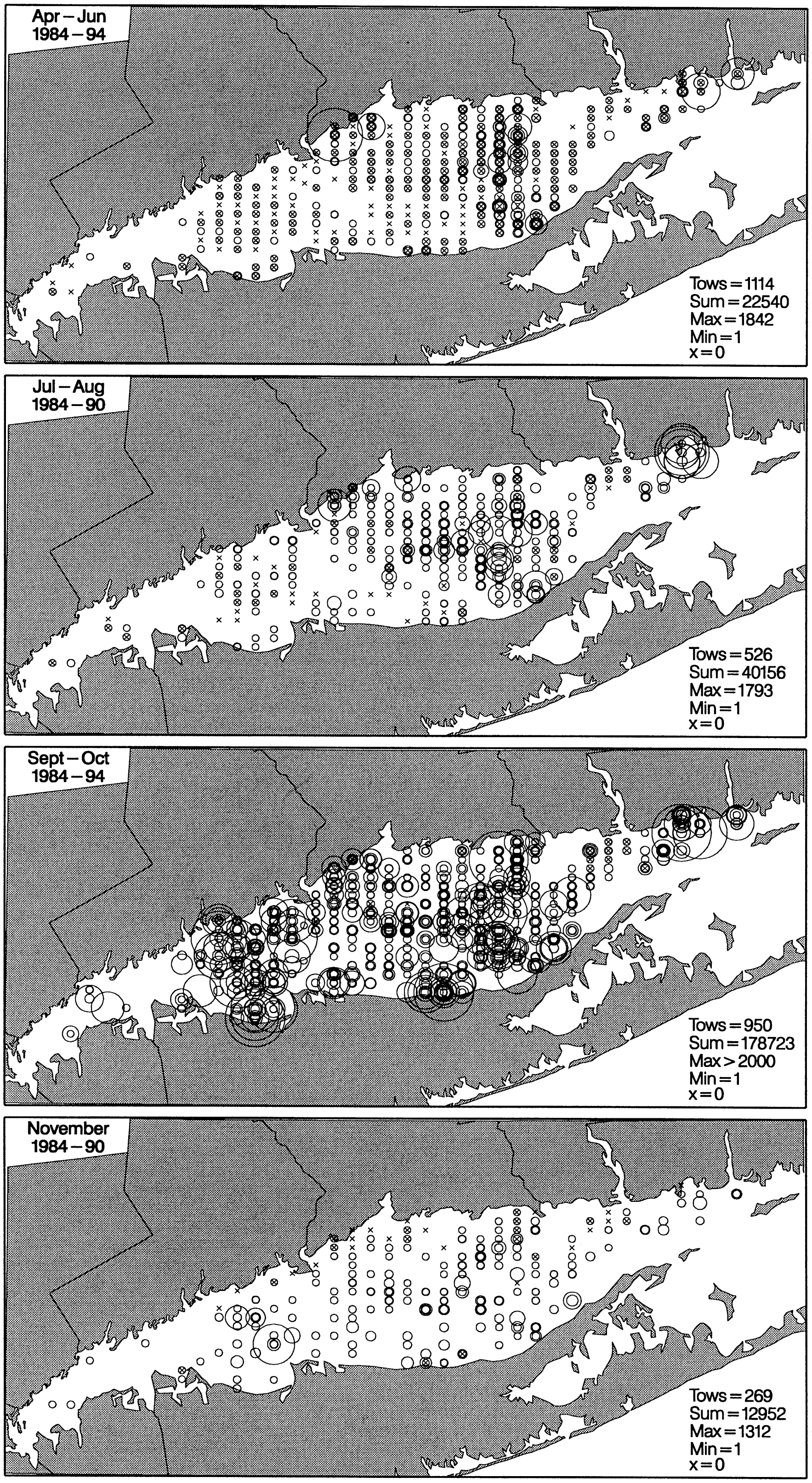


Figure DM-45

Scup (*Stenotomus chrysops*). Seasonal distribution maps based on 254,371 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 2,000 scup.

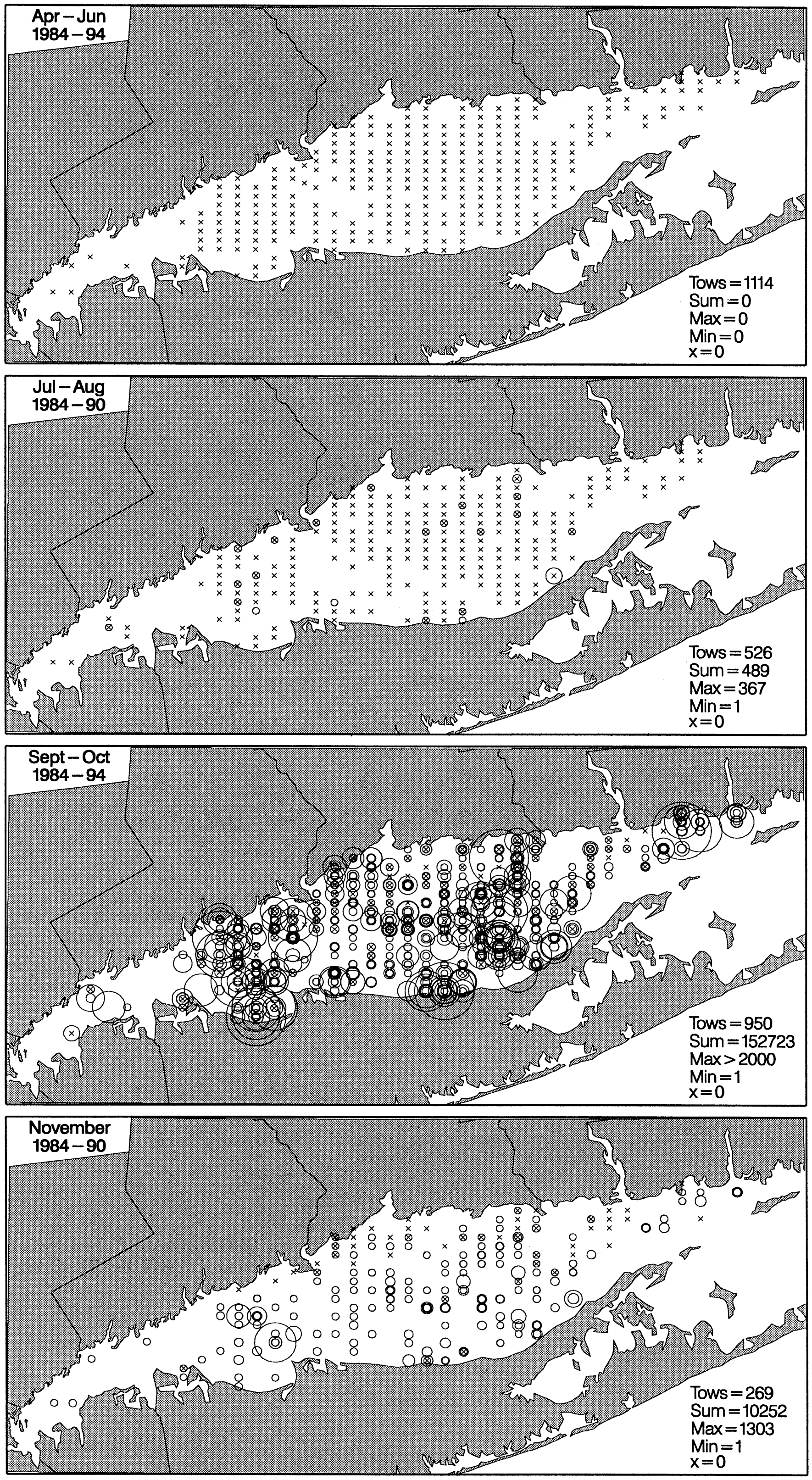


Figure DM-46

Scup (*Stenotomus chrysops*), young-of-year. Seasonal distribution maps based on 163,464 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 2,000 scup.

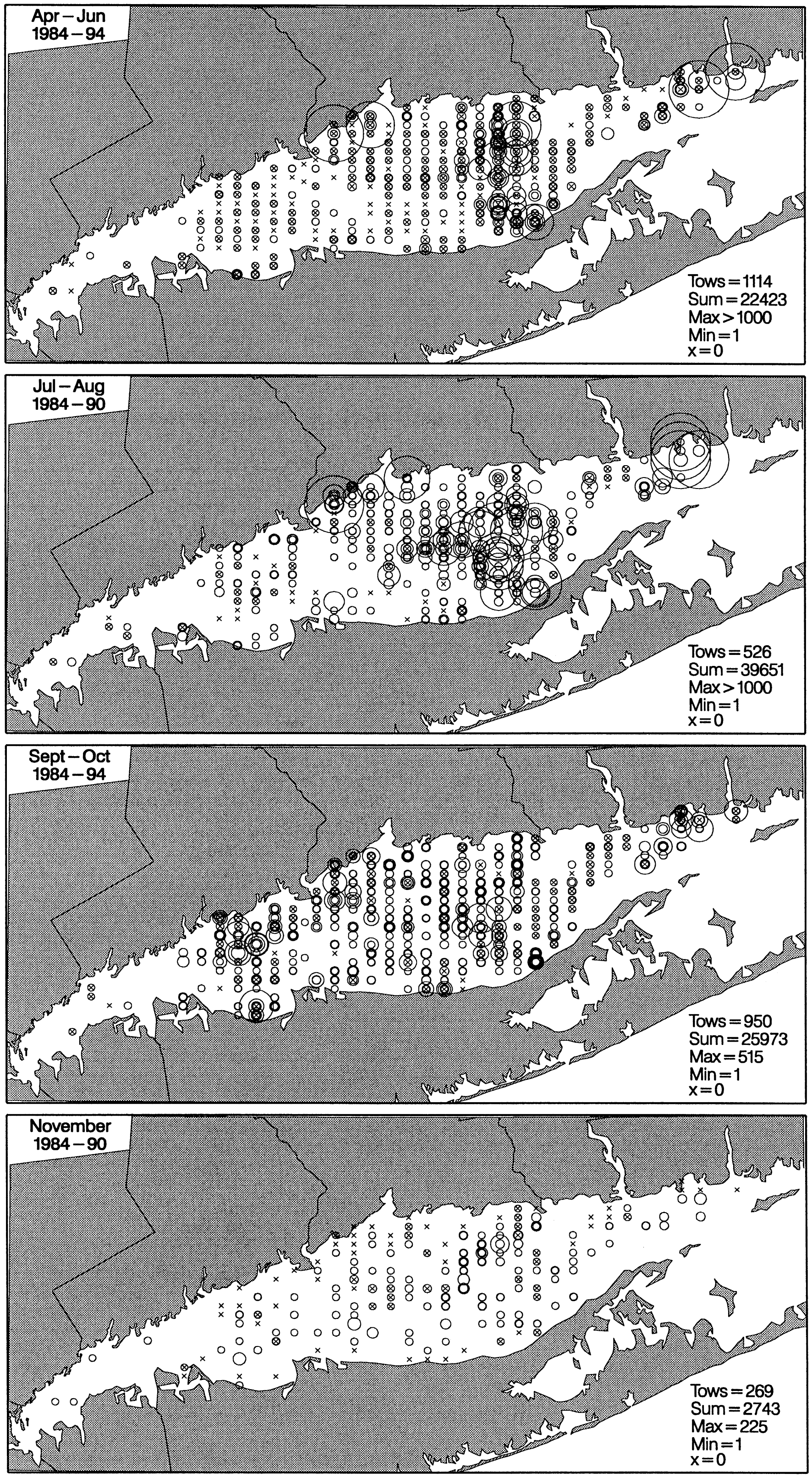


Figure DM-47

Scup (*Stenotomus chrysops*), age 1+. Seasonal distribution maps based on 90,790 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 1,000 scup.

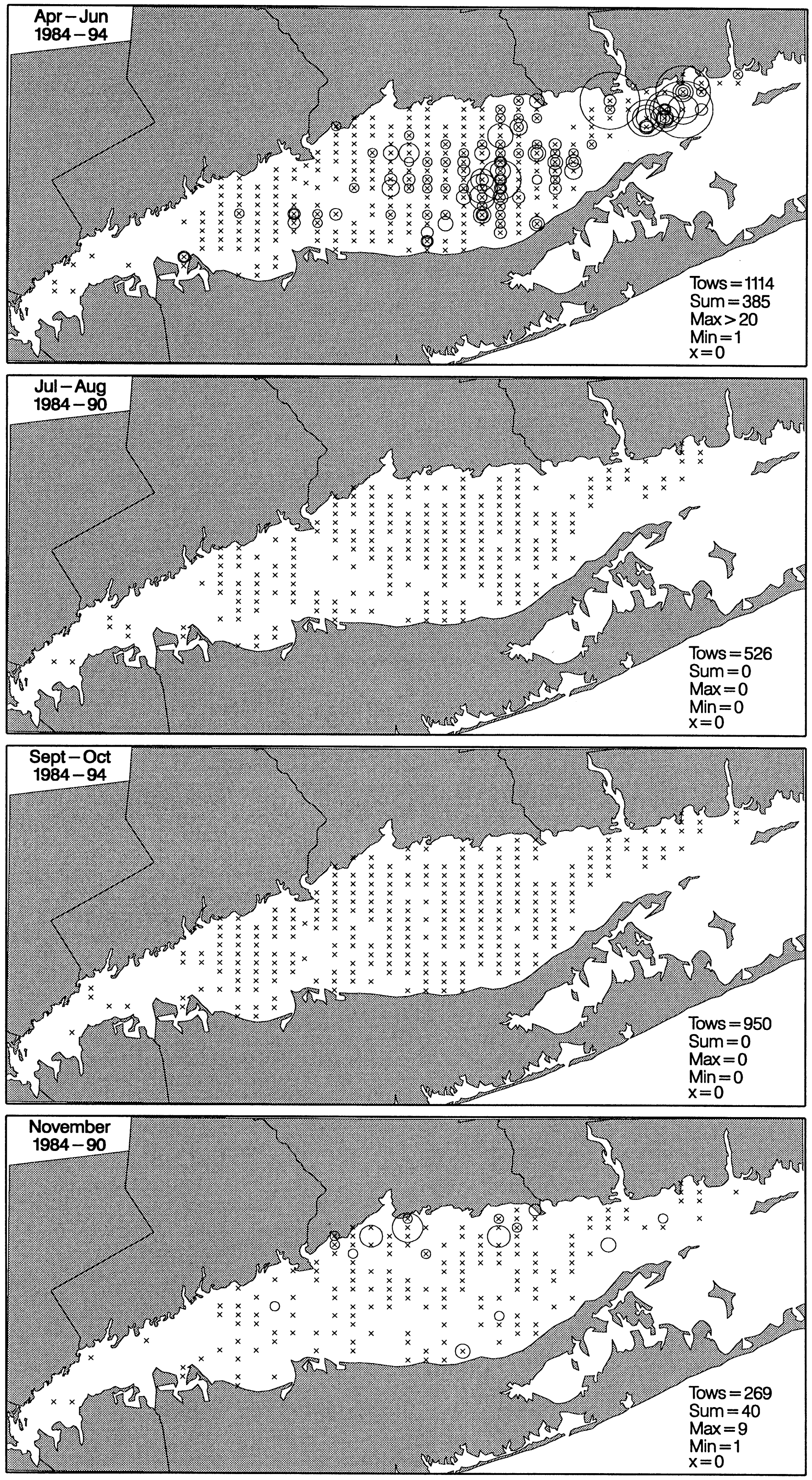


Figure DM-48

Sea raven (*Hemitripterus americanus*). Seasonal distribution maps based on 425 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 20 sea raven.

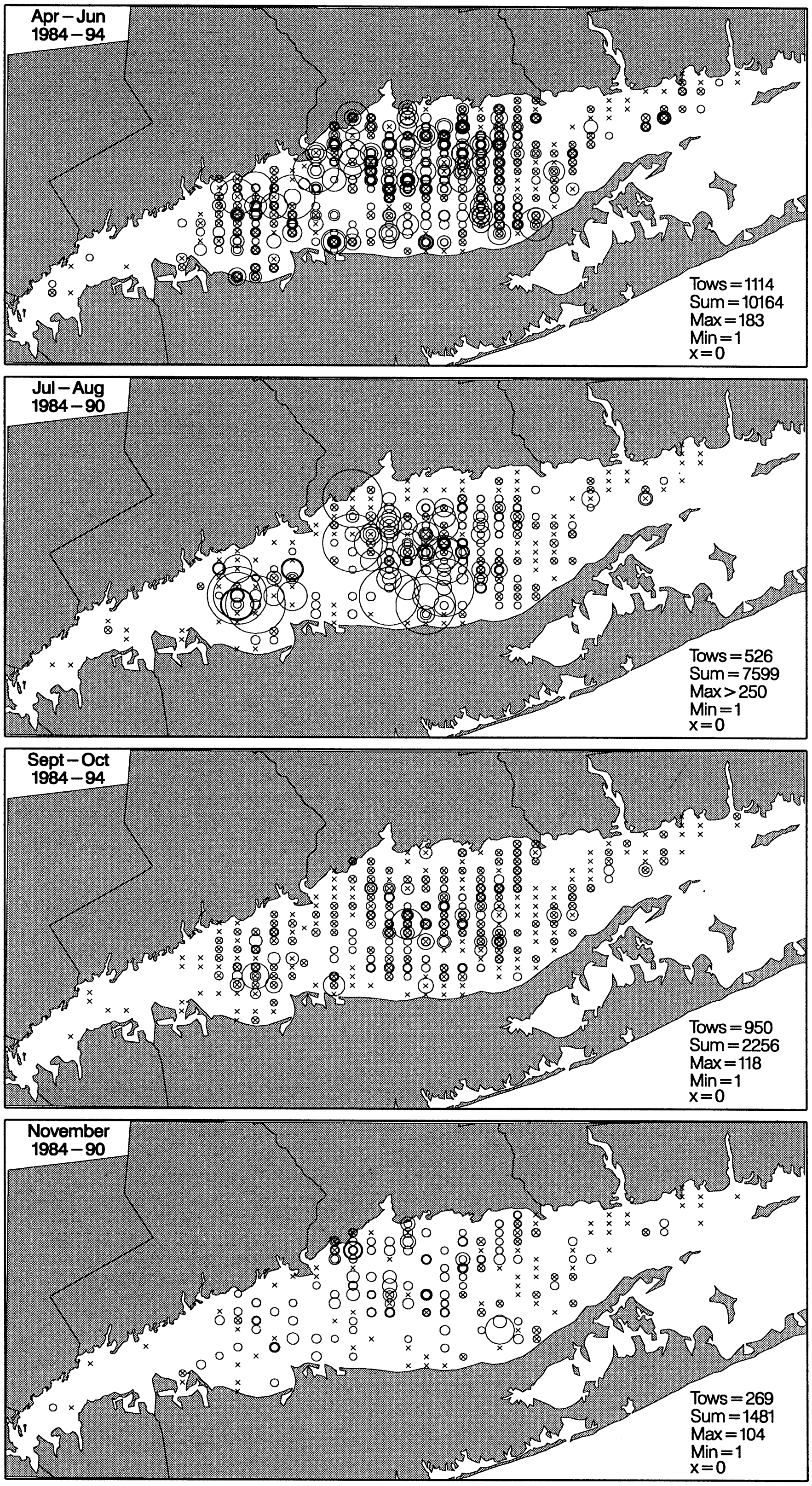


Figure DM-49

Silver hake (*Merluccius bilinearis*). Seasonal distribution maps based on 21,500 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 250 silver hake.

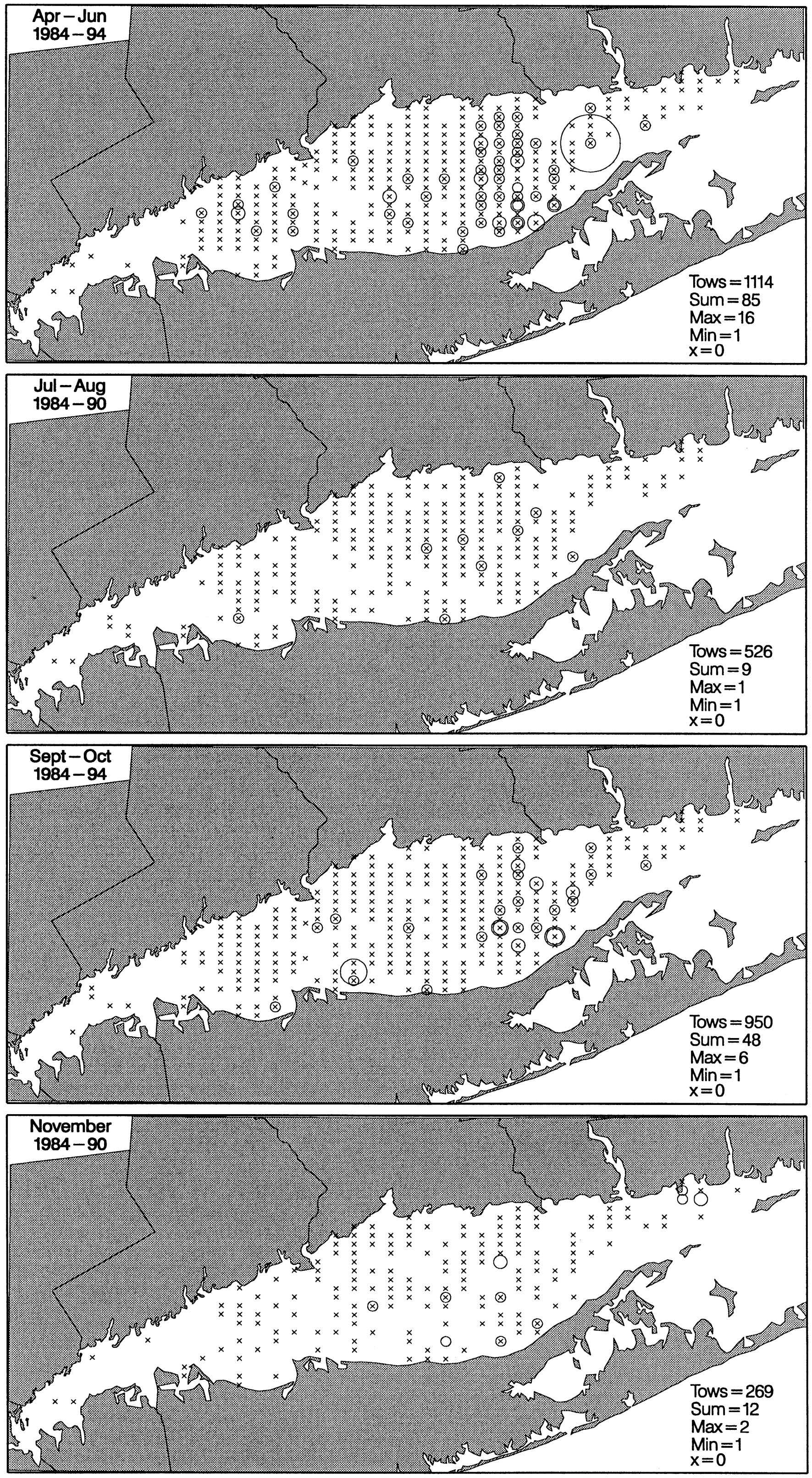


Figure DM-50

Smallmouth flounder (*Etropus microstomus*). Seasonal distribution maps based on 154 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 16 smallmouth flounder.

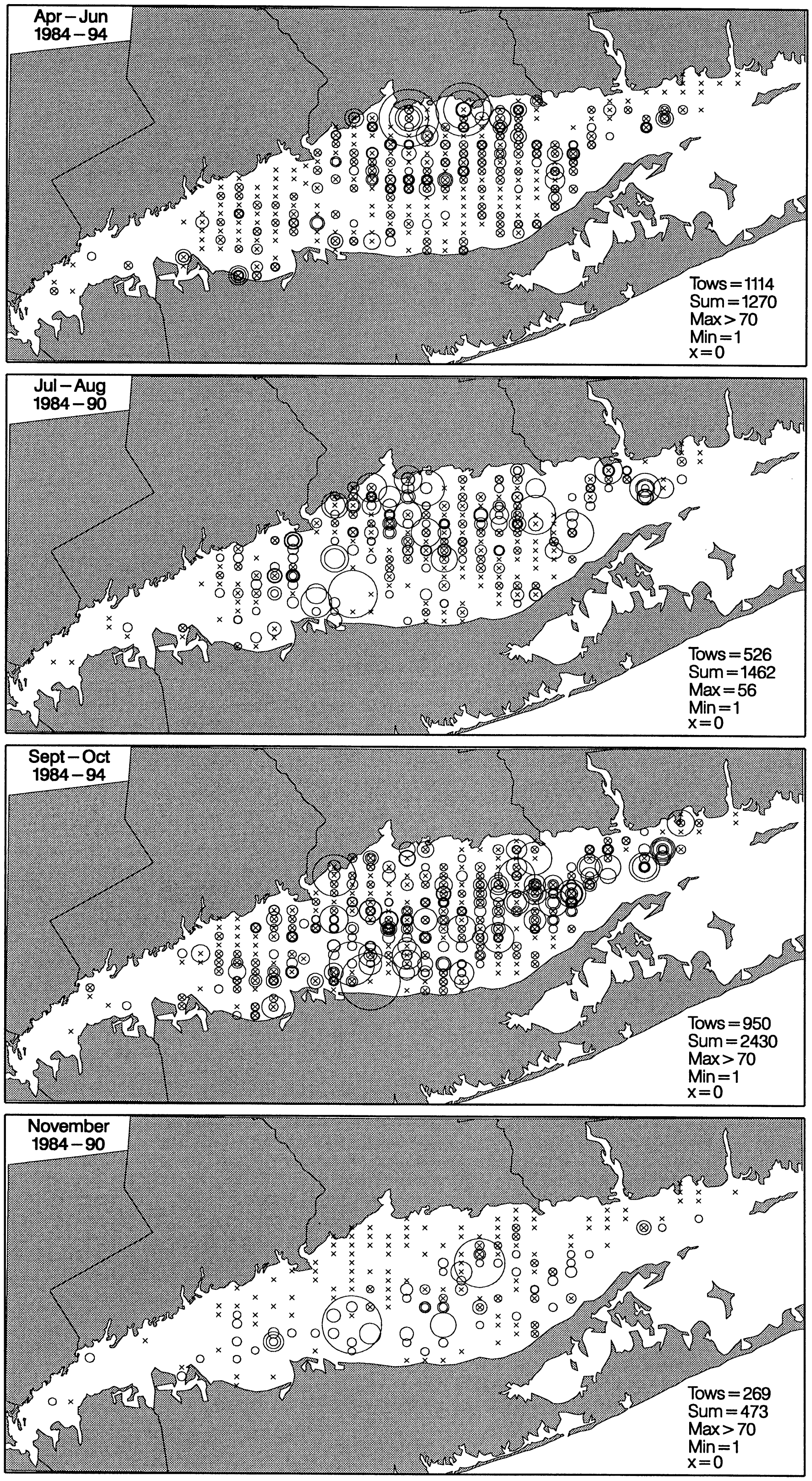


Figure DM-51

Smooth dogfish (*Mustelus canis*). Seasonal distribution maps based on 5,635 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 70 smooth dogfish.

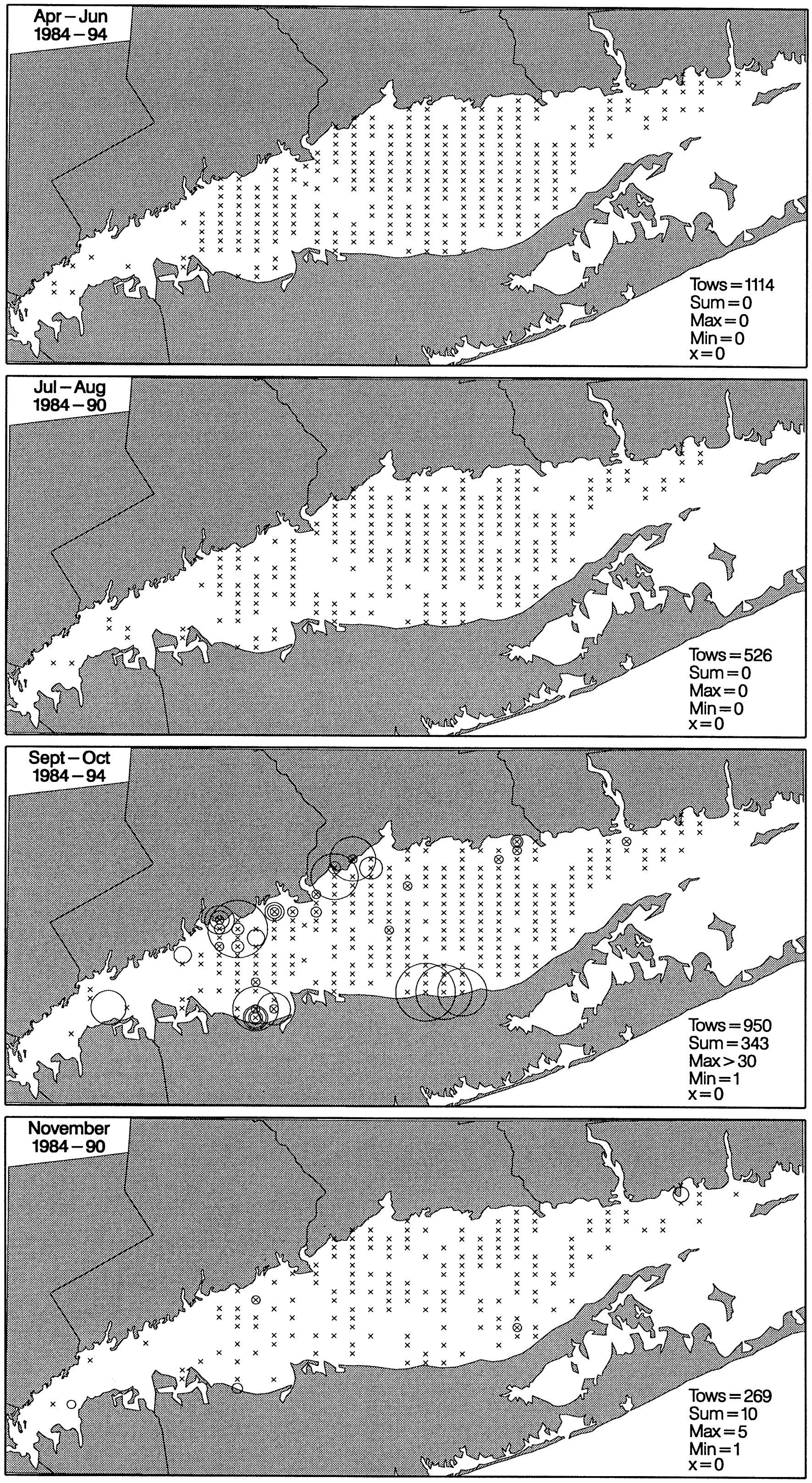


Figure DM-52

Spanish mackerel (*Scomberomorus maculatus*). Seasonal distribution maps based on 353 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 30 Spanish mackerel.

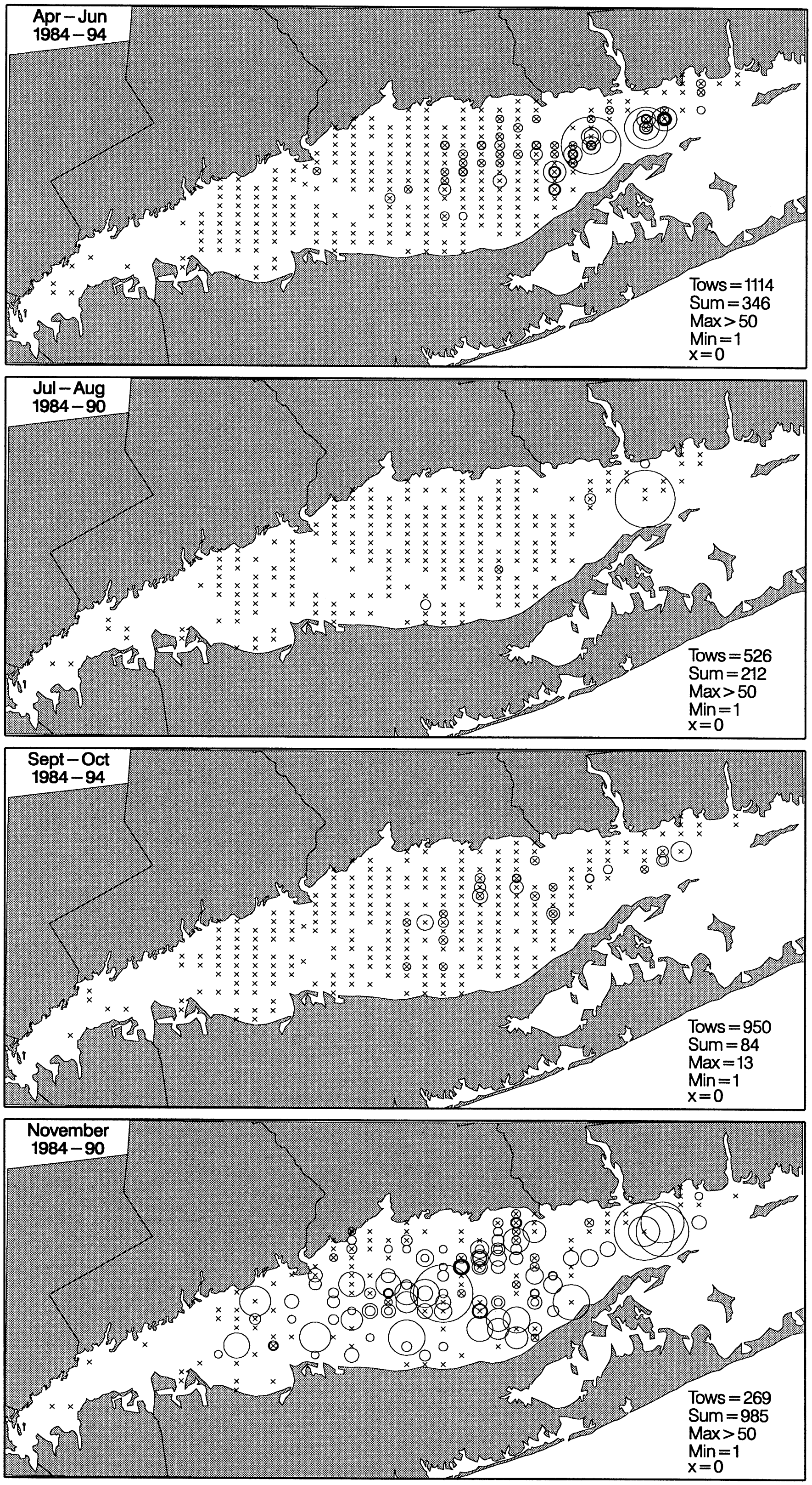


Figure DM-53

Spiny dogfish (*Squalus acanthius*). Seasonal distribution maps based on 1,627 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 50 spiny dogfish.

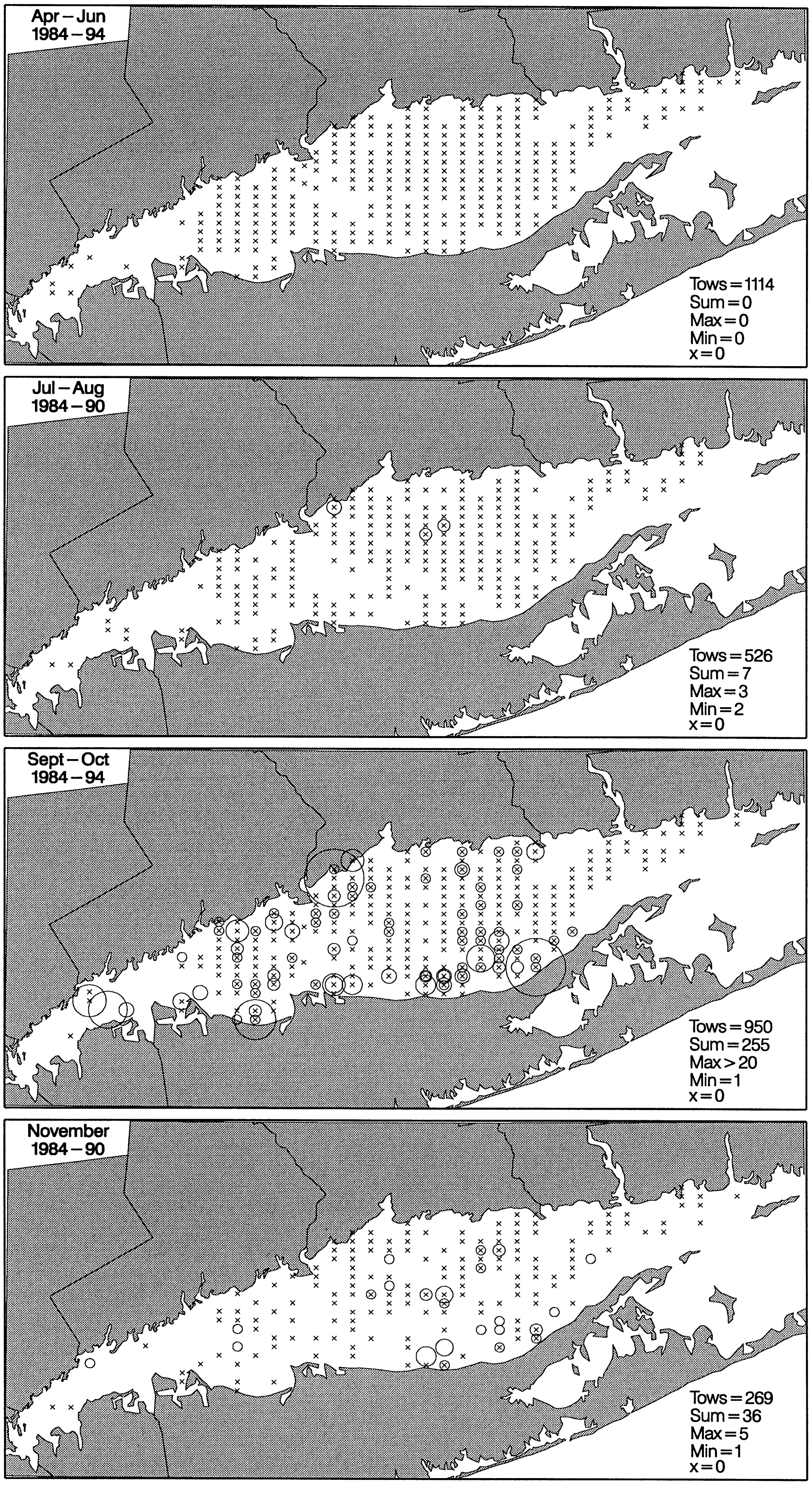


Figure DM-54

Spot (*Leiostomus xanthurus*). Seasonal distribution maps based on 298 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 20 spot.

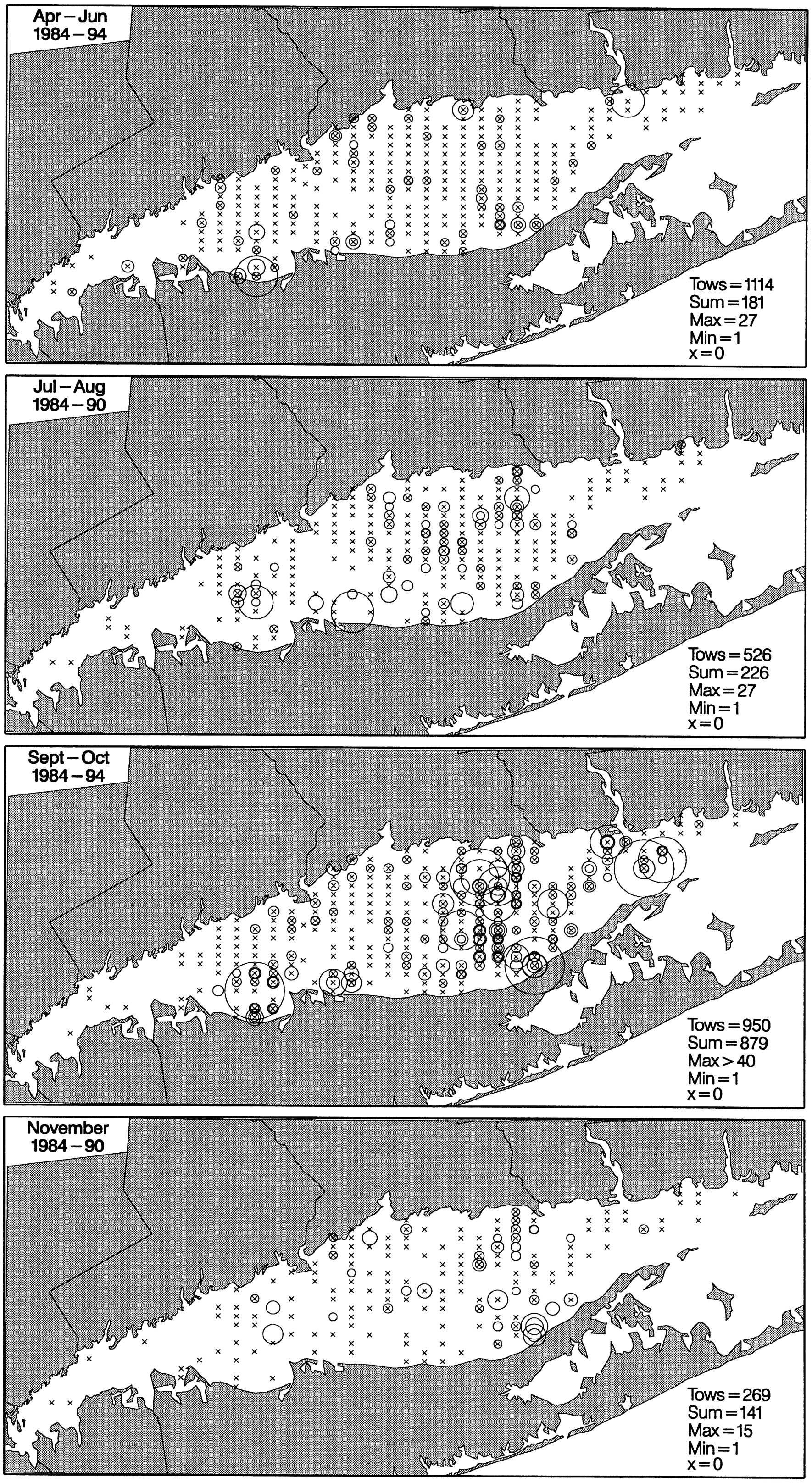


Figure DM-55

Spotted hake (*Urophycis regia*). Seasonal distribution maps based on 1,427 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 40 spotted hake.

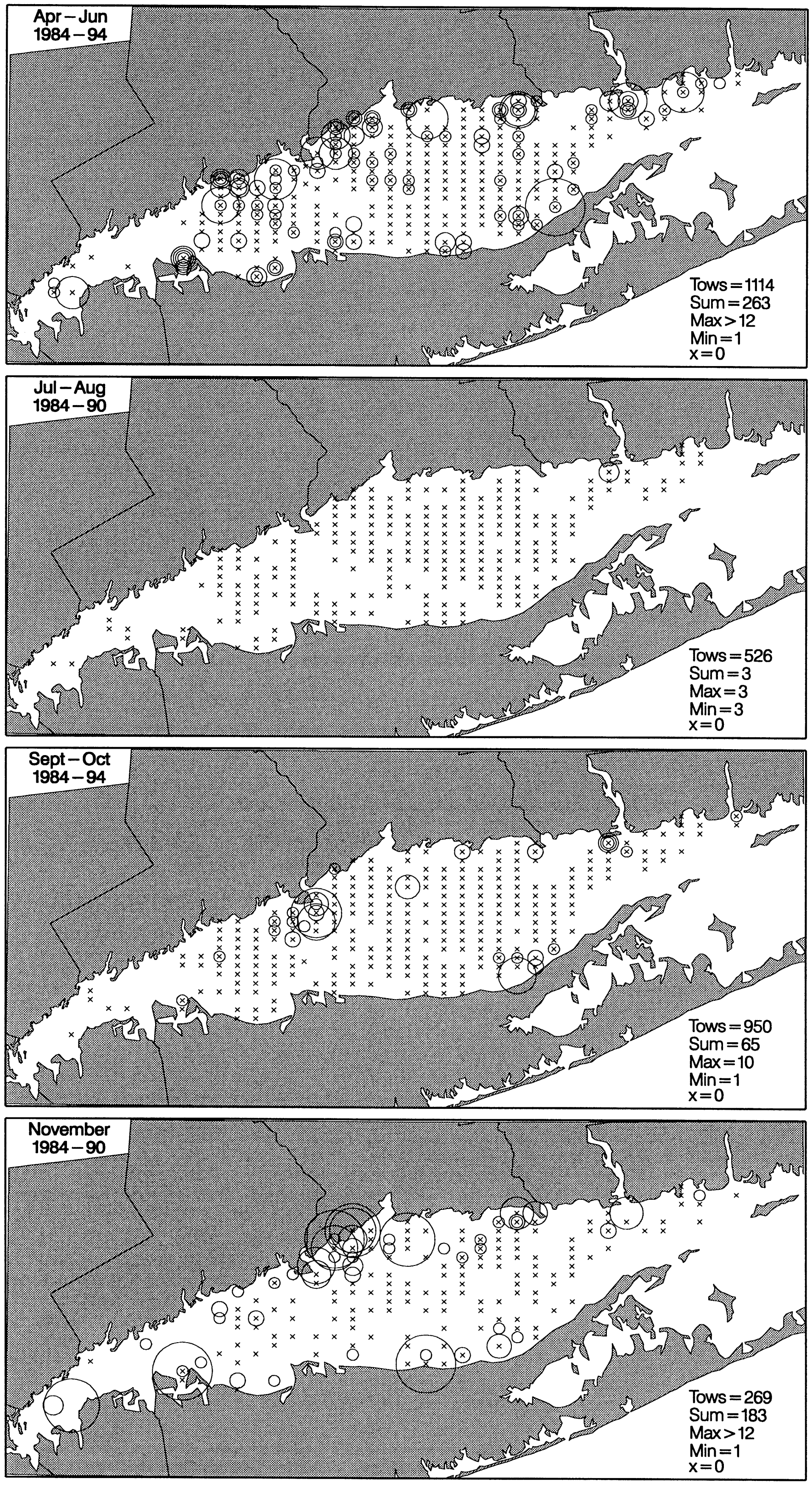


Figure DM-56

Striped bass (*Morone saxatilis*). Seasonal distribution maps based on 514 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 12 striped bass.

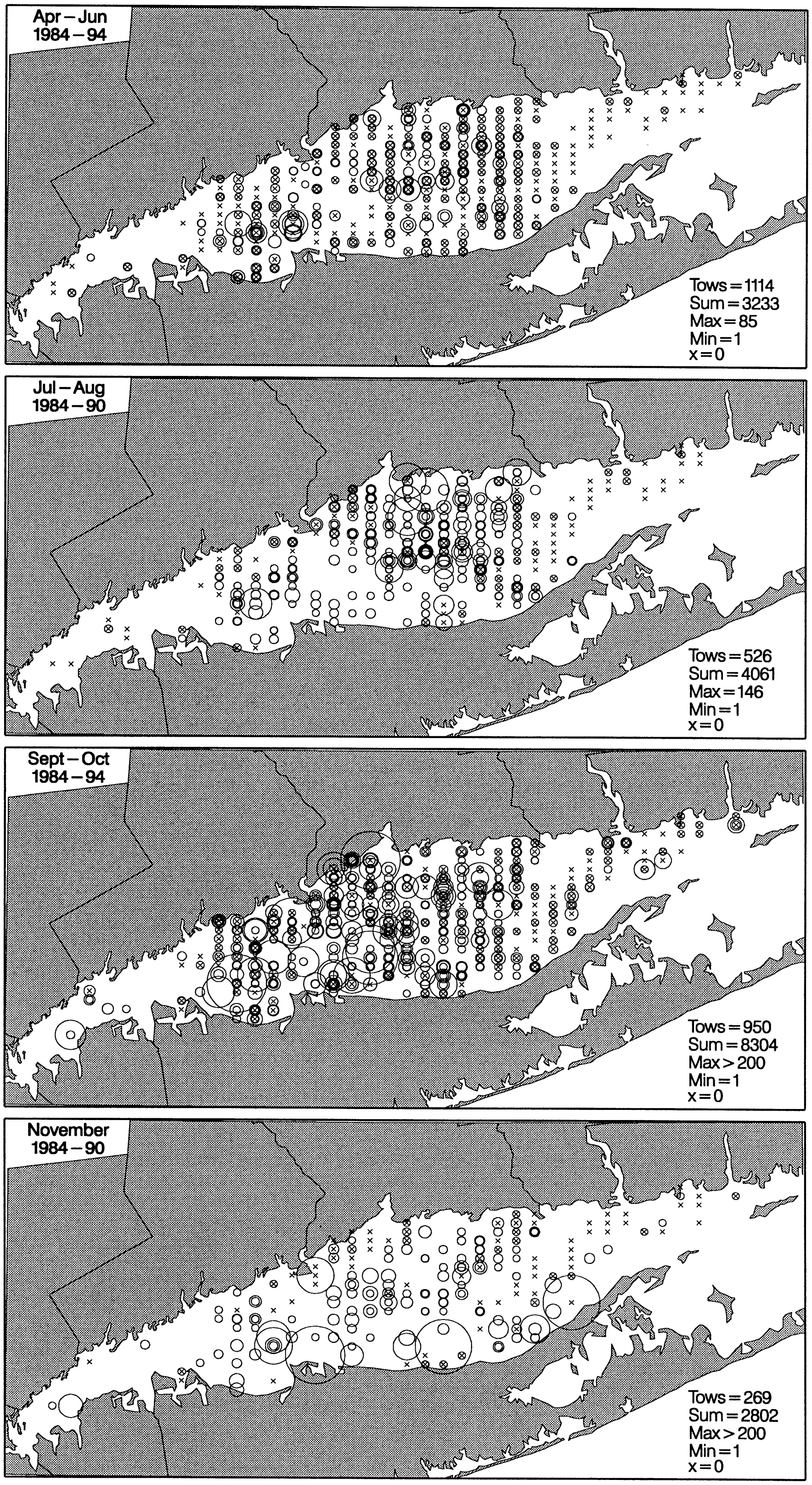


Figure DM-57

Striped searobin (*Prionotus evolans*). Seasonal distribution maps based on 18,400 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 200 striped searobin.

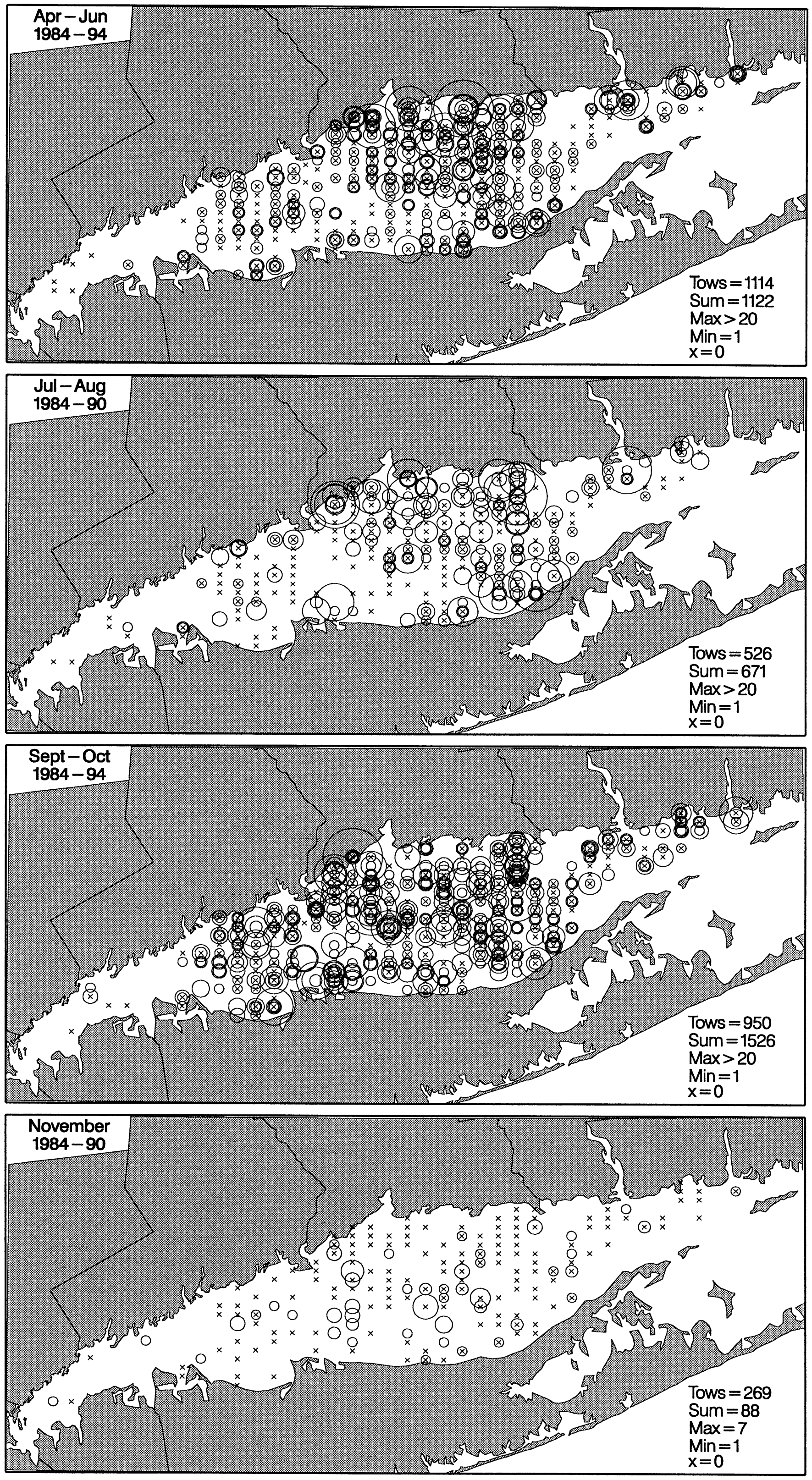


Figure DM-58

Summer flounder (*Paralichthys dentatus*). Seasonal distribution maps based on 3,407 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 20 summer flounder.

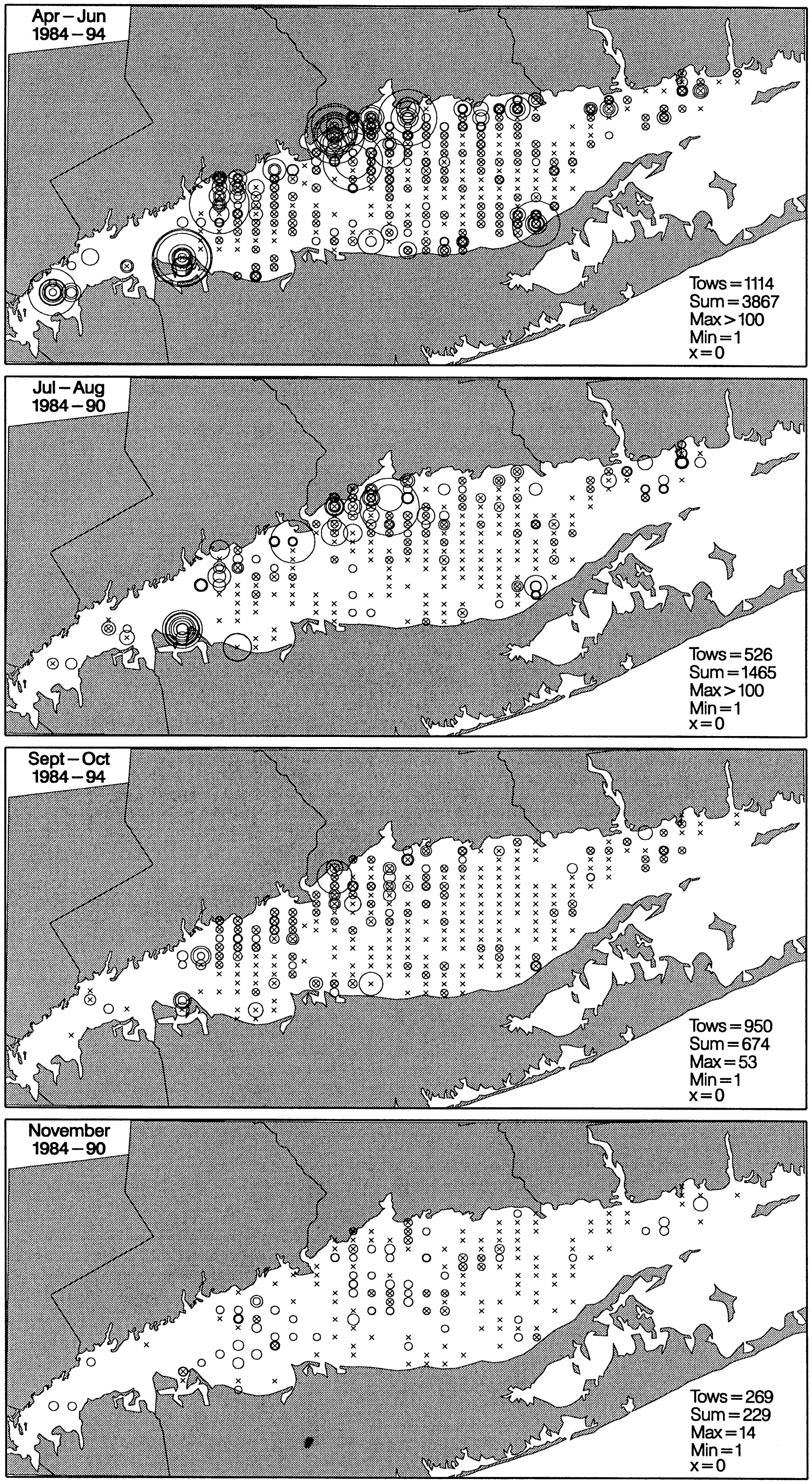


Figure DM-59

Tautog (*Tautoga onitis*). Seasonal distribution maps based on 6,235 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 100 tautog.

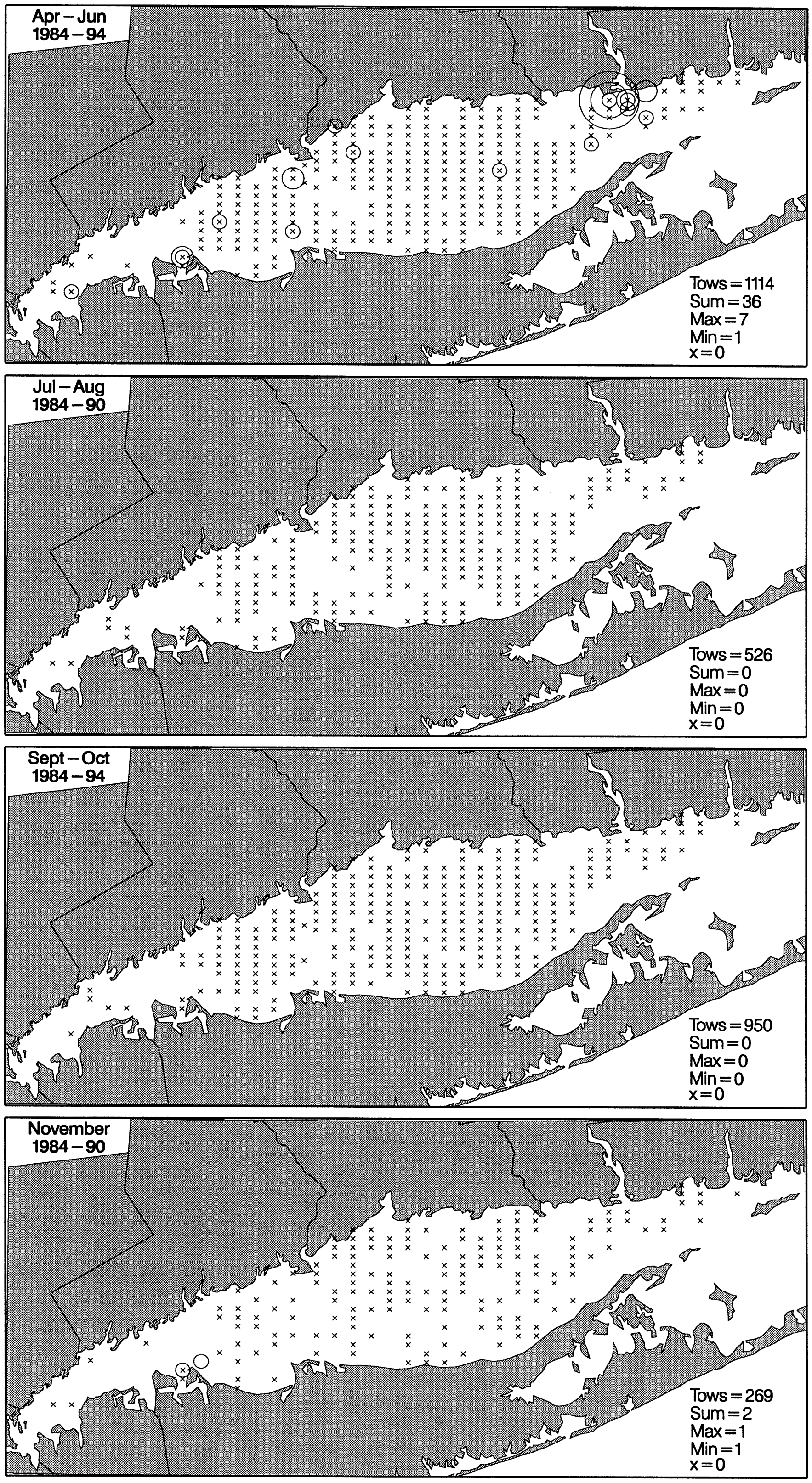


Figure DM-60

Tomcod (*Microgadus tomcod*). Seasonal distribution maps based on 38 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of seven tomcod.

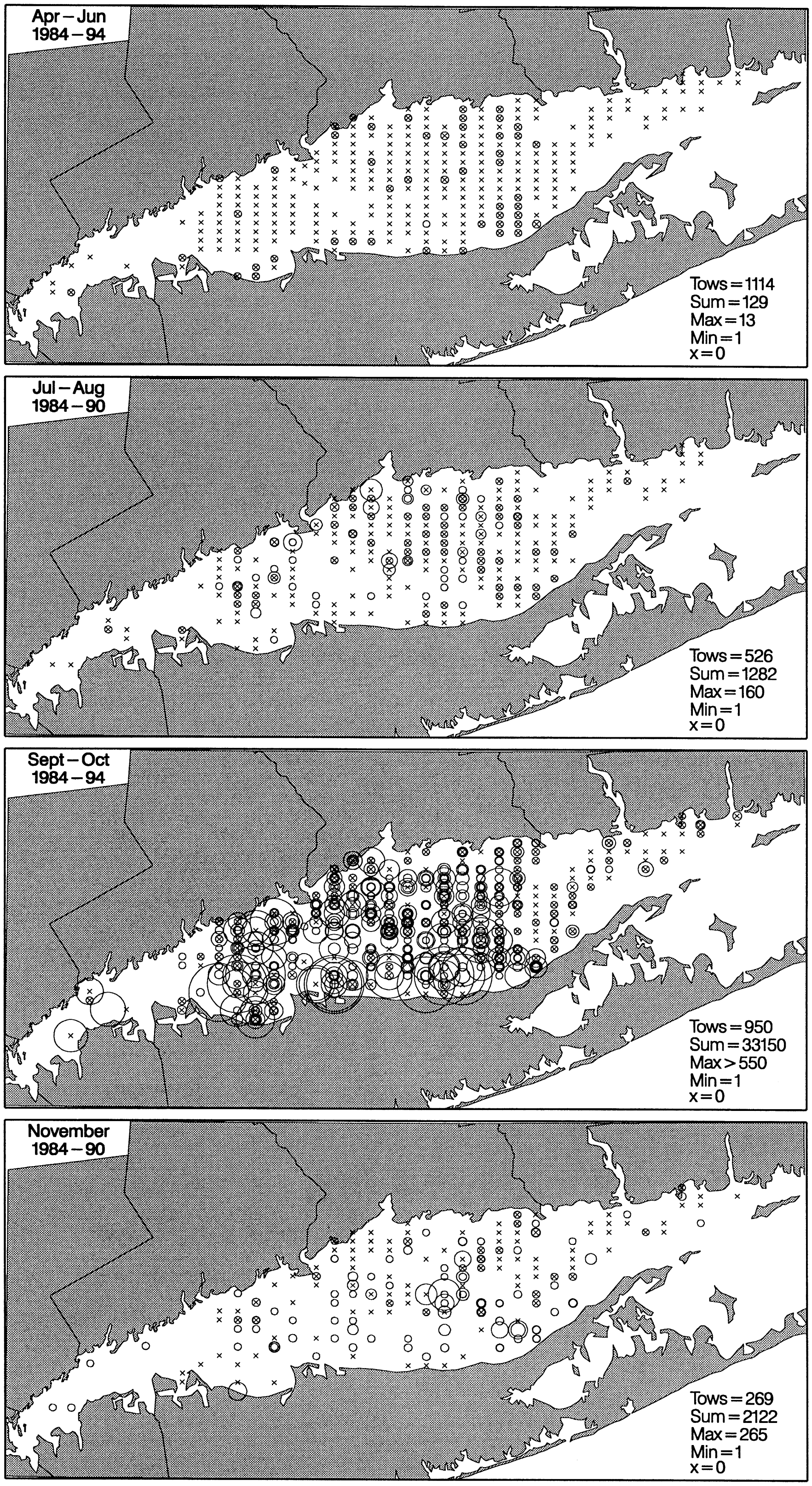


Figure DM-61

Weakfish (*Cynoscion regalis*). Seasonal distribution maps based on 36,683 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 550 weakfish.

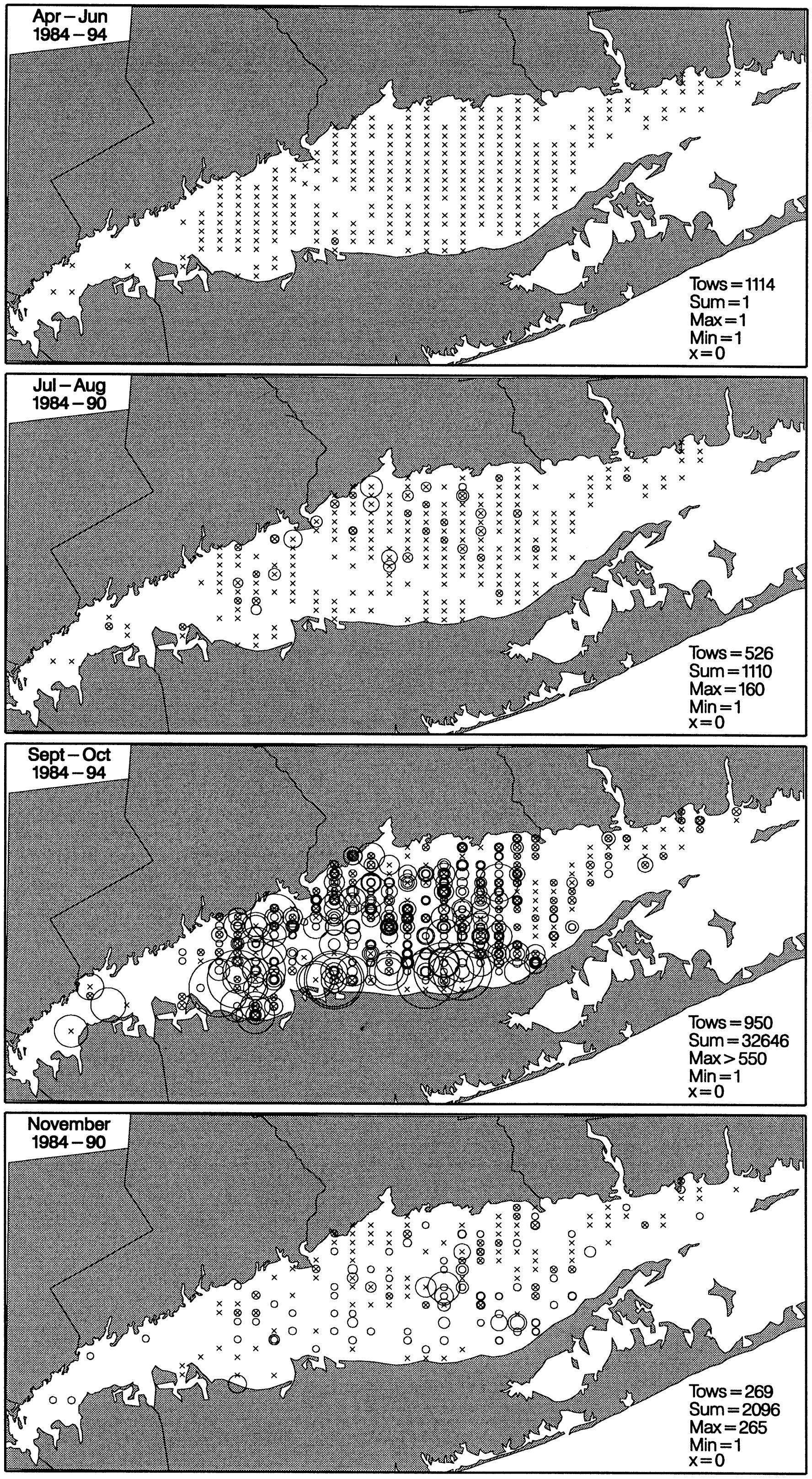


Figure DM-62
Weakfish (*Cynoscion regalis*) young-of-year. Seasonal distribution maps based on 35,853 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 550 weakfish.

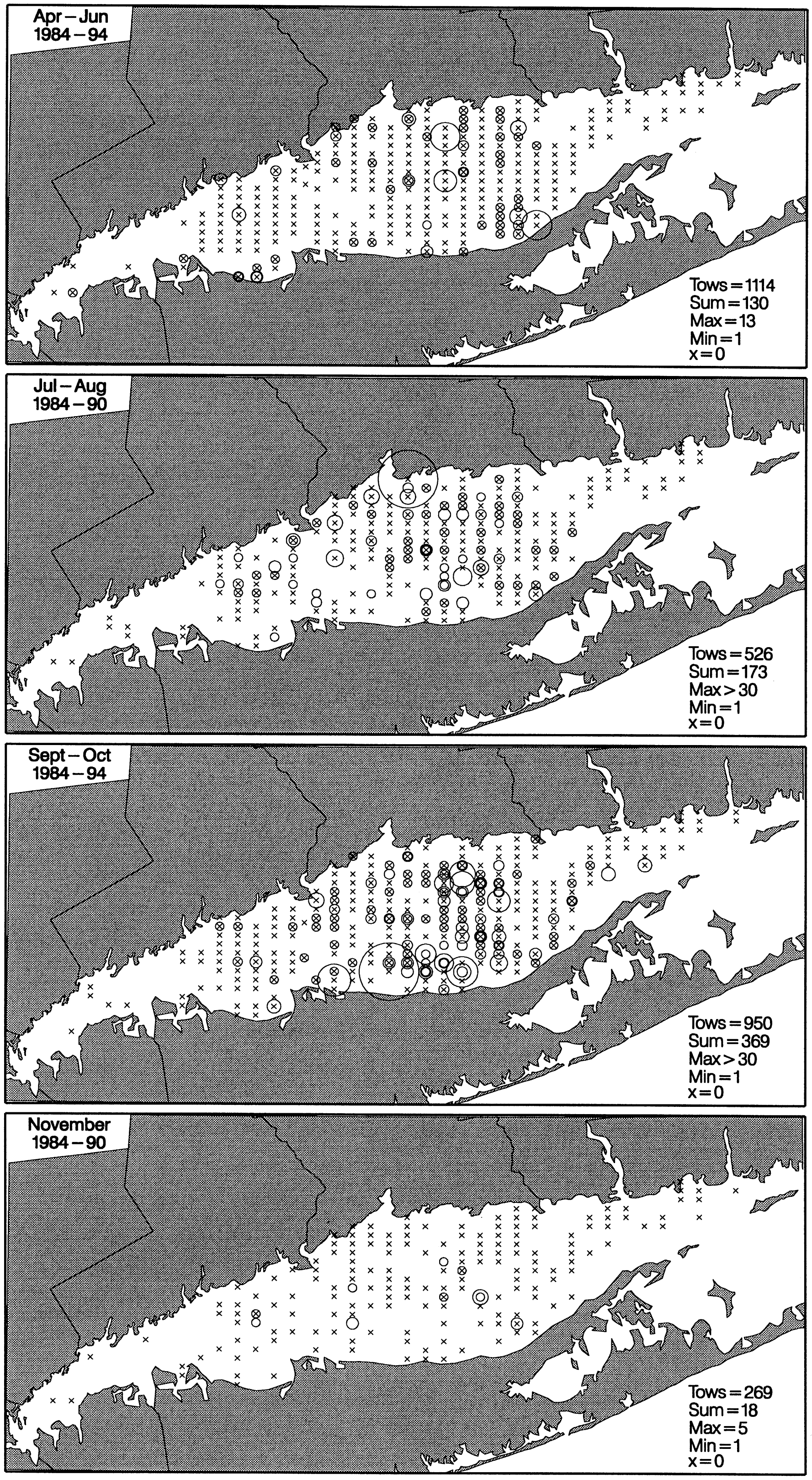


Figure DM-63

Weakfish (*Cynoscion regalis*) ages 1+. Seasonal distribution maps based on 690 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 30 weakfish.

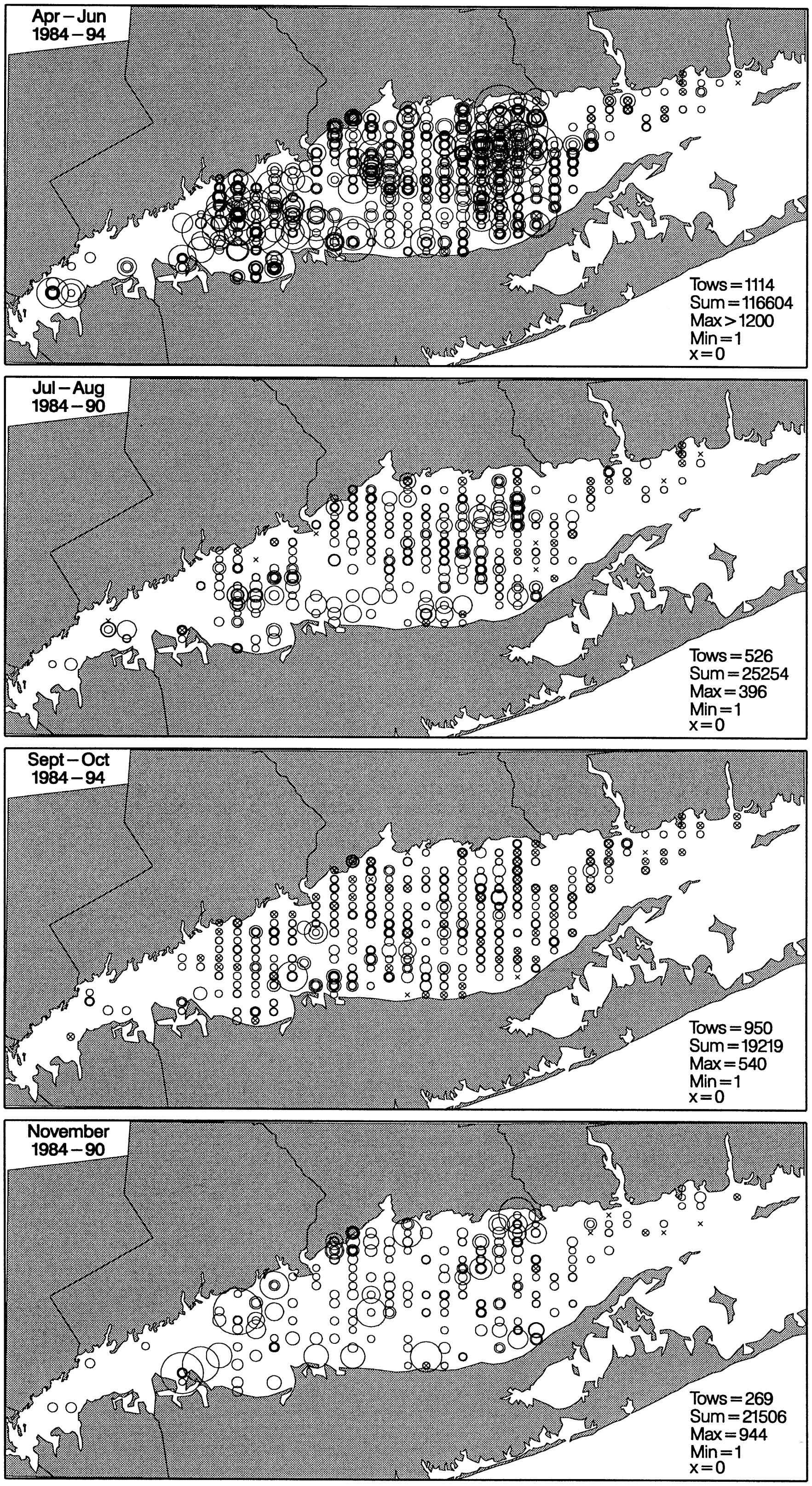


Figure DM-64

Windowpane flounder (*Scophthalmus aquosus*). Seasonal distribution maps based on 182,583 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 1,200 windowpane flounder.

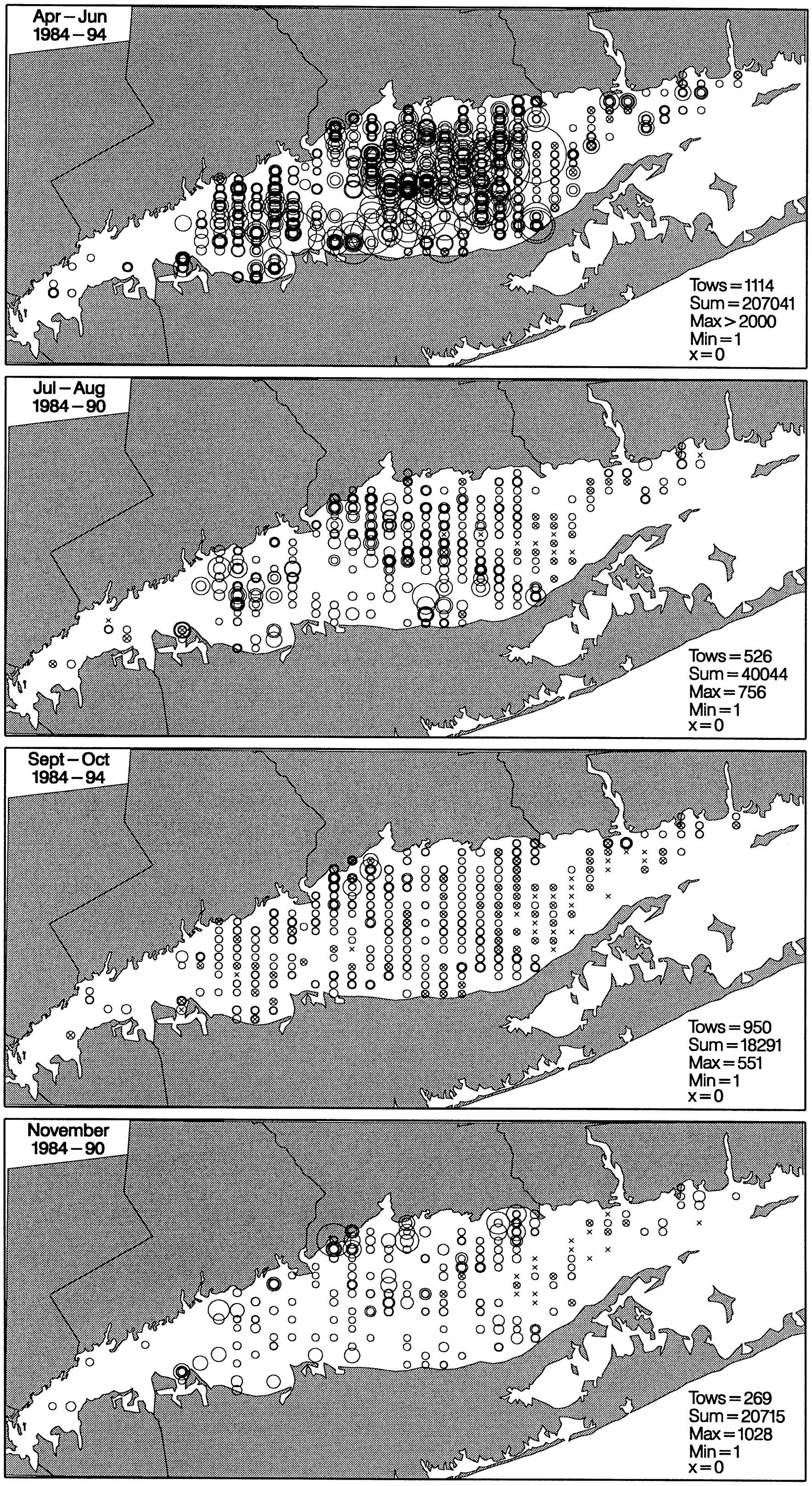


Figure DM-65

Winter flounder (*Pseudopleuronectes americanus*). Seasonal distribution maps based on 286,091 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 2,000 winter flounder.

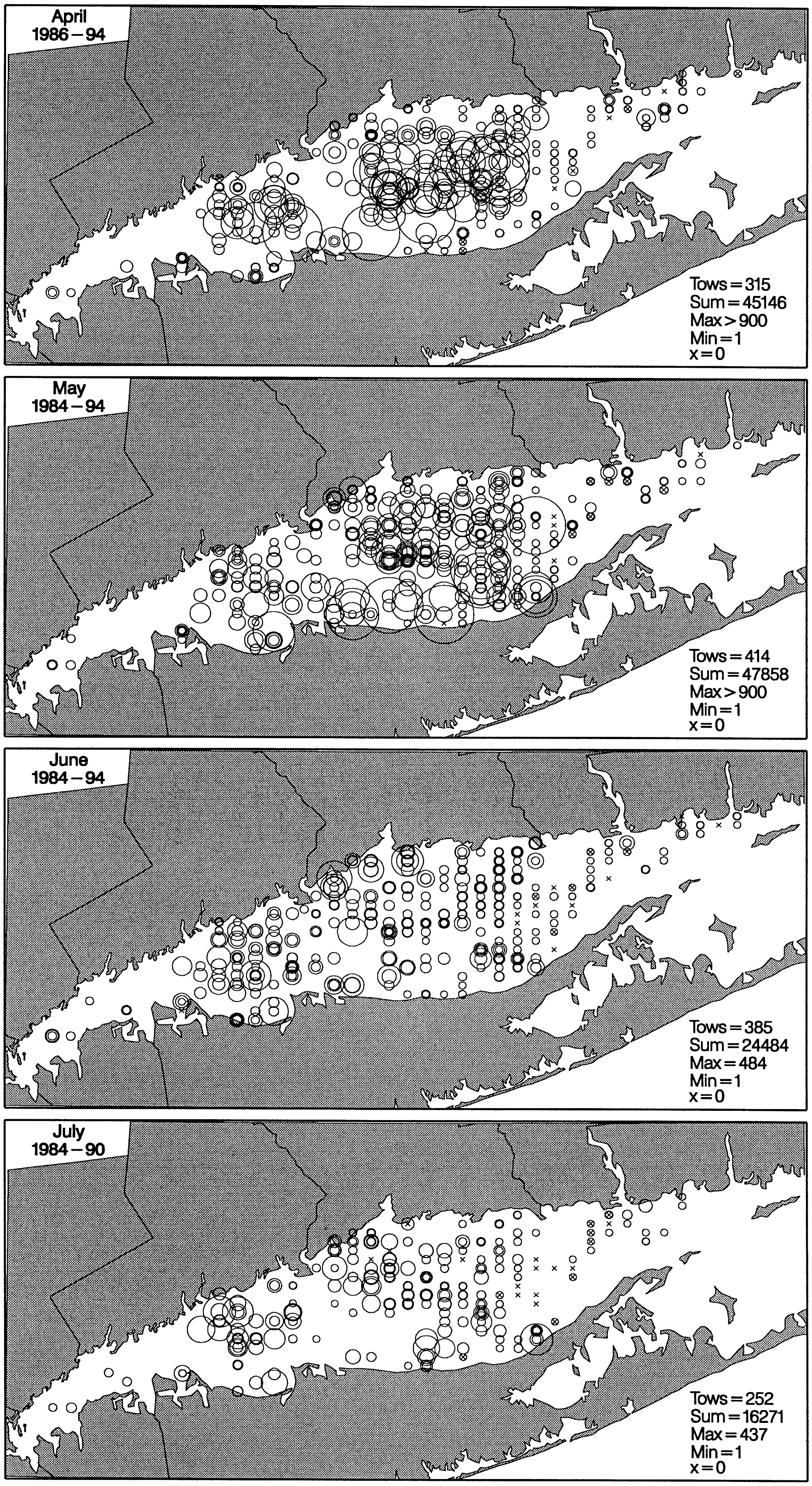


Figure DM-66

Winter flounder (*Pseudopleuronectes americanus*), <20 cm, April–July. Monthly distribution maps based on 133,759 fish taken in 1,366 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 900 winter flounder.

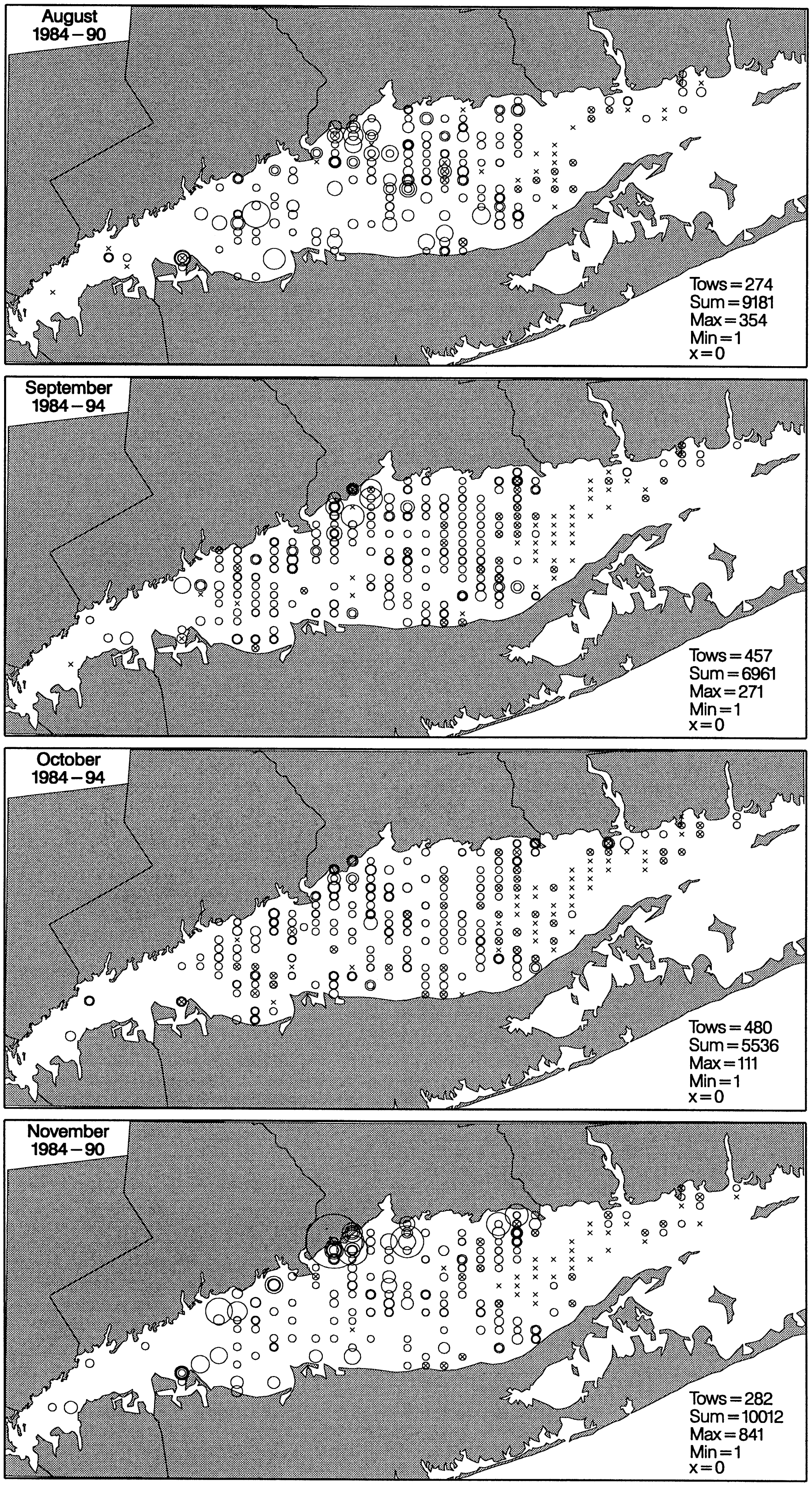


Figure DM-67

Winter flounder (*Pseudopleuronectes americanus*), <20 cm, August–November. Monthly distribution maps based on 31,690 fish taken in 1,493 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 841 winter flounder.

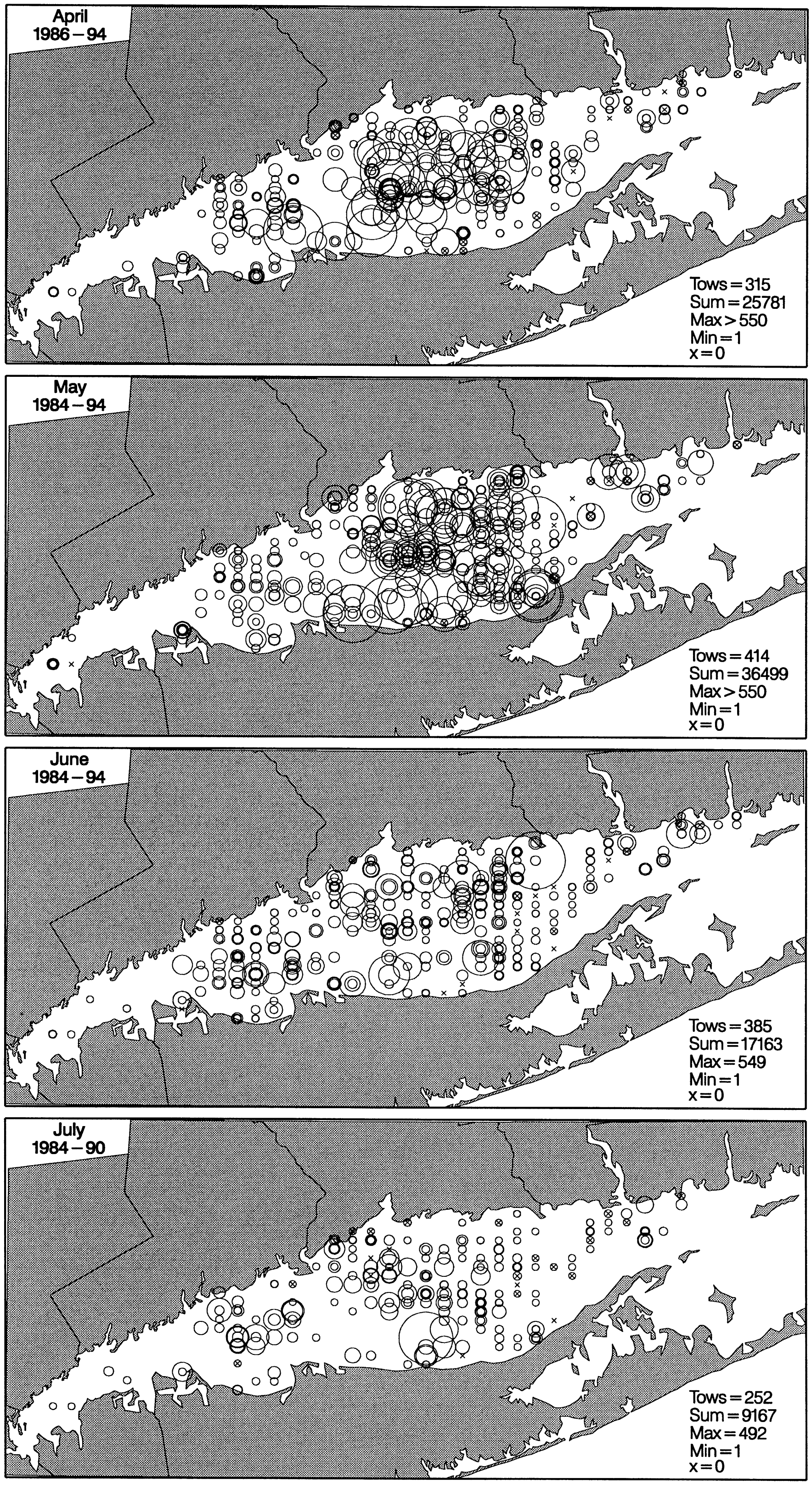


Figure DM-68

Winter flounder (*Pseudopleuronectes americanus*), 20–29 cm, April–July. Monthly distribution maps based on 88,610 fish taken in 1,366 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 550 winter flounder.

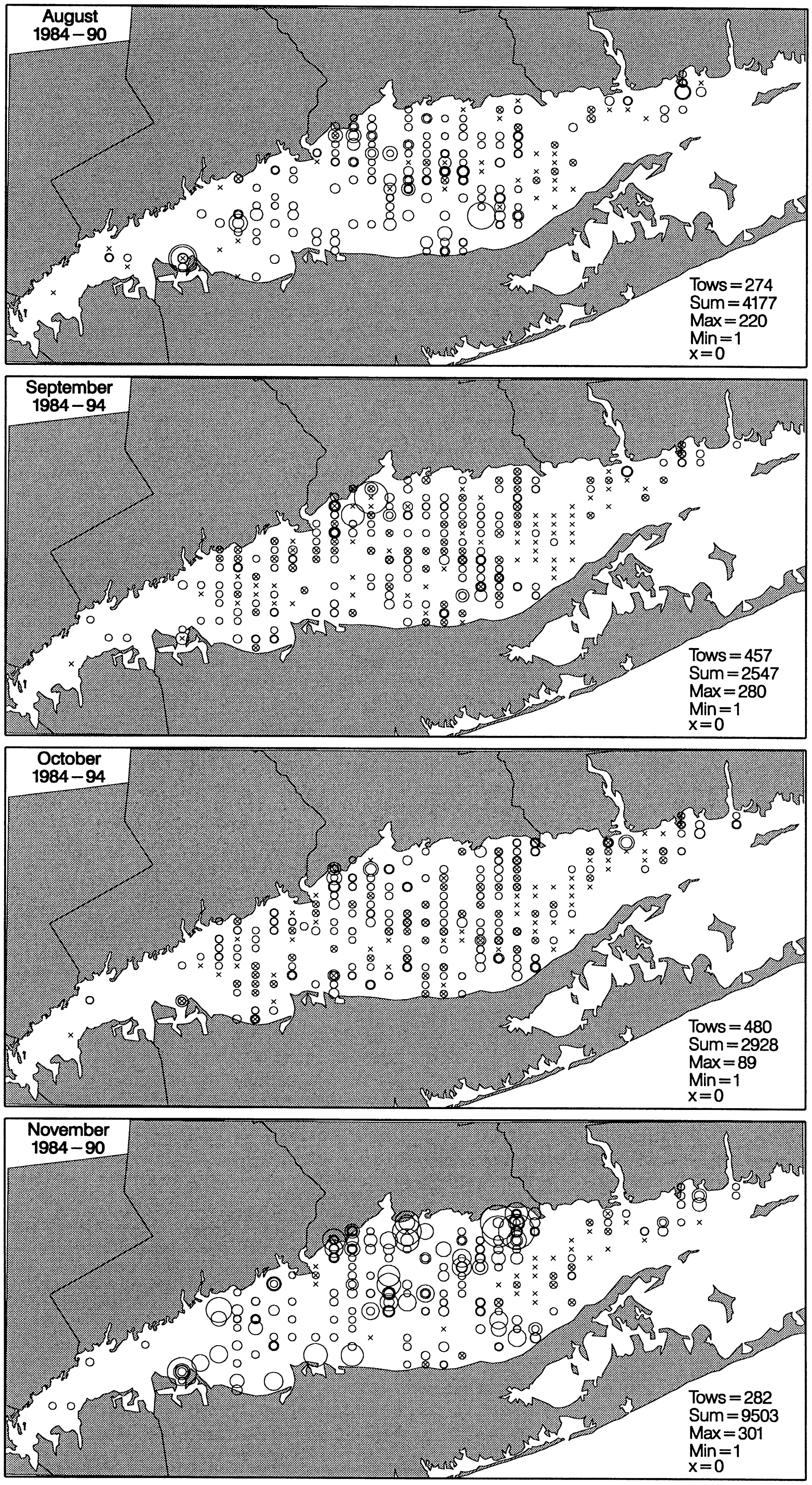


Figure DM-69

Winter flounder (*Pseudopleuronectes americanus*), 20–29 cm, August–November. Monthly distribution maps based on 19,155 fish taken in 1,493 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 301 winter flounder.

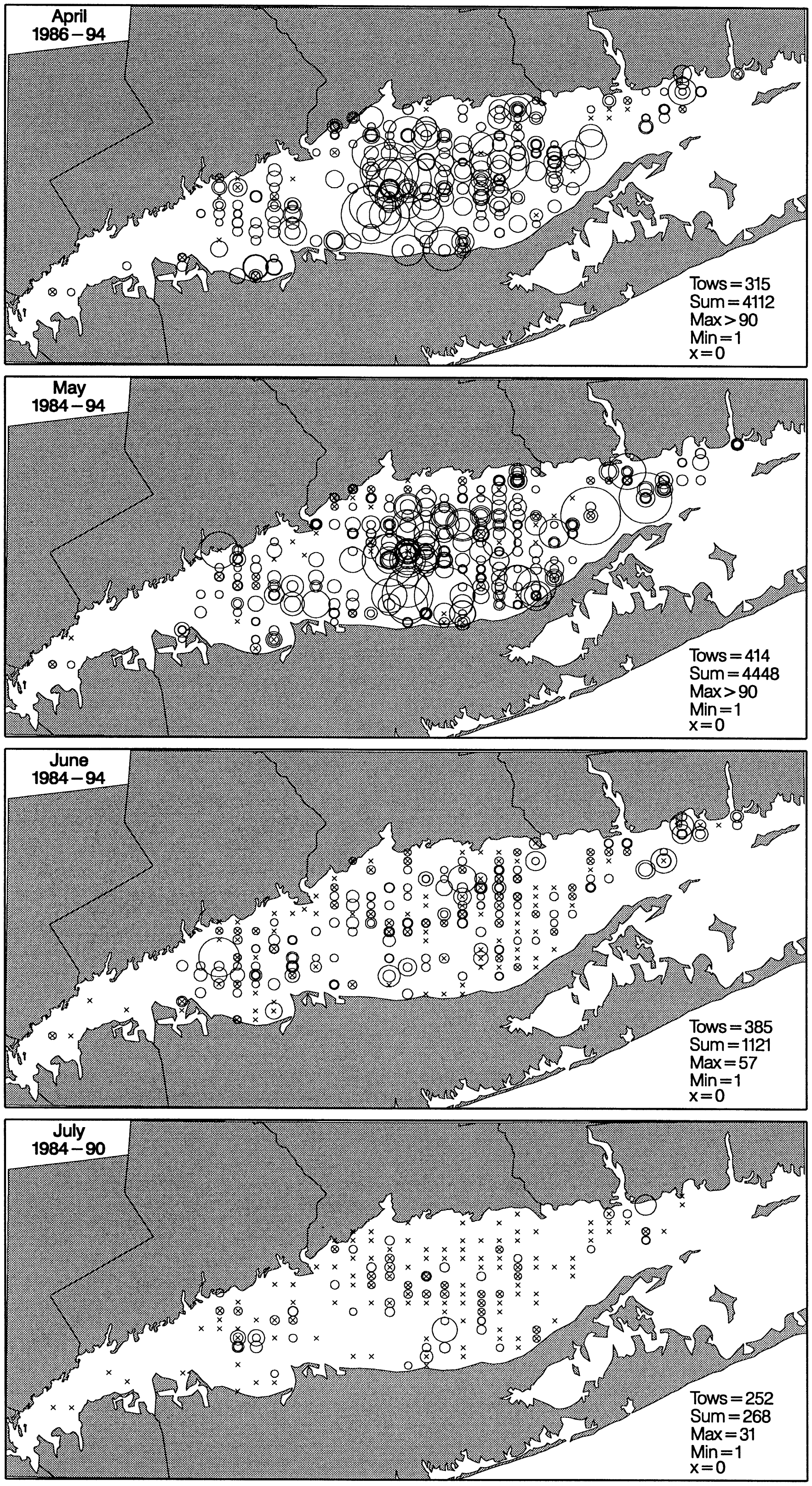


Figure DM-70
Winter flounder (*Pseudopleuronectes americanus*), 30+ cm, April–July. Monthly distribution maps based on 9,949 fish taken in 1,366 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 90 winter flounder.

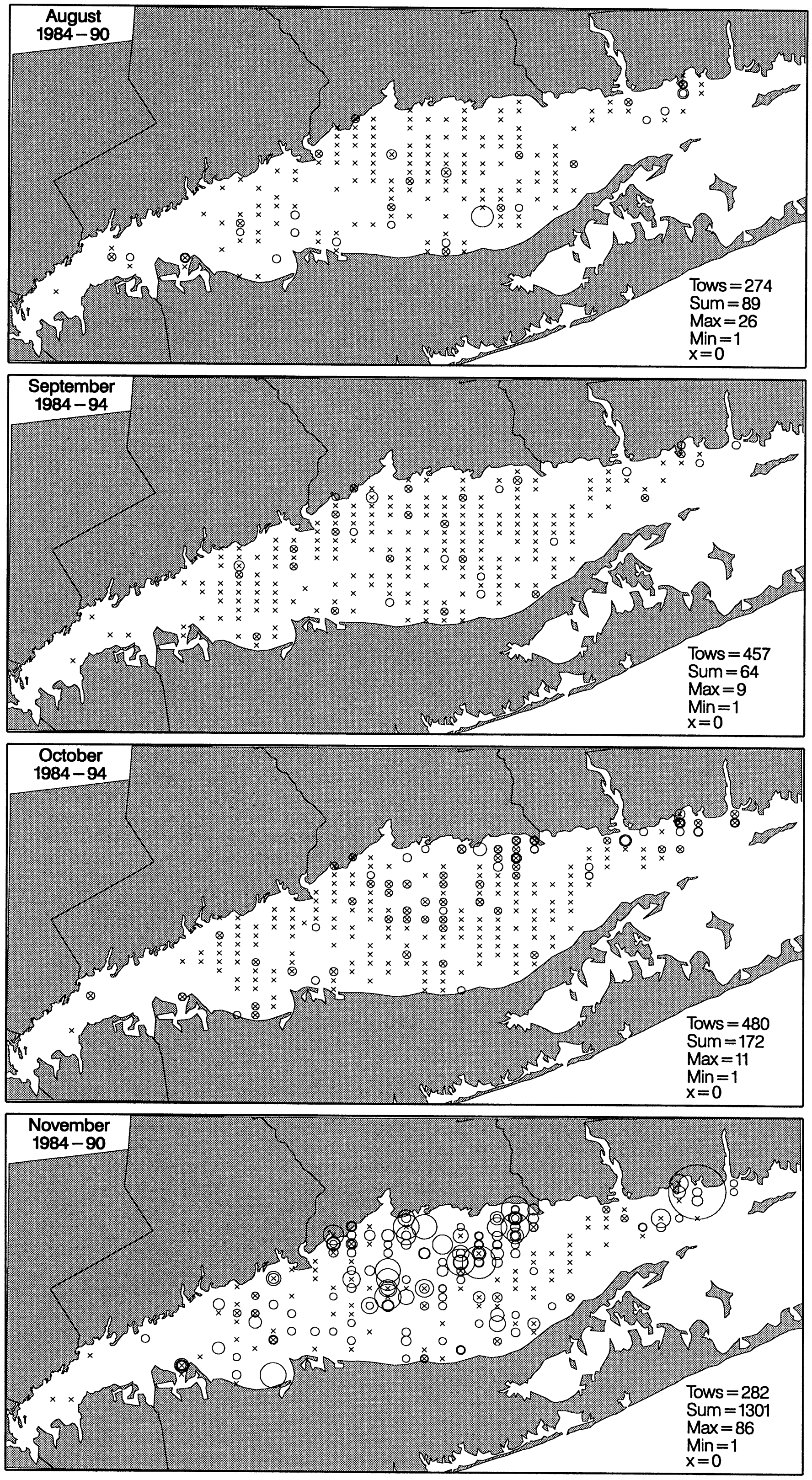


Figure DM-71

Winter flounder (*Pseudopleuronectes americanus*), 30+ cm, August–November. Monthly distribution maps based on 1,626 fish taken in 1,493 tows between 1984 and 1994. The largest circle size represents a tow with a catch of 26 winter flounder.

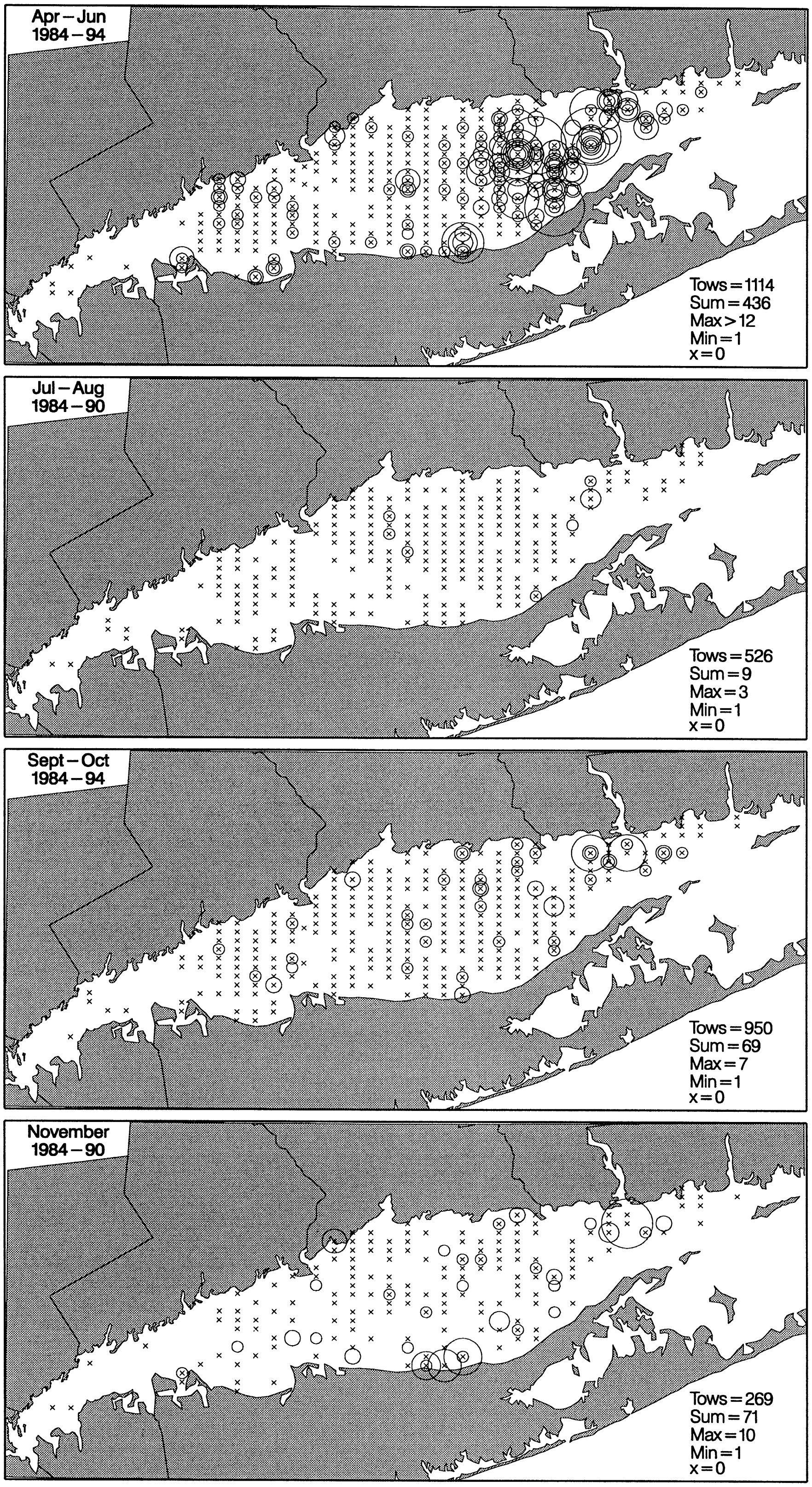


Figure DM-72

Winter skate (*Raja ocellata*). Seasonal distribution maps based on 585 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 12 winter skate.

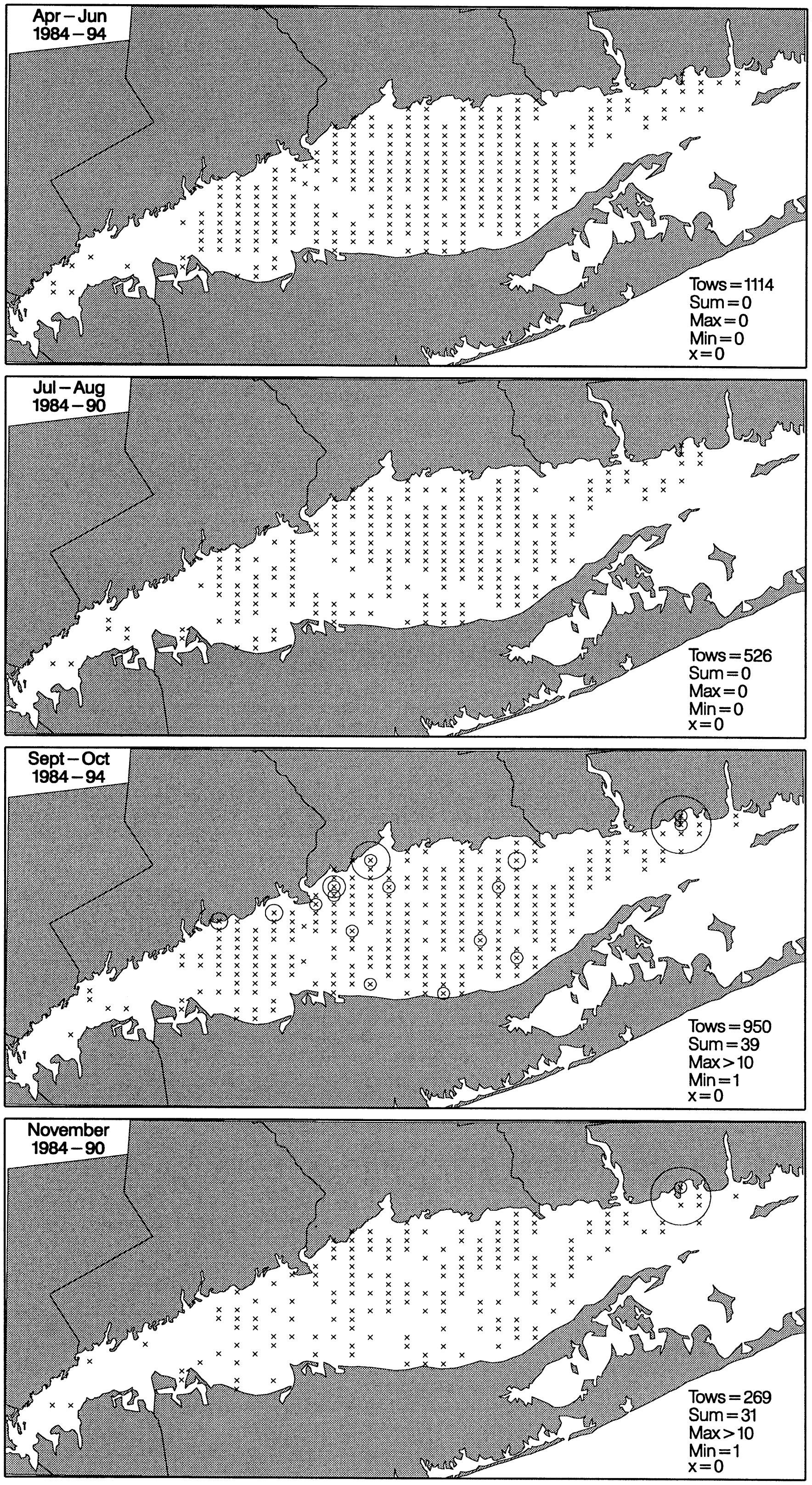


Figure DM-73

Yellow jack (*Caranx bartholomaei*). Seasonal distribution maps based on 70 fish taken in 2,859 tows between 1984 and 1994. The largest circle size represents a tow with a catch of greater than 10 yellow jack.

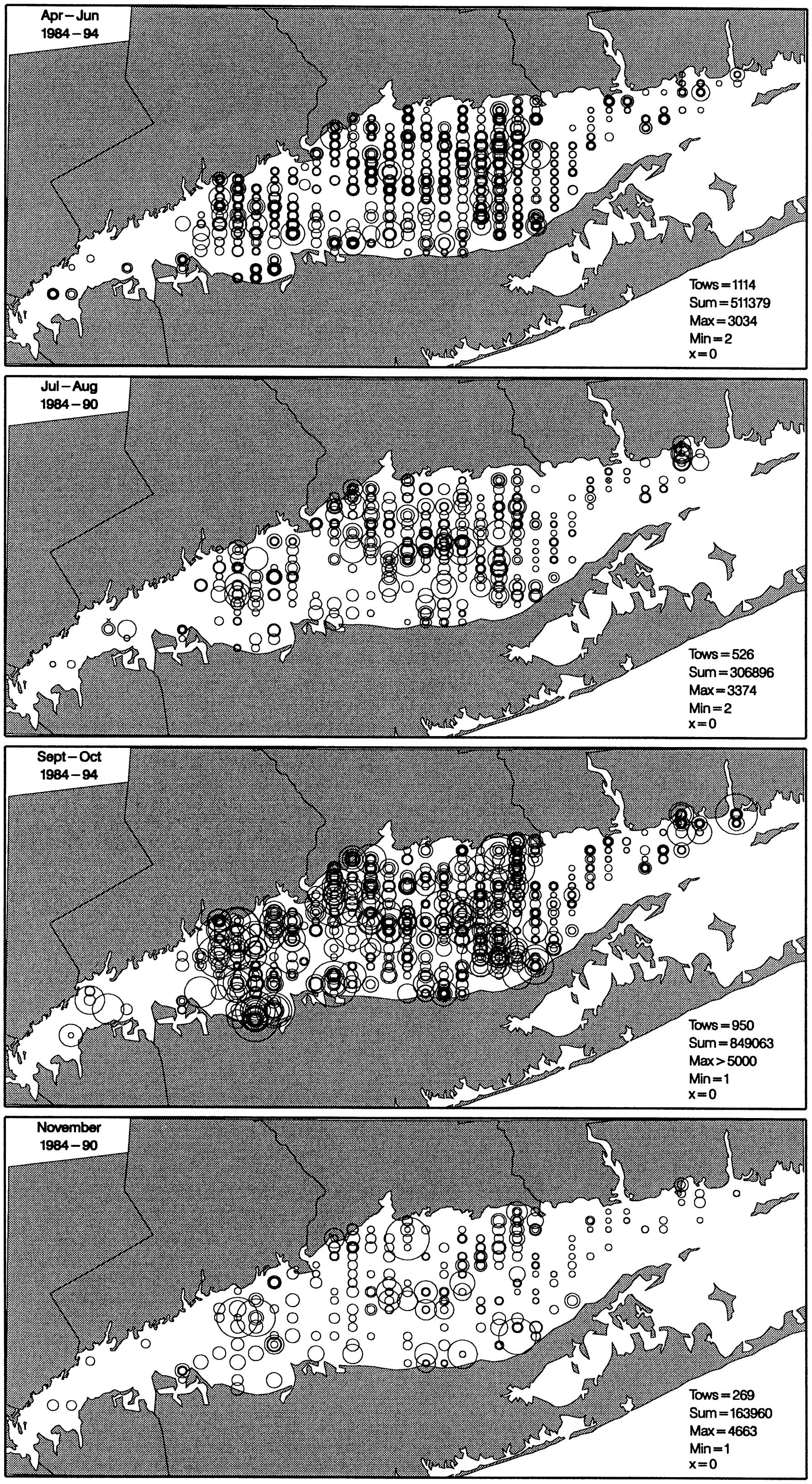


Figure DM-74.
Distribution of aggregate catch/tow by season. The largest circle size represents a tow with a catch of greater than 5,000 fish.

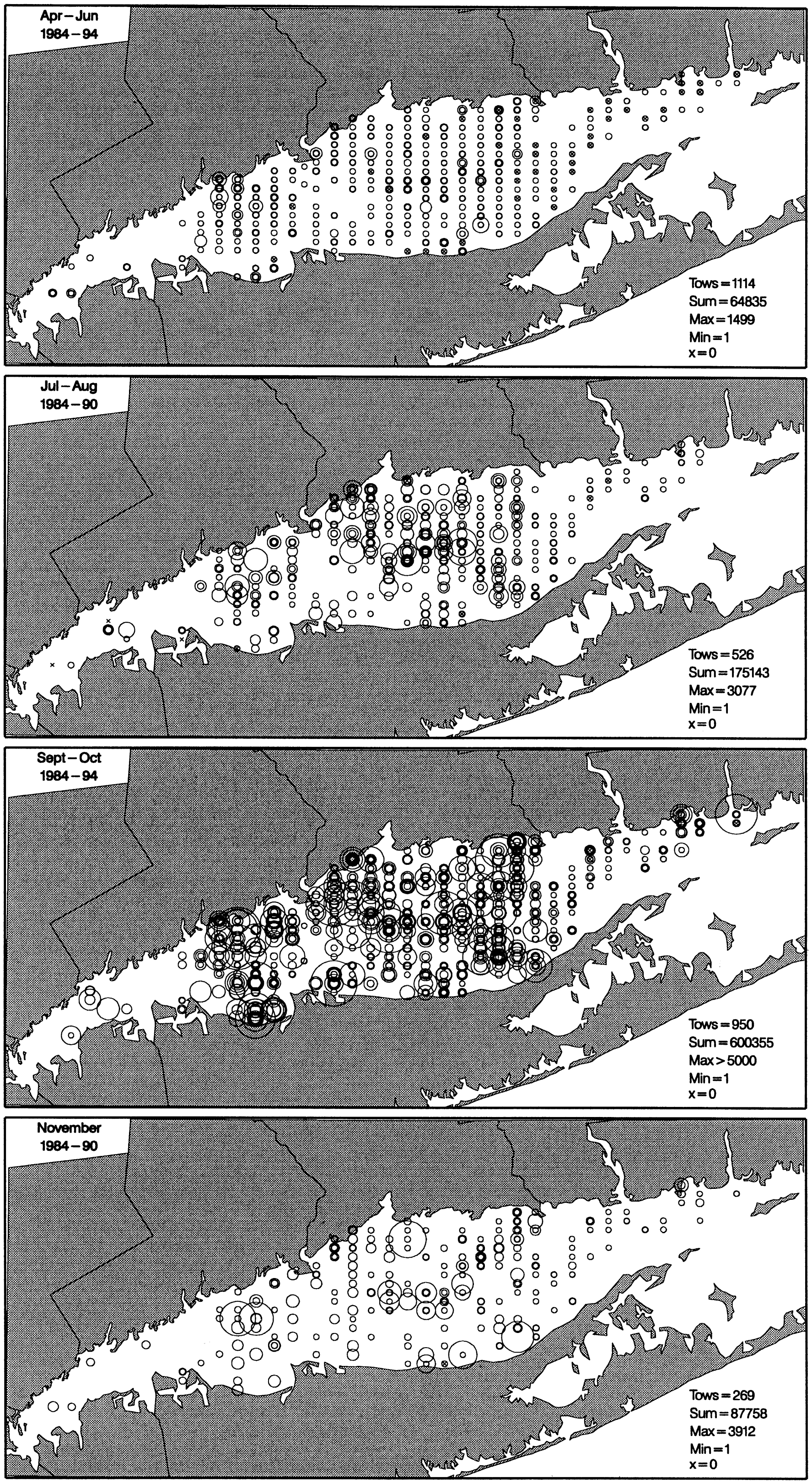


Figure DM-75

Distribution of aggregate pelagic catch/tow by season. The largest circle size represents a tow with a catch of greater than 5,000 pelagic fish.

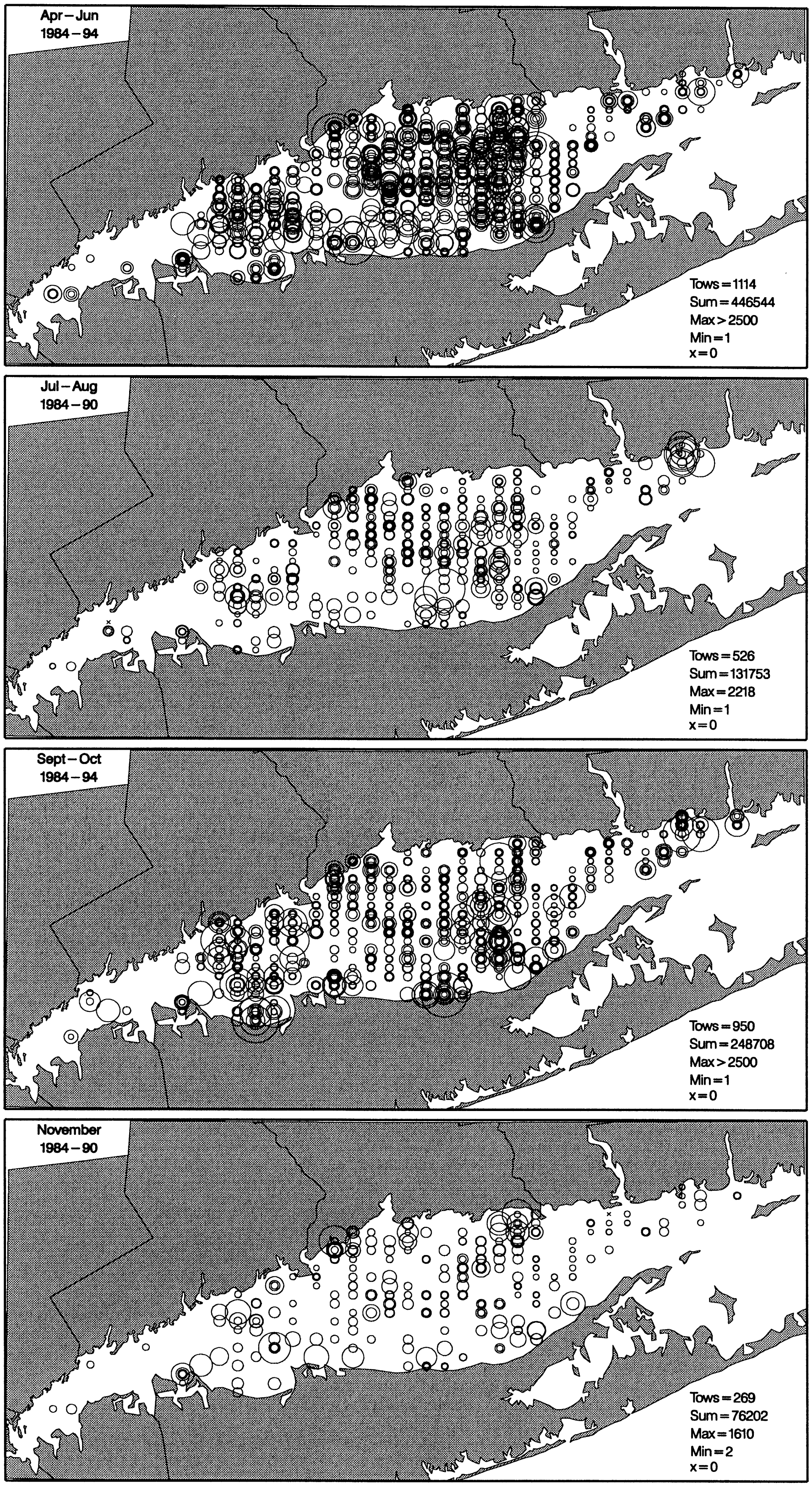
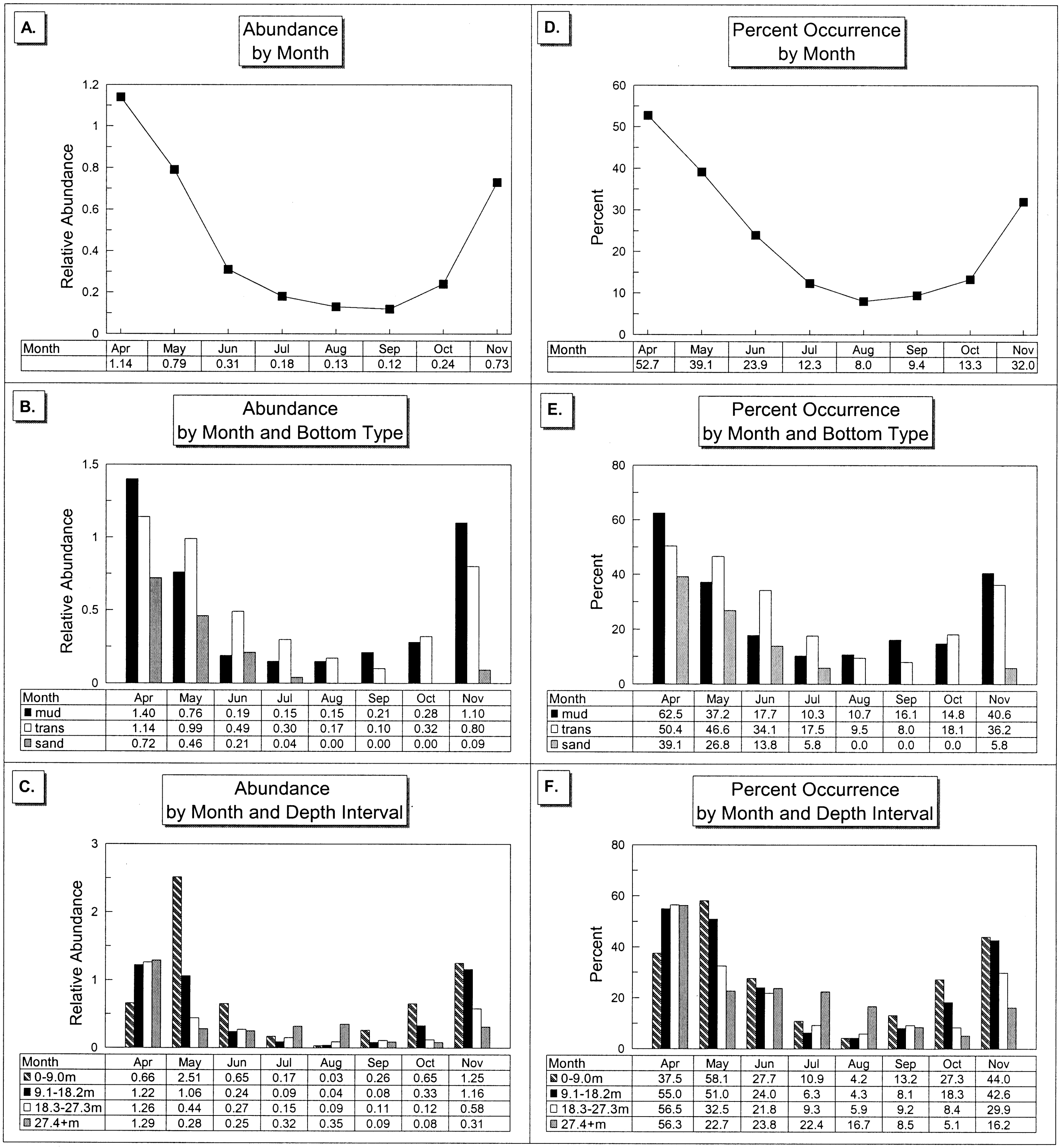


Figure DM-76

Distribution of aggregate demersal catch/tow by season. The largest circle size represents a tow with a catch of greater than 2,500 demersal fish.

Indices of Abundance: Figs. IN-1 through IN-53



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	1.14	0.79	0.31	0.18	0.13	0.12	0.24	0.73

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	52.7	39.1	23.9	12.3	8.0	9.4	13.3	32.0

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	1.40	0.76	0.19	0.15	0.15	0.21	0.28	1.10
□ trans	1.14	0.99	0.49	0.30	0.17	0.10	0.32	0.80
▨ sand	0.72	0.46	0.21	0.04	0.00	0.00	0.00	0.09

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	62.5	37.2	17.7	10.3	10.7	16.1	14.8	40.6
□ trans	50.4	46.6	34.1	17.5	9.5	8.0	18.1	36.2
▨ sand	39.1	26.8	13.8	5.8	0.0	0.0	0.0	5.8

C. Abundance by Month and Depth Interval

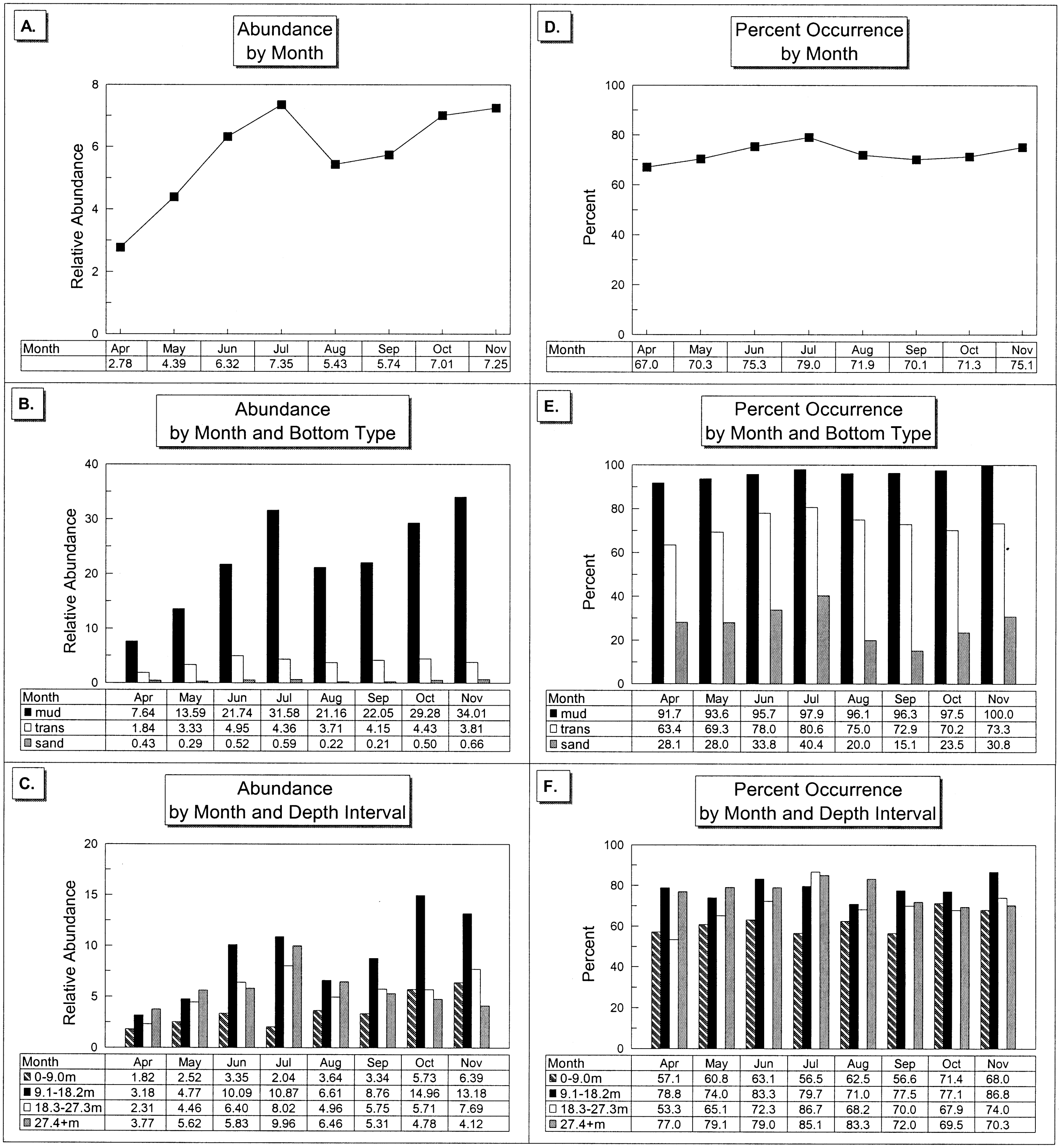
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.66	2.51	0.65	0.17	0.03	0.26	0.65	1.25
■ 9.1-18.2m	1.22	1.06	0.24	0.09	0.04	0.08	0.33	1.16
□ 18.3-27.3m	1.26	0.44	0.27	0.15	0.09	0.11	0.12	0.58
▨ 27.4+m	1.29	0.28	0.25	0.32	0.35	0.09	0.08	0.31

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	37.5	58.1	27.7	10.9	4.2	13.2	27.3	44.0
■ 9.1-18.2m	55.0	51.0	24.0	6.3	4.3	8.1	18.3	42.6
□ 18.3-27.3m	56.5	32.5	21.8	9.3	5.9	9.2	8.4	29.9
▨ 27.4+m	56.3	22.7	23.8	22.4	16.7	8.5	5.1	16.2

Figure IN-1

Alewife (*Alosa pseudoharengus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	2.78	4.39	6.32	7.35	5.43	5.74	7.01	7.25

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	67.0	70.3	75.3	79.0	71.9	70.1	71.3	75.1

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	7.64	13.59	21.74	31.58	21.16	22.05	29.28	34.01
□ trans	1.84	3.33	4.95	4.36	3.71	4.15	4.43	3.81
▩ sand	0.43	0.29	0.52	0.59	0.22	0.21	0.50	0.66

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	91.7	93.6	95.7	97.9	96.1	96.3	97.5	100.0
□ trans	63.4	69.3	78.0	80.6	75.0	72.9	70.2	73.3
▩ sand	28.1	28.0	33.8	40.4	20.0	15.1	23.5	30.8

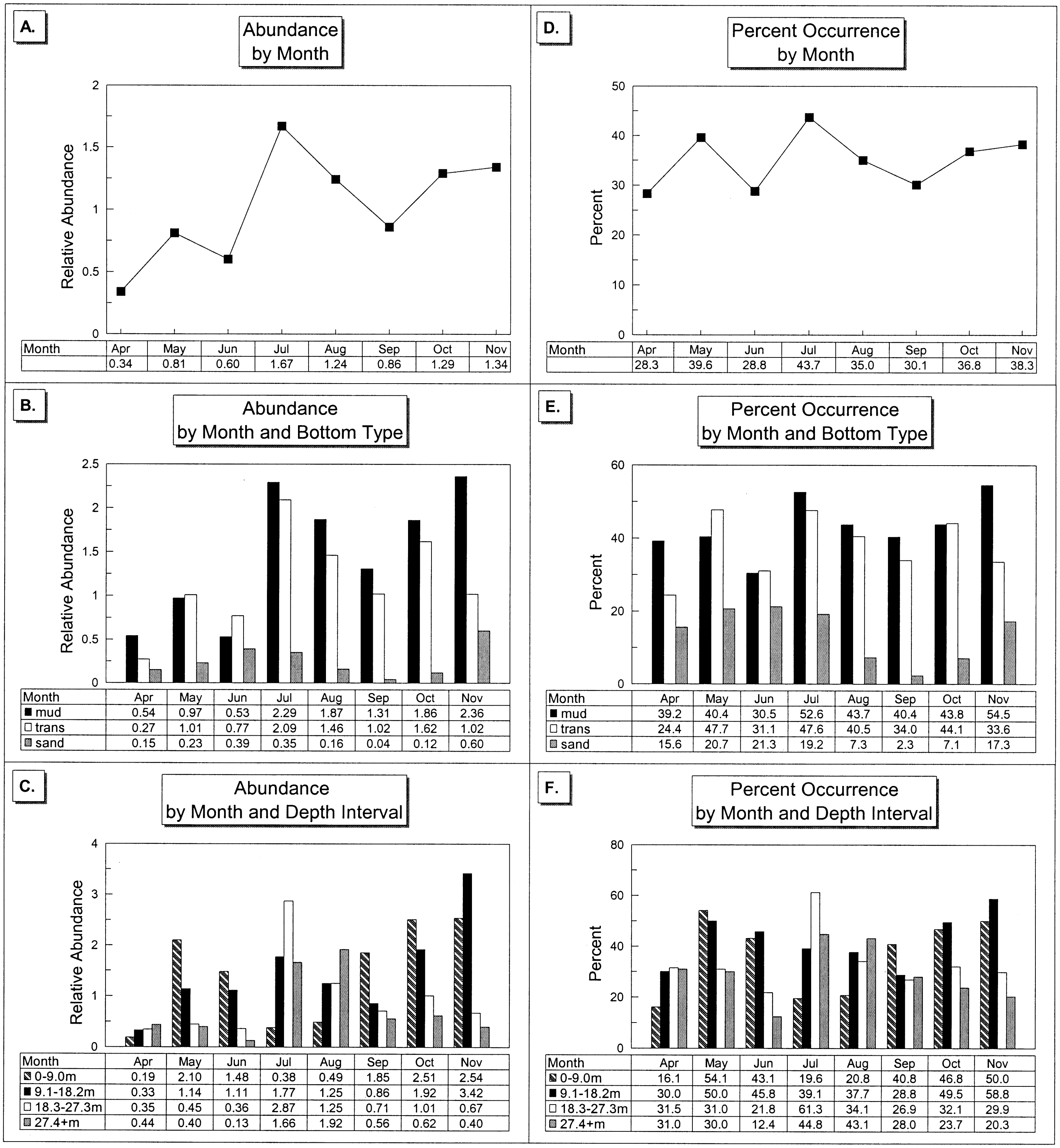
C.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	1.82	2.52	3.35	2.04	3.64	3.34	5.73	6.39
■ 9.1-18.2m	3.18	4.77	10.09	10.87	6.61	8.76	14.96	13.18
□ 18.3-27.3m	2.31	4.46	6.40	8.02	4.96	5.75	5.71	7.69
▩ 27.4+m	3.77	5.62	5.83	9.96	6.46	5.31	4.78	4.12

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	57.1	60.8	63.1	56.5	62.5	56.6	71.4	68.0
■ 9.1-18.2m	78.8	74.0	83.3	79.7	71.0	77.5	77.1	86.8
□ 18.3-27.3m	53.3	65.1	72.3	86.7	68.2	70.0	67.9	74.0
▩ 27.4+m	77.0	79.1	79.0	85.1	83.3	72.0	69.5	70.3

Figure IN-2
American lobster (*Homarus americanus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.34	0.81	0.60	1.67	1.24	0.86	1.29	1.34

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	28.3	39.6	28.8	43.7	35.0	30.1	36.8	38.3

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.54	0.97	0.53	2.29	1.87	1.31	1.86	2.36
□ trans	0.27	1.01	0.77	2.09	1.46	1.02	1.62	1.02
▩ sand	0.15	0.23	0.39	0.35	0.16	0.04	0.12	0.60

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	39.2	40.4	30.5	52.6	43.7	40.4	43.8	54.5
□ trans	24.4	47.7	31.1	47.6	40.5	34.0	44.1	33.6
▩ sand	15.6	20.7	21.3	19.2	7.3	2.3	7.1	17.3

C. Abundance by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.19	2.10	1.48	0.38	0.49	1.85	2.51	2.54
■ 9.1-18.2m	0.33	1.14	1.11	1.77	1.25	0.86	1.92	3.42
□ 18.3-27.3m	0.35	0.45	0.36	2.87	1.25	0.71	1.01	0.67
▩ 27.4+m	0.44	0.40	0.13	1.66	1.92	0.56	0.62	0.40

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	16.1	54.1	43.1	19.6	20.8	40.8	46.8	50.0
■ 9.1-18.2m	30.0	50.0	45.8	39.1	37.7	28.8	49.5	58.8
□ 18.3-27.3m	31.5	31.0	21.8	61.3	34.1	26.9	32.1	29.9
▩ 27.4+m	31.0	30.0	12.4	44.8	43.1	28.0	23.7	20.3

Figure IN-3

American shad (*Alosa sapidissima*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

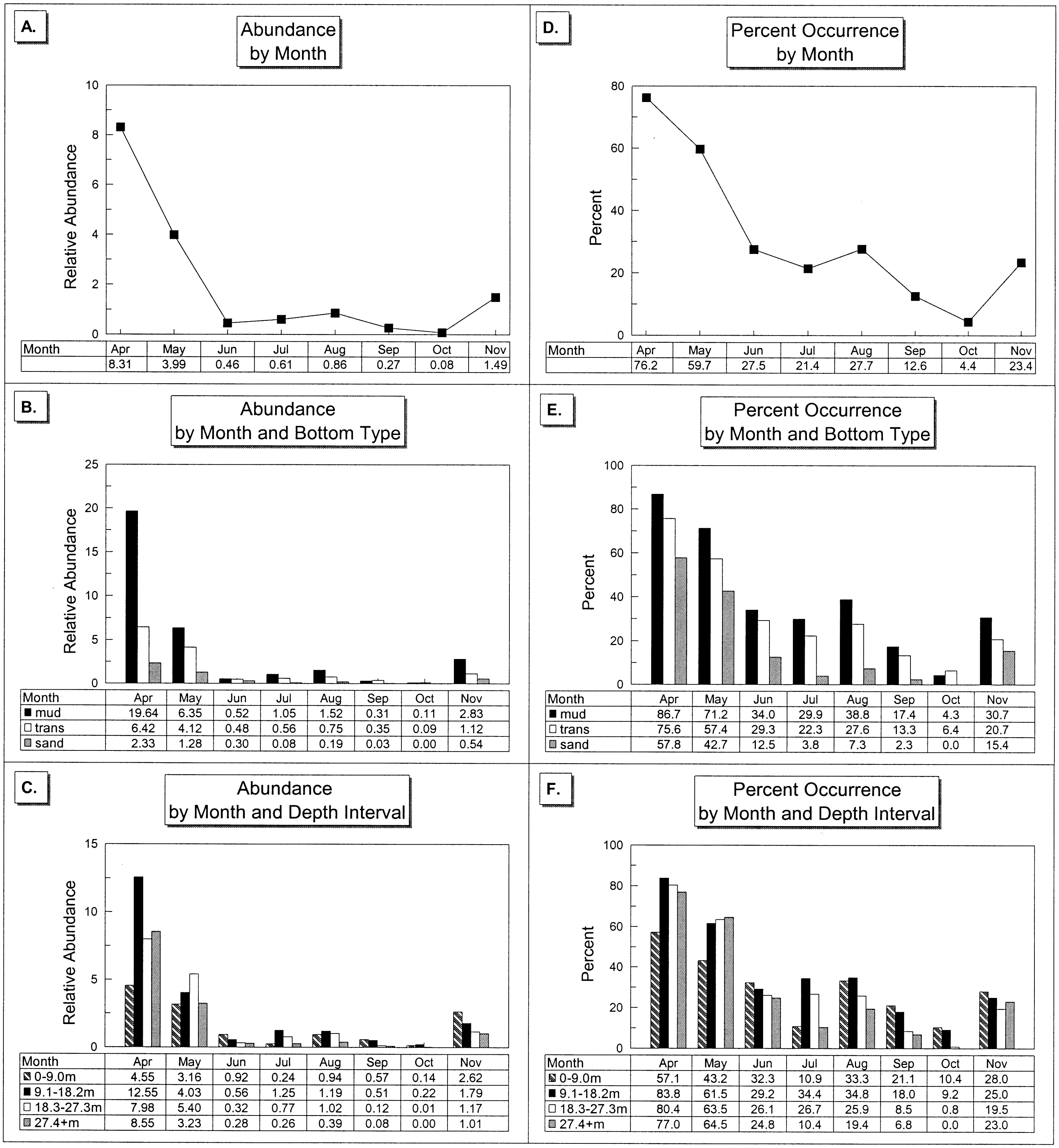
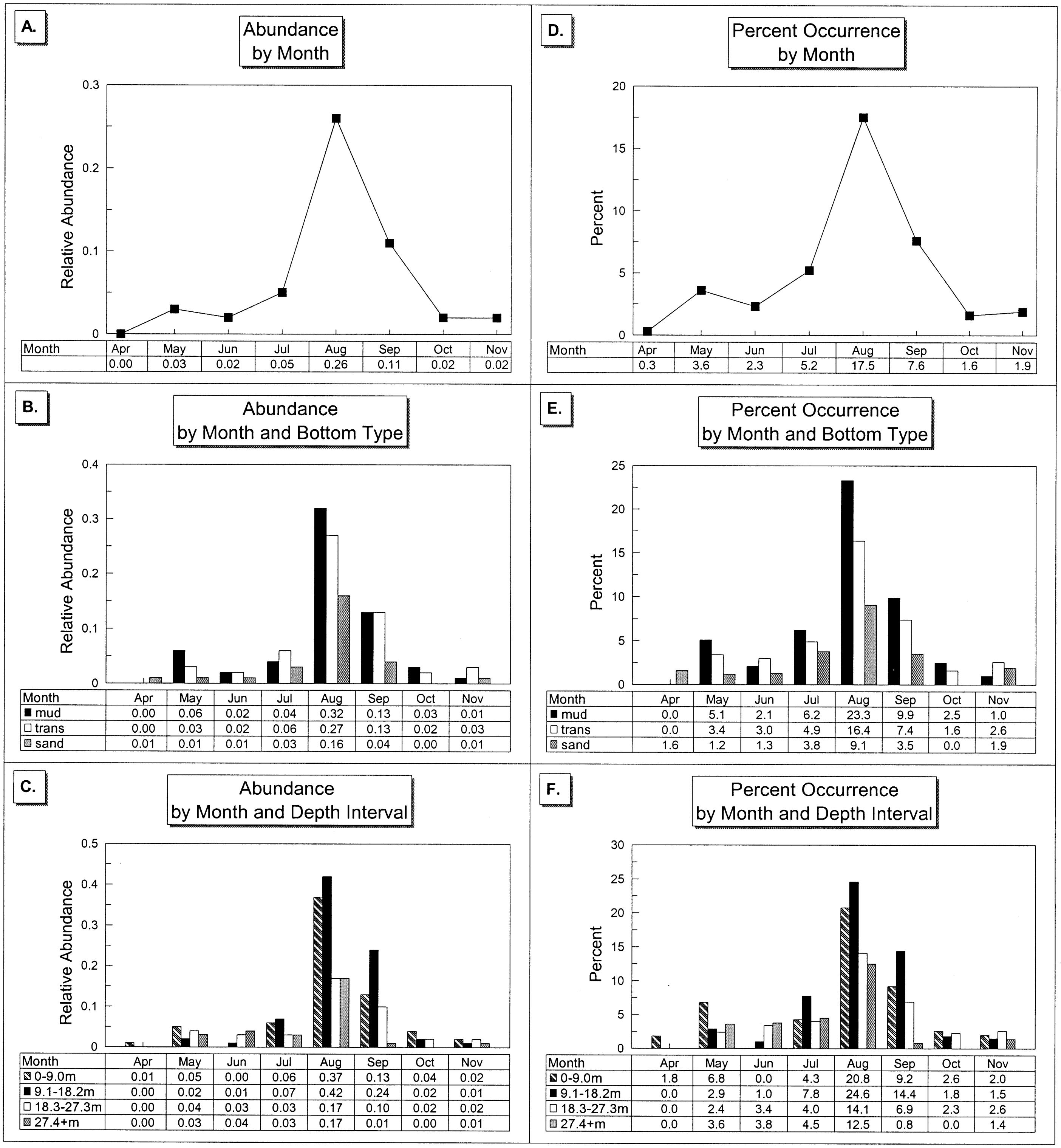


Figure IN-4

Atlantic herring (*Clupea harengus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.03	0.02	0.05	0.26	0.11	0.02	0.02

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.3	3.6	2.3	5.2	17.5	7.6	1.6	1.9

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.06	0.02	0.04	0.32	0.13	0.03	0.01
□ trans	0.00	0.03	0.02	0.06	0.27	0.13	0.02	0.03
▩ sand	0.01	0.01	0.01	0.03	0.16	0.04	0.00	0.01

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	5.1	2.1	6.2	23.3	9.9	2.5	1.0
□ trans	0.0	3.4	3.0	4.9	16.4	7.4	1.6	2.6
▩ sand	1.6	1.2	1.3	3.8	9.1	3.5	0.0	1.9

C. Abundance by Month and Depth Interval

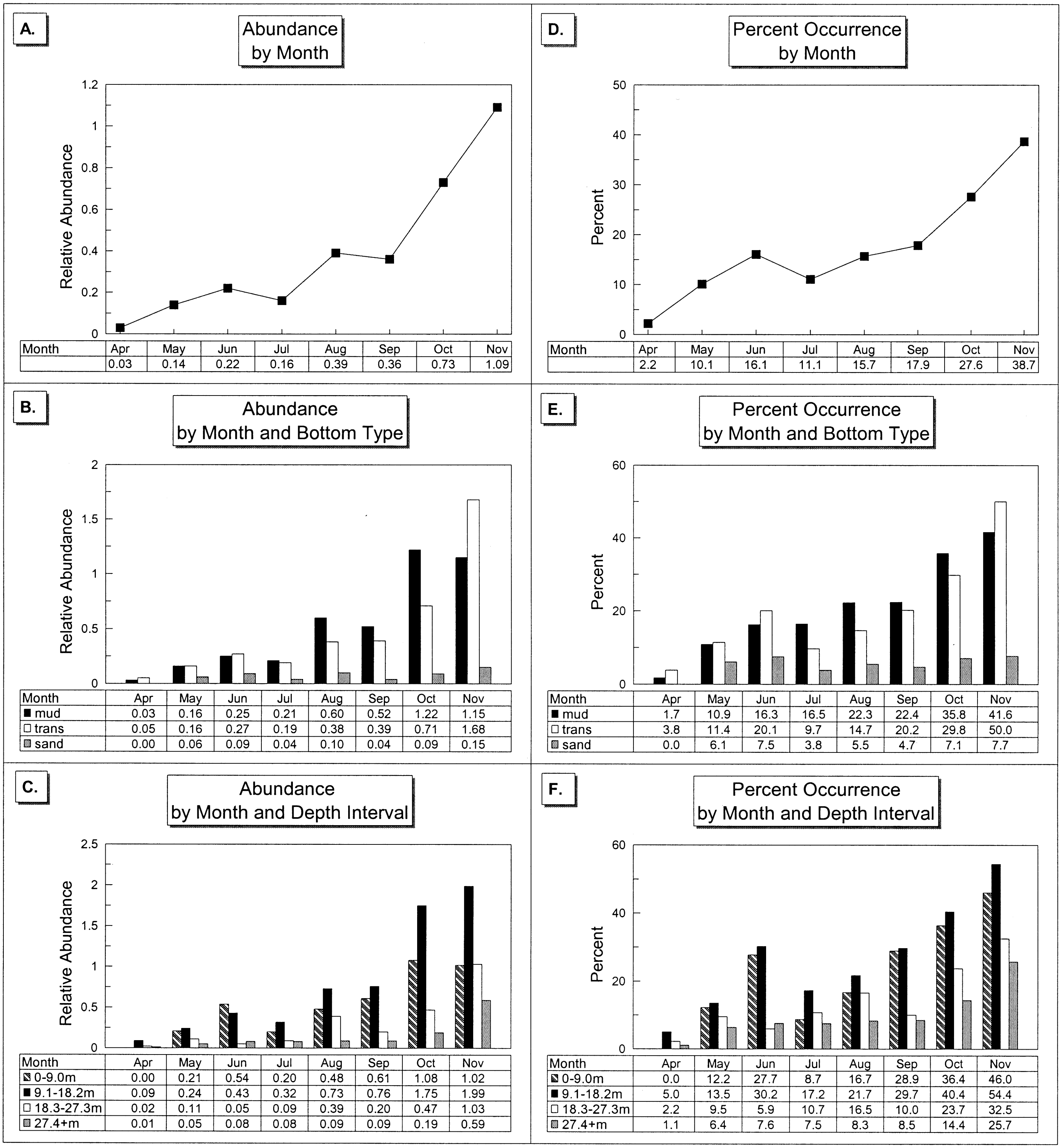
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.01	0.05	0.00	0.06	0.37	0.13	0.04	0.02
■ 9.1-18.2m	0.00	0.02	0.01	0.07	0.42	0.24	0.02	0.01
□ 18.3-27.3m	0.00	0.04	0.03	0.03	0.17	0.10	0.02	0.02
▩ 27.4+m	0.00	0.03	0.04	0.03	0.17	0.01	0.00	0.01

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	1.8	6.8	0.0	4.3	20.8	9.2	2.6	2.0
■ 9.1-18.2m	0.0	2.9	1.0	7.8	24.6	14.4	1.8	1.5
□ 18.3-27.3m	0.0	2.4	3.4	4.0	14.1	6.9	2.3	2.6
▩ 27.4+m	0.0	3.6	3.8	4.5	12.5	0.8	0.0	1.4

Figure IN-5

Atlantic mackerel (*Scomber scombrus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.03	0.14	0.22	0.16	0.39	0.36	0.73	1.09

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	2.2	10.1	16.1	11.1	15.7	17.9	27.6	38.7

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.03	0.16	0.25	0.21	0.60	0.52	1.22	1.15
□ trans	0.05	0.16	0.27	0.19	0.38	0.39	0.71	1.68
▨ sand	0.00	0.06	0.09	0.04	0.10	0.04	0.09	0.15

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	1.7	10.9	16.3	16.5	22.3	22.4	35.8	41.6
□ trans	3.8	11.4	20.1	9.7	14.7	20.2	29.8	50.0
▨ sand	0.0	6.1	7.5	3.8	5.5	4.7	7.1	7.7

C.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.21	0.54	0.20	0.48	0.61	1.08	1.02
■ 9.1-18.2m	0.09	0.24	0.43	0.32	0.73	0.76	1.75	1.99
□ 18.3-27.3m	0.02	0.11	0.05	0.09	0.39	0.20	0.47	1.03
▨ 27.4+m	0.01	0.05	0.08	0.08	0.09	0.09	0.19	0.59

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	12.2	27.7	8.7	16.7	28.9	36.4	46.0
■ 9.1-18.2m	5.0	13.5	30.2	17.2	21.7	29.7	40.4	54.4
□ 18.3-27.3m	2.2	9.5	5.9	10.7	16.5	10.0	23.7	32.5
▨ 27.4+m	1.1	6.4	7.6	7.5	8.3	8.5	14.4	25.7

Figure IN-6

Atlantic menhaden (*Brevoortia tyrannus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

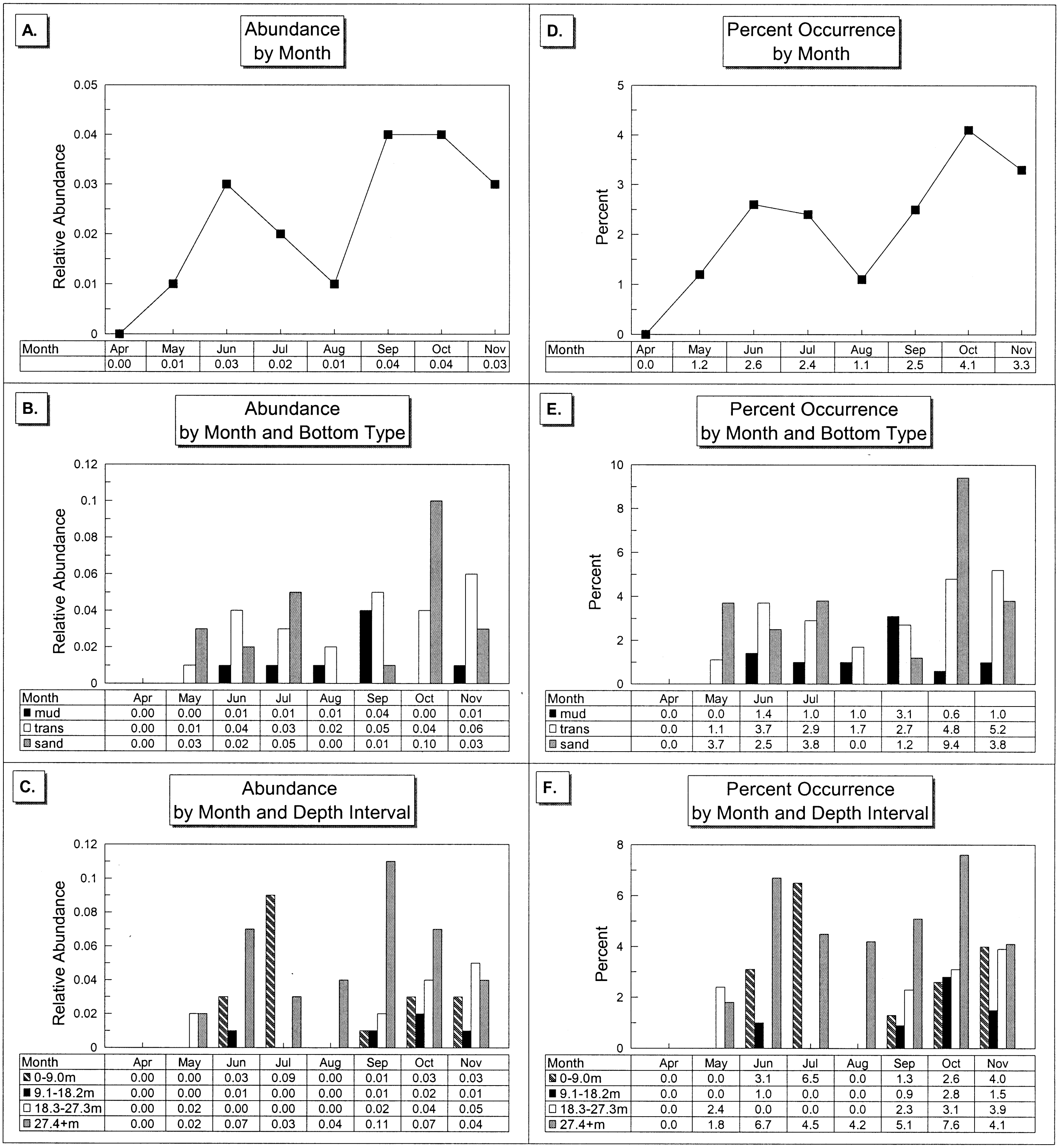
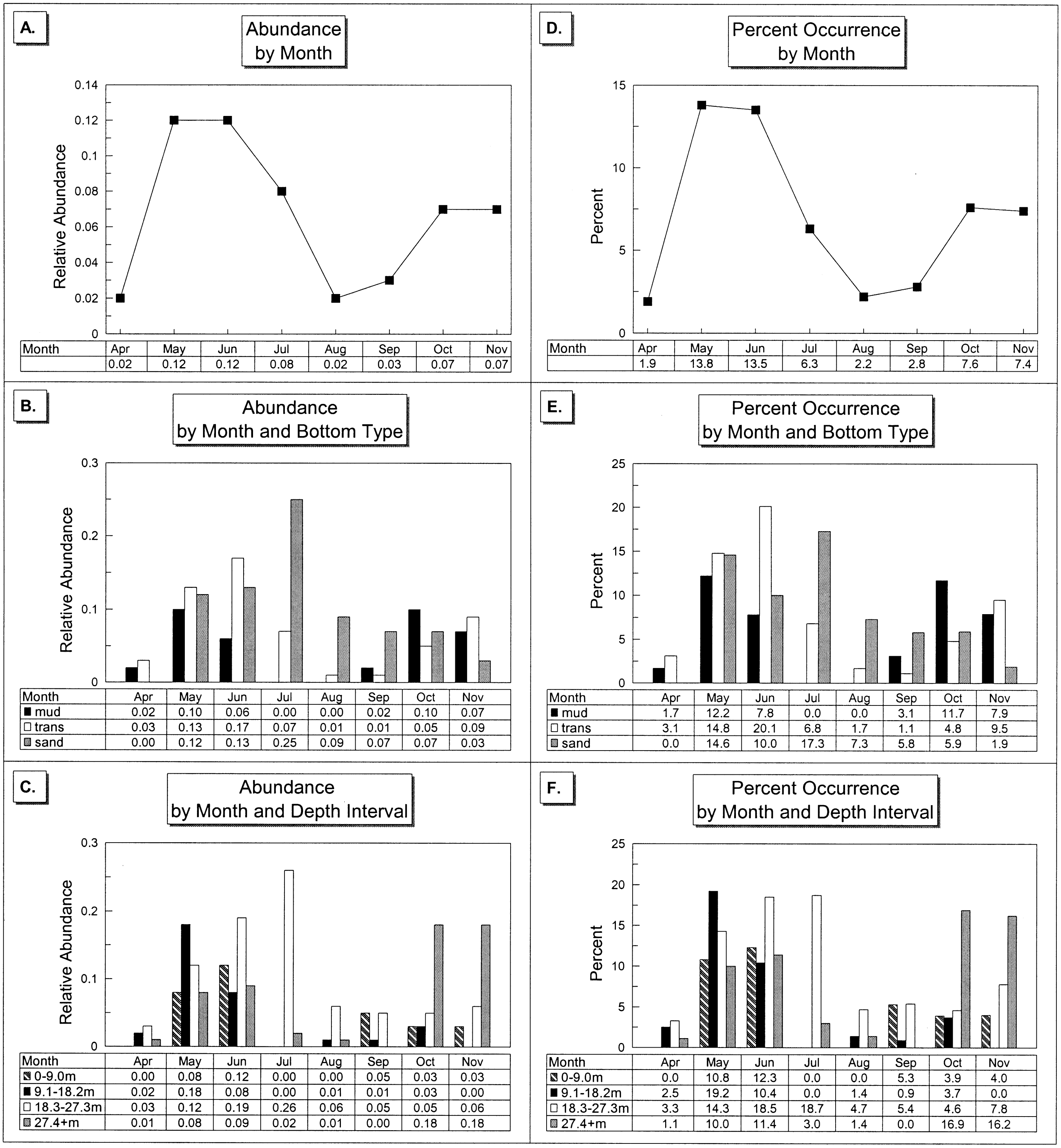


Figure IN-7

Atlantic sturgeon (*Acipenser oxyrinchus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.02	0.12	0.12	0.08	0.02	0.03	0.07	0.07

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	1.9	13.8	13.5	6.3	2.2	2.8	7.6	7.4

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.02	0.10	0.06	0.00	0.00	0.02	0.10	0.07
□ trans	0.03	0.13	0.17	0.07	0.01	0.01	0.05	0.09
▩ sand	0.00	0.12	0.13	0.25	0.09	0.07	0.07	0.03

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	1.7	12.2	7.8	0.0	0.0	3.1	11.7	7.9
□ trans	3.1	14.8	20.1	6.8	1.7	1.1	4.8	9.5
▩ sand	0.0	14.6	10.0	17.3	7.3	5.8	5.9	1.9

C. Abundance by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.08	0.12	0.00	0.00	0.05	0.03	0.03
■ 9.1-18.2m	0.02	0.18	0.08	0.00	0.01	0.01	0.03	0.00
□ 18.3-27.3m	0.03	0.12	0.19	0.26	0.06	0.05	0.05	0.06
▩ 27.4+m	0.01	0.08	0.09	0.02	0.01	0.00	0.18	0.18

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	10.8	12.3	0.0	0.0	5.3	3.9	4.0
■ 9.1-18.2m	2.5	19.2	10.4	0.0	1.4	0.9	3.7	0.0
□ 18.3-27.3m	3.3	14.3	18.5	18.7	4.7	5.4	4.6	7.8
▩ 27.4+m	1.1	10.0	11.4	3.0	1.4	0.0	16.9	16.2

Figure IN-8

Black sea bass (*Centropristis striata*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

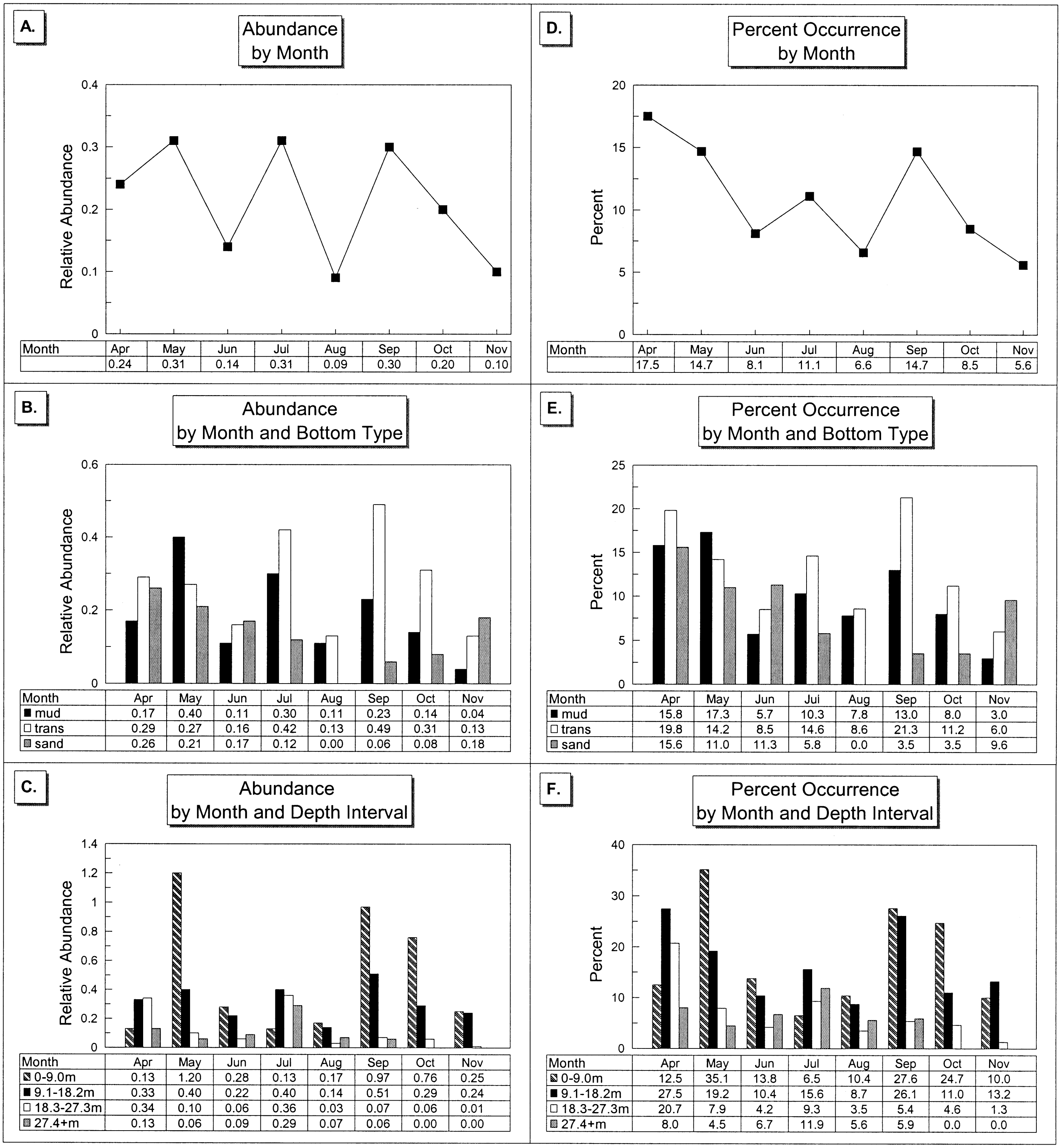
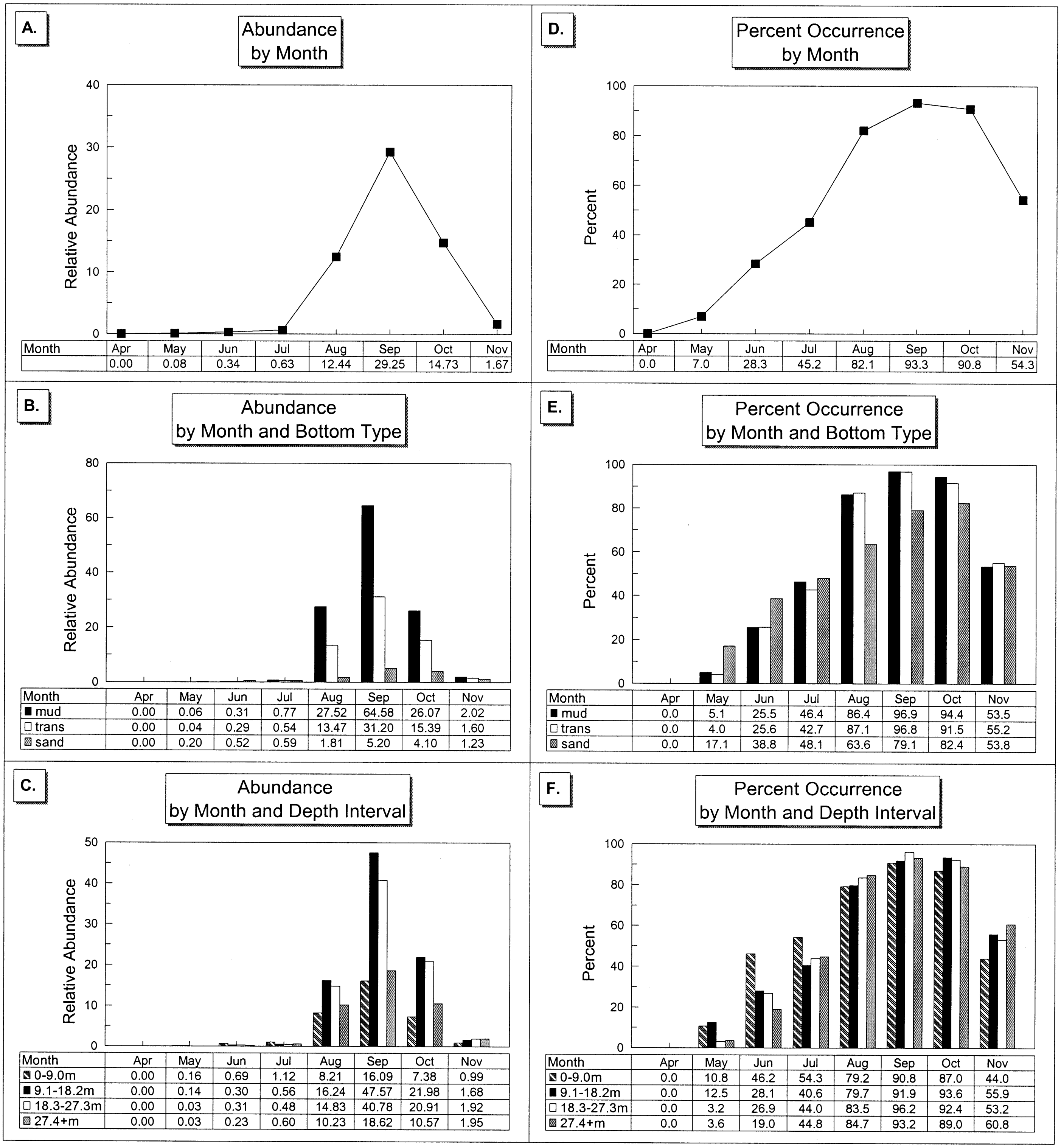


Figure IN-9

Blueback herring (*Alosa aestivalis*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.08	0.34	0.63	12.44	29.25	14.73	1.67

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	7.0	28.3	45.2	82.1	93.3	90.8	54.3

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.06	0.31	0.77	27.52	64.58	26.07	2.02
□ trans	0.00	0.04	0.29	0.54	13.47	31.20	15.39	1.60
▨ sand	0.00	0.20	0.52	0.59	1.81	5.20	4.10	1.23

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	5.1	25.5	46.4	86.4	96.9	94.4	53.5
□ trans	0.0	4.0	25.6	42.7	87.1	96.8	91.5	55.2
▨ sand	0.0	17.1	38.8	48.1	63.6	79.1	82.4	53.8

C. Abundance by Month and Depth Interval

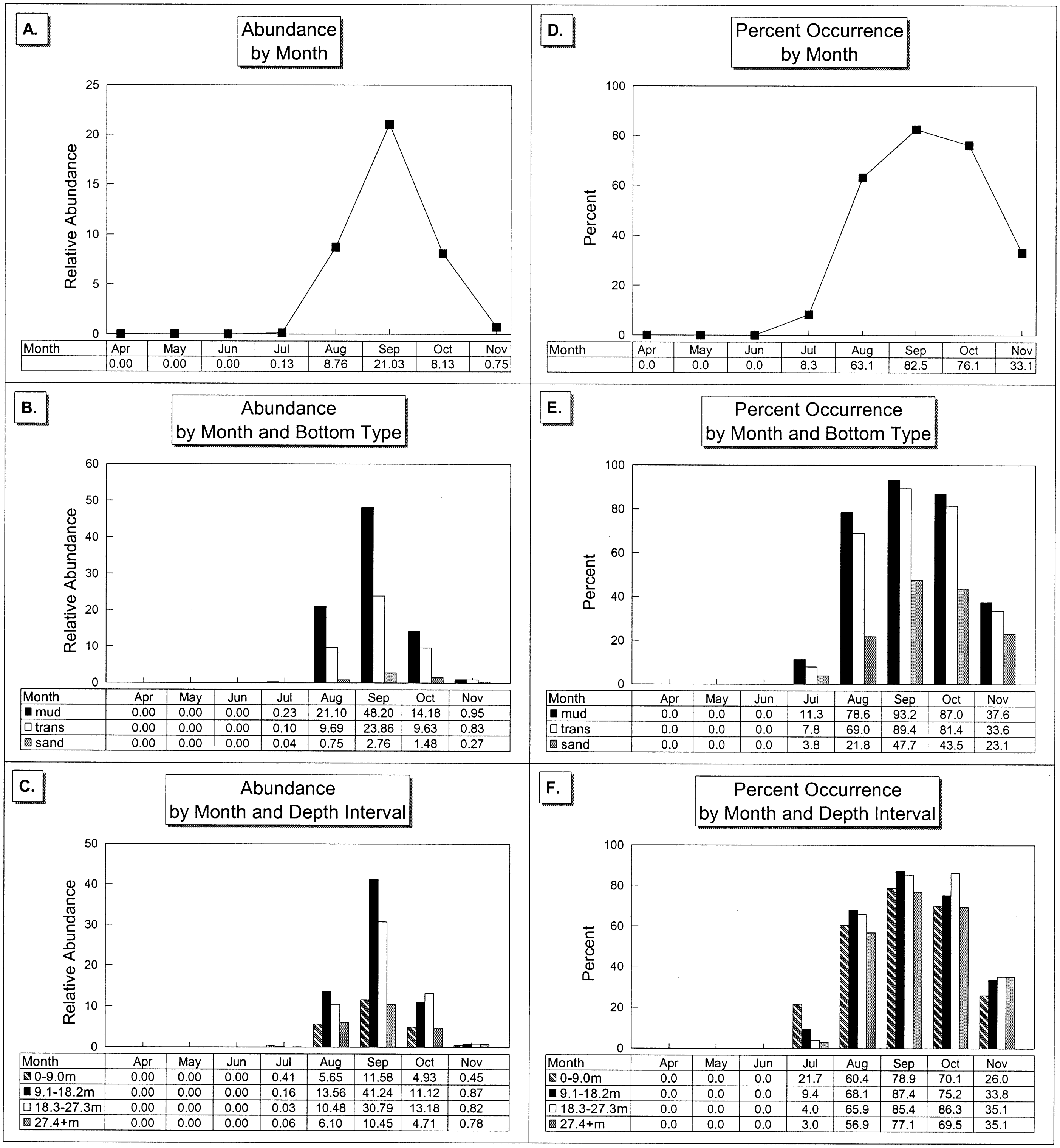
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.16	0.69	1.12	8.21	16.09	7.38	0.99
■ 9.1-18.2m	0.00	0.14	0.30	0.56	16.24	47.57	21.98	1.68
□ 18.3-27.3m	0.00	0.03	0.31	0.48	14.83	40.78	20.91	1.92
▨ 27.4+m	0.00	0.03	0.23	0.60	10.23	18.62	10.57	1.95

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	10.8	46.2	54.3	79.2	90.8	87.0	44.0
■ 9.1-18.2m	0.0	12.5	28.1	40.6	79.7	91.9	93.6	55.9
□ 18.3-27.3m	0.0	3.2	26.9	44.0	83.5	96.2	92.4	53.2
▨ 27.4+m	0.0	3.6	19.0	44.8	84.7	93.2	89.0	60.8

Figure IN-10

Bluefish (*Pomatomus saltatrix*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.00	0.00	0.13	8.76	21.03	8.13	0.75

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	0.0	0.0	8.3	63.1	82.5	76.1	33.1

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.00	0.00	0.23	21.10	48.20	14.18	0.95
□ trans	0.00	0.00	0.00	0.10	9.69	23.86	9.63	0.83
▨ sand	0.00	0.00	0.00	0.04	0.75	2.76	1.48	0.27

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	0.0	0.0	11.3	78.6	93.2	87.0	37.6
□ trans	0.0	0.0	0.0	7.8	69.0	89.4	81.4	33.6
▨ sand	0.0	0.0	0.0	3.8	21.8	47.7	43.5	23.1

C. Abundance by Month and Depth Interval

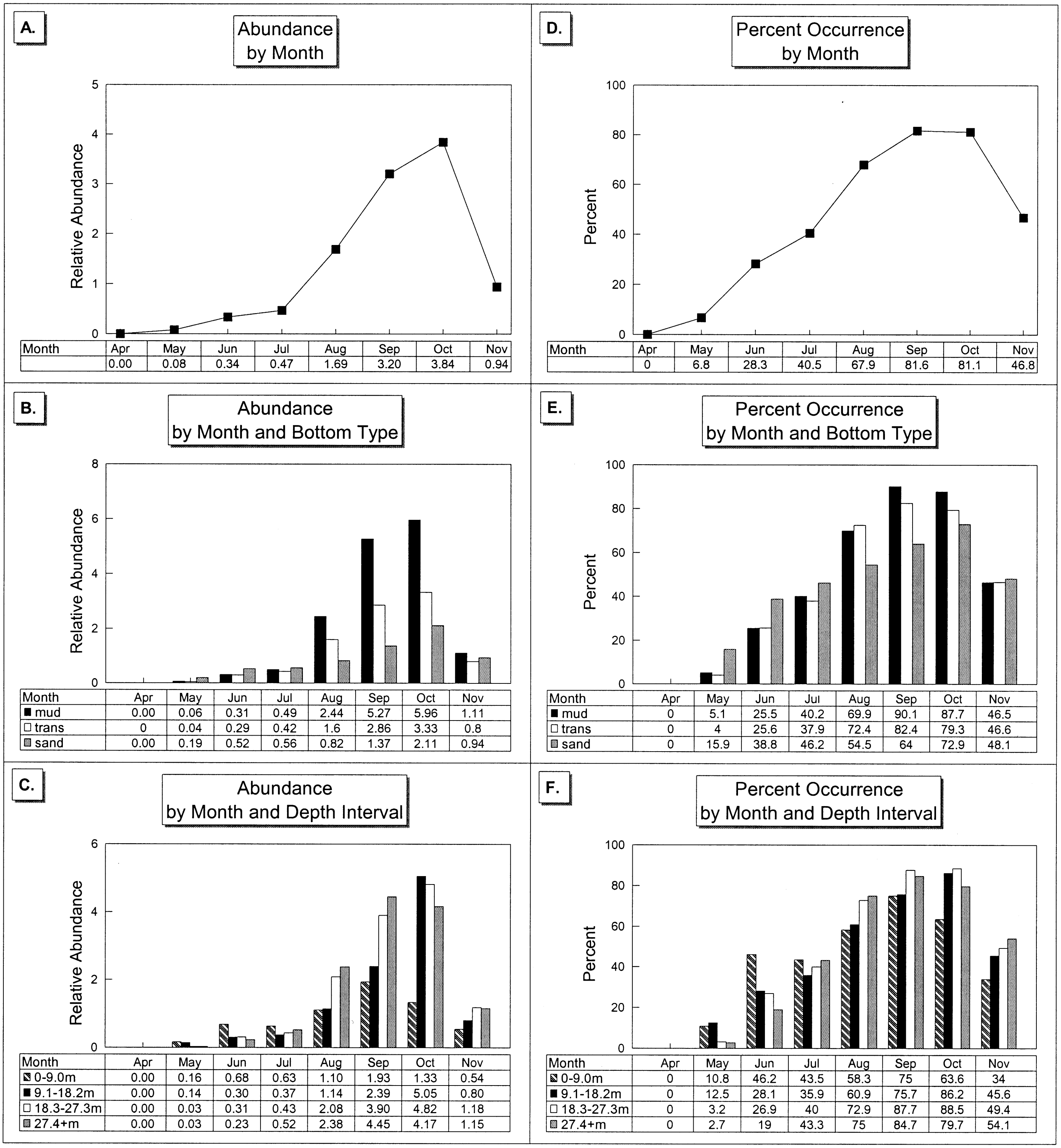
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.00	0.00	0.41	5.65	11.58	4.93	0.45
■ 9.1-18.2m	0.00	0.00	0.00	0.16	13.56	41.24	11.12	0.87
□ 18.3-27.3m	0.00	0.00	0.00	0.03	10.48	30.79	13.18	0.82
▨ 27.4+m	0.00	0.00	0.00	0.06	6.10	10.45	4.71	0.78

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	0.0	0.0	21.7	60.4	78.9	70.1	26.0
■ 9.1-18.2m	0.0	0.0	0.0	9.4	68.1	87.4	75.2	33.8
□ 18.3-27.3m	0.0	0.0	0.0	4.0	65.9	85.4	86.3	35.1
▨ 27.4+m	0.0	0.0	0.0	3.0	56.9	77.1	69.5	35.1

Figure IN-11

Bluefish (*Pomatomus saltatrix*), young-of-year. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.08	0.34	0.47	1.69	3.20	3.84	0.94

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0	6.8	28.3	40.5	67.9	81.6	81.1	46.8

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.06	0.31	0.49	2.44	5.27	5.96	1.11
□ trans	0	0.04	0.29	0.42	1.6	2.86	3.33	0.8
▨ sand	0.00	0.19	0.52	0.56	0.82	1.37	2.11	0.94

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0	5.1	25.5	40.2	69.9	90.1	87.7	46.5
□ trans	0	4	25.6	37.9	72.4	82.4	79.3	46.6
▨ sand	0	15.9	38.8	46.2	54.5	64	72.9	48.1

C. Abundance by Month and Depth Interval

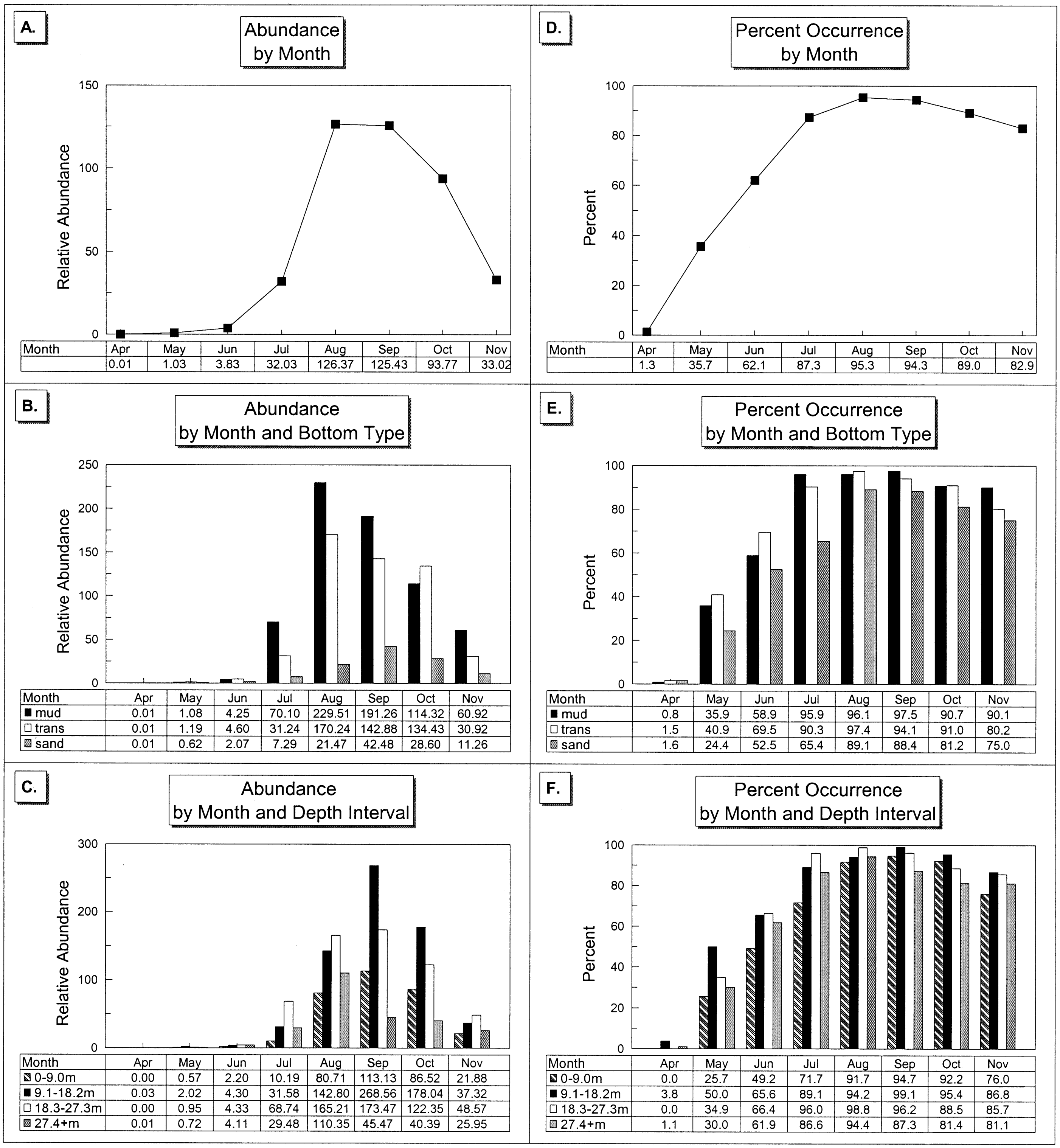
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.16	0.68	0.63	1.10	1.93	1.33	0.54
■ 9.1-18.2m	0.00	0.14	0.30	0.37	1.14	2.39	5.05	0.80
□ 18.3-27.3m	0.00	0.03	0.31	0.43	2.08	3.90	4.82	1.18
▨ 27.4+m	0.00	0.03	0.23	0.52	2.38	4.45	4.17	1.15

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0	10.8	46.2	43.5	58.3	75	63.6	34
■ 9.1-18.2m	0	12.5	28.1	35.9	60.9	75.7	86.2	45.6
□ 18.3-27.3m	0	3.2	26.9	40	72.9	87.7	88.5	49.4
▨ 27.4+m	0	2.7	19	43.3	75	84.7	79.7	54.1

Figure IN-12

Bluefish (*Pomatomus saltatrix*), age 1+. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.01	1.03	3.83	32.03	126.37	125.43	93.77	33.02

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	1.3	35.7	62.1	87.3	95.3	94.3	89.0	82.9

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.01	1.08	4.25	70.10	229.51	191.26	114.32	60.92
□ trans	0.01	1.19	4.60	31.24	170.24	142.88	134.43	30.92
▨ sand	0.01	0.62	2.07	7.29	21.47	42.48	28.60	11.26

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.8	35.9	58.9	95.9	96.1	97.5	90.7	90.1
□ trans	1.5	40.9	69.5	90.3	97.4	94.1	91.0	80.2
▨ sand	1.6	24.4	52.5	65.4	89.1	88.4	81.2	75.0

C.

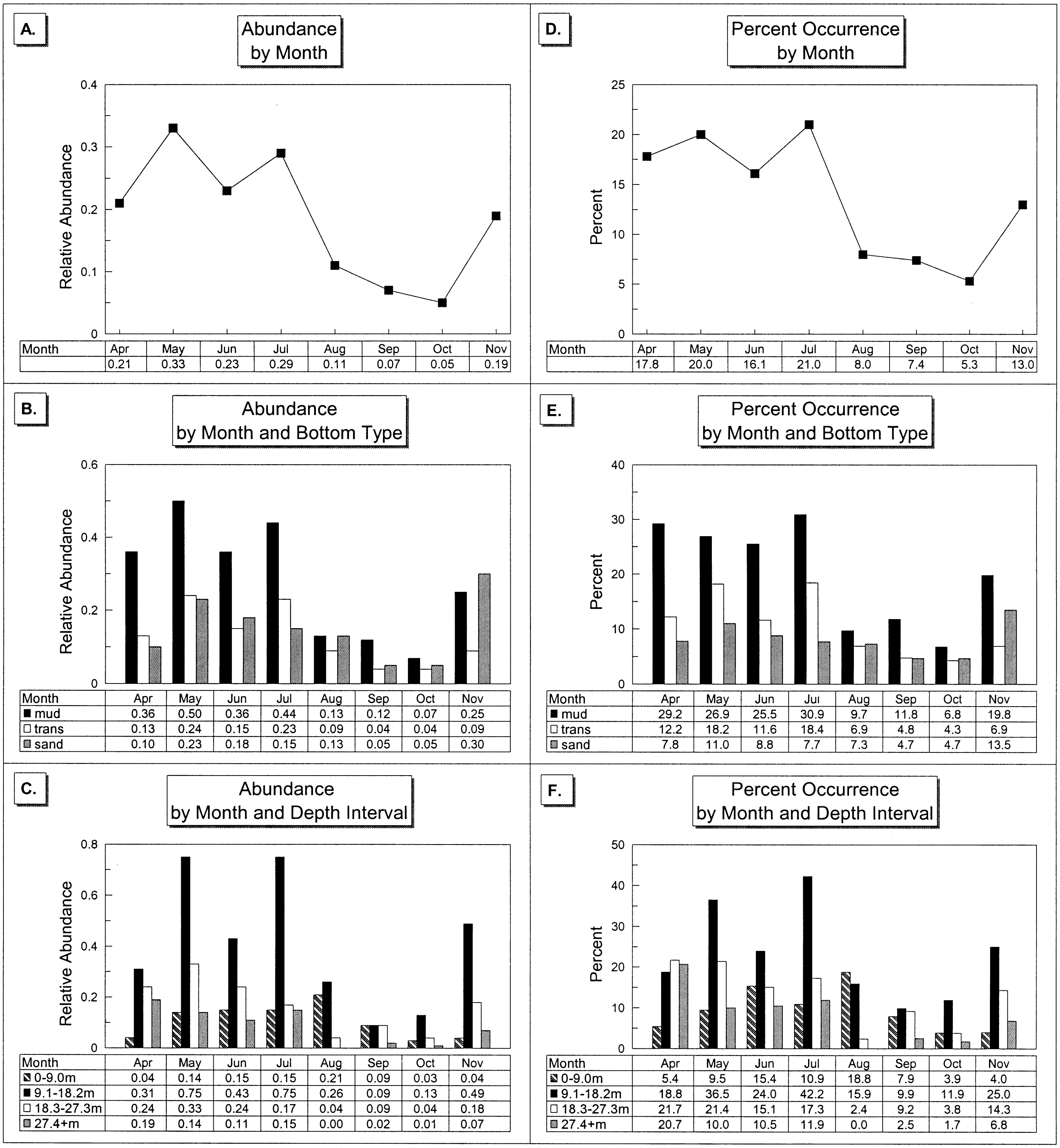
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.57	2.20	10.19	80.71	113.13	86.52	21.88
■ 9.1-18.2m	0.03	2.02	4.30	31.58	142.80	268.56	178.04	37.32
□ 18.3-27.3m	0.00	0.95	4.33	68.74	165.21	173.47	122.35	48.57
▨ 27.4+m	0.01	0.72	4.11	29.48	110.35	45.47	40.39	25.95

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	25.7	49.2	71.7	91.7	94.7	92.2	76.0
■ 9.1-18.2m	3.8	50.0	65.6	89.1	94.2	99.1	95.4	86.8
□ 18.3-27.3m	0.0	34.9	66.4	96.0	98.8	96.2	88.5	85.7
▨ 27.4+m	1.1	30.0	61.9	86.6	94.4	87.3	81.4	81.1

Figure IN-13

Butterfish (*Peprilus triacanthus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.21	0.33	0.23	0.29	0.11	0.07	0.05	0.19

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	17.8	20.0	16.1	21.0	8.0	7.4	5.3	13.0

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.36	0.50	0.36	0.44	0.13	0.12	0.07	0.25
□ trans	0.13	0.24	0.15	0.23	0.09	0.04	0.04	0.09
▩ sand	0.10	0.23	0.18	0.15	0.13	0.05	0.05	0.30

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	29.2	26.9	25.5	30.9	9.7	11.8	6.8	19.8
□ trans	12.2	18.2	11.6	18.4	6.9	4.8	4.3	6.9
▩ sand	7.8	11.0	8.8	7.7	7.3	4.7	4.7	13.5

C.

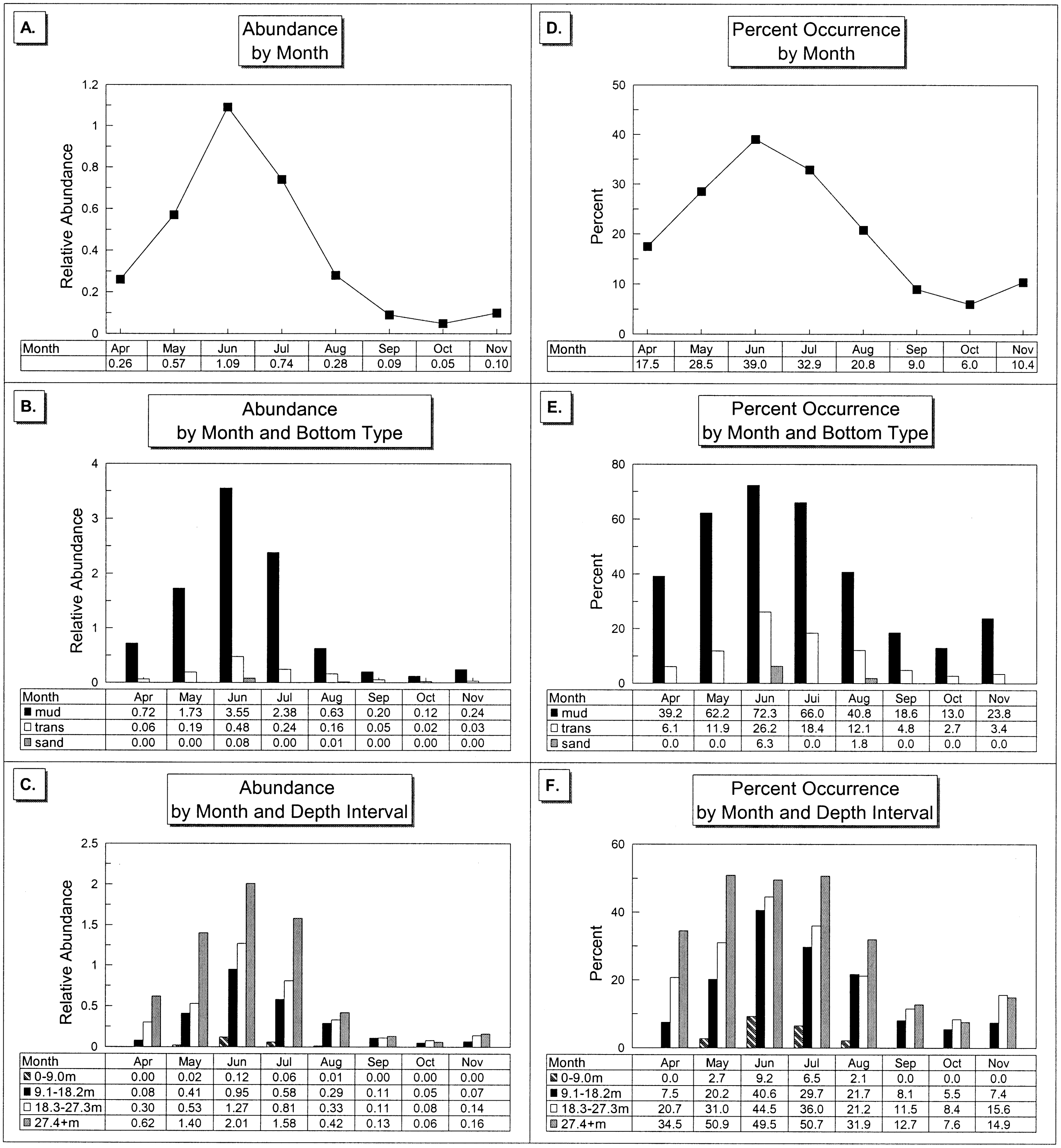
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.04	0.14	0.15	0.15	0.21	0.09	0.03	0.04
■ 9.1-18.2m	0.31	0.75	0.43	0.75	0.26	0.09	0.13	0.49
□ 18.3-27.3m	0.24	0.33	0.24	0.17	0.04	0.09	0.04	0.18
▩ 27.4+m	0.19	0.14	0.11	0.15	0.00	0.02	0.01	0.07

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	5.4	9.5	15.4	10.9	18.8	7.9	3.9	4.0
■ 9.1-18.2m	18.8	36.5	24.0	42.2	15.9	9.9	11.9	25.0
□ 18.3-27.3m	21.7	21.4	15.1	17.3	2.4	9.2	3.8	14.3
▩ 27.4+m	20.7	10.0	10.5	11.9	0.0	2.5	1.7	6.8

Figure IN-14

Cunner (*Tautogolabrus adspersus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.26	0.57	1.09	0.74	0.28	0.09	0.05	0.10

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	17.5	28.5	39.0	32.9	20.8	9.0	6.0	10.4

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.72	1.73	3.55	2.38	0.63	0.20	0.12	0.24
□ trans	0.06	0.19	0.48	0.24	0.16	0.05	0.02	0.03
▨ sand	0.00	0.00	0.08	0.00	0.01	0.00	0.00	0.00

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jui	Aug	Sep	Oct	Nov
■ mud	39.2	62.2	72.3	66.0	40.8	18.6	13.0	23.8
□ trans	6.1	11.9	26.2	18.4	12.1	4.8	2.7	3.4
▨ sand	0.0	0.0	6.3	0.0	1.8	0.0	0.0	0.0

C. Abundance by Month and Depth Interval

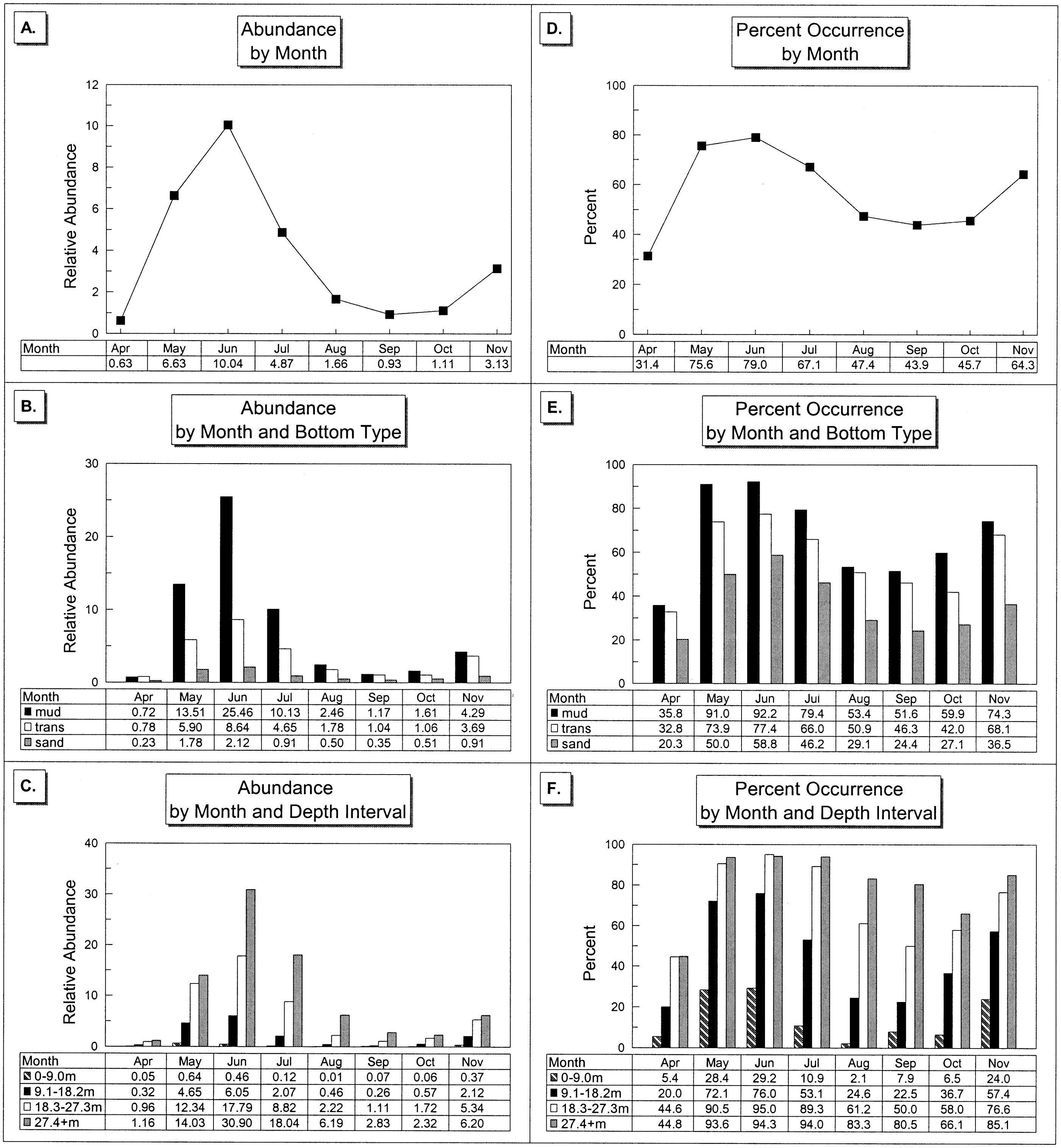
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.02	0.12	0.06	0.01	0.00	0.00	0.00
■ 9.1-18.2m	0.08	0.41	0.95	0.58	0.29	0.11	0.05	0.07
□ 18.3-27.3m	0.30	0.53	1.27	0.81	0.33	0.11	0.08	0.14
▨ 27.4+m	0.62	1.40	2.01	1.58	0.42	0.13	0.06	0.16

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	2.7	9.2	6.5	2.1	0.0	0.0	0.0
■ 9.1-18.2m	7.5	20.2	40.6	29.7	21.7	8.1	5.5	7.4
□ 18.3-27.3m	20.7	31.0	44.5	36.0	21.2	11.5	8.4	15.6
▨ 27.4+m	34.5	50.9	49.5	50.7	31.9	12.7	7.6	14.9

Figure IN-15

Fourbeard rockling (*Enchelyopus cimbrius*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.63	6.63	10.04	4.87	1.66	0.93	1.11	3.13

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.72	13.51	25.46	10.13	2.46	1.17	1.61	4.29
□ trans	0.78	5.90	8.64	4.65	1.78	1.04	1.06	3.69
▨ sand	0.23	1.78	2.12	0.91	0.50	0.35	0.51	0.91

C.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.05	0.64	0.46	0.12	0.01	0.07	0.06	0.37
■ 9.1-18.2m	0.32	4.65	6.05	2.07	0.46	0.26	0.57	2.12
□ 18.3-27.3m	0.96	12.34	17.79	8.82	2.22	1.11	1.72	5.34
▨ 27.4+m	1.16	14.03	30.90	18.04	6.19	2.83	2.32	6.20

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	31.4	75.6	79.0	67.1	47.4	43.9	45.7	64.3

E.

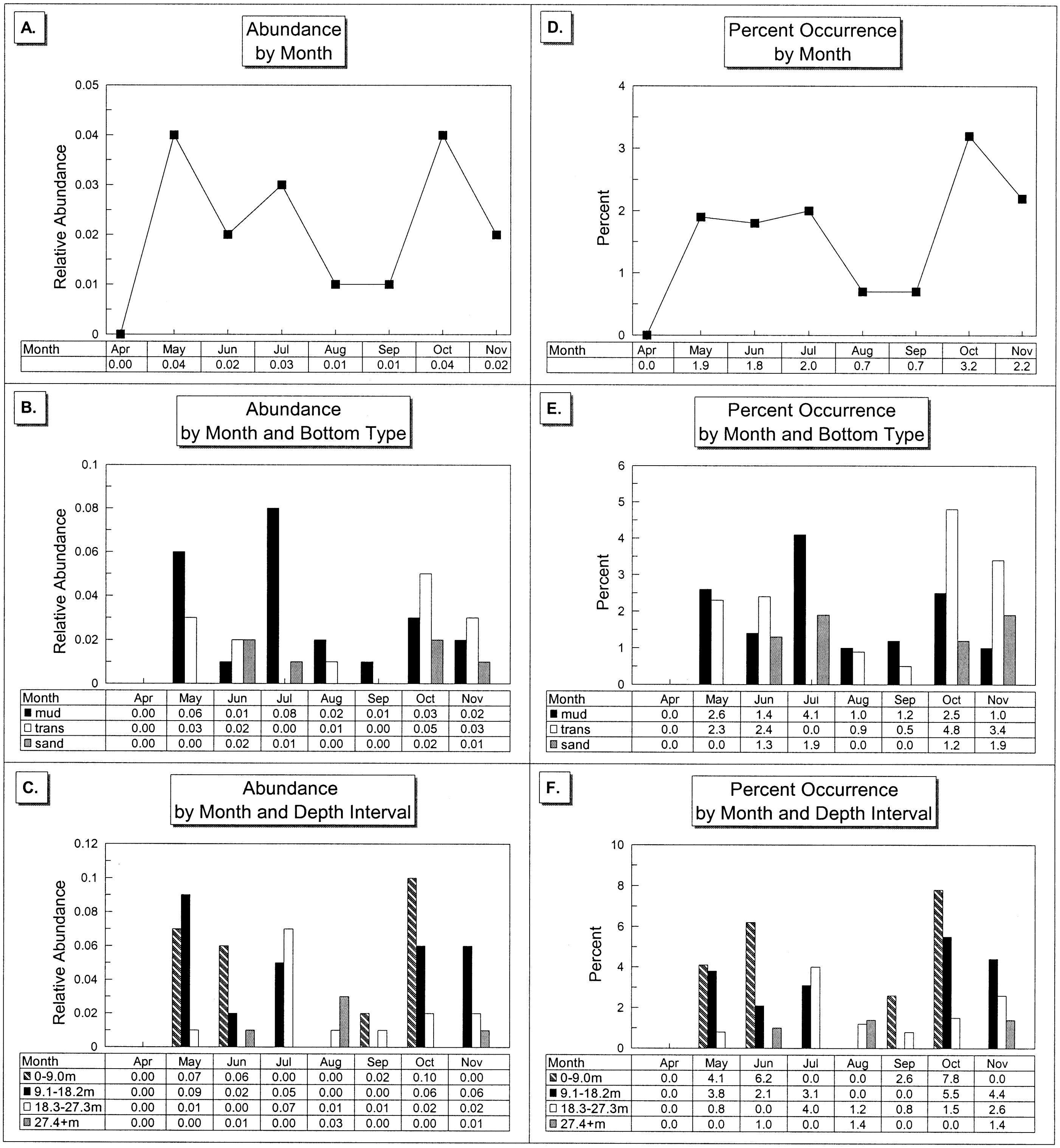
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	35.8	91.0	92.2	79.4	53.4	51.6	59.9	74.3
□ trans	32.8	73.9	77.4	66.0	50.9	46.3	42.0	68.1
▨ sand	20.3	50.0	58.8	46.2	29.1	24.4	27.1	36.5

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	5.4	28.4	29.2	10.9	2.1	7.9	6.5	24.0
■ 9.1-18.2m	20.0	72.1	76.0	53.1	24.6	22.5	36.7	57.4
□ 18.3-27.3m	44.6	90.5	95.0	89.3	61.2	50.0	58.0	76.6
▨ 27.4+m	44.8	93.6	94.3	94.0	83.3	80.5	66.1	85.1

Figure IN-16

Fourspot flounder (*Paralichthys oblongus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.04	0.02	0.03	0.01	0.01	0.04	0.02

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	1.9	1.8	2.0	0.7	0.7	3.2	2.2

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.06	0.01	0.08	0.02	0.01	0.03	0.02
□ trans	0.00	0.03	0.02	0.00	0.01	0.00	0.05	0.03
▨ sand	0.00	0.00	0.02	0.01	0.00	0.00	0.02	0.01

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	2.6	1.4	4.1	1.0	1.2	2.5	1.0
□ trans	0.0	2.3	2.4	0.0	0.9	0.5	4.8	3.4
▨ sand	0.0	0.0	1.3	1.9	0.0	0.0	1.2	1.9

C. Abundance by Month and Depth Interval

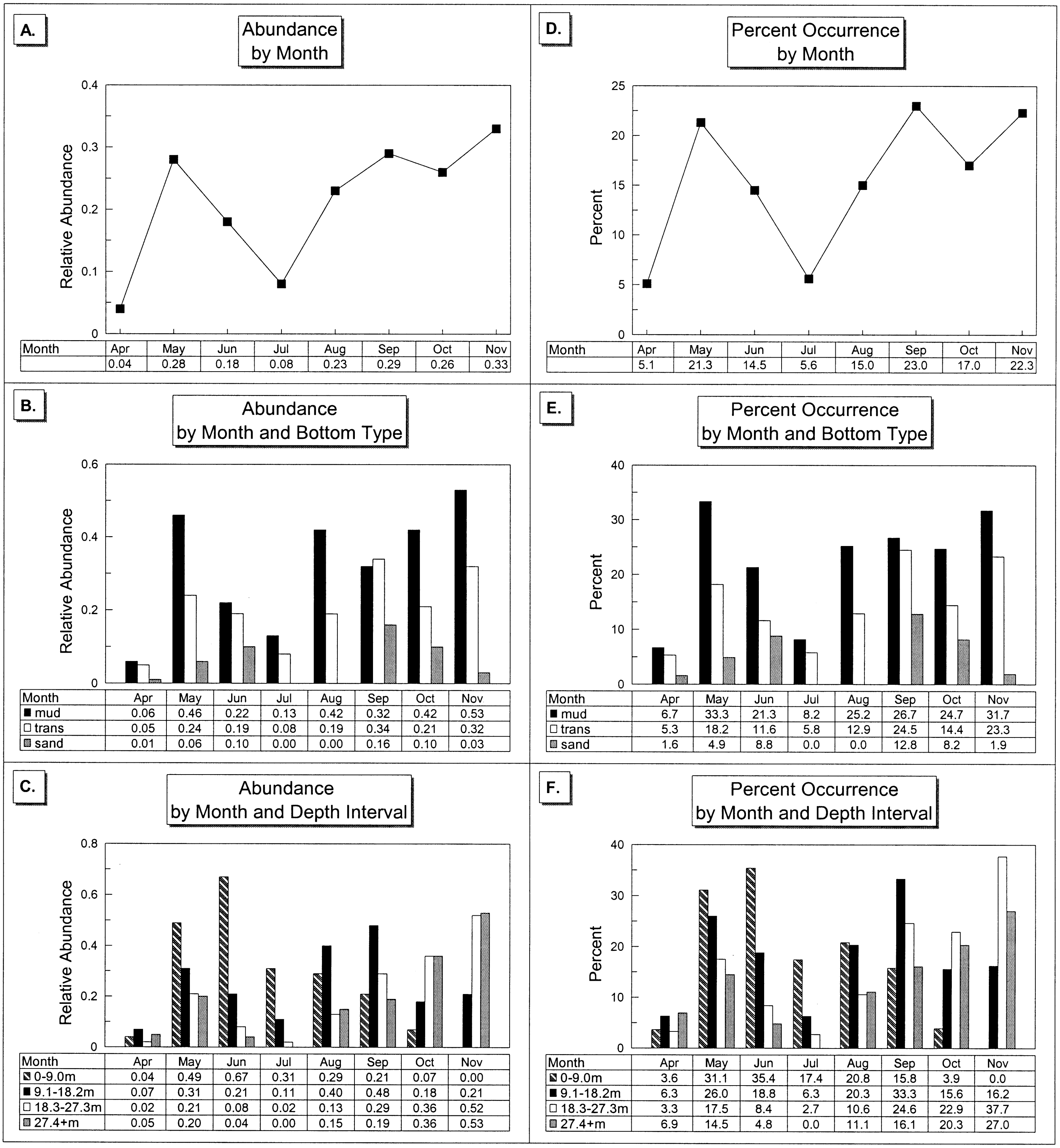
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.07	0.06	0.00	0.00	0.02	0.10	0.00
■ 9.1-18.2m	0.00	0.09	0.02	0.05	0.00	0.00	0.06	0.06
□ 18.3-27.3m	0.00	0.01	0.00	0.07	0.01	0.01	0.02	0.02
▨ 27.4+m	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.01

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	4.1	6.2	0.0	0.0	2.6	7.8	0.0
■ 9.1-18.2m	0.0	3.8	2.1	3.1	0.0	0.0	5.5	4.4
□ 18.3-27.3m	0.0	0.8	0.0	4.0	1.2	0.8	1.5	2.6
▨ 27.4+m	0.0	0.0	1.0	0.0	1.4	0.0	0.0	1.4

Figure IN-17

Hickory shad (*Alosa mediocris*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.04	0.28	0.18	0.08	0.23	0.29	0.26	0.33

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	5.1	21.3	14.5	5.6	15.0	23.0	17.0	22.3

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.06	0.46	0.22	0.13	0.42	0.32	0.42	0.53
□ trans	0.05	0.24	0.19	0.08	0.19	0.34	0.21	0.32
▨ sand	0.01	0.06	0.10	0.00	0.00	0.16	0.10	0.03

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	6.7	33.3	21.3	8.2	25.2	26.7	24.7	31.7
□ trans	5.3	18.2	11.6	5.8	12.9	24.5	14.4	23.3
▨ sand	1.6	4.9	8.8	0.0	0.0	12.8	8.2	1.9

C. Abundance by Month and Depth Interval

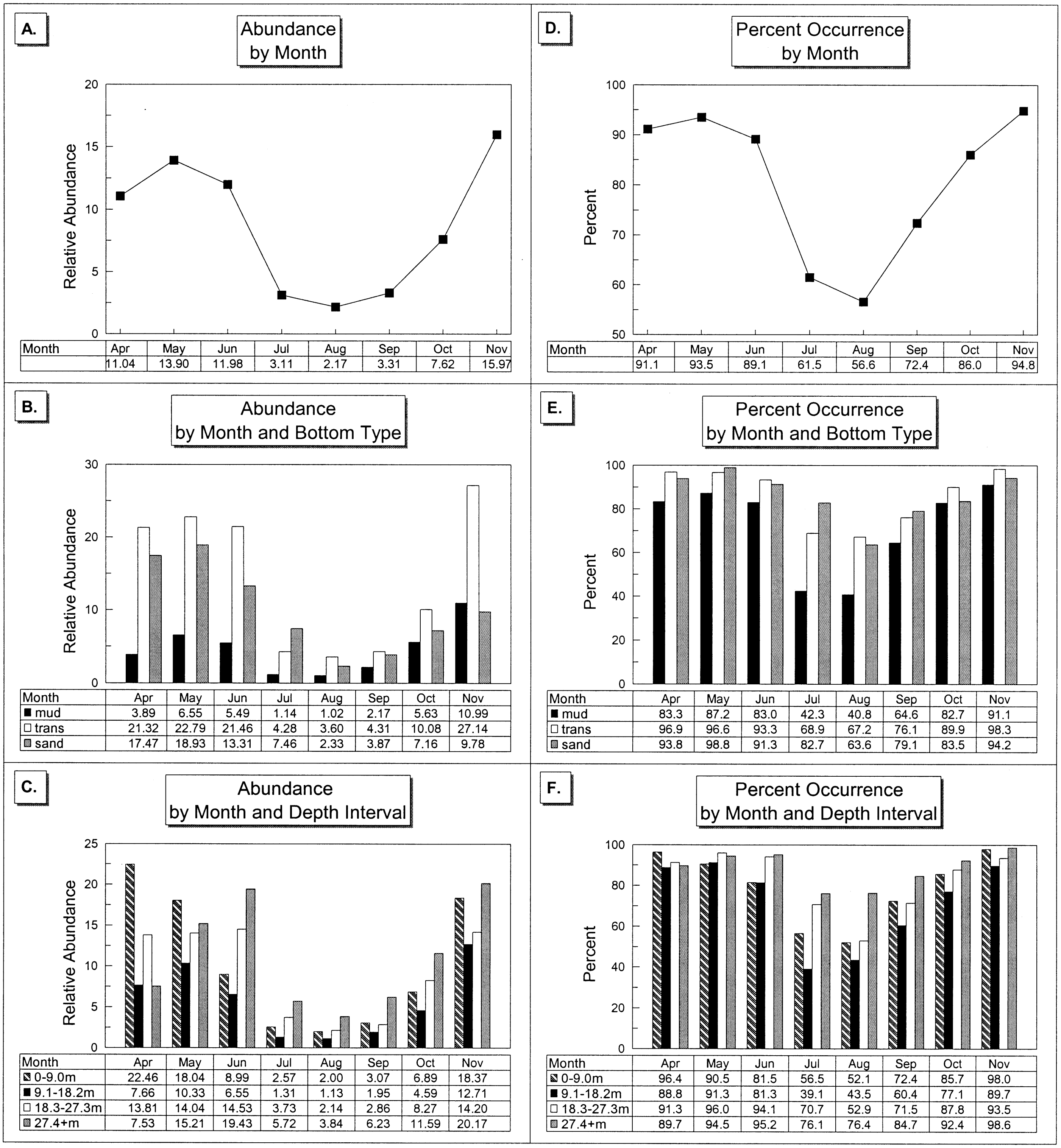
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.04	0.49	0.67	0.31	0.29	0.21	0.07	0.00
■ 9.1-18.2m	0.07	0.31	0.21	0.11	0.40	0.48	0.18	0.21
□ 18.3-27.3m	0.02	0.21	0.08	0.02	0.13	0.29	0.36	0.52
▨ 27.4+m	0.05	0.20	0.04	0.00	0.15	0.19	0.36	0.53

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	3.6	31.1	35.4	17.4	20.8	15.8	3.9	0.0
■ 9.1-18.2m	6.3	26.0	18.8	6.3	20.3	33.3	15.6	16.2
□ 18.3-27.3m	3.3	17.5	8.4	2.7	10.6	24.6	22.9	37.7
▨ 27.4+m	6.9	14.5	4.8	0.0	11.1	16.1	20.3	27.0

Figure IN-18

Hogchoker (*Trinectes maculatus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	11.04	13.90	11.98	3.11	2.17	3.31	7.62	15.97

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	91.1	93.5	89.1	61.5	56.6	72.4	86.0	94.8

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	3.89	6.55	5.49	1.14	1.02	2.17	5.63	10.99
□ trans	21.32	22.79	21.46	4.28	3.60	4.31	10.08	27.14
▨ sand	17.47	18.93	13.31	7.46	2.33	3.87	7.16	9.78

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	83.3	87.2	83.0	42.3	40.8	64.6	82.7	91.1
□ trans	96.9	96.6	93.3	68.9	67.2	76.1	89.9	98.3
▨ sand	93.8	98.8	91.3	82.7	63.6	79.1	83.5	94.2

C. Abundance by Month and Depth Interval

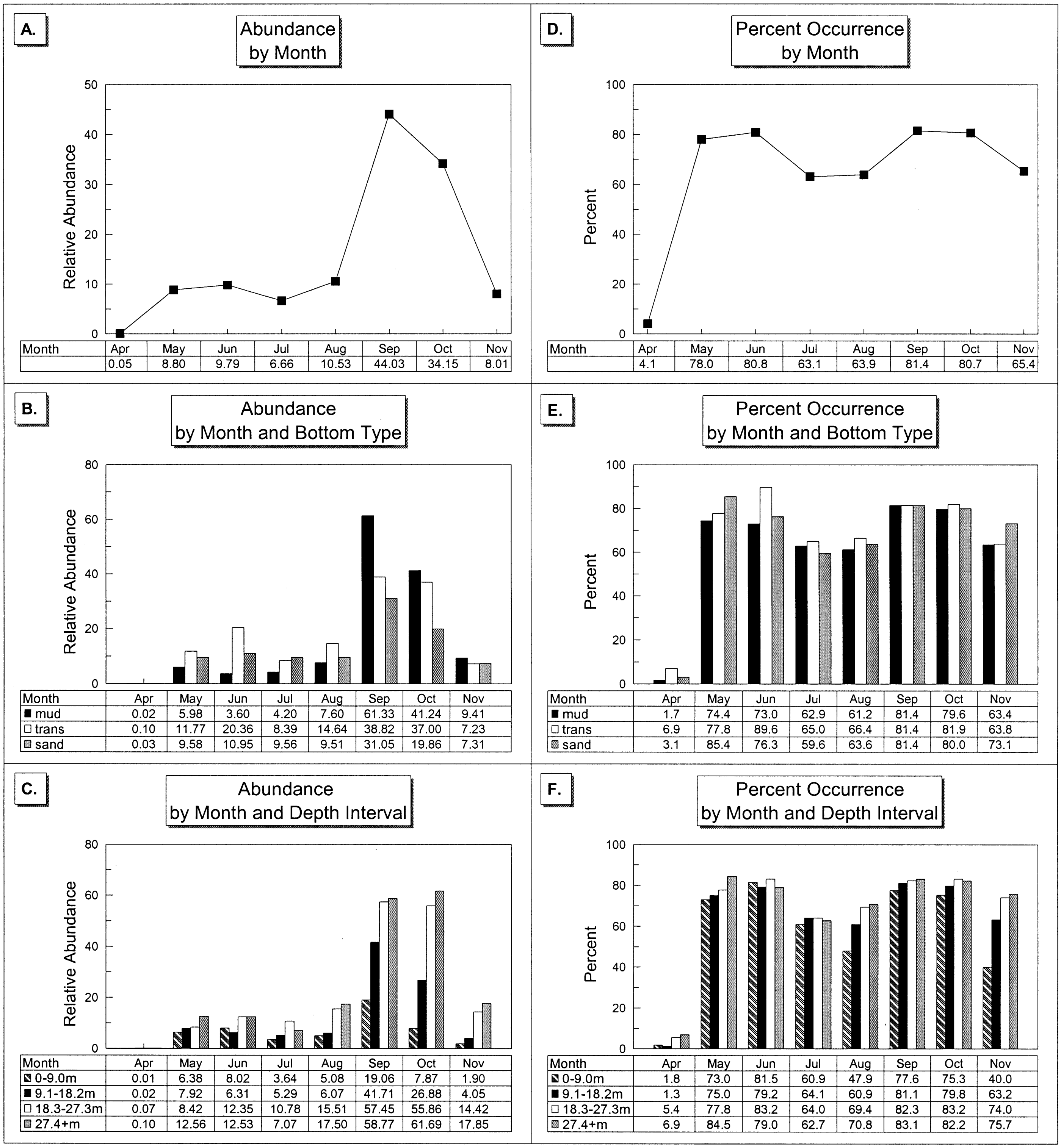
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	22.46	18.04	8.99	2.57	2.00	3.07	6.89	18.37
■ 9.1-18.2m	7.66	10.33	6.55	1.31	1.13	1.95	4.59	12.71
□ 18.3-27.3m	13.81	14.04	14.53	3.73	2.14	2.86	8.27	14.20
▨ 27.4+m	7.53	15.21	19.43	5.72	3.84	6.23	11.59	20.17

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	96.4	90.5	81.5	56.5	52.1	72.4	85.7	98.0
■ 9.1-18.2m	88.8	91.3	81.3	39.1	43.5	60.4	77.1	89.7
□ 18.3-27.3m	91.3	96.0	94.1	70.7	52.9	71.5	87.8	93.5
▨ 27.4+m	89.7	94.5	95.2	76.1	76.4	84.7	92.4	98.6

Figure IN-19

Little skate (*Raja erinacea*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.05	8.80	9.79	6.66	10.53	44.03	34.15	8.01

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	4.1	78.0	80.8	63.1	63.9	81.4	80.7	65.4

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.02	5.98	3.60	4.20	7.60	61.33	41.24	9.41
□ trans	0.10	11.77	20.36	8.39	14.64	38.82	37.00	7.23
▩ sand	0.03	9.58	10.95	9.56	9.51	31.05	19.86	7.31

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	1.7	74.4	73.0	62.9	61.2	81.4	79.6	63.4
□ trans	6.9	77.8	89.6	65.0	66.4	81.4	81.9	63.8
▩ sand	3.1	85.4	76.3	59.6	63.6	81.4	80.0	73.1

C. Abundance by Month and Depth Interval

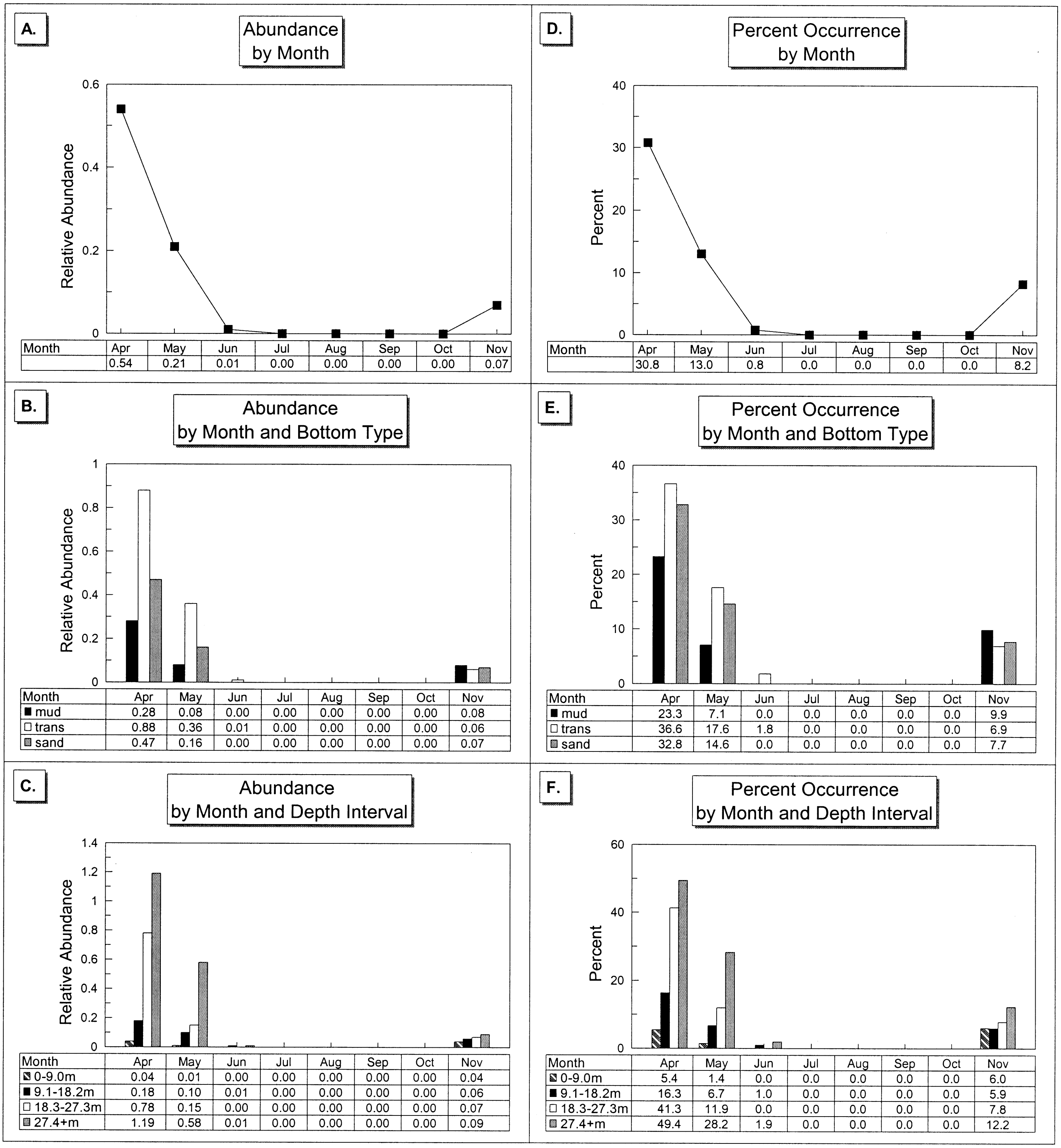
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.01	6.38	8.02	3.64	5.08	19.06	7.87	1.90
■ 9.1-18.2m	0.02	7.92	6.31	5.29	6.07	41.71	26.88	4.05
□ 18.3-27.3m	0.07	8.42	12.35	10.78	15.51	57.45	55.86	14.42
▩ 27.4+m	0.10	12.56	12.53	7.07	17.50	58.77	61.69	17.85

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	1.8	73.0	81.5	60.9	47.9	77.6	75.3	40.0
■ 9.1-18.2m	1.3	75.0	79.2	64.1	60.9	81.1	79.8	63.2
□ 18.3-27.3m	5.4	77.8	83.2	64.0	69.4	82.3	83.2	74.0
▩ 27.4+m	6.9	84.5	79.0	62.7	70.8	83.1	82.2	75.7

Figure IN-20

Long-finned squid (*Loligo pealei*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.54	0.21	0.01	0.00	0.00	0.00	0.00	0.07

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	30.8	13.0	0.8	0.0	0.0	0.0	0.0	8.2

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.28	0.08	0.00	0.00	0.00	0.00	0.00	0.08
□ trans	0.88	0.36	0.01	0.00	0.00	0.00	0.00	0.06
▩ sand	0.47	0.16	0.00	0.00	0.00	0.00	0.00	0.07

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	23.3	7.1	0.0	0.0	0.0	0.0	0.0	9.9
□ trans	36.6	17.6	1.8	0.0	0.0	0.0	0.0	6.9
▩ sand	32.8	14.6	0.0	0.0	0.0	0.0	0.0	7.7

C.

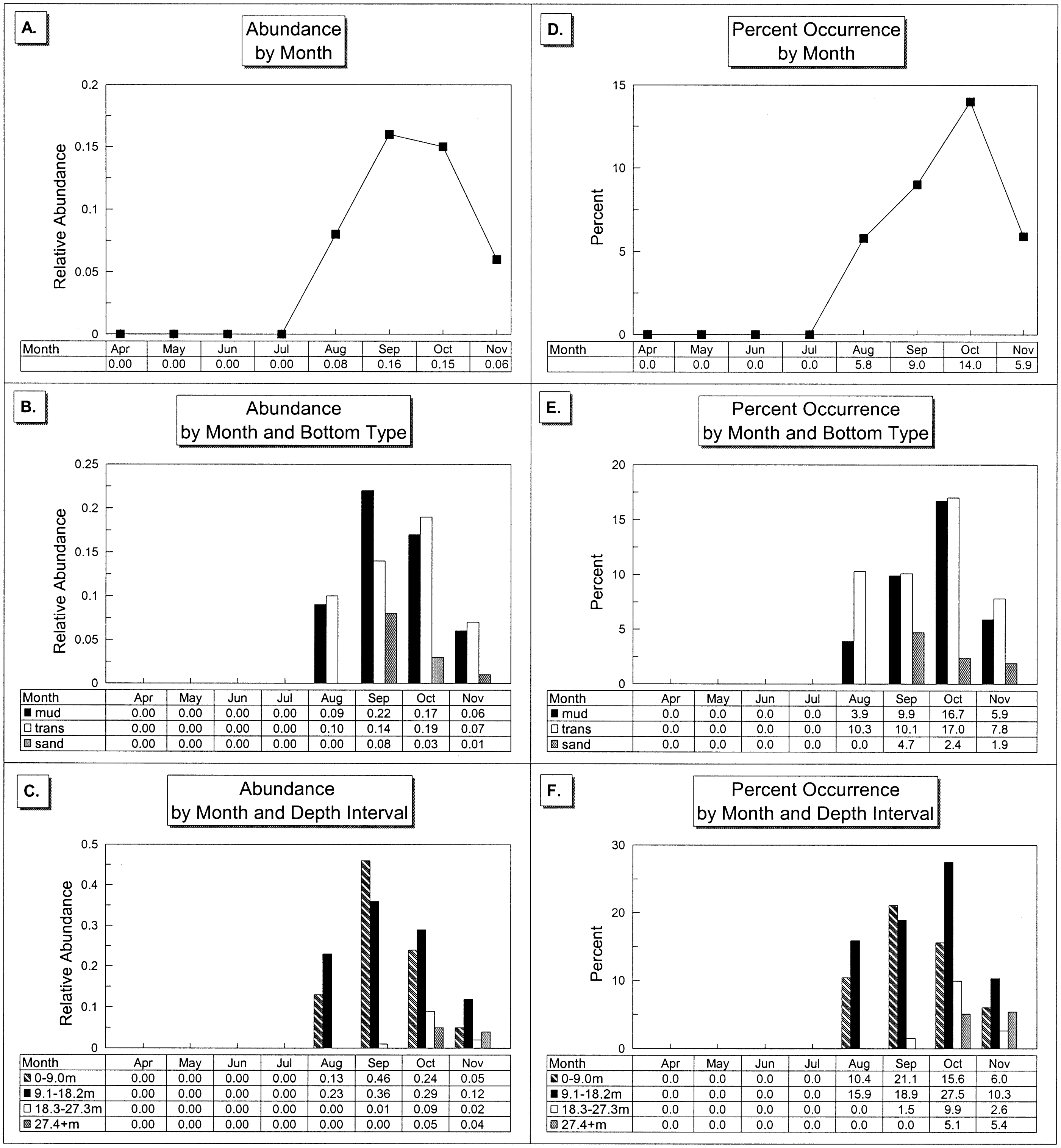
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.04
■ 9.1-18.2m	0.18	0.10	0.01	0.00	0.00	0.00	0.00	0.06
□ 18.3-27.3m	0.78	0.15	0.00	0.00	0.00	0.00	0.00	0.07
▩ 27.4+m	1.19	0.58	0.01	0.00	0.00	0.00	0.00	0.09

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	5.4	1.4	0.0	0.0	0.0	0.0	0.0	6.0
■ 9.1-18.2m	16.3	6.7	1.0	0.0	0.0	0.0	0.0	5.9
□ 18.3-27.3m	41.3	11.9	0.0	0.0	0.0	0.0	0.0	7.8
▩ 27.4+m	49.4	28.2	1.9	0.0	0.0	0.0	0.0	12.2

Figure IN-21

Longhorn sculpin (*Myoxocephalus octodecemspinosus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.00	0.00	0.00	0.08	0.16	0.15	0.06

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	0.0	0.0	0.0	5.8	9.0	14.0	5.9

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.00	0.00	0.00	0.09	0.22	0.17	0.06
□ trans	0.00	0.00	0.00	0.00	0.10	0.14	0.19	0.07
▩ sand	0.00	0.00	0.00	0.00	0.00	0.08	0.03	0.01

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	0.0	0.0	0.0	3.9	9.9	16.7	5.9
□ trans	0.0	0.0	0.0	0.0	10.3	10.1	17.0	7.8
▩ sand	0.0	0.0	0.0	0.0	0.0	4.7	2.4	1.9

C.

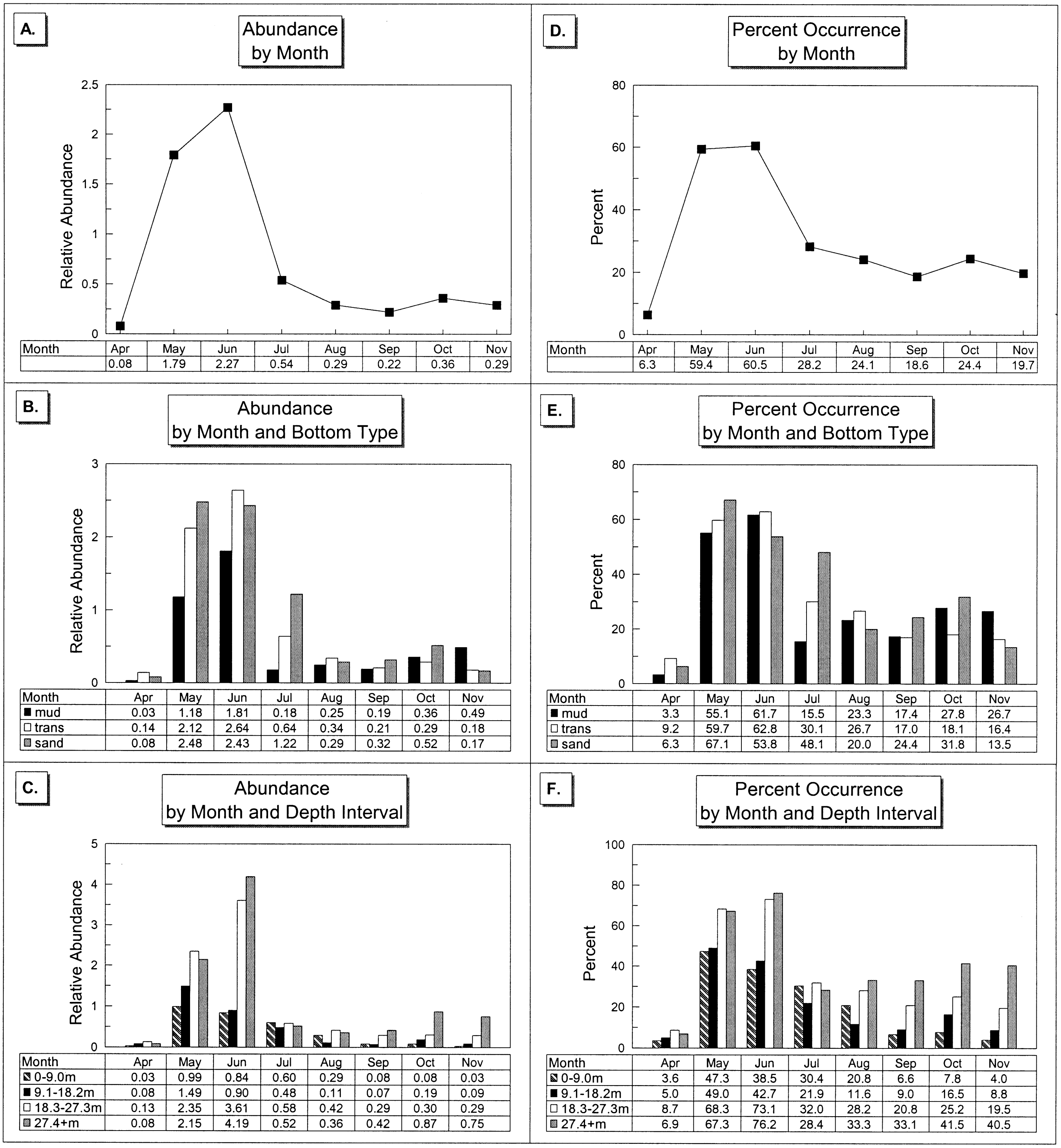
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.00	0.00	0.00	0.13	0.46	0.24	0.05
■ 9.1-18.2m	0.00	0.00	0.00	0.00	0.23	0.36	0.29	0.12
□ 18.3-27.3m	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.02
▩ 27.4+m	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.04

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	0.0	0.0	0.0	10.4	21.1	15.6	6.0
■ 9.1-18.2m	0.0	0.0	0.0	0.0	15.9	18.9	27.5	10.3
□ 18.3-27.3m	0.0	0.0	0.0	0.0	0.0	1.5	9.9	2.6
▩ 27.4+m	0.0	0.0	0.0	0.0	0.0	0.0	5.1	5.4

Figure IN-22

Moonfish (*Selene setapinnis*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.08	1.79	2.27	0.54	0.29	0.22	0.36	0.29

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	6.3	59.4	60.5	28.2	24.1	18.6	24.4	19.7

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.03	1.18	1.81	0.18	0.25	0.19	0.36	0.49
□ trans	0.14	2.12	2.64	0.64	0.34	0.21	0.29	0.18
▨ sand	0.08	2.48	2.43	1.22	0.29	0.32	0.52	0.17

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	3.3	55.1	61.7	15.5	23.3	17.4	27.8	26.7
□ trans	9.2	59.7	62.8	30.1	26.7	17.0	18.1	16.4
▨ sand	6.3	67.1	53.8	48.1	20.0	24.4	31.8	13.5

C. Abundance by Month and Depth Interval

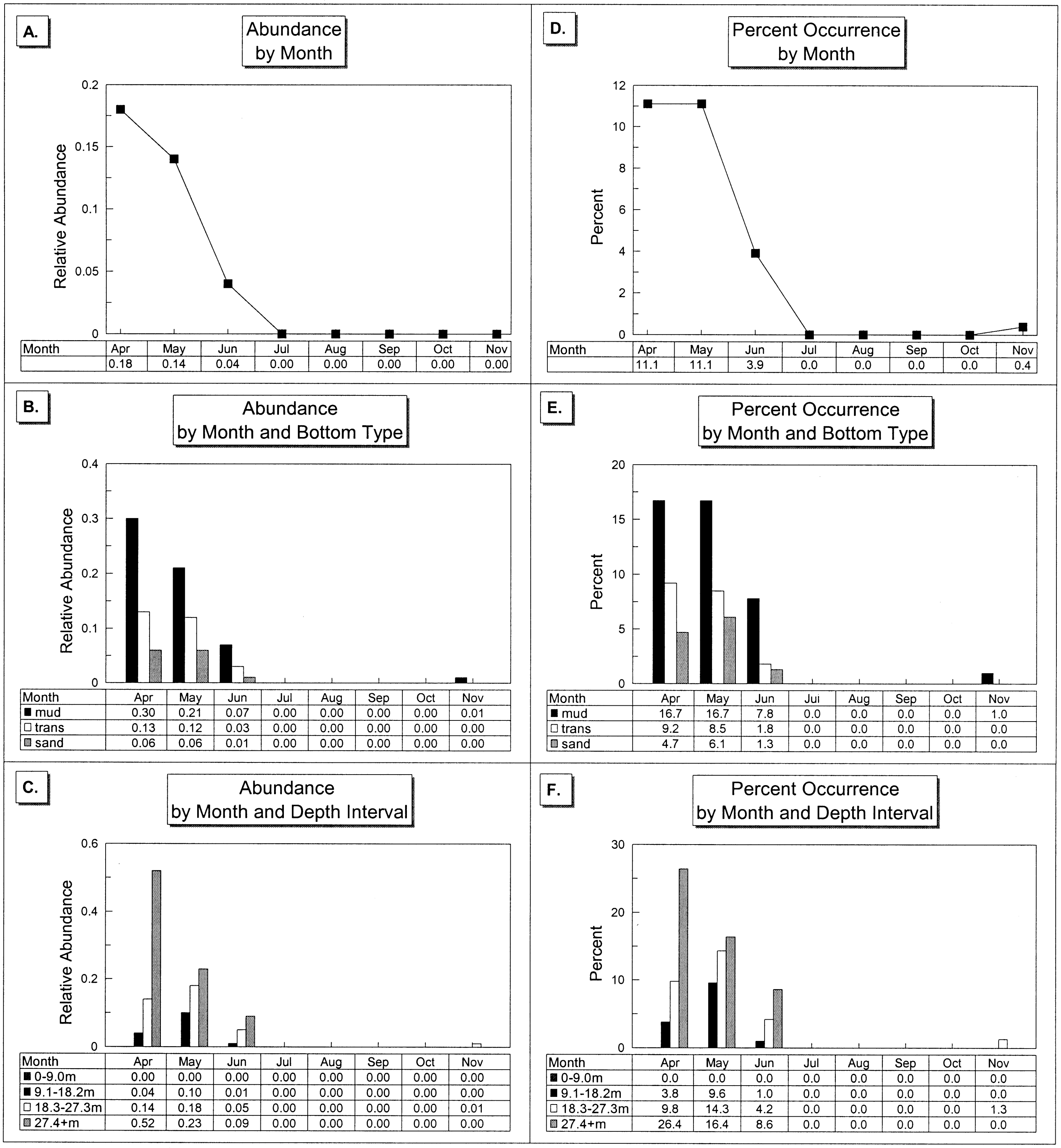
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.03	0.99	0.84	0.60	0.29	0.08	0.08	0.03
■ 9.1-18.2m	0.08	1.49	0.90	0.48	0.11	0.07	0.19	0.09
□ 18.3-27.3m	0.13	2.35	3.61	0.58	0.42	0.29	0.30	0.29
▨ 27.4+m	0.08	2.15	4.19	0.52	0.36	0.42	0.87	0.75

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	3.6	47.3	38.5	30.4	20.8	6.6	7.8	4.0
■ 9.1-18.2m	5.0	49.0	42.7	21.9	11.6	9.0	16.5	8.8
□ 18.3-27.3m	8.7	68.3	73.1	32.0	28.2	20.8	25.2	19.5
▨ 27.4+m	6.9	67.3	76.2	28.4	33.3	33.1	41.5	40.5

Figure IN-23

Northern searobin (*Prionotus carolinus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.18	0.14	0.04	0.00	0.00	0.00	0.00	0.00

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	11.1	11.1	3.9	0.0	0.0	0.0	0.0	0.4

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.30	0.21	0.07	0.00	0.00	0.00	0.00	0.01
□ trans	0.13	0.12	0.03	0.00	0.00	0.00	0.00	0.00
▨ sand	0.06	0.06	0.01	0.00	0.00	0.00	0.00	0.00

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	16.7	16.7	7.8	0.0	0.0	0.0	0.0	1.0
□ trans	9.2	8.5	1.8	0.0	0.0	0.0	0.0	0.0
▨ sand	4.7	6.1	1.3	0.0	0.0	0.0	0.0	0.0

C.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ 0-9.0m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
■ 9.1-18.2m	0.04	0.10	0.01	0.00	0.00	0.00	0.00	0.00
□ 18.3-27.3m	0.14	0.18	0.05	0.00	0.00	0.00	0.00	0.01
▨ 27.4+m	0.52	0.23	0.09	0.00	0.00	0.00	0.00	0.00

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ 0-9.0m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
■ 9.1-18.2m	3.8	9.6	1.0	0.0	0.0	0.0	0.0	0.0
□ 18.3-27.3m	9.8	14.3	4.2	0.0	0.0	0.0	0.0	1.3
▨ 27.4+m	26.4	16.4	8.6	0.0	0.0	0.0	0.0	0.0

Figure IN-24

Ocean pout (*Macrozoarces americanus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

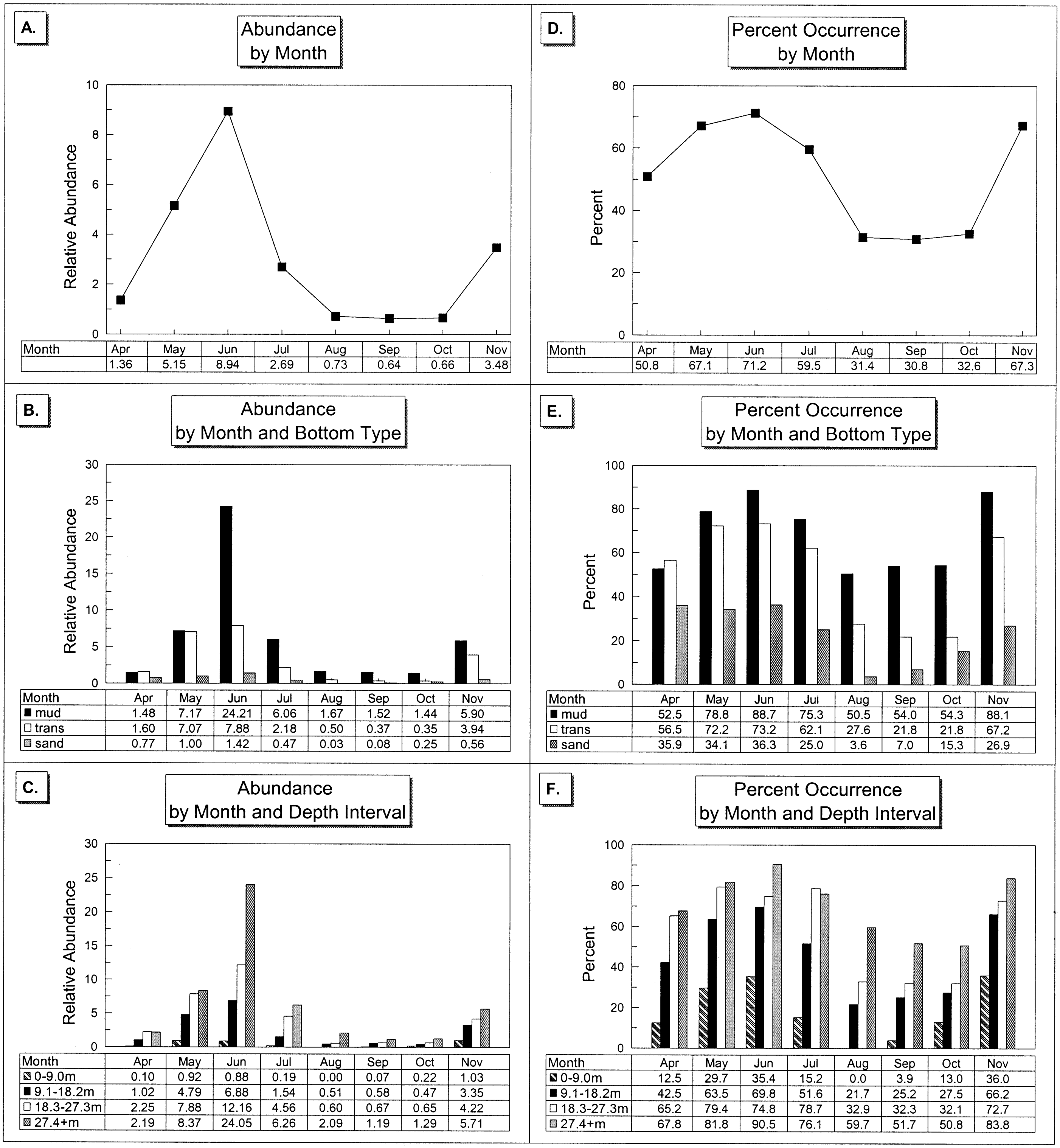
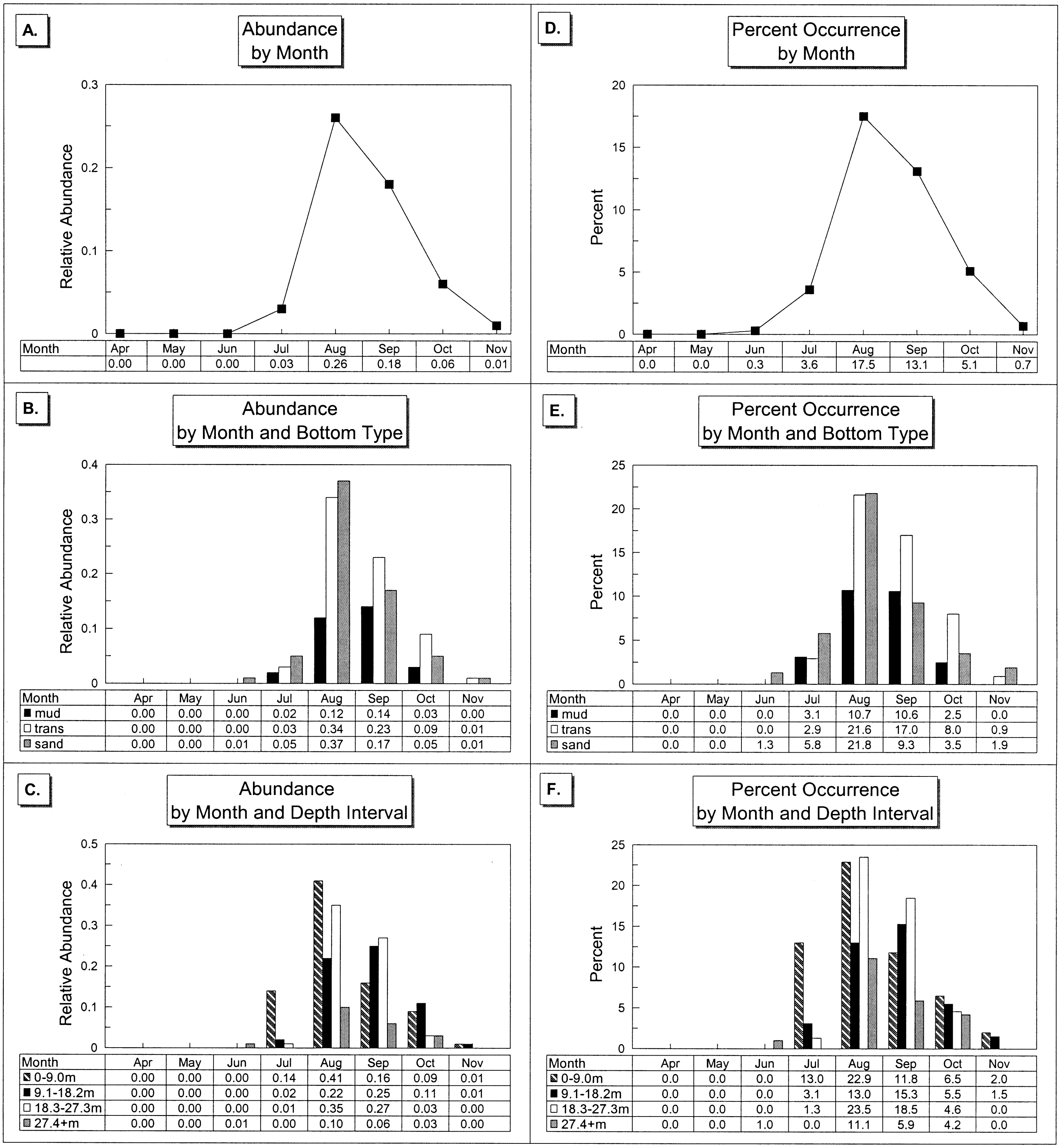


Figure IN-25

Red hake (*Urophycis chuss*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.00	0.00	0.03	0.26	0.18	0.06	0.01

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	0.0	0.3	3.6	17.5	13.1	5.1	0.7

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.00	0.00	0.02	0.12	0.14	0.03	0.00
□ trans	0.00	0.00	0.00	0.03	0.34	0.23	0.09	0.01
▩ sand	0.00	0.00	0.01	0.05	0.37	0.17	0.05	0.01

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	0.0	0.0	3.1	10.7	10.6	2.5	0.0
□ trans	0.0	0.0	0.0	2.9	21.6	17.0	8.0	0.9
▩ sand	0.0	0.0	1.3	5.8	21.8	9.3	3.5	1.9

C. Abundance by Month and Depth Interval

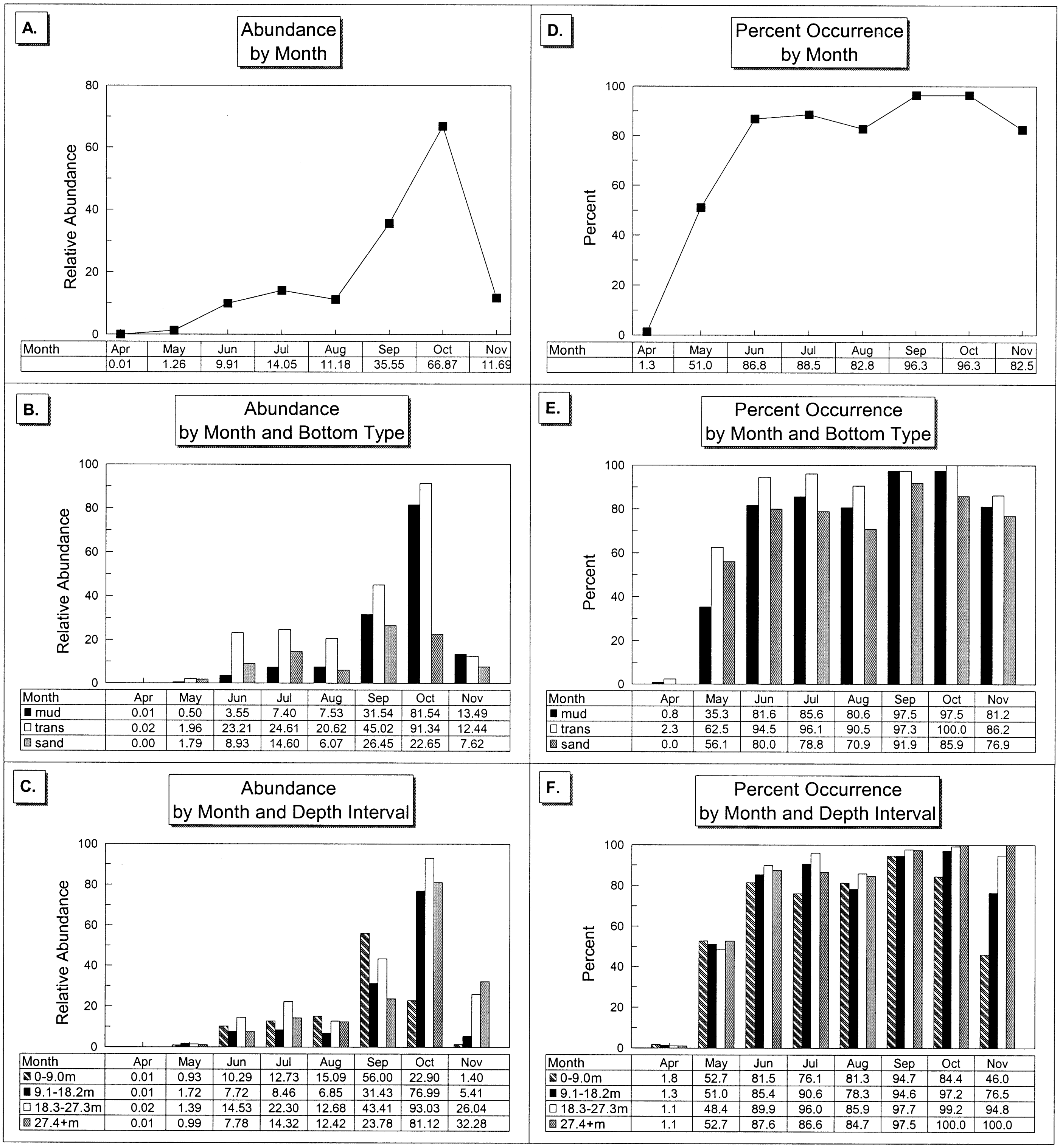
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.00	0.00	0.14	0.41	0.16	0.09	0.01
■ 9.1-18.2m	0.00	0.00	0.00	0.02	0.22	0.25	0.11	0.01
□ 18.3-27.3m	0.00	0.00	0.00	0.01	0.35	0.27	0.03	0.00
▩ 27.4+m	0.00	0.00	0.01	0.00	0.10	0.06	0.03	0.00

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	0.0	0.0	13.0	22.9	11.8	6.5	2.0
■ 9.1-18.2m	0.0	0.0	0.0	3.1	13.0	15.3	5.5	1.5
□ 18.3-27.3m	0.0	0.0	0.0	1.3	23.5	18.5	4.6	0.0
▩ 27.4+m	0.0	0.0	1.0	0.0	11.1	5.9	4.2	0.0

Figure IN-26

Rough scad (*Trachurus lathami*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.01	1.26	9.91	14.05	11.18	35.55	66.87	11.69

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.01	0.50	3.55	7.40	7.53	31.54	81.54	13.49
□ trans	0.02	1.96	23.21	24.61	20.62	45.02	91.34	12.44
▩ sand	0.00	1.79	8.93	14.60	6.07	26.45	22.65	7.62

C.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.01	0.93	10.29	12.73	15.09	56.00	22.90	1.40
■ 9.1-18.2m	0.01	1.72	7.72	8.46	6.85	31.43	76.99	5.41
□ 18.3-27.3m	0.02	1.39	14.53	22.30	12.68	43.41	93.03	26.04
▩ 27.4+m	0.01	0.99	7.78	14.32	12.42	23.78	81.12	32.28

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	1.3	51.0	86.8	88.5	82.8	96.3	96.3	82.5

E.

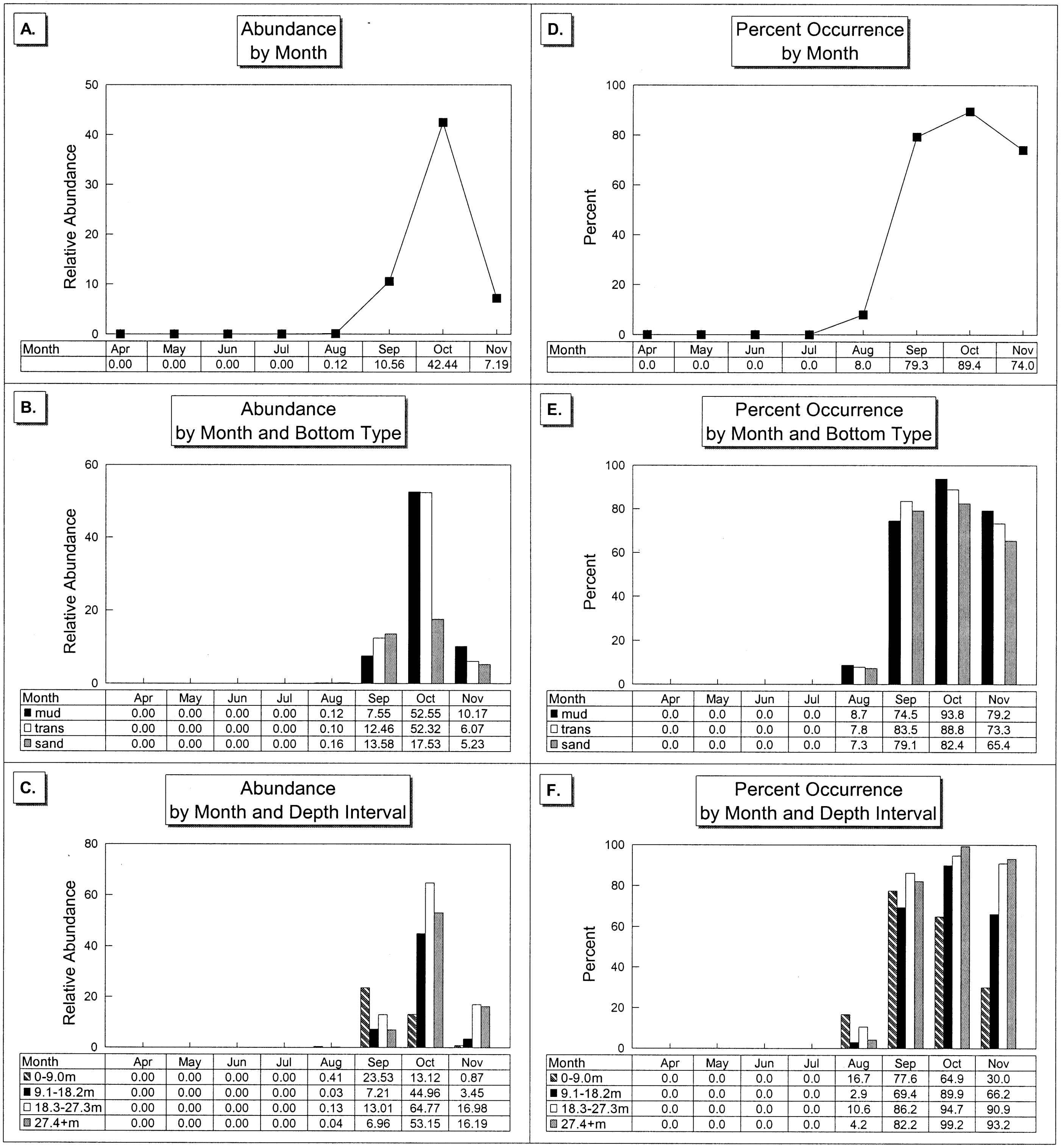
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.8	35.3	81.6	85.6	80.6	97.5	97.5	81.2
□ trans	2.3	62.5	94.5	96.1	90.5	97.3	100.0	86.2
▩ sand	0.0	56.1	80.0	78.8	70.9	91.9	85.9	76.9

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	1.8	52.7	81.5	76.1	81.3	94.7	84.4	46.0
■ 9.1-18.2m	1.3	51.0	85.4	90.6	78.3	94.6	97.2	76.5
□ 18.3-27.3m	1.1	48.4	89.9	96.0	85.9	97.7	99.2	94.8
▩ 27.4+m	1.1	52.7	87.6	86.6	84.7	97.5	100.0	100.0

Figure IN-27

Scup (*Stenotomus chrysops*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.00	0.00	0.00	0.12	10.56	42.44	7.19

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	0.0	0.0	0.0	8.0	79.3	89.4	74.0

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.00	0.00	0.00	0.12	7.55	52.55	10.17
□ trans	0.00	0.00	0.00	0.00	0.10	12.46	52.32	6.07
▨ sand	0.00	0.00	0.00	0.00	0.16	13.58	17.53	5.23

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	0.0	0.0	0.0	8.7	74.5	93.8	79.2
□ trans	0.0	0.0	0.0	0.0	7.8	83.5	88.8	73.3
▨ sand	0.0	0.0	0.0	0.0	7.3	79.1	82.4	65.4

C.

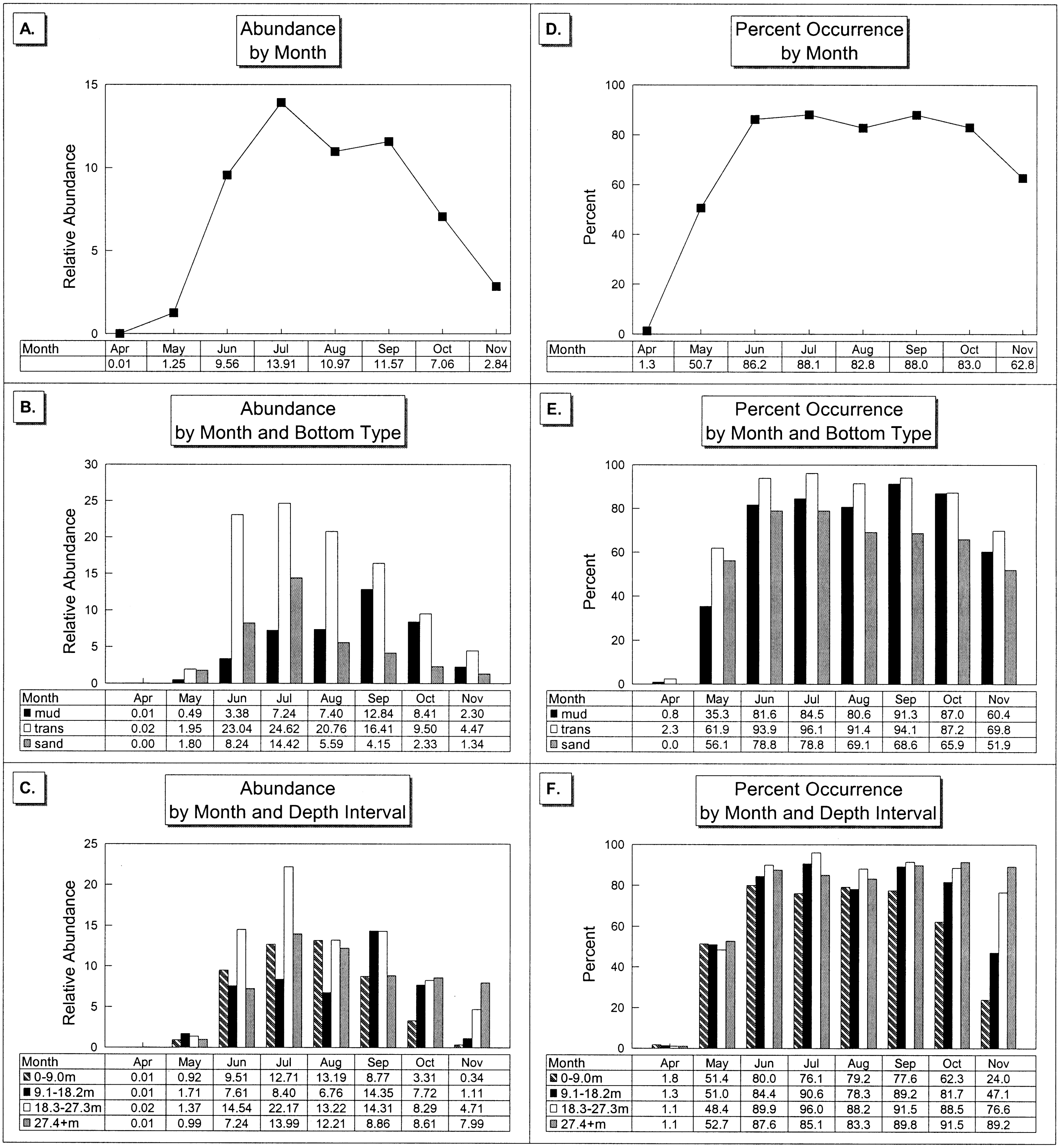
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.00	0.00	0.00	0.41	23.53	13.12	0.87
■ 9.1-18.2m	0.00	0.00	0.00	0.00	0.03	7.21	44.96	3.45
□ 18.3-27.3m	0.00	0.00	0.00	0.00	0.13	13.01	64.77	16.98
▨ 27.4+m	0.00	0.00	0.00	0.00	0.04	6.96	53.15	16.19

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	0.0	0.0	0.0	16.7	77.6	64.9	30.0
■ 9.1-18.2m	0.0	0.0	0.0	0.0	2.9	69.4	89.9	66.2
□ 18.3-27.3m	0.0	0.0	0.0	0.0	10.6	86.2	94.7	90.9
▨ 27.4+m	0.0	0.0	0.0	0.0	4.2	82.2	99.2	93.2

Figure IN-28

Scup (*Stenotomus chrysops*), young-of-year. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.01	1.25	9.56	13.91	10.97	11.57	7.06	2.84

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.01	0.49	3.38	7.24	7.40	12.84	8.41	2.30
□ trans	0.02	1.95	23.04	24.62	20.76	16.41	9.50	4.47
▨ sand	0.00	1.80	8.24	14.42	5.59	4.15	2.33	1.34

C. Abundance by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.01	0.92	9.51	12.71	13.19	8.77	3.31	0.34
■ 9.1-18.2m	0.01	1.71	7.61	8.40	6.76	14.35	7.72	1.11
□ 18.3-27.3m	0.02	1.37	14.54	22.17	13.22	14.31	8.29	4.71
▨ 27.4+m	0.01	0.99	7.24	13.99	12.21	8.86	8.61	7.99

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	1.3	50.7	86.2	88.1	82.8	88.0	83.0	62.8

E. Percent Occurrence by Month and Bottom Type

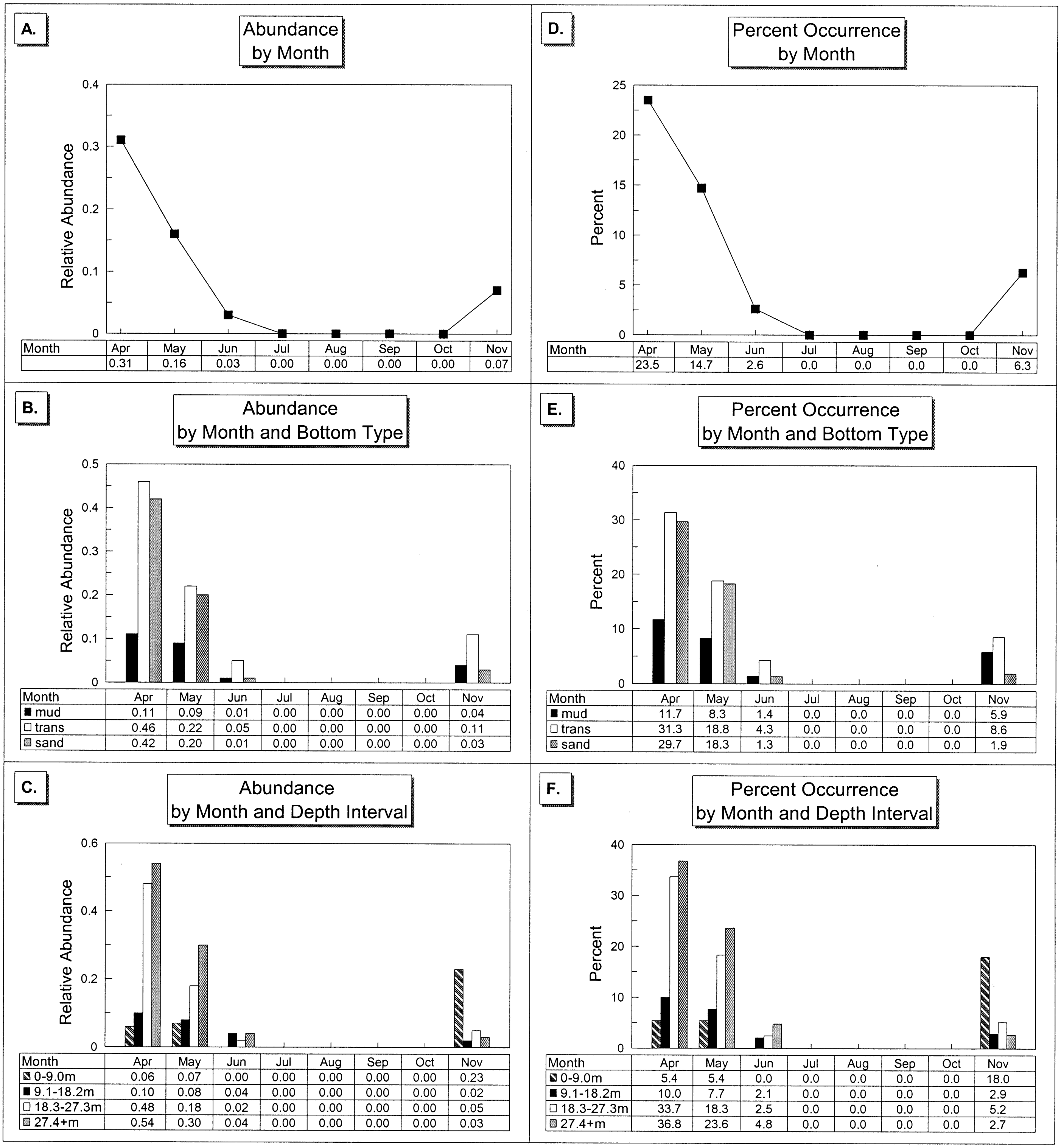
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.8	35.3	81.6	84.5	80.6	91.3	87.0	60.4
□ trans	2.3	61.9	93.9	96.1	91.4	94.1	87.2	69.8
▨ sand	0.0	56.1	78.8	78.8	69.1	68.6	65.9	51.9

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	1.8	51.4	80.0	76.1	79.2	77.6	62.3	24.0
■ 9.1-18.2m	1.3	51.0	84.4	90.6	78.3	89.2	81.7	47.1
□ 18.3-27.3m	1.1	48.4	89.9	96.0	88.2	91.5	88.5	76.6
▨ 27.4+m	1.1	52.7	87.6	85.1	83.3	89.8	91.5	89.2

Figure IN-29

Scup (*Stenotomus chrysops*), ages 1+. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.31	0.16	0.03	0.00	0.00	0.00	0.00	0.07

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	23.5	14.7	2.6	0.0	0.0	0.0	0.0	6.3

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
mud	0.11	0.09	0.01	0.00	0.00	0.00	0.00	0.04
trans	0.46	0.22	0.05	0.00	0.00	0.00	0.00	0.11
sand	0.42	0.20	0.01	0.00	0.00	0.00	0.00	0.03

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
mud	11.7	8.3	1.4	0.0	0.0	0.0	0.0	5.9
trans	31.3	18.8	4.3	0.0	0.0	0.0	0.0	8.6
sand	29.7	18.3	1.3	0.0	0.0	0.0	0.0	1.9

C. Abundance by Month and Depth Interval

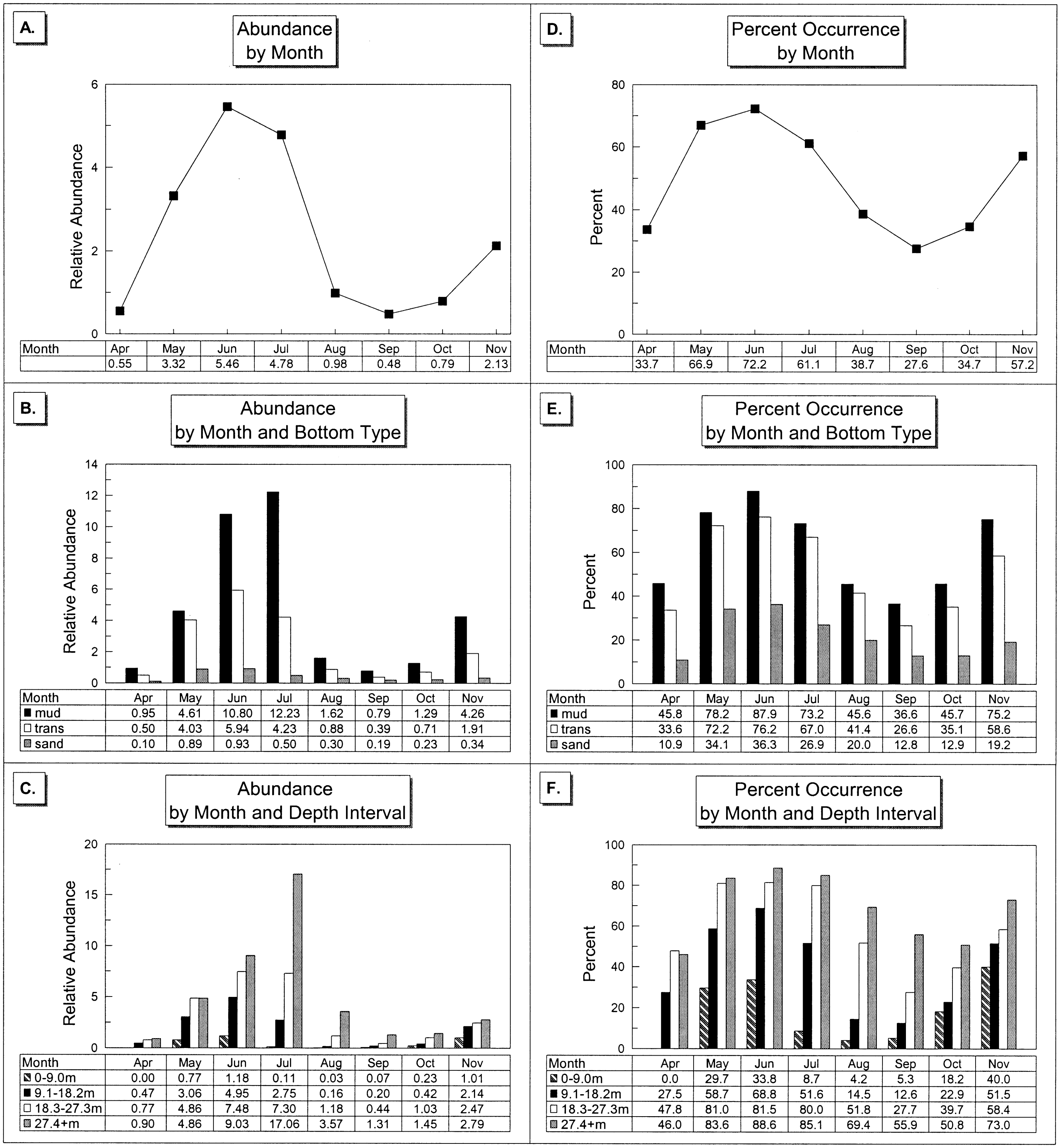
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
0-9.0m	0.06	0.07	0.00	0.00	0.00	0.00	0.00	0.23
9.1-18.2m	0.10	0.08	0.04	0.00	0.00	0.00	0.00	0.02
18.3-27.3m	0.48	0.18	0.02	0.00	0.00	0.00	0.00	0.05
27.4+m	0.54	0.30	0.04	0.00	0.00	0.00	0.00	0.03

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
0-9.0m	5.4	5.4	0.0	0.0	0.0	0.0	0.0	18.0
9.1-18.2m	10.0	7.7	2.1	0.0	0.0	0.0	0.0	2.9
18.3-27.3m	33.7	18.3	2.5	0.0	0.0	0.0	0.0	5.2
27.4+m	36.8	23.6	4.8	0.0	0.0	0.0	0.0	2.7

Figure IN-30

Sea raven (*Hemitripterus americanus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.55	3.32	5.46	4.78	0.98	0.48	0.79	2.13

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.95	4.61	10.80	12.23	1.62	0.79	1.29	4.26
□ trans	0.50	4.03	5.94	4.23	0.88	0.39	0.71	1.91
▩ sand	0.10	0.89	0.93	0.50	0.30	0.19	0.23	0.34

C. Abundance by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.77	1.18	0.11	0.03	0.07	0.23	1.01
■ 9.1-18.2m	0.47	3.06	4.95	2.75	0.16	0.20	0.42	2.14
□ 18.3-27.3m	0.77	4.86	7.48	7.30	1.18	0.44	1.03	2.47
▩ 27.4+m	0.90	4.86	9.03	17.06	3.57	1.31	1.45	2.79

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	33.7	66.9	72.2	61.1	38.7	27.6	34.7	57.2

E. Percent Occurrence by Month and Bottom Type

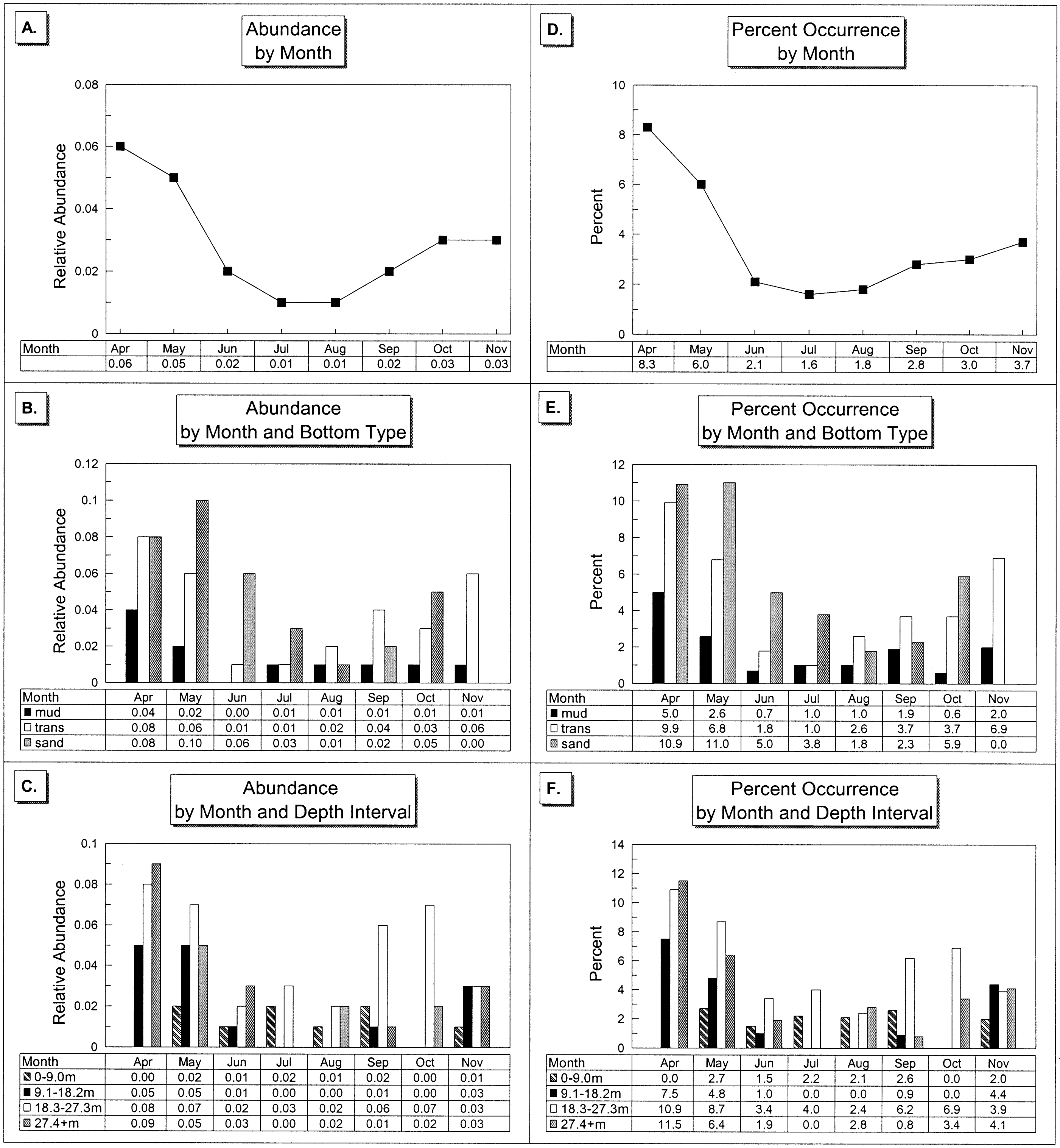
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	45.8	78.2	87.9	73.2	45.6	36.6	45.7	75.2
□ trans	33.6	72.2	76.2	67.0	41.4	26.6	35.1	58.6
▩ sand	10.9	34.1	36.3	26.9	20.0	12.8	12.9	19.2

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	29.7	33.8	8.7	4.2	5.3	18.2	40.0
■ 9.1-18.2m	27.5	58.7	68.8	51.6	14.5	12.6	22.9	51.5
□ 18.3-27.3m	47.8	81.0	81.5	80.0	51.8	27.7	39.7	58.4
▩ 27.4+m	46.0	83.6	88.6	85.1	69.4	55.9	50.8	73.0

Figure IN-31

Silver hake (*Merluccius bilinearis*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.06	0.05	0.02	0.01	0.01	0.02	0.03	0.03

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	8.3	6.0	2.1	1.6	1.8	2.8	3.0	3.7

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.04	0.02	0.00	0.01	0.01	0.01	0.01	0.01
□ trans	0.08	0.06	0.01	0.01	0.02	0.04	0.03	0.06
▩ sand	0.08	0.10	0.06	0.03	0.01	0.02	0.05	0.00

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	5.0	2.6	0.7	1.0	1.0	1.9	0.6	2.0
□ trans	9.9	6.8	1.8	1.0	2.6	3.7	3.7	6.9
▩ sand	10.9	11.0	5.0	3.8	1.8	2.3	5.9	0.0

C. Abundance by Month and Depth Interval

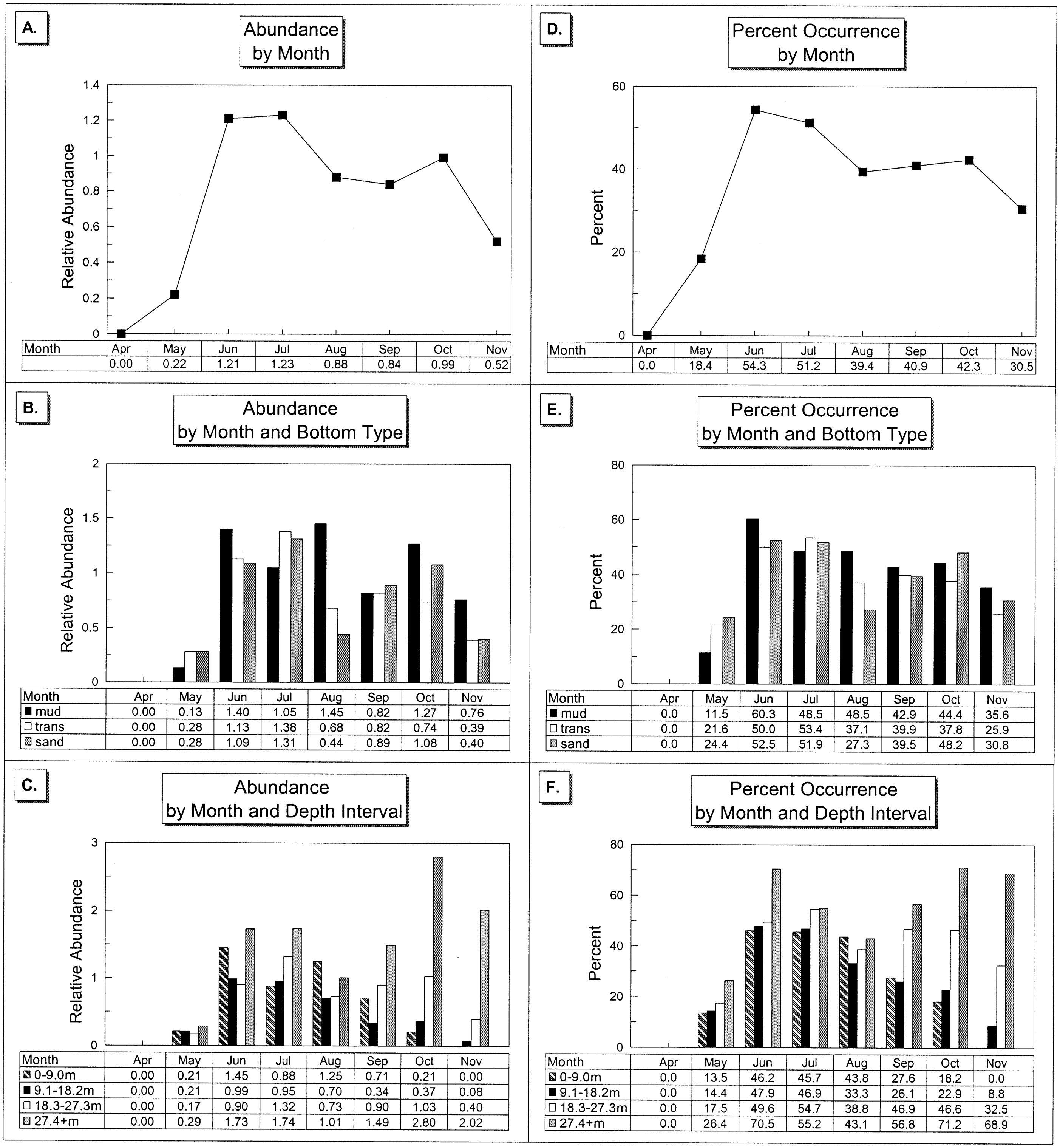
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.02	0.01	0.02	0.01	0.02	0.00	0.01
■ 9.1-18.2m	0.05	0.05	0.01	0.00	0.00	0.01	0.00	0.03
□ 18.3-27.3m	0.08	0.07	0.02	0.03	0.02	0.06	0.07	0.03
▩ 27.4+m	0.09	0.05	0.03	0.00	0.02	0.01	0.02	0.03

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	2.7	1.5	2.2	2.1	2.6	0.0	2.0
■ 9.1-18.2m	7.5	4.8	1.0	0.0	0.0	0.9	0.0	4.4
□ 18.3-27.3m	10.9	8.7	3.4	4.0	2.4	6.2	6.9	3.9
▩ 27.4+m	11.5	6.4	1.9	0.0	2.8	0.8	3.4	4.1

Figure IN-32

Smallmouth flounder (*Etropus microstomus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.22	1.21	1.23	0.88	0.84	0.99	0.52

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	18.4	54.3	51.2	39.4	40.9	42.3	30.5

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.13	1.40	1.05	1.45	0.82	1.27	0.76
□ trans	0.00	0.28	1.13	1.38	0.68	0.82	0.74	0.39
▨ sand	0.00	0.28	1.09	1.31	0.44	0.89	1.08	0.40

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	11.5	60.3	48.5	48.5	42.9	44.4	35.6
□ trans	0.0	21.6	50.0	53.4	37.1	39.9	37.8	25.9
▨ sand	0.0	24.4	52.5	51.9	27.3	39.5	48.2	30.8

C. Abundance by Month and Depth Interval

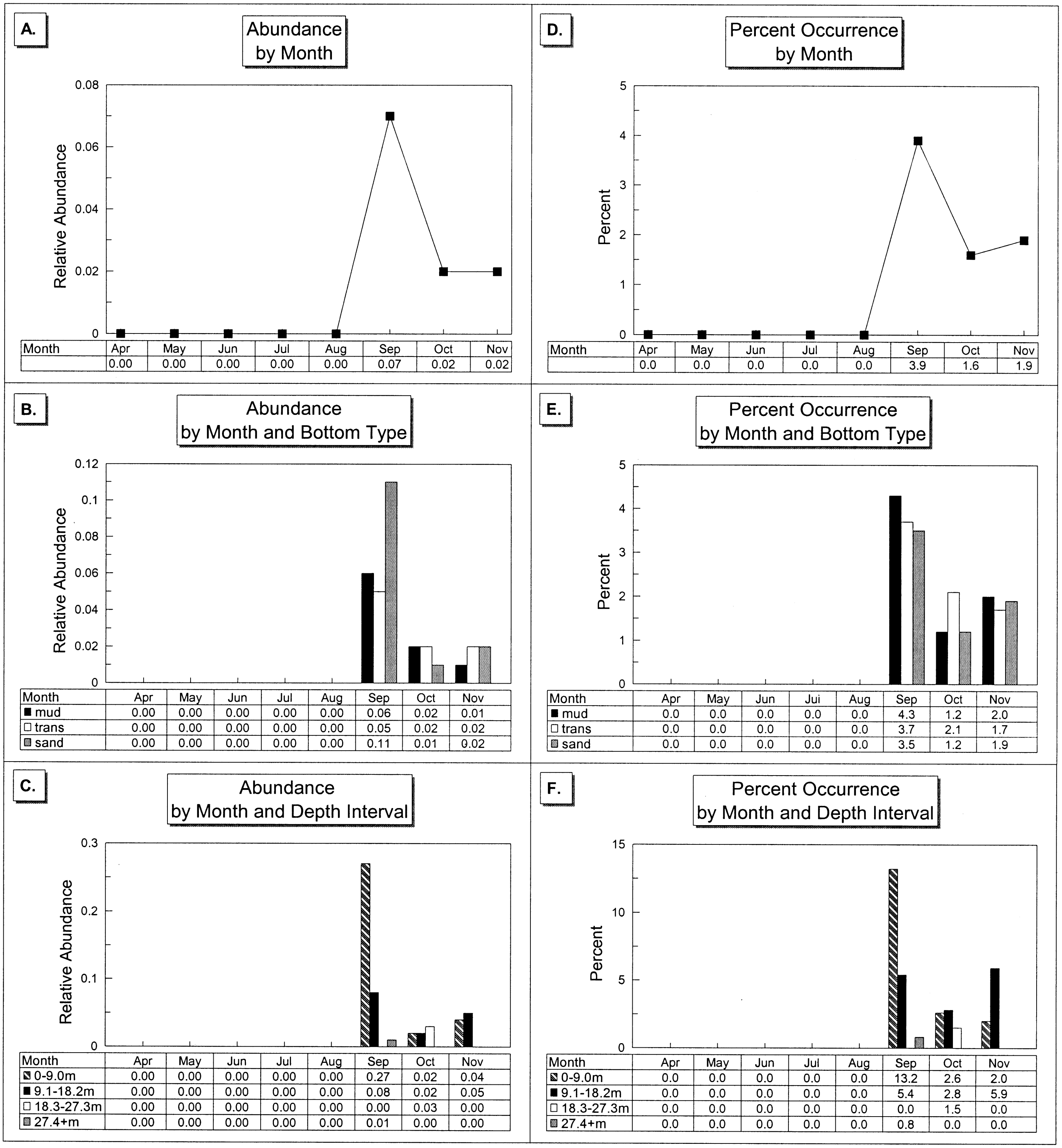
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.21	1.45	0.88	1.25	0.71	0.21	0.00
■ 9.1-18.2m	0.00	0.21	0.99	0.95	0.70	0.34	0.37	0.08
□ 18.3-27.3m	0.00	0.17	0.90	1.32	0.73	0.90	1.03	0.40
▨ 27.4+m	0.00	0.29	1.73	1.74	1.01	1.49	2.80	2.02

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	13.5	46.2	45.7	43.8	27.6	18.2	0.0
■ 9.1-18.2m	0.0	14.4	47.9	46.9	33.3	26.1	22.9	8.8
□ 18.3-27.3m	0.0	17.5	49.6	54.7	38.8	46.9	46.6	32.5
▨ 27.4+m	0.0	26.4	70.5	55.2	43.1	56.8	71.2	68.9

Figure IN-33

Smooth dogfish (*Mustelus canis*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.00	0.00	0.00	0.00	0.07	0.02	0.02

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	0.0	0.0	0.0	0.0	3.9	1.6	1.9

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.00	0.00	0.00	0.00	0.06	0.02	0.01
□ trans	0.00	0.00	0.00	0.00	0.00	0.05	0.02	0.02
▨ sand	0.00	0.00	0.00	0.00	0.00	0.11	0.01	0.02

E.

Month	Apr	May	Jun	Jui	Aug	Sep	Oct	Nov
■ mud	0.0	0.0	0.0	0.0	0.0	4.3	1.2	2.0
□ trans	0.0	0.0	0.0	0.0	0.0	3.7	2.1	1.7
▨ sand	0.0	0.0	0.0	0.0	0.0	3.5	1.2	1.9

C.

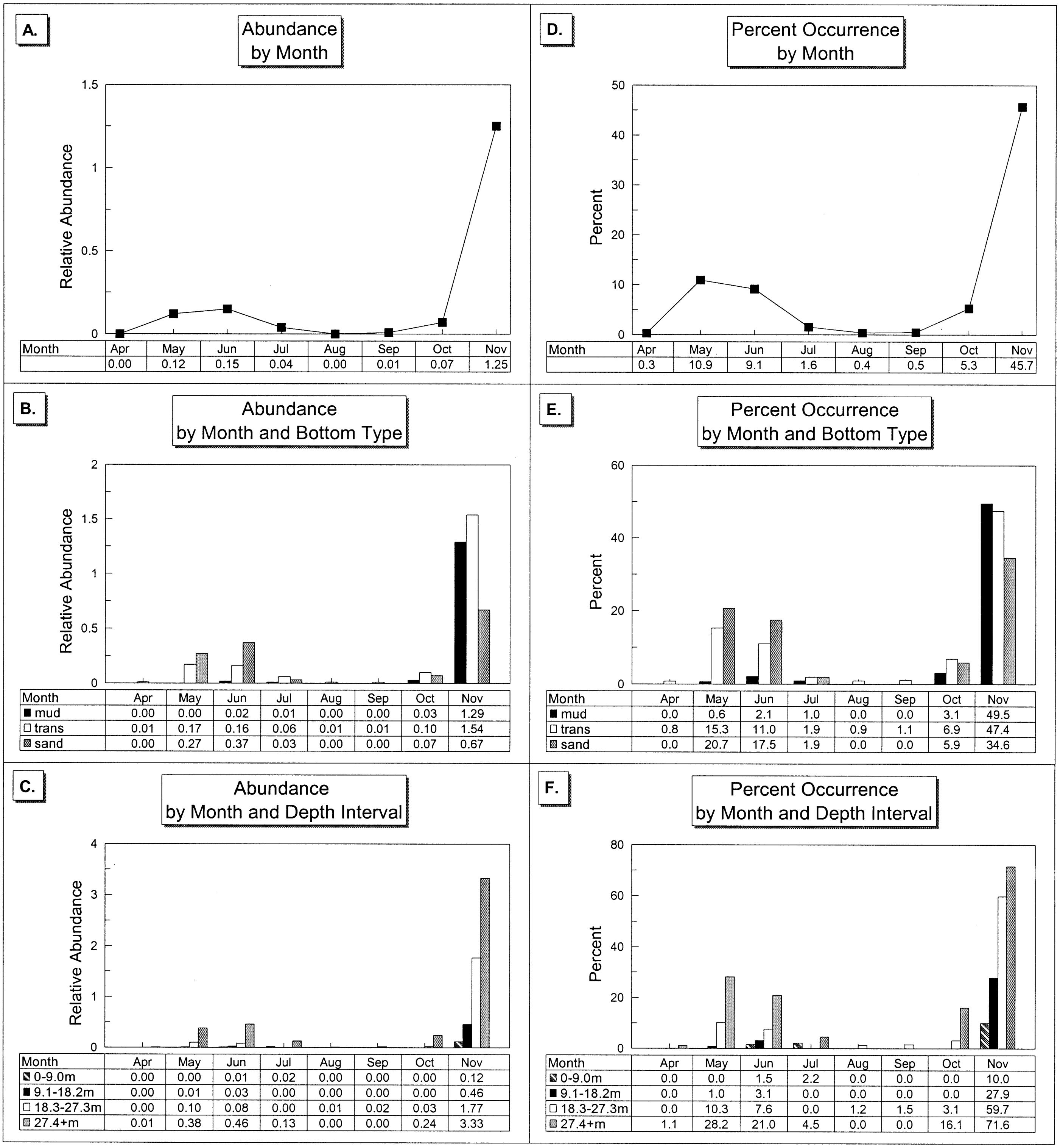
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.00	0.00	0.00	0.00	0.27	0.02	0.04
■ 9.1-18.2m	0.00	0.00	0.00	0.00	0.00	0.08	0.02	0.05
□ 18.3-27.3m	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
▨ 27.4+m	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	0.0	0.0	0.0	0.0	13.2	2.6	2.0
■ 9.1-18.2m	0.0	0.0	0.0	0.0	0.0	5.4	2.8	5.9
□ 18.3-27.3m	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0
▨ 27.4+m	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0

Figure IN-34

Spanish mackerel (*Scomberomorus maculatus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.12	0.15	0.04	0.00	0.01	0.07	1.25

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.3	10.9	9.1	1.6	0.4	0.5	5.3	45.7

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.00	0.02	0.01	0.00	0.00	0.03	1.29
□ trans	0.01	0.17	0.16	0.06	0.01	0.01	0.10	1.54
▩ sand	0.00	0.27	0.37	0.03	0.00	0.00	0.07	0.67

E.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	0.6	2.1	1.0	0.0	0.0	3.1	49.5
□ trans	0.8	15.3	11.0	1.9	0.9	1.1	6.9	47.4
▩ sand	0.0	20.7	17.5	1.9	0.0	0.0	5.9	34.6

C.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.12
■ 9.1-18.2m	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.46
□ 18.3-27.3m	0.00	0.10	0.08	0.00	0.01	0.02	0.03	1.77
▩ 27.4+m	0.01	0.38	0.46	0.13	0.00	0.00	0.24	3.33

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	0.0	1.5	2.2	0.0	0.0	0.0	10.0
■ 9.1-18.2m	0.0	1.0	3.1	0.0	0.0	0.0	0.0	27.9
□ 18.3-27.3m	0.0	10.3	7.6	0.0	1.2	1.5	3.1	59.7
▩ 27.4+m	1.1	28.2	21.0	4.5	0.0	0.0	16.1	71.6

Figure IN-35

Spiny dogfish (*Squalus acanthius*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

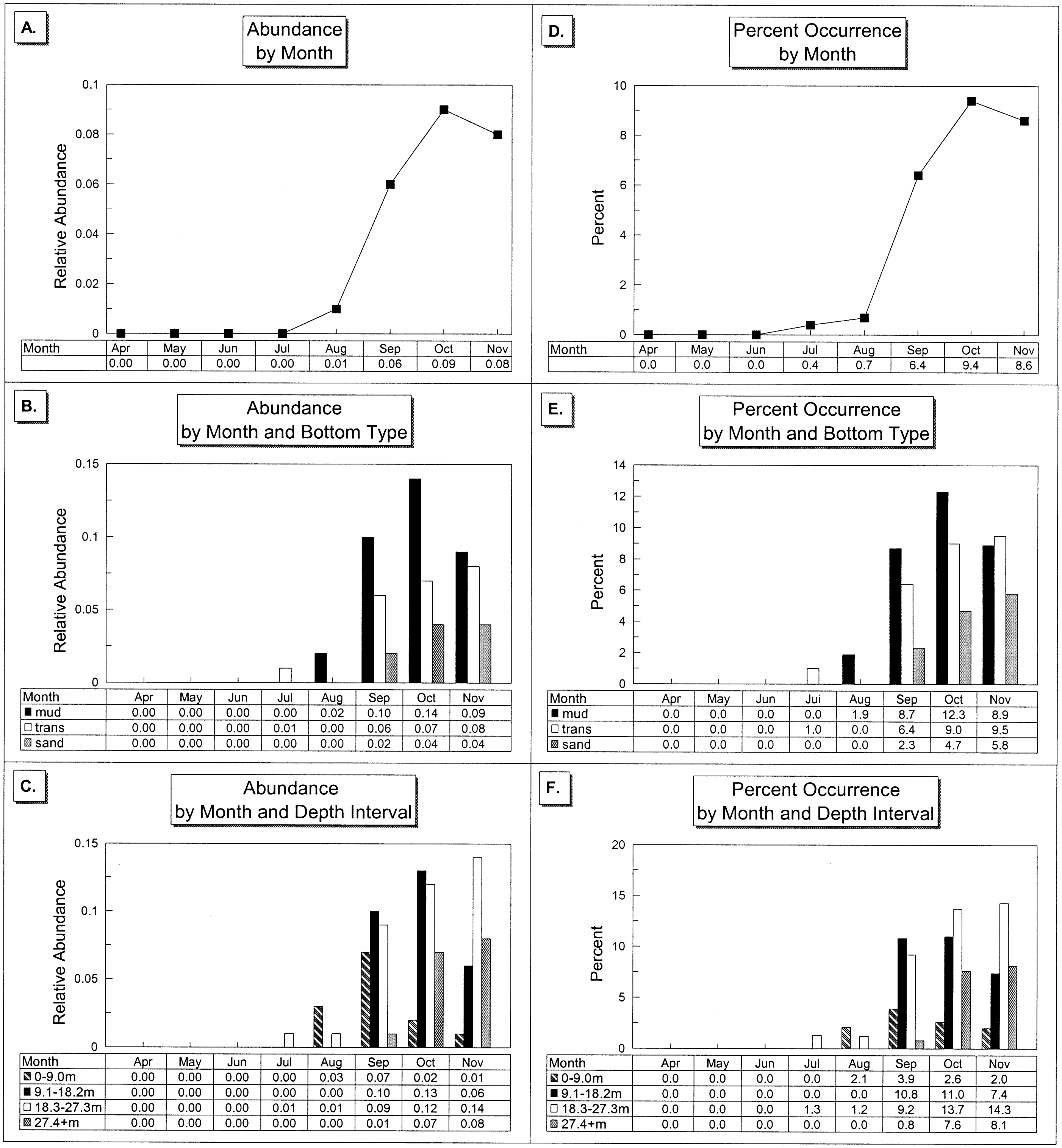
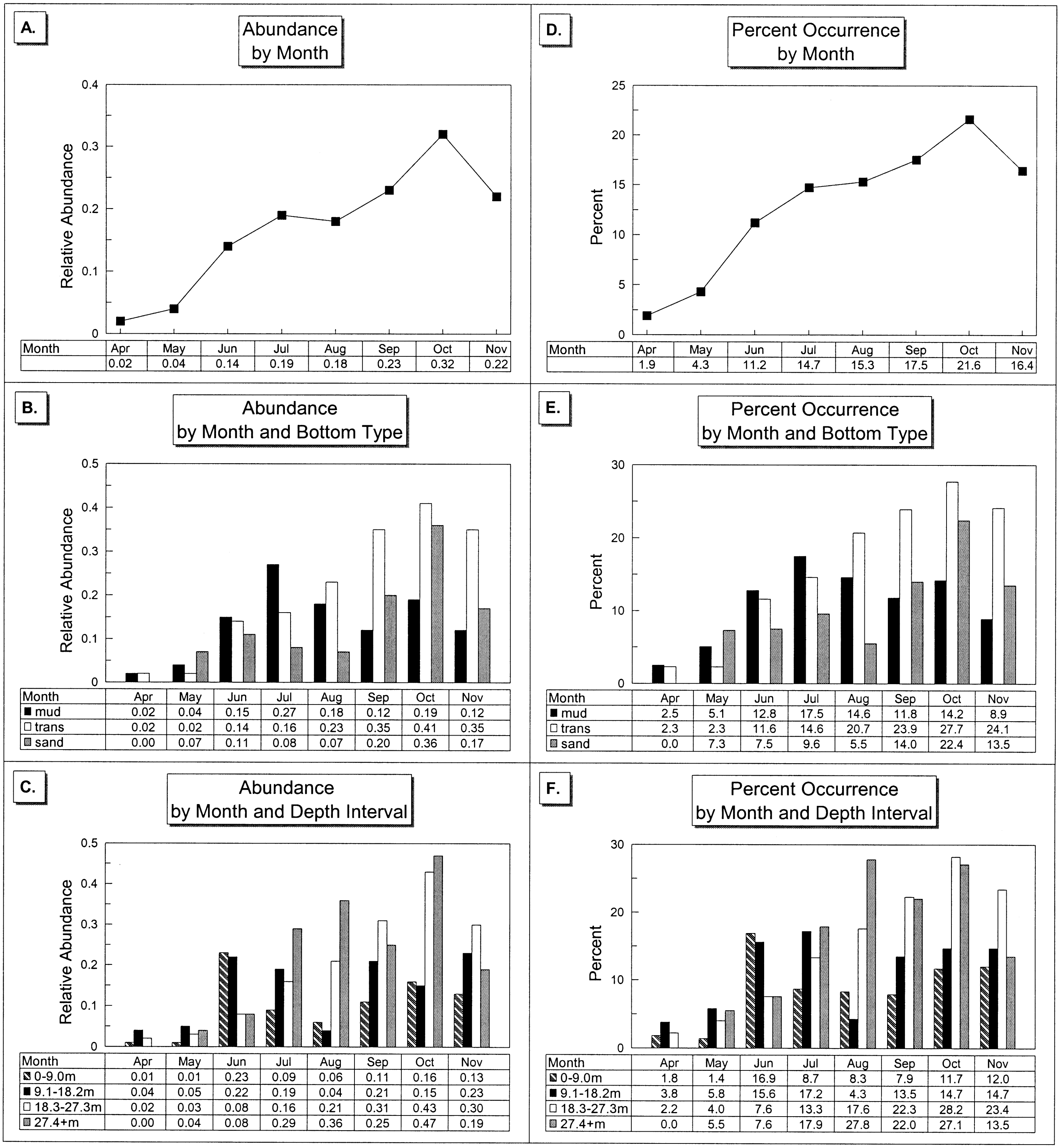


Figure IN-36

Spot (*Leiostomus xanthurus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.02	0.04	0.14	0.19	0.18	0.23	0.32	0.22

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	1.9	4.3	11.2	14.7	15.3	17.5	21.6	16.4

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.02	0.04	0.15	0.27	0.18	0.12	0.19	0.12
□ trans	0.02	0.02	0.14	0.16	0.23	0.35	0.41	0.35
▨ sand	0.00	0.07	0.11	0.08	0.07	0.20	0.36	0.17

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	2.5	5.1	12.8	17.5	14.6	11.8	14.2	8.9
□ trans	2.3	2.3	11.6	14.6	20.7	23.9	27.7	24.1
▨ sand	0.0	7.3	7.5	9.6	5.5	14.0	22.4	13.5

C. Abundance by Month and Depth Interval

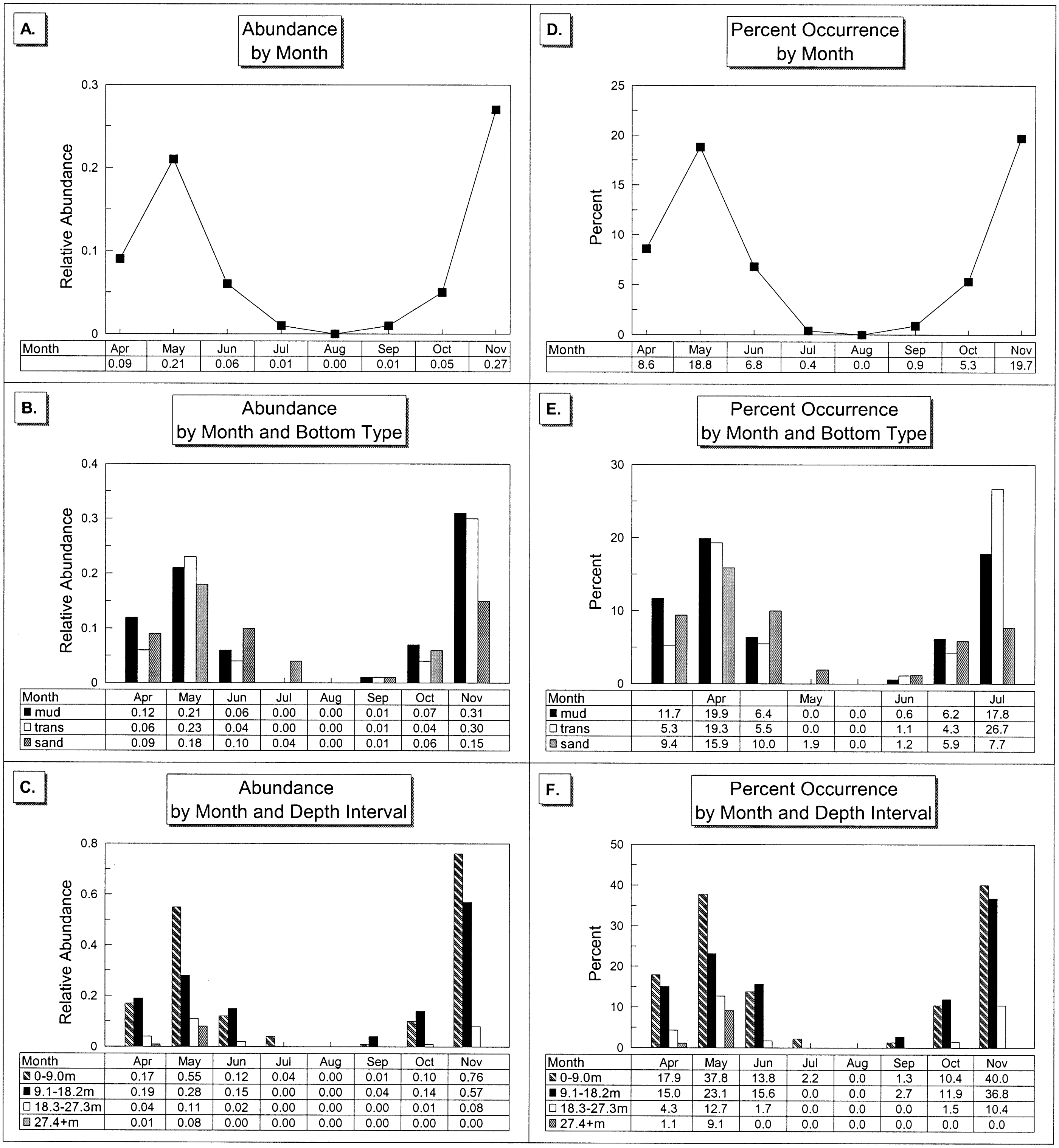
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.01	0.01	0.23	0.09	0.06	0.11	0.16	0.13
■ 9.1-18.2m	0.04	0.05	0.22	0.19	0.04	0.21	0.15	0.23
□ 18.3-27.3m	0.02	0.03	0.08	0.16	0.21	0.31	0.43	0.30
▨ 27.4+m	0.00	0.04	0.08	0.29	0.36	0.25	0.47	0.19

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	1.8	1.4	16.9	8.7	8.3	7.9	11.7	12.0
■ 9.1-18.2m	3.8	5.8	15.6	17.2	4.3	13.5	14.7	14.7
□ 18.3-27.3m	2.2	4.0	7.6	13.3	17.6	22.3	28.2	23.4
▨ 27.4+m	0.0	5.5	7.6	17.9	27.8	22.0	27.1	13.5

Figure IN-37

Spotted hake (*Urophycis regia*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.09	0.21	0.06	0.01	0.00	0.01	0.05	0.27

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	8.6	18.8	6.8	0.4	0.0	0.9	5.3	19.7

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.12	0.21	0.06	0.00	0.00	0.01	0.07	0.31
□ trans	0.06	0.23	0.04	0.00	0.00	0.01	0.04	0.30
▨ sand	0.09	0.18	0.10	0.04	0.00	0.01	0.06	0.15

E.

Month		Apr		May		Jun		Jul
■ mud	11.7	19.9	6.4	0.0	0.0	0.6	6.2	17.8
□ trans	5.3	19.3	5.5	0.0	0.0	1.1	4.3	26.7
▨ sand	9.4	15.9	10.0	1.9	0.0	1.2	5.9	7.7

C.

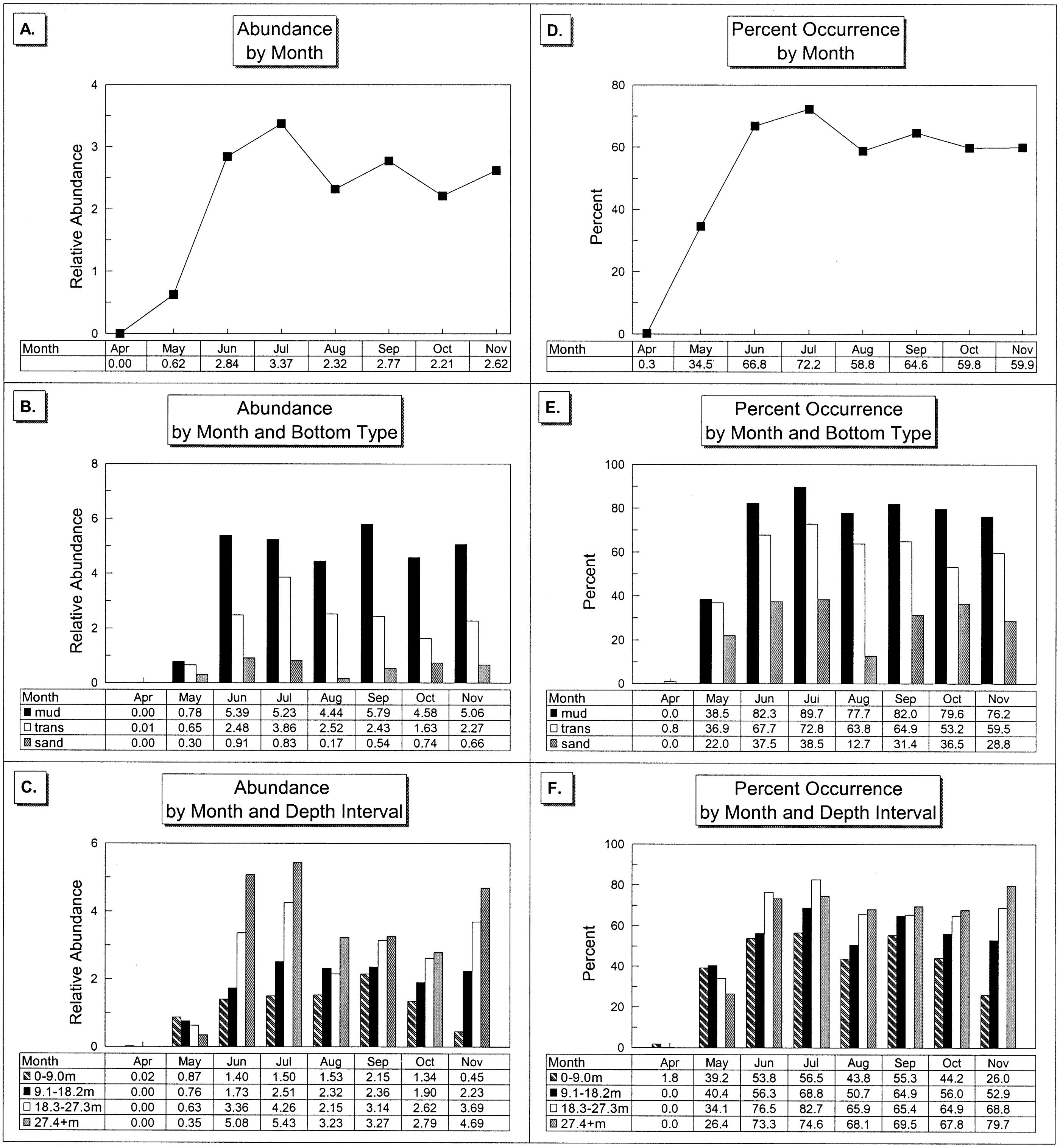
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.17	0.55	0.12	0.04	0.00	0.01	0.10	0.76
■ 9.1-18.2m	0.19	0.28	0.15	0.00	0.00	0.04	0.14	0.57
□ 18.3-27.3m	0.04	0.11	0.02	0.00	0.00	0.00	0.01	0.08
▨ 27.4+m	0.01	0.08	0.00	0.00	0.00	0.00	0.00	0.00

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	17.9	37.8	13.8	2.2	0.0	1.3	10.4	40.0
■ 9.1-18.2m	15.0	23.1	15.6	0.0	0.0	2.7	11.9	36.8
□ 18.3-27.3m	4.3	12.7	1.7	0.0	0.0	0.0	1.5	10.4
▨ 27.4+m	1.1	9.1	0.0	0.0	0.0	0.0	0.0	0.0

Figure IN-38

Striped bass (*Morone saxatilis*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.62	2.84	3.37	2.32	2.77	2.21	2.62

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.3	34.5	66.8	72.2	58.8	64.6	59.8	59.9

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.78	5.39	5.23	4.44	5.79	4.58	5.06
□ trans	0.01	0.65	2.48	3.86	2.52	2.43	1.63	2.27
▨ sand	0.00	0.30	0.91	0.83	0.17	0.54	0.74	0.66

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jui	Aug	Sep	Oct	Nov
■ mud	0.0	38.5	82.3	89.7	77.7	82.0	79.6	76.2
□ trans	0.8	36.9	67.7	72.8	63.8	64.9	53.2	59.5
▨ sand	0.0	22.0	37.5	38.5	12.7	31.4	36.5	28.8

C. Abundance by Month and Depth Interval

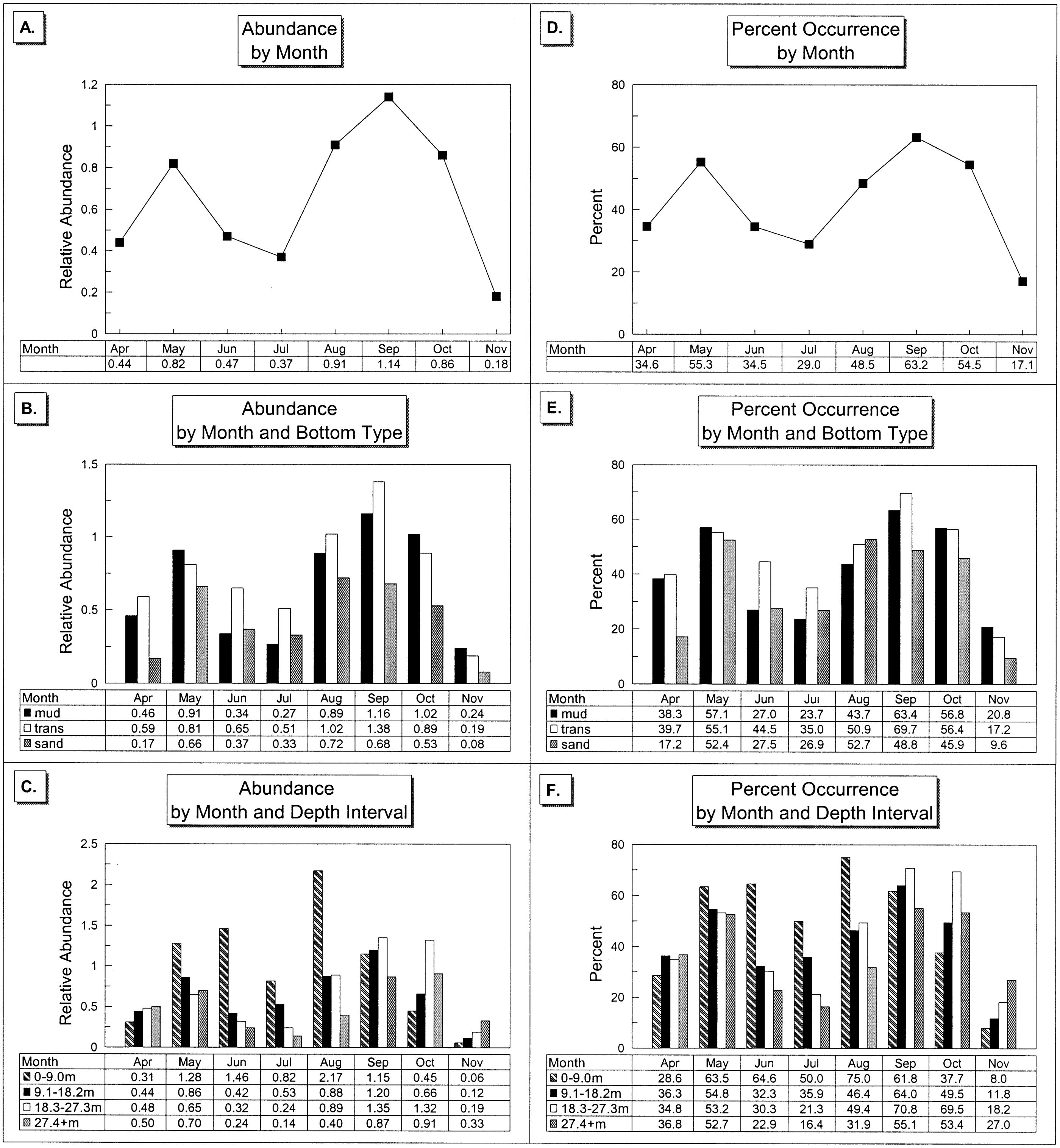
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.02	0.87	1.40	1.50	1.53	2.15	1.34	0.45
■ 9.1-18.2m	0.00	0.76	1.73	2.51	2.32	2.36	1.90	2.23
□ 18.3-27.3m	0.00	0.63	3.36	4.26	2.15	3.14	2.62	3.69
▨ 27.4+m	0.00	0.35	5.08	5.43	3.23	3.27	2.79	4.69

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	1.8	39.2	53.8	56.5	43.8	55.3	44.2	26.0
■ 9.1-18.2m	0.0	40.4	56.3	68.8	50.7	64.9	56.0	52.9
□ 18.3-27.3m	0.0	34.1	76.5	82.7	65.9	65.4	64.9	68.8
▨ 27.4+m	0.0	26.4	73.3	74.6	68.1	69.5	67.8	79.7

Figure IN-39

Striped searobin (*Prionotus evolans*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.44	0.82	0.47	0.37	0.91	1.14	0.86	0.18

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	34.6	55.3	34.5	29.0	48.5	63.2	54.5	17.1

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.46	0.91	0.34	0.27	0.89	1.16	1.02	0.24
□ trans	0.59	0.81	0.65	0.51	1.02	1.38	0.89	0.19
▨ sand	0.17	0.66	0.37	0.33	0.72	0.68	0.53	0.08

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	38.3	57.1	27.0	23.7	43.7	63.4	56.8	20.8
□ trans	39.7	55.1	44.5	35.0	50.9	69.7	56.4	17.2
▨ sand	17.2	52.4	27.5	26.9	52.7	48.8	45.9	9.6

C. Abundance by Month and Depth Interval

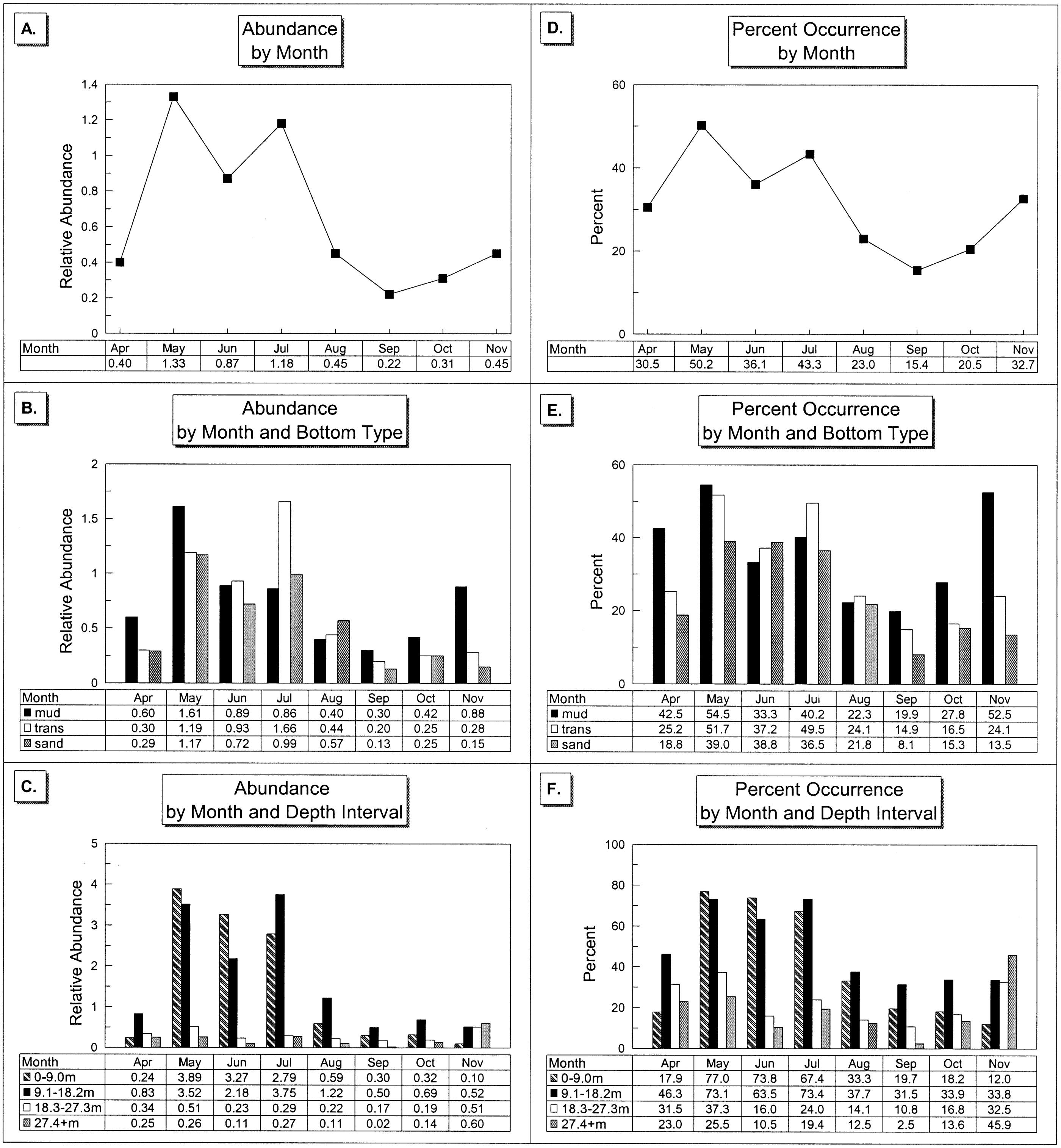
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.31	1.28	1.46	0.82	2.17	1.15	0.45	0.06
■ 9.1-18.2m	0.44	0.86	0.42	0.53	0.88	1.20	0.66	0.12
□ 18.3-27.3m	0.48	0.65	0.32	0.24	0.89	1.35	1.32	0.19
▨ 27.4+m	0.50	0.70	0.24	0.14	0.40	0.87	0.91	0.33

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	28.6	63.5	64.6	50.0	75.0	61.8	37.7	8.0
■ 9.1-18.2m	36.3	54.8	32.3	35.9	46.4	64.0	49.5	11.8
□ 18.3-27.3m	34.8	53.2	30.3	21.3	49.4	70.8	69.5	18.2
▨ 27.4+m	36.8	52.7	22.9	16.4	31.9	55.1	53.4	27.0

Figure IN-40

Summer flounder (*Paralichthys dentatus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.40	1.33	0.87	1.18	0.45	0.22	0.31	0.45

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	30.5	50.2	36.1	43.3	23.0	15.4	20.5	32.7

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
mud	0.60	1.61	0.89	0.86	0.40	0.30	0.42	0.88
trans	0.30	1.19	0.93	1.66	0.44	0.20	0.25	0.28
sand	0.29	1.17	0.72	0.99	0.57	0.13	0.25	0.15

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
mud	42.5	54.5	33.3	40.2	22.3	19.9	27.8	52.5
trans	25.2	51.7	37.2	49.5	24.1	14.9	16.5	24.1
sand	18.8	39.0	38.8	36.5	21.8	8.1	15.3	13.5

C. Abundance by Month and Depth Interval

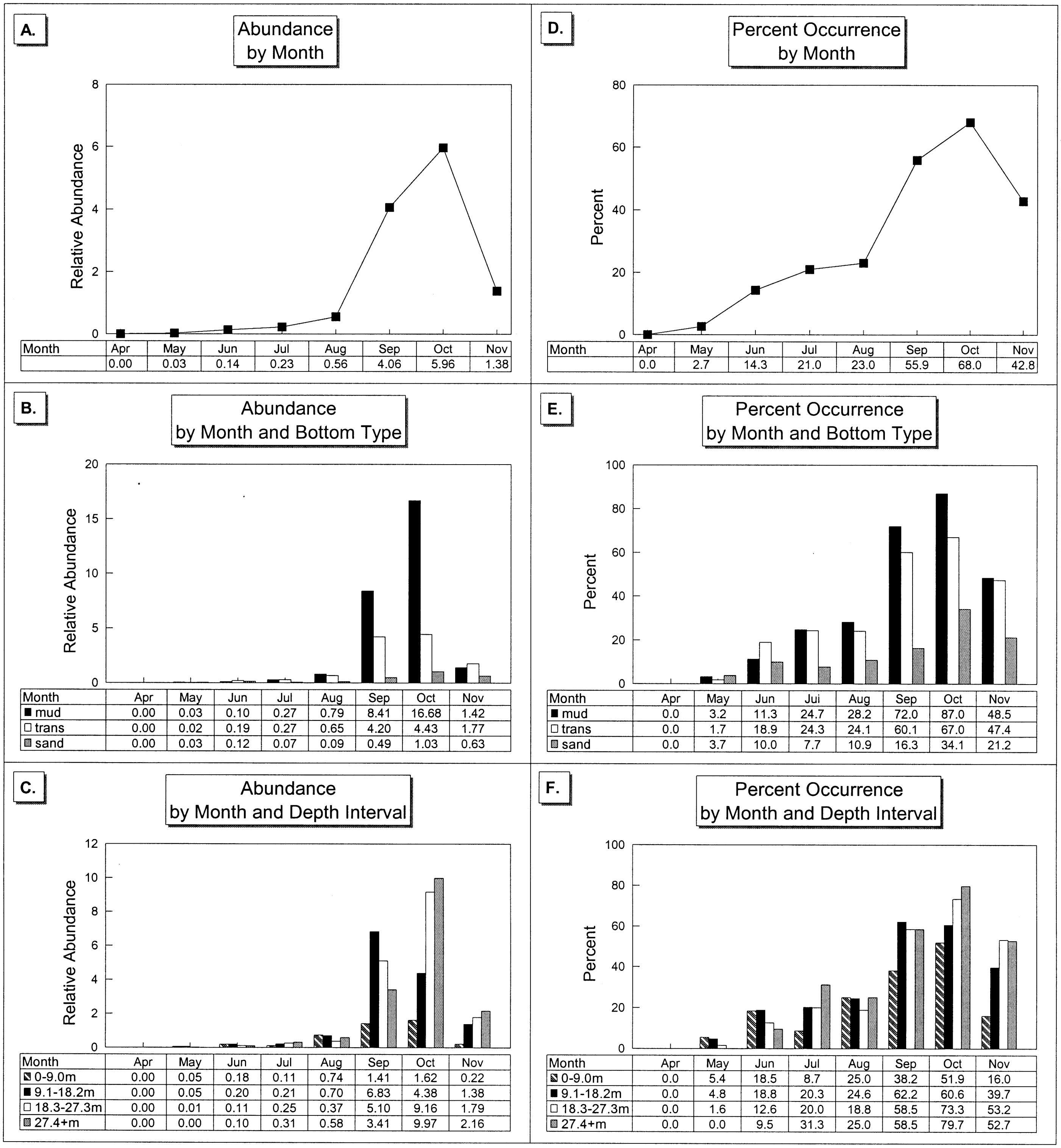
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
0-9.0m	0.24	3.89	3.27	2.79	0.59	0.30	0.32	0.10
9.1-18.2m	0.83	3.52	2.18	3.75	1.22	0.50	0.69	0.52
18.3-27.3m	0.34	0.51	0.23	0.29	0.22	0.17	0.19	0.51
27.4+m	0.25	0.26	0.11	0.27	0.11	0.02	0.14	0.60

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
0-9.0m	17.9	77.0	73.8	67.4	33.3	19.7	18.2	12.0
9.1-18.2m	46.3	73.1	63.5	73.4	37.7	31.5	33.9	33.8
18.3-27.3m	31.5	37.3	16.0	24.0	14.1	10.8	16.8	32.5
27.4+m	23.0	25.5	10.5	19.4	12.5	2.5	13.6	45.9

Figure IN-41

Tautog (*Tautoga onitis*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.03	0.14	0.23	0.56	4.06	5.96	1.38

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	2.7	14.3	21.0	23.0	55.9	68.0	42.8

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.03	0.10	0.27	0.79	8.41	16.68	1.42
□ trans	0.00	0.02	0.19	0.27	0.65	4.20	4.43	1.77
▩ sand	0.00	0.03	0.12	0.07	0.09	0.49	1.03	0.63

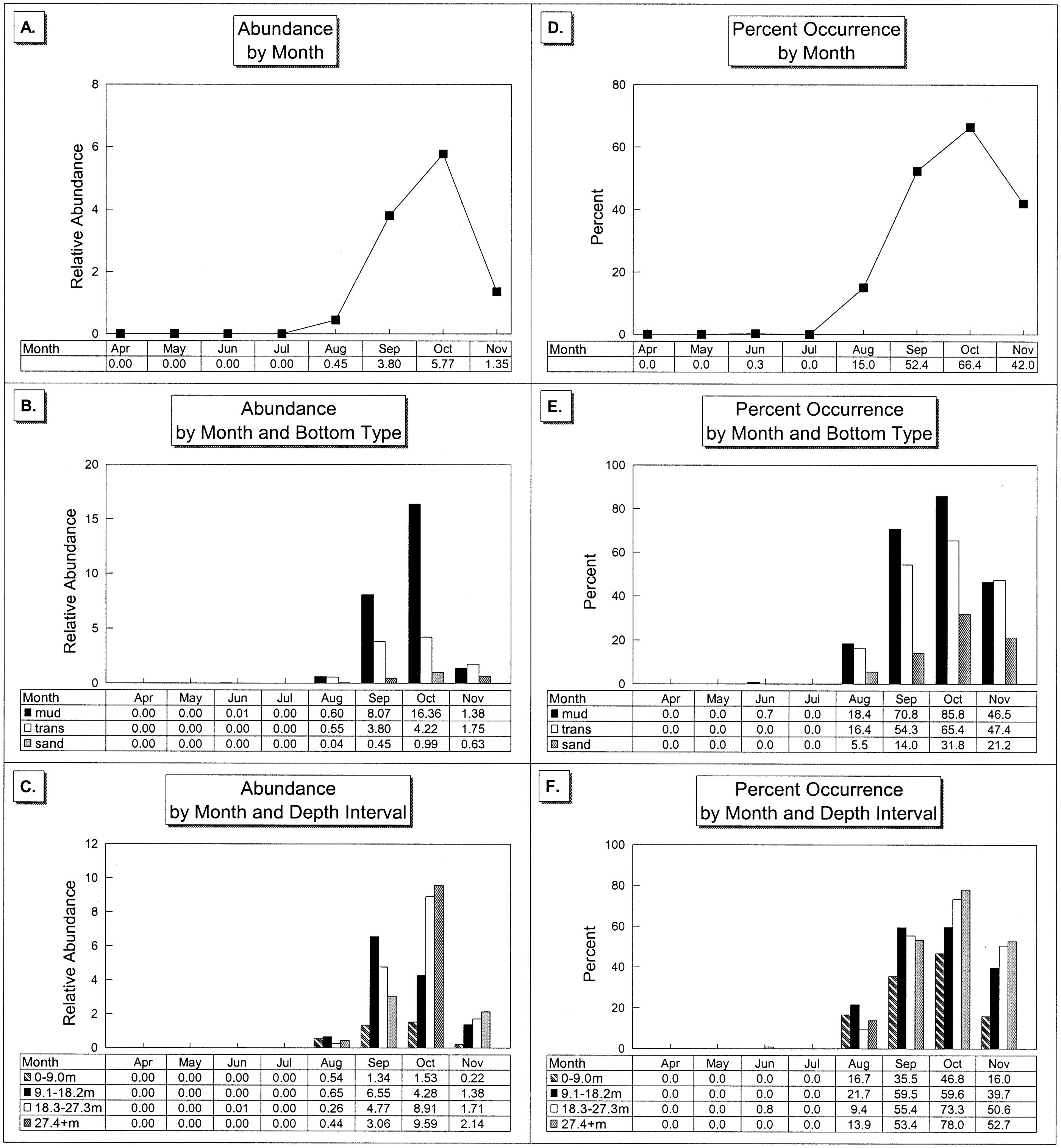
Month	Apr	May	Jun	Jui	Aug	Sep	Oct	Nov
■ mud	0.0	3.2	11.3	24.7	28.2	72.0	87.0	48.5
□ trans	0.0	1.7	18.9	24.3	24.1	60.1	67.0	47.4
▩ sand	0.0	3.7	10.0	7.7	10.9	16.3	34.1	21.2

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.05	0.18	0.11	0.74	1.41	1.62	0.22
■ 9.1-18.2m	0.00	0.05	0.20	0.21	0.70	6.83	4.38	1.38
□ 18.3-27.3m	0.00	0.01	0.11	0.25	0.37	5.10	9.16	1.79
▩ 27.4+m	0.00	0.00	0.10	0.31	0.58	3.41	9.97	2.16

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	5.4	18.5	8.7	25.0	38.2	51.9	16.0
■ 9.1-18.2m	0.0	4.8	18.8	20.3	24.6	62.2	60.6	39.7
□ 18.3-27.3m	0.0	1.6	12.6	20.0	18.8	58.5	73.3	53.2
▩ 27.4+m	0.0	0.0	9.5	31.3	25.0	58.5	79.7	52.7

Figure IN-42

Weakfish (*Cynoscion regalis*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.00	0.00	0.00	0.45	3.80	5.77	1.35

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	0.0	0.3	0.0	15.0	52.4	66.4	42.0

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.00	0.01	0.00	0.60	8.07	16.36	1.38
□ trans	0.00	0.00	0.00	0.00	0.55	3.80	4.22	1.75
▨ sand	0.00	0.00	0.00	0.00	0.04	0.45	0.99	0.63

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	0.0	0.7	0.0	18.4	70.8	85.8	46.5
□ trans	0.0	0.0	0.0	0.0	16.4	54.3	65.4	47.4
▨ sand	0.0	0.0	0.0	0.0	5.5	14.0	31.8	21.2

C. Abundance by Month and Depth Interval

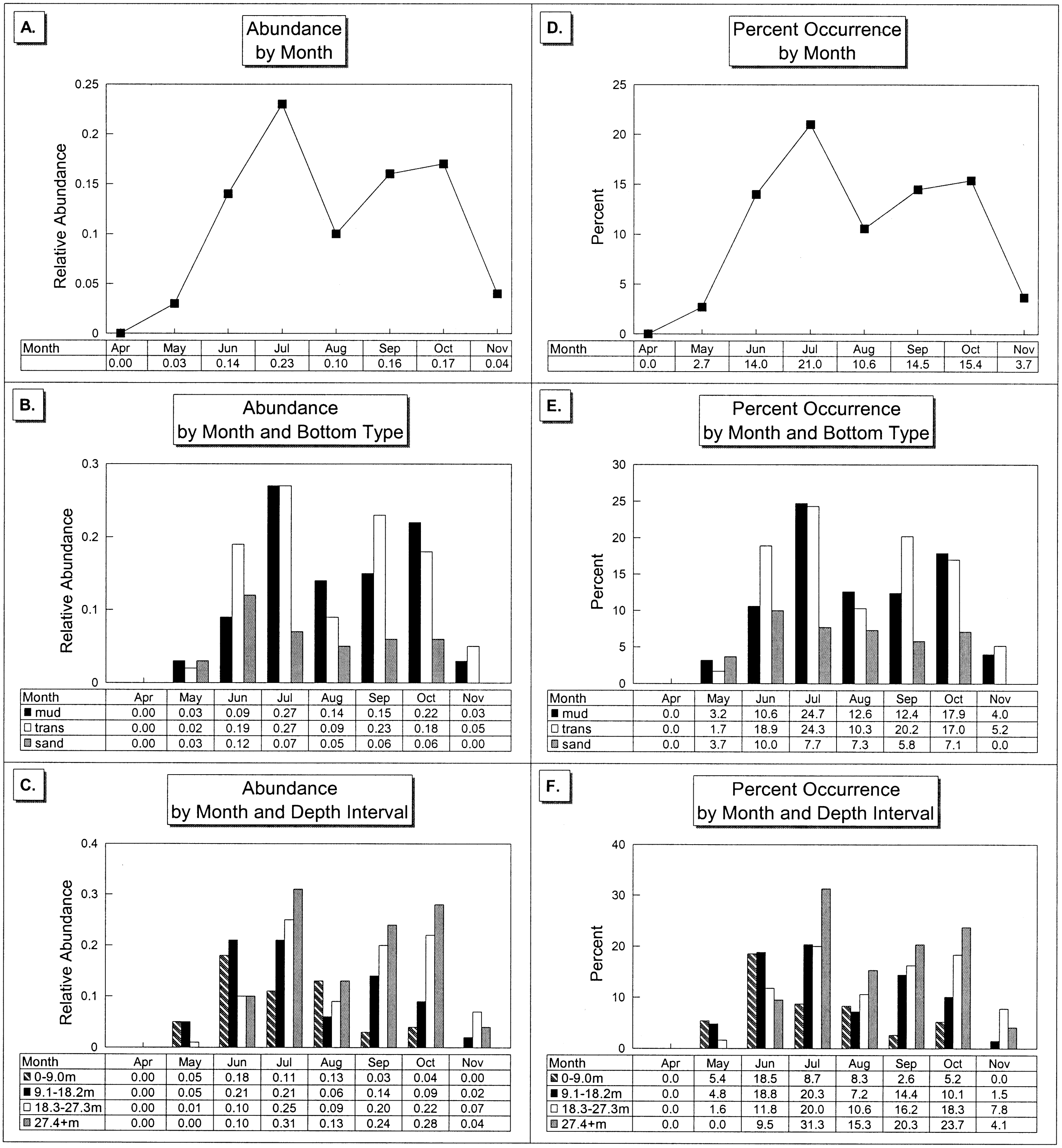
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.00	0.00	0.00	0.54	1.34	1.53	0.22
■ 9.1-18.2m	0.00	0.00	0.00	0.00	0.65	6.55	4.28	1.38
□ 18.3-27.3m	0.00	0.00	0.01	0.00	0.26	4.77	8.91	1.71
▨ 27.4+m	0.00	0.00	0.00	0.00	0.44	3.06	9.59	2.14

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	0.0	0.0	0.0	16.7	35.5	46.8	16.0
■ 9.1-18.2m	0.0	0.0	0.0	0.0	21.7	59.5	59.6	39.7
□ 18.3-27.3m	0.0	0.0	0.8	0.0	9.4	55.4	73.3	50.6
▨ 27.4+m	0.0	0.0	0.0	0.0	13.9	53.4	78.0	52.7

Figure IN-43

Weakfish (*Cynoscion regalis*), young-of-year. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.00	0.03	0.14	0.23	0.10	0.16	0.17	0.04

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.0	2.7	14.0	21.0	10.6	14.5	15.4	3.7

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.00	0.03	0.09	0.27	0.14	0.15	0.22	0.03
□ trans	0.00	0.02	0.19	0.27	0.09	0.23	0.18	0.05
▩ sand	0.00	0.03	0.12	0.07	0.05	0.06	0.06	0.00

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.0	3.2	10.6	24.7	12.6	12.4	17.9	4.0
□ trans	0.0	1.7	18.9	24.3	10.3	20.2	17.0	5.2
▩ sand	0.0	3.7	10.0	7.7	7.3	5.8	7.1	0.0

C. Abundance by Month and Depth Interval

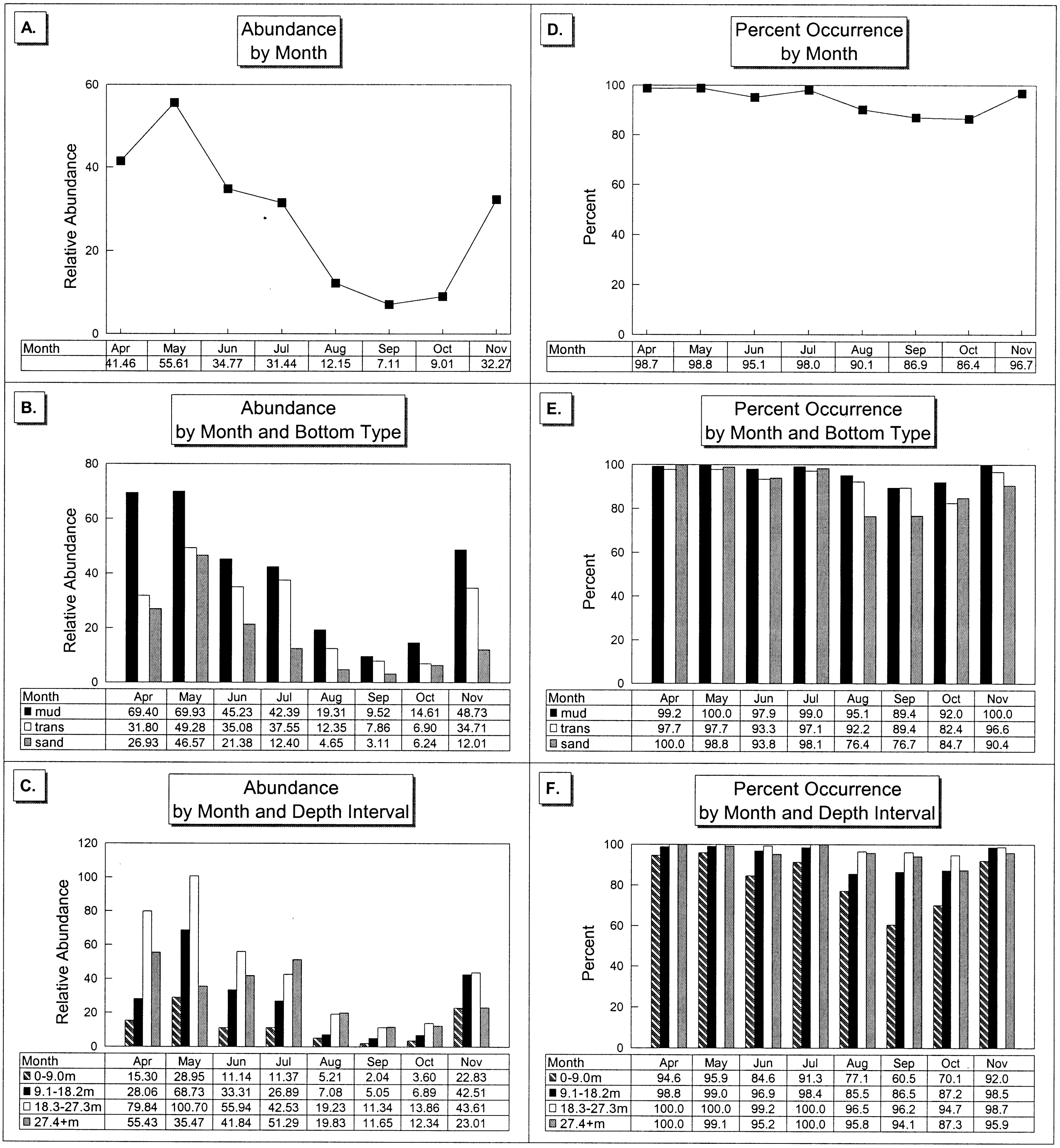
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.00	0.05	0.18	0.11	0.13	0.03	0.04	0.00
■ 9.1-18.2m	0.00	0.05	0.21	0.21	0.06	0.14	0.09	0.02
□ 18.3-27.3m	0.00	0.01	0.10	0.25	0.09	0.20	0.22	0.07
▩ 27.4+m	0.00	0.00	0.10	0.31	0.13	0.24	0.28	0.04

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.0	5.4	18.5	8.7	8.3	2.6	5.2	0.0
■ 9.1-18.2m	0.0	4.8	18.8	20.3	7.2	14.4	10.1	1.5
□ 18.3-27.3m	0.0	1.6	11.8	20.0	10.6	16.2	18.3	7.8
▩ 27.4+m	0.0	0.0	9.5	31.3	15.3	20.3	23.7	4.1

Figure IN-44

Weakfish (*Cynoscion regalis*), ages 1+. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	41.46	55.61	34.77	31.44	12.15	7.11	9.01	32.27

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	98.7	98.8	95.1	98.0	90.1	86.9	86.4	96.7

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	69.40	69.93	45.23	42.39	19.31	9.52	14.61	48.73
□ trans	31.80	49.28	35.08	37.55	12.35	7.86	6.90	34.71
▨ sand	26.93	46.57	21.38	12.40	4.65	3.11	6.24	12.01

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	99.2	100.0	97.9	99.0	95.1	89.4	92.0	100.0
□ trans	97.7	97.7	93.3	97.1	92.2	89.4	82.4	96.6
▨ sand	100.0	98.8	93.8	98.1	76.4	76.7	84.7	90.4

C. Abundance by Month and Depth Interval

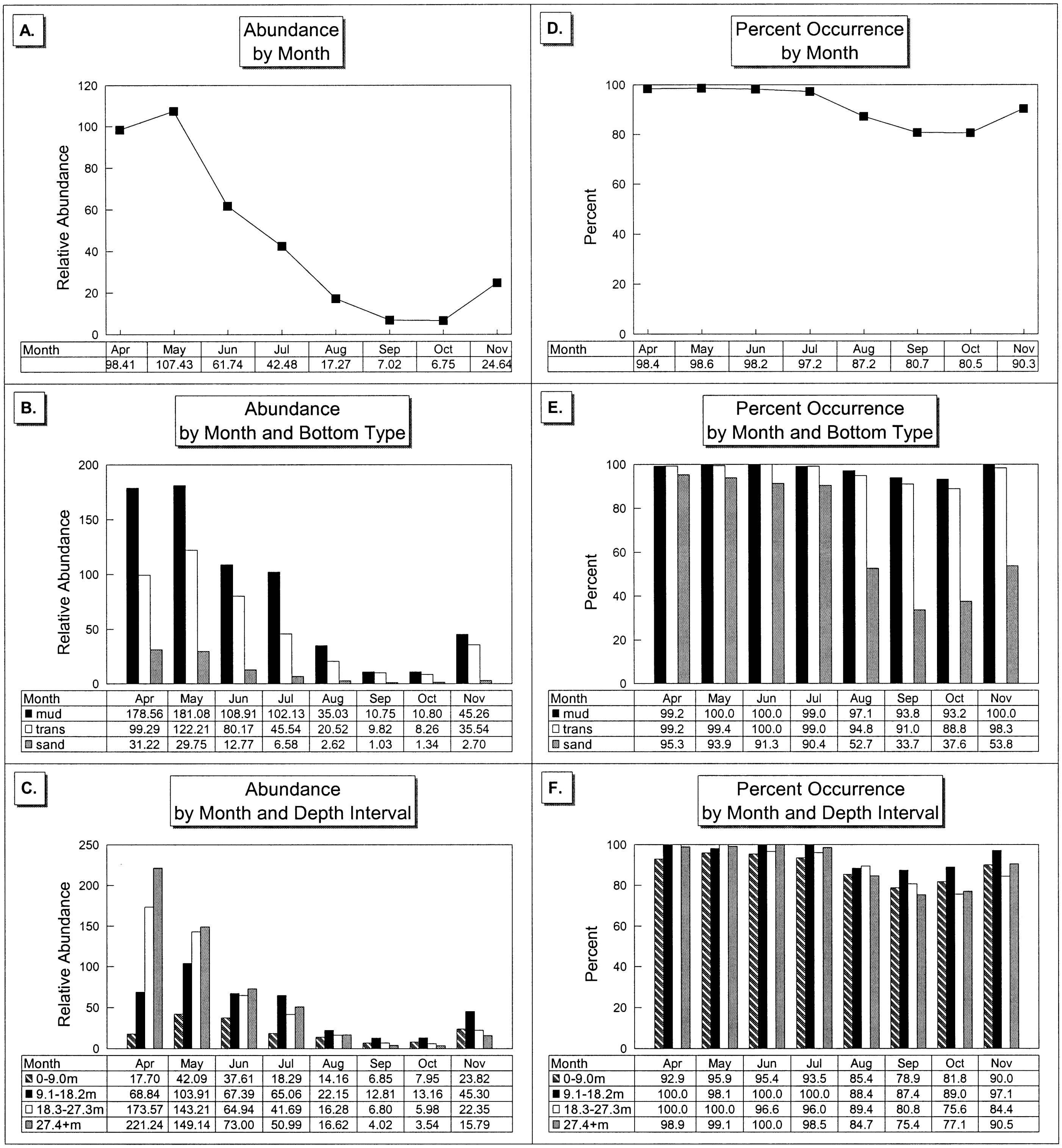
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	15.30	28.95	11.14	11.37	5.21	2.04	3.60	22.83
■ 9.1-18.2m	28.06	68.73	33.31	26.89	7.08	5.05	6.89	42.51
□ 18.3-27.3m	79.84	100.70	55.94	42.53	19.23	11.34	13.86	43.61
▨ 27.4+m	55.43	35.47	41.84	51.29	19.83	11.65	12.34	23.01

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	94.6	95.9	84.6	91.3	77.1	60.5	70.1	92.0
■ 9.1-18.2m	98.8	99.0	96.9	98.4	85.5	86.5	87.2	98.5
□ 18.3-27.3m	100.0	100.0	99.2	100.0	96.5	96.2	94.7	98.7
▨ 27.4+m	100.0	99.1	95.2	100.0	95.8	94.1	87.3	95.9

Figure IN-45

Windowpane flounder (*Scophthalmus aquosus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	98.41	107.43	61.74	42.48	17.27	7.02	6.75	24.64

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	98.4	98.6	98.2	97.2	87.2	80.7	80.5	90.3

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	178.56	181.08	108.91	102.13	35.03	10.75	10.80	45.26
□ trans	99.29	122.21	80.17	45.54	20.52	9.82	8.26	35.54
▨ sand	31.22	29.75	12.77	6.58	2.62	1.03	1.34	2.70

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	99.2	100.0	100.0	99.0	97.1	93.8	93.2	100.0
□ trans	99.2	99.4	100.0	99.0	94.8	91.0	88.8	98.3
▨ sand	95.3	93.9	91.3	90.4	52.7	33.7	37.6	53.8

C. Abundance by Month and Depth Interval

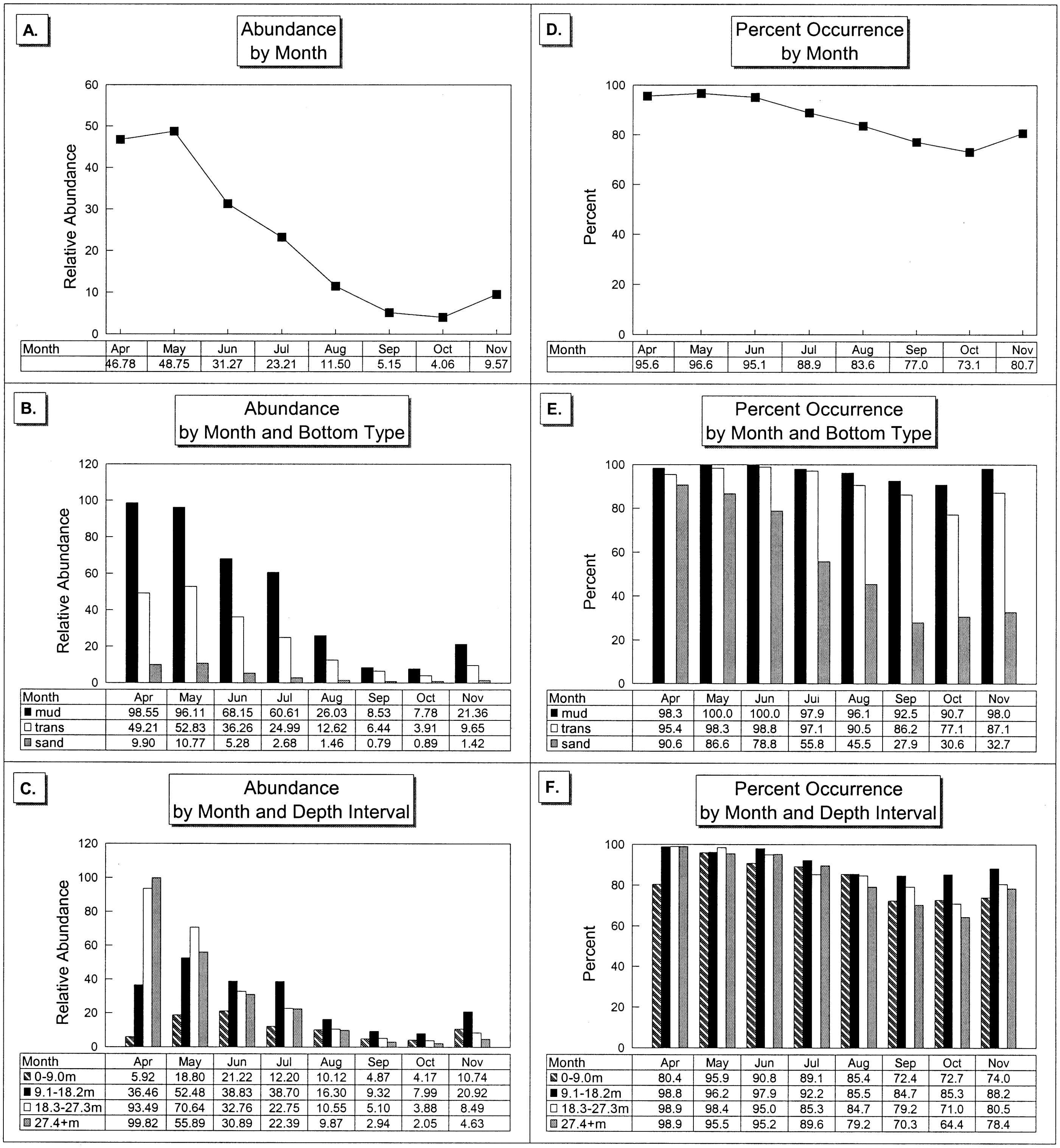
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	17.70	42.09	37.61	18.29	14.16	6.85	7.95	23.82
■ 9.1-18.2m	68.84	103.91	67.39	65.06	22.15	12.81	13.16	45.30
□ 18.3-27.3m	173.57	143.21	64.94	41.69	16.28	6.80	5.98	22.35
▨ 27.4+m	221.24	149.14	73.00	50.99	16.62	4.02	3.54	15.79

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	92.9	95.9	95.4	93.5	85.4	78.9	81.8	90.0
■ 9.1-18.2m	100.0	98.1	100.0	100.0	88.4	87.4	89.0	97.1
□ 18.3-27.3m	100.0	100.0	96.6	96.0	89.4	80.8	75.6	84.4
▨ 27.4+m	98.9	99.1	100.0	98.5	84.7	75.4	77.1	90.5

Figure IN-46

Winter flounder (*Pleuronectes americanus*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	46.78	48.75	31.27	23.21	11.50	5.15	4.06	9.57

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	95.6	96.6	95.1	88.9	83.6	77.0	73.1	80.7

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	98.55	96.11	68.15	60.61	26.03	8.53	7.78	21.36
□ trans	49.21	52.83	36.26	24.99	12.62	6.44	3.91	9.65
▩ sand	9.90	10.77	5.28	2.68	1.46	0.79	0.89	1.42

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	98.3	100.0	100.0	97.9	96.1	92.5	90.7	98.0
□ trans	95.4	98.3	98.8	97.1	90.5	86.2	77.1	87.1
▩ sand	90.6	86.6	78.8	55.8	45.5	27.9	30.6	32.7

C. Abundance by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	5.92	18.80	21.22	12.20	10.12	4.87	4.17	10.74
■ 9.1-18.2m	36.46	52.48	38.83	38.70	16.30	9.32	7.99	20.92
□ 18.3-27.3m	93.49	70.64	32.76	22.75	10.55	5.10	3.88	8.49
▩ 27.4+m	99.82	55.89	30.89	22.39	9.87	2.94	2.05	4.63

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	80.4	95.9	90.8	89.1	85.4	72.4	72.7	74.0
■ 9.1-18.2m	98.8	96.2	97.9	92.2	85.5	84.7	85.3	88.2
□ 18.3-27.3m	98.9	98.4	95.0	85.3	84.7	79.2	71.0	80.5
▩ 27.4+m	98.9	95.5	95.2	89.6	79.2	70.3	64.4	78.4

Figure IN-47

Winter flounder (*Pleuronectes americanus*), <20 cm. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

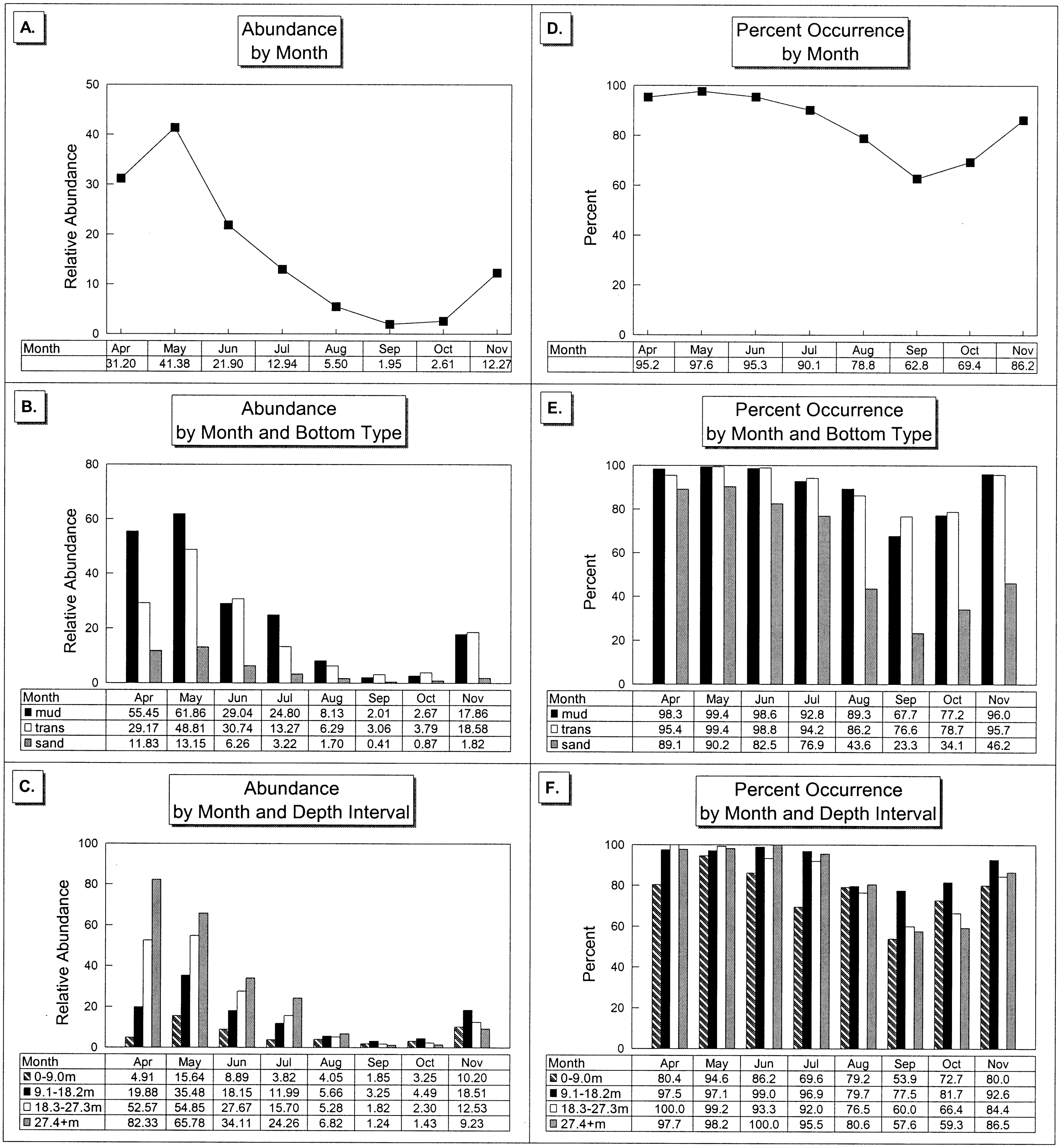
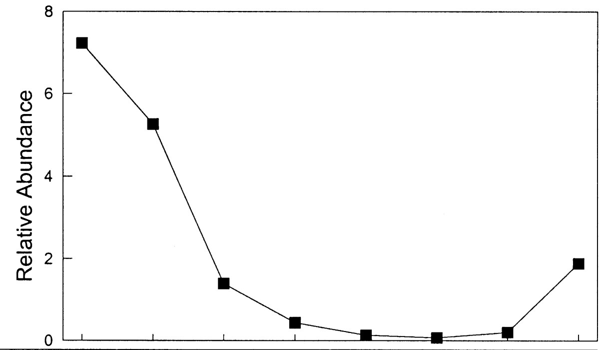


Figure IN-48

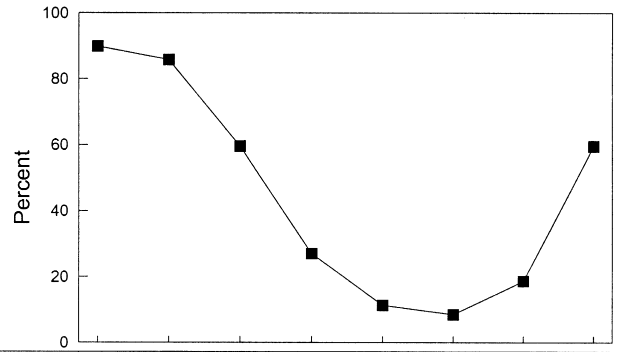
Winter flounder (*Pleuronectes americanus*), 20–29 cm. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

A. Abundance by Month



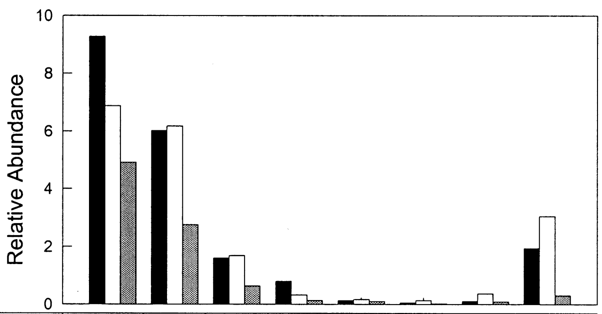
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	7.23	5.26	1.39	0.44	0.14	0.08	0.21	1.88

D. Percent Occurrence by Month



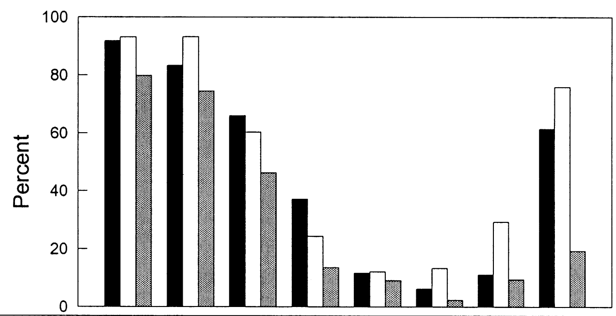
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	89.8	85.7	59.5	27.0	11.3	8.5	18.6	59.5

B. Abundance by Month and Bottom Type



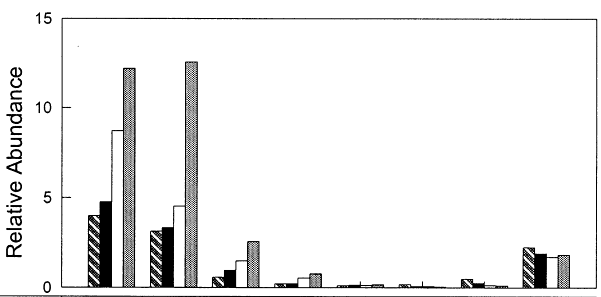
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	9.28	6.03	1.59	0.80	0.13	0.06	0.11	1.94
□ trans	6.88	6.17	1.69	0.31	0.16	0.13	0.36	3.05
▨ sand	4.91	2.75	0.63	0.13	0.10	0.02	0.08	0.30

E. Percent Occurrence by Month and Bottom Type



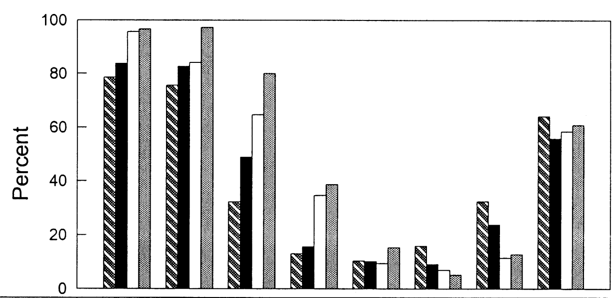
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	91.7	83.3	66.0	37.1	11.7	6.2	11.1	61.4
□ trans	93.1	93.2	60.4	24.3	12.1	13.3	29.3	75.9
▨ sand	79.7	74.4	46.3	13.5	9.1	2.3	9.4	19.2

C. Abundance by Month and Depth Interval



Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	4.00	3.13	0.58	0.22	0.11	0.18	0.48	2.24
■ 9.1-18.2m	4.76	3.32	0.95	0.21	0.15	0.08	0.25	1.90
□ 18.3-27.3m	8.70	4.53	1.48	0.54	0.12	0.06	0.12	1.70
▨ 27.4+m	12.21	12.57	2.56	0.76	0.16	0.04	0.11	1.83

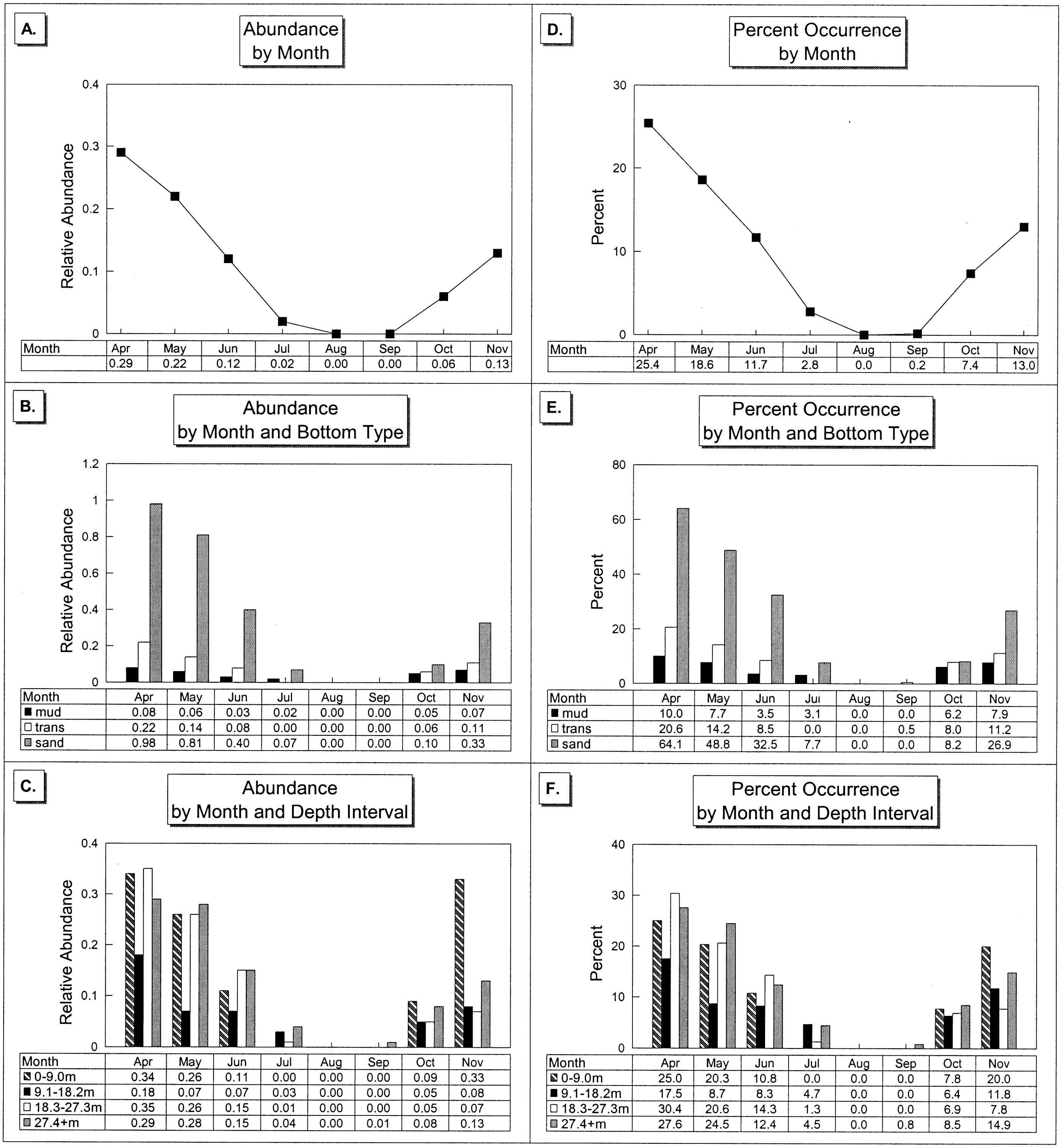
F. Percent Occurrence by Month and Depth Interval



Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	78.6	75.7	32.3	13.0	10.4	15.8	32.5	64.0
■ 9.1-18.2m	83.8	82.7	49.0	15.6	10.1	9.0	23.9	55.9
□ 18.3-27.3m	95.7	84.1	64.7	34.7	9.4	6.9	11.5	58.4
▨ 27.4+m	96.6	97.3	80.0	38.8	15.3	5.1	12.7	60.8

Figure IN-49

Winter flounder (*Pleuronectes americanus*), 30+ cm. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	0.29	0.22	0.12	0.02	0.00	0.00	0.06	0.13

B.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	0.08	0.06	0.03	0.02	0.00	0.00	0.05	0.07
□ trans	0.22	0.14	0.08	0.00	0.00	0.00	0.06	0.11
▩ sand	0.98	0.81	0.40	0.07	0.00	0.00	0.10	0.33

C.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	0.34	0.26	0.11	0.00	0.00	0.00	0.09	0.33
■ 9.1-18.2m	0.18	0.07	0.07	0.03	0.00	0.00	0.05	0.08
□ 18.3-27.3m	0.35	0.26	0.15	0.01	0.00	0.00	0.05	0.07
▩ 27.4+m	0.29	0.28	0.15	0.04	0.00	0.01	0.08	0.13

D.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	25.4	18.6	11.7	2.8	0.0	0.2	7.4	13.0

E.

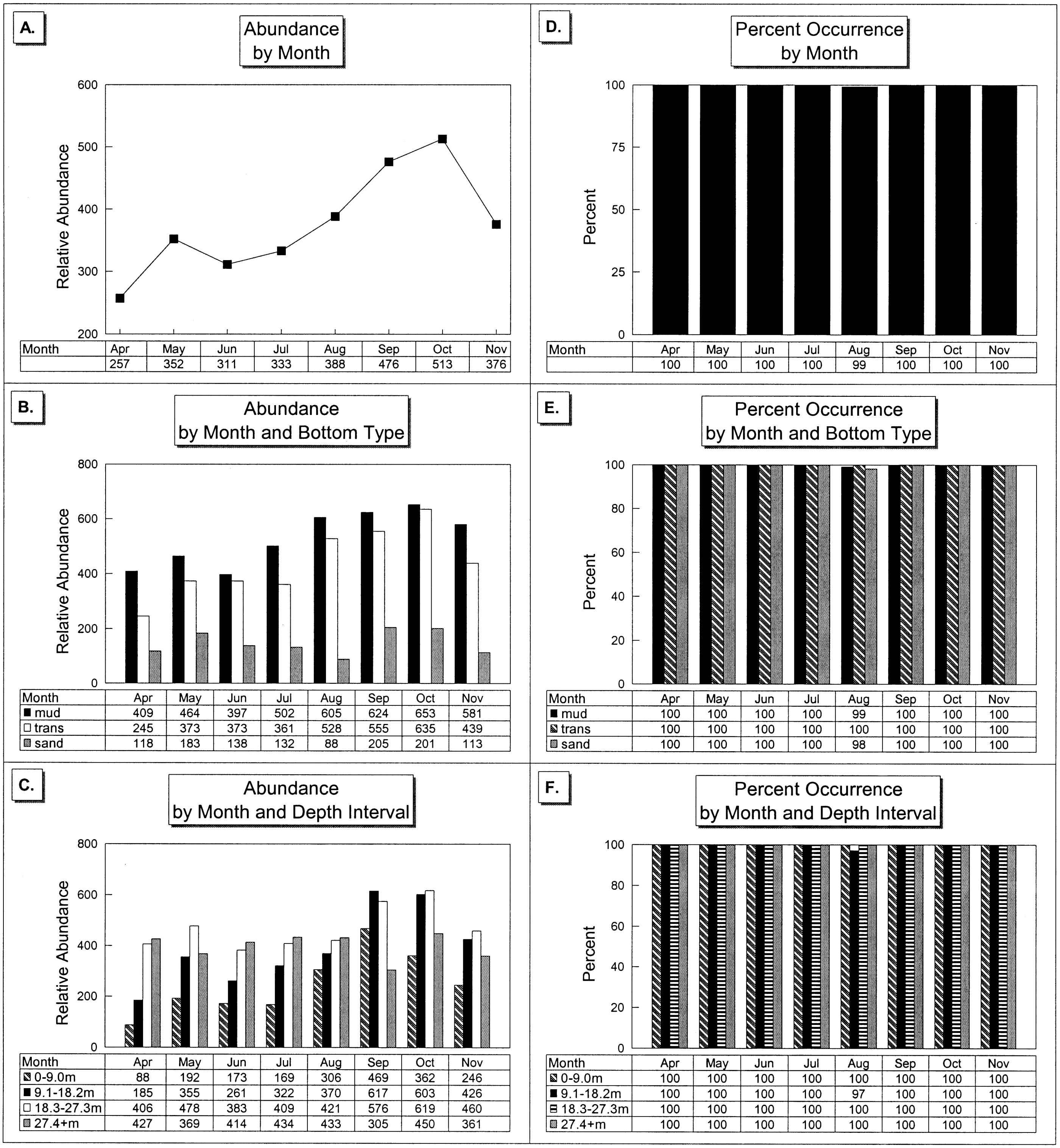
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	10.0	7.7	3.5	3.1	0.0	0.0	6.2	7.9
□ trans	20.6	14.2	8.5	0.0	0.0	0.5	8.0	11.2
▩ sand	64.1	48.8	32.5	7.7	0.0	0.0	8.2	26.9

F.

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	25.0	20.3	10.8	0.0	0.0	0.0	7.8	20.0
■ 9.1-18.2m	17.5	8.7	8.3	4.7	0.0	0.0	6.4	11.8
□ 18.3-27.3m	30.4	20.6	14.3	1.3	0.0	0.0	6.9	7.8
▩ 27.4+m	27.6	24.5	12.4	4.5	0.0	0.8	8.5	14.9

Figure IN-50

Winter skate (*Raja ocellata*). Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	257	352	311	333	388	476	513	376

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	100	100	100	100	99	100	100	100

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
mud	409	464	397	502	605	624	653	581
trans	245	373	373	361	528	555	635	439
sand	118	183	138	132	88	205	201	113

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
mud	100	100	100	100	99	100	100	100
trans	100	100	100	100	100	100	100	100
sand	100	100	100	100	98	100	100	100

C. Abundance by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
0-9.0m	88	192	173	169	306	469	362	246
9.1-18.2m	185	355	261	322	370	617	603	426
18.3-27.3m	406	478	383	409	421	576	619	460
27.4+m	427	369	414	434	433	305	450	361

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
0-9.0m	100	100	100	100	100	100	100	100
9.1-18.2m	100	100	100	100	97	100	100	100
18.3-27.3m	100	100	100	100	100	100	100	100
27.4+m	100	100	100	100	100	100	100	100

Figure IN-51

Aggregate catch indices. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

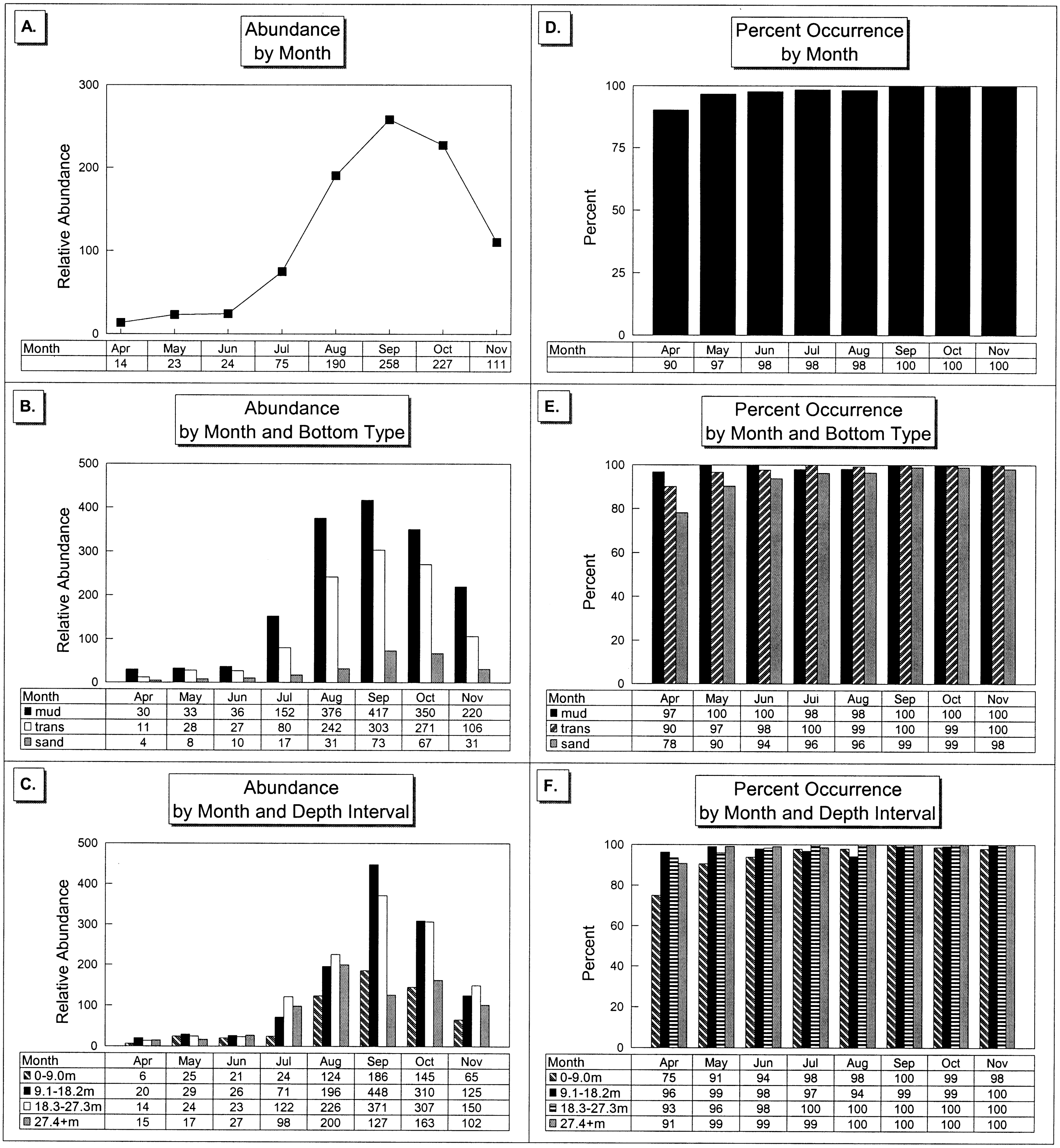
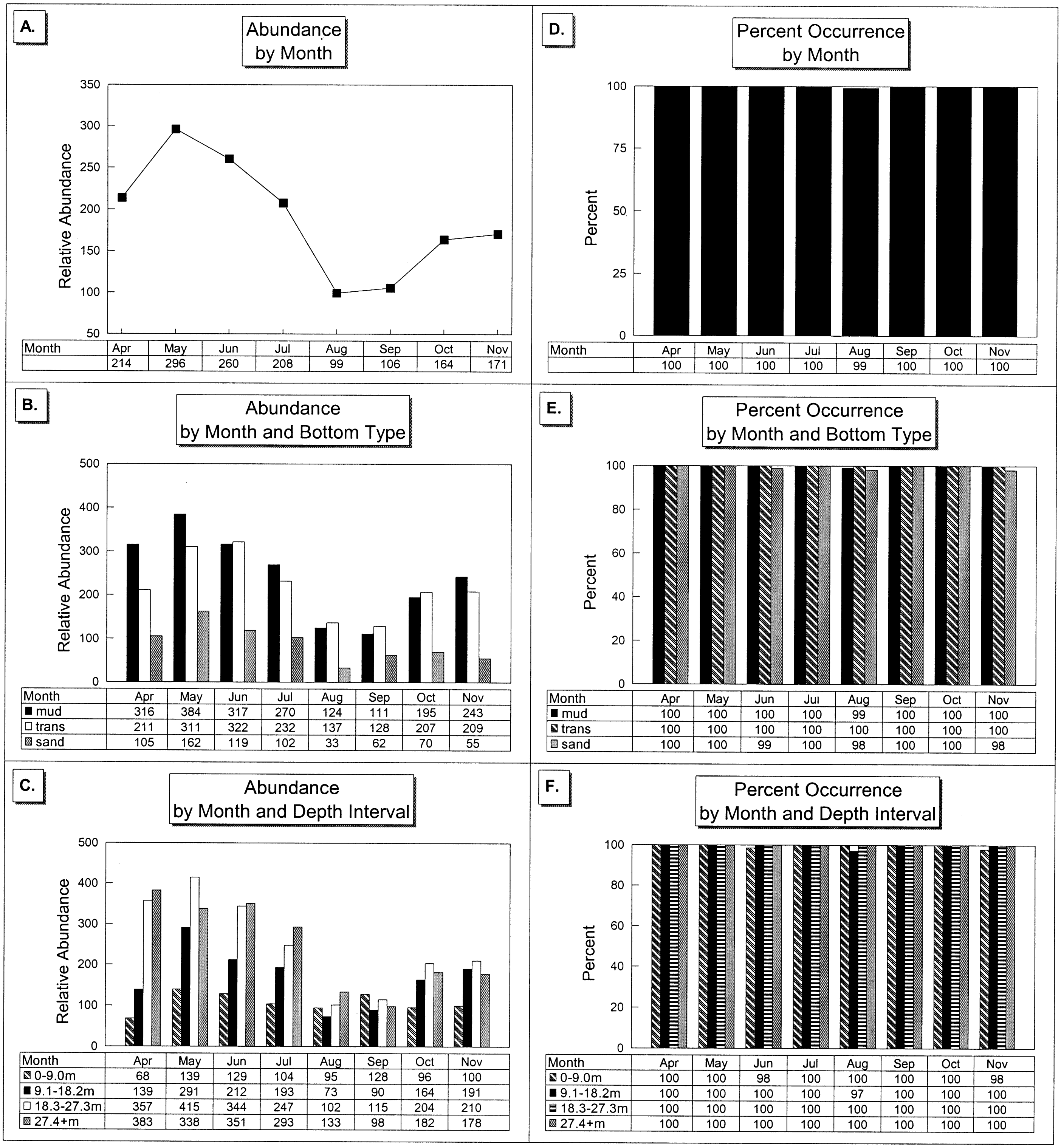


Figure IN-52

Aggregate pelagic finfish indices. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.



A. Abundance by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	214	296	260	208	99	106	164	171

D. Percent Occurrence by Month

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	100	100	100	100	99	100	100	100

B. Abundance by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	316	384	317	270	124	111	195	243
□ trans	211	311	322	232	137	128	207	209
▨ sand	105	162	119	102	33	62	70	55

E. Percent Occurrence by Month and Bottom Type

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
■ mud	100	100	100	100	99	100	100	100
▧ trans	100	100	100	100	100	100	100	100
▨ sand	100	100	99	100	98	100	100	98

C. Abundance by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	68	139	129	104	95	128	96	100
■ 9.1-18.2m	139	291	212	193	73	90	164	191
□ 18.3-27.3m	357	415	344	247	102	115	204	210
▨ 27.4+m	383	338	351	293	133	98	182	178

F. Percent Occurrence by Month and Depth Interval

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
▧ 0-9.0m	100	100	98	100	100	100	100	98
■ 9.1-18.2m	100	100	100	100	97	100	100	100
▤ 18.3-27.3m	100	100	100	100	100	100	100	100
▨ 27.4+m	100	100	100	100	100	100	100	100

Figure IN-53

Aggregate demersal finfish indices. Relative abundance (geometric mean catch/tow) catch/tow and percent occurrence (proportion of samples in which at least one individual was observed) by month, month and bottom type, and month and depth interval.

Length Frequencies: Figs. LF-1 through LF-26

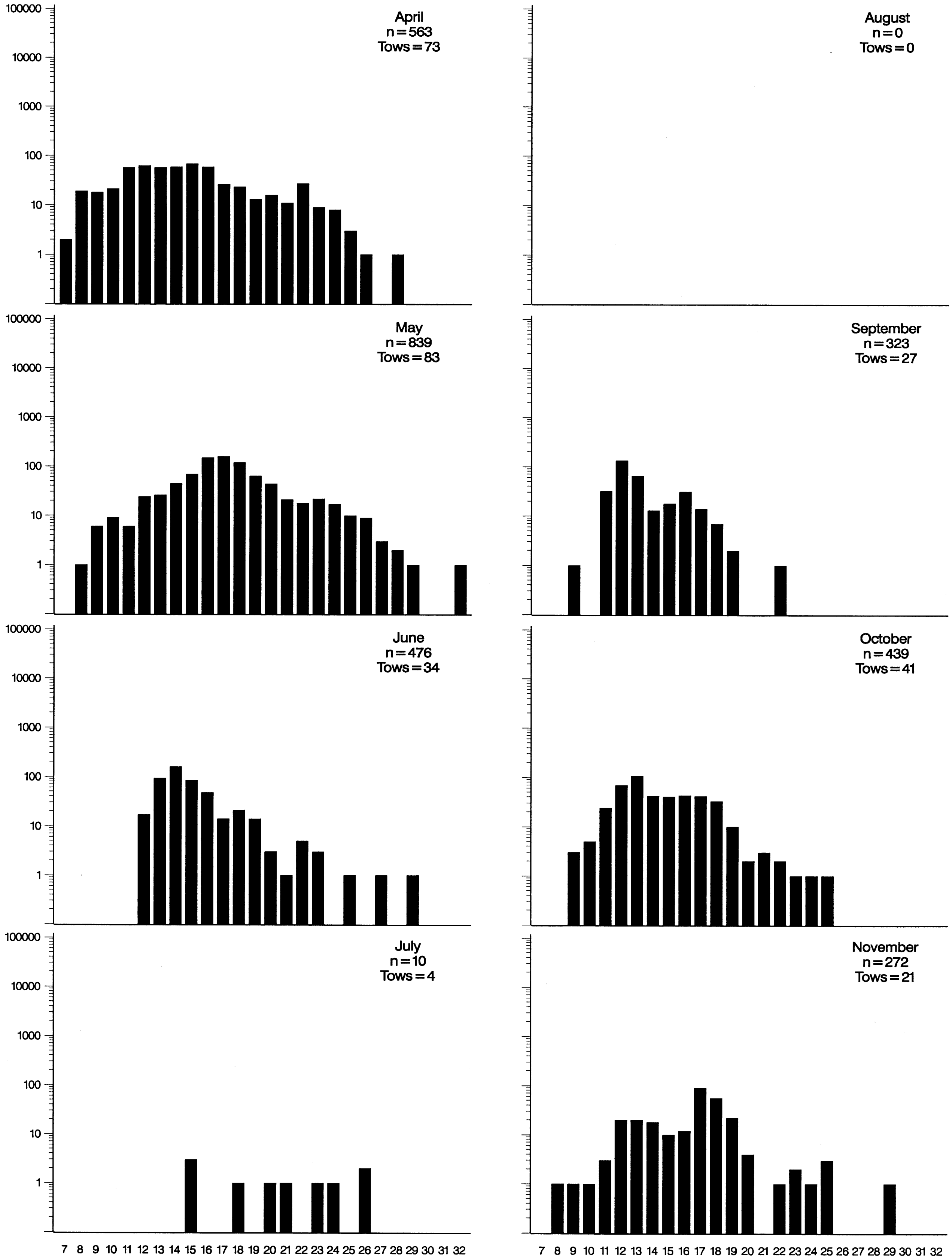


Figure LF-1

Alewife (*Alosa pseudoharengus*). Monthly log10 length frequencies (cm) based on 2,922 fish taken in 283 tows between 1989 and 1994.

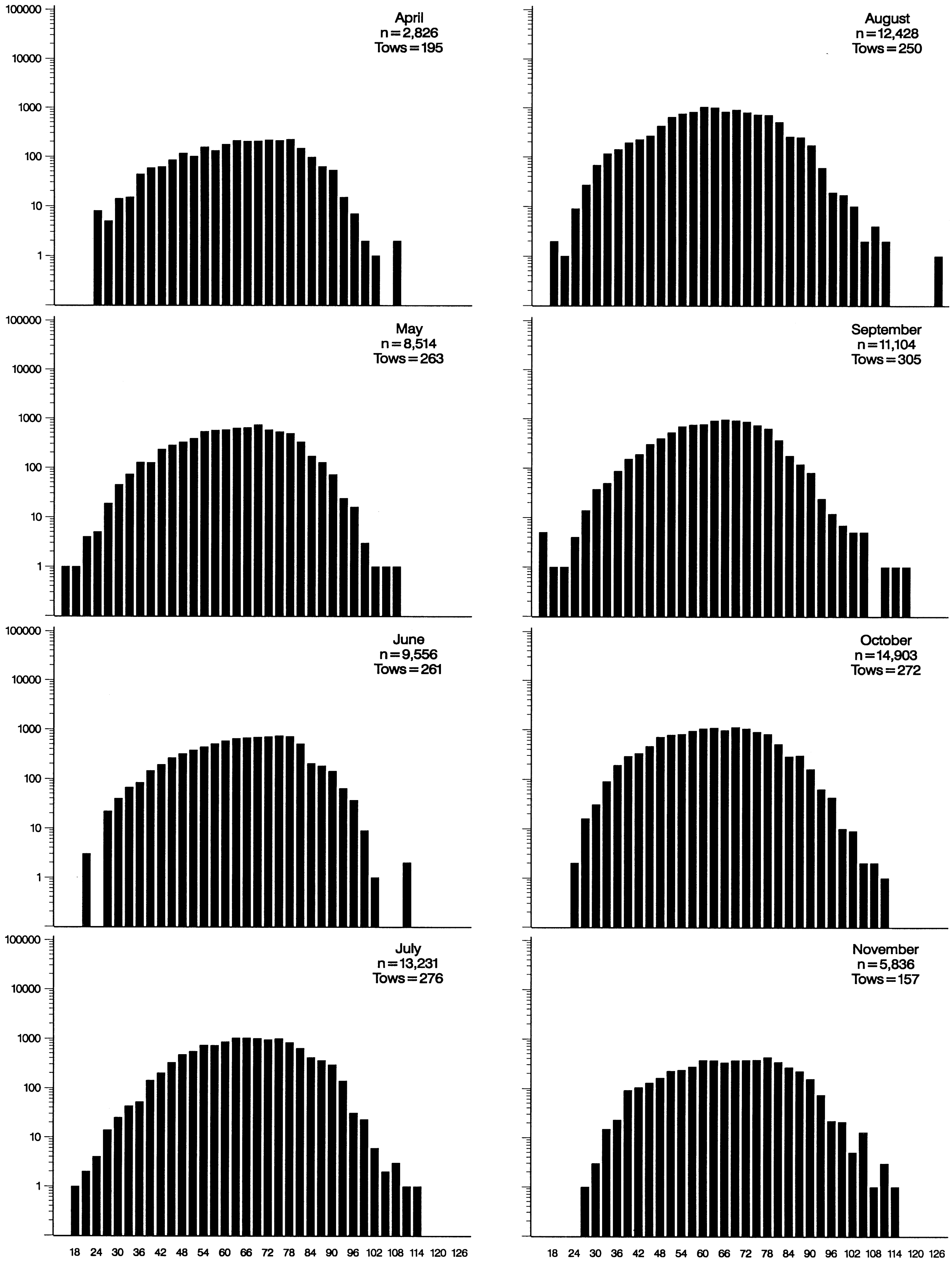


Figure LF-2
American lobster (*Homarus americanus*). Monthly log10 length frequencies (cm) based on 78,398 lobsters taken in 1,979 tows between 1985 and 1994.

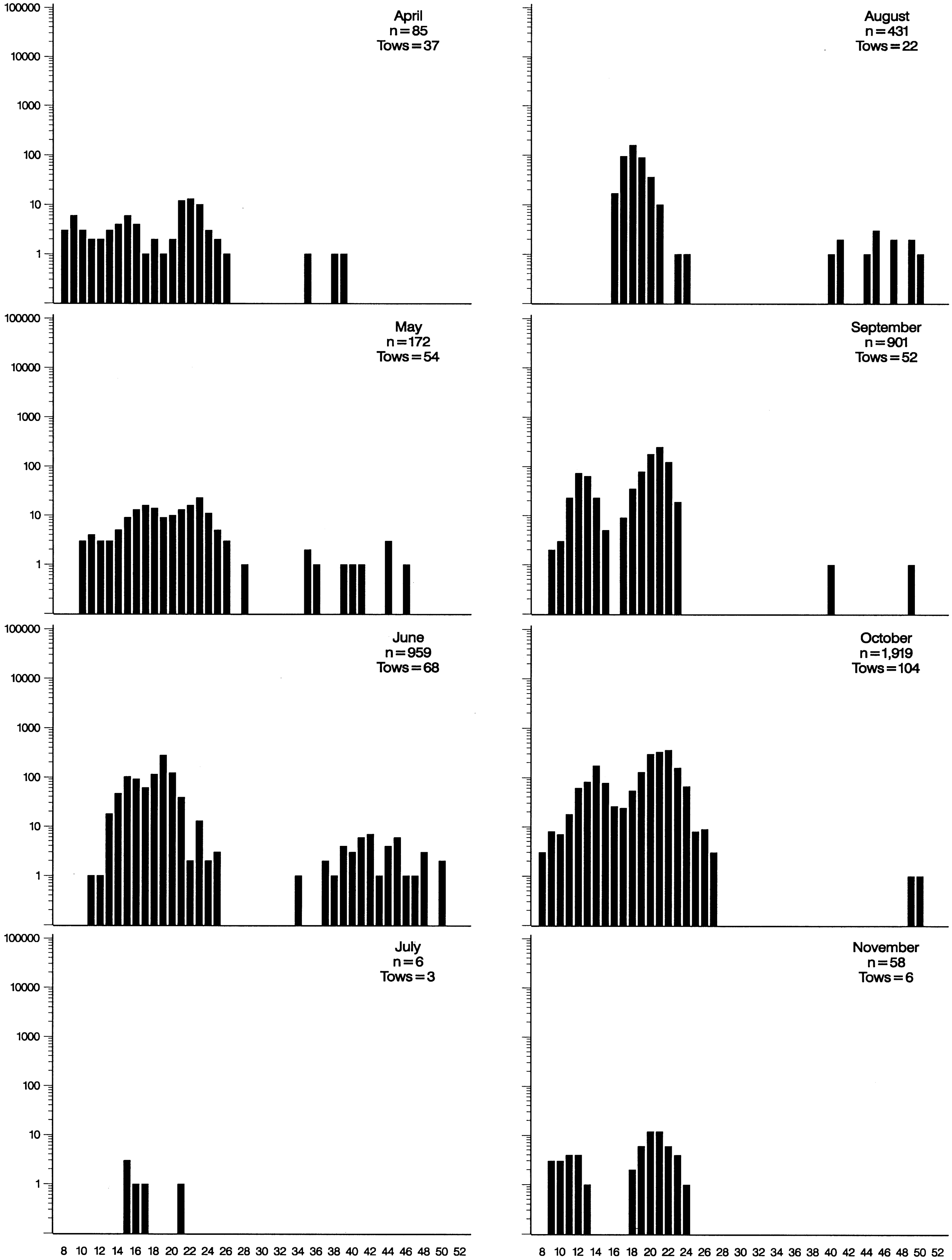


Figure LF-3

American shad (*Alosa sapidissima*). Monthly log10 length frequencies (cm) based on 4,531 fish taken in 346 tows between 1989 and 1994.

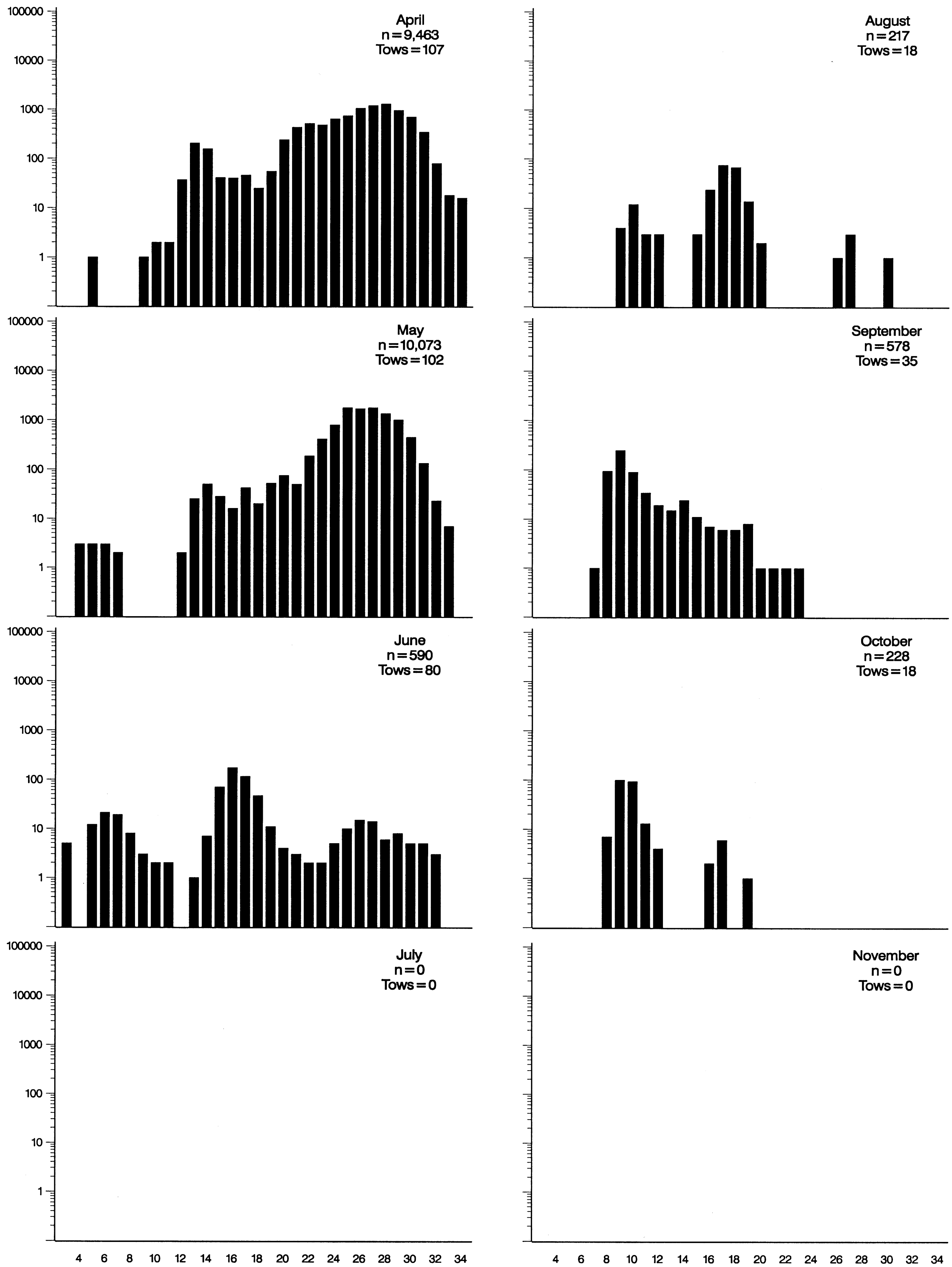


Figure LF-4

Atlantic herring (*Clupea harengus*). Monthly log10 length frequencies (cm) based on 21,149 fish taken in 360 tows between 1989 and 1994.

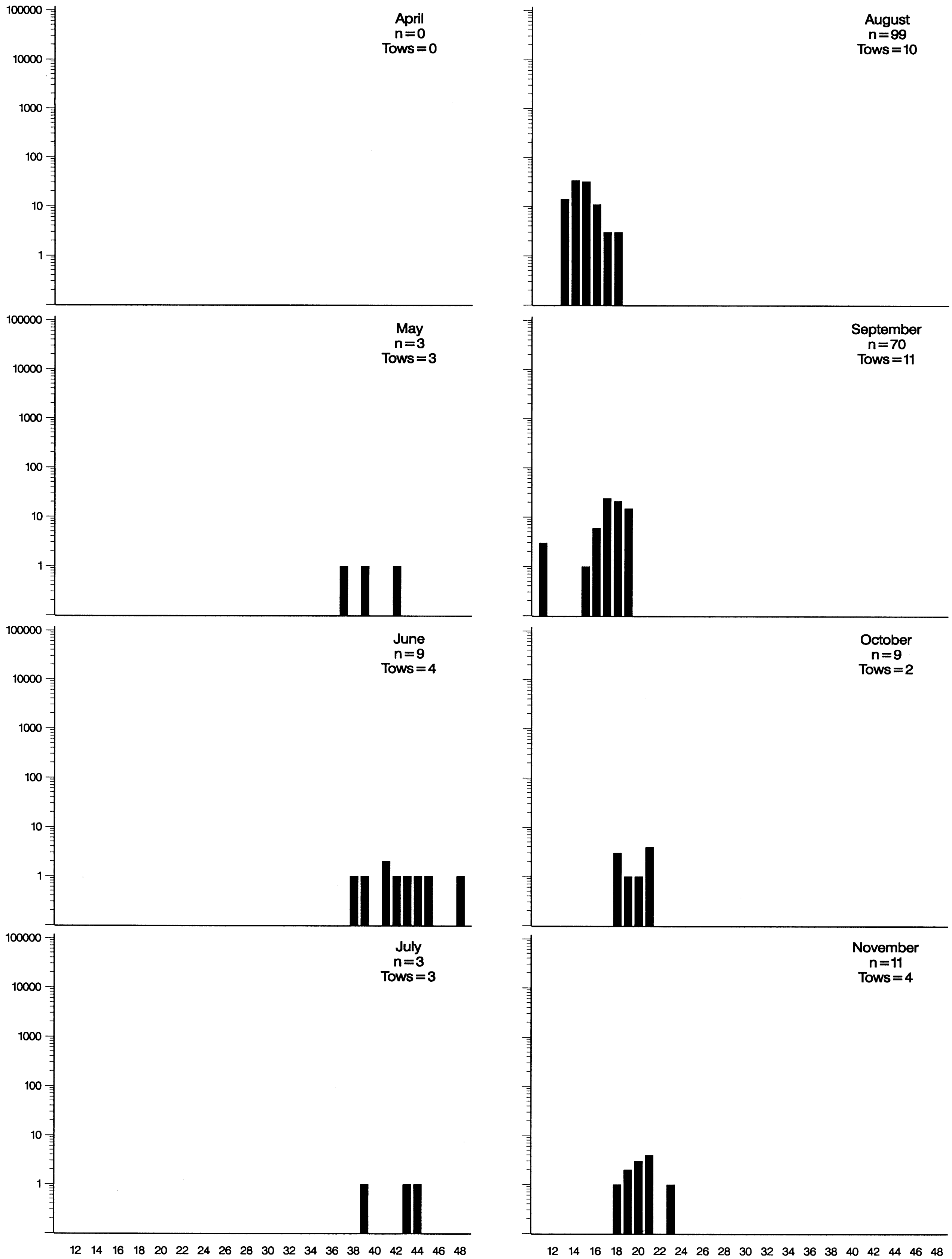


Figure LF-5

Atlantic mackerel (*Scomber scombrus*). Monthly log10 length frequencies (cm) based on 204 fish taken in 37 tows between 1989 and 1994.

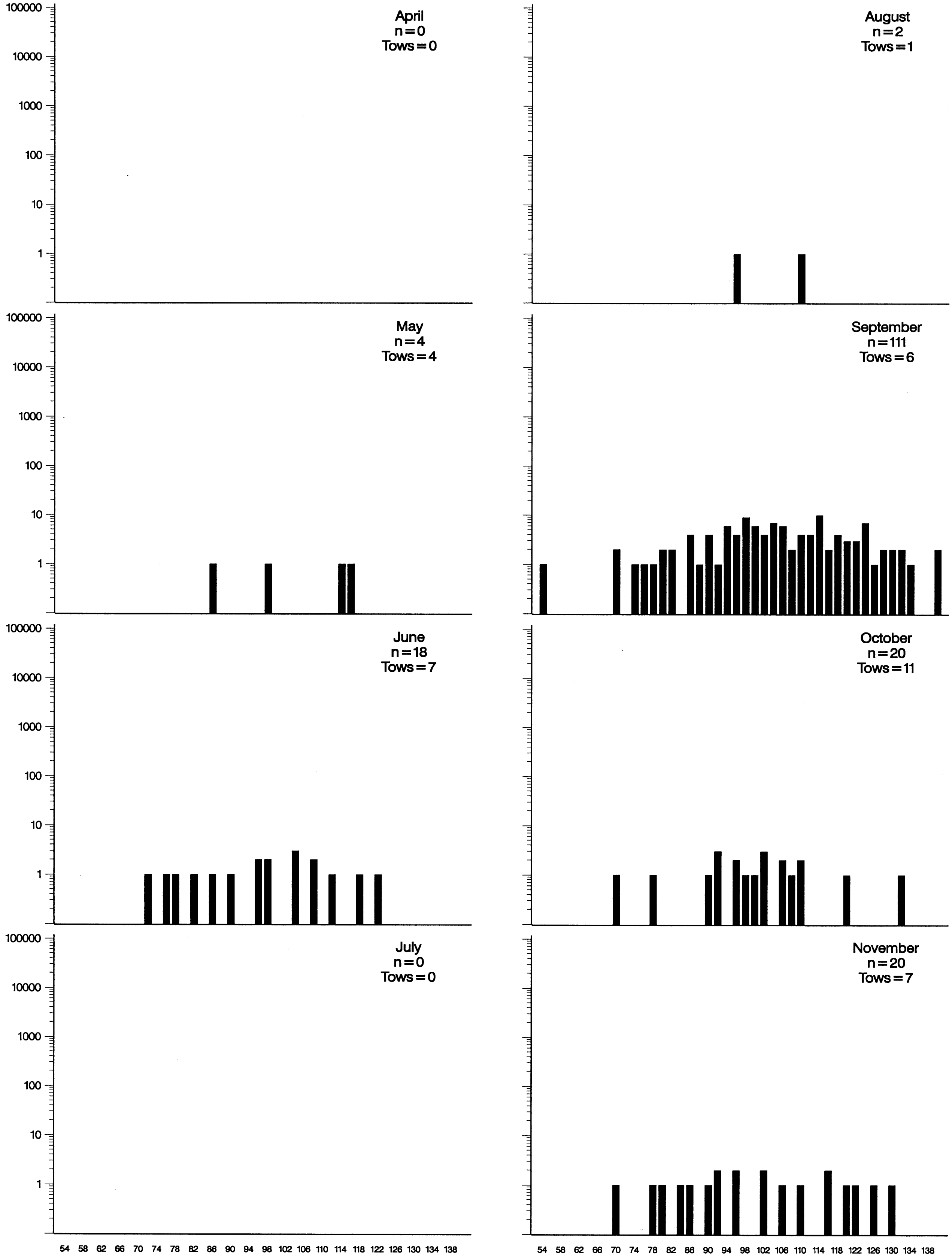


Figure LF-6

Atlantic sturgeon (*Acipenser oxyrhynchus*). Monthly log10 length frequencies (cm) based on 175 fish taken in 36 tows between 1989 and 1994.

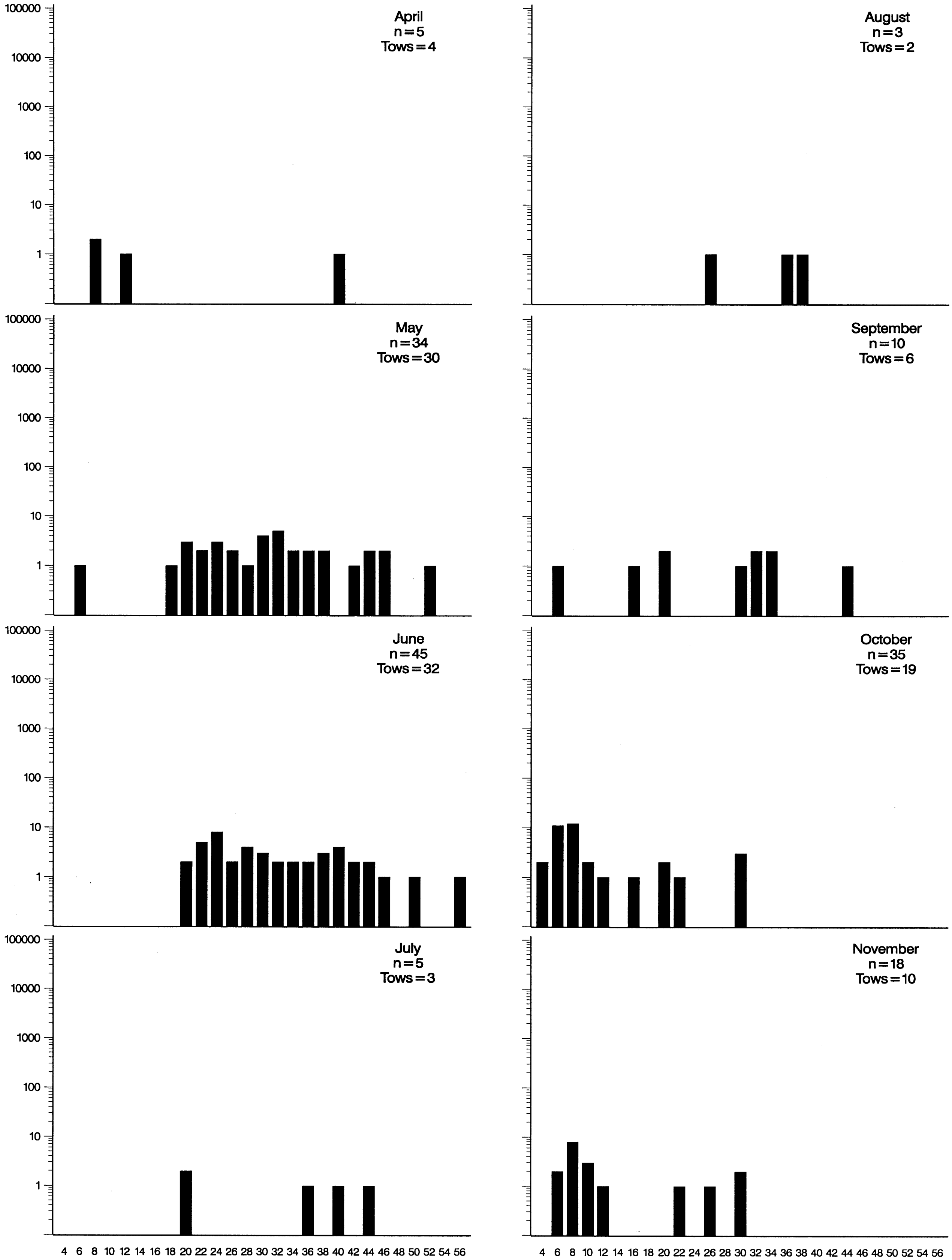


Figure LF-7

Black sea bass (*Centropristis striata*). Monthly log10 length frequencies (cm) based on 155 fish taken in 106 tows between 1989 and 1994.

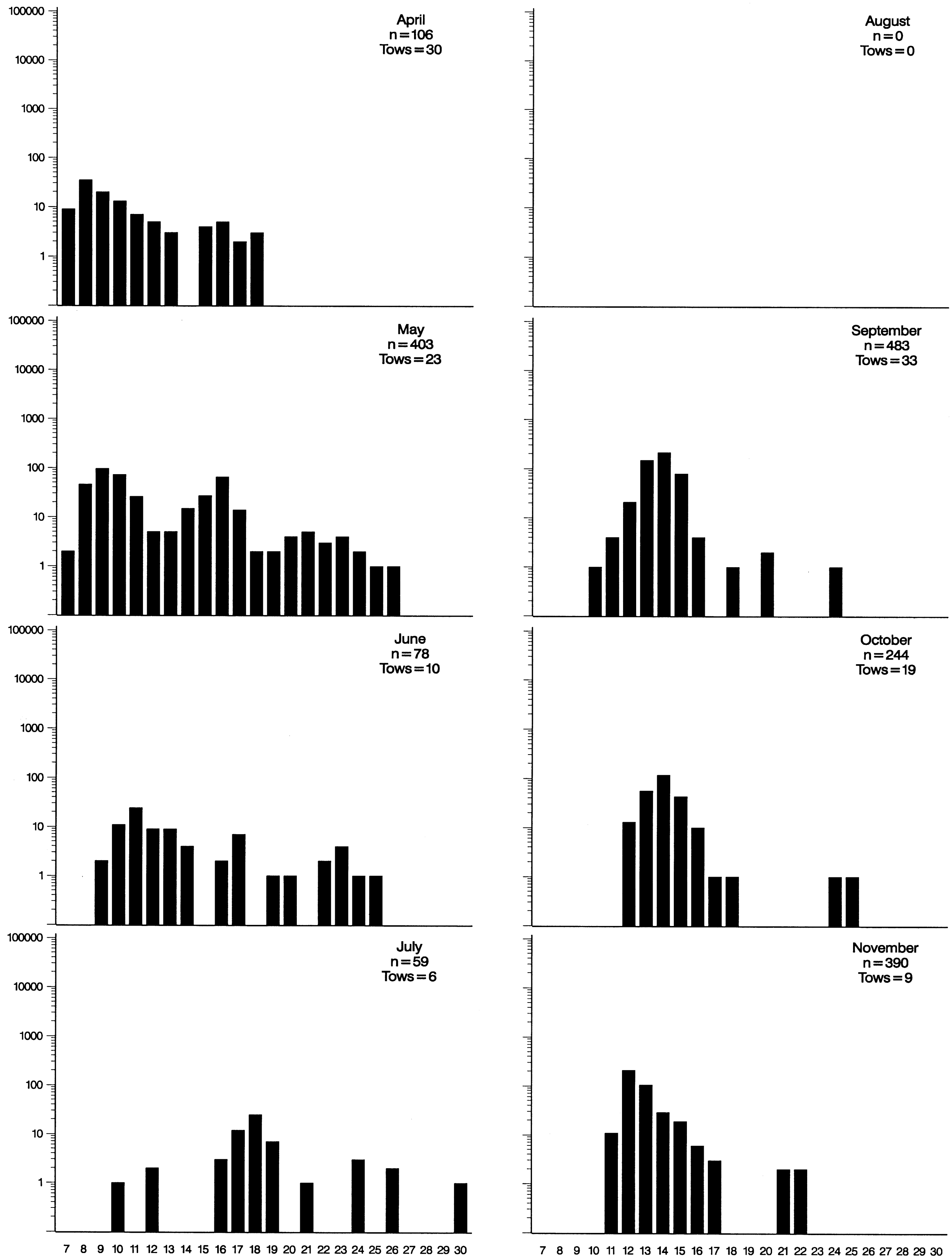


Figure LF-8

Blueback herring (*Alosa aestivalis*). Monthly log10 length frequencies (cm) based on 1,763 fish taken in 130 tows between 1989 and 1994.

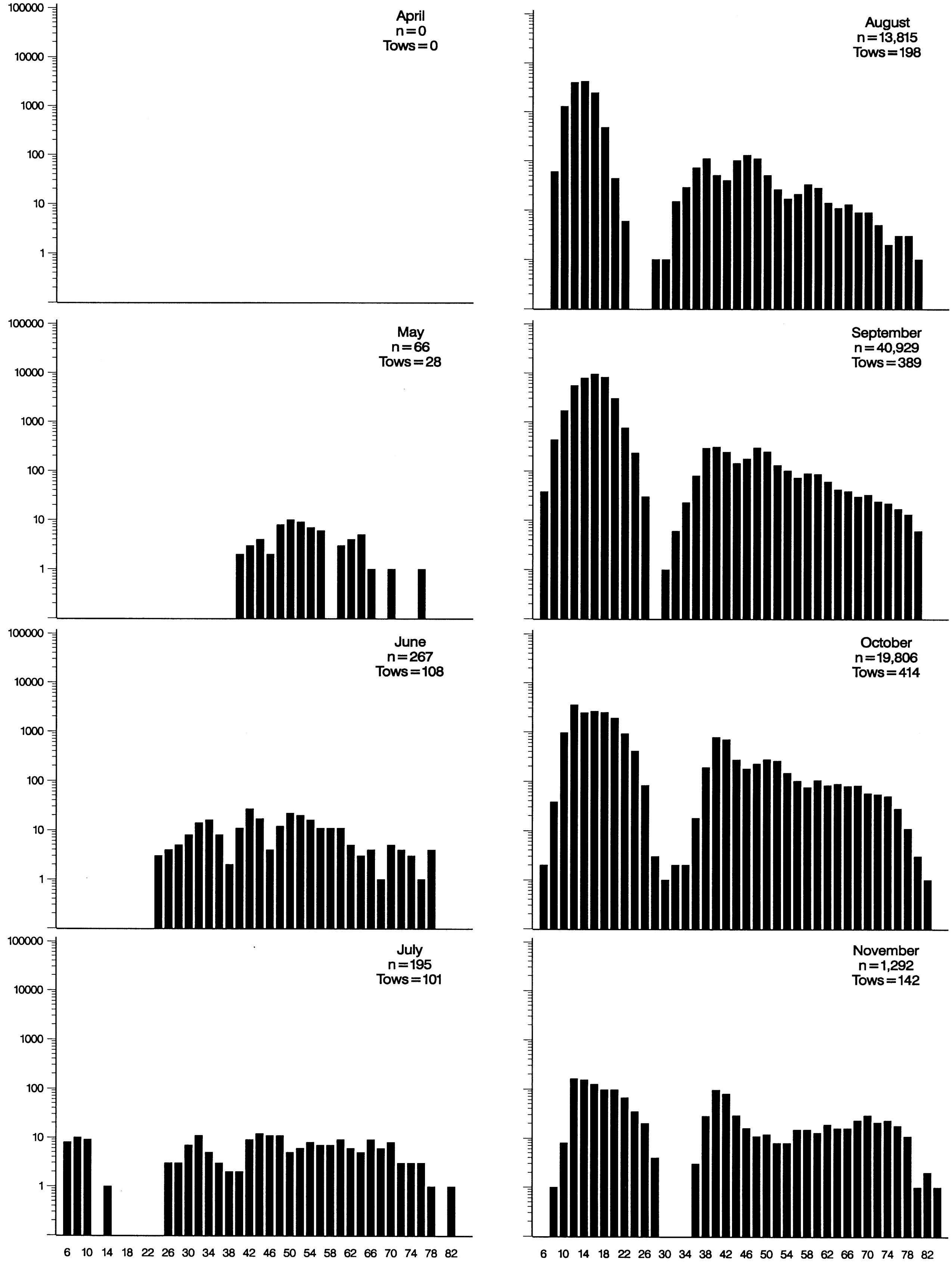


Figure LF-9

Bluefish (*Pomatomus saltatrix*). Monthly log10 length frequencies (cm) based on 76,370 fish taken in 1,380 tows between 1984 and 1994.

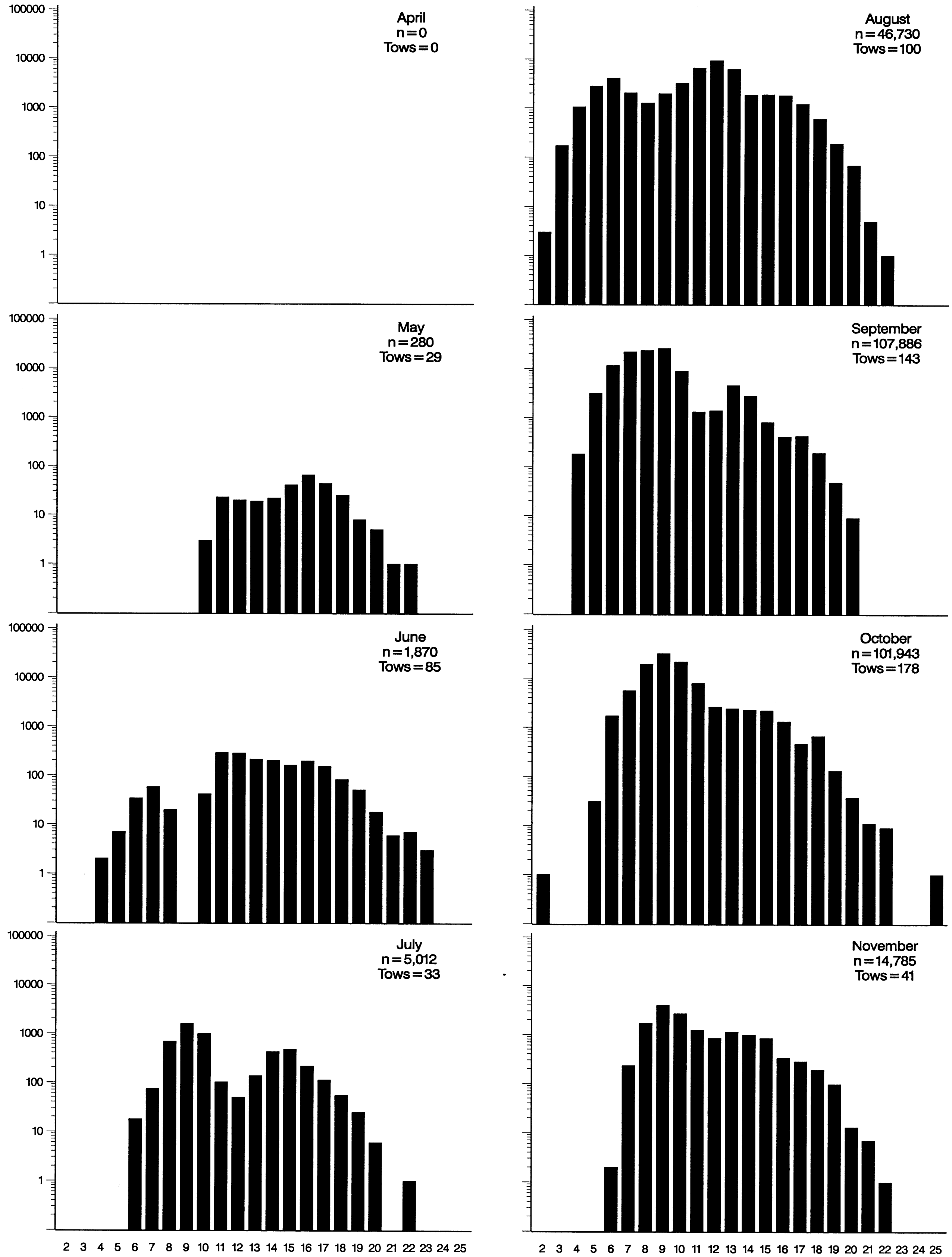


Figure LF-10

Butterfish (*Peprilus triacanthus*). Monthly log10 length frequencies (cm) based on 278,506 fish taken in 609 tows between 1987 and 1994.

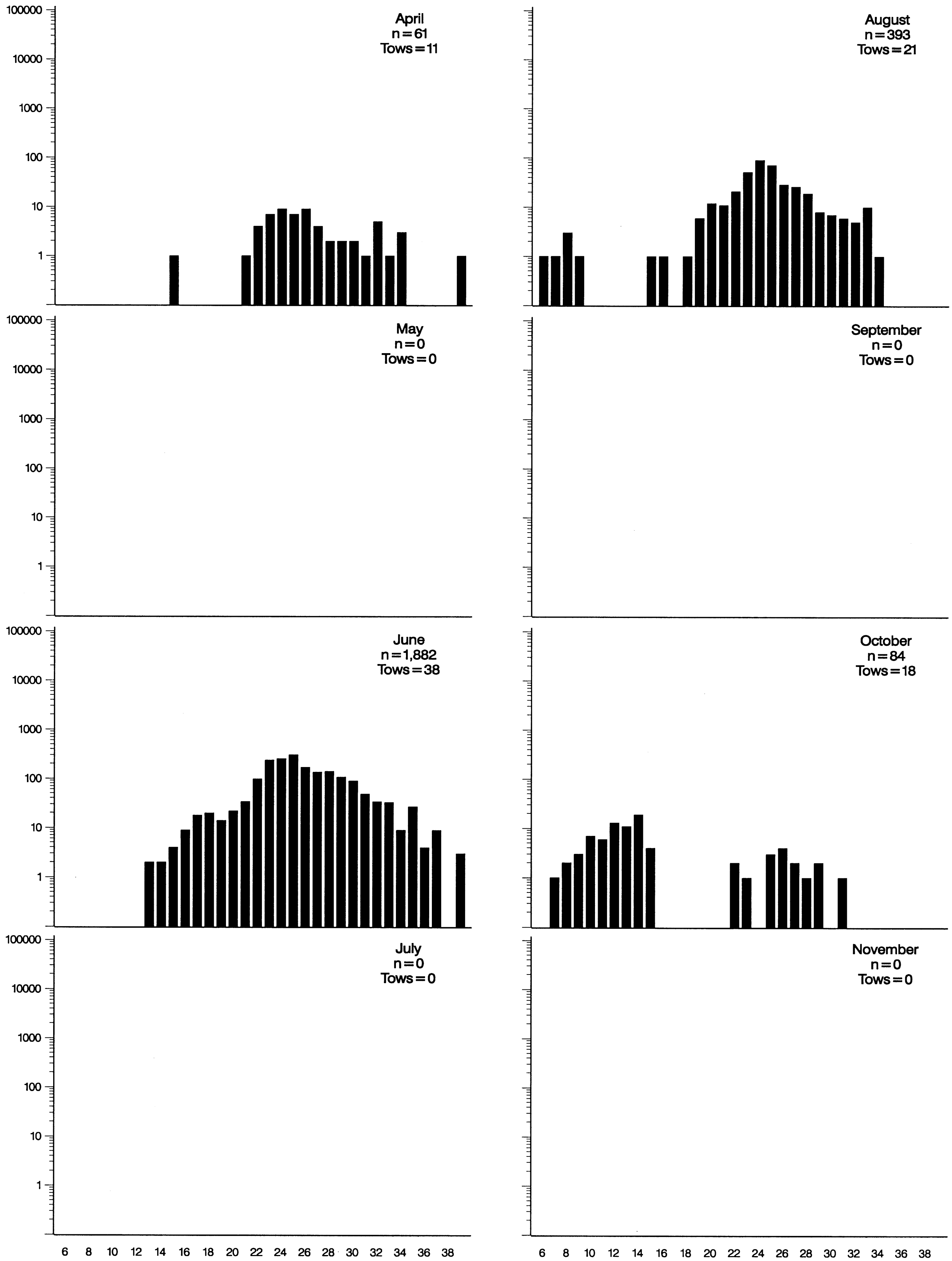


Figure LF-11

Fourspot flounder (*Paralichthys oblongus*). Monthly log10 length frequencies (cm) based on 2,420 fish taken in 88 tows between 1989 and 1990.

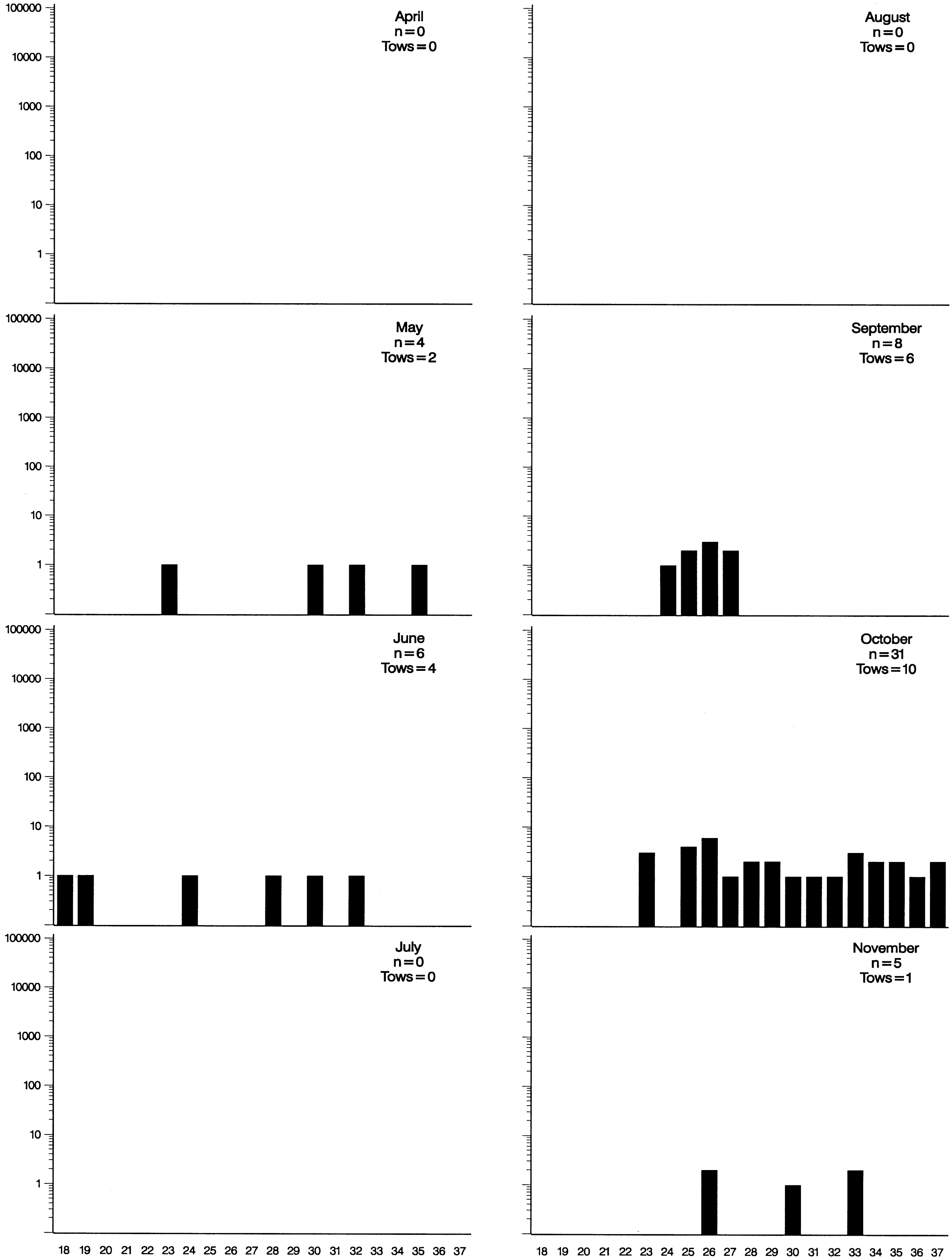


Figure LF-12

Hickory shad (*Alosa mediocris*). Monthly log10 length frequencies (cm) based on 54 fish taken in 23 tows between 1991 and 1994.

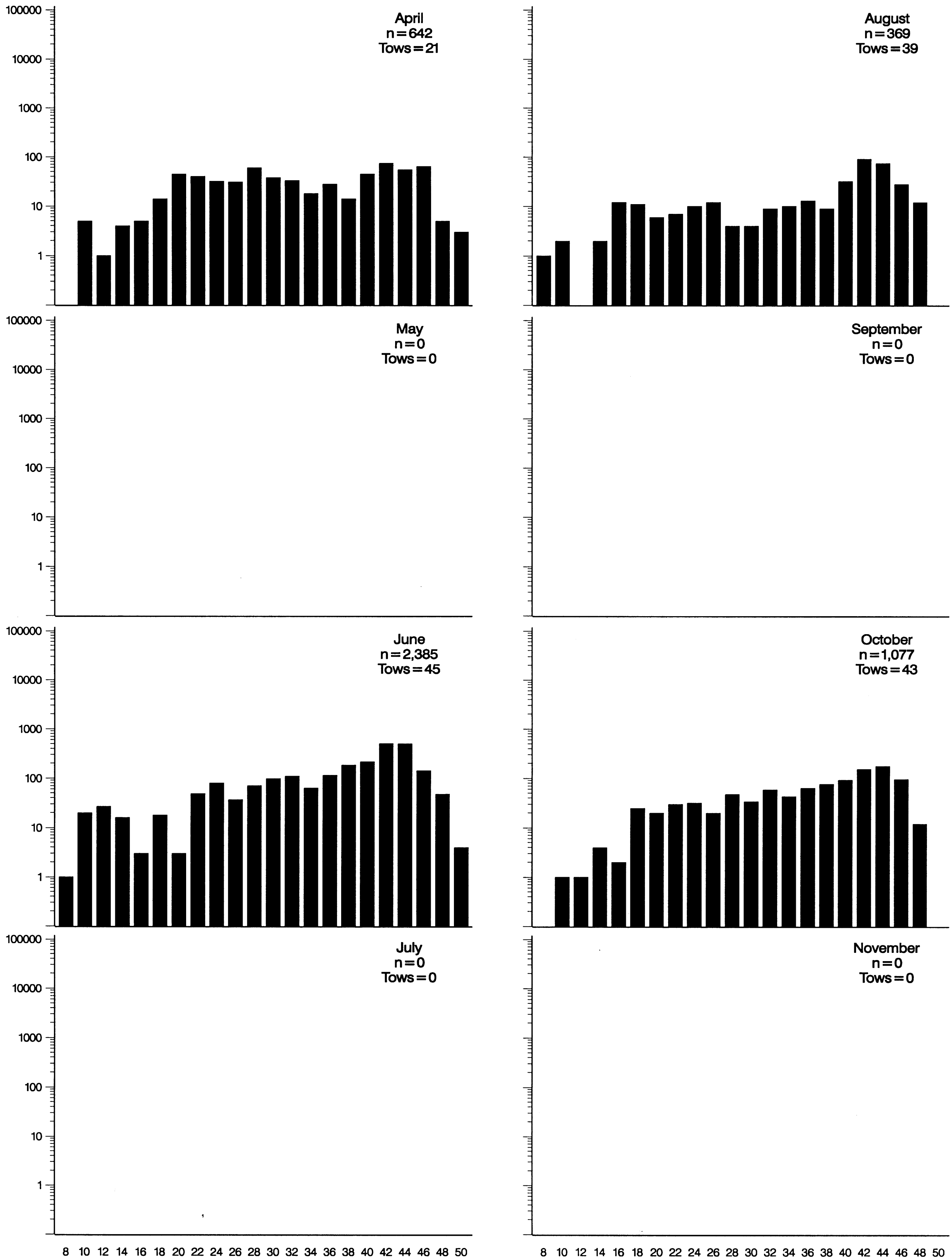


Figure LF-13

Little skate (*Raja erinacea*). Monthly log10 length frequencies (cm) based on 4,473 fish taken in 148 tows between 1989 and 1990.

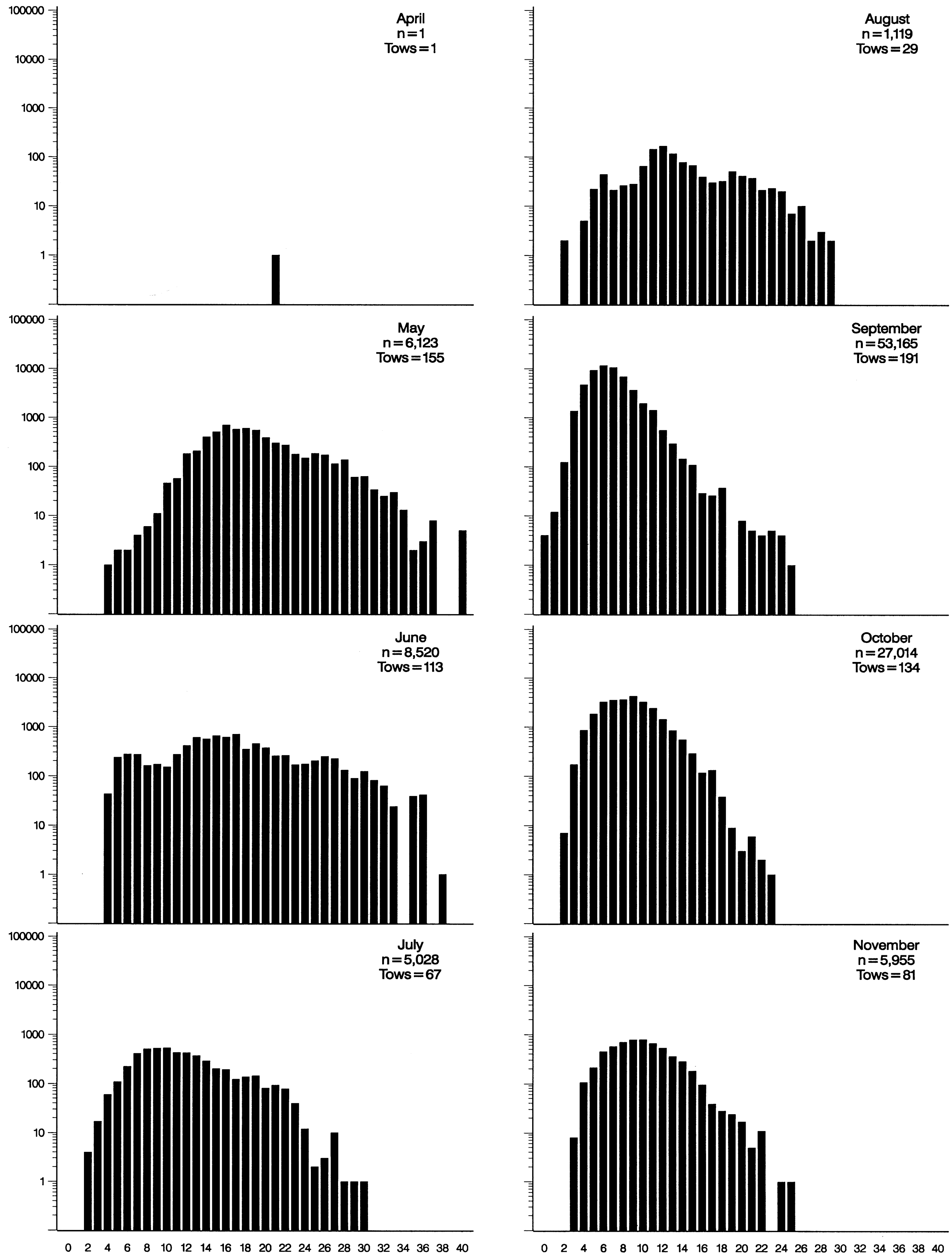


Figure LF-14

Long-finned squid (*Loligo pealei*). Monthly log10 length frequencies (cm) based on 106,925 squid taken in 771 tows between 1987 and 1994.

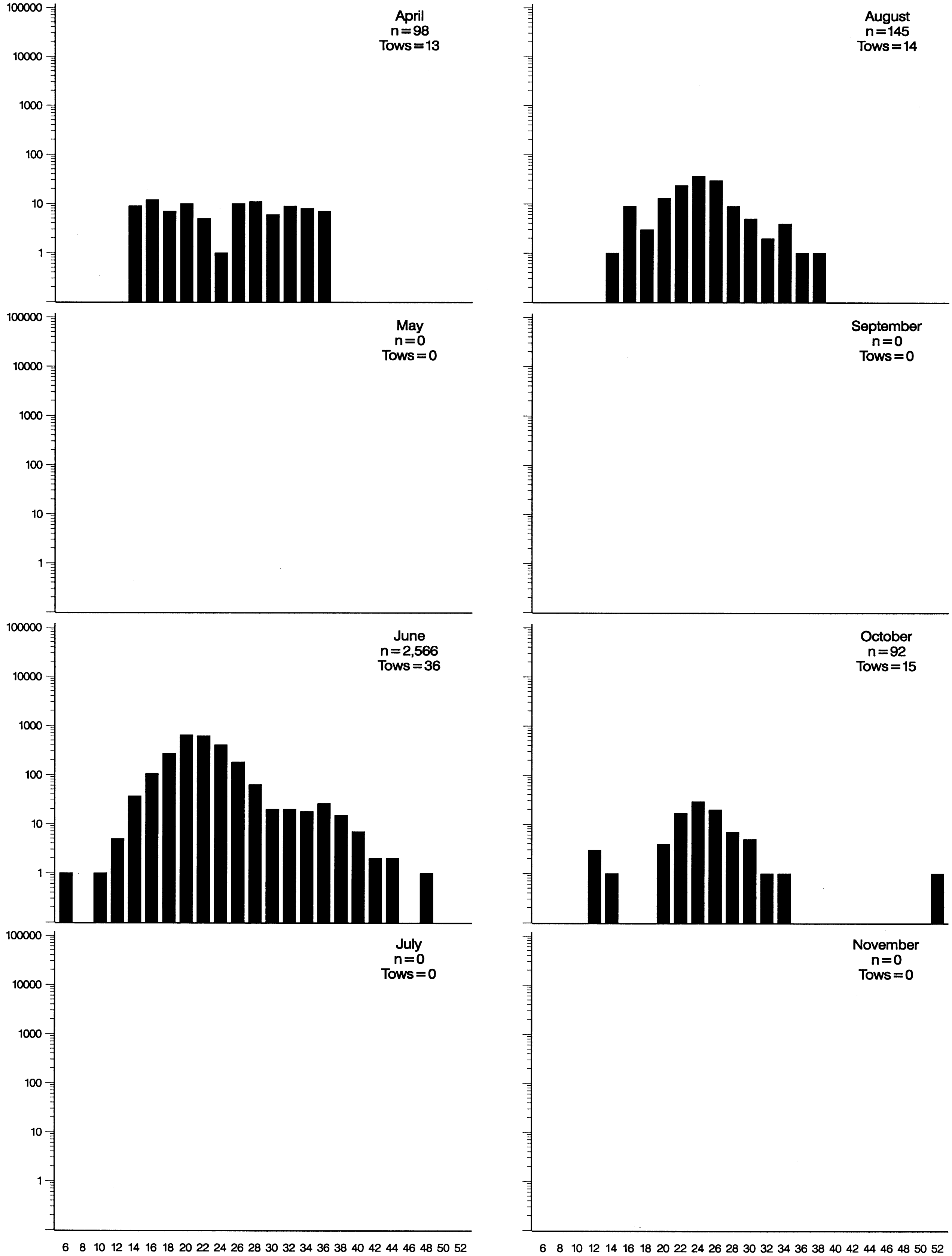


Figure LF-15

Red hake (*Urophycis chuss*). Monthly log10 length frequencies (cm) based on 2,901 fish taken in 78 tows between 1989 and 1990.

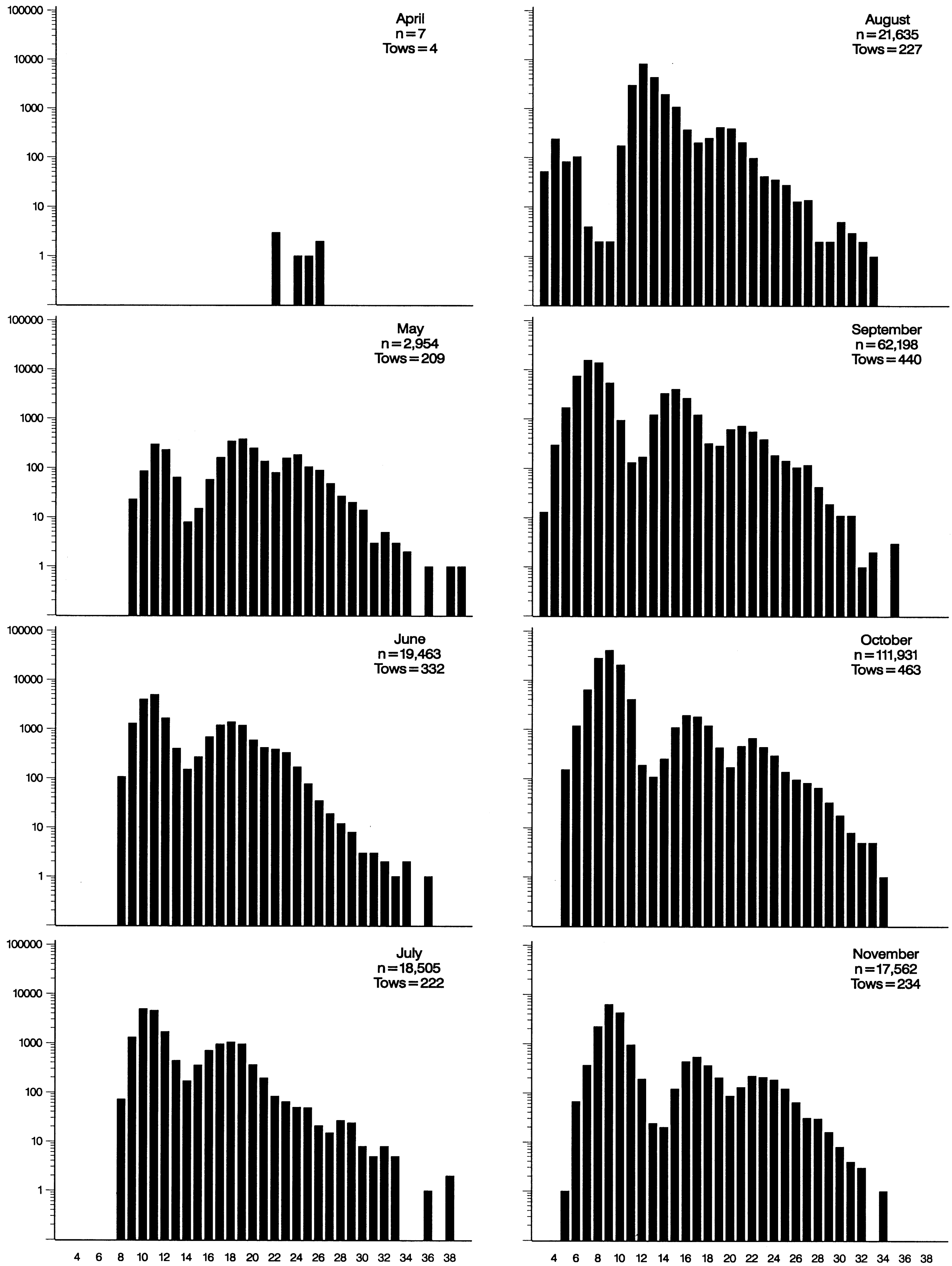


Figure LF-16

Scup (*Stenotomus chrysops*). Monthly log10 length frequencies (cm) based on 254,255 fish taken in 2,131 tows between 1984 and 1994.

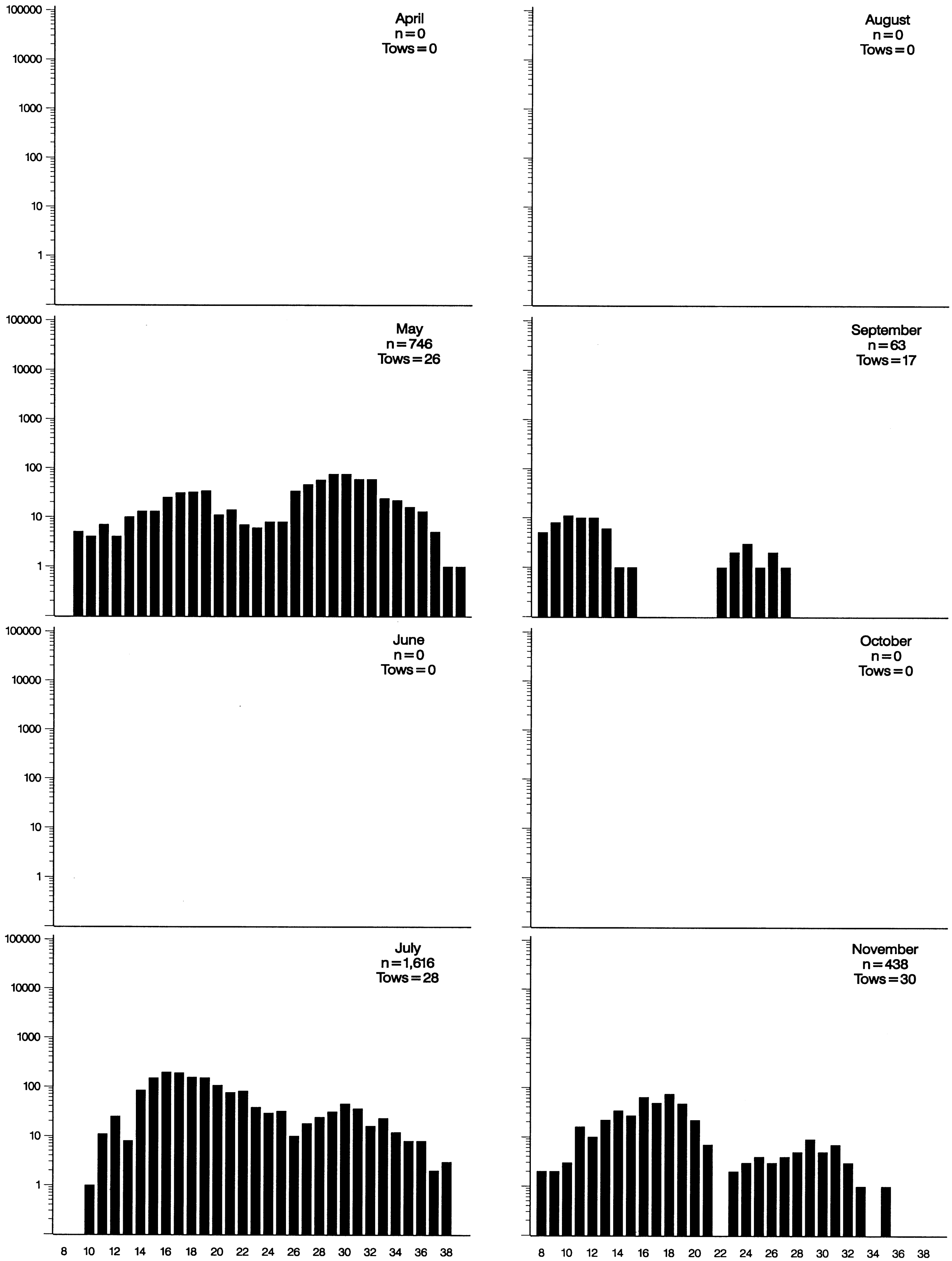


Figure LF-17

Silver hake (*Merluccius bilinearis*). Monthly log10 length frequencies (cm) based on 2,863 fish taken in 101 tows between 1989 and 1990.

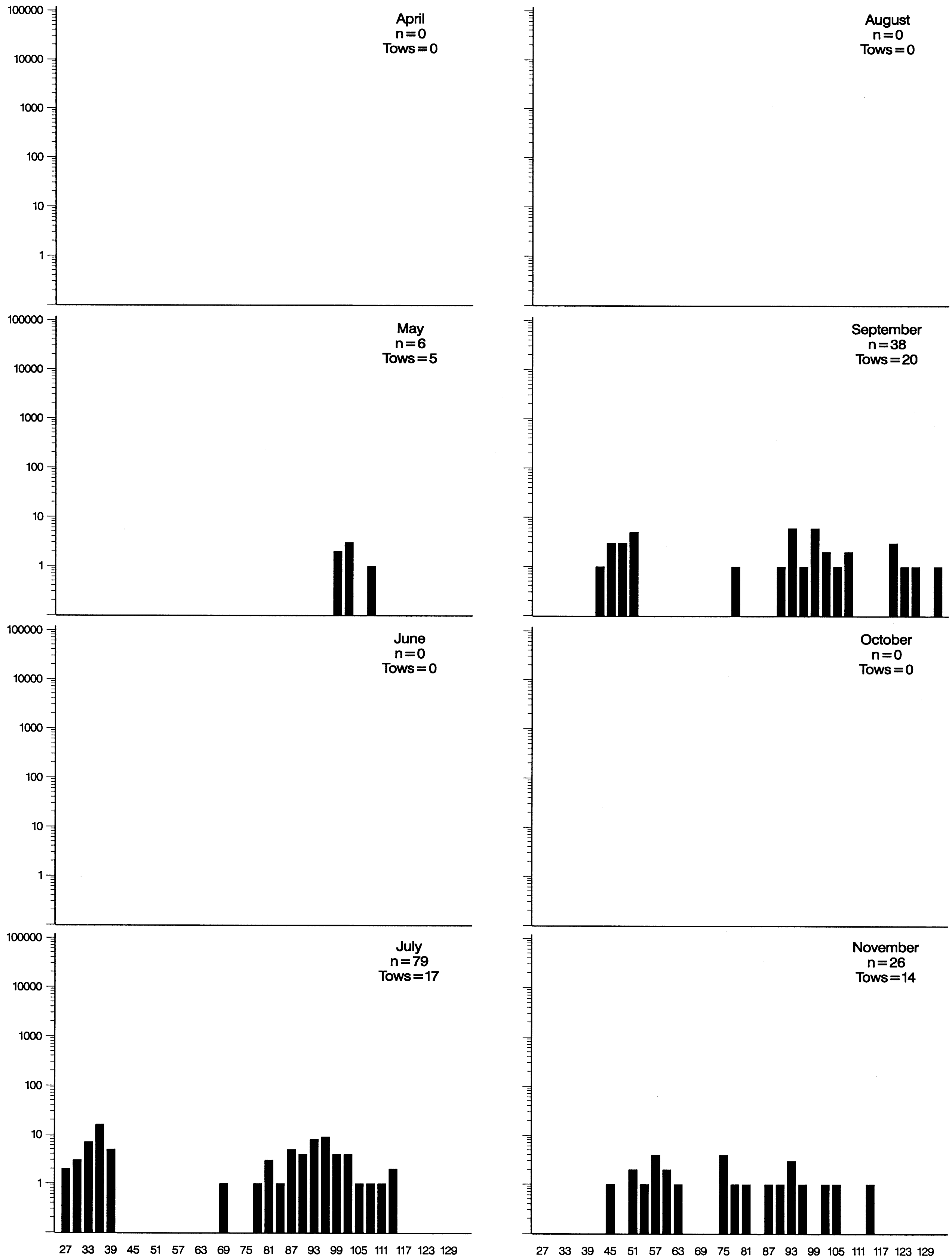


Figure LF-18

Smooth dogfish (*Mustelus canis*). Monthly log10 length frequencies (cm) based on 149 fish taken in 56 tows between 1989 and 1990. The frequency is plotted on the log scale and length is in centimeters.

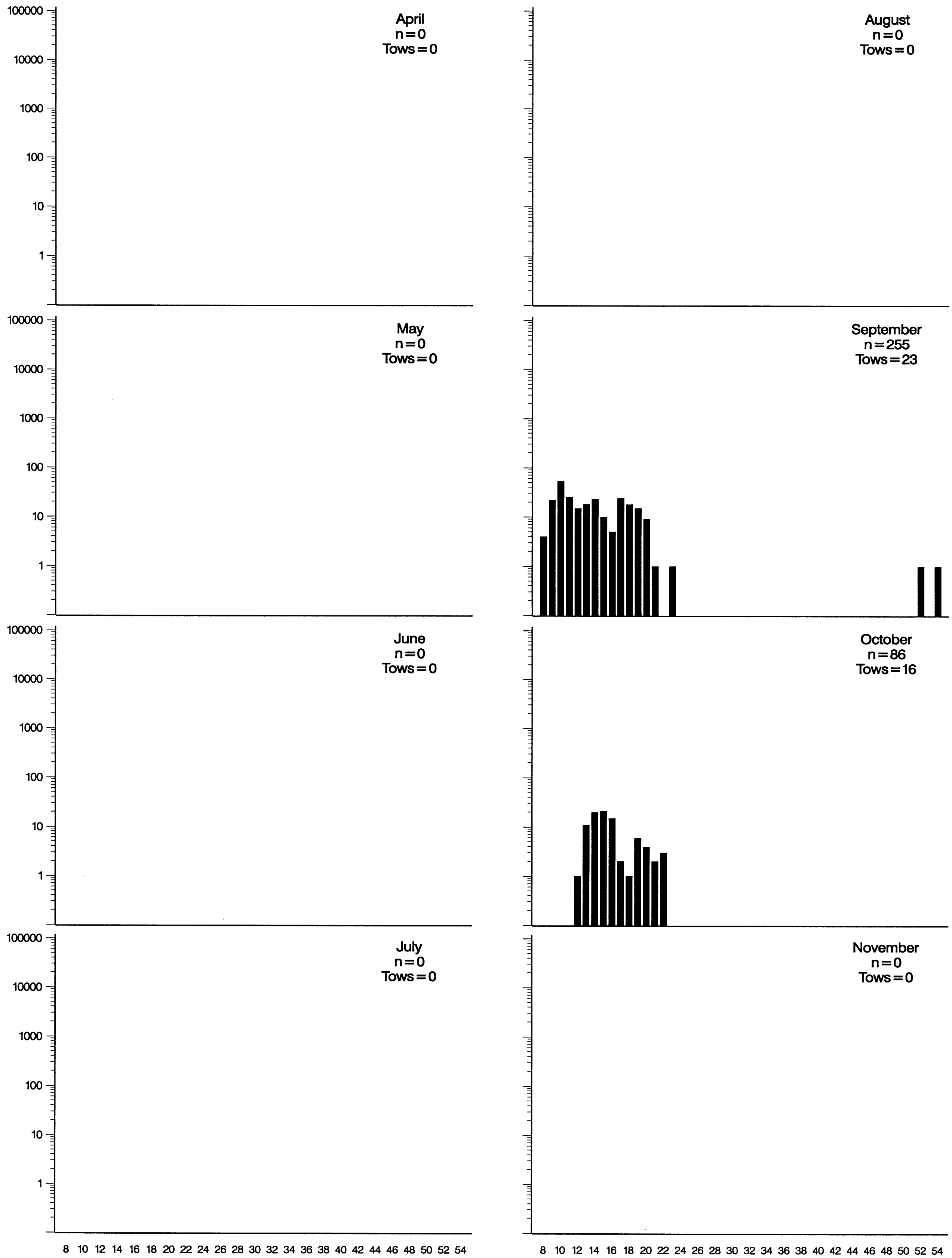


Figure LF-19

Spanish mackerel (*Scomberomorus maculatus*). Monthly log10 length frequencies (cm) based on 341 fish taken in 39 tows between 1991 and 1994.

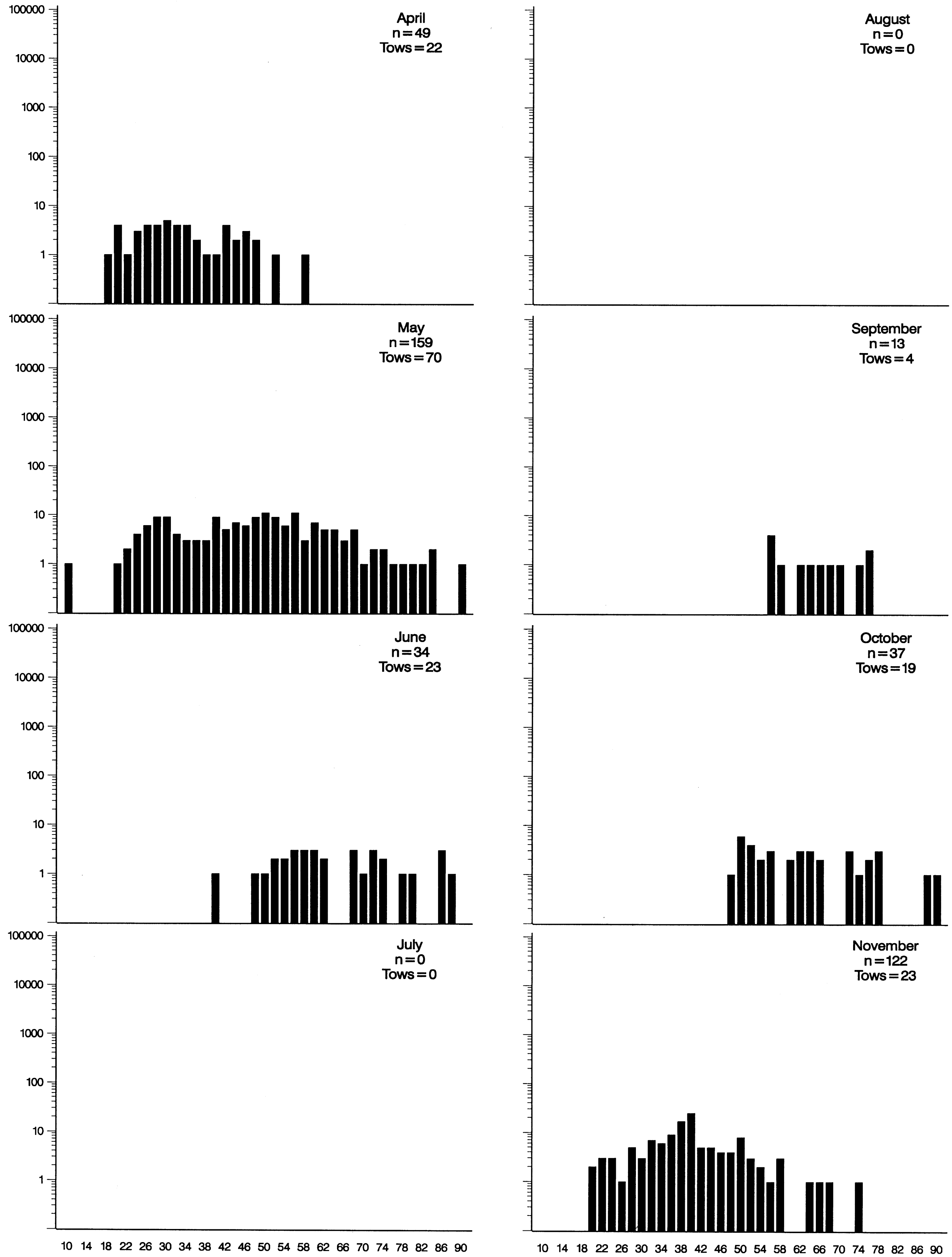


Figure LF-20

Striped bass (*Morone saxatilis*). Monthly log10 length frequencies (cm) based on 414 fish taken in 161 tows between 1989 and 1994.

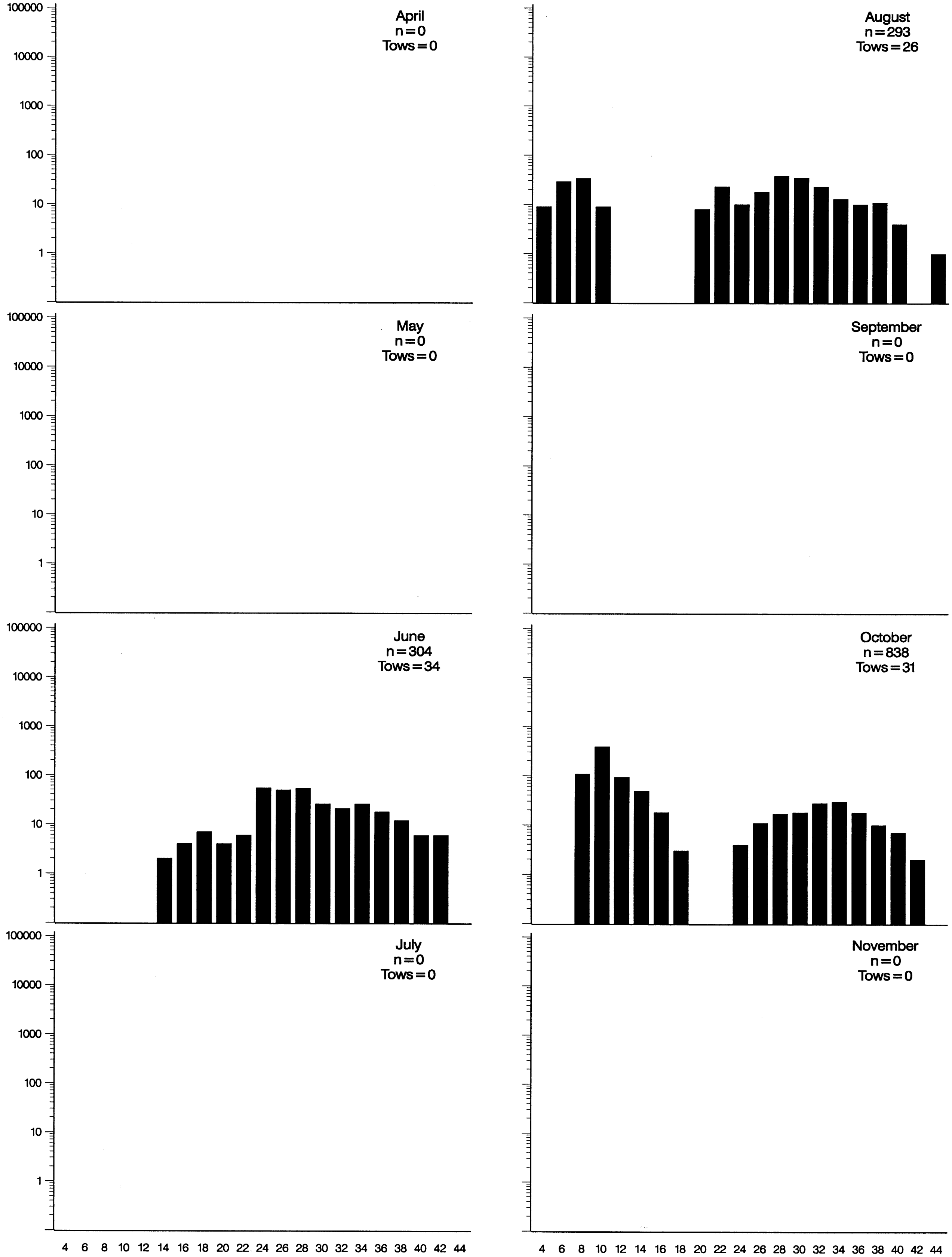


Figure LF-21

Striped searobin (*Prionotus evolans*). Monthly log10 length frequencies (cm) based on 1,435 fish taken in 91 tows between 1989 and 1990.

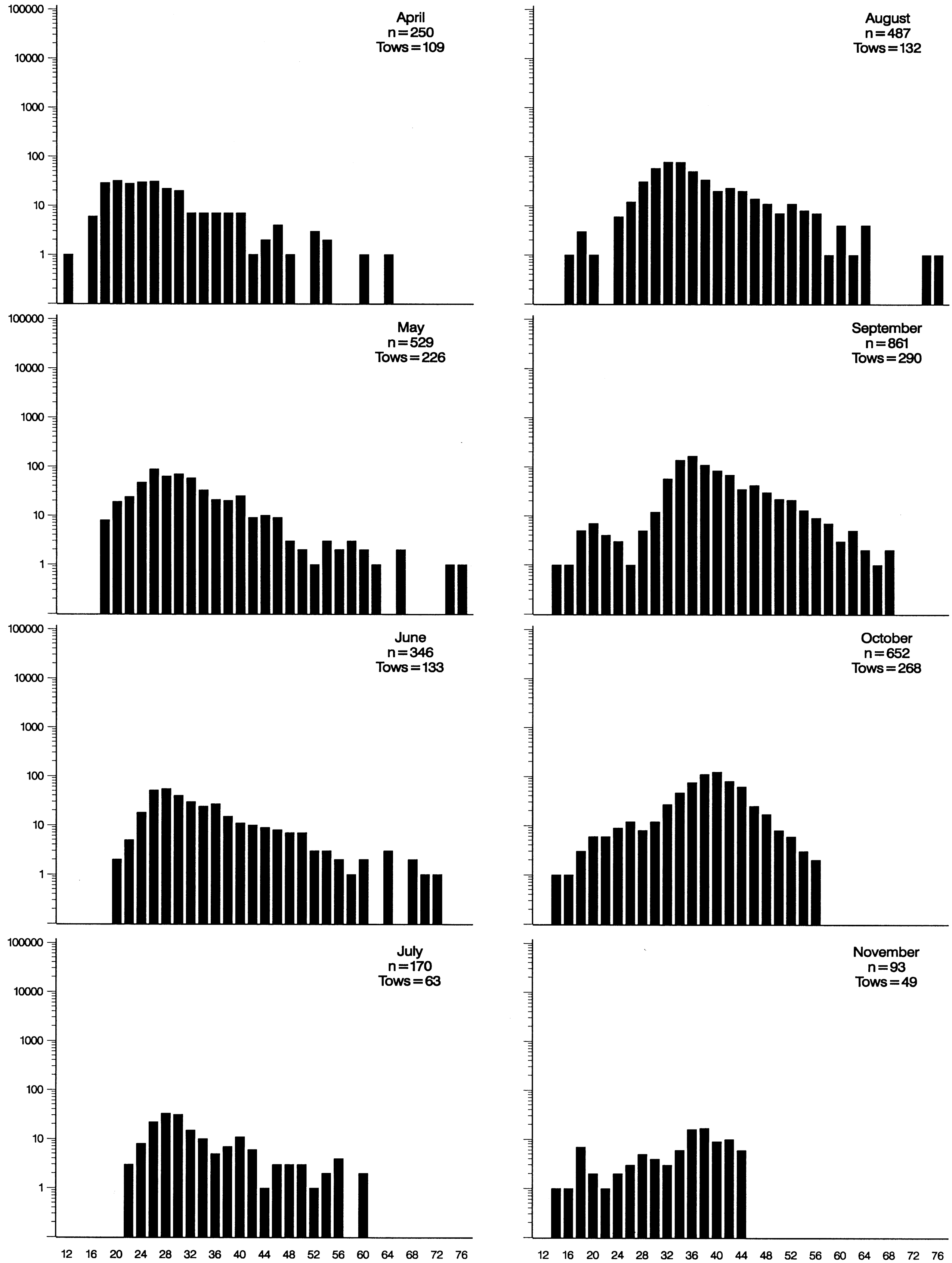


Figure LF-22

Summer flounder (*Paralichthys dentatus*). Monthly log10 length frequencies (cm) based on 3,388 fish taken in 1,270 tows between 1984 and 1994.

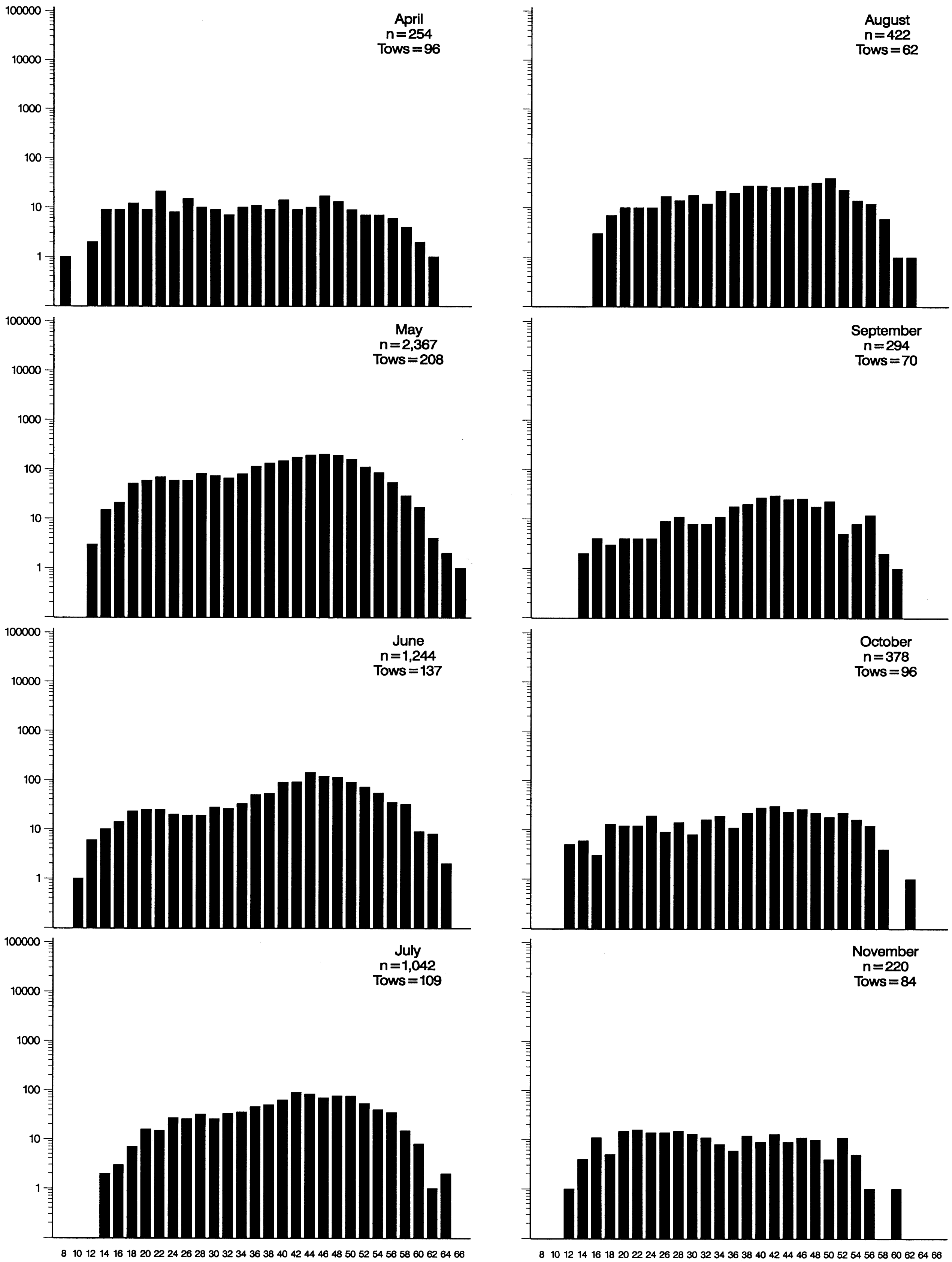


Figure LF-23

Tautog (*Tautoga onitis*). Monthly log10 length frequencies (cm) based on 6,221 fish taken in 862 tows between 1984 and 1994.

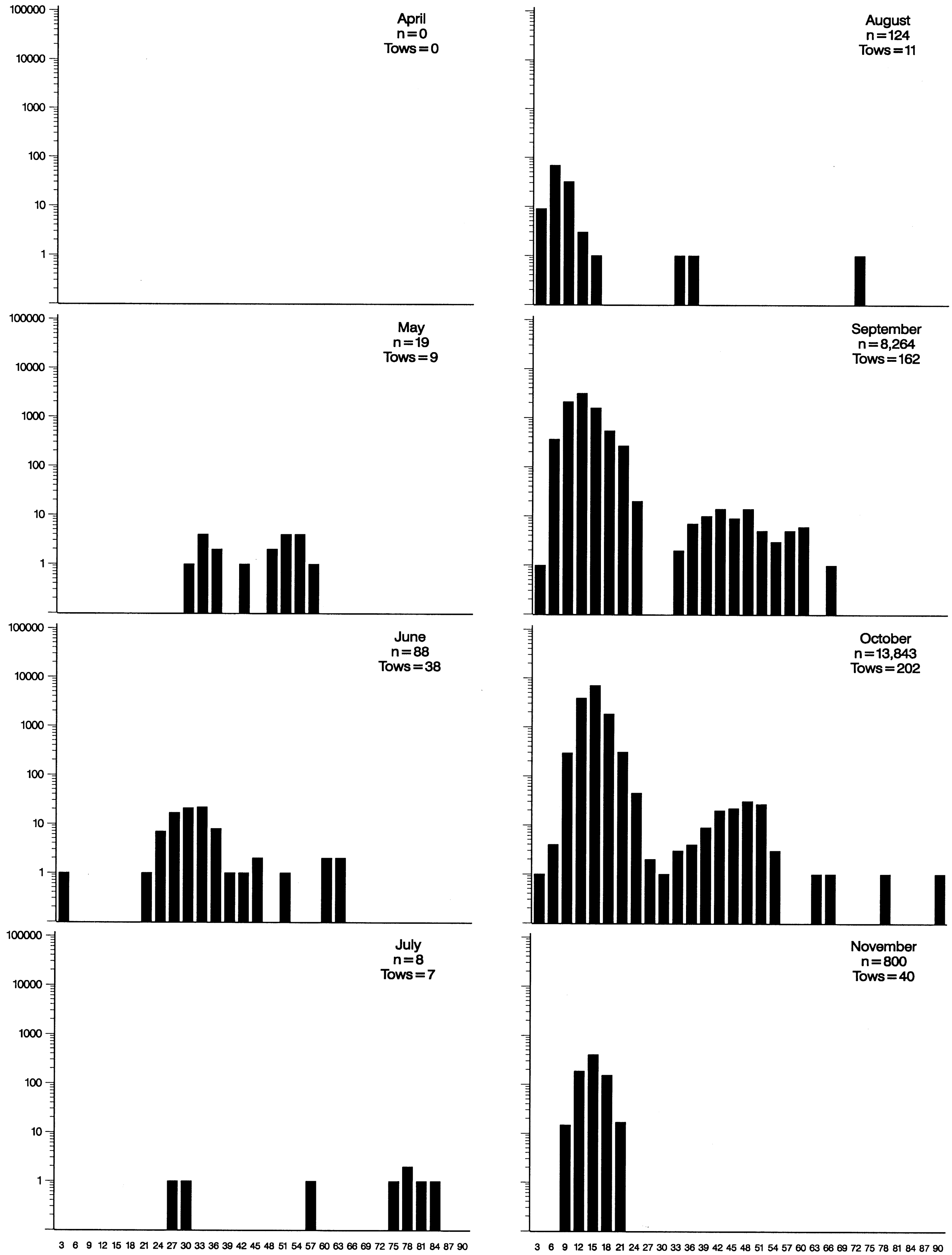


Figure LF-24

Weakfish (*Cynoscion regalis*). Monthly log10 length frequencies (cm) based on 23,146 fish taken in 469 tows between 1984 and 1994.

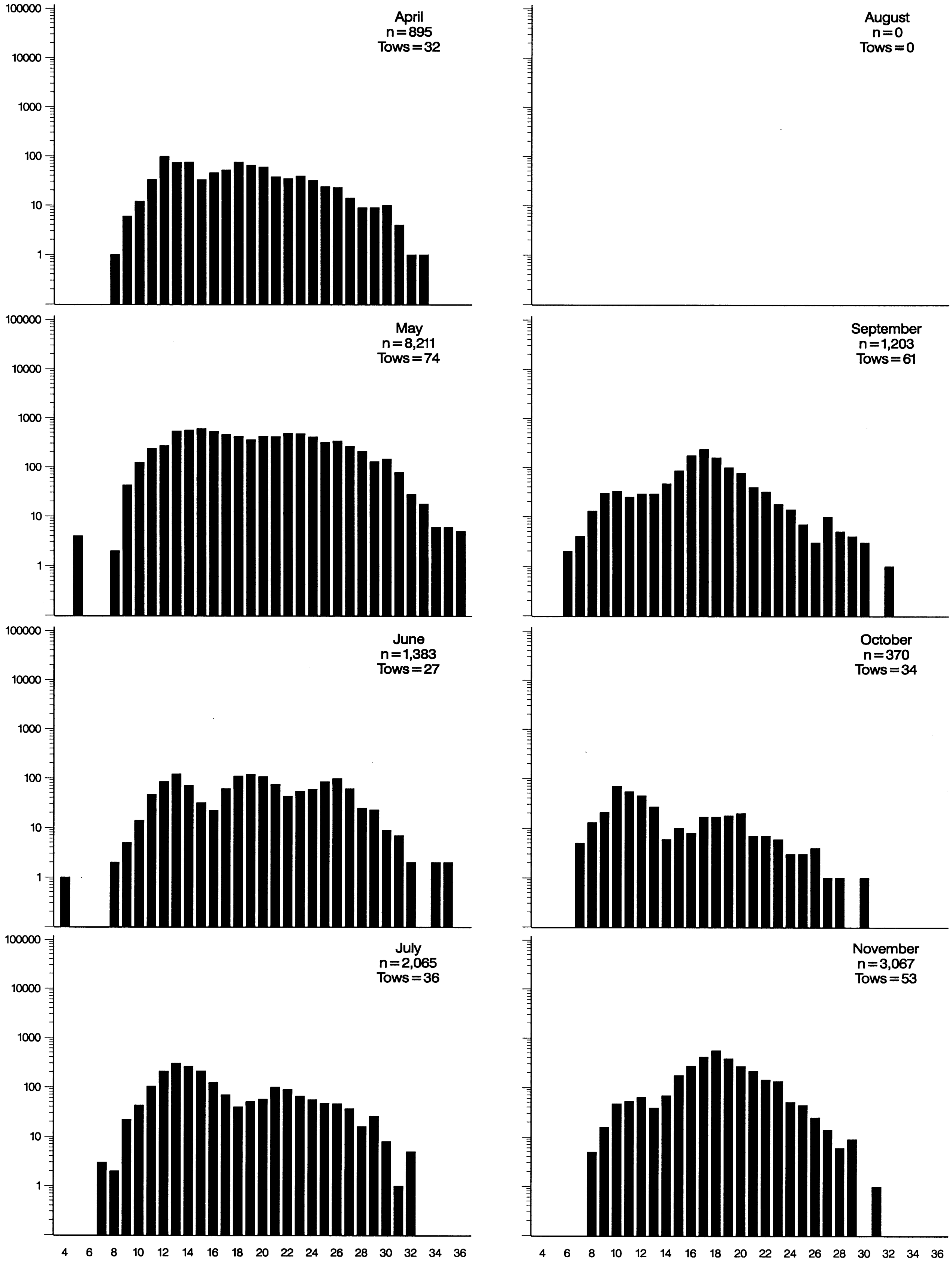


Figure LF-25

Windowpane flounder (*Scophthalmus aquosus*). Monthly log10 length frequencies (cm) based on 17,194 fish taken in 317 tows between 1989 and 1994.

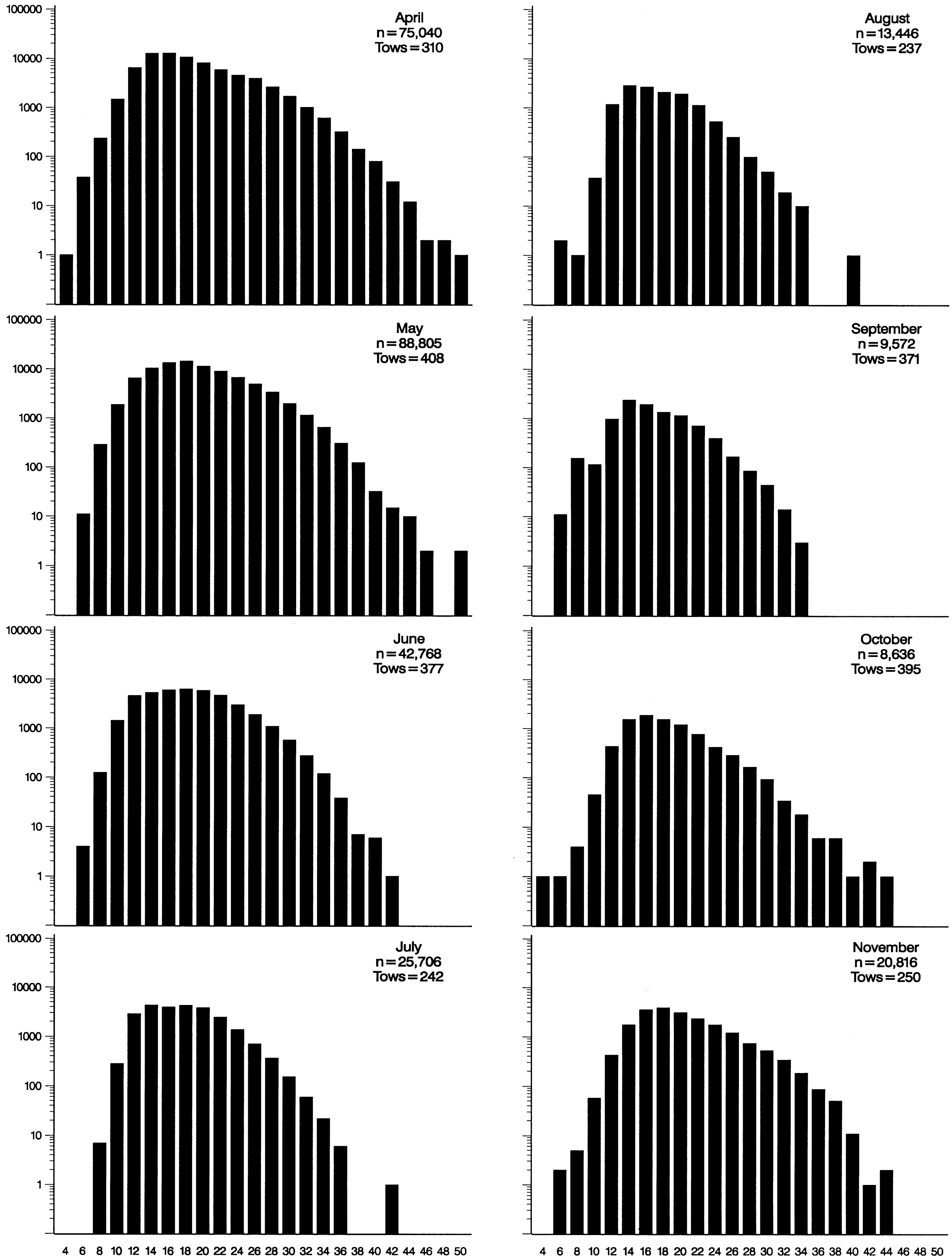


Figure LF-26
Winter flounder (*Pseudopleuronectes americanus*). Monthly log10 length frequencies (cm) based on 284,789 fish taken in 2,590 tows between 1984 and 1994.

Appendices

Appendix I

Catch information for 25 rarely occurring species. In lieu of distribution maps, catch information is provided for species which totaled less than 10 individuals captured from 1984 to 1994, or were not counted during the entire time series (For scientific name, see Table 5).

Species	Date	Site	Depth Interval	Bottom Type	Count
American eel	06/07/84	57-09	9–18 m	sand	1
American eel	06/07/84	00-10	27+ m	transitional	1
American eel	09/17/86	12-35	27+ m	transitional	1
American eel	05/23/89	57-09	9-18 m	sand	1
American eel	10/02/89	14-36	27+ m	transitional	1
American eel	06/04/93	03-14	18–27 m	mud	1
Amer. sand lance	04/14/93	55-13	9–18 m	sand	1
Amer. sand lance	04/15/93	57-09	9–18 m	sand	1
Amer. sand lance	04/15/93	59-13	18–27 m	mud	1
Amer. sand lance	04/11/94	13-33	0–9 m	sand	1
Amer. sand lance	04/18/94	58-24	0–9 m	sand	1
Amer. sand lance	04/18/94	02-27	18–27 m	transitional	1
Amer. sand lance	04/20/94	02-10	9–18 m	transitional	7
Amer. sand lance	04/21/94	55-13	9–18 m	sand	12
Amer. sand lance	06/06/94	06-11	0–9 m	mud	1,000
Amer. sand lance	06/14/94	01-29	9–18 m	sand	3
Atlantic cod	11/20/90	07-30	27+ m	sand	1
Atlantic bonito	09/17/85	02-10	9–18 m	transitional	2
Atlantic bonito	10/02/87	17-40	9–18 m	transitional	1
Atlantic bonito	09/19/88	17-37	0–9 m	transitional	1
Atlantic bonito	11/08/89	03-12	18–27 m	mud	1
Atlantic bonito	10/25/93	59-12	18–27 m	mud	2
Atl. silverside	09/10/92	56-13	9–18 m	transitional	1
Atl. silverside	04/07/93	14-28	0–9 m	transitional	1
Atl. silverside	04/14/93	55-13	9–18 m	sand	28
Atl. silverside	04/14/93	56-13	9–18 m	transitional	11
Atl. silverside	04/14/93	00-14	27+ m	mud	3
Atl. silverside	04/15/93	02-11	9–18 m	transitional	2
Atl. silverside	04/15/93	57-09	9–18 m	sand	1
Atl. silverside	04/15/93	59-13	18–27 m	mud	1
Atl. silverside	04/15/93	58-11	18–27 m	mud	4
Atl. silverside	04/19/93	06-11	0–9 m	mud	1
Atl. silverside	04/19/93	05-12	9–18 m	mud	2
Atl. silverside	04/11/94	10-28	27+ m	transitional	1
Atl. silverside	04/18/94	02-27	18–27 m	transitional	1
Atl. silverside	04/19/94	11-23	9–18 m	mud	1
Atl. salmon	04/06/93	15-34	0–9 m	transitional	1
Banded rudderfish	09/05/89	18-37	0–9 m	transitional	1
Bigeye	11/02/87	13-35	27+ m	transitional	1
Bigeye	10/03/88	17-38	9–18 m	transitional	1
Bigeye	10/03/88	14-37	27+ m	transitional	1
Bigeye	10/02/89	14-36	27+ m	transitional	2
Bigeye	09/11/90	12-35	27+ m	transitional	1
Bigeye	09/14/94	03-27	18–27 m	transitional	1
Conger eel	09/16/92	58-24	0–9 m	sand	1
Conger eel	06/10/93	11-26	18–27 m	transitional	2
Conger eel	10/19/93	05-26	18–27 m	transitional	1
Dwarf goatfish	09/07/88	58-22	0–9 m	sand	1
Gray triggerfish	10/17/85	05-24	27+ m	transitional	1
Gray triggerfish	10/13/93	07-22	18–27 m	mud	1
Inshore lizardfish	11/08/89	03-13	18–27 m	mud	2

continued

Appendix I (continued)

Species	Date	Site	Depth Interval	Bottom Type	Count
Inshore lizardfish	10/25/94	56-13	9–18 m	transitional	1
Lookdown	10/31/90	14-25	0–9 m	mud	2
Lookdown	09/08/94	05-11	9–18 m	mud	1
Lookdown	10/07/94	14-25	0–9 m	mud	1
Lookdown	10/24/94	03-12	18–27 m	mud	1
Lumpfish	04/06/93	18-40	0–9 m	transitional	2
Northern sennet	10/24/84	56-14	9–18 m	transitional	1
Northern sennet	09/11/89	01-29	9–18 m	sand	1
Northern sennet	10/14/93	58-24	0–9 m	sand	1
Northern sennet	10/18/93	18-37	0–9 m	transitional	1
Orange filefish	10/08/85	12-28	18–27 m	transitional	1
Orange filefish	11/03/89	10-26	27+ m	transitional	1
Orange filefish	09/13/93	15-34	0–9 m	transitional	1
Orange filefish	10/19/94	12-35	27+ m	transitional	1
Red cornetfish	09/21/90	14-32	9–18 m	sand	1
Red cornetfish	09/13/93	08-30	27+ m	sand	1
Red goatfish	10/22/84	00-18	18–27 m	mud	1
Red goatfish	10/23/90	04-27	18–27 m	transitional	1
Red goatfish	10/23/90	06-25	27+ m	transitional	1
Red goatfish	10/18/91	59-18	18–27 m	mud	1
Red goatfish	09/14/93	03-27	18–27 m	transitional	1
Red goatfish	10/13/93	05-22	27+ m	mud	1
Sandbar shark	10/23/90	06-25	27+ m	transitional	1
Sea lamprey	04/15/87	12-23	9–18 m	mud	1
Sea lamprey	04/07/88	05-25	27+ m	transitional	1
Sea lamprey	04/19/90	03-11	9–18 m	transitional	1
Sea lamprey	04/22/91	06-23	27+ m	mud	1
Sea lamprey	04/06/93	15-34	0–9 m	transitional	1
Sea lamprey	05/11/93	05-13	9–18 m	mud	1
Seasnail	04/05/88	15-34	0–9 m	transitional	1
Seasnail	05/02/90	04-26	18–27 m	transitional	6
Seasnail	05/02/90	06-29	27+ m	sand	1
Seasnail	05/07/90	12-25	9–18 m	transitional	1
Short bigeye	11/25/85	14-36	27+ m	transitional	1
Short bigeye	09/09/88	09-24	18–27 m	transitional	1
Short bigeye	09/07/89	12-35	27+ m	transitional	1
Short bigeye	09/08/89	05-25	27+ m	transitional	1
Short bigeye	10/18/93	13-36	27+ m	transitional	1
Short bigeye	10/19/94	14-36	27+ m	transitional	1
Short bigeye	11/15/84	13-35	27+ m	transitional	1
Short bigeye	08/20/85	12-28	18-27 m	transitional	1
Striped cusk-eel	05/05/88	10-29	18–27 m	sand	1
White perch	04/19/89	12-18	0–9 m	mud	1
White perch	04/20/89	13-19	0–9 m	mud	1
White perch	04/06/93	15-34	0–9 m	transitional	4
White perch	04/19/94	14-28	0–9 m	transitional	1
Yellowtail flounder	04/07/88	05-25	27+ m	transitional	1
Yellowtail flounder	05/02/88	12-35	27+ m	transitional	2
Yellowtail flounder	05/05/88	10-29	18–27 m	sand	1
Yellowtail flounder	05/05/88	09-28	18–27 m	sand	1
Yellowtail flounder	05/11/88	08-20	18–27 m	mud	1
Yellowtail flounder	08/03/88	59-18	18–27 m	mud	1
Yellowtail flounder	05/02/90	10-23	27+ m	sand	1

Note: Bay anchovy (*Anchoa mitchelli*) were frequently encountered but not counted. American sand lance (*Ammodytes americanus*) and Atlantic silversides (*Menidia menidia*) were occasionally encountered but not counted until 1992.

Appendix II

Total catch of 84 species by year from 1984–94.

Species	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Total
Alewife	284	37	242	819	415	473	287	103	122	934	1,431	5,147
American eel	2	0	1	0	0	2	0	0	0	1	0	6
American lobster	5,819	3,529	4,920	6,865	6,033	7,645	9,690	8,464	8,161	12,639	9,127	82,892
American sand lance	0	0	0	0	0	0	0	0	0	3	1,025	1,028
American shad	1,839	423	641	1,036	3,208	4,007	550	361	380	1,142	1,723	15,310
Atlantic bonito	0	2	0	1	1	1	0	0	0	2	0	7
Atlantic cod	0	0	0	0	0	0	1	0	0	0	0	1
Atlantic croaker	0	0	0	0	0	0	0	0	0	41	3	44
Atlantic herring	114	510	2,536	2,549	2,721	2,560	25,029	4,005	4,565	6,271	3,850	54,710
Atlantic mackerel	68	17	20	29	45	376	46	2	4	17	11	635
Atlantic menhaden	132	304	718	600	335	623	407	348	1,115	298	411	5,291
Atlantic salmon	0	0	0	0	0	0	0	0	0	1	0	1
Atlantic silverside	0	0	0	0	0	0	0	0	1	54	358	
Atlantic sturgeon	11	3	6	6	7	13	9	3	30	60	60	208
Banded rudderfish	0	0	0	0	0	1	0	0	0	0	0	1
Bigeye	0	0	0	1	2	2	1	0	0	0	1	7
Bigeye scad	0	0	0	0	15	63	1	1	0	0	3	83
Black sea bass	34	53	43	24	22	21	39	39	5	20	34	334
Blueback herring	1,676	116	267	104	247	367	124	38	175	106	1,199	4,419
Bluefish	9,719	8,809	5,685	3,531	3,858	12,568	8,194	5,846	5,269	6,469	16,244	86,192
Butterfish	37,010	67,945	44,616	42,519	60,745	94,928	80,778	40,537	95,961	67,087	54,378	686,504
Clearnose skate	0	0	3	2	1	1	3	2	8	8	1	29
Conger eel	0	0	0	0	0	0	0	0	1	3	0	4
Crevalle jack	0	1	0	1	4	0	0	0	0	6	8	20
Cunner	346	98	97	129	72	268	196	75	30	65	25	1,401
Dwarf goatfish	0	0	0	0	1	0	0	0	0	0	0	1
Fourbeard rockling	368	88	184	312	563	686	393	163	150	242	93	3,242
Fourspot flounder	2,673	2,739	2,125	2,112	4,654	2,924	4,698	3,556	2,771	1,447	1,674	31,373
Goosefish	1	8	1	1	1	15	3	8	10	4	8	60
Gray triggerfish	0	1	0	0	0	0	0	0	0	1	0	2
Grubby	0	1	1	1	5	9	6	0	0	0	5	28
Hickory shad	71	4	7	6	4	40	2	1	12	10	31	188
Hogchoker	294	282	140	87	113	118	259	104	61	73	37	1,568
Inshore lizardfish	0	0	0	0	0	2	0	0	0	0	1	3
Little skate	2,751	4,603	4,300	3,847	9,470	9,349	11,902	6,481	3,494	6,051	6,714	68,962
Long-finned squid	0	0	11,017	15,135	33,400	21,304	23,789	12,322	32,780	58,312	25,400	233,459
Longhorn sculpin	14	82	51	32	107	107	263	139	31	11	7	844
Lookdown	0	0	0	0	0	0	2	0	0	0	3	5
Lumpfish	0	0	0	0	0	0	0	0	0	2	0	2
Mackerel scad	0	0	0	0	0	0	1	2	6	0	4	13
Moonfish	6	226	22	7	142	60	10	24	62	6	149	714
Northern kingfish	0	0	0	0	0	1	1	4	2	10	7	25
Northern pipefish	1	0	1	0	3	0	0	0	5	21	2	33
Northern puffer	1	2	6	0	3	2	2	5	1	28	4	54
Northern searobin	580	2,249	546	280	605	381	357	609	313	951	878	7,749
Northern sennet	1	0	0	0	0	1	0	0	0	2	0	4
Ocean pout	23	3	14	14	30	58	39	42	18	66	42	349
Orange filefish	0	1	0	0	0	1	0	0	0	1	1	4
Oyster toadfish	3	4	9	0	0	3	4	1	0	2	0	26
Planehead filefish	4	20	1	0	25	13	23	1	0	10	1	98
Pollock	5	0	3	8	6	2	0	0	0	0	0	24
Rainbow smelt	0	0	0	0	5	4	2	2	0	9	9	31

continued

Appendix II (continued)

Species	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Total
Red cornetfish	0	0	0	0	0	0	1	0	0	1	0	2
Red goatfish	1	0	0	0	0	0	2	1	0	2	0	6
Red hake	3,703	1,153	3,061	2,258	3,809	7,365	3,300	2,085	1,604	4,183	546	33,067
Rock gunnel	0	6	0	6	5	10	9	0	0	0	1	37
Rough scad	33	32	19	89	180	81	41	1	0	100	13	589
Round herring	22	15	0	1	0	0	0	0	2	6	2	48
Sandbar shark	0	0	0	0	0	0	1	0	0	0	0	1
Scup (porgy)	8,754	18,041	16,337	9,750	12,562	37,619	21,194	45,790	13,646	32,209	38,469	254,371
Sea lamprey	0	0	0	1	1	0	1	1	0	2	0	6
Sea raven	53	59	70	88	52	34	44	19	4	1	1	425
Seasnail	0	0	0	0	1	0	8	0	0	0	0	9
Short bigeye	1	2	0	0	1	2	0	0	0	1	1	8
Silver hake	1,516	723	1,464	1,848	3,429	3,551	4,243	1,539	543	508	2,136	21,500
Smallmouth flounder	2	0	2	15	39	13	4	20	12	30	17	154
Smooth dogfish	840	919	850	526	564	374	284	193	304	420	361	5,635
Spanish mackerel	0	0	0	0	0	11	0	2	1	233	106	353
Spiny dogfish	84	252	173	76	434	99	417	14	6	14	58	1,627
Spot	0	34	38	10	29	0	8	2	0	124	53	298
Spotted hake	76	69	96	55	255	12	42	73	68	497	184	1,427
Striped bass	10	13	12	30	31	59	117	38	42	81	81	514
Striped cusk-eel	0	0	0	0	1	0	0	0	0	0	0	1
Striped searobin	1,430	2,294	2,035	1,482	2,086	2,211	2,353	865	856	1,491	1,297	18,400
Summer flounder	208	240	704	531	411	47	242	263	186	293	282	3,407
Tautog	719	831	795	624	629	791	692	501	265	164	224	6,235
Tomcod	2	1	0	8	2	3	3	4	8	5	2	38
Weakfish	368	2,679	7,940	328	1,360	5,908	2,246	4,320	1,317	2,061	8,156	36,683
White perch	0	0	0	0	0	2	0	0	0	4	1	7
Windowpane flounder	26,185	18,888	22,513	15,588	26,920	31,082	14,738	8,487	2,978	8,526	6,678	182,583
Winter flounder	13,812	13,792	19,022	22,696	36,717	45,562	60,008	26,622	9,548	16,831	21,481	286,091
Winter skate	1	20	34	17	114	120	85	50	31	62	51	585
Yellow jack	0	0	0	0	0	41	8	11	2	2	6	70
Yellowtail flounder	0	0	0	0	7	0	1	0	0	0	0	8