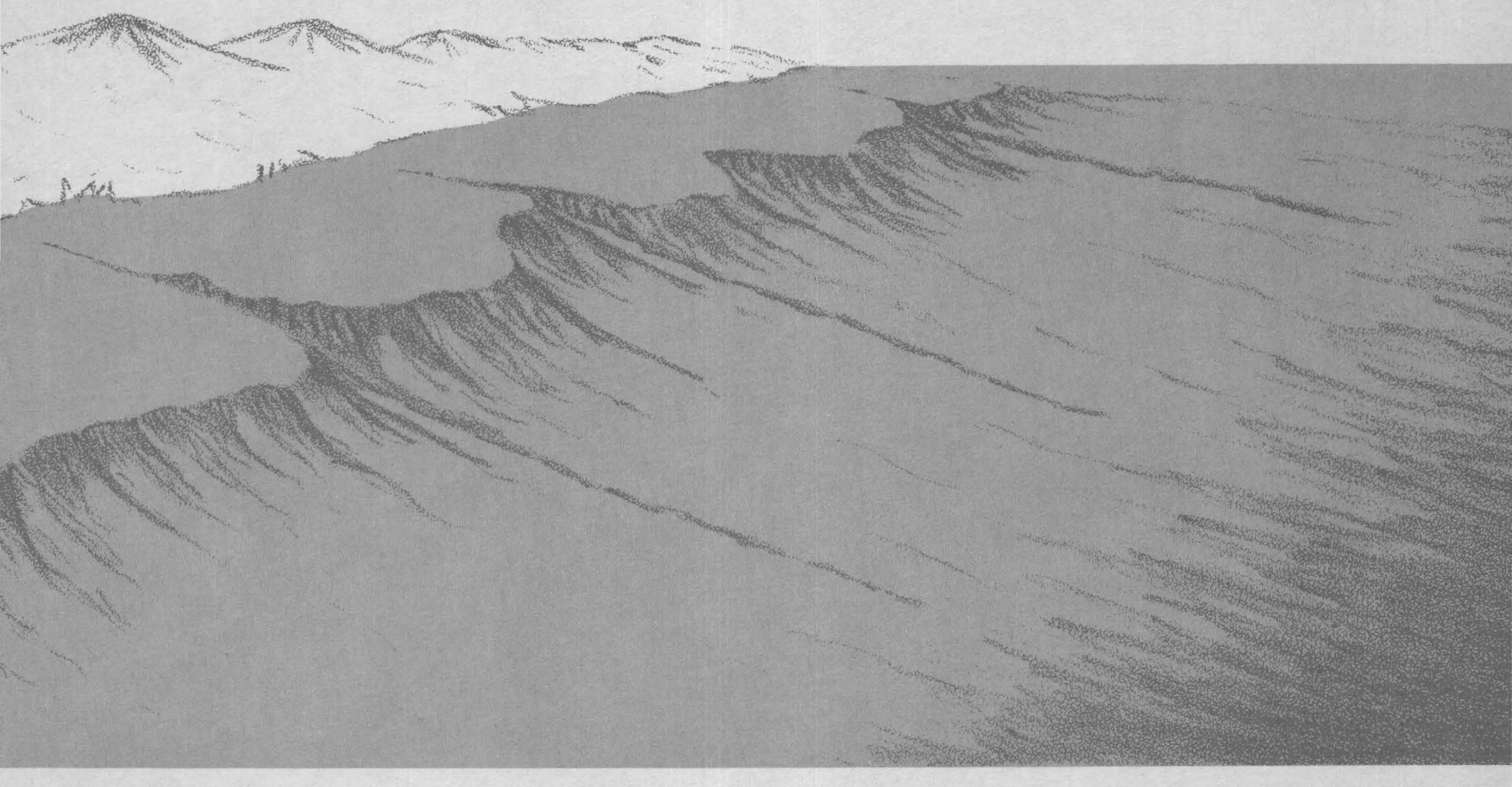
Atlantic Continental Shelf and Slope of the United States



Macrobenthic Invertebrate Fauna of the Middle Atlantic Bight Region— Faunal Composition and Quantitative Distribution

GEOLOGICAL SURVEY PROFESSIONAL PAPER 529-N

Atlantic Continental Shelf and Slope of the United States— Macrobenthic Invertebrate Fauna of the Middle Atlantic Bight Region—Faunal Composition and Quantitative Distribution

By ROLAND L. WIGLEY *and* ROGER B. THEROUX

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A description of the quantitative distribution of macrobenthic invertebrate animals in relation to geographic location, water depth, bottom sediments, and range in bottom water temperature

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By ROLAND L. WIGLEY [1] and ROGER B. THEROUX [1]

ABSTRACT

In the early 1960's, a quantitative survey of the macrobenthic invertebrate fauna was conducted in the Middle Atlantic Bight region. Purposes of this survey were to obtain a preliminary measure of the macrobenthic standing crop, particularly of biomass, and secondarily, to determine the principal taxonomic components of the fauna and the general features of their distribution. Sampling was conducted at 563 locations; water depths ranged from 4 to 3,080 m. An analysis of faunal composition and of quantitative distributions from the survey is presented in this report. Quantities are expressed in terms of density and biomass.

Dominant taxonomic components in numbers of individuals were (in percentage of total fauna): Arthropoda (46), Mollusca (25), Annelida (21), Echinodermata (4), and Coelenterata (1). Dominant in biomass were (in percentage of total fauna): Mollusca (71), Echinodermata (12), Annelida (7), Arthropoda (5), and Ascidiacea (2). The quantity of fauna, both density and biomass, decreased substantially from shallow to deep water. Another major trend was the marked decrease in quantity from north to south within the Middle Atlantic Bight. Bottom sediment composition strongly influenced both the kind and the quantity of macrobenthic animals. Coarse-grained sediments generally supported the largest quantities of animals, including many sessile forms. Fine-grained sediments usually contained a depauperate fauna; attached organisms were uncommon. No obvious correlations were detected between the amount of organic carbon in bottom sediments and the quantity of benthic animals present. Marked seasonal changes in bottom water temperature were associated with an abundant fauna composed of diverse forms, whereas uniform temperatures throughout the year were associated with a sparse fauna composed of a moderate variety of species. Taxonomic groups that were dominant in a significant number of samples, in terms of number of individuals, were: Bivalvia, Annelida, Echinoidea, Ophiuroidea, Crustacea, and the bathyal assemblage. Groups dominant in terms of biomass were: Bivalvia, Annelida, Echinoidea, Ophiuroidea, Holothuroidea, and the bathyal assemblage.

[1] National Marine Fisheries Service, Woods Hole, Mass. 02543.

INTRODUCTION

This report [2] describes, in quantitative terms, the macrobenthic invertebrate fauna inhabiting the Middle Atlantic Bight region. It deals primarily with faunal (a) taxonomic composition; (b) geographic distribution; and (c) relationships to bathymetric level, bottom sediment composition, sediment organic carbon, and water temperature. Regional differences in faunal composition and quantitative distribution within the Middle Atlantic Bight region are analyzed and documented.[3] Further studies of these data, in addition to the primarily descriptive analyses presented here, are in progress.

RECONNAISSANCE SURVEY

A reconnaissance survey of macrobenthic invertebrates in the Middle Atlantic Bight region was conducted as part of a larger survey of the entire Atlantic coast of the United States (Emery and Schlee, 1963). This survey by the Bureau of Commercial Fisheries (now the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce) was conducted in cooperation with the Woods Hole Oceanographic Institution, Woods Hole, Mass., and the U.S. Geological Survey. The major objective of the biological phase of this survey was to obtain an overview of the general composition and distribution of the macrobenthos. Sufficient understanding of the

[2] Financial support for the preparation of this report was provided by the National Oceanic and Atmospheric Administration (NOAA), Marine Ecosystems Analysis Prigram, New York Bight Project, Stony Brook, N. Y.

[3] An earlier, unpublished report, "Macrobenthic Invertebrate Fauna of the Middle Atlantic Bight Region: Part 1. Collection Data and Environmental Measurements," by Roland L. Wigley, Roger B. Theroux, and Harriett E. Murray (1976, 34 p.), is available at the Northeast Fisheries Center, Woods Hole, Mass.

fauna, especially the distributional aspects, was desired to permit the rational selection of one or more communities of benthic animals for detailed study. One or two of the more important communities or associations, suitable from both the practical and the theoretical viewpoints, will be selected for detailed study of taxonomic composition, productivity, interspecific competition for food, and related aspects. This latter phase of the investigation is included in the long-range objectives of the National Marine Fisheries Service for studying food-chain dynamics as they pertain to fish production on the Continental Shelf off the Eastern United States. Because of the need for measures of energy flow in the production cycles, emphasis in the benthic survey was placed on measurements of biomass (referred to as wet weight or damp weight), and number of individual animals per unit area (density) was considered secondary.

MIDDLE ATLANTIC BIGHT REGION

The Middle Atlantic Bight region is defined as that body of water overlying the Continental Shelf off the Northeastern United States, bounded on the north by Cape Cod and Nantucket Shoals, Mass., and extending southward to Cape Hatteras, N. C. Its shoreward boundary is the coastline; its seaward boundary is the upper margin of the Continental Slope, the so-called shelf-break or outer edge of the Continental Shelf. The geographic region included in this study consists of the Middle Atlantic Bight proper, plus the adjacent inshore bays and sounds, and the offshore extension that consists of the Continental Slope and the shallower part of the Continental Rise (fig. 1). This larger area is called the Middle Atlantic Bight region. For purposes of comparative description, this region has been divided into three roughly equal geographic subareas: Southern New England, New York Bight, and Chesapeake Bight.

PREVIOUS STUDIES

Although no previous quantitative studies of the macrobenthic fauna encompassed the entire Middle Atlantic region, comprehensive studies of small sections of this region, a few rather large-scale qualitative studies, and numerous reports of an ancillary nature have been made. Altogether, substantial literature exists on this general subject that has been produced at an ever-increasing rate since about the middle of the 19th century. A few examples of the early reports are those by: Adams (1839), on new species of mollusks; Agassiz and Agassiz (1865), on echinoderm morphology and development; Desor (1848), on the natural history of benthic invertebrates from Nantucket Shoals; Leidy (1855), on the invertebrates from coastal waters of Rhode Island and New Jersey; and Verrill (1866), on new species and ecological observations on New England coelenterates and echinoderms. Early studies provide some of the basic taxonomic framework for this fauna, provide clues to the pattern of geographic distribution, and give a preliminary insight to regional ecology. Two classic reports in the early literature that deal with major surveys of invertebrate animals within the Middle Atlantic Bight region are: (1) the U.S. Fish Commission survey of Vineyard Sound and adjacent waters, conducted in 1871–73 (Verrill, 1873) and (2) the U.S. Bureau of Fisheries survey of the waters of Woods Hole and vicinity, conducted in 1903–05 (Summer, Osburn, and Cole, 1913). Both surveys dealt mainly with epibenthic invertebrates and covered much the same area—primarily Vineyard Sound and Buzzards Bay in southeastern Massachusetts.

Six published indexes and bibliographies provide good coverage of the general literature pertaining to the benthic invertebrates (and related subjects) of this region. The citations in these bibliographies include many old and new reports. The six reference works are:

(1) "Publications of the United States Bureau of Fisheries 1871–1940" (Aller, 1958).
(2) "A Preliminary Bibliography with KWICK Index on the Ecology of Estuaries and Coastal Areas of the Eastern United States" (Livingstone, 1965).
(3) "Marine and Estuarine Environments, Organisms and Geology of the Cape Cod Region, an Indexed Bibliography, 1665–1965" (Yentsch, Carriker, Parker, and Zullo, 1966).
(4) "The Effects of Waste Disposal in the New York Bight" (sections 8 and 9) (U.S. National Marine Fisheries Service, Middle Atlantic Coastal Fisheries Center, 1972).
(5) "Coastal and Offshore Environmental Inventory, Cape Hatteras to Nantucket Shoals" (Saila, 1973).
(6) "Bibliography of the New York Bight: Part 1—List of Citations; Part 2—Indexes" (U.S. National Oceanic and Atmospheric Administration, 1974).

A sizable part of this benthic invertebrate literature deals with topics having little relevance to the present quantitative study. Reports consisting of species descriptions, many of the studies of physio-

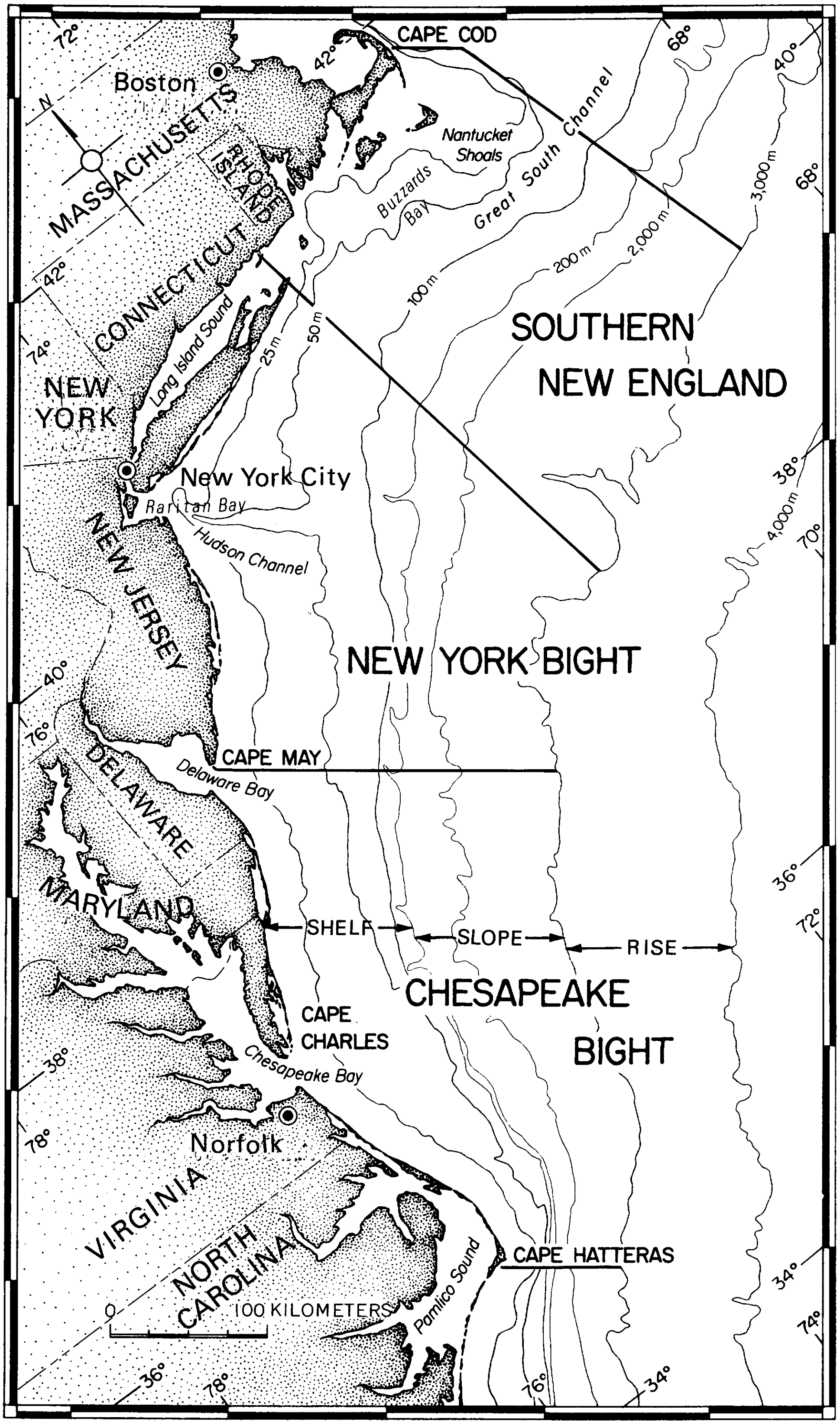

FIGURE 1.—Chart of the Middle Atlantic Bight region showing the location of geographical features and the three subarea divisions: Southern New England, New York Bight, and Chesapeake Bight.

logical processes, morphology, habits and behavior, parasites, diseases, growth rates, and similar topics are peripheral to the central theme of quantitative distribution. Another large segment of the literature (also only marginally pertinent to the present study) pertains to pelagic larval stages of benthic invertebrates, intertidal fauna, some aspects of fishery resources, predation, commensalism, and other related subjects.

Quantitative studies of the benthos have been conducted at various locations throughout the region in more recent years, particularly within the last two decades. Most of these studies were made on inshore and coastal regions, few on the Continental Shelf, and fewer still on the Continental Slope and Rise. The principal quantitative reports that we consulted in evaluating distribution and relative densities and (or) biomass are listed separately (although there is some overlap) for the following three zones: (1) inshore and coastal waters; (2) Continental Shelf; and (3) Continental Slope and Rise.

(1) **Inshore and coastal waters.**—Southern Massachusetts, Rhode Island, and Connecticut: Lee (1944), Sanders (1956, 1958, 1960), Stickney and Stringer (1957), Phelps (1964), Rhoads (1963), and Parker (1974); New York-New Jersey: Dean and Haskin (1964), Franz and Hendler (1971), Phillips (1972), O'Connor (1972), D'Agostino and Colgate (1973), Kaplan, Welker, and Kraus (1974), McGrath (1974), and Dean (1975); Delaware to Cape Hatteras, North Carolina: Stone (1963), Tenore (1972), Boesch (1972, 1973), Leathem and others (1973), Palmer and Lear (1973), Maurer and others (1974), Watling and others (1974), and Watling and Maurer (1975).

(2) **Continental Shelf.**—Wigley and McIntyre (1964), Emery, Merrill, and Trumbull (1965), Emery and Uchupi (1972), Pearce (1972), Rowe (1973), and Steimle and Stone (1973). An up-to-date review of the major species and faunal associations inhabiting the Middle Atlantic Bight was prepared by Pratt (1973).

(3) **Continental Slope and Continental Rise.**—Sanders, Hessler, and Hampson (1965), Wigley and Emery (1967), Rowe and Menzies (1969), Rowe and Menzel (1971), Emery and Uchupi (1972), George and Menzies (1973), Menzies, George, and Rowe (1973), and Haedrich, Rowe, and Polloni (1975).

Several ecologically oriented reports based entirely, or in part, on the samples used in this study have been published. Macrobenthos from a series of stations across the Continental Shelf south of Martha's Vineyard, Mass., was included in a report by Wigley and McIntyre (1964). A description of sea-bottom photographs and grab-sample contents taken concurrently by the Campbell sampler (Emery and Merrill, 1964) was based partly on samples collected for the present study. An investigation encompassing a large offshore area, extending from Nova Scotia, Canada, southward to New Jersey, that dealt mainly with the quantity of macrobenthic invertebrates in relation to bottom sediment types was published by Emery, Merrill, and Trumbull (1965). The quantity of benthic invertebrates in grab samples from the Continental Slope off the Middle Atlantic region was compared with quantities observed in associated sea-bottom photographs (Wigley and Emery, 1967). A report by Wigley and Stinton (1973) on the remains of dead marine animals, particularly mollusks, in a part of the Middle Atlantic Bight off Southern New England, was also based on samples collected for the present study.

Several quantitative studies of the macrobenthos are in progress. Many of these studies are being conducted in coastal areas, and most of the studies pertain directly to assessments of environmental quality. In addition, two large-scale offshore investigations are underway. One is in the Chesapeake-New Jersey region in anticipation of petroleum exploration, and possible production, in this region, and another is in the New York-New Jersey area. Impetus for this work is directly related to ocean dumping and waste disposal from the New York-New Jersey metropolitan area.

A large volume of up-to-date benthic fauna information is currently being issued in the so-called gray literature in which the results of recently completed field studies are issued as contract completion reports, environmental impact statements, public agency (or private corporation) investigation reports, annual reports, or other similar special documents. Many of these reports are issued in Xerographic or mimeographic form, often in irregular series or as a one-of-a-kind report, and, as a consequence, they often are not listed in the usual literature sources.

Hydrography of the Middle Atlantic Bight region is rather well known, at least the general features of circulation, tides, the annual cycle of temperature, patterns of salinity distribution, and other major aspects. Also, some inshore waters, such as Long Island Sound, Raritan Bay, and Chesapeake Bay, have been studied in some detail. However, detailed information concerning chemical properties, water currents, meteorological influences, and related aspects, particularly as they pertain to offshore bottom waters, is lacking.

A bibliography of early (prior to 1951) hydrographic studies is included in the report by Ayers (1951). Rather broad consideration of the hydrography of the entire Bight is given by Bigelow (1933), Emery and Uchupi (1972), and Bumpus, Lynde, and Shaw (1973). Information on water temperature was reported by Walford and Wicklund (1968), Colton and Stoddard (1972, 1973), Churgin and Halminski (1974), and others. Salinity and its bathymetric and geographic distribution are included in the reports by Bigelow and Sears (1935) and Churgin and Halminski (1974). Water circulation and related aspects have been reported by Chase (1959), Ketchum and Corwin (1964), Bumpus (1965), and Bumpus and Lauzier (1965).

Geological information about the Middle Atlantic Bight region is copious and up-to-date. A few major references on this subject are: Emery (1966, 1968), Hülsemann (1967), Ross (1970), Schlee and Pratt (1970), Emery and Uchupi (1972), Trumbull (1972), Hollister (1973), Milliman (1973), Schlee (1973), Swift, Duane, and McKinney (1973), and Stubblefield, Dicken, and Swift (1974).

MATERIALS AND METHODS

MACROFAUNA SAMPLES

This report is based on the analyses of 667 quantitative samples of benthic invertebrates collected at 563 locations (stations) primarily between 1962 and 1965. Three samples collected in 1957 were inadvertently included in the analysis of this suite. The basic sampling strategy was to plot an 18-km (10-mi) grid whose base orientation was roughly perpendicular to the depth gradient. Station locations for all samples are shown in figure 2. Basic station data is given in an unpublished report by Wigley, Theroux, and Murray (see footnote 1 in "Introduction"). The even distribution of stations imparted by the grid is evident, but is masked in some places by additional samples between grid lines.

Samples were obtained during 16 research cruises (table 1). Five research vessels were used, three of which, *Albatross III*, *Delaware I*, and *Albatross IV*, were operated by the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration in the Department of Commerce and its predecessor agency, the Bureau of Commercial Fisheries, then in the Department of the Interior. Two vessels, *Gosnold* and *Asterias*, were operated by the Woods Hole Oceanographic Institution, Woods Hole, Mass.

TABLE 1.—*Research vessels, cruise identification and dates, and number of stations sampled*

Vessel and cruise	Cruise date	Number of stations
ALB III-101 ______	Aug 21–30, 1957	3
DEL-62-7 ________	Jun 13–20, 1962	63
GOS-10 __________	Apr 26, 1963	6
GOS-11 __________	Apr 30, 1963	3
GOS-12 __________	May 2–7, 1963	4
GOS-13 __________	May 9–14, 1963	25
GOS-20 __________	Jul 16, 1963	1
GOS-22 __________	Aug 5–17, 1963	10
GOS-28 __________	Oct 3–6, 1963	9
GOS-29 __________	Oct 8–27, 1963	130
GOS-45 __________	May 15–Jun 30, 1964	53
GOS-49 __________	Aug 1–29, 1964	129
AST-64-1 ________	Apr 22–23, 1964	6
AST-64-2 ________	Jul 1–Aug 9, 1964	74
AST-65-1 ________	May 4–Jun 12, 1965	33
ALB IV-65-11 ____	Aug 17–27, 1965	14
Total ______		563

Quantitative samples were obtained from inshore estuarine areas, the Continental Shelf, Slope, and certain parts of the Continental Rise throughout the Middle Atlantic Bight region, encompassing an area of 303,521 km² (121,408 mi²). The region was divided into geographic subareas designated: Southern New England, New York Bight, and Chesapeake Bight. These subareas (fig. 1) contain 94,700, 82,749, and 126,072 km² (37,880, 33,100, and 50,428 mi²), respectively. More detailed data on the areal expanse of various subunits within the region are listed in table 2. A nearly equal number of samples came from such subarea: Southern New England—186 samples; New York Bight—187 samples; Chesapeake Bight—190 samples.

TABLE 2.—*Areas of several bathymetric zones within each subarea and total area of Middle Atlantic Bight region*

[In square kilometers]

Bathymetric zone	Subarea: Southern New England	Subarea: New York Bight	Subarea: Chesapeake Bight	Total
Bays and Sounds [1] __	2,674	[2] 3,788	17,401	23,863
Continental Shelf				
0– 24 m ________	5,495	8,035	12,015	25,545
25– 49 m ________	8,253	15,045	15,488	38,786
50– 99 m ________	16,986	17,604	6,987	41,577
100–199 m ________	4,826	3,228	1,930	9,984
Total __________	35,560	43,912	36,420	115,892
Continental Slope				
220– 499 m ______	1,853	1,129	1,222	4,204
500– 999 m ______	1,917	1,515	1,813	5,245
1,000–1,999 m ______	3,667	3,514	8,598	15,779
Total __________	7,437	6,158	11,633	25,228
Continental Rise				
2,000–3,999 m ______	49,029	28,891	60,618	138,538
Grand total ____	94,700	82,749	126,072	303,521

[1] Based on areas reported by Bumpus, Lynde, and Shaw (1973).
[2] Includes the Gardiners Bay complex (1,078 km²).

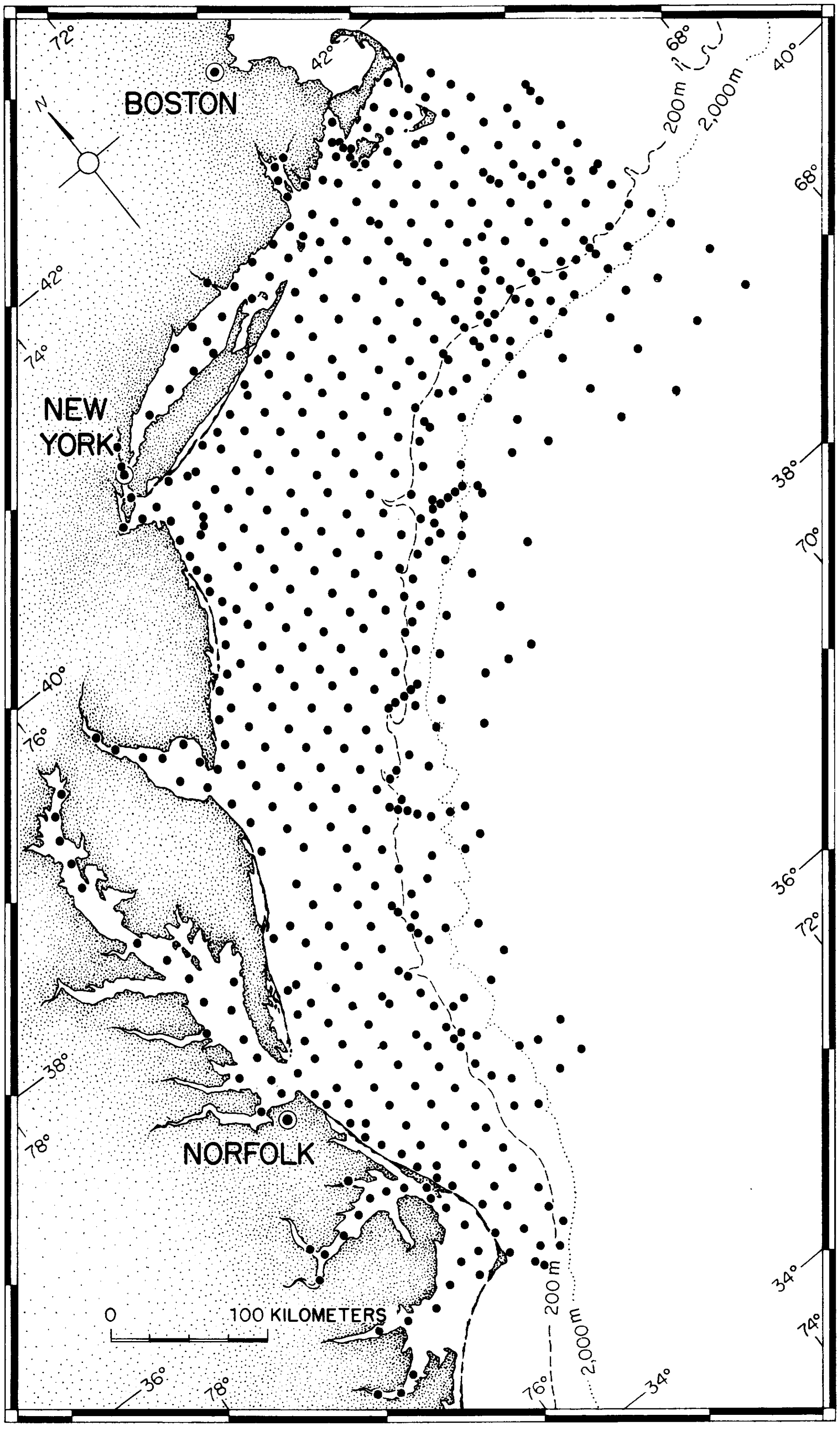

Figure 2.—Chart showing station locations where quantitative samples of macrobenthic invertebrates were obtained.

BENTHOS SAMPLING GEAR

Three different quantitative grab-type bottom samplers were used: the Van Veen grab[4] (Holme and McIntyre, 1971); the Smith-McIntyre sampler (fig. 3) (Smith and McIntyre, 1954); and the Campbell grab (fig. 4) (Menzies, Smith, Emery, 1963). All three are reliable devices for obtaining quantitative samples with relative ease under a wide variety of working conditions. A small vessel was used in sampling inshore waters, and this restricted the use of bottom samplers to the two smaller ones—Van Veen and Smith-McIntyre. Thirteen samples (2 percent), each representing an area of 0.1 m^2, were taken with the Van Veen grab; 195 samples (35 percent) were taken with a 0.1 m^2-size Smith-McIntyre grab; and 355 (63 percent) samples were taken with the 250–kg Campbell grab, each sample representing an area of 0.56 m^2. These devices provided enough material for both biological and geological analyses.

The Campbell grab was equipped with an automatic camera and electronic light source (Emery, Merrill, Trumbull, 1965; Emery and Merrill, 1964), which provided a photograph of the sea bottom that was taken immediately prior to bottom contact. The camera housing, fastened within one of the buckets of the grab (fig. 4), contained two 35-mm motorized cameras spaced to provide stereo separation, if desired. Usually, each camera was loaded with a different type of film; one contained black and white negative material and the other reversal (positive), high-speed daylight color film. The opposite bucket held the electronic strobe light that illuminated the area to be photographed. The device was activated at about 1 m above the bottom by means of a tripweight suspended below the grab. Approximately 200 simultaneous photographs and bottom samples were obtained within the study area. Of this total, 180 photographs were in black and white (examples in figs. 89 to 94) and 20 were in color.

SAMPLE PROCESSING

Processing of samples depended on the size of the equipment and the method of determining sediment volume. Contents of the grab were emptied into a watertight receptacle large enough to hold all the collected substratum. Substrate receptacles for the Van Veen and Smith-McIntyre samplers were 20-liter graduated pails; the receptacle for the Campbell grab was a large rectangular steel tub, which also served as the washing container. The volume of the samples was determined, prior to any treatment. The graduated pails used with Van Veen and Smith-McIntyre samplers gave a direct reading of volume, and precalibrated brass dipsticks were used to determine the volume of Campbell grab samples. Volumes were recorded to the nearest whole liter.

All samples were washed on a sieving screen having 1-mm mesh openings to remove unwanted sediments and retain specimens. The Van Veen and Smith-McIntyre samples were first washed in a specially designed washstand that had adjustable-flow shower heads trained onto the mound of sediment samples. Waterflow gently flooded the organisms out of the sediments and transported them to the sorting sieve where everything greater than 1 mm in size was retained. The Campbell grab samples were washed in the same receptacle that received the sample. Water from hoses with variable nozzles floated sediments and organisms through openings in the container to the sieving screens.

Coarse substrate fractions, such as pebbles and cobbles, that were retained on the screen required further treatment. These larger fractions were sorted out by hand and examined. If clean (no attached organisms), they were discarded; those with attached organisms were retained for later treatment. Organisms and sediments retained by the screen were preserved in a 5 percent buffered seawater solution of formaldehyde in glass containers, labeled, and stored for transport to the laboratory.

Laboratory treatment of preserved specimens involved: (1) rinsing in freshwater to flush off formalin solution; (2) sorting and identifying to the lowest accurate taxonomic level; (3) recording counts of individuals in each taxonomic group; and (4) obtaining damp or wet weights (excess superficial fluids removed with blotting paper) of each group. Included in the weight measurements are skeletal structures that form an integral part of the living animal. This, of course, includes shells of mollusks, brachiopods, crustaceans, echinoderms, and all other organisms having a shell-like skeleton. Weights do not include hermit crab "houses," amphipod or polychaete tubes, or other such accessory structures. After the above treatment, all specimens were preserved in 70 percent ethanol and stored in labeled containers.

DATA REDUCTION

Certain adjustments to the raw data were required to make one sample comparable with another. The criterion of comparability chosen was a unit area of 1 m^2. Adjustments were made to account for

[4] Any trade names in this publication are used for descriptive purposes only and do not constitute endorsement by the U.S. Geological Survey.

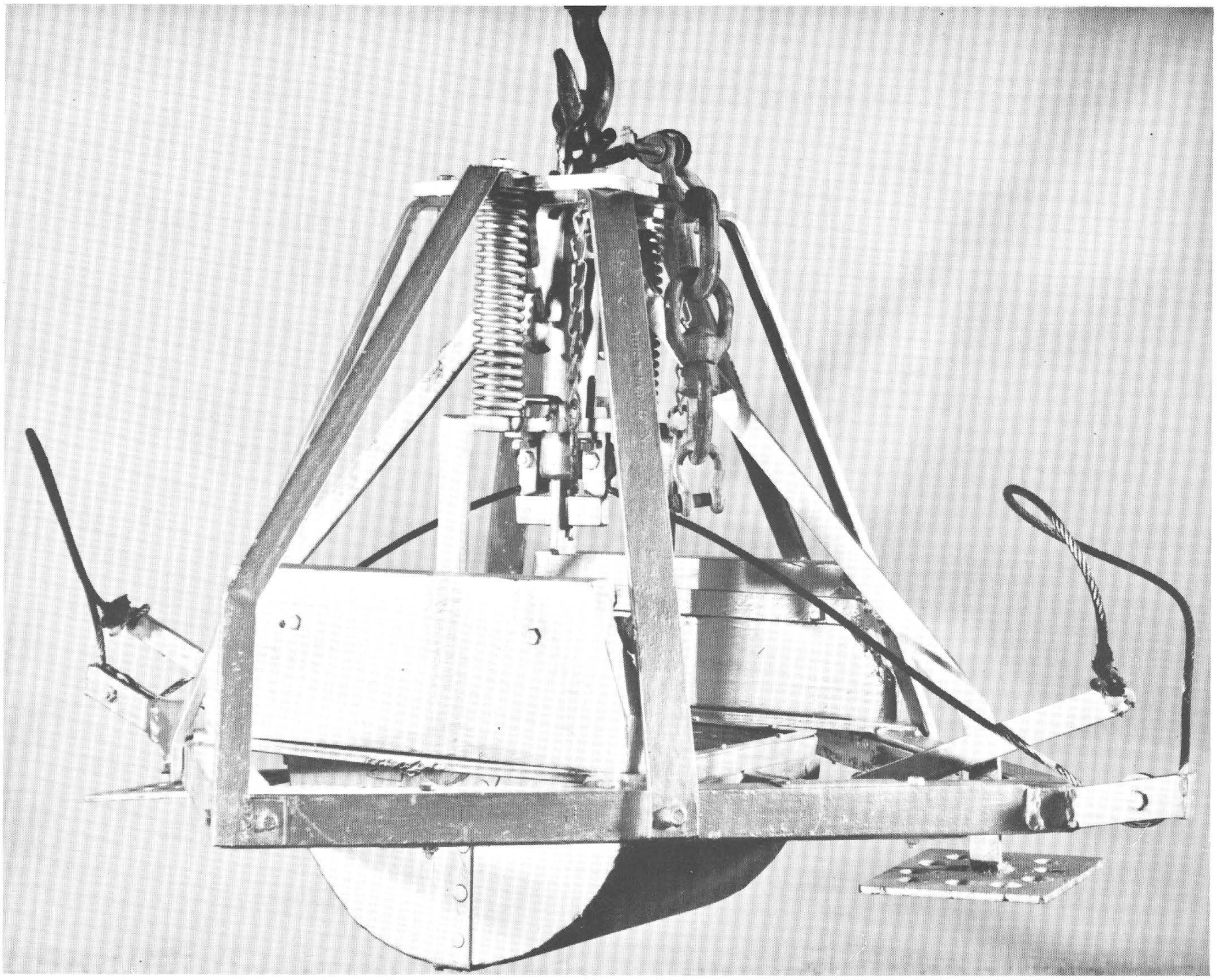

FIGURE 3.—Side view of the Smith-McIntyre spring-loaded bottom sampler in the closed position. Lead weights on each side are set vertically to impede rotation of the sampler during descent and ascent. Vertical distance from frame base to top plate is 52 cm.

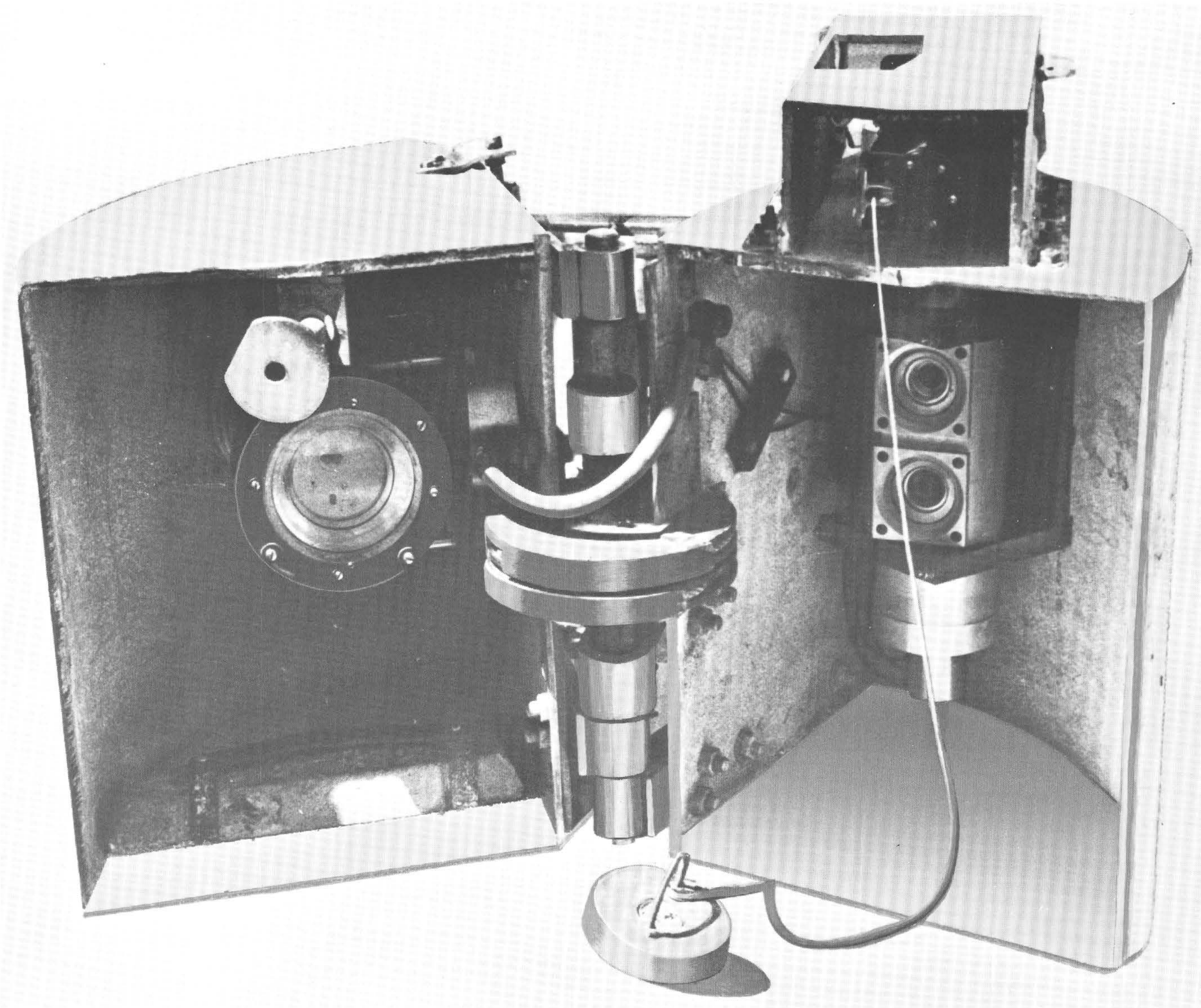

FIGURE 4.—Bottom view of Campbell grab sampler. Camera is installed in right-hand bucket and strobe light is in the left-hand bucket. Width of the buckets (vertical dimension in photograph) is 57 cm.

sampling gear size (area of bottom sampled) and material removed (such as sediment samples for geological analyses), prior to processing.

A MESA (Marine Ecosystems Analysis) formated, IBM compatible, magnetic computer tape of benthic data was made and submitted to MESA, New York Bight project office. A major difference between our data processing system and that of MESA's is the coding schemes used to identify the various taxonomic components. The system we (Demersal Food Chain Investigation at the Northeast Fisheries Center, Woods Hole, Mass.) used was an 11-digit code developed by us in 1962, and it differs substantially from the 10-digit code used by MESA. Our code is divided as follows: Phylum (2 digits); Class (1); Order (2); Family (2); Genus (2); Species (2). At present, our taxonomic code data-file contains approximately 6,000 names from the U.S. east coast.

BATHYMETRY

Water depths, in meters, were obtained by means of echo sounders and corrected for hydrophone depth and temperature effects on the velocity of sound.

TEMPERATURE

Owing to a lack of information on bottom-water temperature, especially in the southeastern part of New York Bight and in Chesapeake Bight, a means of determining temperatures was required. Minimum and maximum temperatures for each sampling site were obtained from various published sources (see "Introduction") and from measurements obtained by the Northeast Fisheries Center. The ranges in temperature were determined by subtracting the minimum from the maximum; they were then grouped into ranges which were used in the temperature analyses.

GEOLOGICAL SAMPLES

A sample of bottom sediment was collected from each macrobenthic sample. A lithological description was made at the time of collection and was based on field-analysis techniques. The sample was placed in a cardboard container, air-dried, and brought to the laboratory ashore for detailed determination of grain-size composition, a measure of organic carbon, and analyses of other chemical and minerological components by geologists of the U.S. Geological Survey and the Woods Hole Oceanographic Institution. Analysis results are on file in Woods Hole Oceanographic Institution Reference No. 71–15, Data File, Continental Margin Program Atlantic Coast of the United States, volumes 1 and 2, compiled and edited by John C. Hathaway, U.S. Geological Survey, Woods Hole, Mass. Data pertaining to bottom sediments and quantity of organic carbon used in our analyses are listed in this document.

FAUNAL COMPOSITION

ENTIRE MIDDLE ATLANTIC BIGHT REGION

The faunal composition in the Middle Atlantic Bight region is moderate—the number of species and higher taxa are neither very abundant nor very sparse. The different species in the samples numbered 435; they represented 17 phyla. This modest variation in taxonomic diversity is typical of a temperate marine fauna. However, to some extent, the observed variation resulted from our knowledge of particular taxonomic groups and our facility (and that of cooperating scientists) in identifying the components of the various groups. This is evident from the relatively large numbers of species in Arthropoda, Annelida, and Mollusca. Also, our priorities in establishing taxonomic work assignments resulted in relatively small effort being devoted to identifying the species composition of the less important (in terms of abundance or biomass) groups, such as Porifera, Platyhelminthes, Hemichordata, Nemertea, and Aschelminthes.

In evaluating the total fauna (all taxonomic groups from all samples), we found that four groups dominated: Arthropoda, Annelida, Mollusca, and Echinodermata. Dominance of these groups was apparent in both number and biomass; however, the order of importance differed substantially between the two measures (table 3; fig. 5). Numerical dominance, here indicated by mean density per square meter and percentage of the total fauna they constituted, was as follows: Arthropoda, 641, (45 percent); Mollusca, 346, (25 percent); Annelida, 298, (21 percent); Echinodermata, 55, (4 percent); and all other groups combined, 65, (5 percent). Biomass, which is here expressed as mean wet weight or damp weight in grams per square meter and percentage of the total fauna, was even more heavily dominated by a few taxonomic groups than was numerical density. Principal components in terms of biomass were: Mollusca, 136, (71 percent); Echinodermata, 23, (12 percent); Annelida, 14, (7 percent); Arthropoda, 9, (5 percent). Minor groups listed here in order of decreasing biomass were: Chordata, Coelenterata, Sipunculida, Nemertea, Bryozoa, Echiura, Porifera, Hemichordata, Pogonophora, Priapulida, Platyhelminthes, Aschelminthes, and Brachiopoda.

TABLE 3.—*Quantitative taxonomic composition of the macrobenthic invertebrate fauna, in both number of individuals and biomass, representing the entire Middle Atlantic Bight region*

Taxonomic group	Number of individuals			Biomass		
	Mean	Percent	Phylum rank	Mean	Percent	Phylum rank
	No./m^2			g/m^2		
PORIFERA	0.56	0.04	13	0.058	0.03	11
COELENTERATA	17.76	1.26	5	2.975	1.56	6
Hydrozoa	9.57	0.68		0.296	0.16	
Anthozoa	8.19	0.58		2.680	1.41	
Alcyonacea	0.51	0.04		0.091	0.05	
Zoantharia	3.81	0.27		2.425	1.27	
Unidentified	3.87	0.28		0.164	0.09	
PLATYHELMINTHES	0.64	0.05	12	0.007	0.004	15
Turbellaria	0.64	0.05		0.007	0.004	
NEMERTEA	4.51	0.32	8	0.619	0.32	8
ASCHELMINTHES	2.60	0.18	10	0.005	0.002	16
Nematoda	2.60	0.18		0.005	0.002	
ANNELIDA	297.77	21.18	3	13.814	7.24	3
POGONOPHORA	1.91	0.14	11	0.012	0.01	13
SIPUNCULIDA	3.94	0.28	9	0.689	0.36	7
ECHIURA	0.15	0.01	14	0.249	0.13	10
PRIAPULIDA	0.01	0.001	16	0.009	0.005	14
MOLLUSCA	346.29	24.63	2	136.131	71.38	1
Polyplacophora	0.45	0.03		0.144	0.08	
Gastropoda	35.79	2.55		3.081	1.62	
Bivalvia	308.27	21.93		132.878	69.68	
Scaphopoda	1.26	0.09		0.022	<0.001	
Cephalopoda	0.33	0.02		0.004	0.002	
Unidentified	0.19	0.01		0.001	<0.001	
ARTHROPODA	640.51	45.56	1	9.013	4.73	4
Pycnogonida	0.54	0.04		0.003	0.002	
Arachnida	0.05	0.004		<0.001	<0.001	
Crustacea	639.92	45.52		9.010	4.72	
Ostracoda	0.22	0.02		0.002	0.001	
Cirripedia	30.02	2.14		3.747	1.96	
Copepoda	0.04	0.003		<0.001	<0.001	
Nebaliacea	0.01	0.001		<0.001	<0.001	
Cumacea	15.92	1.13		0.071	0.04	
Tanaidacea	0.06	0.004		<0.001	<0.001	
Isopoda	12.31	0.88		0.290	0.15	
Amphipoda	572.09	40.70		3.675	1.93	
Mysidacea	2.06	0.15		0.009	0.005	
Decapoda	7.19	0.51		1.214	0.64	
BRYOZOA	12.22	0.87	7	0.329	0.17	9
BRACHIOPODA	<0.01	0.03	17	<0.001	<0.001	17
ECHINODERMATA	54.64	3.89	4	22.775	11.94	2
Holothuroidea	2.15	0.15		5.386	2.82	
Echinoidea	23.09	1.64		13.641	7.15	
Ophiuroidea	28.50	2.03		1.798	0.94	
Asteroidea	0.90	0.06		1.949	1.02	
HEMICHORDATA	0.13	0.01	15	0.029	0.01	12
CHORDATA	14.69	1.05	6	3.721	1.95	5
Ascidiacea	14.69	1.05		3.721	1.95	
UNIDENTIFIED	7.40	0.53		0.274	0.14	

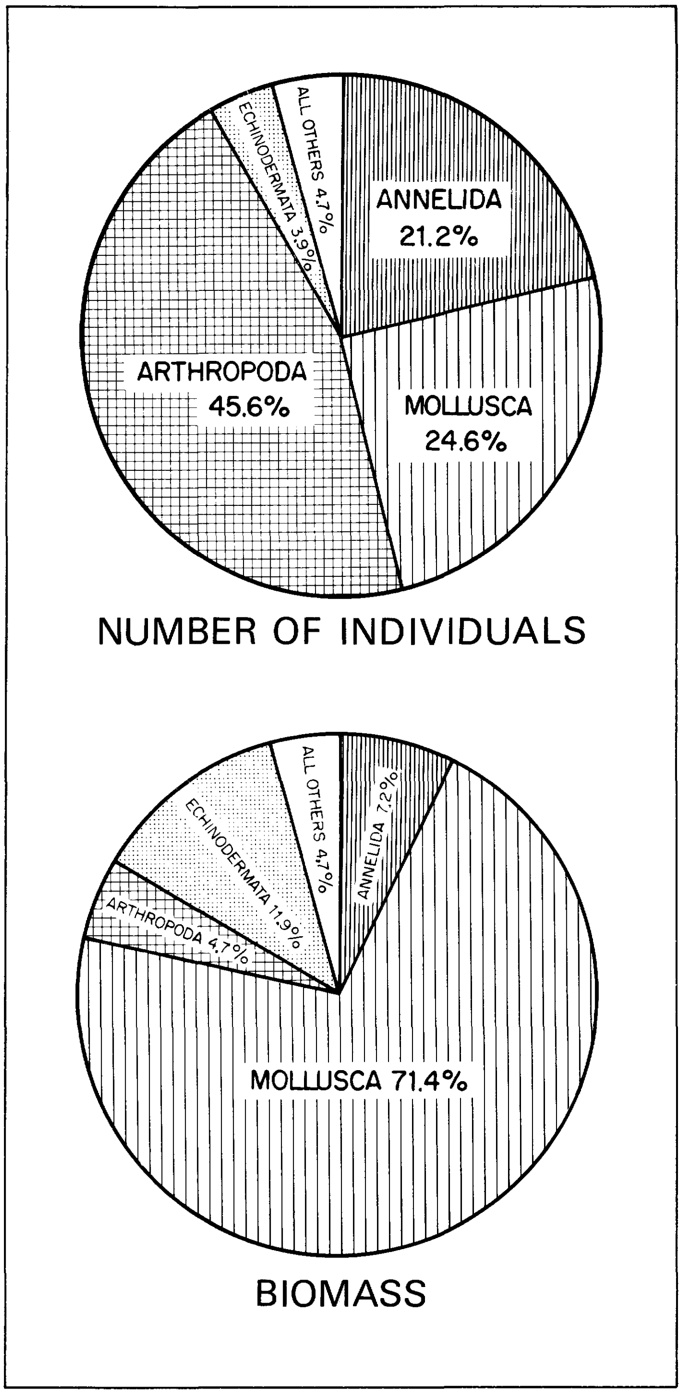

FIGURE 5.—Pie charts illustrating the taxonomic composition of the total macrobenthic fauna in the entire Middle Atlantic Bight region. Number of individuals expressed as a percentage of the total fauna; and biomass, also expressed as a percentage of the total.

Because of the exceptionally large biomass formed by Mollusca, we would like to focus attention on the biomass determination procedures. It has long been standard practice to obtain wet weight biomass values by weighing the entire animal—including shells and all other intregal body parts (Thorson, 1957). This, of course, is to provide consistency in dealing with enormously varied taxonomic assemblages that have different proportions of skeletal structures and water content, both of which are exceedingly low in nutritive value. Some of the Echinoidea, Cirripedia, and other groups possess higher proportions of skeletal structure than mollusks; Brachiopods, Brachyurans, and other groups generally have about the same or slightly smaller proportions of skeletal structure than mollusks; and many Holothuroidea, Annelida, and other soft-bodied groups commonly have a very small proportion of skeletal structure. Water content also varies substantially from group to group, and is particularly high in Ascidiacea and some Coelenterata. Because of these and other variations in body composition, measures other than wet weight biomass must be used to show nutrient value. For purposes of energy pathway studies and dynamic modeling, ecologists often require measures of energy, such as caloric value.

Our determinations of conversion coefficients for converting wet weights to dry weights are incomplete at present. However, by using our conversion values supplemented by values obtained from published reports, we made a preliminary comparison of the percentage composition of the macrobenthic fauna in terms of wet weight and calculated ash-free dry weight. Only modest differences in relative standing of the taxonomic groups were revealed by this comparison. Thus, the major biomass position occupied by mollusks in this region results from their relatively large size combined with rather high numerical abundance.

Dominance of the fauna by a relatively few groups of organisms was also apparent at more specific taxonomic levels—genera and species. In the taxonomic list of species given in table 4 are 441 species that were represented in samples within the Middle Atlantic Bight region. Of this number, less 10 percent are considered important in terms of number and (or) biomass. In number of specimens, some of the more important forms were: *Scalibregma, Nephtys, Maldane, Sabella, Spiophanes* (Annelida); *Alvania, Cylichna, Nassarius* (Gastropoda); *Nucula, Cyclocardia, Astarte, Thyasira* (Bivalvia); *Balanus* (Cirripedia); *Trichophoxus, Leptocheirus, Ampelisca, Unciola* (Amphipoda); *Cirolana* (Isopoda); *Echinarachnius* (Echinoidea).

Important as major contributors to the biomass were: *Cerianthus* (Coelenterata); *Nephtys, Streblosoma, Maldane, Lumbrineris* (Annelida); *Arctica, Astarte, Cyclocardia, Mulinia, Ensis* (Bivalvia); *Buccinum, Nassarius* (Gastropoda); *Trichophoxus,*

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*

- Coelenterata (Cnidaria)
  - Hydrozoa
    - *Hydractinia echinata* Fleming, 1828
  - Anthozoa
    - Alcyonacea
      - *Pennatula aculeata* Danielson and Koren, 1858
    - Zoantharia
      - Zoanthidea
        - *Epizoanthus incrustatus* (Verrill) 1864
      - Actiniaria
        - *Anthaloba perdix* Verrill, 1882
        - *Edwardsia* sp.
        - *Haliplanella luciae* (Verrill) 1898
        - *Haloclava producta* Stimpson, 1856
        - *Paranthus rapiformis* Lesueur, 1817
      - Madreporaria
        - *Astrangia danae* Agassiz, 1847
      - Ceriantharia
        - *Cerianthus borealis* Verrill, 1873
        - *Ceriantheopsis americanus* Verrill, 1866
- Annelida
  - Polychaeta
    - Phyllodocida
      - Phyllodocidae
        - *Eteone* sp.
        - *Eumida sanguinea* (Oersted) 1843
        - *Phyllodoce arenae* Webster, 1879
        - *Phyllodoce mucosa* Oersted, 1843
        - *Phyllodoce* sp.
      - Aphroditidae
        - *Aphrodita hastata* Moore, 1905
      - Polynoidae
        - *Harmothoe extenuata* (Grube) 1840
      - Sigalionidae
        - *Lean-ira* sp.
        - *Pholoe minuta* (Fabricius) 1780
        - *Sigalion arenicola* Verrill, 1879
        - *Sthenelais limicola* (Ehlers) 1864
      - Glyceridae
        - *Glycera americana* Leidy, 1855
        - *Glycera capitata* Oersted, 1843
        - *Glycera dibranchiata* Ehlers, 1868
        - *Glycera robusta* Ehlers, 1868
        - *Glycera tesselata* Grubé, 1863
      - Goniadidae
        - *Goniada brunnea* Treadwell, 1906
        - *Goniada maculata* (Oersted) 1843
        - *Goniadella gracilis* (Verrill) 1873
      - Sphaerodoridae
        - *Sphaerodorum gracilis* (Rathke) 1843
      - Nephtyidae
        - *Aglaophamus circinata* (Verrill) 1874
        - *Aglaophamus* sp.
        - *Nephtys bucera* Ehlers, 1868
        - *Nephtys incisa* Malmgren, 1865
        - *Nephtys picta* Ehlers, 1868
      - Syllidae
        - *Exogone verugera* (Clarapede) 1868
      - Pilgaridae
        - *Ancistrosyllis* sp.
      - Nereidae
        - *Ceratocephale loveni* Malmgren, 1867
        - *Nereis pelagica* Linnaeus, 1758
        - *Nereis* sp.
    - Capitellida
      - Capitellidae
        - *Capitella* sp.
      - Scalibregmidae
        - *Scalibregma inflatum* Rathke, 1843
      - Maldanidae
        - *Asychis biceps* (Sars), 1861
        - *Maldane* sp.
      - Opheleidae
        - *Ammotrypane aulogaster* Rathke, 1843
        - *Ammotrypane* sp.
        - *Ophelia denticulata* Verrill, 1875
        - *Travisia* sp.

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*—Continued

Annelida—Continued
- Polychaeta—Continued
  - Sternaspida
    - Sternaspidae
      - *Sternaspis scutata* (Renier) 1807
  - Spionida
    - Spionidae
      - *Dispio uncinata* Hartman, 1951
      - *Laonice cirrata* (Sars) 1851
      - *Prionospio* sp.
      - *Polydora concharum* Verrill, 1880
      - *Polydora* sp.
      - *Spio setosa* Verrill, 1873
      - *Spiophanes bombyx* (Clarapede) 1870
    - Paraonidae
      - *Aricidea jeffreysii* (McIntosh) 1879
      - *Paraonis fulgens* (Levinsen) 1883
      - *Paraonis neapolitana* Cerruti, 1909
    - Chaetopteridae
      - *Chaetopterus* sp.
      - *Spiochaetopterus* sp.
  - Eunicida
    - Onuphidae
      - *Diopatra cuprea* (Bosc) 1802
      - *Hyalinoecia tubicola* (Müller) 1776
      - *Onuphis conchylega* Sars, 1835
      - *Onuphis eremita* Audoin and Milne-Edwards, 1833
      - *Onuphis opalina* (Verrill) 1873
      - *Onuphis quadricuspis* Sars, 1872
      - *Paradiopatra* sp.
    - Eunicidae
      - *Eunice pennata* (Müller) 1776
      - *Marphysa belli* (Audoin and Milne-Edwards) 1883
    - Lumbrineridae
      - *Lumbrineris acuta* (Verrill) 1875
      - *Lumbrineris fragilis* (Müller) 1776
      - *Lumbrineris tenuis* (Verrill) 1873
      - *Ninoe nigripes* Verrill, 1873
    - Arabellidae
      - *Arabella iricolor* (Montagu) 1804
      - *Drilonereis longa* Webster, 1879
      - *Notocirrus* sp.
  - Amphinomida
    - Amphinomidae
      - *Paramphinome pulchella* Sars, 1872
  - Magelonida
    - Magelonidae
      - *Magelona* sp.
  - Ariciida
    - Orbiniidae
      - *Orbinia ornata* (Verrill) 1873
      - *Orbinia swani* Pettibone, 1957
      - *Scoloplos robustus* (Verrill) 1873
  - Cirratulida
    - Cirratulidae
      - *Chaetozone* sp.
      - *Cirratulus* sp.
      - *Cossura longocirrata* Webster and Benedict, 1883
      - *Tharyx* sp.
  - Oweniida
    - Oweniidae
      - *Owenia fusiformis* delle Chiaje, 1844
  - Terebellida
    - Pectinariidae
      - *Pectinaria gouldii* (Verrill) 1873
    - Ampharetidae
      - *Ampharete acutifrons* (Grube) 1860
      - *Ampharete arctica* Malmgren, 1866
      - *Asabellides oculata* Webster, 1879
      - *Melinna cristata* (Sars) 1851
    - Terebellidae
      - *Amphitrite* sp.
      - *Streblosoma spiralis* (Verrill) 1874

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*—Continued

Annelida—Continued
- Polychaeta—Continued
  - Flabelligerida
    - Flabelligeridae
      - *Brada* sp.
      - *Flabelligera* sp.
      - *Pherusa* sp.
  - Sabellida
    - Sabellidae
      - *Chone infundibuliformis* Kröyer, 1856
      - *Euchone* sp.
      - *Potamilla reniformis* (Linnaeus) 1788
      - *Sabella* sp.

POGONOPHORA
- Oligobrachiidae
  - *Oligobrachia floridana* Nielsen, 1965
- Siboglinidae
  - *Siboglinum angustum* Southward and Brattegard, 1968
  - *Siboglinum bayeri* Southward, 1971
  - *Siboglinum ekmani* Jagerston, 1956
  - *Siboglinum gosnoldae* Southward and Brattegard, 1968
  - *Siboglinum holmei* Southward, 1963
  - *Siboglinum longicollum* Southward and Brattegard, 1968
  - *Siboglinum pholidotum* Southward and Brattegard, 1968
- Polybrachiidae
  - *Crassibrachia sandersi* Southward, 1968
  - *Diplobrachia similis* Southward and Brattegard, 1968
  - *Diplobrachia* sp.
  - *Polybrachia lepida* Southward and Brattegard, 1968
  - *Polybrachia* sp.

SIPUNCULIDA
- *Aspidosiphon spinalis* Ikeda, 1904
- *Aspidosiphon zinni* Cutler, 1969
- *Golfingia catharinae* Müller, 1789
- *Golfingia constricticervix* Cutler, 1969
- *Golfingia elongata* (Keferstein) 1869
- *Golfingia eremita* (Sars) 1851
- *Golfingia flagrifera* (Selenka) 1885
- *Golfingia margaritacea* (Sars) 1851
- *Golfingia minuta* (Keferstein) 1865
- *Golfingia murinae murinae* Cutler, 1969
- *Golfingia trichocephala* (Sluiter) 1902
- *Onchnesoma steenstrupi* Koren and Danielsson, 1875
- *Phascolion strombi* (Montague) 1804
- *Sipunculus norvegicus* Koren and Danielsson, 1875

ECHIURA
- Bonellidae
  - *Bonellia thomensis* Fisher, 1922
  - *Ikedella achaeta* (Zenkevitch, 1958)
  - *Prometor grandis* (Zenkevitch, 1957)
  - *Sluiterina sibogae* (Sluiter, 1902)
  - *Sluiterina* sp.

MOLLUSCA
- Gastropoda
  - Prosobranchia
    - Archaegastropoda
      - *Acmaea testudinalis* (Müller) 1776
      - *Calliostoma bairdi* Verrill and Smith, 1880
      - *Calliostoma occidentale* (Mighels and Adams) 1842
    - Mesogastropoda
      - *Alvania brychia* (Verrill) 1884
      - *Alvania carinata* Mighels and Adams, 1842
      - *Crepidula fornicata* Linnaeus, 1767
      - *Crepidula plana* Say, 1822
      - *Crucibulum striatum* Say, 1824
      - *Epitonium dallianum* Verrill and Smith, 1880

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*—Continued

Mollusca—Continued
 Gastropoda—Continued
  Prosobranchia—Continued
   Mesogastropoda—Continued
    Epitonium greenlandicum (Perry) 1811
    Epitonium multistriatum (Say) 1826
    Fossarus elegans Verrill and Smith, 1882
    Lunatia heros (Say) 1822
    Lunatia triseriata (Say) 1826
    Melanella intermedia (Cantraine) 1835
    Natica clausa Bowderup and Sowerby, 1829
    Natica pusilla Say, 1822
    Polinices duplicatus (Say) 1822
    Polinices immaculatus (Totten) 1835
    Turritellopsis acicula (Stimpson) 1851
   Neogastropoda
    Anachis sp.
    Buccinum undatum Linnaeus, 1758
    Busycon carica (Gmelin) 1791
    Colus pubescens Verrill, 1882
    Colus pygmaeus (Gould) 1841
    Eupleura caudata (Say) 1822
    Mitrella lunata (Say) 1826
    Mitrella zonalis Gould, 1848
    Nassarius trivittatus (Say) 1822
    Neptunea decemcostata (Say) 1826
    Taranis cirrata (Brugnone) 1822
  Euthyneura
   Pyramidelloida
    Odostomia gibbosa Bush, 1909
    Turbonilla interrupta (Totten) 1835
   Cephalapsida
    Cylichna alba (Brown) 1827
    Cylichna gouldi (Couthouy) 1839
    Haminoea solitaria (Say) 1822
    Retusa obtusa (Montagu) 1807
    Scaphander punctostriatus Mighels, 1841
   Notapsida
    Pleurobranchia tarda Verrill, 1880
Bivalvia
 Paleotaxodonta
  Nuculoida
   Nuculidae
    Nucula delphinodonta Mighels and Adams, 1842
    Nucula proxima Say, 1822
    Nucula tenuis Montagu, 1808
   Malletiidae
    Malletia obtusata G.O. Sars, 1872
   Nuculanidae
    Nuculana acuta (Conrad) 1831
    Nuculana tenuisulcata (Couthouy) 1838
    Portlandia inflata (Verrill and Bush) 1897
    Portlandia iris (Verrill and Bush) 1897
    Yoldia limatula (Say) 1831
    Yoldia sapotilla (Gould) 1841
 Cryptodonta
  Solemyoida
   Solemyacidae
    Solemya velum Say, 1822
 Pteriomorphia
  Arcoida
   Arcidae
    Anadara ovalis (Brugiere) 1789
    Bathyarca anomala (Verrill and Bush) 1898
    Bathyarca pectunculoides (Scacchi) 1833
   Limopsidae
    Limopsis minuta Philippi, 1836
    Limopsis sulcata Verrill and Bush, 1898
  Mytiloida
   Mytilidae
    Crenella decussata (Montagu) 1808
    Crenella glandula (Totten) 1834
    Crenella pectinula (Gould) 1841
    Dacrydium vitreum (Holboll and Müller) 1842
    Modiolus modiolus (Linnaeus) 1758

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*—Continued

Bivalvia—Continued
 Pteriomorphia—Continued
  Mytiloida—Continued
   Mytilidae—Continued
    Musculus corrugatus (Stimpson) 1851
    Musculus discors (Linnaeus) 1767
    Musculus niger (Gray) 1824
    Mytilus edulis Linnaeus, 1758
  Pteroidea
   Pectinidae
    Aequipecten glyptus (Verrill) 1882
    Pecten thalassinus Dall, 1886
    Placopecten magellanicus (Gmelin) 1791
   Anomiidae
    Anomia aculeata Linnaeus, 1758
    Anomia simplex Orbigny, 1842
   Limidae
    Limatula subauriculata (Montagu) 1808
 Heterodonta
  Veneroida
   Lucinidae
    Lucinoma filosa (Stimpson) 1851
   Leptonidae
    Aligena elevata (Stimpson) 1851
   Thyasiridae
    Thyasira ferruginosa Forbes, 1844
    Thyasira flexuosa (Montagu) 1803
    Thyasira ovata Verrill and Bush, 1898
    Thyasira pygmaea Verrill and Bush, 1898
    Thyasira trisinuata Orbigny, 1842
   Carditidae
    Cyclocardia borealis (Conrad) 1831
   Astartidae
    Astarte borealis (Schumacher) 1817
    Astarte castanea (Say) 1822
    Astarte elliptica (Brown) 1827
    Astarte quadrans Gould, 1841
    Astarte subequilatera Sowerby, 1854
    Astarte undata Gould, 1841
   Cardiidae
    Cerastoderma pinnulatum (Conrad) 1831
    Laevicardium mortoni (Conrad) 1830
   Mactridae
    Mulinia lateralis (Say) 1822
    Spisula solidissima (Dillwyn) 1817
   Solenidae
    Ensis directus Conrad, 1843
    Siliqua costata Say, 1822
   Tellinidae
    Macoma balthica (Linnaeus) 1758
    Macoma tenta (Say) 1834
    Tellina agilis Stimpson, 1857
   Semelidae
    Abra longicallis Verrill and Bush, 1898
   Arcticidae
    Arctica islandica (Linnaeus) 1767
   Veneridae
    Liocyma fluctuosa (Gould) 1841
    Mercenaria mercenaria (Linnaeus) 1758
    Pitar morrhuanus Linsley, 1848
   Mesodesmatidae
    Mesodesma arctatum (Conrad) 1830
   Petricolidae
    Petricola pholadiformis (Lamarck) 1818
  Myoida
   Myidae
    Mya arenaria Linnaeus, 1758
   Corbulidae
    Corbula contracta Say, 1822
   Hiatellidae
    Cyrtodaria siliqua (Spengler) 1793
    Hiatella arctica (Linnaeus) 1767
    Panomya arctica (Lamarck) 1818
 Analodesmacea
  Pholadomyoida
   Lyonsiidae
    Lyonsia hyalina Conrad, 1831

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*—Continued

Bivalvia—Continued
  Analodesmacea—Continued
    Pholadomyoida—Continued
      Pandoridae
        Pandora gouldiana Dall, 1886
        Pandora inflata Boss and Merrill, 1965
        Pandora inornata Verrill and Bush, 1898
      Thraciidae
        Thracia conradi Couthouy, 1838
        Thracia myopsis (Möller) 1842
      Periplomatidae
        Periploma afinis Verrill and Bush, 1898
        Periploma fragile (Totten) 1835
        Periploma leanum (Conrad) 1831
        Periploma papyratium (Say) 1822
    Septibranchoida
      Poromyidae
        Poromya granulata (Nyest and Westendorp) 1839
      Cuspidariidae
        Cardiomya perrostrata Dall, 1881
        Cardiomya striata (Jeffreys) 1876
        Cuspidaria parva Verrill and Bush, 1898
        Myonera limatula Dall, 1881
  Scaphopoda
    Cadulus pandionis Verrill and Smith, 1880
    Cadulus verrilli Henderson, 1920
    Dentalium occidentale Stimpson, 1851
ARTHROPODA
  Pycnogonida
    Achelia spinosa (Stimpson) 1853
    Anoplodactylus parvus Giltay, 1934
    Nymphon sp.
    Crustacea
      Ostracoda
        Cycloberis sp.
        Pseudophilomedes ferulanus Kornicker, 1959
      Cirripedia
        Balanus balanus (Linnaeus) 1758
        Balanus crenatus Brugiere, 1789
        Balanus venustus niveus Darwin, 1854
      Nebaliacea
      Cumacea
        Diastylis polita S.I. Smith, 1879
        Diastylis quadrispinosa G.O. Sars, 1871
        Diastylis sculpta G.O. Sars, 1871
        Eudorella emarginata (Kröyer) 1846
        Eudorellopsis sp.
        Leptostylis sp.
        Petalosarsia declivis (G.O. Sars) 1864
      Tanaidacea
        Anorthura sp.
        Neotanais sp.
      Isopoda
        Calathura sp.
        Chiridotea arenicola Wigley, 1960
        Chiridotea tuftsi (Stimpson) 1883
        Cirolana polita (Stimpson) 1853
        Cyathura polita (Stimpson) 1855
        Edotea triloba (Say) 1818
        Erichsonella filiformis (Say) 1818
        Idotea sp.
        Ptilanthura tenuis Harger, 1879
  Amphipoda
    Gammaridea
      Gammaridae
        Gammarus annulatus Smith, 1873
        Gammarus mucronatus Say, 1818
        Gammarus palustris Bousfield, 1969
      Crangonycidae
        Crangonyx pseudogracilis Bousfield, 1958
      Melitidae
        Casco bigelowi (Blake) 1929
        Elasmopus levis Smith, 1873
        Maera danae Stimpson, 1853
        Maera loveni (Bruzelius) 1859

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*—Continued

  Amphipoda—Continued
    Gammaridea—Continued
        Melita dentata (Kröyer) 1842
        Melita palmata (Montagu) 1894
      Haustoriidae
        Acanthohaustorius millsi Bousfield, 1965
        Amphiporeia virginiana Shoemaker, 1933
        Bathyporeia parkeri Bousfield, 1973
        Bathyporeia quoddyensis Shoemaker, 1949
        Protohaustorius wigleyi Bousfield, 1965
        Pseudohaustorius borealis Bousfield, 1965
      Phoxocephalidae
        Harpinia propinqua Sars, 1895
        Phoxocephalus holbolli Kröyer, 1842
        Trichophoxis epistomus (Shoemaker) 1938
      Pontogeneidae
        Pontogeneia inermis (Kröyer) 1842
      Pleustidae
        Stenopleustes gracilis (Holmes) 1905
        Stenopleustes inermis Shoemaker, 1949
      Ampeliscidae
        Ampelisca abdita Mills, 1967
        Ampelisca aequicornis Bruzelius, 1859
        Ampelisca agassizi Judd, 1896
        Ampelisca macrocephala Liljeborg, 1852
        Ampelisca vadorum Mills, 1963
        Ampelisca verrilli Mills, 1967
        Byblis gaimardi (Kröyer) 1846
        Byblis serrata Smith, 1873
      Liljeborgiidae
        Liljeborgia sp.
        Listriella sp.
      Lysianassidae
        Anonyx liljeborgi Boeck, 1870
        Anonyx sp.
        Hippomedon propinquus Sars, 1870
        Hippomedon serratus Holmes, 1905
        Orchromenella groenlandica (Hansen) 1887
        Orchromenella pinquis (Boeck) 1861
        Psammonyx nobilis (Stimson) 1853
      Aoridae
        Lembos sp.
        Leptocheirus pinguis (Stimpson) 1853
        Leptocheirus plumulosus Shoemaker, 1932
        Pseudunciola obliquua (Shoemaker) 1949
        Unciola inermis Shoemaker, 1942
        Unciola irrorata Say, 1818
        Unciola leucopis (Kröyer) 1845
      Photidae
        Photis macrocoxa Shoemaker, 1945
        Photis reinhardi Kröyer, 1842
        Protomedia fasciata Kröyer, 1842
      Ischyroceridae
        Ischyrocerus anguipes Kröyer, 1838
      Corophiidae
        Cerapis tubularis Say, 1818
        Corophium insidiosum Crawford, 1937
        Corophium volutator (Pallas) 1766
        Corophium sp.
        Erichthonius brasiliensis (Dana) 1853
        Erichthonius rubricornis Smith, 1873
        Siphonoectes smithianus Rathbun, 1908
      Podoceridae
        Dulichia porrecta (Bate) 1857
    Caprellidea
      Caprellidae
        Aeginina longicornis (Kröyer) 1842–43
        Caprella penantis Leach, 1814
        Caprella septentrionalis Kröyer, 1838
        Caprella unica Mayer, 1903
        Caprella sp.
        Luconatia incerta Mayer, 1903
    Mysidacea
      Bowmaniella portoriciensis Bacescu, 1968

TABLE 4.—*Invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight region*—Continued

ARTHROPODA—Continued
  Amphipoda—Continued
    Mysidacea—Continued
      Erythrops erythropthalma (Goes) 1864
      Heteromysis formosa S.I. Smith, 1873
      Mysidopsis bigelowi Tattersall, 1926
      Neomysis americana (S.I. Smith) 1873
      Promysis atlantica Tattersall, 1923
    Decapoda
      Caridea
        Crangon septemspinosus Say, 1818
        Dichelopandalus leptocerus (Smith) 1881
      Anomura
        Axius serratus Stimpson, 1852
        Callichirus atlanticus (Smith) 1874
        Munida sp.
        Pagurus acadianus Benedict, 1901
        Pagurus arcuatus Squires, 1964
        Pagurus pubescens (Kröyer) 1838
        Upogebia affinis (Say) 1817
      Brachyura
        Cancer borealis Stimpson, 1859
        Cancer irroratus Say, 1817
        Hyas coarctatus Leach, 1815
        Libinia emarginata Leach, 1815
        Ocypode quadrata (Fabricius) 1787
        Pinnixa sayana Stimpson, 1860
BRYOZOA
  Ctenostomata
    Alcyonidiidae
      Alcyonidium sp.
    Cyclostomata
      Crisiidae
        Crisia eburnea (Linnaeus) 1758
    Cheilostomata
      Scrupraridae
        Eucratea loricata (Linnaeus) 1758
        Haplota clavata (Hincks) 1857
      Membraniporidae
        Conopeum reticulum (Linnaeus) 1767
        Membranipora tenuis Desor, 1848
        Membranipora tuberculata (Bosc) 1802
      Electridae
        Electra hastingsae Marcus, 1938
        Electra pilosa (Linnaeus) 1767
      Calloporidae
        Amphiblestrum flemingii (Bush) 1854
        Callopora aurita (Hincks) 1877
        Callopora lineata (Linnaeus) 1767
      Bugulidae
        Bugula turrita (Desor) 1848
        Dendrobeania murrayana (Johnston) 1847
      Cribrilinidae
        Cribrilina punctata (Hassall) 1841
      Schizoporellidae
        Schizoporella unicornis (Johnston) 1847
      Microporellidae
        Microporella ciliata (Pallas) 1766
      Hippoporinidae
        Hippoporina americana (Verrill) 1875
        Hippoporina porosa (Esper) 1796
      Smittinidae
        Rhamphostomella costata Lorenz, 1886
      Cheiloporinidae
        Cryptosula palasiana (Moll) 1803
ECHINODERMATA
  Holothuroidea
    Dendrochirodota
      Cucumaria planci Marenzeller, 1893
      Havelockia scabra (Verrill) 1873
      Psolus fabricii (Duben and Koren) 1846
      Stereoderma unisemita (Stimpson) 1851
      Thyone fusus (Müller) 1788
    Apodida
      Chirodota wigleyi Pawson, 1976
      Synapta sp.

ECHINODERMATA—Continued
    Holothuroidea—Continued
      Molpadiida
        Caudina arenata Gould, 1841
        Molpadia musculus Risso, 1826
        Molpadia oolitica (Pourtales) 1857
  Echinoidea
      Cideroidea
        Stylocidaris affinis Phillips, 1845
      Arbacioidea
        Arbacia punctulata (Lamarck) 1816
      Temnopleuroidea
        Genocidaris maculata Agassiz, 1869
      Clypeasteroidea
        Echinarachnius parma (Lamarck) 1816
        Encope sp.
        Mellita quinquiesperforata (Leske) 1778
      Spatangoidea
        Aceste bdellifera Wyville Thompson, 1877
        Aeropsis rostrata Norman, 1876
        Brisaster fragilis (Duben and Koren) 1844
        Brissopsis atlantica Mortensen, 1907
        Echinocardium cordatum Pennant, 1777
        Schizaster orbignyanus A. Agassiz, 1883
    Ophiuroidea
      Ophiuridae
        Ophiocten scutatem Koehler, 1896
        Ophiocten sericeum (Forbes) 1852
        Ophiomusium lymani Thompson, 1873
        Ophiura acenata
        Ophiura ljungmani (Lyman) 1878
        Ophiura sarsi Lütken, 1858
      Ophiocanthidae
        Amphilimna olivacea (Lyman) 1869
      Ophiactidae
        Ophiopholus aculeata (Linnaeus) 1788
      Amphiuridae
        Amphioplus abdita (Verrill) 1872
        Amphioplus tumidus (Lyman) 1878
        Amphiura fragilis (Verrill) 1885
        Amphiura otteri Ljungman, 1871
        Axiognathus squamatus (delle Chiaje) 1828
        Micropholis atra
      Amphilepidae
        Amphilepis ingolfiana Mortensen, 1933
    Asteroidea
      Asterias forbesii (Desor) 1848
      Asterias vulgaris Verrill, 1866
      Astropecten americana (Verrill) 1880
      Astropecten articulatus Say, 1825
      Leptasterias sp.
HEMICHORDATA
  Enteropneusta
    Balanoglossus sp.
CHORDATA
  Ascidiacea
    Bostrichobranchus pilularis (Verrill) 1871
    Ciona intestinalis (Linnaeus) 1767
    Cnemidocarpa mollis (Stimpson) 1852
    Craterostigma singulare (Van Name) 1912
    Molgula citrina Adler and Hancock, 1848
    Molgula complanata Alder and Hancock, 1870
    Molgula siphonalis Sars, 1859

Leptocheirus, Unciola (Amphipoda); *Cancer* (Decapoda); *Cirolana* (Isopoda); *Astropecten* (*Asteroidea*); *Echinarachnius, Brisaster* (Echinoidea).

SUBAREA DIFFERENCES IN COMPOSITION

The macrobenthic fauna in all three subareas of the Middle Atlantic Bight region was dominated by the same four major taxonomic groups—Arthropoda, Mollusca, Annelida, and Echinodermata (tables 5, 6, 7; and fig. 6). However, there were pronounced variations in absolute and proportional quantities within these groups.

Number of individuals.—Striking diversity in proportional makeup of the fauna was evident in all four dominant taxonomic groups. Arthropoda were particularly abundant in Southern New England, where they constituted 62 percent of the total number of specimens. Southward, they decreased in nearly equal amounts, and accounted for 42 percent of the total fauna in New York Bight and 21 percent in Chesapeake Bight. Nearly the opposite trend was seen in the abundance of Mollusca. In Southern New England, they accounted for about 10 percent of the number of animals, but increased southward to 18 percent in New York Bight and 57 percent in Chesapeake Bight. Annelida showed a somewhat different trend in percentage composition. They formed approximately equal proportions in Southern New England (18 percent) and Chesapeake Bight (15 percent), but constituted a substantially larger proportion of the fauna in New York Bight (33 percent). Echinodermata made up a moderately small (2–5 percent) share of the fauna in all areas, but the number present in Southern New England (4.6 percent of the total fauna) and in New York Bight (4.2 percent) was double the proportion present in Chesapeake Bight (2.3 percent).

Biomass.—Proportional composition of the biomass was more consistent than the number of specimens from one subarea to another. Furthermore, the components had a different order of dominance. Mollusca constituted 64 percent of the biomass in both Southern New England and Chesapeake Bight, and the extra-ordinarily high quantity of 80 percent in New York Bight. Echinodermata ranked second and had roughly equal proportions, between 11 and 13 percent in all subareas. Annelida ranked third and accounted for 9 percent of the biomass in Southern New England, 5 percent in New York Bight, and 10 percent in Chesapeake Bight. Arthropoda, which ranked first in number of specimens, ranked fourth in biomass. They were substantially more important in Southern New England (where they formed 7.5 percent of the fauna) than in the two more southern subareas where they made up 3.2 and 3.1 percent of the biomass, respectively. Miscellaneous taxonomic groups (Ascidiacea, Coelenterata, Bryozoa, Nemertea, and nine additional groups) were moderately important in Southern New England (6.9 percent) and Chesapeake Bight (10.0 percent), whereas in New York Bight they accounted for only 1.3 percent of the biomass.

The relationship between faunal composition and geographic distribution, water depth, bottom sediments, sediment organic content, and water temperature are analyzed in subsequent sections. Quantitative geographic distribution of dominant faunal components is discussed in the section "Dominant Faunal Components."

GEOGRAPHIC DISTRIBUTION

Before ecological communities or associations of a particular region can be ascertained, the distribution of the important taxonomic groups in that region must be known.

The graphic presentation, in the form of charts, of the quantitative geographic distribution of various major taxonomic components of the benthic fauna is one of the more useful methods of expressing quantitative occurrence for the purpose of determining ecological communities. Throughout this report where the phrase "major taxonomic component" is used, we are referring to the higher taxa—phyla, classes, and orders—as listed in tables 12 and 13. The charts permit the reader to visually integrate relationships between other organisms and between the numerous abiotic factors that may influence the occurrence of a particular species or faunal group. With these aspects in mind, we prepared two quantitative distribution charts for each major taxonomic group found in the Middle Atlantic Bight region. One chart presents the number of individuals (density) and the second presents their weight (biomass); both are expressed in terms of $1m^2$ of bottom area.

TOTAL MACROBENTHIC FAUNA OF ALL TAXONOMIC GROUPS

The density distribution of benthic animals, all taxonomic groups combined, in the Middle Atlantic Bight region showed two major trends. One trend pertains to density in relation to inshore-offshore location. High densities generally prevailed in the coastal areas, moderate densities on the Continental Shelf, and low densities in the offshore, deep waters. A second trend in density distribution pertains to latitudinal differences. In the northern part of the Middle Atlantic Bight region, especially those areas off southern Massachusetts and Rhode Island, there are extensive tracts where the density of benthic animals was high (greater than $1,000/m^2$) or very

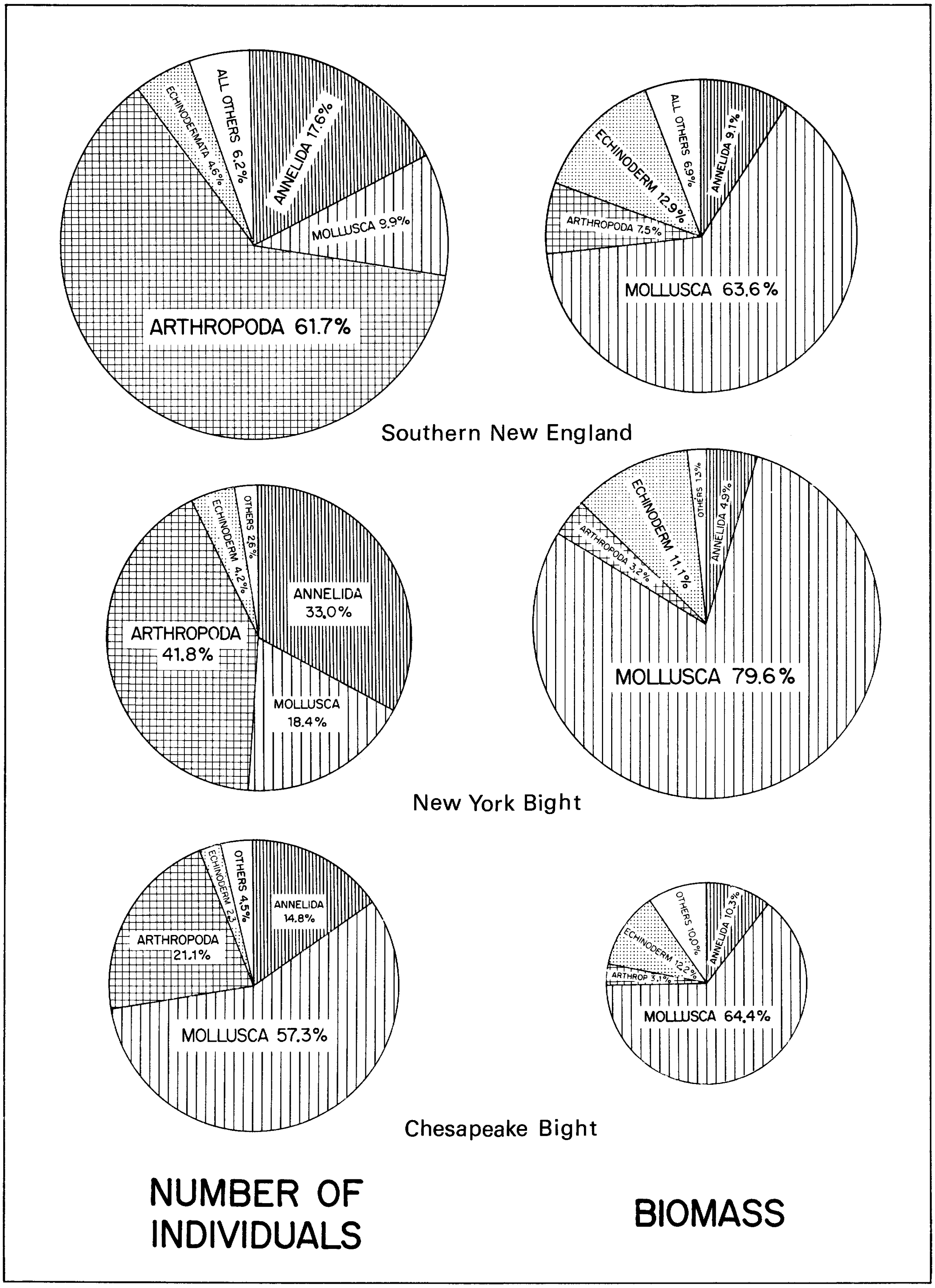

FIGURE 6.—Pie charts illustrating the taxonomic composition of the total macrobenthic fauna for each subarea in the Middle Atlantic Bight region. Numbers of individuals are shown on the left side, and biomasses are shown on the right side. The area of each circle is proportional to the mean density or mean biomass.

TABLE 5.—*Quantitative taxonomic composition of the macrobenthic invertebrate fauna, in both number of individuals and biomass, representing the Southern New England subarea*

Taxonomic group	Number of individuals			Biomass		
	Mean	Percent	Phylum rank	Mean	Percent	Phylum rank
	No./m²			g/m²		
PORIFERA	0.75	0.04	13	0.113	0.05	10
COELENTERATA	29.26	1.50	6	4.617	2.19	6
Hydrozoa	14.52	0.74		0.624	0.30	
Anthozoa	14.74	0.75		3.993	1.90	
Alcyonacea	0.80	0.04		0.165	0.08	
Zoantharia	6.31	0.32		3.566	1.69	
Unidentified	7.63	0.39		0.262	0.12	
PLATYHELMINTHES	1.46	0.07	11	0.012	0.01	14
Turbellaria	1.46	0.07		0.012	0.01	
NEMERTEA	5.99	0.31	10	0.781	0.37	8
ASCHELMINTHES	6.06	0.31	9	0.007	<0.01	16
Nematoda	6.06	0.31		0.007	<0.01	
ANNELIDA	343.92	17.60	2	19.051	9.05	3
POGONOPHORA	1.27	0.06	12	0.009	<0.01	15
SIPUNCULIDA	9.31	0.48	8	1.369	0.65	7
ECHIURA	0.09	<0.01	15	0.051	0.02	11
PRIAPULIDA	0.03	<0.01	16	0.021	0.01	13
MOLLUSCA	193.67	9.91	3	133.869	63.58	1
Polyplacophora	1.06	0.05		0.428	0.20	
Gastropoda	39.75	2.03		3.489	1.66	
Bivalvia	150.40	7.69		129.924	61.70	
Scaphopoda	0.90	0.05		0.014	<0.01	
Cephalopoda	0.99	0.05		0.013	<0.01	
Unidentified	0.57	0.03		0.002	<0.01	
ARTHROPODA	1206.10	61.71	1	15.746	7.48	4
Pycnogonida	0.49	0.03		0.002	<0.01	
Arachnida	-	-		-	-	
Crustacea	1205.61	61.68		15.744	7.48	
Ostracoda	0.32	0.02		0.002	<0.01	
Cirripedia	20.57	1.05		7.339	3.49	
Copepoda	0.09	<0.01		0.001	<0.01	
Nebaliacea	-	-		-	-	
Cumacea	29.00	1.48		0.135	0.06	
Tanaidacea	0.11	<0.01		0.001	<0.01	
Isopoda	9.76	0.50		0.218	0.10	
Amphipoda	1136.87	58.17		7.023	3.34	
Mysidacea	1.34	0.07		0.009	<0.01	
Decapoda	7.55	0.39		1.017	0.48	
BRYOZOA	26.47	1.35	7	0.774	0.37	9
BRACHIOPODA	-	-		-	-	
ECHINODERMATA	90.00	4.60	4	27.276	12.95	2
Holothuroidea	4.83	0.25		14.038	6.67	
Echinoidea	9.97	0.51		6.397	3.04	
Ophiuroidea	73.39	3.75		4.612	2.19	
Asteroidea	1.81	0.09		2.231	1.06	
HEMICHORDATA	0.27	0.01	14	0.050	0.02	12
CHORDATA	32.13	1.64	5	6.364	3.02	5
Ascidiacea	32.13	1.64		6.364	3.02	
UNIDENTIFIED	7.75	0.40		0.445	0.21	

TABLE 6.—*Quantitative taxonomic composition of the macrobenthic invertebrate fauna, in both number of individuals and biomass, representing the New York Bight subarea*

Taxonomic group	Number of individuals			Biomass		
	Mean	Percent	Phylum rank	Mean	Percent	Phylum rank
	No./m2			g/m2		
PORIFERA	0.53	0.04	11	0.027	0.01	11
COELENTERATA	8.82	0.74	5	1.386	0.50	5
Hydrozoa	4.42	0.37		0.064	0.02	
Anthozoa	4.40	0.37		1.321	0.50	
Alcyonacea	0.62	0.05		0.064	0.02	
Zoantharia	3.11	0.26		1.166	0.42	
Unidentified	0.67	0.06		0.092	0.03	
PLATYHELMINTHES	0.06	0.01	15	0.003	<0.01	14
Turbellaria	0.06	0.01		0.003	<0.01	
NEMERTEA	2.65	0.22	8	0.740	0.27	6
ASCHELMINTHES	0.13	0.01	13	0.001	<0.01	15
Nematoda	0.13	0.01		0.001	<0.01	
ANNELIDA	391.67	33.00	2	13.393	4.88	3
POGONOPHORA	0.84	0.07	10	0.004	<0.01	13
SIPUNCULIDA	2.00	0.17	9	0.324	0.12	7
ECHIURA	0.18	0.02	12	0.282	0.10	9
PRIAPULIDA	-	-		-	-	
MOLLUSCA	218.98	18.45	3	218.634	79.60	1
Polyplacophora	0.06	0.01		0.001	<0.01	
Gastropoda	22.01	1.85		2.352	0.86	
Bivalvia	195.32	16.46		216.253	78.74	
Scaphopoda	1.59	0.13		0.028	0.01	
Cephalopoda	-	-		-	-	
Unidentified	-	-		-	-	
ARTHROPODA	496.15	41.81	1	8.719	3.17	4
Pycnogonida	0.06	0.01		0.001	<0.01	
Arachnida	0.14	0.01		0.001	<0.01	
Crustacea	495.95	41.79		8.717	3.17	
Ostracoda	0.28	0.02		0.002	<0.01	
Cirripedia	69.75	5.88		3.979	1.45	
Copepoda	0.02	<0.01		<0.001	<0.01	
Nebaliacea	0.01	<0.01		<0.001	<0.01	
Cumacea	8.58	0.72		0.045	0.02	
Tanaidacea	0.02	<0.01		<0.001	<0.01	
Isopoda	10.58	0.89		0.356	0.13	
Amphipoda	396.58	33.42		2.547	0.93	
Mysidacea	0.95	0.08		0.005	<0.01	
Decapoda	9.18	0.77		1.782	0.65	
BRYOZOA	4.93	0.42	7	0.103	0.04	10
BRACHIOPODA	-	-		-	-	
ECHINODERMATA	49.48	4.17	4	30.446	11.09	2
Holothuroidea	0.86	0.07		0.513	0.19	
Echinoidea	40.24	3.39		25.801	9.39	
Ophiuroidea	7.66	0.65		0.552	0.20	
Asteroidea	0.72	0.06		3.581	1.30	
HEMICHORDATA	0.07	0.01	14	0.004	<0.01	12
CHORDATA	5.43	0.46	6	0.340	0.12	8
Ascidiacea	5.43	0.46		0.340	0.12	
UNIDENTIFIED	4.81	0.41		0.245	0.09	

TABLE 7.—*Quantitative taxonomic composition of the macrobenthic invertebrate fauna, in both number of individuals and biomass, representing the Chesapeake Bight subarea*

Taxonomic group	Number of individuals			Biomass		
	Mean	Percent	Phylum rank	Mean	Percent	Phylum rank
	No./m²			g/m²		
PORIFERA	0.42	0.04	12	0.037	0.04	11
COELENTERATA	15.26	1.41	5	2.933	3.31	5
Hydrozoa	9.78	0.90		0.202	0.23	
Anthozoa	5.48	0.51		2.731	3.08	
Alcyonacea	0.12	0.01		0.045	0.05	
Zoantharia	2.04	0.19		2.549	2.87	
Unidentified	3.32	0.31		0.138	0.16	
PLATYHELMINTHES	0.39	0.04	13	0.007	0.01	14
Turbellaria	0.39	0.04		0.007	0.01	
NEMERTEA	4.88	0.45	8	0.342	0.39	9
ASCHELMINTHES	1.64	0.15	10	0.006	0.01	15
Nematoda	1.64	0.15		0.006	0.01	
ANNELIDA	160.16	14.78	3	9.102	10.27	3
POGONOPHORA	3.59	0.33	9	0.022	0.02	13
SIPUNCULIDA	0.59	0.05	11	0.383	0.43	8
ECHIURA	0.18	0.02	14	0.411	0.46	7
PRIAPULIDA	0.01	<0.01	16	0.005	0.01	16
MOLLUSCA	620.97	57.29	1	57.144	64.45	1
Polyplacophora	0.24	0.02		0.006	0.01	
Gastropoda	45.46	4.19		3.400	3.83	
Bivalvia	573.98	52.95		53.713	60.58	
Scaphopoda	1.29	0.12		0.025	0.03	
Cephalopoda	-	-		-	-	
Unidentified	-	-		-	-	
ARTHROPODA	228.88	21.12	2	2.711	3.06	6
Pycnogonida	1.06	0.10		0.006	0.01	
Arachnida	-	-		-	-	
Crustacea	227.82	21.02		2.705	3.05	
Ostracoda	0.05	<0.01		<0.001	0.05	
Cirripedia	0.18	0.02		0.003	<0.01	
Copepoda	-	-		-	-	
Nebaliacea	0.03	<0.01		<0.001	<0.01	
Cumacea	10.35	0.95		0.035	0.04	
Tanaidacea	0.04	<0.01		<0.001	<0.01	
Isopoda	16.53	1.53		0.297	0.33	
Amphipoda	191.93	17.71		1.509	1.70	
Mysidacea	3.84	0.35		0.013	0.02	
Decapoda	4.87	0.45		0.848	0.96	
BRYOZOA	5.45	0.50	7	0.115	0.13	10
BRACHIOPODA	0.01	<0.01	17	<0.001	<0.01	17
ECHINODERMATA	25.07	2.31	4	10.818	12.20	2
Holothuroidea	0.80	0.07		1.714	1.93	
Echinoidea	19.04	1.76		8.766	9.89	
Ophiuroidea	5.06	0.47		0.271	0.31	
Asteroidea	0.17	0.02		0.067	0.08	
HEMICHORDATA	0.06	<0.01	15	0.030	0.03	12
CHORDATA	6.74	0.62	6	4.461	5.03	4
Ascidiacea	6.74	0.62		4.461	5.03	
UNIDENTIFIED	9.61	0.89		0.135	0.15	

high (greater than 5,000/m^2). Moreover, relatively few areas were found on the Continental Shelf where the density was low (less than 200/m^2). Conversely, in the southern region, off Delaware-Virginia-North Carolina, there are few areas where benthic animals were found in very high density and limited expanses of high density. Moderate to low density areas were not uncommon. The middle region (New York-New Jersey region), located between the relatively high density northern area and the somewhat depauperate southern sector, was more or less intermediate in density. This north to south trend of decreasing density on the Continental Shelf is shown in figure 7, where the density of all taxonomic groups combined is plotted. There were no detectable north-south differences in density of the fauna in deepwater (Continental Slope and Rise) areas.

Biomass distribution (fig. 8) of the total macrobenthic fauna revealed patterns similar to those of density. Both inshore-offshore and north-south trends are clearly shown. In the Middle Atlantic Bight region, most large biomasses (greater than 500 g/m^2) were found along the Inner Continental Shelf. In addition to their presence inshore, moderately large biomasses (100 to 500 g/m^2) were characteristic of central and offshore parts of the shelf. Small and moderately small (less than 100 g/m^2) biomasses prevailed in the deepwater areas beyond the shelf break.

The north-south differences in biomass were very pronounced. On the inshore Continental Shelf off southern Massachusetts and Rhode Island, extensive areas of large biomasses were found. Throughout much of the shelf region there were substantial expanses of moderately large biomasses. Small quantities (less than 25 g/m^2) were limited to a relatively few tracts of small or moderate size. This general pattern contrasts sharply with that found off the Delaware-Virginia-North Carolina region. Large and moderately large biomasses were much less common and were more restricted in areal extent. Also, small biomasses (less than 25 g/m^2) prevailed in rather extensive areas. No important north-south differences in either biomass or density were found in offshore deepwaters—Continental Slope and Rise.

MAJOR TAXONOMIC COMPONENTS

Porifera (figs. 9 and 10) were found in small areas widely scattered throughout the region. A large proportion were on the outer shelf, slope, and rise. Densities were predominantly between 1/m^2 and 24/m^2. At four inshore and midshelf localities, density ranged from 25/m^2 to 75/m^2. Biomass was generally small, less than 0.5 g/m^2, but localities ranged from 0.5 and 11.5 g/m^2 in nine localities.

Coelenterata (figs. 11 and 12) were distributed broadly throughout the region. They were particularly widespread on the Continental Shelf and Slope. Densities over most of their range were low, less than 25/m^2. Moderate densities (25/m^2 to 999/m^2) were found in only a few small areas, and high densities (greater than 1,000/m^2) were rare. Biomasses of coelenterates revealed a distribution pattern similar to that of density (except for the moderate quantities (5 to 99 g/m^2) in rather extensive areas off southern New England), and throughout most of their range were less than 5 g/m^2.

Hydrozoa (figs. 13 and 14) have a rather wide distribution in the Middle Atlantic Bight region. Except for part of southern New England, they were present in a broad band on the Continental Shelf extending from Cape Cod to Cape Hatteras. They were present in some of the northern bays, but were not found in central or southern bays. They were found in a few places on the Continental Slope. Densities over most of their range averaged between 1/m^2 and 49/m^2. They were present in moderate to high densities (50/m^2 to 1,071/m^2) in a few relatively small areas. Biomass was small (less than 0.5 g/m^2) over most of their range, but moderate to large quantities (0.5 to 47 g/m^2) were present in in small areas, especially inshore and in the Cape Cod region and Chesapeake Bight.

Alcyonaria [Alcyonacea] (figs. 15 and 16) were distributed in a narrow band in offshore waters along the Outer Continental Shelf, Slope, and part of the Continental Rise. The band extended from the Cape Cod region southward to within 100 km of Cape Hatteras. Densities at all localities were low (less than 26/m^2) and were very low (less than 9/m^2) over much of their range. Biomass was small to moderate (0.01 to 5 g/m^2) over most of their range, but in two small areas south of Cape Cod, it was between 5 and 9 g/m^2.

Zoantharia (figs. 17 and 18) were widely distributed in a somewhat scattered pattern throughout the region. Their largest area of occurrence was in offshore Southern New England. Although they were taken in the bays, on the Continental Shelf, Slope, and Rise, they were most common on the Outer Continental Shelf. Throughout most of their range their densities were less than 25/m^2. For a rather large area on the outer shelf of Southern

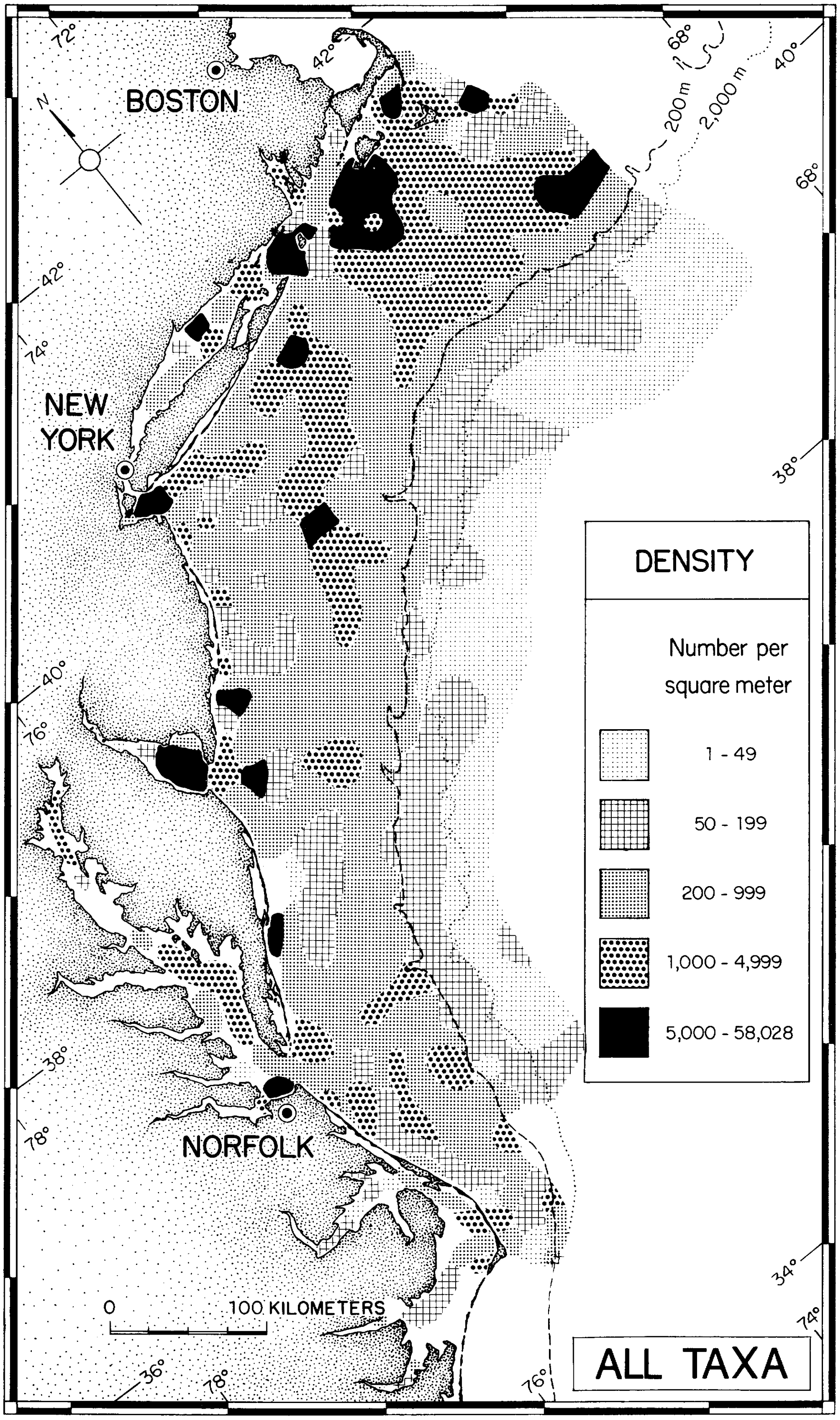

FIGURE 7.—Geographic distribution of the density of all taxonomic groups combined for the Middle Atlantic Bight region. Density is expressed as number of individuals per square meter of bottom area.

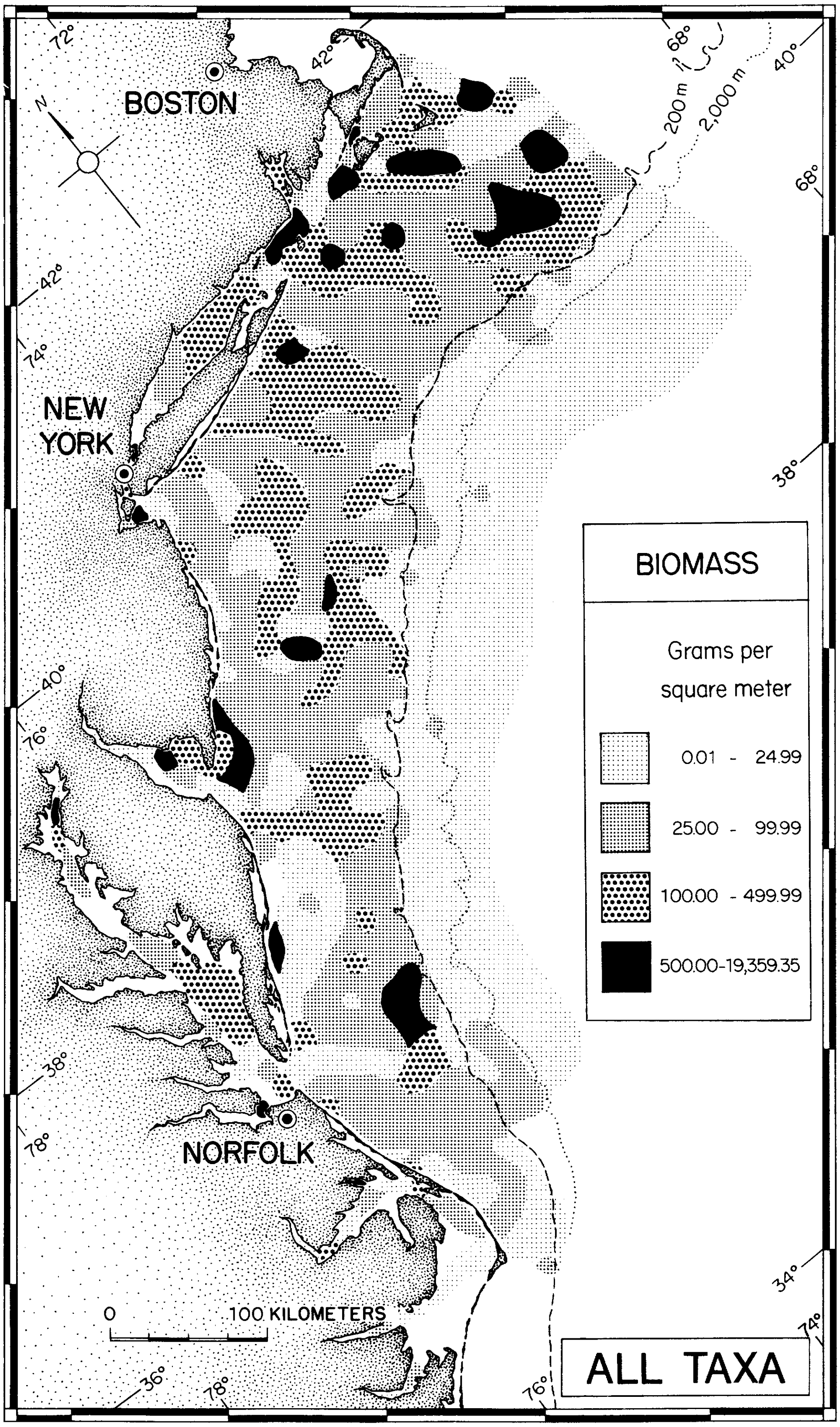

FIGURE 8.—Geographic distribution of the biomass of all taxonomic groups combined and expressed as damp weight per square meter of bottom area.

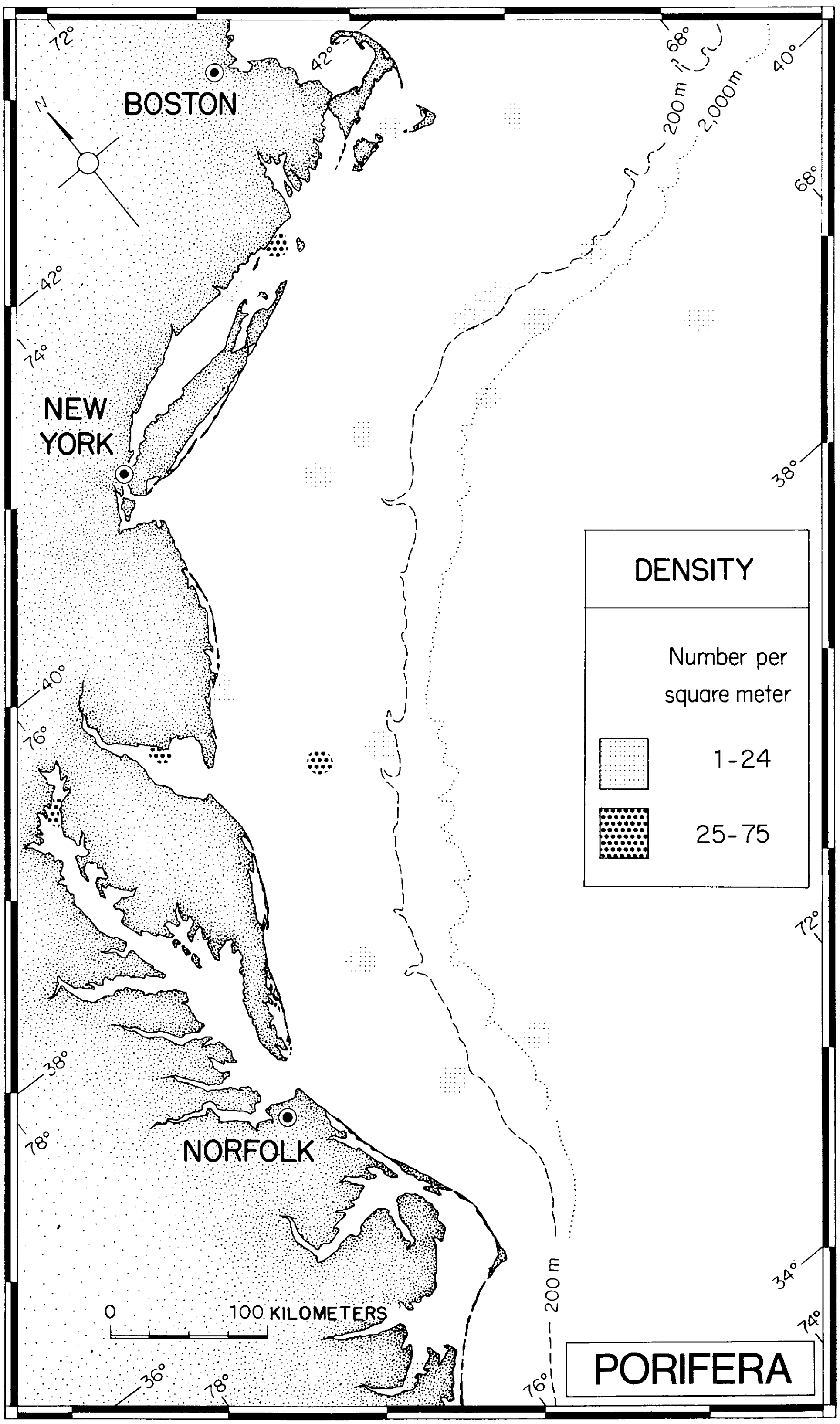

FIGURE 9.—Geographic distribution of the density of Porifera, expressed as number of individuals per square meter of bottom area.

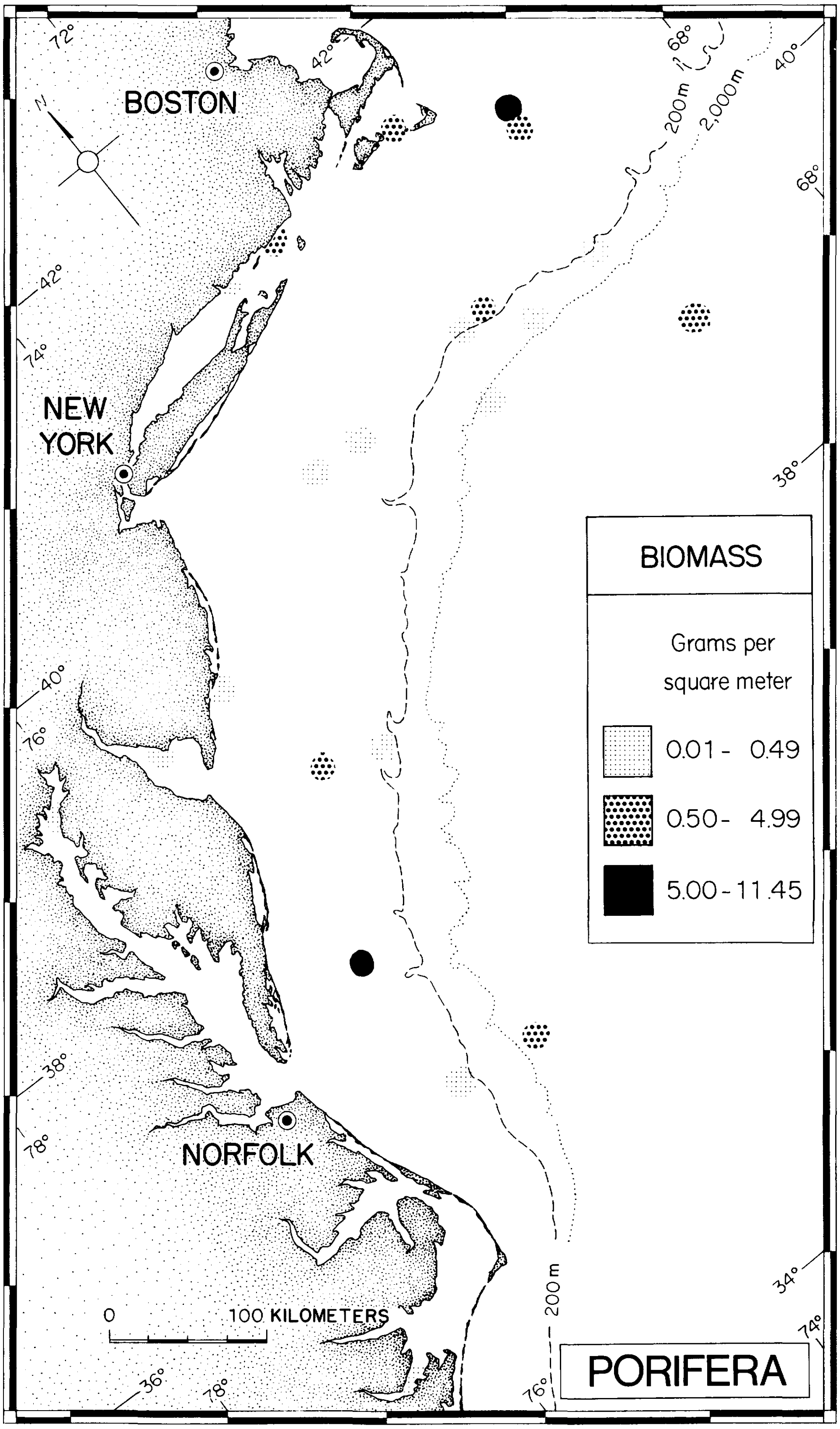

FIGURE 10.—Geographic distribution of the biomass of Porifera, expressed as damp weight per square meter of bottom area.

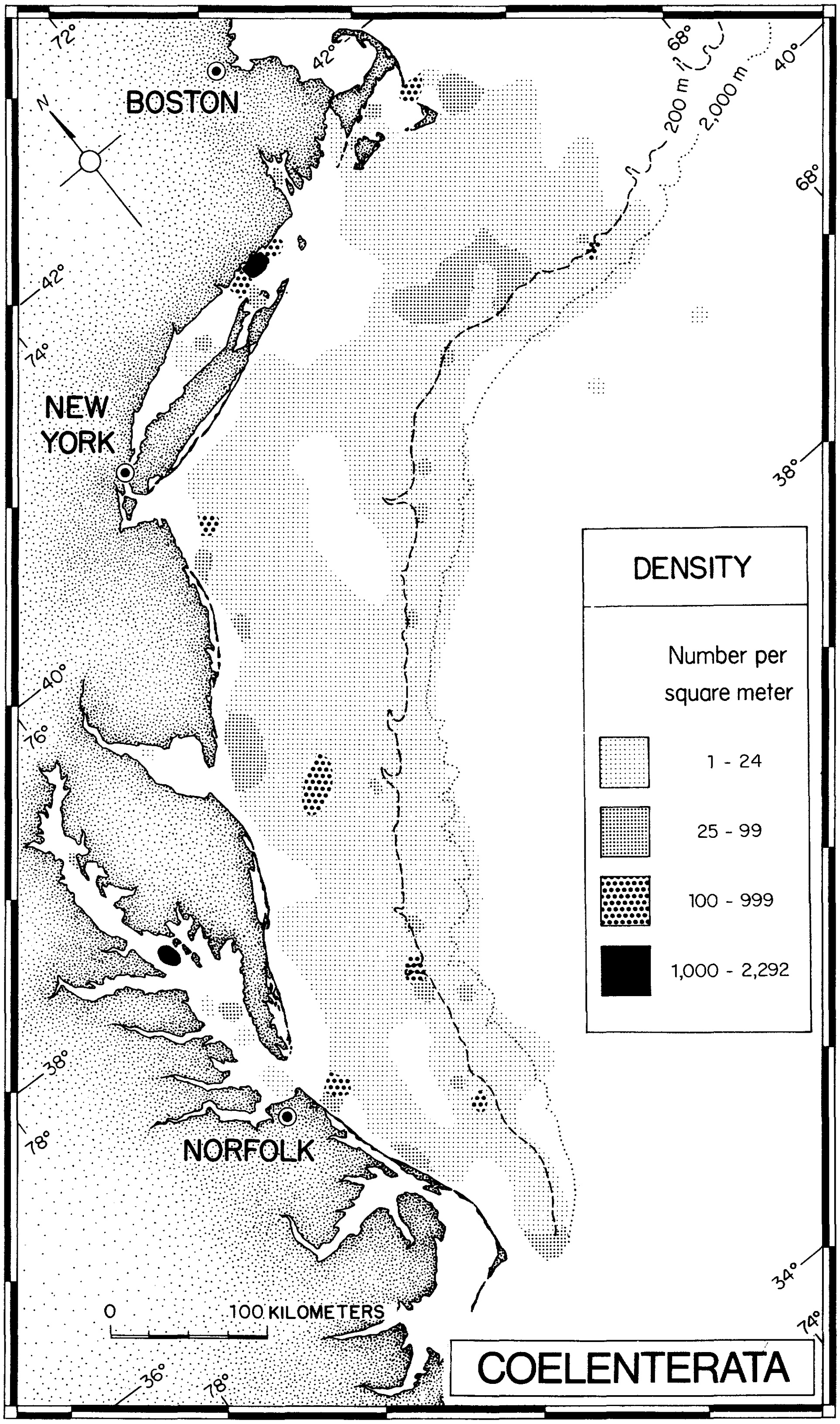

FIGURE 11.—Geographic distribution of the density of Coelenterata, expressed as number of individuals per square meter of bottom area.

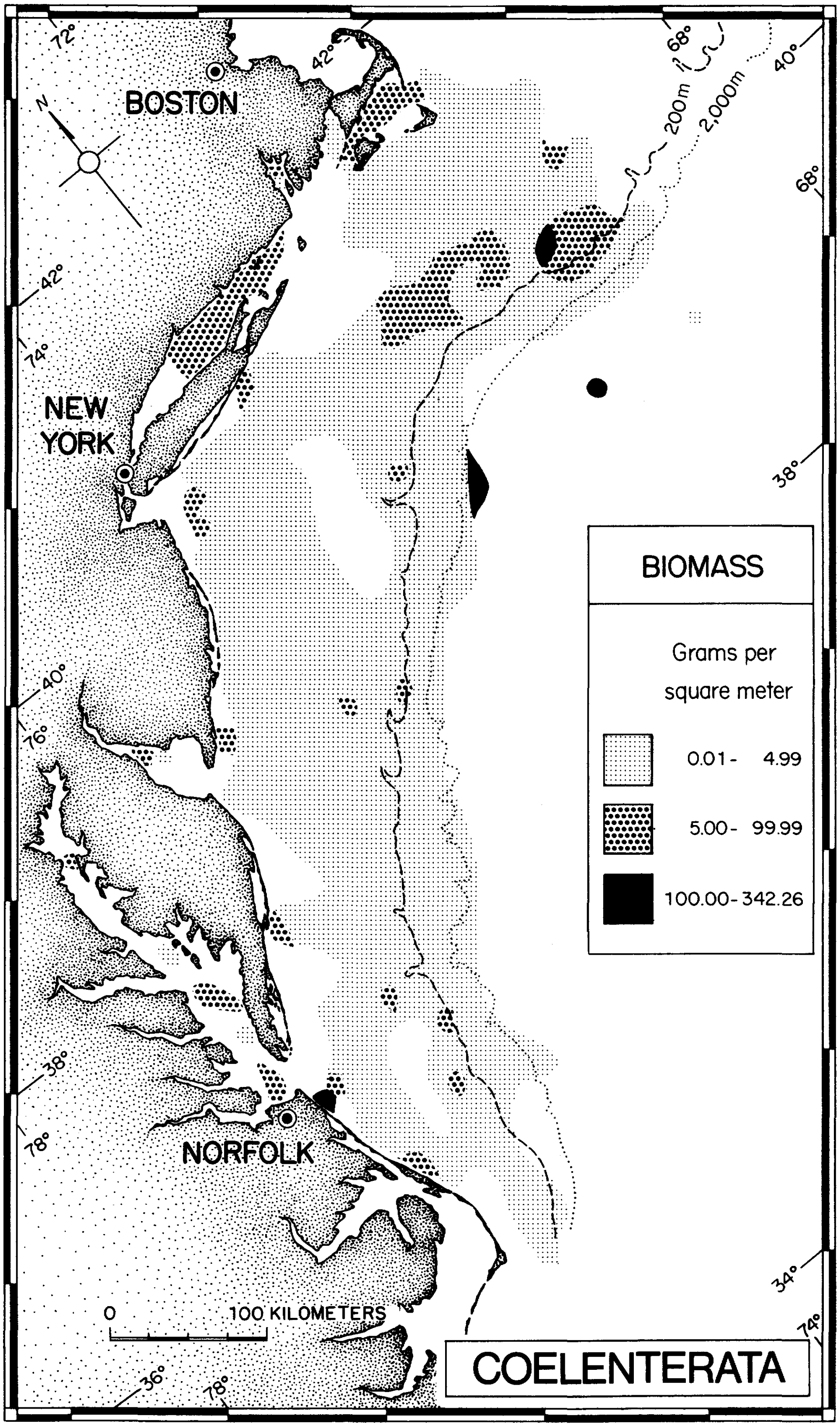

FIGURE 12.—Geographic distribution of the biomass of Coelenterata, expressed as damp weight per square meter of bottom area.

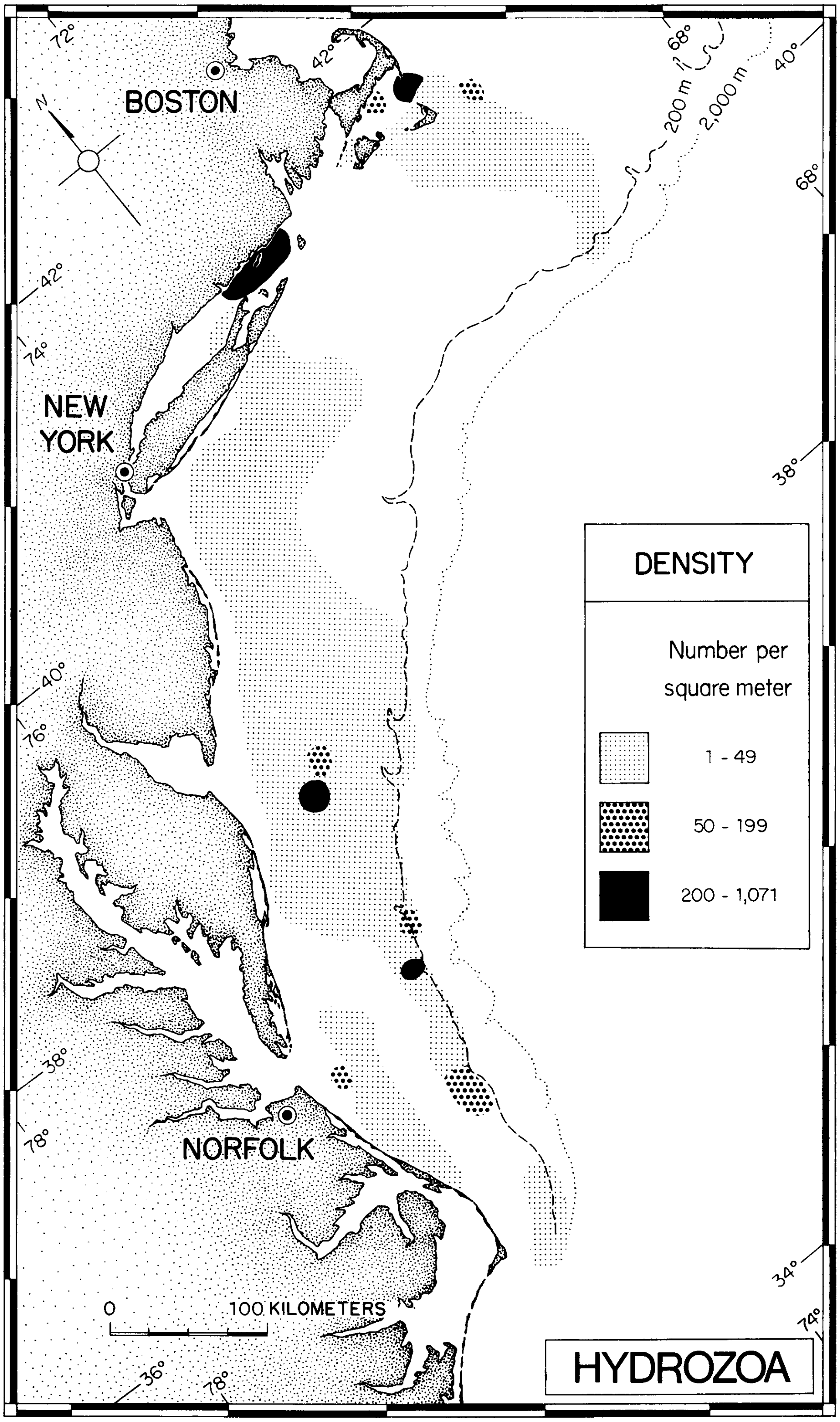

FIGURE 13.—Geographic distribution of the density of Hydrozoa, expressed as number of individuals per square meter of bottom area.

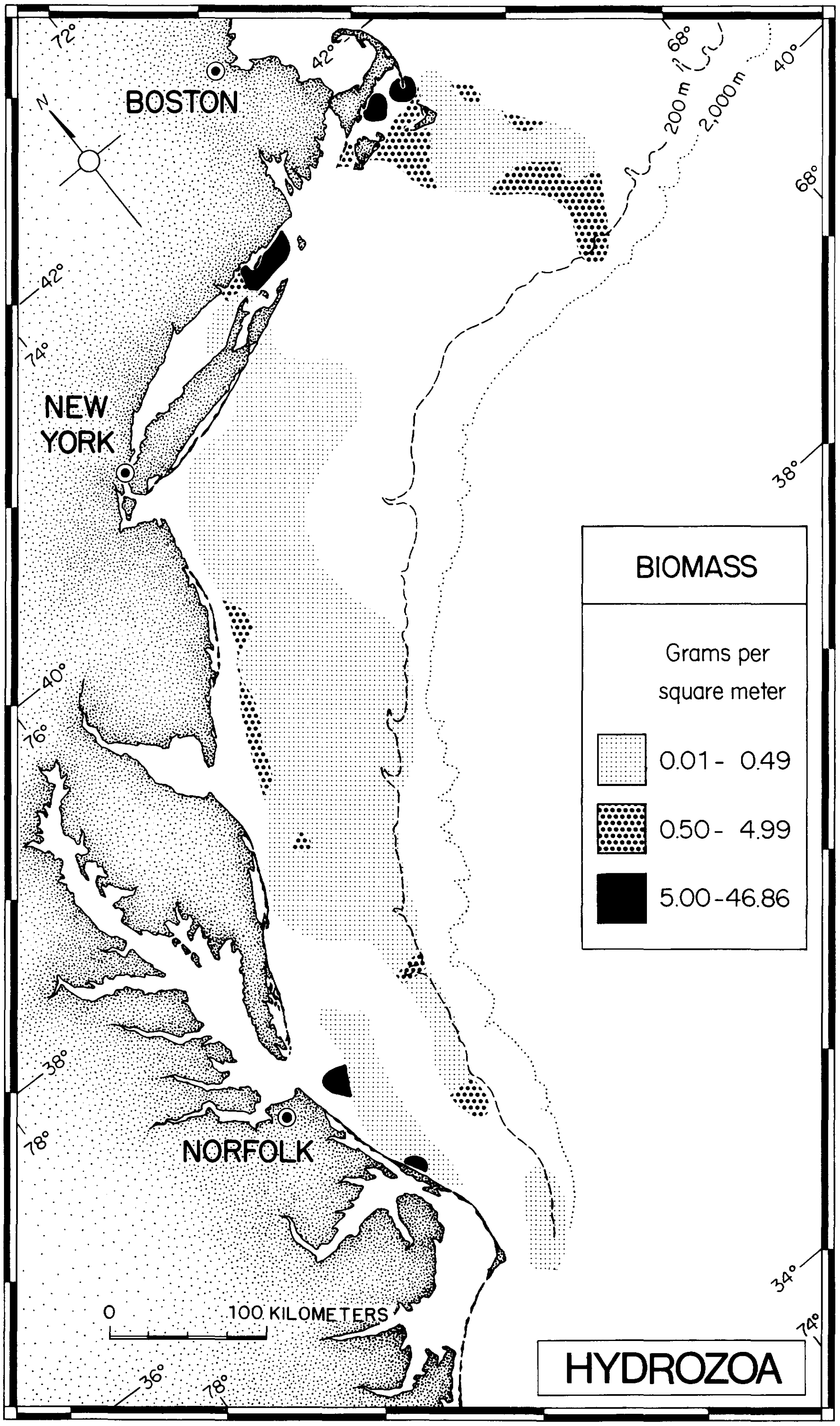

FIGURE 14.—Geographic distribution of the biomass of Hydrozoa, expressed as damp weight per square meter of bottom area.

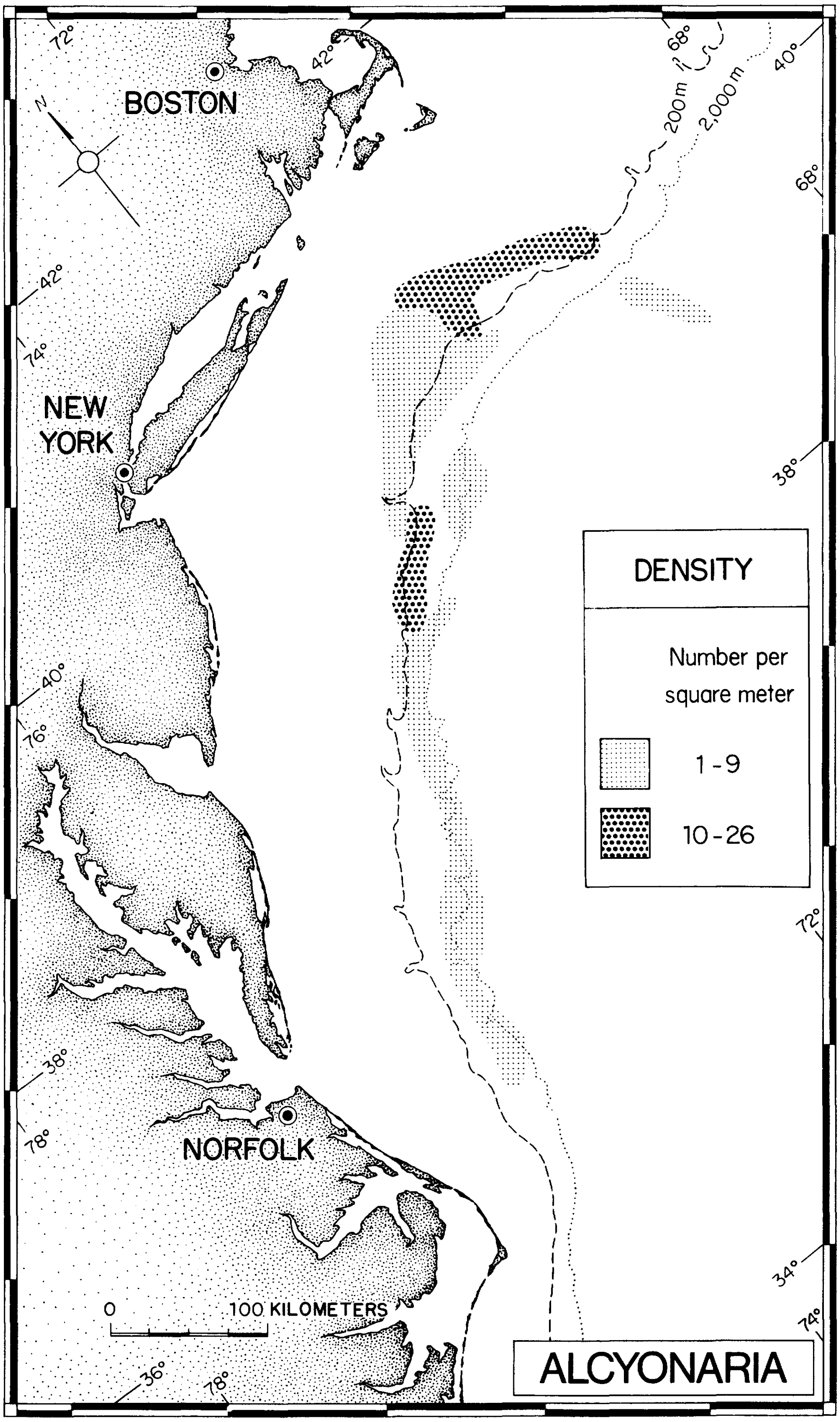

FIGURE 15.—Geographic distribution of the density of Alcyonaria, expressed as number of individuals per square meter of bottom area.

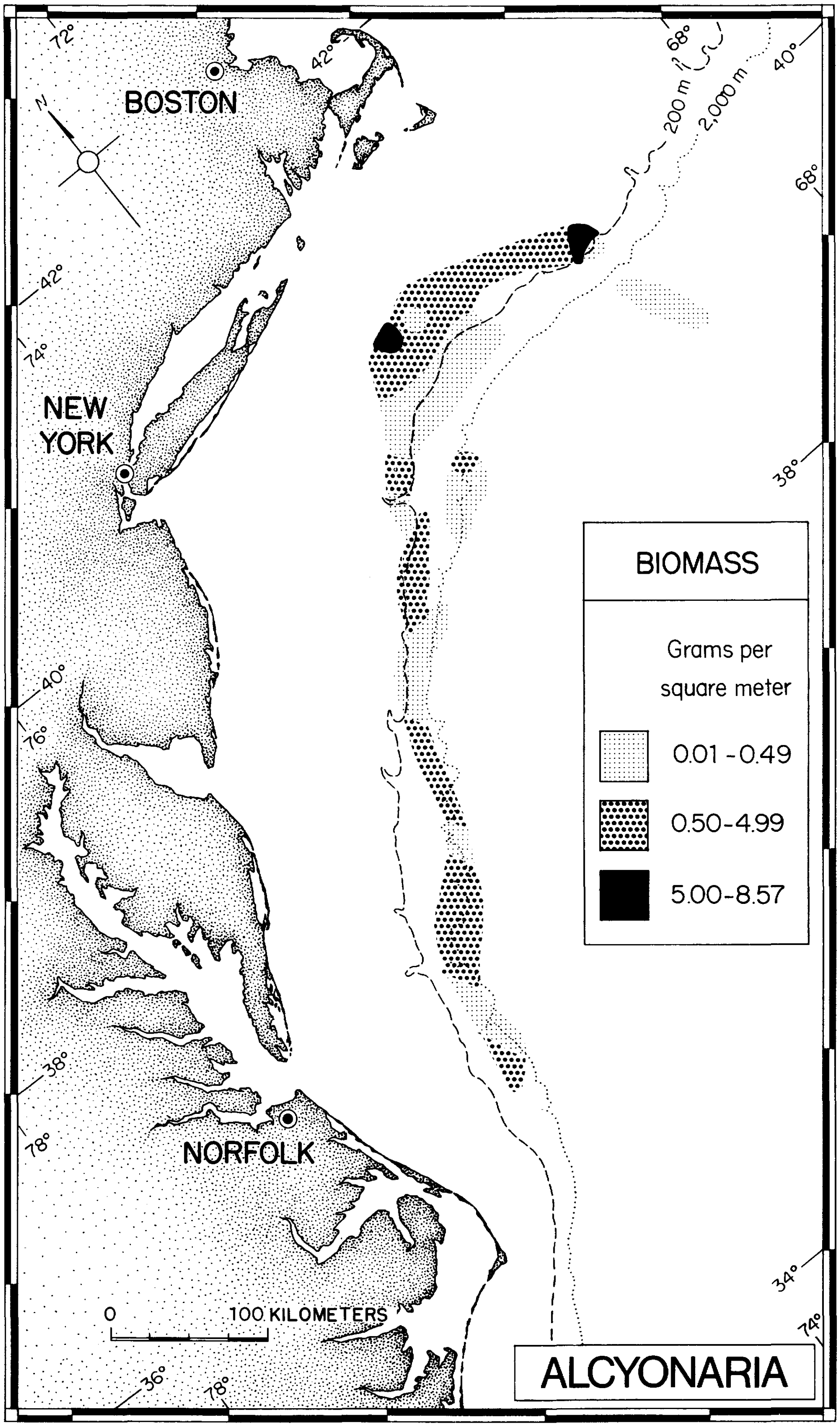

FIGURE 16.—Geographic distribution of the biomass of Alcyonaria, expressed as damp weight per square meter of bottom area.

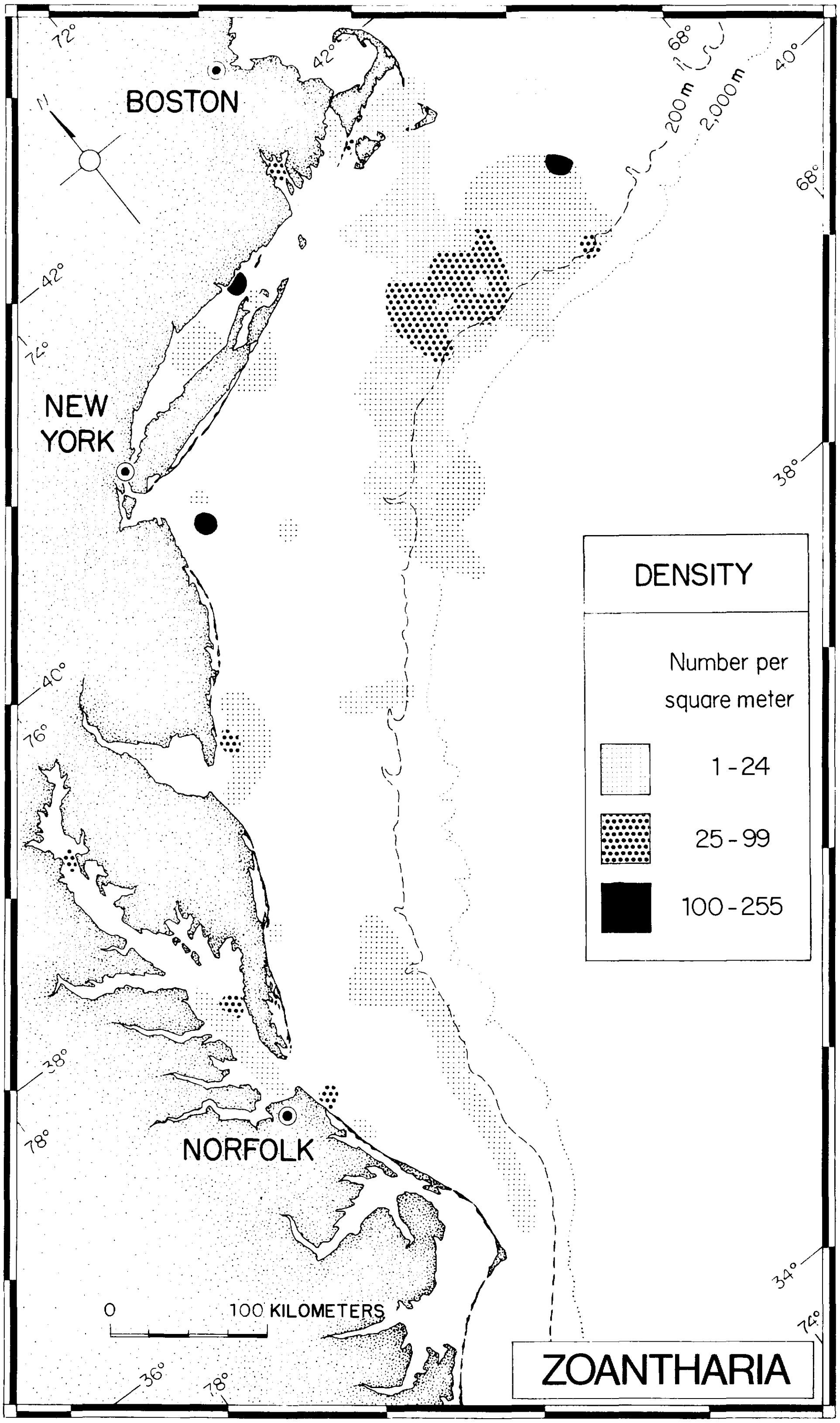

FIGURE 17.—Geographic distribution of the density of Zoantharia, expressed as number of individuals per square meter of bottom area.

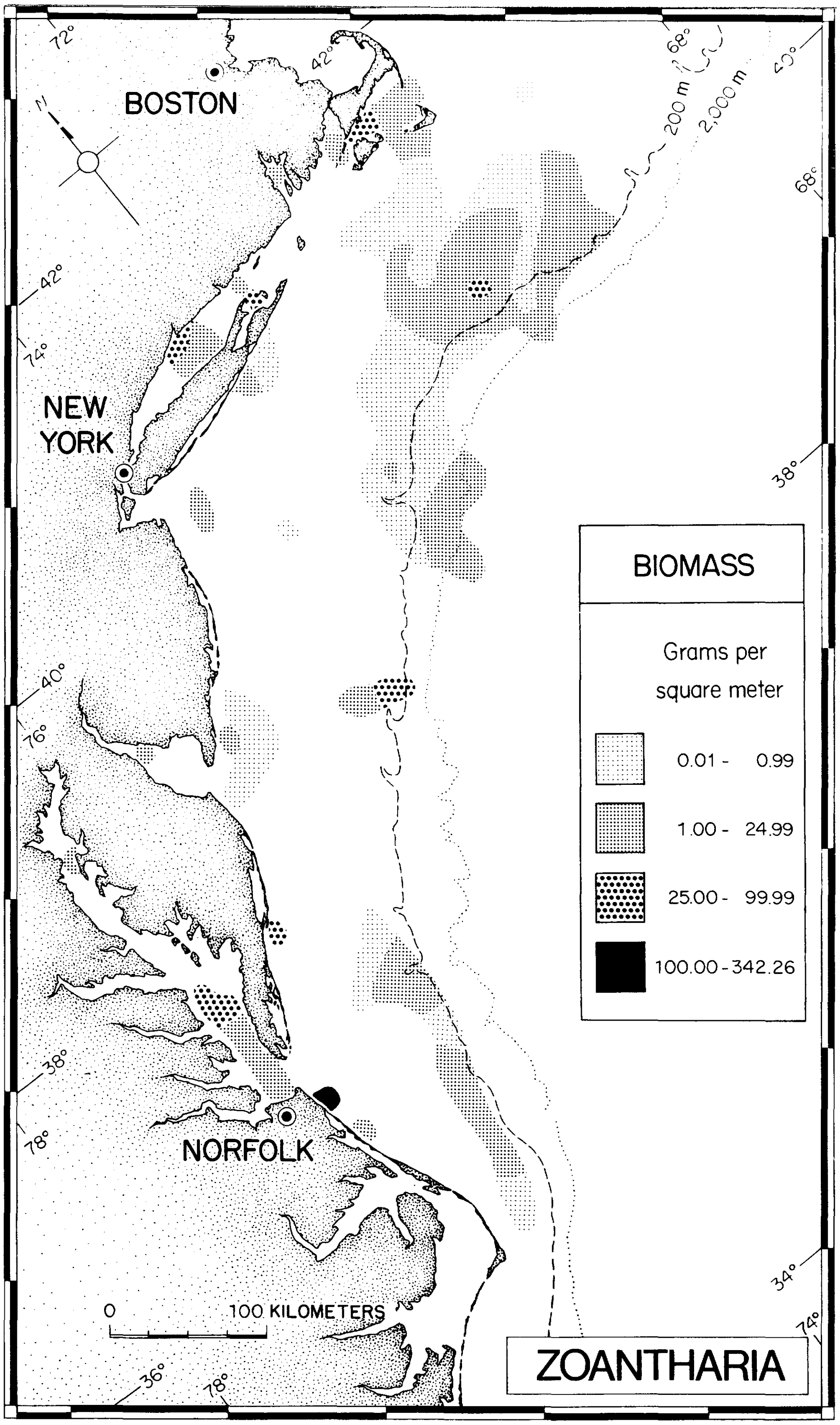

FIGURE 18.—Geographic distribution of the biomass of Zoantharia, expressed as damp weight per square meter of bottom area.

New England, their density was between 25/m² and 99/m². They were present in only three small areas at densities greater than 100/m². Biomass in about half their area of occurrence was less than 1 g/m², and between 1 and 25 g/m² in the other half. A few relatively small areas, most of which were in coastal or inshore locations, had biomasses ranging from 25 to 342 g/m².

Platyhelminthes (figs. 19 and 20) were distributed rather widely on the Continental Shelf throughout the region. For the most part they occurred in rather small patches. Densities were low (less than 25/m²) at all locations except one. Biomass was small (less than 0.5 g/m²) throughout their range, except at two localities.

Nemertea (figs. 21 and 22) were very common and were distributed over a large part of the Middle Atlantic Bight region. Their density, however, was generally low, between 1/m² and 24/m². At only a few places in the bays and on the Continental Shelf south of Cape Cod did their density average between 25/m² and 235/m². Nemertea were absent from most sampling stations in the bays and on the Continental Rise. Nemerteans accounted for a small proportion of the region's biomass. At most localities where they were found, their biomass was less than 1 g/m². Over an estimated 10 percent of their range, their biomass was between 1 to 25 g/m². At only two localities was their biomass greater than 25 g/m².

Nematoda (figs. 23 and 24) were found in a moderate-sized area of the region, somewhat scattered, but most common along the Outer Continental Shelf, Slope, and Continental Rise. Densities were generally low, ranging from 1/m² to 24/m². Moderate densities (25/m² to 627/m²) were found in a few localities, mainly on the Continental Shelf south of Cape Cod. Biomass was very small, less than 0.2 g/m² in most localities, and between 0.2 and 0.4 g/m² in one area in the Chesapeake Bight subarea. A very large number of small nematodes, particularly the larval stages, are believed to have passed through the sieving screen during sample processing. What proportion of the nematode biomass that is represented by the large specimens retained on the screen, reported here, is unknown.

Annelida (figs. 25 and 26) were ubiquitous throughout the entire Middle Atlantic Bight region. Densities were highest on the Continental Shelf. A particularly large area of moderately high density (500/m² to 1,999/m²) was found on the shelf south of Massachusetts. Moderate densities prevailed in the New York Bight subarea, and low densities (less than 25/m²) in extensive areas in Chesapeake Bight. Low densities, also, were characteristic of the Continental Rise. Biomass reflected the same pattern as density. Over a very large part of the Continental Shelf, extending from Long Island, N.Y., southward to Cape Hatteras, the biomass of Annelida was between 1 to 25 g/m². Off southern Massachusetts, a large expanse contained between 25 and 200 g/m². Low biomasses (less than 1 g/m²) were characteristic of the Continental Rise.

Pogonophora (figs. 27 and 28) were present throughout the entire deepwater area between Cape Cod and Cape Hatteras, primarily, on the Continental Slope and Rise, plus several localities on the Outer Continental Shelf. They were present in rather low densities (to 24/m²) throughout most of their area of occurrence. Moderate densities (25/m² to 99/m²) were found in several areas along the Continental Slope. In only one locality, densities were high (100/m² to 335/m²). Biomass was small, less than 0.5 g/m², in all localities except two, where it ranged from 0.5 to 2.9 g/m².

Sipuncula [=Sipunculida] (figs. 29 and 30) were found over a wide geographic area, extending from the Cape Cod region southward to Cape Hatteras and were centered primarily on the Continental Shelf and Slope. Moderate numbers were found on the Continental Rise, but only limited numbers in the bays and sounds. In the northern part, they were found in shallow waters, whereas in the middle and southern sectors they were absent from the inner and middle shelf regions. Their density was less than 24/m² throughout most of their range, but in several localities in the northern shelf area it ranged from 25/m² to 99/m². At only one location, a northern inshore area off Rhode Island, were they found in high density (100 and 311/m²). In roughly half their area of occurrence, biomass was less than 1 g/m²; in somewhat less than half their area of occurrence, biomass ranged from 1 to 25 g/m²; in only two areas, the Continental Slope and Rise biomass was large (25 to 85 g/m²).

Echiura (figs. 31 and 32) were sparsely distributed in the region, and most were found on the Continental Rise. One small patch was found on the mid-Continental Shelf off Virginia and two small patches were found in inshore waters at the tip of Long Island, N.Y., and in Pamlico Sound, N.C. Density ranged from 1/m² to 21/m² and biomass ranged from 0.01 g/m² to 27 g/m².

Priapulida (figs. 31 and 32) were found in only three places—two on the Continental Slope and one on the Continental Rise. Quantities were very small.

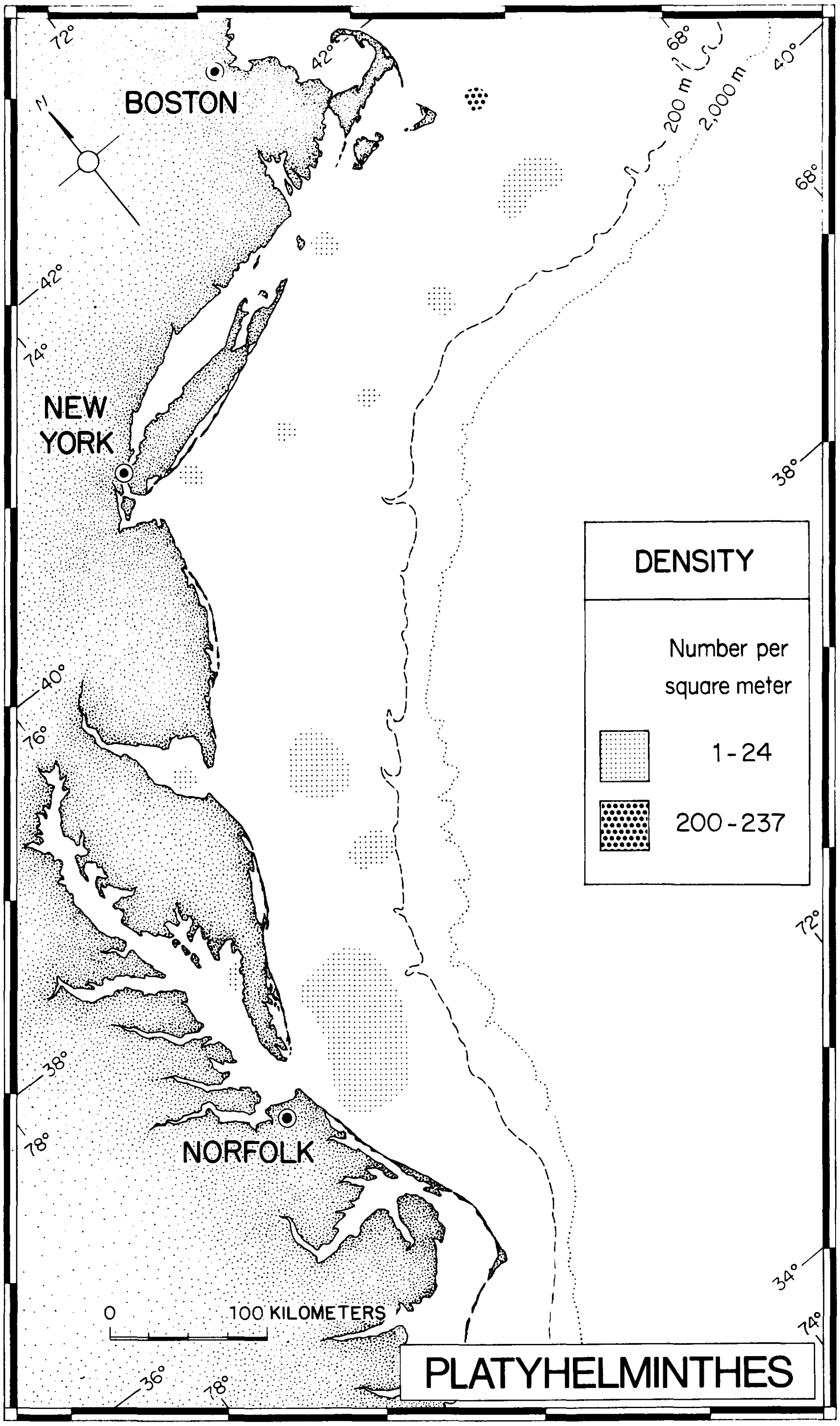

FIGURE 19.—Geographic distribution of the density of Platyhelminthes, expressed as number of individuals per square meter of bottom area.

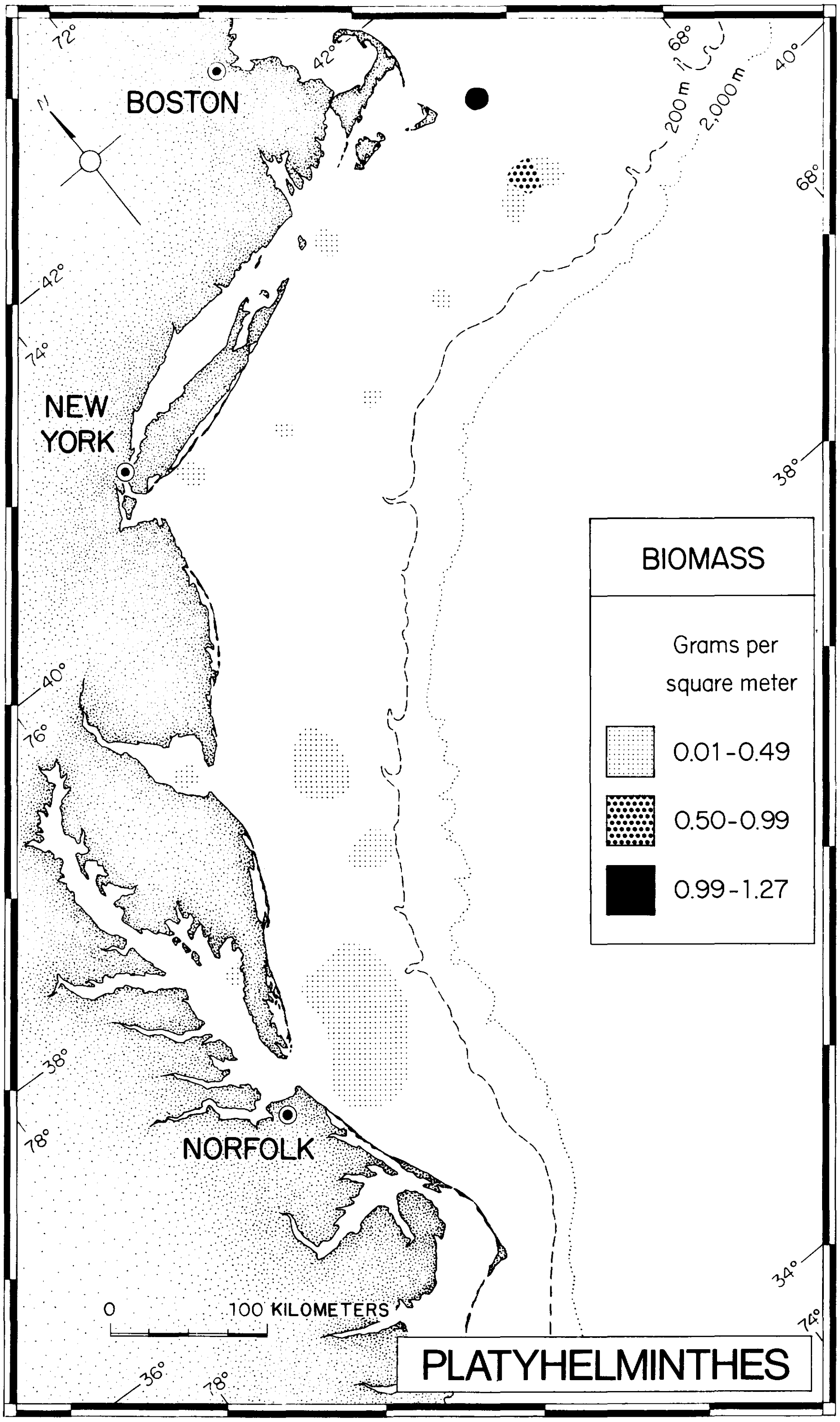

FIGURE 20.—Geographic distribution of the biomass of Plathyhelminthes, expressed as damp weight per square meter of bottom area.

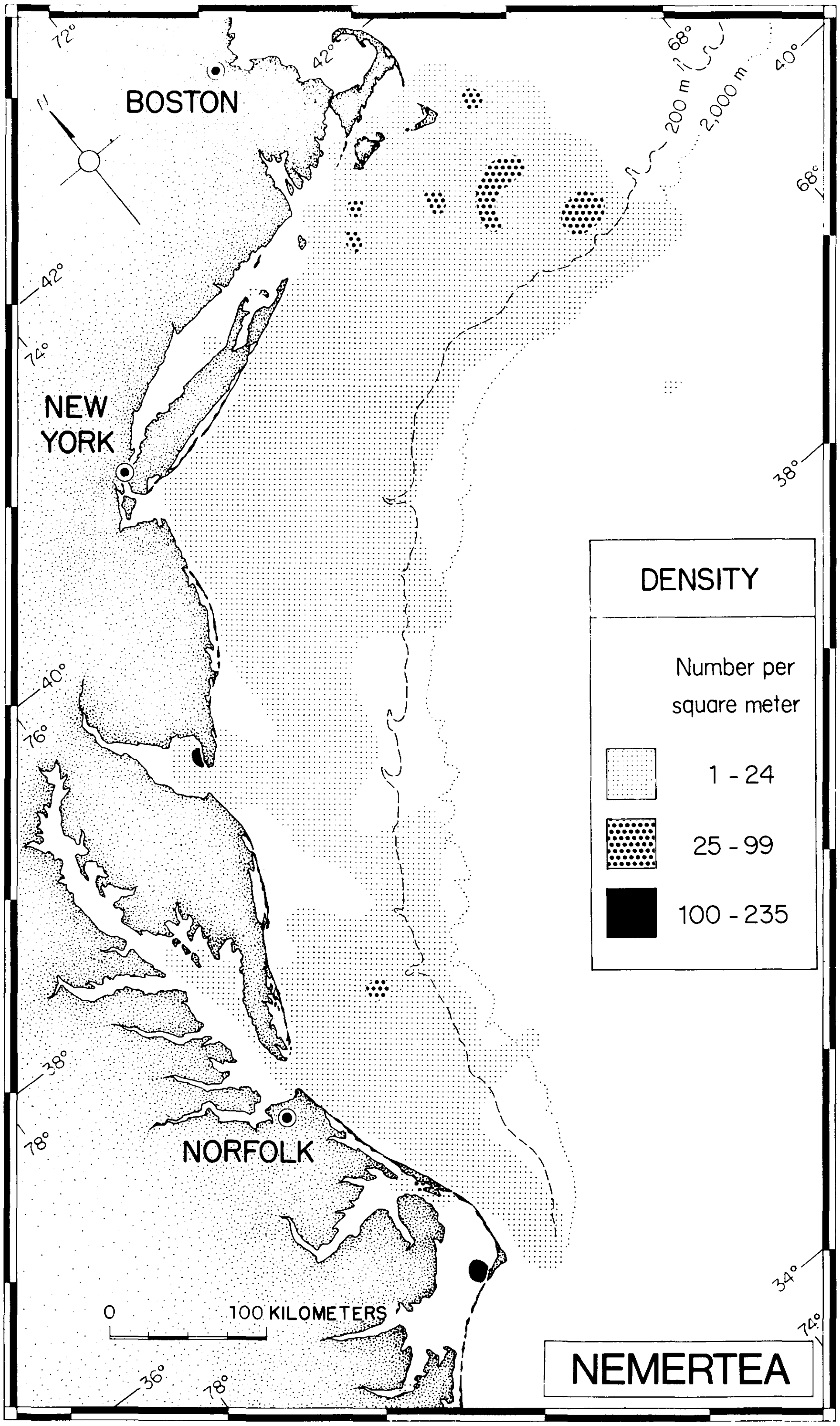

FIGURE 21.—Geographic distribution of the density of Nemertea, expressed as number of individuals per square meter of bottom area.

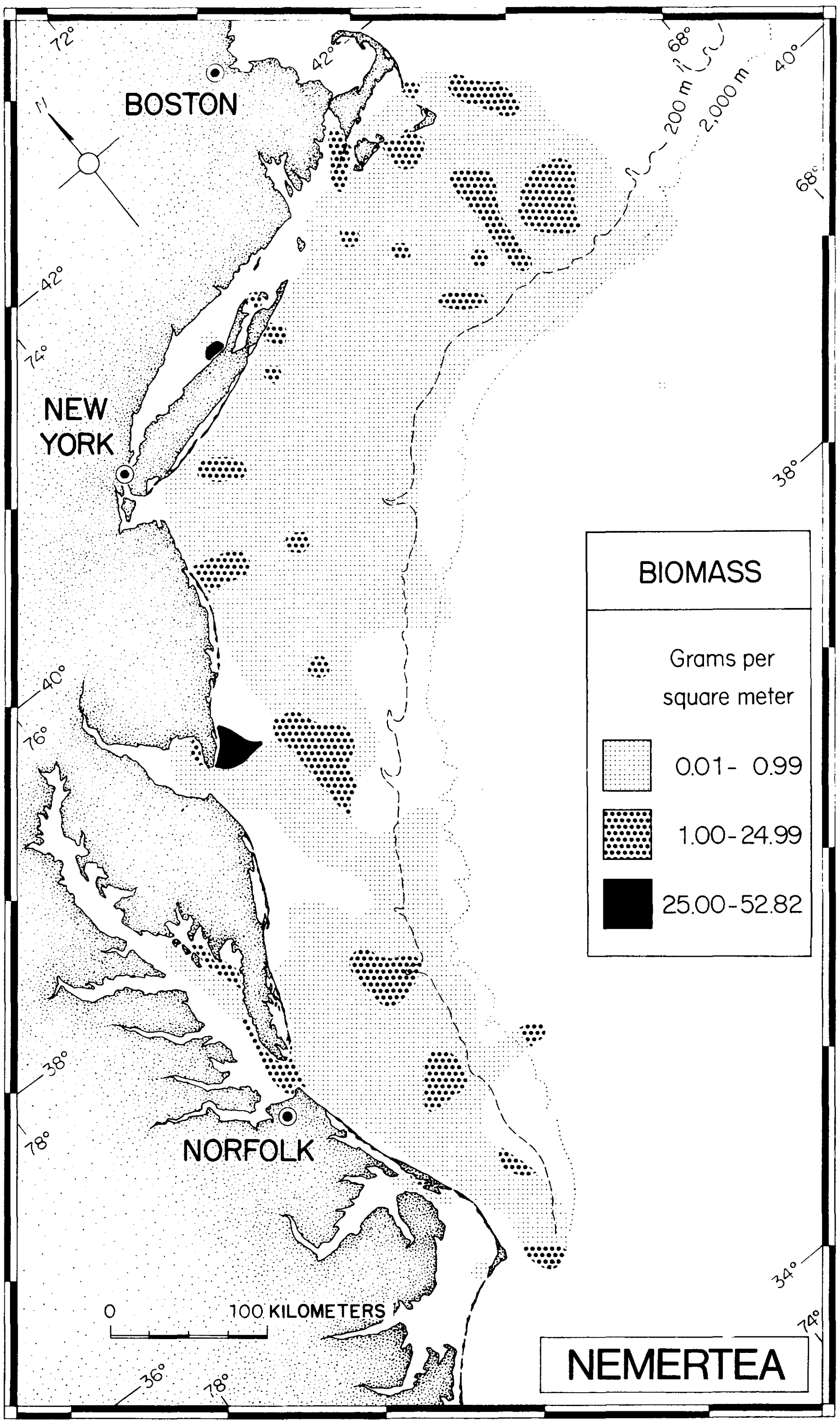

FIGURE 22.—Geographic distribution of the biomass of Nemertea, expressed as damp weight per square meter of bottom area.

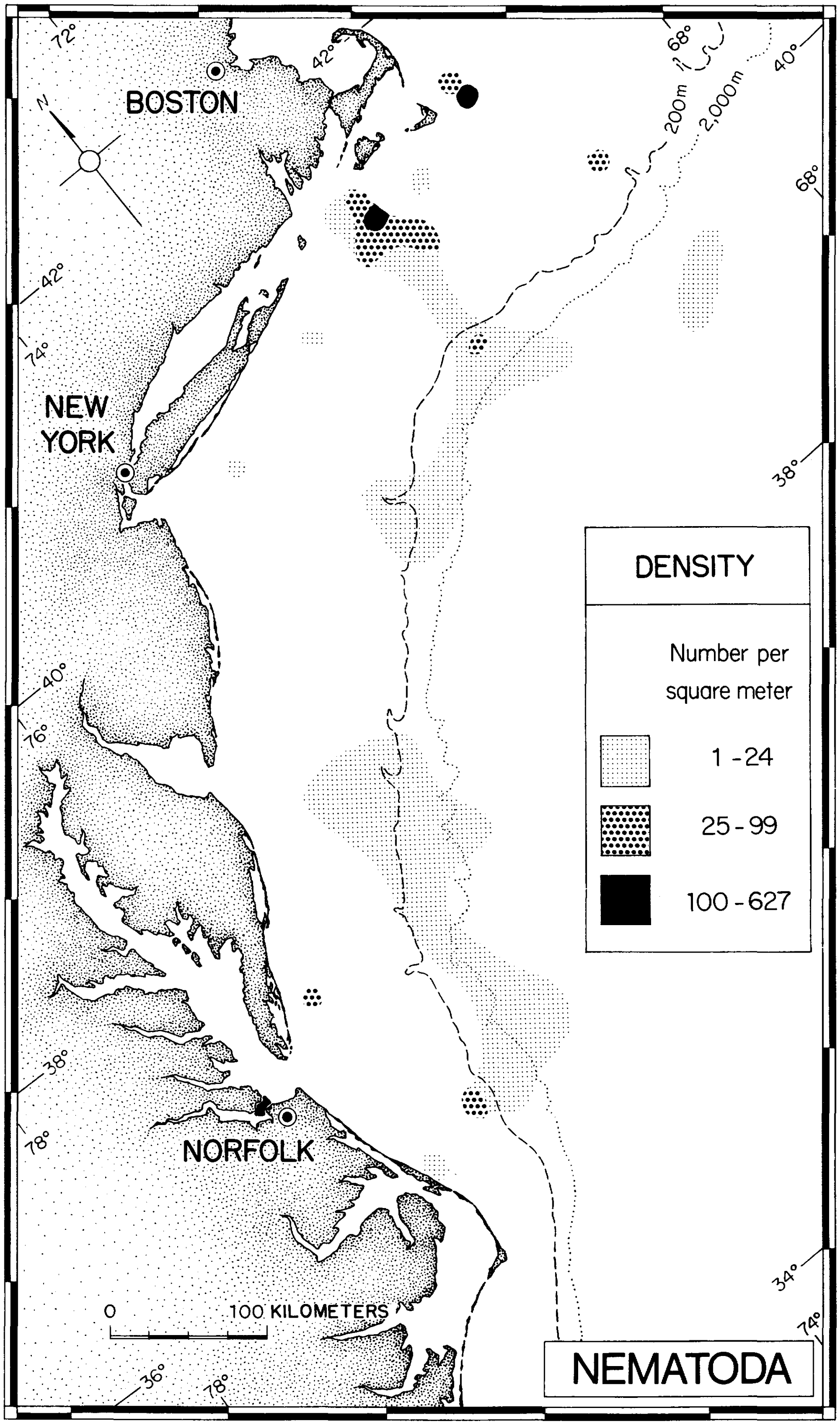

FIGURE 23.—Geographic distribution of the density of Nematoda, expressed as number of individuals per square meter of bottom area.

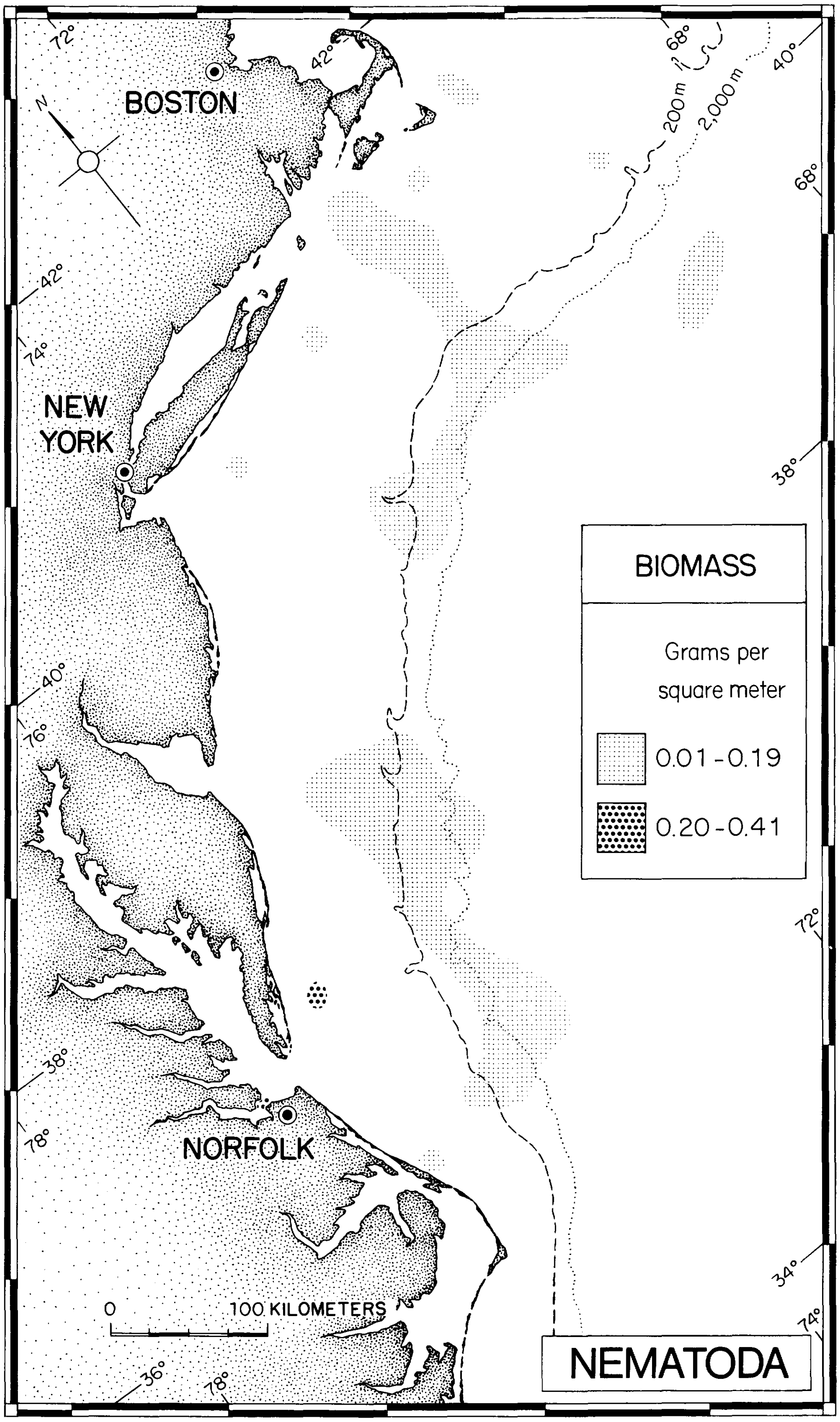

FIGURE 24.—Geographic distribution of the biomass of Nematoda, expressed as damp weight per square meter of bottom area.

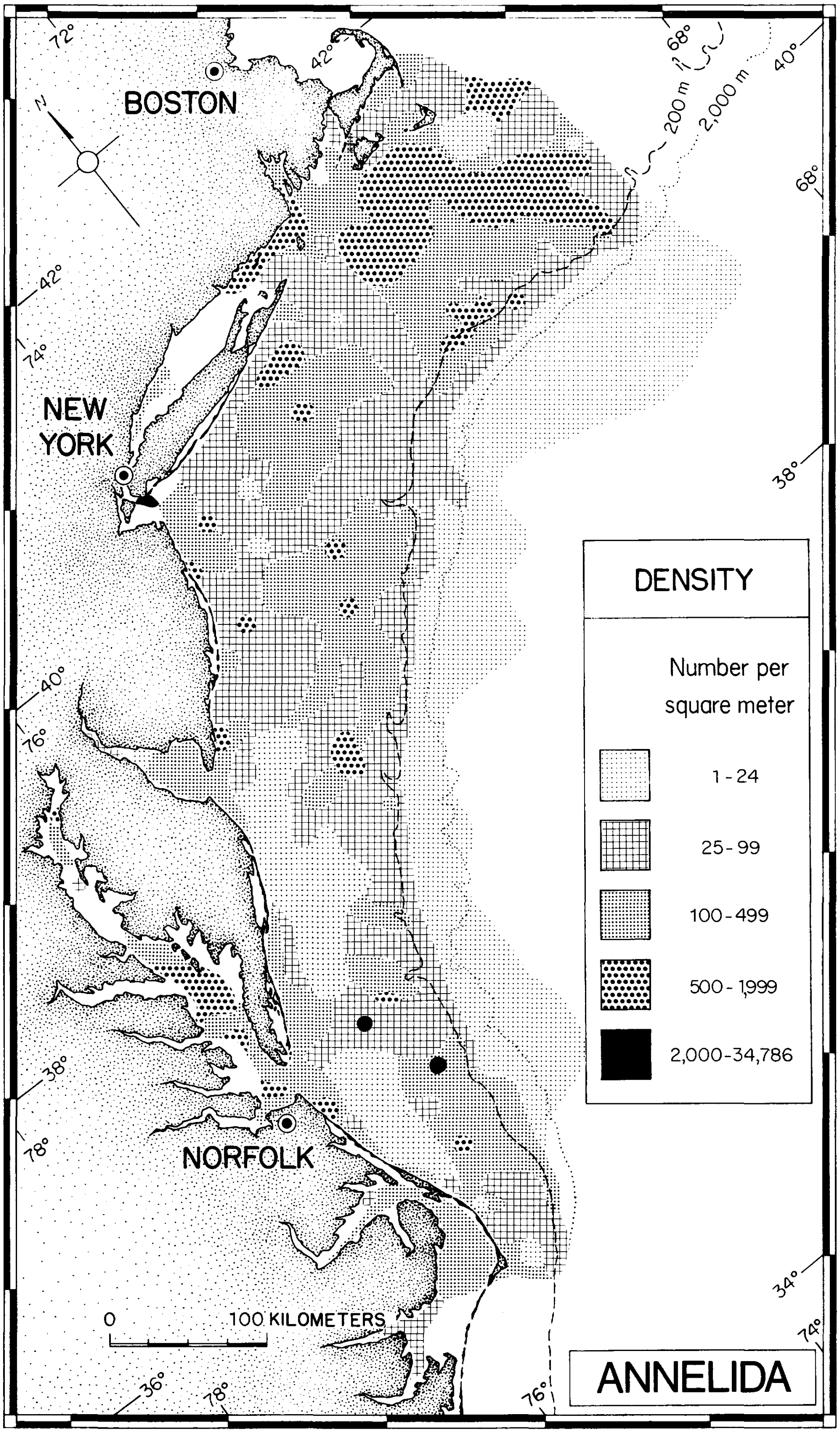

FIGURE 25.—Geographic distribution of the density of Annelida, expressed as number of individuals per square meter of bottom area.

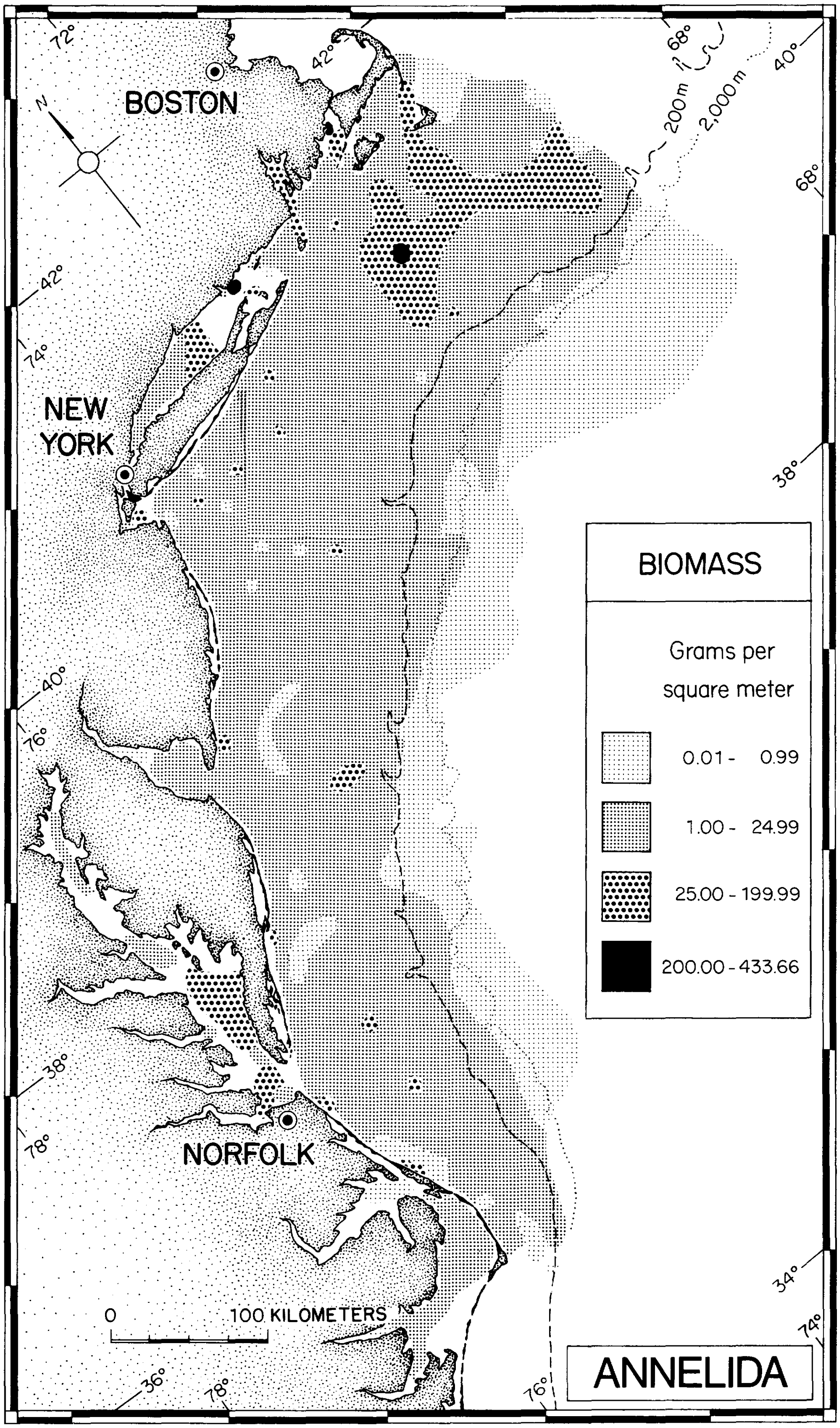

FIGURE 26.—Geographic distribution of the biomass of Annelida, expressed as damp weight per square meter of bottom area.

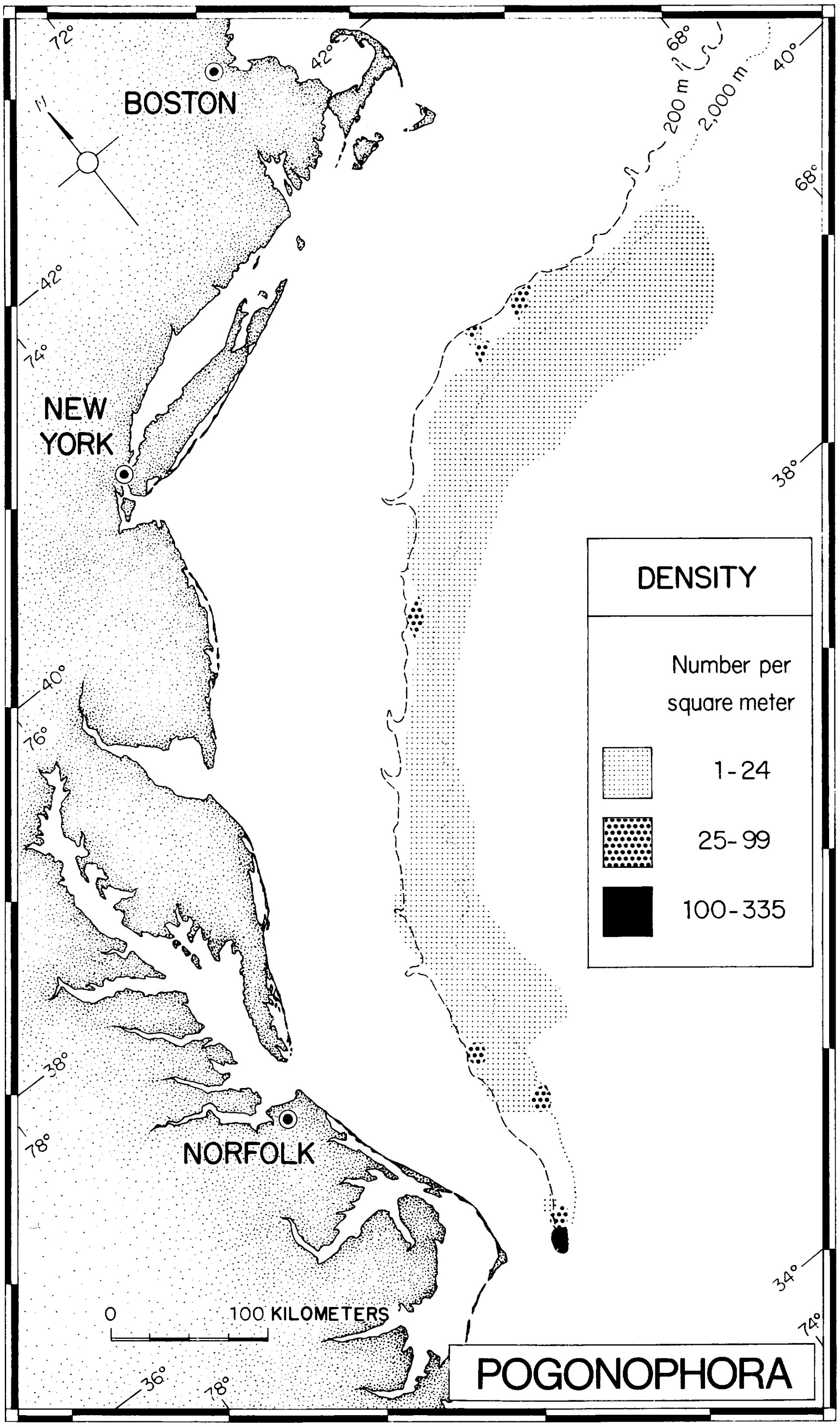

FIGURE 27.—Geographic distribution of the density of Pogonophora, expressed as number of individuals per square meter of bottom area.

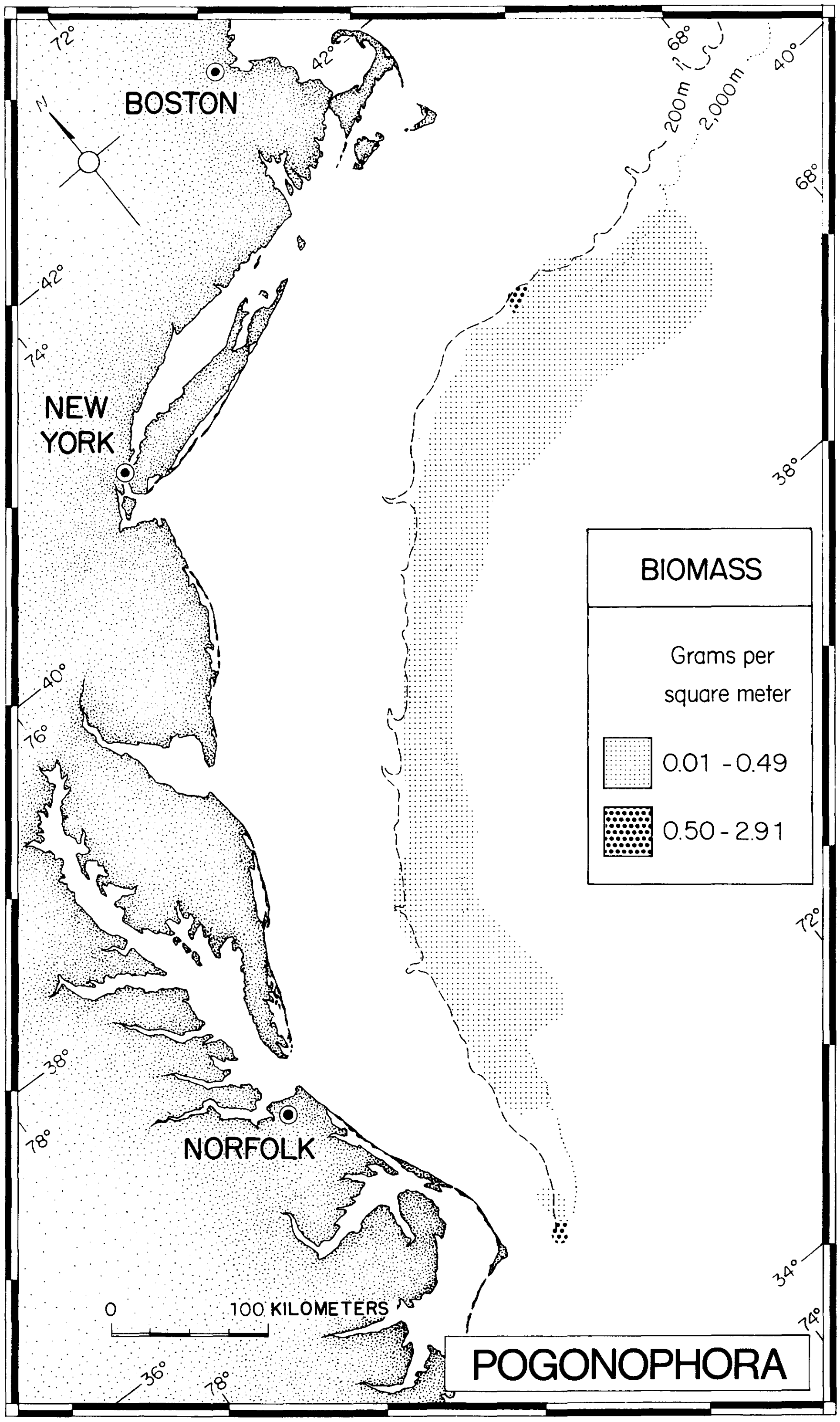

FIGURE 28.—Geographic distribution of the biomass of Pogonophora, expressed as damp weight per square meter of bottom area.

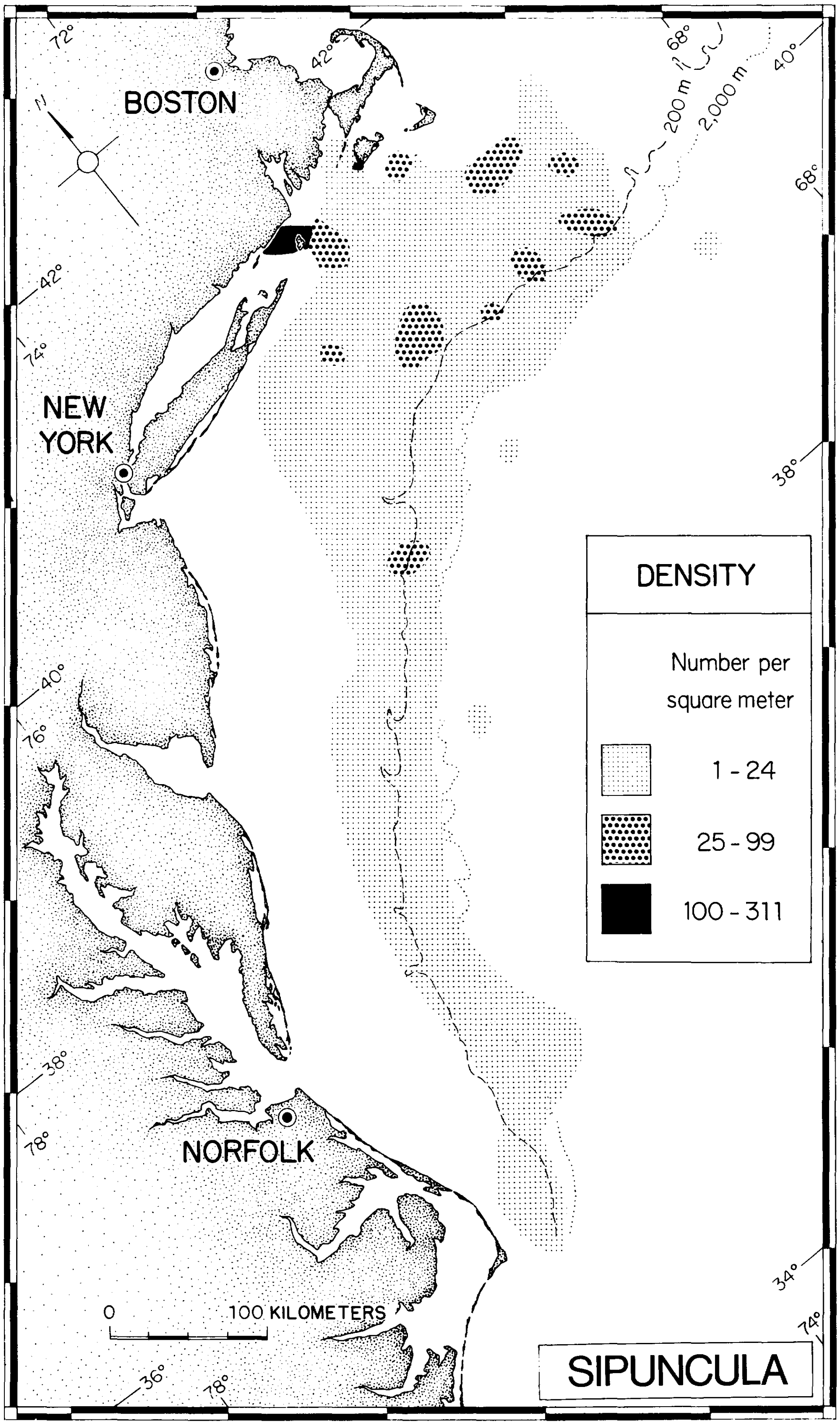

FIGURE 29.—Geographic distribution of the density of Sipuncula, expressed as number of individuals per square meter of bottom area.

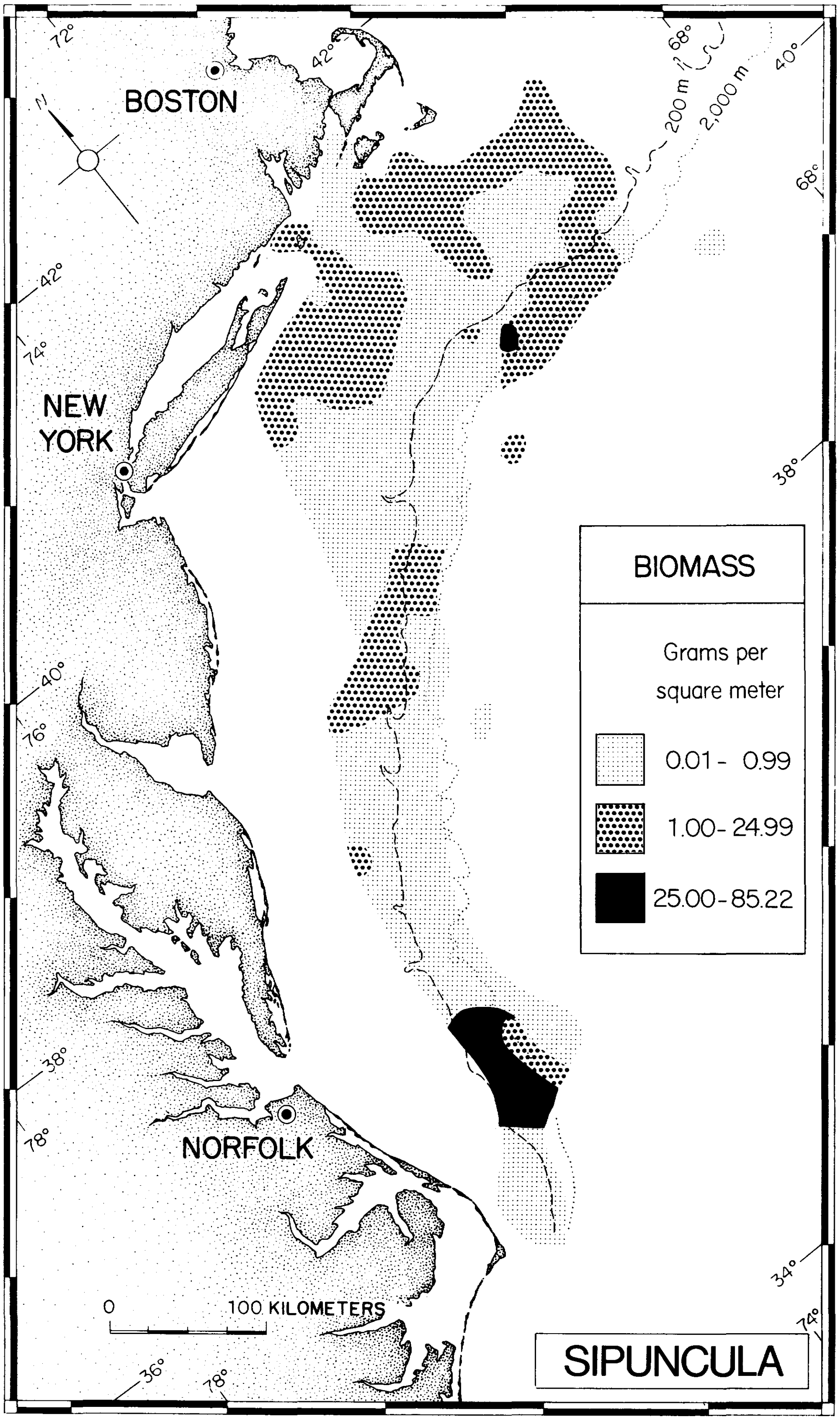

FIGURE 30.—Geographic distribution of the biomass of Sipuncula, expressed as damp weight per square meter of bottom area.

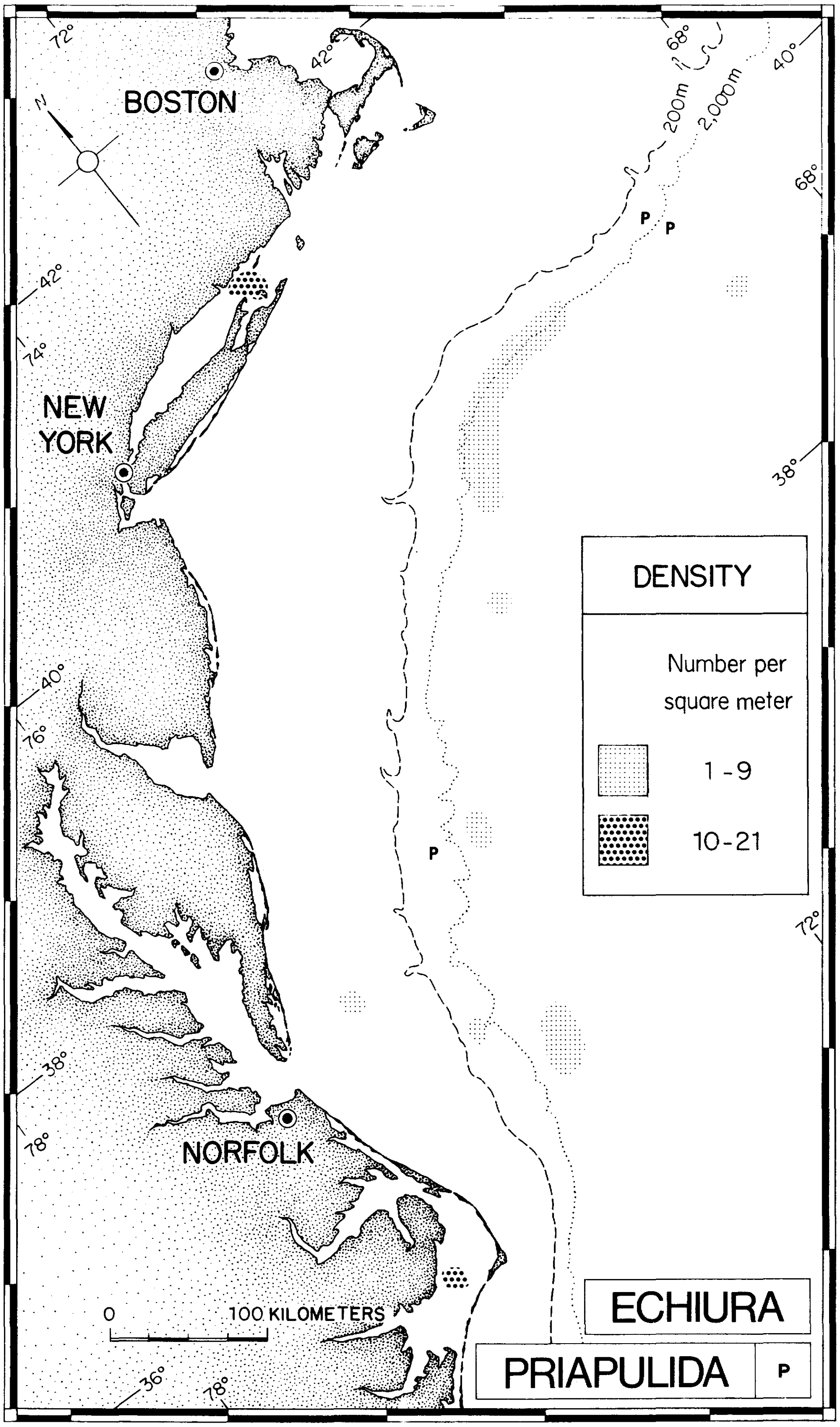

FIGURE 31.—Geographic distribution of the density of Echiura and Priapulida (*P*), expressed as number of individuals per square meter of bottom area.

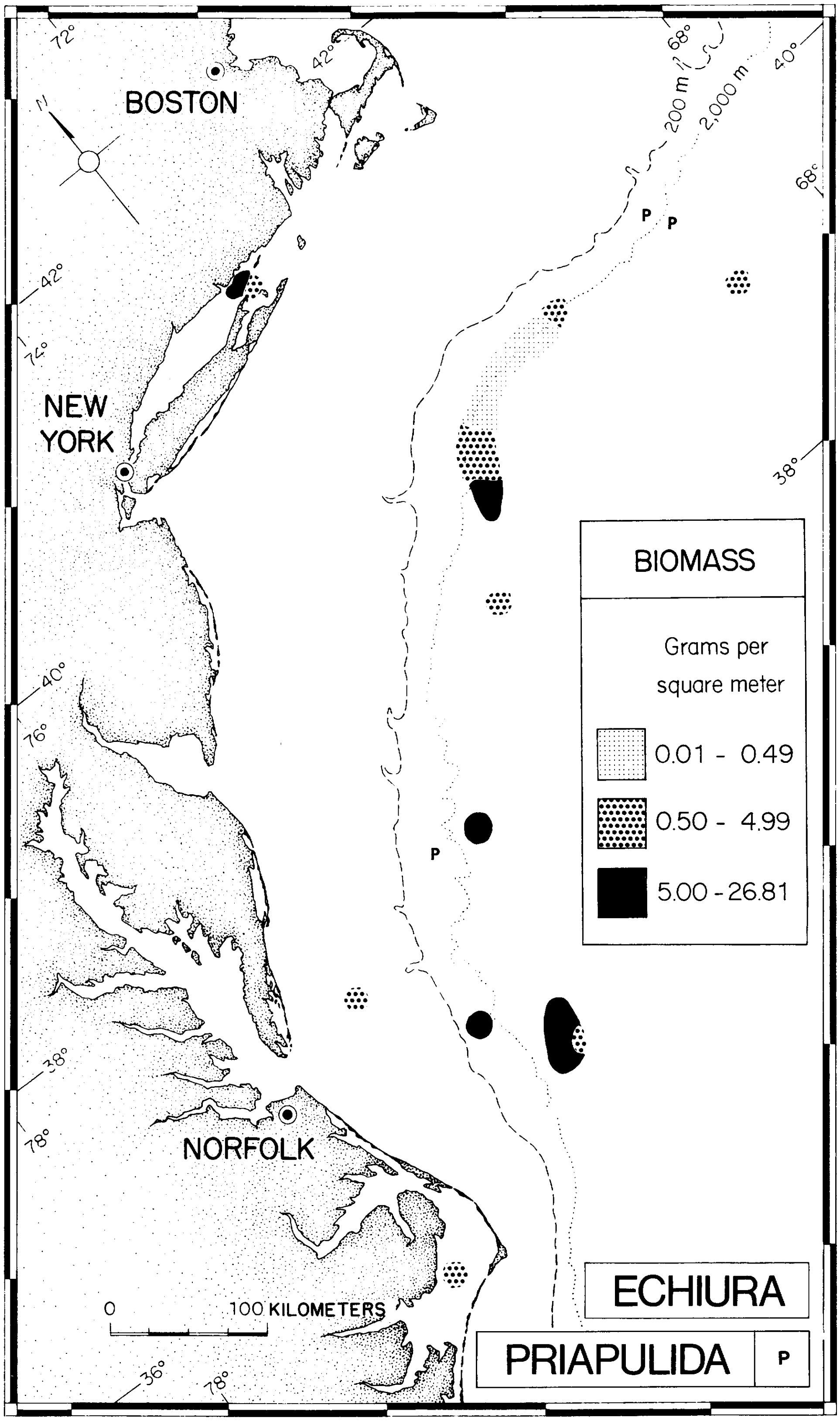

FIGURE 32.—Geographic distribution of the biomass of Echiura and Priapulida (*P*), expressed as damp weight per square meter of bottom area.

Mollusca (figs. 33 and 34) were found at virtually all sampling stations in the Middle Atlantic Bight region; their geographical distribution was exceptionally broad. Density was as high as 58,000/m^2. Four density bands extend north to south, roughly parallel to the coast, throughout most of the region. The first band is in the bays and sounds and includes the inner Continental Shelf. This is a high-density (large areas having densities greater than 50/m^2) band. The second band, parallel to the first, occupies the approximate middle of the Continental Shelf; this is a low-density (mostly less than 50/m^2) band. The third band is along the Outer Continental Shelf and upper slope. This is a high density (mostly greater than 50/m^2) band that broadens at the northern end. The fourth band, along the Lower Continental Slope and Continental Rise, is a low-density (fewer than 50/m^2) band. Biomass of mollusks is as great as 9,555 g/m^2. Exceptionally large areas of large biomass (greater than 100 g/m^2) occurred on the Continental Shelf, particularly between Cape Cod and Delaware Bay. Moderate quantities (5 to 99 g/m^2) also prevailed in extensive areas in this region. In the Chesapeake Bight subarea, the typical biomass of mollusks was less than 5 g/m^2, except in some inner shelf areas and along the shelf break.

Polyplacophora (figs. 35 and 36) were distributed in small and rather widely separated patches, primarily on the Outer Continental Shelf, Slope, and Rise. They were found in only two localities in inshore waters. Density throughout most of their area of occurrence was less than 24/m^2, and biomass typically was smaller than 0.5 g/m^2.

Gastropoda (figs. 37 and 38) were distributed over extensive areas extending from the northern to the southern boundaries of the region and from inshore waters to the outermost areas sampled. Outside the bays and sounds, their distribution generally formed bands parallel to the coastline. A moderately high density (10/m^2 to 99/m^2) band was present along the coast. Just seaward of this high-density band was a low-density (less than 10/m^2) band. In the central and outer parts of the Continental Shelf, gastropods were absent, except in the area south of Rhode Island and Massachusetts where a density of 10/m^2 to 999/m^2 was found. Along the Upper Continental Slope, the density was moderately high, and low-density bands were on either side. Biomass was small to moderate (0.01 to 5/m^2) over most areas of gastropod distribution. Intermediate (5 to 25 g/m^2) patches of biomasses were distributed primarily along the inner shelf areas and in bays and sounds, but a few patches were found in the midshelf regions south of Cape Cod and south of Long Island. Large biomasses (25 to 394 g/m^2) were restricted almost exclusively to bays and sounds, except for one small area in midshelf depths south of Nantucket Shoals.

Bivalvia (figs. 39 and 40) were ubiquitous throughout the Middle Atlantic Bight region .Their pattern of density formed bands more or less parallel to the coastline. A narrow band of moderate density (50 to 500/m^2) was found along the coast. A somewhat broader band of low density (less than 25/m^2) ran through the central part of the shelf. Another band of moderate density, very broad in the Southern New England area and narrower in the southern section, extended the entire length of the region. Biomass patterns were essentially similar to those of density. Two bands of small biomass (0.01 to 5 g/m^2) were found, one offshore beginning on the outer part of the Continental Shelf and extending to the deepest depths sampled; the other occupied the midshelf regions east of Long Island and below New York City. Two bands of moderate biomasses (5 to 50 g/m^2) were situated on the Inner and Outer Continental Shelf. Patches of large biomasses (50 to 19,300+g/m^2) were found in bays and sounds throughout the entire region and on the middle to outer shelf region of Southern New England and New York Bight. Large offshore biomasses in the more southerly regions were confined to the outer shelf.

Scaphopoda (figs. 41 and 42) were distributed in a narrow (25 to 50 km) band along the Outer Continental Shelf and Slope extending the entire length of the Middle Atlantic Bight region. Density was low (less than 24/m^2) throughout this band, except at four localized areas where it ranged from 25/m^2 to 77/m^2. Biomass was small (less than 0.5 g/m^2) throughout most of this band, and reached a maximum of only 2.46 g/m^2.

Cephalopoda (figs. 35 and 36) were represented entirely by eggs. They occurred in moderately small quantities at only two localities on the Outer Continental Shelf off southern Massachusetts.

Arthropoda (figs. 43 and 44) were nearly ubiquitous throughout the entire region. They were one of the most comman taxonomic groups found; maximum density was 19,171/m^2. High densities (greater than 2,000/m^2) were prevalent in large areas of the Continental Shelf in the Southern New England subarea and in the northern half of the New York Bight. Moderately high densities (200/m^2 to 1,999/m^2) were found over extensive areas in

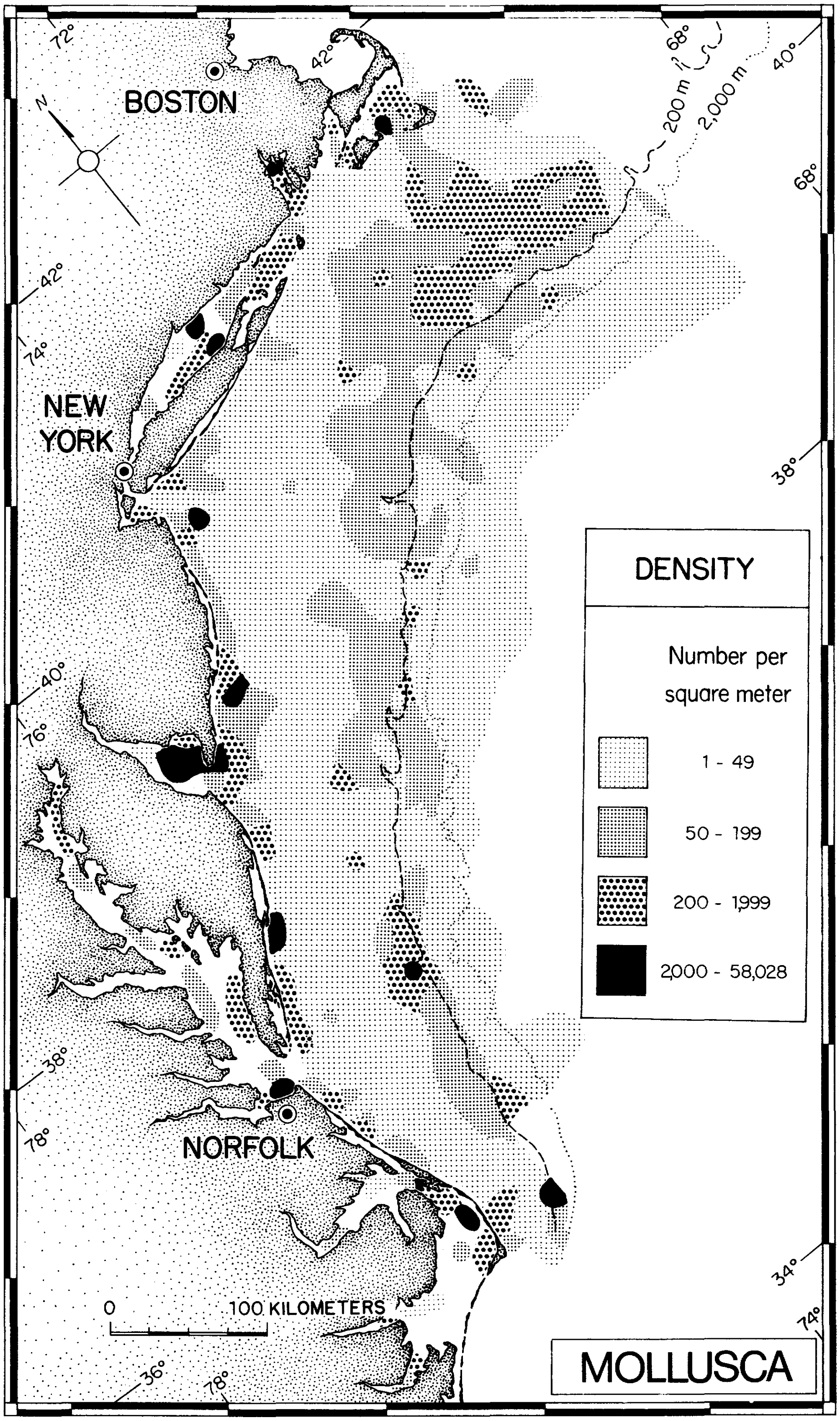

FIGURE 33.—Geographic distribution of the density of Mollusca, expressed as number of individuals per square meter of bottom area.

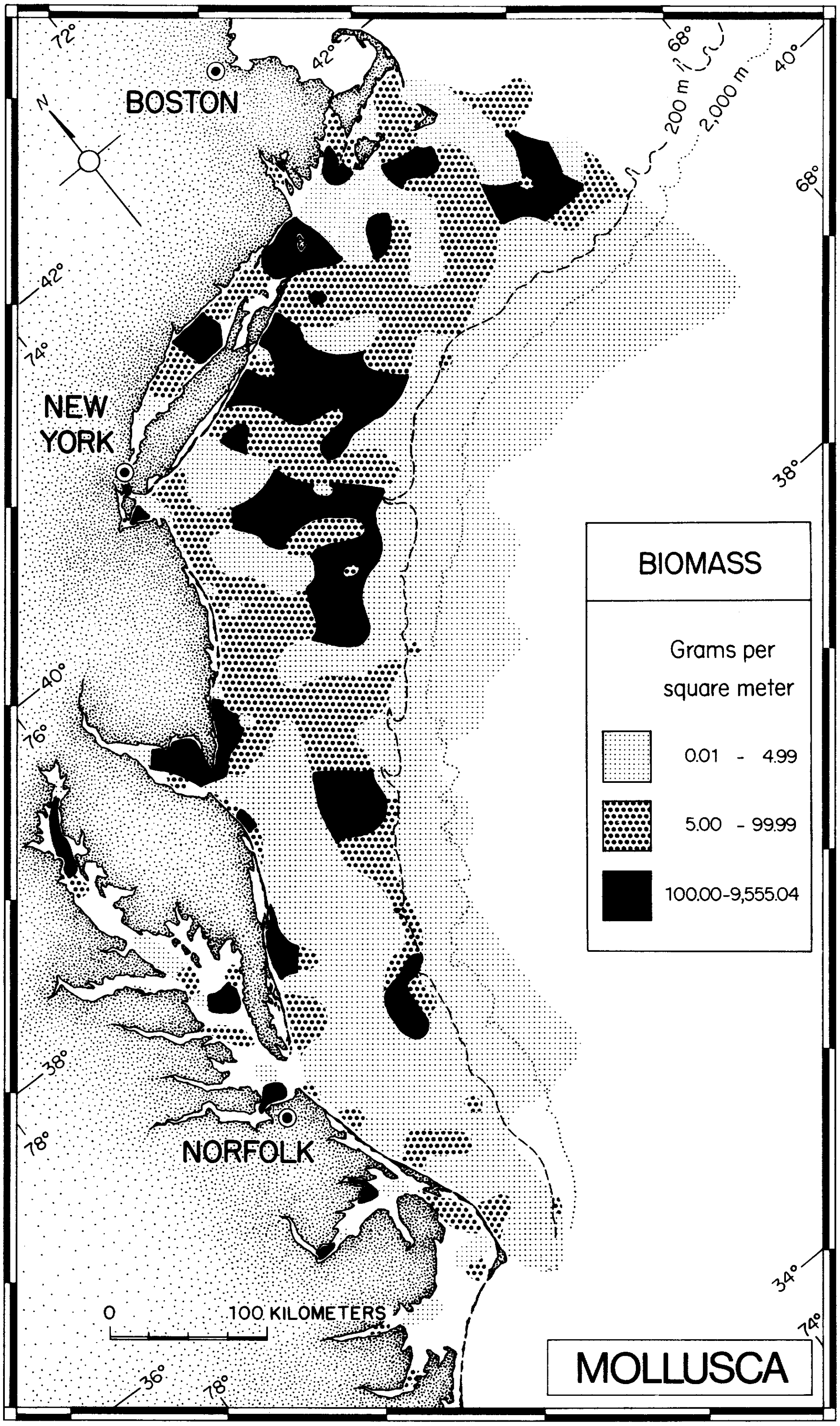

FIGURE 34.—Geographic distribution of the biomass of Mollusca, expressed as damp weight per square meter of bottom area.

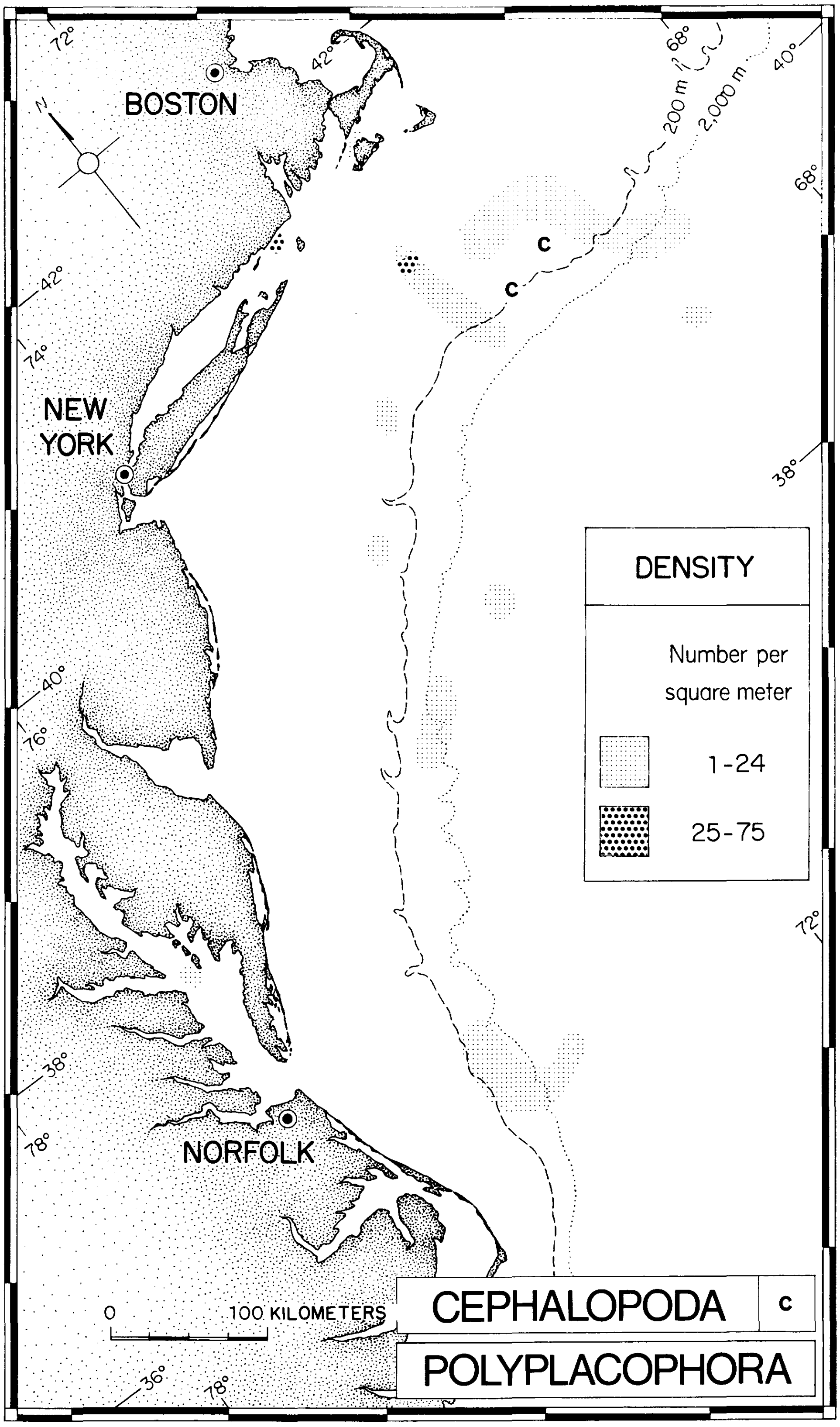

FIGURE 35.—Geographic distribution of the density of Cephalopoda (*C*) and Polyplacophora, expressed as number of individuals per square meter of bottom area.

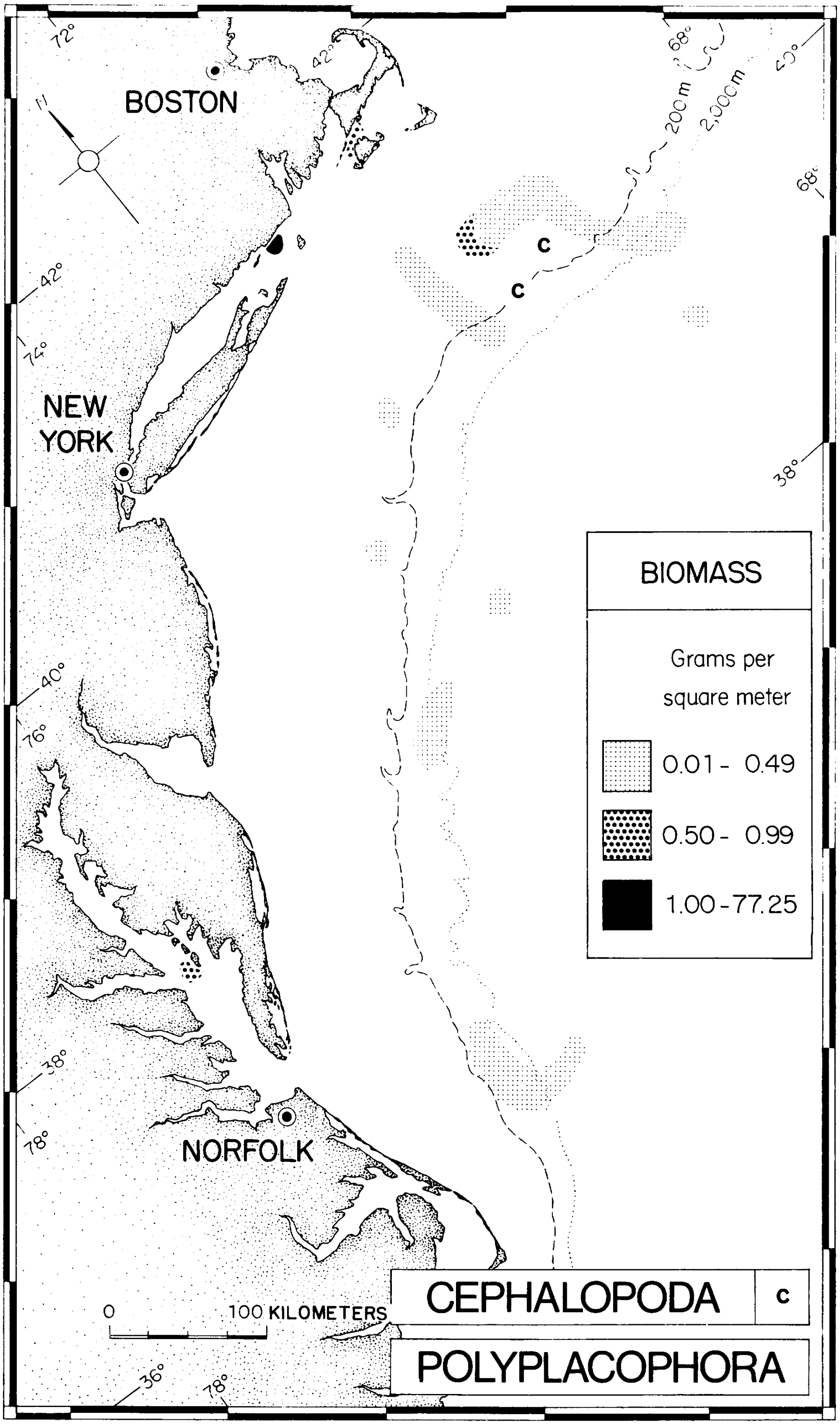

FIGURE 36.—Geographic distribution of the biomass of Cephalopoda (*C*) and Polyplacophora, expressed as damp weight per square meter of bottom area.

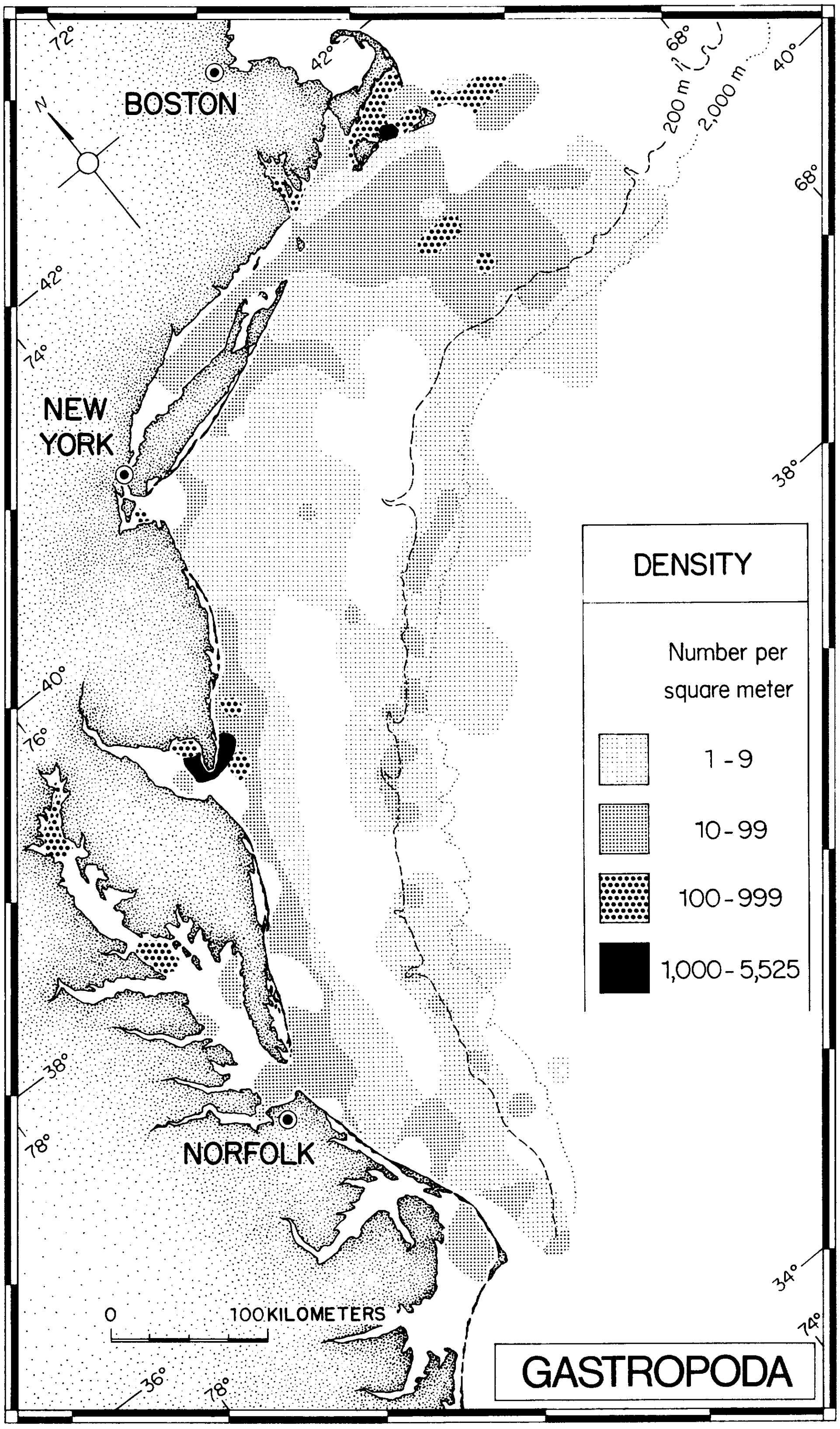

FIGURE 37.—Geographic distribution of the density of Gastropoda, expressed as number of individuals per square meter of bottom area.

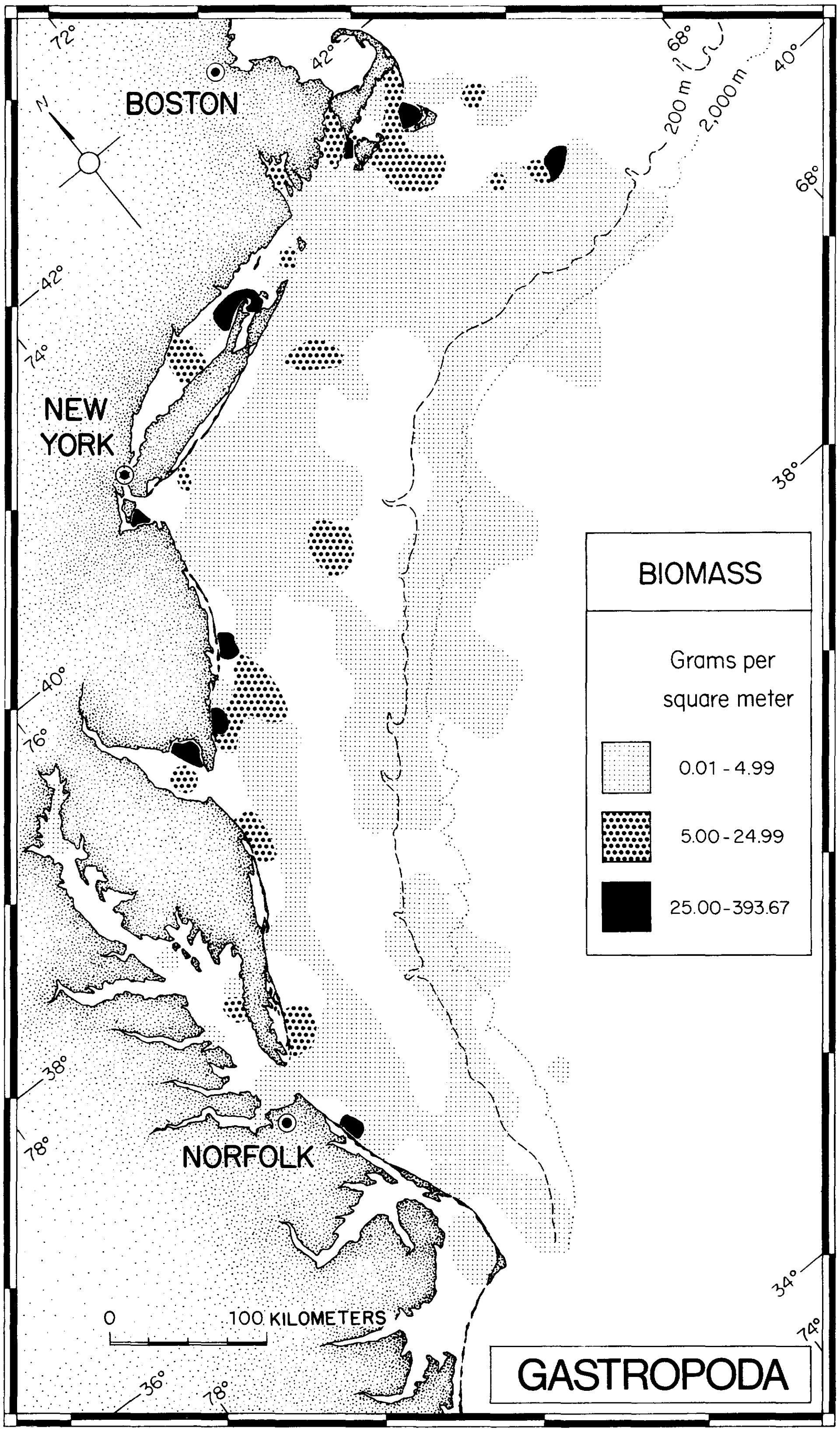

FIGURE 38.—Geographic distribution of the biomass of Gastropoda, expressed as damp weight per square meter of bottom area.

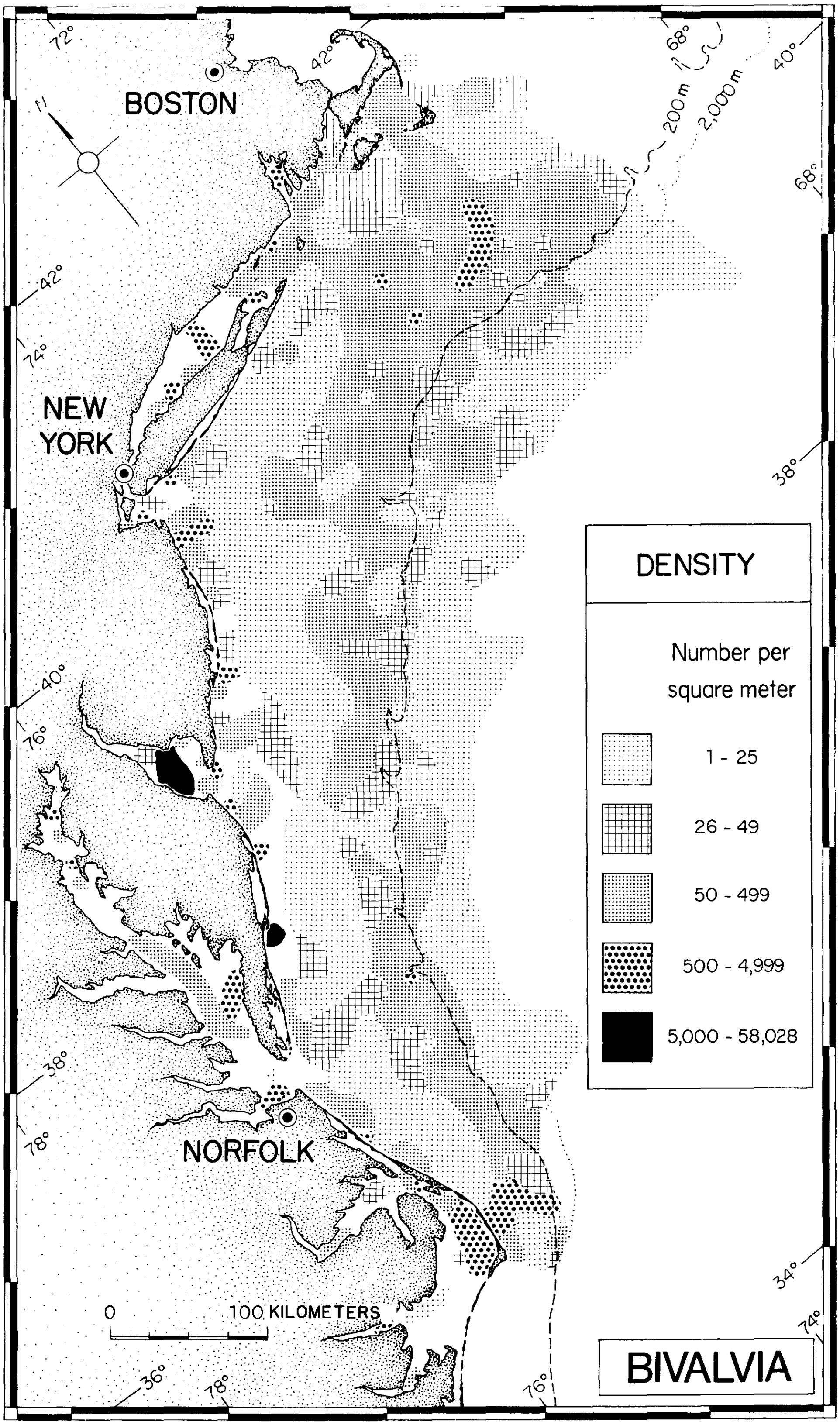

FIGURE 39.—Geographic distribution of the density of Bivalvia, expressed as number of individuals per square meter of bottom area.

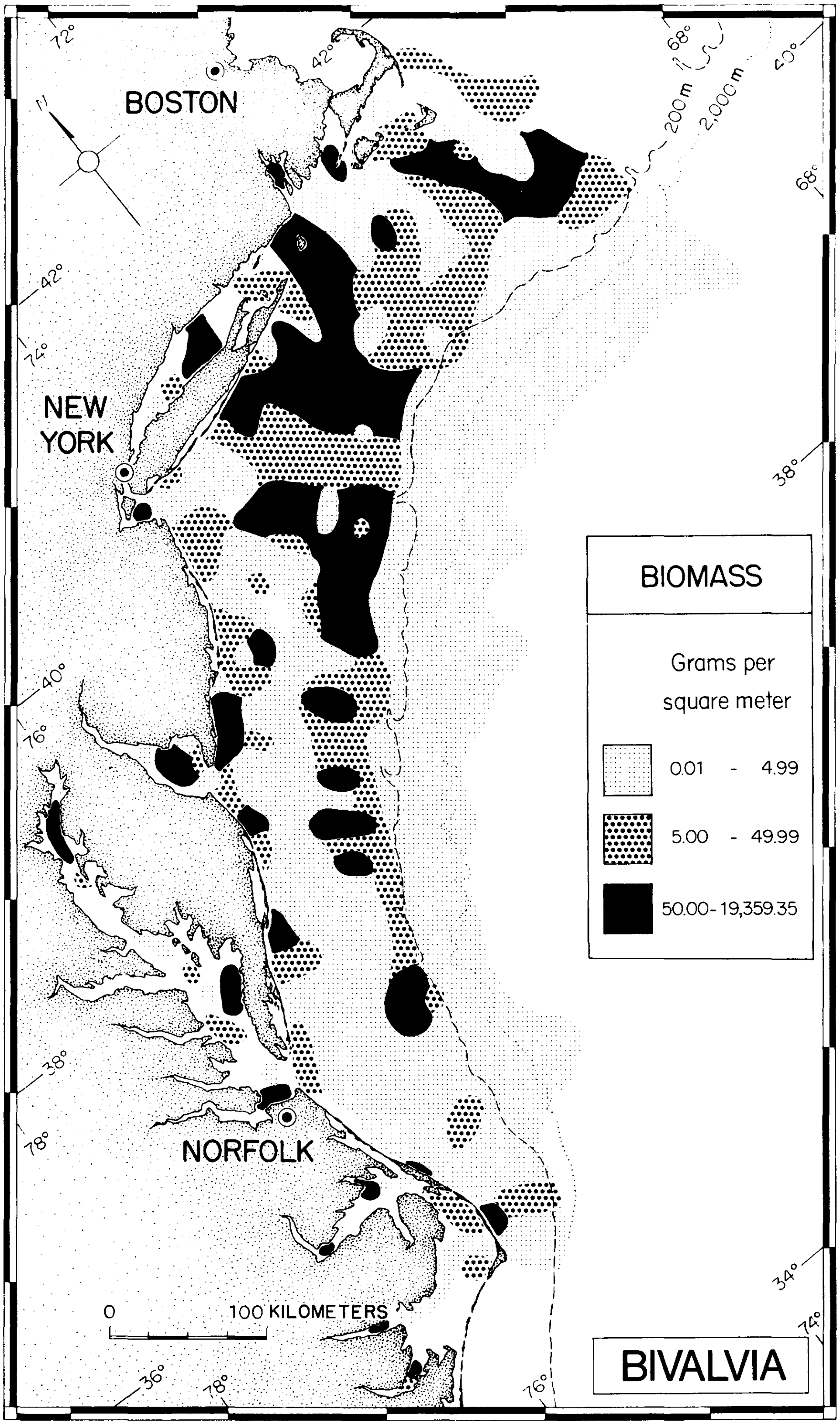

FIGURE 40.—Geographic distribution of the biomass of Bivalvia, expressed as damp weight per square meter of bottom area.

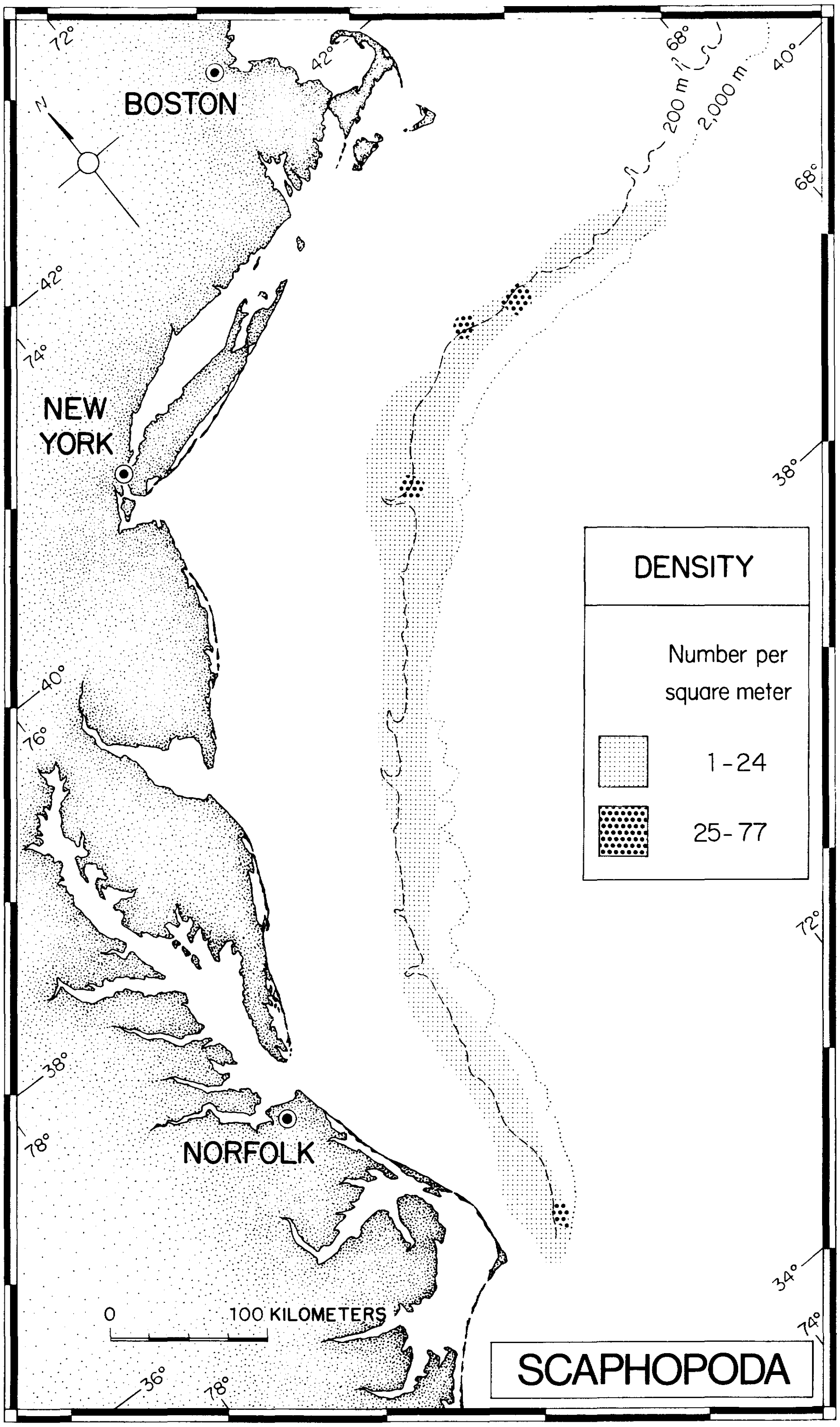

FIGURE 41.—Geographic distribution of the density of Scaphopoda, expressed as number of individuals per square meter of bottom area.

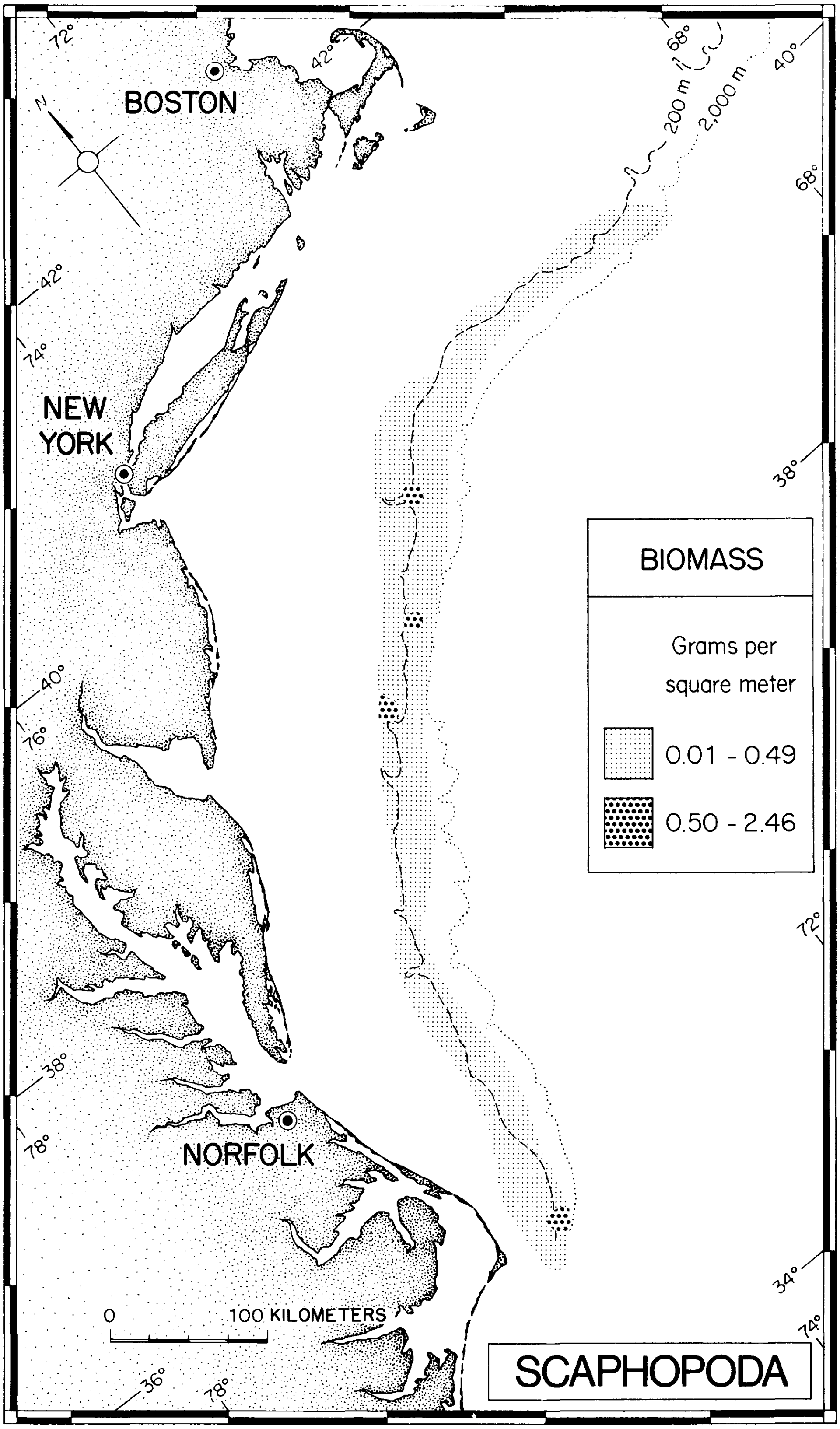

FIGURE 42.—Geographic distribution of the biomass of Scaphopoda, expressed as damp weight per square meter of bottom area.

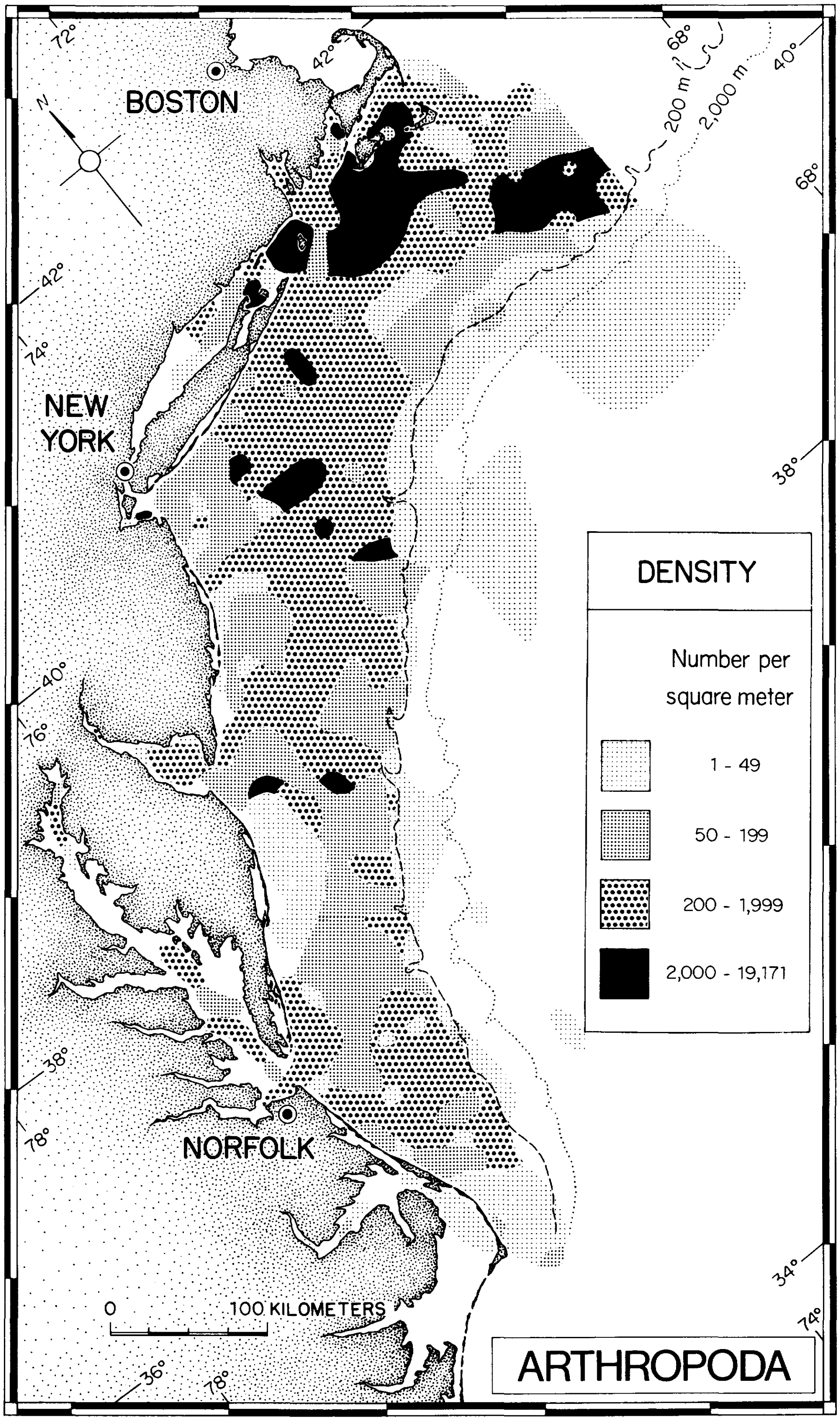

FIGURE 43.—Geographic distribution of the density of Arthropoda, expressed as number of individuals per square meter of bottom area.

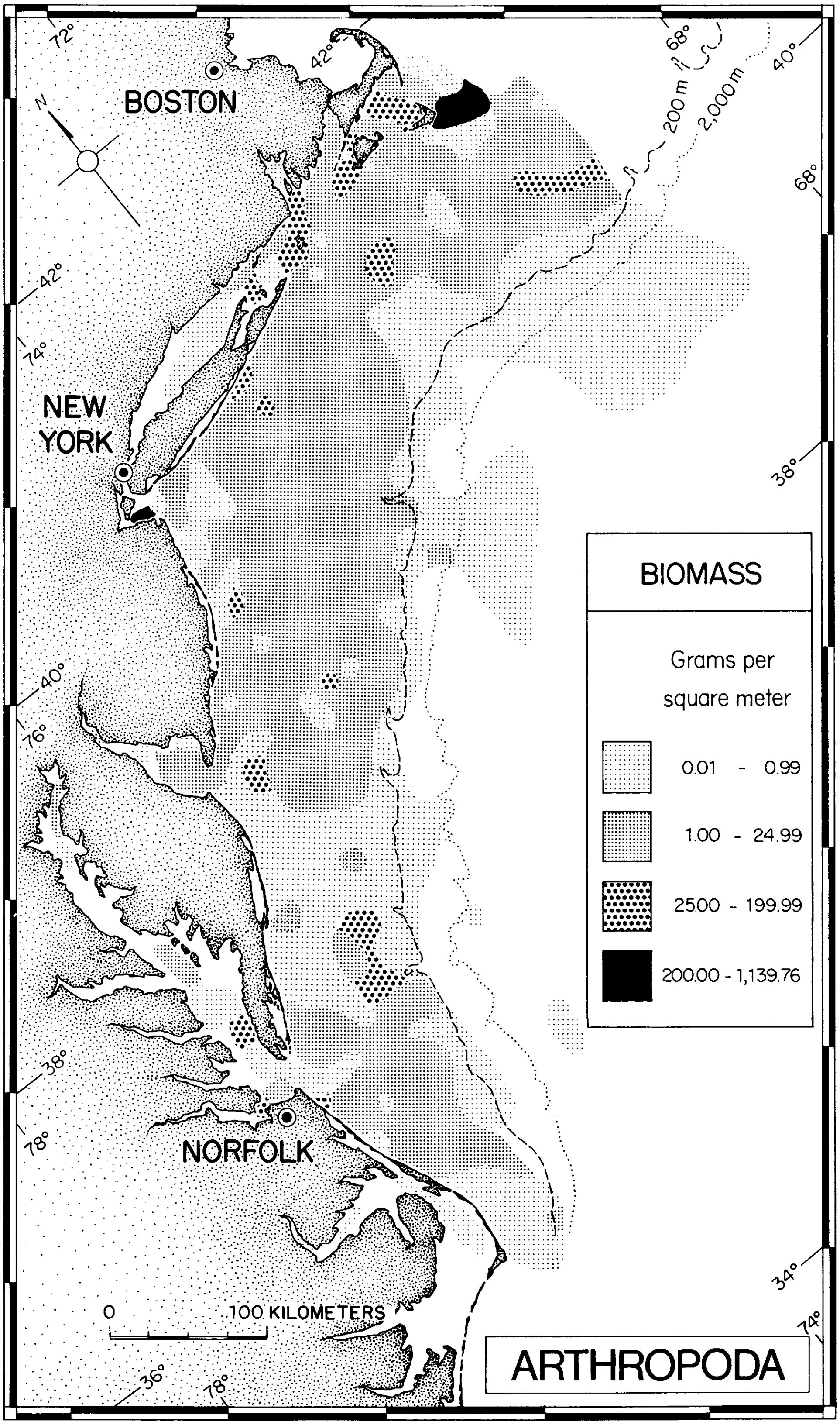

FIGURE 44.—Geographic distribution of the biomass of Arthropoda, expressed as damp weight per square meter of bottom area.

inshore waters and on the Continental Shelf throughout the region. Low densities (less than 50/m^2) prevailed in the offshore deepwaters. Biomass had a somewhat similar pattern of distribution. Large (greater than 200/m^2) and moderately large (25 to 199 g/m^2) biomasses were most common on the Continental Shelf in Southern New England. Moderate quantities (1 to 25 g/m^2) were found in extensive areas of the Continental Shelf. Small quantities (less than 1 g/m^2) were prevalent in the Chesapeake Bight subarea and in offshore deepwater.

Pycnogonida, Arachnida, Ostracoda, Nebaliacea, and Copepoda (fig. 45) were found in only a few scattered localities. Densities varied in magnitude from one group to another, but generally they were low, and the biomass of all groups was very small.

Cirripedia (figs. 46 and 47) were present in only a few localities, primarily on the Continental Shelf. Most were found in the area from New York northward to Cape Cod, also the area of its highest density (500 to 7,932/m^2). Biomass was distributed in a similar pattern and reached quantities ranging from 500 to 1,104 g/m^2 at localities of highest density.

Cumacea (figs. 48 and 49) were widely distributed throughout the region, particularly on the Continental Shelf, from shallow inshore waters to offshore deepwaters, and from Cape Cod to Cape Hatteras. High densities (greater than 500/m^2) and moderately high densities (100/m^2 to 499/m^2) were common on the central Continental Shelf off Southern New England, and along the outer margin of the Continental Shelf in the Chesapeake Bight subarea. Low densities (less than 25/m^2) prevailed for most of their area of occurrence on the Continental Shelf and in all deepwater areas. Biomass was small (less than 0.5 g/m^2), except for widely scattered patches of limited size.

Tanaidacea (figs. 50 and 51) were found only in deepwater. They were found in small and widely separated areas on the Continental Slope and Rise ranging from offshore Cape Code to the offshore Chesapeake Bay region. In all localities their density was low, less than 6/m^2, and their biomass was small, less than 0.05 g/m^2.

Isopoda (figs. 52 and 53) were widely dispersed over the Continental Shelf throughout the region at densities ranging from 1/m^2 to 24/m^2. Moderate-size areas, more or less equally distributed over the Continental Shelf, contained populations between 25/m^2 and 199/m^2. High densities (200/m^2 to 1,053/m^2) were restricted to small areas, chiefly the bays and the Inner Continental Shelf. Biomass throughout most of their area of occurrence was less than 0.5 g/m^2. Some moderately large areas, rather evenly scattered throughout the region, contained biomasses between 0.5 and 5.0 g/m^2. In a few small areas, along the middle and inner shelf between New Jersey and Virginia, they were present in relatively large quantities, 5 to 12.6 g/m^2.

Amphipoda (figs. 54 and 55) were ubiquitous in the Middle Atlantic Bight region where densities ranged from 10/m^2 to more than 19,000/m^2. Lowest densities were most closely associated with the deep water below the shelf break and in patches along the coastline. Moderate densities (50/m^2 to 500/m^2) predominated on the Continental Shelf below the eastern tip of Long Island. Higher densities (500/m^2 to 5,000/m^2) were distributed in relatively large areas off Southern New England, somewhat smaller areas in the New York Bight region, and the smallest areas in the more southerly reaches of the study area. Highest densities (5,000/m^2 to 19,000/m^2) were found only in comparatively small patches in the Southern New England region. Biomass ranged from 0.01 to 175 g/m^2. Largest biomasses (25 to 175 g/m^2) were, like density, most prevalent in the northern sectors of the study area and in a few discrete patches in the south. Intermediate biomasses (1–25 g/m^2) were present over large parts of the Southern New England and New York Bight Continental Shelves, and in smaller areas farther south. Generally, the inshore and offshore areas contained the smallest (0.01 to 1 g/m^2) biomasses.

Mysidacea (figs. 56 and 57) were present in scattered localities from Cape Cod to Cape Hatteras. All samples except one were from the Continental Shelf, primarily in coastal areas and the Inner Continental Shelf. Densities were low (less than 25/m^2) in about half their area of occurrence and moderate (25/m^2–385/m^2) in the remaining half. Biomass of mysids was small (less than 1.4 g/m^2) at all localities.

Decapoda (figs. 58 and 59) were found over a large part of the Middle Atlantic Bight. They were broadly distributed on the Continental Shelf, extending from Cape Cod to Cape Hatteras. Densities over most of this expanse were low (less than 25/m^2) and moderate (25/m^2 to 99/m^2) to high (100/m^2 to 395/m^2) in rather small scattered patches in all sections. Biomass was distributed somewhat differently in that most of the largest quantities were on the Inner and Middle Continental Shelf and smaller quantities were on the Outer Continental Shelf.

Bryozoa (figs. 60 and 61) were distributed in moderate-sized patches in the study area. Densities, for the most part, were rather low (1/m^2 to 24/m^2);

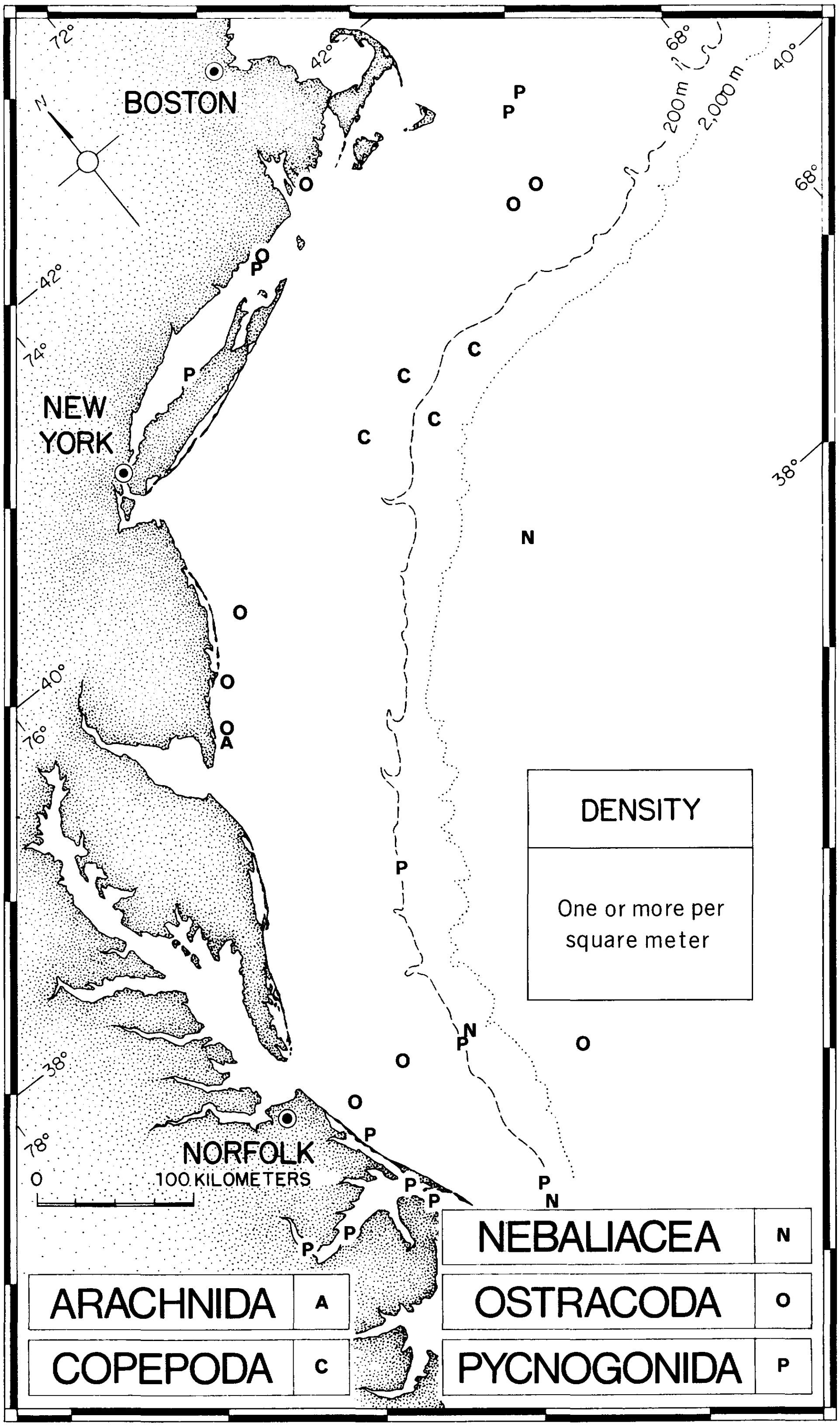

FIGURE 45.—Geographic distribution of the density of Arachnida (*A*), Copepoda (*C*), Nebaliacea (*N*), Ostracoda (*O*), and Pycnogonida (*P*), expressed as number of individuals per square meter of bottom area.

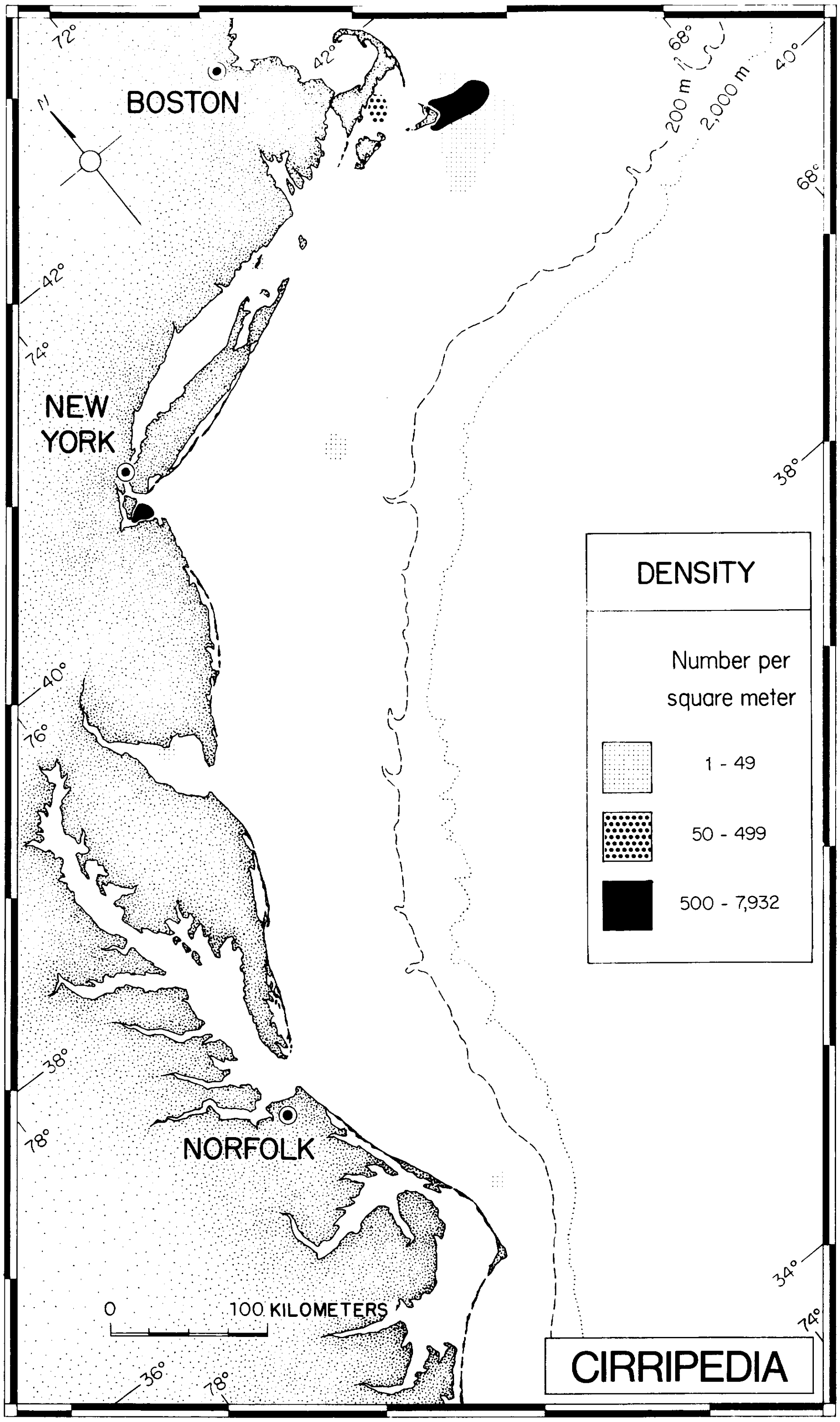

FIGURE 46.—Geographic distribution of the density of Cirripedia, expressed as number of individuals per square meter of bottom area.

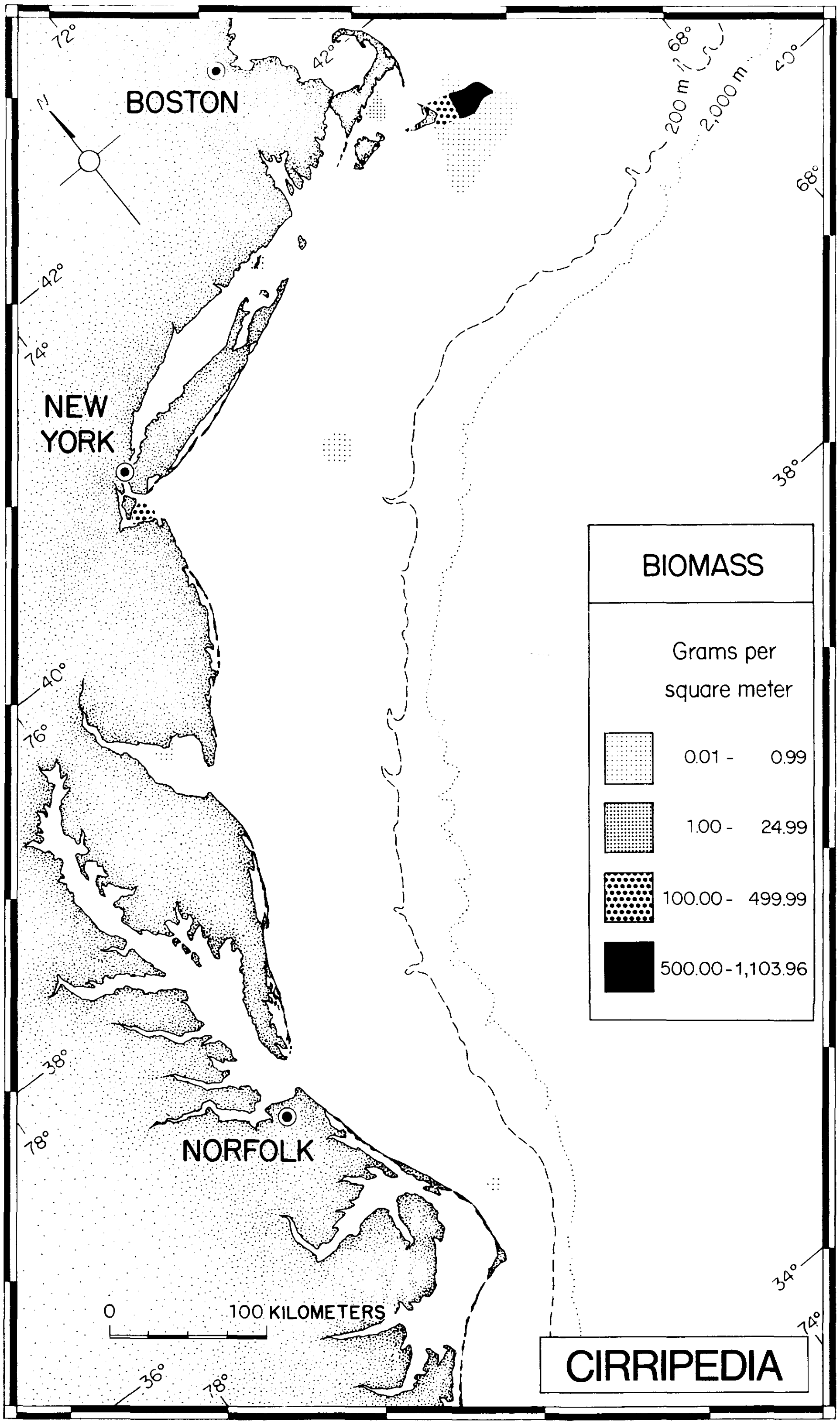

FIGURE 47.—Geographic distribution of the biomass of Cirripedia, expressed as damp weight per square meter of bottom area.

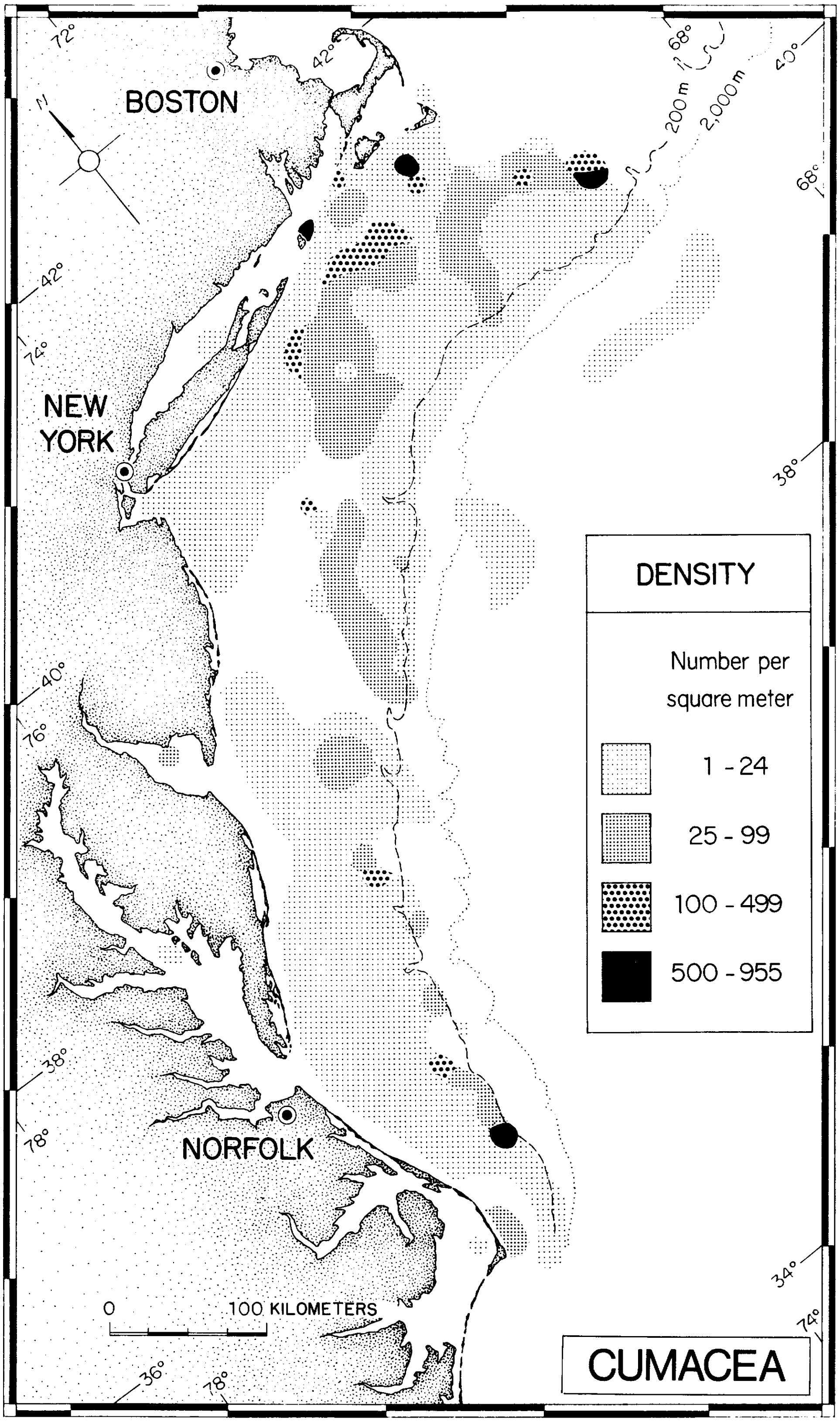

FIGURE 48.—Geographic distribution of the density of Cumacea, expressed as number of individuals per square meter of bottom area.

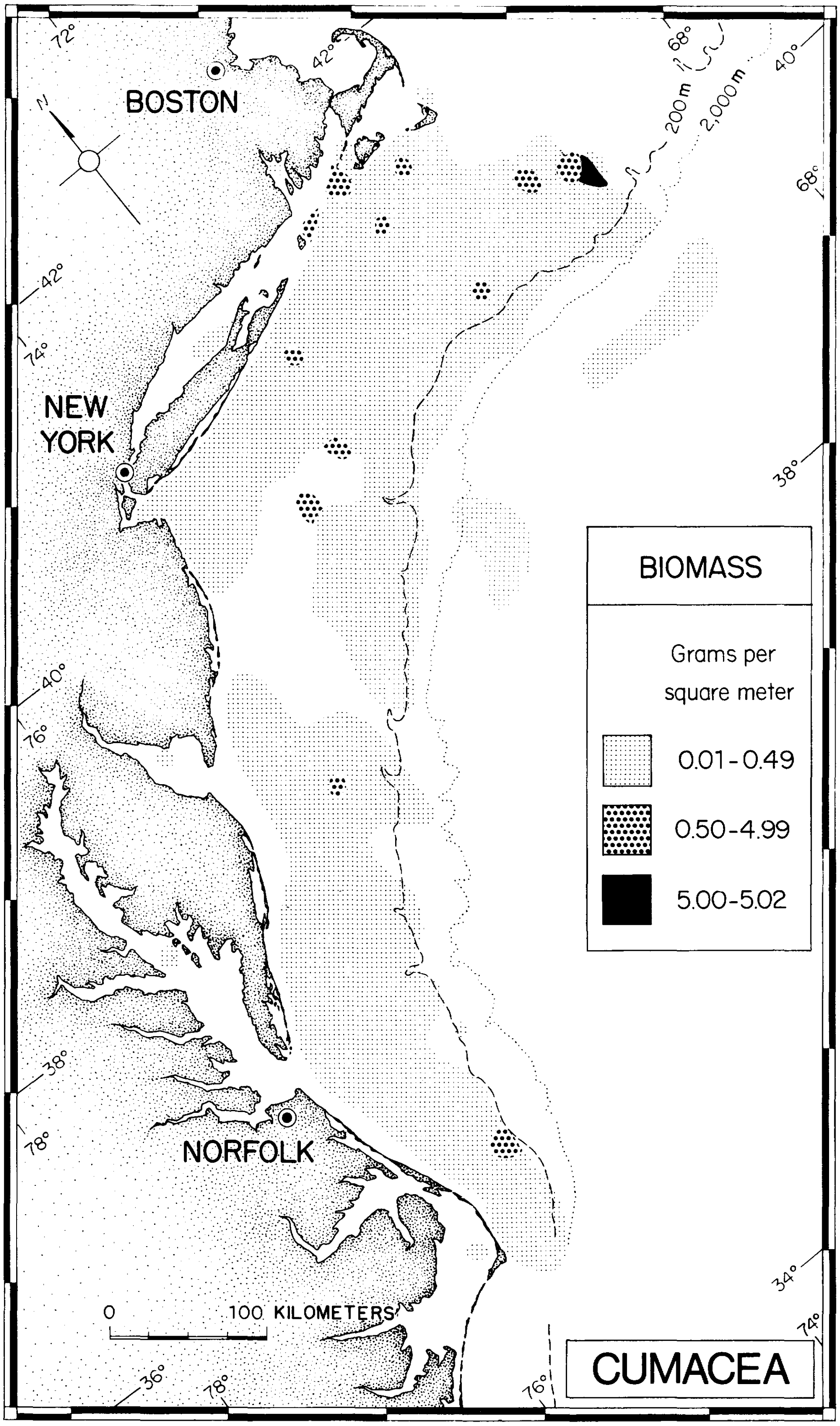

FIGURE 49.—Geographic distribution of the biomass of Cumacea, expressed as damp weight per square meter of bottom area.

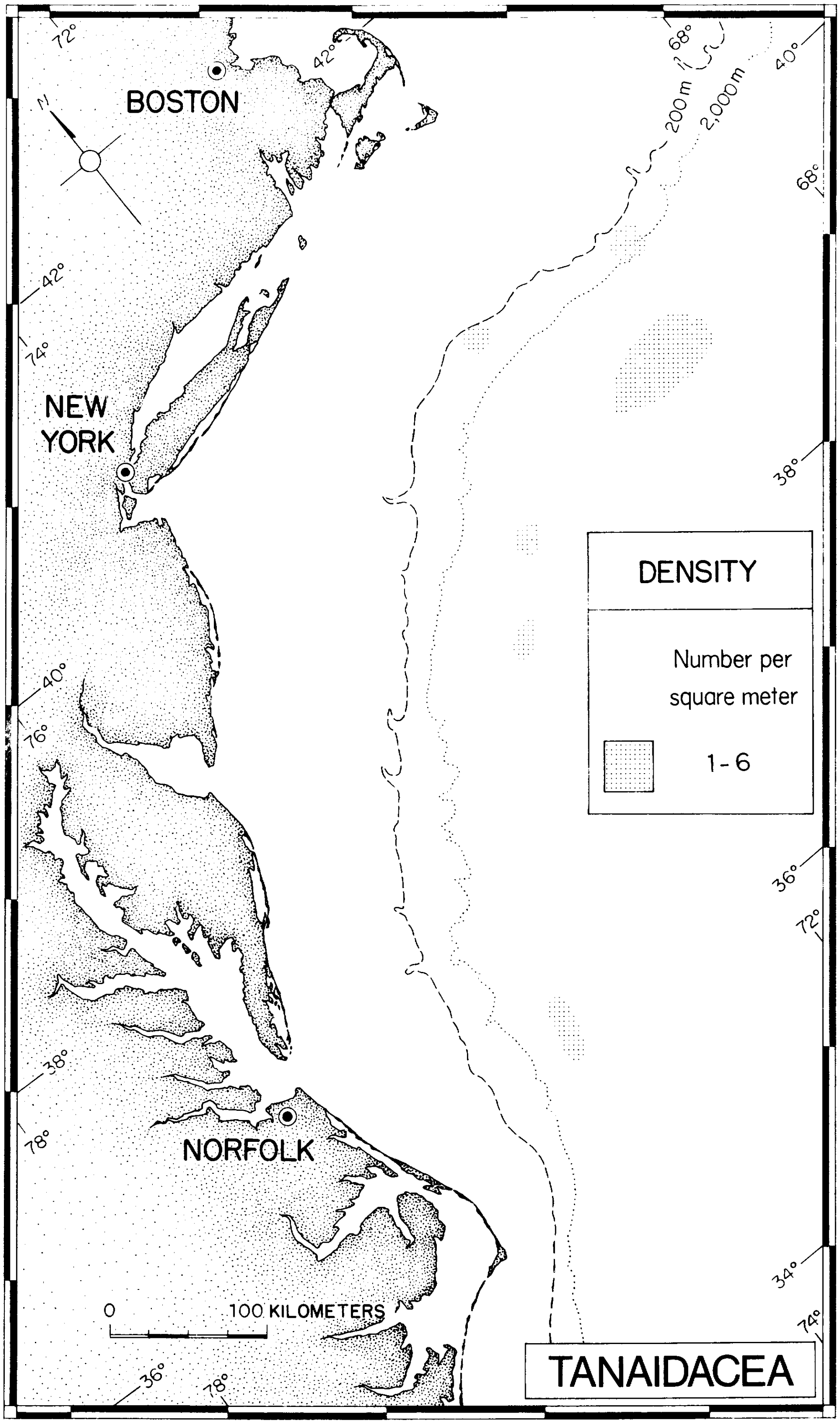

FIGURE 50.—Geographic distribution of the density of Tanaidacea, expressed as number of individuals per square meter of bottom area.

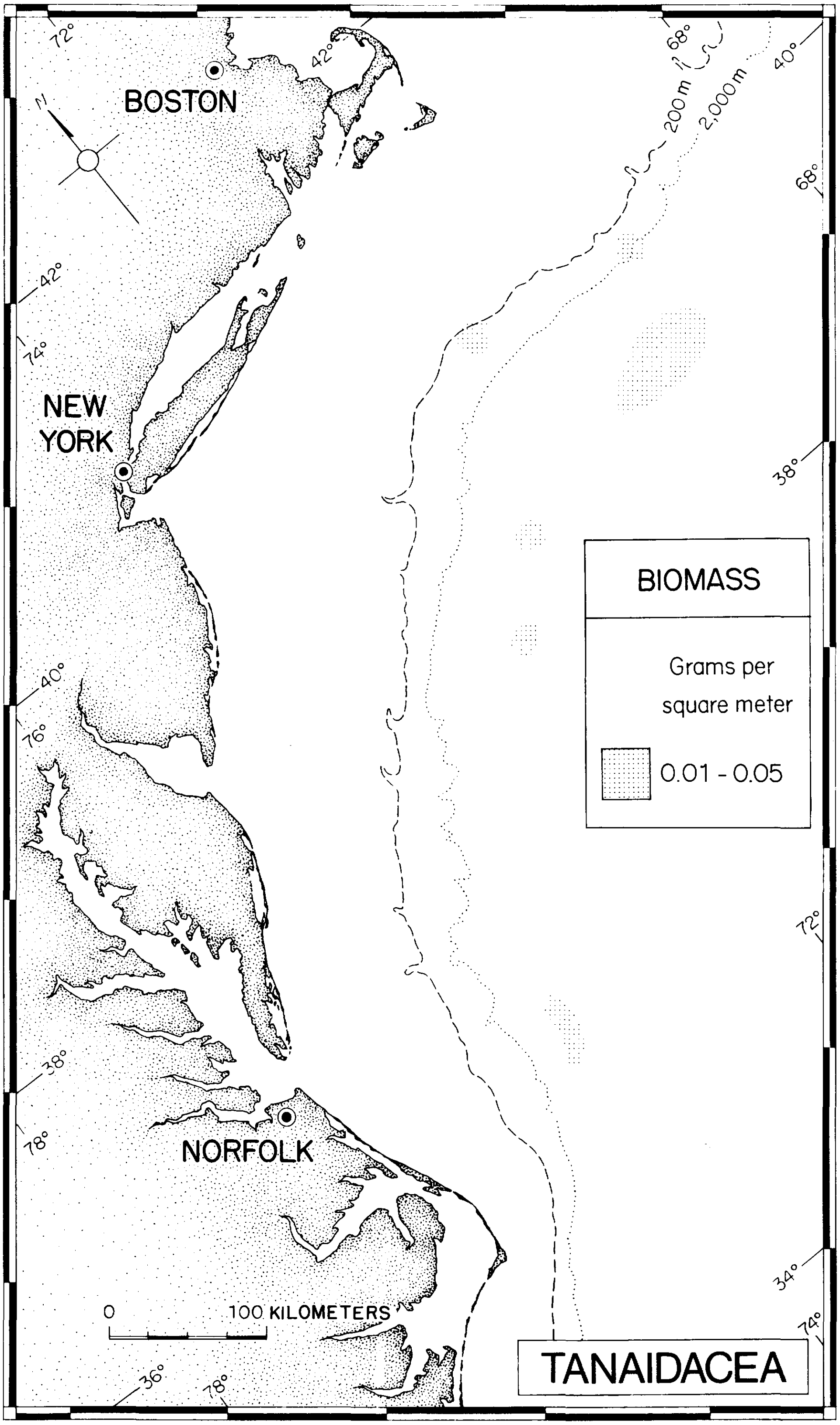

FIGURE 51.—Geographic distribution of the biomass of Tanaidacea, expressed as damp weight per square meter of bottom area.

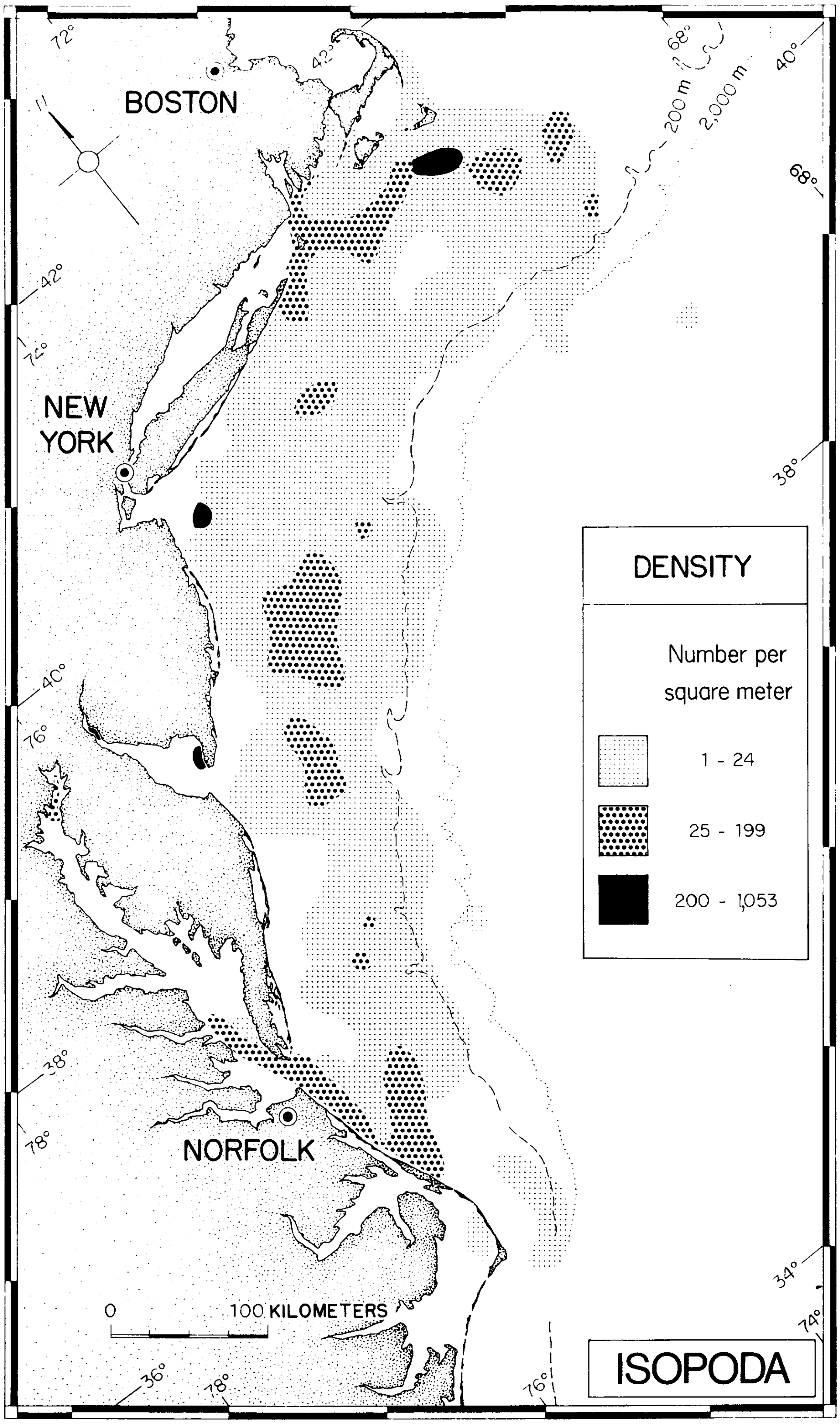

FIGURE 52.—Geographic distribution of the density of Isopoda, expressed as number of individuals per square meter of bottom area.

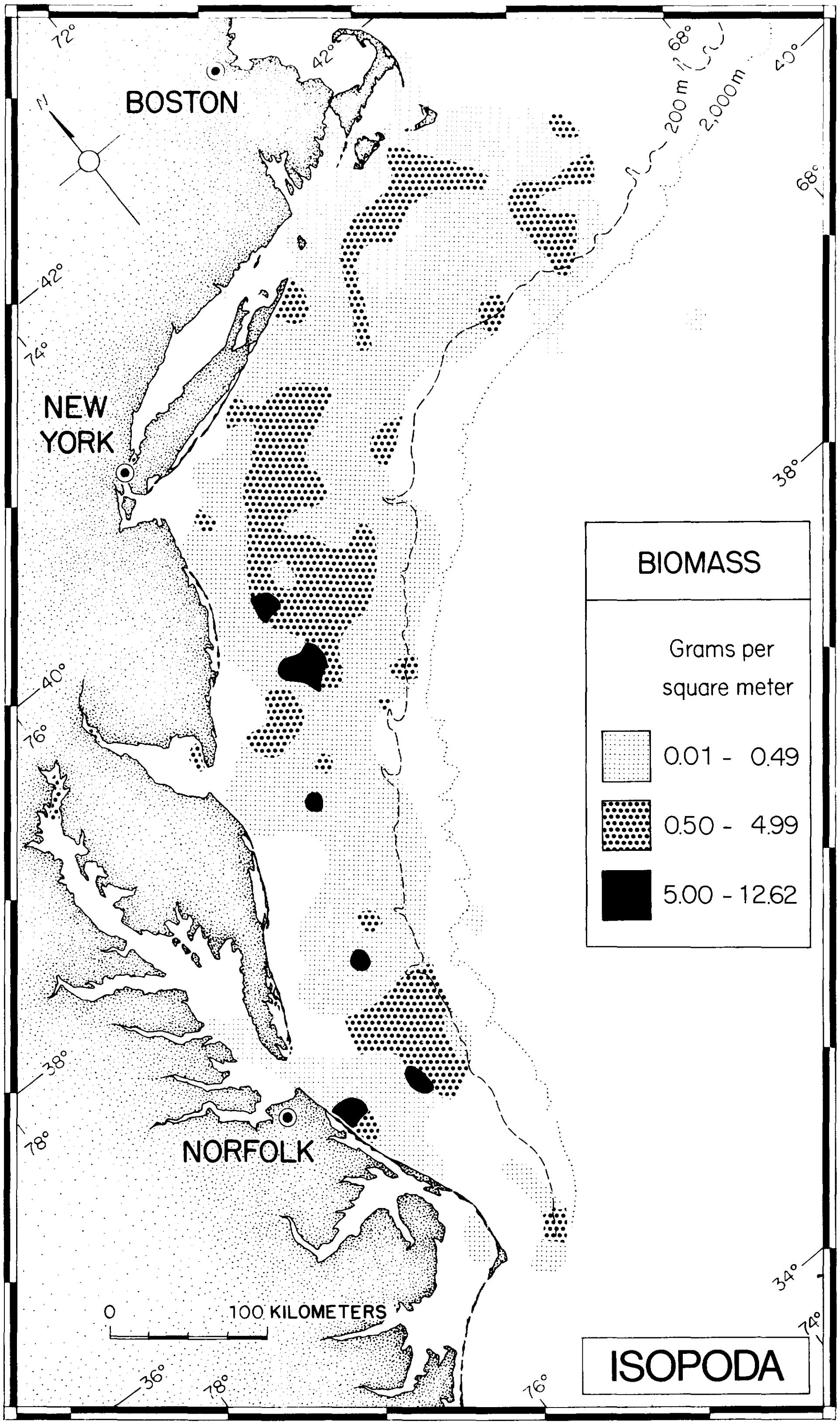

FIGURE 53.—Geographic distribution of the biomass of Isopoda, expressed as damp weight per square meter of bottom area.

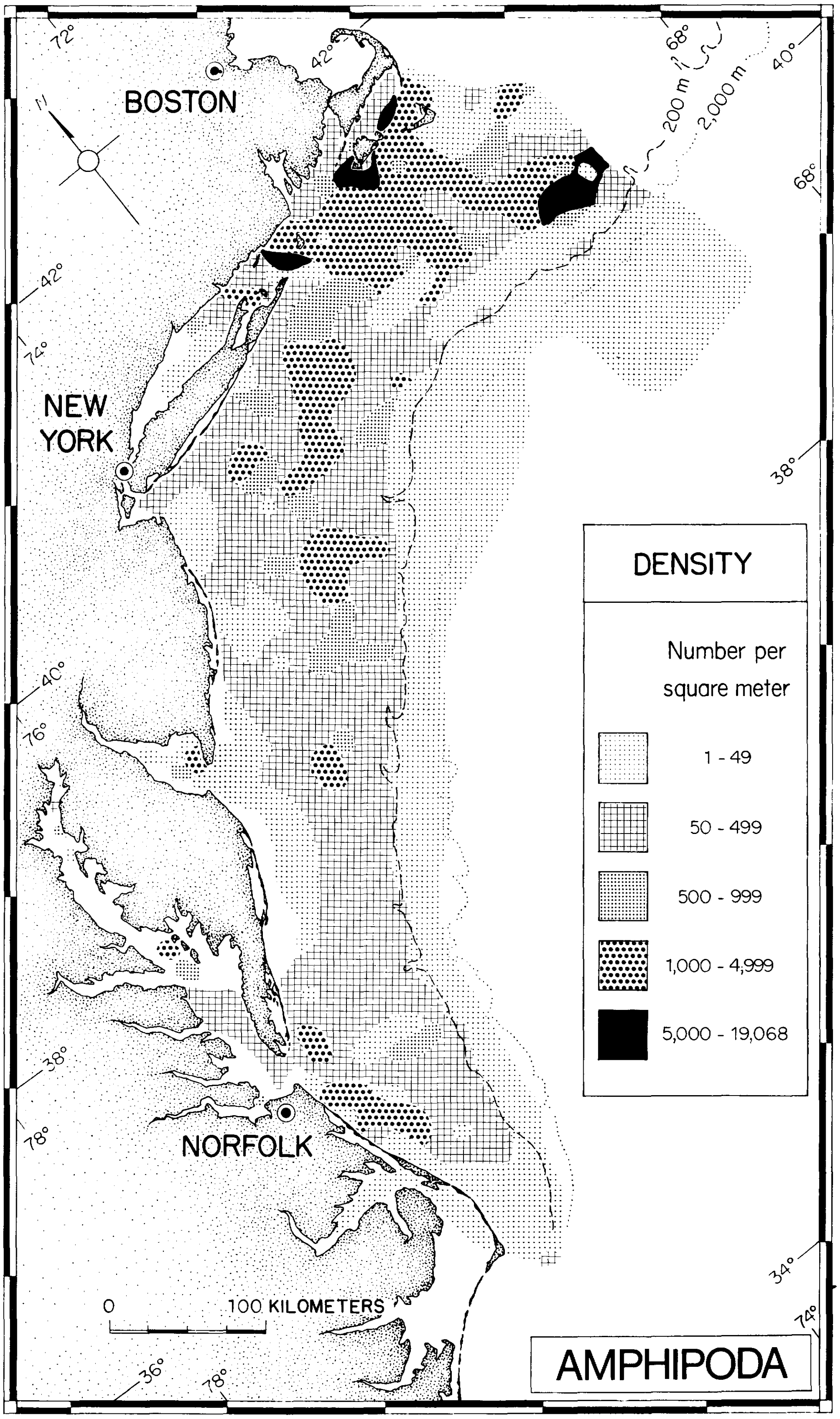

FIGURE 54.—Geographic distribution of the density of Amphipoda, expressed as number of individuals per square meter of bottom area.

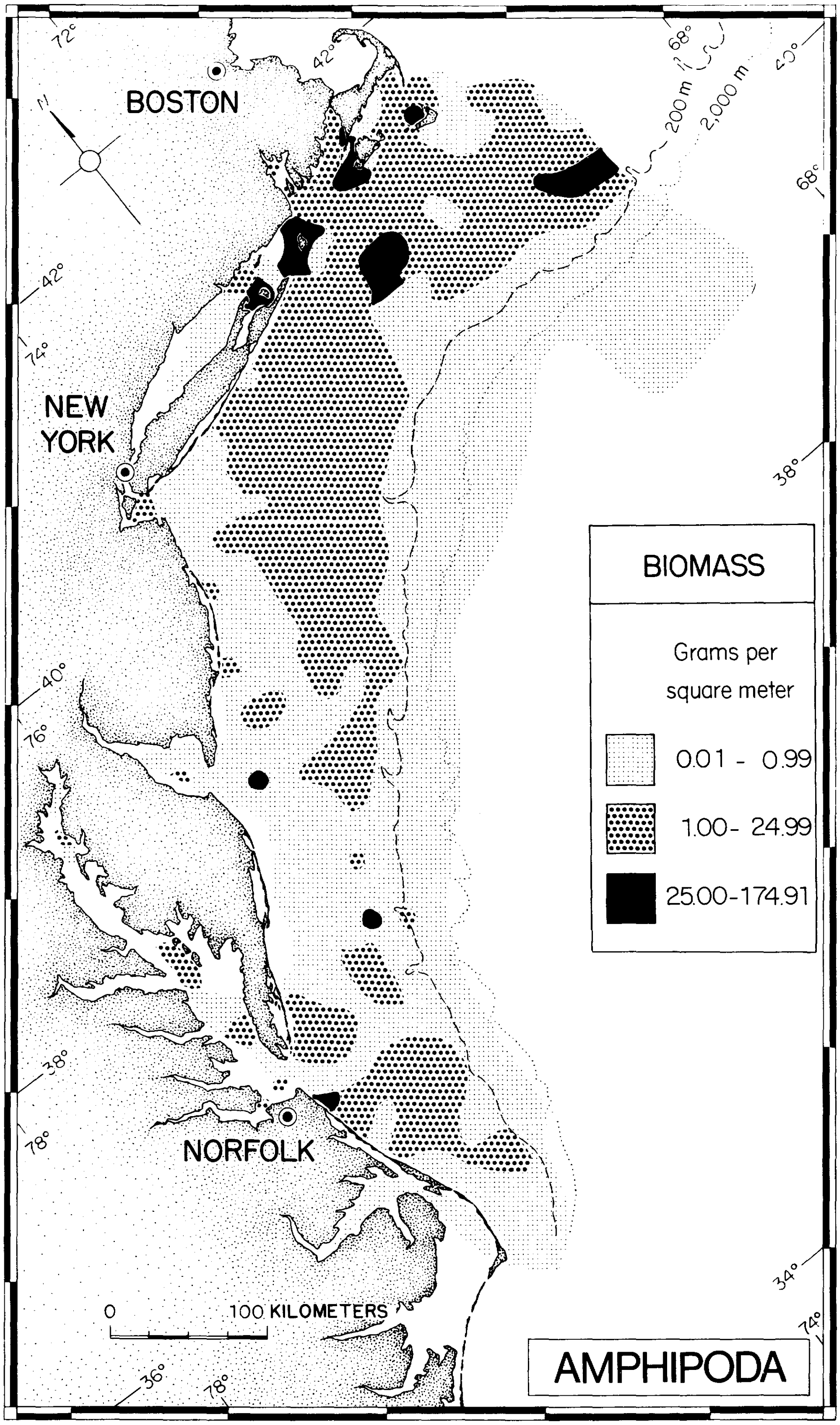

FIGURE 55.—Geographic distribution of the biomass of Amphipoda, expressed as damp weight per square meter of bottom area.

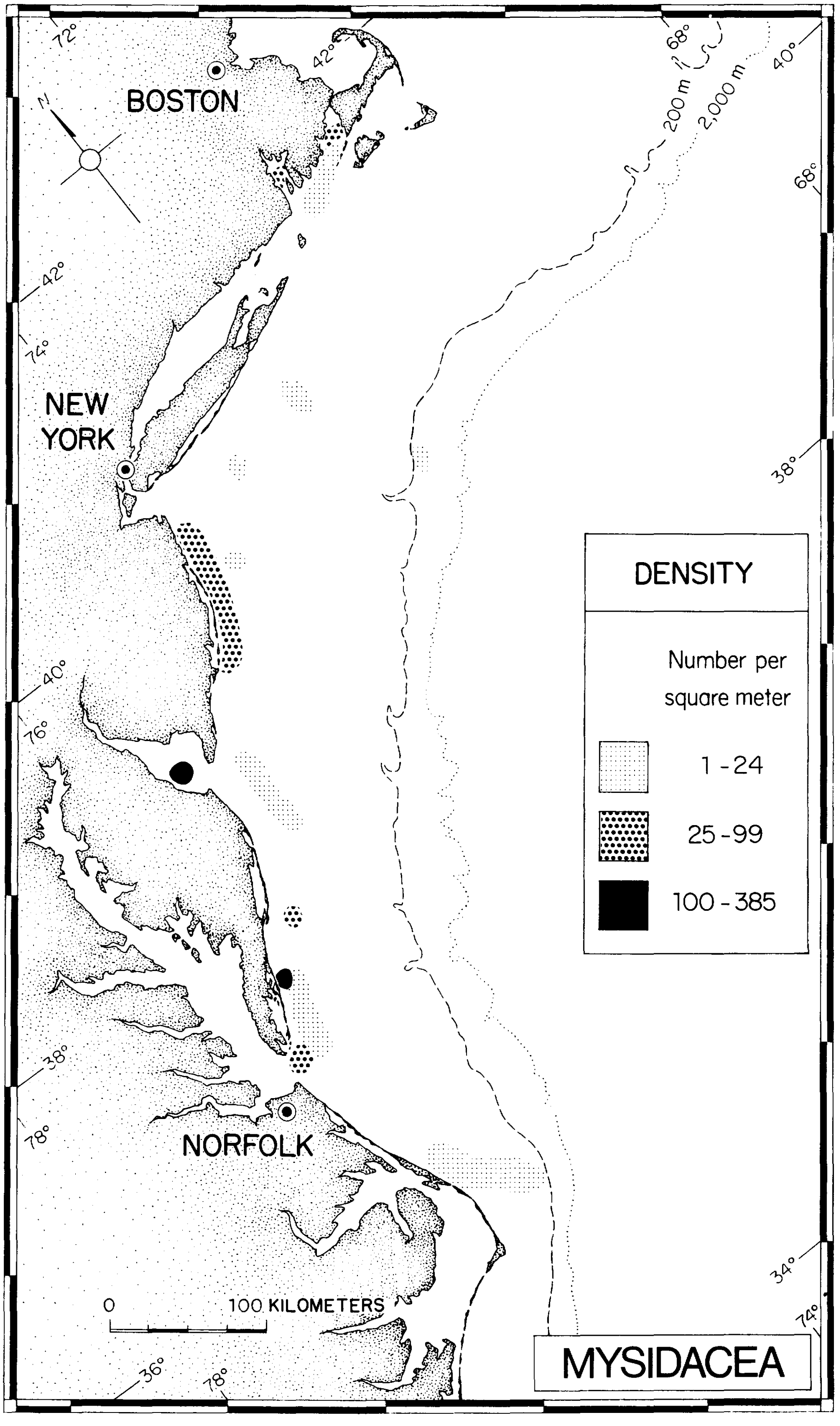

FIGURE 56.—Geographic distribution of the density of Mysidacea, expressed as number of individuals per square meter of bottom area.

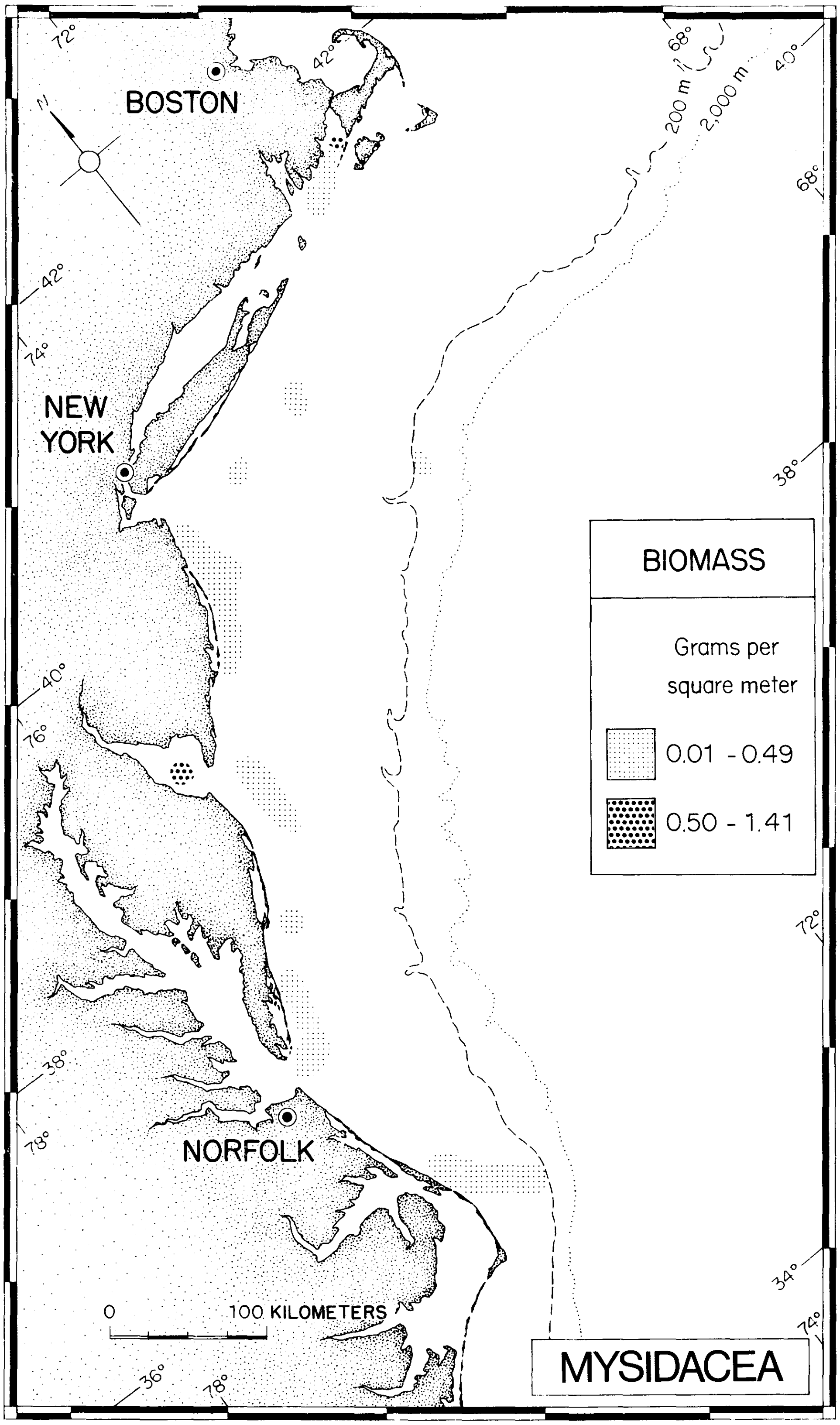

FIGURE 57.—Geographic distribution of the biomass of Mysidacea, expressed as damp weight per square meter of bottom area.

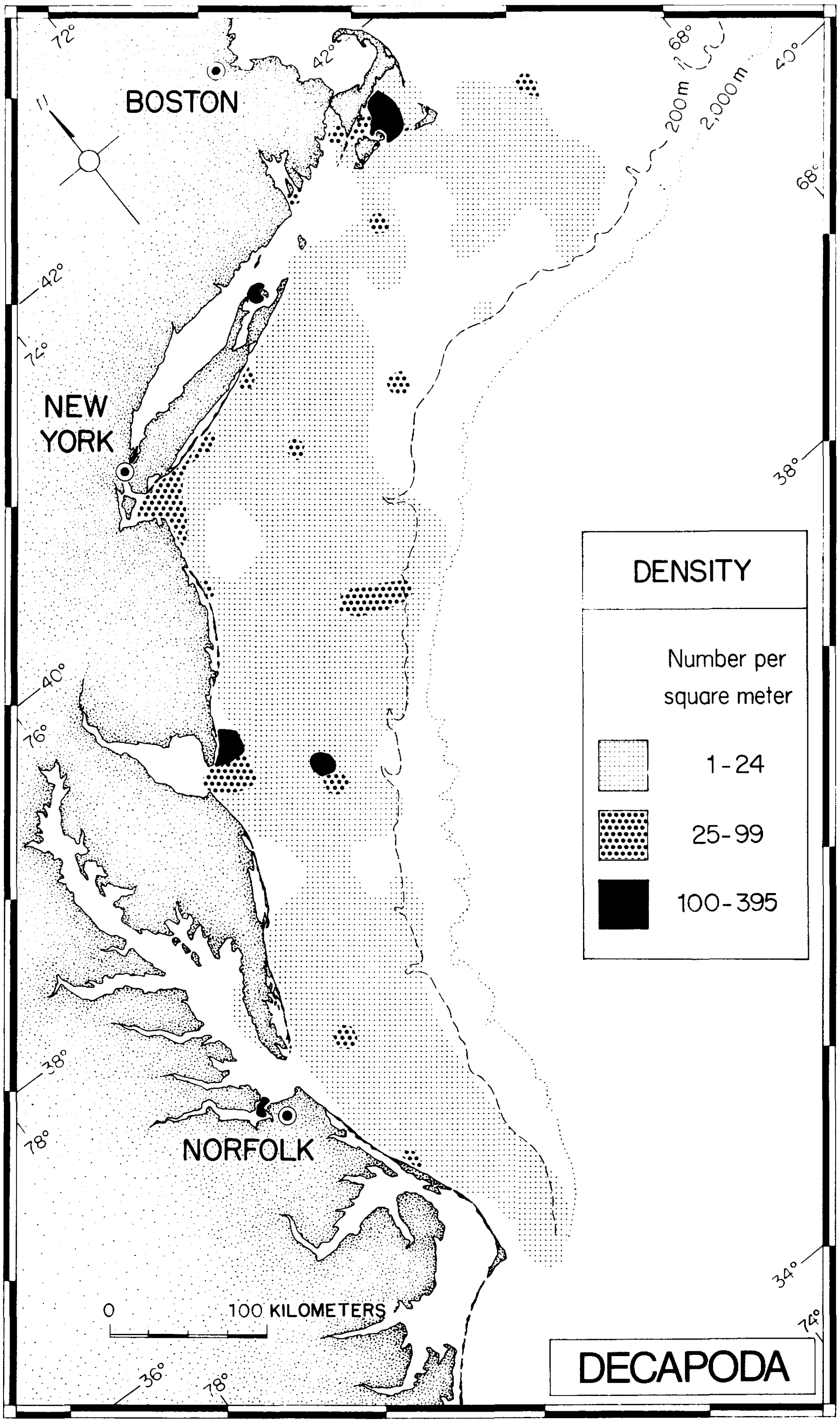

FIGURE 58.—Geographic distribution of the density of Decapoda, expressed as number of individuals per square meter of bottom area.

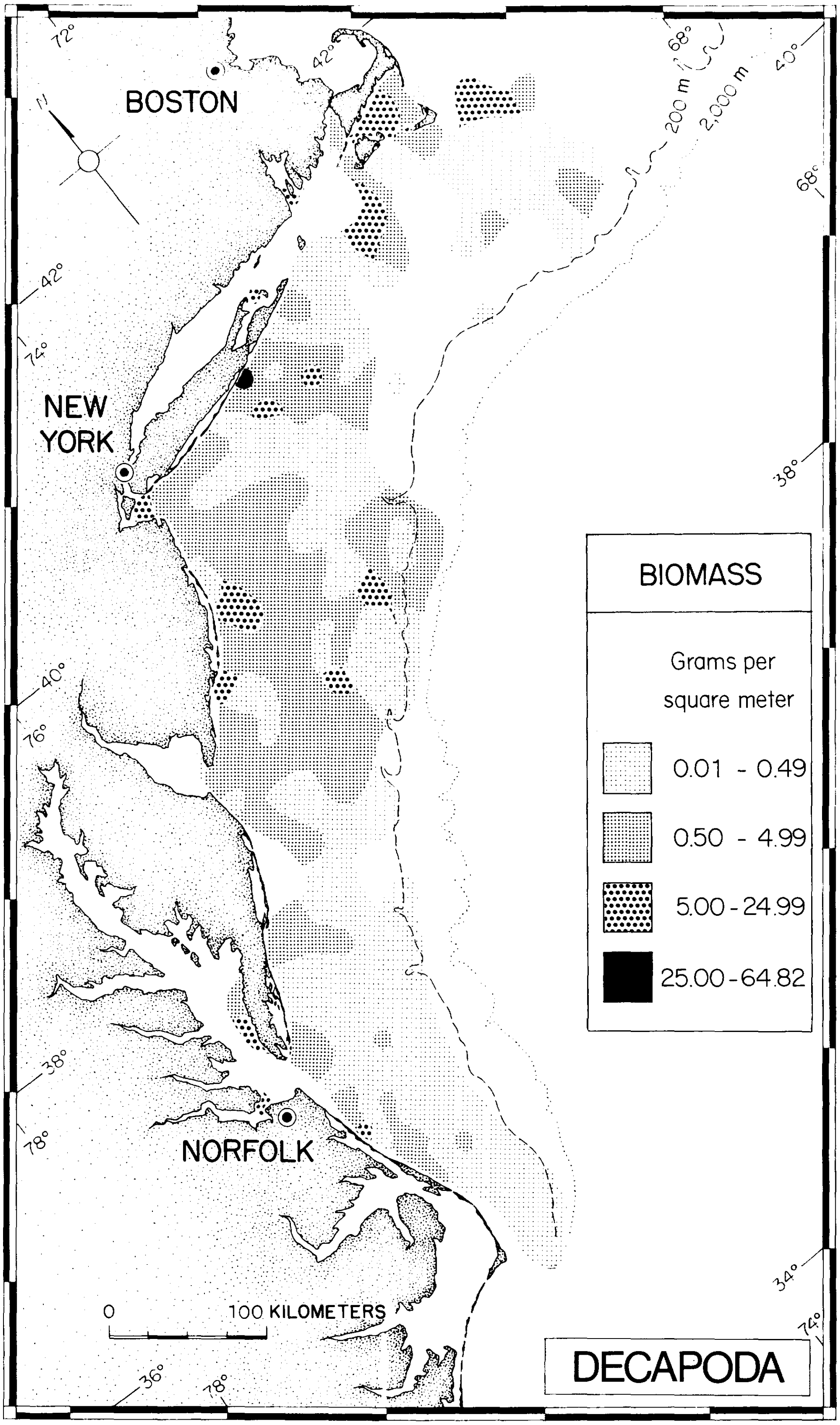

FIGURE 59.—Geographic distribution of the biomass of Decapoda, expressed as damp weight per square meter of bottom area.

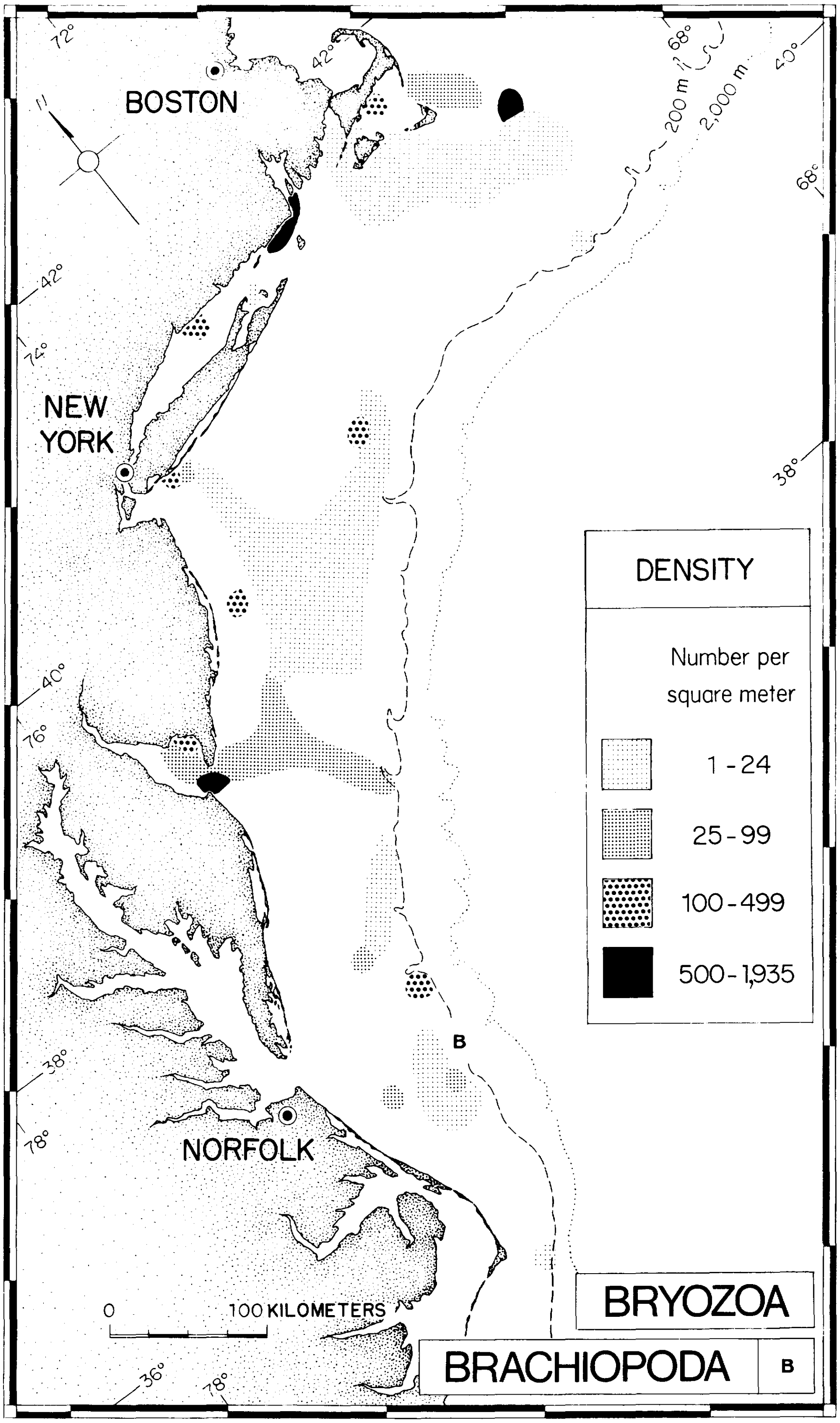

FIGURE 60.—Geographic distribution of the density of Bryozoa and Brachiopoda (*B*), expressed as number of individuals per square meter of bottom area.

higher densities occupied smaller, discrete patches on the periphery. Biomass, similarly, was moderately small (0.01 to 1.0 g/m^2) over most of their range, and larger biomass (1 to 52 g/m^2) was found only in small isolated patches.

Brachiopoda (figs. 60 and 61) were distributed only in a relatively small area on the Outer Continental Shelf northeast of Cape Hatteras and southeast of Norfolk, Va. Densities ranged from 1/m^2 to 99/m^2 and biomass was less than 1 g/m^2.

Echinodermata (figs. 62 and 63) were widely distributed throughout the region. High densities (greater than 200/m^2) and moderately high densities (25/m^2 to 199/m^2) were found on the Outer Continental Shelf in Southern New England, along the inner shelf in New York Bight, and on the central shelf in Chesapeake Bight. Echinoderms were present in low densities (less than 25/m^2) in most of the bays and sounds, over substantial parts of the shelf, and in the deepwater beyond the Continental Shelf. The biomass distribution was somewhat similar to that of density, but considerably more irregular. Large (5 and 99 g/m^2) and very large (100 and 855 g/m^2) biomasses were common over large expanses of the Continental Shelf and in several places on the slope and rise.

Holothuroidea (figs. 64 and 65) were distributed in a broad irregular area centered along the Outer Continental Shelf extending from Cape Code to Chesapeake Bay. Densities over most of this area were relatively low (less than 25/m^2). In a few areas, particularly off southern Massachusetts, the density ranged from 25/m^2 to 201/m^2. Biomass was small to moderately small (0.01 to 5 g/m^2) over most of their range except in two fairly extensive areas on the Outer Continental Shelf, one south of Cade Cod and the other east of Norfolk, Va., where biomasses were between 5 and 664 g/m^2.

Echinoidea (figs. 66 and 67) were found over much of the Continental Shelf throughout the entire region. They were absent in the bays and sounds (with one exception in outer Long Island Sound) and were present on the Continental Slope and Rise only in this northern region. Densities in a little over half their area of occurrence were less than 25/m^2. Along the inner shelf in the northern and central sections and in midshelf in the Chesapeake Bight region, they were present in densities ranging from 25/m^2 to 500/m^2, and, in a few limited areas in the New York-Delaware sector, densities were between 500/m^2 and 2,083/m^2. Echinoids constituted a rather sustantial biomass. In most of their range, their biomass averaged between 0.01 and 25 g/m^2. In roughly 10 percent of their range, biomass averaged between 25 and 100 g/m^2. In roughly 5 percent of their area of occupancy, including a large area on the Outer Continental Shelf off Cape Cod, their biomass ranged from 100 to 855 g/m^2.

Ophiuroidea (figs. 68 and 69) were distributed along the entire length of the Middle Atlantic Bight region, primarily in deep water (100 m or greater), but extending inshore in Southern New England and a few localities farther south. Densities were moderately low (less than 25/m^2) over most of their range. Moderate and high (25/m^2 to 1,018/m^2) concentrations were found in a rather broad band along the Outer Continental Shelf between offshore New York and Cape Cod. The pattern of biomass was somewhat different from that of density. Moderately small biomass (less than 1 g/m^2) was found over roughly one half of its range, and moderate (1 to 25 g/m^2) to high (25 to 77 g/m^2) over extensive patches throughout their area of occupancy.

Asteroidea (figs. 70 and 71) were found over a rather extensive area between Cape Cod and Cape Hatteras. They were more common and their density was highest in the New England region. In most localities, their density ranged from 1/m^2 to 9/m^2. In New England Bight (and at one locality in New York Bight), their density in a rather large area ranged from 10/m^2 to 48/m^2. In the Chesapeake Bight, they were found primarily in deepwater areas extending from the Outer Shelf to the Continental Rise. Biomass of starfish over most of their range averaged between 5 and 50 g/m^2. At a few places in Southern New England-New York Bight, their biomass was between 50 and 210 g/m^2. In the Chesapeake Bight, asteroids were found mainly on the Continental Slope and Rise and constituted a small biomass, commonly less than 0.5 g/m^2.

Hemichordata (figs. 72 and 73) were found at only four localities, three were on the Outer Continental Shelf and Slope south of Rhode Island and one along the coast at Cape May, N.J. Quantities at all localities were very small.

Ascidiacea (figs. 72 and 73) were distributed in rather patchy areas over a large part of the Middle Atlantic Bight region. They were common in the bays and sounds in the northern section and in Chesapeake Bay. In the Southern New England subarea, their density was low (less than 25/m^2) to high (500/m^2 to 2,640/m^2) on the Shelf, and on the slope and rise. In New York Bight, their density was commonly lower than 100/m^2. In Chesapeake Bight, their density was generally low on the Continental Shelf, but ranged from 100/m^2 to 499/m^2 in

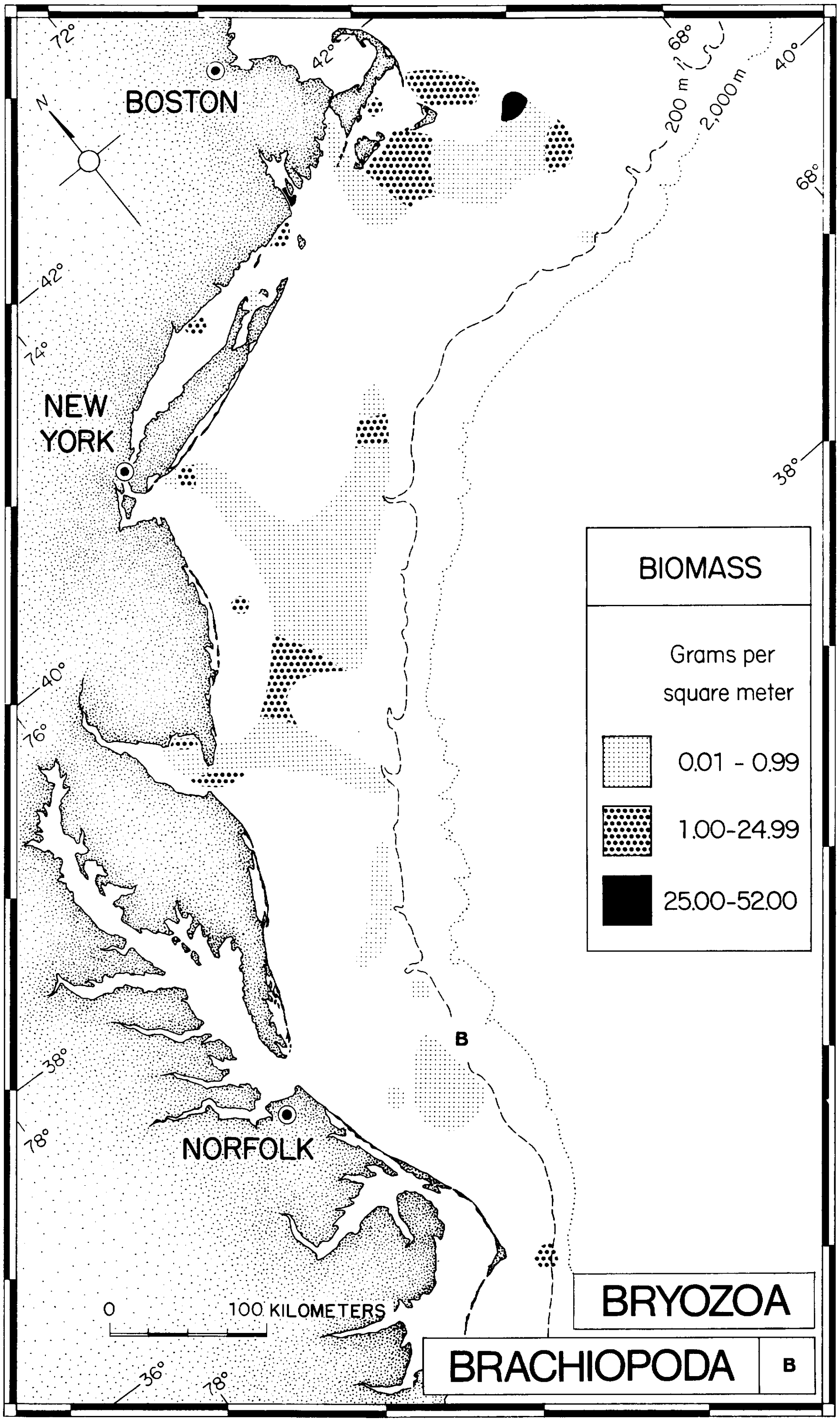

FIGURE 61.—Geographic distribution of the biomass of Bryozoa and Brachiopoda (*B*), expressed as damp weight per square meter of bottom area.

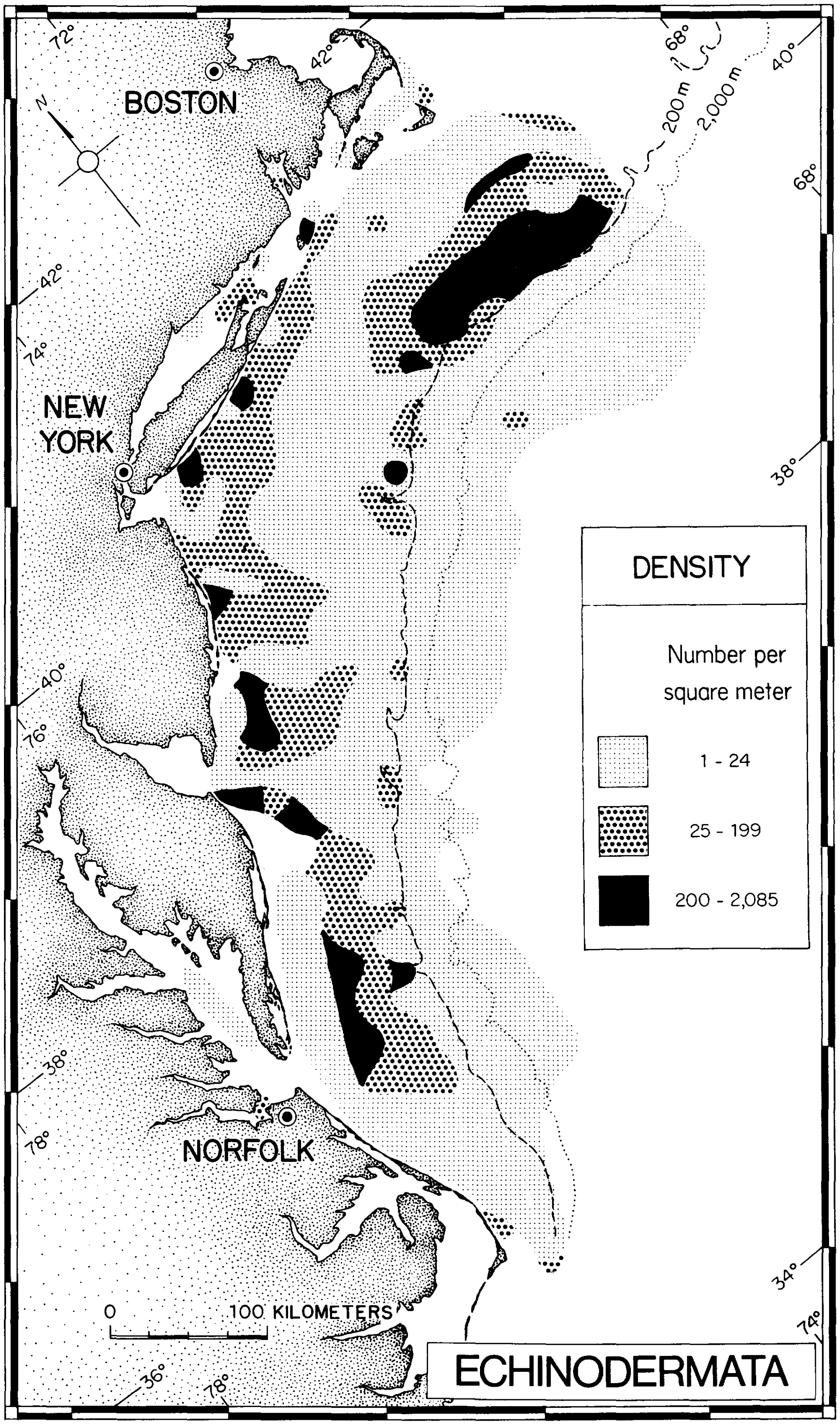

FIGURE 62.—Geographic distribution of the density of Echinodermata, expressed as number of individuals per square meter of bottom area.

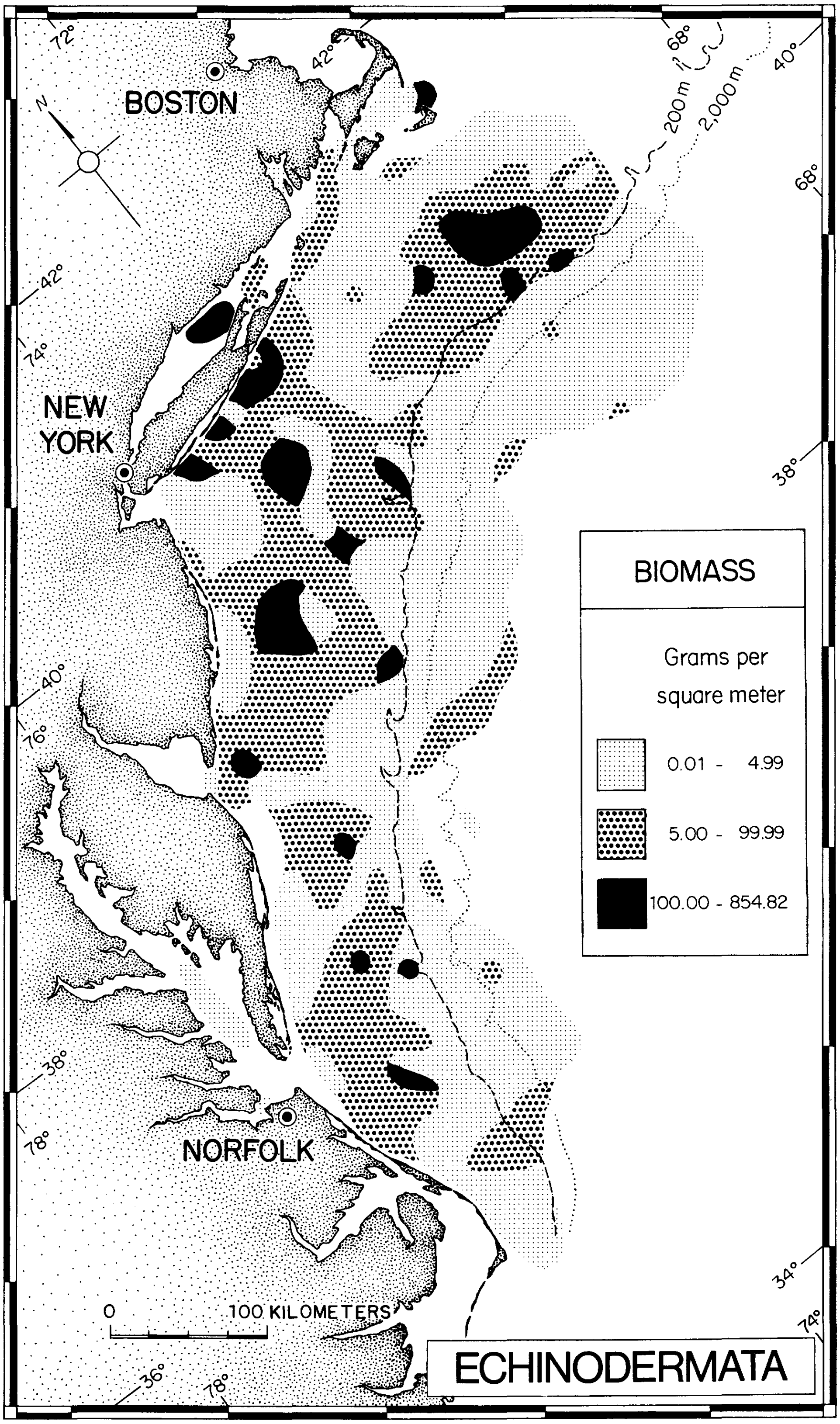

FIGURE 63.—Geographic distribution of the biomass of Echinodermata, expressed as damp weight per square meter of bottom area.

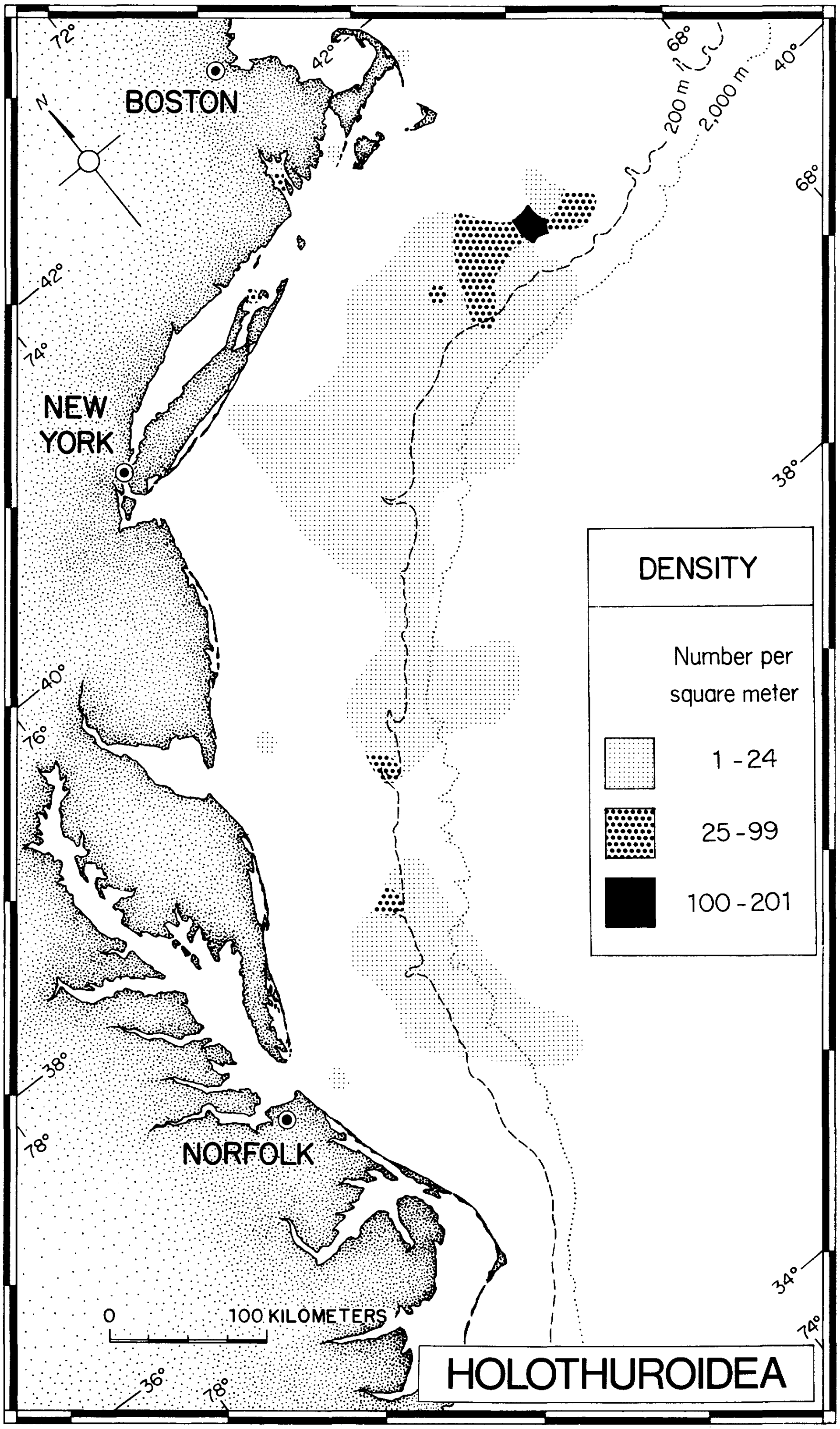

FIGURE 64.—Geographic distribution of the density of Holothuroidea, expressed as number of individuals per square meter of bottom area.

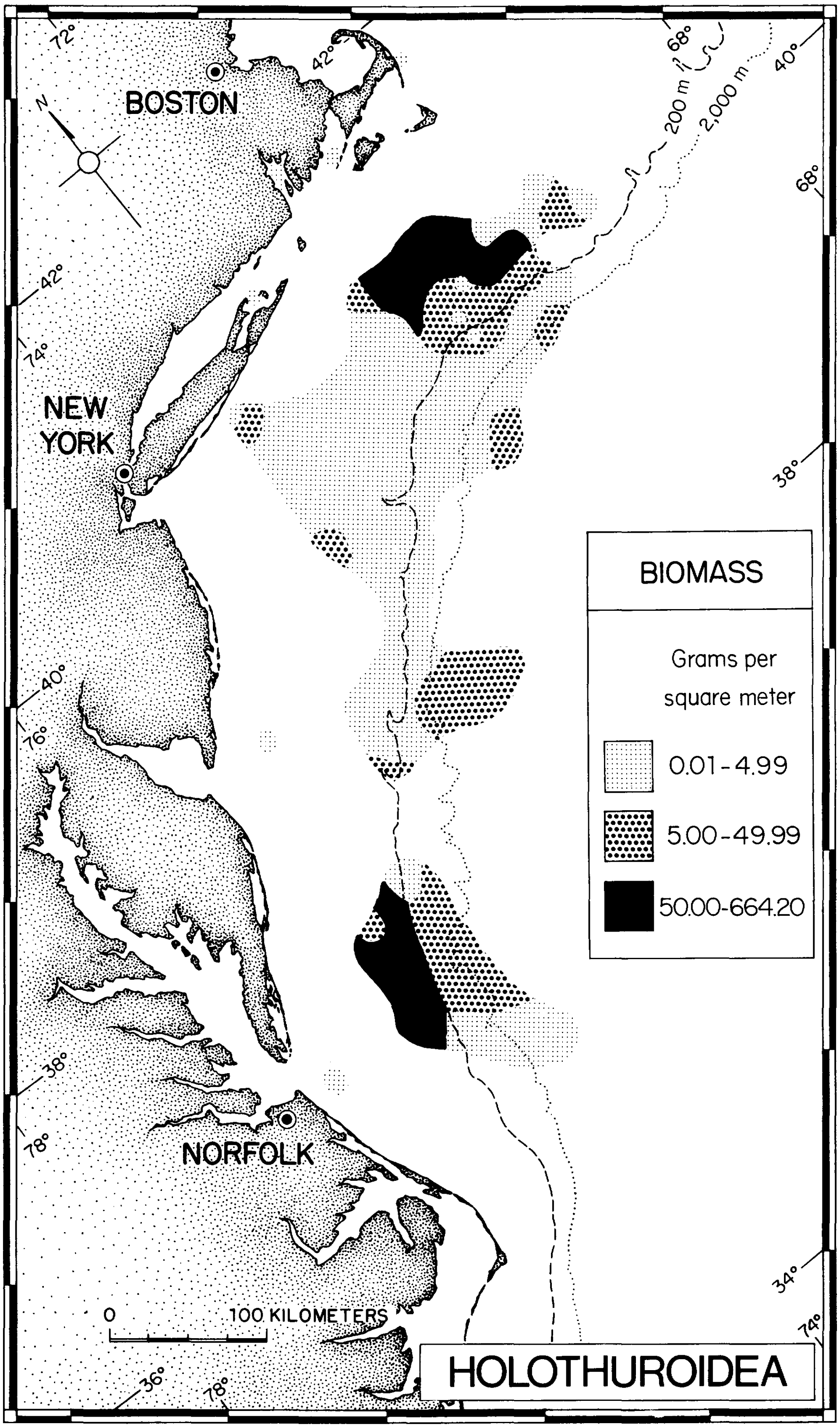

FIGURE 65.—Geographic distribution of the biomass of Holothuroidea, expressed as damp weight per square meter of bottom area.

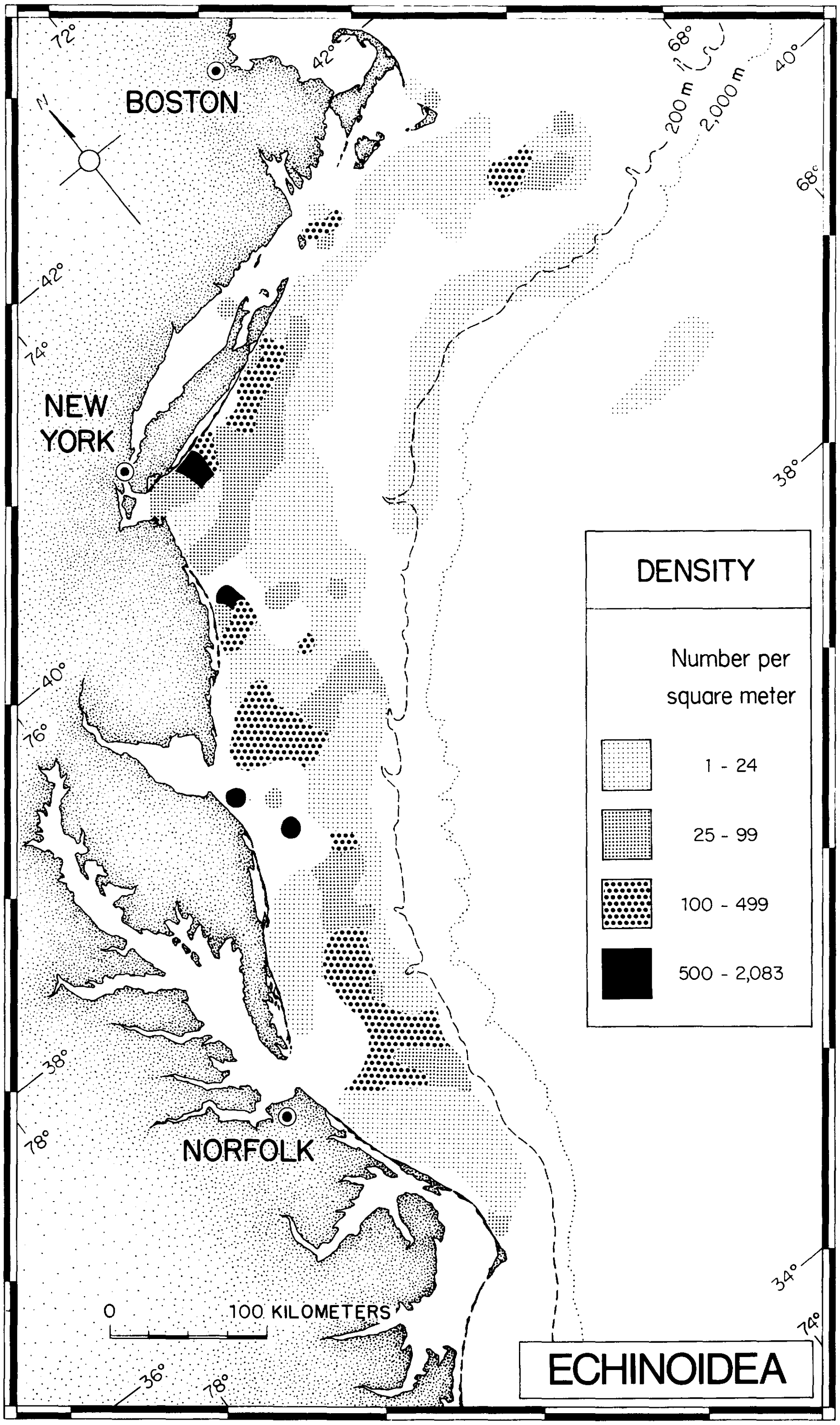

FIGURE 66.—Geographic distribution of the density of Echinoidea, expressed as number of individuals per square meter of bottom area.

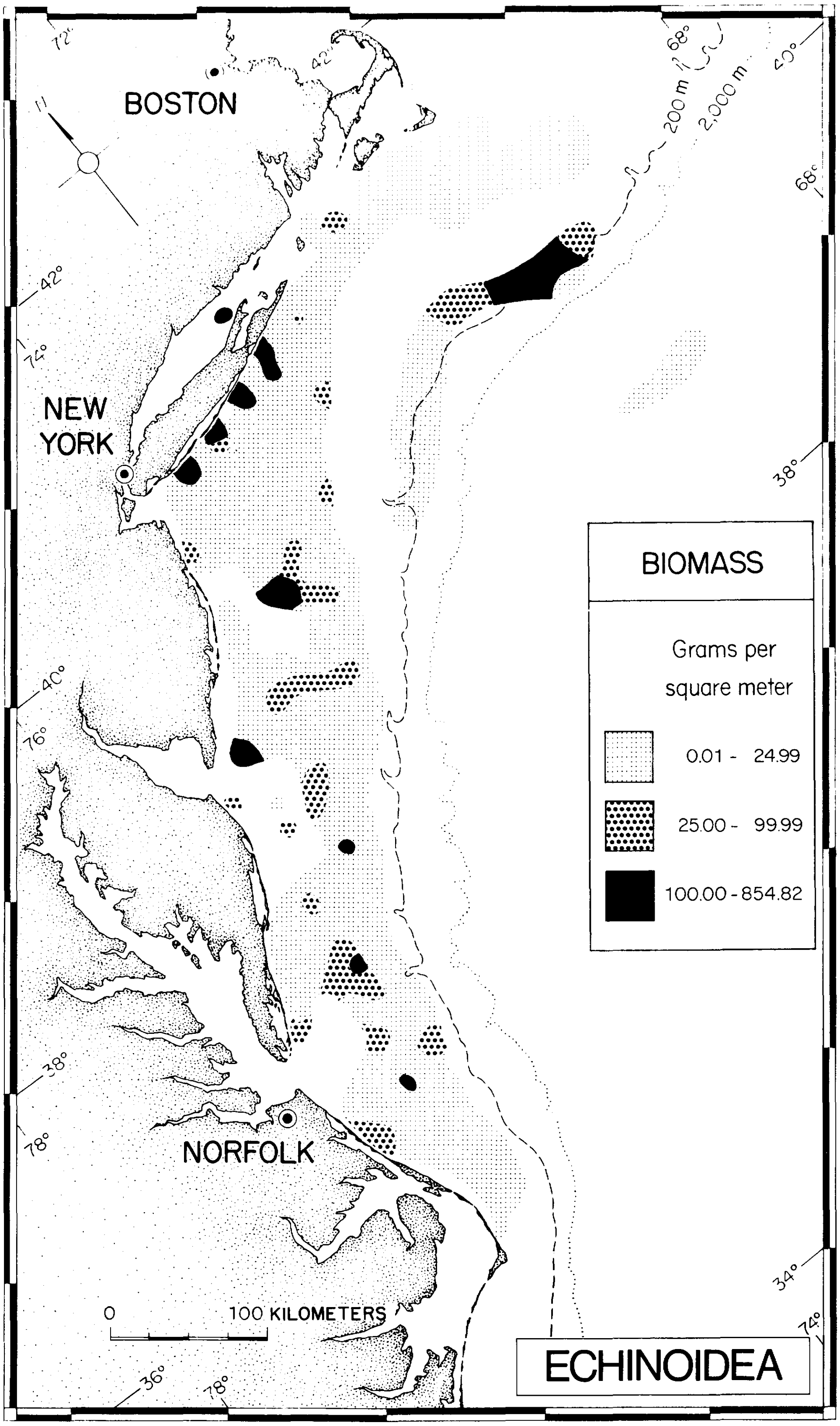

FIGURE 67.—Geographic distribution of the biomass of Echinoidea, expressed as damp weight per square meter of bottom area.

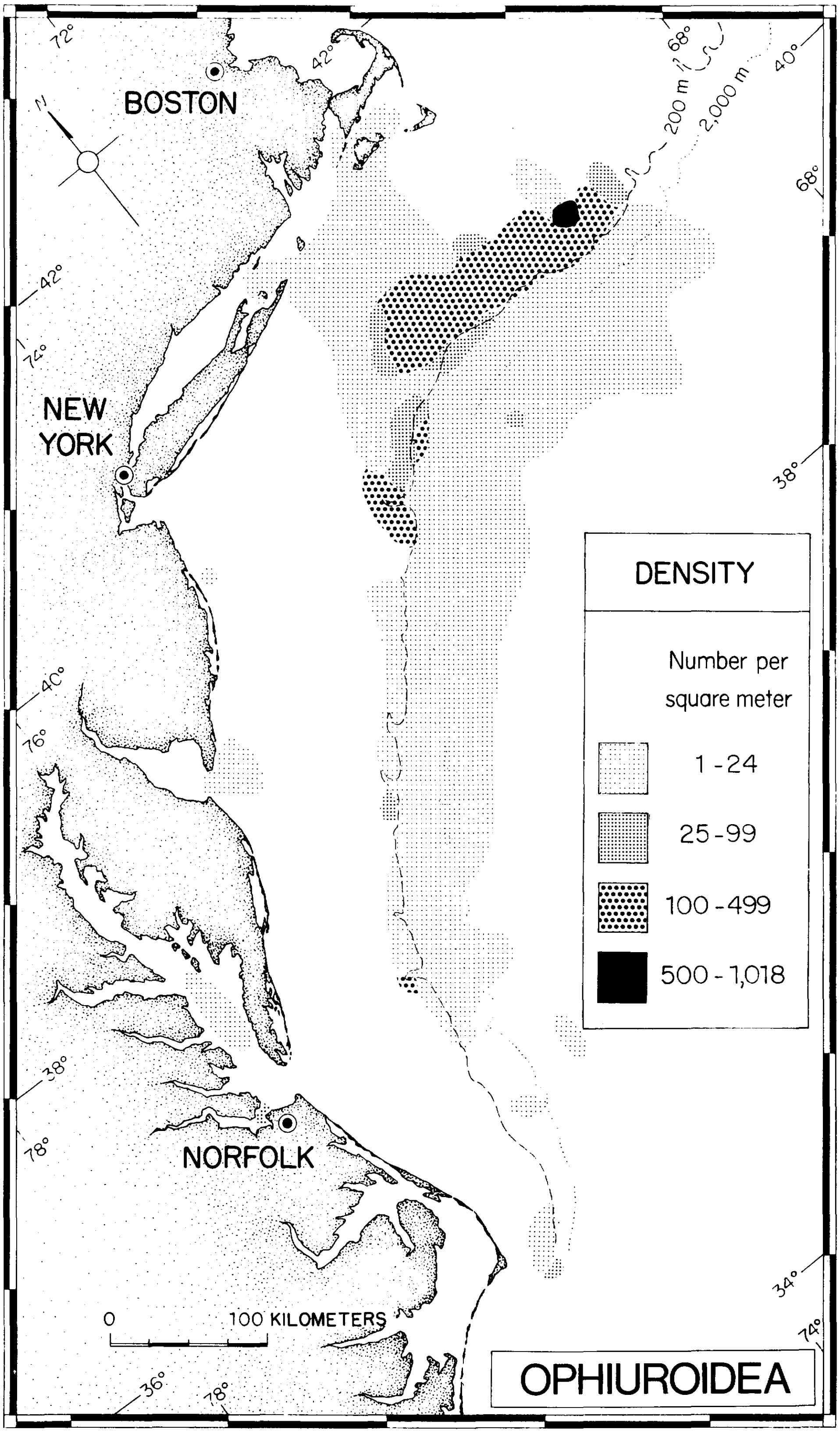

FIGURE 68.—Geographic distribution of the density of Ophiuroidea, expressed as number of individuals per square meter of bottom area.

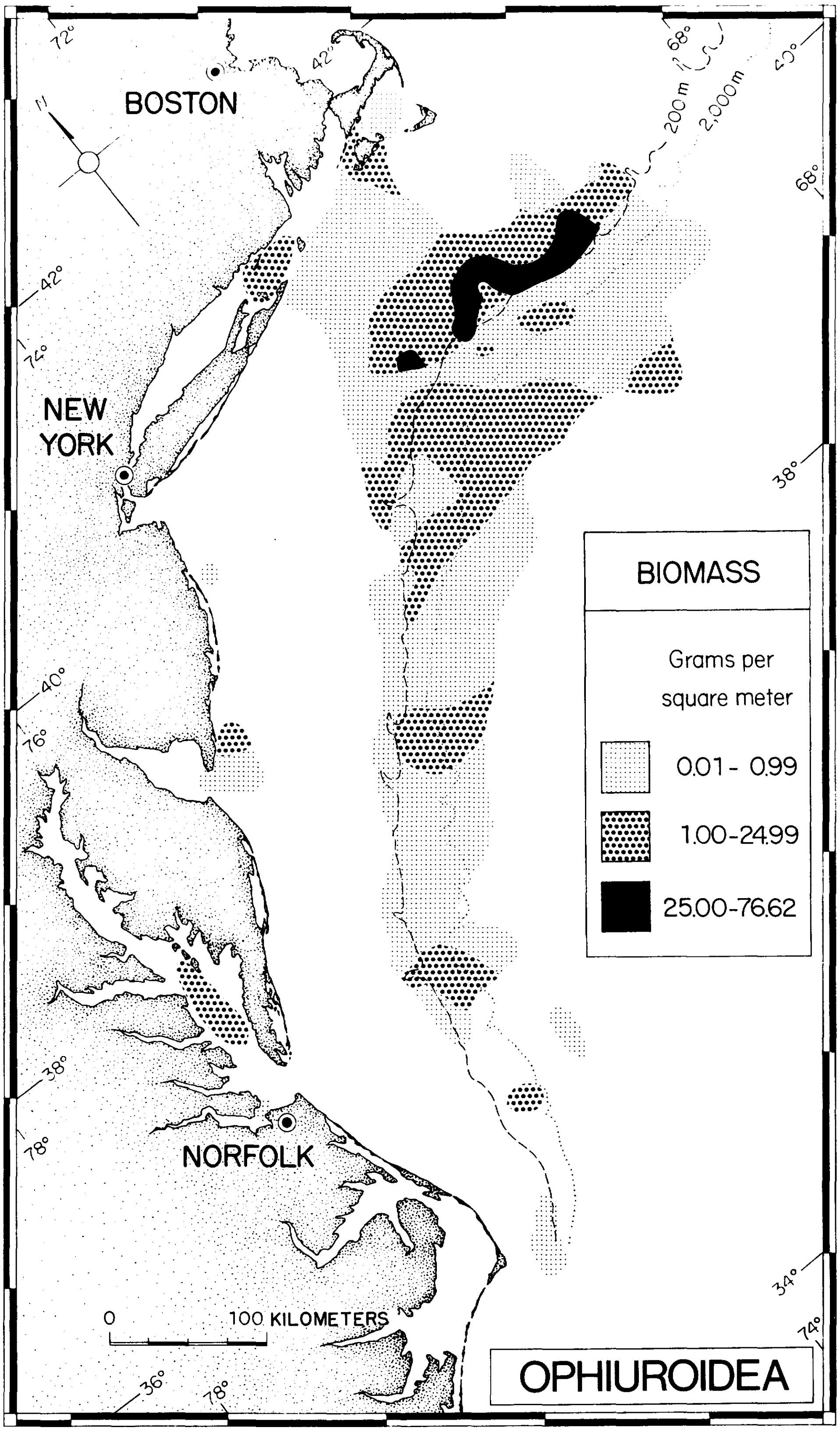

FIGURE 69.—Geographic distribution of the biomass of Ophiuroidea, expressed as damp weight per square meter of bottom area.

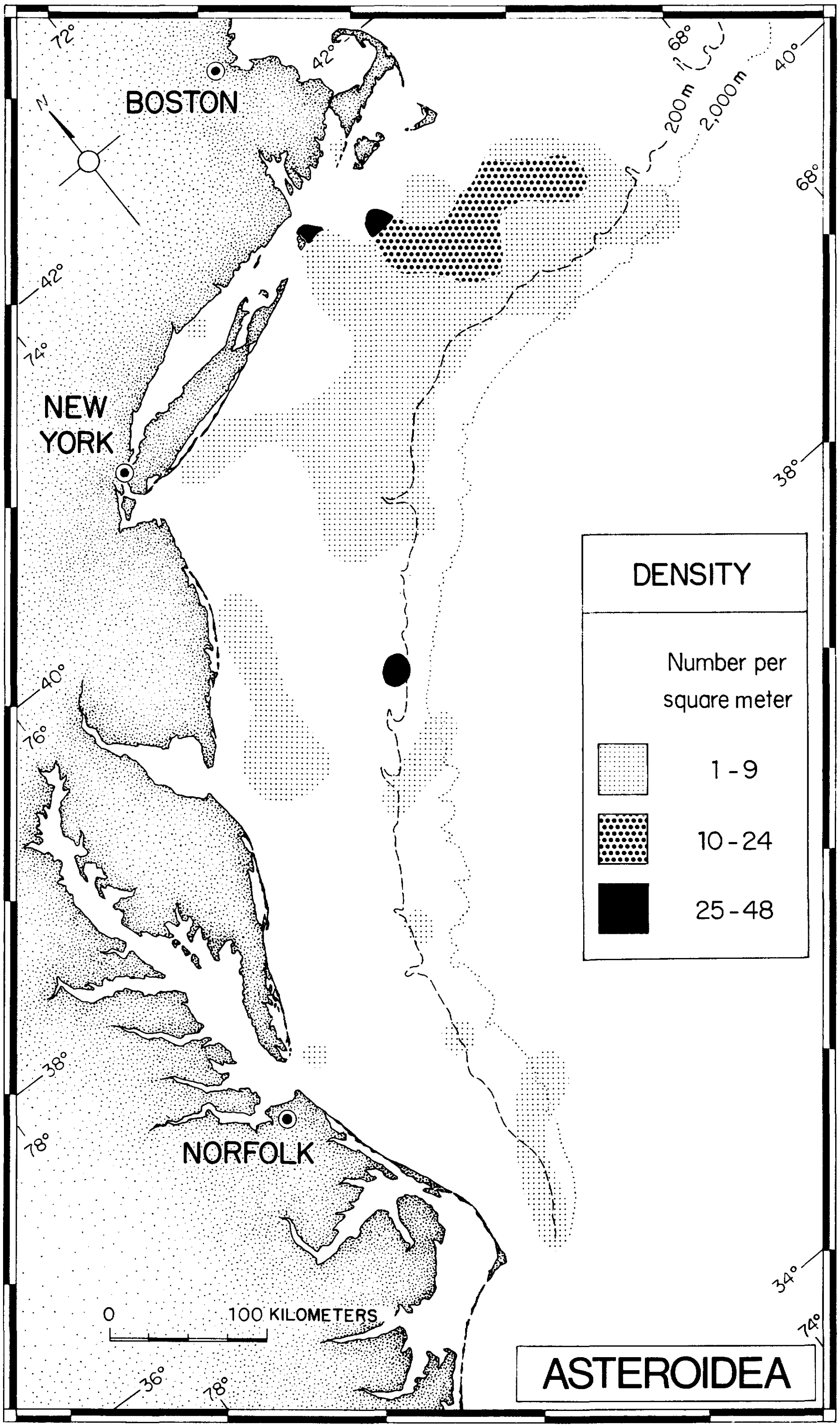

FIGURE 70.—Geographic distribution of the density of Asteroidea, expressed as number of individuals per square meter of bottom area.

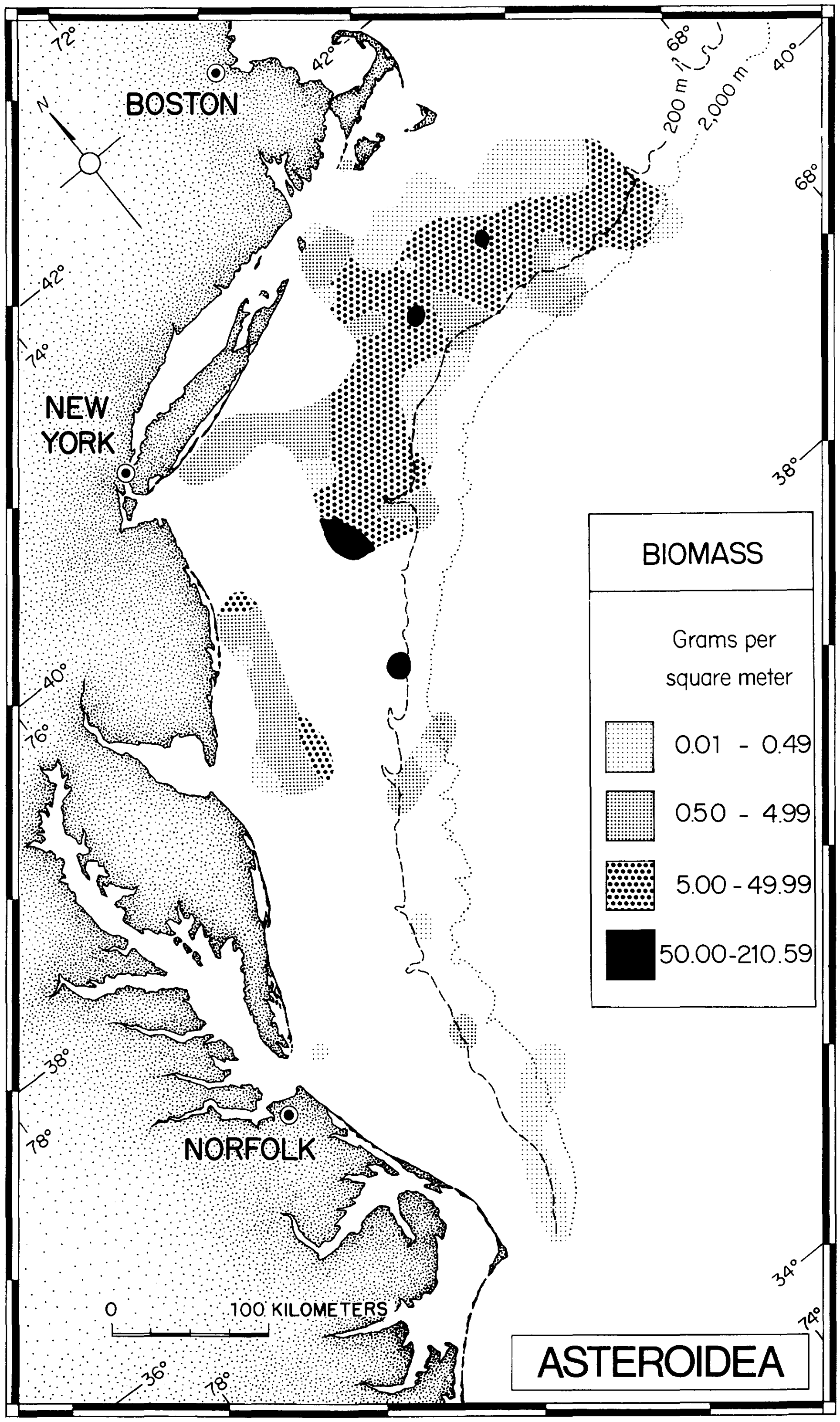

FIGURE 71.—Geographic distribution of the biomass of Asteroidea, expressed as damp weight per square meter of bottom area.

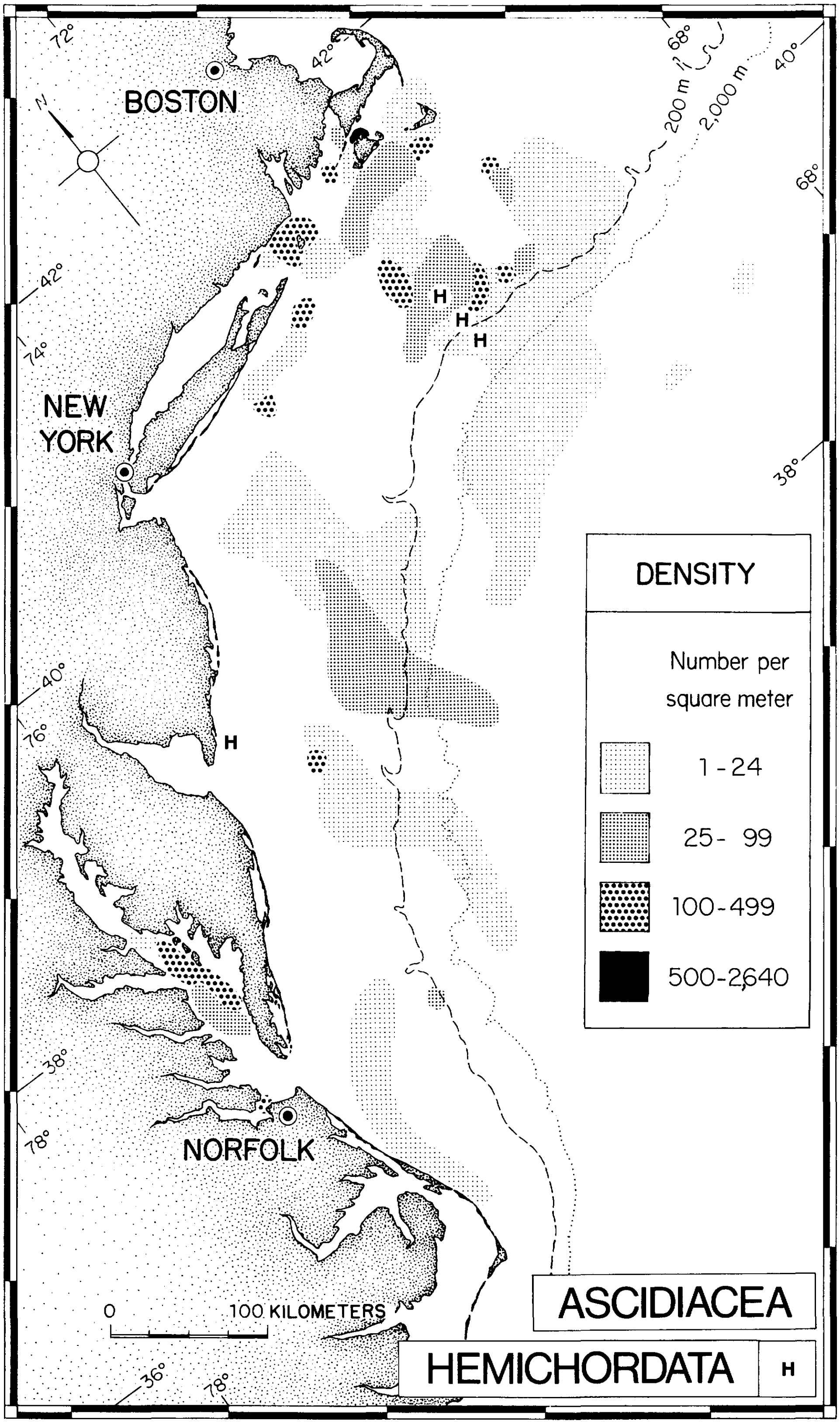

FIGURE 72.—Geographic distribution of the density of Ascidiacea and Hemichordata (*H*), expressed as number of individuals per square meter of bottom area.

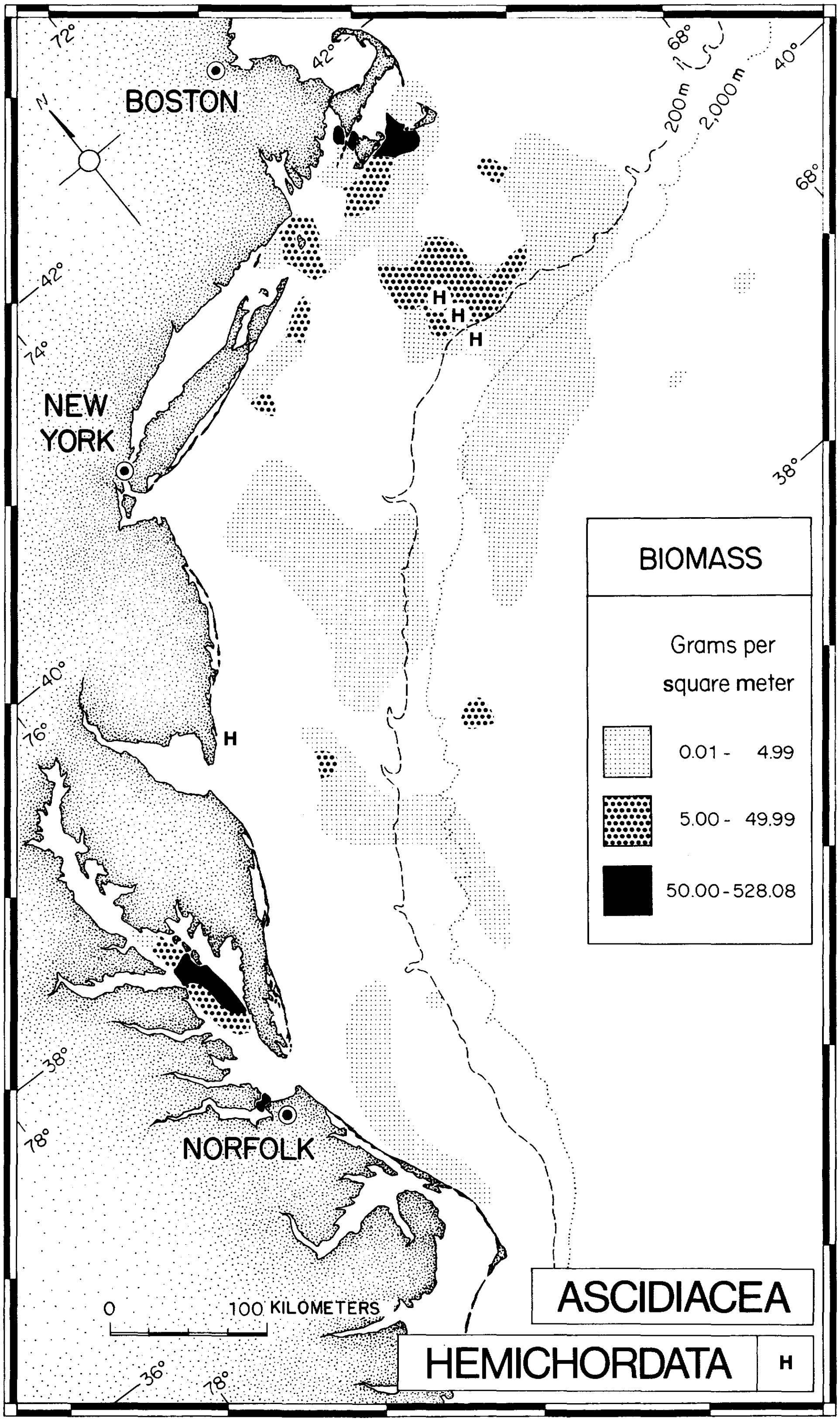

FIGURE 73.—Geographic distribution of the biomass of Ascidiacea and Hemichordata (*H*), expressed as damp weight per square meter of bottom area.

Chesapeake Bay. The pattern of biomass was similar to that for density. Biomass in most areas was less than 5 g/m^2. In substantial areas in Southern New England, and in a few small areas farther south, the biomass averaged between 5 and 528 g/m^2.

SELECTED GENERA AND SPECIES

This section deals with the geographic distribution of 24 selected genera and species of macrobenthic invertebrates. These particular forms were selected because of their common occurrence and a few were selected because of their distinctive distribution. See figures 74–79.

The species and genera illustrated, listed by phylum, are as follows:

PHYLUM ANNELIDA

Sternaspis scutata (Renier) (fig. 74*A*), a moderately small (1 cm), stout, burrowing polychaete of the family Sternaspidae. It commonly inhabits silty sediments.

Scalibregma inflatum (Rathke) (fig. 74*B*), a medium-size (1–5 cm) polychaete of the family Scalibregmidae. This species, which commonly is found in silty sand, is an important food of demersal fish.

Hyalinoecia tubicola (Müller) (fig. 74*C*), a large (10–25 cm), tube-dwelling polychaete of the family Onuphidae. This is an active, epibenthic species that is characteristic of deep water.

PHYLUM POGONOPHORA

Siboglinum ekmani (Jagerston) (fig. 74*D*), a small (5 cm), slender pogonophoran of the family Siboglinidae. This is a tube-dwelling species characteristic of a deepwater environment.

PHYLUM MOLLUSCA

Arctica islandica (Linnaeus) (fig. 75*A*), a rather large (8–15 cm), bivalve of the family Arcticidae. This is a slow-growing Continental Shelf species that is very abundant in some localities. It usually inhabits silty sand sediments.

Cerastoderma pinnulatum (Conrad) (fig. 75*B*), a moderately small (1 cm), bivalve of the family Cardiidae. This small cockle has been taken in a wide variety of bottom sediments.

Thyasira spp. (fig. 75*C*), represented in our samples by five species of small (less than 1 cm), bivalves of the family Thyasiridae. The species represented are: *ferruginosa, flexuosa, ovate, pygmaea,* and *trisinuata.* These bivalves are most commonly found in offshore waters and in fine-grained bottom sediments.

Cyclocardia borealis (Conrad) (fig. 75*D*), a medium-size (3–5 cm), bivalve of the family Carditidae. Although it is more common in boreal waters, our samples showed it had a broad distribution in the Middle Atlantic Bight region.

Lucinoma blakeana (Stimpson) (fig. 76*A*), a moderately large (5–7 cm), bivalve of the family Lucinidae. This thin-shelled species is most common in the Outer Continental Shelf waters.

Ensis directus (Conrad) (fig. 76*B*), a large (10–17 cm), bivalve of the family Solenidae. This is a very active, sand-dwelling species that inhabits shallow inshore waters as well as the Offshore Continental Shelf.

Polinices spp. (fig. 76*C*), represented in our samples by two species, *P. duplicatus* and *P. immaculatus.* These species of carnivorous gastropods, family Naticidae, are typically found on sandy sediments.

Alvania spp. (fig. 76*D*), represented in our samples by at least two species, *A. brychia* and *A. carinata.* These small (less than 5 mm) gastropods, family Rissoidae, are usually associated with silt-clay bottom sediments.

PHYLUM ARTHROPODA

Ampelisca spp. (fig. 77*A*), this genus of gammaridean amphipods is represented in our samples by six species: *abdita, aequicornis, agassizi, macrocephala, vadorum,* and *verrilli.* They are medium-size (4–7 mm), to moderately large (20 mm), tube-dwelling species. This is a common genus and representatives are distributed in inshore and offshore waters; very abundant in some localities.

Leptocheirus pinguis (Stimpson) (fig. 77*B*), a moderately large (10–17 mm), gammaridean amphipod, family Aoridae, that is typical in Continental Shelf sand and silty-sand habitats. This species is a very important food of demersal fish.

Phoxocephalus holbolli (Kröyer) (fig. 77*C*), a moderately small (5–7 mm), member of the family Phoxocephalidae. This species characteristically inhabits bottom sediments composed of fine sand.

Trichophoxus epistomus (Shoemaker) (fig. 77*D*), a medium-size (6–8 mm), burrowing amphipod of the family Phoxocephalidae. It is a widely distributed species that inhabits sand and silty-sand sediments.

Cirolana spp. (fig. 78*A*), a medium-size (1–2 cm), member of the Isopoda, family Cirolanidae. It is represented chiefly by *C. polita* (Stimpson), but at least one additional species is included. This is a

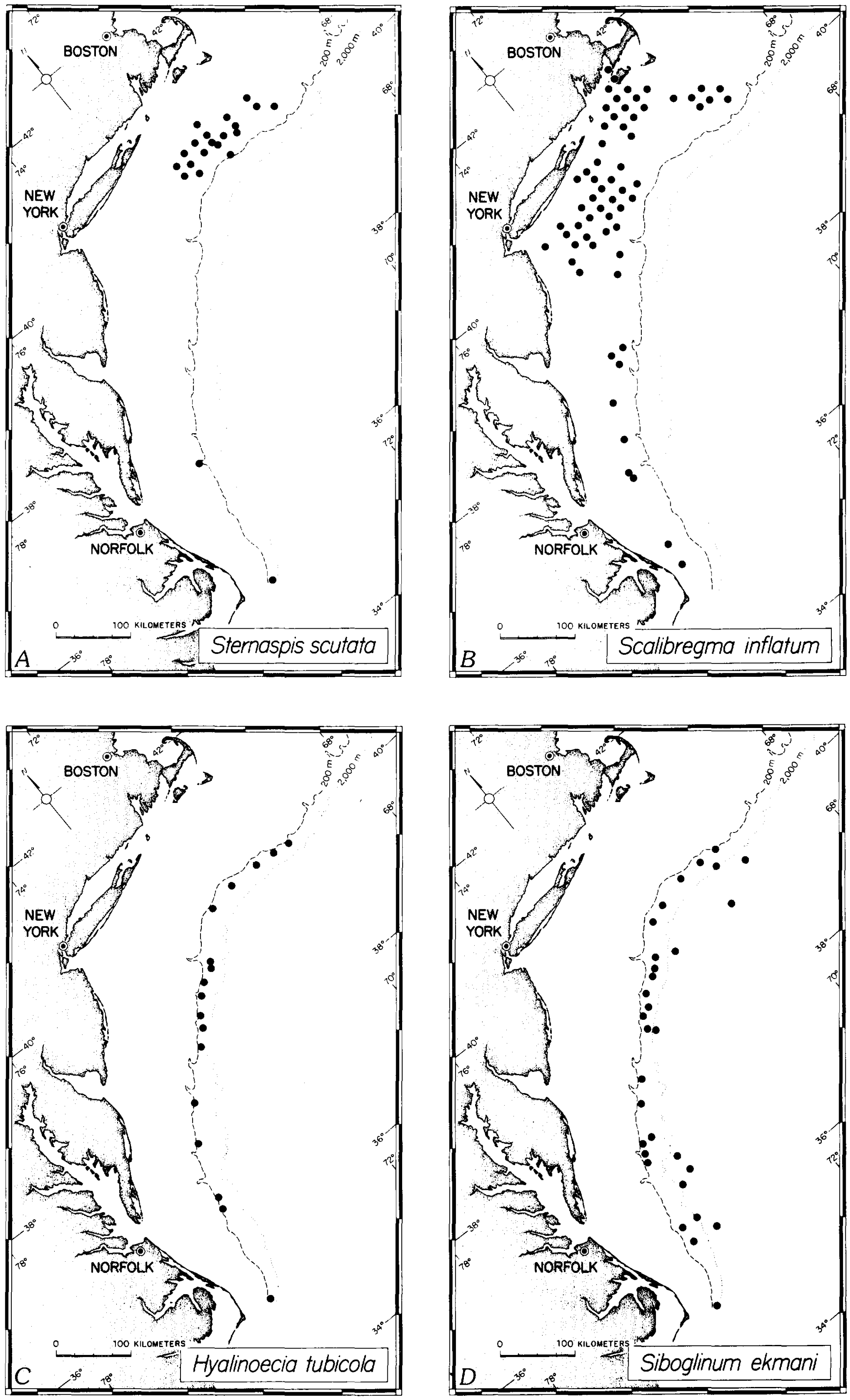

FIGURE 74.—Geographic distribution (indicated by dots) of three selected species of Annelida (*A-C*) and one Pogonophora (*D*).

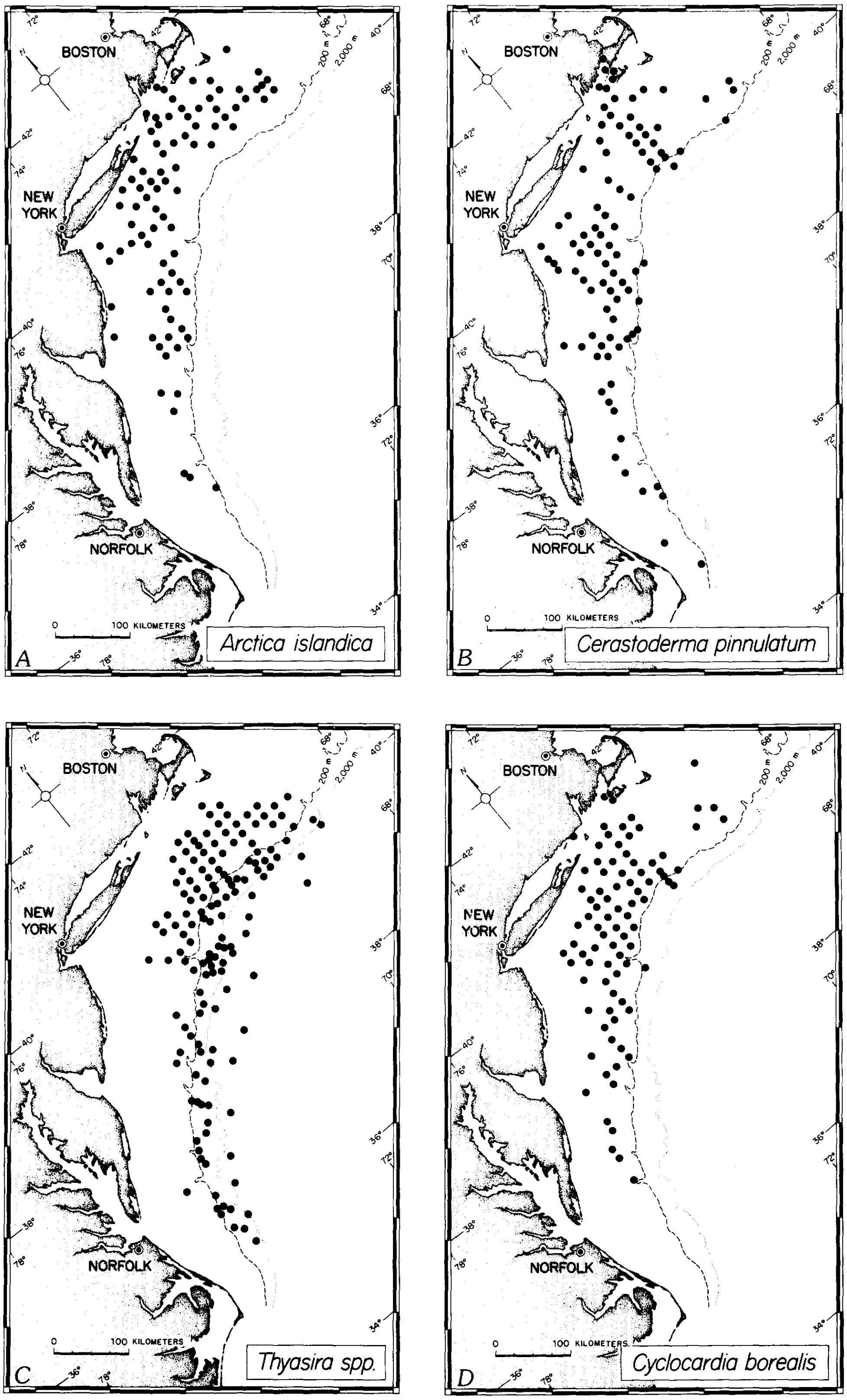

FIGURE 75.—Geographic distribution (indicated by dots) of selected bivalves, phylum Mollusca.

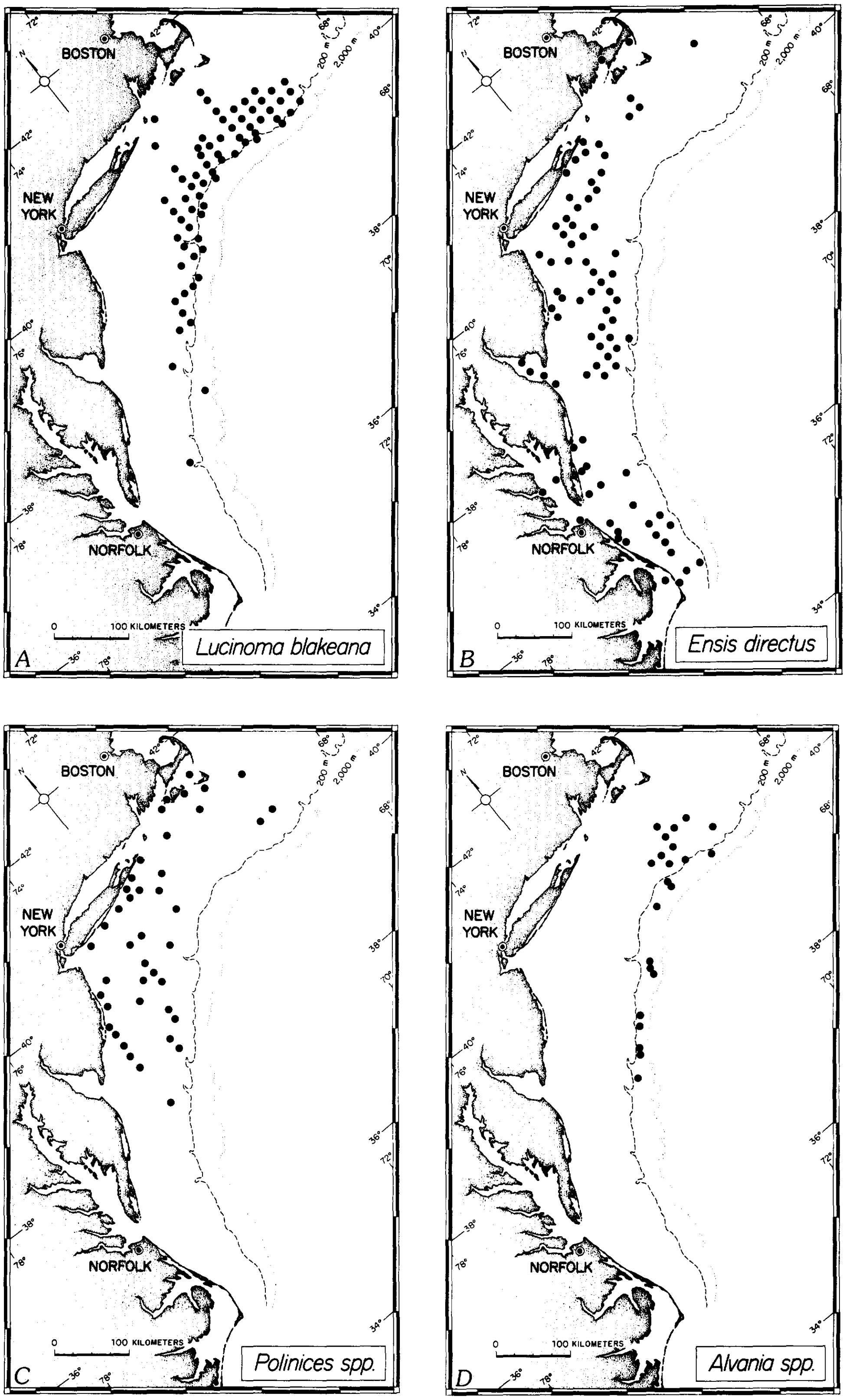

FIGURE 76.—Geographic distribution (indicated by dots) of selected bivalves (*A*, *B*) and gastropods (*C*, *D*), phylum Mollusca.

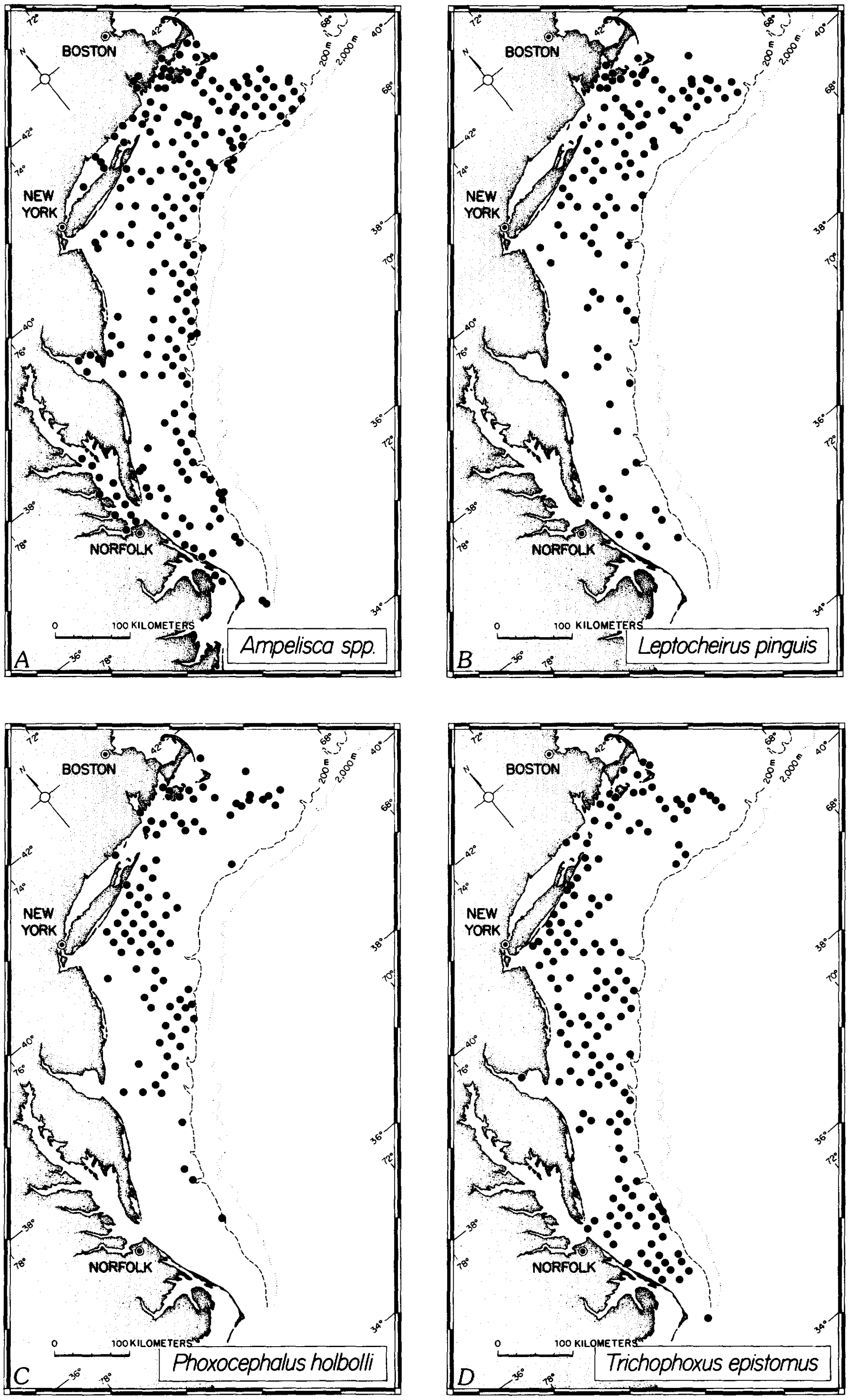

FIGURE 77.—Geographic distribution (indicated by dots) of selected amphipods, phylum Arthropoda.

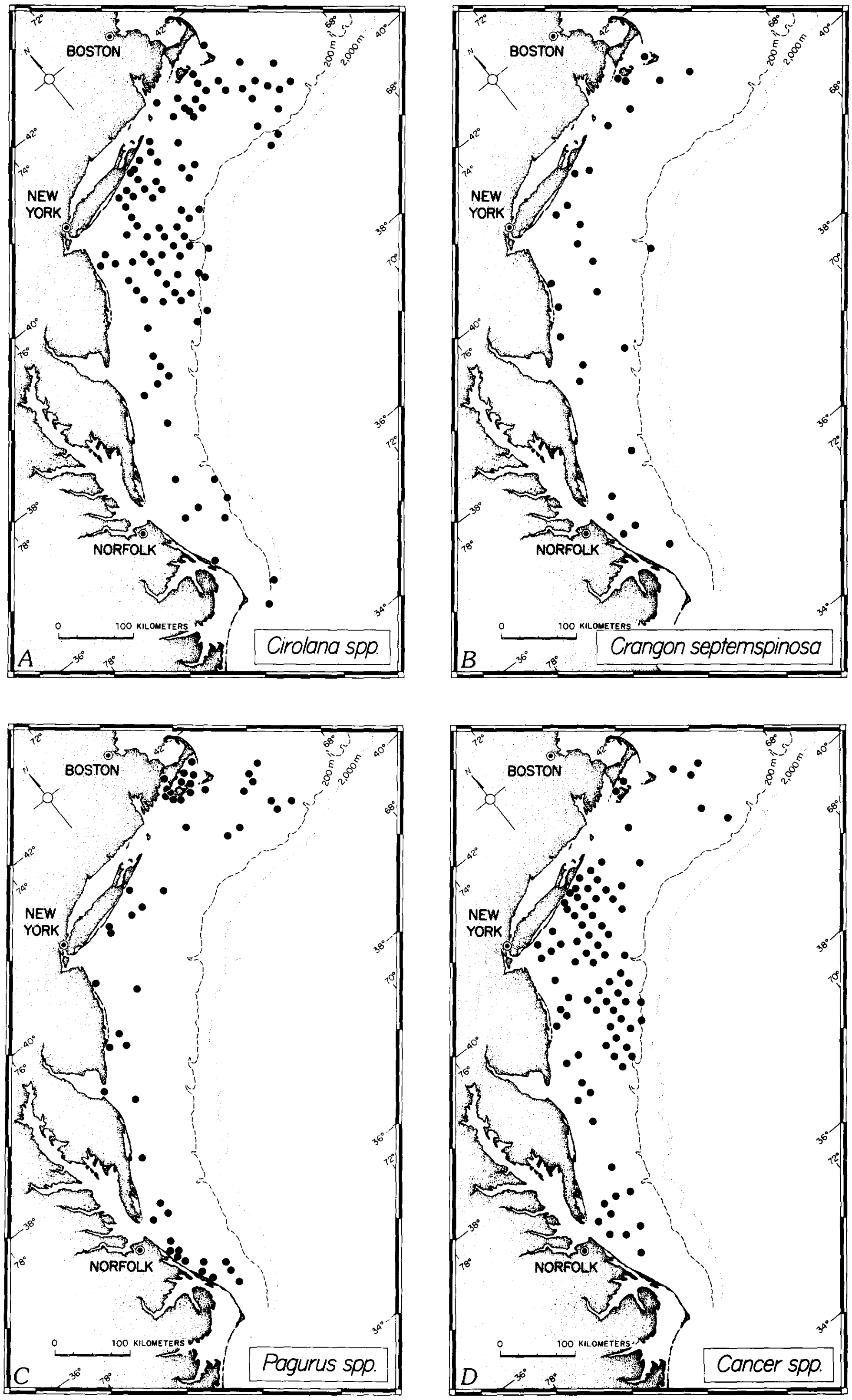

FIGURE 78.—Geographic distribution (indicated by dots) of a selected isopod (*A*) and decapods (*B*, *C*, *D*), phylum Arthropoda.

common and widely distributed genus in the Middle Atlantic Bight region.

Crangon setemspinosa (Say) (fig. 78*B*), a moderately small (5–8 cm), caridean shrimp, order Decapoda. Typically, it inhabits sandy sediments, and is distributed throughout the region in both inshore waters and much of the Continental Shelf.

Pagurus spp. (fig. 78*C*), medium-size (5–10 cm), members of the order Decapoda, family Paguridae. They are represented in our samples by three species: *P. acadianus, P. arcuatus,* and *P. pubescens.* The most common and broadly distributed species is *acadianus.*

Cancer spp. (fig. 78*D*), a rather large (5–15 cm), heavy-shelled brachyuran crab, order Decapoda, family Cancridae. This genus was represented by two species: *C. borealis* and *C. irroratus.* Both species inhabit a variety of bottom sediments and are found throughout the Middle Atlantic Bight region.

PHYLUM ECHINODERMATA

Echinarachnius parma (Lamarck) (fig. 79*A*), a moderately large (5–8 cm), member of the class Echinoidea, family Scutellidae. This is a very common species and is characteristic of sandy bottom sediments.

Echinocardium cordatum (Pennant) (fig. 79*B*), a rather large (5–10 cm), member of the class Echinoidea, family Spatangidae. This is a burrowing species that usually inhabits sand sediments in moderately shallow water. It is found only in the southern part of the region.

Astropecten spp. (fig. 79*C*), moderately small (8–12 cm), members of the subclass Asteroidea, family Astropectinidae. This genus is represented by two species: *A. americanus* (Verrill), and *A. articulatus* (Say). These are carnivorous, burrowing species that are common in silty-sand bottom sediments on the Outer Continental Shelf.

Amphilimna olivacea (Lyman) (fig. 79*D*), a long-armed species of moderate size (10 mm disc), that belongs to the subclass Ophiuroidea, family Ophiocanthidae. It is a moderately deepwater inhabitant, which we found only in the northern sector of the region along the Outer Continental Shelf and upper slope.

BATHYMETRIC DISTRIBUTION

TOTAL MACROBENTHIC FAUNA OF ALL TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

A pronounced decrease in total macrobenthos (that is, a summation of all taxonomic categories) was associated with an increase in water depth from the shallowest to deepest water depth classes. This relationship applied to both the number of individuals and the biomass. Consistent trends of decreasing quantities, as the depth increased within all three subareas, revealed the general nature and widespread occurrence of this relationship (figs. 80 and 81). (See table 8.)

TABLE 8.—*Number of samples within each depth range class in each subarea and for the entire Middle Atlantic Bight region*

Depth range (m)	Subarea: Southern New England	New York Bight	Chesapeake Bight	Entire region
0–24	35	46	84	165
25–49	27	48	48	123
50–99	56	47	15	118
100–199	19	9	6	34
200–499	14	8	6	28
500–999	8	7	10	25
1,000–1,999	11	10	13	24
2,000–3,080	16	12	8	36
Total	186	187	190	563

Number of individuals.—The density of macrobenthic invertebrates was highest (averaged 2,079/m^2) in the shallowest depth class, 0–24 m, and decreased to 46/m^2 in deep water (2,000–3,999 m), a 98 percent reduction. Table 9 lists the mean number of individuals and biomass for each

TABLE 9.—*Mean number of individuals and biomass of the macrobenthic invertebrate fauna in relation to water depth for each subarea and for the entire Middle Atlantic Bight region*

Water depth (meters, to nearest in.)	Mean number of individuals per square meter: SNE	NYB	CHB	Entire area	Mean biomass in grams per square meter: SNE	NYB	CHB	Entire area
0–24	2,426	2,430	1,742	2,079	404	804	114	368
25–49	3,090	752	722	1,254	343	123	102	163
50–99	2,988	1,390	795	2,073	237	166	80	189
100–199	934	442	969	810	89	36	109	79
200–499	468	255	350	382	34	17	28	28
500–999	251	206	387	293	17	7	11	12
1,000–1,999	75	66	75	72	5	5	11	7
2,000–3,080	48	47	40	46	8	7	10	8

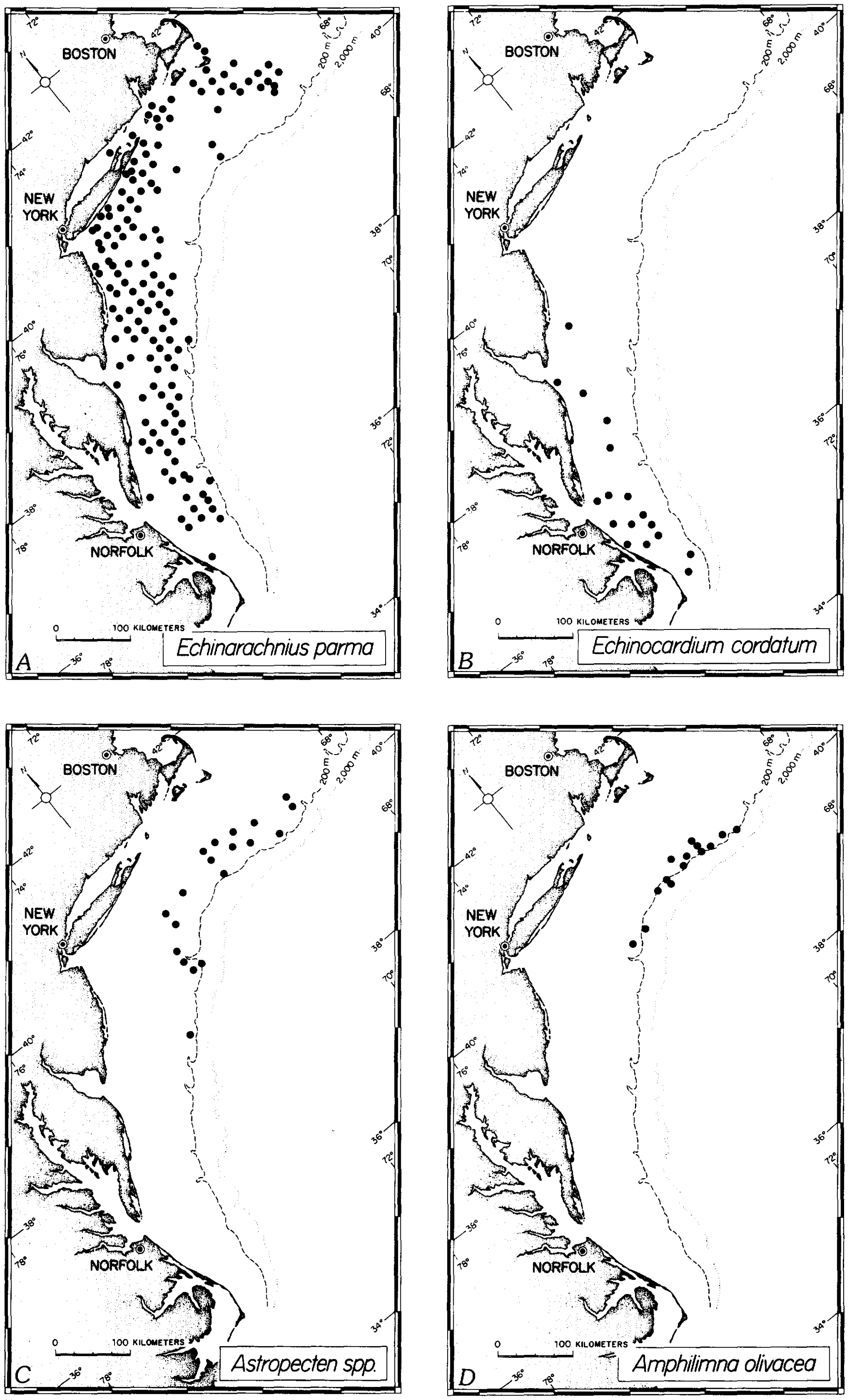

Figure 79.—Geographic distribution (indicated by dots) of selected echinoids (*A*, *B*), asteroids (*C*), and ophiuroids (*D*), phylum Echinodermata.

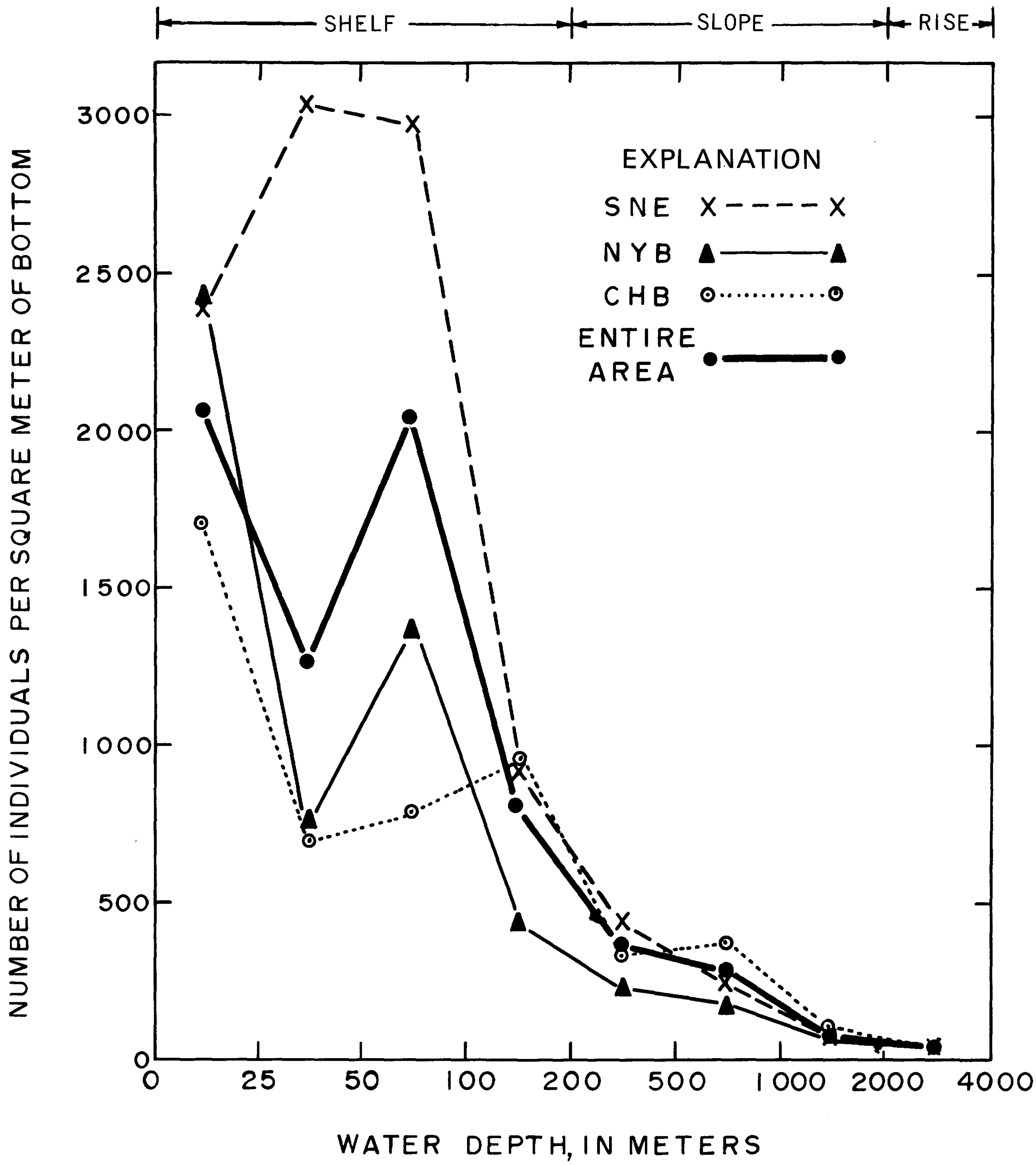

FIGURE 80.—Relationship between number of individuals and water depth. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight region. Abbreviations: SNE, Southern New England; NYB, New York Bight; CHB, Chesapeake Bight.

of eight water-depth classes for the entire Middle Atlantic Bight region (columns 5 and 9), and for each subarea. Density decreased substantially, although somewhat irregularly, as the depth increased on the Continental Shelf. At midshelf, the average density ranged from 1,254/m^2 to 2,073/m^2, and along the outer shelf it dropped to 810/m^2. Density of organisms declined further on the Continental Slope. Along the upper slope, the faunal density averaged 382/m^2, at midslope 293/m^2, and on the lower slope 72/m^2. The decline continued onto the Continental Rise, where macrobenthic organisms

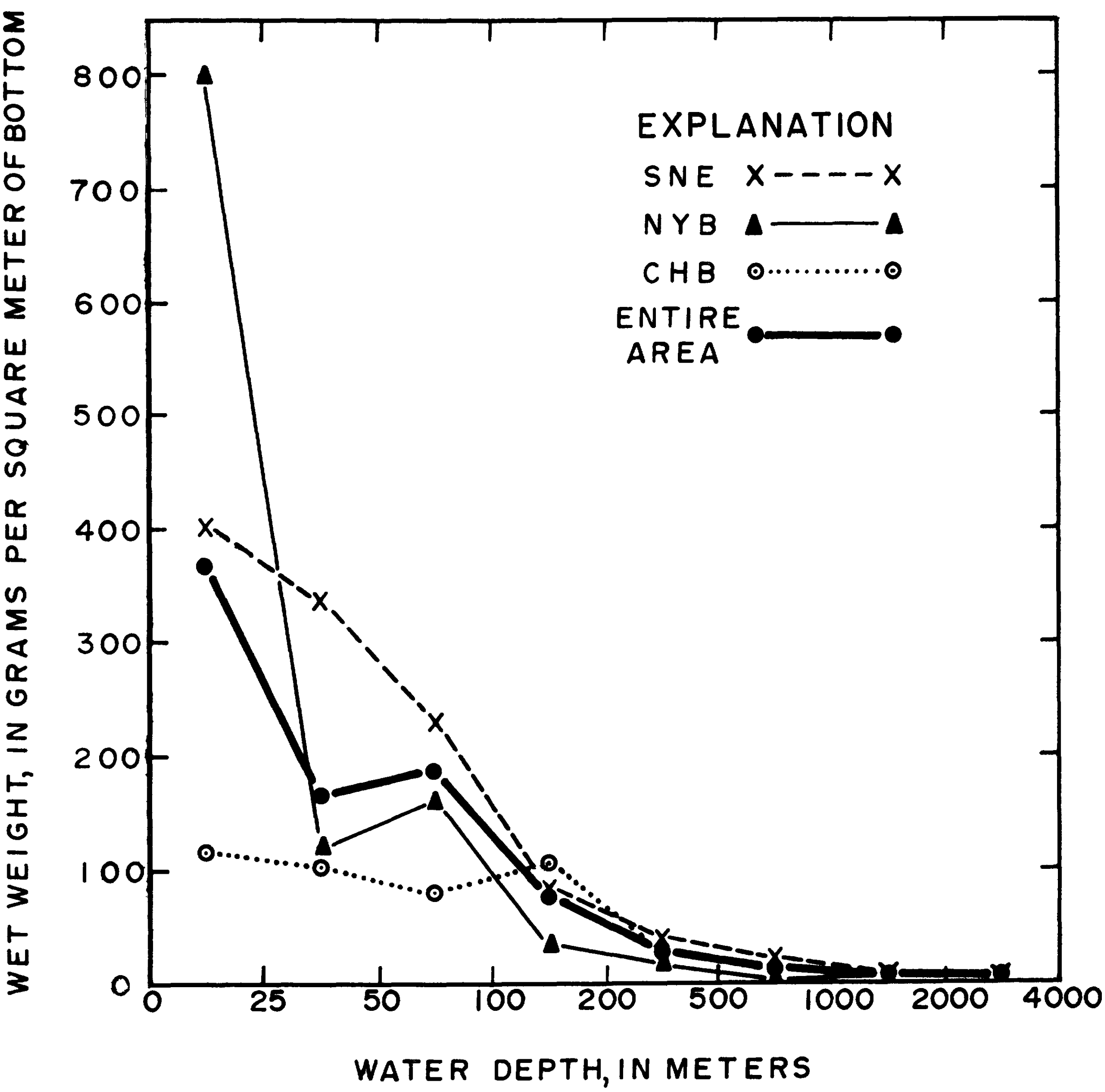

FIGURE 81.—Relationship between biomass (wet weight) and water depth. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight region. Abbreviations: SNE, Southern New England; NYB, New York Bight; CHB, Chesapeake Bight.

averaged only 46/m^2. Although there were regional variations in density, which are described below, the trend in density with respect to water depth was clear. Density was highest in the most shallow water and varied inversely with water depth.

The rate of change in density as related to bathymetric changes is not readily perceived from the values listed in table 9. Therefore, another tabulation (table 10) was constructed in which the rate of change in density—expressed as the increase or decrease in number of individuals per square meter of bottom, per meter increase in water depth—was calculated and listed. The rate changes in density per unit change in water depth were greatest on the Continental Shelf. A decrease of 33 individuals per meter increase in water depth occurred in inner-shelf waters, from 0–24 m to 24–49 m. At midshelf depths, the rate of change was spurious, and reversed to an increase of 22 individuals per meter. Modest rate changes (about −17 individuals per meter) in density were found in the Outer Continental Shelf region. Only small changes from (−0.2 to −0.3

TABLE 10.—*Change and rate of change in density of invertebrates in relation to water depth*

Water depth			Number of individuals	Change in number of individuals	Rate change in number of individuals
Range	Mean	Change			
m	m	m	No./m^2	No./m^2	No./m^2/m
0-24	12.5	-	2,078.66	-	-
25-49	37.5	25	1,253.64	-825.02	-33.00
50-99	75	37.5	2,072.87	+819.23	+21.85
100-199	150	75	809.68	-1263.19	-16.84
200-499	350	200	381.68	- 428.00	- 2.14
500-999	750	400	292.76	- 88.92	- 0.22
1,000-1,999	1,500	750	72.38	- 220.38	- 0.29
2,000-3,999	2,540	1,040	45.75	- 26.63	- 0.026

TABLE 11.—*Change and rate of change in biomass of invertebrates in relation to water depth*

Water depth			Biomass	Change in biomass	Rate change in biomass per meter depth
Range	Mean	Change			
m	m	m	g/m^2	g/m^2	g/m^2/m
0-24	12.5	-	368	-	-
25-49	37.5	25	163	-205	-8.20
50-99	75	37.5	189	+ 26	+0.69
100-199	150	75	79	-110	-1.47
200-499	350	200	28	- 51	-0.26
500-999	750	400	12	- 16	-0.04
1,000-1,999	1,500	750	7	- 5	-0.007
2,000-3,999	2,540	1,040	8	+ 1	+0.001

individual per meter increase in depth) were evident on the Continental Slope. Very small changes (−0.026 specimen per 1-meter) were detected on the Continental Rise.

Biomass.—The relationship between invertebrate macrobenthic biomass and water depth (table 9, last column) parallels the pattern described above for density. Biomass was greatest (averaged 368 g/m^2) in the shallowest depth class. It decreased irregularly across the shelf, where average values ranged from 163 g/m^2 to 189 g/m^2 at midshelf, and averaged 79 g/m^2 along the Outer Continental Shelf. Biomass on the Continental Slope ranged from 7 g/m^2 on the lower slope to 28 g/m^2 on the upper slope. On the Continental Rise, the biomass averaged 8 g/m^2.

The rate of change in biomass per 1-m increase in water depth was greatest in shallow water and least in deepwater. This is evident, in the rate-change column of table 11. The average biomass diminished 8.2 g/m^2 for each meter of water depth, from the shallowest depth class (0–24 m) to the next deeper depth class (25–49 m). At midshelf, the biomass showed an increase, which was probably caused by regional differences in biomass (described below) and which, to some extent, reflects the larger standing crop of several taxonomic groups (Gastropoda, Ophiuroidea, Alcyonacea, and others) along the Outer Continental Shelf. The rate of biomass change on the Outer Continental Shelf averaged −1.5 g/m^2 per 1-m increase in depth. The rate of change diminished progressively down the slope: −0.26, −0.04, and −0.007 g/m^2. On the Continental Rise, there was a slight increase in biomass rate-change (+0.001 g/m^2); but this, again, was probably due to the regional differences in biomass and to the few samples that were collected.

The trend of decreasing biomass as water depth increases was clearly evident. Despite a few irregularities, the reduction in biomass, from an average of 368 g/m^2 in shallow water to 8 g/m^2 in deep water, amounts to a 98 percent change. This is precisely the same change described for the density of organisms.

SUBAREAS

SOUTHERN NEW ENGLAND

The number of individuals was, on the average, substantially higher in Southern New England than in the other subareas. This is evident from the density values given in table 9, column 2, and plotted in figure 80. On the Continental Shelf, the average density for each bathymetric class in the subarea ranged from 934/m^2 to 3,090/m^2, and the overall average was 2,360/m^2, whereas shelf densities for the entire Middle Atlantic Bight region ranged from 810/m^2 to 2,079/m^2 and averaged only 1,554/m^2. The comparative average values for New York Bight and Chesapeake Bight were 1,254/m^2 and 1,057/m^2. On the Continental Slope, the faunal density, also, was moderately high compared with that of other subareas. The density of the Continental Slope fauna in Southern New England averaged 265/m^2, compared with 249/m^2 for the entire Middle Atlantic Bight region, 171/m^2 for New York Bight, and 271/m^2 for the Chesapeake Bight. The density of organisms on the Southern New England Continental Rise averaged 48/m^2, a quantity only slightly higher than densities in the other subareas (40/m^2 to 47/m^2) and for the entire Middle Atlantic Bight region (46/m^2).

The standing-crop biomass on the Continental Shelf and Upper Continental Slope in the Southern New England subarea was considerably greater than the Middle Atlantic Bight region averages (table 9 and fig. 81). Biomass averages for four depth classes on the Continental Shelf ranged from 89 to 404 g/m^2, and the overall average was 268 g/m^2. That quantity was only slightly less than the 282 g/m^2 found in New York Bight, but much greater than the 101 g/m^2 found in Chesapeake Bight. For midshelf depths between 25 and 99 m, the quantities of biomass in Southern New England (which averaged 237 and 343 g/m^2) surpassed the amounts found in the other subareas. Biomass on the Continental Slope was greater (average 19 g/m^2) in Southern New England than in either New York Bight (10 g/m^2) or Chesapeake Bight (17 g/m^2). The mean biomass of 8 g/m^2 on the Continental Rise in this subarea was average for the entire region. It was slightly higher than that for New York Bight (7 g/m^2) and slightly lower than that for Chesapeake Bight (10 g/m^2).

NEW YORK BIGHT

The number of individuals in the New York Bight subarea fell between that in Southern New England and in Chesapeake Bight (table 9 and fig. 80) on the Continental Shelf. Densities averaged between 442/m^2 and 2,430/m^2; overall average was 1,254/m^2. This density compares with 1,554/m^2 for the entire Middle Atlantic Bight region, 2,360/m^2 for Southern New England, and 1,057/m^2 for Chesapeake Bight. Highest densities, as expected, were in the shallowest depth class (0–24 m). Unusually low densities, compared with those from adjacent bathymetric classes and adjacent subareas, of 752/m^2 and 442/m^2, were found on the Continental Shelf at water depths between 25 and 49 m and 100 to 199 m (table 9, column 3). Faunal densities in these two depth classes were roughly one-half the density expected. The cause of these unusually low densities was the sparsity of representatives in several taxonomic groups. (See discussion under "Taxonomic Groups.")

Fauna on the Continental Slope of the New York Bight subarea, also was relatively sparse, compared to other subareas. Densities ranged from 66/m^2 to 255/m^2, and averaged 176/m^2. This overall average is about 35 percent below the average slope density for both Southern New England and Chesapeake Bight.

The faunal density of 47/m^2 on the Continental Rise was nearly equal to that in the other two subareas.

Biomass in New York Bight fell between those in the Southern New England and Chesapeake Bight subareas. Unusually large and small quantities were found in the various bathymetric classes. On the Continental Shelf, the biomass ranged from the uncommonly small quantity of 36 g/m^2 on the outer shelf to the unexpectedly large 804 g/m^2 in the inshore region. Although the overall quantity of biomass for the Continental Shelf, which averaged 282 g/m^2, was highest in the region, this was due largely to the influence of shallow-water components. A biomass of 123 g/m^2 near midshelf was substantially lower—about 50 percent—than was anticipated. Also, the outer shelf biomass (36 g/m^2) was smaller than expected by at least 100 percent. These small biomass values correspond to the low densities of the fauna in the New York Bight subarea described above.

Biomass on the Continental Slope ranged from 5 to 17 g/m^2, and averaged only 10 g/m^2. This is substantially less than the quantities found in adjacent subareas, which averaged 19 g/m^2 in Southern New England and 17 g/m^2 in Chesapeake Bight.

On the Continental Rise, the average biomass of 7 g/m^2 was smaller than that found in adjacent subareas, which averaged 8 and 10 g/m^2 respectively in Southern New England and Chesapeake Bight. New York Bight biomass was 13 percent and 30 percent smaller than counterpart values in the adjacent subareas.

A discussion of the taxonomic components that were in short supply or unusually plentiful is included in "Taxonomic groups."

CHESAPEAKE BIGHT

The number of individuals was slightly lower in this subarea than in New York Bight and much lower than in Southern New England. The average density in the various bathymetric classes on the Continental Shelf ranged from 722/m^2 to 1,742/m^2, which was generally lower than in other subareas, and overall averaged only 1,057/m^2. Comparative quantities in Southern New England and New York Bight were 2,360/m^2 and 1,254/m^2, respectively. Unusually low densities of 722/m^2 and 795/m^2 were found at midshelf depths; conversely, an unexpectedly high density (969/m^2) was found on the outer shelf.

On the Continental Slope, the faunal density was relatively high, averaging 271/m^2, and ranging from 75/m^2 to 387/m^2. These densities were slightly higher than those at comparative depths in Southern New England and much higher than those in New York Bight.

On the Continental Rise, the faunal density averaged 40/m^2, which was slightly less than densities at this bathymetric level in the other subareas.

The biomass of the benthic fauna in Chesapeake Bight was substantially less than that in other parts of the Middle Atlantic Bight region. Average values for the various depth classes on the Continental Shelf ranged from 80 to 114 g/m^2. This subarea, with its rather narrow Continental Shelf, did not have the marked difference in biomass between inshore shallow water regions and the outer shelf margin that was so pronounced in both Southern New England and New York Bight. Thus, Chesapeake Bight is somewhat different from the other subareas in two aspects; it is characterized by: (1) a small biomass on the Continental Shelf and a rather large biomass on the slope and rise; and (2) little difference in biomass from shallow to deepwater on the Continental Shelf.

Biomass on the Continental Slope was moderately high, ranging from 28 g/m^2 on the upper slope to 11 g/m^2 on the lower part. The average for the entire slope was 17 g/m^2. This value was slightly lower than that for Southern New England (19 g/m^2), but much higher than that for New York Bight, which averaged only 10 g/m^2.

Biomass on the Continental Rise averaged 10 g/m^2. This was the highest for this depth class in any subarea in the entire Middle Atlantic Bight region.

TABLE 12.—*Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the entire Middle Atlantic Bight region*

[In number per square meter]

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	no./m²	no./m²	no./m²	no./m²	no./m²	no./m²	no./m²	no./m²
PORIFERA	1.25	0.52	0.07	0.74	0.21	0.08	0.12	0.06
COELENTERATA	34.93	8.96	9.03	40.76	13.90	4.52	3.88	1.11
Hydrozoa	19.58	6.90	2.13	27.71	3.96	0.08	-	-
Anthozoa	15.35	2.06	6.90	13.05	9.94	4.44	3.88	1.11
Alcyonacea	0.01	-	0.52	2.76	1.61	1.20	0.97	0.61
Zoantharia	5.01	1.13	5.63	9.44	5.04	1.76	0.06	0.17
Unidentified	10.33	0.93	0.75	0.85	3.29	1.48	2.85	0.33
PLATYHELMINTHES								
Turbellaria	1.70	0.21	0.43	-	-	-	-	-
NEMERTEA	5.30	5.87	6.27	2.74	1.64	0.72	1.21	0.11
ASCHELMINTHES								
Nematoda	5.01	0.94	3.21	0.47	0.82	2.52	0.50	0.64
ANNELIDA	472.07	265.75	352.66	238.26	178.00	61.84	17.26	6.44
POGONOPHORA	-	0.55	0.05	-	7.21	21.32	5.21	2.53
SIPUNCULIDA	0.96	4.63	5.54	9.85	11.89	2.00	2.06	1.31
ECHIURA	0.27	0.02	-	-	-	-	0.35	0.72
PRIAPULIDA	-	-	-	-	-	-	0.24	-
MOLLUSCA	911.14	61.79	183.62	192.97	87.03	187.52	34.03	26.63
Polyplacophora	0.52	0.05	0.95	-	0.07	0.60	0.71	0.28
Gastropoda	95.52	13.95	11.54	13.47	9.21	18.40	2.59	1.25
Bivalvia	815.01	47.03	169.37	171.74	70.18	161.40	29.79	12.69
Scaphopoda		0.76	0.86	2.50	7.39	7.12	0.94	-
Cephalopoda	-	-	-	5.26	0.18	-	-	-
Unidentified	-	-	0.90	-	-	-	-	-
ARTHROPODA	552.99	803.12	1414.19	62.64	45.13	6.68	1.27	2.77
Pycnogonida	1.33	0.46	0.22	0.06	-	-	-	-
Arachnida	0.16	-	-		-	-	-	-
Crustacea	551.50	802.66	1413.97	62.58	45.13	6.68	1.27	2.77
Ostracoda	0.57	0.02	0.18	-	-	-	-	0.17
Cirripedia	101.98	0.60	0.03	-	-	-	-	-
Copepoda	-	-	0.08	-	0.21	0.20	-	-
Nebaliacea	-	-	0.05	-	-	-	-	0.06
Cumacea	1.99	31.43	36.36	8.82	4.68	0.48	0.35	0.69
Tanaidacea	-	-	-	-	0.18	-	0.06	0.72
Isopoda	17.57	20.96	11.25	1.76	1.14	0.96	0.18	0.19
Amphipoda	407.47	742.20	1361.25	49.35	38.46	4.96	0.62	0.94
Mysidacea	6.90	0.11	0.02	-	0.07	-	-	-
Decapoda	15.02	7.34	4.75	2.65	0.39	0.08	0.06	-
BRYOZOA	25.34	33.99	3.47	0.15	-	-	-	-
BRACHIOPODA	-	-	0.02	-	-	-	-	-
ECHINODERMATA	42.88	41.82	78.33	235.59	28.21	2.88	2.65	6.48
Holothuroidea	0.70	0.14	5.90	2.06	9.46	0.52	0.62	0.39
Echinoidea	41.14	40.24	10.20	1.03	0.46	-	0.06	0.17
Ophiuroidea	0.73	0.38	61.03	231.03	17.86	2.20	1.62	5.86
Asteroidea	0.31	1.02	2.10	1.47	0.43	0.16	0.35	0.06
HEMICHORDATA	0.15	-	0.35	0.15	-	0.20	-	-
CHORDATA								
Ascidiacea	11.79	35.28	9.91	19.50	1.29	-	0.76	2.58
UNIDENTIFIED	12.88	5.66	4.81	5.85	6.32	2.48	2.85	6.78

TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

The quantitative distribution of each phylum and 28 major subcomponents (classes and orders) as they were related to eight bathymetric classes are listed in tables 12 and 13 and are shown graphically in figures 82–87. The data pertain to the entire Middle Atlantic Bight region; later sections deal with similar relationships within each subarea. They were relatively sparse in New York Bight, and were present in intermediate quantity in Chesapeake Bight.

Hydrozoa were common on the Continental Shelf in all subareas, but were rare below 500 m. The

TABLE 13.—*Mean biomass listed by major taxonomic groups for each bathymetric class, representing the entire Middle Atlantic Bight region*

[In grams per square meter]

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.036	0.190	<0.001	0.033	0.018	<0.001	0.019	0.035
COELENTERATA	4.653	1.419	1.297	14.986	1.020	0.303	0.464	0.513
Hydrozoa	0.860	0.130	0.055	0.025	0.048	0.001	-	-
Anthozoa	3.793	1.289	1.242	14.962	0.972	0.302	0.464	0.513
Alcyonacea	0.012	-	0.172	0.428	0.083	0.107	0.221	0.048
Zoantharia	3.588	1.175	0.892	14.431	0.721	0.164	0.048	0.198
Unidentified	0.192	0.114	0.179	0.103	0.169	0.031	0.196	0.266
PLATYHELMINTHES	0.011	0.006	0.012	-	-	-	-	-
Turbellaria	0.011	0.006	0.012	-	-	-	-	-
NEMERTEA	0.878	0.884	0.637	0.297	0.106	0.012	0.193	0.001
ASCHELMINTHES	0.006	0.003	0.005	0.003	0.004	0.011	0.004	0.004
Nematoda	0.006	0.003	0.005	0.003	0.004	0.011	0.004	0.004
ANNELIDA	19.339	12.830	20.002	7.452	7.907	5.280	0.786	0.404
POGONOPHORA	-	0.003	<0.001	-	0.056	0.145	0.020	0.010
SIPUNCULIDA	0.125	0.293	1.033	0.218	1.003	3.488	2.082	0.451
ECHIURA	0.175	0.015	-	-	-	-	0.664	2.414
PRIAPULIDA	-	-	-	-	-	-	0.147	-
MOLLUSCA	301.965	94.611	122.904	16.566	2.140	1.187	0.450	0.233
Polyplacophora	0.474	0.006	0.013	-	<0.001	0.004	0.008	0.005
Gastropoda	6.789	0.876	4.202	0.055	0.135	0.171	0.031	0.009
Bivalvia	294.703	93.709	118.671	16.404	1.863	0.914	0.400	0.218
Scaphopoda		0.022	0.014	0.034	0.140	0.098	0.011	-
Cephalopoda	-	-	-	0.072	0.002	-	-	-
Unidentified	-	-	0.004	-	-	-	-	-
ARTHROPODA	19.213	7.963	7.551	0.674	0.226	0.080	0.042	0.031
Pycnogonida	0.009	0.001	0.001	0.001	-	-	-	-
Arachnida	0.001	-	-	-	-	-	-	-
Crustacea	19.203	7.962	7.549	0.674	0.226	0.080	0.042	0.031
Ostracoda	0.005	<0.001	0.001	-	-	-	-	0.001
Cirripedia	12.774	0.015	<0.001	-	-	-	-	-
Copepoda	-	-	<0.001	-	0.001	0.002	-	-
Nebaliacea	-	-	<0.001	-	-	-	-	0.001
Cumacea	0.014	0.095	0.192	0.055	0.027	0.005	0.004	0.014
Tanaidacea	-	-	-	-	0.002	-	0.001	0.005
Isopoda	0.138	0.761	0.347	0.130	0.046	0.008	0.005	0.002
Amphipoda	3.526	5.583	6.659	0.276	0.141	0.048	0.004	0.008
Mysidacea	0.030	0.002	<0.001	-	0.001	-	-	-
Decapoda	2.716	1.506	0.350	0.213	0.008	0.017	0.029	-
BRYOZOA	0.555	0.684	0.079	0.002	-	-	-	-
BRACHIOPODA	-	-	0.001	-	-	-	-	-
ECHINODERMATA	13.757	38.227	33.734	35.478	15.516	1.026	2.353	3.433
Holothuroidea	0.076	0.504	20.831	6.260	5.334	0.027	1.132	2.739
Echinoidea	11.578	37.411	4.352	13.498	6.560	-	0.107	0.233
Ophiuroidea	0.255	0.031	2.601	14.212	3.611	0.995	0.998	0.461
Asteroidea	1.848	0.282	5.950	1.509	0.005	0.004	0.116	0.001
HEMICHORDATA	0.041	-	0.066	0.044	-	0.002	-	-
CHORDATA	7.077	5.801	0.924	2.608	0.054	-	0.004	0.399
Ascidiacea	7.077	5.801	0.924	2.608	0.054	-	0.004	0.399
UNIDENTIFIED	0.238	0.376	0.412	0.140	0.064	0.148	0.197	0.084

quantity of hydroids varied only modestly from one subarea to another, except for the irregular occurrence of very high or low densities, which may have resulted from the vagaries of sampling. Both density and biomass revealed the same intersubarea trends; slightly higher quantities in Southern New England, lower quantities in New York Bight, and intermediate quantities in Chesapeake Bight.

Anthozoa, as a group, were distributed much the same, in relation to the bathymetric level, in all three subareas. However, one of the main subgroups, the Alcyonacea, presented a different pattern. They were common at middepths and in deep water (50 to 3,999 m) in Southern New England and New York Bight, but in Chesapeake Bight they were found only in very shallow (0–24 m) and very deep (1,000–3,999 m) waters.

Platyhelminthes occupied the same bathymetric classes in all three subareas. The largest quantities, in terms of both density and biomass, were found

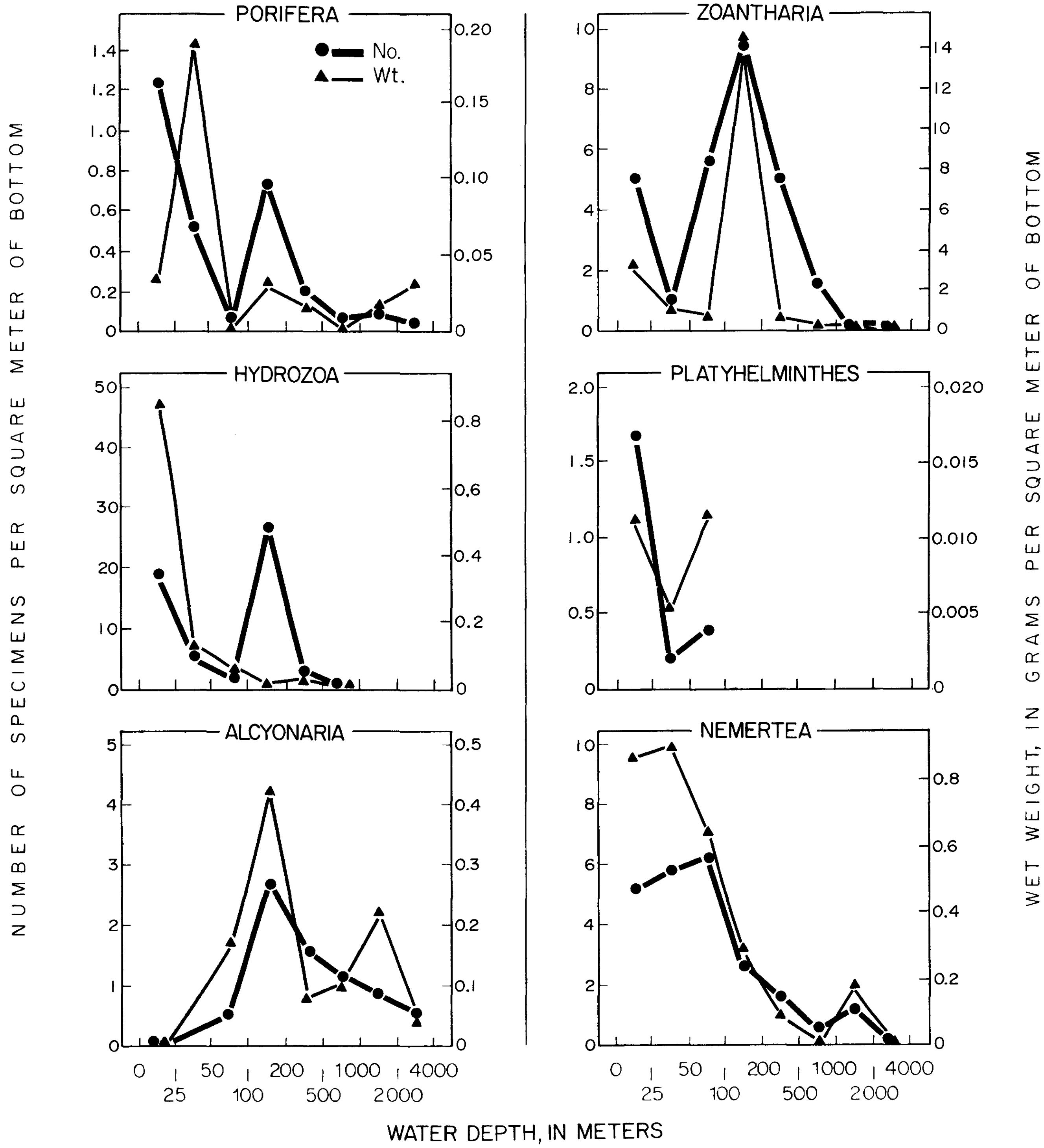

FIGURE 82.—Density (No.) and biomass (wt.) in relation to water depth in the entire Middle Atlantic Bight region for Porifera, Hydrozoa, Alcycnaria, Zoantharia, Platyhelminthes, and Nemertea.

in Southern New England, lowest amounts in New York Bight, and intermediate quantities in Chesapeake Bight.

Nemertea were distributed similarly (as described in the preceding section) in regard to the bathymetric level in all subareas. In terms of density, Nemertea ranked first in Southern New England with an average of 6/m², ranked second in New York Bight with 2.6/m², and were least abundant in Chesapeake Bight with 0.4/m². Biomass values

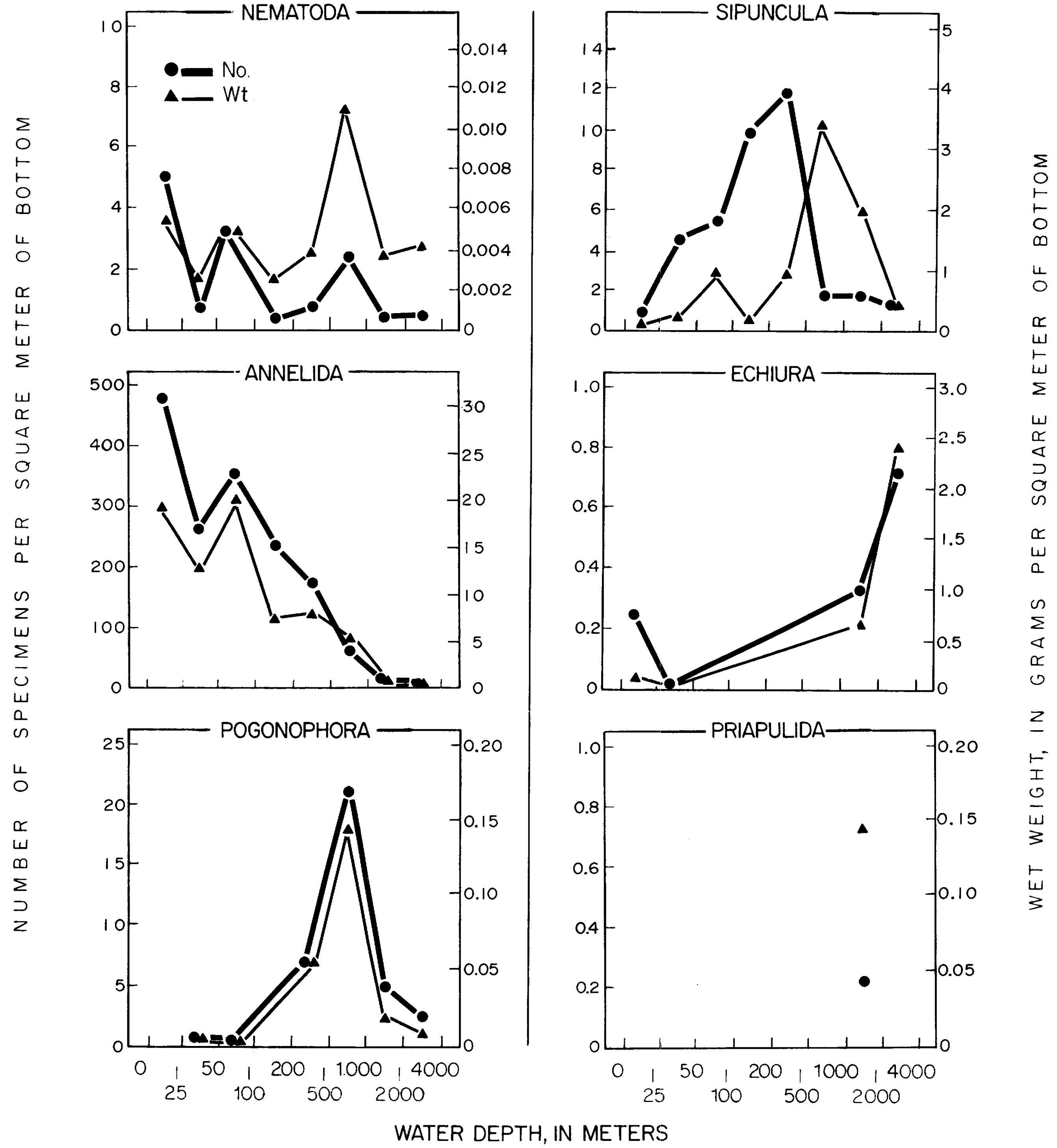

FIGURE 83.—Density (No.) and biomass (wt.) in relation to water depth in the entire Middle Atlantic Bight region for Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

reflected the same sequential order, with average values of 0.8 g/m², 0.7 g/m², and 0.3 g/m².

Nematoda were more widely distributed bathymetrically and were found in larger quantities in Southern New England (average density 6/m² and biomass 0.007 g/m²) than in the other two subareas. In New York Bight, their distribution was irregular, and they were present in relatively small quantities (average density of 0.1/m² and biomass less than 0.001 g/m²). In Chesapeake Bight, nematodes were

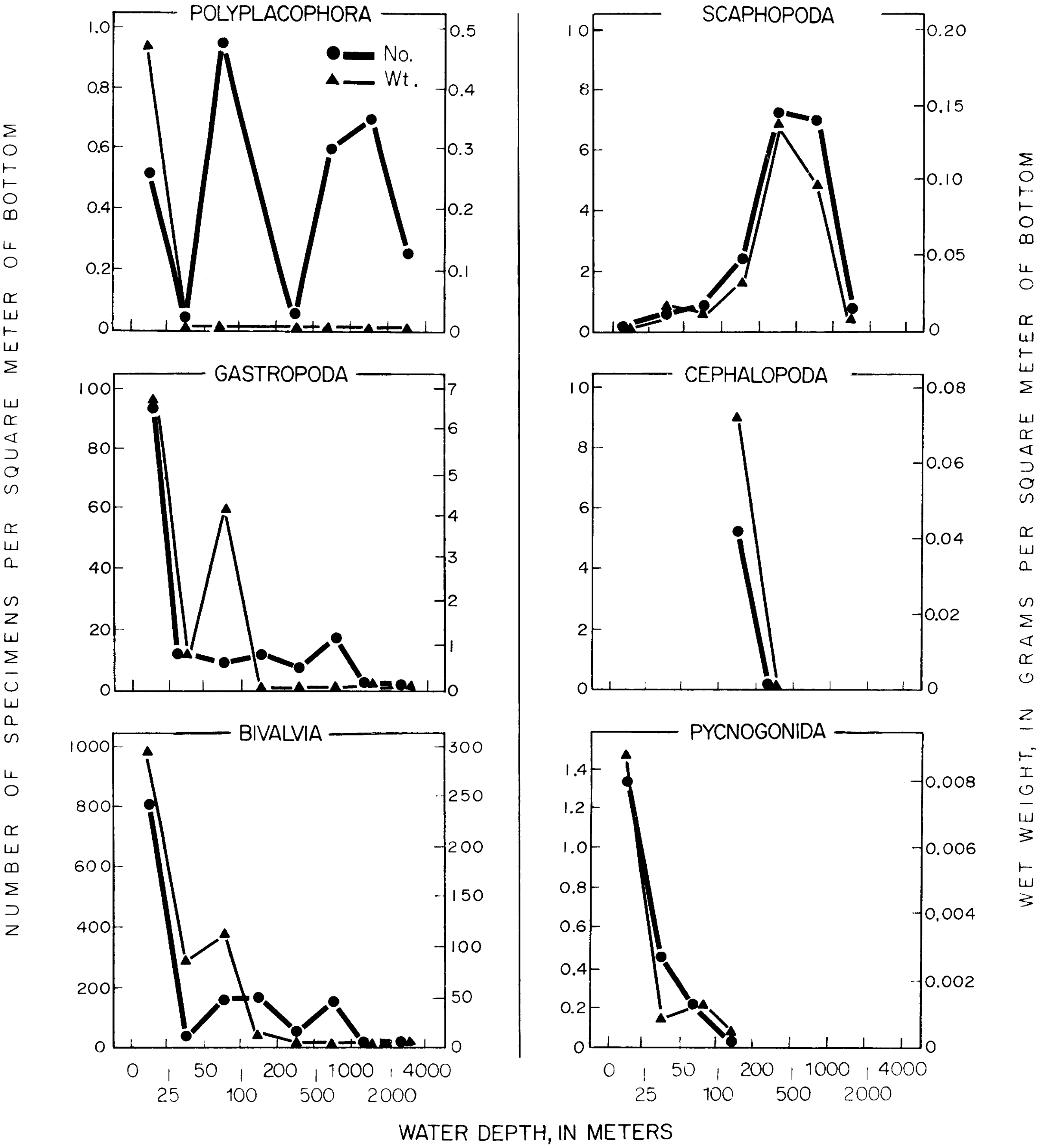

FIGURE 84.—Density (No.) and biomass (wt.) in relation to water depth in the entire Middle Atlantic Bight region for Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

slightly irregular in distribution, and the quantity fell between those in Southern New England and those in New York Bight (density averaged $2/m^2$ and biomass 0.006 g/m^2).

Annelida were widely distributed in all subareas. They were most abundant in Southern New England, intermediate in New York Bight, and relatively sparse in Chesapeake Bight. An exceptionally high

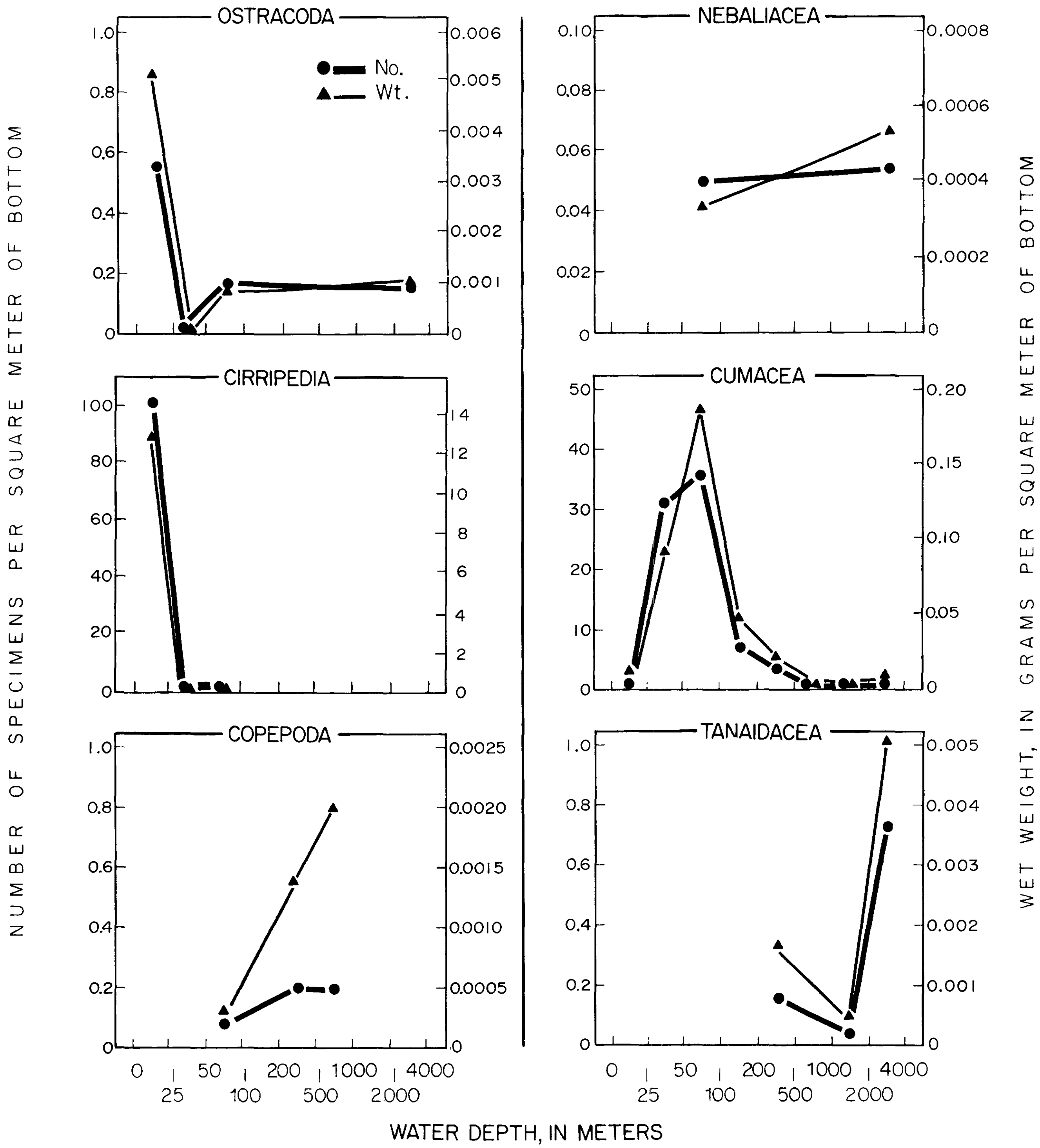

FIGURE 85.—Density (No.) and biomass (wt.) in relation to water depth in the entire Middle Atlantic Bight region for Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

density of annelids (1,120/m²) occurred in the shallow waters (0–24 m) of New York Bight, as compared with the other subareas where the density at this depth averaged 316/m² and 183/m². Biomass trends were similar to those of density; Southern New England averaged 19 g/m², New York Bight 13 g/m², and Chesapeake Bight 9 g/m².

Pogonophora were found primarily in deepwater (200 to 3,999 m) in all three subareas. Density and biomass were approximately equal in Southern New

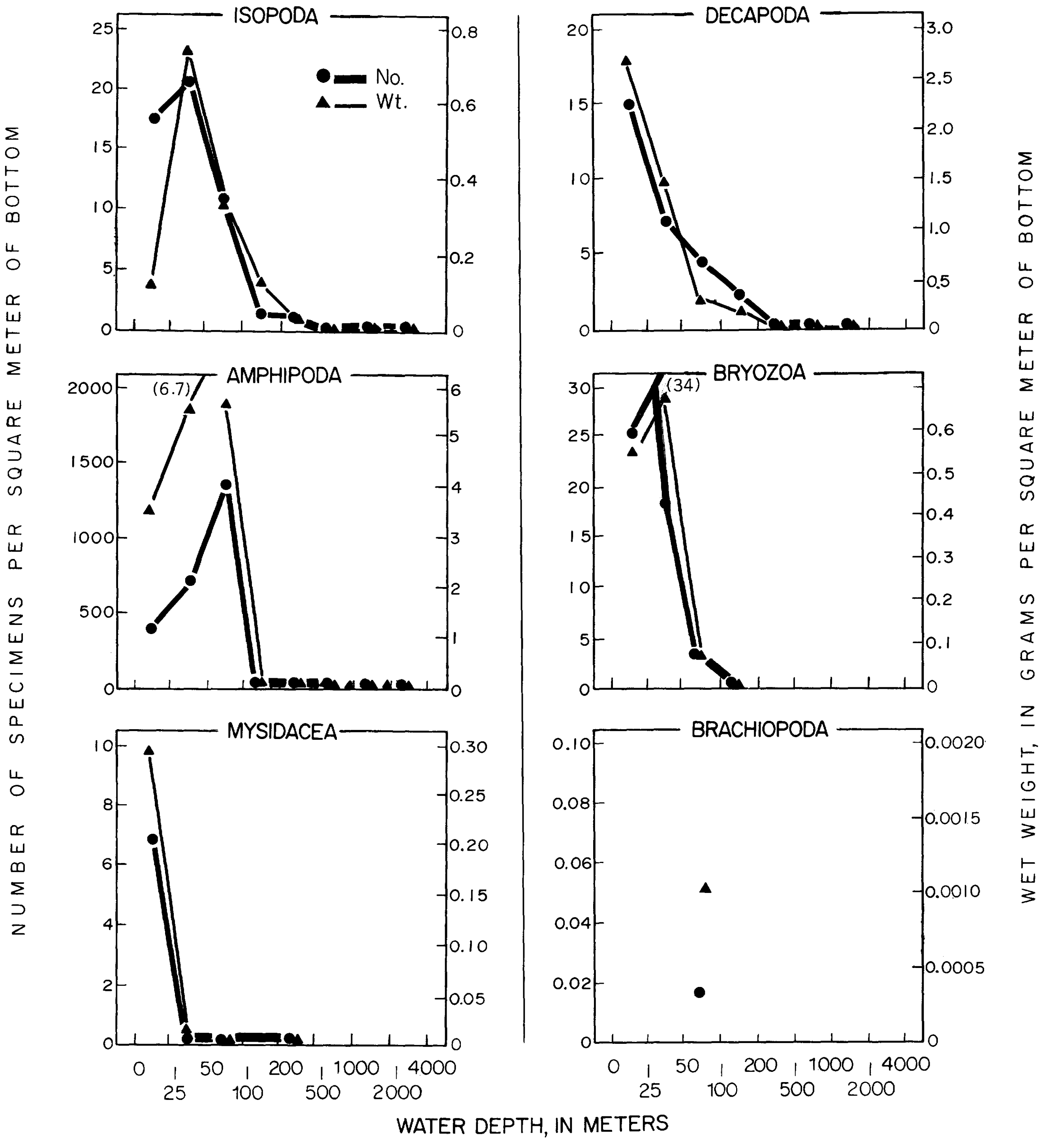

FIGURE 86.—Density (No.) and biomass (wt.) in relation to water depth in the entire Middle Atlantic Bight region for Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

England and New York Bight, but were three to four times more abundant in Chesapeake Bight. In the two northern subareas, the density of pogonophorans averaged approximately 5/m^2 in the deep water, whereas in Chesapeake Bight their average density was 16/m^2. On the Continental Shelf in Chesapeake Bight, pogonophorans were found in unusually shallow water. Live specimens and tubes were taken from water as shallow as 66 m, and tubes only were present at 43 m.

Sipunculida were widely distributed bathymetrically in all three subareas, but there was a marked

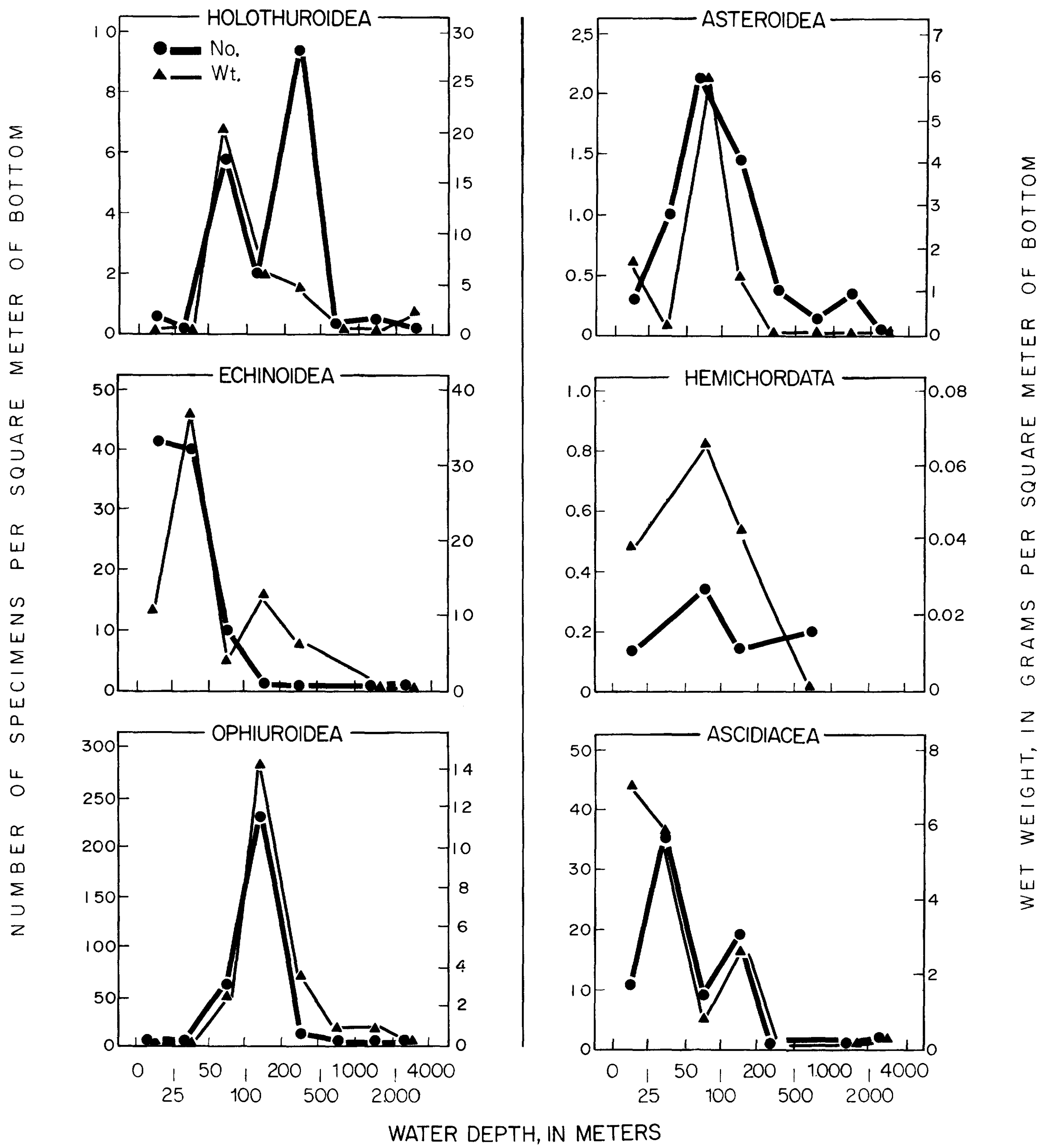

FIGURE 87.—Density (No.) and biomass (wt.) in relation to water depth in the entire Middle Atlantic Bight region for Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

difference in density and biomass. Density was highest (average about 9/m²) in Southern New England, intermediate (3/m²) in New York Bight, and lowest (1.5/m²) in Chesapeake Bight. Trends in biomass were nearly the same; largest (1.4 g/m²) in Southern New England and substantially lower (0.4 and 0.8 g/m²) in New York Bight and Chesapeake Bight.

Echiura were found in both very shallow (less than 50 m) and very deep (greater than 1,000 m) water in two subareas, New York Bight and Chesa-

TABLE 14.—*Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the Southern New England subarea*

[In number per square meter]

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	2.60	3.37	-	1.32	0.43	0.25	0.18	0.13
COELENTERATA	113.40	4.75	12.23	19.68	15.64	3.00	3.18	0.51
Hydrozoa	73.20	2.19	0.82	-	2.36	-	-	-
Anthozoa	40.20	2.56	11.41	19.68	13.28	3.00	3.18	0.51
Alcyonacea	-	-	1.05	2.42	2.14	0.50	0.45	0.25
Zoantharia	3.40	2.04	9.79	16.47	9.64	-	0.18	0.13
Unidentified	36.80	0.52	0.57	0.79	1.50	2.50	2.55	0.13
PLATYHELMINTHES	6.77	0.22	0.50	-	-	-	-	-
Turbellaria	6.77	0.22	0.50	-	-	-	-	-
NEMERTEA	3.06	12.00	9.96	3.47	2.07	0.75	2.09	0.13
ASCHELMINTHES	17.97	1.56	6.66	0.84	0.86	5.13	0.18	0.75
Nematoda	17.97	1.56	6.66	0.84	0.86	5.13	0.18	0.75
ANNELIDA	315.54	547.37	484.36	333.63	254.93	106.00	13.73	7.19
POGONOPHORA	-	-	-	-	7.14	10.38	2.64	1.56
SIPUNCULIDA	4.49	20.15	7.70	15.32	18.79	2.50	0.18	1.50
ECHIURA	-	-	-	-	-	-	0.91	0.38
PRIAPULIDA	-	-	-	-	-	-	0.54	-
MOLLUSCA	478.97	91.36	209.01	134.01	72.43	106.13	44.18	12.07
Polyplacophora	2.14	0.22	1.89	-	-	0.25	0.64	0.13
Gastropoda	135.83	46.07	19.43	2.11	9.14	13.13	2.73	0.25
Bivalvia	340.57	45.07	185.80	120.74	55.50	91.25	40.45	11.69
Scaphopoda		-	-	1.74	7.43	1.50	0.36	-
Cephalopoda	-	-	-	9.42	0.36	-	-	-
Unidentified	-	-	1.89	-	-	-	-	-
ARTHROPODA	1370.57	2146.64	2080.46	61.59	45.14	10.13	1.45	3.63
Pycnogonida	1.23	1.37	0.21	-	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-
Crustacea	1369.34	2145.27	2080.25	61.59	45.14	10.13	1.45	3.63
Ostracoda	1.11	-	1.37	-	-	-	-	-
Cirripedia	107.46	2.41	-	-	-	-	-	-
Copepoda	-	-	0.11	-	0.43	0.63	-	-
Nebaliacea	-	-	-	-	-	-	-	-
Cumacea	1.26	88.30	49.18	7.53	3.07	0.75	0.36	1.00
Tanaidacea	-	-	-	-	0.36	-	0.18	0.88
Isopoda	4.94	36.67	10.46	1.37	0.93	2.50	0.18	0.31
Amphipoda	1220.31	2008.67	2015.79	52.16	39.71	6.25	0.73	1.44
Mysidacea	7.03	0.11	-	-	-	-	-	-
Decapoda	27.23	9.11	3.34	0.53	0.64	-	-	-
BRYOZOA	83.29	73.63	0.29	0.26	-	-	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	4.12	39.49	154.71	321.11	40.51	3.00	3.18	8.63
Holothuroidea	1.83	-	11.71	2.11	8.86	-	1.00	0.25
Echinoidea	1.29	34.89	14.68	1.42	0.79	-	0.18	0.38
Ophiuroidea	0.89	0.89	125.14	315.47	30.29	3.00	1.64	8.00
Asteroidea	0.11	3.81	3.18	2.11	0.57	-	0.36	-
HEMICHORDATA	-	-	0.73	0.26	-	0.63	-	-
CHORDATA	20.69	73.63	15.30	34.58	2.43	-	1.36	2.31
Ascidiacea	20.69	73.63	15.30	34.58	2.43	-	1.36	2.31
UNIDENTIFIED	4.26	16.93	7.09	7.63	7.21	3.50	1.55	9.25

peake. Bight. In Southern New England they were present only in deep water, 1,000 to 1,999 m. Densities were low in all areas in both shallow and deep water. Biomass, however, was larger (1.3 to 6.7 g/m²) in deep water than in shallow water; also it was larger in New York Bight and Chesapeake Bight than in Southern New England, where the average quantities were less than 0.5 g/m².

Priapulida were rare; they were taken in only two subareas, Southern New England and Chesapeake Bight. All samples were from the same bathymetric class—1,000 to 1,999 m. Densities were less than

TABLE 15.—*Mean biomass listed by major taxonomic groups for each bathymetric class, representing the Southern New England subarea*
[In grams per square meter]

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.147	0.478	-	0.059	0.035	0.002	0.002	0.079
COELENTERATA	5.640	2.264	2.117	23.411	31.412	0.054	0.429	2.478
Hydrozoa	2.933	0.287	0.081	-	0.142	-		-
Anthozoa	2.708	1.977	2.036	23.411	31.270	0.054	0.429	2.478
Alcyonacea	-	-	0.361	0.435	0.081	0.005	0.116	0.004
Zoantharia	1.833	1.950	1.542	22.935	31.126	-	0.148	2.091
Unidentified	0.875	0.027	0.133	0.040	0.062	0.049	0.166	0.382
PLATYHELMINTHES	0.036	0.003	0.016	-	-	-	-	-
Turbellaria	0.036	0.003	0.016	-	-	-	-	-
NEMERTEA	0.752	2.010	1.013	0.232	0.164	0.011	0.103	0.001
ASCHELMINTHES	0.003	0.008	0.010	0.005	0.005	0.015	0.002	0.006
Nematoda	0.003	0.008	0.010	0.005	0.005	0.015	0.002	0.006
ANNELIDA	23.800	24.373	31.012	10.416	5.575	3.276	0.796	0.299
POGONOPHORA	-	-	-	-	0.089	0.032	0.011	0.369
SIPUNCULIDA	0.588	1.126	1.412	1.142	1.453	10.676	0.012	1.003
ECHIURA	-	-	-	-	-	-	0.472	0.267
PRIAPULIDA	-	-	-	-	-	-	0.361	-
MOLLUSCA	294.898	263.083	131.102	4.572	2.004	0.958	0.524	0.312
Polyplacophora	2.207	0.025	0.027	-	-	0.002	0.008	0.001
Gastropoda	4.088	2.238	7.914	0.013	0.054	0.076	0.049	0.004
Bivalvia	288.598	260.820	123.154	4.403	1.831	0.858	0.460	0.306
Scaphopoda		-	-	0.027	0.115	0.021	0.006	-
Cephalopoda	-	-	-	0.129	0.004	-	-	-
Unidentified	-	-	0.008	-	-	-	-	-
ARTHROPODA	53.305	16.668	10.685	0.533	0.224	0.058	0.024	-
Pycnogonida	0.006	0.002	0.002	-	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-
Crustacea	53.299	16.665	10.682	0.533	0.224	0.058	0.024	0.049
Ostracoda	0.011	-	0.002	-	-	-	-	-
Cirripedia	38.960	0.056	-	-	-	-	-	-
Copepoda	-	-	<0.001	-	0.003	0.006	-	-
Nebaliacea	-	-	-	-	-	-	-	-
Cumacea	0.020	0.277	0.269	0.056	0.014	0.008	0.004	0.026
Tanaidacea	-	-	-	-	0.004	-	0.002	0.006
Isopoda	0.053	0.616	0.343	0.095	0.047	0.019	0.013	0.003
Amphipoda	10.558	13.957	9.827	0.377	0.144	0.025	0.006	0.014
Mysidacea	0.045	0.001	-	-	-	-	-	-
Decapoda	3.652	1.758	0.241	0.005	0.013	-	-	-
BRYOZOA	1.917	2.755	0.044	0.003	-	-	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	13.141	4.560	57.353	44.956	23.066	1.714	1.307	4.586
Holothuroidea	0.101	-	43.353	3.342	3.950	-	0.331	3.579
Echinoidea	12.277	4.229	2.261	17.123	12.991	-	0.332	0.525
Ophiuroidea	0.489	0.058	5.312	22.570	6.118	1.714	0.519	0.482
Asteroidea	0.274	0.274	6.427	1.922	0.006	-	0.126	-
HEMICHORDATA	-	-	0.139	0.080	-	0.006	-	-
CHORDATA	9.697	24.289	1.666	4.625	0.106	-	0.007	0.369
Ascidiacea	9.697	24.289	1.666	4.625	0.106	-	0.007	0.369
UNIDENTIFIED	0.095	1.138	0.066	0.195	0.100	0.035	0.466	0.142

0.6/m² and biomass less than 0.4 g/m²; occurrence records were too few to make comparisons.

Mollusca were abundant in terms of the number of individuals and were dominant in biomass in all three subareas. A comparison of each molluscan class, by subarea, is presented separately.

Densities of Polyplacophora were low in all subareas. Relatively, they were more numerous in Southern New England, where the average density was 1/m². In New York Bight, they were found in only two depth classes (50–99 m and 2,000–3,999 m), and their average density was low—0.1/m² to 0.5/m². In Chesapeake Bight, they were present in five depth classes, and their average density ranged from 0.1/m² to 1.3/m². Biomass, also, was small in all areas; values ranged from 0.001 to 2.2 g/m² and were generally proportional to the densities.

Gastropoda were one of the more common components of the Mollusca. In each subarea, they showed a similar distribution in relation to water

TABLE 16.—*Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the New York Bight subarea*

[In number per square meter]

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2
PORIFERA	1.02	0.94	0.17	-	-	-	-	-
COELENTERATA	19.54	6.06	4.42	9.33	7.51	10.29	1.80	1.58
Hydrozoa	11.26	4.65	1.40	2.00	-	0.29	-	-
Anthozoa	8.28	1.41	3.02	7.33	7.51	10.00	1.80	1.58
Alcyonacea	-	-	0.04	5.33	1.88	3.71	1.60	0.75
Zoantharia	8.28	0.60	2.38	0.67	0.75	6.29	-	0.33
Unidentified	-	0.81	0.60	1.33	4.88	-	0.20	0.50
PLATYHELMINTHES	0.04	0.13	0.09	-	-	-	-	-
Turbellaria	0.04	0.13	0.09	-	-	-	-	-
NEMERTEA	3.30	4.17	2.55	1.78	0.50	0.29	-	0.17
ASCHELMINTHES	-	0.04	0.13	-	1.13	0.29	0.60	-
Nematoda	-	0.04	0.13	-	1.13	0.29	0.60	-
ANNELIDA	1119.52	136.60	265.94	127.22	113.88	43.43	24.10	7.33
POGONOPHORA	-	-	-	-	1.25	9.71	3.80	3.50
SIPUNCULIDA	-	0.50	4.32	4.89	7.50	1.29	2.80	0.50
ECHIURA	0.52	-	-	-	-	-	-	0.83
PRIAPULIDA	-	-	-	-	-	-	-	-
MOLLUSCA	652.31	54.94	109.88	117.87	86.00	129.43	23.60	20.66
Polyplacophora	-	-	0.13	-	-	-	-	0.50
Gastropoda	62.46	4.31	5.38	44.44	12.25	31.29	3.80	2.33
Bivalvia	589.85	50.63	102.61	68.99	64.25	86.00	18.40	17.83
Scaphopoda	-	-	1.76	4.44	9.50	12.14	1.40	-
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	488.05	492.13	978.18	48.67	22.89	4.57	1.20	2.17
Pycnogonida	0.24	-	-	-	-	-	-	-
Arachnida	0.57	-	-	-	-	-	-	-
Crustacea	487.24	492.13	978.18	48.67	22.89	4.57	1.20	2.17
Ostracoda	1.15	-	-	-	-	-	-	-
Cirripedia	283.48	-	0.06	-	-	-	-	-
Copepoda	-	-	0.09	-	-	-	-	-
Nebaliacea	-	-	-	-	-	-	-	0.17
Cumacea	2.07	3.38	25.27	13.78	2.38	-	0.60	0.75
Tanaidacea	-	-	-	-	-	-	-	0.33
Isopoda	5.43	21.73	13.69	2.44	2.13	-	0.20	-
Amphipoda	171.09	459.10	932.10	23.78	18.13	4.57	0.20	0.92
Mysidacea	3.61	0.17	0.04	-	0.25	-	-	-
Decapoda	20.41	7.75	6.93	8.67	-	-	0.20	-
BRYOZOA	11.91	3.83	4.04	-	-	-	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	120.65	38.79	10.84	125.67	13.75	3.00	2.70	3.33
Holothuroidea	1.07	0.04	0.77	1.11	6.50	0.29	0.40	0.50
Echinoidea	118.04	38.44	5.08	0.89	0.25	-	-	-
Ophiuroidea	0.61	-	3.59	123.00	6.75	2.71	2.10	2.83
Asteroidea	0.93	0.31	1.40	0.67	0.25	-	0.20	-
HEMICHORDATA	0.28	-	-	-	-	-	-	-
CHORDATA	1.24	13.52	5.57	0.67	0.25	-	-	3.33
Ascidiacea	1.24	13.52	5.57	0.67	0.25	-	-	3.33
UNIDENTIFIED	11.89	0.77	0.79	5.56	0.50	3.29	5.00	3.08

depth. Densities generally were highest (29/m^2) in Southern New England, intermediate (21/m^2) in New York Bight, and lowest (16/m^2) in Chesapeake Bight. Biomass reflected this same trend of decreasing abundance, 1.8 g/m^2 in the north to 1.0 g/m^2 in the south.

Bivalvia were different from many other major taxa in having the highest densities (averaging 300/m^2) in the Chesapeake Bight subarea, intermediate densities (averaging 125/m^2) in New York Bight, and lowest densities (averaging 111/m^2) in Southern New England. Particularly high densities

TABLE 17.—*Mean biomass listed by major taxonomic groups for each bathymetric class, representing the New York Bight subarea*

[In grams per square meter]

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.010	0.092	0.002	-	-	-	-	-
COELENTERATA	2.956	0.380	0.439	7.119	0.551	0.966	0.164	0.625
Hydrozoa	0.179	0.050	0.024	0.027	-	0.003	-	-
Anthozoa	2.776	0.330	0.415	7.092	0.551	0.963	0.164	0.625
Alcyonacea	-	-	0.001	0.699	0.185	0.376	0.104	0.032
Zoantharia	2.776	0.202	0.362	6.092	0.122	0.587	-	0.307
Unidentified	-	0.128	0.052	0.301	0.244	-	0.060	0.286
PLATYHELMINTHES	0.002	0.004	0.004	-	-	-	-	-
Turbellaria	0.002	0.004	0.004	-	-	-	-	-
NEMERTEA	2.048	0.711	0.183	0.152	0.011	0.003	-	0.002
ASCHELMINTHES	-	<0.001	0.001	-	0.002	0.003	0.006	-
Nematoda	-	<0.001	0.001	-	0.002	0.003	0.006	-
ANNELIDA	31.180	7.980	11.257	3.956	10.350	3.149	0.894	0.723
POGONOPHORA	-	-	-	-	0.008	0.046	0.030	0.012
SIPUNCULIDA	-	0.116	0.858	0.522	0.934	0.083	0.194	0.007
ECHIURA	0.519	-	-	-	-	-	-	2.400
PRIAPULIDA	-	-	-	-	-	-	-	-
MOLLUSCA	710.785	41.072	131.048	2.738	2.264	1.011	0.515	0.226
Polyplacophora	-	-	0.001	-	-	-	-	0.012
Gastropoda	7.897	0.426	1.073	0.167	0.346	0.133	0.030	0.014
Bivalvia	702.888	40.646	129.944	2.507	1.708	0.687	0.469	0.199
Scaphopoda	-	-	0.030	0.064	0.210	0.191	0.016	-
Cephalopda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	23.438	5.669	5.667	1.162	0.163	0.113	0.110	0.018
Pycnogonida	0.005	-	-	-	-	-	-	-
Arachnida	0.003	-	-	-	-	-	-	-
Crustacea	23.430	5.669	5.667	1.162	0.163	0.113	0.110	0.018
Ostracoda	0.010	-	-	-	-	-	-	-
Cirripedia	16.175	-	0.001	-	-	-	-	-
Copepoda	-	-	<0.001	-	-	-	-	-
Nebaliacea	-	-	-	-	-	-	-	0.002
Cumacea	0.017	0.014	0.127	0.080	0.016	-	0.006	0.007
Tanaidacea	-	-	-	-	-	-	-	0.003
Isopoda	0.075	0.874	0.394	0.234	0.076	-	0.002	-
Amphipoda	2.678	2.831	4.579	0.059	0.068	0.113	0.002	0.007
Mysidacea	0.016	0.004	<0.001	-	0.002	-	-	-
Decapoda	4.458	1.947	0.565	0.789	-	-	0.100	-
BRYOZOA	0.206	0.153	0.052	-	-	-	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	32.851	66.242	8.434	19.354	2.590	1.154	3.459	2.472
Holothuroidae	0.132	0.145	0.629	0.098	0.571	0.013	2.487	1.906
Echinoidea	25.864	65.592	7.472	14.844	0.226	-	-	-
Ophiuroidea	0.435	-	0.184	4.246	1.790	1.141	0.724	0.567
Asteroidea	6.420	0.505	7.244	0.781	0.002	-	0.248	-
HEMICHORDATA	0.022	-	-	-	-	-	-	-
CHORDATA	0.094	0.791	0.294	0.100	0.002	-	-	-
Ascidiacea	0.094	0.791	0.294	0.100	0.002	-	-	0.544
UNIDENTIFIED	0.376	0.229	0.264	0.113	0.005	0.471	0.044	0.025

(1,136/m² and 590/m²) in Chesapeake Bight and New York Bight were found in shallow water, 0–24 m. Differences in density, associated with water depth, were the same in each subarea. Biomass averaged nearly the same in the three subareas; it was only slightly higher (average 109 g/m²) in New York Bight, and about equal (84 and 85 g/m²) in Chesapeake Bight and Southern New England. Decreases in biomass as the water depth increased were generally similar in all subareas.

Scaphopoda were present in moderately deep water in all subareas. They were present in highest density (5.8/m²) in New York Bight, and about equal densities (approximately 3/m²) in Southern New England and Chesapeake Bight. Biomass of scaphopods was small in all subareas and the relative quantities were similar to their density. Largest biomass (average 0.1 g/m^2) was in New York Bight, and substantially smaller quantities (about 0.04 g/m^2) were present in Southern New England and Chesapeake Bight.

Cephalopoda, which were represented by benthic eggs, were present only in Southern New England. They were taken at water depths between 100 m and 499 m. Highest density (average $9.4/m^2$) was taken at 100 to 199 m, and lowest density (average $0.4/m^2$) was taken in deeper water. Biomass averaged 0.12 g/m^2 along the Outer Continental Shelf and 0.004 g/m^2 on the Continental Slope.

Arthropoda were represented principally by Crustacea; only minor quantities of Pycnogonida and Arachnida were present in the samples.

Pycnogonida occurred in shallow water only; from 0 m to 99 m in Southern New England, 0 m to 24 m in New York Bight, and 0 m to 199 m in Chesapeake Bight. Density was low ($0.2/m^2$) in New York Bight, and Pycnogonida were taken only in Long Island Sound. Densities in Southern New England and Chesapeake Bight were roughly similar, and averages ranged from $2.0/m^2$ to $0.2/m^2$ in each subarea. Highest densities were in shallow water, and lowest densities were in deep water in each subarea. Biomass of pycnogonids was very small (equal to or less than 0.01 g/m^2) in all subareas. Trends of biomass in relation to water depth were similar to those for density.

Arachnida were incompletely sampled because of their small size. They were present only in New York Bight where their average density was less than $0.6/m^2$ and biomass less than 0.003 g/m^2.

Crustacea were the single most numerous taxonomic group in all three subareas. Average density in the various bathymetric classes ranged from $1/m^2$ to $2{,}145/m^2$ and tended to decrease as water depth increased. Density differences from one subarea to another were substantial; highest densities were found in Southern New England, intermediate densities in New York Bight, and lowest densities in Chesapeake Bight. Biomass was moderate, ranging from an average of 0.006 g/m^2 in deep water to 53 g/m^2 in shallow water. Differences in biomass from one subarea to another were similar to those of density. Biomass in Southern New England averaged 16 g/m^2; in New York Bight, 9 g/m^2; and in Chesapeake Bight, 3 g/m^2.

Ostracoda were incompletely sampled, but showed a similar pattern of occurrence in each subarea. They were present only in shallow water, 0 to 99 m, and always in low density ($1.4/m^2$ or less). Biomass was extremely small, averaging 0.01 g/m^2 or less.

Cirripedia were present only in shallow water (less than 99 m) in all subareas. Because of their spotty distribution and highly clustered occurrence, their density varied considerably from one subarea to another and between bathymetric classes. Highest average density ($283/m^2$) was found in 0 to 24 m in New York Bight, intermediate density ($107/m^2$) in 0 to 24 m in Southern New England, and low density (less than $1/m^2$) in Chesapeake Bight. In water deeper than 24 m, their density was low (maximum of $2.4/m^2$) in all subareas. Biomass of barnacles was largest (39 g/m^2) at 0 to 24 m in Southern New England, intermediate (16 g/m^2) in New York Bight, and very small (less than 0.003 g/m^2) in Chesapeake Bight, and was small to very small in all subareas at water depths greater than 25 m.

Copepoda were incompletely sampled because of their small size. In Southern New England,they were taken at three depth classes (50–99 m, 200–499 m, and 500–999 m); in New York Bight, they were taken at one depth class (50–99 m), and none were taken in Chesapeake Bight. Average density and biomass in all localities were very small—maximum values $0.6/m^2$ and 0.003 g/m^2, respectively.

Nebaliacea were incompletely sampled. None were taken in Southern New England. A few were taken in very deep water (2,000 to 3,999 m) in New York Bight, where their density averaged $0.17/m^2$. A few specimens were taken at water depths of 50 to 99 m in Chesapeake Bight, where their density averaged $0.4/m^2$. Biomass was very small, equal to or less than 0.003 g/m^2.

Cumacea were widely distributed bathymetrically and geographically. Their bathymetric distribution was similar in all subareas, but their density, and biomass to a limited extent, differed from one subarea to another. Cumaceans were most abundant in Southern New England, where their average density was $29/m^2$ and their biomass was 0.13 g/m^2. Approximately equal densities (average $8/m^2$ and $10/m^2$, respectively) and biomass (average 0.045 and 0.035 g/m^2) were present in New York Bight and Chesapeake Bight.

Tanaidacea were present only in deep water and at low densities ($0.18/m^2$ to $1.0/m^2$). In New York Bight and Chesapeake Bight, they were present only in very deep water (2,000–3,999 m), but in Southern New England they were found in both deep water

TABLE 18.—*Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the Chesapeake Bight subarea*
[In number per square meter]

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2
PORIFERA	0.82	0.17	-	-	-	-	0.15	-
COELENTERATA	10.67	14.25	11.47	154.66	18.33	1.70	6.07	1.63
Hydrozoa	1.80	11.81	9.27	154.00	13.00	-	-	-
Anthozoa	8.87	2.44	2.20	0.66	5.33	1.70	6.07	1.63
Alcyonacea	0.02	-	-	-	-	-	0.92	1.13
Zoantharia	3.89	1.15	0.27	0.33	-	-	-	-
Unidentified	4.96	1.29	1.93	0.33	5.33	1.70	5.15	0.50
PLATYHELMINTHES	0.50	0.29	1.27	-	-	-	-	-
Turbellaria	0.50	0.29	1.27	-	-	-	-	-
NEMERTEA	7.32	4.13	4.13	1.83	2.17	1.00	1.38	-
ASCHELMINTHES	2.35	1.50	-	-	0.33	2.00	0.69	1.38
Nematoda	2.35	1.50	-	-	0.33	2.00	0.69	1.38
ANNELIDA	182.73	236.48	132.73	102.83	84.00	39.40	15.00	3.63
POGONOPHORA	-	1.42	0.40	-	15.33	38.20	8.46	3.00
SIPUNCULIDA	0.02	0.04	1.33	-	1.67	2.10	3.08	2.13
ECHIURA	0.25	0.04	-	-	-	-	0.15	1.25
PRIAPULIDA	-	-	-	-	-	-	0.13	-
MOLLUSCA	1232.94	52.00	319.53	492.50	122.49	293.30	33.47	8.88
Polyplacophora	0.13	-	-	-	0.33	1.30	1.31	0.25
Gastropoda	96.82	5.52	1.40	3.00	5.33	13.60	1.54	1.63
Bivalvia	1135.99	44.54	316.93	487.50	112.33	270.30	29.54	7.00
Scaphopoda	-	1.94	1.20	2.00	4.50	8.10	1.08	-
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	247.89	358.40	293.80	86.99	74.83	5.40	1.15	2.00
Pycnogonida	1.96	0.42	0.93	0.33	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-
Crustacea	245.93	357.98	292.87	86.66	74.83	5.40	1.15	2.00
Ostracoda	0.02	0.04	-	-	-	-	-	0.75
Cirripedia	0.31	0.19	-	-	-	-	-	-
Copepoda	-	-	-	-	-	-	-	-
Nebaliacea	-	-	0.40	-	-	-	-	-
Cumacea	2.26	27.50	23.13	5.50	11.50	0.60	0.15	-
Tanaidacea	-	-	-	-	-	-	-	1.00
Isopoda	29.48	11.35	6.47	2.00	0.33	0.40	0.15	0.25
Amphipoda	198.23	312.90	259.67	78.83	62.67	4.20	0.85	-
Mysidacea	8.65	0.06	-	-	-	-	-	-
Decapoda	6.98	5.94	3.20	0.33	0.33	0.20	-	-
BRYOZOA	8.55	2.31	13.73	-	-	-	-	-
BRACHIOPODA	-	-	0.13	-	-	-	-	-
ECHINODERMATA	16.45	45.98	11.74	129.67	18.83	2.70	2.15	6.88
Holothuroidea	0.04	0.31	0.27	3.33	14.83	1.10	0.46	0.50
Echinoidea	15.63	45.04	9.53	-	-	-	-	-
Ophiuroidea	0.73	0.48	1.67	125.67	3.67	1.20	1.23	6.13
Asteroidea	0.05	0.15	0.27	0.67	0.33	0.40	0.46	0.25
HEMICHORDATA	0.13	-	-	-	-	-	-	-
CHORDATA	13.87	0.79	3.33	-	-	-	0.85	2.00
Ascidiacea	13.87	0.79	3.33	-	-	-	0.85	2.00
UNIDENTIFIED	17.01	4.21	1.27	0.67	12.00	1.10	2.31	7.38

(1,000–3,999 m) and at middepths (200–499 m). Biomass, also, was small at all localities (0.003 to 0.006 g/m^2), and no geographic differences were apparent.

Isopoda were distributed in the same bathymetric pattern and at roughly equal densities in all subareas. In each subarea, the high densities, which ranged from 22/m^2 to 36/m^2, were found in shallow water (0–49 m); intermediate densities at middepths (50–999 m); and low densities, 0.3/m^2 to 0.2/m^2, were found in deep water (1,000 m or deeper). Biomass was small (maximum bathymetric class aver-

TABLE 19.—*Mean biomass listed by major taxonomic groups for each bathymetric class, representing the Chesapeake Bight subarea*

[In grams per square meter]

Taxomonic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.004	0.126	-	-	-	-	0.048	-
COELENTERATA	5.170	1.984	0.923	0.110	0.352	0.039	0.725	0.165
Hydrozoa	0.369	0.120	0.055	0.100	0.035	-	-	-
Anthozoa	4.802	1.864	0.868	0.010	0.317	0.039	0.725	0.165
Alcyonacea	0.024	-	-	-	-	-	0.399	0.160
Zoantharia	4.764	1.713	0.121	0.007	-	-	-	-
Unidentified	0.013	0.150	0.747	0.003	0.317	0.039	0.326	0.005
PLATYHELMINTHES	0.006	0.009	0.021	-	-	-	-	-
Turbellaria	0.006	0.009	0.021	-	-	-	-	-
NEMERTEA	0.289	0.423	0.653	0.720	0.100	0.018	0.417	-
ASCHELMINTHES	0.009	0.002	-	-	0.003	0.014	0.005	0.008
Nematoda	0.009	0.002	-	-	0.003	0.014	0.005	0.008
ANNELIDA	10.996	11.186	6.298	3.312	10.092	8.374	0.694	0.134
POGONOPHORA	-	0.009	0.001	-	0.047	0.305	0.020	0.010
SIPUNCULIDA	<0.001	<0.001	0.163	-	0.043	0.120	5.287	0.011
ECHIURA	0.060	0.038	-	-	-	-	1.336	6.731
PRIAPULIDA	-	-	-	-	-	-	0.078	-
MOLLUSCA	81.043	53.362	66.783	75.288	2.295	1.493	0.338	0.084
Polyplacophora	0.011	-	-	-	0.003	0.008	0.014	0.002
Gastropoda	7.304	0.558	0.148	0.018	0.042	0.273	0.015	0.012
Bivalvia	73.728	52.772	66.619	75.257	2.147	1.118	0.297	0.069
Scaphopoda	-	0.032	0.016	0.013	0.103	0.094	0.012	-
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	2.694	5.361	1.755	0.392	0.317	0.074	0.006	0.012
Pycnogonida	0.012	0.001	0.003	0.003	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-
Crustacea	2.682	5.360	1.752	0.388	0.317	0.074	0.006	0.012
Ostracoda	<0.001	<0.001	-	-	-	-	-	0.005
Cirripedia	0.002	0.008	-	-	-	-	-	-
Copepoda	-	-	-	-	-	-	-	-
Nebaliacea	-	-	0.003	-	-	-	-	-
Cumacea	0.011	0.075	0.105	0.017	0.072	0.006	0.002	-
Tanaidacea	-	-	-	-	-	-	-	0.005
Isopoda	0.208	0.730	0.216	0.083	0.003	0.004	0.002	0.002
Amphipoda	1.060	3.624	1.350	0.282	0.235	0.022	0.003	-
Mysidacea	0.030	0.001	-	-	-	-	-	-
Decapoda	1.371	0.922	0.079	0.007	0.007	0.042	-	-
BRYOZOA	0.179	0.049	0.291	-	-	-	-	-
BRACHIOPODA	-	-	0.001	-	-	-	-	-
ECHINODERMATA	3.556	29.148	2.598	28.728	15.138	0.378	2.386	2.568
Holothuroidea	0.035	1.145	0.047	24.745	14.940	0.059	0.766	2.308
Echinoidea	3.462	27,895	2.381	-	-	-	-	-
Ophiuroidea	0.059	0.046	0.053	2.693	0.192	0.318	1.613	0.258
Asteroidea	<0.001	0.062	0.116	1.290	0.007	0.001	0.007	0.002
HEMICHORDATA	0.068	-	-	-	-	-	-	-
CHORDATA	9.809	0.412	0.125	-	-	-	0.003	0.242
Ascidiacea	9.809	0.412	0.125	-	-	-	0.003	0.242
UNIDENTIFIED	0.223	0.094	0.021	0.003	0.060	0.011	0.087	0.058

age was 0.6 g/m²) in all bathymetric classes in each subarea.

Amphipoda were the most abundant taxonomic group in the Middle Atlantic Bight region. Major differences in density were found from one subarea to another. In Southern New England, they were most numerous, averaging 1,137/m²; in New York Bight, they were moderately common, averaging 396/m²; and in Chesapeake Bight, they were least numerous, averaging 192/m². Biomass, also, differed from one subarea to another. In Southern New England, it averaged 7.0 g/m²; in New York Bight, it averaged 2.5 g/m²; and in Chesapeake Bight, it averaged only 1.5 g/m². Relationships of density and biomass to water depth were very similar among the three subareas.

Mysidacea, although incompletely sampled, revealed the same trend of decreasing density as water depth increased in all three subareas. They were taken only at depths less than 500 m, but were most common at depths from 0 to 24 m, where their average density ranged from 3.6/m² to 8.6/m². In water depths greater than 25 m, their average density ranged from $0.25/m^2$ to $0.4/m^2$. Biomass was small (maximum bathymetric class average 0.04 g/m^2) in all subareas.

Decapoda revealed a bathymetric distribution pattern that was similar in each subarea. They were regularly taken at depths from 0 to 200 m, but only occasionally at greater depths. The density of decapods was about the same ($8/m^2$) in Southern New England and New York Bight, but substantially lower ($3/m^2$) in Chesapeake Bight. Biomass was largest (1.6 g/m^2) in New York Bight, intermediate (1.1 g/m^2) in Southern New England, and smallest (0.8 g/m^2) in Chesapeake Bight. The trends of density and biomass in relation to water depth were similar in all subareas.

Bryozoa had much the same bathymetric distribution in all subareas. In Southern New England, they were found in each bathymetric class on the Continental Shelf (0–199 m), and in New York Bight and Chesapeake Bight, they were found at depths from 0 to 99 m. Density was much higher in Southern New England (overall average of $39/m^2$) than in the other subareas, where the average was about $6/m^2$ to $8/m^2$ in each. Biomass was relatively high in Southern New England, where it averaged 1.2 g/m^2, compared to an average of less than 0.2 g/m^2 in New York and Chesapeake Bights.

Brachiopoda were absent in the Southern New England and New York Bight subareas; they were present in only one sample from Chesapeake Bight at a depth of 91 m.

Echinodermata were very common in all subareas and were present in all bathymetric classes. Echinoidea and Ophiuroidea were the two dominant subgroups. These and the other two major classes are described below.

Holothuroidea were widely distributed bathymetrically as well as geographically. They were present in all depth classes from the shallowest to deepest. The pattern of density distribution in relation to depth was the same in each subarea. Highest density ($1/m^2$ to $15/m^2$) occurred along the Outer Continental Shelf and upper slope and decreased in both shallower and deeper water. The biomass of the holothurians was substantially greater in Southern New England than in the other subareas. On the outer shelf and upper slope off Southern New England, their average biomass ranged between 23 and 51 g/m^2. In New York Bight, their average biomass was less than 0.7 g/m^2 at these bathymetric levels. In Chesapeake Bight, their average biomass at all depths was 7 g/m^2 and was largest (15 to 25 g/m^2) at depths between 100 and 500 m. Biomass in very deep water (greater than 1,000 m) averaged about 2 to 3 g/m^2 in all subareas, whereas in shallow water, 0 to 50 m, the average quantity usually was smaller than 1 g/m^2.

Echinoidea showed a pronounced decrease in density from shallow to deep water. This relationship between density and water depth was the same in all subareas; however, echinoids were found across the shelf into deep water (at depths greater than 2,000 m) in Southern New England, to moderate depths (500 m) in New York Bight, and to only 99 m in Chesapeake Bight. Average densities were highest (bathymetric class average up to $118/m^2$) in New York Bight, intermediate in Chesapeake Bight, and slightly lower in Southern New England. Echinoids accounted for a major share of the biomass, especially in New York Bight, where inner shelf quantities averaged 26 g/m^2 and 66 g/m^2. In Southern New England, biomass averages on the inner shelf were 4 g/m^2 and 12 g/m^2; and in Chesapeake Bight, were 3 g/m^2 and 28 g/m^2.

Ophiuroidea were distributed bathymetrically much the same in each subarea. High density (averages of $123/m^2$ to $350/m^2$) occurred at middepths, and decreased to densities of less than $1/m^2$ in shallow shelf waters, and to $1/m^2$ to $8/m^2$ in very deep water (greater than 1,000 m). Biomass was largest, averaging up to 22 g/m^2, in Southern New England; intermediate in New York Bight; and smallest (0.5 to 2.7 g/m^2) in Chesapeake Bight. Trends in density and biomass in relation to water depth were the same in all subareas.

Asteroidea had a rather low density and a wide bathymetric range in all subareas. The general relationship between density and water depth was a relatively high density ($0.7/m^2$ to $4/m^2$) at middepths, 25 to 200 m, and low density ($0.2/m^2$ to $0.5/m^2$) in shallower and deeper waters. Overall density was highest in Southern New England, intermediate in New York Bight, and lowest in Chesapeake Bight. Although their density was modest, asteroids constituted a substantial biomass at middepths, which was largest in Southern New England, averaging 2 to 17 g/m^2; intermediate in New York Bight, averaging 0.8 to 7 g/m^2; and smallest in Chesapeake Bight, averaging 0.1 to 1.2 g/m^2.

Hemichordata were sparse in all subareas and in all bathymetric classes (a total of 6) in which they were found. Average densities were less than $0.7/m^2$, and average biomasses were less than 0.14 g/m^2. In Southern New England, their bathymetric range was from 50 to 999 m, whereas in New York Bight and

Chesapeake Bight, they were found only in very shallow (0 to 24 m) waters.

Chordata (Ascidiacea) were widely distributed bathymetrically and geographically. In all three subareas, density was highest on the Continental Shelf, lowest on the Continental Slope, and intermediate on the Continental Rise. Densities were substantially higher (average 32/m^2) in Southern New England than in both New York Bight (average 5/m^2) and Chesapeake Bight (average 7/m^2). Trends in biomass of ascidians were similar to those in density; largest quantities were found in Southern New England (average 5.8 g/m^2), smallest in New York Bight (average 0.3 g/m^2), and intermediate quantities in Chesapeake Bight (average 2.1 g/m^2).

RELATION TO BOTTOM SEDIMENTS

DISTRIBUTION OF SEDIMENT TYPES

The geographic distribution of bottom sediments in the Middle Atlantic Bight region is shown in figure 88. (See table 20 for number of samples for each type of bottom sediment.) The most striking feature of these distributional patterns is the prevalence of sand on the Continental Shelf throughout the entire region. Silt and clay sediments predominate in the deeper waters, especially on the Continental Slope and Rise. Sediments in the bays and sounds are characterized by their wide diversity of types.

Gravel was relatively rare and found only in Southern New England. Sand-gravel was uncommon and found mainly in Southern New England and New York Bight. Shell sediments, also, were relatively rare; they were found only in Chesapeake Bight. Sand-shell mixtures were moderately common, especially in New York Bight and Chesapeake Bight. Although sand sediments were present throughout much of the entire region, they were especially widespread on the Continental Shelf. They were the dominant sediment type in shelf waters in all subareas. Silty sand was common on the outer shelf off Southern New England and along the Continental Slope in all subareas. Silt was most common on the Continental Slope, but also was found in substantially large areas on the Continental Rise. Clay sediments were dominant on the Continental Rise in all subareas and were present in limited areas on the Continental Slope.

TABLE 20.—*Number of samples for each bottom-sediment type in each subarea and for the entire Middle Atlantic Bight region*

Bottom sediments	Subarea: Southern New England	New York Bight	Chesapeake Bight	Entire region
Gravel	3	0	0	3
Sand-gravel	11	5	2	18
Shell	1	0	3	4
Sand-shell	1	16	27	44
Sand	83	118	84	285
Silty sand	52	18	24	94
Silt	25	16	28	69
Clay	10	14	22	46
Total	186	187	190	563

The bathymetric distribution of sediments throughout the entire region showed a decided decrease in particle size as depth increased. The coarser grained substrates, gravel and shell, were confined to water depths of less than 50 m; sand-gravel substrates were not found in depths beyond 100 m; and sand-shell was restricted to depths of less than 200 m. Sand was present at depths down to a maximum of 500 m. Among the finer grained substrates, silty sand was ubiquitous throughout the entire bathymetric range. Silts, also, were present at nearly all depths. Clay sediments were found in bays, sounds, and coastal areas down to a depth of 49 m, and although they were absent from most of the shelf and upper slope areas, they were present from midslope (500 m) down to the deepest depths sampled.

Photographs of the sea bottom (figs. 89 to 94) taken with the Campbell grab photographic system show the sediment surface in different bottom types. Three of the photographs show the camera-tripping weight, which stirs up fine particles when it strikes bottom. One of these photographs shows coarse sediments and two show fine-grained sediments. The presence or absence of fine-grained particles in suspension provides an indication of the amount of silt-clay in the sediment.

TOTAL MACROBENTHIC FAUNA OF ALL TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

The relation of density and biomass of all organisms to bottom sediments in the entire Middle Atlantic Bight region is depicted in figures 95 and 96. Density tended to decrease as particle size decreased (table 21, fig. 95). Average densities ranged from a high of 2,667/m^2 in gravel to a low of 165/m^2 in clay. Intermediate values were present in sediment types of intermediate particle sizes. Sand-gravel contained an average of 2,089/m^2, whereas shell contained 1,639/m^2. The average density for sand-shell was 2,006/m^2; and sand, silty sand, and silt contained an average of 1,716/m^2, 1,286/m^2, and 486/m^2, respectively.

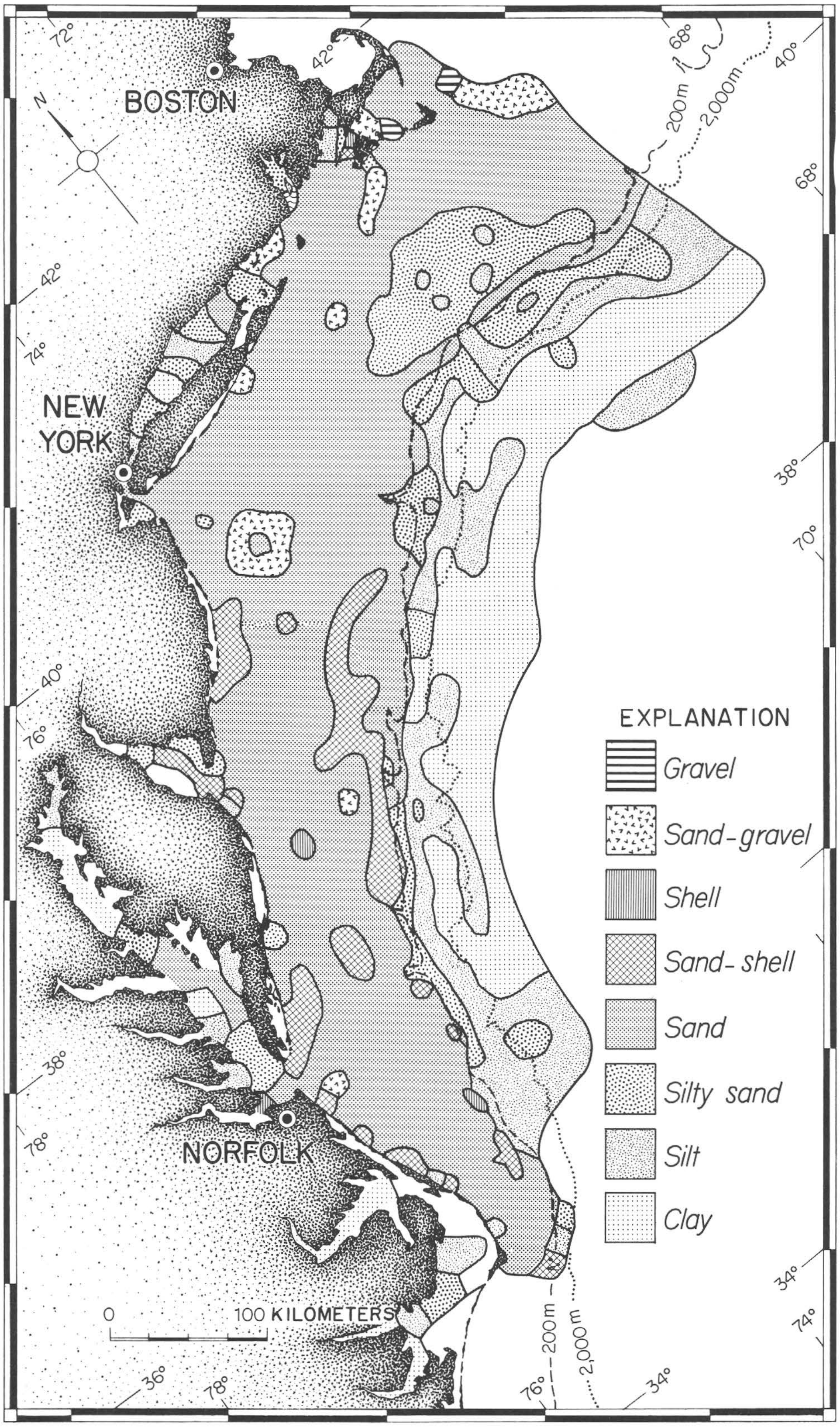

FIGURE 88.—Geographic distribution of bottom-sediment types in the Middle Atlantic Bight region.

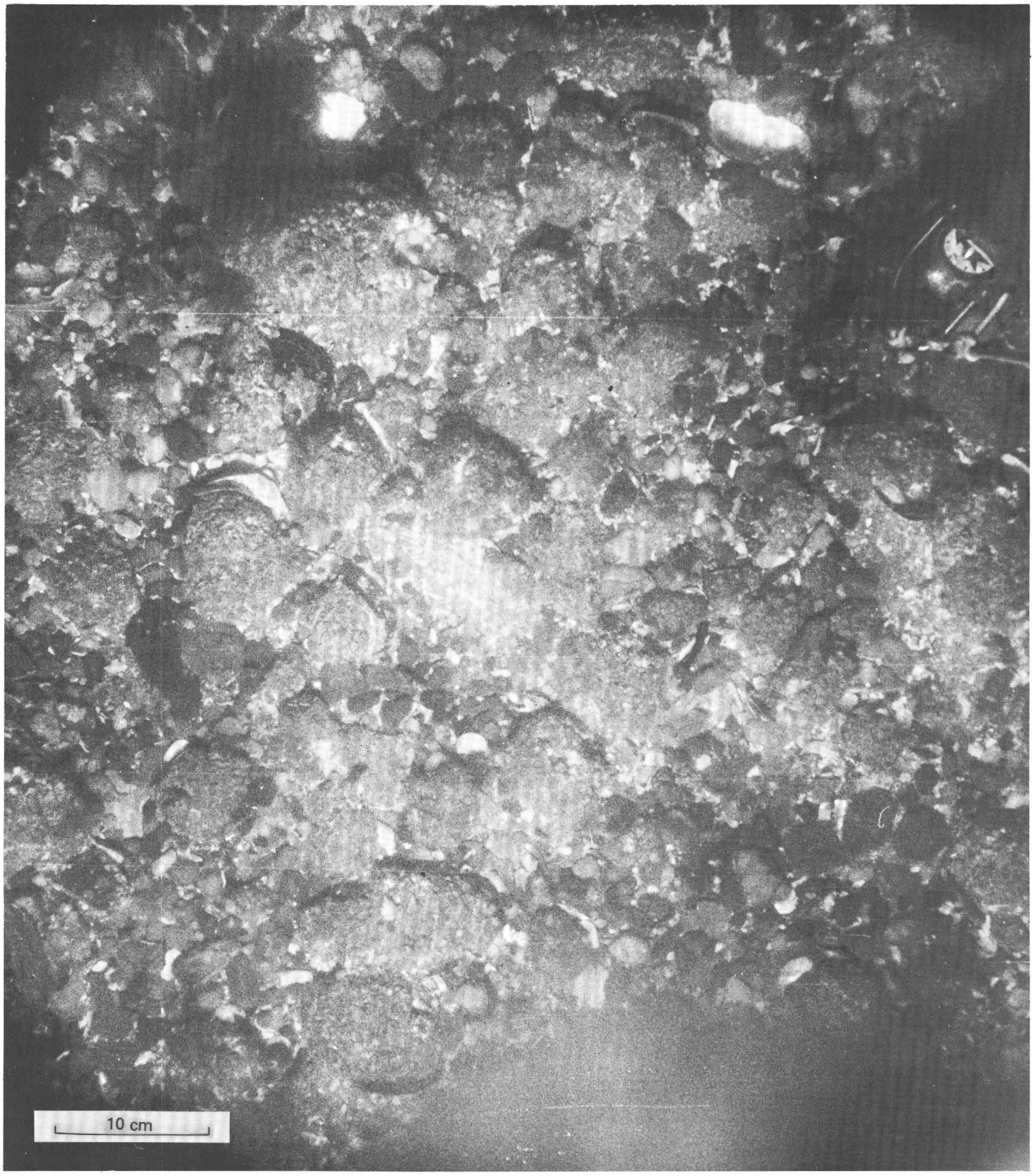

FIGURE 89.—Gravel bottom at a depth of 23 m in the Nantucket Shoals region, south of Cape Cod, Mass. The most common gravels range in diameter from 5 to 15 cm. Camera tripping-weight is visible in the upper right-hand corner. Photograph was taken at station 1103, located at lat. 41°11′ N., long. 69°40′ W.

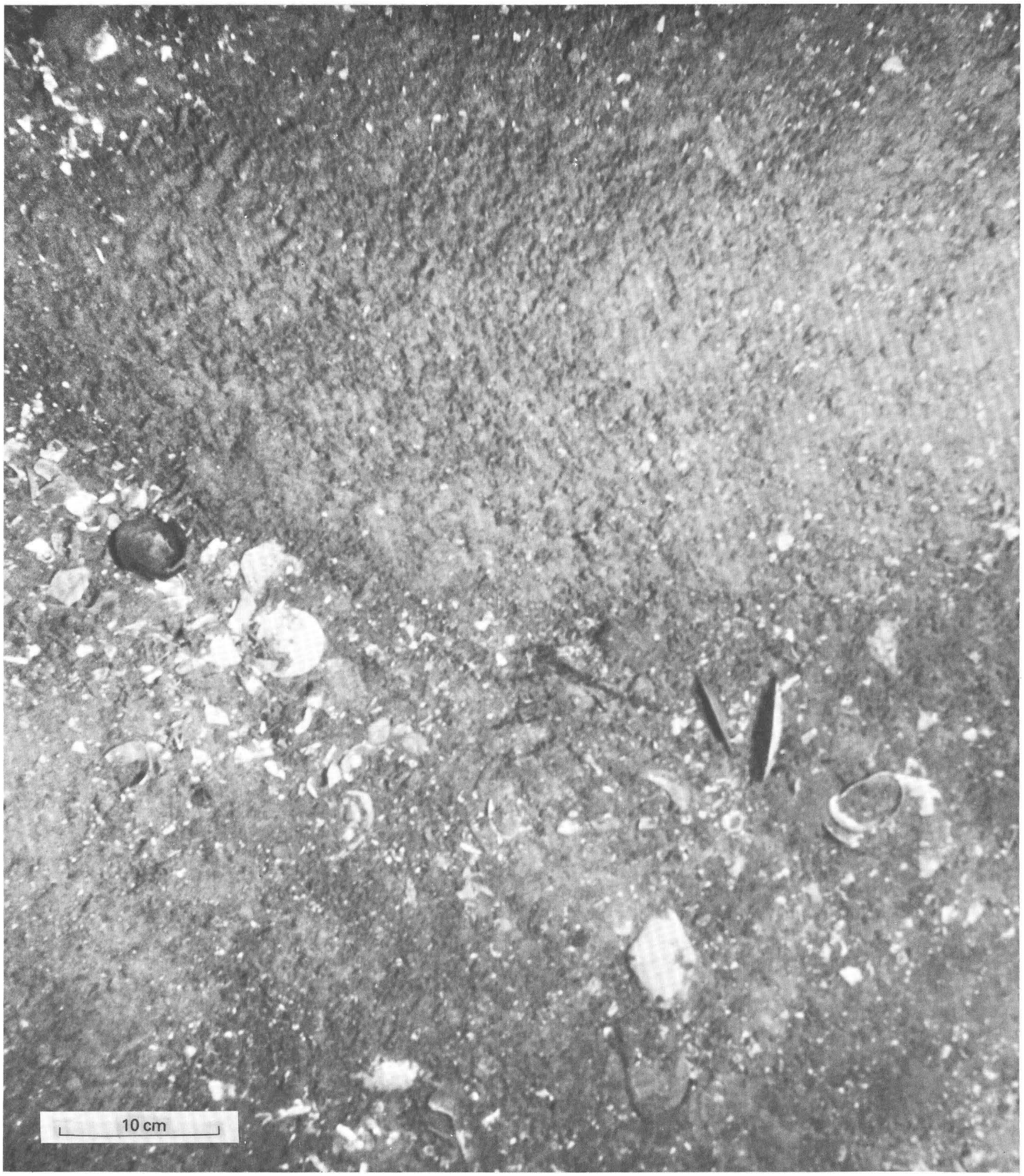

FIGURE 90.—Sand bottom containing small amounts of shell, located on the Continental Shelf northeast of Cape Charles, Va., at a depth of 48 m. Shell remains are mainly bivalve mollusks and a few echinoid tests and spines. Photograph was taken at station 1421, located at lat. 37°30′ N., long. 74°44′ W.

FIGURE 91.—Silty-sand bottom at a depth of 406 m on the Continental Slope east of New Jersey. In the upper left is a sodastraw worm tube (*Hyalinoecia tubicola*); in the lower left is the camera tripping-weight; the tips of brittlestar arms and numerous animal tracks are evident in other areas. Photograph was taken at station 1335, located at lat. 39°10′ N., long. 72°30′ W.

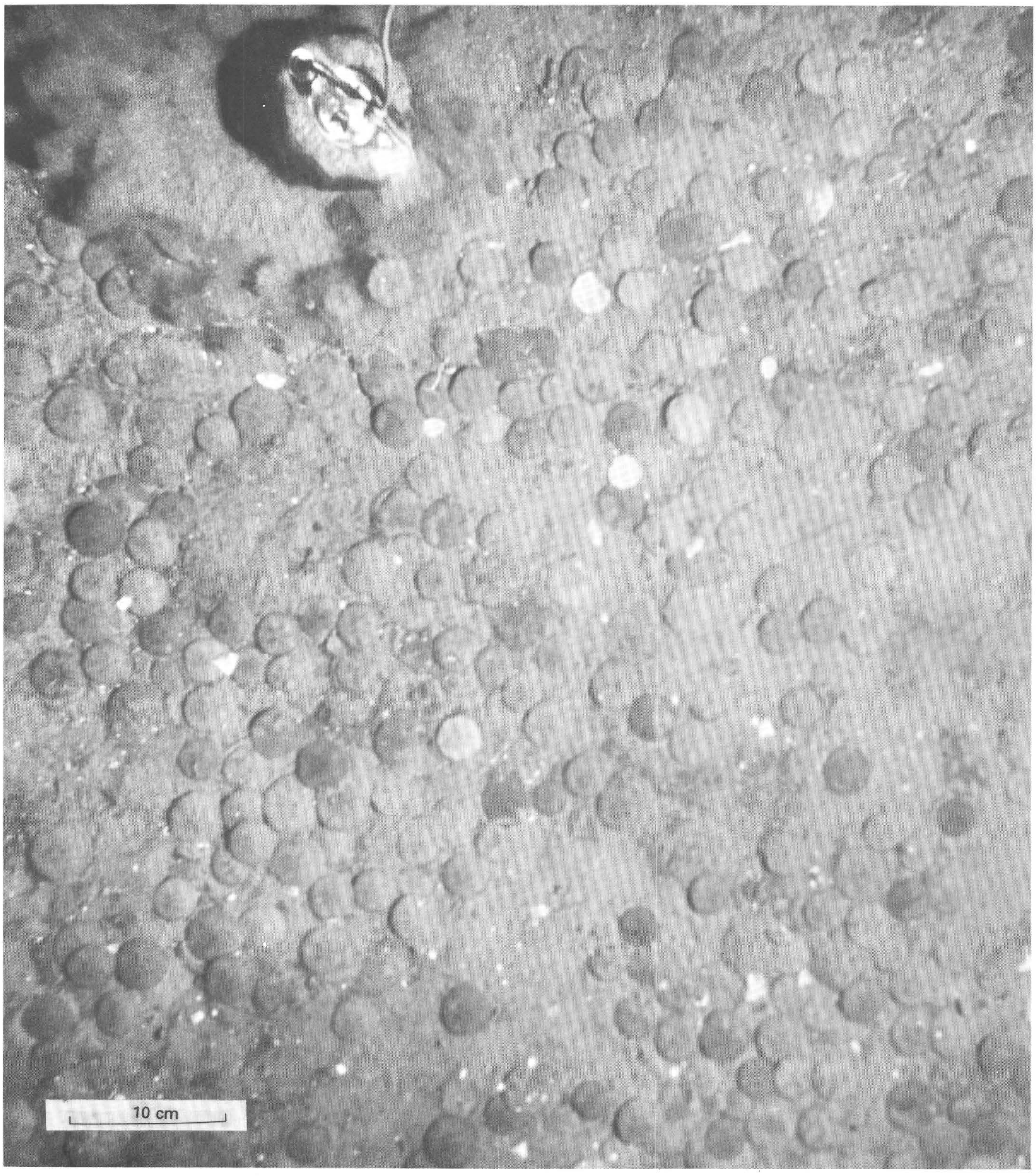

FIGURE 92.—Sand bottom inhabited by a dense assemblage of sand dollars (*Echinarchnius parma*) at a depth of 48 m near midshelf east of Delaware. The sand dollars are 2 to 3 cm in diameter. Photograph was taken at station 1418, located at lat. 37°59′ N., long. 74°29′ W.

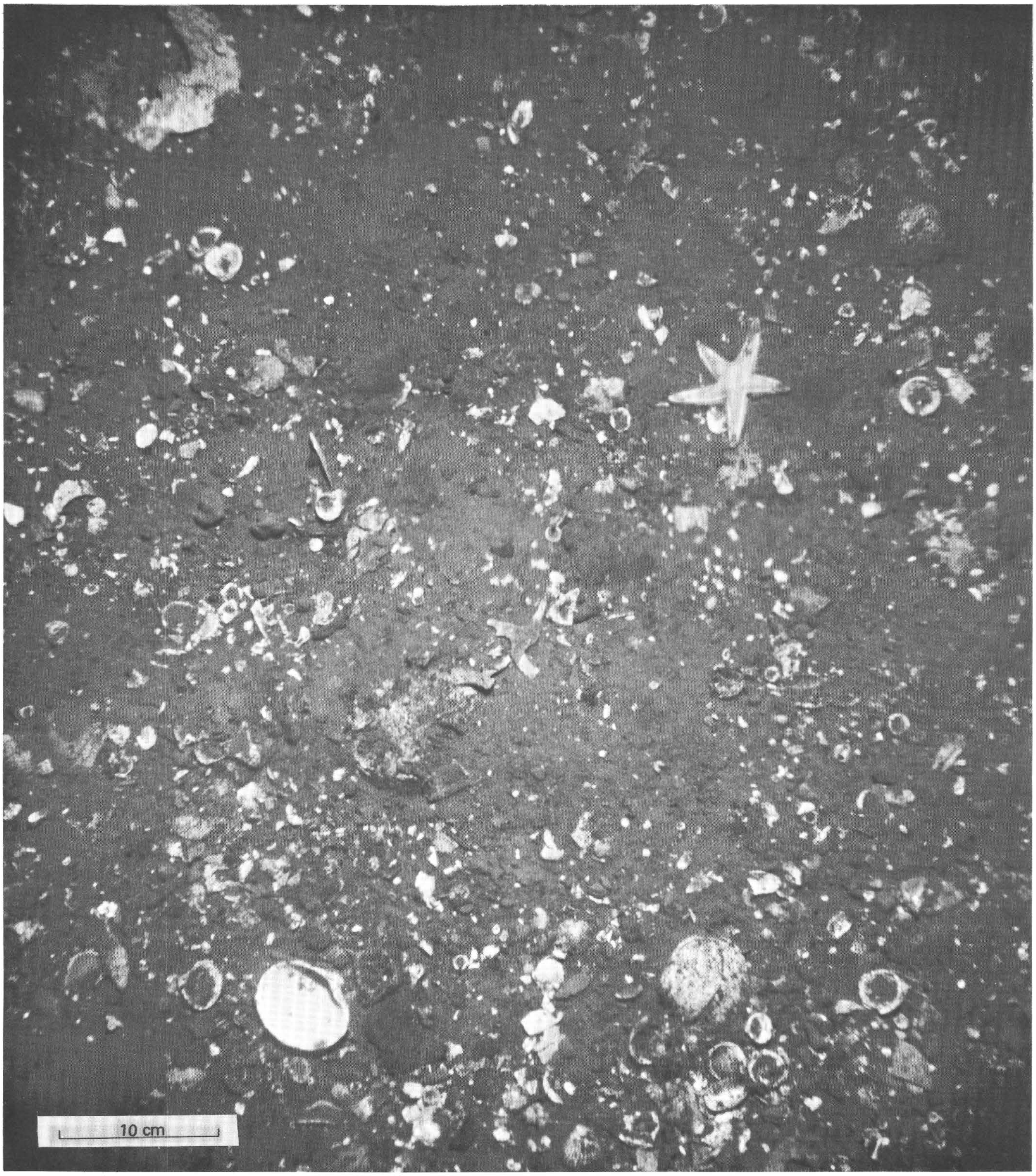

FIGURE 93.—Sand-shell bottom at a depth of 69 m near the Outer Continental Shelf northeast of Cape May, N. J. The starfish is *Astropecten*; the shell remains are *Placopecten*, *Arctica*, and *Astarte*. Photograph was taken at station 1360, located at lat. 38°40′ N., long. 73°30′ W.

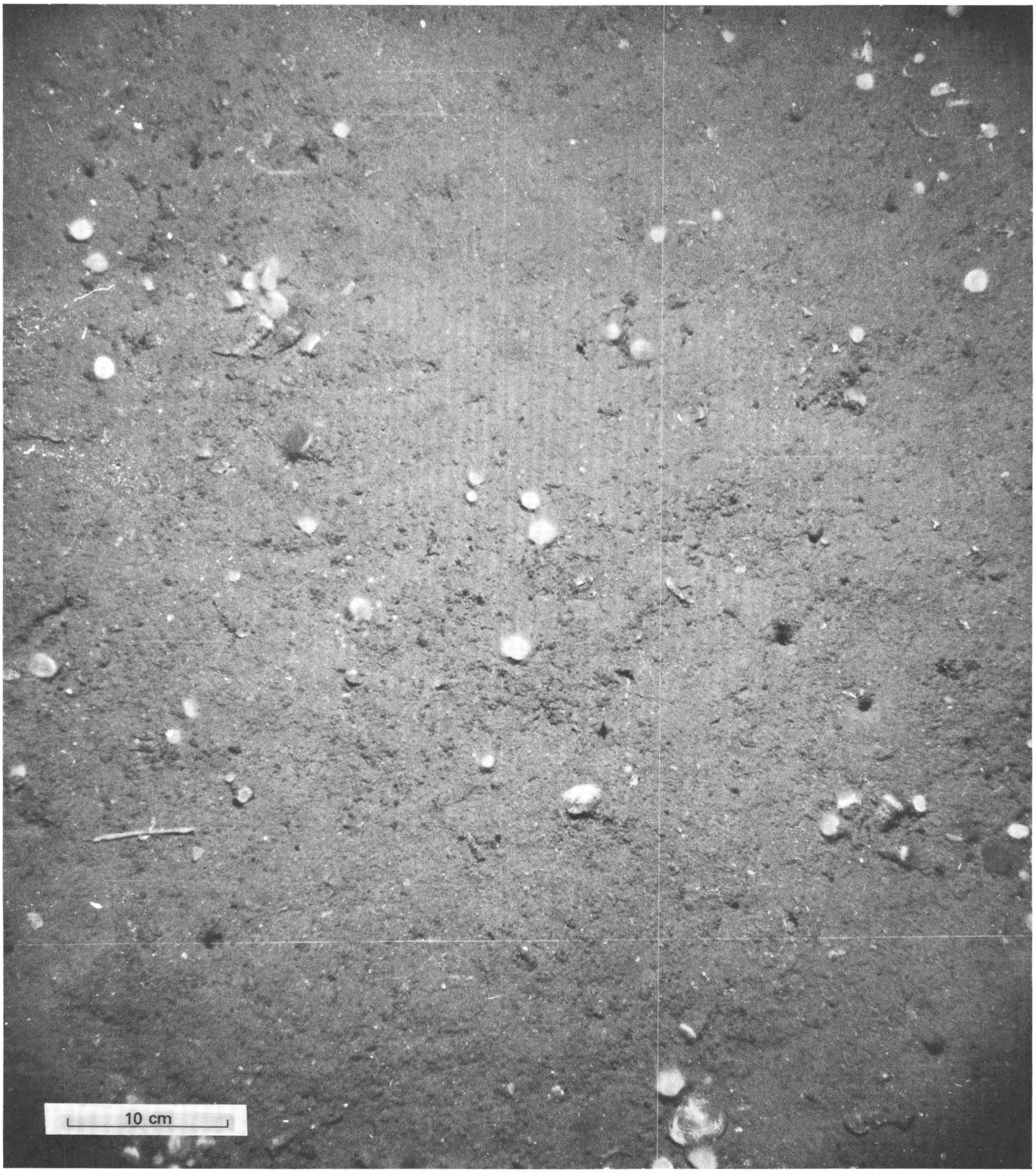

FIGURE 94.—Silty-sand bottom at a depth of 178 m on the Outer Continental Shelf near Hudson Channel, south of New York City. Dominant animals are sea anemones (Zoantharia). Bivalve shells and polychaete tubes are moderately common. Photograph was taken at station 1324, located at lat. 39°20′ N., long. 72°18′ W.

TABLE 21.—*Mean number of individuals and biomass of the macrobenthic invertebrate fauna in relation to bottom sediments for each subarea and for the entire Middle Atlantic Bight region*

Sediment type	Mean number of individuals				Mean biomass			
	SNE	NYB	CHB	Entire area	SNE	NYB	CHB	Entire area
	No./m^2	No./m^2	No./m^2	No./m^2	g/m^2	g/m^2	g/m^2	g/m^2
Gravel	2,667	-	-	2,667	286	-	-	286
Sand-gravel	3,157	448	311	2,089	379	94	12	256
Shell	2,925	-	1,211	1,639	117	-	706	559
Sand-shell	259	769	2,804	2,006	3	82	72	74
Sand	2,912	1,391	989	1,716	321	146	85	179
Silty-sand	1,131	1,906	1,157	1,286	105	1,725	100	414
Silt	660	464	343	486	76	72	35	59
Clay	62	105	249	165	5	6	102	52

Unlike density, the mean biomass of all organisms in relation to sediments within the Middle Atlantic Bight region (table 21, fig. 96) did not show a consistent trend of decreasing quantity as particle size decreased. The largest biomass values occurred in shell, 559 g/m^2, and silty sand, 414 g/m^2. The smallest biomass values of 52, 59, and 74 g/m^2 were found in clay, silt, and sand-shell, respectively. Intermediate quantities were present in gravel, sand-gravel, and sand where biomasses of 286, 256, and 179 g/m^2, respectively, were found.

SUBAREAS

SOUTHERN NEW ENGLAND

The mean density of all organisms in relation to bottom sediments in the Southern New England subarea (fig. 97) showed a trend similar (a general decrease in density as particle size decreased) to that described above for the entire Middle Atlantic Bight region (fig. 95). Two exceptions are notable in this correlation with substrates. The highest density was in sand-gravel, the second coarsest sediment type, where 3,157/m^2 were found, and gravel, the coarsest, contained 2,667/m^2. Sand-shell, ranked fourth in coarseness, contained the second lowest density of 259/m^2, and clay, the finest grained substrate, contained the lowest density, 62/m^2. Densities in shell, sand, silty sand, and silt were 2,925/m^2, 2,912/m^2, 1,131/m^2, and 660/m^2, respectively.

Biomass in the Southern New England subarea ranged from 379 g/m^2 in sand-gravel substrates to 3 g/m^2 in sand-shell (fig. 98). No definite linear relationship between biomass and decreasing particle size was seen; although, in general, the coarser grained substrates contained larger biomasses than the finer grained. Gravel, shell, and sand sediments contained, respectively, 286, 117, and 321 g/m^2, whereas silty sand, silt, and clay substrates contained a biomass of 105, 77, and 5 g/m^2, respectively.

NEW YORK BIGHT

Gravel and shell substrates were not present at sampling stations in the New York Bight. The sandy substrates contained the highest densities, which increased as particle size decreased; the highest density was found in silty-sand (1,906/m^2) (fig. 97). Sand-gravel, sand-shell, and sand sediments contained densities of 448/m^2, 769/m^2, and 1,391/m^2, respectively, but silt had a density of 464/m^2 and clay a density of 105/m^2.

The mean biomass of all organisms was generally small, below 100 g/m^2, in most substrates. Sand-gravel contained 94 g/m^2; sand-shell, 82 g/m^2; silt, 72 g/m^2; and clay, 6 g/m^2; sand with a biomass of 146 g/m^2 exceeded the norm, but silty sand with 1,725 g/m^2 contained the largest biomass of all sediment types throughout the entire study area (fig. 98). No definite correlation with sediment particle size was discernible.

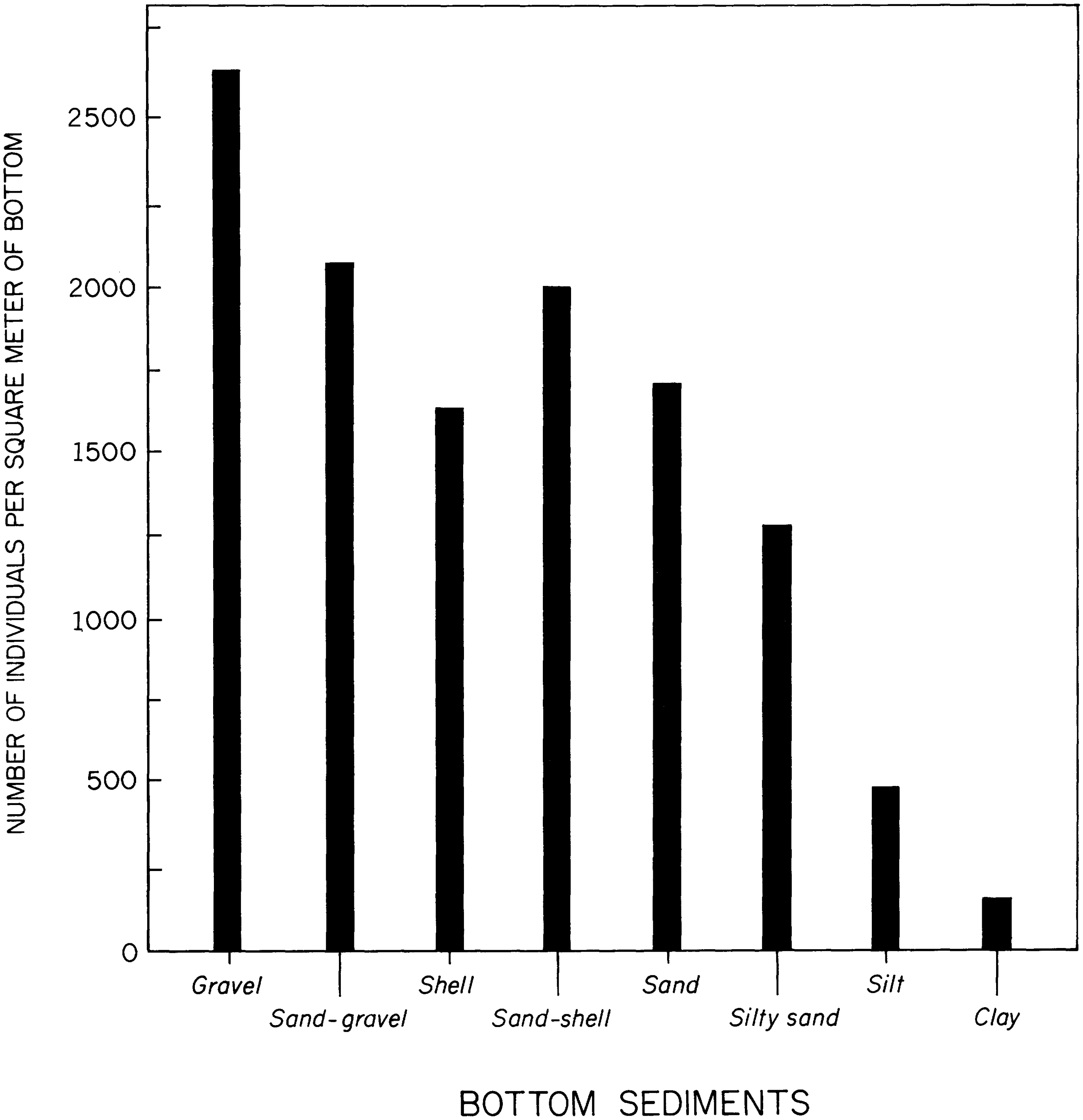

FIGURE 95.—Relation between number of individuals and bottom-sediment types. Values represent all taxonomic groups combined for the entire Middle Atlantic Bight region.

CHESAPEAKE BIGHT

Gravel was the only sediment type absent from the Chesapeake Bight subarea. The density of organisms in this subarea showed a general tendency of being relatively low in both the coarsest and finest substrates (fig. 97). In the coarse sediments, sand-gravel ranked first with a density of 311/m². Among the finer sediments, densities of 343/m² and 249/m² were found in silt and clay, respectively. Density values in the medium to moderately fine substrates averaged approximately 1,000 individuals per square meter; 989/m², 1,157/m², and 1,211/m²

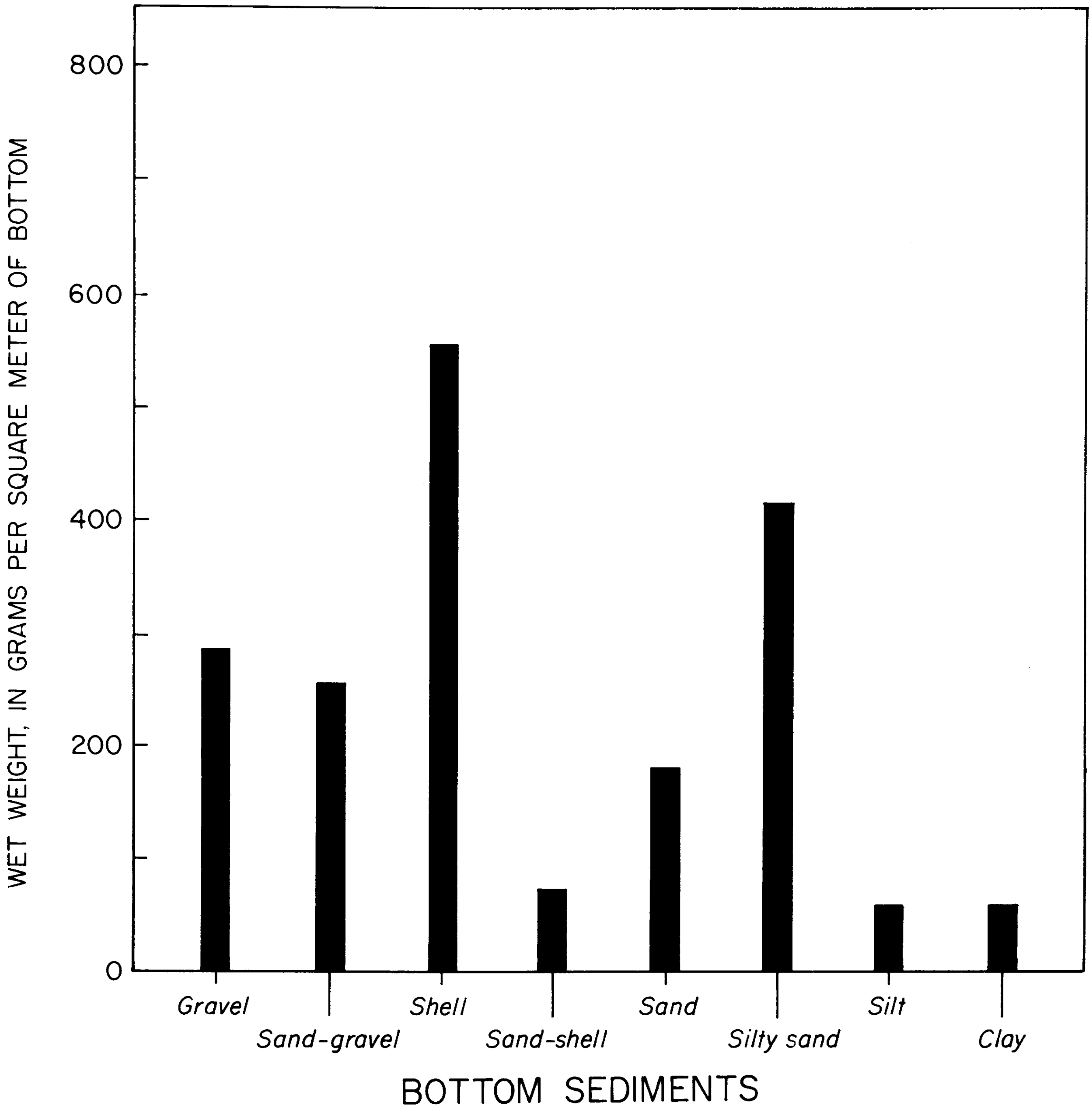

FIGURE 96.—Relation between biomass and bottom-sediment types. Values represent all taxonomic groups combined for the entire Middle Atlantic Bight region.

in sand, silty sand, and shell, respectively. The highest density of all organisms in this subarea, by a significant amount, 2,804/m², was found in sand-shell.

The mean biomass of all organisms in the Chesapeake Bight was generally lower than that in either the Southern New England or the New York Bights. However, shell and clay sediments in this subarea contained the largest recorded biomasses of the entire region (fig. 98). The biomass of all organisms in shell was 706 g/m² in Chesapeake Bight versus 117 g/m² in Southern New England. Silty-sand and clay sediments were the only other substrates whose biomasses equalled or exceeded 100 g/m² in this sub-

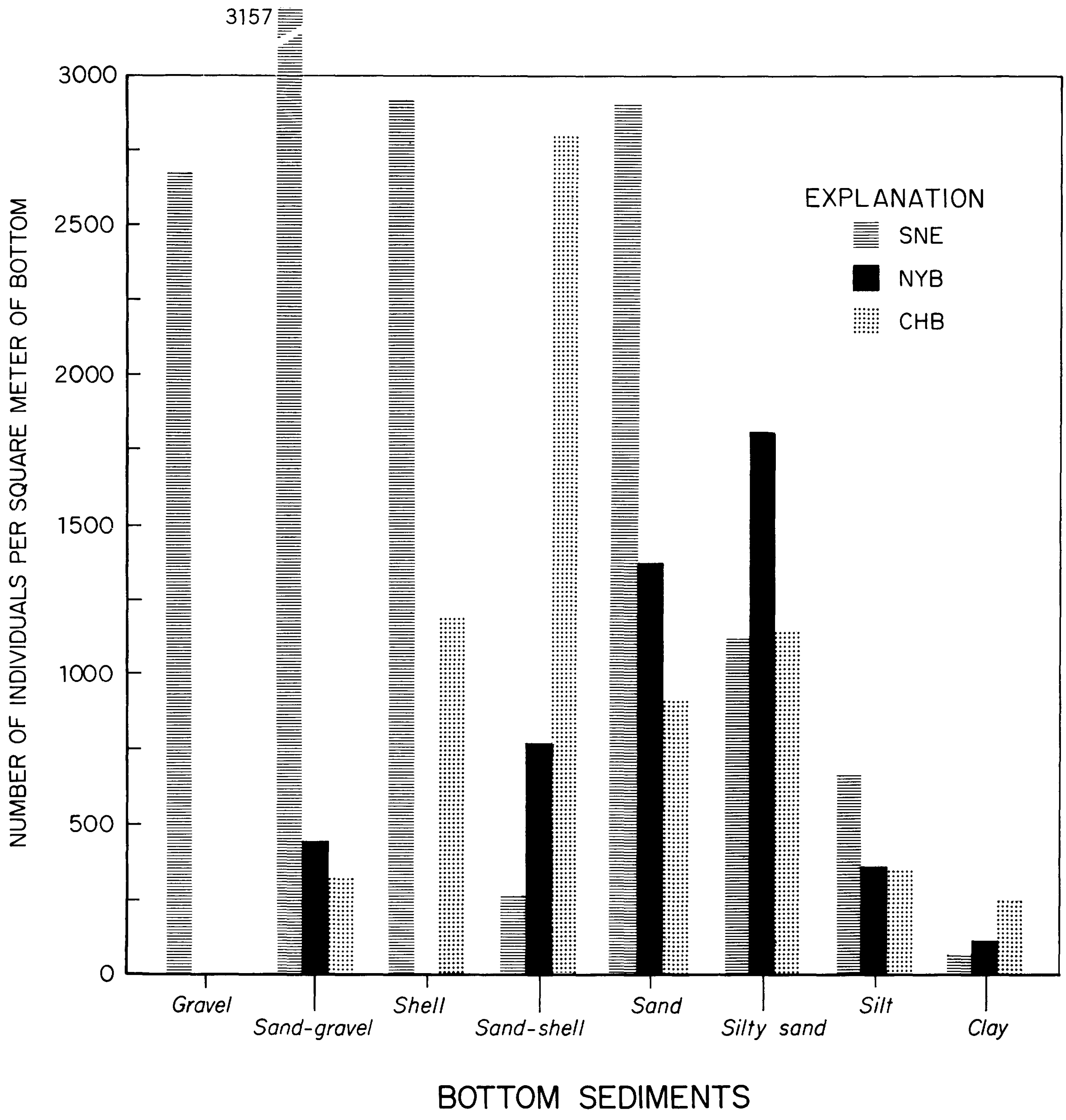

FIGURE 97.—Relation between number of individuals and bottom-sediment types. Values represent all taxonomic groups combined for each subarea. Abbreviations: SNE, Southern New England; NYB, New York Bight; CHB, Chesapeake Bight.

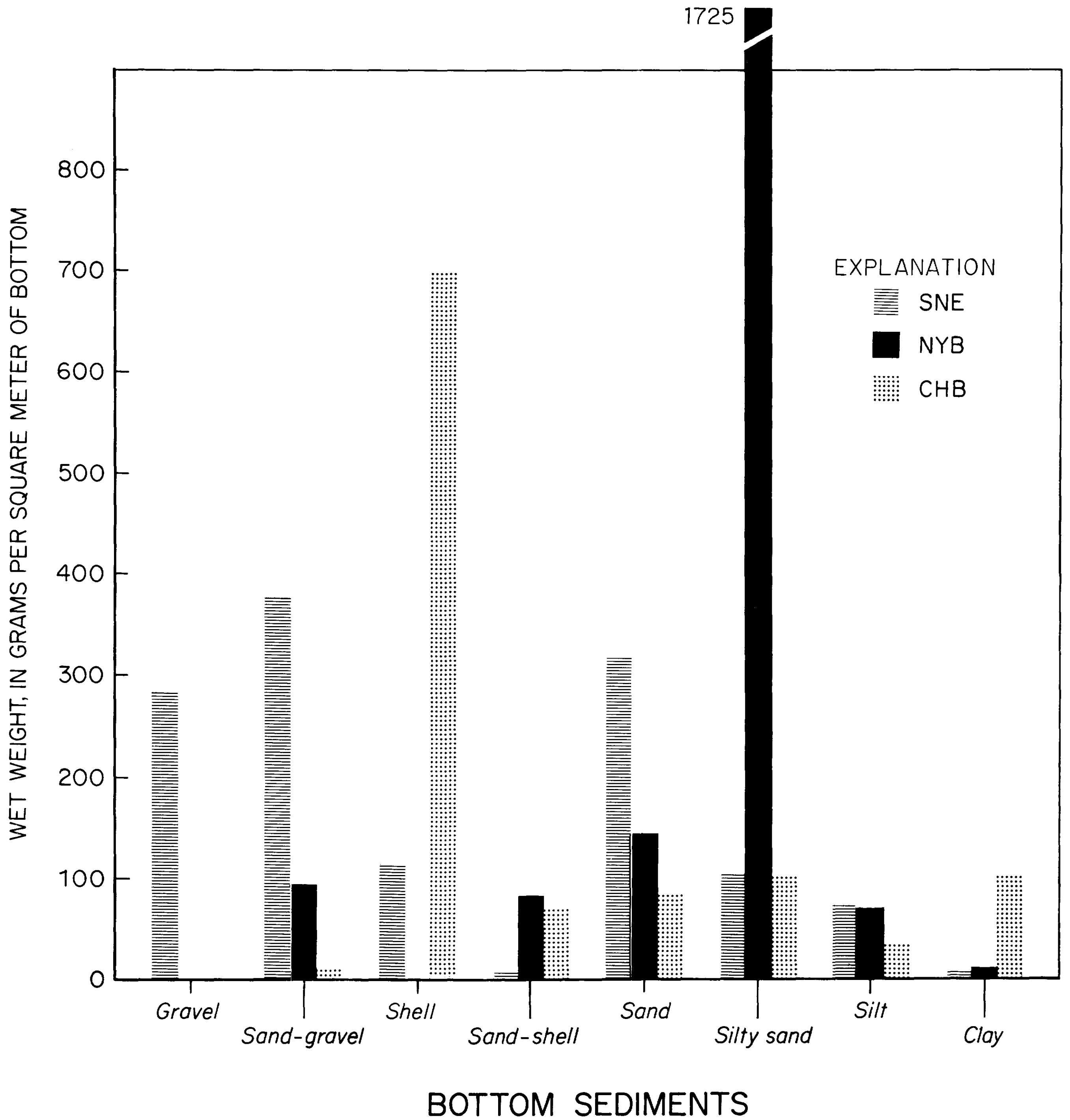

FIGURE 98.—Relation between biomass (wet weight) and bottom-sediment types. Values represent all taxonomic groups combined for each subarea. Abbreviations: SNE, Southernern New England; NYB, New York Bight; CHB, Chesapeake Bight.

area. Biomasses of 85, 72, 35, and 12 g/m² were found in sand, sand-shell, silt, and sand-gravel sediments, respectively.

TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

Mean densities and biomass of individual taxa, in relation to bottom sediments, for the entire Middle Atlantic Bight region are given in tables 22 and 23, and illustrated in figures 99–104.

SUBAREAS

The following six tables deal with each taxon's density and biomass in relation to bottom sediments in each subarea:

Tables 24 and 25, Southern New England
Tables 26 and 27, New York Bight
Tables 28 and 29, Chesapeake Bight

RELATION TO SEDIMENT

ORGANIC CARBON

This section contains an analysis of the relationships between the quantity of organic matter in bottom sediments, and the quantity of benthic organisms. Prior to making the analysis, we considered two general cause-and-effect relationships: first, the possibility that where organic carbon was more abundant, it might provide a greater quantity of food, and thus support a larger standing crop of benthic animals; and second, the possibility (converse of the preceding) that where animals were more abundant, they might produce a larger amount of organic matter (fecal deposits, for example) in the sediments. In either possibility, high abundance would be associated with high carbon content.

Results of the analyses, as described below, revealed no general correlation between sediment organic carbon and the quantity of benthic animals. A few taxonomic groups showed good correlations—some direct and some inverse—between abundance and organic content, but they were the rare exceptions. (See table 30 for the number of samples for each class of sediment organic carbon.)

DISTRIBUTION OF SEDIMENT ORGANIC CARBON

The geographic distribution of organic carbon in the bottom sediments of the Middle Atlantic Bight region is shown in figure 105. Sediments blanketing almost the entire Continental Shelf throughout this region contained only a small amount (0.01–0.49 percent weight class) of organic carbon. Slightly larger quantities (0.5–0.99 percent) were broadly distributed in sediments on the Continental Slope and Rise, plus a moderately large area on the Outer Continental Shelf off Southern New England. Moderate quantities of organic carbon (1.0–1.99 percent) were widely distributed along the Continental Slope, with some incursions onto the shelf and onto the Continental Rise. The largest quantities of organic carbon (2.00–7.16 percent) were found in the bays and sounds, plus in one small area on the upper Continental Slope northeast of Cape Hatteras. Sediments in some inshore waters such as Buzzards Bay, Long Island Sound, Delaware Bay, Chesapeake Bay, and Pamlico Sound also contained patches of small and moderate quantities of organic carbon.

TOTAL MACROBENTHIC FAUNA OF ALL TAXONOMIC GROUPS

Mean quantities of benthic animals were calculated for seven sediment organic carbon classes within each of the three subareas and for the entire Middle Atlantic Bight region. These data, for both density and biomass, are listed in table 31 and illustrated in figures 106 and 107. The values for density range from 182/m² to 5,236/m², and no trends are apparent. There were no correlations between density of organisms and the quantity of organic carbon in any of the subareas or for the region as a whole. Mean biomasses for the seven organic carbon classes in the various subareas and the entire region ranged from 14 g/m² to 2,657 g/m². No correlations were seen between biomass and the quantity of sediment organic carbon. Because of the erratic values within carbon classes and between adjacent carbon classes in both density and biomass, we consider the trends to be spurious.

TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

The analysis in this section is based on the density and biomass of each major taxonomic group in the seven classes of sediment organic carbon from the entire Middle Atlantic Bight region. Density values are listed in table 32 and biomass values in table 33; these data are illustrated in figures 108 through 113.

TABLE 22.—*Mean number of individuals listed by taxonomic groups in each bottom-sediment type for the entire Middle Atlantic Bight region*

[In number per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2
PORIFERA	5.53	4.44	-	2.25	0.19	0.26	0.46	0.28
COELENTERATA	28.33	165.17	40.00	9.00	10.45	30.70	5.11	3.50
Hydrozoa	3.67	95.17	29.25	6.02	6.40	15.47	0.03	-
Anthozoa	24.66	70.00	10.75	2.98	4.05	15.23	5.08	3.50
Alcyonacea	-	-	-	-	0.17	1.41	1.12	0.61
Zoantharia	10.33	1.83	-	2.30	1.87	12.27	2.61	2.43
Unidentified	14.33	68.17	10.75	0.68	2.01	1.55	1.35	0.46
PLATYHELMINTHES	-	13.17	-	0.36	0.29	-	0.32	-
Turbellaria	-	13.17	-	0.36	0.29	-	0.32	-
NEMERTEA	8.00	5.50	1.50	2.52	5.39	6.67	1.57	0.61
ASCHELMINTHES	0.67	40.78	39.25	1.93	0.75	1.67	2.45	0.30
Nematoda	0.67	40.78	39.25	1.93	0.75	1.67	2.45	0.30
ANNELIDA	289.00	389.39	362.75	174.09	412.36	272.42	90.70	27.39
POGONOPHORA	-	-	-	-	0.04	3.18	3.86	1.80
SIPUNCULIDA	-	9.61	-	0.43	4.32	4.48	4.81	0.89
ECHIURA	-	-	-	-	0.01	0.50	0.32	0.30
PRIAPULIDA	-	-	-	-	-	-	0.09	0.04
MOLLUSCA	1083.33	93.12	414.25	1448.41	198.41	478.90	270.18	96.51
Polyplacophora	2.00	4.17	-	-	0.17	0.56	0.84	0.33
Gastropoda	1064.33	21.67	87.50	6.00	20.88	89.54	19.78	4.70
Bivalvia	17.00	67.28	326.75	1442.23	176.18	383.70	247.13	91.28
Scaphopoda	-	-	-	0.18	0.79	3.20	2.43	0.20
Cephalopoda	-	-	-	-	0.02	1.90	-	-
Unidentified	-	-	-	-	0.37	-	-	-
ARTHROPODA	361.34	1176.35	705.00	298.85	1007.93	349.33	40.94	20.95
Pycnogonida	-	5.11	-	1.05	0.28	0.12	-	1.65
Arachnida	-	-	-	-	0.09	-	-	-
Crustacea	361.34	1171.24	705.00	297.80	1007.56	349.21	40.94	19.30
Ostracoda	-	1.17	-	0.91	0.20	-	0.09	-
Cirripedia	6.67	141.28	-	0.59	22.28	84.38	0.49	-
Copepoda	-	-	-	-	0.04	0.06	0.07	-
Nebaliacea	-	-	-	-	0.02	-	-	0.02
Cumacea	-	1.56	6.25	31.73	23.84	5.74	2.35	0.46
Tanaidacea	-	-	-	-	-	0.02	0.28	0.26
Isopoda	-	5.78	6.25	10.68	16.86	11.09	7.00	0.11
Amphipoda	272.00	1008.67	266.25	238.57	933.33	240.55	30.33	18.41
Mysidacea	-	0.11	-	3.93	2.83	1.86	-	-
Decapoda	82.67	12.67	50.25	11.39	8.16	5.51	0.33	0.04
BRYOZOA	3.00	163.56	376.00	24.34	3.78	29.04	-	-
BRACHIOPODA	-	-	-	-	0.01	-	-	-
ECHINODERMATA	-	1.45	6.25	32.34	56.90	114.49	30.97	3.71
Holothuroidea	-	0.17	-	0.36	1.38	7.51	1.23	0.22
Echinoidea	-	-	-	30.07	40.85	0.24	0.10	0.04
Ophiuroidea	-	1.28	6.25	1.52	13.53	105.62	28.84	3.41
Asteroidea	-	-	-	0.39	1.14	1.12	0.80	0.04
HEMICHORDATA	-	-	-	-	0.14	0.33	0.07	-
CHORDATA	885.33	17.56	68.75	5.70	10.90	13.67	3.85	2.54
Ascidiacea	885.33	17.56	68.75	5.70	10.90	13.67	3.85	2.54
UNIDENTIFIED	2.33	8.56	1.50	6.16	6.12	6.83	15.67	5.72

TABLE 23.—*Mean biomass of each taxonomic group listed by bottom-sediment type for the entire Middle Atlantic Bight region*

[In grams per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.210	0.886	-	0.245	0.011	0.010	0.002	0.030
COELENTERATA	18.600	6.382	1.550	6.930	1.003	7.052	1.977	1.954
Hydrozoa	1.133	2.767	0.788	0.634	0.263	0.085	<0.001	-
Anthozoa	17.467	3.615	0.762	6.297	0.740	6.966	1.977	1.954
Alcyonacea	-	-	-	-	0.023	0.107	0.146	0.115
Zoantharia	17.047	2.140	-	6.233	0.619	6.702	1.746	1.626
Unidentified	0.420	1.475	0.762	0.063	0.098	0.158	0.086	0.213
PLATYHELMINTHES	-	0.071	-	0.007	0.008	-	0.002	-
Turbellaria	-	0.071	-	0.007	0.008	-	0.002	-
NEMERTEA	5.813	0.739	0.110	0.355	0.714	0.694	0.474	0.006
ASCHELMINTHES	0.007	0.011	0.072	0.009	0.002	0.004	0.009	0.003
Nematoda	0.007	0.011	0.072	0.009	0.002	0.004	0.009	0.003
ANNELIDA	24.283	8.709	27.802	8.591	14.117	26.146	6.744	2.436
POGONOPHORA	-	-	-	-	<0.001	0.024	0.059	0.007
SIPUNCULIDA	-	1.589	-	0.033	0.560	1.094	1.292	0.142
ECHIURA	-	-	-	-	0.006	0.308	1.154	0.648
PRIAPULIDA	-	-	-	-	-	-	0.058	0.022
MOLLUSCA	16.953	156.634	387.138	37.523	121.066	343.231	25.886	43.874
Polyplacophora	0.227	4.292	-	-	0.004	0.010	0.009	0.005
Gastropoda	11.487	2.424	1.062	2.195	3.114	6.856	0.331	0.019
Bivalvia	5.240	149.919	386.075	35.327	117.933	336.270	25.513	43.848
Scaphopoda	-	-	-	0.001	0.012	0.068	0.033	0.002
Cephalopoda	-	-	-	-	<0.001	0.026	-	-
Unidentified	-	-	-	-	0.002	-	-	-
ARTHROPODA	14.573	73.624	33.640	6.019	10.010	5.865	0.277	0.126
Pycnogonida	-	0.022	-	0.006	0.001	0.002	-	0.011
Arachnida	-	-	-	-	<0.001	-	-	-
Crustacea	14.573	73.602	33.640	6.013	10.008	5.863	0.277	0.115
Ostracoda	-	0.012	-	0.007	0.002	-	0.001	-
Cirripedia	0.143	61.358	-	0.003	2.872	1.969	0.015	-
Copepoda	-	-	-	-	<0.001	<0.001	0.001	-
Nebaliacea	-	-	-	-	<0.001	-	-	<0.001
Cumacea	-	0.016	0.015	0.089	0.111	0.029	0.016	0.008
Tanaidacea	-	-	-	-	-	<0.001	0.002	0.002
Isopoda	-	0.239	0.062	0.433	0.448	0.089	0.057	0.001
Amphipoda	0.600	4.649	1.032	2.052	5.768	2.464	0.149	0.081
Mysidacea	-	0.001	-	0.021	0.010	0.015	-	-
Decapoda	13.830	7.328	19.520	2.894	0.646	1.244	0.036	0.022
BRYOZOA	1.187	3.236	13.010	0.514	0.154	0.051	-	-
BRACHIOPODA	-	-	-	-	<0.001	-	-	-
ECHINODERMATA	-	0.974	0.125	13.563	29.792	25.147	5.687	1.449
Holothuroidea	-	0.163	-	0.352	2.393	14.665	0.158	0.927
Echinoidea	-	-	-	12.632	24.411	1.171	0.799	0.040
Ophiuroidea	-	0.811	0.125	0.044	1.187	5.425	1.816	0.480
Asteroidea	-	-	-	0.535	1.780	3.886	2.914	0.001
HEMICHORDATA	-	-	-	-	0.022	0.105	0.001	-
CHORDATA	204.080	1.627	108.645	0.479	1.890	3.922	0.826	0.725
Ascidiacea	204.080	1.627	108.645	0.479	1.890	3.922	0.826	0.725
UNIDENTIFIED	0.350	1.373	0.020	0.589	0.138	0.362	0.241	0.269

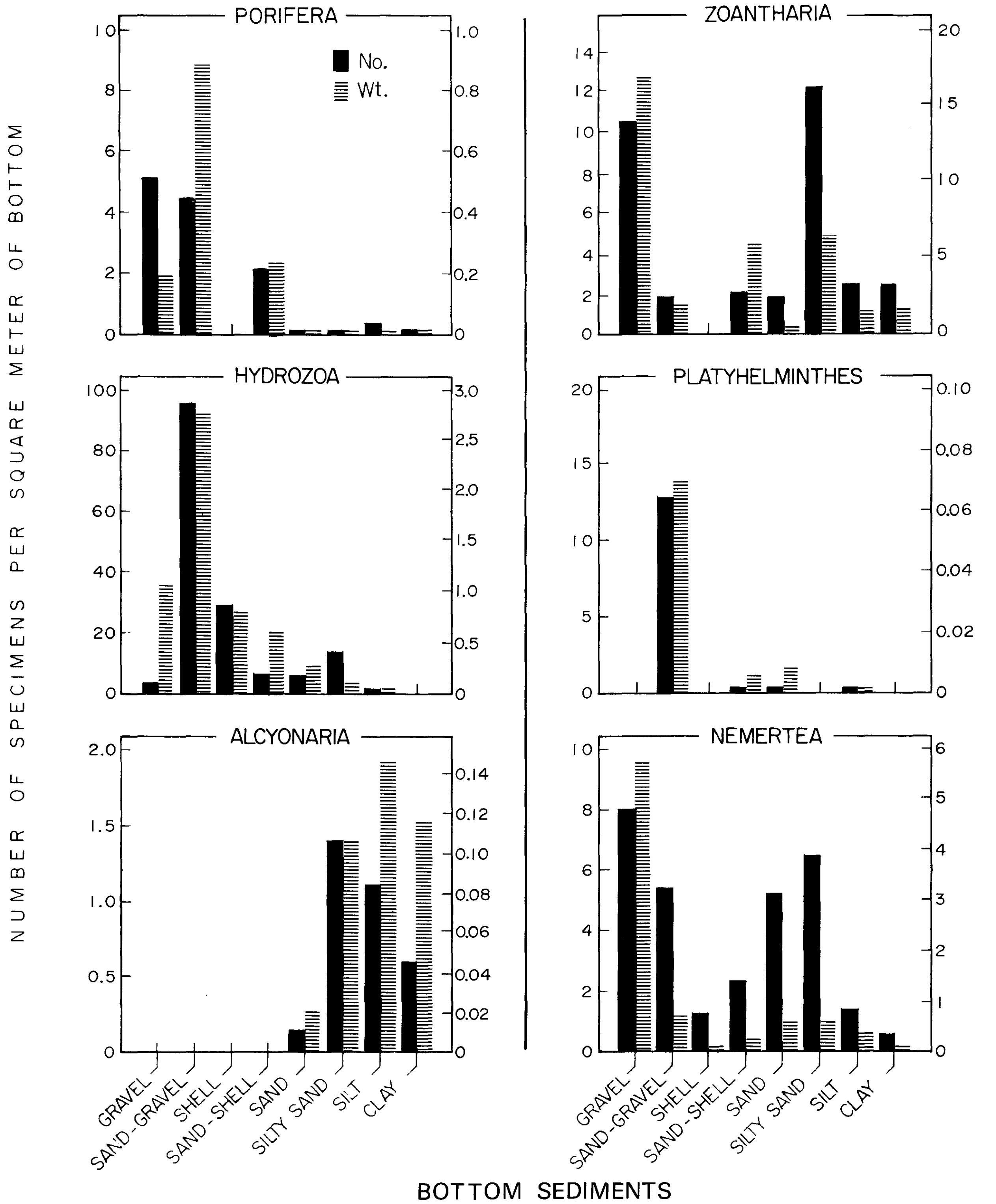

FIGURE 99.—Density (No.) and biomass (wt.) in relation to bottom sediments in the entire Middle Atlantic Bight region for Porifera, Hydrozoa, Alcyonaria, Zoantharia, Platyhelminthes, and Nemertea.

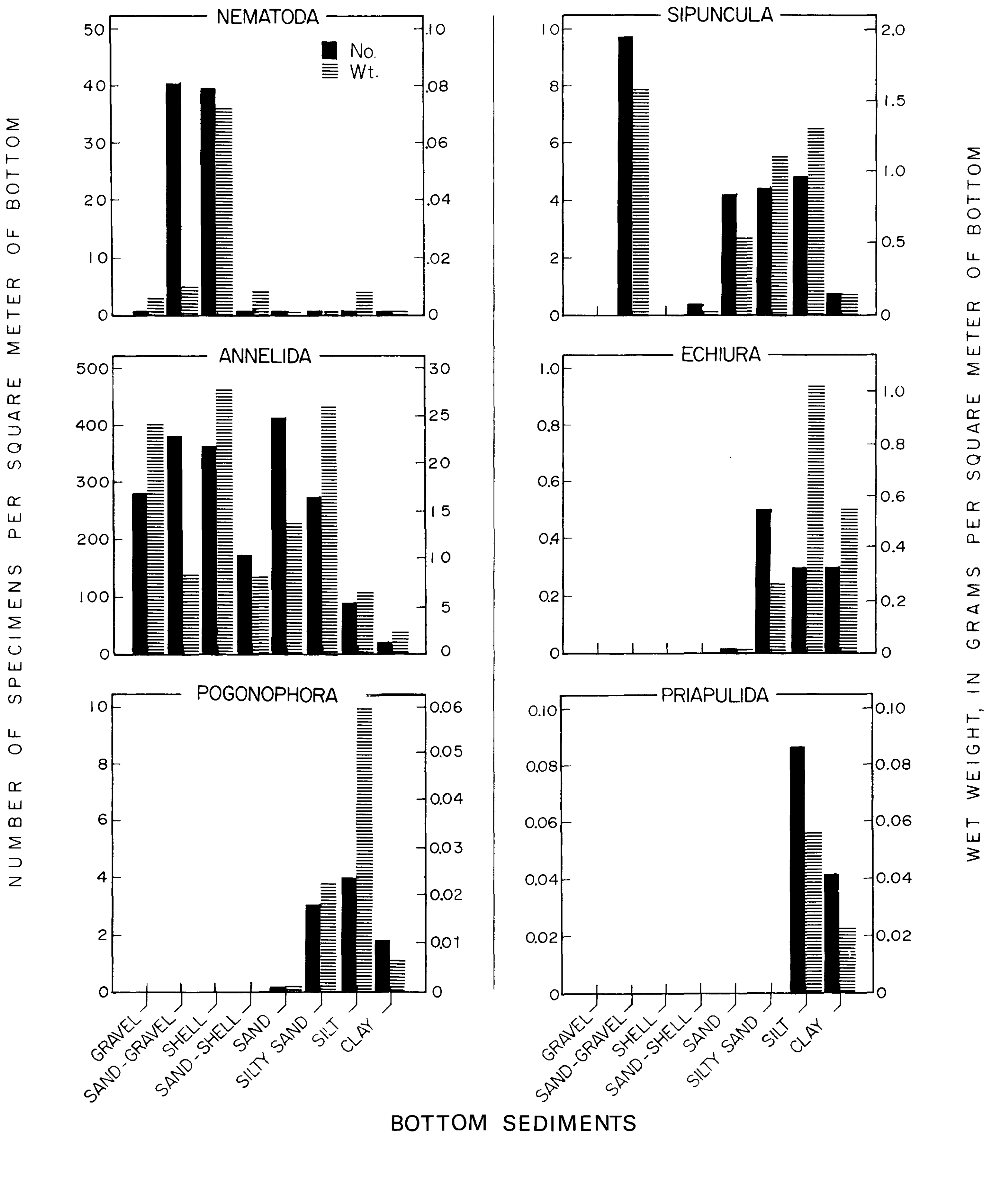

FIGURE 100.—Density (No.) and biomass (wt.) in relation to bottom sediments in the entire Middle Atlantic Bight region for Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

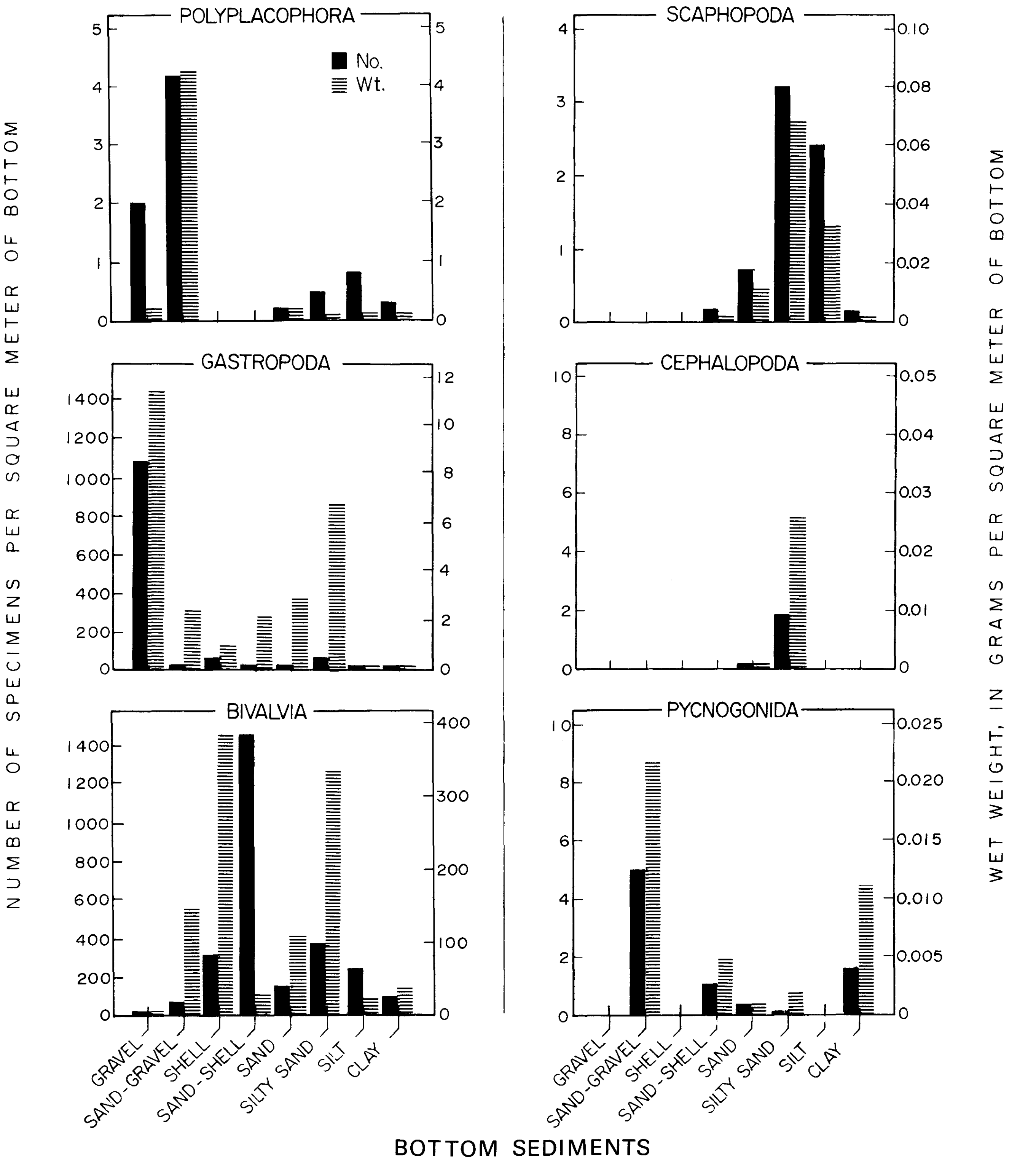

FIGURE 101.—Density (No.) and biomass (wt.) in relation to bottom sediments in the entire Middle Atlantic Bight region for Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

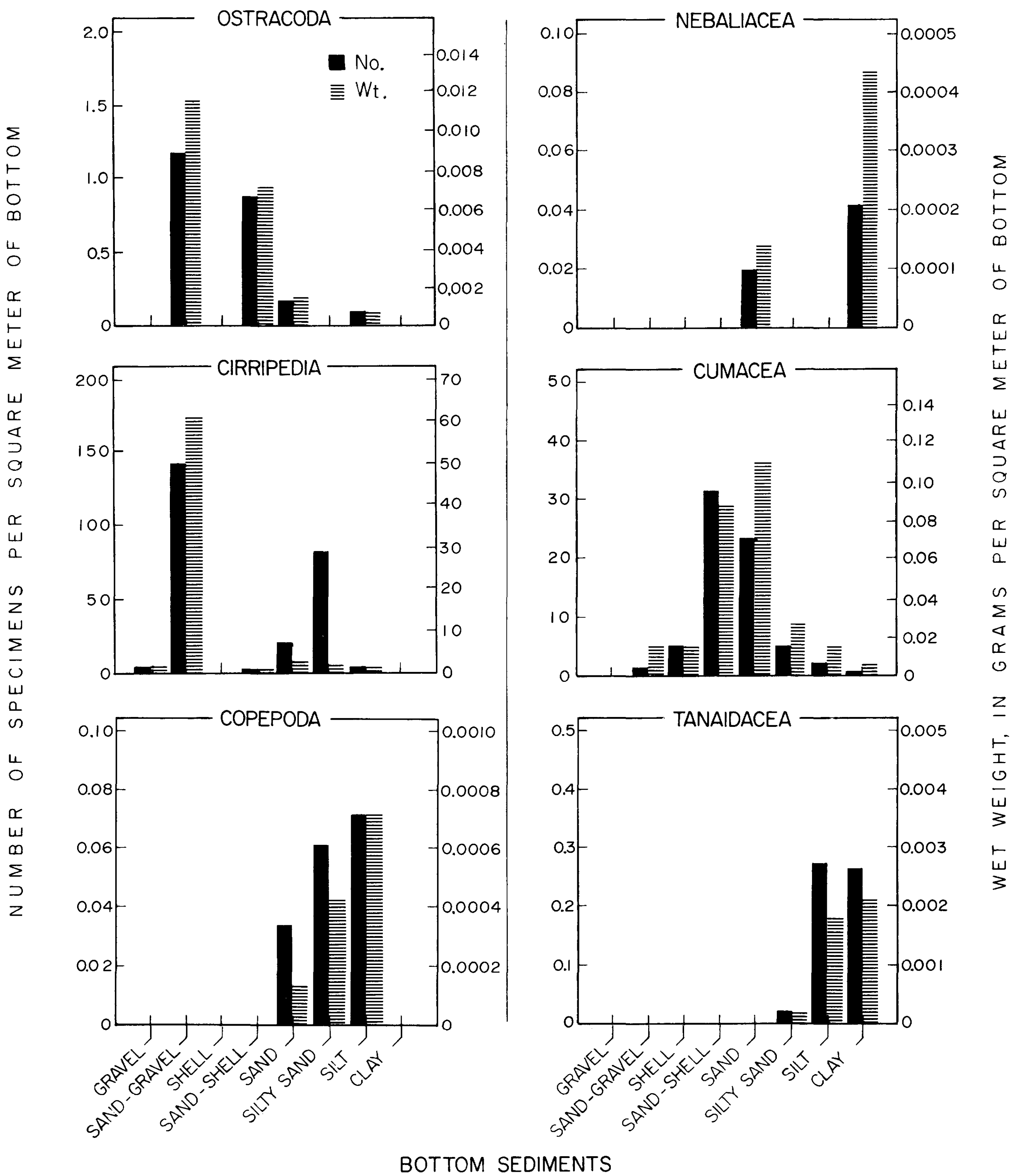

FIGURE 102.—Density (No.) and biomass (wt.) in relation to bottom sediments in the entire Middle Atlantic Bight region for Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

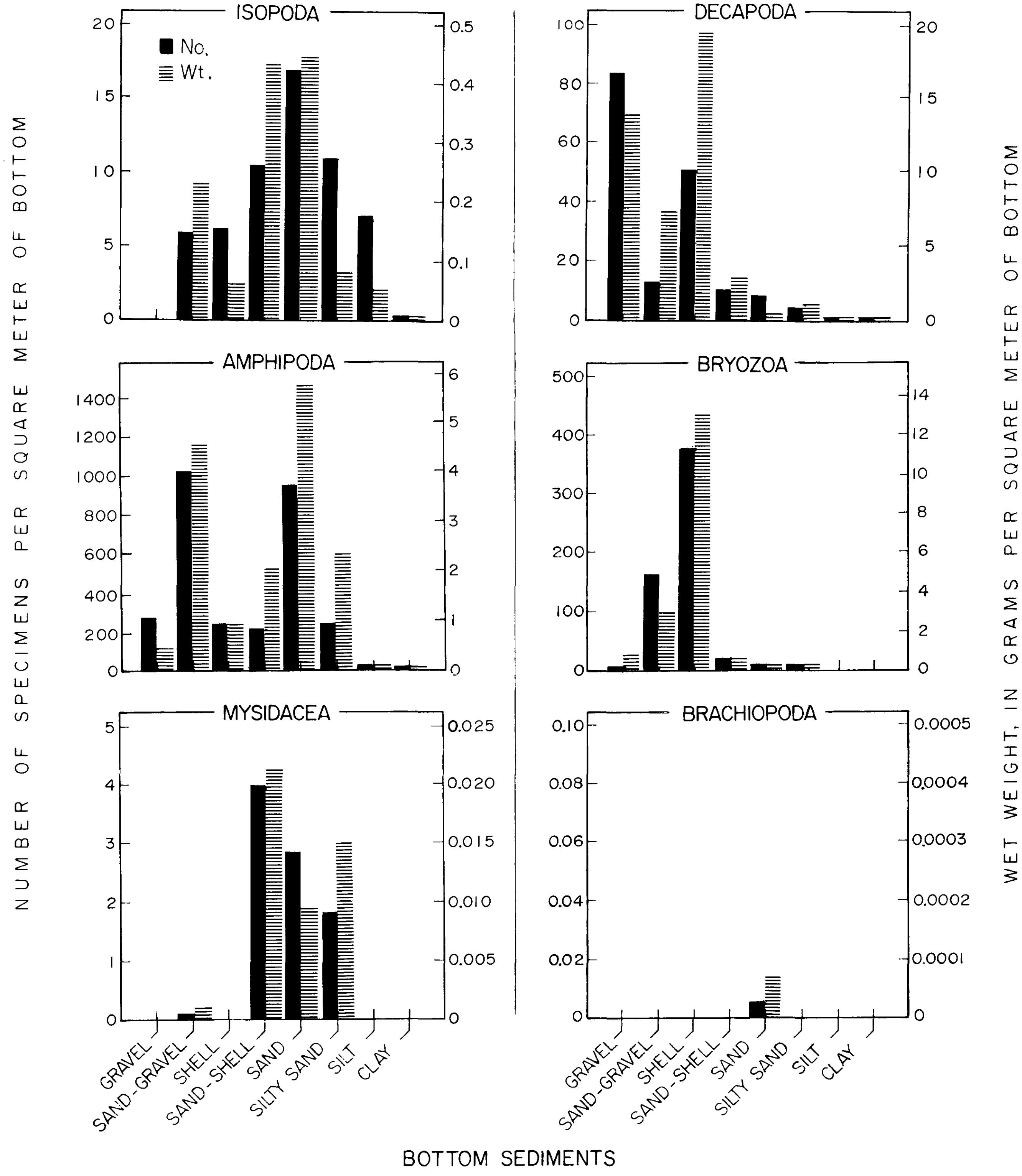

FIGURE 103.—Density (No.) and biomass (wt.) in relation to bottom sediments in the entire Middle Atlantic Bight region for Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

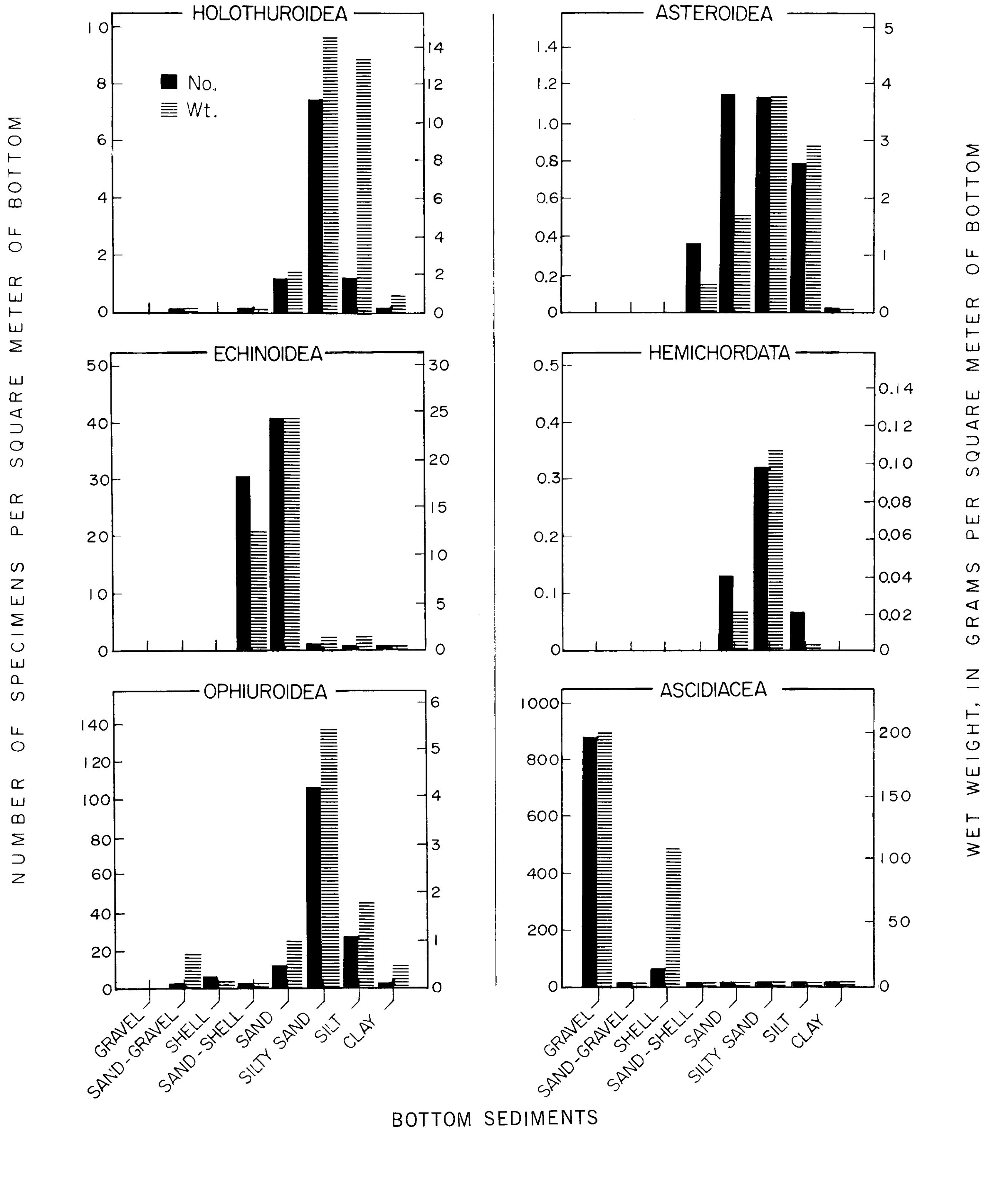

FIGURE 104.—Density (No.) and biomass (wt.) in relation to bottom sediments in the entire Middle Atlantic Bight region for Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

TABLE 24.—*Mean number of individuals listed by taxonomic group in each bottom-sediment type for the Southern New England subarea*

[In number per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2
PORIFERA	5.33	7.27	-	-	0.39	0.17	-	0.20
COELENTERATA	28.33	256.91	-	-	18.38	15.29	7.44	2.40
Hydrozoa	3.67	144.09	-	-	13.23	0.12	-	-
Anthozoa	24.66	122.82	-	-	5.15	15.17	7.44	2.40
Alcyonacea	-	-	-	-	0.13	1.50	2.08	0.70
Zoantharia	10.33	1.27	-	-	4.29	12.63	4.56	0.20
Unidentified	14.33	111.55	-	-	0.73	1.04	0.80	1.50
PLATYHELMINTHES	-	21.55	-	-	0.40	-	0.04	-
Turbellaria	-	21.55	-	-	0.40	-	0.04	-
NEMERTEA	8.00	6.91	-	4.00	7.94	5.56	2.52	-
ASCHELMINTHES	0.67	66.73	-	-	2.29	2.65	2.20	0.80
Nematoda	0.67	66.73	-	-	2.29	2.65	2.20	0.80
ANNELIDA	289.00	555.18	750.00	23.00	433.31	330.82	118.52	9.10
POGONOPHORA	-	-	-	-	0.05	1.33	5.36	3.00
SIPUNCULIDA	-	15.73	-	-	11.20	7.06	10.12	0.90
ECHIURA	-	-	-	-	-	0.04	0.24	0.80
PRIAPULIDA	-	-	-	-	-	-	0.24	-
MOLLUSCA	1083.33	145.10	375.00	76.00	126.94	222.47	336.44	21.10
Polyplacophora	2.00	6.82	-	-	0.37	0.98	1.32	0.20
Gastropoda	1064.33	33.64	275.00	65.00	19.23	34.19	4.40	0.60
Bivalvia	17.00	104.64	100.00	11.00	105.51	182.73	328.00	20.30
Scaphopoda	-	-	-	-	0.49	1.13	2.72	-
Cephalopoda	-	-	-	-	0.06	3.44	-	-
Unidentified	-	-	-	-	1.28	-	-	-
ARTHROPODA	361.34	1770.35	300.00	154.00	2228.16	326.63	54.60	3.80
Pycnogonida	-	8.36	-	-	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-
Crustacea	361.34	1761.99	300.00	154.00	2228.16	326.63	54.60	3.80
Ostracoda	-	1.91	-	-	0.47	-	-	-
Cirripedia	6.67	231.18	-	-	15.22	-	-	-
Copepoda	-	-	-	-	0.07	0.12	0.20	-
Nebaliacea	-	-	-	-	-	-	-	-
Cumacea	-	2.36	-	-	57.65	8.27	5.64	1.20
Tanaidacea	-	-	-	-	-	0.04	0.44	0.80
Isopoda	-	4.36	25.00	-	19.05	2.58	0.96	0.30
Amphipoda	272.00	1508.18	225.00	154.00	2125.11	309.40	47.36	1.50
Mysidacea	-	-	-	-	0.89	3.37	-	-
Decapoda	82.67	14.00	50.00	-	9.70	2.85	-	-
BRYOZOA	3.00	267.45	1500.00	-	5.59	0.17	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	-	0.28	-	-	58.59	187.35	81.28	8.20
Holothuroidea	-	-	-	-	3.83	9.69	3.00	0.20
Echinoidea	-	-	-	-	22.01	0.37	0.28	0.20
Ophiuroidea	-	0.28	-	-	30.11	175.85	76.28	7.80
Asteroidea	-	-	-	-	2.64	1.44	1.72	-
HEMICHORDATA	-	-	-	-	0.31	0.38	0.20	-
CHORDATA	885.33	28.45	-	2.00	18.98	23.37	7.20	3.50
Ascidiacea	885.33	28.45	-	2.00	18.98	23.37	7.20	3.50
UNIDENTIFIED	2.33	13.73	-	-	7.33	8.10	6.88	8.30

TABLE 25.—*Mean biomass of each taxonomic group listed by bottom-sediment type for the Southern New England subarea*

[In grams per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	g/m2	g/m2	g/m2	g/m2	g/m2	g/m2	g/m2	g/m2
PORIFERA	0.210	1.450	-	-	0.036	0.003	-	0.127
COELENTERATA	18.600	9.225	-	-	1.470	9.294	2.576	0.928
Hydrozoa	1.133	4.019	-	-	0.796	0.047	-	-
Anthozoa	17.467	5.206	-	-	0.674	9.247	2.576	0.928
Alcyonacea	-	-	-	-	0.003	0.047	0.168	0.129
Zoantharia	17.047	2.793	-	-	0.586	9.075	2.367	0.163
Unidentified	0.420	2.414	-	-	0.085	0.125	0.041	0.636
PLATYHELMINTHES	-	0.116	-	-	0.012	-	<0.001	-
Turbellaria	-	0.116	-	-	0.012	-	<0.001	-
NEMERTEA	5.813	1.111	-	0.020	0.887	0.750	0.119	-
ASCHELMINTHES	0.007	0.018	-	-	0.005	0.006	0.010	0.008
Nematoda	0.007	0.018	-	-	0.005	0.006	0.010	0.008
ANNELIDA	24.283	11.169	30.500	1.670	21.470	25.835	7.427	0.445
POGONOPHORA	-	-	-	-	<0.001	0.023	0.017	0.012
SIPUNCULIDA	-	2.600	-	-	1.256	1.761	0.958	0.628
ECHIURA	-	-	-	-	-	0.001	0.093	0.709
PRIAPULIDA	-	-	-	-	-	-	0.159	-
MOLLUSCA	16.953	223.297	4.250	0.430	252.317	22.494	10.734	0.525
Polyplacophora	0.227	7.023	-	-	0.003	0.018	0.016	0.002
Gastropoda	11.487	3.917	3.750	0.370	6.302	0.793	0.104	0.029
Bivalvia	5.240	212.357	0.500	0.060	245.996	21.622	10.664	0.494
Scaphopoda	-	-	-	-	0.009	0.014	0.039	-
Cephalopoda	-	-	-	-	0.001	0.047	-	-
Unidentified	-	-	-	-	0.005	-	-	-
ARTHROPODA	14.573	113.338	30.500	0.630	17.579	2.761	0.380	0.049
Pycnogonida	-	0.036	-	-	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-
Crustacea	14.573	113.303	30.500	0.630	17.579	2.761	0.380	0.049
Ostracoda	-	0.019	-	-	0.003	-	-	-
Cirripedia	0.143	100.404	-	-	3.136	-	-	-
Copepoda	-	-	-	-	<0.001	0.001	0.002	-
Nebaliacea	-	-	-	-	-	-	-	-
Cumacea	-	0.024	-	-	0.260	0.037	0.037	0.030
Tanaidacea	-	-	-	-	-	<0.001	0.004	0.006
Isopoda	-	0.357	0.250	-	0.392	0.171	0.010	0.001
Amphipoda	0.600	6.501	1.750	0.630	13.252	2.354	0.327	0.012
Mysidacea	-	-	-	-	0.002	0.027	-	-
Decapoda	13.830	5.998	28.500	-	0.533	0.171	-	-
BRYOZOA	1.187	5.293	52.000	-	0.364	0.001	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	-	1.326	-	-	23.924	35.282	49.234	0.756
Holothuroidea	-	-	-	-	7.238	21.704	35.195	0.174
Echinoidea	-	-	-	-	12.642	1.605	2.206	0.185
Ophiuroidea	-	1.326	-	-	3.215	9.134	3.896	0.397
Asteroidea	-	-	-	-	0.829	2.840	7.937	-
HEMICHORDATA	-	-	-	-	0.062	0.080	0.002	-
CHORDATA	204.080	2.646	-	0.170	1.894	6.313	2.054	0.542
Ascidiacea	204.080	2.646	-	0.170	1.894	6.313	2.054	0.542
UNIDENTIFIED	0.350	2.228	-	-	0.334	0.344	0.424	0.094

TABLE 26.—*Mean number of individuals listed by taxonomic group in each bottom-sediment type for the New York Bight subarea*

[In number per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	-	-	-	4.31	0.15	0.72	-	-
COELENTERATA	-	6.40	-	9.01	3.53	50.17	4.89	1.78
Hydrozoa	-	2.60	-	8.63	2.07	23.89	0.13	-
Anthozoa	-	3.80	-	0.38	1.46	26.28	4.76	1.78
Alcyonacea	-	-	-	-	0.32	2.94	0.50	1.21
Zoantharia	-	3.80	-	0.38	0.53	23.72	4.13	0.14
Unidentified	-	-	-	-	0.61	2.56	0.13	0.43
PLATYHELMINTHES	-	-	-	0.25	0.07	-	-	-
Turbellaria	-	-	-	0.25	0.07	-	-	-
NEMERTEA	-	4.00	-	3.31	3.03	2.28	1.38	0.14
ASCHELMINTHES	-	-	-	-	0.07	0.50	0.50	-
Nematoda	-	-	-	-	0.07	0.50	0.50	-
ANNELIDA	-	142.40	-	224.25	532.79	285.39	48.69	11.29
POGONOPHORA	-	-	-	-	0.02	2.89	4.69	2.07
SIPUNCULIDA	-	-	-	0.56	2.46	1.89	1.88	0.79
ECHIURA	-	-	-	-	-	1.33	0.38	0.29
PRIAPULIDA	-	-	-	-	-	-	-	-
MOLLUSCA	-	4.60	-	127.50	141.52	837.97	378.38	74.72
Polyplacophora	-	-	-	-	0.05	-	0.13	0.29
Gastropoda	-	0.40	-	8.25	25.66	39.17	13.44	2.43
Bivalvia	-	4.20	-	119.25	114.54	793.33	362.50	71.36
Scaphopoda	-	-	-	-	1.27	5.67	2.31	0.64
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	-	289.80	-	330.38	620.04	700.27	15.45	2.14
Pycnogonida	-	-	-	-	-	0.61	-	-
Arachnida	-	-	-	-	0.22	-	-	-
Crustacea	-	289.80	-	330.38	619.82	699.66	15.45	2.14
Ostracoda	-	-	-	2.50	0.11	-	-	-
Cirripedia	-	-	-	-	43.03	440.67	2.13	-
Copepoda	-	-	-	-	0.03	-	-	-
Nebaliacea	-	-	-	-	-	-	-	0.14
Cumacea	-	0.40	-	10.31	11.80	1.67	0.38	0.64
Tanaidacea	-	-	-	-	-	-	-	0.29
Isopoda	-	8.60	-	11.00	12.25	12.28	5.69	0.14
Amphipoda	-	267.60	-	286.44	541.72	233.33	6.56	0.79
Mysidacea	-	0.40	-	3.13	1.07	-	-	-
Decapoda	-	12.80	-	17.00	9.81	11.71	0.69	0.14
BRYOZOA	-	0.40	-	18.56	3.90	9.06	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	-	-	-	23.70	73.02	9.61	1.95	3.64
Holothuroidea	-	-	-	0.63	0.50	4.44	0.38	0.43
Echinoidea	-	-	-	21.38	60.83	0.22	-	-
Ophiuroidea	-	-	-	0.75	10.94	3.39	1.44	3.21
Asteroidea	-	-	-	0.94	0.75	1.56	0.13	-
HEMICHORDATA	-	-	-	-	0.11	-	-	-
CHORDATA	-	0.60	-	15.56	5.62	0.22	3.94	2.43
Ascidiacea	-	0.60	-	15.56	5.62	0.22	3.94	2.43
UNIDENTIFIED	-	-	-	11.69	4.97	0.94	1.94	5.50

TABLE 27.—*Mean biomass of each taxonomic group listed by bottom-sediment type for the New York Bight subarea*

[In grams per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	-	-	-	0.292	0.002	0.007	-	-
COELENTERATA	-	1.596	-	0.476	0.778	4.605	3.908	0.452
Hydrozoa	-	0.036	-	0.046	0.055	0.253	0.001	-
Anthozoa	-	1.560	-	0.430	0.722	4.352	3.906	0.452
Alcyonacea	-	-	-	-	0.054	0.226	0.039	0.058
Zoantharia	-	1.560	-	0.430	0.609	3.784	3.830	0.149
Unidentified	-	-	-	-	0.059	0.342	0.038	0.245
PLATYHELMINTHES	-	-	-	0.005	0.004	-	-	-
Turbellaria	-	-	-	0.005	0.004	-	-	-
NEMERTEA	-	0.212	-	0.358	0.814	0.562	1.594	0.001
ASCHELMINTHES	-	-	-	-	<0.001	0.001	0.005	-
Nematoda	-	-	-	-	<0.001	0.001	0.005	-
ANNELIDA	-	4.126	-	9.349	12.187	42.360	6.749	1.839
POGONOPHORA	-	-	-	-	<0.001	0.017	0.024	0.009
SIPUNCULIDA	-	-	-	0.020	0.456	0.216	0.153	0.009
ECHIURA	-	-	-	-	-	1.327	1.676	0.142
PRIAPULIDA	-	-	-	-	-	-	-	-
MOLLUSCA	-	72.496	-	50.451	78.800	1640.064	55.188	0.880
Polyplacophora	-	-	-	-	<0.001	-	0.001	0.009
Gastropoda	-	0.092	-	3.828	1.786	8.334	1.069	0.018
Bivalvia	-	72.404	-	46.623	76.994	1631.601	54.088	0.846
Scaphopoda	-	-	-	-	0.020	0.128	0.029	0.006
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	-	15.284	-	9.858	8.771	19.821	0.209	0.091
Pycnogonida	-	-	-	-	-	0.012	-	-
Arachnida	-	-	-	-	0.001	-	-	-
Crustacea	-	15.284	-	9.858	8.770	19.808	0.209	0.091
Ostracoda	-	-	-	0.020	0.001	-	-	-
Cirripedia	-	-	-	-	4.728	10.283	0.064	-
Copepoda	-	-	-	-	<0.001	-	-	-
Nebaliacea	-	-	-	-	-	-	-	0.001
Cumacea	-	0.004	-	0.036	0.062	0.017	0.004	0.006
Tanaidacea	-	-	-	-	-	-	-	0.003
Isopoda	-	0.054	-	0.481	0.480	0.074	0.042	0.001
Amphipoda	-	2.090	-	2.209	2.765	5.758	0.028	0.008
Mysidacea	-	0.004	-	0.016	0.006	-	-	-
Decapoda	-	13.132	-	7.097	0.726	3.677	0.071	0.071
BRYOZOA	-	0.004	-	0.308	0.096	0.164	-	-
BRACHIOPODA	-	-	-	-	-	-	-	-
ECHINODERMATA	-	-	-	8.437	44.257	101.885	2.436	2.096
Holothuroidea	-	-	-	0.054	0.335	0.427	1.560	1.634
Echinoidea	-	-	-	7.184	39.688	1.479	-	-
Ophiuroidea	-	-	-	0.008	0.587	87.889	0.721	0.463
Asteroidea	-	-	-	1.191	3.648	12.090	0.155	-
HEMICHORDATA	-	-	-	-	0.009	-	-	-
CHORDATA	-	0.036	-	1.307	0.264	0.029	0.273	0.462
Ascidiacea	-	0.036	-	1.307	0.264	0.029	0.273	0.462
UNIDENTIFIED	-	-	-	1.567	0.066	0.668	0.018	0.047

TABLE 28.—*Mean number of individuals listed by taxonomic group in each bottom-sediment type for the Chesapeake Bight subarea*

[In number per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	-	-	-	1.11	0.05	0.08	11.11	0.50
COELENTERATA	-	57.50	53.33	9.33	8.13	47.30	3.15	5.09
Hydrozoa	-	57.50	39.00	4.70	1.51	42.42	-	-
Anthozoa	-	-	14.33	4.63	6.62	4.88	3.15	5.09
Alcyonacea	-	-	-	-	-	0.08	0.61	0.18
Zoantharia	-	-	-	3.52	1.38	2.88	-	4.91
Unidentified	-	-	14.33	1.11	5.24	1.92	2.54	-
PLATYHELMINTHES	-	-	-	0.44	0.50	-	0.75	-
Turbellaria	-	-	-	0.44	0.50	-	0.75	-
NEMERTEA	-	1.50	2.00	2.00	6.17	12.38	0.82	1.18
ASCHELMINTHES	-	-	52.33	3.15	0.18	0.42	1.32	0.32
Nematoda	-	-	52.33	3.15	0.18	0.42	1.32	0.32
ANNELIDA	-	95.00	233.67	149.96	222.50	136.38	89.86	45.95
POGONOPHORA	-	-	-	-	0.07	7.42	16.93	1.09
SIPUNCULIDA	-	-	-	0.37	0.14	0.83	1.75	0.95
ECHIURA	-	-	-	-	0.02	0.88	0.36	0.09
PRIAPULIDA	-	-	-	-	-	-	-	0.09
MOLLUSCA	-	28.50	427.33	2282.00	348.92	764.78	149.21	144.64
Polyplacophora	-	-	-	-	0.13	0.08	0.82	0.41
Gastropoda	-	9.00	25.00	2.48	15.81	247.25	37.14	8.00
Bivalvia	-	19.50	402.33	2279.22	332.58	511.92	109.00	136.23
Scaphopoda	-	-	-	0.30	0.40	5.83	2.25	-
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	-	125.50	338.66	285.51	347.06	135.38	43.32	40.77
Pycnogonida	-	-	-	1.70	0.94	-	-	3.45
Arachnida	-	-	-	-	-	-	-	-
Crustacea	-	125.50	338.66	283.81	346.12	135.38	43.32	37.32
Ostracoda	-	-	-	-	0.05	-	0.21	-
Cirripedia	-	-	-	0.96	0.11	-	-	-
Copepoda	-	-	-	-	-	-	-	-
Nebaliacea	-	-	-	-	0.07	-	-	-
Cumacea	-	-	8.33	45.59	7.33	3.33	0.54	-
Tanaidacea	-	-	-	-	-	-	0.29	-
Isopoda	-	6.50	-	10.89	21.17	28.63	13.14	-
Amphipoda	-	114.00	280.00	213.33	305.83	96.79	28.71	37.32
Mysidacea	-	-	-	4.56	7.23	-	-	-
Decapoda	-	5.00	50.33	8.48	4.33	6.63	0.43	-
BRYOZOA	-	-	1.33	28.67	1.86	4.21	-	-
BRACHIOPODA	-	-	-	-	0.02	-	-	-
ECHINODERMATA	-	1.50	8.33	38.66	32.54	35.29	2.64	1.73
Holothuroidea	-	1.50	-	0.22	0.18	5.08	0.14	0.09
Echinoidea	-	-	-	36.33	31.39	-	-	-
Ophiuroidea	-	-	8.33	2.04	0.77	30.13	2.14	1.55
Asteroidea	-	-	-	0.07	0.20	0.08	0.36	0.09
HEMICHORDATA	-	-	-	-	-	0.46	-	-
CHORDATA	-	-	0.92	-	10.33	2.75	0.82	2.18
Ascidiacea	-	-	0.92	-	10.33	2.75	0.82	2.18
UNIDENTIFIED	-	1.50	2.00	3.11	6.52	8.50	31.36	4.68

TABLE 29.—*Mean biomass of each taxonomic group listed by bottom-sediment type in the Chesapeake Bight subarea*

[In grams per square meter]

Taxonomic group	Bottom sediments							
	Gravel	Sand-gravel	Shell	Sand-shell	Sand	Silty sand	Silt	Clay
	g/m2	g/m2	g/m2	g/m2	g/m2	g/m2	g/m2	g/m2
PORIFERA	-	-	-	0.226	0.001	0.026	0.004	0.005
COELENTERATA	-	2.710	2.067	10.988	0.858	3.883	0.340	3.375
Hydrozoa	-	2.710	1.050	0.982	0.028	0.042	-	-
Anthozoa	-	-	1.017	10.006	0.830	3.841	0.340	3.375
Alcyonacea	-	-	-	-	-	0.004	0.187	0.144
Zoantharia	-	-	-	9.903	0.665	3.747	-	3.231
Unidentified	-	-	1.017	0.103	0.165	0.090	0.153	-
PLATYHELMINTHES	-	-	-	0.009	0.011	-	0.004	-
Turbellaria	-	-	-	0.009	0.011	-	0.004	-
NEMERTEA	-	0.015	0.147	0.366	0.404	0.672	0.151	0.012
ASCHELMINTHES	-	-	0.097	0.015	0.001	0.002	0.011	0.002
Nematoda	-	-	0.097	0.015	0.001	0.002	0.011	0.002
ANNELIDA	-	6.640	26.903	8.398	9.562	14.659	6.131	3.722
POGONOPHORA	-	-	-	-	<0.001	0.031	0.117	0.004
SIPUNCULIDA	-	-	-	0.042	0.016	0.308	2.241	0.006
ECHIURA	-	-	-	-	0.022	0.210	1.804	0.941
PRIAPULIDA	-	-	-	-	-	-	-	0.046
MOLLUSCA	-	0.335	514.767	31.236	50.749	65.537	22.591	90.937
Polyplacophora	-	-	-	-	0.011	0.001	0.007	0.004
Gastropoda	-	0.040	0.167	1.295	1.830	18.885	0.111	0.015
Bivalvia	-	0.295	514.600	29.939	48.903	46.511	22.444	90.918
Scaphopoda	-	-	-	0.002	0.005	0.141	0.030	-
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	-	1.040	17.340	3.106	3.755	2.143	0.225	0.183
Pycnogonida	-	-	-	0.009	0.005	-	-	0.024
Arachnida	-	-	-	-	-	-	-	-
Crustacea	-	1.040	17.340	3.097	3.751	2.143	0.225	0.160
Ostracoda	-	-	-	-	<0.001	-	0.001	-
Cirripedia	-	-	-	0.005	0.004	-	-	-
Copepoda	-	-	-	-	-	-	-	-
Nebaliacea	-	-	-	-	<0.001	-	-	-
Cumacea	-	-	0.020	0.124	0.031	0.021	0.005	-
Tanaidacea	-	-	-	-	-	-	0.001	-
Isopoda	-	0.050	-	0.422	0.457	0.146	0.107	-
Amphipoda	-	0.860	0.793	2.011	2.589	0.231	0.060	0.160
Mysidacea	-	-	-	0.026	0.022	-	-	-
Decapoda	-	0.130	16.527	0.510	0.646	1.745	0.050	-
BRYOZOA	-	-	0.013	0.655	0.027	0.075	-	-
BRACHIOPODA	-	-	-	-	<0.001	-	-	-
ECHINODERMATA	-	1.470	0.167	17.104	15.197	10.890	0.806	1.352
Holothuroidea	-	1.470	-	0.543	0.498	10.092	0.217	0.820
Echinoidea	-	-	-	16.328	14.579	-	-	-
Ophiuroidea	-	-	0.167	0.067	0.025	0.796	0.583	0.529
Asteroidea	-	-	-	0.166	0.096	0.002	0.005	0.002
HEMICHORDATA	-	-	-	-	-	0.240	-	-
CHORDATA	-	-	144.867	-	4.170	1.662	0.047	0.976
Ascidiacea	-	-	144.867	-	4.170	1.662	0.047	0.976
UNIDENTIFIED	-	0.100	0.027	0.032	0.046	0.172	0.204	0.490

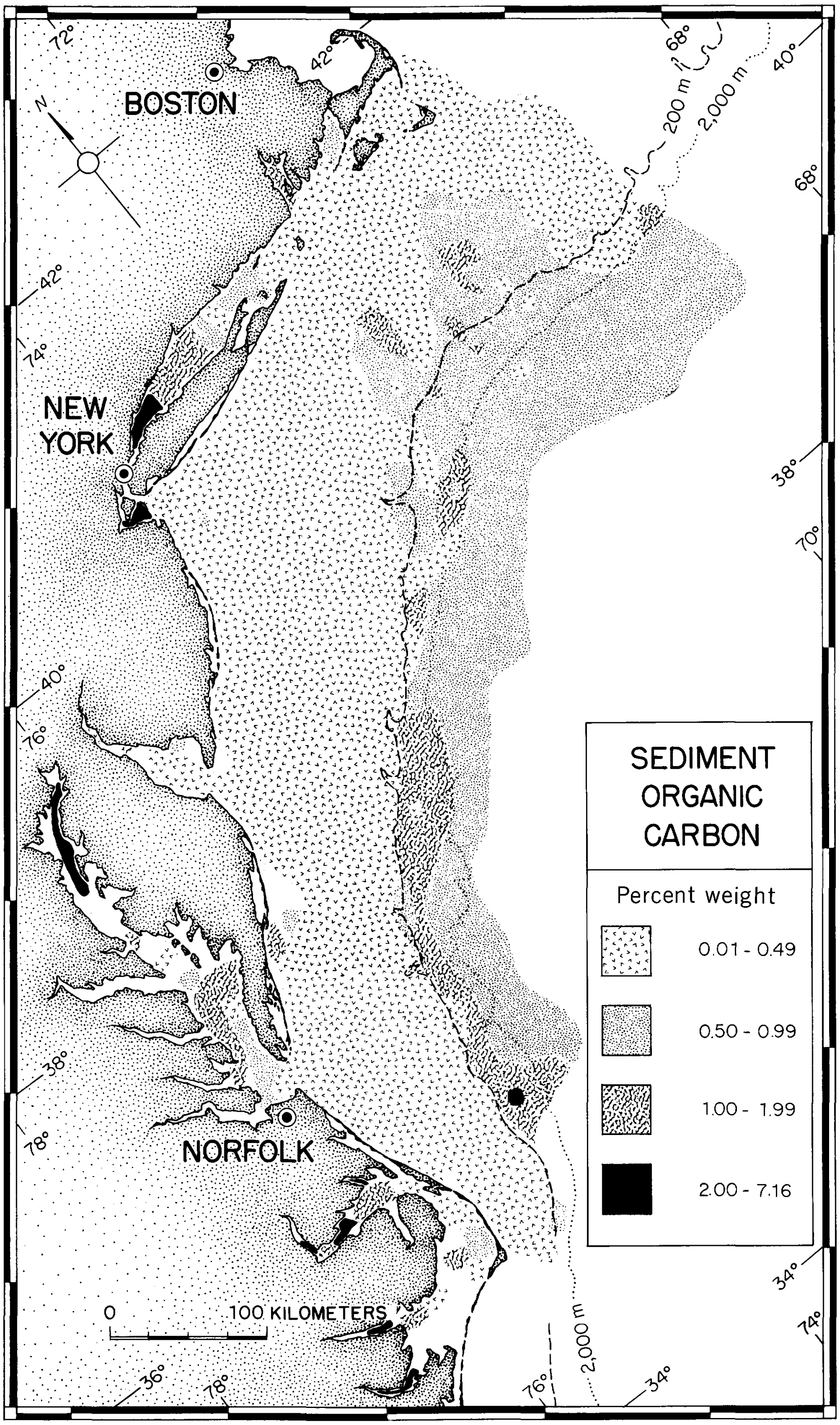

FIGURE 105.—Geographic distribution of organic carbon in the bottom sediments of the Middle Atlantic Bight region.

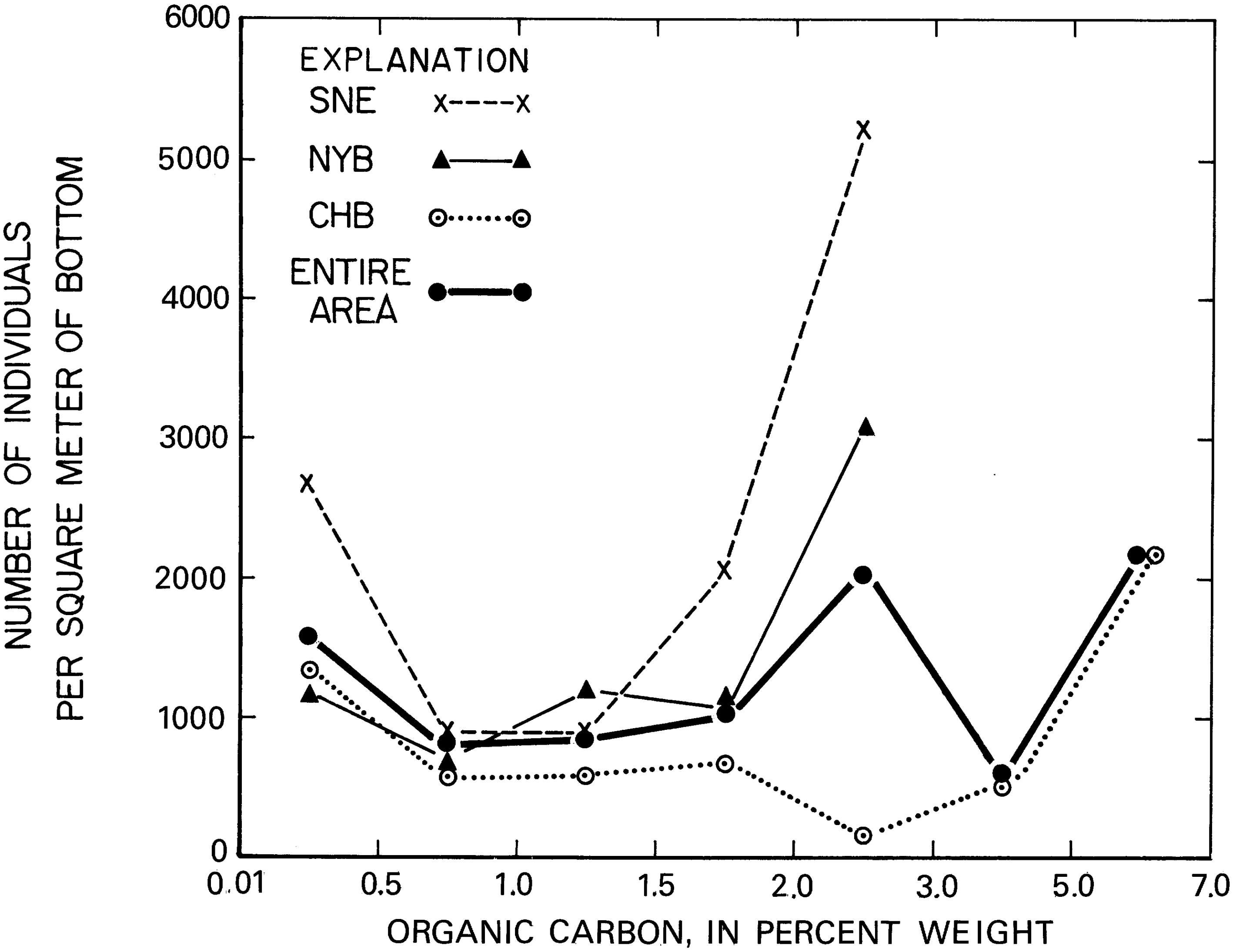

FIGURE 106.—Relation between number of individuals and sediment organic carbon. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight region. Abbreviations: SNE, Southern New England; NYB, New York Bight; CHB, Chesapeake Bight.

Neither the density nor the biomass values correlated in a general way with the amount of sediment organic carbon. Most of the taxonomic groups showed erratic trends in both density and biomass in relation to carbon. However, a few individual groups revealed good correlations. The groups that showed a direct relation between density (table 32) and carbon were Porifera (fig. 108), Pycnogonida (fig. 110), and Copepoda (fig. 111); Nematoda (fig. 109) revealed an inverse relation. Cirripedia (fig. 111) showed a direct relation between biomass (table 33) and carbon, and Cumacea (fig. 111) and Echinoidea (fig. 113) showed an inverse relation. Where quantitative relationships between higher taxa (such as phyla, classes, and orders) from a broad geographical area and sediment organic carbon are evaluated, little evidence of interdependence is seen.

SOUTHERN NEW ENGLAND

The analysis in this section is based on the density and biomass of each major taxonomic group in the seven classes of sediment organic carbon for a much smaller geographic area. Density values are listed in table 34, and biomass values are listed in table 35. The range of values and their fluctuations resemble those described (tables 32 and 33) for the entire Middle Atlantic Bight region. In one group (Copepoda), a direct correlation between quantity of organic carbon and density was seen, and in two groups (Sipunculida and Amphipoda), an inverse relationship was seen. In the vast majority of taxonomic groups, however, the quantity of animals varied in irregular patterns in relation to carbon content. The wide fluctuations and inconsistencies between similar groups indicate that in this subarea, there is no general correlation between higher groups of macrobenthic animals and the quantity of organic carbon in the bottom sediments. Similar fluctuations and inconsistencies were apparent in the analyses of data from both the New York and the Chesapeake Bights.

TABLE 30.—*Number of samples for each class of sediment organic carbon in each subarea and for the entire Middle Atlantic Bight region*

Organic carbon (percent to nearest 0.1)	Subarea			Entire region
	Southern New England	New York Bight	Chesapeake	
0.01–0.4	93	139	117	349
0.5 –0.9	55	29	26	110
1.0 –1.4	14	9	17	40
1.5 –1.9	4	6	15	25
2.0 –2.9	1	4	4	9
3.0 –4.9	0	0	9	9
5.0 –7.2	0	0	1	1
No data	19	0	1	20
Total	186	187	190	563

RELATION TO RANGE IN BOTTOM WATER TEMPERATURE

This section deals with the relationship between faunal components and the annual range of bottom-water temperature in the Middle Atlantic Bight region. Inasmuch as the data base does not contain a time-series array of temperature measurements, we relied on published sources for these data (see page N12). The normal range of temperature in this region is rather wide, particularly in some of the shallow, inshore locations where the actual temperatures may dip slightly below 0°C or rise above 24°C (24°+ temperature range).

Range of temperature, as opposed to discrete temperature observations made at the time of sample collection, serve as an index of annual change. For analysis purposes, the various annual temperature changes were grouped into seven classes: (1) 0°–3.9°; (2) 4.0°–7.9°; (3) 8.0°–11.9°; (4) 12.0°–15.9°; (5) 16.0°–19.9°; (6) 20.0°–23.9°; and (7) more than 24.0° change. All references to temperature in this section, therefore, pertain to ranges rather than to discrete measurements. A temperature range of 0°–3.9° indicates only that the water temperature variation is not more than 3.9° over the year.

TABLE 31.—*Mean number of individuals and biomass of the macrobenthic invertebrate fauna in relation to percent organic carbon in bottom sediments for each subarea and for the entire Middle Atlantic Bight region*

Organic carbon (Percent to nearest 0.1)	Mean number of individuals per square meter				Mean biomass in grams per square meter			
	SNE	NYB	CHB	Entire area	SNE	NYB	CHB	Entire area
0.01–0.4	2,643	1,226	1,372	1,653	326	130	77	164
.5 – .9	903	750	623	796	80	79	143	94
1.0 –1.4	902	1,208	596	841	65	2,223	66	551
1.5 –1.9	2,052	1,061	707	1,007	116	61	63	71
2.0 –2.9	5,236	3,126	182	2,052	218	2,657	14	1,211
3.0 –4.9	--	--	597	597	--	--	156	156
5.0+	--	--	2,244	2,244	--	--	555	555

TABLE 32.—*Mean number of individuals of each taxonomic group listed by sediment organic carbon content class, representing the entire Middle Atlantic Bight region*

[In number per square meter]

Taxonomic group	Sediment organic carbon content (percent)						
	0.01-0.4	0.5-0.9	1.0-1.4	1.5-1.9	2.0-2.9	3.0-4.9	5.0+
	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2	No./m^2
PORIFERA	0.65	0.17	0.12	-	-	1.22	32.00
COELENTERATA	12.59	43.41	8.00	7.56	-	10.78	-
Hydrozoa	8.09	22.99	-	0.08	-	-	-
Anthozoa	4.50	20.42	8.00	7.48	-	10.78	-
Alcyonacea	0.19	1.15	1.20	0.24	-	-	-
Zoantharia	2.32	6.64	6.08	5.28	-	10.78	-
Unidentified	1.99	12.63	0.72	1.96	-	-	-
PLATYHELMINTHES	0.89	0.05	0.52	-	-	-	-
Turbellaria	0.89	0.05	0.52	-	-	-	-
NEMERTEA	4.43	3.39	2.95	10.36	0.22	1.22	-
ASCHELMINTHES	2.99	2.11	1.50	0.68	0.44	-	-
Nematoda	2.99	2.11	1.50	0.68	0.44	-	-
ANNELIDA	355.38	204.20	139.12	137.48	135.22	36.56	548.00
POGONOPHORA	0.01	3.25	14.50	2.68	3.33	-	-
SIPUNCULIDA	3.75	5.58	2.22	0.84	0.22	-	-
ECHIURA	0.01	0.47	0.20	0.08	-	-	-
PRIAPULIDA	-	0.02	0.15	-	-	-	-
MOLLUSCA	362.00	147.63	485.02	656.24	909.33	403.33	730.00
Polyplacophora	0.44	0.35	0.62	0.24	1.22	-	-
Gastropoda	27.40	14.25	18.22	260.24	52.22	112.11	-
Bivalvia	333.36	129.13	463.98	394.60	853.67	291.22	730.00
Scaphopoda	0.79	2.28	2.20	1.16	2.22	-	-
Cephalopoda	0.01	1.63	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	823.82	308.14	88.62	123.64	994.78	94.22	537.00
Pycnogonida	0.36	0.39	0.28	-	3.11	5.33	-
Arachnida	0.07	-	-	-	-	-	-
Crustacea	823.39	307.74	88.35	123.64	991.67	88.89	537.00
Ostracoda	0.26	0.29	-	-	-	-	-
Cirripedia	10.90	46.32	-	-	885.11	-	-
Copepoda	0.03	0.05	0.12	-	-	-	-
Nebaliacea	0.02	0.01	-	-	-	-	-
Cumacea	19.54	3.12	3.05	0.44	1.22	-	-
Tanaidacea	0.02	0.23	-	-	-	-	-
Isopoda	14.36	4.70	0.40	28.72	10.11	12.11	140.00
Amphipoda	767.29	244.73	83.92	86.00	84.22	76.78	397.00
Mysidacea	2.56	1.89	-	2.20	-	-	-
Decapoda	8.42	6.40	0.85	6.28	11.00	-	-
BRYOZOA	8.98	1.45	3.80	60.00	-	-	-
BRACHIOPODA	0.01	-	-	-	-	-	-
ECHINODERMATA	53.02	56.26	80.82	2.72	0.67	-	-
Holothuroidea	1.62	3.36	4.02	2.28	-	-	-
Echinoidea	35.79	0.39	0.12	-	-	-	-
Ophiuroidea	14.85	51.93	75.48	0.36	0.67	-	-
Asteroidea	0.74	0.58	1.20	0.08	-	-	-
HEMICHORDATA	0.14	0.14	0.25	-	-	-	-
CHORDATA	18.64	11.00	7.00	0.44	6.33	-	-
Ascidiacea	18.64	11.00	7.00	0.44	6.33	-	-
UNIDENTIFIED	5.34	8.99	5.72	4.32	1.22	49.67	397.00

TABLE 33.—*Mean biomass of each taxonomic group listed by sediment organic carbon content class, representing the entire Middle Atlantic Bight region*

[In grams per square meter]

Taxonomic group	Sediment organic carbon content (percent)						
	0.01-0.4	0.5-0.9	1.0-1.4	1.5-1.9	2.0-2.9	3.0-4.9	5.0+
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.056	0.007	0.002	-	-	0.012	0.110
COELENTERATA	2.175	5.252	4.687	3.050	-	0.620	-
Hydrozoa	0.403	0.225	-	0.001	-	-	-
Anthozoa	1.772	5.027	4.687	3.049	-	0.620	-
Alcyonacea	0.026	0.186	0.347	0.148	-	-	-
Zoantharia	1.643	4.375	4.274	2.847	-	0.620	-
Unidentified	0.103	0.466	0.066	0.054	-	-	-
PLATYHELMINTHES	0.009	<0.001	0.003	-	-	-	-
Turbellaria	0.009	<0.001	0.003	-	-	-	-
NEMERTEA	0.674	0.531	0.239	1.081	0.010	0.012	-
ASCHELMINTHES	0.004	0.006	0.006	0.006	0.004	-	-
Nematoda	0.004	0.006	0.006	0.006	0.004	-	-
ANNELIDA	12.449	15.851	11.415	14.018	18.834	3.023	9.770
POGONOPHORA	<0.001	0.022	0.094	0.009	0.007	-	-
SIPUNCULIDA	0.469	1.116	0.132	2.486	0.004	-	-
ECHIURA	0.005	0.883	0.471	0.695	-	-	-
PRIAPULIDA	-	0.031	0.039	-	-	-	-
MOLLUSCA	108.172	39.215	509.982	45.543	1164.252	151.494	540.870
Polyplacophora	0.225	0.012	0.022	0.004	0.004	-	-
Gastropoda	2.987	3.599	0.390	6.410	11.398	0.052	-
Bivalvia	104.948	35.532	509.534	39.113	1152.831	151.442	540.870
Scaphopoda	0.012	0.050	0.036	0.016	0.019	-	-
Cephalopoda	<0.001	0.022	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	10.299	8.568	0.567	1.550	26.347	0.462	2.250
Pycnogonida	0.002	0.002	0.006	-	0.031	0.027	-
Arachnida	<0.001	-	-	-	-	-	-
Crustacea	10.296	8.566	0.561	1.550	26.316	0.435	2.250
Ostracoda	0.002	0.003	-	-	-	-	-
Cirripedia	3.912	5.076	-	-	20.679	-	-
Copepoda	<0.001	<0.001	0.001	-	-	-	-
Nebaliacea	<0.001	<0.001	-	-	-	-	-
Cumacea	0.073	0.022	0.012	0.004	0.012	-	-
Tanaidacea	<0.001	0.002	-	-	-	-	-
Isopoda	0.393	0.099	0.004	0.074	0.076	0.109	1.500
Amphipoda	4.589	2.212	0.518	0.320	0.258	0.326	0.750
Mysidacea	0.015	0.014	-	0.004	-	-	-
Decapoda	1.312	1.137	0.026	1.148	5.291	-	-
BRYOZOA	0.219	0.020	0.071	2.080	-	-	-
BRACHIOPODA	<0.001	-	-	-	-	-	-
ECHINODERMATA	26.393	14.647	21.929	0.200	0.306	-	-
Holothuroidea	2.656	9.097	8.532	0.091	-	-	-
Echinoidea	21.102	1.805	0.825	-	-	-	-
Ophiuroidea	0.909	3.083	6.224	0.107	0.306	-	-
Asteroidea	1.726	0.662	6.348	0.002	-	-	-
HEMICHORDATA	0.034	0.024	0.039	-	-	-	-
CHORDATA	3.212	8.139	1.000	0.009	0.479	-	-
Ascidiacea	3.212	8.139	1.000	0.009	0.479	-	-
UNIDENTIFIED	0.255	1.920	0.376	0.125	1.062	0.229	1.830

TABLE 34.—*Mean number of individuals of each taxonomic group listed by sediment organic carbon content class, representing the Southern New England subarea*

[In grams per square meter]

Taxonomic group	Sediment organic carbon content (percent)						
	0.01-0.4	0.5-0.9	1.0-1.4	1.5-1.9	2.0-2.9	3.0-4.9	5.0+
	No./m2	No./m2	No./m2	No./m2	No./m2	No./m2	No./m2
PORIFERA	1.13	0.07	0.36	-	-	-	-
COELENTERATA	24.02	48.58	16.43	22.00	-	-	-
Hydrozoa	17.11	19.58	-	-	-	-	-
Anthozoa	6.92	29.00	16.43	22.00	-	-	-
Alcyonacea	0.36	1.11	1.00	-	-	-	-
Zoantharia	5.54	4.20	14.93	22.00	-	-	-
Unidentified	1.02	23.70	0.50	-	-	-	-
PLATYHELMINTHES	2.61	0.09	-	-	-	-	-
Turbellaria	2.61	0.09	-	-	-	-	-
NEMERTEA	6.04	4.38	6.00	-	-	-	-
ASCHELMINTHES	9.17	1.96	3.71	-	-	-	-
Nematoda	9.17	1.96	3.71	-	-	-	-
ANNELIDA	375.12	264.82	219.79	345.25	131.00	-	-
POGONOPHORA	0.06	3.05	3.71	-	-	-	-
SIPUNCULIDA	10.64	9.58	2.36	-	-	-	-
ECHIURA	-	0.18	0.43	-	-	-	-
PRIAPULIDA	-	0.04	0.29	-	-	-	-
MOLLUSCA	160.92	87.40	200.98	1078.25	5094.00	-	-
Polyplacophora	1.59	0.31	0.71	-	-	-	-
Gastropoda	53.10	17.31	21.48	217.00	33.00	-	-
Bivalvia	105.74	65.11	178.64	861.25	5061.00	-	-
Scaphopoda	0.44	1.42	0.14	-	-	-	-
Cephalopoda	0.05	3.25	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	1908.70	381.66	195.28	217.25	11.00	-	-
Pycnogonida	-	0.78	-	-	-	-	-
Arachnida	-	-	-	-	-	-	-
Crustacea	1908.70	380.87	195.28	217.25	11.00	-	-
Ostracoda	0.37	0.47	-	-	-	-	-
Cirripedia	40.48	0.38	-	-	-	-	-
Copepoda	0.06	0.11	0.36	-	-	-	-
Nebaliacea	-	-	-	-	-	-	-
Cumacea	36.57	3.82	8.00	2.75	-	-	-
Tanaidacea	0.09	0.24	-	-	-	-	-
Isopoda	13.91	2.76	0.86	6.25	-	-	-
Amphipoda	1804.69	368.36	185.35	182.00	11.00	-	-
Mysidacea	0.80	2.18	-	13.75	-	-	-
Decapoda	11.73	2.55	0.71	12.50	-	-	-
BRYOZOA	15.90	0.16	-	375.00	-	-	-
BRACHIOPODA	-	-	-	-	-	-	-
ECHINODERMATA	68.91	79.20	225.50	13.75	-	-	-
Holothuroidea	4.26	4.29	11.07	13.75	-	-	-
Echinoidea	14.64	0.56	0.36	-	-	-	-
Ophiuroidea	48.57	73.33	213.07	-	-	-	-
Asteroidea	1.44	1.02	1.00	-	-	-	-
HEMICHORDATA	0.28	0.27	0.71	-	-	-	-
CHORDATA	55.87	5.93	17.43	-	-	-	-
Ascidiacea	55.87	5.93	17.43	-	-	-	-
UNIDENTIFIED	3.77	15.45	8.57	0.50	-	-	-

TABLE 35.—*Mean biomass of each taxonomic group listed by sediment organic carbon content class, representing the Southern New England subarea*

[In grams per square meter]

Taxonomic group	Sediment organic carbon content (percent)						
	0.01-0.4	0.5-0.9	1.0-1.4	1.5-1.9	2.0-2.9	3.0-4.9	5.0+
	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2
PORIFERA	0.090	<0.001	0.007	-	-	-	-
COELENTERATA	2.962	8.334	2.994	3.458	-	-	-
Hydrozoa	1.030	0.348	-	-	-	-	-
Anthozoa	1.932	7.986	2.994	3.458	-	-	-
Alcyonacea	0.063	0.200	0.704	-	-	-	-
Zoantharia	1.774	7.102	2.185	3.458	-	-	-
Unidentified	0.095	0.684	0.105	-	-	-	-
PLATYHELMINTHES	0.014	<0.001	-	-	-	-	-
Turbellaria	0.014	<0.001	-	-	-	-	-
NEMERTEA	0.956	0.599	0.378	-	-	-	-
ASCHELMINTHES	0.008	0.005	0.014	-	-	-	-
Nematoda	0.008	0.005	0.014	-	-	-	-
ANNELIDA	18.383	14.718	9.650	45.445	37.440	-	-
POGONOPHORA	<0.001	0.027	0.014	-	-	-	-
SIPUNCULIDA	1.139	2.032	0.196	-	-	-	-
ECHIURA	-	0.079	0.366	-	-	-	-
PRIAPULIDA	-	0.062	0.038	-	-	-	-
MOLLUSCA	241.154	26.045	4.883	44.446	180.130	-	-
Polyplacophora	0.843	0.004	0.051	-	-	-	-
Gastropoda	6.246	1.073	0.043	5.888	1.960	-	-
Bivalvia	234.057	24.776	4.785	38.558	178.170	-	-
Scaphopoda	0.008	0.017	0.004	-	-	-	-
Cephalopoda	<0.001	0.175	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	26.777	2.723	1.415	8.501	0.110	-	-
Pycnogonida	-	0.004	-	-	-	-	-
Arachnida	-	-	-	-	-	-	-
Crustacea	26.777	2.719	1.415	8.501	0.110	-	-
Ostracoda	0.002	0.005	-	-	-	-	-
Cirripedia	14.674	0.008	-	-	-	-	-
Copepoda	<0.001	<0.001	0.004	-	-	-	-
Nebaliacea	-	-	-	-	-	-	-
Cumacea	0.124	0.027	0.028	0.028	-	-	-
Tanaidacea	<0.001	0.002	-	-	-	-	-
Isopoda	0.248	0.122	0.010	0.062	-	-	-
Amphipoda	10.344	2.368	1.369	1.278	0.110	-	-
Mysidacea	0.002	0.024	-	0.008	-	-	-
Decapoda	1.382	0.162	0.004	7.125	-	-	-
BRYOZOA	0.434	0.001	-	13.000	-	-	-
BRACHIOPODA	-	-	-	-	-	-	-
ECHINODERMATA	23.653	19.749	43.389	0.548	-	-	-
Holothuroidea	8.467	13.620	22.195	0.548	-	-	-
Echinoidea	10.847	1.167	2.356	-	-	-	-
Ophiuroidea	2.830	4.918	15.930	-	-	-	-
Asteroidea	1.509	0.044	2.908	-	-	-	-
HEMICHORDATA	0.055	0.048	0.111	-	-	-	-
CHORDATA	9.428	4.599	1.461	-	-	-	-
Ascidiacea	9.428	4.599	1.461	-	-	-	-
UNIDENTIFIED	0.544	0.280	0.156	0.538	-	-	-

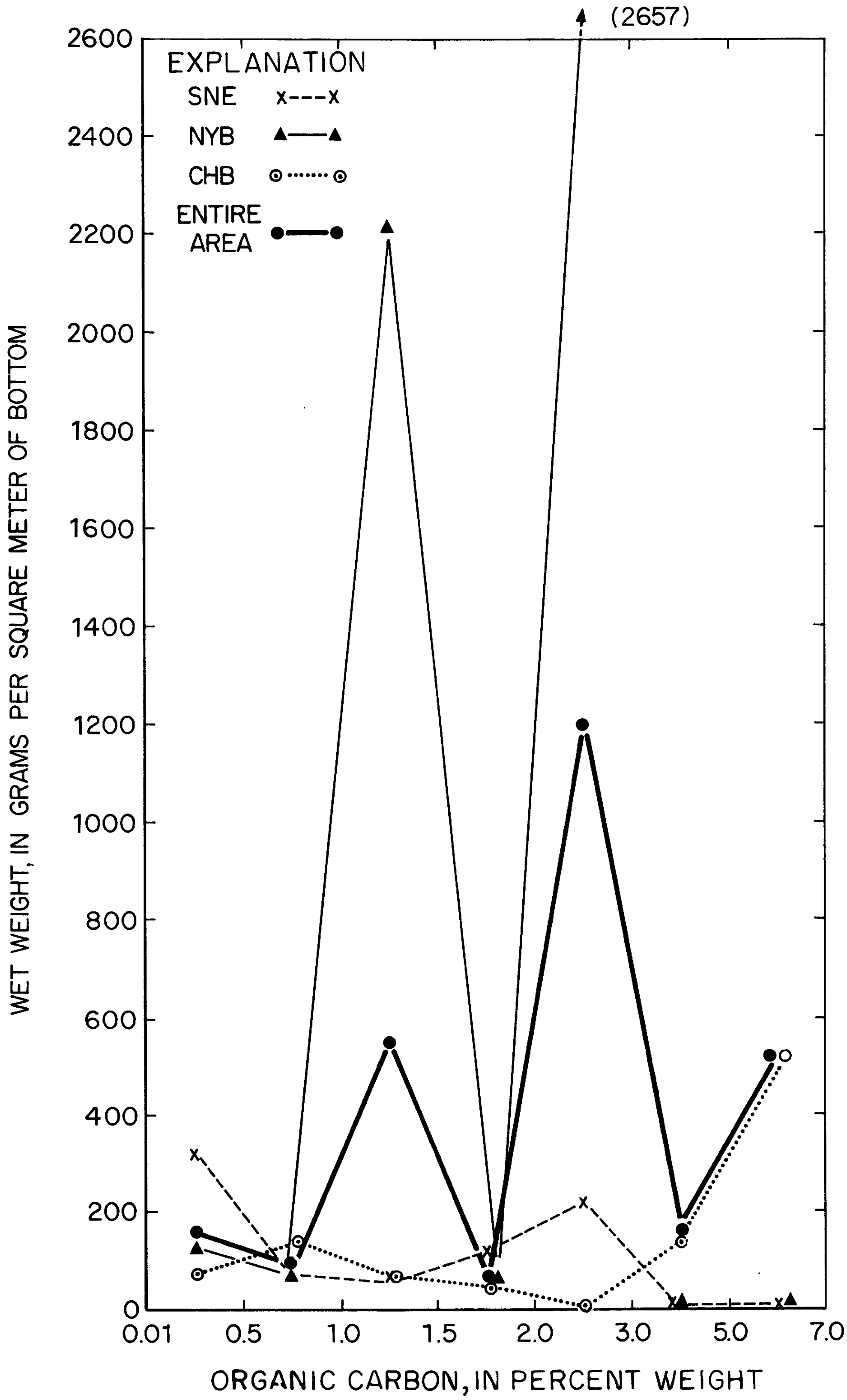

FIGURE 107.—Relation between biomass and sediment organic carbon. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight region. Abbreviations: SNE, Southern New England; NYB, New York Bight; CHB, Chesapeake Bight.

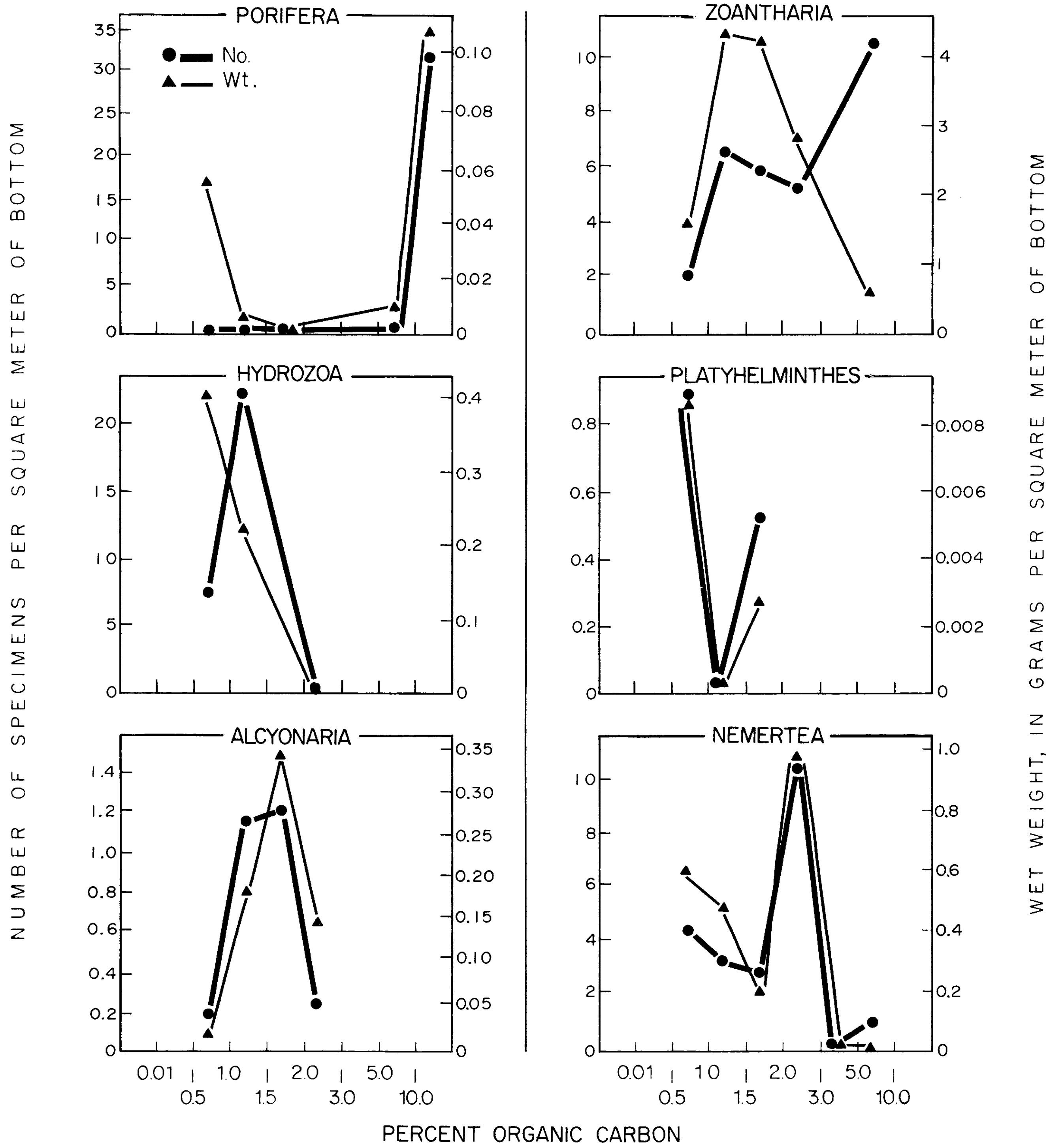

FIGURE 108.—Density (No.) and biomass (wt.) in relation to sediment organic carbon in the entire Middle Atlantic Bight region for Porifera, Hydrozoa, Alcyonaria, Zoantharia, Platyhelminthes, and Nemertea.

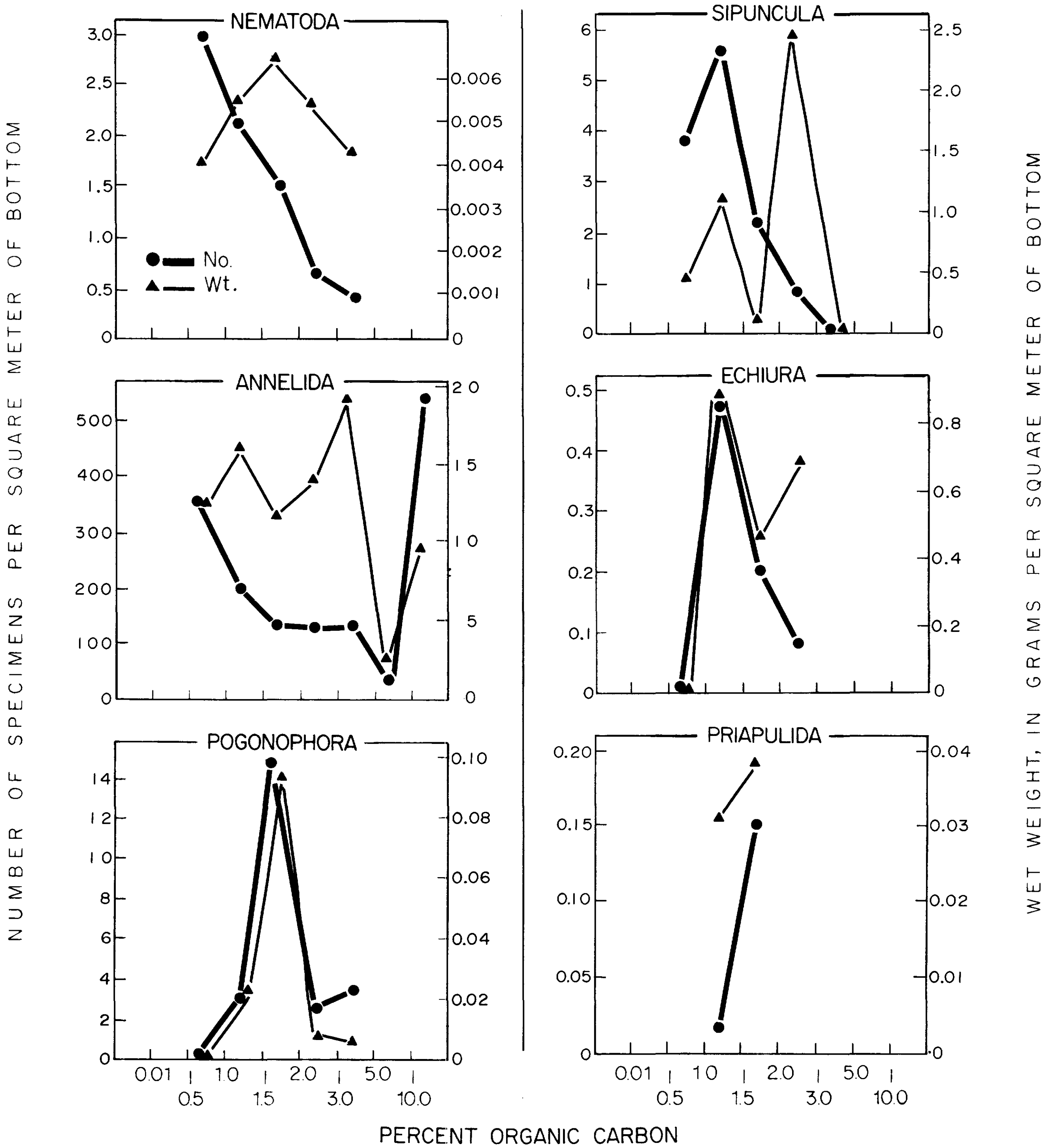

FIGURE 109.—Density (No.) and biomass (wt.) in relation to sediment organic carbon in the entire Middle Atlantic Bight region for Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

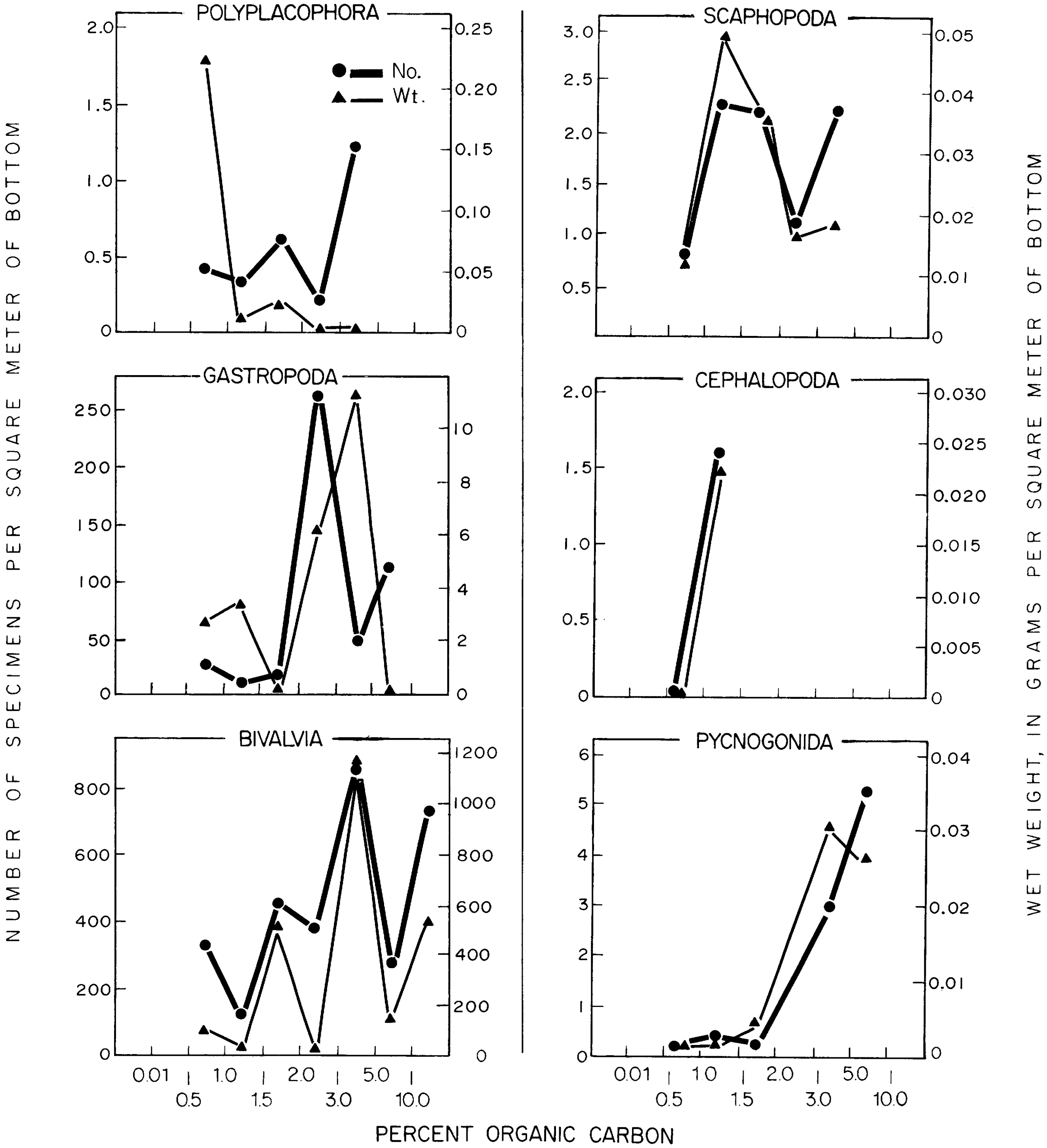

FIGURE 110.—Density (No.) and biomass (wt.) in relation to sediment organic carbon in the entire Middle Atlantic Bight region for Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

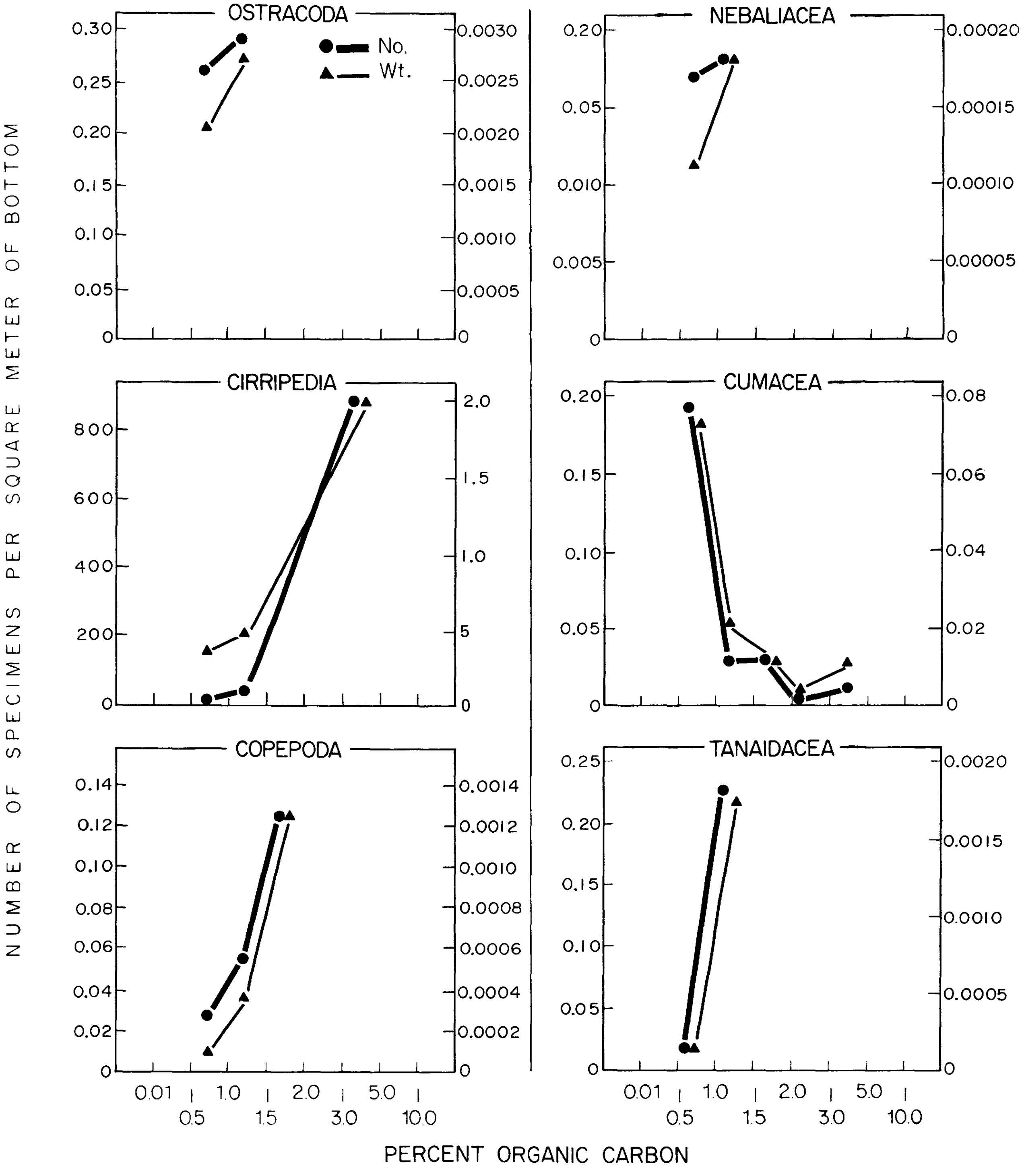

FIGURE 111.—Density (No.) and biomass (wt.) in relation to sediment organic carbon in the entire Middle Atlantic Bight region for Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

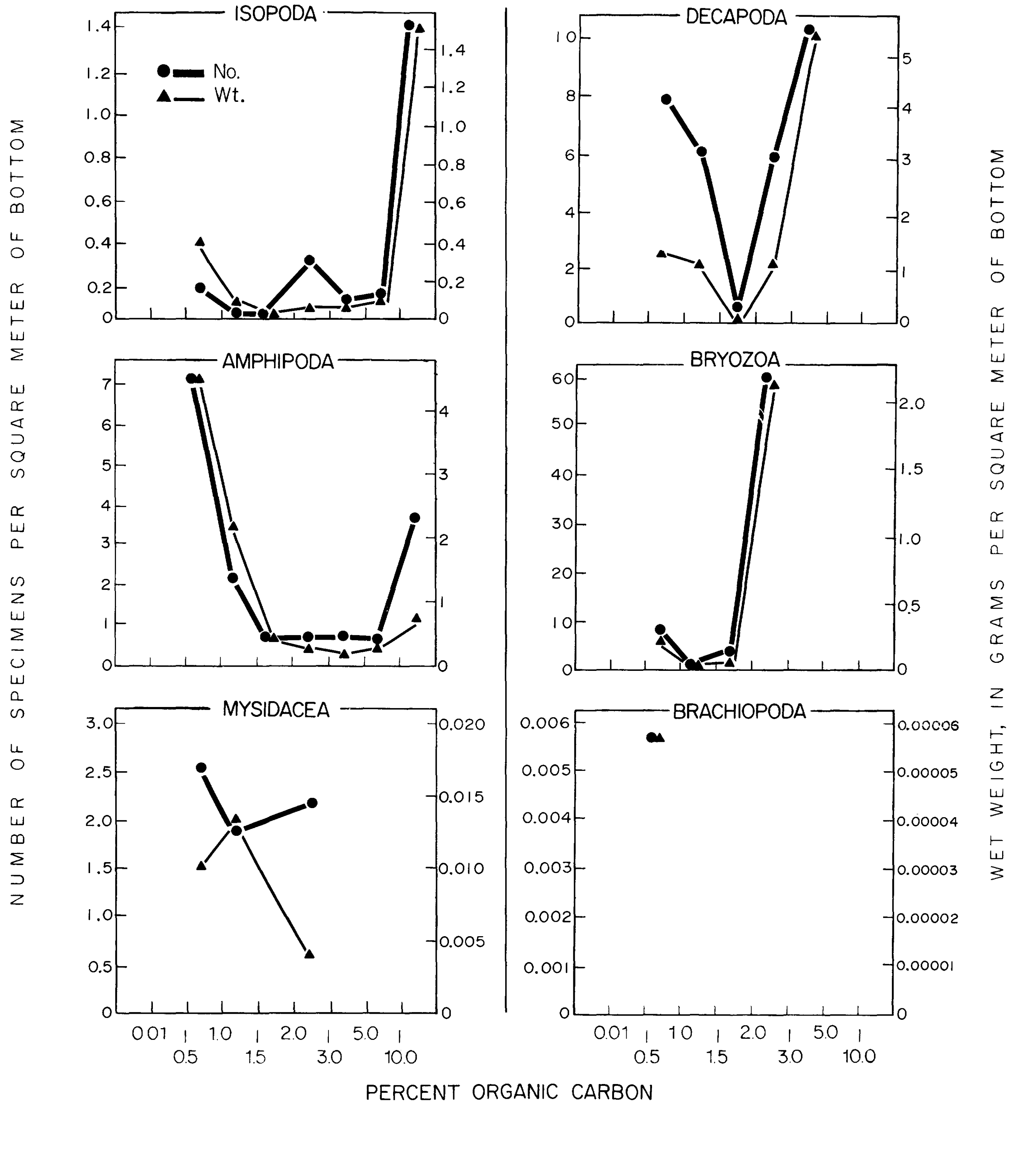

FIGURE 112.—Density (No.) and biomass (wt.) in relation to sediment organic carbon in the entire Middle Atlantic Bight region for Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

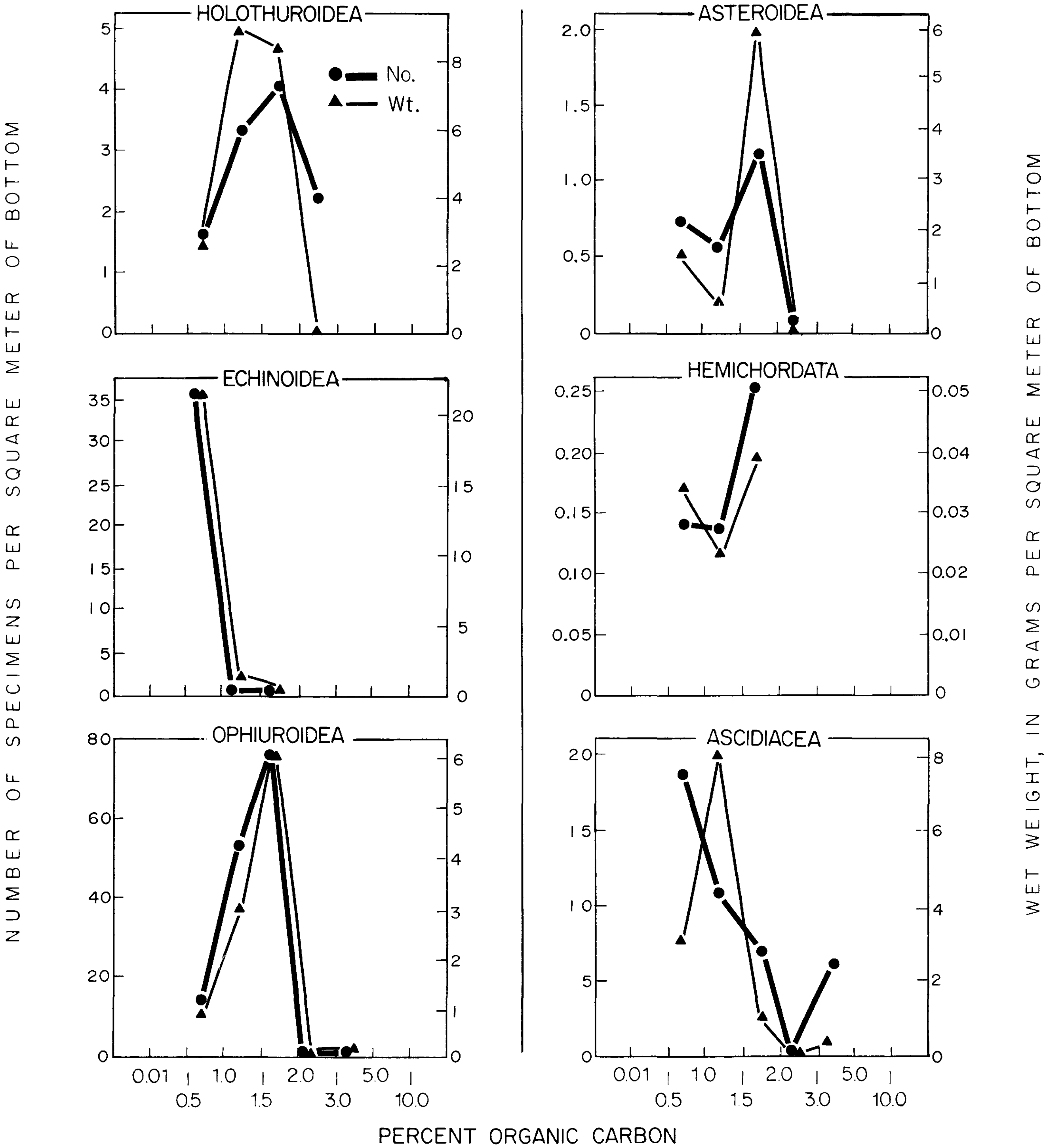

FIGURE 113.—Density (No.) and biomass (wt.) in relation to sediment organic carbon in the entire Middle Atlantic Bight region for Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

The areal distribution of temperature ranges and the distribution of samples within each temperature-range class for each subarea and the entire Middle Atlantic Bight region is shown in figure 114 in table 36. Although each temperature-range class was represented in each subarea, there were striking differences in the annual temperature regime. This broad range was especially pronounced on the Continental Shelf. In Southern New England, most of the Continental Shelf had an annual range in temperature (or degrees difference between high and low temperatures) from 12° to 24°C. In contrast, most of the Continental Shelf in Chesapeake Bight had a substantially wider annual range, from about 20° to 24°C. In New York Bight, the temperature was between these two extremes.

Depth has the major effect on temperature range. Greatest temperature variations were found in the shoalest water and least in the deepwater areas.

TABLE 36.—*Number of samples within each water temperature range class in each subarea and for the entire Middle Atlantic Bight region*

Temperature range (degrees Celsius to nearest 0.1°)	Subarea: Southern New England	New York Bight	Chesapeake Bight	Entire region
0– 3.9	46	36	28	110
4.0– 7.9	7	5	5	17
8.0–11.9	12	16	5	33
12.0–15.9	52	42	8	102
16.0–19.9	31	32	16	79
20.0–23.9	28	52	74	154
24.0+	10	4	54	68
Total	186	187	190	563

TOTAL MACROBENTHIC FAUNA OF ALL TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

The relationship between range in bottom-water temperature in the region and density and biomass of all organisms is listed in table 37 and illustrated in figures 115 and 116.

The mean density of all organisms throughout the entire region tended to increase as temperature range increased, at least until values of 12° to 15.9°C were attained. Where temperature ranges were higher, 16°–24°+C, mean densities, although high, tended to fluctuate more. Lowest mean density (133/m²) was found where temperature varied least (0°–3.9°C), increasing significantly as temperature range widened (591/m² in 4°–7.9°C and 851/m² in 8°–11.9°C), culminating in highest density (2,072/m²) in the midrange class of 12°–15.9°C. In the broader temperature classes (16°–24°C), mean densities, although high, did not show any definite trends.

The mean biomass of all organisms in the region showed a definite tendency of increasing as the temperature range broadened. Smallest biomass (10 g/m²) was found in the narrowest range (0°–3.9°C), and largest values (303 and 290 g/m²) in the broadest ranges (20°–23.9° and 24°+C, respectively). Biomass in the intermediate temperature ranges was from 40 to 240 g/m².

TABLE 37.—*Mean number of individuals and biomass of the macrobenthic invertebrate fauna, all taxonomic groups combined, in relation to range in bottom-water temperature*

Temperature range	Mean number of individuals: SNE	NYB	CHB	Entire area	Mean biomass: SNE	NYB	CHB	Entire area
°C	No./m²	No./m²	No./m²	No./m²	g/m²	g/m²	g/m²	g/m²
0.0-3.9	174	124	76	133	10	8	11	10
4.0-7.9	769	321	612	591	67	19	24	40
8.0-11.9	960	721	1,006	851	105	102	91	101
12.0-15.9	2,797	1,408	854	2,072	189	143	137	166
16.0-19.9	3,235	870	398	1,702	409	161	68	240
20.0-23.9	2,475	2,143	1,692	1,987	156	704	78	303
24.0+	2,361	1,471	1,061	1,276	1,011	392	149	290

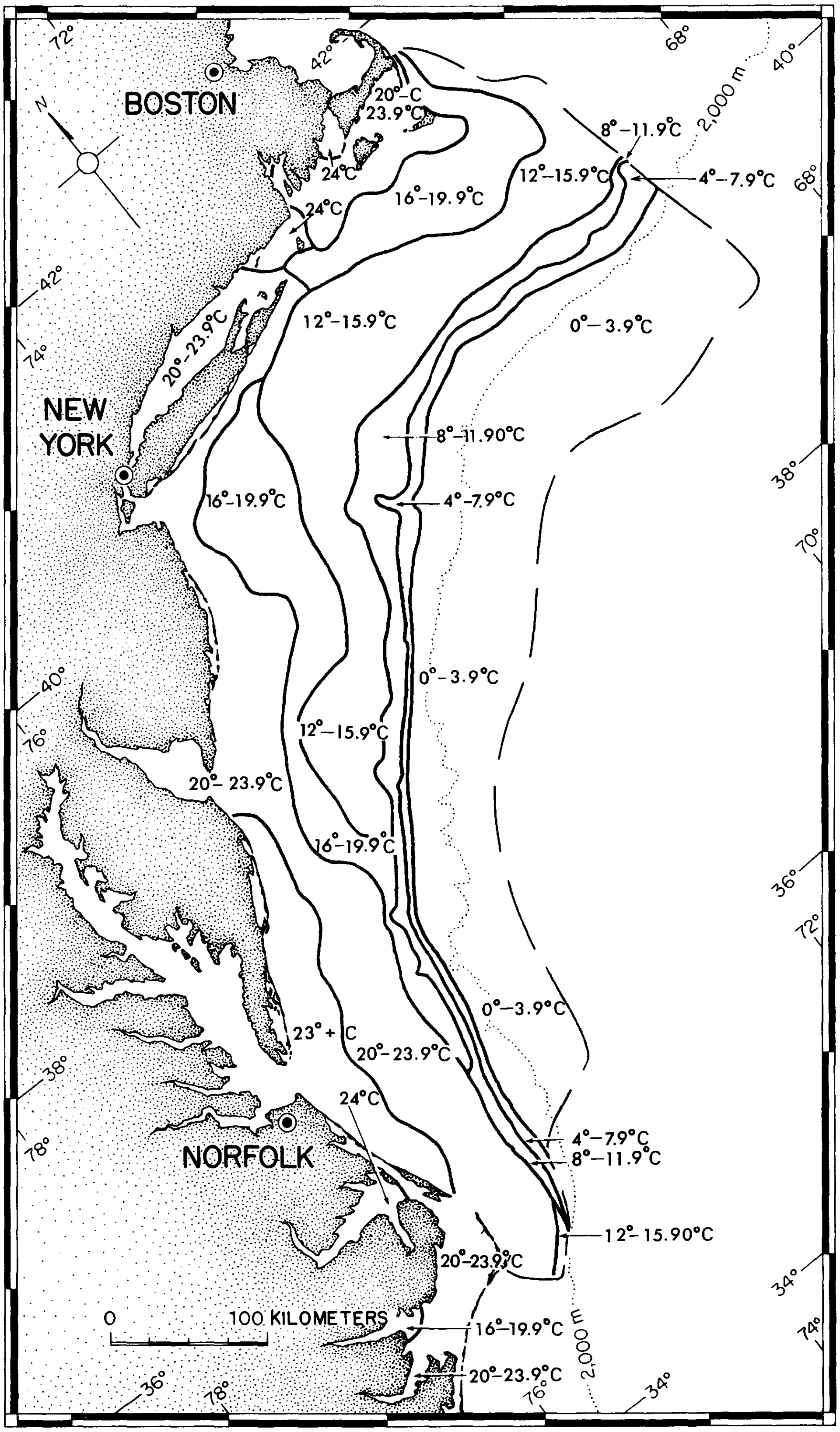

FIGURE 114.—Distribution of the range in bottom-water temperature (in degrees Celsius) the Middle Atlantic Bight region. Lines delimit areas of comparable temperature range; they are not isotherms. Dashed line shows boundary of sampling area.

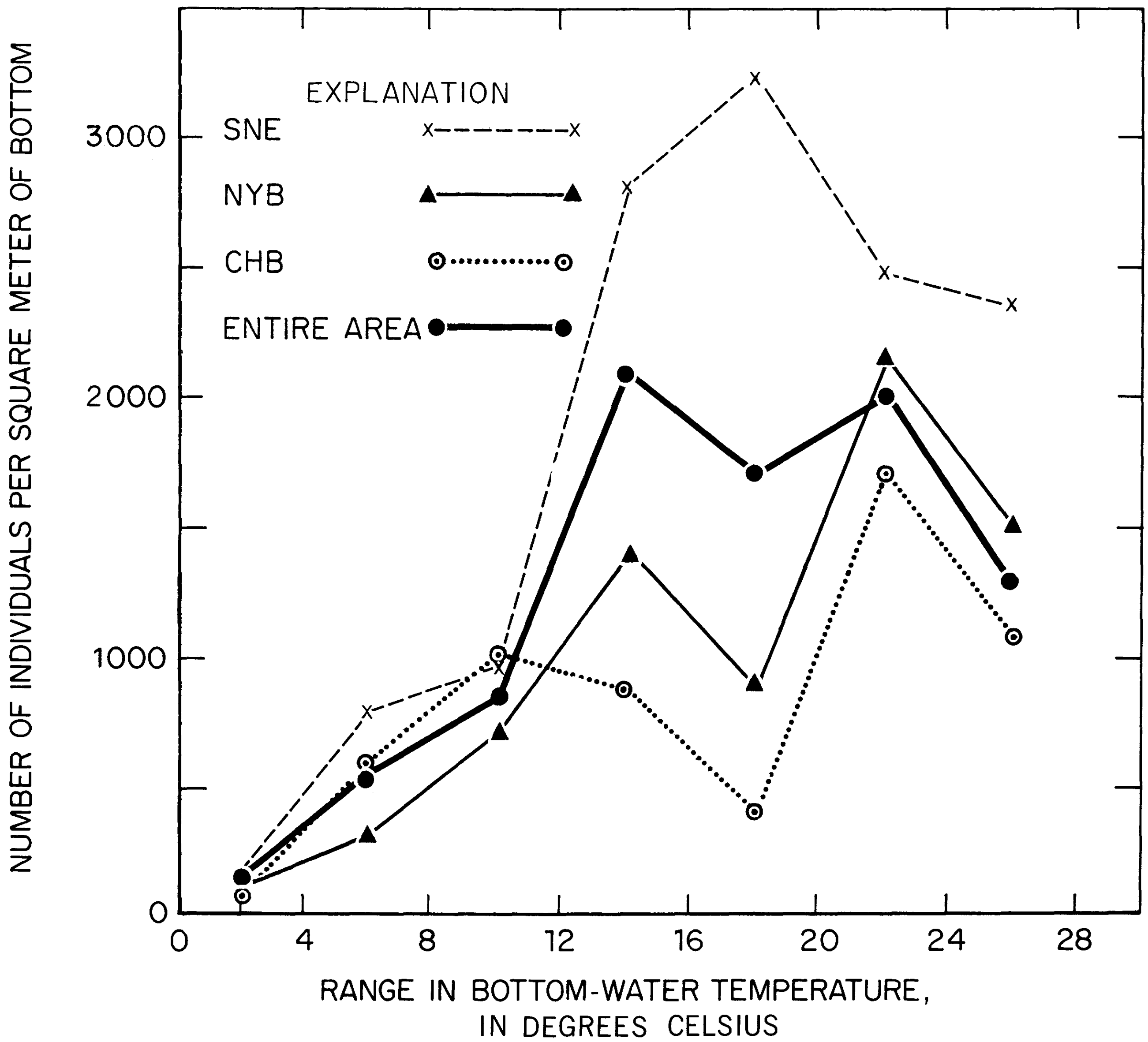

FIGURE 115.—Relation between number of individuals and range in bottom-water temperature. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight region. Abbreviations: SNE, Southern New England; NYB, New York Bight; CHB, Chesapeake Bight.

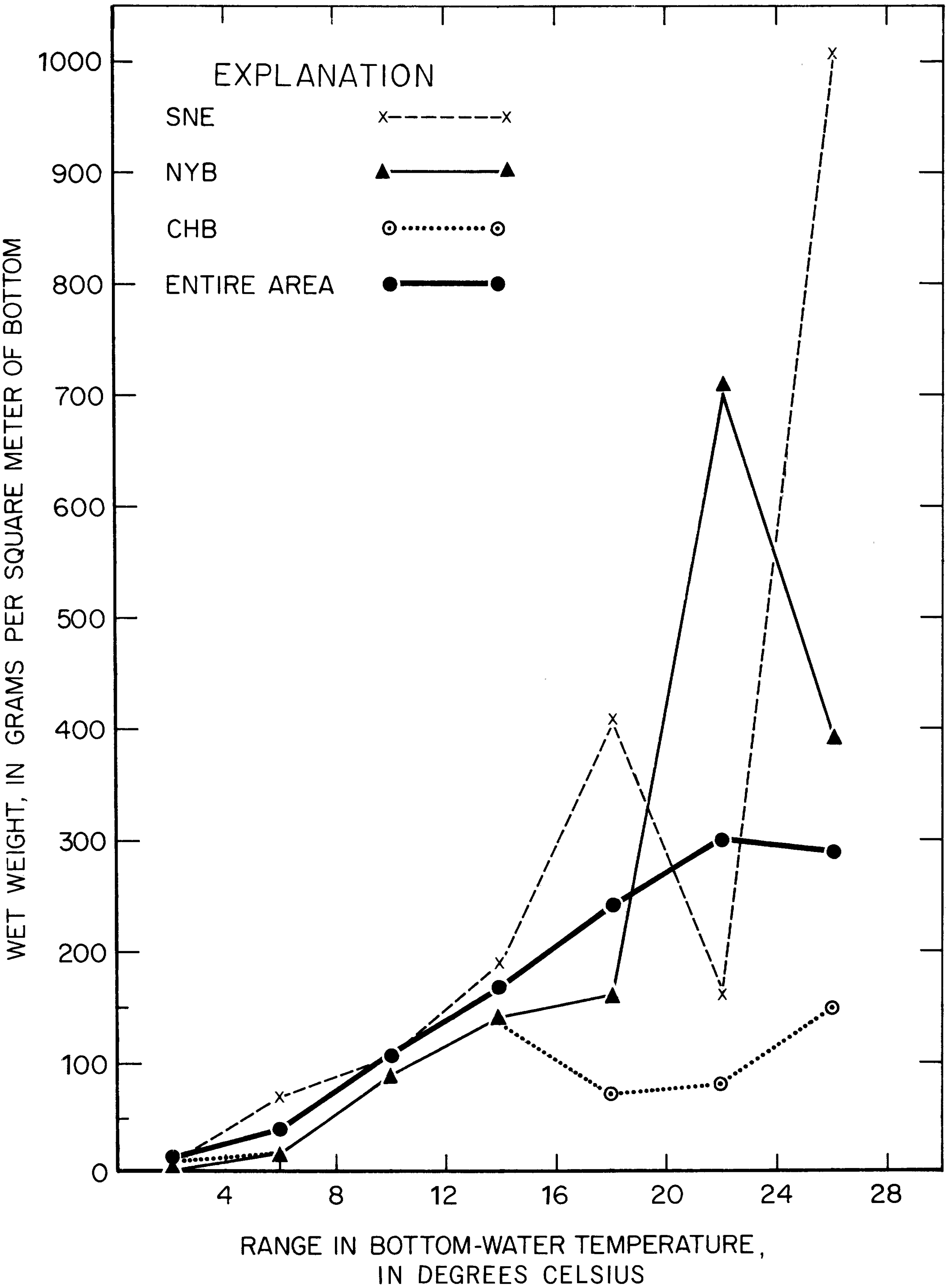

FIGURE 116.—Relation between biomass and range in bottom-water temperature. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight region. Abbreviations: SNE, Southern New England; NYB, New York Bight; CHB, Chesapeake Bight.

SUBAREAS

SOUTHERN NEW ENGLAND

The mean density of all organisms in each temperature-range class, except one, was higher in Southern New England than in the two other subareas. The exception was in the 8°–11.9°C class, where density in Chesapeake Bight slightly exceeded that in Southern New England (1,006/m² versus 960/m²). The relationship between density and broadening temperature range was also most consistent in this subarea. Mean values of density increased steadily (174/m², 769/m², 960/m², 2,797/m², and 3,235/m²) as temperature range widened until 16°–19.9°C was reached; values then declined slightly (2,475/m² in 20°–23.9°C, and 2,361/m² in 24°+C).

In almost all temperature-range classes, the mean biomass was larger than those in either New York Bight or Chesapeake Bight. In the 0°–3.9°C class, Chesapeake Bight had a slightly larger biomass (11 versus 10 g/m²) than Southern New England, but the greatest disparity, which may simply be due to sampling variability, was found in the 20°–23.9°C class, where the biomass in New York Bight was significantly larger than that in Southern New England (704 versus 156 g/m²). Except for the two examples just mentioned, mean biomass in Southern New England was generally larger than those in New York Bight and Chesapeake Bight and tended to increase as temperature range broadened. Smallest average biomass (10 g/m²) was found in 0°–3.9°C class, and largest (1,011 g/m²) in the 24°+C class. Biomasses ranging from 67 to 409 g/m² were found in the intermediate classes, table 37.

NEW YORK BIGHT

Although the general tendencies of macrofaunal density in the New York Bight subarea were to increase as temperature range increased and to fall between those of Southern New England and Chesapeake Bight, some notable exceptions were seen. Density values increased in the first four temperature classes (0°–3.9° to 12°–15.9°C) from 124/m² to 1,408/m²; dipped to 870/m² in the 16°–19.9°C class; rose again to their highest point, 2,143/m², in the 20°–23.9°C class; then decreased again to 1,471/m² in the broadest range. Comparatively, the mean density of organisms in New York Bight in the first three temperature classes (0°–3.9° to 8°–11.9°C) was the lowest of the three subareas, and Chesapeake Bight occupied the intermediate position; but in the remaining classes, the density of New York Bight fell between the densities of Southern New England and Chesapeake Bight.

The average biomass of all organisms in New York Bight was very similar to that of Chesapeake Bight in the narrow to moderate temperature classes (0°–3.9° to 12°–15.9°C), ranging from 8 to 143 g/m²; was between those of Southern New England and Chesapeake Bight in both the 16°–19.9° and 24°+C classes (161 and 392 g/m², respectively); but was largest (704 g/m²) of any subarea in the 20°–23.9°C class.

CHESAPEAKE BIGHT

The relationship between mean density and biomass of all organisms and range in temperature was least consistent and generally lowest in this subarea. Densities in the first three classes tended to increase (76/m², 612/m², and 1,006/m²) as range broadened, culminating in the greatest density in the 8°–11.9°C class of any of the subareas. Values between 398/m² and 1,692/m² were found in the other temperature classes, but showed no definite pattern, and, overall, were lower than in the other subareas.

Biomass values in the first four temperature classes (0°–3.9° to 12°–15.9°) paralleled those of Southern New England and New York Bight very closely both in the general trend of increasing as temperature range broadened and in amount, which ranged from 11 to 137 g/m². However, in the broader classes, both the trend and the mean of biomass values fell drastically, except in the 24°+C range, where the largest biomass (149 g/m²) in this subarea was recorded. See figure 116 and table 37.

TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

This section deals with the relationship between the mean density and biomass of each taxonomic group in the entire Middle Atlantic Bight region and the range in bottom-water temperature. Densities of each taxonomic group by temperature class are listed in table 38. Corresponding biomass values for each taxonomic group are listed in table 39. These data are illustrated in figures 117 through 122.

SUBAREA DIFFERENCES IN DISTRIBUTION OF TAXONOMIC GROUPS

This section deals with the relation of temperature range to each taxonomic group within each of the three subareas. Density data listed by temperature-range class are presented separately for each subarea in tables 40, 41, and 42; corresponding biomass values are listed in tables 43, 44, and 45.

TABLE 38.—*Mean number of individuals of each taxonomic group listed by temperature-range class, representing the entire Middle Atlantic Bight region*

[In number per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	0.07	0.65	0.73	0.48	0.14	0.62	1.75
COELENTERATA	3.69	16.06	10.12	20.28	8.22	17.21	53.10
Hydrozoa	0.02	1.94	3.15	11.95	5.91	12.16	24.84
Anthozoa	3.67	14.12	6.97	8.33	2.30	5.06	28.26
Alcyonacea	1.10	2.71	1.24	0.77	-	-	-
Zoantharia	0.85	9.53	4.18	6.60	1.78	4.15	4.37
Unidentified	1.72	1.88	1.55	0.96	0.52	0.91	23.90
PLATYHELMINTHES	-	-	0.45	0.37	3.05	0.21	0.46
Turbellaria	-	-	0.45	0.37	3.05	0.21	0.46
NEMERTEA	0.70	2.82	2.64	6.21	7.58	5.78	3.00
ASCHELMINTHES	1.09	0.53	0.45	2.50	10.77	0.40	2.90
Nematoda	1.09	0.53	0.45	2.50	10.77	0.40	2.90
ANNELIDA	52.65	237.71	188.61	330.29	341.84	469.56	273.22
POGONOPHORA	5.17	1.29	2.33	3.95	-	0.04	-
SIPUNCULIDA	4.12	11.18	4.88	6.11	7.19	0.46	2.24
ECHIURA	0.35	-	-	-	-	0.30	-
PRIAPULIDA	0.07	-	-	-	-	-	-
MOLLUSCA	46.64	213.47	130.82	157.70	113.29	832.22	421.84
Polyplacophora	0.45	-	0.42	0.98	-	0.04	1.26
Gastropoda	6.76	3.35	13.79	10.98	13.72	92.50	35.91
Bivalvia	36.53	205.71	107.27	143.37	99.44	739.38	384.66
Scaphopoda	2.90	4.12	3.91	1.33	0.13	0.30	-
Cephalopoda	-	0.29	5.42	-	-	-	-
Unidentified	-	-	-	1.04	-	-	-
ARTHROPODA	7.27	57.53	324.24	1402.02	1130.56	551.00	455.19
Pycnogonida	-	-	-	0.12	0.67	0.41	2.59
Archnida	-	-	-	-	-	0.17	-
Crustacea	7.27	57.53	324.24	1401.90	1129.89	550.42	452.60
Ostracoda	0.05	-	-	0.21	-	0.47	0.34
Cirripedia	-	-	-	0.22	45.42	86.18	0.31
Copepoda	0.10	-	0.12	0.06	-	-	-
Nebaliacea	0.02	-	-	-	0.05	0.01	-
Cumacea	0.97	5.94	12.61	32.68	35.00	14.10	1.04
Tanaidacea	0.30	-	-	-	-	-	-
Isopoda	0.54	1.59	3.88	9.06	26.70	18.84	11.53
Amphipoda	5.17	46.29	305.36	1352.94	1018.78	411.23	424.09
Mysidacea	0.02	-	-	0.06	0.05	4.58	6.47
Decapoda	0.10	3.71	2.27	6.68	3.89	15.00	8.82
BRYOZOA	-	-	5.27	1.85	27.19	21.36	15.90
BRACHIOPODA	-	-	-	-	0.02	-	-
ECHINODERMATA	5.46	46.07	171.09	114.75	29.56	60.11	6.54
Holothuroidea	1.69	4.42	2.42	7.13	0.16	0.82	0.07
Echinoidea	0.07	1.00	1.52	14.43	27.05	58.30	5.10
Ophiuroidea	3.53	39.82	164.27	91.42	0.71	0.60	1.25
Asteroidea	0.16	0.82	2.88	1.76	1.63	0.39	0.12
HEMICHORDATA	0.05	-	0.15	0.40	-	0.16	-
CHORDATA	1.26	1.18	3.97	20.33	17.19	19.75	22.17
Ascidiacea	1.26	1.18	3.97	20.33	17.19	19.75	22.17
UNIDENTIFIED	4.34	2.53	5.42	6.11	5.84	7.51	18.04

Porifera in the Southern New England subarea occurred in all temperature classes except 12.0°–15.9°C. They were found in only four classes in New York Bight: the 8.0°–11.9°, 12.0°–15.9°, 20.0°–23.9°, and 24.0°+C classes. In Chesapeake Bight, they were found in only three of the temperature classes: 0°–3.9°C, 20.0°–23.9°, and 24.0°+C. The density of sponges in each of the subareas in the Middle Atlantic Bight region was moderate to moderately low, ranging from 0.13/m² to 7.5/m² in Southern New England, from 0.25/m² to 3.0/m² in New York Bight, and from 0.07/m² to 0.6/m² in Chesapeake Bight. No increase in density was apparent as temperature range broadened, although the highest densities in the two northern subareas were found in the broadest temperature-range class. The biomass of sponges was small in all three subareas.

TABLE 39.—*Mean biomass of each taxonomic group listed by temperature-range class, representing the entire Middle Atlantic Bight region*

[In grams per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.018	0.035	0.033	0.044	0.163	0.047	0.069
COELENTERATA	0.536	1.376	13.093	1.972	0.465	2.766	7.306
Hydrozoa	<0.001	0.067	0.014	0.073	0.150	0.464	1.090
Anthozoa	0.536	1.309	13.079	1.899	0.315	2.302	6.216
Alcyonacea	0.145	0.122	0.298	0.227	-	-	-
Zoantharia	0.214	1.096	12.639	1.552	0.172	2.198	5.822
Unidentified	0.177	0.091	0.142	0.120	0.143	0.104	0.394
PLATYHELMINTHES	-	-	0.004	0.013	0.019	0.004	0.006
Turbellaria	-	-	0.004	0.013	0.019	0.004	0.006
NEMERTEA	0.070	0.170	0.456	0.648	0.945	1.018	0.372
ASCHELMINTHES	0.006	0.004	0.002	0.004	0.007	<0.001	0.012
Nematoda	0.006	0.004	0.002	0.004	0.007	<0.001	0.012
ANNELIDA	2.553	8.539	7.778	20.046	12.917	18.093	18.281
POGONOPHORA	0.028	0.008	0.005	0.033	-	<0.001	-
SIPUNCULIDA	1.777	0.589	0.172	1.082	0.546	0.019	0.302
ECHIURA	0.995	-	-	-	-	0.200	-
PRIAPULIDA	0.045	-	-	-	-	-	-
MOLLUSCA	0.668	2.500	44.608	94.656	149.427	242.580	238.765
Polyplacophora	0.005	-	0.004	0.014	-	0.004	1.149
Gastropoda	0.078	0.031	0.059	4.865	0.815	6.221	3.013
Bivalvia	0.540	2.405	44.411	89.736	148.611	236.351	234.603
Scaphopoda	0.045	0.061	0.060	0.037	<0.001	0.004	-
Cephalopoda	-	0.003	0.074	-	-	-	-
Unidentified	-	-	-	0.004	-	-	-
ARTHROPODA	0.068	0.668	1.816	7.867	27.728	10.865	4.842
Pycnogonida	-	-	-	0.001	0.002	0.003	0.016
Arachnida	-	-	-	-	-	<0.001	-
Crustacea	0.068	0.668	1.816	7.866	27.726	10.861	4.826
Ostracoda	<0.001	-	-	0.001	-	0.004	0.003
Cirripedia	-	-	-	0.004	17.055	4.944	0.006
Copepoda	<0.001	-	<0.001	<0.001	-	-	-
Nebaliacea	<0.001	-	-	-	<0.001	<0.001	-
Cumacea	0.009	0.046	0.067	0.191	0.113	0.048	0.005
Tanaidacea	0.002	-	-	-	-	-	-
Isopoda	0.015	0.079	0.215	0.301	0.807	0.304	0.178
Amphipoda	0.029	0.137	1.441	6.286	8.806	3.205	2.730
Mysidacea	<0.001	-	-	0.002	<0.001	0.017	0.034
Decapoda	0.011	0.406	0.092	1.081	0.944	2.339	1.870
BRYOZOA	-	-	0.072	0.031	0.930	0.656	0.074
BRACHIOPODA	-	-	-	-	<0.001	-	-
ECHINODERMATA	2.678	26.076	32.712	36.910	44.558	22.415	0.861
Holothuroidea	1.710	5.461	1.263	21.355	5.876	0.417	0.048
Echinoidea	0.190	12.372	13.120	6.675	38.513	19.870	0.355
Ophiuroidea	0.741	7.825	10.459	3.962	0.017	0.160	0.317
Asteroidea	0.037	0.418	7.870	4.918	0.152	1.968	0.141
HEMICHORDATA	<0.001	-	0.046	0.076	-	0.044	-
CHORDATA	0.139	0.071	0.527	2.042	1.621	4.357	15.495
Ascidiacea	0.139	0.071	0.527	2.042	1.621	4.357	15.495
UNIDENTIFIED	0.128	0.142	0.073	0.450	0.270	0.310	0.297

Coelenterata were found in each of the three subareas in all temperature-range classes except the 24.0°+C class in New York Bight. Since the coelenterates are made up of several subcomponents, a detailed analysis will be given under the separate components. Coelenterates, as a group, were significant contributors to the overall macrofauna in all three subareas in both density and biomass.

Hydrozoa in Southern New England were present in all classes except the 0°–3.9° and 8.0°–11.9°C

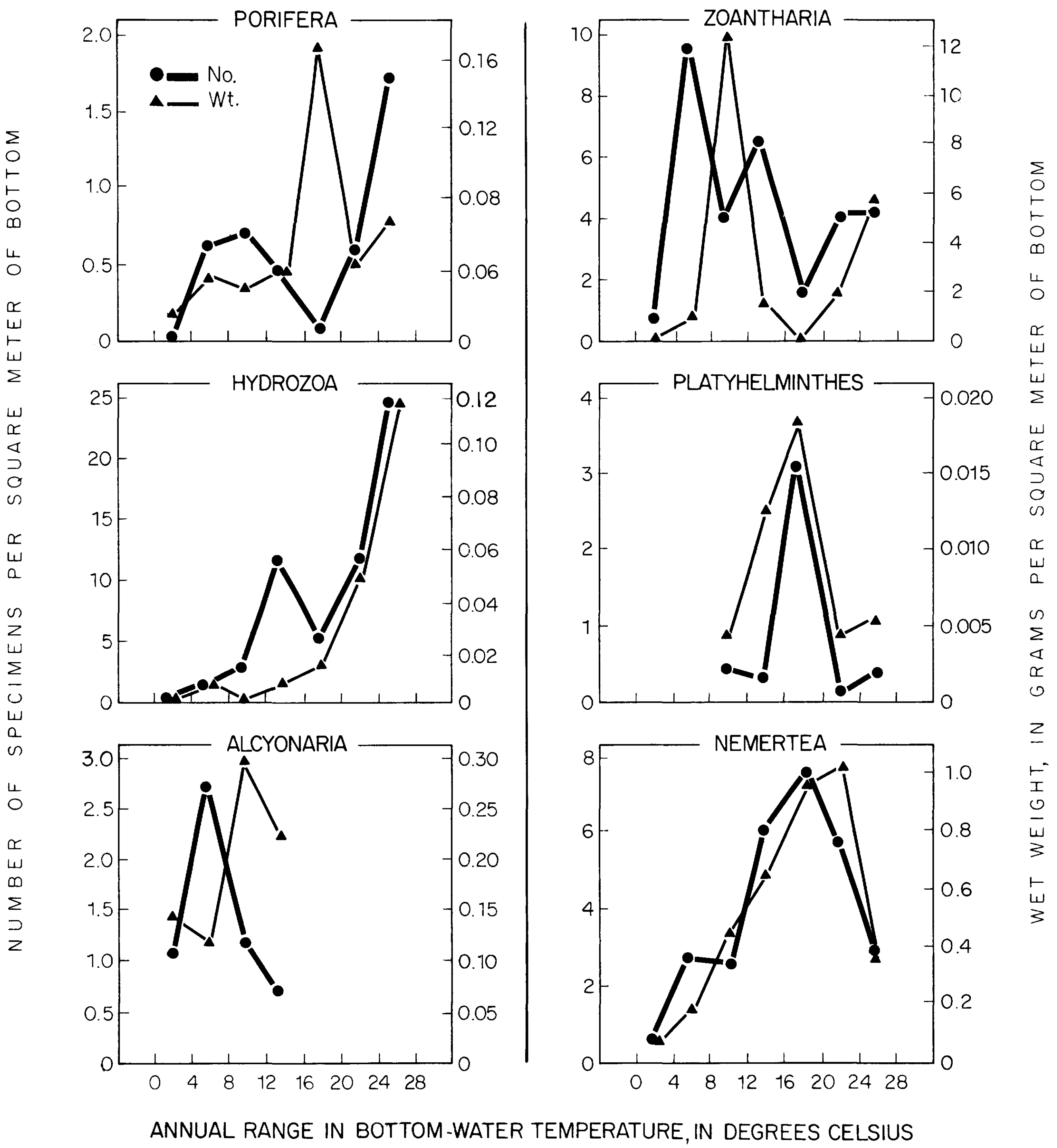

FIGURE 117.—Density (No.) and biomass (wt.) in relation to range in bottom-water temperature in the entire Middle Atlantic Bight region for Porifera, Hydrozoa, Alcyonaria, Zoantharia, Plathyhelminthes, and Nemertea.

classes. In New York Bight, their presence was detected in all classes except the 4.0°–7.9°C and the 24.0°+C classes. In Chesapeake Bight, they were present in all the broader range classes, but were absent in the two narrowest (0°–3.9° and 4.0°–7.9°C). Among the three subareas, mean densities

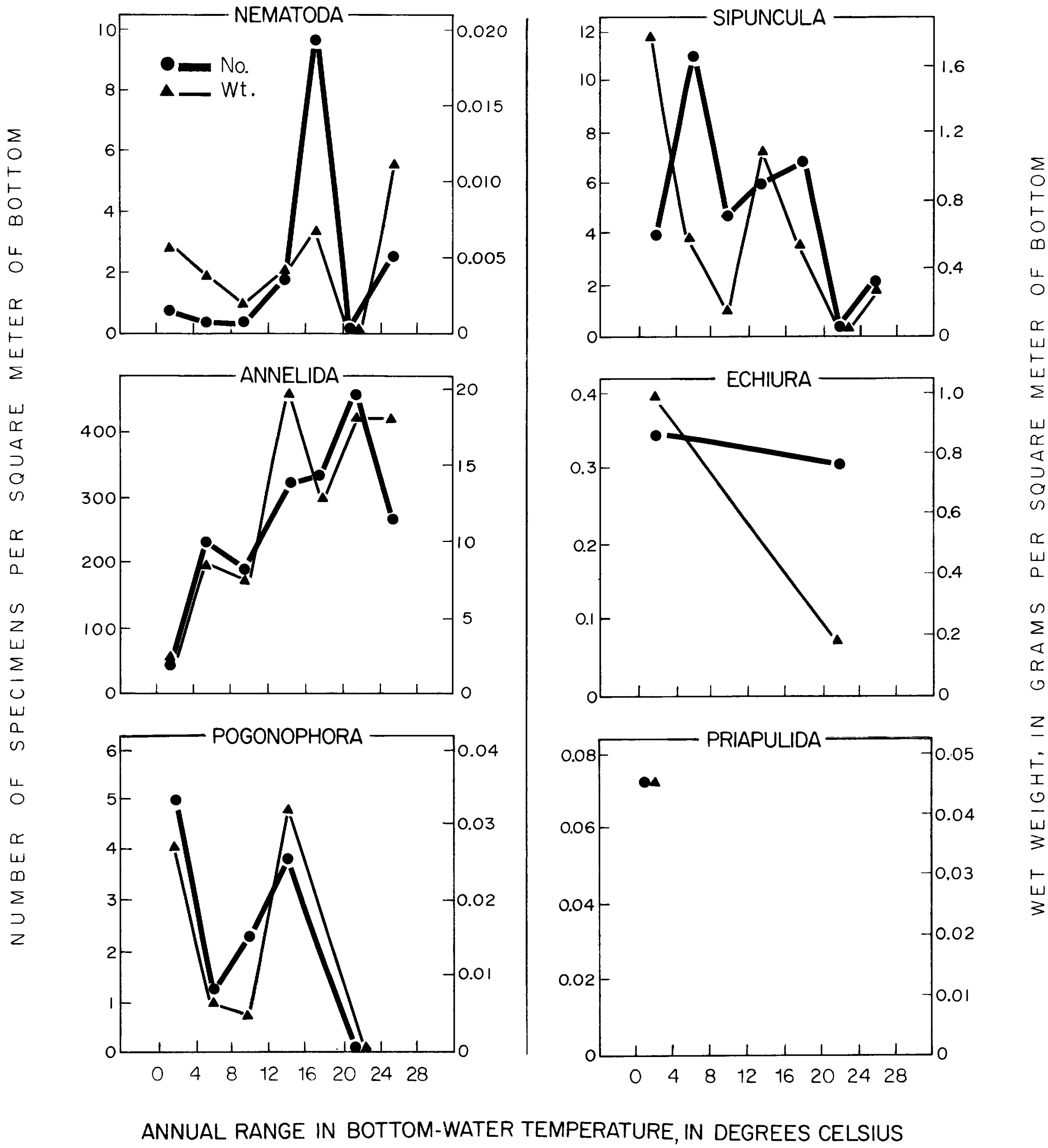

FIGURE 118.—Density (No.) and biomass (wt.) in relation to range in bottom-water temperature in the entire Middle Atlantic Bight region for Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

were higher in Southern New England and Chesapeake Bight and somewhat lower in New York Bight. In Southern New England, the range of densities was from a low of 1.2/m² in the 12.0°–15.9°C class to a high of 153/m² in the broadest class, 24.0°+C. In New York Bight, the lowest density value (0.06/m²) was in the 0°–3.9° class and the highest (11/m²) was in the 20.0°–23.9°C class.

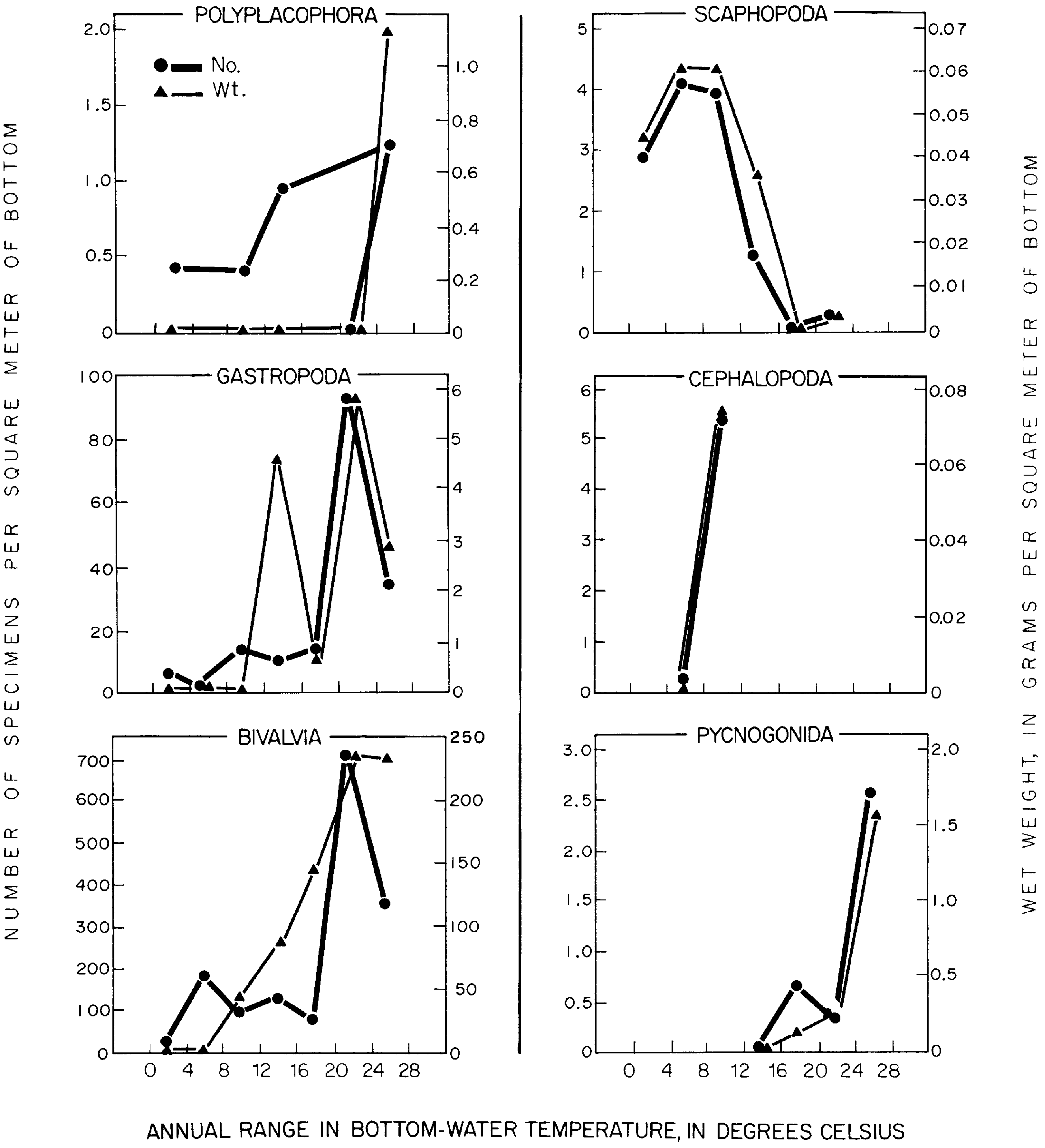

FIGURE 119.—Density (No.) and biomass (wt.) in relation to range in bottom-water temperature in the entire Middle Atlantic Bight region for Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

Chesapeake Bight contained relatively high densities, ranging from a low of 3/m² in the broadest temperature range to a high of 123/m² at midrange. In both Southern New England and New York Bight, density values were highest in the broader ranges, whereas, in Chesapeake Bight, highest values were recorded in the midrange classes. Biomass values for hydroids paralleled density values in that they were

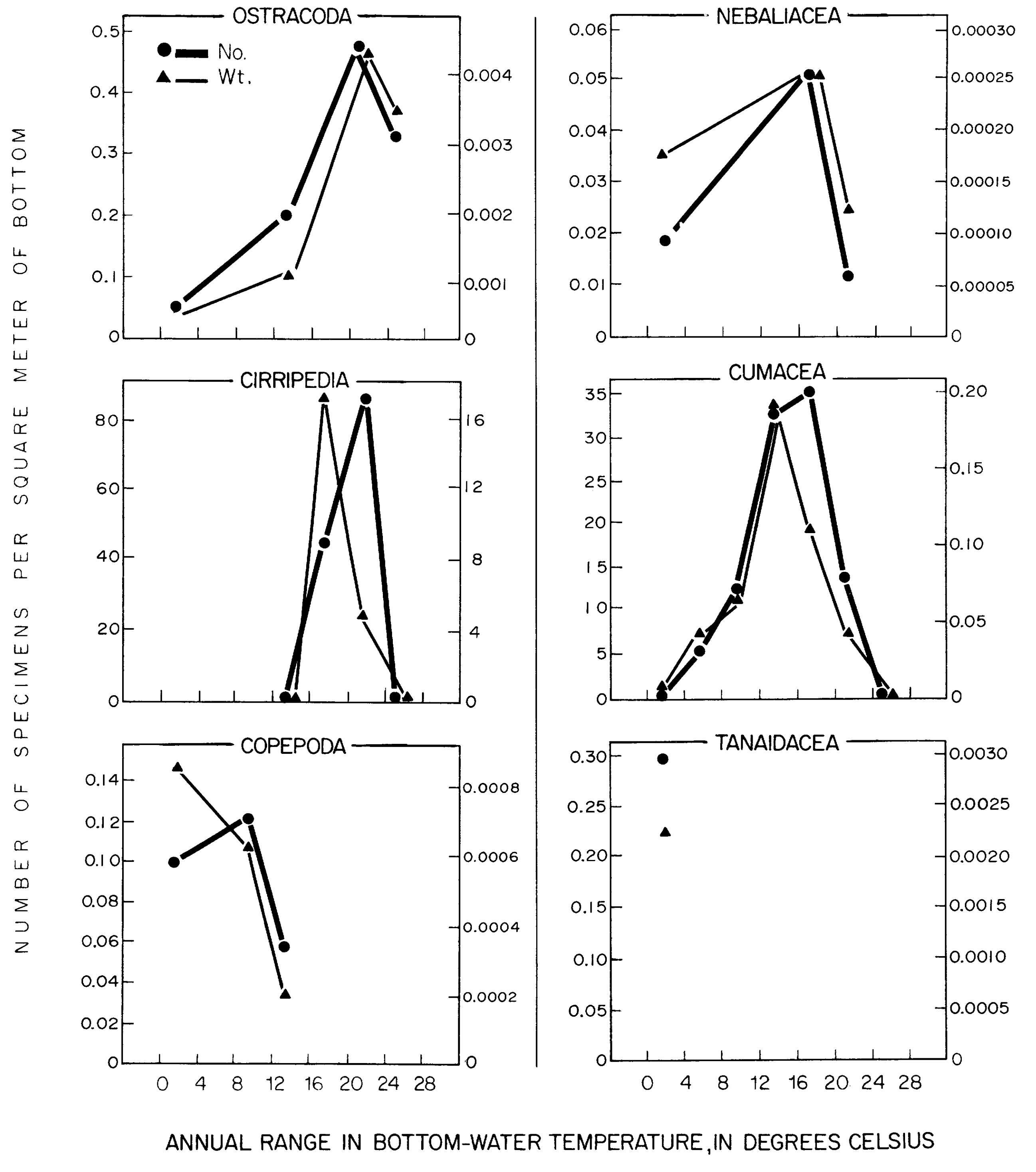

FIGURE 120.—Density (No.) and biomass (wt.) in relation to range in bottom-water temperature in the entire Middle Atlantic Bight region for Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

higher in both Southern New England and Chesapeake Bight than in New York Bight. The mean biomass in Southern New England was smallest (0.1 g/m^2) in the 12.0°–15.9°C class and largest (4.3 g/m^2) in the broadest class. In New York Bight, biomass ranged from trace amounts in the 0°–3.9°C

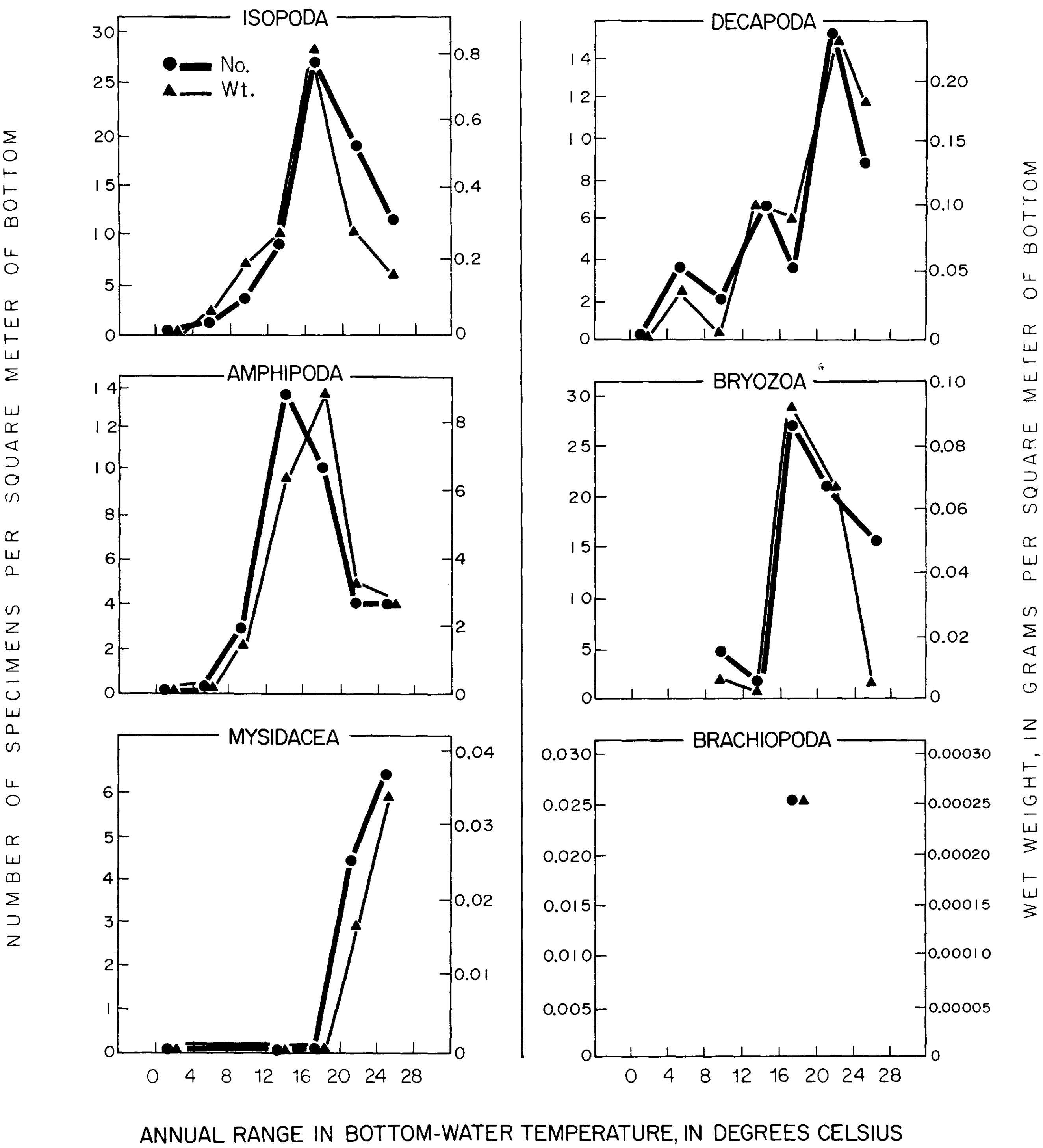

FIGURE 121.—Density (No.) and biomass (wt.) in relation to range in bottom-water temperature in the entire Middle Atlantic Bight region for Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

class to 0.2 g/m² in the 20.0°–23.9°C class. Chesapeake Bight biomass of hydroids generally increased as temperature range broadened, going from 0.04 g/m² in the 8.0°–11.9°C class to 0.57 g/m² in the 24.0°+C class.

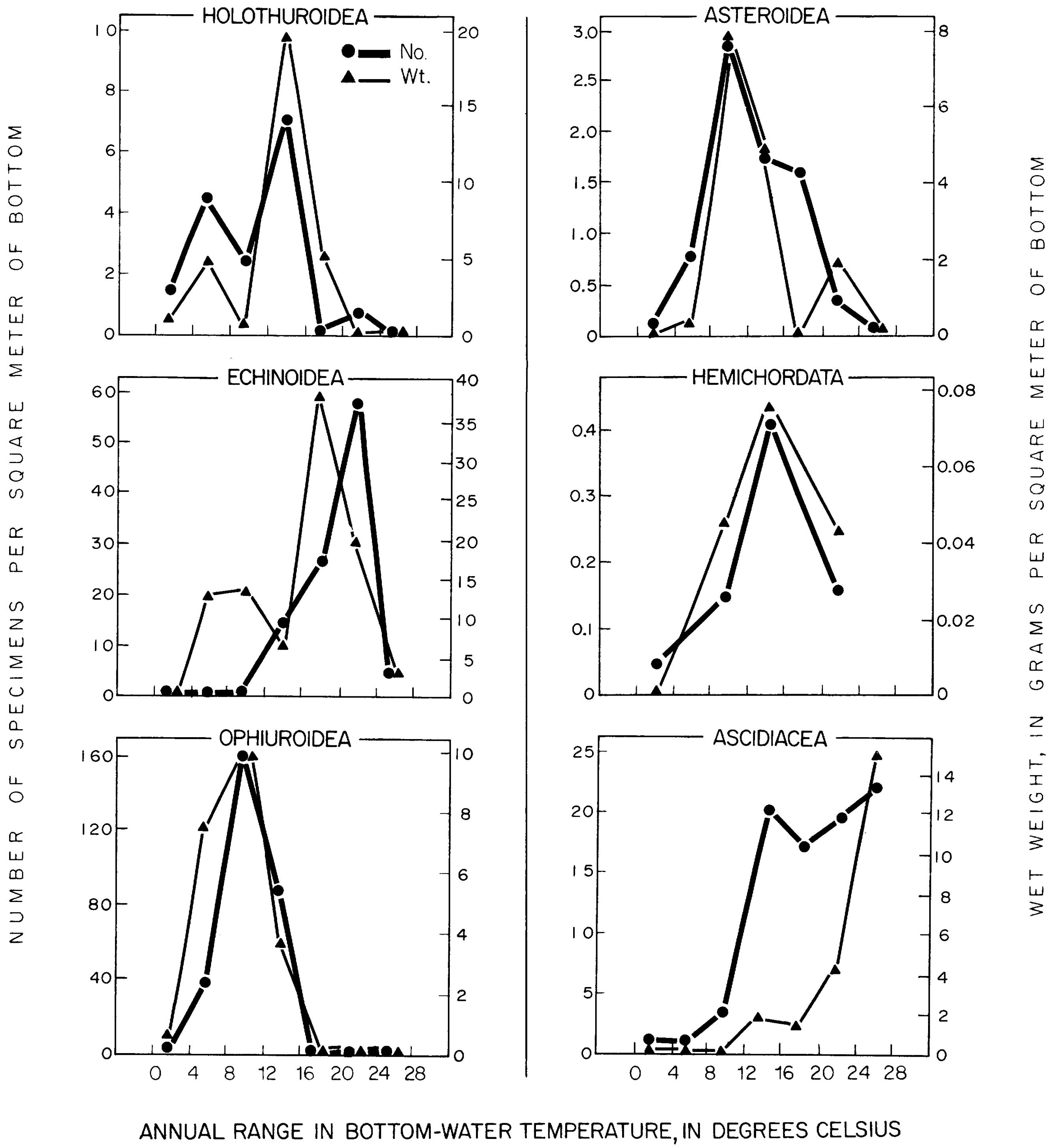

FIGURE 122.—Density (No.) and biomass (wt.) in relation to range in bottom-water temperature in the entire Middle Atlantic Bight region for Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

Anthozoa were present in all temperature-range classes in both Southern New England and Chesapeake Bight subareas and in all but the 24.0° +C class in New York Bight. Densities were quite similar in both Chesapeake Bight and New York Bight, but were considerably higher in Southern New England. The range of densities in Southern New England was from 1/m² in the 16.0°–19.9°C class to a high of 123/m² in the 24.0°+C class. Densities in New York Bight ranged from a low of 0.4/m² in the 12.0°–15.9°C class to a high of 9/m² in 4.0°–7.9°C. In Chesapeake Bight, the range of density was from 2/m² in the 12.0°–15.9°C class to 13/m² in the 24.0°+C class. Average biomass as well as density, was larger in Southern New England than in the other two subareas, ranging from a low of 0.07/m² in the 16.0°–19.9°C class to a high of 31 g/m² in the 8.0°–11.9°C class; intermediate values occurred in the other classes. In New York Bight, the smallest biomass (0.19 g/m²) was found in the 12.0°–15.9°C class and largest (4 g/m²) was in the 8.0°–11.9°C class. In Chesapeake Bight, the smallest biomass (0.9 g/m²) was in the 4.0°–7.9°C class and the highest, 7.2 g/m², in the broadest temperature range.

Alcyonacea were most prevalent in Southern New England, where they were found in four of the seven temperature classes. They were found in only three classes in New York Bight, and in only one class in Chesapeake Bight. Densities and biomasses of alcyonaceans were moderate to moderately low. Their density in Southern New England ranged from 0.7/m² in the 0°–3.9°C class to 2/m² in the 8.0°–11.9°C class; whereas, in New York Bight, slightly higher densities ranged from 0.9/m² in the 8.0°–11.9°C class to 7/m² in the 4.0°–7.9°C class. In Chesapeake Bight, alcyonaceans were found only in the 0°–3.9°C class, where their density was 0.8/m². The biomass was moderately low, ranging from 0.04 to 0.4 g/m² in all three subareas.

Zoantharia were found in all temperature-range classes in Southern New England, in all but the broadest class in the New York Bight, but were present in only three classes in the Chesapeake Bight (16.9°–19.9°, 20.0°–23.9°, and 24.0°+C). Highest densities were found in Southern New England, where the average density ranged from nearly 1/m² to 23/m²; whereas, in New York Bight, they ranged from 0.2/m² to 8/m². Chesapeake Bight contained the fewest number of individuals; densities ranged from 0.4/m² to 5/m². Biomass was parallel to density in that biomasses were largest in Southern New England, intermediate in New York Bight, and moderately low in Chesapeake Bight. In Southern New England, biomass values ranged from 0.05 to 30 g/m²; in New York Bight, from a low of 0.004 to a high of 3.4 g/m²; and in Chesapeake Bight, from 0.1 to 7 g/m². In Southern New England and New York Bight, the largest biomass was found in the mid-range class, 8.0°–11.9°C. However, in Chesapeake Bight, the zoantharians were restricted to the broader range classes.

The relationship between Platyhelminthes distribution and temperature range in each of the three subareas was slightly different. In Southern New England, they were found in three classes, from 12.0° to 23.9°C; in New York Bight, they were found in only two classes, 12.0°–15.9° and 20.0°–23.9°C; and in Chesapeake Bight, they were found in four classes, 8.0°–11.9°C and the three broader range classes from 16.0°–24.0°+C. Densities were low to moderate (0.04/m² to 8/m²); the densities were higher in both Southern New England and Chesapeake Bight than in New York Bight. Biomass in the three subareas was small (0.002 to 0.04 g/m²), and both Southern New England and Chesapeake Bight contained larger biomasses than those in New York Bight.

Nemertea were found in all temperature ranges in each of the subareas of the Middle Atlantic Bight region. Densities of these organisms were generally higher in Southern New England than in the other two subareas; although, among the various temperature ranges in all areas, the distribution of density values was fairly equitable. Biomass values were comparatively low in all three subareas. Biomass was largest in Southern New England, intermediate in New York Bight, and smallest in Chesapeake Bight. Biomass ranged from 0.05 g/m² to 1.4 g/m² in Southern New England, from 0.003 g/m² to 1.8 g/m² in New York Bight, and from 0.07 g/m² to 0.6 g/m² in Chesapeake Bight. Generally, biomass was slightly larger in the broader range classes than in the narrower ones in each of the subareas.

Nematoda were most widely distributed in Southern New England and Chesapeake Bight, where they were found in all temperature ranges except one; in Southern New England, they were absent in the 20°+C class; and in Chesapeake Bight, they were absent in the 8.0°–11.9°C class. In New York Bight, they were found in only four of the classes: 0°–3.9°C, 8.0°–11.9°C, 12.0°–15.9°C, and 16.0°–19.9°C. Densities of nematodes were greatest in Southern New England (0.2/m² to 27/m²), intermediate in Chesapeake Bight (0.3/m² to 3.7/m²), and lowest in New York Bight (0.05/m² to 0.5/m²). The contribution of nematodes to biomass is quite small. Biomass in Southern New England ranged from 0.002 to 0.02 g/m²; in New York Bight, from trace amounts to

TABLE 40.—*Mean number of individuals of each taxonomic group listed by temperature-range class, representing the Southern New England subarea*

[In number per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	0.13	1.57	1.67	-	0.36	0.57	7.50
COELENTERATA	3.12	29.86	14.00	16.88	5.03	40.28	275.80
Hydrozoa	-	4.71	-	1.17	3.90	34.21	152.70
Anthozoa	3.12	25.14	14.00	15.71	1.13	6.07	123.10
Alcyonacea	0.66	1.57	2.17	1.52	-	-	-
Zoantharia	0.91	22.86	10.83	12.75	0.94	5.00	1.00
Unidentified	1.54	0.71	1.00	1.44	0.19	1.07	122.10
PLATYHELMINTHES	-	-	-	0.54	7.64	0.21	-
Turbellaria	-	-	-	0.54	7.64	0.21	-
NEMERTEA	1.06	3.00	5.00	9.00	14.00	2.04	2.60
ASCHELMINTHES	1.46	0.71	0.92	3.94	26.90	0.18	-
Nematoda	1.46	0.71	0.92	3.94	26.90	0.18	-
ANNELIDA	84.76	384.29	314.92	413.15	668.90	223.86	511.30
POGONOPHORA	5.15	-	-	-	-	-	-
SIPUNCULIDA	6.46	21.00	8.83	7.94	18.19	1.89	15.20
ECHIURA	0.35	-	-	-	-	-	-
PRIAPULIDA	0.13	-	-	-	-	-	-
MOLLUSCA	45.17	133.14	143.33	204.38	121.29	544.61	165.70
Polyplacophora	0.24	-	0.50	1.92	-	0.21	7.50
Gastropoda	5.70	1.43	2.17	15.50	30.94	174.36	44.80
Bivalvia	37.11	127.14	123.42	184.92	90.36	369.50	113.40
Scaphopoda	2.13	3.86	2.33	-	-	0.54	-
Cephalopoda	-	0.71	14.92	-	-	-	-
Unidentified	-	-	-	2.04	-	-	-
ARTHROPODA	11.20	95.28	93.50	1910.58	2226.74	1476.25	1221.90
Pycnogonida	-	-	-	0.23	1.19	-	4.30
Arachnida	-	-	-	-	-	-	-
Crustacea	11.20	95.28	93.50	1910.34	2225.55	1476.25	1217.60
Ostracoda	-	-	-	0.40	-	0.64	2.10
Cirripedia	-	-	-	0.38	115.74	7.04	2.10
Copepoda	0.24	-	-	0.12	-	-	-
Nebaliacea	-	-	-	-	-	-	-
Cumacea	1.50	1.71	3.08	42.86	83.71	15.79	1.00
Tanaidacea	0.46	-	-	-	-	-	-
Isopoda	0.74	1.57	1.50	7.36	34.90	9.07	3.30
Amphipoda	8.06	92.00	88.08	1855.94	1986.68	1405.75	1192.80
Mysidacea	-	-	-	-	-	4.96	1.10
Decapoda	0.20	-	0.83	3.27	4.52	33.00	15.20
BRYOZOA	-	-	0.42	0.21	65.03	68.32	97.90
BRACHIOPODA	-	-	-	-	-	-	-
ECHINODERMATA	7.59	92.28	358.58	195.56	31.22	9.78	3.30
Holothuroidea	2.43	5.29	4.25	12.12	0.16	2.21	0.20
Echinoidea	0.17	1.57	2.25	15.21	27.00	6.46	-
Ophiuroidea	4.85	84.57	349.00	165.15	0.16	1.00	2.70
Asteroidea	0.13	0.86	3.08	3.08	3.90	0.11	0.40
HEMICHORDATA	0.11	-	0.42	0.79	-	-	-
CHORDATA	1.52	2.29	10.75	26.23	35.64	104.89	35.50
Ascidiacea	1.52	2.29	10.75	26.23	35.64	104.89	35.50
UNIDENTIFIED	5.83	5.29	7.33	8.14	13.87	2.00	14.00

only 0.003 g/m²; and in Chesapeake Bight, from trace amounts to 0.01 g/m².

Annelida were found in all temperature classes in each of the subareas of the Middle Atlantic Bight region and were major contribtuors in both density and biomass of the overall macrobenthic fauna. Overall densities diminished slightly in a southerly direction through the subareas. Also, in the three subareas, slightly greater densities were found in the broader temperature-range groupings than in the narrower ones. Density values in Southern New England ranged from 85/m² in the narrowest class to 669/m² in the 16.0°–19.9°C class. In the other classes, the average density ranged from greater than 200/m² to slightly more than 500/m². In the New York Bight, lowest density was in the 0°–3.9°C

TABLE 41.—*Mean number of individuals of each taxonomic group listed by temperature-range class, representing the New York Bight subarea*

[In number per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	-	-	0.25	1.17	-	0.67	3.00
COELENTERATA	4.64	9.00	4.75	4.64	5.06	19.35	-
Hydrozoa	0.06	-	1.88	4.24	1.50	10.94	-
Anthozoa	4.58	9.00	2.88	0.40	3.56	8.40	-
Alcyonacea	1.83	7.00	0.94	-	-	-	-
Zoantharia	1.44	0.40	0.50	0.24	3.31	7.77	-
Unidentified	1.31	1.60	1.44	0.17	0.25	0.64	-
PLATYHELMINTHES	-	-	-	0.24	-	0.04	-
Turbellaria	-	-	-	0.24	-	0.04	-
NEMERTEA	0.17	2.00	1.25	3.52	3.78	3.43	3.25
ASCHELMINTHES	0.47	-	0.25	0.05	0.06	-	-
Nematoda	0.47	-	0.25	0.05	0.06	-	-
ANNELIDA	40.33	196.60	102.00	277.40	147.06	961.90	700.00
POGONOPHORA	4.39	-	-	-	-	-	-
SIPUNCULIDA	2.64	7.40	3.44	4.45	-	-	-
ECHIURA	0.28	-	-	-	-	0.46	-
PRIAPULIDA	-	-	-	-	-	-	-
MOLLUSCA	56.33	37.40	109.56	54.62	87.75	585.33	360.75
Polyplacophora	0.17	-	0.38	-	-	-	-
Gastropoda	10.58	1.20	25.56	5.86	3.38	56.56	6.25
Bivalvia	40.94	33.00	77.88	48.21	84.38	528.77	354.50
Scaphopoda	4.64	3.20	5.75	0.55	-	-	-
Cephalopoda	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	6.33	48.60	401.31	1023.31	582.97	439.71	347.25
Pycnogonida	-	-	-	-	-	0.21	-
Arachnida	-	-	-	-	-	0.50	-
Crustacea	6.33	48.60	401.31	1023.31	582.97	439.00	347.25
Ostracoda	-	-	-	-	-	1.02	-
Cirripedia	-	-	-	0.07	-	250.77	-
Copepoda	-	-	0.25	-	-	-	-
Nebaliacea	0.06	-	-	-	-	-	-
Cumacea	0.94	13.40	14.50	24.69	3.09	2.60	-
Tanaidacea	0.11	-	-	-	-	-	-
Isopoda	0.53	2.80	4.88	12.14	25.66	10.08	3.00
Amphipoda	4.58	20.20	379.62	974.29	550.00	153.50	329.50
Mysidacea	0.06	-	-	0.14	0.12	3.19	-
Decapoda	0.06	12.20	2.06	11.98	4.09	17.85	14.75
BRYOZOA	-	-	10.56	2.74	0.12	10.23	25.50
BRACHIOPODA	-	-	-	-	-	-	-
ECHINODERMATA	4.39	18.20	81.75	16.90	35.66	109.94	31.50
Holothuroidea	1.78	-	1.81	0.40	0.06	0.94	-
Echinoidea	-	1.20	0.25	15.74	35.59	107.46	31.50
Ophiuroidea	2.56	15.40	76.19	0.38	-	0.54	-
Asteroidea	0.06	1.60	3.50	0.38	-	1.00	-
HEMICHORDATA	-	-	-	-	-	0.25	-
CHORDATA	1.17	0.80	0.12	16.38	6.97	1.10	-
Ascidiacea	1.17	0.80	0.12	16.38	6.97	1.10	-
UNIDENTIFIED	3.17	1.20	5.44	2.67	0.78	10.67	-

class, where 40/m² were found; in the 20.0°–23.9°C class, a high of 962/m² were found. Another significantly high density was found in the broadest range class in this region, 700/m² in the 24.0°+C class. Considerably lower values were found in the other classes in this subarea, ranging from 102/m² to nearly 200/m². Density values in Chesapeake Bight were lowest in the narrowest temperature range (15.7/m²) and were highest (217/m²) in the 20.0°–23.9°C range. Two other classes contained densities greater than 100/m², the 8.0°–11.9°C and the 24.0°+C, but less than 100/m² were found in the 4.0°–7.9°C, 12.0°–15.9°C, and 16.0°–19.9°C classes. Biomass of annelids also diminished slightly to the south across the shelf and slope; greatest overall values were found in Southern New England, where

TABLE 42.—*Mean number of individuals of each taxonomic group listed by temperature-range class, representing the Chesapeake Bight subarea*

[In number per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	0.07	-	-	-	-	0.61	0.59
COELENTERATA	3.36	3.80	18.00	124.50	20.69	6.99	15.78
Hydrozoa	-	-	14.80	122.50	18.62	4.66	3.00
Anthozoa	3.36	3.80	3.20	2.00	2.06	2.32	12.80
Alcyonacea	0.82	-	-	-	-	-	-
Zoantharia	-	-	-	-	0.38	1.28	5.32
Unidentified	2.54	3.80	3.20	2.00	1.69	1.04	7.48
PLATYHELMINTHES	-	-	3.00	-	0.25	0.34	0.57
Turbellaria	-	-	3.00	-	0.25	0.34	0.57
NEMERTEA	0.79	3.40	1.40	2.12	2.75	8.85	3.06
ASCHELMINTHES	1.29	0.80	-	0.25	0.94	0.77	3.65
Nematoda	1.29	0.80	-	0.25	0.94	0.77	3.65
ANNELIDA	15.71	73.60	162.60	69.38	97.69	216.55	197.52
POGONOPHORA	6.21	4.40	15.40	50.38	-	0.08	-
SIPUNCULIDA	2.18	1.20	-	2.88	0.25	0.24	-
ECHIURA	0.43	-	-	-	-	0.31	-
PRIAPULIDA	0.07	-	-	-	-	-	-
MOLLUSCA	36.63	502.00	168.80	395.50	148.88	1114.54	473.80
Polyplacophora	1.14	-	0.40	-	-	-	0.20
Gastropoda	3.61	8.20	4.00	8.50	1.06	86.78	36.46
Bivalvia	29.89	488.40	162.60	372.88	147.19	1027.32	437.13
Scaphopoda	1.98	5.40	1.80	14.12	0.62	0.43	-
Cephalopoda	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	2.04	13.62	631.40	85.09	101.88	279.11	319.37
Pycnogonida	-	-	-	-	1.00	0.70	2.46
Arachnida	-	-	-	-	-	-	-
Crustacea	2.04	13.62	631.40	85.09	100.88	278.40	316.91
Ostracoda	0.21	-	-	-	-	0.03	0.04
Cirripedia	-	-	-	-	-	0.47	-
Copepoda	-	-	-	-	-	-	-
Nebaliacea	-	-	-	-	0.25	0.03	-
Cumacea	0.14	4.40	29.40	8.84	4.44	21.55	1.13
Tanaidacea	0.29	-	-	-	-	-	-
Isopoda	0.21	0.40	6.40	3.88	12.88	28.70	13.68
Amphipoda	1.18	8.42	589.20	71.38	81.06	216.03	288.74
Mysidacea	-	-	-	-	-	5.40	6.11
Decapoda	-	0.40	6.40	1.00	2.25	6.19	7.20
BRYOZOA	-	-	-	7.88	8.00	11.40	-
BRACHIOPODA	-	-	-	-	0.12	-	-
ECHINODERMATA	3.32	9.20	4.60	103.12	14.12	44.14	5.30
Holothuroidea	0.36	7.60	-	10.00	0.38	0.20	0.06
Echinoidea	-	-	1.40	2.50	10.06	43.36	4.09
Ophiuroidea	2.61	1.60	2.80	90.12	3.19	0.50	1.07
Asteroidea	0.36	-	0.40	0.50	0.50	0.07	0.07
HEMICHORDATA	-	-	-	-	-	0.15	-
CHORDATA	0.96	-	-	2.75	1.88	0.65	21.35
Ascidiacea	0.96	-	-	2.75	1.88	0.65	21.35
UNIDENTIFIED	3.39	-	0.80	11.00	0.38	7.38	20.13

the range of biomass was from 2.1 to 37 g/m² in the extremes of the temperature ranges. In Southern New England, biomass tended to increase as temperature range broadened. In New York Bight, biomass distribution of annelids was somewhat similar to that in Southern New England; the smallest biomasses (3 g/m²) were found in the narrowest class and largest (30 g/m²) in the broadest class. Annelid biomass in Chesapeake Bight ranged from 2 g/m² in the narrowest class to 15 g/m² in the broadest. Biomasses between 3 and 11 g/m² were found in the other classes.

Pogonophora definitely preferred the southernmost reaches of the Middle Atlantic Bight region, and were most abundant in Chesapeake Bight in both density and biomass. In each of the other two

TABLE 43.—*Mean biomass of each taxonomic group listed by temperature-range class, representing the Southern New England subarea*

[In grams per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.029	0.084	0.085	-	0.416	0.023	0.450
COELENTERATA	0.563	2.869	30.689	4.564	0.337	6.140	7.257
Hydrozoa	-	0.163	-	0.102	0.267	2.079	4.314
Anthozoa	0.563	2.706	30.689	3.544	0.070	4.061	2.943
Alcyonacea	0.042	0.039	0.442	0.446	-	-	-
Zoantharia	0.321	2.660	30.185	2.900	0.050	3.992	0.350
Unidentified	0.200	0.007	0.062	0.198	0.020	0.069	2.593
PLATYHELMINTHES	-	-	-	0.018	0.041	0.003	-
Turbellaria	-	-	-	0.018	0.041	0.003	-
NEMERTEA	0.046	0.219	0.961	0.965	1.423	1.134	0.406
ASCHELMINTHES	0.007	0.007	0.004	0.007	0.015	0.002	-
Nematoda	0.007	0.007	0.004	0.007	0.015	0.002	-
ANNELIDA	2.069	9.734	9.136	29.241	24.401	22.209	37.169
POGONOPHORA	0.038	-	-	-	-	-	-
SIPUNCULIDA	2.534	0.804	0.366	1.231	1.388	0.021	2.052
ECHIURA	0.206	-	-	-	-	-	-
PRIAPULIDA	0.086	-	-	-	-	-	-
MOLLUSCA	0.669	3.586	4.521	85.263	279.812	86.146	926.886
Polyplacophora	0.003	-	0.005	0.028	-	0.024	7.725
Gastropoda	0.042	0.014	0.018	8.496	1.791	4.407	2.592
Bivalvia	0.596	3.479	4.256	76.731	278.021	81.710	916.569
Scaphopoda	0.028	0.086	0.038	-	-	0.005	-
Cephalopoda	-	0.007	0.204	-	-	-	-
Unidentified	-	-	-	0.008	-	-	-
ARTHROPODA	0.082	0.465	0.342	9.312	64.580	11.604	10.654
Pycnogonida	-	-	-	0.002	0.002	-	0.021
Arachnida	-	-	-	-	-	-	-
Crustacea	0.082	0.465	0.342	9.310	64.578	11.604	10.633
Ostracoda	-	-	-	0.002	-	0.006	0.021
Cirripedia	-	-	-	0.008	43.464	0.603	0.043
Copepoda	0.002	-	-	<0.001	-	-	-
Nebaliacea	-	-	-	-	-	-	-
Cumacea	0.015	0.017	0.021	0.276	0.258	0.054	0.010
Tanaidacea	0.004	-	-	-	-	-	-
Isopoda	0.020	0.179	0.101	0.212	0.728	0.112	0.035
Amphipoda	0.037	0.269	0.212	8.574	18.260	6.933	9.417
Mysidacea	-	-	-	-	-	0.013	0.125
Decapoda	0.004	-	0.008	0.238	1.868	3.883	0.982
BRYOZOA	-	-	0.004	0.046	2.357	2.284	2.698
BRACHIOPODA	-	-	-	-	-	-	-
ECHINODERMATA	3.280	49.097	56.991	54.862	30.305	2.707	2.698
Holothuroidea	2.332	5.864	2.674	37.909	14.702	0.115	0.031
Echinoidea	0.262	25.983	27.111	2.378	15.497	2.374	-
Ophiuroidea	0.656	17.241	25.008	7.465	0.002	0.057	1.709
Asteroidea	0.030	0.009	2.198	7.110	0.104	0.161	0.958
HEMICHORDATA	0.001	-	0.126	0.150	-	-	-
CHORDATA	0.148	0.097	1.418	3.137	3.850	23.102	22.993
Ascidacea	0.148	0.097	1.418	3.137	3.850	23.102	22.993
UNIDENTIFIED	0.183	0.280	0.101	0.684	0.261	0.880	0.280

subareas, they were found only in the narrowest temperature-range class. Density of pogonophorans was 5/m² in Southern New England and was 4/m² in New York Bight. Highest densities were found in Chesapeake Bight, where average densities ranged from 4/m² in the 4.0°–7.9°C class to 50/m² in the midpoint class of 12.0°–15.9°C. In the 0°–3.9°C and the 8.0°–11.9°C classes, density values were 6/m²

TABLE 44.—*Mean biomass of each taxonomic group listed by temperature-range class, representing the New York Bight subarea*

[In grams per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	-	-	0.004	0.106	-	0.007	0.030
COELENTERATA	0.563	0.572	3.944	0.223	0.381	2.909	-
Hydrozoa	<0.001	-	0.016	0.030	0.029	0.184	-
Anthozoa	0.563	0.572	3.928	0.193	0.352	2.725	-
Alcyonacea	0.154	0.362	0.284	-	-	-	-
Zoantharia	0.243	0.004	3.429	0.180	0.318	2.628	-
Unidentified	0.166	0.206	0.215	0.013	0.034	0.097	-
PLATYHELMINTHES	-	-	-	0.009	-	0.002	-
Turbellaria	-	-	-	0.009	-	0.002	-
NEMERTEA	0.003	0.138	0.081	0.264	0.920	1.839	0.065
ASCHELMINTHES	0.003	-	0.002	<0.001	<0.001	-	-
Nematoda	0.003	-	0.002	<0.001	<0.001	-	-
ANNELIDA	3.277	5.290	5.452	11.390	6.523	29.611	11.482
POGONOPHORA	0.023	-	-	-	-	-	-
SIPUNCULIDA	0.279	0.714	0.081	1.089	-	-	-
ECHIURA	0.800	-	-	-	-	0.459	-
PRIAPULIDA	-	-	-	-	-	-	-
MOLLUSCA	0.886	1.032	65.235	104.818	77.520	604.364	373.000
Polyplacophora	0.004	-	0.004	-	-	-	-
Gastropoda	0.115	0.020	0.099	1.284	0.208	6.652	6.875
Bivalvia	0.679	0.974	65.049	103.522	77.312	597.712	366.125
Scaphopoda	0.088	0.038	0.083	0.012	-	-	-
Cephalopoda	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	0.094	1.460	2.379	7.436	5.139	21.060	1.327
Pycnogonida	-	-	-	-	-	0.004	-
Arachnida	-	-	-	-	-	0.002	-
Crustacea	0.094	1.460	2.379	7.435	5.139	21.054	1.327
Ostracoda	-	-	-	-	-	0.009	-
Cirripedia	-	-	-	<0.001	-	14.308	-
Copepoda	-	-	0.001	-	-	-	-
Nebaliacea	<0.001	-	-	-	-	-	-
Cumacea	0.008	0.088	0.076	0.115	0.020	0.019	-
Tanaidacea	0.001	-	-	-	-	-	-
Isopoda	0.018	0.016	0.348	0.422	0.785	0.336	0.030
Amphipoda	0.038	0.060	1.872	4.565	3.843	2.445	0.715
Mysidacea	<0.001	-	-	0.004	0.001	0.015	-
Decapoda	0.028	1.296	0.082	2.329	0.490	3.922	0.582
BRYOZOA	-	-	0.146	0.012	0.001	0.305	0.128
BRACHIOPODA	-	-	-	-	-	-	-
ECHINODERMATA	2.227	9.336	24.745	16.669	70.033	42.436	5.582
Holothuroidea	1.456	-	0.599	0.496	0.218	0.116	-
Echinoidea	-	5.688	6.686	13.105	69.815	36.202	5.582
Ophiuroidea	0.702	2.238	2.879	0.006	-	0.385	-
Asteroidea	0.069	1.410	14.581	3.062	-	5.733	-
HEMICHORDATA	-	-	-	-	-	0.020	-
CHORDATA	0.182	0.104	0.024	1.061	0.226	0.083	-
Ascidiacea	0.182	0.104	0.024	1.061	0.226	0.083	-
UNIDENTIFIED	0.113	0.816	0.073	0.192	0.411	0.363	-

and 15/m², respectively. The biomass of pogonophorans in Southern New England was 0.04 g/m² and in New York Bight was 0.02 g/m². In Chesapeake Bight, biomass ranged from trace amounts in the 20.0°–23.9°C class to 0.4 g/m² in the 12.0°–15.9°C class. In the narrower classes, biomass ranged from 0.02 to 0.03 g/m².

TABLE 45.—*Mean biomass of each taxonomic group listed by temperature-range class, representing the Chesapeake Bight subarea*

[In grams per square meter]

Taxonomic group	Range in bottom water temperature (°C)						
	0°-3.9°	4.0°-7.9°	8.0°-11.9°	12.0°-15.9°	16.0°-19.9°	20.0°-23.9°	24.0°+
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
PORIFERA	0.022	-	-	-	-	0.085	0.002
COELENTERATA	0.457	0.092	0.138	0.283	0.877	1.389	7.857
Hydrozoa	-	-	0.038	0.114	0.163	0.050	0.574
Anthozoa	0.457	0.092	0.100	0.169	0.714	1.339	7.283
Alcyonacea	0.304	-	-	-	-	-	-
Zoantharia	-	-	-	-	0.116	1.216	7.267
Unidentified	0.153	0.092	0.100	0.169	0.598	0.123	0.016
PLATYHELMINTHES	-	-	0.030	-	0.013	0.007	0.007
Turbellaria	-	-	0.030	-	0.013	0.007	0.007
NEMERTEA	0.198	0.134	0.442	0.606	0.072	0.398	0.389
ASCHELMINTHES	0.009	0.004	-	0.002	0.004	<0.001	0.014
Nematoda	0.009	0.004	-	0.002	0.004	<0.001	0.014
ANNELIDA	2.415	10.114	11.968	5.719	3.453	8.442	15.287
POGONOPHORA	0.016	0.026	0.034	0.416	-	<0.001	-
SIPUNCULIDA	2.460	0.164	-	0.075	0.009	0.031	-
ECHIURA	2.544	-	-	-	-	0.093	-
PRIAPULIDA	0.036	-	-	-	-	-	-
MOLLUSCA	0.386	2.448	74.814	102.282	40.568	47.532	101.399
Polyplacophora	0.010	-	0.004	-	-	-	0.016
Gastropoda	0.091	0.066	0.030	0.066	0.136	6.605	2.805
Bivalvia	0.268	2.334	74.740	101.804	40.428	40.921	98.578
Scaphopoda	0.017	0.048	0.040	0.412	0.004	0.006	-
Cephalopoda	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-
ARTHROPODA	0.011	0.162	3.354	0.744	1.501	3.374	4.029
Pycnogonida	-	-	-	-	0.004	0.003	0.016
Arachnida	-	-	-	-	-	-	-
Crustacea	0.011	0.162	3.354	0.744	1.497	3.371	4.013
Ostracoda	0.001	-	-	-	-	<0.001	<0.001
Cirripedia	-	-	-	-	-	0.007	-
Copepoda	-	-	-	-	-	-	-
Nebaliacea	-	-	-	-	0.001	<0.001	-
Cumacea	0.001	0.044	0.150	0.032	0.019	0.065	0.005
Tanaidacea	0.001	-	-	-	-	-	-
Isopoda	0.002	0.004	0.064	0.248	1.003	0.355	0.216
Amphipoda	0.006	0.030	3.014	0.454	0.412	2.329	1.642
Mysidacea	-	-	-	-	-	0.020	0.019
Decapoda	-	0.084	0.126	0.010	0.063	0.594	2.130
BRYZOA	-	-	-	0.034	0.022	0.286	-
BRACHIOPODA	-	-	-	-	0.001	-	-
ECHINODERMATA	1.951	10.514	0.178	26.493	21.229	15.801	4.193
Holothuroidea	1.015	10.356	-	23.266	0.094	0.743	0.054
Echinoidea	-	-	0.132	0.849	20.504	15.012	4.057
Ophiuroidea	0.930	0.158	0.038	1.966	0.082	0.040	0.082
Asteroidea	0.006	-	0.008	0.412	0.549	0.006	<0.001
HEMICHORDATA	-	-	-	-	-	0.078	-
CHORDATA	0.071	-	-	0.074	0.093	0.268	15.254
Ascidiacea	0.071	-	-	0.074	0.093	0.268	15.254
UNIDENTIFIED	0.058	-	0.004	0.274	0.008	0.058	0.322

Sipunculida were ubiquitous in Southern New England but not in the other two subareas. In New York Bight, they were present only in the first four classes, but in Chesapeake Bight they were present in all but two of the classes, the 8.0°–11.9°C and 24.0°+C classes. Overall, in each of the three subareas, sipunculid density was moderate. In Southern New England, density values ranged from 2/m² to 21/m²; in New York Bight, substantially lower quantities ranged from 3/m² to 7/m²; in Chesapeake Bight, even lower values were found, from 0.24/m² to 3/m². Biomass distribution was essentially similar to that of density among the subareas—largest in Southern New England, intermediate in Chesapeake Bight, and smallest in New York Bight. Biomass ranged from 0.02 to 3 g/m^2 in Southern New England, 0.08 to 1 g/m^2 in New York Bight, and 0.009 to 3 g/m^2 in Chesapeake Bight. No definite relationship was discernible between biomass and temperature range.

Echiura were not common in any of the subareas of the Middle Atlantic Bight region and were found in only the narrowest temperature class in Southern New England (0.3/m^2 weighing 0.2 g/m^2). In New York Bight, they were found in only two classes—the narrowest, where density was 0.3/m^2 and biomass 0.8 g/m^2, and in the 20.0°–23.9° class where density was 0.5/m^2 and biomass, 0.5 g/m^2. In Chesapeake Bight, they were present in the same two classes and in roughly the same magnitudes; 0.4/m^2 weighing 2.5 g/m^2 in the narrowest class and 0.3/m^2 weighing 0.09 g/m^2 in the broader class.

Priapulida were neither broadly distributed nor plentiful in any of the subareas. They were present in only the narrowest temperature range in both Southern New England and Chesapeake Bight, and were absent entirely in the New York Bight.

Mollusca were recorded in all temperature classes in each of the subareas of the Middle Atlantic Bight region. As a group, mollusks were most abundant in Chesapeake Bight; Southern New England was second, followed by New York Bight. Because mollusks are made up of several subcomponents, a detailed analysis will be found among the several contributors to the total molluscan fauna.

Polyplacophora were more plentiful in Southern New England than in the other two subareas. In Southern New England, they were found in five temperature classes; in New York Bight, two classes; and in Chesapeake Bight, three classes. In Southern New England, the trend of increasing density as temperature range broadened was discernible. The highest density (8/m^2) occurred in the broadest class, and the lowest (0.2/m^2) in the narrowest, 0°–3.9°C, as well as in the 20.0°–23.9°C class. In New York Bight, in the 0°–3.9°C and 8.0°–11.9°C classes, polyplacophoran densities were 0.2/m^2 and 0.4/m^2, respectively, but in Chesapeake Bight their density ranged from 0.2/m^2 to 1/m^2 and tended to increase as temperature range narrowed. Where they were found in Chesapeake Bight, the lowest density was in 20.0°–23.9°C class and the highest density in the narrowest temperature range. Chiton biomass in the Southern New England subarea tended to follow the pattern established for density, and the smallest biomass (0.003 g/m^2) was found in the narrowest range, and the largest biomass (8 g/m^2) in the broadest range. In New York Bight, in both classes in which chitons occurred, the biomass was similar, 0.004 g/m^2. Chiton biomasses in Chesapeake Bight were nearly identical in the narrowest class (0.01 g/m^2) and in the broadest (0.02 g/m^2). In midrange, the biomass was 0.004 g/m^2.

Gastropoda were found in all temperature-range classes in each of the subareas. Both density and biomass tended to decrease as latitude decreased; greatest values for both were found in Southern New England, intermediate values in New York Bight, and lowest in Chesapeake Bight. No definite relationships was discernible between density and temperature range in any of the subareas. Gastropod density ranged from 1/m^2 in the 4.0°–7.9°C class to 174/m^2 in 20.0°–23.9°C in Southern New England, where generally lower densities occurred in the narrower ranges and higher densities in the broader ranges (see table 40). In New York Bight, gastropod density ranged from 1/m^2 in the 4.0°–7.9°C class to 57/m^2 in 20.0°–23.9°C. Here, moderately high density values occurred at both ends of the temperature-range spectrum. Density values in Chesapeake Bight ranged from 1/m^2 in the 16.0°–19.9°C class to 87/m^2 in the adjacent class, 20.0°–23.9°C. Intermediate values, tending on the lower side, were found in the other classes. Overall gastropod biomass values were comparatively low, and in Southern New England ranged from 0.01 g/m^2 in the 4.0°–7.9°C and 8.0°–11.9°C classes to 9 g/m^2 in 12.0°–15.9°C. In New York Bight, gastropod biomass ranged from 0.02 g/m^2 in the 4.0°–7.9°C class to 7 g/m^2 in the two broadest classes. Biomasses of 1 g/m^2 or less were found in the other classes. In Chesapeake Bight, which contained the smallest biomass of gastropods, values ranged from 0.03 g/m^2 in the 8.0°–11.9°C class, to 7 g/m^2 in 20.0°–23.9°C. In only one other class, 24.0° + C, were biomasses of more than 2 g/m.^{2} Values in all other classes were below 1 g/m^2.

Bivalvia were the largest contributors of molluscan abundance and occurred in all temperature-range classes in each of the subareas of the Middle Atlantic Bight region. Greatest overall densities of bivalves were found in Chesapeake Bight and Southern New England. The single largest average density occurred in the 20.0°–23.9°C class in Chesapeake Bight, where 1,027/m² were found. The next highest density occurred in the same class in the New York Bight. However, in this subarea, other density values were below those of similar classes in either of the two other subareas. In Southern New England, bivalve density ranged from 37/m² in the 0°–3.9°C class to 370/m² in 20.0°–23.9°C. Values below 100/m² occurred in the 16.0°–19.9°C class, but in all other classes density values were between 100/m² and 200/m². In New York Bight, which contained the lowest overall values, density exceeded 100/m² in only the two broadest classes, the previously mentioned high of 528/m² in the 20.0°–23.9°C class and 354/m² in 24.0°+C. Density values ranging from 33/m² to 84/m² occurred in the other classes in New York Bight. The density of bivalves in Chesapeake Bight was 30/m² in 0°–3.9°C and, in all other classes, was more than 100/m²; 147/m² and 163/m² occurred in the 16.0°–19.9°C and 8.0°–11.9°C classes, respectively, and more than 370/m² in the remaining three classes. A considerably different picture unfolds when considering biomass among the three subareas in the Middle Atlantic Bight region. New York Bight, on the whole, had a higher biomass than any of the other two subareas; Southern New England was second. The biomass in Chesapeake Bight, notwithstanding its leadership in density, was lowest among the three subareas. Average biomass in Southern New England ranged from 0.6 g/m² in the 0°–3.9°C class to 917 g/m² in the broadest, the 24.0°+C, class. In Southern New England, the tendency was that biomass increased as temperature range broadened, but the actual values were widely divergent. In New York Bight, average bivalve biomass ranged from 0.7 g/m² to 597 g/m² in the 0°–3.9°C class and the 20.0°–23.9°C class, respectively. However, a greater part of the remaining classes contained values that were about 100 g/m² or more, whereas in Southern New England, the tendency was for considerably smaller biomasses to occur. The biomass of bivalves in Chesapeake Bight ranged from 0.3 g/m² in the 0°–3.9°C class to 102 g/m² in the 12.0°–15.9°C class. The remaining classes contained less than 100 g/m².

Scaphopoda were most prevalent in Chesapeake Bight and were absent only in the broadest class. In New York Bight, they occupied the narrower to midrange classes and were absent from the broader range classes (16.0°–24.0°+C); in Southern New England, Scaphopoda occupied the three narrower range classes (0°–11.9°C), were absent in the next two between 12.0° and 19.9°C, were present in the 20.0°–23.9°C range, and absent in the broadest range, 24.0°+C. Density values were highest in Chesapeake Bight, where mean densities ranged from 0.4/m² to 14/m². In New York Bight, where densities were between those of the other two subareas, the range of density was from 0.6/m² to 6/m². Scaphopod densities in Southern New England ranged from 0.5/m² to 4/m². On the whole, scaphopod biomass values were largest in the Chesapeake Bight subarea. Biomass ranged from 0.004 g/m² to 0.4 g/m². In New York Bight, biomass values ranged from 0.01 g/m² to 0.08 g/m². The biomass of tusk shells in Southern New England was somewhat comparable to that in the New York Bight. Smallest biomass was 0.005 g/m² in the 20.0°–23.9°C class; in the other three classes in which tusk shells were present in Southern New England, values ranged between 0.03 and 0.09 g/m².

Cephalopoda were found only in Southern New England and only in the 4.0°–7.9°C and the 8.0°–11.9°C classes. Density values were high, 0.7/m² and 15/m² in the two classes, respectively, whereas biomass values were comparatively lower, 0.007 and 0.2 g/m².

Arthropoda density and biomass values are summations of the subcomponents of this phylum and are reflected in the crustacean abundances given below.

Pycnogonida occurred in each of the subareas of the Middle Atlantic Bight region,but were restricted in each of them to only a relatively few temperature classes. In Southern New England, pycnogonids occurred in three classes, the 12.0°–15.9°, the 16.0°–19.9°, and the 24.0°+C; in New York Bight, they were found only in the 20.0°–23.9°C class; and in Chesapeake Bight, were found in the three broad-range categories between 16.0°+, and 24.0°+C. Overall density was highest in Southern New England and ranged from 0.2/m² to 4/m², lowest in New York Bight where only 0.2/m² was found, and intermediate in Chesapeake Bight where the range was from 0.7/m² to 3/m². Pycnogonid biomass was on the whole quite low, in Southern New England the range of biomass was from 0.002 to 0.02 g/m². In New York Bight, 0.004 g/m² was found and in Chesapeake Bight, the range was from 0.003 to 0.02 g/m².

Arachnida were very sparsely distributed, occurring only in the New York Bight subarea and in only one temperature class, 20.0°–23.9°C. Density was 0.5/m² and biomass,0.002 g/m².

Crustacea were major contributors to the macrofauna in the Middle Atlantic Bight region, occurring in all temperature-range classes in each of the subareas. Generally, both density and biomass diminished to the south, so that abundance was greatest in Southern New England, intermediate in New York Bight, and lowest in Chesapeake Bight. In Southern New England, crustacean densities were highest in the midrange classes and less in both narrowing and broadening temperature ranges, although substantial densities occurred in the latter. The range of density in Southern New England was from $11/m^2$ to $2,226/m^2$. In the three broadest classes (from 12°C to 24°+C), density values in Southern New England were more than $1,000/m^2$, whereas in the narrower classes they were below $100/m^2$. In the New York Bight, essentially the same conditions prevailed and lowest density ($6/m^2$) was in the narrowest class, and $1,023/m^2$ in the 12.0°–15.9°C class. In the classes between 8°C and 24°+C, excluding 12.0°–15.9°C, density values were betwen $300/m^2$ and $600/m^2$. Crustacean density in Chesapeake Bight ranged from $2/m^2$ in the narrowest class to $631/m^2$ in the 8.0°–11.9°C class. Crustacean biomass and density were similar in that largest amounts occurred in Southern New England, intermediate in New York Bight, and lowest in Chesapeake Bight. Biomass ranged from 0.08 g/m^2 in 0°–3.9°C, to 65 g/m^2 in 16.0°–19.9°C in Southern New England; somewhat smaller biomasses ($10/m^2$–$11/m^2$) were found in the two broadest classes, but they diminished sharply as temperature range narrowed. In New York Bight, essentially the same conditions prevailed where biomass increased as temperature range broadened. The smallest biomass occurred in the 0°–3.9°C class with 0.09 g/m^2, and largest, 21 g/m^2, in the 20.0°–23.9°C class. The 24.0°+C class biomass dropped, significantly, to 1 g/m^2. In the remaining classes, biomass varied from 1 to 7 g/m^2. The crustacean biomass in Chesapeake Bight was moderately small and ranged from 0.01 g/m^2 in the narrowest class to 4 g/m^2 in 24.0°+C. Values of less than 1 g/m^2 were found in the 4.0°–7.9° and the 12.0°–15.9°C classes and ranged from 2 to 3 g/m^2 in the other three classes.

Ostracoda were found in each of the subareas in rather limited distribution. In Southern New England, they occurred in only three temperature classes, the two broadest and the midpoint categories; in New Bight, they were relegated to one temperature class, 20.0°–23.9°C; and in Chesapeake Bight, they were found in the two broadest classes. As in other groups, greatest densities and biomasses occurred in Southern New England. The values of biomass and density were relatively low, especially in Chesapeake Bight where only traces of biomass and very low values in density were found.

Cirripedia, although not widely distributed among temperature ranges, contained significant amounts in both density and biomass, especially in Southern New England and New York Bight. In Southern New England, barnacles were found in temperature ranges from 12.0°–24.0°+C, but were relegated to two classes in New York Bight, 12.0°–15.9°C and the 20.0°–23.9°C; in Chesapeake Bight, they occurred only in the 20.0°–23.9°C class where both density and biomass were low. The highest individual density of barnacles ($251/m^2$) was found in New York Bight in the 20.0°–23.9° class. In the 12.0°–15.9°C class, however, the density values were quite low ($0.07/m^2$). In Southern New England, densities ranged from $0.4/m^2$ to $116/m^2$ in the 12.0°–15.9°C and the 16.0–19.9°C classes, respectively. Lower values occurred in the two broadest classes where the density ranged from $2/m^2$ and $7/m^2$. Southern New England contained the single largest biomass of barnacles, 43 g/m^2 in the 16.0°–19.9°C class. In the remaining three classes, less than 1 g/m^2 were found. In New York Bight, 14 g/m^2 of barnacles were recorded in 20.0°–23.9°C, and only trace amounts were found in 12.0°–15.9°C.

Copepoda did not contribute greatly to the total macrofauna of the Middle Atlantic Bight region and were sparsely distributed in only two subareas. In Southern New England, copepoda were found in the narrowest temperature-range class and in the 12.0°–15.9°C class in low densities and small biomasses. In New York Bight, they were relegated in low abundance to one class, 8.0°–11.9°C.

Nebaliacea were present only in New York Bight and Chesapeake Bight in low abundances. In New York Bight, they were found only in the 0°–3.9°C class where density was $0.06/m^2$ and biomass was trace amounts. In Chesapeake Bight, they occurred in two classes, 16.0°–19.9°C and 20.0°–23.9°C, where densities of $0.25/m^2$ and $0.03/m^2$ and biomasses of 0.001 and <0.001 g/m^2 were found.

Cumacea were present in all temperature classes in both Southern New England and Chesapeake Bight subareas, but were absent from the 24.0°+C class in New York Bight. Density values in each of the three subareas were moderate to moderately high, whereas biomass values were moderate to moderately low. On the whole, cumaceans favored the middle temperature ranges, and in Southern New England, the average density ranged from $1/m^2$ to

84/m². Densities in New York Bight were lower than they were in Southern New England and ranged from 0.9/m² to 25/m². In Chesapeake Bight, density ranged from 0.1/m² to 29/m². Biomass of cumaceans was greatest in Southern New England and tapered off to the south. The average biomass in Southern New England ranged from 0.01 g/m² to 3 g/m². In New York Bight, the smallest biomass was 0.01 g/m² and the largest was 0.1 g/m². In Chesapeake Bight, which contained the lowest biomass of cumaceans, the range was between 0.001 g/m² and 0.2 g/m².

Tanaidacea were restricted to the narrowest range class in each of the three subareas of the Middle Atlantic Bight region. Greatest abundance was found in Southern New England, the next greatest in Chesapeake Bight, and lowest in New York Bight. Densities (maximum 0.46/m²) and biomass (maximum 0.004 g/m²) were low in all subareas.

Isopoda occurred in all of the temperature-range classes throughout the Middle Atlantic Bight region, and greatest abundance was in Southern New England, next highest in Chesapeake Bight, and lowest in New York Bight. Densities of isopods in Southern New England ranged from 0.07/m² to 35/m². Values of density on either side of the midtemperature range diminished significantly, more so in the narrower ranges than in the broader ones. In New York Bight, the range of density values was from 0.5/m² to 26/m². Density also decreased as temperature range narrowed. In Chesapeake Bight, the same trends prevailed. The lowest density was 0.2/m² and the highest was 29/m². The largest overall biomass values occurred in Chesapeake Bight, second largest in Southern New England, and smallest in New York Bight. The largest biomass was recorded in the 16.0°–19.9°C class in Chesapeake Bight, where 1 g/m² of organisms was found. The smallest biomass in this subarea was found in the 0°–3.9°C class (only 0.002 g/m²). In the New York Bight, the smallest biomass (0.02 g/m²) occurred in 0°–3.9°C and 4.0°–7.9°C. The largest biomass in this subarea (0.8 g/m²) occurred in the 16.0°–19.9°C class. In Southern New England, as in other areas, the smallest biomass (0.02 g/m²) was recorded in the 0°–3.9°C class. The largest biomass of isopods in Southern New England was present in 16.0°–19.9°C, where 0.7 g/m² was found.

Amphipoda were found in all temperature ranges in each of the subareas; and, especially in density, amphipods were the single most numerous group among the crustaceans. Southern New England had highest densities of amphipods, followed by New York Bight and Chesapeake Bight. The density values in Southern New England ranged from 8/m² in the narrowest temperature class to 1,987/m² in the 16.0°–19.9°C class. In Southern New England, the broader classes contained considerably higher densities of amphipods than did the narrower classes. Densities in the New York Bight ranged from 5/m² in 0°–3.9°C to 974/m² in the 12.0°–15.9°C class. Densities in other classes ranged from 20/m² to 379/m². The density of amphipods in Chesapeake Bight was lowest in 0°–3.9°C, where 1/m² was found, and highest in 8.0°–11.9°C where 589/m² were found. Although amphipod biomasses were moderately high, they did not contribute as significantly to overall faunal abundance as did their densities. In Southern New England, biomass ranged from 0.04 g/m² in 0°–3.9°C to 18 g/m² in 16.0°–19.9°C. In Southern New England, larger biomasses, as well as greater densities, were found in the broader range classes. Biomass in New York Bight ranged from 0.4 g/m² in the narrowest class to 5 g/m² in the 12.0°–15.9°C class. In classes, Amphipod biomass was lower in Chesapeake Bight than in the other two subareas and ranged from 0.006 g/m² in the narrowest to 3 g/m² in the 8.0°–11.9°C class. Biomasses greater than 1 g/m² occurred in only two other classes, 20.0°–23.9°C, and 24.0° + C. In the remaining classes, biomasses were less than 1 g/m².

Mysidacea occurrence in each of the subareas was confined generally to the broader temperature ranges. In Southern New England, they occurred in only the two broadest ranges; in New York Bight, they occurred in four temperature classes: 0°–3.9°, 12.0°–15.9°C, 16.0°–19.9°C, and 20.0°–23.9°C; in Chesapeake Bight, as in Southern New England, they were in the two broadest classes. Mysid density in Southern New England was moderately high, 1/m² to 5/m². In New York Bight, density was 0.06/m² in the narrowest class, and in the remaining three classes averaged from 0.1/m² in the two narrower classes to 3/m² in the broadest. In Chesapeake Bight, mysid density in the two broadest classes was 5/m² and 6/m². The biomass of mysids was moderately low in all subareas, and, in Southern New England, in the two classes in which they occurred, was 0.01 and 0.1 g/m². In New York Bight, the smallest biomass was found in the narrowest class, where only trace amounts were found; in the remaining three classes, it ranged from 0.001 to 0.02 g/m². In Chesapeake Bight, moderately small biomasses (0.02g/m²) occurred in the two broadest classes.

Decapoda were found in all temperature ranges only in New York Bight; in both Southern New England and Chesapeake Bight, they were absent in one class. Average densities were moderately high in all subareas; overall densities were highest in Southern New England, next highest in New York Bight, and lowest in Chesapeake Bight. Decapod density in Southern New England ranged from 0.2/m^2 to 33/m^2. In the New York Bight subarea, lowest density was 0.06/m^2, and highest was 18/m^2. Chesapeake Bight density ranged from 0.4/m^2 to 7/m^2. Biomass was highest in the New York Bight subarea; smallest biomass, 0.03 g/m^2, occurred in the narrowest class, and largest biomass, 4 g/m^2, occurred in the 20.0°–23.9°C class. In Southern New England, biomass ranged from 0.004 to 4 g/m^2. In Chesapeake Bight, smallest biomass, 0.01 g/m^2, was found in the 12.0°–15.9°C class, and largest biomass, 2.1 g/m^2, in 24.0°+C.

Bryozoa were present in five temperature classes between 8.0° and 24.0°C in both Southern New England and New York Bight. In Chesapeake Bight, they were present in three of the classes between 12.0° and 23.9°C. Densities decreasd to the south. Densities in Southern New England tended to increase as temperature range broadened; highest density was 98/m^2. In New York Bight, lowest density (0.1/m^2) occurred at the midpoint, 16.0°–19.9°C, of the five classes in which bryozoans were found. Values increased disproportionately on either side of this class. Density values in Chesapeake Bight increased as temperature range broadened in the three classes in which they occurred. Densities were 8/m^2 in both the 12.0°–15.9°C class and the 16.0°–19.9°C class, and 11/m^2 in the 20.0°–23.9°C class. The biomass of bryozoans in the three subareas was moderately small, and only in Southern New England did biomass values exceed 1 g/m^2 (ranging from 0.004 g/m^2 to 9 g/m^2). Biomasses in the New York Bight subarea ranged from 0.001 g/m^2 to 0.3 g/m^2. In the three classes in Chesapeake Bight in which bryozoans occurred, their biomasses ranged from 0.02 to 0.3 g/m^2.

Brachiopoda were found in only one temperature class (16.0°–19.9°C) in Chesapeake Bight and were absent in the other two subareas. Both density and biomass of brachiopods were low, 0.1/m^2 density weighing 0.001 g/m^2.

Echinodermata as a group were significant contributors to the overall macrofauna of the Middle Atlantic Bight region and were found in all temperature ranges in each of the subareas. As a group, the density of echinoderms was highest in Southern New England and diminished to the south. However, largest biomasses were found in New York Bight, second highest in Southern New England, and lowest in Chesapeake Bight. The detailed analysis of the subcomponents of the echinoderms follows.

Holothuroidea were found in all temperature ranges in Southern New England, but not in the other two subareas. In New York Bight, they occurred in five of the seven temperature classes and were absent in the 4.0°–7.9°C and the 24.0°+C classes; in Chesapeake Bight, they occurred in six of the seven and were absent in the 8.0°–11.9°C class. Density values were highest in Southern New England, intermediate in Chesapeake Bight, and lowest in New York Bight. In Southern New England, density ranged from 0.2/m^2 to 12/m^2. In New York Bight, densities ranged from 0.06/m^2 to 2/m^2. In Chesapeake Bight, densities ranged from 0.06/m^2 to 10/m^2. The biomass of holothurians paralleled the distribution of density values; largest biomasses occurred in Southern New England, second largest in Chesapeake Bight, and smallest in New York Bight. Biomasses ranging from 0.03 g/m^2 to 38 g/m^2 occurred in Southern New England. In New York Bight, only one class contained biomass greater than 1 g/m^2; that was the 0°–3.9°C class where 2 g/m^2 occurred. The biomass in the remaining temperature classes increased from 0.1 g/m^2 to 0.6 g/m^2 as the temperature range narrowed. Biomass of holothurians in Chesapeake Bight was highest (23 g/m^2) in the 12.0°–15.9°C class, and lowest (0.05 g/m^2) in the 24.0°+C class.

Echinoidea occurred in nearly all temperature-range classes in each of the subareas, and were absent from only the 24.0°+C class in Southern New England, the 0°–3.9°C class in New York Bight, and the 0°–3.9°C and 4.0°–7.9°C classes in Chesapeake Bight. Overall densities were highest in New York Bight, intermediate in Chesapeake Bight, and lowest in Southern New England. Highest density recorded in New York Bight was 108/m^2 in the 20.0°–23.9°C class. The next highest density (43/m^2) in this class was in Chesapeake Bight, whereas density in Southern New England for this class was only 7/m^2. The next highest density of echinoids was 36/m^2 in the 16.0°–19.9°C class in New York Bight; in Chesapeake Bight in the same class, 10/m^2 were found, whereas 27/m^2 were recorded in Southern New England. The lowest overall value occurred in the 0°–3.9°C class in Southern New England where 0.2/m^2 was found. Biomasses of echinoids shifted somewhat, and, as in density values, greatest amounts occurred in New York Bight, but the second greatest amounts occurred in Southern New England, and smallest in

Chesapeake Bight. The largest biomass occurred in the 16.0°–19.9°C class in New York Bight, where 70 g/m² were found. Comparatively, 21 g/m² and 16 g/m² occurred in the same class in Chesapeake Bight and Southern New England, respectively. The second largest biomass occurred in the 8.0°–11.9°C class in Southern New England where 27 g/m² of organisms were found. In the same class in New York Bight, biomass was 7 g/m²; but in Chesapeake Bight, it had diminished to 0.1 g/m².

Ophiuroidea were found in all temperature-range classes in both Southern New England and Chesapeake Bight, but in New York Bight it was absent from the 16.0°–19.9°C and 24.0°+C classes. Highest densities by a substantial margin occurred in Southern New England where 349/m² and 165/m² were found in the 8.0°–11.9°C and 12.0°–15.9°C classes, respectively. In the comparable classes in Chesapeake Bight, the values were 3/m² and 90/m² and in New York Bight, 76/m² and 0.4/m². High density also occurred in the 4.0°–7.9°C class in Southern New England where 85/m² were recorded. The distribution of brittle star biomass was similar to that of density, in that largest biomasses occurred in Southern New England, second largest in New York Bight, and smallest amounts in Chesapeake Bight. Largest biomass, 25 g/m², was found in the 8.0°–11.9°C class in Southern New England, and 17 g/m² were found in the 4.0°–7.9°C class in the same subarea. In similar classes in New York Bight, the values were 3 and 2 g/m², respectively; but in Chesapeake Bight, the values were 0.04 and 0.2 g/m².

Asteroidea were present in all temperature ranges in Southern New England, which also contained the highest densities of sea stars. In New York Bight, asteroids were present in five of the seven temperature-range classes and absent from the 16.0°–19.9°C and the 24.0°+C classes; in Chesapeake Bight, they were present in six classes and absent from the 4.0°–7.9°C class. Highest densities of sea stars, 3.9/m², in Southern New England were found in 16.0°–19.9°C, and 3.1/m² in 8.0°–11.9°C and 12.0°–15.9°C; the remaining classes contained fewer than 1/m². The second highest density of sea stars, 3.5/m², was found in New York Bight in 8.0°–11.9°C class, and 1.6/m² and 1/m² in the 4.0°–7.9°C and 20.0°–23.9°C classes, respectively; fewer than 1/m² occurred in the other classes. Chesapeake Bight contained the lowest overall density of sea stars, and in no temperature class did the density exceed 0.5/m². Sea star biomass was largest in the New York Bight subarea, followed by Southern New England and Chesapeake Bight. The largest biomass, 15 g/m², occurred in the 8.0°–11.9°C class in New York Bight. The next largest biomass, 7 g/m², occurred in Southern New England in 12.0°–15.9°C. In Southern New England, only one other temperature range class, 8.0°–11.9°C, contained a moderately large biomass, 2.2 g/m². All other classes in this subarea had biomasses of sea stars less than 1 g/m². In New York Bight, four classes contained biomass in excess of 1 g/m²; these were 4.0°–7.9°C (1 g/m²), 8.0°–11.9°C (15 g/m²) 12.0°–15.9°C (3 g/m²), and 20.0°–23.9°C (6 g/m²). 0.07 g/m² occurred in the 0°–3.9°C class in this subarea. Chesapeake Bight biomasses were small. Largest in this subarea was 0.6 g/m² in the 16.0°–19.9°C class and 0.04 g/m² in the 12.0°–15.9°C. In the remaining temperature classes, the biomass of sea stars ranged from trace amounts to 0.008 g/m².

Hemichordata were sparsely distributed throughout the Middle Atlantic Bight region. They occurred in only three temperature classes in Southern New England, where densities ranged from 0.1/m² to 0.8/m² and biomass ranged from 0.001 to 0.10 g/m². In New York Bight subarea, hemichordates were found in only one temperature class, 20.0°–23.9°C, where 0.25/m² weighing 0.02 g/m² were found. In Chesapeake Bight, hemichordates were found in only the 20.0°–23.9°C class where density was 0.2/m² and biomass, 0.08 g/m².

Ascidiacea occurred in all temperature ranges in Southern New England and in all except the broadest range in New York Bight; they were present in five classes in Chesapeake Bight, and absent from the 4.0°–7.9°C and 8.0°–11.9°C classes. Greatest densities and biomass were found in Southern New England, next greatest in Chesapeake Bight, and lowest in New York Bight. Average densities in Southern New England ranged from 2/m² in 0°–3.9°C to 105/m² in 20.0°–23.9°C. On the whole, in this subarea, density increased as temperature range broadened to the 20.0°–23.9°C class and then dropped to 36/m² in the 24.0°+C class. In Chesapeake Bight, density ranged from 0.65/m² to 21/m². In New York Bight, densities ranged from 0.1/m² to 16/m². No definite relationship was discernible between density and temperature range in New York Bight. Ascidian biomass in Southern New England ranged from 0.1 g/m² in both the 0°–3.9°C and the 4.0°–7.9°C classes to 23 g/m² in both the 20.0°–23.9°C and the 24.0°+C classes. As temperature range broadened in this subarea, an increase in biomass was apparent. In Chesapeake Bight, the same relationship was seen—lowest biomass, 0.07 g/m², was recorded in the narrowest range class and highest, 15 g/m², in the broadest class. Ascidian biomass in New York Bight ranged from 0.02 g/m² to 1 g/m².

DOMINANT FAUNAL COMPONENTS

The purpose of this section is to identify and describe the taxonomic groups that constitute the principal faunal components at each sampling site station. Sites having the same dominant groups were combined to make patterns of distribution more distinct, and these patterns facilitate our understanding of the faunal composition and its distribution. The term "dominance", as used in this report, refers to the taxonomic group that, mathematically, contributed the highest number of individuals or greatest total accumulated wet weight. Again, it has been necessary to express the results in both density and biomass, because of the marked differences revealed by each.

In numbers of individuals, six taxonomic groups were dominant: Bivalvia, Annelida, Echinoidea, Ophiuroidea, Crustacea, and the bathyal group. All except the bathyal group are composed of a single taxonomic component; the bathyal group is an assemblage of several taxonomic groups, including such diverse forms as Pogonophora, Anthozoa, Sipunculida, Echiura, and Holothuroidea. In biomass, the dominant components were: Holothuroidea, Bivalvia, Annelida, Echinoidea, Ophiuroidea, and the bathyal group.

BAYS AND SOUNDS

Dominant faunal components in the bays and sounds were characterized by their diversity. Many sites relatively close to one another, even adjacent stations, supported faunas of totally different dominant forms.

In numbers of individuals, three faunal groups commonly constituted the principal faunal components in the bays and sounds: Crustacea, Annelida, and Bivalvia (fig. 123). In the Southern New England subarea, Crustacea was the group most widely distributed. In New York Bight and Chesapeake Bight, the dominant components were more equally divided among all three groups: Crustacea, Annelida, and Bivalvia.

In biomass, only two taxonomic groups were important as dominant components: Annelida and Bivalvia (fig. 124). In all geographic areas, these two groups were more or less equally distributed in the bays and sounds.

CONTINENTAL SHELF

Six groups were important as dominant taxa on the Continental Shelf: Bivalvia, Annelida, Crustacea, Echinoidea, Ophiuroidea, and Holothuroidea. Each of these groups (except Ophiuroidea) differed markedly in geographic distribution and area occupied when their dominance in terms of density was compared to their dominance in biomass. There were few, but profound, differences in composition of dominant taxa evaluated according to density as compared with biomass. Taxonomic groups that were dominant in both density and biomass were: Bivalvia, Annelida, Echinoidea, and Ophiuroidea.

In number of individuals, dominant taxa (fig. 123) were Bivalvia, Annelida, Echinoidea, Ophiuroidea, and Crustacea. Crustacea was by far the most important group in areal coverage. This group was particularly prominent in Southern New England and New York Bight. Even in Chesapeake Bight, Crustacea was the most widespread group, but was not overwhelmingly so as it was in the two northern subareas. Annelida was dominant in moderate-size areas throughout the Middle Atlantic Bight. Bivalvia and Echinoidea were dominant mainly in New York Bight and Chesapeake Bight. Ophiuroidea was the principal component only in the outer-shelf areas in Southern New England and northern New York Bight.

In biomass (fig. 124), the distributional pattern of dominant taxons was strikingly different from that described above for the number of individuals. In the Southern New England subarea, Annelida and Bivalvia were the groups having the greatest geographic coverage. Holothuroidea and Ophiuroidea were important in moderately small areas of the mid- and outer-shelf regions. In New York Bight, Bivalvia was the major group and Echinoidea was moderately important in the southern part. Ophiuroidea dominated only in a small area along the Outer Continental Shelf in Southern New England and the northern part of New York Bight. In Chesapeake Bight, Echinoidea was the most widely distributed group, and Bivalvia and Annelida were the dominant forms in moderate-size areas.

CONTINENTAL SLOPE

Dominant taxa on the Continental Slope were limited primarily to Bivalvia, Annelida, and the bathyal group.

In number of individuals, the faunas on the Continental Slope in Southern New England and New York Bight were dominated about equally by Bivalvia and Annelida (fig. 123). Farther south in Chesapeake Bight, the bathyal group was dominant in the deeper part of the slope. The bathyal group, Bivalvia, and Annelida constituted the major components in this subarea.

In biomass, the dominant taxa were Annelida, particularly along the upper slope, and the bathyal group, especially on the lower slope (fig. 124).

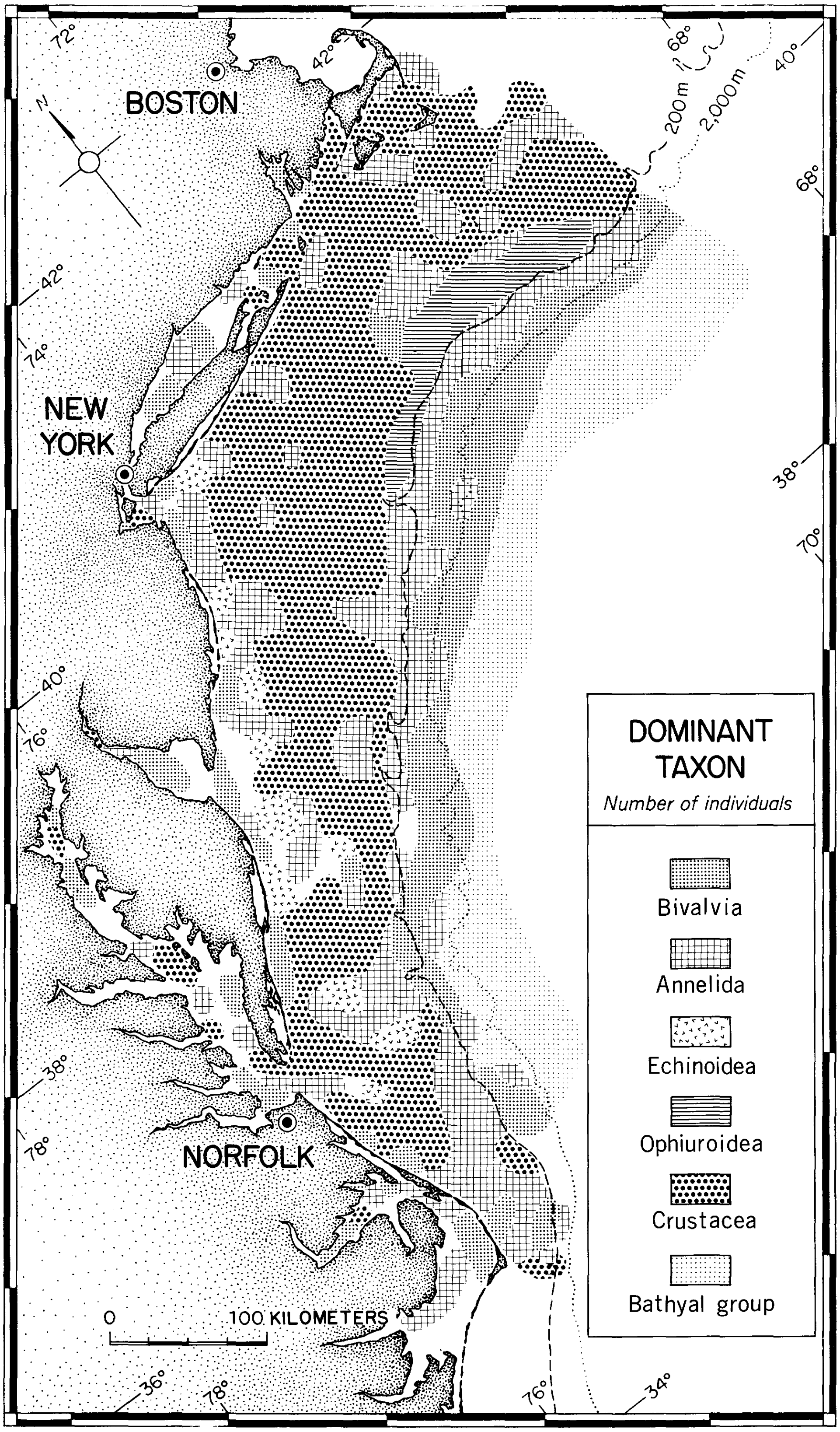

FIGURE 123.—Geographic distribution of the number of individuals for each dominant taxon in the entire Middle Atlantic Bight region.

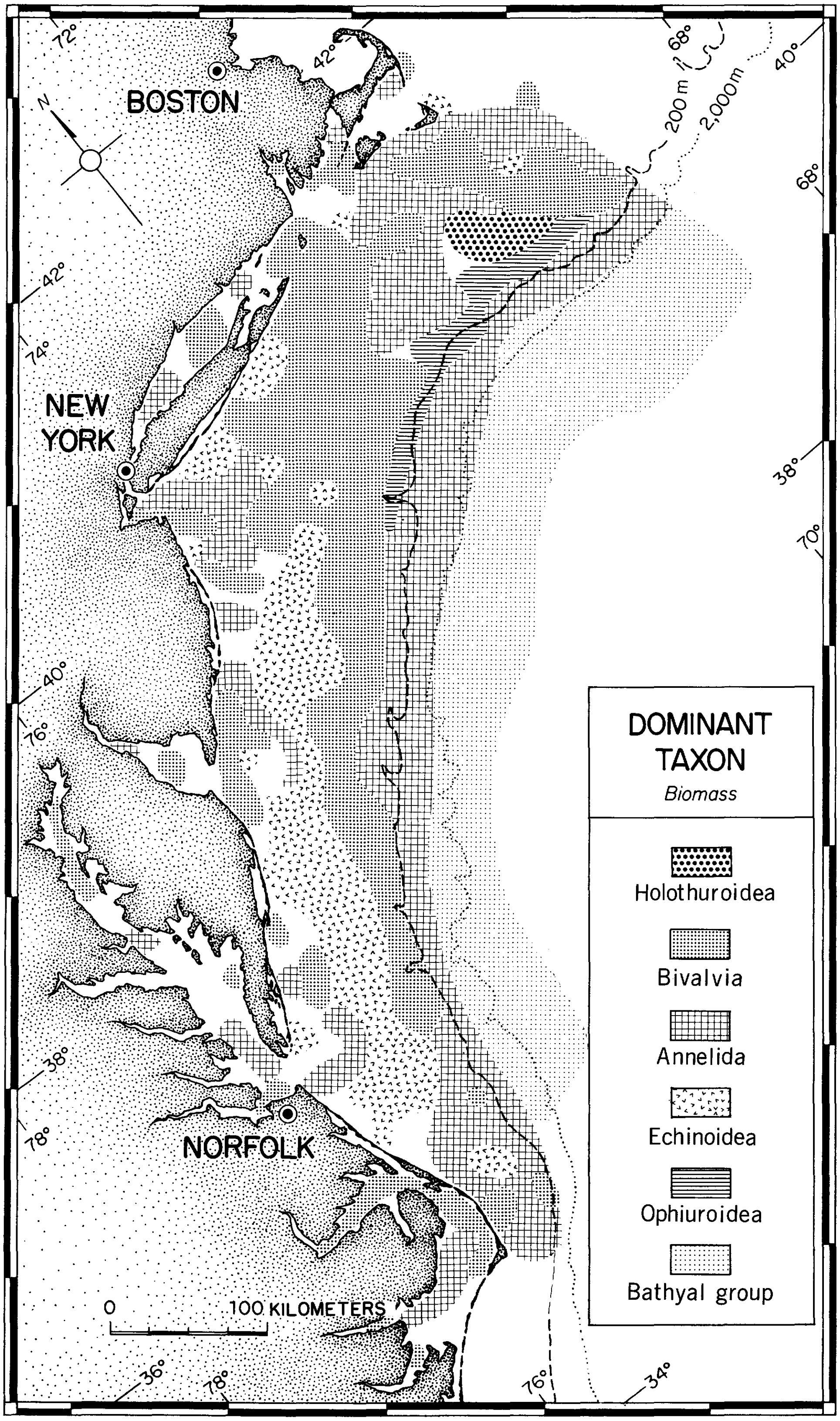

FIGURE 124.—Geographic distribution of the biomass for each dominant taxon in the entire Middle Atlantic Bight region.

CONTINENTAL RISE

Dominant taxa on the Continental Rise were limited to three major groups: Bivalvia, the bathyal group, and Annelida.

In number of individuals, only two groups constituted the principal components: Bivalvia and the bathyal group. Bivalvia were dominant in a moderately large area in the shallower parts of the Continental Rise (fig. 123), and the bathyal group was dominant in a large area including the deeper parts of the rise.

In biomass, also, only two groups were dominant: Annelida and the bathyal group (fig. 124). Annelida contributed the principal biomass component in a relatively small and narrow geographic area in the shallower parts of the Continental Rise. The bathyal group, on the other hand, was dominant over a large geographic area, including all the deepwater parts of the rise.

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UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, *Secretary*

GEOLOGICAL SURVEY

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[Letters designate the chapters]