MACROBENTHIC INVERTEBRATE FAUNA OF THE MIDDLE ATLANTIC BIGHT REGION: PART II. FAUNAL COMPOSITION AND QUANTITATIVE DISTRIBUTION

by

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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 in terms of biomass, and secondarily, to determine the principal taxonomic components of the fauna and learn the general features of their distribution. Sampling was conducted at 563 locations; water depths represented ranged from 4 to 3,080 m. An analysis of faunal composition and quantitative distributions, from the survey, are presented in this report. Quantities are expressed in terms of density and biomass.

Dominant taxonomic components, in numbers of individuals, in decreasing order of importance were: Arthropoda (46%), Mollusca (25%), Annelida (21%), Echinodermata (4%), and Coelenterata (1%), Dominant in biomass, in decreasing order of importance were: 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 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.

INTRODUCTION

This report[1/] 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 with 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. Further studies of these data, in addition to the primarily descriptive analyses presented here, are in progress, and will be treated in subsequent reports. The first report in this series, entitled "Macrobenthic Invertebrate Fauna of the Middle Atlantic Bight Region: Part I. Collection Data and Environmental Measurements," by Roland L. Wigley, Roger B. Theroux, and Harriett E. Murray, 34 pages, was issued June 30, 1976.

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

1/ Financial support for the preparation of this report was provided by the National Oceanic and Atmospheric Administration, Marine Ecosystems Analysis Program, New York Bight Project, Stony Brook, New York.

Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce) was conducted in cooperation with the Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, and the U.S. Geological Survey, Field Laboratory, Woods Hole, Massachusetts. 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 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 theoretical viewpoints, will be selected for detailed study of their taxonomic composition, productivity, interspecific competition for food, and related aspects. This latter phase of the investigation is scheduled as part of the long-range objectives by the National Marine Fisheries Service of 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 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, Massachusetts, and extending southward to Cape Hatteras, North Carolina. 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 shallower part of the continental rise (fig. 1). This larger area is called the Middle Atlantic Bight Region. For purposes of comparative description, with particular reference to New York Bight, this region has been divided into three roughly equal geographic subareas: Southern New England, New York Bight, and Chesapeake Bight.

Previous Studies

Although there have been no previous quantitative studies of the macrobenthic fauna that encompassed the entire Middle Atlantic Region, there have been comprehensive studies of small sections of this Region a few rather large-scale qualitative studies, and numerous reports of an ancillary nature. Altogether, there exists a substantial literature on this general subject that has been produced at an ever-increasing rate since about the middle of the nineteenth century. A few examples of the early reports are those by: Adams (1839), describing new species of mollusks; Agassiz and Agassiz (1865), pertaining to echinoderm morphology and development; Desore (1848), on the natural

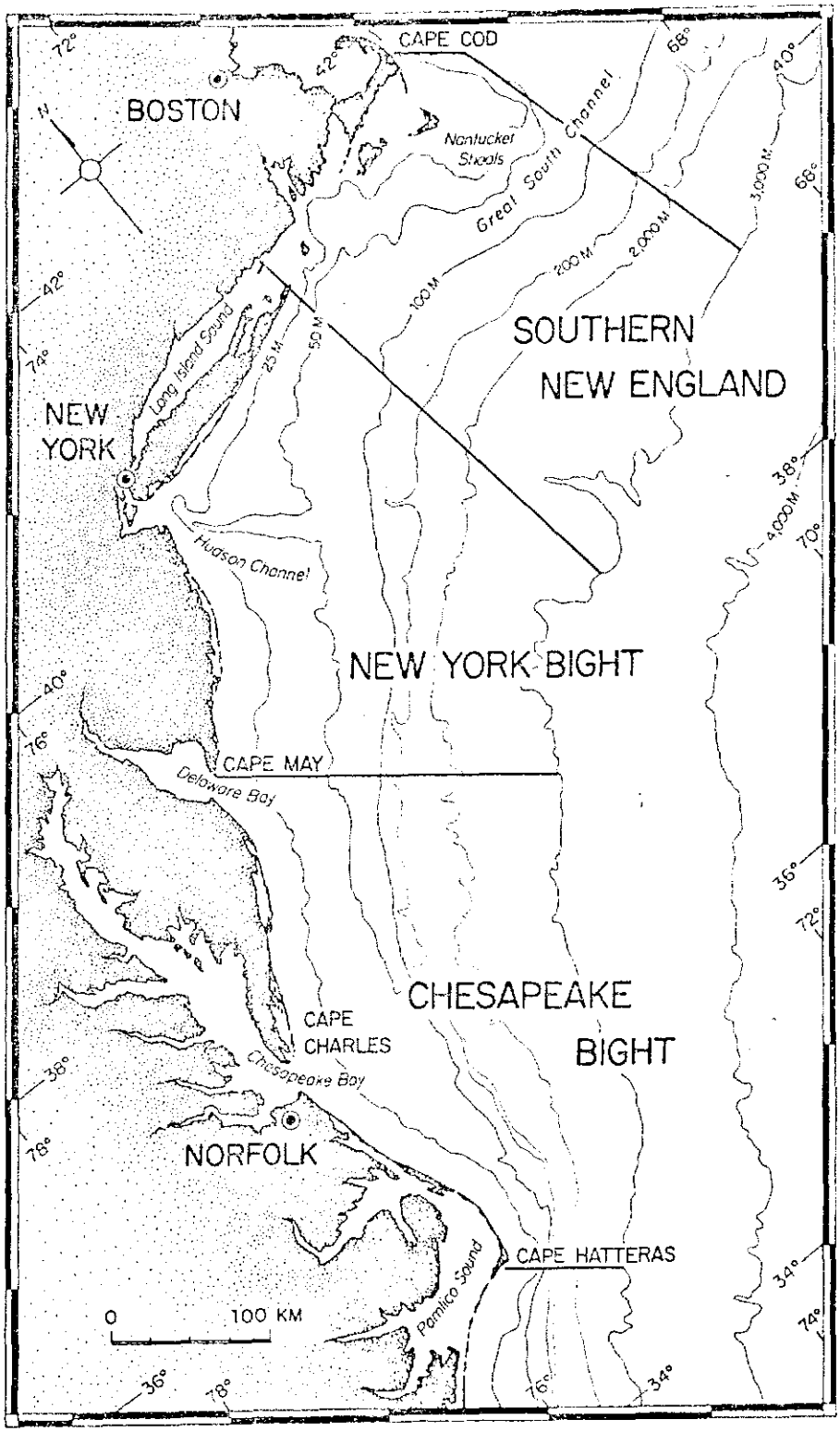


Figure 1.--Chart of the Middle Atlantic Bight Region showing the location of geographical features and the three subarea divisions: Southern New England, New York Bight, and Chesapeake Bight.

history of benthic invertebrates from Nantucket Shoals; Leidy (1885), an account of the invertebrates from coastal waters of Rhode Island and New Jersey; and Verrill (1866), descriptions of new species and ecological observations of New England coelenterates and echinoderms. Early studies of this type provide some of the basic taxonomic framework for this fauna, plus providing clues to the pattern of geographic distribution, and a preliminary insight to regional ecology. Two classical 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 (Sumner, Osburn, and Cole, 1913). Both surveys dealt mainly with epibenthic invertebrates and covered much the same area -- primarily Vineyard Sound and Buzzards Bay, located 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 of the older reports as well as the new. The six reference works are:

(1) Publications of the United States Bureau of Fisheries 1871-1940. Compiled by Barbara B. Aller and published in 1958.

(2) A Preliminary Bibliography with KWICK Index on the Ecology of Estuaries and Coastal Areas of the Eastern United States. Compiled by Robert Livingstone, Jr., and published in 1965.

(3) Marine and Estuarine Environments, Organisms and Geology of the Cape Cod Region, an Indexed Bibliography, 1665-1965. Compiled by Anne E. Yentsch, M. R. Carriker, R. H. Parker, and V. A. Zullo, and published in 1966.

(4) The Effects of Waste Disposal in the New York Bight: Sections 8 and 9 (Literature Cited). Compiled by the National Marine Fisheries Service, Middle Atlantic Coastal Fisheries Center, Sandy Hook, New Jersey. Published in 1972.

(5) Coastal and Offshore Environmental Inventory: Cape Hatteras to Nantucket Shoals. Edited by Saul B. Saila and published in 1973.

(6) Bibliography of the New York Bight: Part 1 -- List of Citations; Part 2 -- Indices. Compiled by the National Oceanic and Atmospheric Administration, Marine Ecosystems Analysis Program, Stony Brook, N.Y., and published in 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 physiological 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 is that pertaining 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. A preponderance of these studies were carried out in 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 in a few instances) for the following three zones: (1) inshore and coastal waters, (2) continental shelf, and (3) continental slope and rise.

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 Haskins (1964), Franz and Hendler (1971), Phillips (1971), 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 et al. (1973), Palmer and Lear (1973), Maurer et al. (1974), Watling et al. (1974), Watling and Maurer (1975).

Quantitative studies dealing mainly with the continental shelf:--Wigley and McIntyre (1964), Emery, Merrill, and Trumbull (1965), Emery and Uchupi (1972), Pearce (1972), Steimle and Stone (1973), and Rowe (1973). An up-to-date review of the major species and faunal associations inhabiting the Middle Atlantic Bight was prepared by Pratt (1973).

Quantitative studies pertaining chiefly to the 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 forming the basis of this study have previously been published. Macrobenthos from a series of stations across the continental shelf south of Martha's Vineyard, Massachusetts, 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). Remains of dead marine animals, particularly mollusks, reported by Wigley and Stinton (1973) for a portion of the Middle Atlantic Bight located off southern New England, also, were based on samples collected for the present study.

A number of quantitative studies of the macrobenthos are in progress at the present time. A substantial proportion of these studies are being conducted in coastal areas, and in large measure they pertain directly to assessments of environmental quality. In addition, there are two large-scale offshore investigations underway. One of these is being conducted in the Chesapeake-New Jersey region in anticipation of petroleum exploration, and possible production, in this region. The other large-scale study is being conducted 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. Characteristically, 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 Xerox or mimeograph form, often in irregular series or as a one-of-a-kind report, 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, Chesapeake Bay, and others, have been studied in some detail. There is, however, a lack of detailed information concerning chemical properties, water currents, meteorological influences, and related aspects, particularly as they pertain to offshore bottom waters.

A bibliography of early (pre-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), and 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 pertaining to the Middle Atlantic Bight Region is copious and up-to-date. A few of the 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). Samples were obtained primarily between 1962 and 1965. Three samples collected in 1957 were inadvertently included in the analysis of this suite. The basic sampling strategy was 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 a companion report by Wigley, Theroux, and Murray, Northeast Fisheries Center, Woods Hole, Massachusetts, June 30, 1976 (see INTRODUCTION). The regularity of station locations imparted by the grid is evident, but is masked in some places by additional samples between grid lines.

Samples were obtained during the course of 16 research cruises (table 1). Five research vessels were utilized for sampling, 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, Massachusetts.

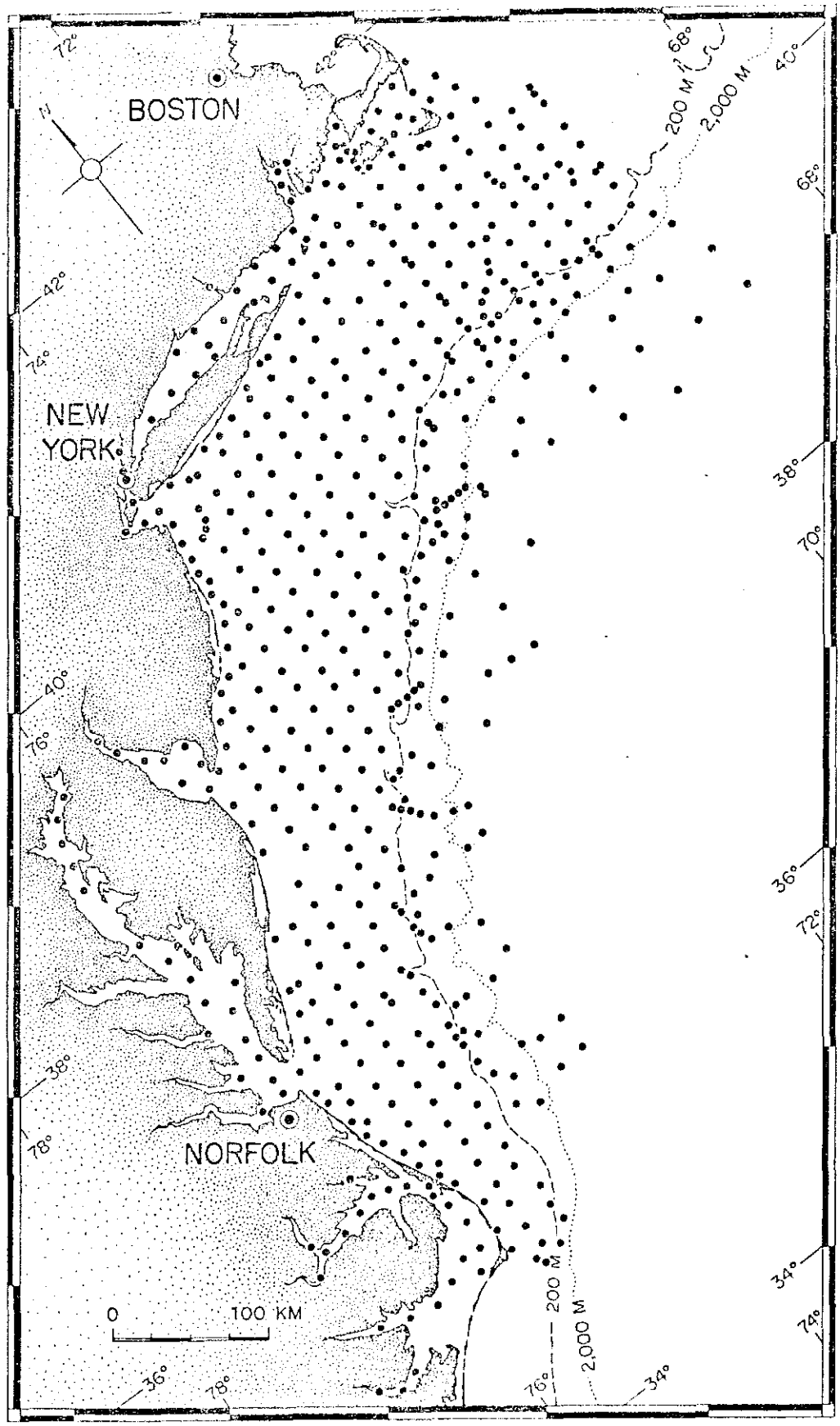


Figure 2.--Chart of station locations where quantitative samples of macrobenthic invertebrates were obtained.

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 portions of the continental rise throughout the Middle Atlantic Bight Region, encompassing an area of 303,521 km^2 (121,408 mi^2). For the purposes of a geographic perspective, the region was divided into subareas designated: Southern New England, New York Bight, and Chesapeake Bight. These subareas, delineated in figure 1, contain 94,700, 82,749, and 126,072 km^2 (37,880, 33,100, 50,428 mi^2), respectively. More detailed data pertaining to the areal expanse of various sub-units within the region are listed in table 2. Each subarea contains a nearly equal number of samples: Southern New England--186 samples; New York Bight--187 samples; Chesapeake Bight--190 samples.

Benthos Sampling Gear

Samples were obtained using three different quantitative grab-type bottom samplers: the Van Veen grab (Holme and McIntyre, 1971); the Smith-McIntyre sampler (Smith and McIntyre, 1954), illustrated in figure 3; and the Campbell grab (Menzies, Smith, Emery, 1963), illustrated in figure 4. All three are reliable devices for obtaining quantitative samples with relative ease under a wide variety of working conditions. Because a small vessel was employed in sampling inshore waters, this restricted the use of bottom samplers to the two smaller ones-- Van Veen and Smith-McIntyre. A total of 13 samples (2%), each covering an area of 0.1 m^2, were taken with the Van Veen grab; 195 samples (35%) were taken with a 0.1 m^2-size Smith-McIntyre grab; and 355 (63%) samples were taken with the 250-kg Campbell grab, each sample covered an area of 0.56 m^2. These devices provided enough material for both biological and geological analyses.

Table 2.--Areas, in square kilometers, of several bathymetric zones within each subarea and for the entire Middle Atlantic Bight Region.

Bathymetric zone	Subarea: Southern New England	Subarea: New York Bight	Subarea: Chesapeake Bight	Total
	km^2	km^2	km^2	km^2
Bays and Sounds[1]	2,674	3,788[2]	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
	35,560	43,912	36,420	115,892
Continental Slope				
200 - 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
	7,437	6,158	11,633	25,228
Continental Rise				
2,000 - 3,999 m	49,029	28,891	60,618	138,538
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 km^2).

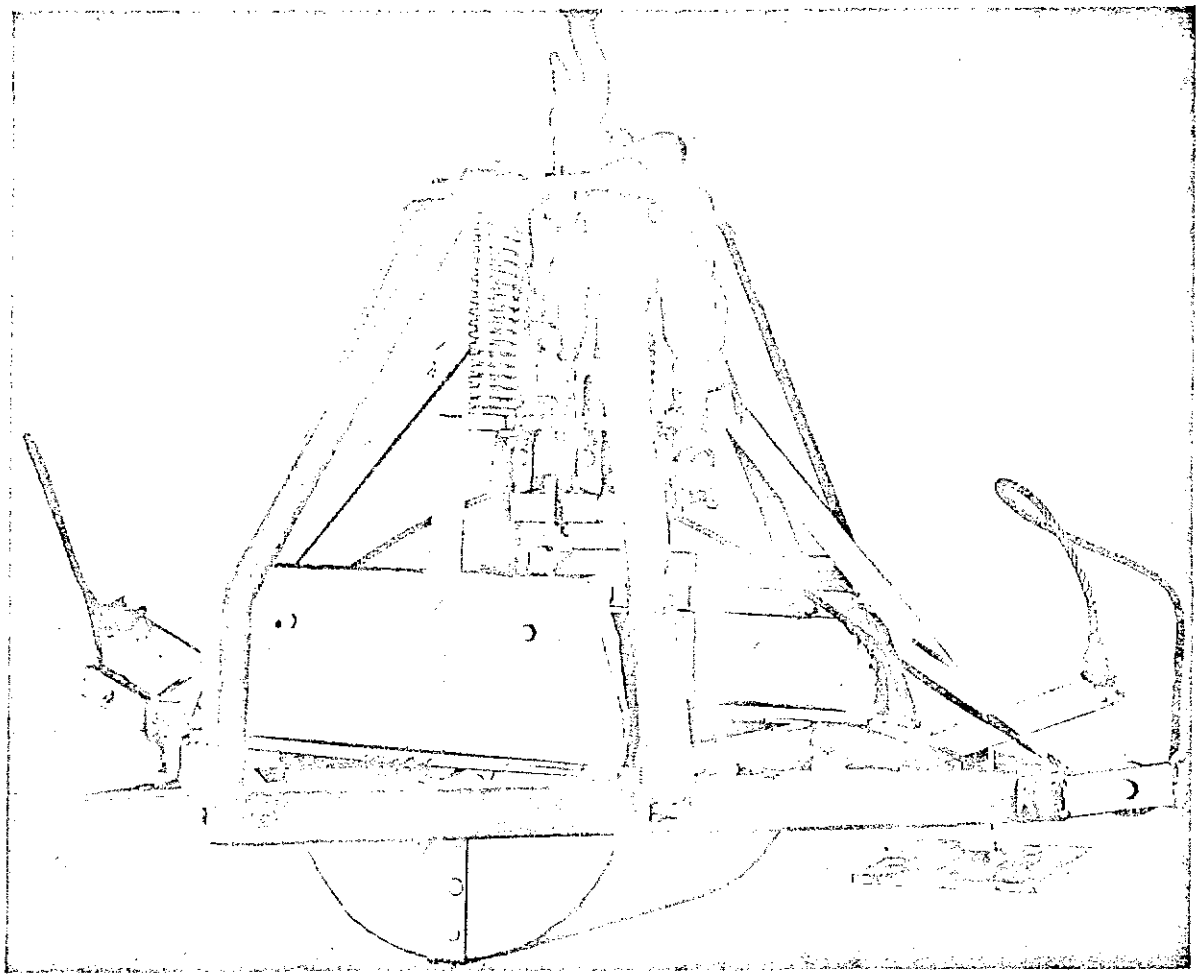


Figure 3.--Side view of the Smith-McIntyre spring-loaded bottom sampler in the closed position. Lead weights on each side are set vertically to impede rotation of the sampler during descent and ascent.

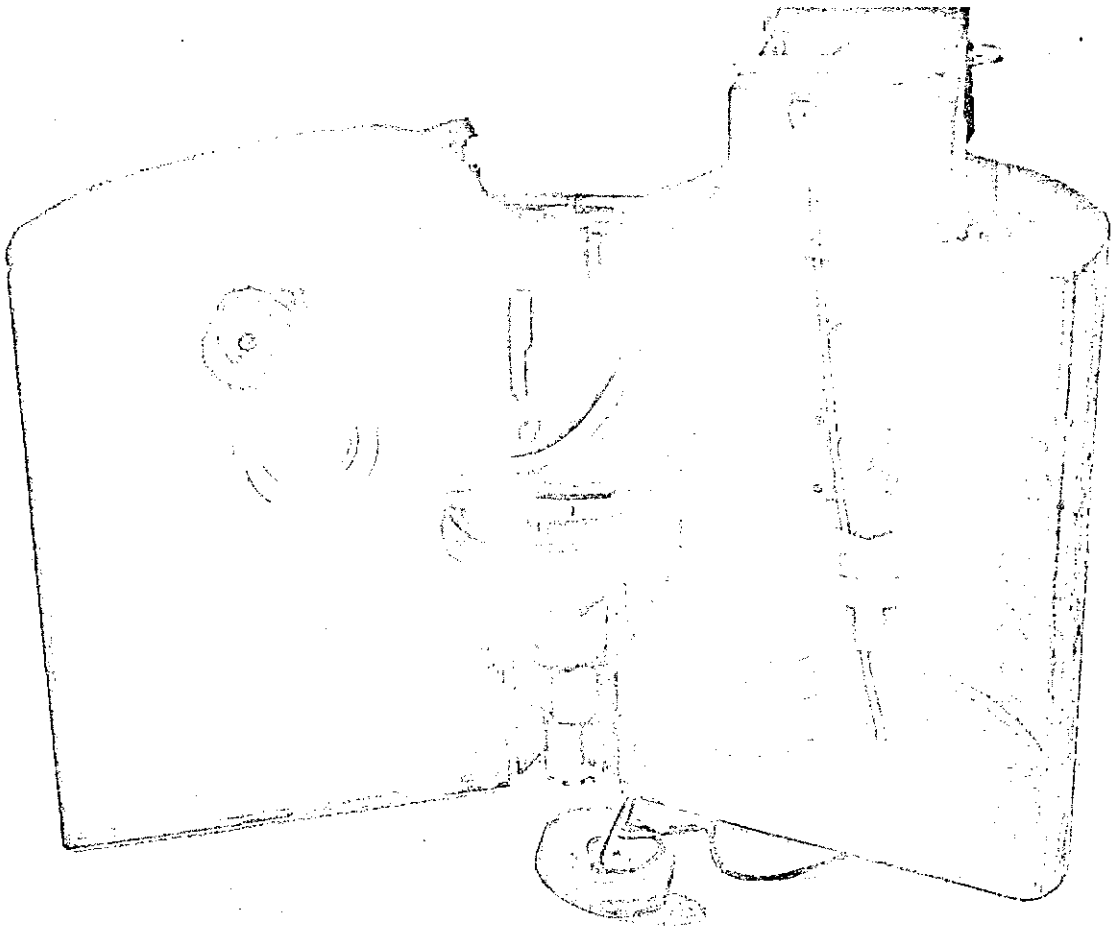


Figure 4.--Bottom view of Campbell grab sampler. Camera is installed in right-hand bucket and strobe light is in the left-hand bucket. Width of the buckets (vertical dimension in photograph) is 57 cm.

In addition to samples of sediment and fauna, 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 immediately prior to bottom contact. The camera housing, fastened within one of the buckets of the grab, contained two 35-mm motorized cameras spaced to provide stereo separation, if desired. Usually, during the course of this work, each camera was loaded with a different type of film, one with black and white negative material and the other with reversal (positive), high speed daylight color film. The opposite bucket contained the electronic strobe light which illuminated the area to be photographed. The device was activated at about 1 m above the bottom by means of a trip-weight 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

The method of processing samples from the different sampling devices differed only in the size of the equipment and method of determining sediment volume. Contents of the grab were emptied into a water-tight receptacle large enough to accommodate the maximum amount of substratum the device could contain. Substrate receptacles for the Van Veen and Smith-McIntyre

samplers were 20-liter graduated pails and for the Campbell grab a large rectangular steel tub. This tub also served as the washing container. The volume of the samples was determined prior to any other treatment. The graduated pails used with Van Veen and Smith-McIntyre samplers gave a direct reading of volume whereas pre-calibrated brass dip-sticks were used to determine the volume of Campbell grab samples. Volumes were recorded to the nearest whole liter.

All samples were washed on a seiving screen having 1-mm mesh openings to remove unwanted sediments and retain specimens. Washing methods differed for samples from the two smaller grabs and the larger one. A specially designed wash stand employing adjustable flow shower heads trained onto the mound of sediment contained in a boxlike apparatus was used to wash Van Veen and Smith-McIntyre samples. Water flow gently flooded the organisms out of the sediments and transported them to the sorting sieve where everything greater than 1 mm was retained. Washing of Campbell grab samples was accomplished in the receptacle which received the sample. Water from hoses with variable nozzles floated sediments and organisms through openings in the container to the seiving screens.

Samples containing coarse substrate fractions, i.e., pebbles, cobbles, etc., retained on the screen required further treatment to reduce their bulk for preservation. Sorted out by hand, these larger fractions were examined and if clean (no attached organisms) discarded,those with attached organisms were retained for later treatment. Organisms and sediments

retained by the screen were preserved in a 5% buffered seawater solution of formaldehyde in glass containers, labeled, and stored for transport to the laboratory.

Laboratory treatment of each sample of preserved specimens involved 1) rinsing in fresh water to flush off formalin solution; 2) sorting and identifying to the lowest taxonomic level consistent with accuracy; 3) recording counts of individuals in each taxonomic group; and 4) obtaining damp or wet weights (i.e., 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 accessory structures of that type. After the above treatment, all specimens were preserved in 70% ethanol and stored in suitably labeled containers.

Data Reduction

Certain adjustments to the raw data were required in order to make them comparable, one sample with another. The criterion of comparability chosen was a unit area of 1 square meter. Adjustments were made to account for 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 MESA's occurs in the coding schemes used to identify the various taxonomic components. The system we (Demersal Food Chain Investigation at the Northeast Fisheries Center, Woods Hole) employed 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

Due to a lack of suitable bottom water temperature information, especially in the southeastern portion of New York Bight and in Chesapeake Bight, alternative means of determining temperatures were 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 vessels on file at this facility. The range in temperature was determined by subtraction, grouped into range classes, and these range values 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, based on field-analysis techniques. The sample was then 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 Woods Hole Oceanographic Institution. Analysis results are contained in Woods Hole Oceanographic Institution Reference No. 71-15, Data File, Continental Margin Program Atlantic Coast of the United States, Vols. 1 and 2, compiled and edited by John C. Hathaway, U.S. Geological Survey, Woods Hole, Massachusetts. 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

According to the number of species present or number of groups of higher taxa present, 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 encountered 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) it was found to be dominated by four groups: Arthropoda, Annelida, Mollusca, and Echinodermata. Dominance of these groups was apparent both in 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%), Mollusca - 346 - (25%), Annelida - 298 - (21%), Echinodermata - 55 - (4%), and all other groups combined - 65 - (5%). Biomass, which is here expressed as mean wet weight or

Table 3.--Quantitative taxonomic composition of the macrobenthic invertebrate fauna, in terms of 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	4.61	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	

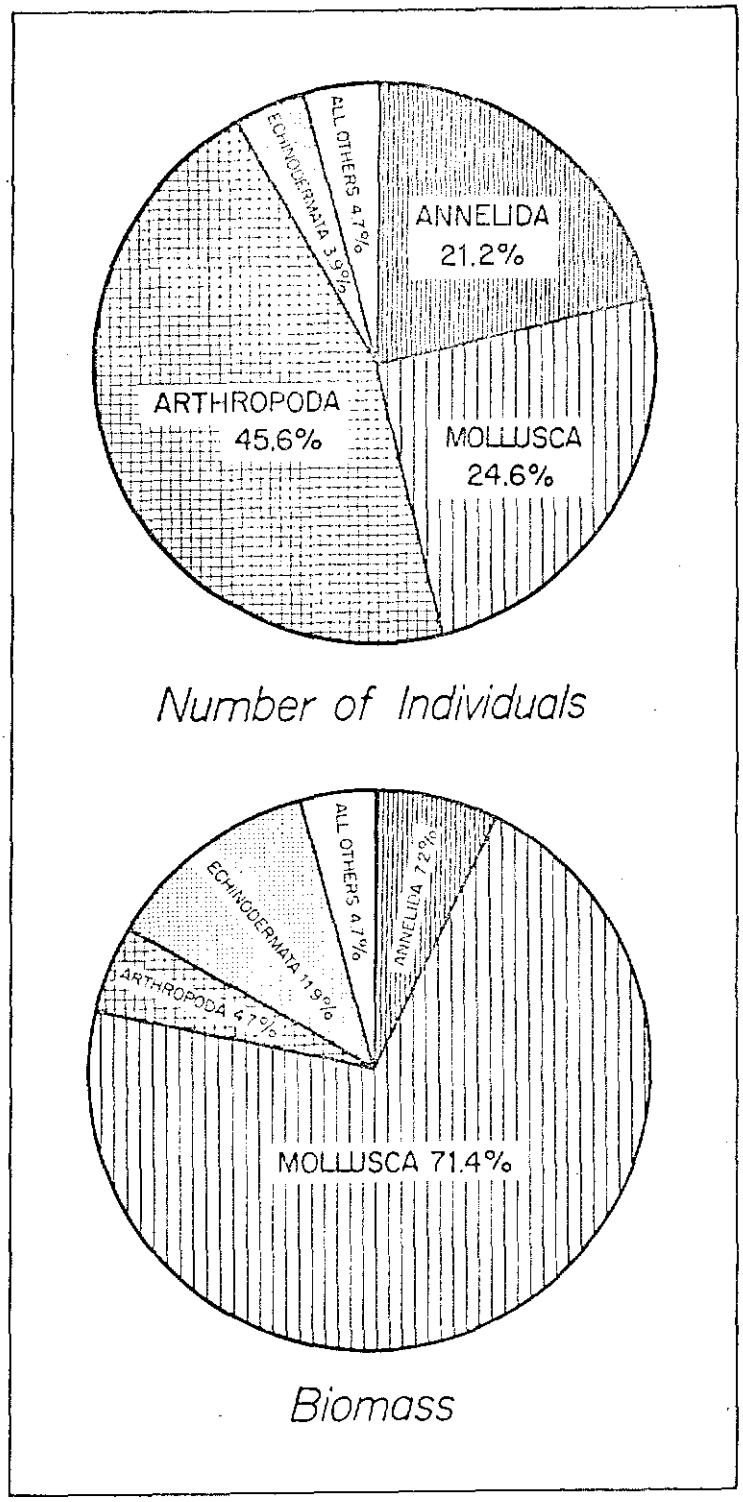


Figure 5.--Pie chart illustrating the taxonomic composition of the total macrobenthic fauna in the entire Middle Atlantic Bight Region: upper chart--percentage number of individuals; lower chart--percentage biomass.

damp weight in grams per square meter and percentage of the total fauna was even more heavily dominated by a few taxonomic groups than numerical density. Principal components in terms of biomass were: Mollusca - 136 - (71%), Echinodermata - 23 - (12%), Annelida - 14 - (7%), Arthropoda - 9 - (5%). Minor groups listed here in decreasing order of importance in terms of biomass were: Chordata, Coelenterata, Sipunculida, Nemertea, Bryozoa, Echiura, Porifera, Hemichordata, Pogonophora, Priapulida, Platyhelminthes, Aschelminthes, and Brachiopoda.

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 435 species that were represented in samples within the Middle Atlantic Bight Region. Of this number less than approximately 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, Leptocheirus, Unciola (Amphipoda); Cancer (Decapoda); Cirolana (Isopoda); Astropecten (Asteroidea); Echinarachnius, Brisaster (Echinoidea).

Large differences occurred in dominant forms from one subarea to another, and these are described in the following section.

Table 4.--List of invertebrate species contained in quantitative samples taken within the Middle Atlantic Bight Region.

COELENTERATA
- 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
      - *Harmathoe extenuata* (Grube) 1840
    - Sigalionidae
      - *Leanira* 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* Grube, 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.

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
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

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
      - *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
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
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
      - *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 pinguis (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
Siphonoecetes 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 portoricensis Bacescu, 1968
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.
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* Alder and Hancock, 1848
  - *Molgula complanata* Alder and Hancock, 1870
  - *Molgula siphonalis* Sars, 1859

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 Specimens: 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% of the total number of specimens. They decreased in nearly equal amounts to the southward, and accounted for 41% of the total fauna in New York Bight and 21% in Chesapeake Bight. Nearly the opposite trend was evident in the abundance of Mollusca. In Southern New England they accounted for about 10% of the number of animals, but increased southward to 18% in New York Bight and 57% in Chesapeake Bight. Annelida exhibited a somewhat different trend in percentage composition. They formed approximately equal proportions in Southern New England (18%) and Chesapeake Bight (15%), but constituted a substantially larger proportion of the fauna in New York Bight (33%). Echinodermata made up a moderately small (2% to 5%) share of the fauna in all areas, but the number present in Southern New England (4.6% of the total fauna), and in New York Bight (4.2%), was double the proportion present in Chesapeake Bight (2.3%).

Biomass: Proportional composition of the biomass was more consistent from one subarea to another than number of specimens. Furthermore, the components exhibited a different order of dominance. In terms of biomass the Mollusca were especially important -- constituting percentage compositions of 64% in both Southern New England and Chesapeake Bight and the extraordinarily high quantity of 79.6% in New York Bight. Echinodermata ranked second with roughly equal proportions, between 11% and 13% in all subareas. Annelida ranked third in importance; they accounted for 9% of the biomass in Southern New England, 5% in New York Bight, and 10% 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% of the fauna) than in the two more southern subareas where they made up 3.2% and 3.1% of the biomass, respectively. Miscellaneous taxonomic groups (Ascidiacea, Coelenterata, Bryozoa, Nemertea and nine additional groups) were moderately important in Southern New England (6.9%) and Chesapeake Bight (10.0%), whereas in New York Bight they accounted for only 1.3% of the biomass.

Faunal composition is further analyzed in subsequent sections as it pertains to geographic distribution, relationships with water depth, bottom sediments, sediment organic content, and range in water temperature. Quantitative geographic distribution of dominant faunal components is discussed in a separate section below, entitled Dominant Faunal Components, page 371.

Table 5.--Quantitative taxonomic composition of the macrobenthic invertebrate fauna, in terms of both number of individuals and biomass, representing the Southern New England subarea.

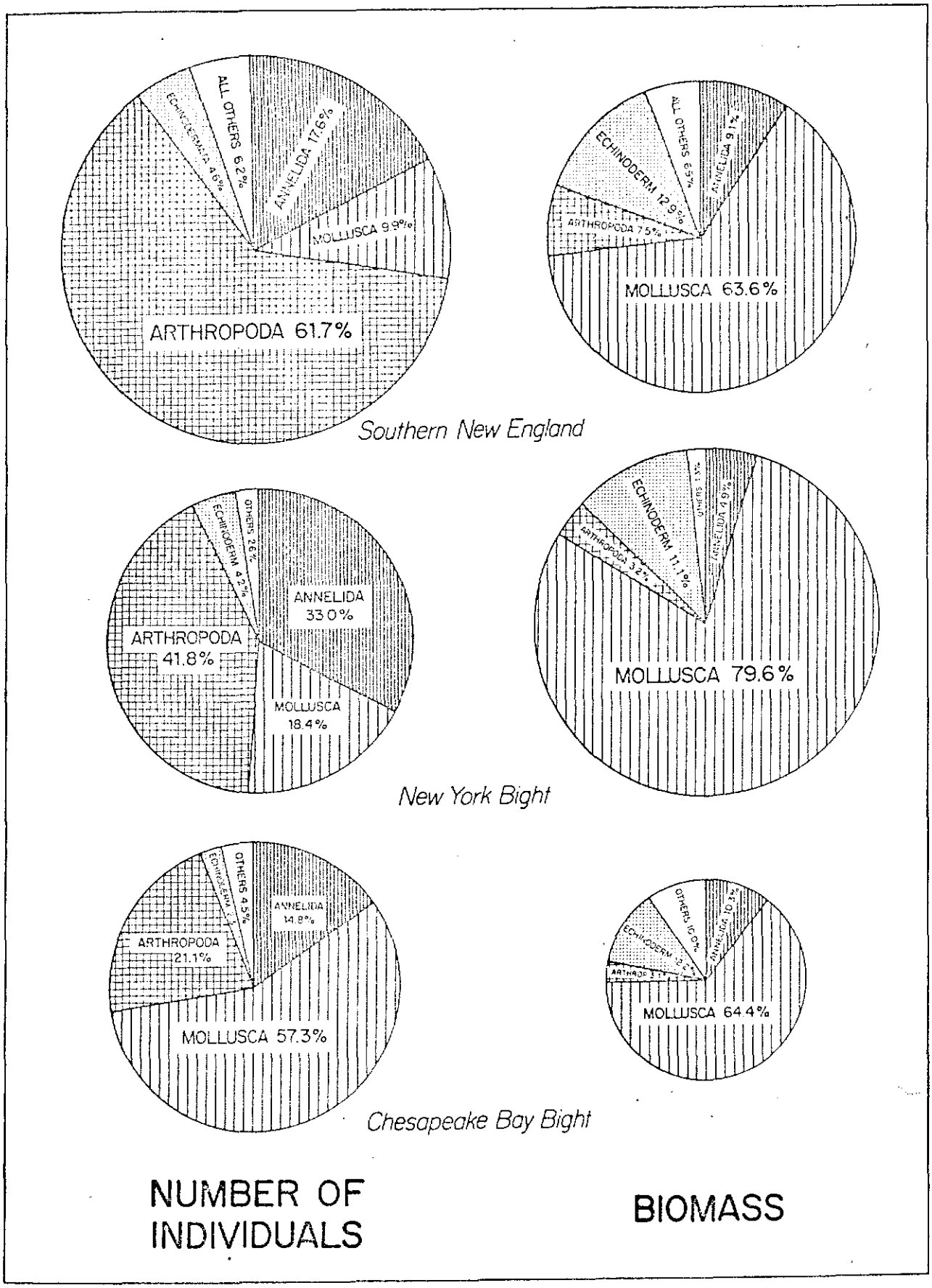
Taxonomic group	Number of individuals			Biomass		
	Mean	Percent	Phylum rank	Mean	Percent	Phylum rank
	No./m^2			g/m^2		
PORIFERA	0.75	0.04	13	0.113	0.05	10
COELENTERATA	29.26	1.50	6	4.617	2.19	6
Hydrozoa	14.52	0.74		0.624	0.30	
Anthozoa	14.74	0.75		3.993	1.90	
Alcyonacea	0.80	0.04		0.165	0.08	
Zoantharia	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	6	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 terms of 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./m^2			g/m^2		
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 terms of 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./m^2			g/m^2		
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	



gure 6.--Pie chart 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-hand side, and biomasses are shown on the right-hand side. The area of each circle is proportional to the mean density or mean biomass.

GEOGRAPHIC DISTRIBUTION

It is generally recognized that 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. It permits the reader to visually integrate relationships with other organisms and with 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 encountered 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 one square meter of bottom area.

Geographic distributions are presented in three sub-sections: (1) distribution of the total macrobenthic fauna, that is, all taxonomic groups combined; (2) distribution of each major taxonomic component; and (3) distribution of a few selected genera and species.

Total Macrobenthic Fauna (All Taxonomic Groups Combined)

The density distribution of benthic animals, all taxonomic groups combined, in the Middle Atlantic Bight Region exhibited two major trends. One trend pertains to density in relation to inshore-offshore location. High densities generally occurred in the coastal areas, moderate densities prevailed on the continental shelf, and low densities were characteristic of 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 were extensive tracts where the density of benthic animals was high (greater than 1,000/m^2) or very high (greater than 5,000/m^2). Moreover, there were relatively few areas 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 were few areas where benthic animals occurred in very high density (greater than 5,000/m^2) and limited expanses of high density (greater than 1,000/m^2). Moderate to low density (less than 200/m^2) areas were not uncommon. The middle region--the 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 evident in figure 7, in which 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 that of density. Both the inshore-offshore and

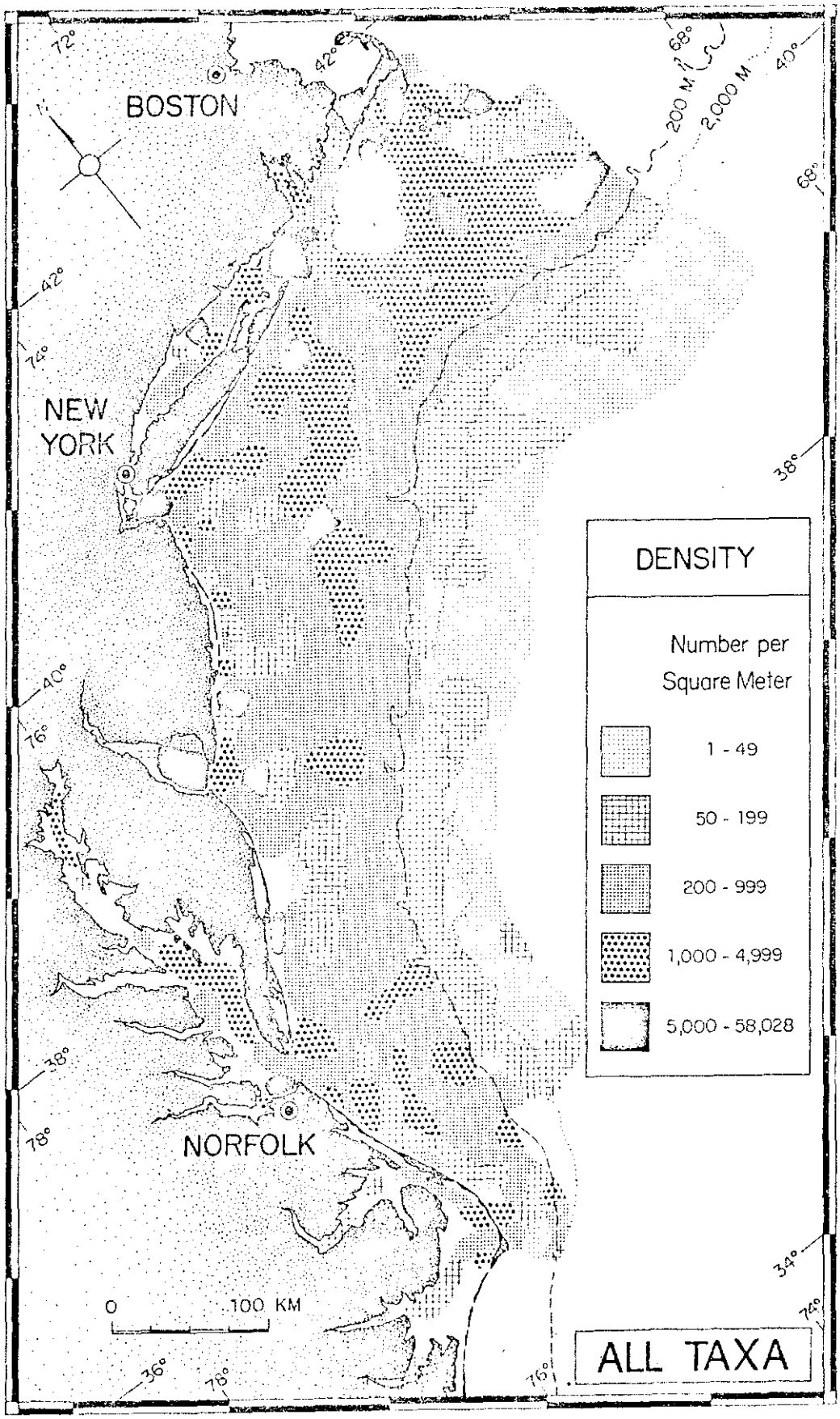


Figure 7.--Geographic distribution of the density of all taxonomic groups combined, expressed as number of individuals per square meter of bottom.

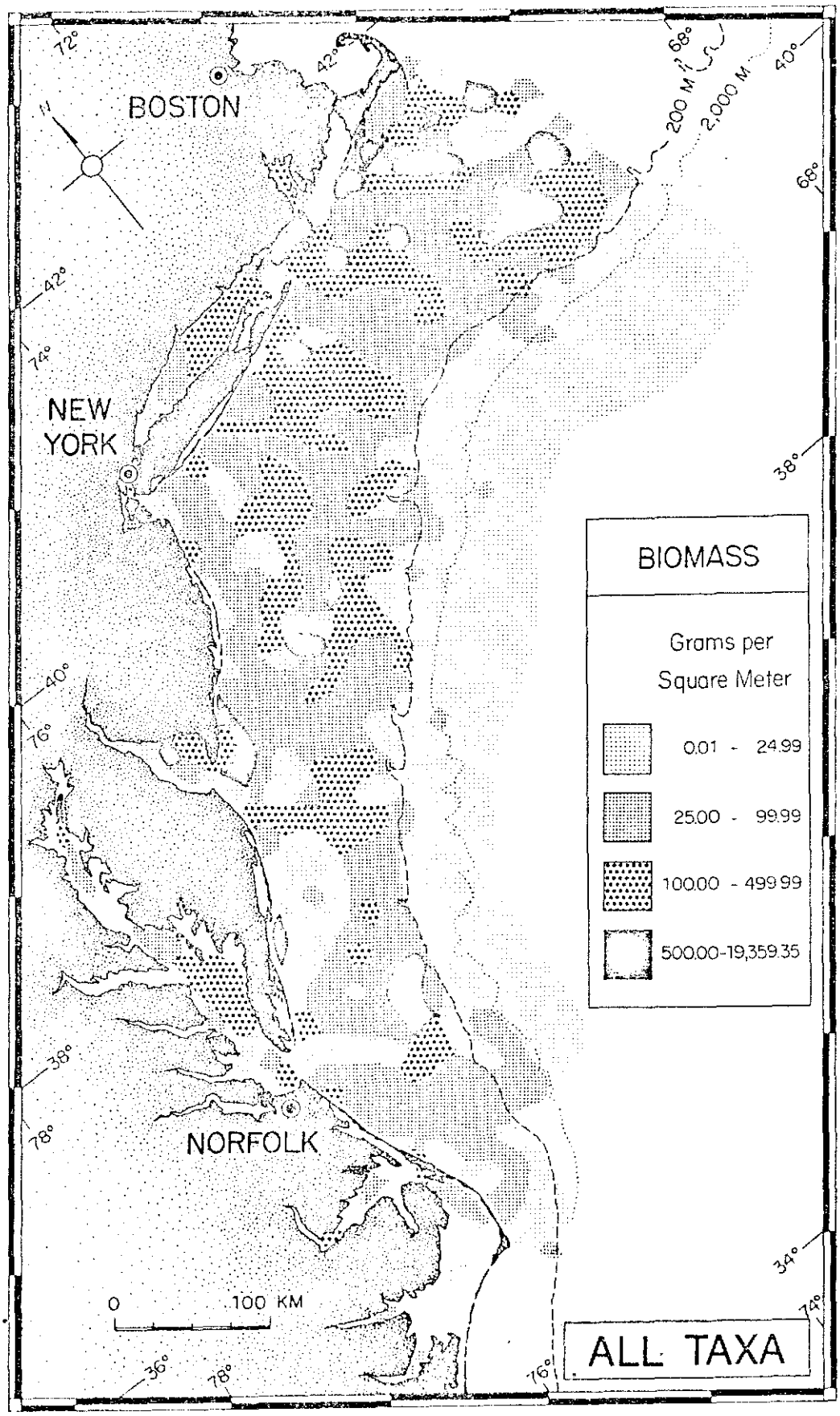


Figure 8.--Geographic distribution of the biomass of all taxonomic groups combined, expressed as damp weight per square meter of bottom.

north-south trends were clearly exhibited by this parameter. Throughout most of the Middle Atlantic Bight Region large biomasses (greater than 500 g/m^2) most commonly occurred along the inner continental shelf. Moderately large biomasses (100 to 500 g/m^2) were characteristic of central and offshore parts of the shelf, in addition to their presence inshore. 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 there were moderately extensive areas of large biomasses (greater than 500 g/m^2). Throughout much of the shelf region there were substantial expanses of moderately large biomasses (100 to 500 g/m^2). 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 there were rather extensive areas where small biomasses (less than 25 g/m^2) prevailed. As with density, there were no important north-south differences in biomass in offshore deepwaters--continental slope and rise.

Major Taxonomic Components

Porifera (figs. 9 and 10) occurred in small areas widely scattered throughout the Region. A large proportion were located on the outer shelf, slope, and rise. Densities were predominantly between 1 and 24/m^2. At four localities situated inshore and at mid-shelf their density ranged between 25 and 75/m^2. Biomass was generally small, less than 0.5 g/m^2. At nine localities their biomass ranged between 0.5 and 11.5 g/m^2.

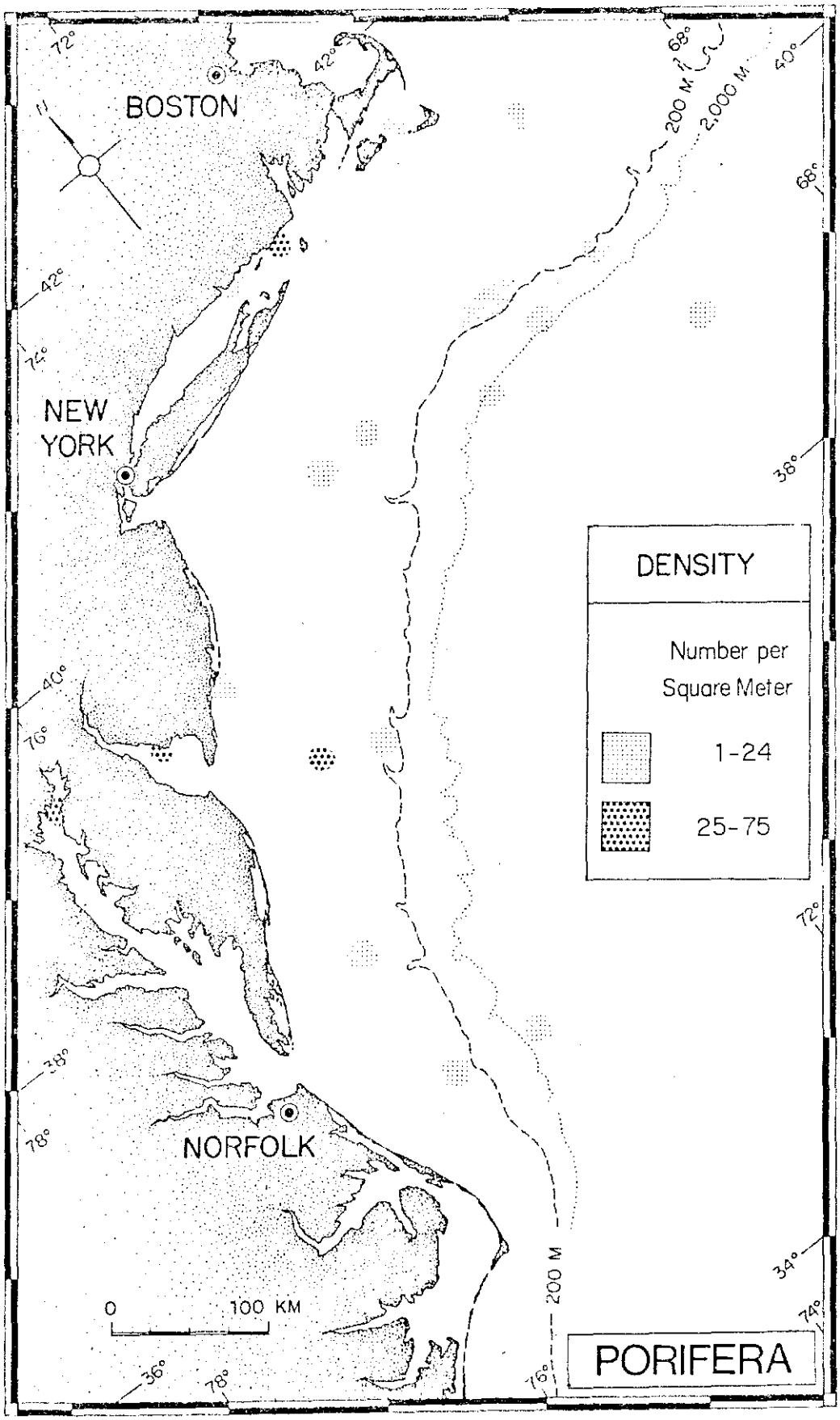


Figure 9.--Geographic distribution of the density of Porifera, expressed as number of individuals per square meter of bottom.

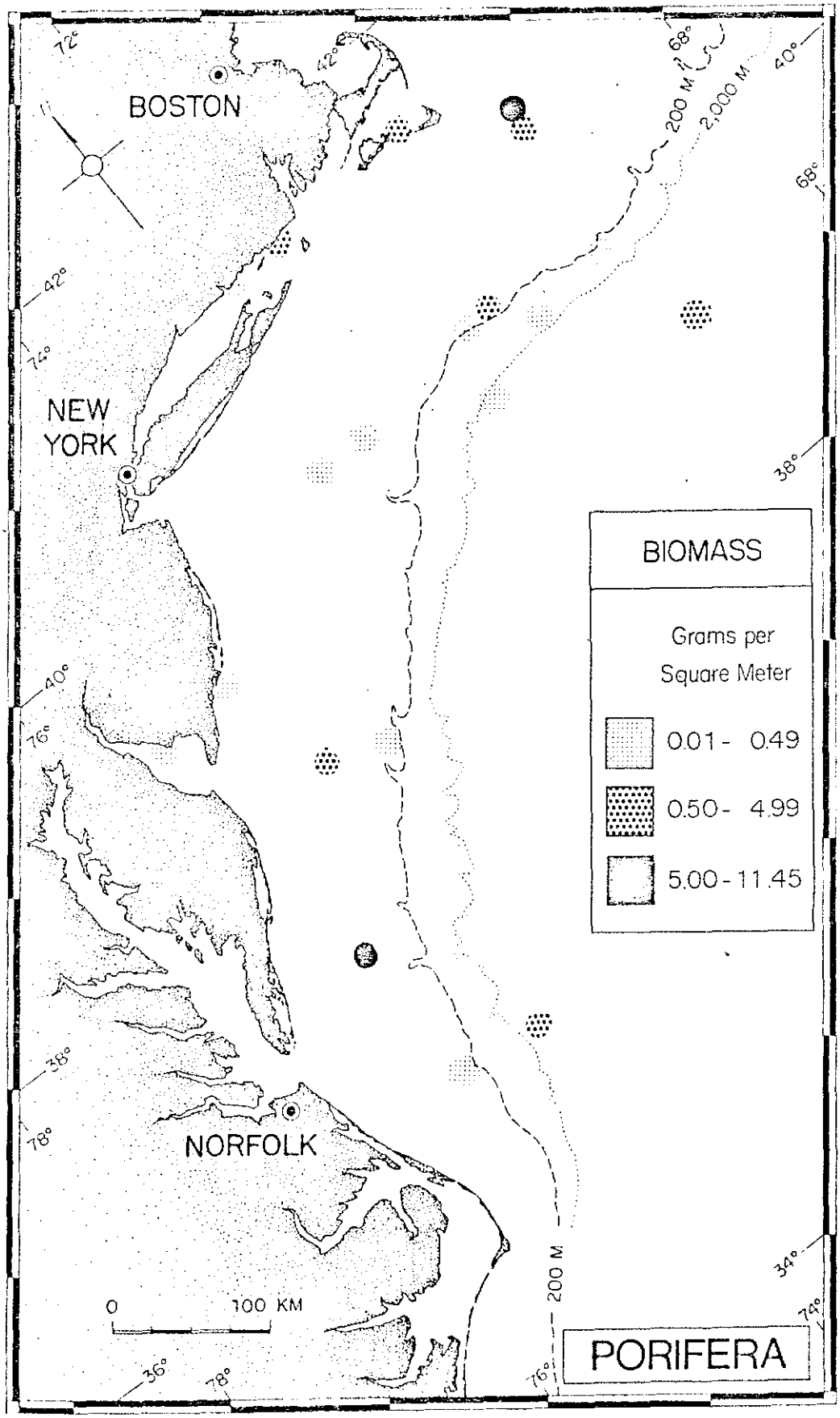


Figure 10.--Geographic distribution of the biomass of Porifera, expressed as damp weight per square meter of bottom.

Coelenterata (figs. 11 and 12) were broadly distributed 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 to 999/m^2) occurred in only a few small areas, and high densities (greater than 1,000/m^2) were rare. Biomass of coelenterates revealed a distribution pattern similar to density, except for the occurrence of moderate quantities (5 to 99 g/m^2) in rather extensive areas off southern New England. Biomasses of coelenterates throughout most of their range were less than 5 g/m^2.

Hydrozoa (figs. 13 and 14) exhibited 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 encountered in central or southern bays. In a few locations they occurred on the continental slope. Densities over most of their range averaged between 1 and 49/m^2. They were present in moderate to high densities (50 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 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, the 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 25/m^2) and were very low (less than 9/m^2) over much of

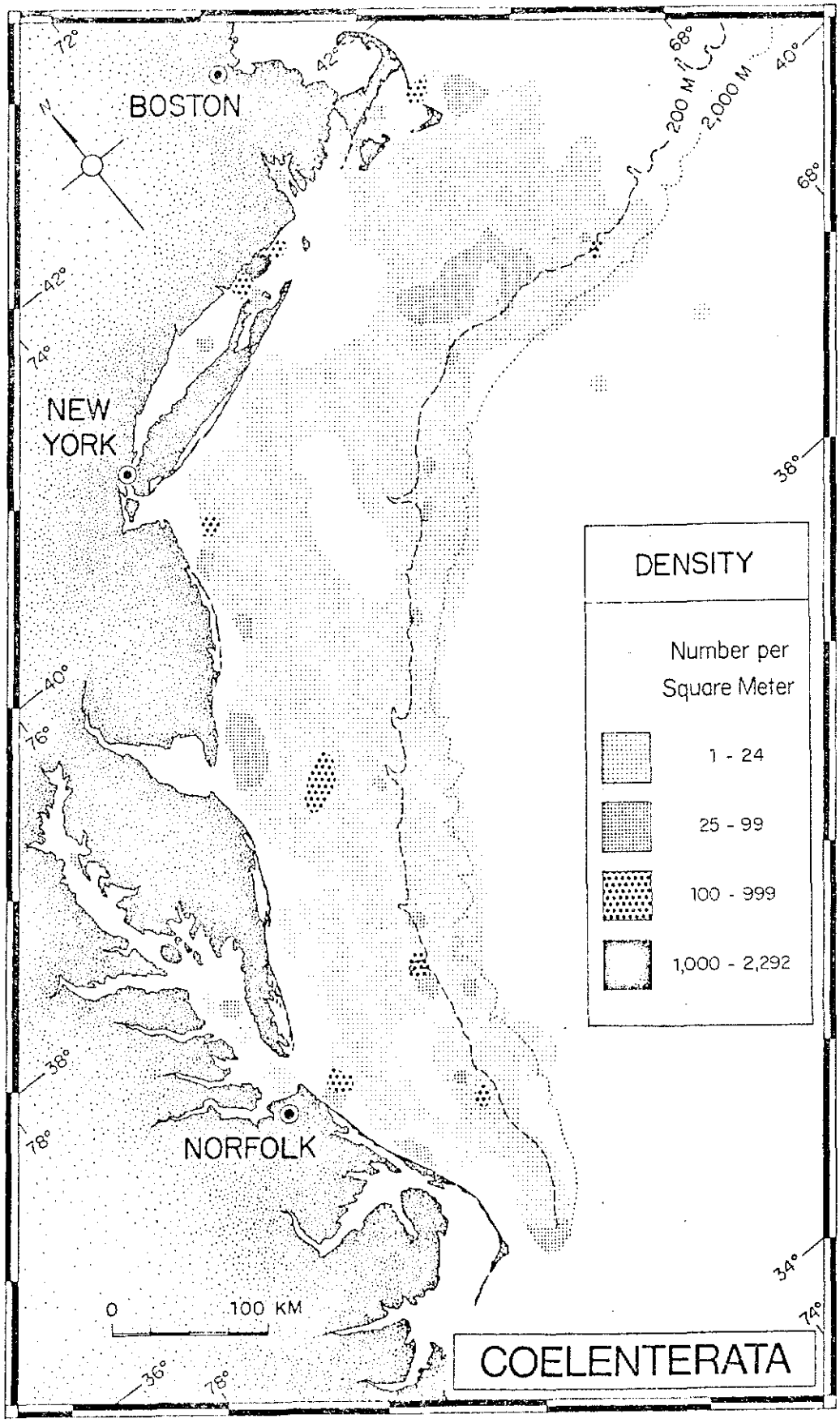


Figure 11.--Geographic distribution of the density of Coelenterata, expressed as number of individuals per square meter of bottom.

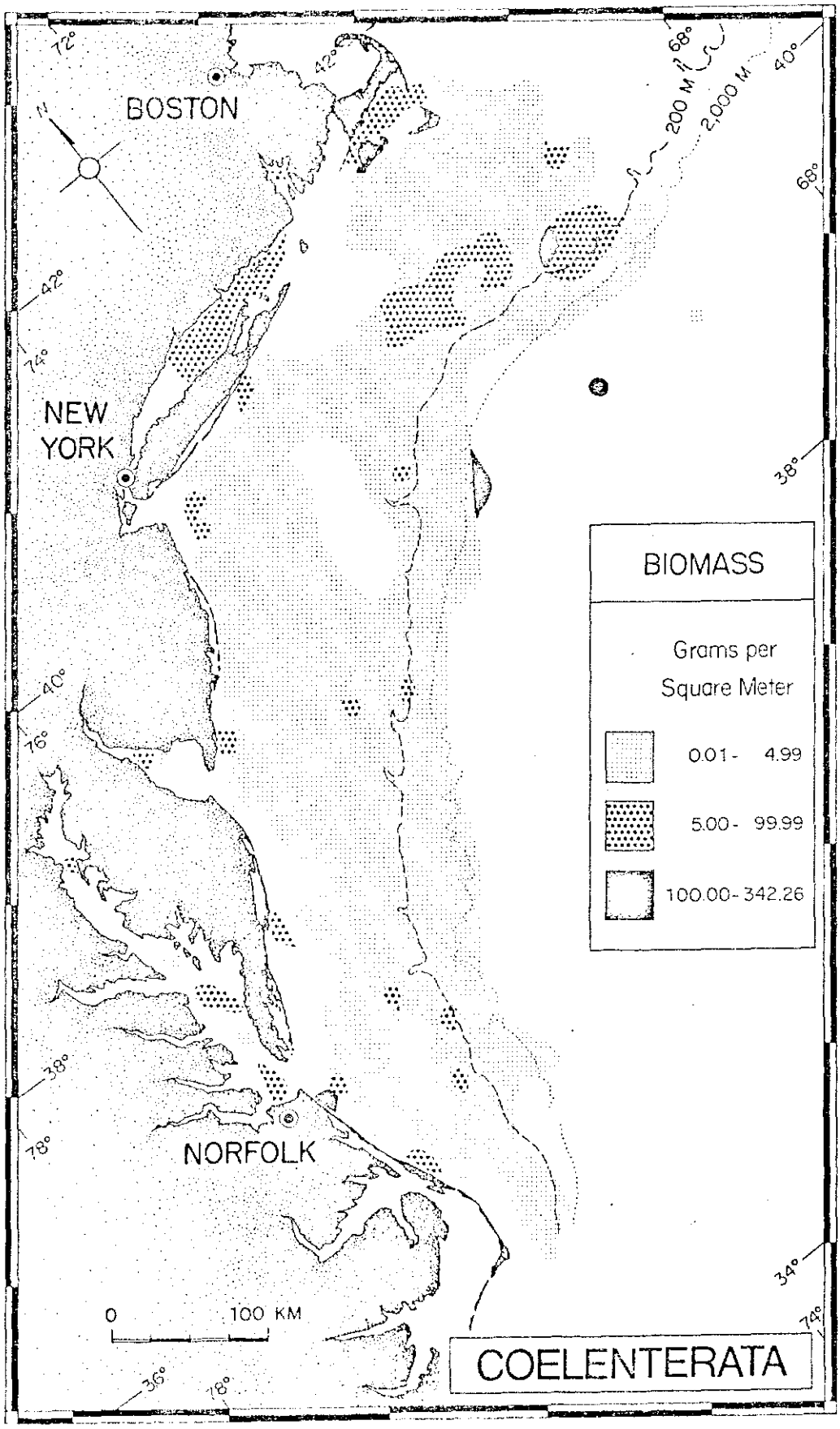


Figure 12.--Geographic distribution of the biomass of Coelenterata, expressed as damp weight per square meter of bottom.

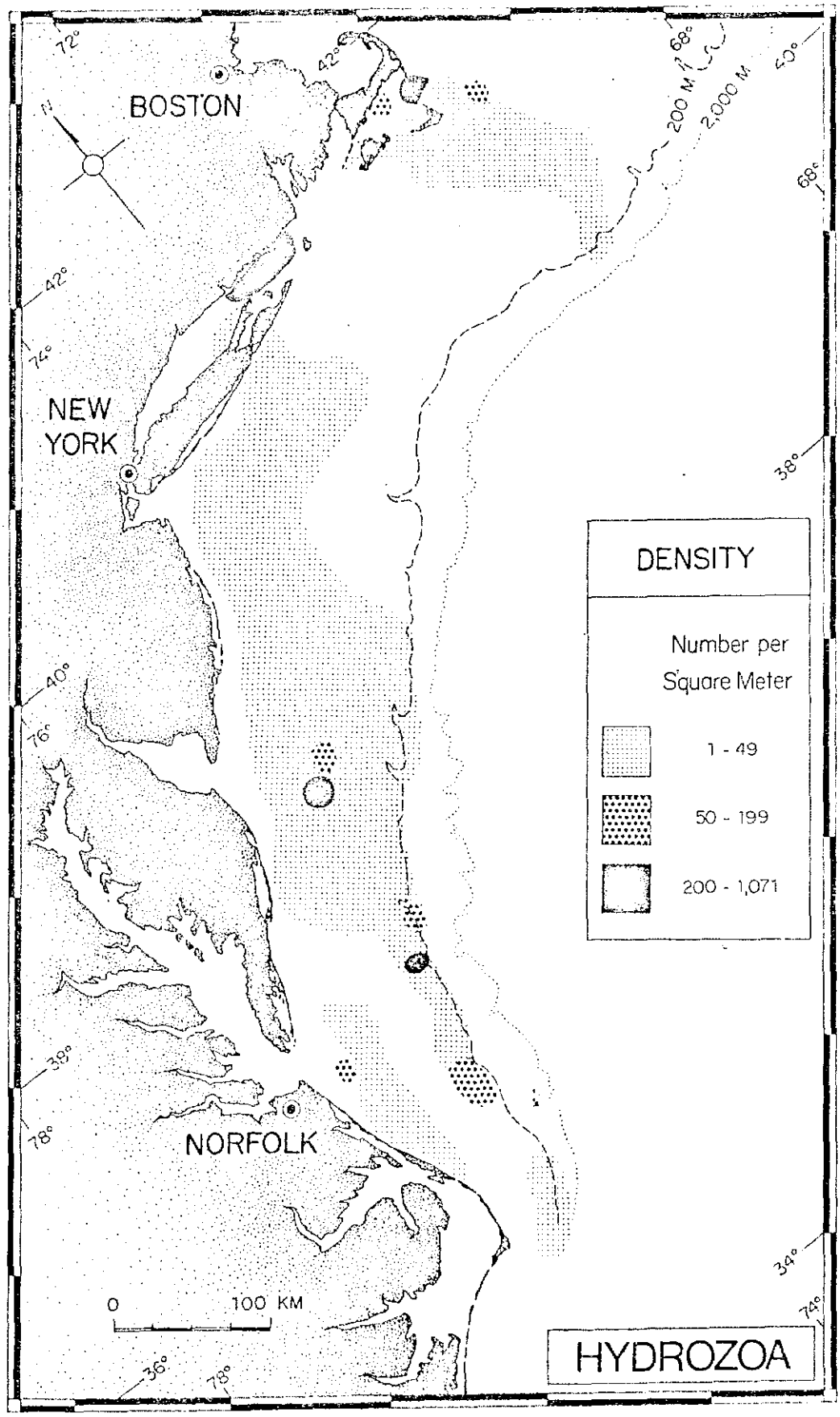


Figure 13.--Geographic distribution of the density of Hydrozoa, expressed as number of individuals per square meter of bottom.

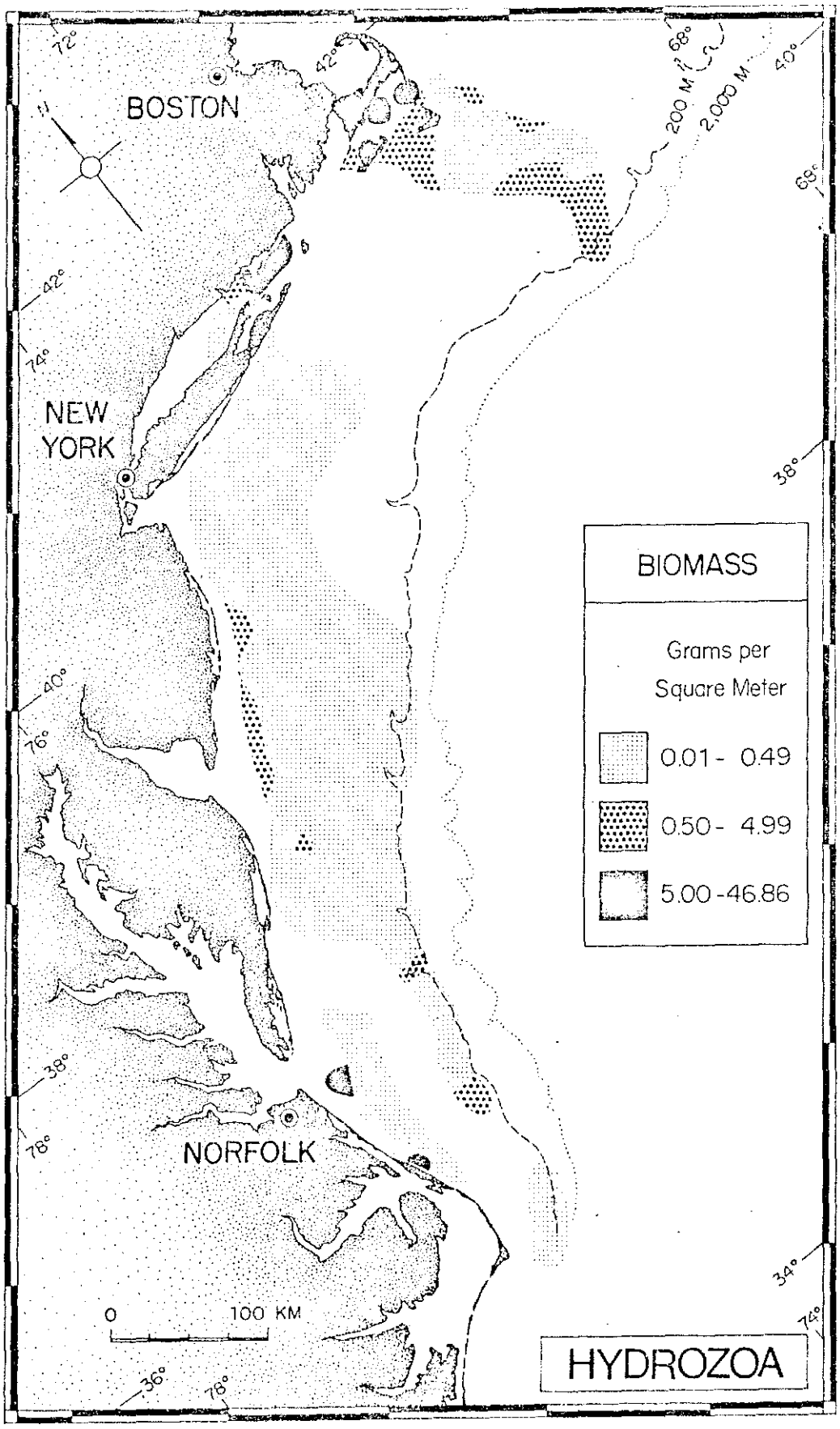


Figure 14.--Geographic distribution of the biomass of Hydrozoa, expressed as damp weight per square meter of bottom.

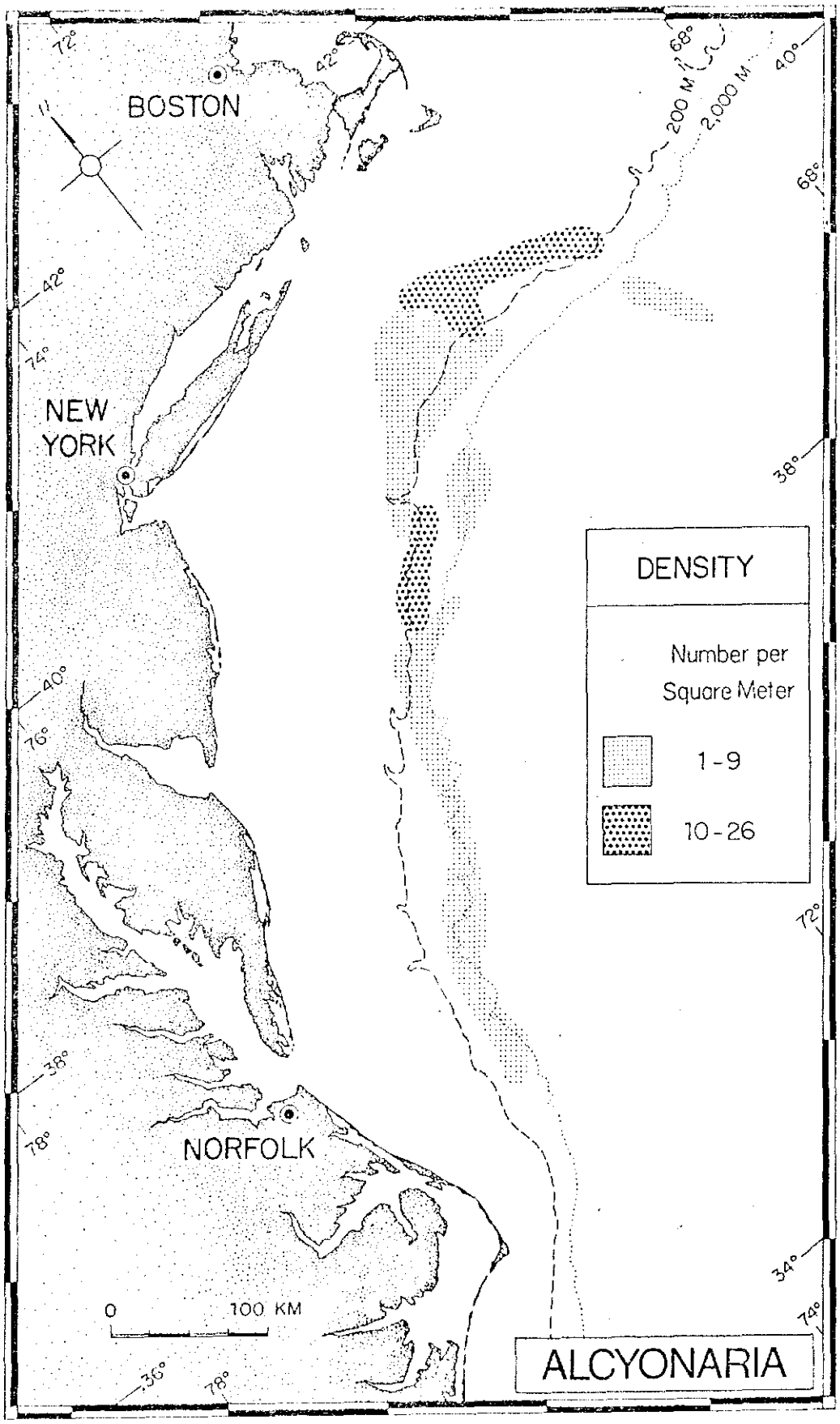


Figure 15.--Geographic distribution of the density of Alcyonaria, expressed as number of individuals per square meter of bottom.

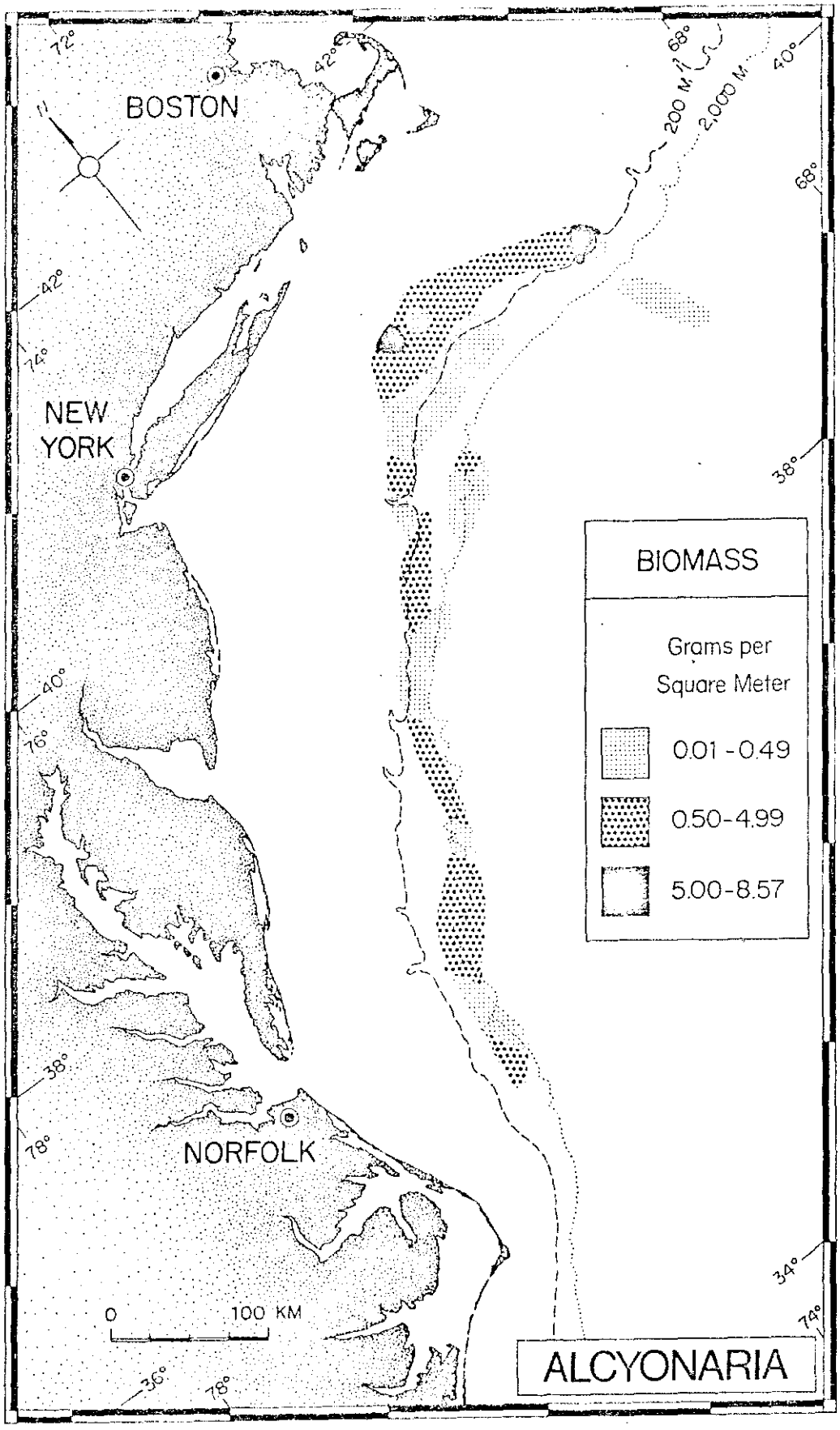


Figure 16.--Geographic distribution of the biomass of Alcyonaria, expressed as damp weight per square meter of bottom.

their range. Biomass was small to moderate over most of their range of occurrence (0.01 to 5 g/m^2) with two small areas south of Cape Cod containing 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 they occurred at densities of less than 25/m^2. For a rather large area on the outer shelf of Southern New England their density ranged between 25 and 99/m^2. They were present in only three small areas at densities greater than 100/m^2. Biomass in about half their area of occurrence was less than 1 g/m^2, and between 1 and 25 g/m^2 in the other half. A few relatively small areas, most of which were in coastal or inshore locations, had biomasses ranging between 25 and 342 g/m^2.

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/m^2) at all locations except one. Biomass was small (less than 0.5 g/m^2) throughout their range, except at two localities.

Nemertea (figs. 21 and 22) were very common and were distributed over a large proportion of the Middle Atlantic Bight Region. Their density, however, was generally low, between 1 and 24/m^2. At only a few places in bays and on the continental shelf south of Cape Cod did their density average between 25 and 235/m^2. Nemertea were absent from most sampling

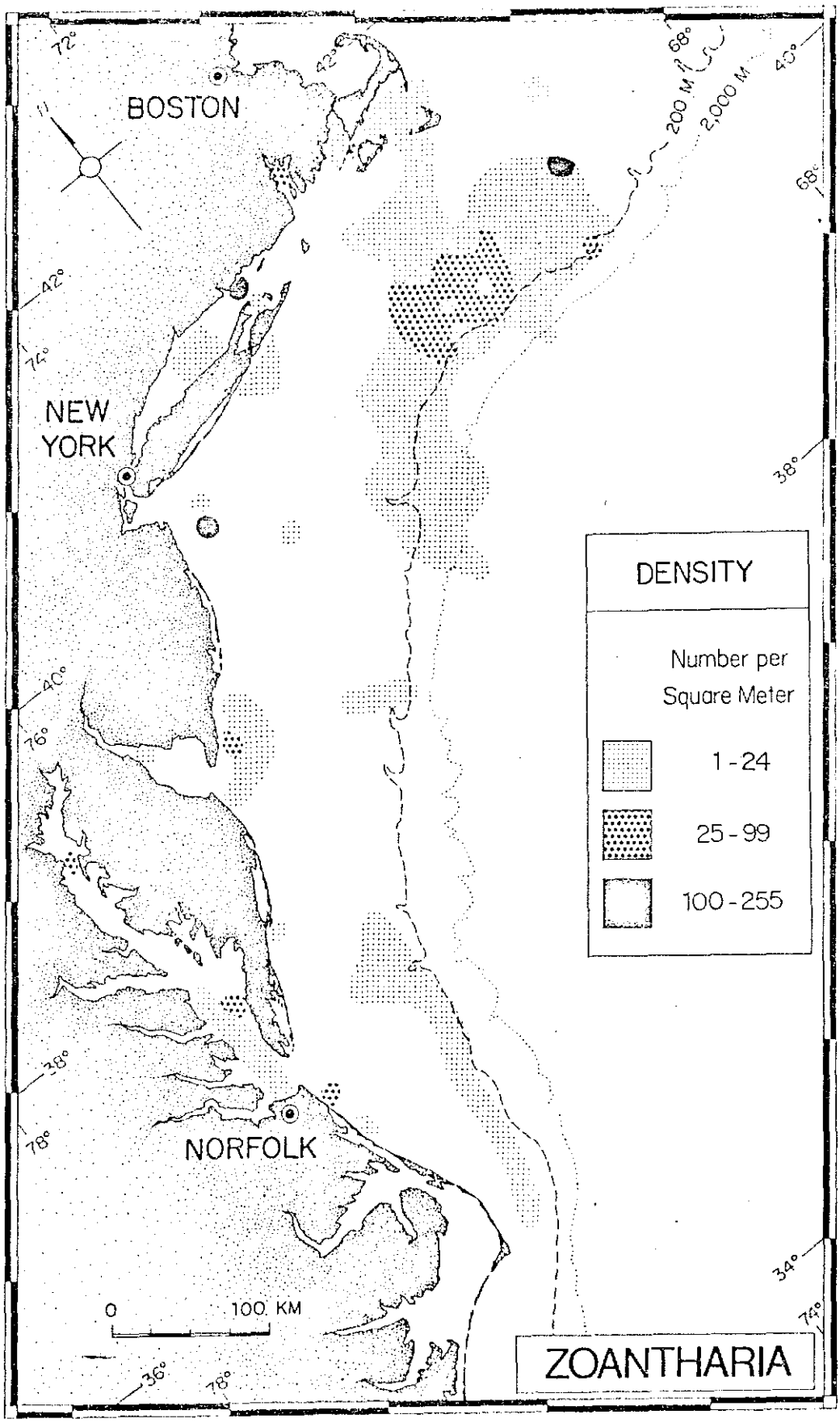


Figure 17.--Geographic distribution of the density of Zoantharia, expressed as number of individuals per square meter of bottom.

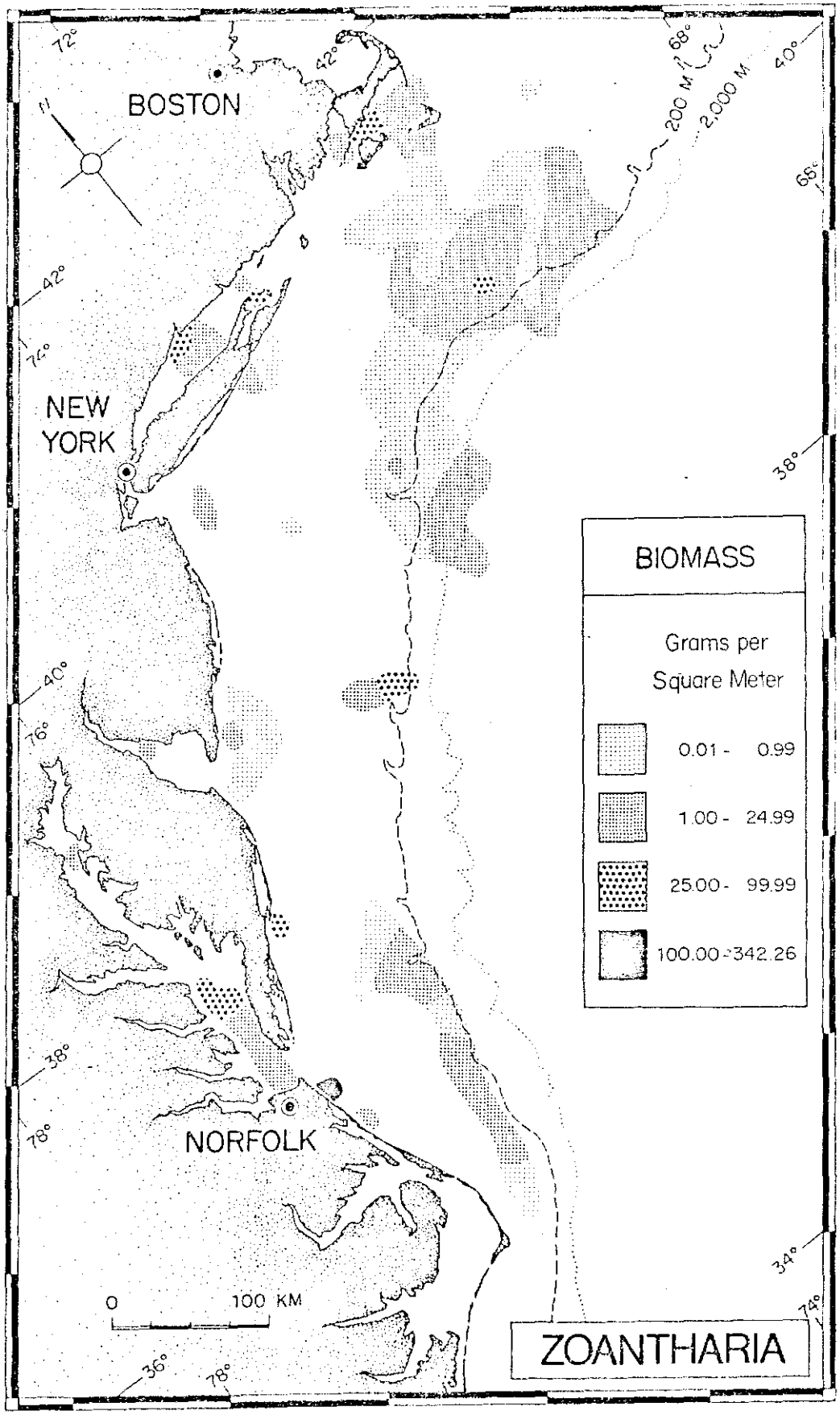


Figure 18.--Geographic distribution of the biomass of Zoantharia, expressed as damp weight per square meter of bottom.

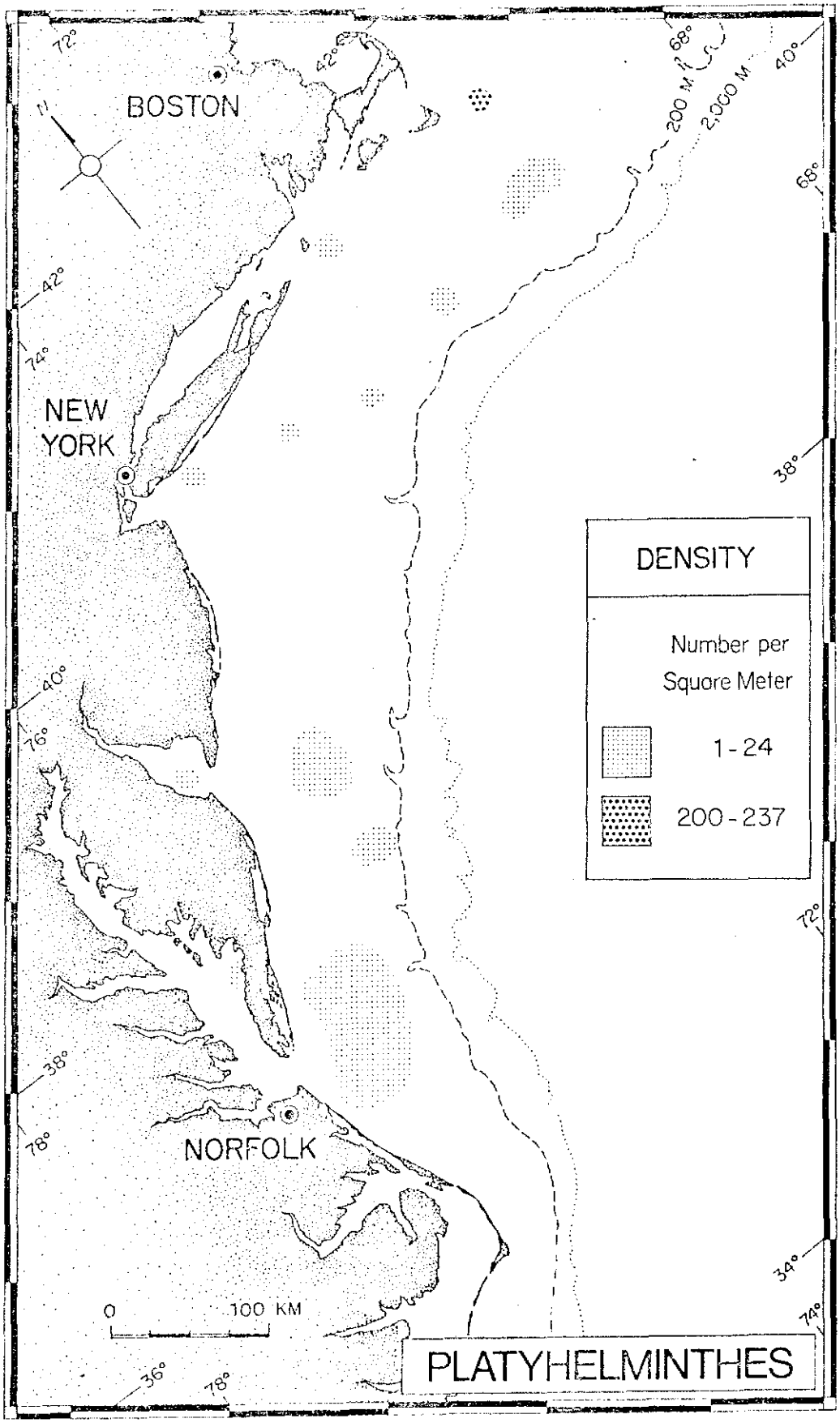


Figure 19.--Geographic distribution of the density of Platyhelminthes, expressed as number of individuals per square meter of bottom.

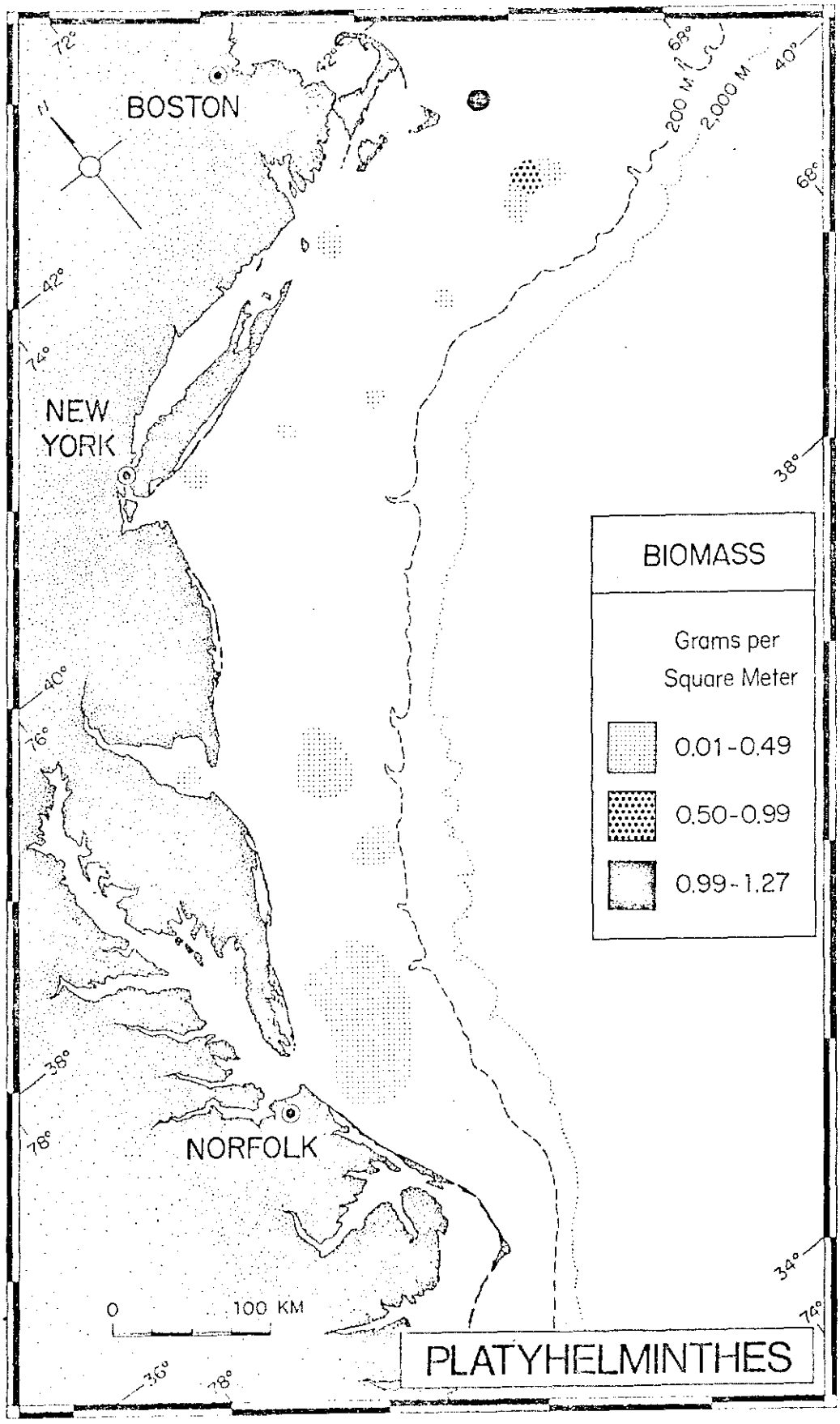


Figure 20.--Geographic distribution of the biomass of Platyhelminthes, expressed as damp weight per square meter of bottom.

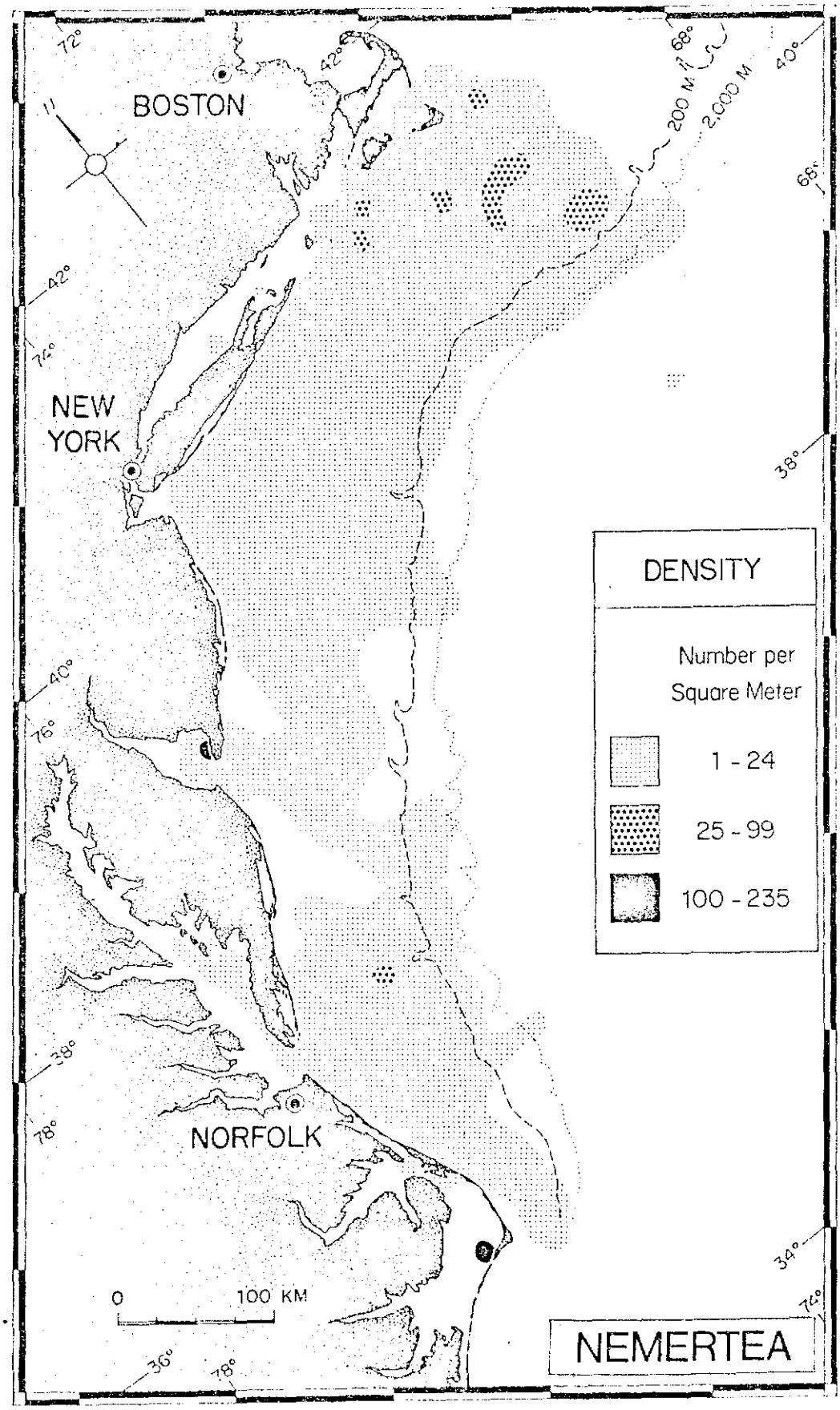


Figure 21.--Geographic distribution of the density of Nemertea, expressed as number of individuals per square meter of bottom.

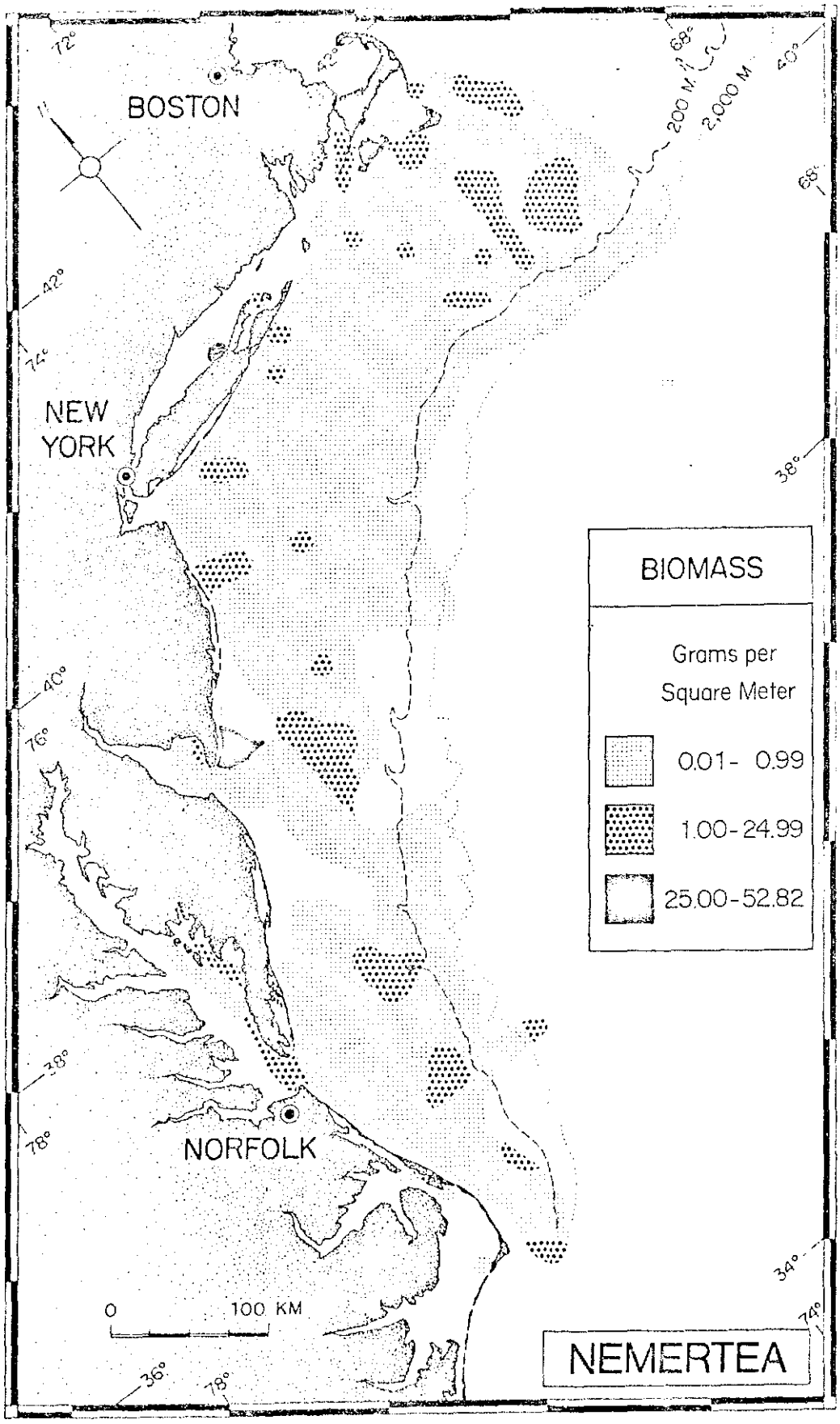


Figure 22.--Geographic distribution of the biomass of Nemertea, expressed as damp weight per square meter of bottom.

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 occurred their biomass was less than 1 g/m^2. Over a moderate proportion of their range, estimated at about ten percent, their biomass ranged between 1 and 25 g/m^2. At only two localities was their biomass greater than 25 g/m^2.

Nematoda (figs. 23 and 24) occurred 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 to 24/m^2. Moderate densities (25 to 627/m^2) were encountered in a few localities mainly on the continental shelf south of Cape Cod. Biomass was very small, less than 0.2 g/m^2 in most localities, and between 0.2 and 0.4 g/m^2 in one area located in the Chesapeake Bight subarea.

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 to 1,999/m^2) occurred on the shelf south of Massachusetts. Moderate densities prevailed in the New York Bight subarea, and low densities (less than 25/m^2) were encountered 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 portion of the continental shelf, extending from Long Island, New York, southward to Cape Hatteras, the biomass of Annelida ranged between 1 and 25 g/m^2. Off southern Massachusetts a large expanse contained between 25 and 200 g/m^2. Low biomasses (less than 1 g/m^2) were characteristic of the continental rise.

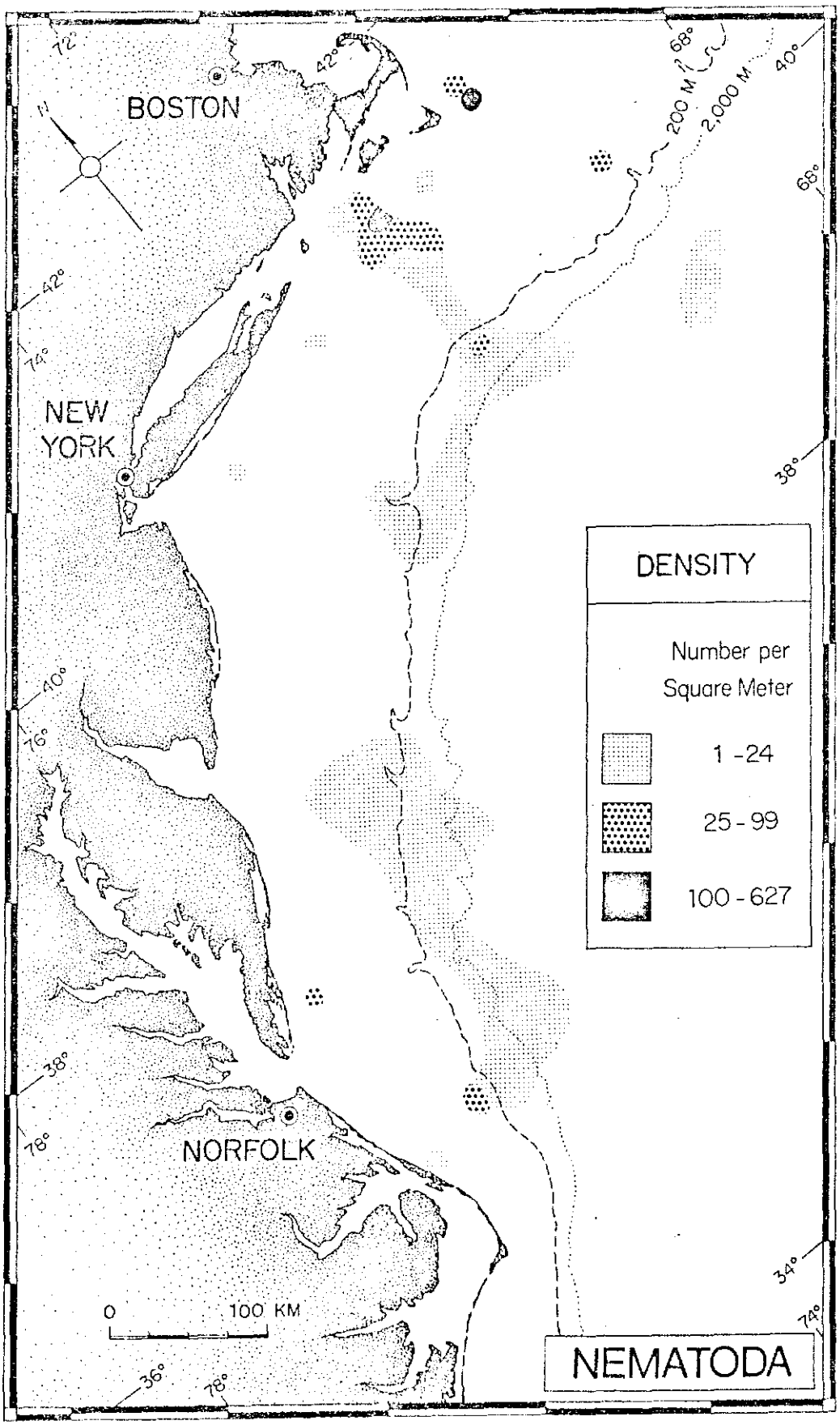


Figure 23.--Geographic distribution of the density of Nematoda, expressed as number of individuals per square meter of bottom.

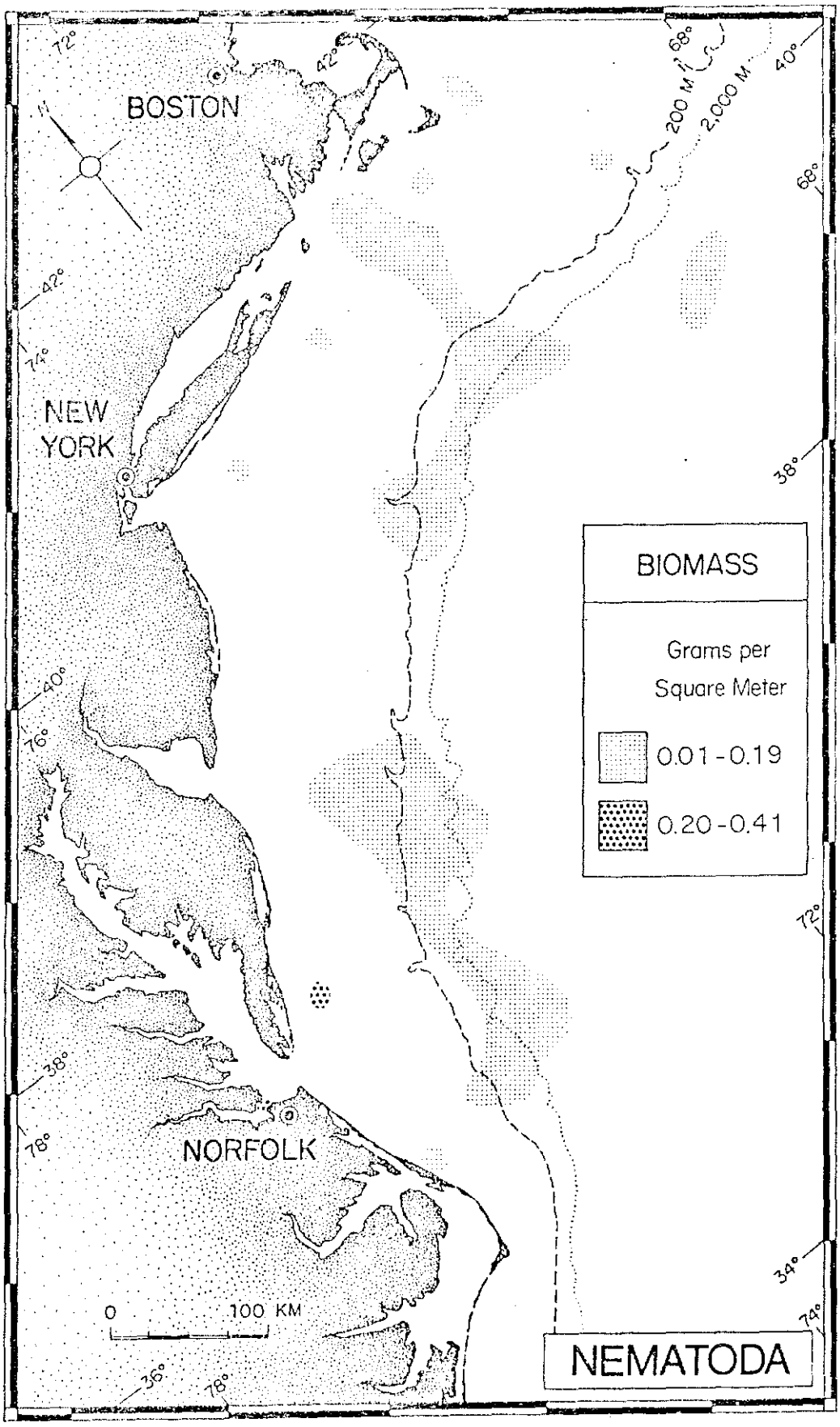


Figure 24.--Geographic distribution of the biomass of Nematoda, expressed as damp weight per square meter of bottom.

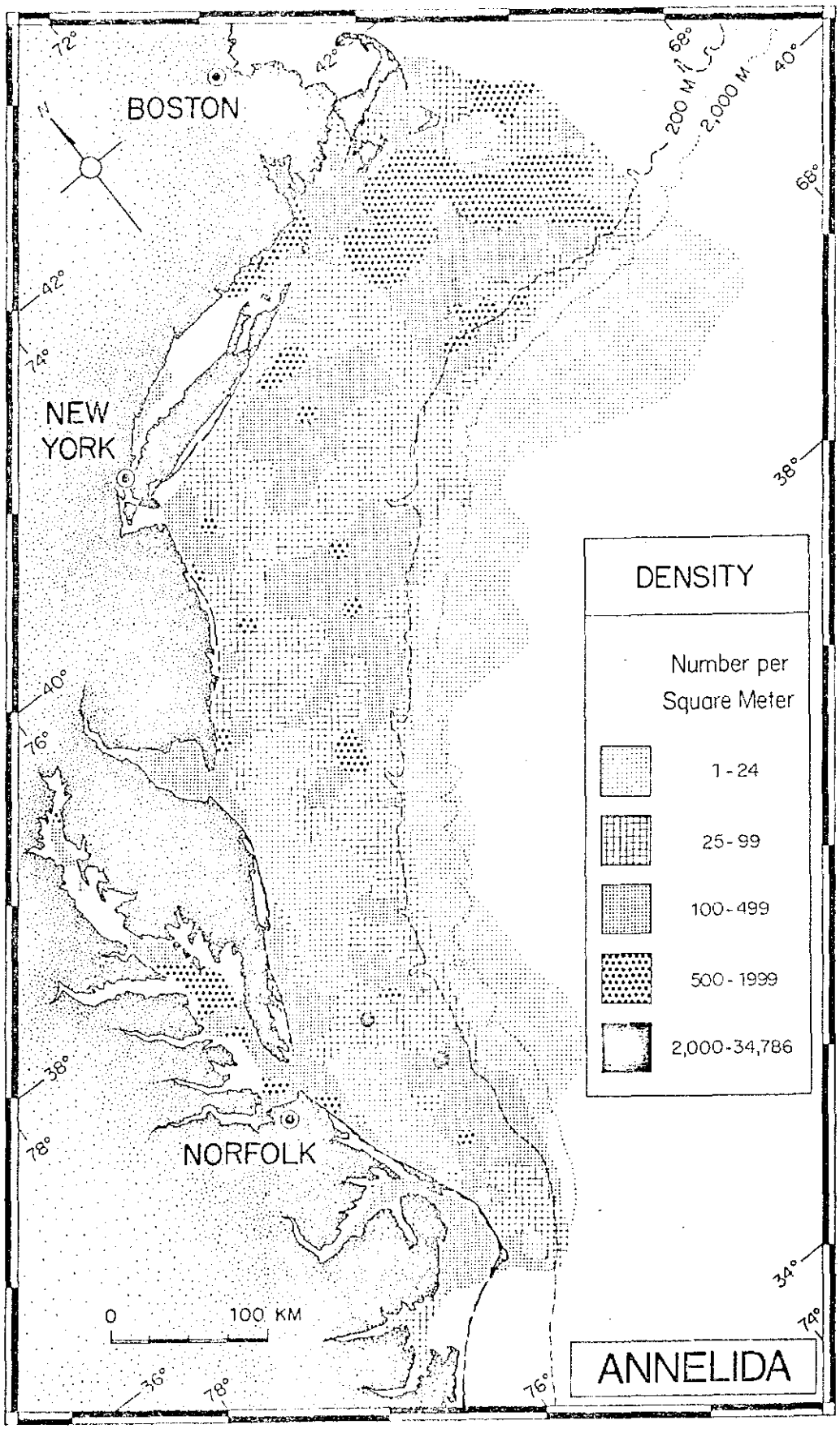


Figure 25.--Geographic distribution of the density of Annelida, expressed as number of individuals per square meter of bottom.

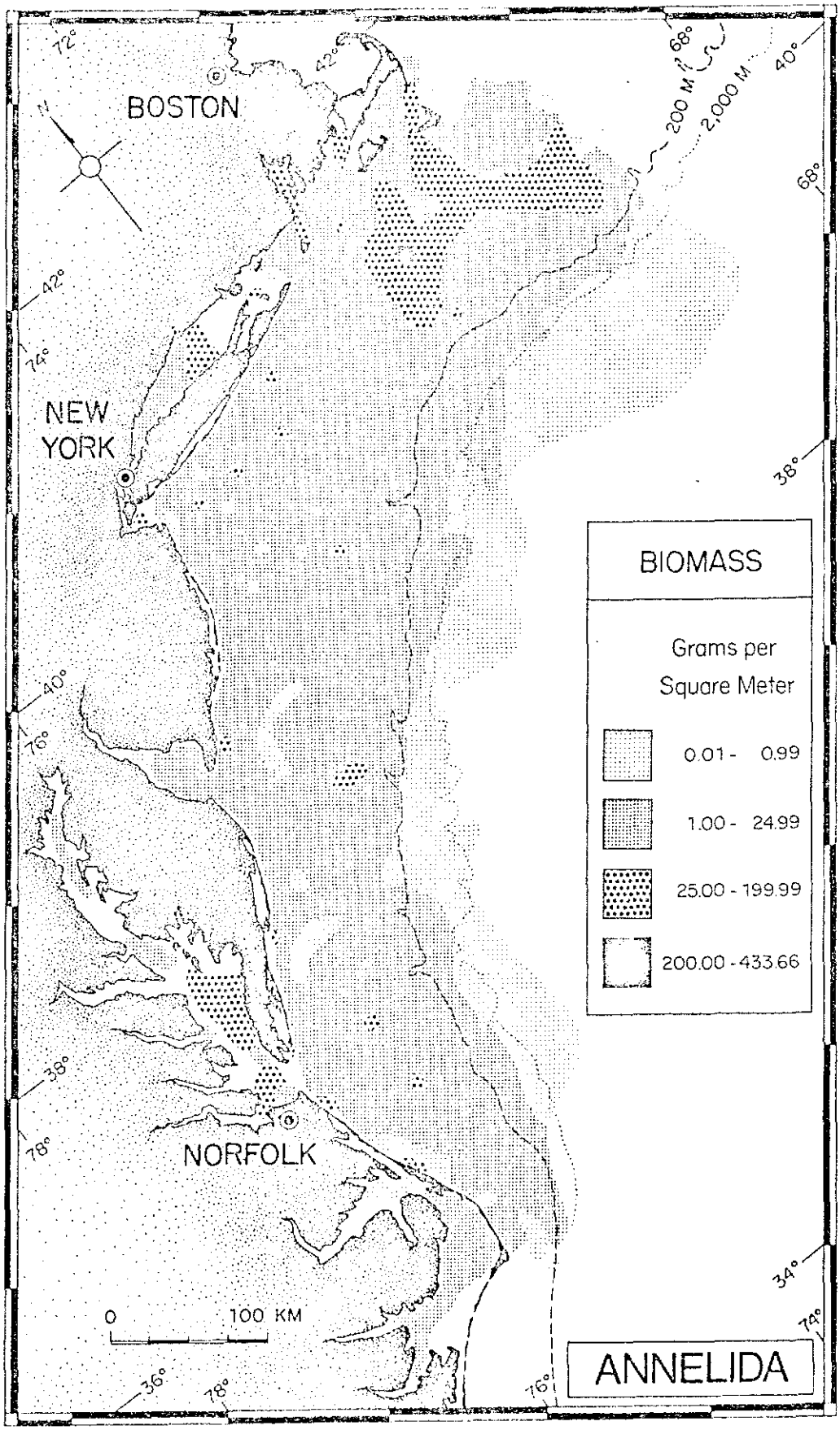


Figure 26.--Geographic distribution of the biomass of Annelida, expressed as damp weight per square meter of bottom.

Pogonophora (figs. 27 and 28) were present throughout the entire deep-water area between Cape Cod and Cape Hatteras. Their primary area of occurrence was on the continental slope and rise, plus several localities on the outer continental shelf. They were present in rather low densities (to 24/m^2), throughout most of their area of occurrence. Moderate densities (25 to 99/m^2) occurred in several localized areas along the continental slope. In only one locality were densities high (100 to 335/m^2). Biomass was small, less than 0.5 g/m^2, in all localities except two, where their biomass ranged between 0.5 and 2.9 g/m^2.

Sipuncula [=Sipunculida] (figs. 29 and 30) occurred over a wide geographic area, extending from the Cape Cod region southward to Cape Hatteras. Their occurrence was centered primarily on the continental shelf and slope, with moderate occurrences on the continental rise but only limited occurrences in the bays and sounds. In the northern sector they occurred 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/m^2 throughout most of their range, but in several localities in the northern shelf area their density ranged between 25 and 99/m^2. At only one location, a northern inshore area off Rhode Island, did they occur in high density (100 and 311/m^2). Biomass over roughly half their area of occurrence was less than 1 g/m^2. At somewhat less than half their area of occurrence the biomass ranged between 1 and 24 g/m^2. They constituted a large biomass (25 to 85 g/m^2) in only two areas, both on the continental slope and rise.

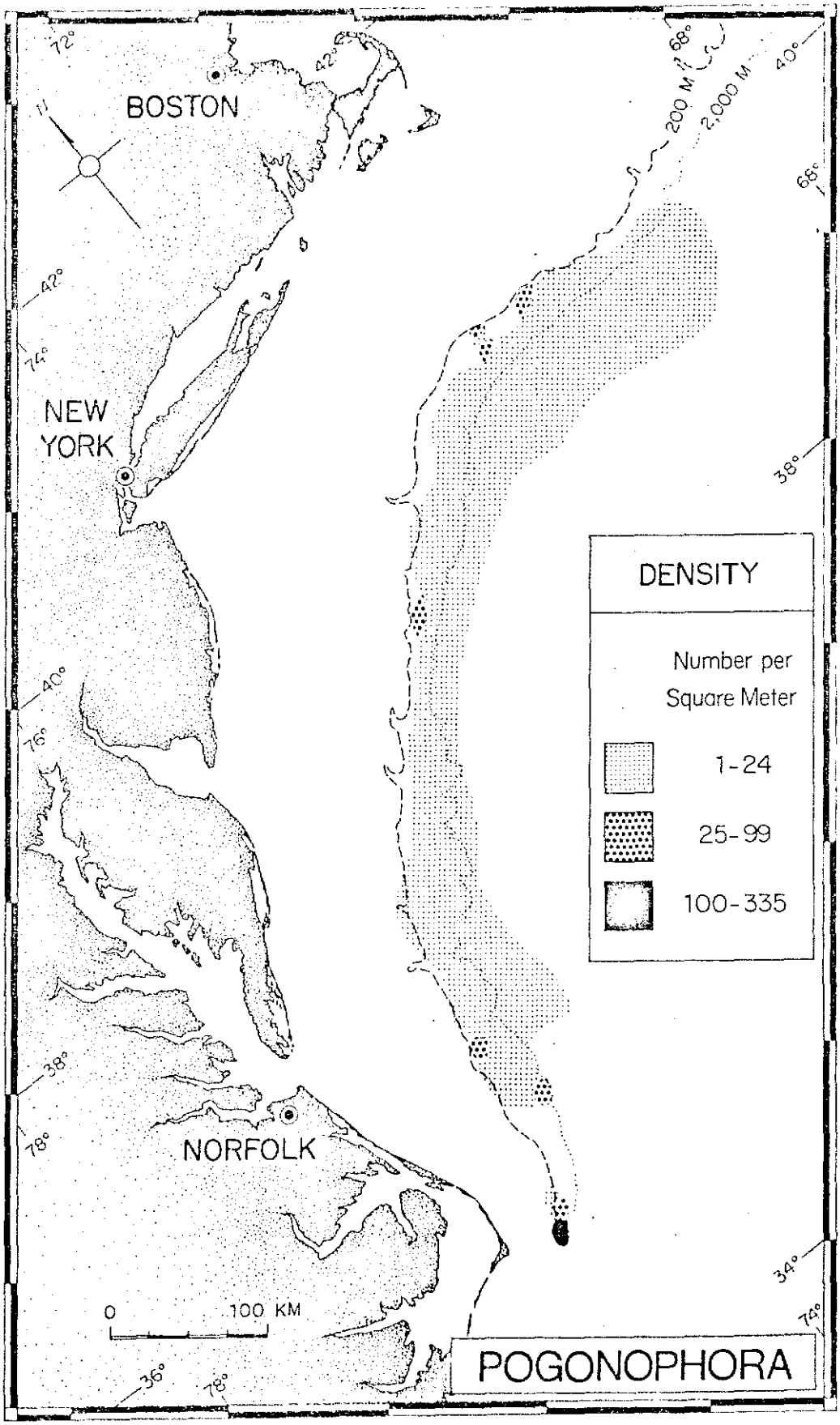


Figure 27.--Geographic distribution of the density of Pogonophora, expressed as number of individuals per square meter of bottom.

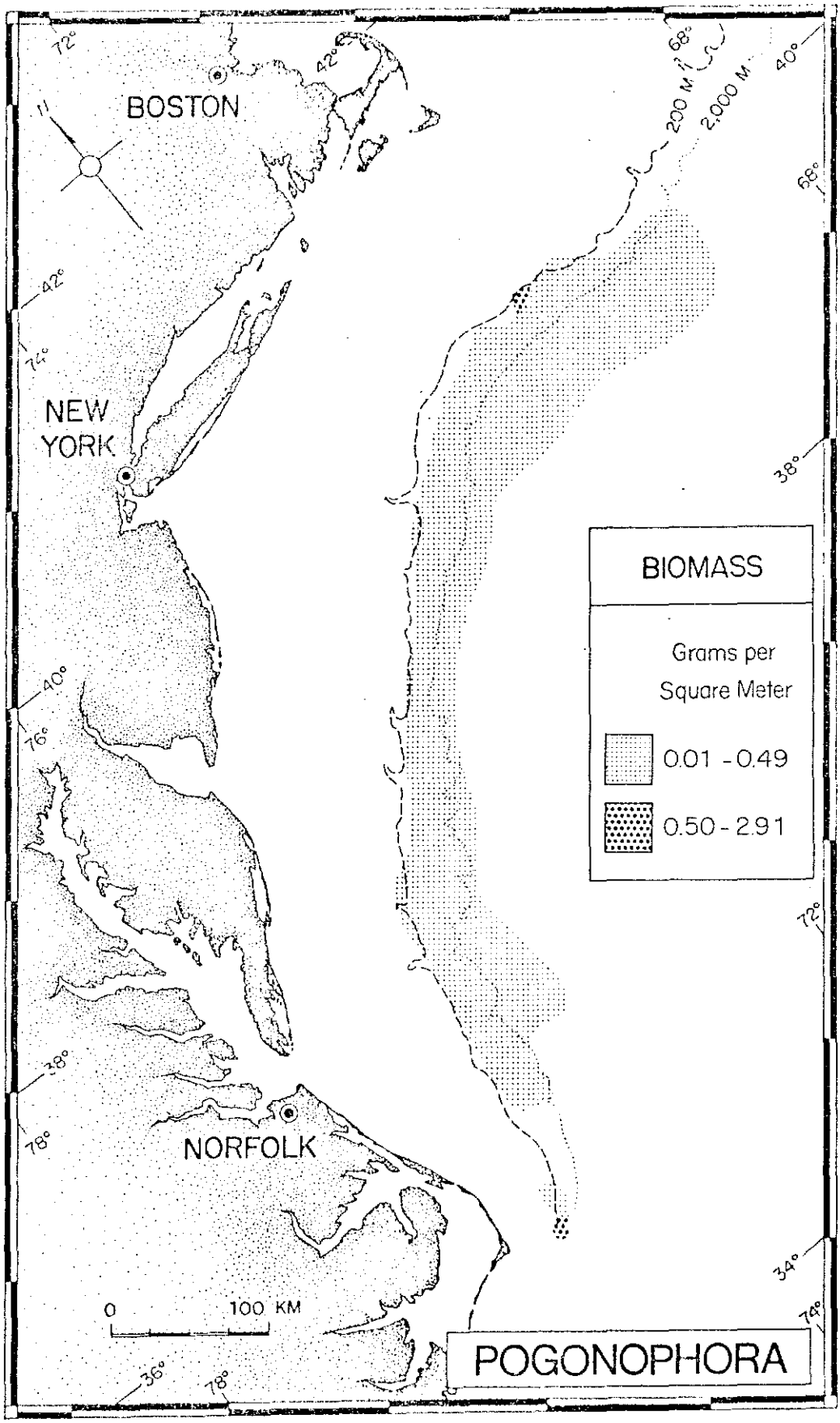


Figure 28.--Geographic distribution of the biomass of Pogonophora, expressed as damp weight per square meter of bottom.

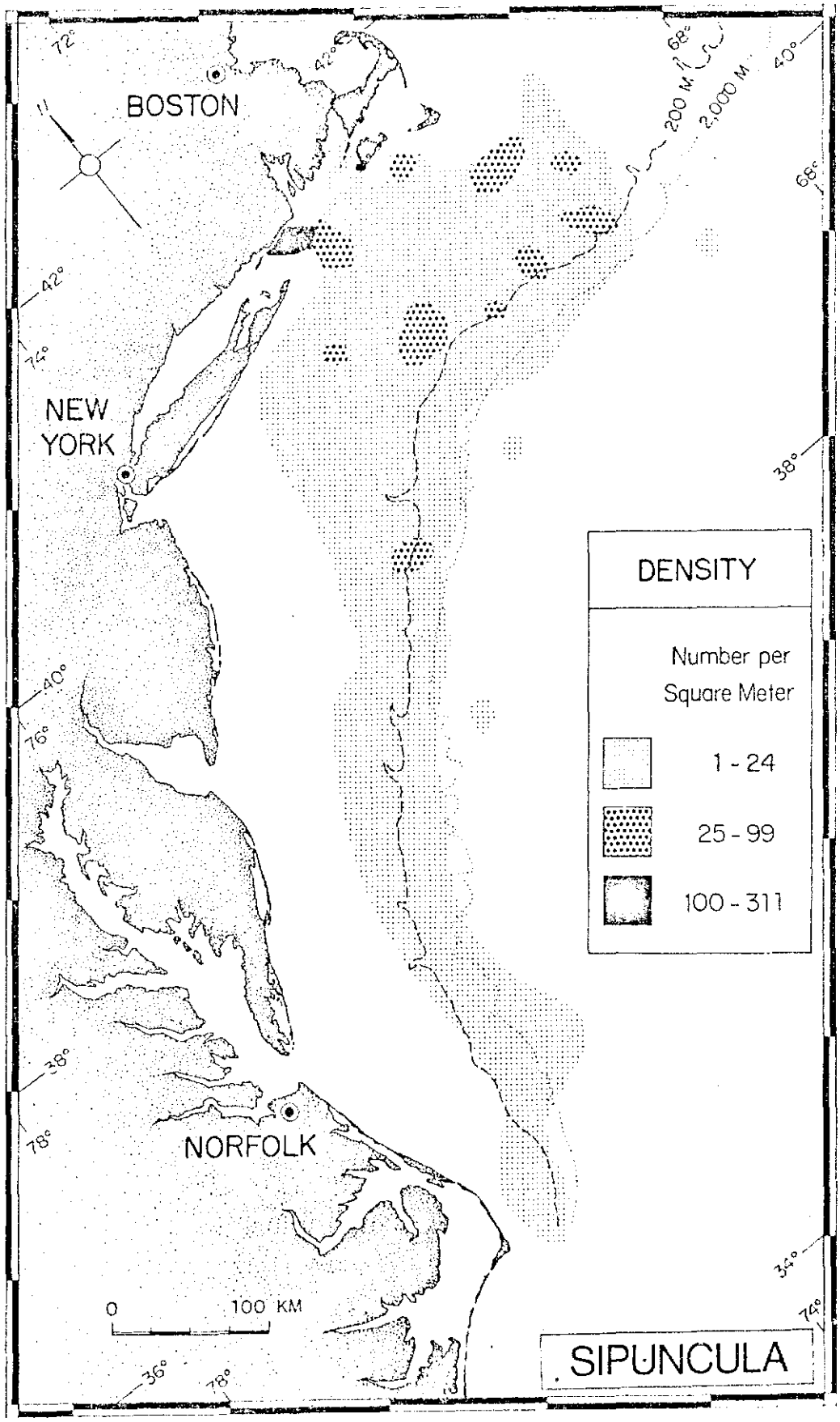


Figure 29.--Geographic distribution of the density of Sipuncula, expressed as number of individuals per square meter of bottom.

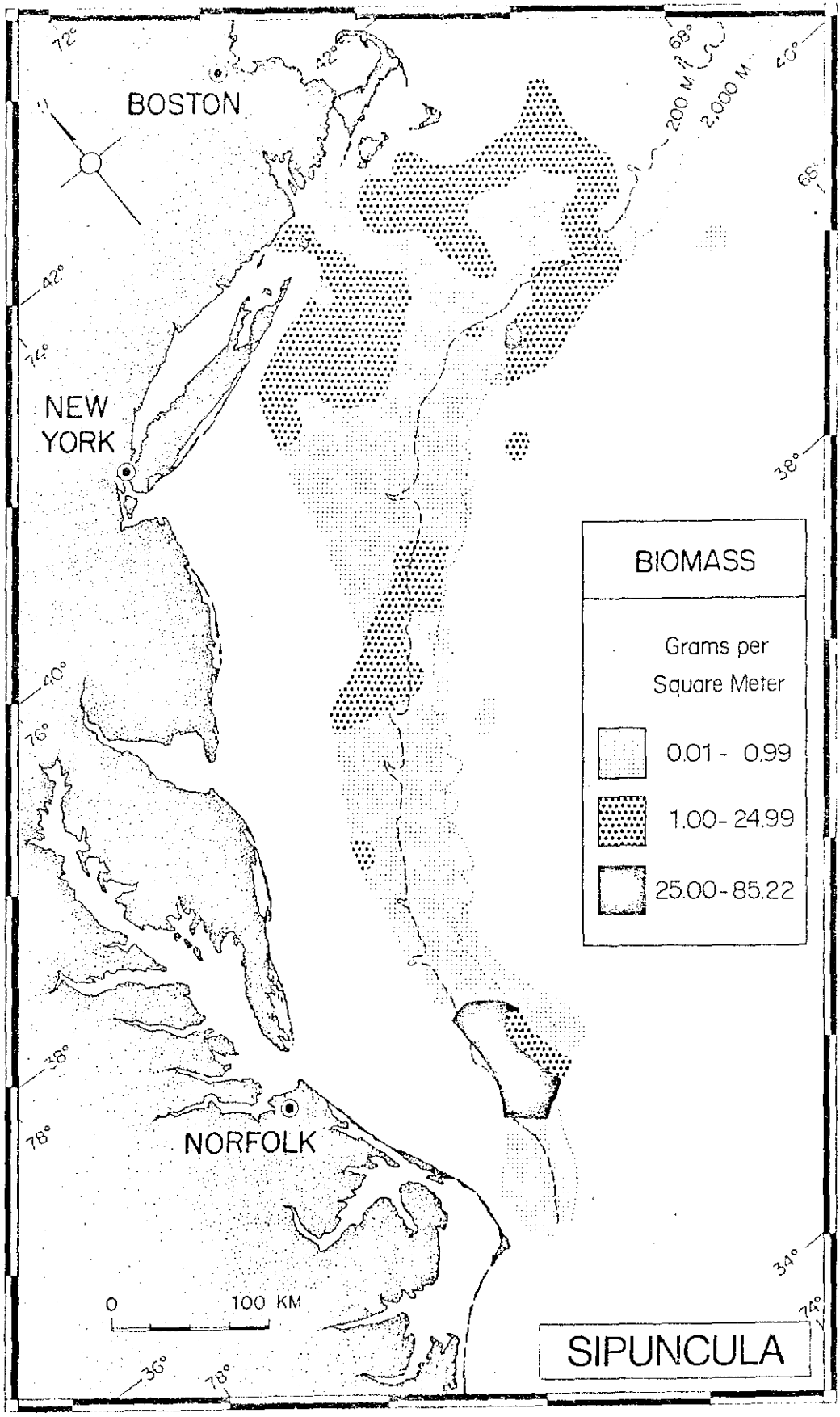


Figure 30.--Geographic distribution of the biomass of Sipuncula, expressed as damp weight per square meter of bottom.

Echiura (figs. 31 and 32) were sparsely distributed in the Region and occurred most commonly on the continental rise. One small patch occurred on the mid-continental shelf off Delaware 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 to 21/m^2 and biomass ranged from a low of 0.01 g/m^2 to a high of 27 g/m^2.

Priapulida (figs. 31 and 32) were found only at two localities on the continental slope and one on the continental rise. Quantities were very low at all localities.

Mollusca (figs. 33 and 34) occurred at virtually all sampling stations in the Middle Atlantic Bight Region, thus their geographical distribution was exceptionally broad. Density ranged up to over 58,000/m^2. From an overall view, there were four density bands extending north to south roughly parallel to the coast throughout most of the Region. The first band was located in the bays and sounds and includes the entire continental shelf. This is a high-density (large areas with densities greater than 50/m^2) band. The second band, parallel to the first, occupied the approximate middle of the continental shelf; this was a low-density (mostly less than 50/m^2) band. The third band was located along the outer continental shelf and upper slope. This was a high density (mostly greater than 50/m^2) band with a broad northern end. The fourth band, located along the lower continental slope and continental rise, was a low-density (fewer than 50/m^2) band. Biomass of mollusks ranged up to more than 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 biomass of mollusks was typically less than 5 g/m^2, except in some inner shelf areas and along the shelf break.

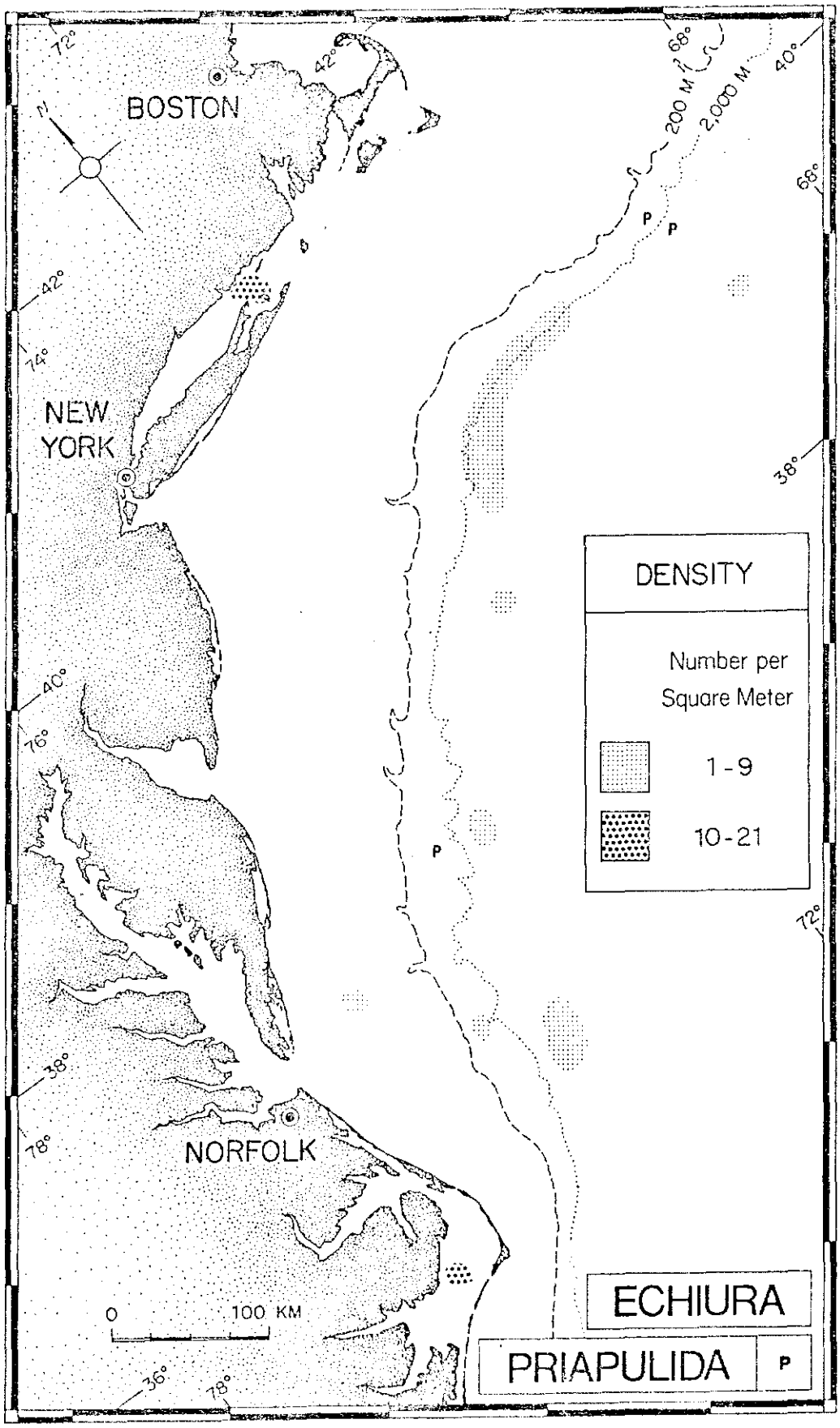


Figure 31.--Geographic distribution of the density of Echiura and Priapulida, expressed as number of individuals per square meter of bottom.

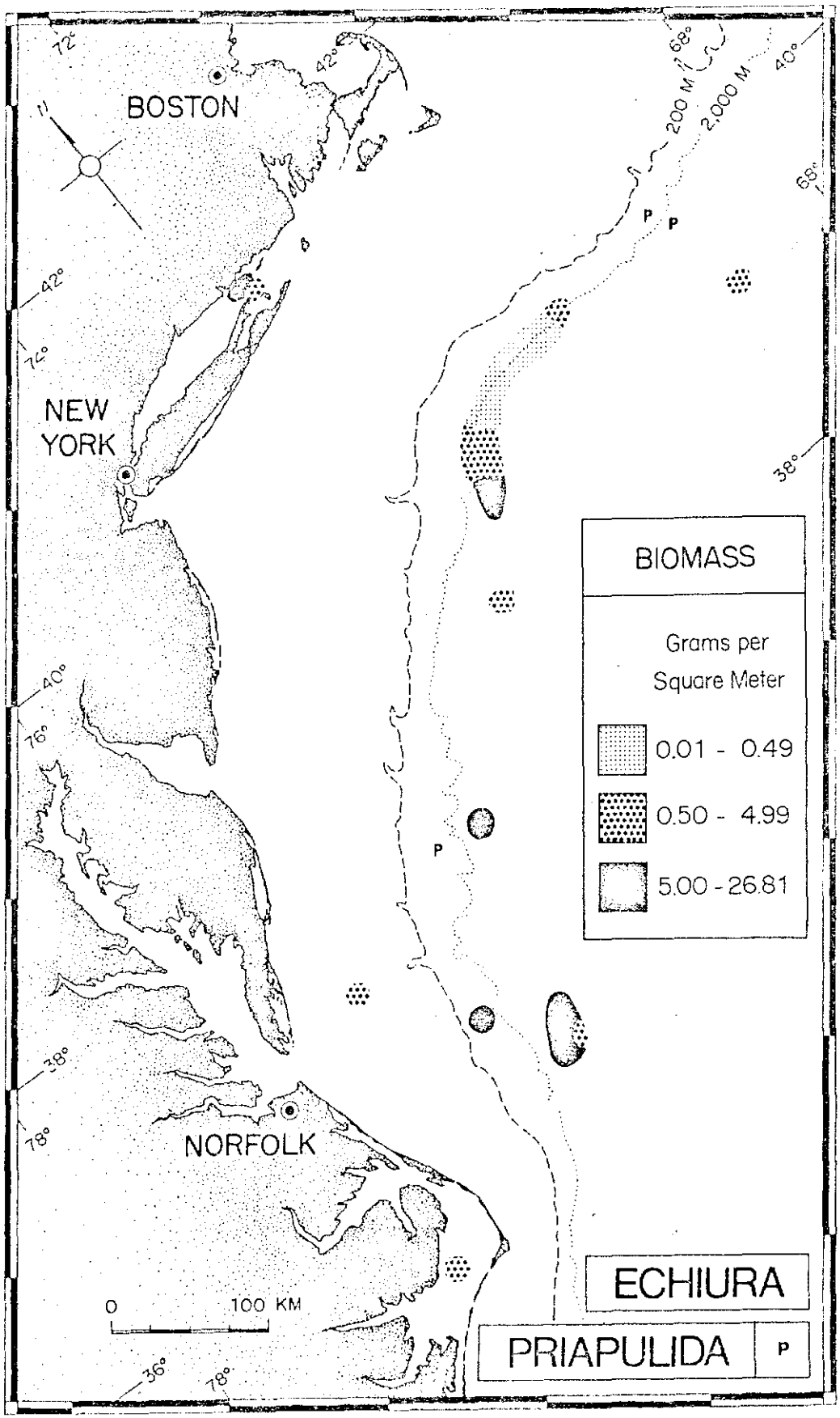


Figure 32.--Geographic distribution of the biomass of Echiura and Priapulida, expressed as damp weight per square meter of bottom.

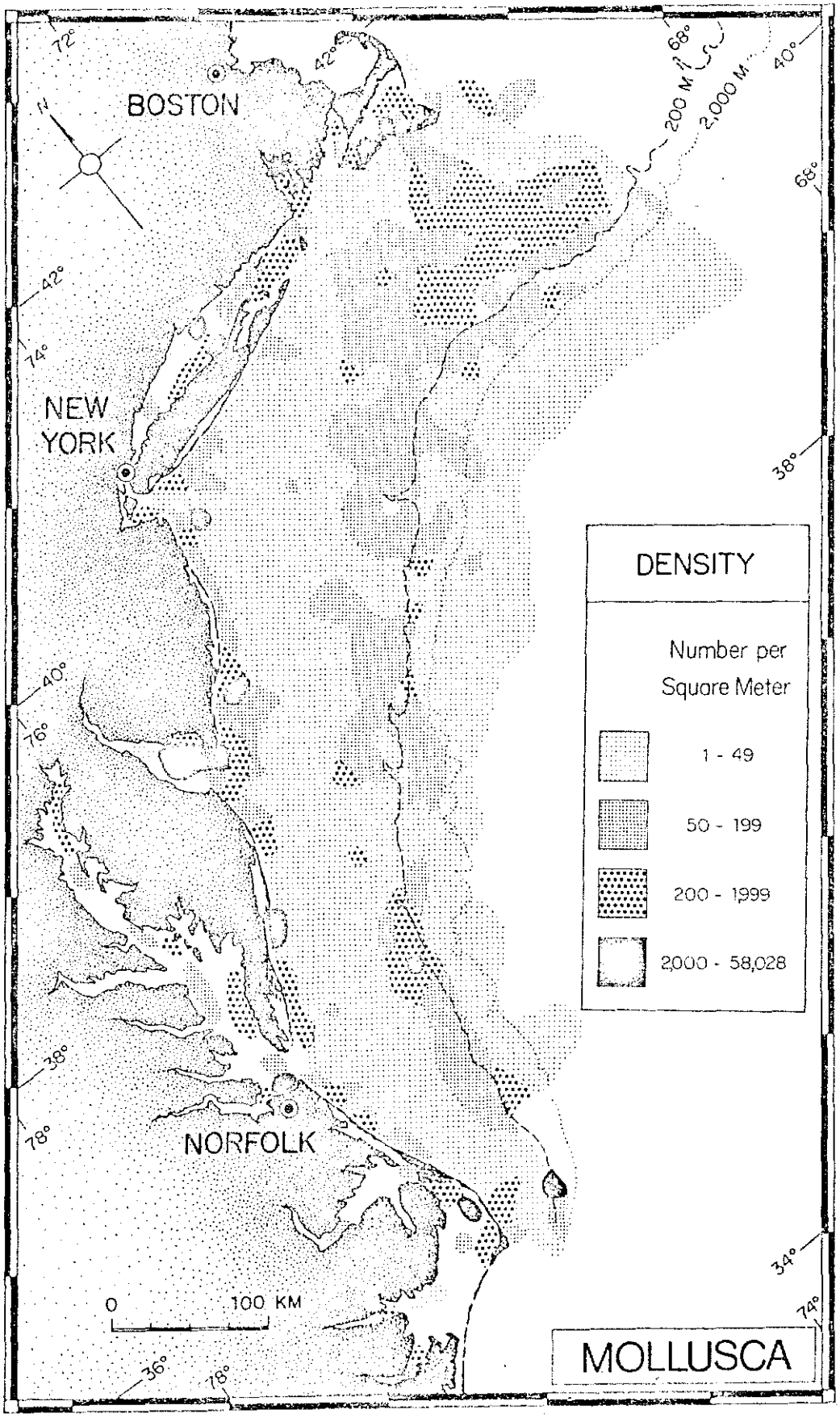


Figure 33.--Geographic distribution of the density of Mollusca, expressed as number of individuals per square meter of bottom.

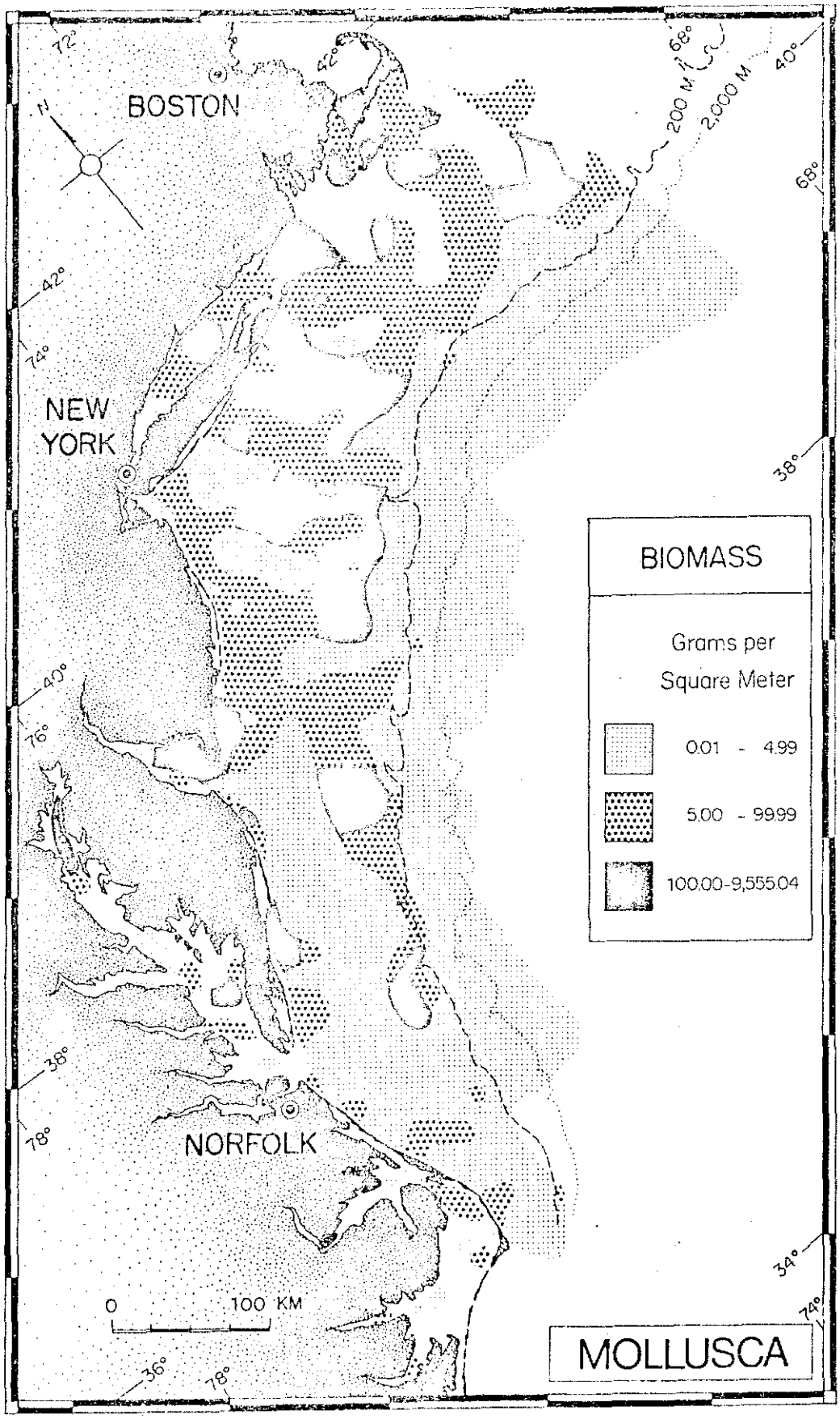


Figure 34.--Geographic distribution of the biomass of Mollusca, expressed as damp weight per square meter of bottom.

Polyplacophora (figs. 35 and 36) were distributed in small, rather widely separated patches, primarily on the outer continental shelf, slope, and rise. They occurred in only two localities in inshore waters. Density throughout most of their area of occurrence was less than 24/m^2, and biomass was typically smaller than 0.5 g/m^2.

Gastropoda (figs. 37 and 38) were distributed over extensive areas extending from the northern to southern boundaries of the Region and from inshore waters to the outermost areas sampled. In addition to their occurrence in the bays and sounds, their distribution generally formed bands parallel to the coastline. A moderately high density (10 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 portions of the continental shelf gastropods were absent, except in the area south of Rhode Island and Massachusetts where a density of 10 to 999/m^2 occurred. Along the upper continental slope they occurred in moderately high density, with low density bands on either side. Biomass was small to moderate (0.01 to 5 g/m^2) over the major portion of gastropod distribution. Intermediate (5 to 25 g/m^2) biomasses were patchily distributed primarily along the inner shelf areas and in bays and sounds, but a few patches occurred in the mid-shelf regions south of Cape Cod and southeast 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 mid-shelf depths south of Nantucket Island.

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

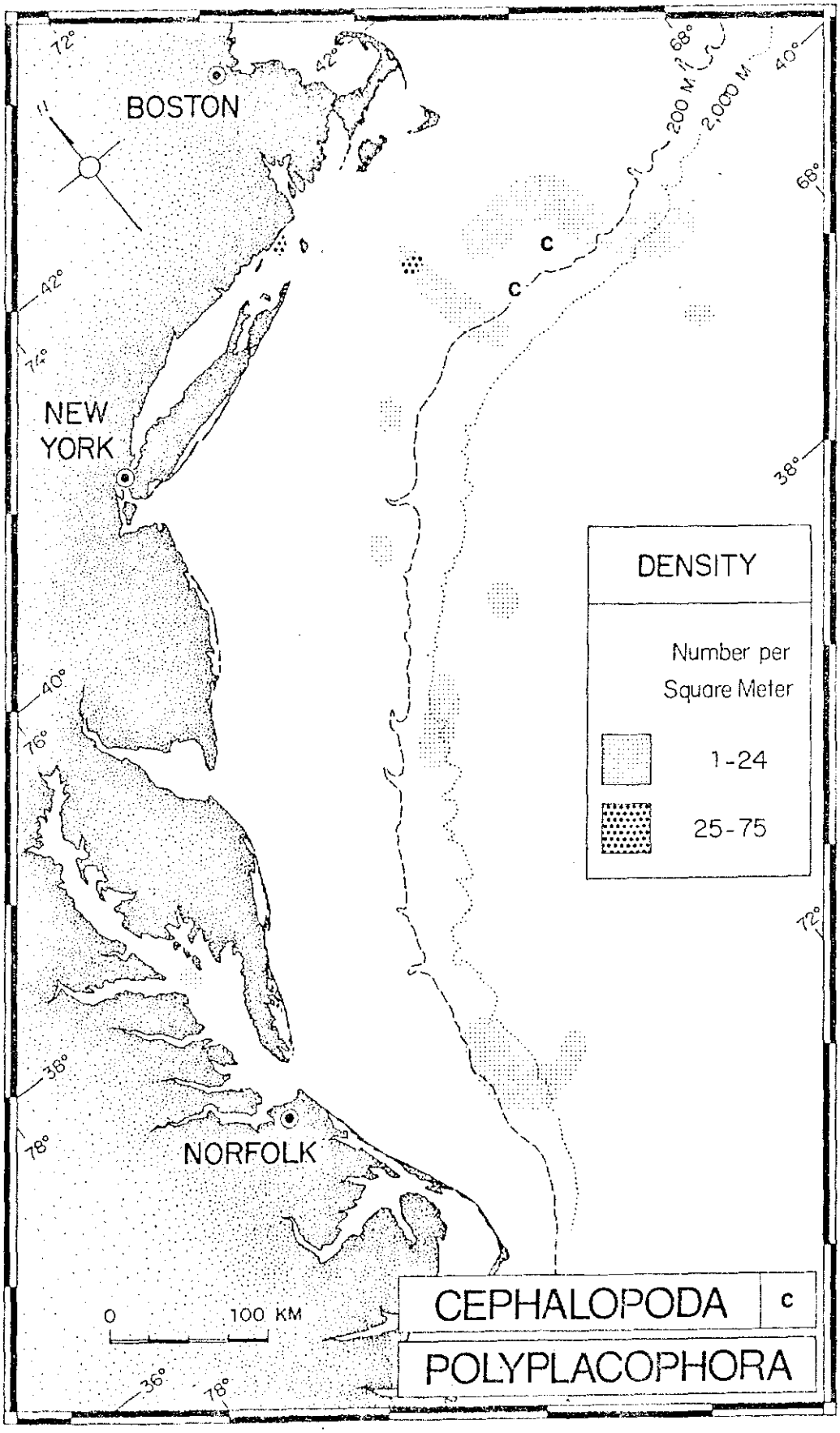


Figure 35.--Geographic distribution of the density of Cephalopoda and Polyplacophora, expressed as number of individuals per square meter of bottom.

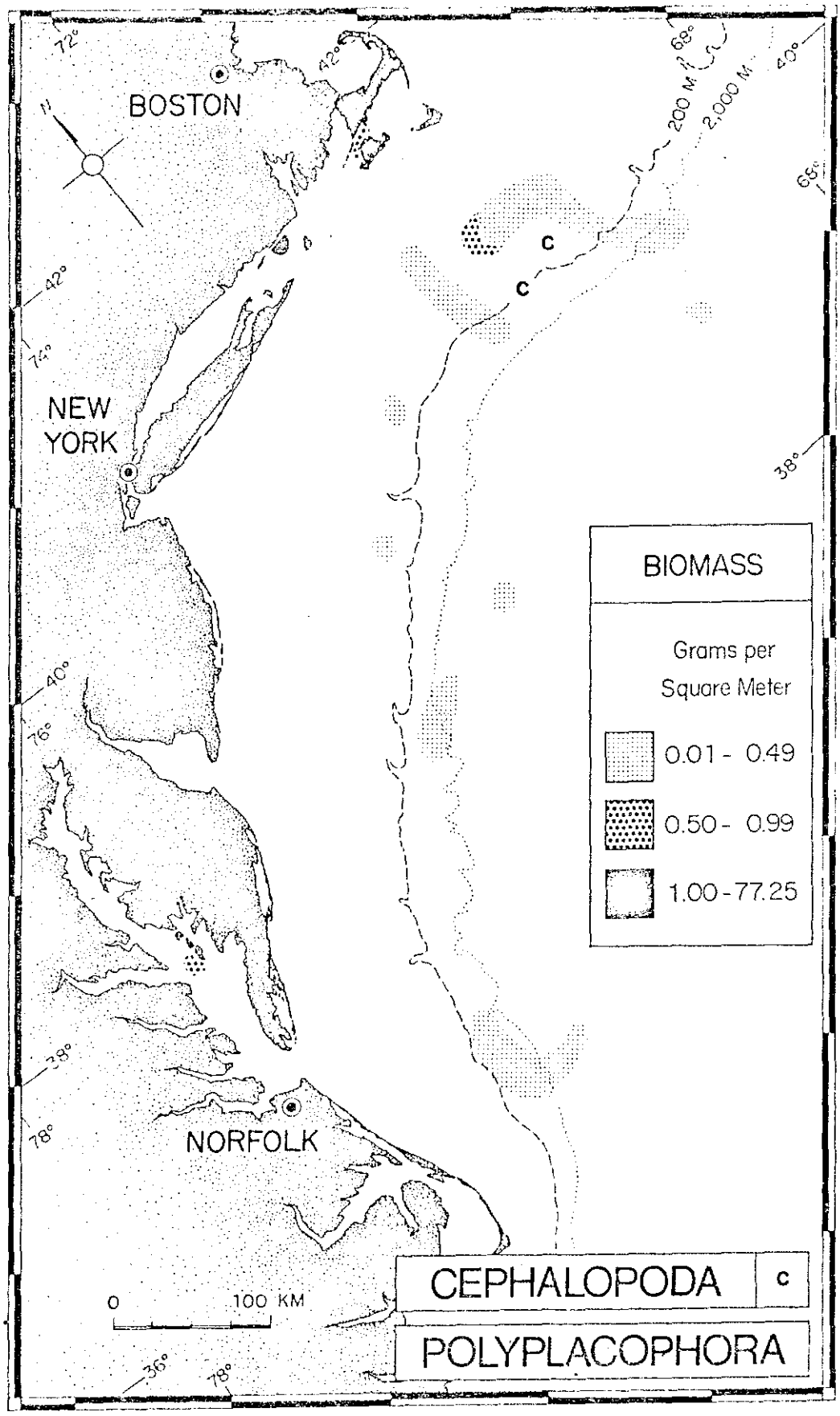


Figure 36.--Geographic distribution of the biomass of Cephalopoda and Polyplacophora, expressed as damp weight per square meter of bottom.

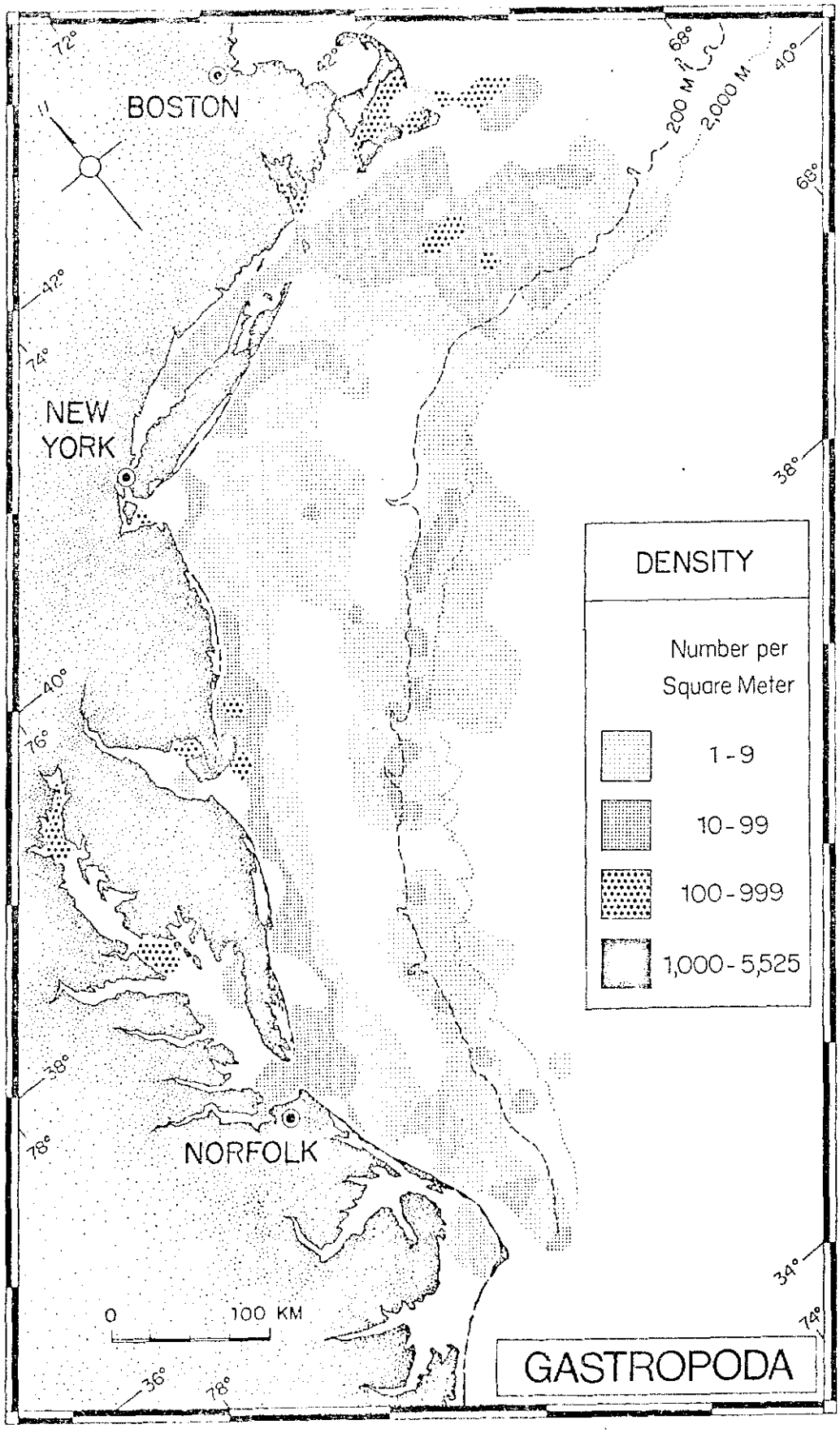


Figure 37.--Geographic distribution of the density of Gastropoda, expressed as number of individuals per square meter of bottom.

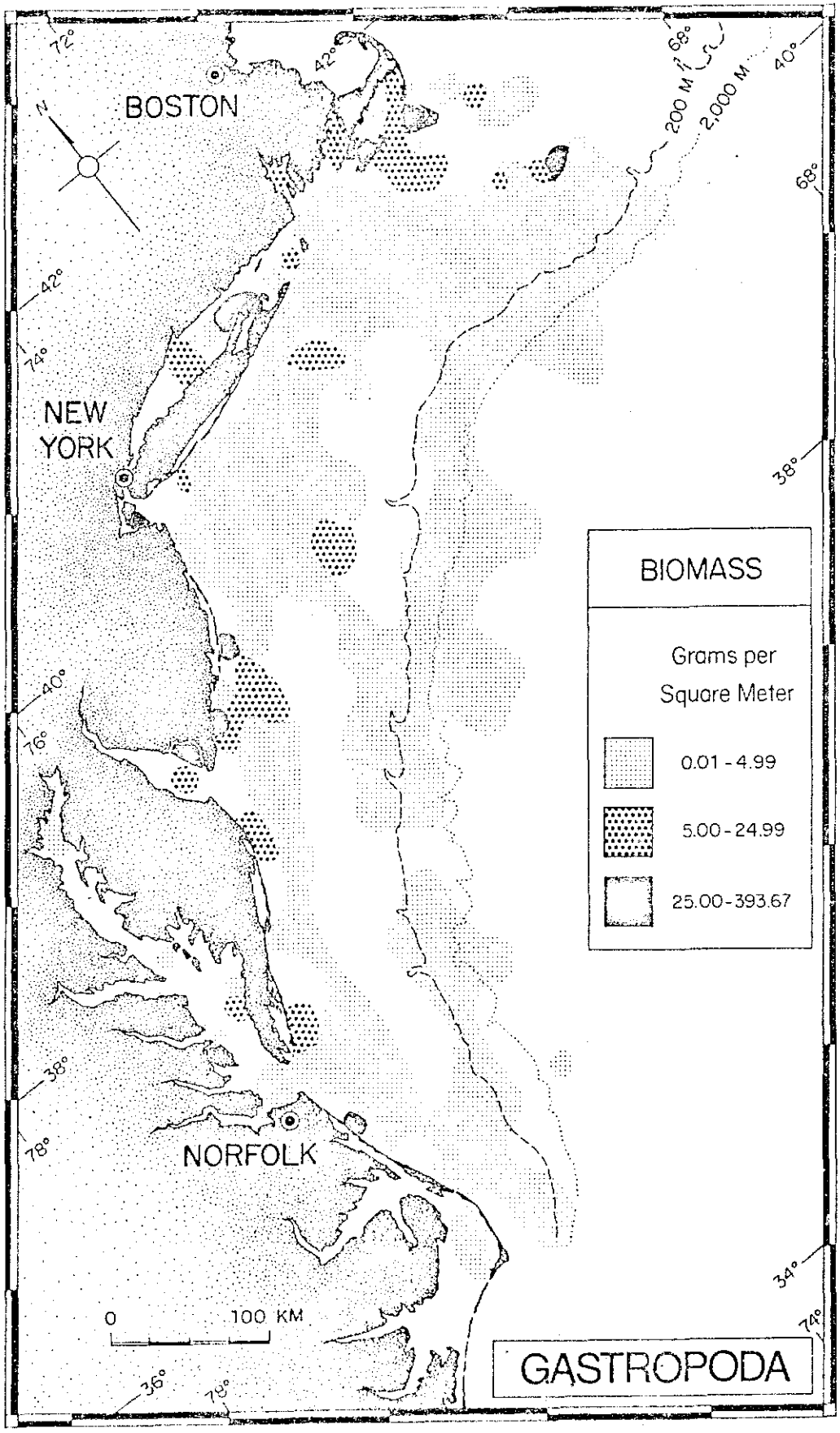


Figure 38.--Geographic distribution of the biomass of Gastropoda, expressed as damp weight per square meter of bottom.

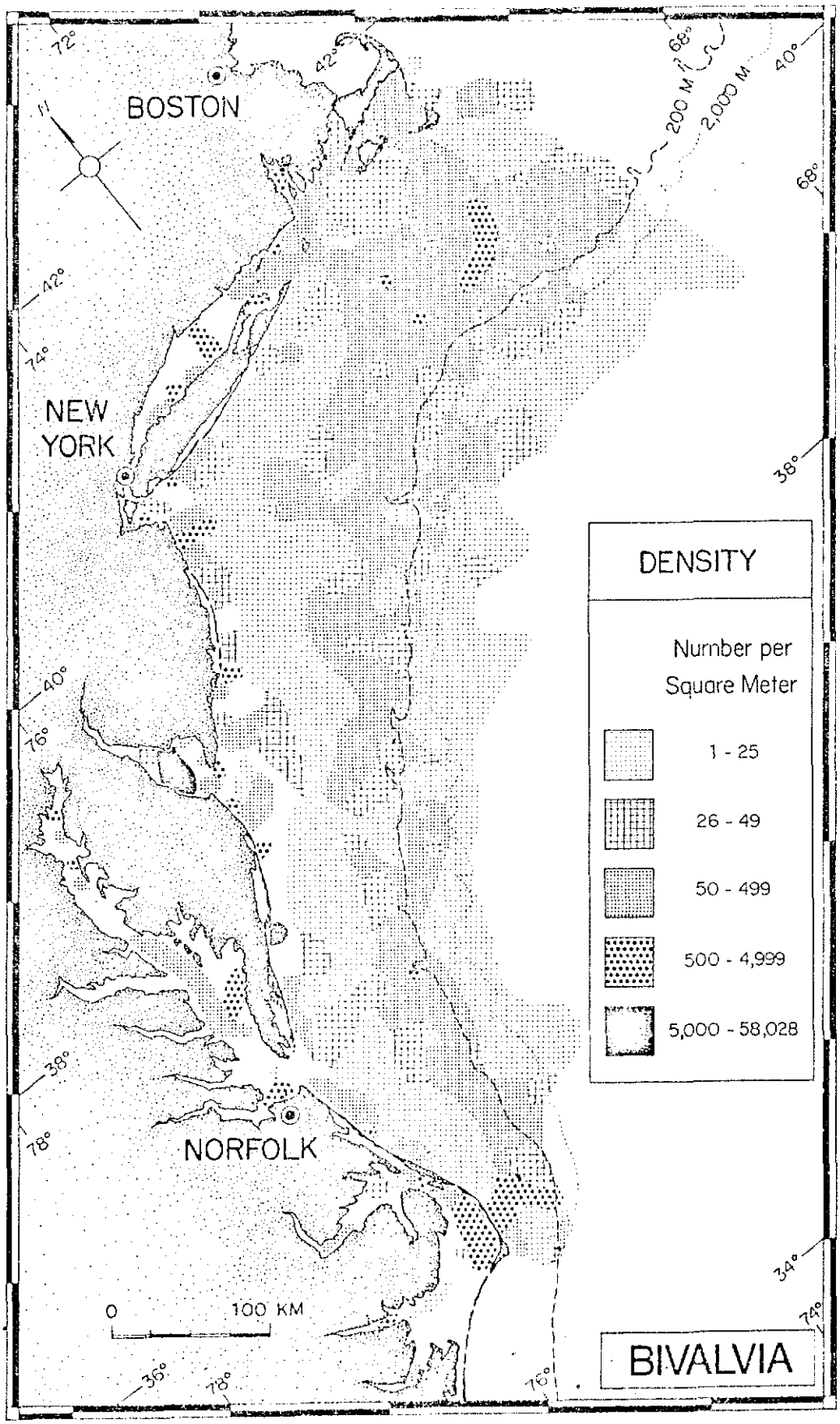


Figure 39.--Geographic distribution of the density of Bivalvia, expressed as number of individuals per square meter of bottom.

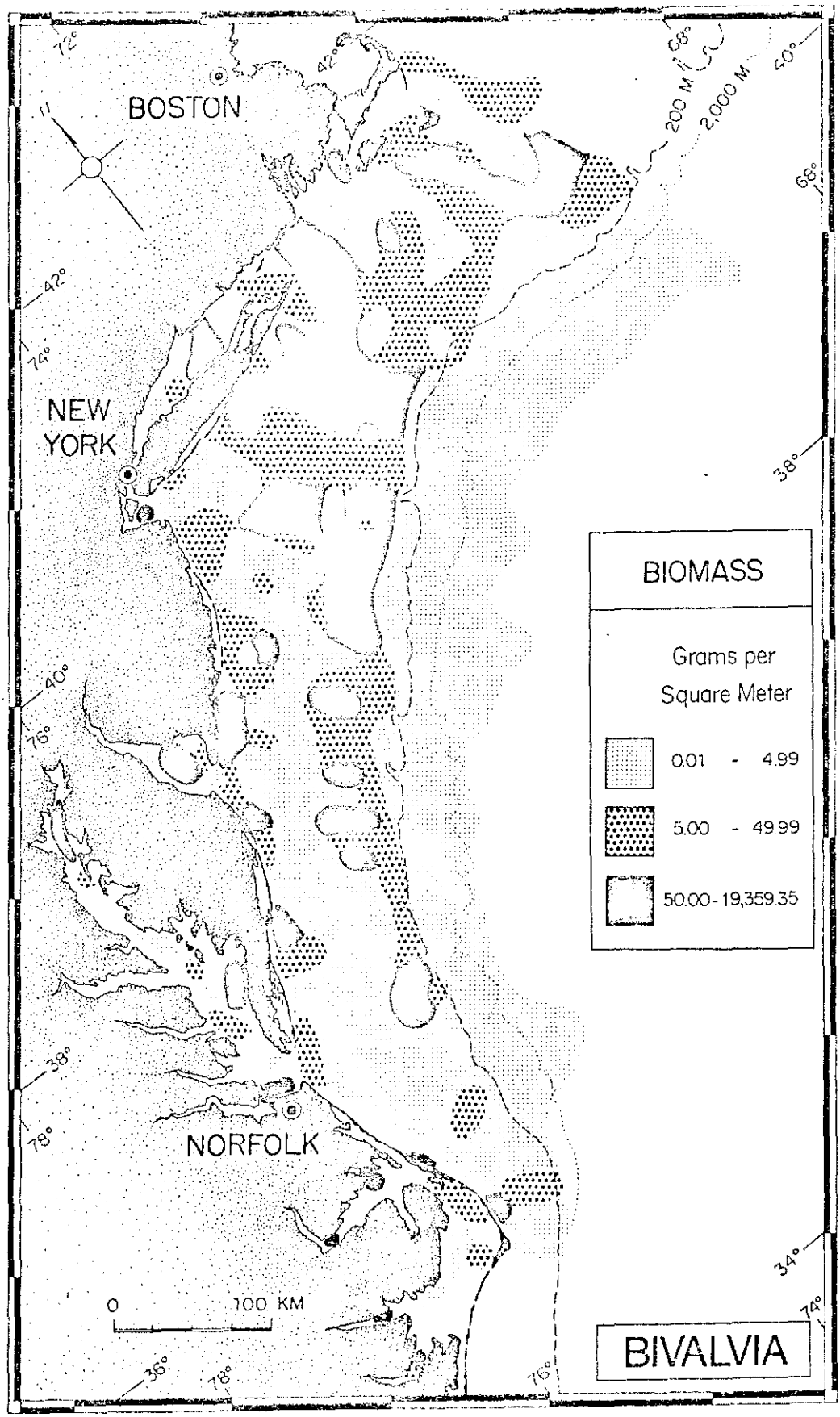


Figure 40.--Geographic distribution of the biomass of Bivalvia, expressed as damp weight per square meter of bottom.

500/m^2) occurred along the coast. A somewhat broader band of low density (less than 25/m^2) was distributed 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) occurred, one offshore beginning on the upper part of the continental shelf and extending to the deepest depths sampled; the other occupied the mid-shelf 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) occurred 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 their density ranged between 25 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 2.5 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 common taxonomic groups

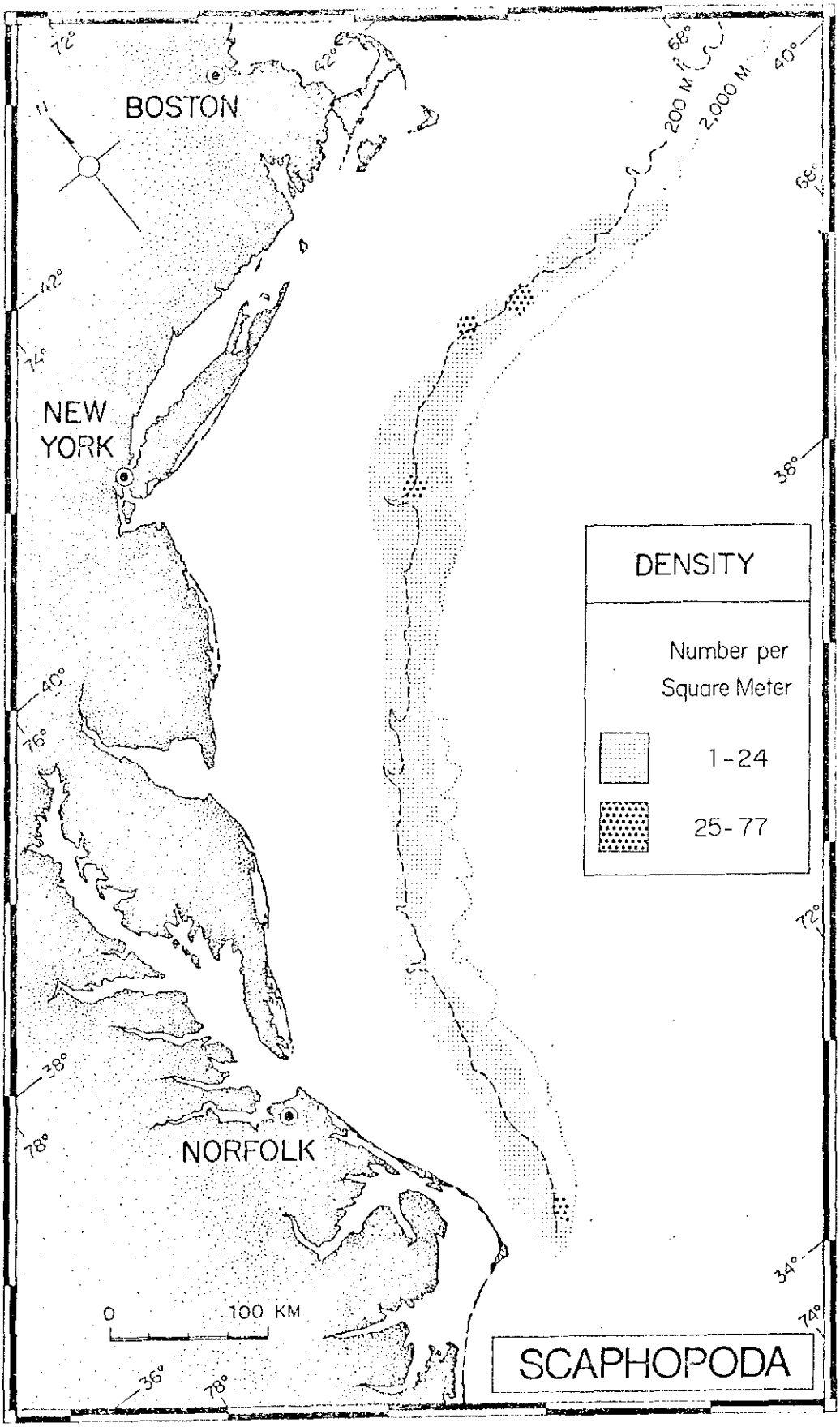


Figure 41.--Geographic distribution of the density of Scaphopoda, expressed as number of individuals per square meter of bottom.

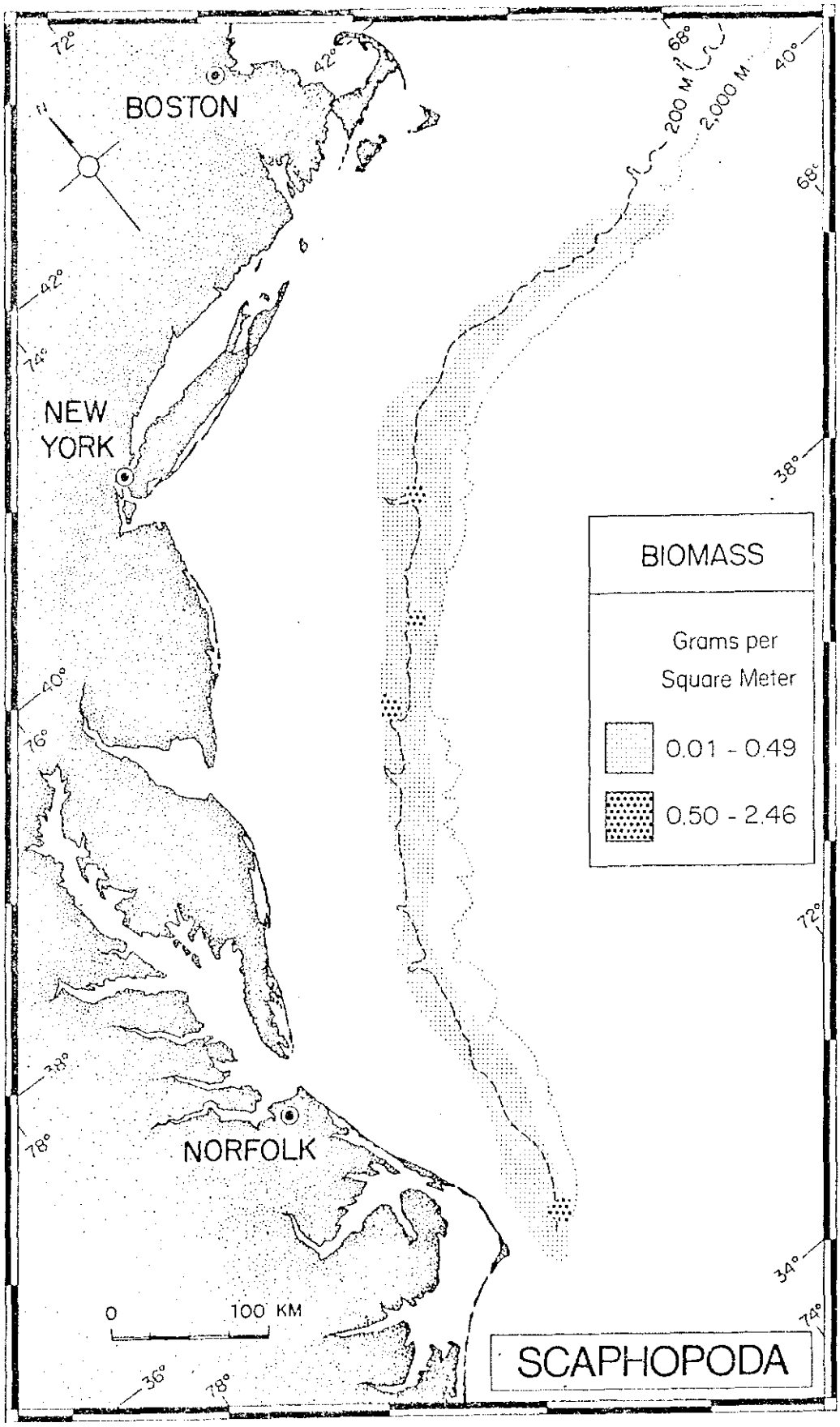


Figure 42.--Geographic distribution of the biomass of Scaphopoda, expressed as damp weight per square meter of bottom.

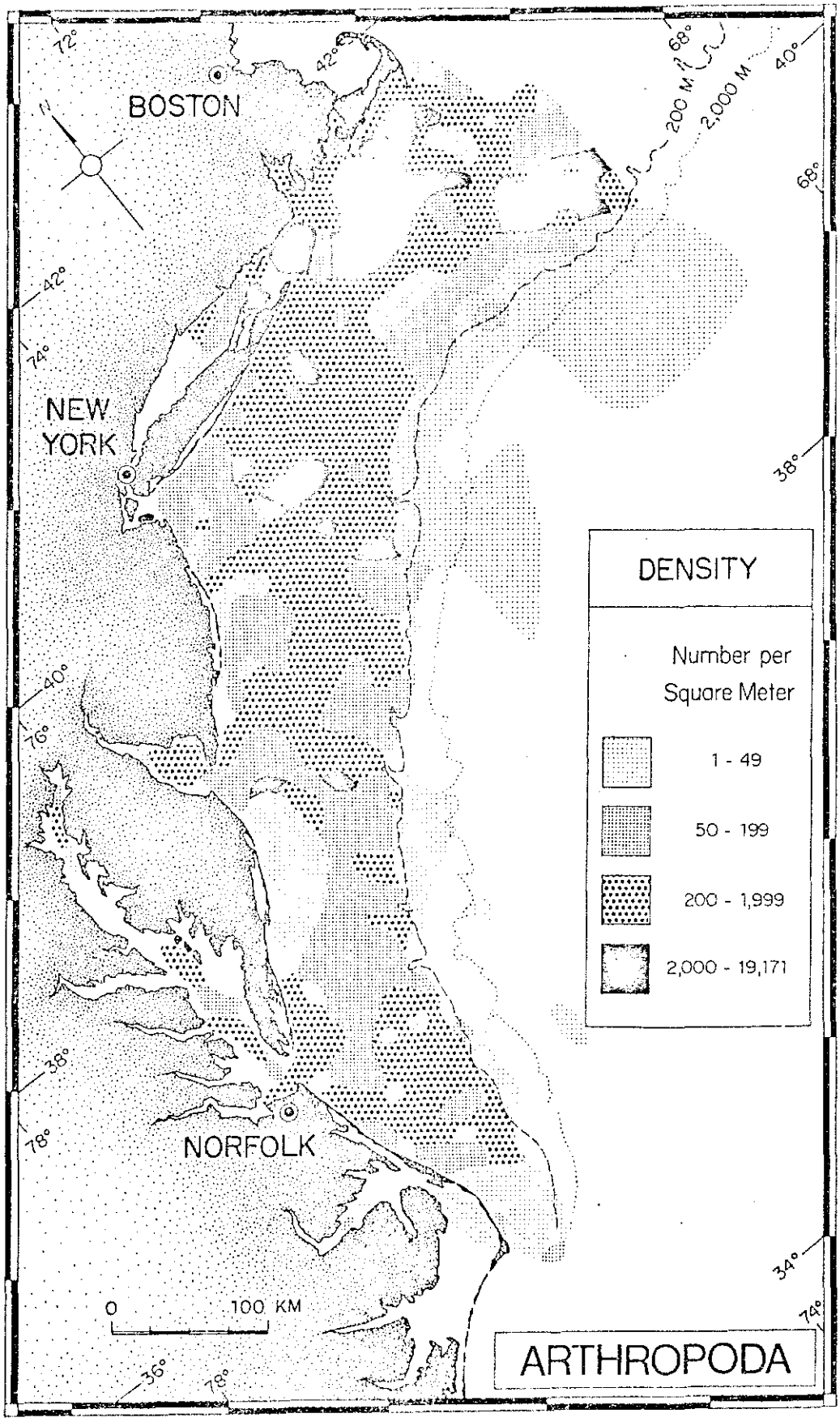


Figure 43.--Geographic distribution of the density of Arthropoda, expressed as number of individuals per square meter of bottom.

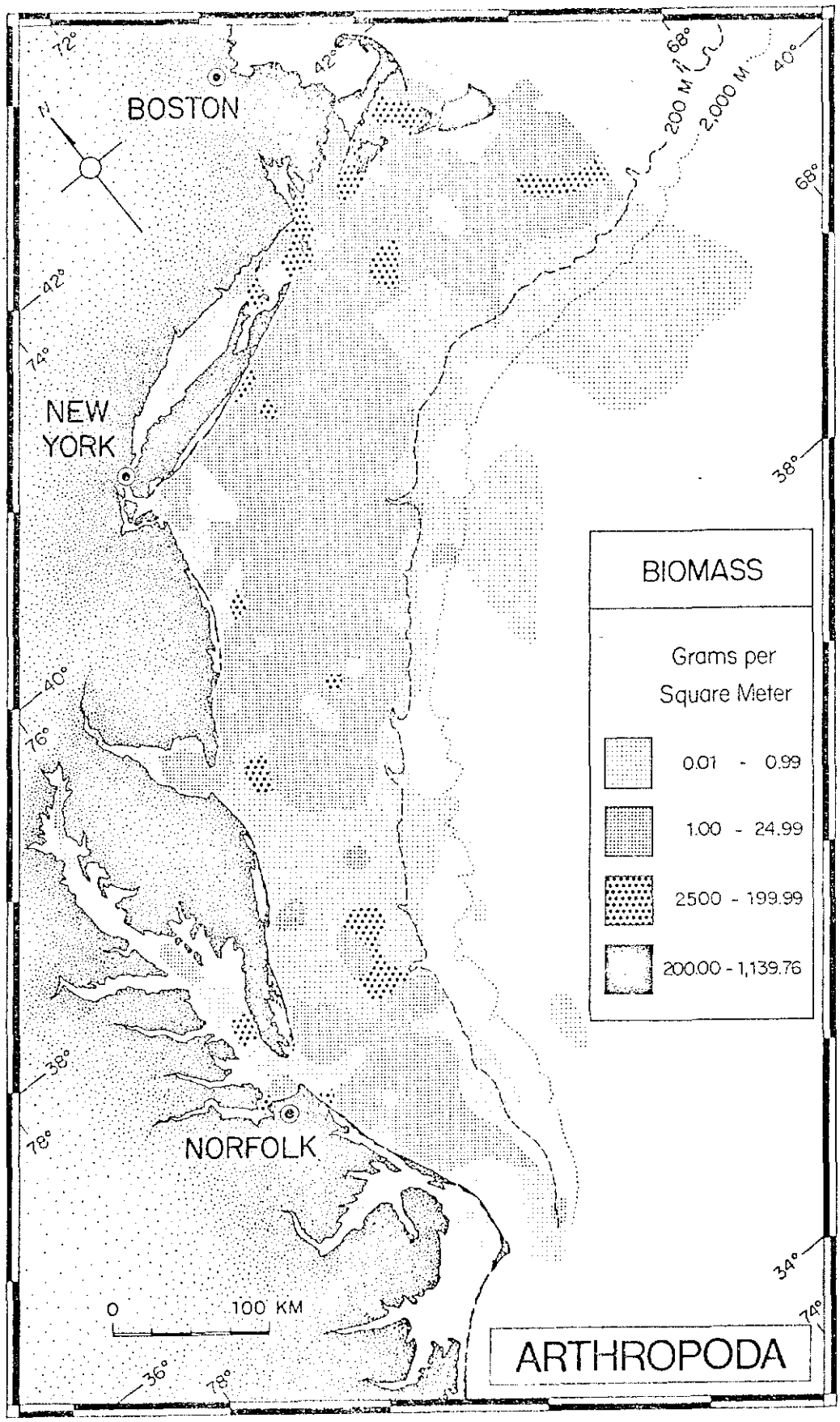


Figure 44.--Geographic distribution of the biomass of Arthropoda, expressed as damp weight per square meter of bottom.

encountered; 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 the northern half of the New York Bight. Moderately high densities (200 to 1,999/m^2) occurred over extensive areas in inshore waters and on the continental shelf throughout the Region. Low densities (less than 50/m^2) prevailed in the offshore deepwaters. Biomass exhibited a somewhat similar pattern of distribution. Large (greater than 200 g/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) occurred over 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, and Nebaliacea (fig. 45) were encountered 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) occurred in only a few localities, primarily on the continental shelf. They were encountered most frequently and in highest density (500 to 7,932/m^2) in the area from New York northward to Cape Cod. Biomass was distributed in a similar pattern and reached quantities ranging between 500 and 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. They occurred all the way 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 to 499/m^2) were common on the central continental shelf off Southern New England, and along the outer margin of the continental shelf

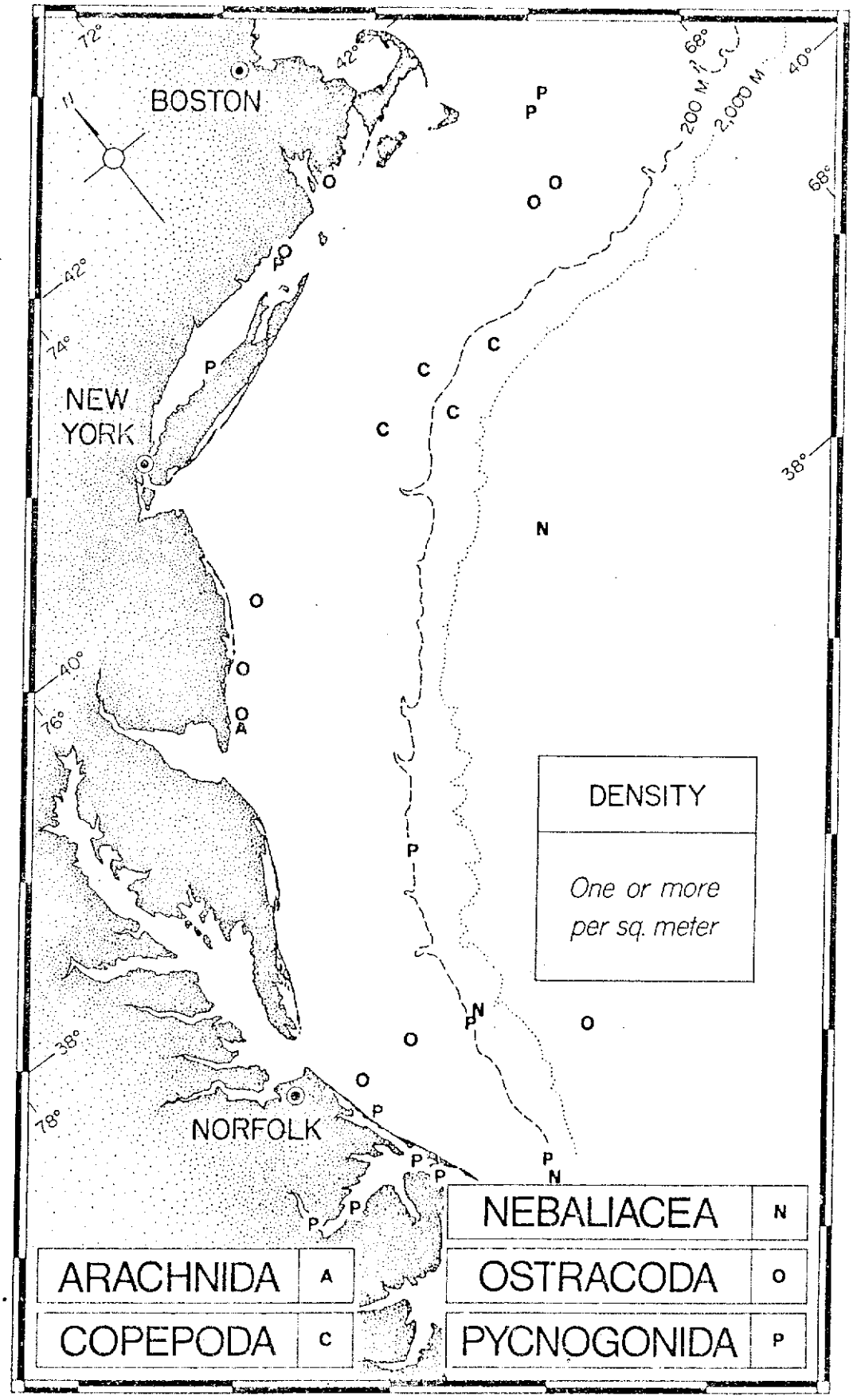


Figure 45.--Geographic distribution of the density of Arachnida, Copepoda, Nebaliacea, Ostracoda, and Pycnogonida, expressed as number of individuals per square meter of bottom

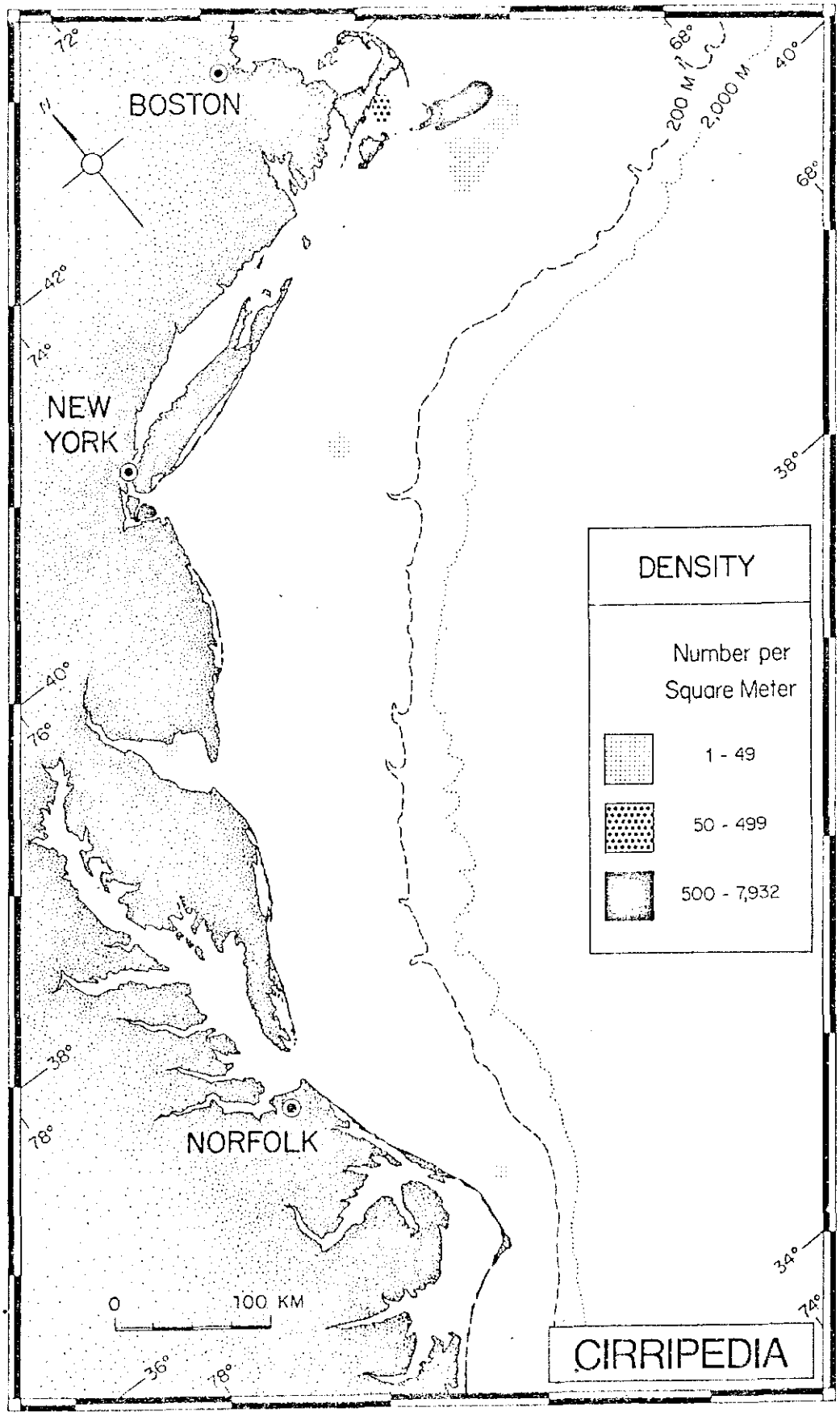


Figure 46.--Geographic distribution of the density of Cirripedia, expressed as number of individuals per square meter of bottom.

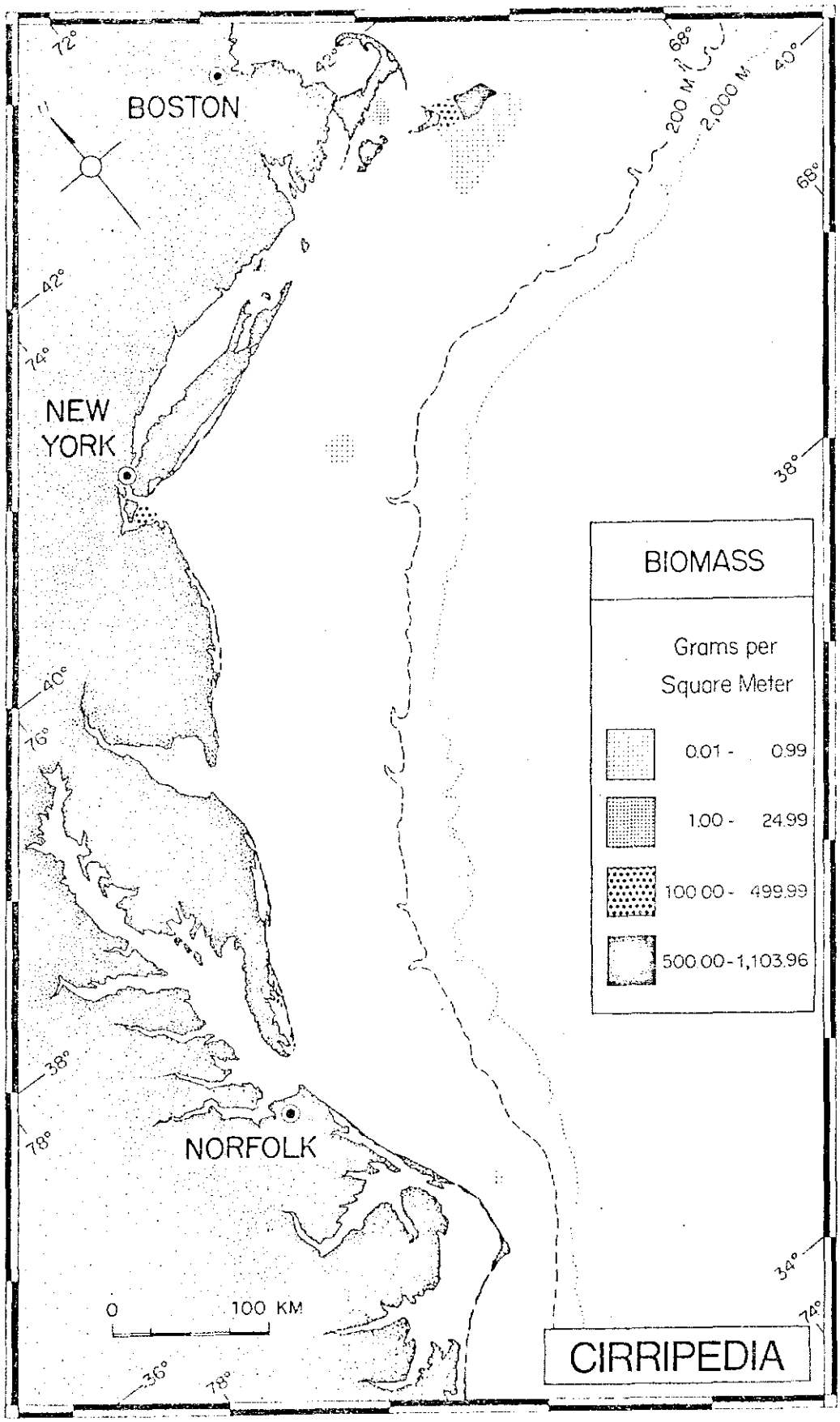


Figure 47.--Geographic distribution of the biomass of Cirripedia, expressed as damp weight per square meter of bottom.

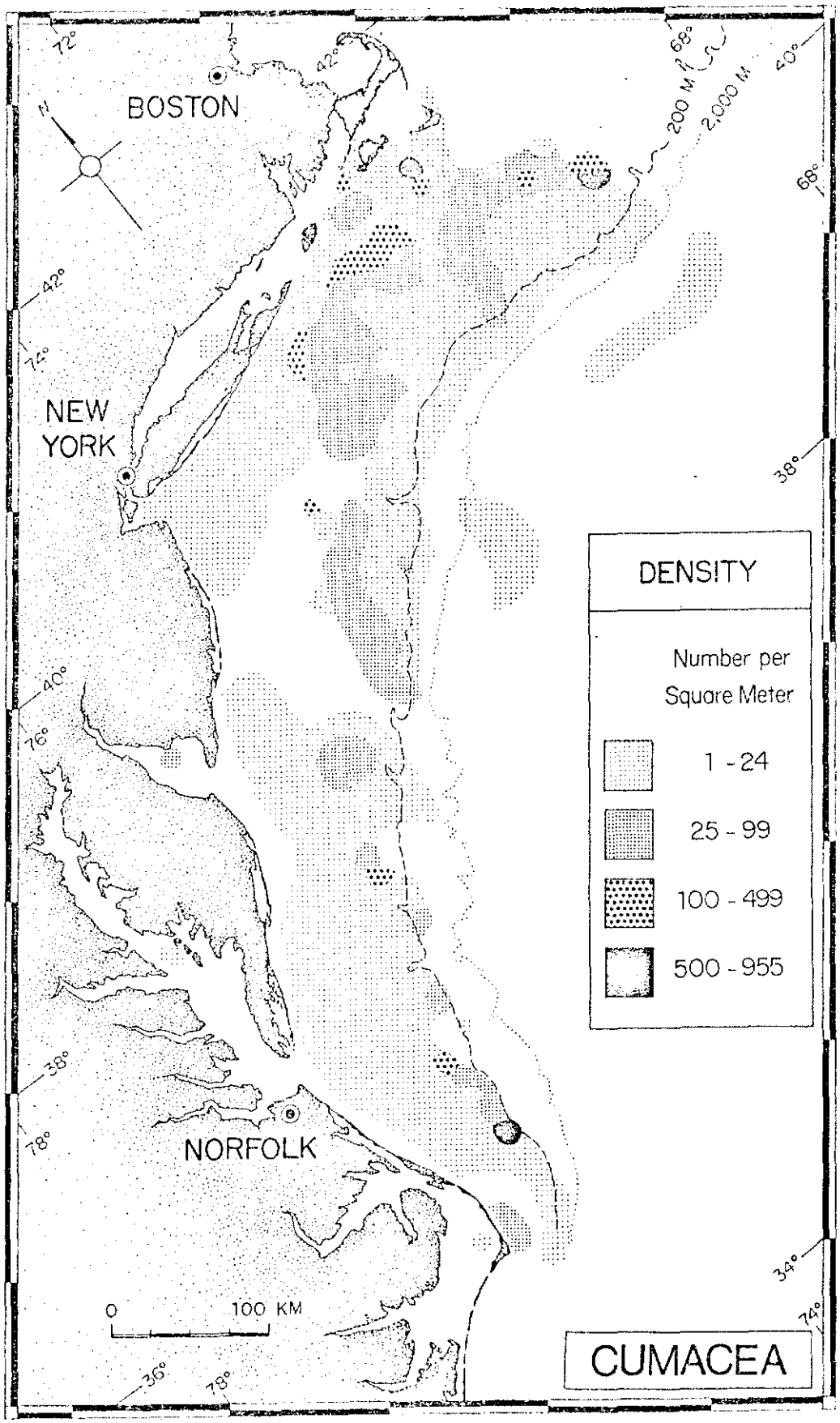


Figure 48.--Geographic distribution of the density of Cumacea, expressed as number of individuals per square meter of bottom.

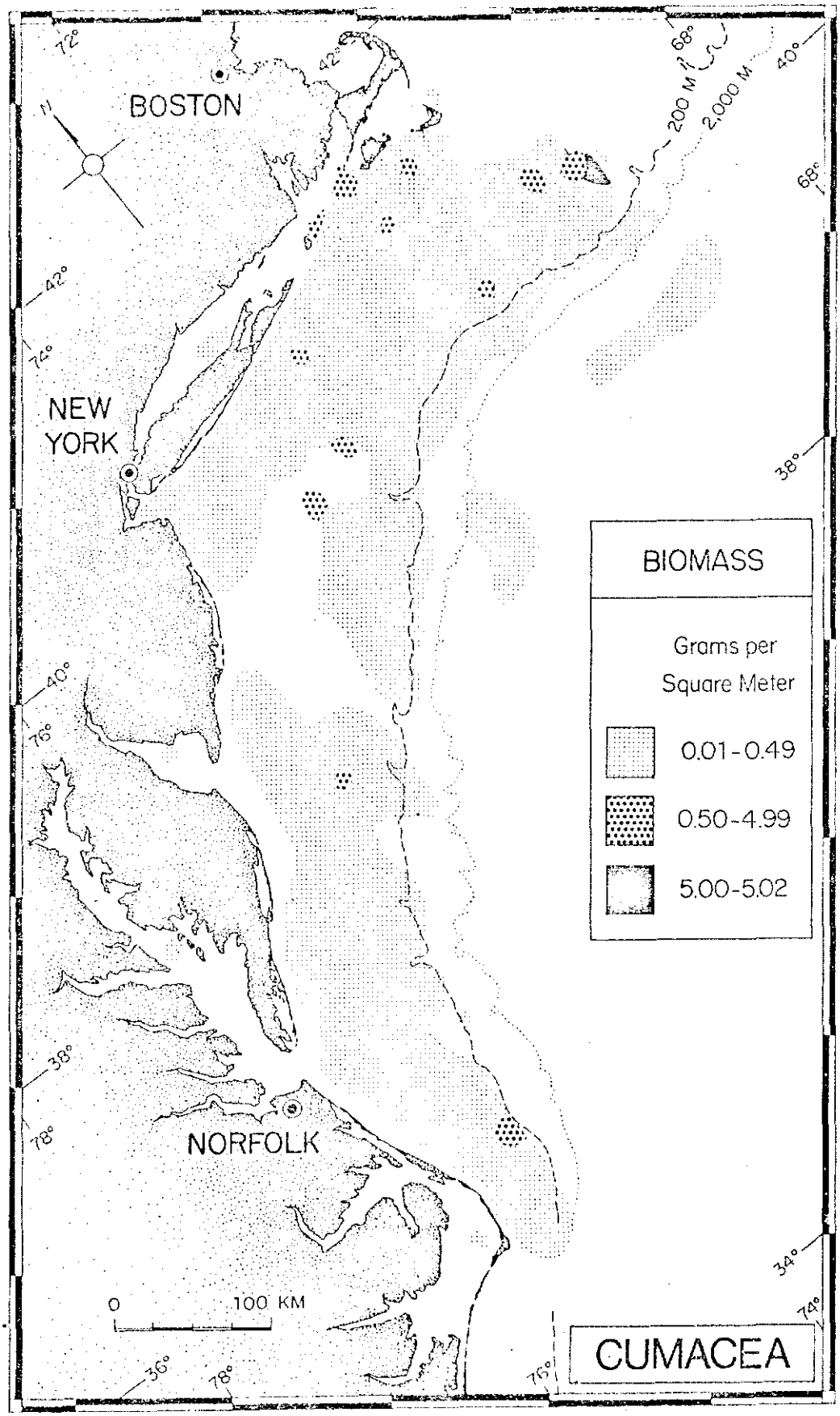


Figure 49.--Geographic distribution of the biomass of Cumacea, expressed as damp weight per square meter of bottom.

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) occurred only in deepwater. They were found in small, widely separated areas on the continental slope and rise ranging from offshore Cape Cod 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 between 1 and 24/m^2. Moderate-size areas, more or less equally distributed over the continental shelf, contained populations between 25 and 199/m^2. High densities (200 to 1,053/m^2) were restricted to small geographic areas, limited chiefly to 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 with densities ranging from 10 to over 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 to 500/m^2) predominated on the continental shelf below the eastern tip of Long Island. Higher densities (500 to 5,000/m^2) were distributed in

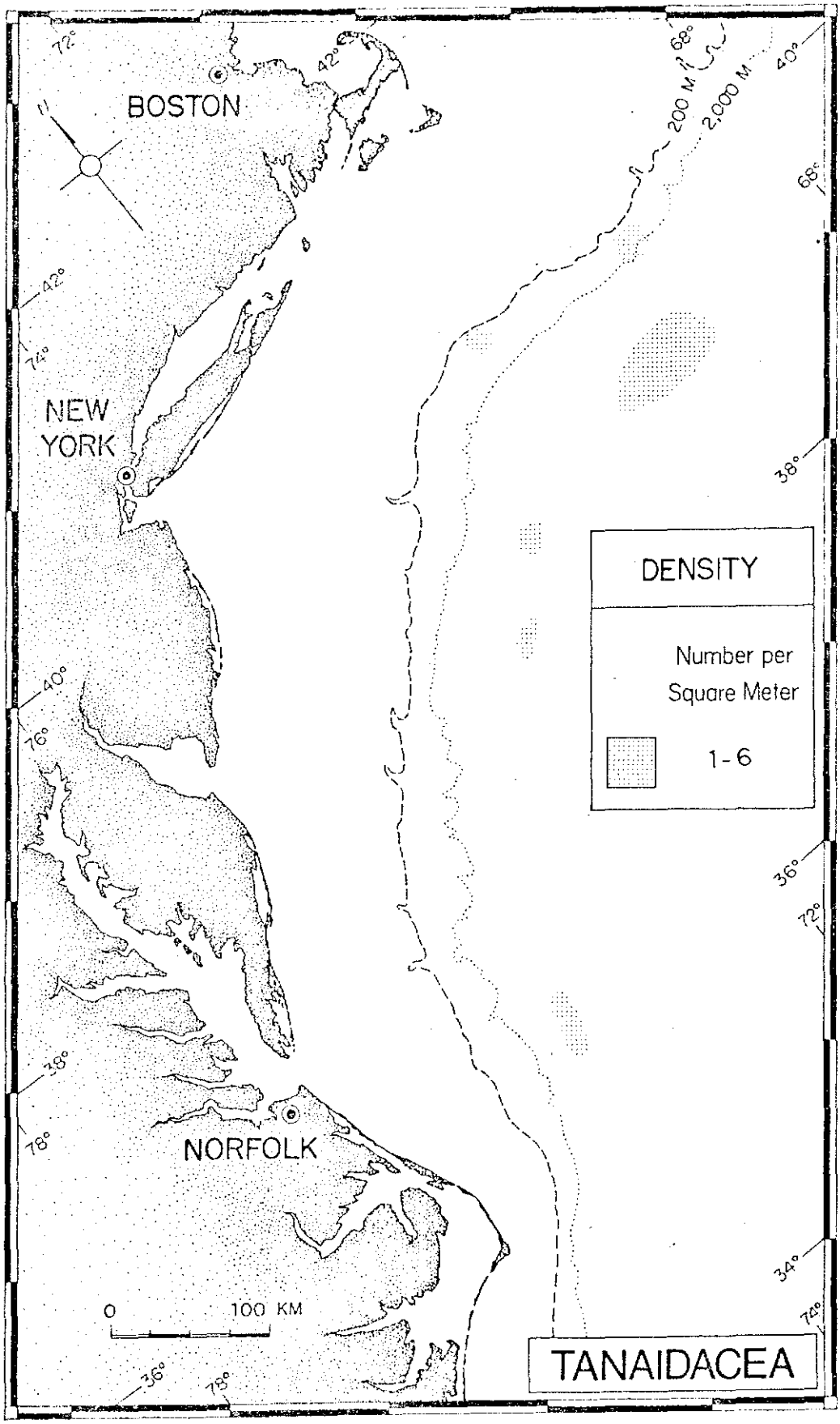


Figure 50.--Geographic distribution of the density of Tanaidacea, expressed as number of individuals per square meter of bottom.

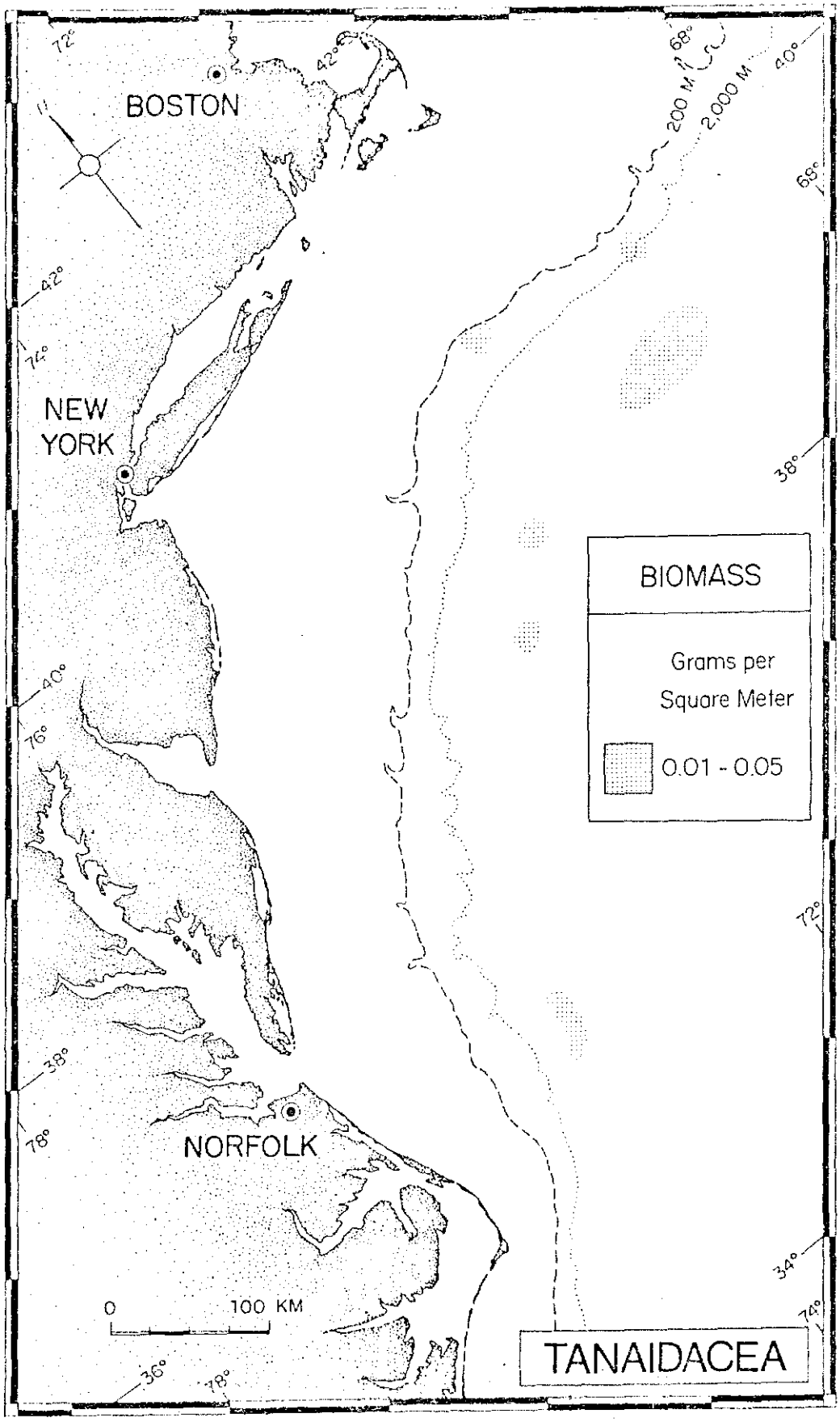


Figure 51.--Geographic distribution of the biomass of Tanaidacea, expressed as damp weight per square meter of bottom.

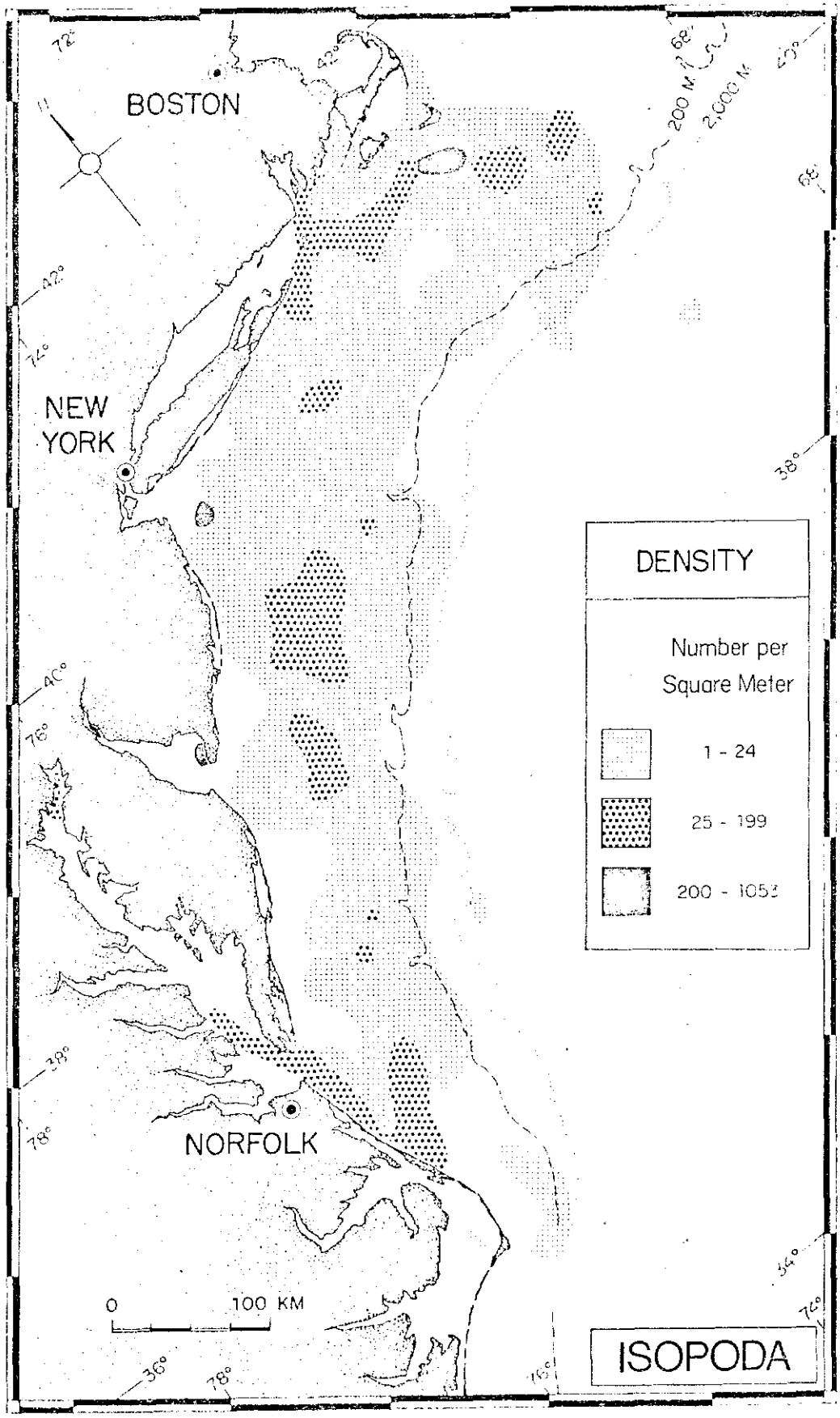


Figure 52.--Geographic distribution of the density of Isopoda, expressed as number of individuals per square meter of bottom.

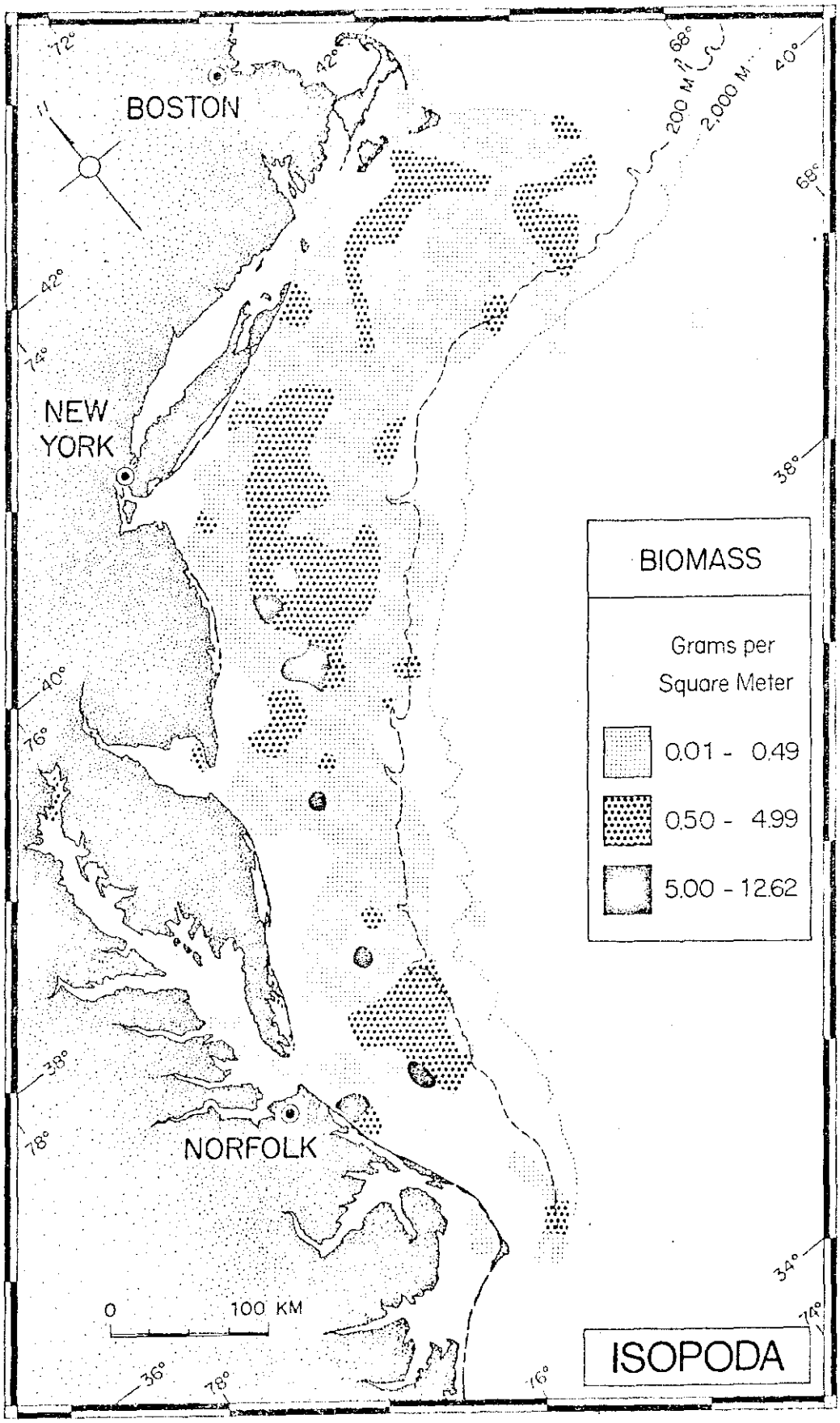


Figure 53.--Geographic distribution of the biomass of Isopoda, expressed as damp weight per square meter of bottom.

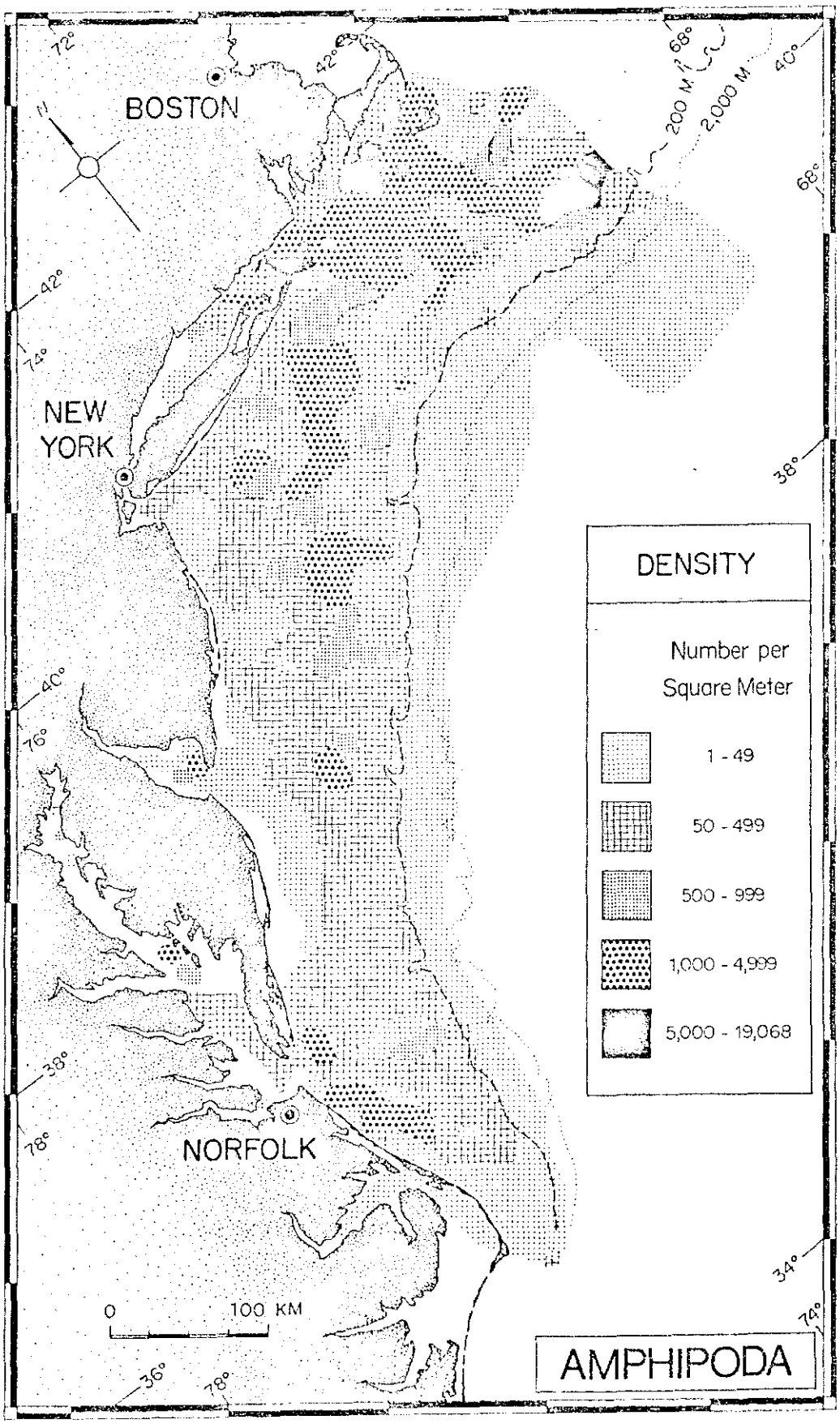


Figure 54.--Geographic distribution of the density of Amphipoda, expressed as number of individuals per square meter of bottom.

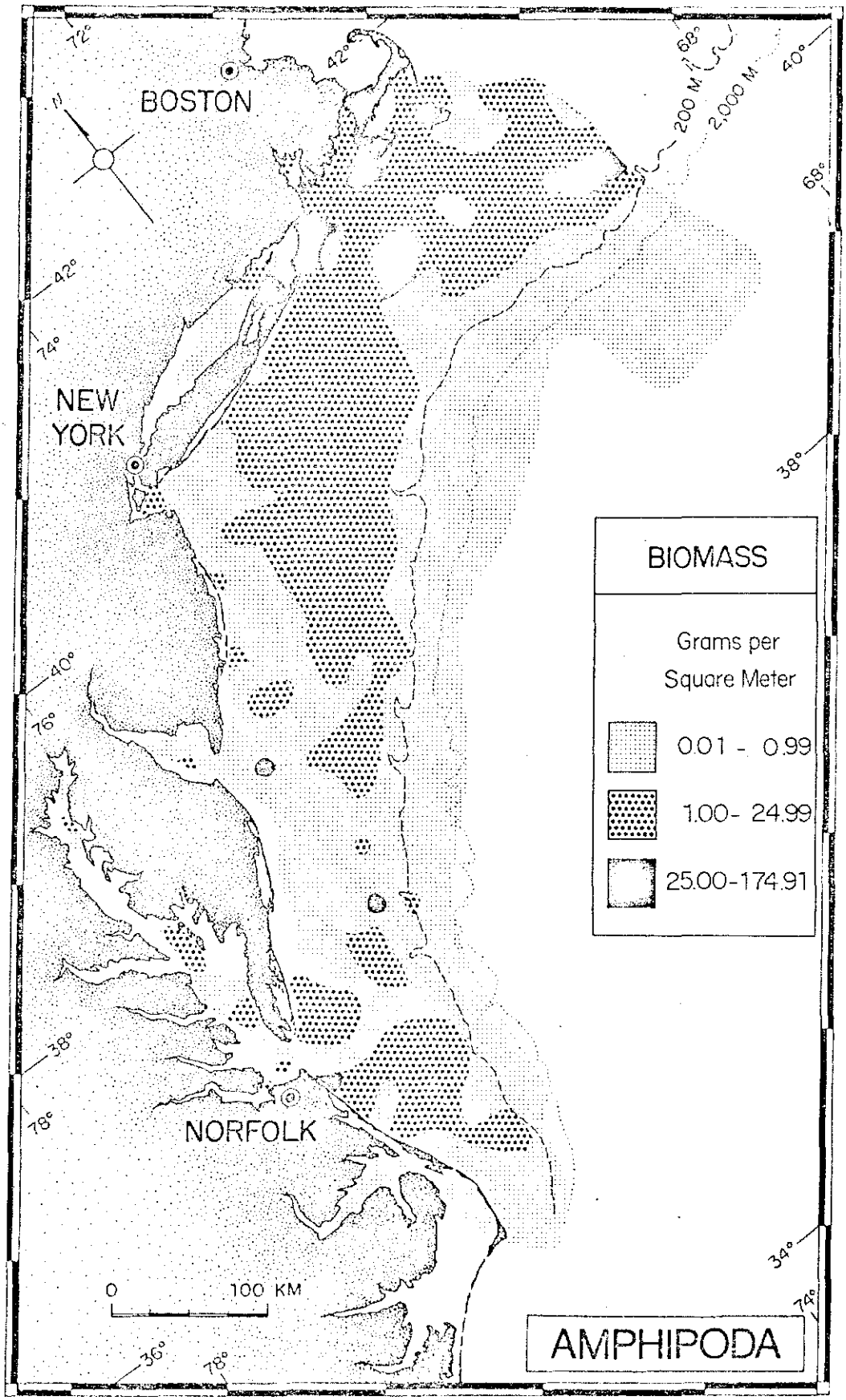


Figure 55.--Geographic distribution of the biomass of Amphipoda, expressed as damp weight per square meter of bottom.

relatively large areas off Southern New England, somewhat smaller ones in the New York Bight region, and were smallest in the more southerly reaches of the study area. Highest densities (5,000 to 19,000/m^2) occurred 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 with a few discrete patches in the south. Intermediate biomasses (1-25 g/m^2) were present over large portions 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 records 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 density (25 to 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) occurred over a large portion 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). Moderate (25 to 99/m^2) and high (100 to 395/m^2) densities occurred in rather small scattered patches in all sections. Biomass was distributed somewhat differently in that the largest quantities tended to occur on the inner and middle continental shelf and with smaller quantities on the outer shelf.

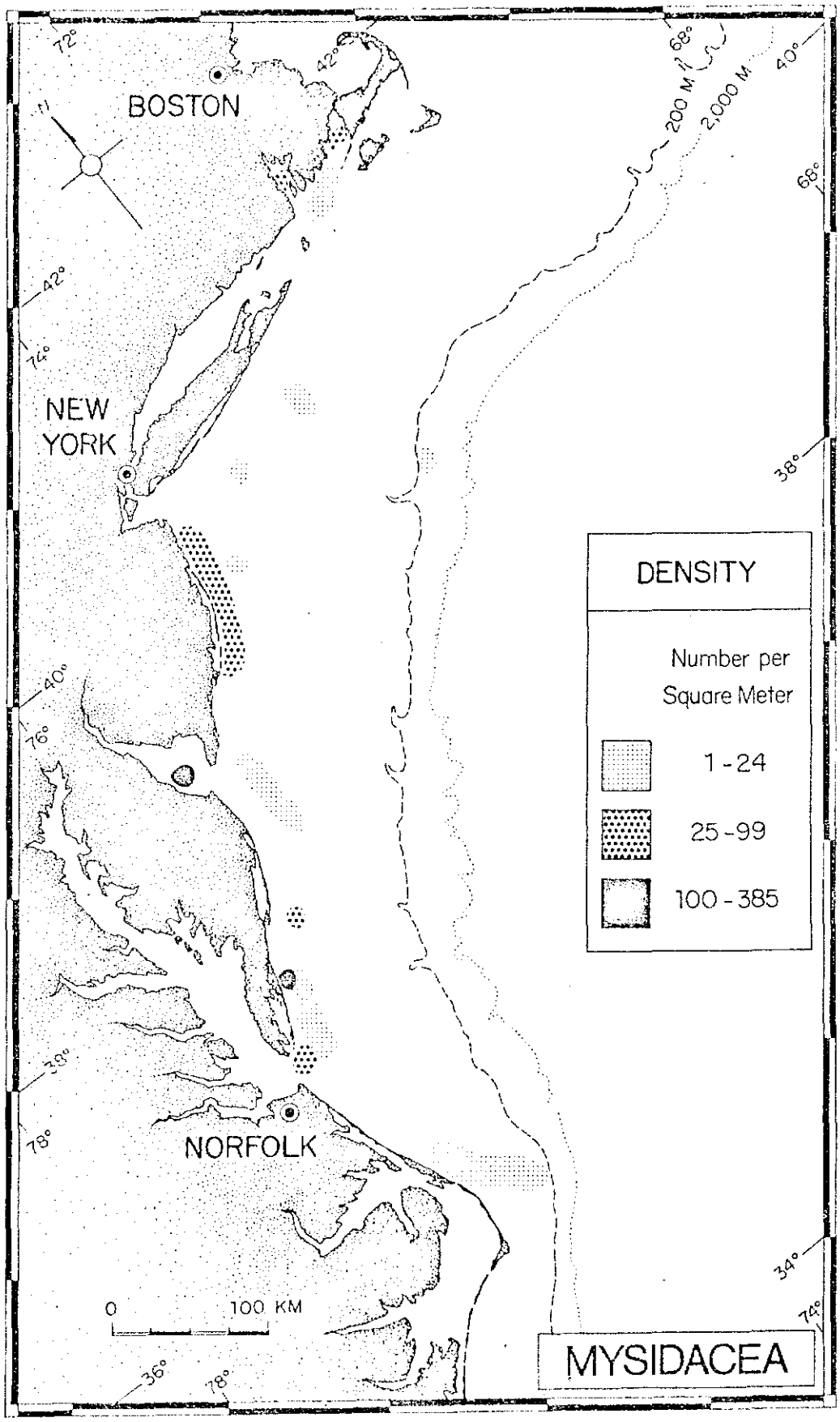


Figure 56.--Geographic distribution of the density of Mysidacea, expressed as number of individuals per square meter of bottom.

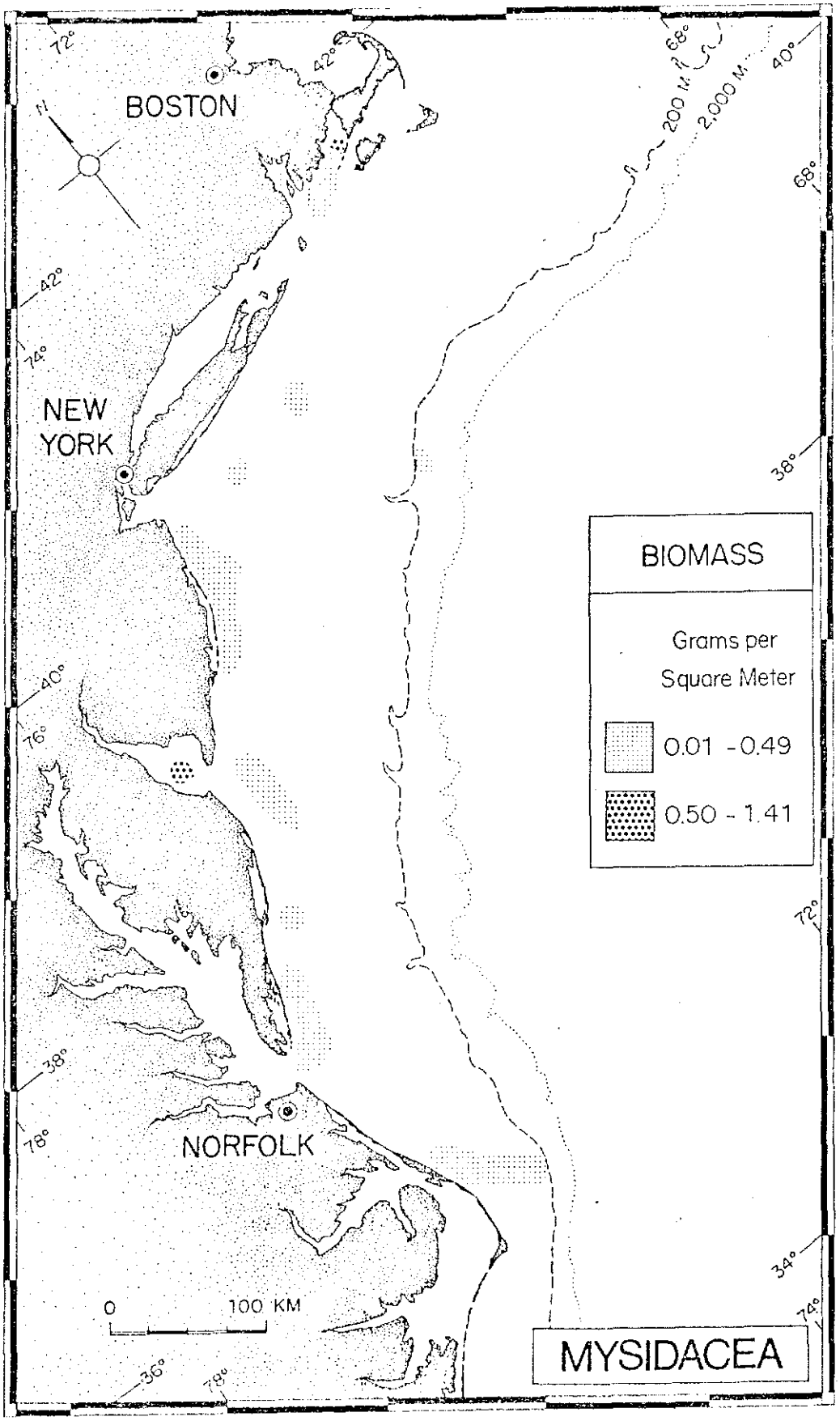


Figure 57.--Geographic distribution of the biomass of Mysidacea, expressed as damp weight per square meter of bottom.

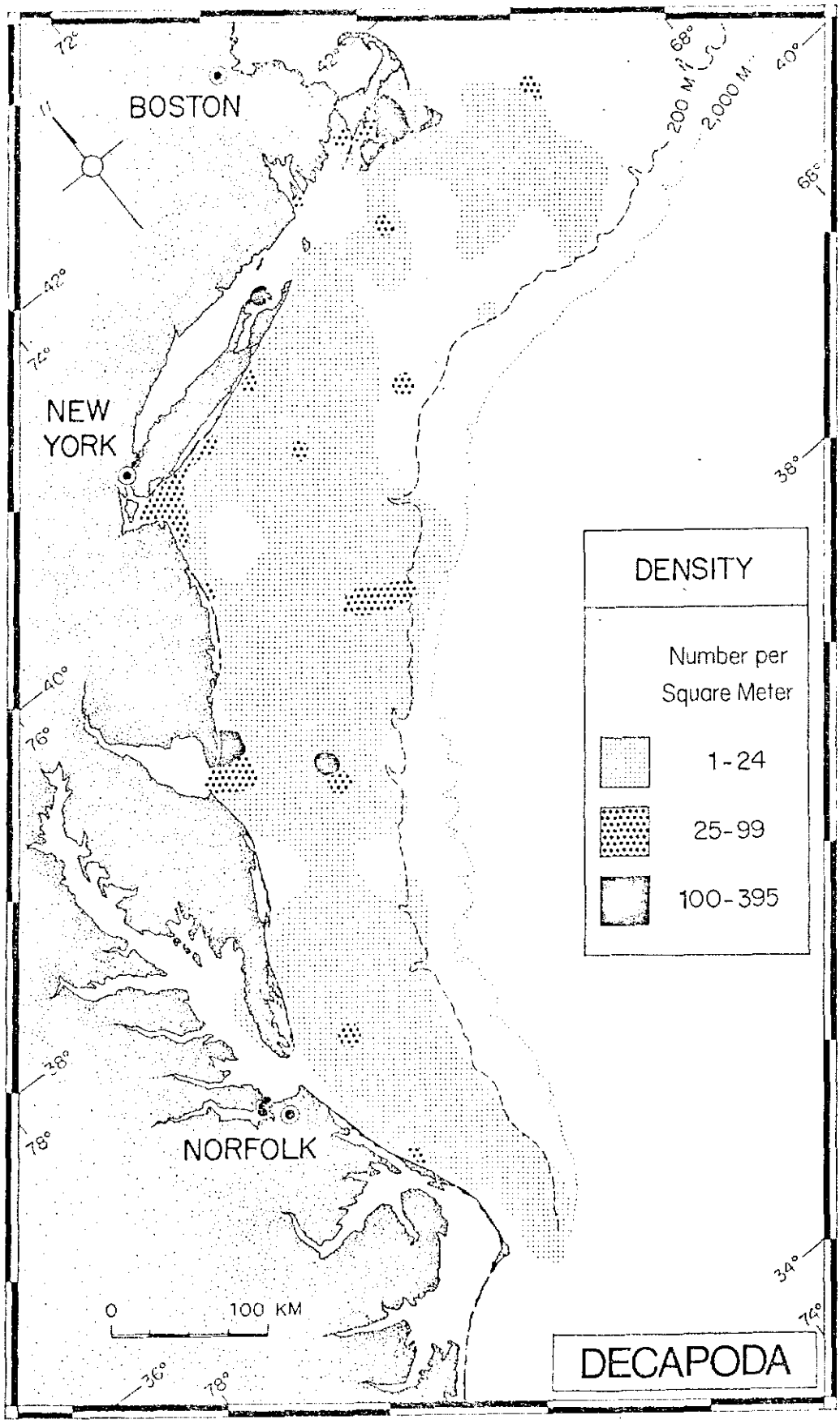


Figure 58.--Geographic distribution of the density of Decapoda, expressed as number of individuals per square meter of bottom.

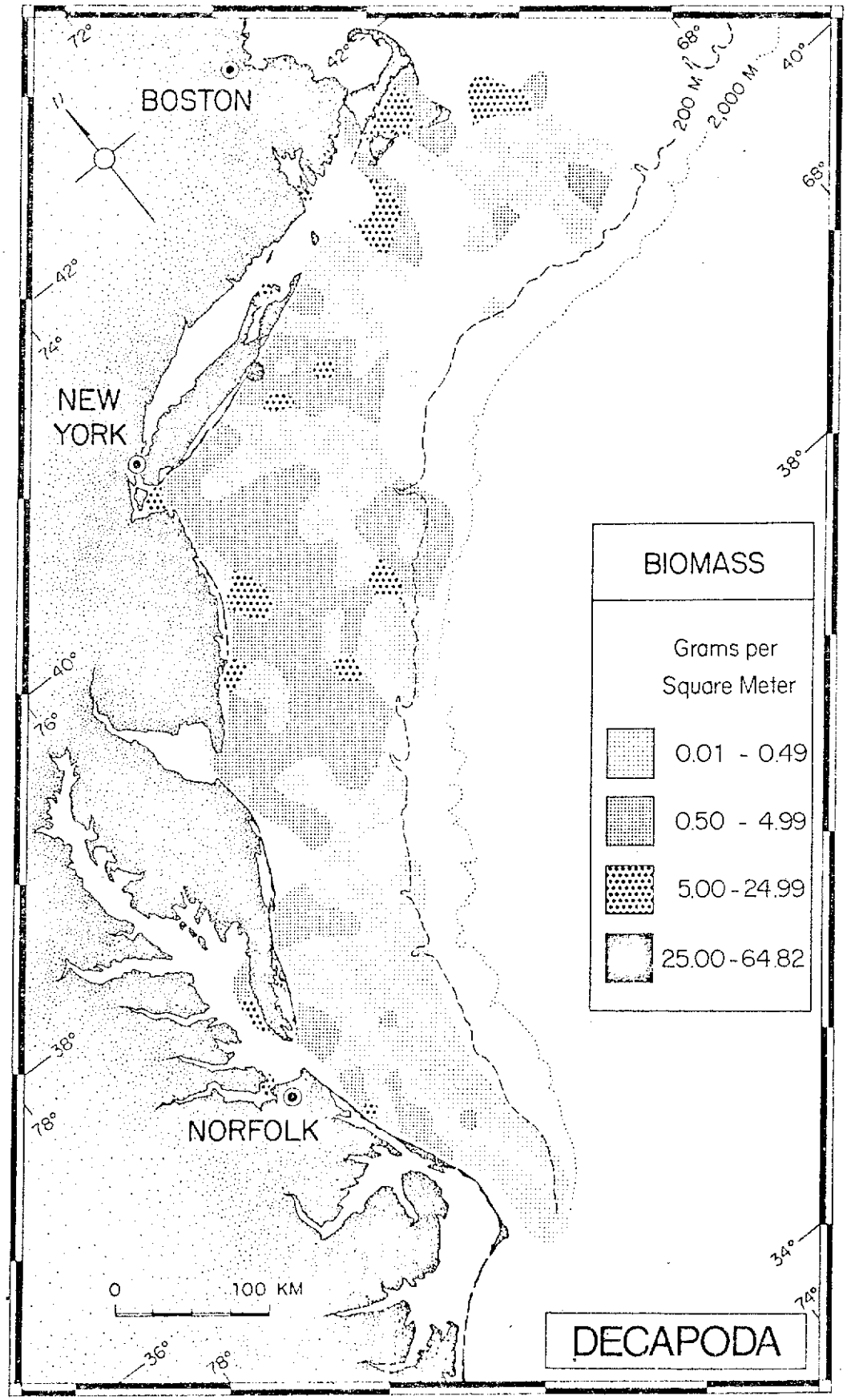


Figure 59.--Geographic distribution of the biomass of Decapoda, expressed as damp weight per square meter of bottom.

Bryozoa (figs. 60 and 61) were distributed in moderate-sized patches in the study area. Densities, for the most part, were rather low (1 to 24/m^2) over the majority of their range of occurrence with higher densities occupying smaller, discrete patches on the periphery. Biomass, similarly, was moderately small (0.01 to 1.0 g/m^2) over most of their range, again with larger biomass (1 to 52 g/m^2) occurring only in small isolated patches.

Brachiopoda (figs. 60 and 61) were distributed only in a relatively small area on the outer continental shelf north of Cape Hatteras and southeast of Norfolk, Virginia. Densities ranged between 1 and 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 to 199/m^2) occurred 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 localities 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 Cod 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

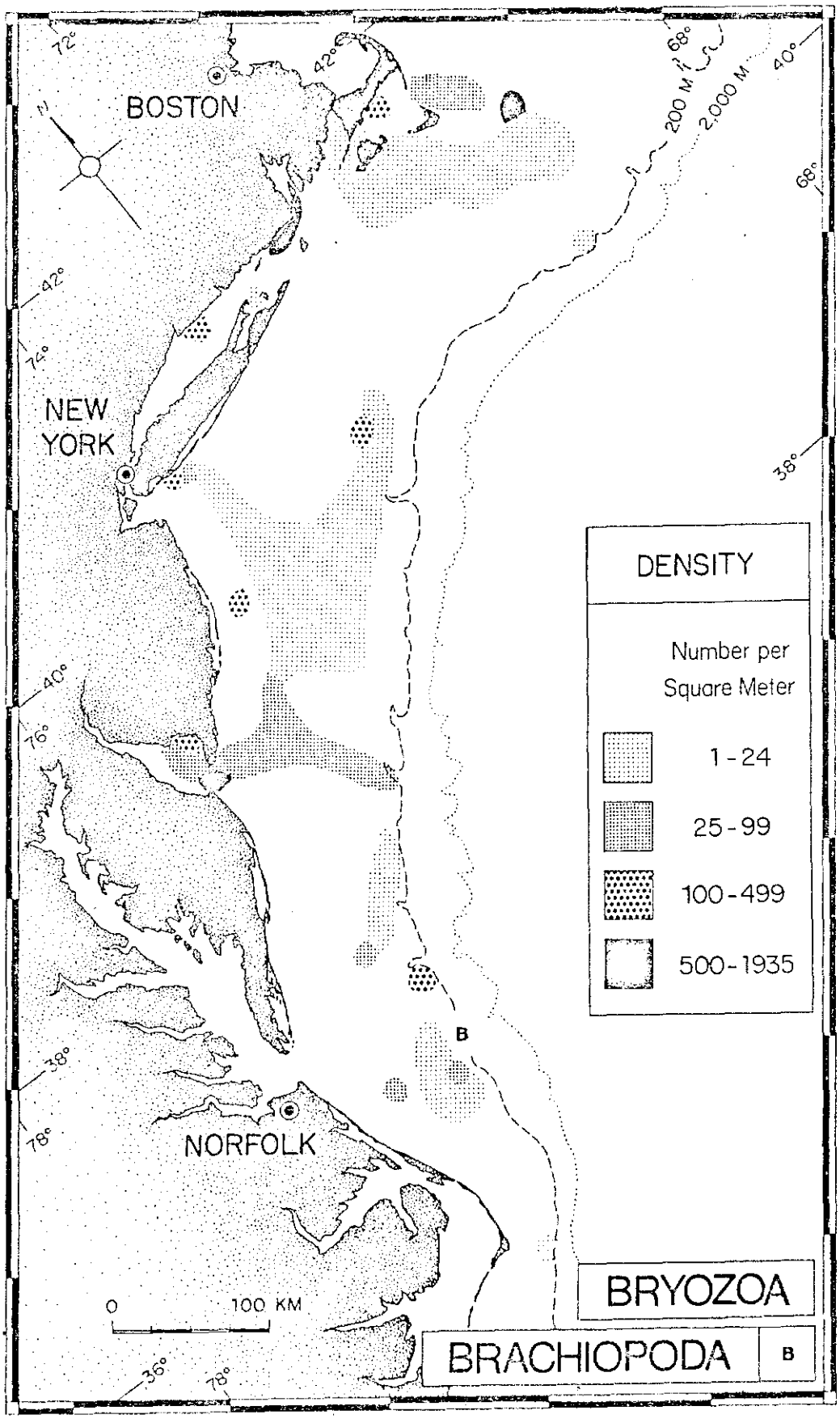


Figure 60.--Geographic distribution of the density of Bryozoa and Brachiopoda, expressed as number of individuals per square meter of bottom.

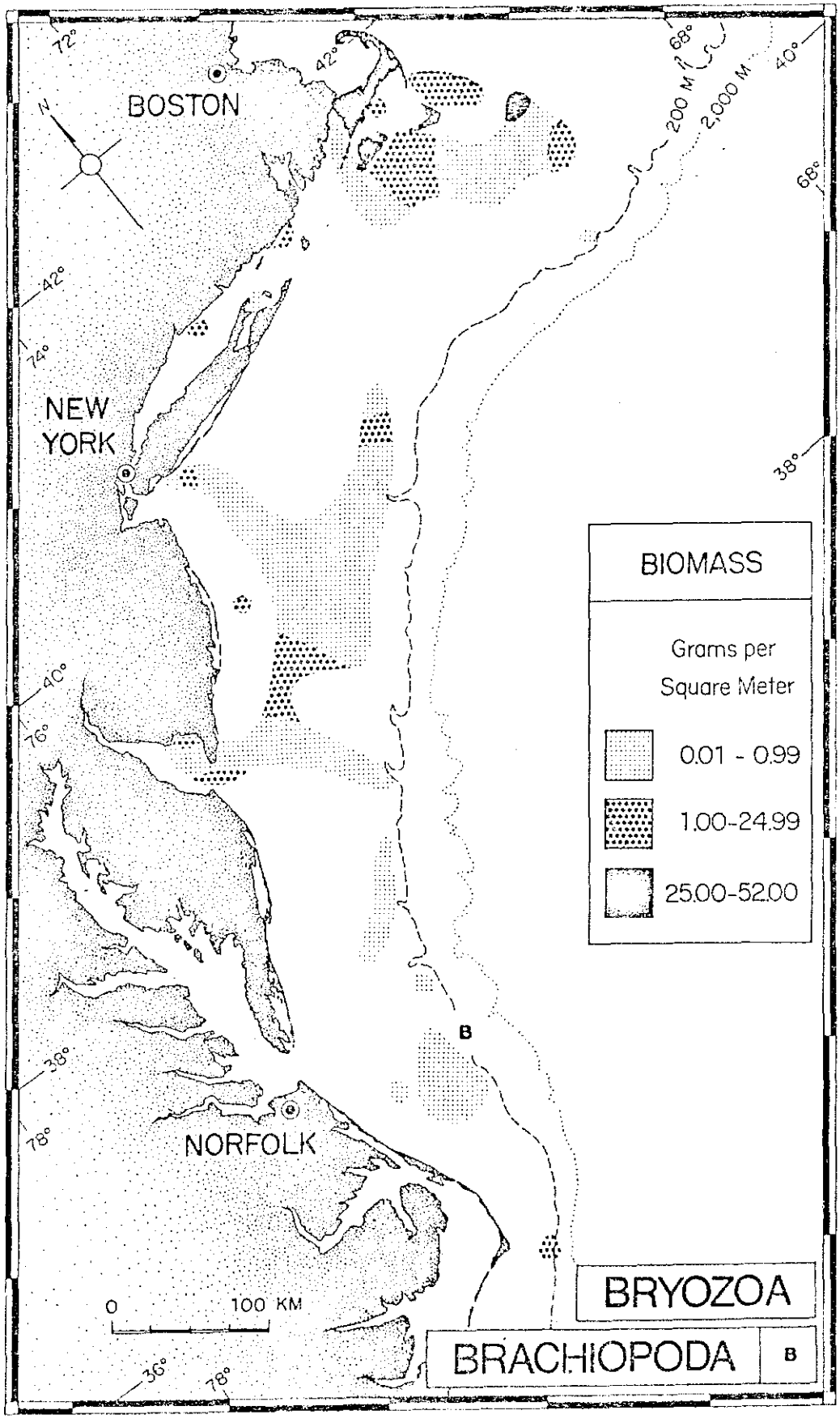


Figure 61.--Geographic distribution of the biomass of Bryozoa and Brachiopoda, expressed as damp weight per square meter of bottom.

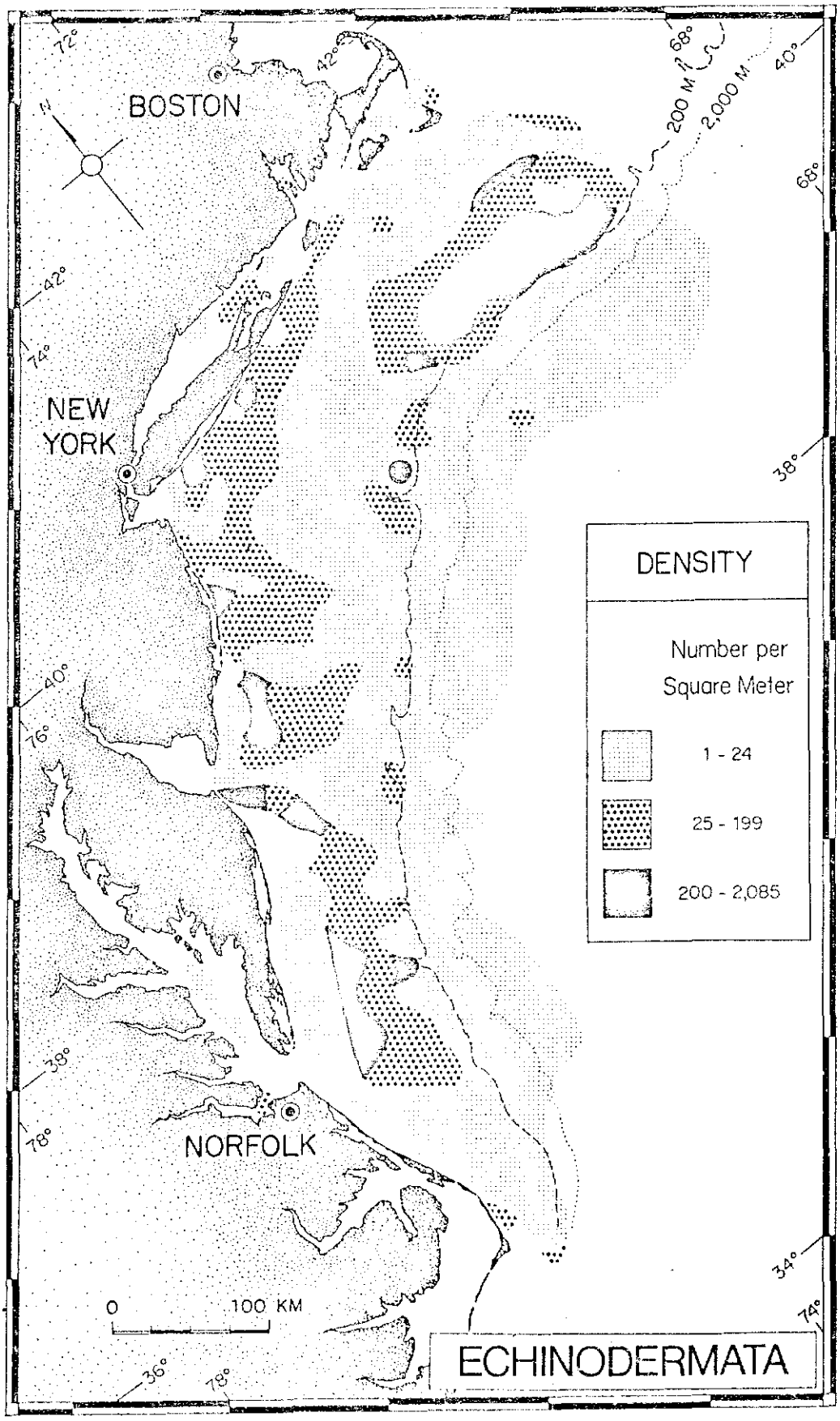


Figure 62.--Geographic distribution of the density of Echinodermata, expressed as number of individuals per square meter of bottom.

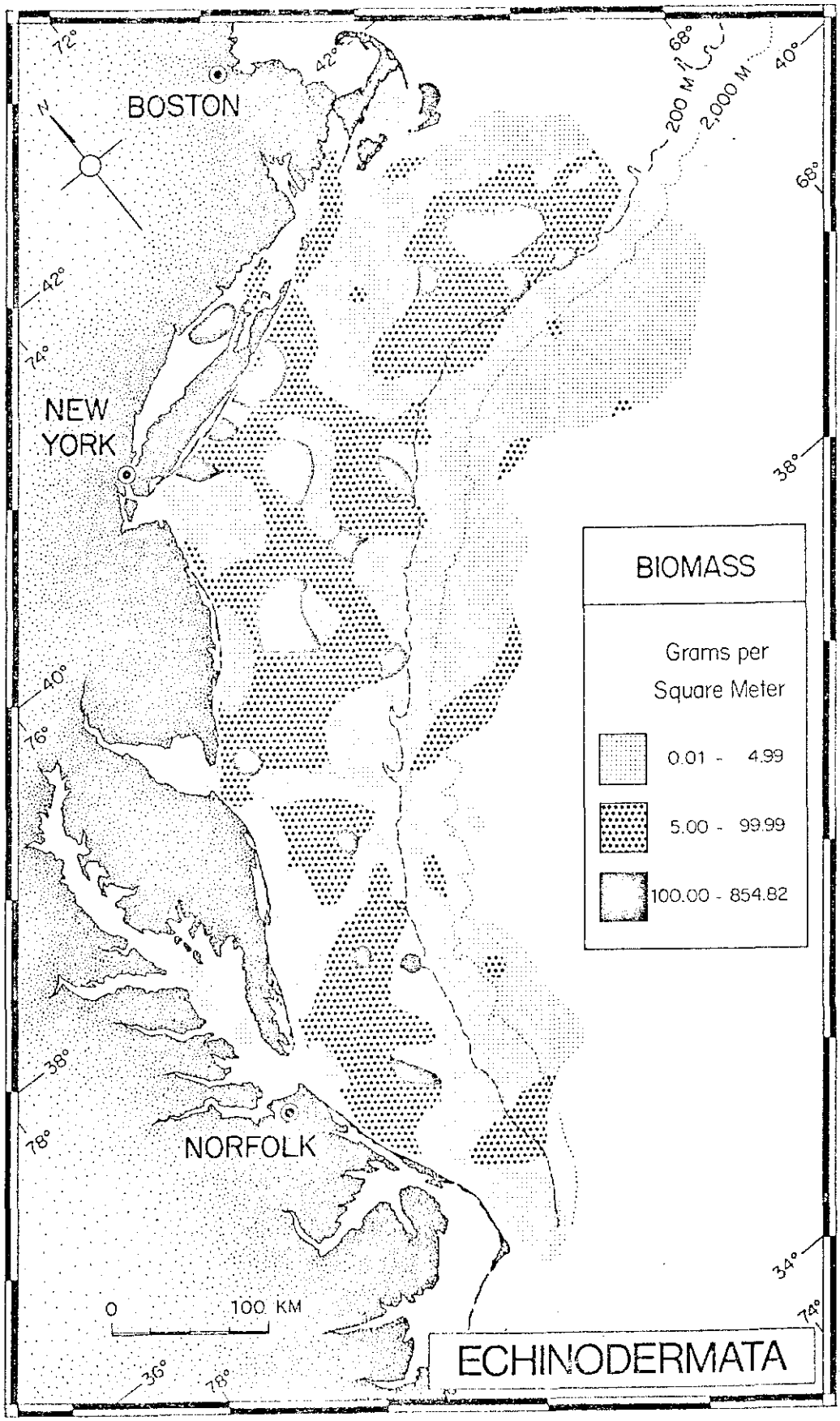


Figure 63.--Geographic distribution of the biomass of Echinodermata, expressed as damp weight per square meter of bottom.

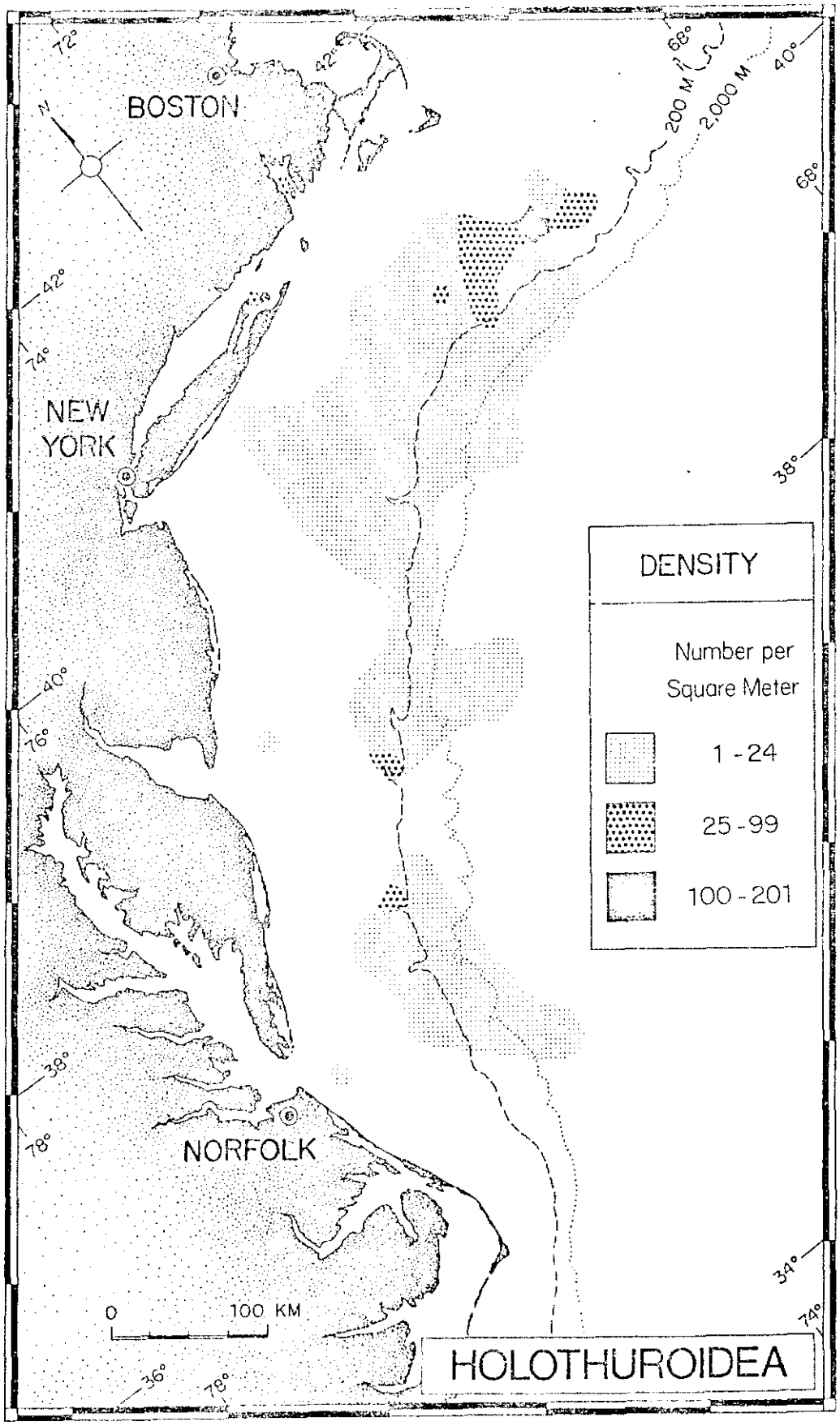


Figure 64.--Geographic distribution of the density of Holothuroidea, expressed as number of individuals per square meter of bottom.

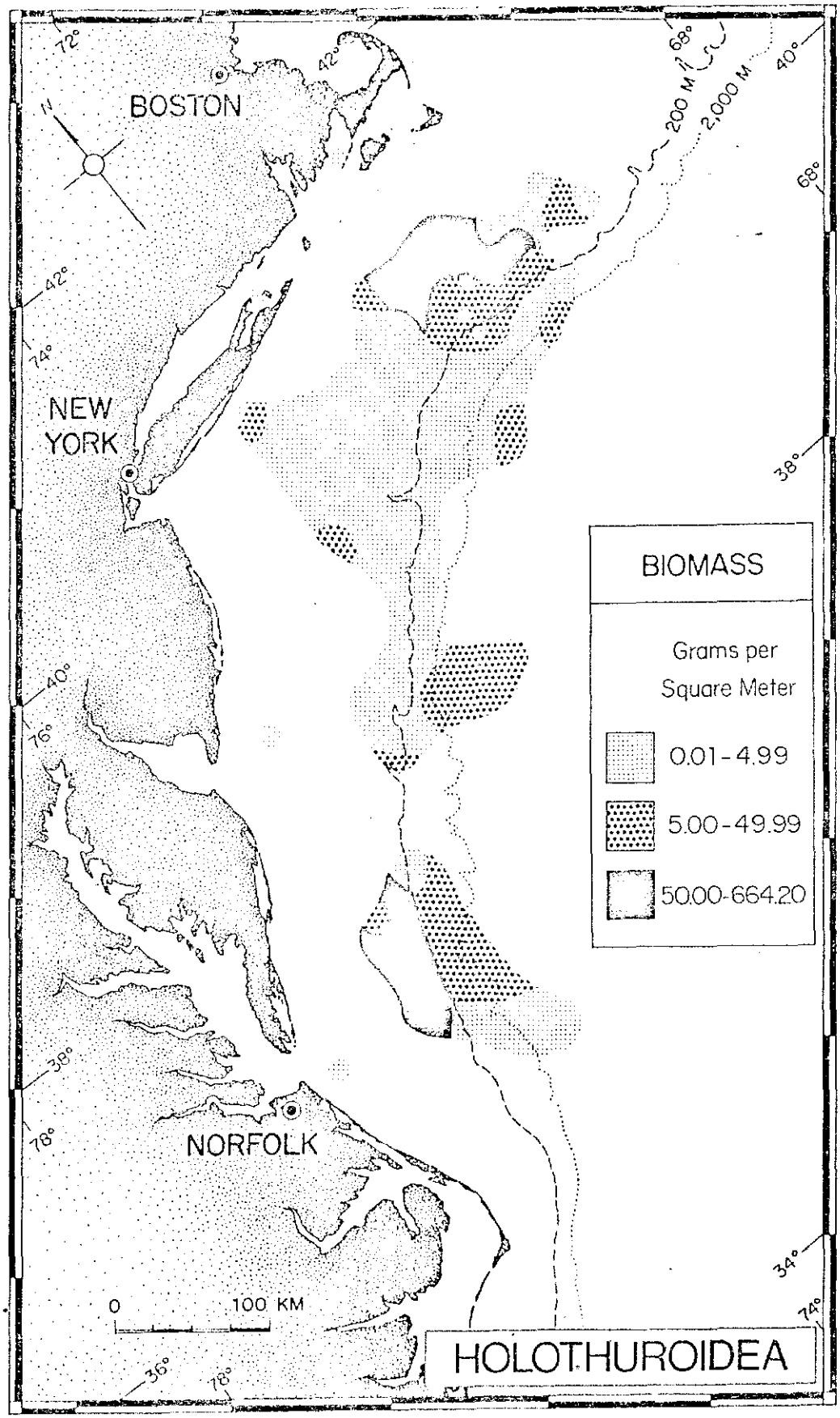


Figure 65.--Geographic distribution of the biomass of Holothuroidea, expressed as damp weight per square meter of bottom.

the density ranged from 25 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 Cape Cod and the other east of Norfolk, Virginia, where biomasses between 5 and 664 g/m^2 occurred.

Echinoidea (figs. 66 and 67) occurred 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 mid-shelf in the Chesapeake Bight region they were present in densities ranging between 25 and 500/m^2 and in a few limited areas in the New York-Delaware sector, they occurred at densities between 500 and 2,083/m^2. Echinoids constituted a rather substantial biomass. In most of their range their biomass averaged between 0.01 and 25 g/m^2. In roughly ten percent of their range biomass averaged between 25 and 100 g/m^2. In roughly one twentieth of their area of occupancy, including a large area on the outer continental shelf off Cape Cod, their biomass ranged between 100 and 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 to 1,018/m^2) concentrations occurred in a rather broad band along the outer continental shelf between

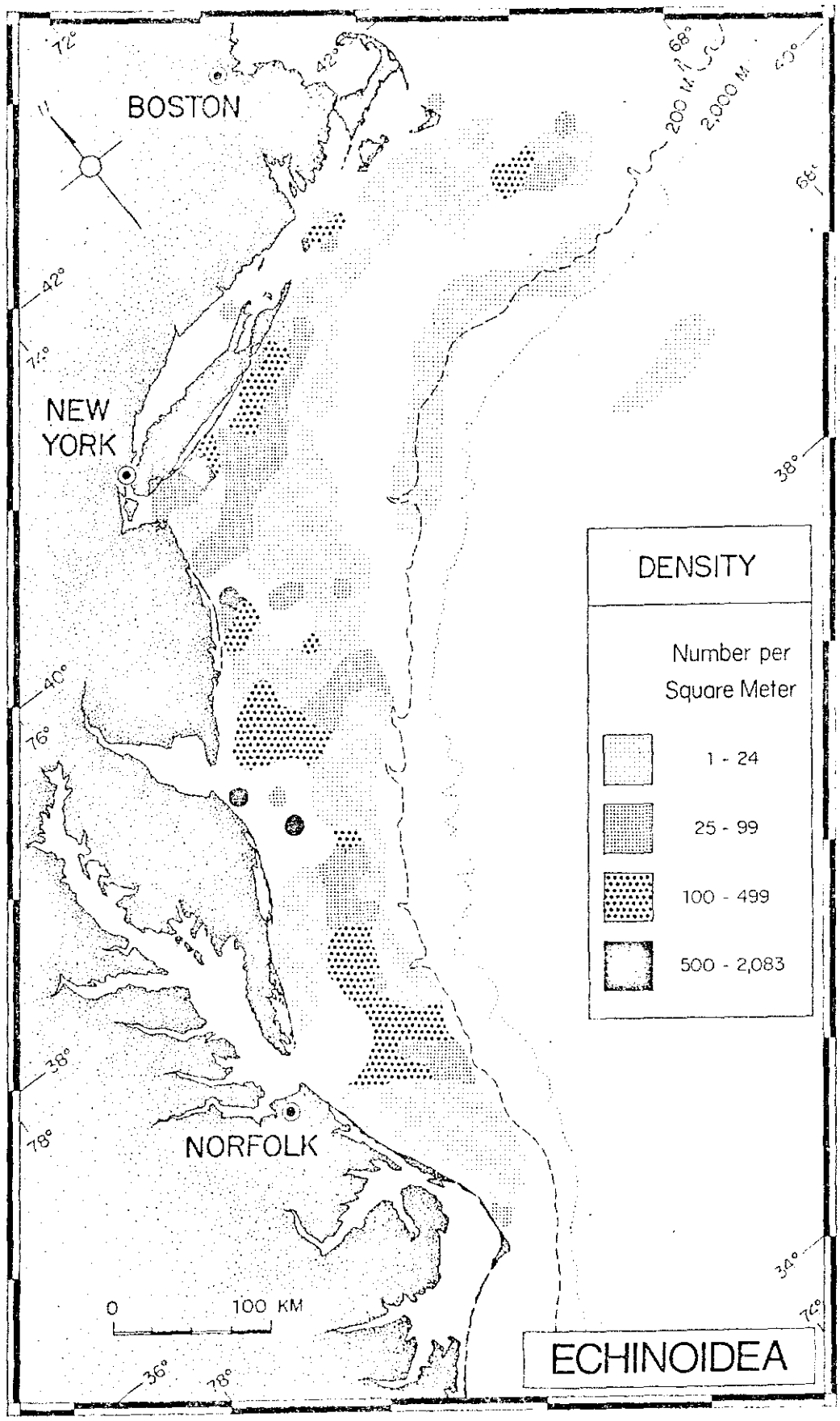


Figure 66.--Geographic distribution of the density of Echinoidea, expressed as number of individuals per square meter of bottom.

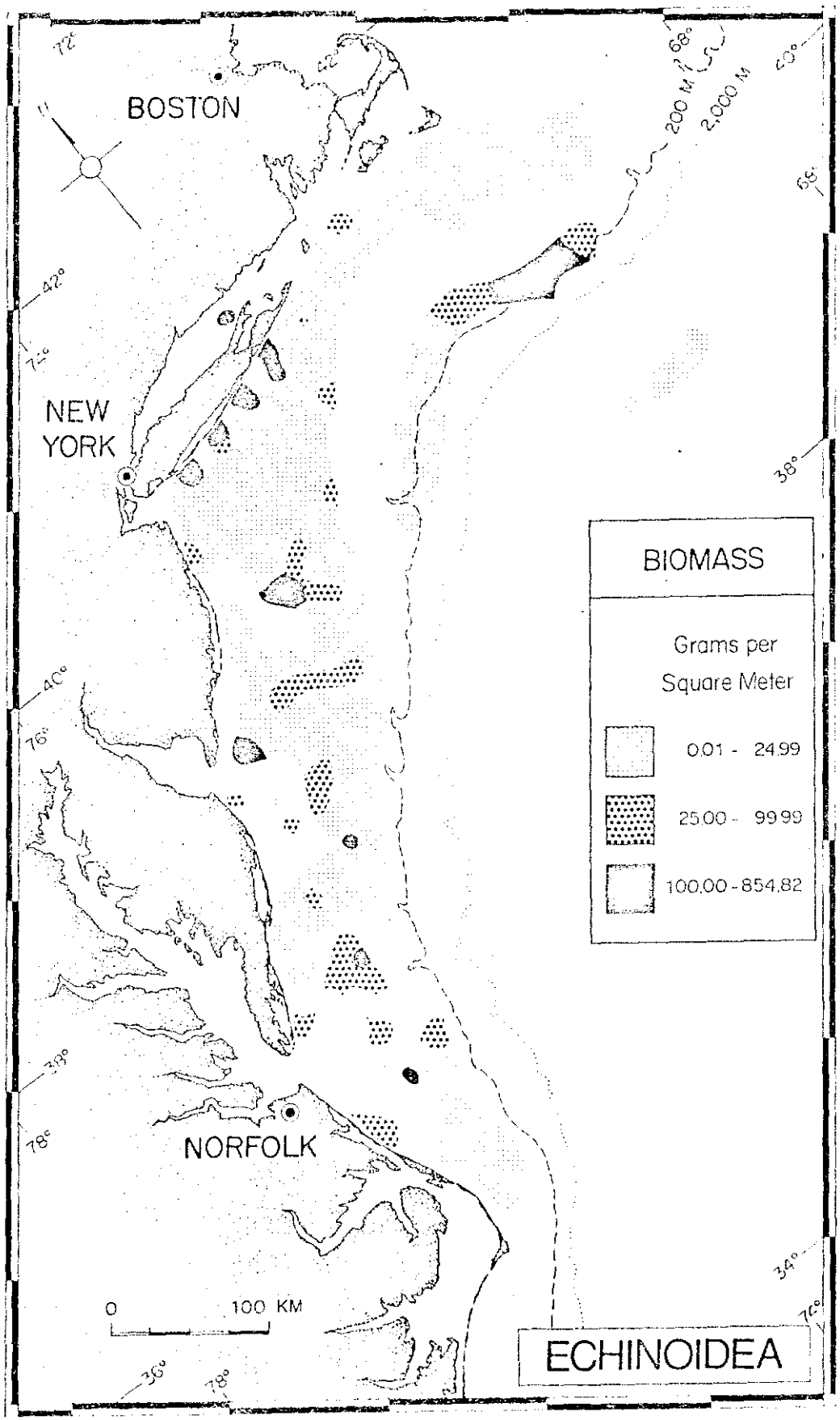


Figure 67.--Geographic distribution of the biomass of Echinoidea, expressed as damp weight per square meter of bottom.

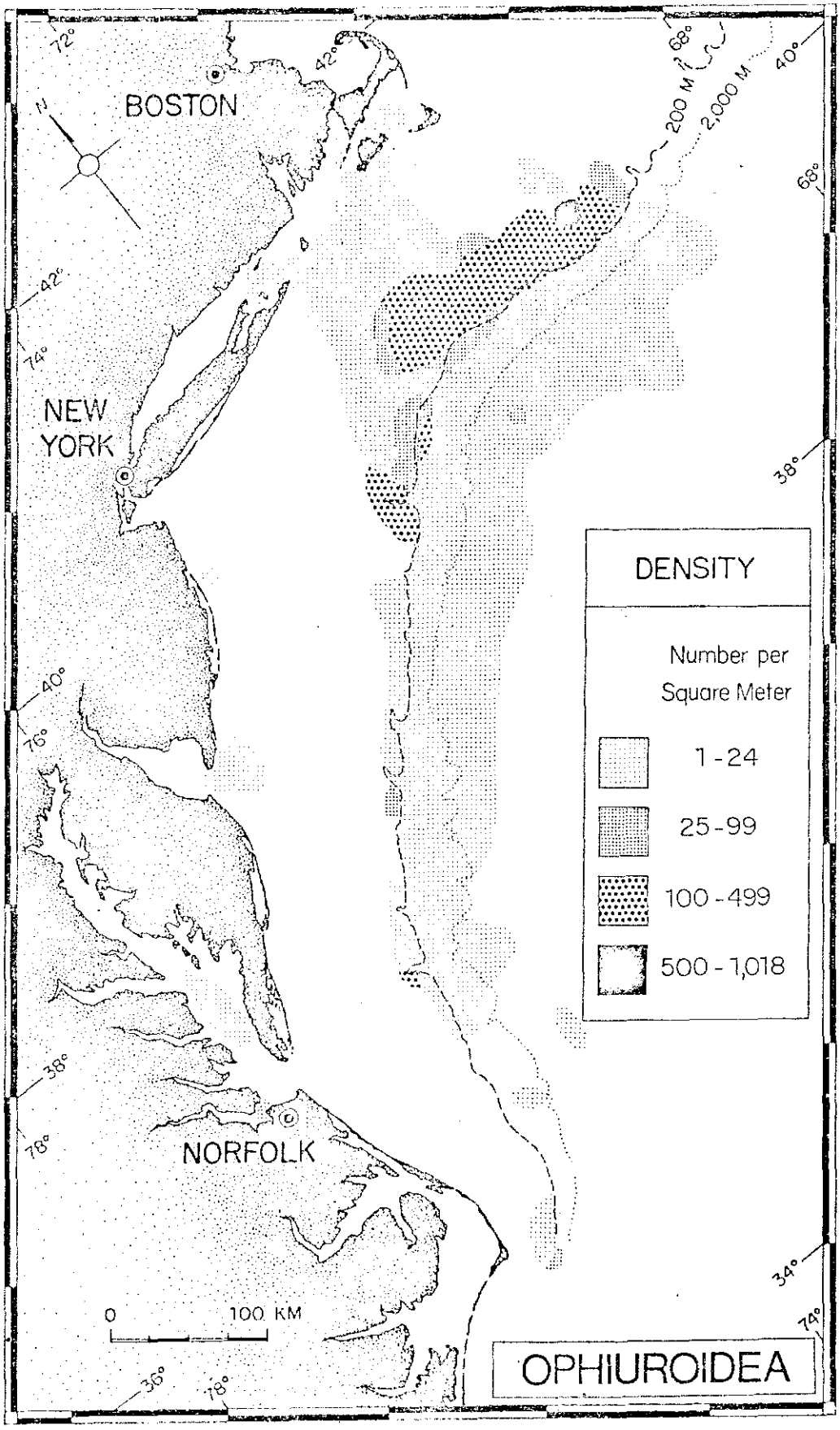


Figure 68.--Geographic distribution of the density of Ophiuroidea, expressed as number of individuals per square meter of bottom.

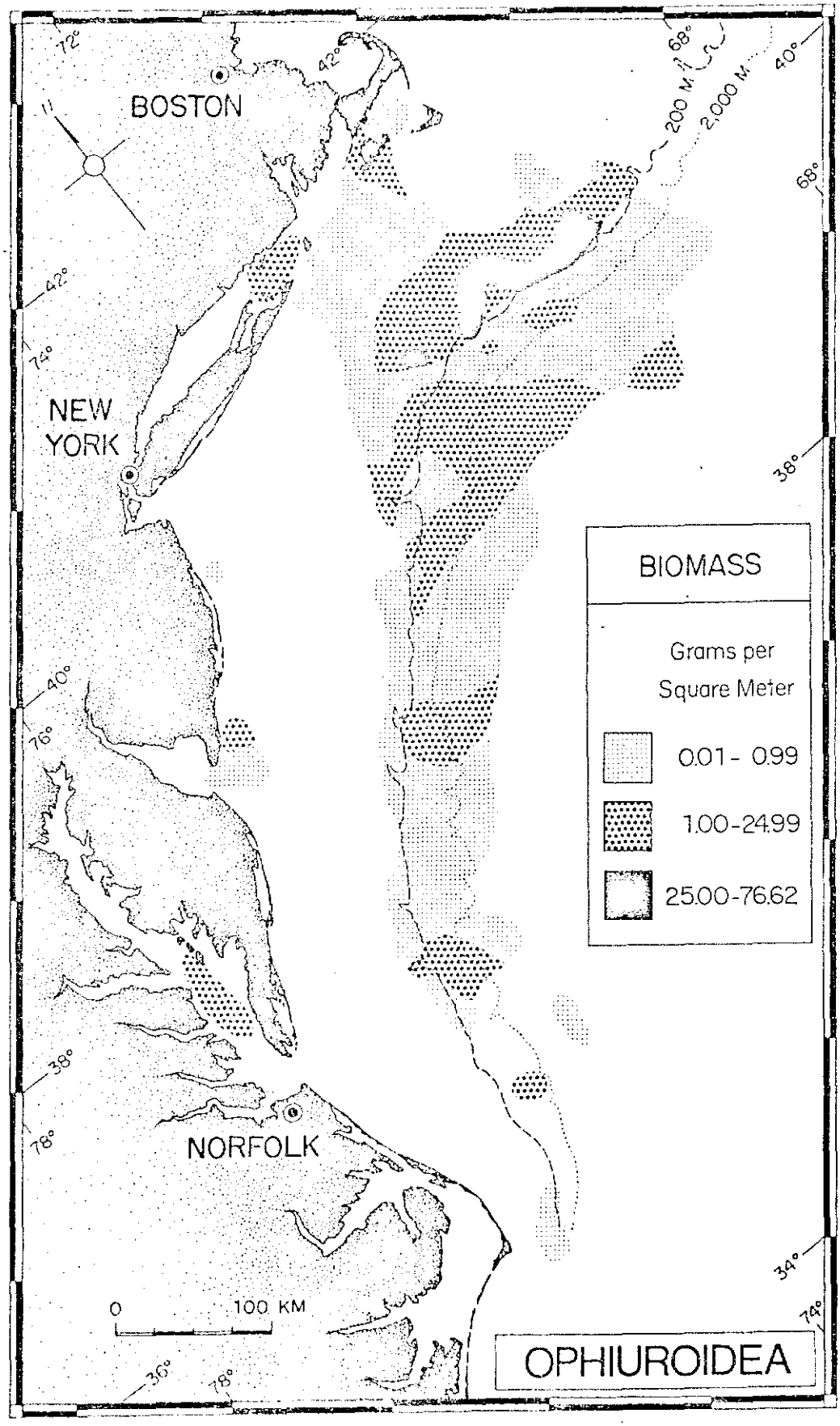


Figure 69.--Geographic distribution of the biomass of Ophiuroidea, expressed as damp weight per square meter of bottom.

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) occurred over roughly one half of its range, and moderate (1 to 25 g/m^2) to high (25 to 77 g/m^2) biomass occurred over extensive patches throughout their area of occupancy.

Asteroidea (figs. 70 and 71) occurred over a rather extensive area between Cape Cod and Cape Hatteras. Their occurrence was more common and density was highest in the New England region. In most localities their density ranged between 1 and 9/m^2. In the New England area (and at one locality in New York Bight) their density in a rather large area ranged between 10 and 48/m^2. Their occurrence in the Chesapeake Bight region was primarily in deepwater areas extending from the outer shelf to the continental rise. Biomass of starfishes over most of their range averaged between 5 and 50 g/m^2. At a few localities in the Southern New England-New York Bight area their biomass ranged between 50 and 210 g/m^2. In the Chesapeake Bight subarea, asteroids occurred 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 encountered at only four localities, three were located on the outer continental shelf and slope south of Rhode Island and at one locality along the coast at Cape May, New Jersey. 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 they occurred in low (less than 25/m^2) to high (500 to 2,640/m^2) density on the shelf, and in low density on the

slope and rise. In New York Bight their density was commonly lower, $100/m^2$. In Chesapeake Bight their density was generally low on the continental shelf, but ranged up to 100 to $499/m^2$ in 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.

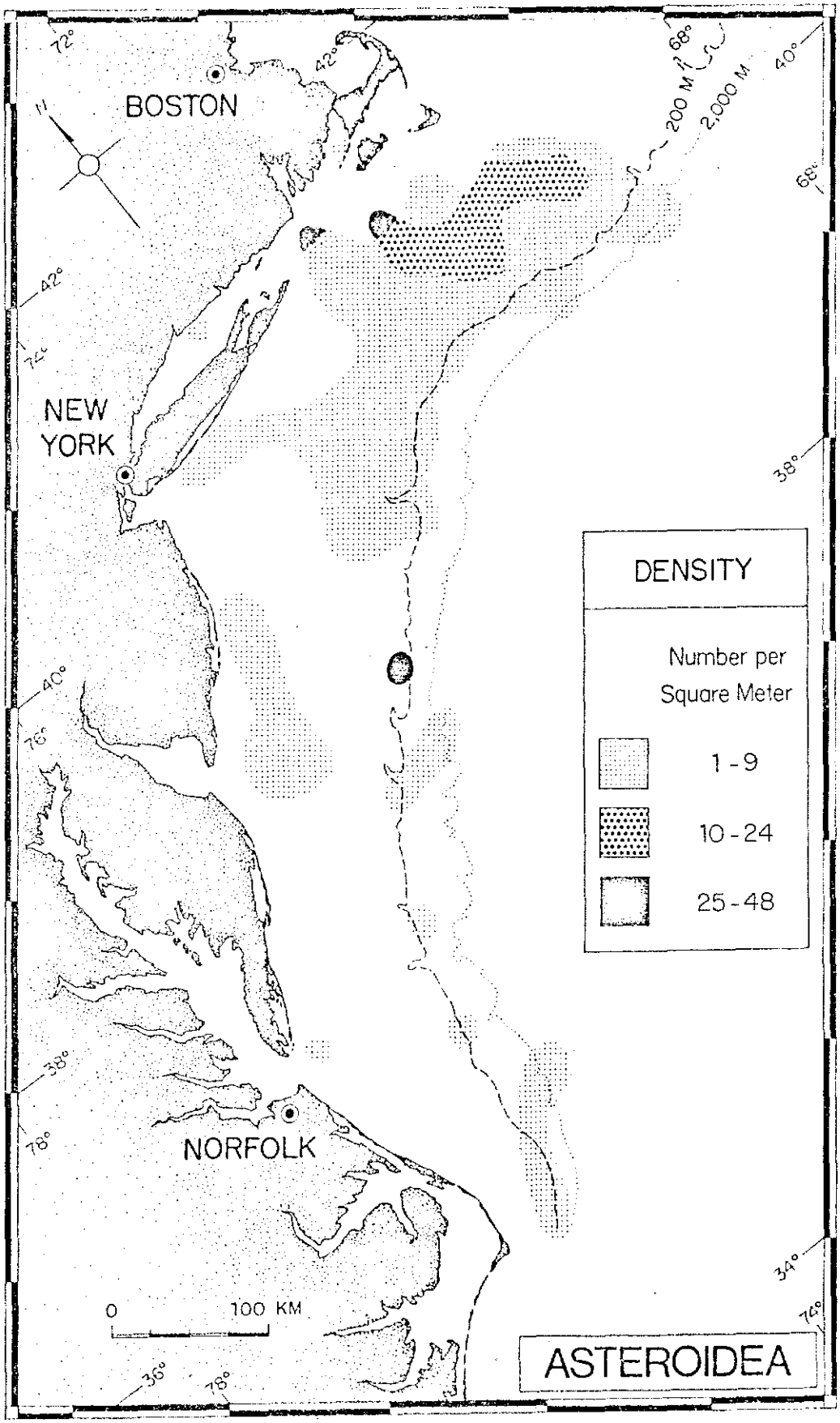


Figure 70.--Geographic distribution of the density of Asteroidea, expressed as number of individuals per square meter of bottom.

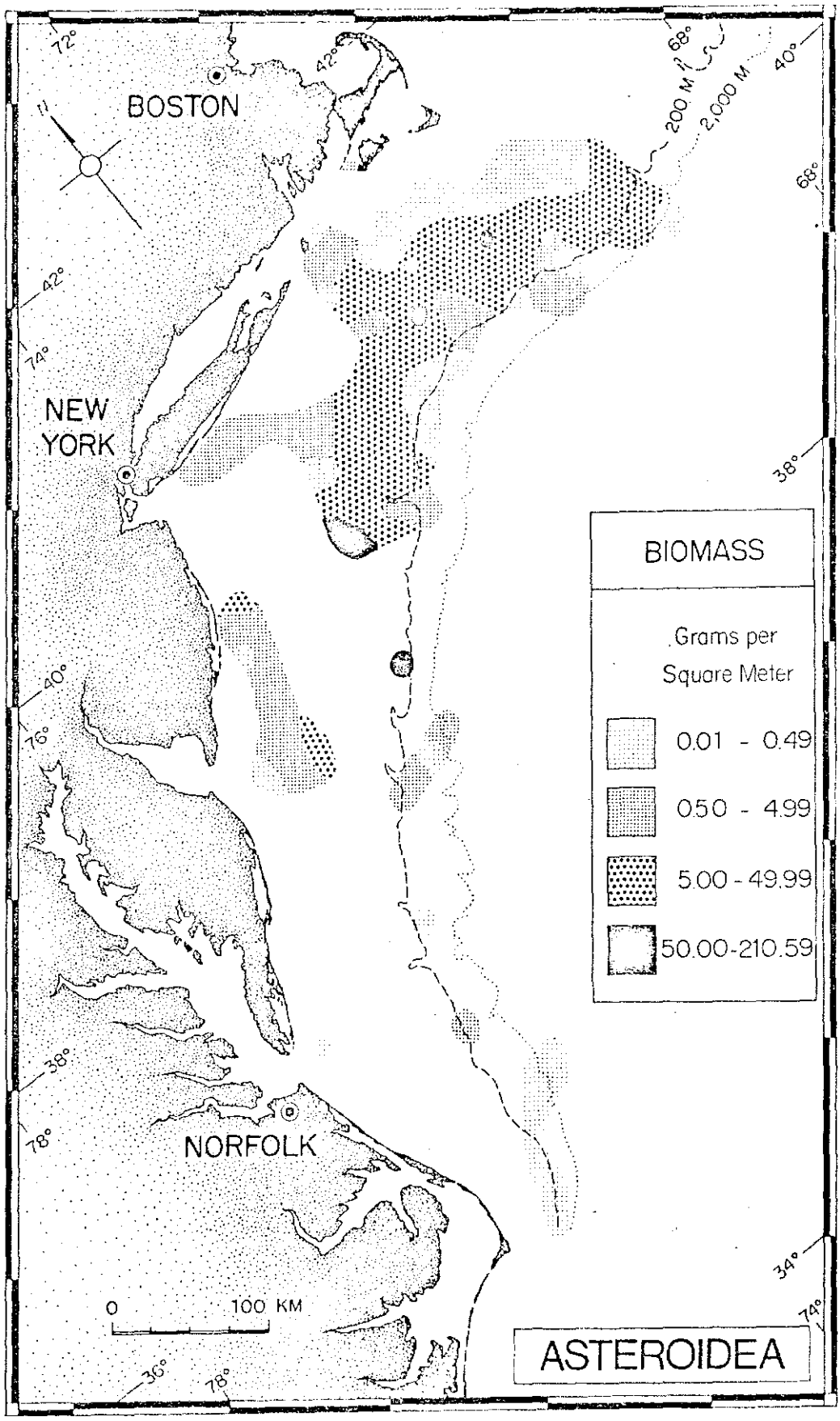


Figure 71.--Geographic distribution of the biomass of Asteroidea, expressed as damp weight per square meter of bottom.

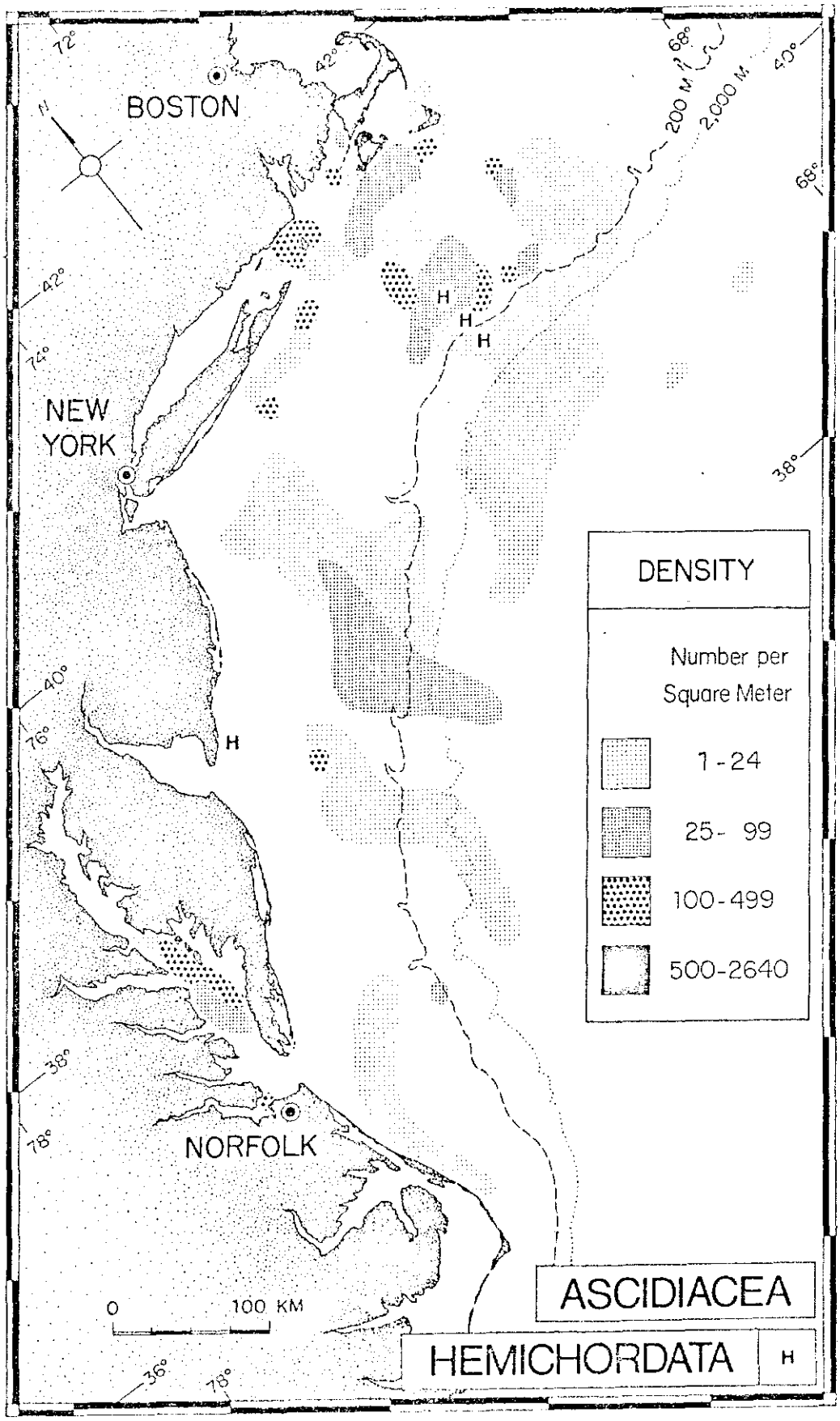


Figure 72.--Geographic distribution of the density of Ascidiacea and Hemichordata, expressed as number of individuals per square meter of bottom.

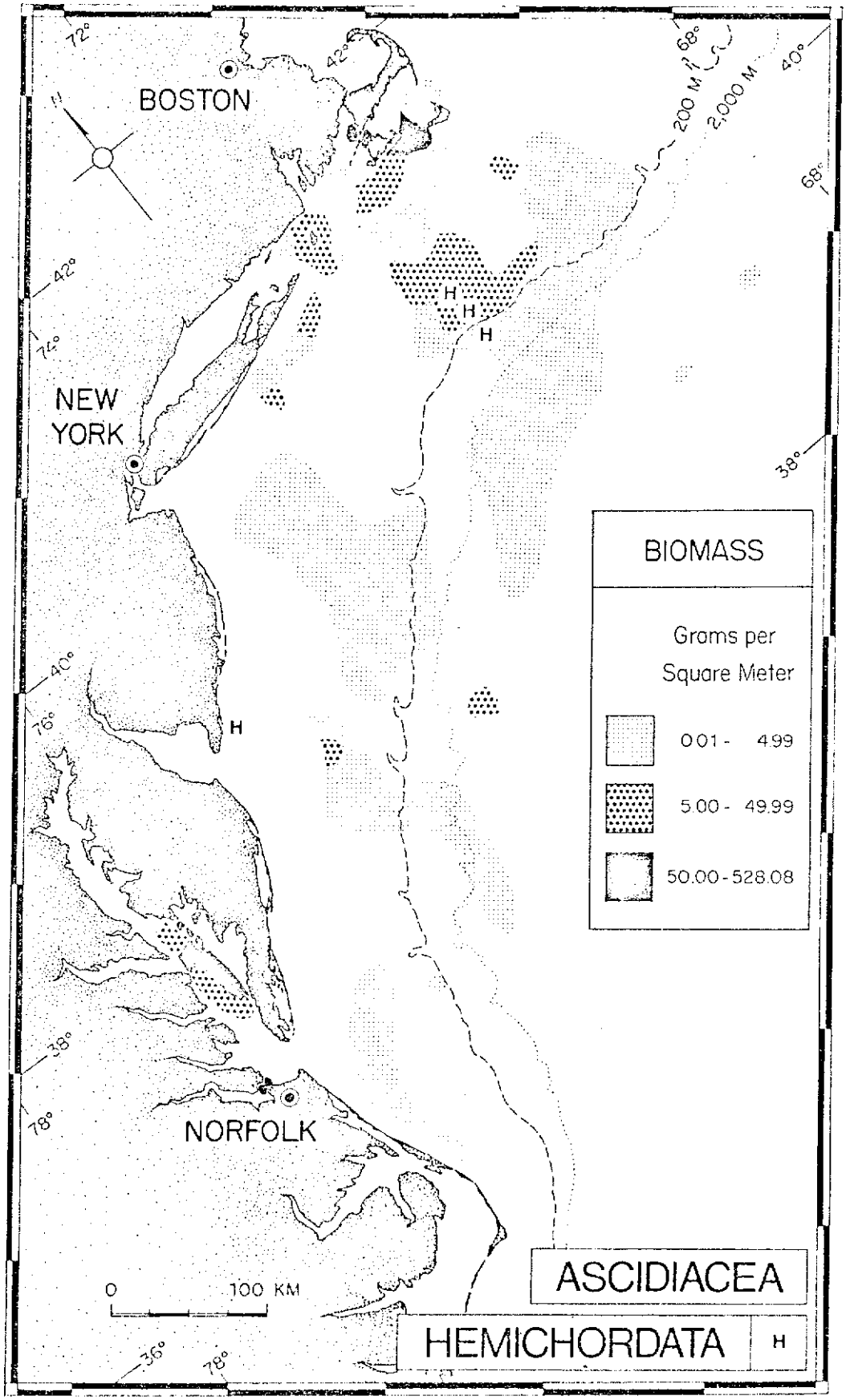


Figure 73.--Geographic distribution of the biomass of Ascidiacea and Hemichordata, expressed as damp weight per square meter of bottom.

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, in some cases, their distinctive distribution. Their occurrence in our samples is illustrated in six figures, figures 74-79.

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

Phylum Annelida

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

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

Scalibregma inflatum (Rathke)--figure 74--a medium-size polychaete of the family Scalibregmidae. This species, which commonly occurs in silty sand, is an important food of demersal fish.

Phylum Pogonophora

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

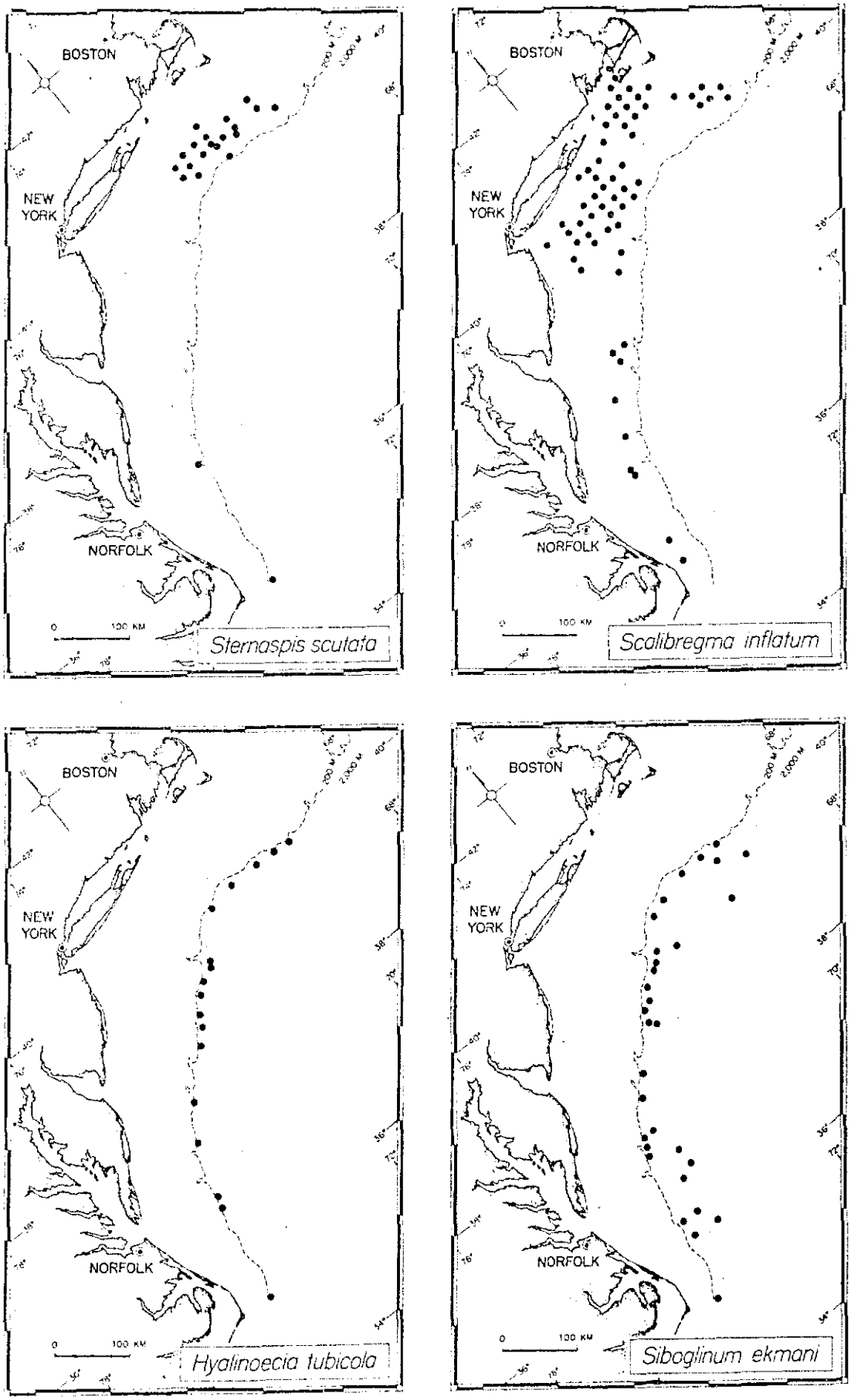


Figure 74.--Geographic distribution of three selected species of Annelida and of one Pogonophora (lower right).

Phylum Mollusca

Arctica islandica (Linnaeus)--figure 75--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)--figure 75--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.--figure 75--represented in our samples by five species of small (less than 1 cm) bivalves of the family Thyasiridae. The species represented are: ferruginosa, flexuosa, ovata, pygmaea, and trisinuata. These bivalves are most commonly found in offshore waters and in fine-grained bottom sediments.

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

Lucinoma blakeana (Stimpson)--figure 76--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)--figure 76--a large (10-17 cm) bivalve of the family Solenidae. This is a very active, sand-dwelling species that also inhabits shallow inshore waters, as well as the offshore continental shelf.

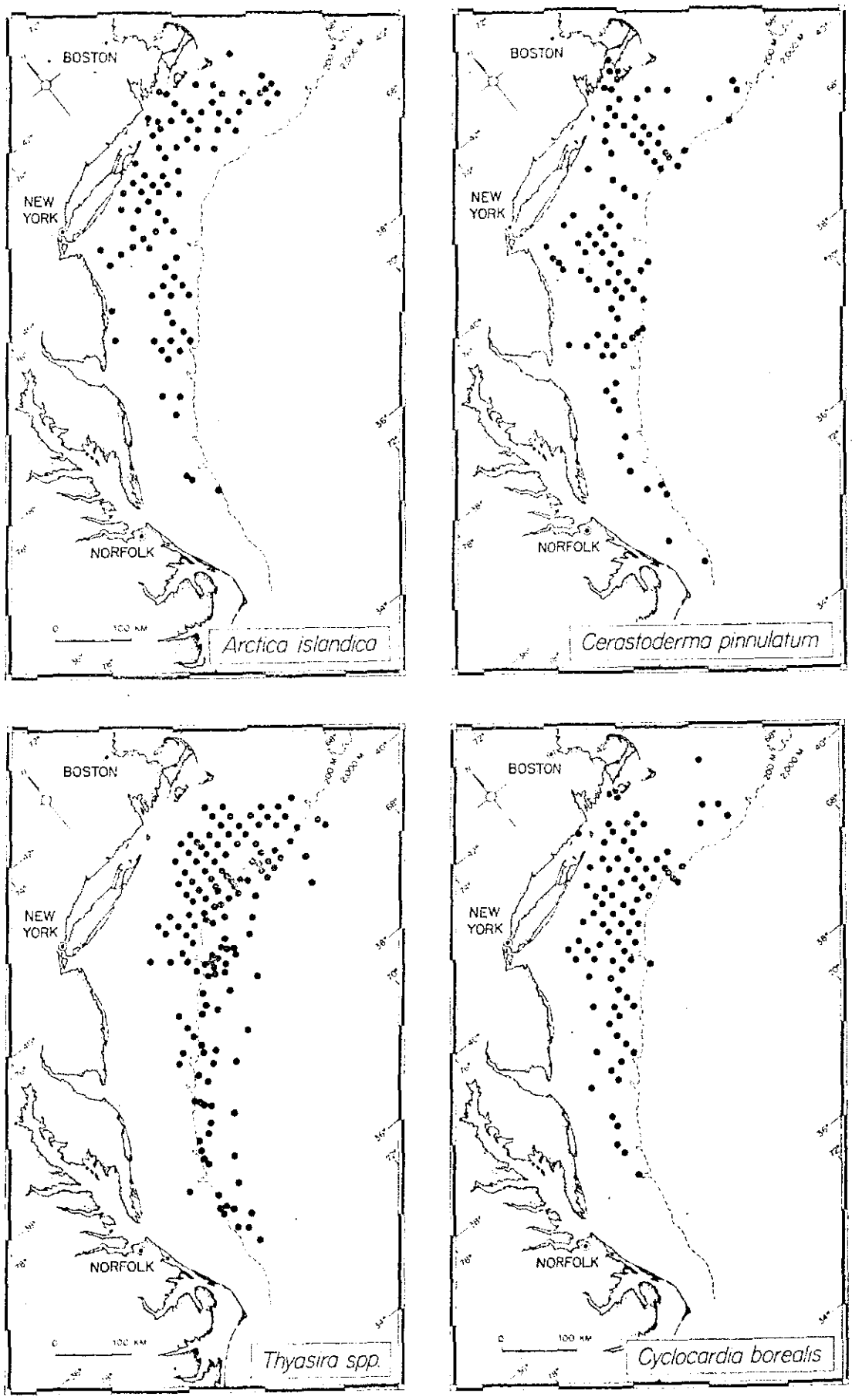


Figure 75.--Geographic distribution of selected bivalves, phylum Mollusca.

Polinices spp.--figure 76--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.--figure 76--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.--figure 77--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 with representatives distributed in inshore and offshore waters; very abundant in some localities.

Leptocheirus pinguis (Stimpson)--figure 77--a moderately large (10-17 mm) gammaridean amphipod, family Aoridae, that typically occurs in continental shelf sand and silty sand habitats. This species is a very important food of demersal fish.

Phoxocephalus holbolli (Kröyer)--figure 77--a moderately small (5-7 mm) member of the family Phoxocephalidae. This species characteristically inhabits bottom sediments composed of fine sand.

Trichophoxus epistomus (Shoemaker)--figure 77--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.

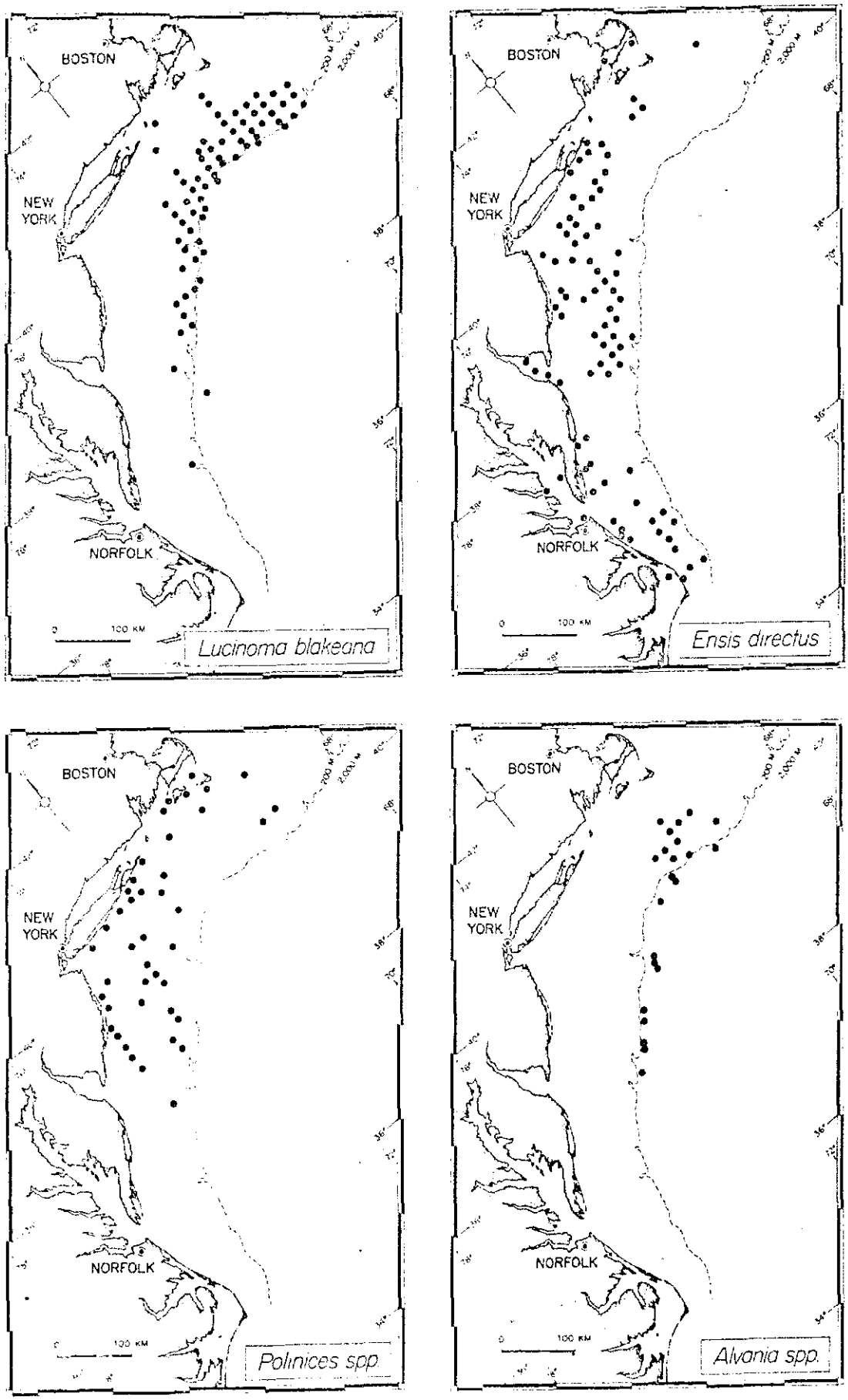


Figure 76.--Geographic distribution of selected bivalves (top) and gastropods (bottom), phylum Mollusca.

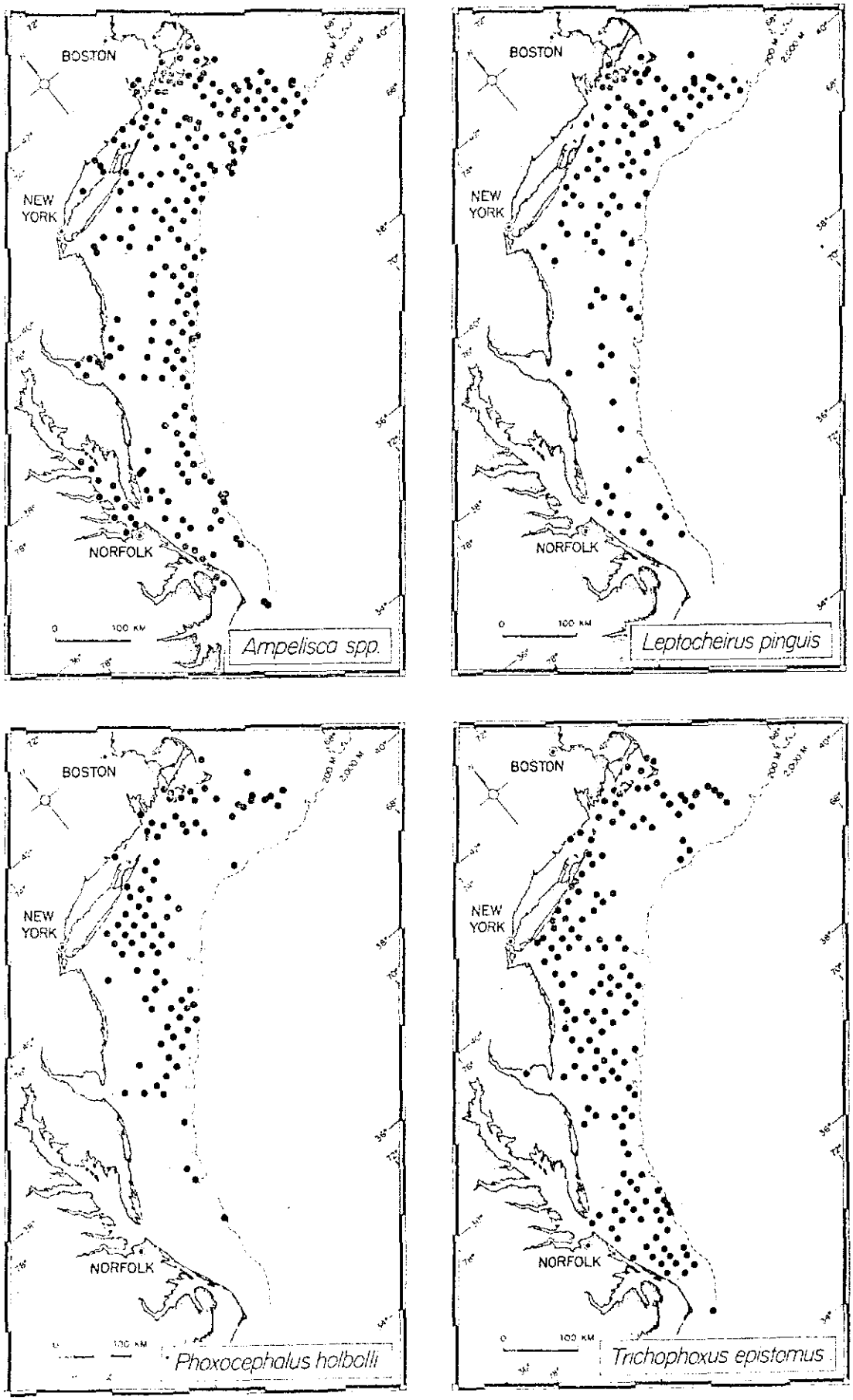


Figure 77.--Geographic distribution of selected amphipods, phylum Arthropoda.

Cirolana spp.--figure 78--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 common and widely distributed genus in the Middle Atlantic Bight Region.

Crangon septemspinosa (Say)--figure 78--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 over much of the continental shelf.

Pagurus spp.--figure 78--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.--figure 78--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 different bottom sediments and occur throughout the Middle Atlantic Bight Region.

Phylum Echinodermata

Echinarachnius parma (Lamarck)--figure 79--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)--figure 79--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 occurs only in the southern part of the Region.

Astropecten spp.--figure 79--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)--figure 79--a long-armed species of moderate size (10 mm disc) that belongs to the subclass Ophiuroidea, family Ophiocanthidae. It is a moderately deepwater inhabitant that was taken in our samples only in the northern sector of the Region along the outer continental shelf and upper slope.

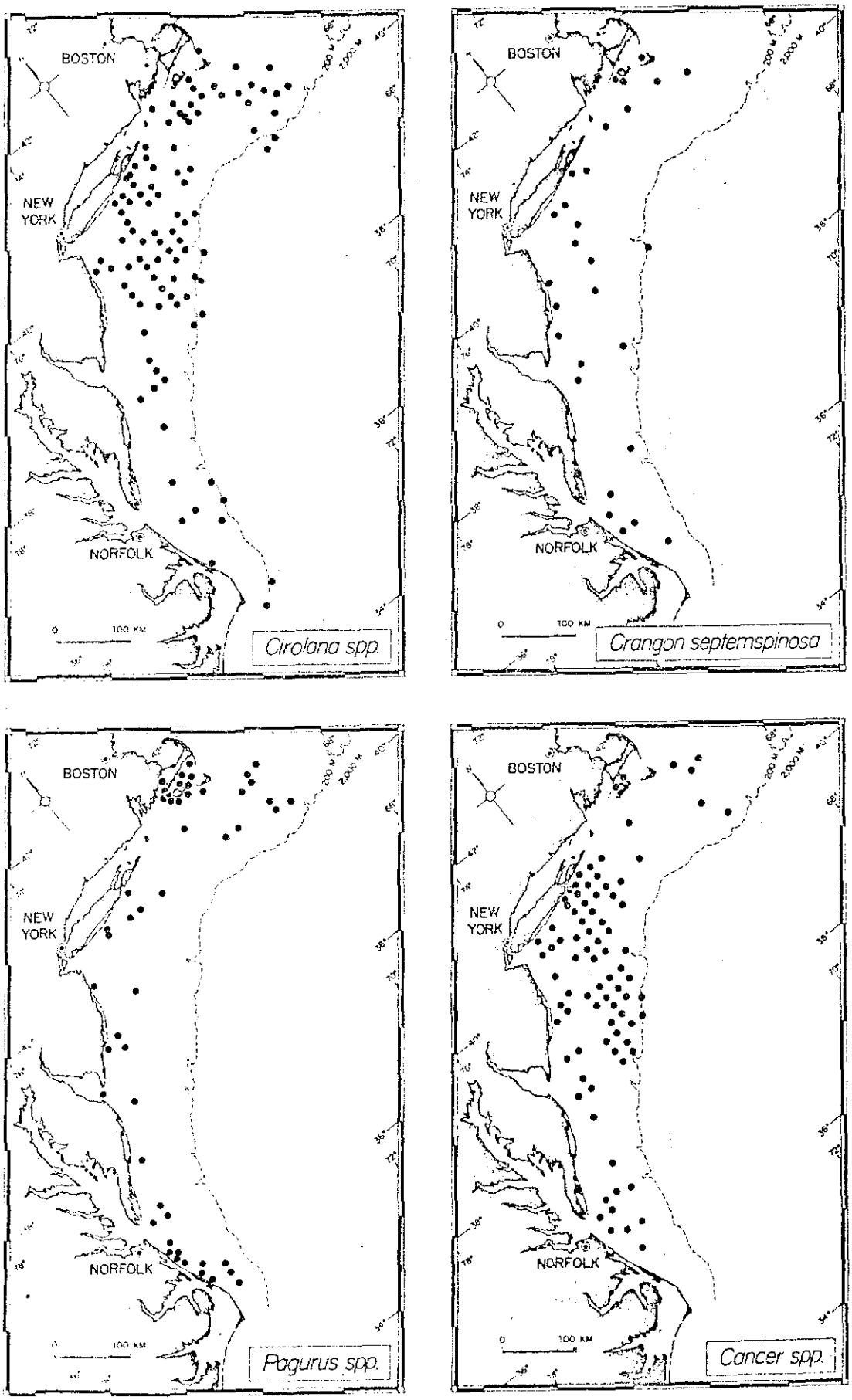


Figure 78.--Geographic distribution of a selected isopod (upper left) and decapods, phylum Arthropoda.

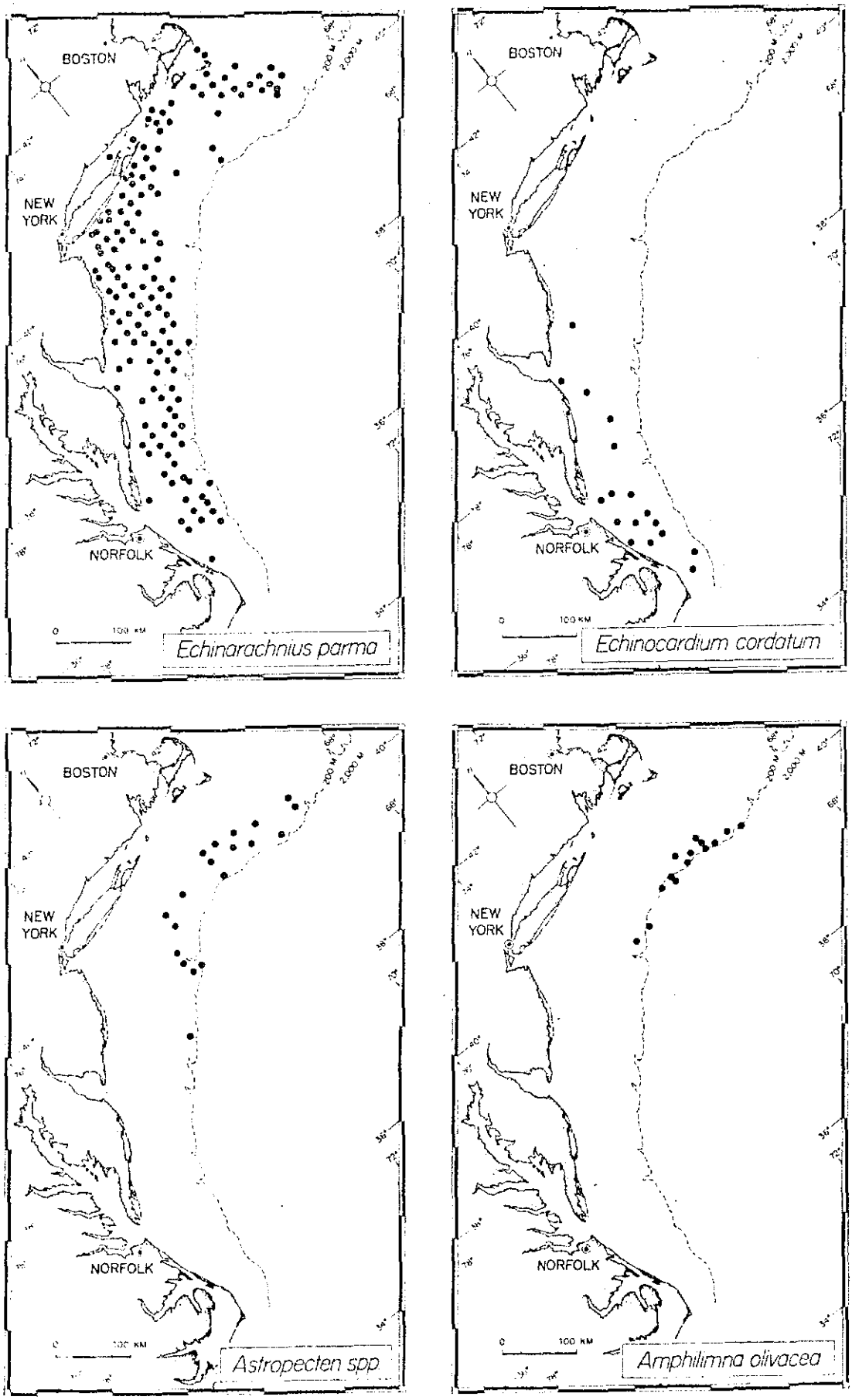


Figure 79.--Geographic distribution of selected echinoids (top), asteroids (lower left), and ophiuroids (lower right), phylum Echinodermata.

BATHYMETRIC DISTRIBUTION

Total Macrobenthic Fauna -- All Taxonomic Groups Combined

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 biomass. Consistent trends of decreasing quantities with depth within all three subareas revealed the general nature and widespread occurrence of this relationship (figs. 80 and 81).

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% reduction. Table 8 lists the mean number of individuals and biomass for each 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, with increased depth on the continental shelf. At mid-shelf depths 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 continued to decline on the continental slope. Along the upper slope the faunal density averaged 382/m^2, at mid-slope 293/m^2, and on the lower slope 72/m^2. A further decline in density continued onto the continental rise, where macrobenthic organisms averaged only 46/m^2. Although there were regional variations in density, which will be described below, the trend in density with respect to water depth was clear. Density was highest in the shallowest water and varied inversely with water depth.

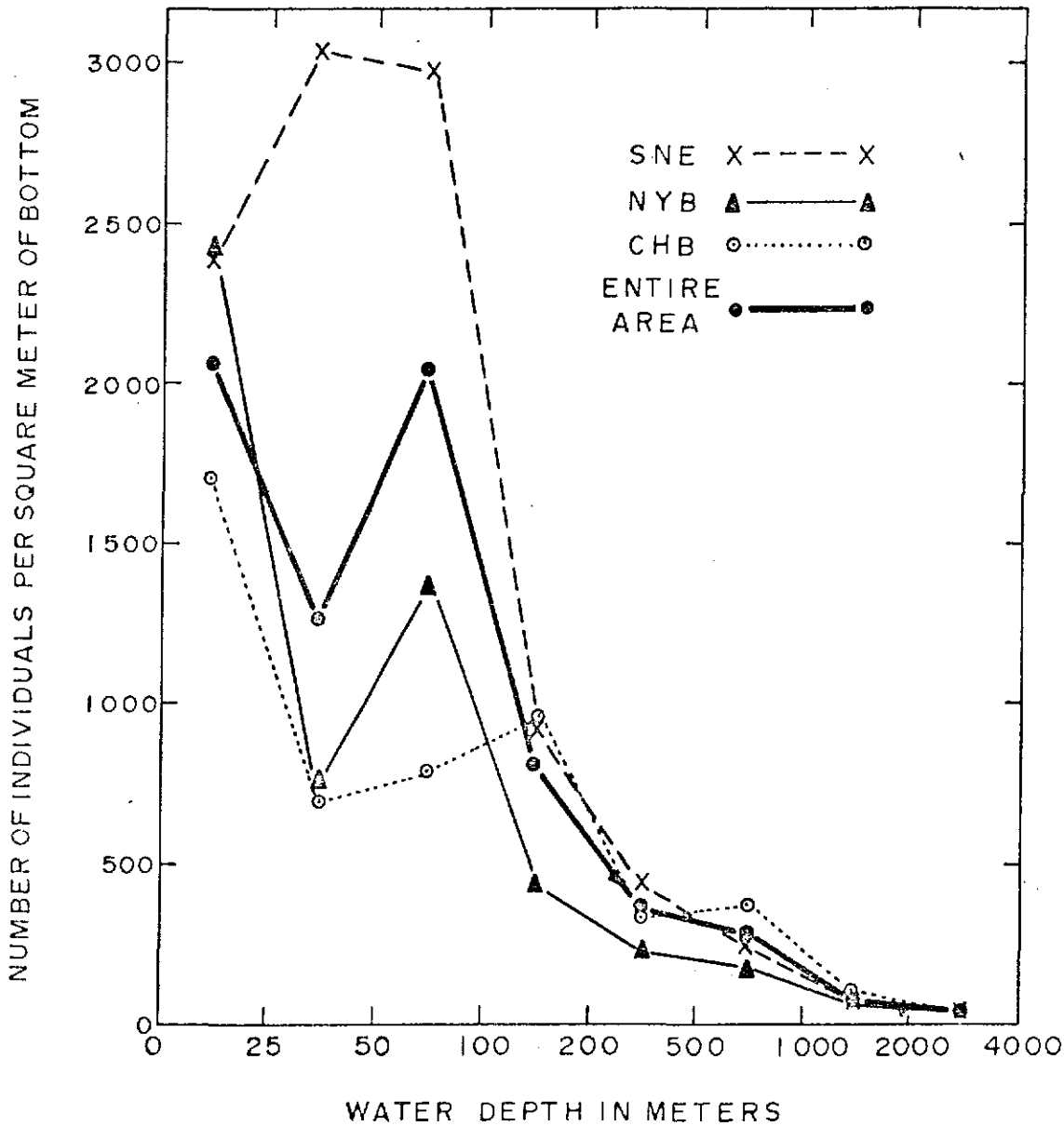


Figure 80.--Relation between number of individuals and water depth. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight Region.

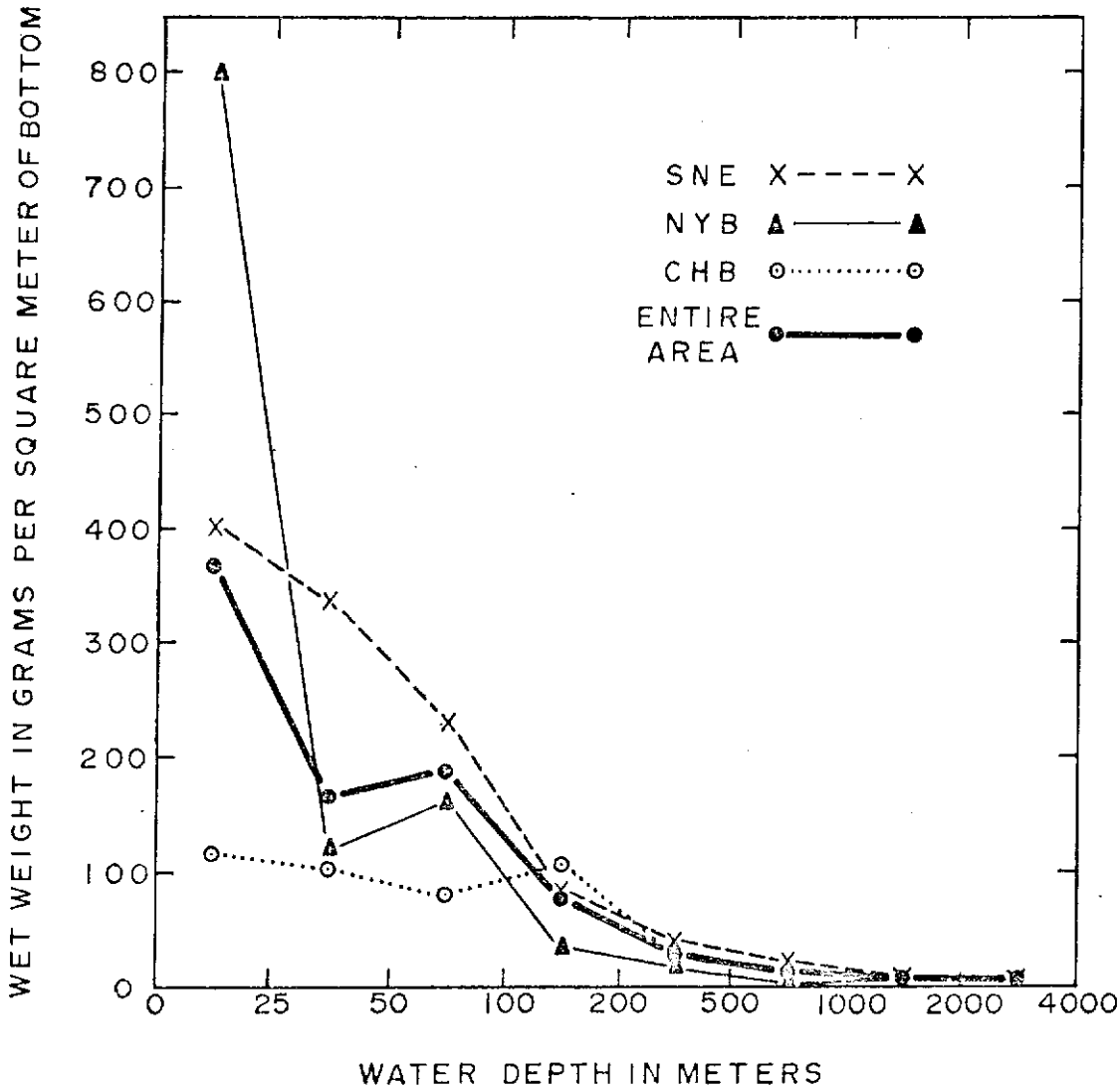


Figure 81.--Relation between biomass (wet weight) and water depth. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight Region.

Rate of change in density as related to bathymetric changes is not readily perceived from the values listed in table 8. Therefore, another tabulation (table 9) 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. 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 mid-shelf 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 occurred in the outer shelf region. Only small changes (-0.2 to -0.3 individual per square meter) 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 parallels the pattern described above for density (table 8, right-hand column). 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 to 189 g/m^2 at mid-shelf, and averaged 79 g/m^2 along the outer shelf. Biomass on the continental slope averaged between 28 and 7 g/m^2. The larger value refers to the upper slope, and the smaller to the lower slope; intermediate quantities of biomass occurred at intermediate levels. On the continental rise the biomass averaged 8 g/m^2.

Rate of change in biomass per 1-meter increase in water depth was greatest in shallow water and least in deep water. This is evident in rate-change values listed in the right-hand column of table 10. Average biomass

Table 8.--Mean number of individuals and biomass of the macrobenthic invertebrate fauna in relation to water depth. Values are listed separately for each subarea and for the entire Middle Atlantic Bight Region.

Water depth	Mean number of individuals				Mean biomass			
	SNE	NYB	CHB	Entire area	SNE	NYB	CHB	Entire area
m	No./m^2	No./m^2	No./m^2	No./m^2	g/m^2	g/m^2	g/m^2	g/m^2
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

Table 9.--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 10.--Change and rate of change in biomass of invertebrates in relation to water depth.

Water depth				Change	Rate change
Range	Mean	Change	Biomass	in biomass	in biomass per meter depth
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

diminished 8.2 g/m^2 with each meter of water depth, from the shallowest depth class (0-24 m) to the next deeper depth class (25-49 m). At mid-shelf there was an increase in biomass, which is believed to be caused by regional differences in biomass (described below) and, to some extent, reflects the larger standing crop of several taxonomic groups (Gastropoda, Ophiuroidea, Alcyonacea, and others) along the outer continental shelf. Rate of biomass change on the outer continental shelf averaged -1.5 g/m^2 per 1-meter 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, appears to be due to regional differences in biomass and low sampling intensity.

The trend of decreasing biomass with increased water depth 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% change. This is precisely the same change described above for density of organisms.

Subareas

Southern New England

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 8, column 2, and plotted in figure 80. On the continental shelf the average density for each bathymetric-class in the subarea ranged from 934 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 442 to 2,430/m^2 and averaged only 1,554/m^2. Comparative average values for New York Bight and Chespeake Bight were 1,254 and 1,057/m^2. On the

continental slope the faunal density, also, was moderately high compared with other subareas. Density of the continental slope fauna in Southern New England averaged 265/m^2, compared to 249/m^2 for the entire Middle Atlantic Bight Region, 171/m^2 for the New York Bight subarea, and 271/m^2 for the Chesapeake Bight subarea. Density of organisms on the Southern New England continental rise averaged 48/m^2, a quantity only slightly higher than in the other subareas (40 to 47/m^2) and for the entire Middle Atlantic Bight Region (46/m^2).

Biomass: 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 8 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 mid-shelf 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 encountered 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). 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

Number of Individuals in the New York Bight subarea was intermediate between that in Southern New England and Chesapeake Bight (table 8 and fig. 80). Densities on the continental shelf averaged between 442 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 -- as compared with adjacent bathymetric classes and adjacent subareas -- with values of 752 and 442/m^2, were encountered on the continental shelf at water depths between 25 and 49 m and 100 to 199 m (table 8 , 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 a number of taxonomic groups. Additional comments on this aspect are given in the discussion of taxonomic variation below.

Fauna on the continental slope of the New York Bight subarea, also, was relatively sparse, compared to other subareas. Densities ranged from 66 to 255/m^2, and averaged 176/m^2. This overall average is about 35% 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 was intermediate between that in the Southern New England and Chesapeake Bight subareas. Unusually large and small quantities were encountered 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 mid-shelf was substantially lower -- on the order of fifty percent -- than was anticipated. Also, the outer shelf biomass (36 g/m^2) was smaller than

expected by at least 100%. 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% and 30% smaller than counterpart values in the adjacent subareas.

A discussion of the taxonomic components that were in short supply or unusually plentiful follows under the heading TAXONOMIC GROUPS.

Chesapeake Bight

Number of Individuals was slightly lower in this subarea than in New York Bight and much lower than in Southern New England. Average density in the various bathymetric classes on the continental shelf ranged from 722 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 and 1,254/m^2, respectively. Unusually low densities of 722 and 795/m^2 were encountered at mid-shelf depths; conversely, an unexpectedly high density (969/m^2) occurred on the outer shelf.

On the continental slope the faunal density was relatively high, averaging 271/m^2, with a range from 75 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.

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 exhibit the marked difference in biomass from inshore, shallow water regions to 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 deep water 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. 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.

Taxonomic Groups

Entire Middle Atlantic Bight Region

This section contains a brief description of the quantitative distribution of each phylum and 28 major sub-components (classes and orders) as they were related to eight bathymetric classes (tables 11 and 12; figs. 82-87). These comments pertain to the entire Middle Atlantic Bight Region; later sections deal with similar relationships within each subarea.

Porifera (fig. 82) occurred in small quantities (1.3 to 0.1 m/^{2} in all bathymetric classes. The highest density occurred in shallow water, 0-24 m.

Table 11.--Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the entire Middle Atlantic Bight Region.

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	1.25	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

Table 12.--Mean biomass listed by major taxonomic groups for each bathymetric class, representing the entire Middle Atlantic Bight Region.

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

Biomass was small; average quantity per depth class ranged from less than 0.001 to 0.04 g/m^2. There were no evident correlations between biomass and water depth.

Coelenterata were about equally represented in number of individuals between Hydrozoa and the two anthozoan subcomponents, Alcyonaria (Alcyonacea) and Zoantharia (fig. 82). Hydroids were present at all depths on the continental shelf and on the upper half of the continental slope. Density was highest in the inner shelf region and along the outer shelf with densities of 20 and 28/m^2, respectively. Lowest average density was at depths from 500 to 1,000 m. The decreasing biomass of hydroids corresponded rather closely with increased water depth. Anthozoans were represented in all bathymetric classes. Densities ranged from 1.1/m^2 in deep water (2,000-3,999 m) to 15.4/m^2 in the shallowest depth (0-24 m); the trend of abundance with water depth was irregular. Biomass of anthozoans averaged between 0.3 g/m^2 to nearly 15 g/m^2 at the various depths but was not correlated with depth, except that quantities were generally higher on the continental shelf and generally lower on the continental slope and rise.

Platyhelminthes (fig. 82), which consisted entirely of Turbellaria, occurred only in rather shallow water, between 0 and 99 m. Density ranged from 0.4 to 1.7/m^2, with the highest density in the shallowest bathymetric class. Biomass was exceedingly small at all depths, ranging from 0.006 to 0.012 g/m^2.

Nemertea (fig. 82) were present in all bathymetric classes. Densities ranged from 0.1 to 6.3/m^2. Highest densities occurred on the inner and middle continental shelf and decreased with only slight irregularity to lowest density on the continental rise. The relationship between biomass and water depth was very similar to that of density. Greatest biomass, 0.9 g/m^2, occurred in the inner shelf at 0 to 50 m, and bathymetric-class averages decreased to 0.001 g/m^2 at depths of 2,000-3,999 m.

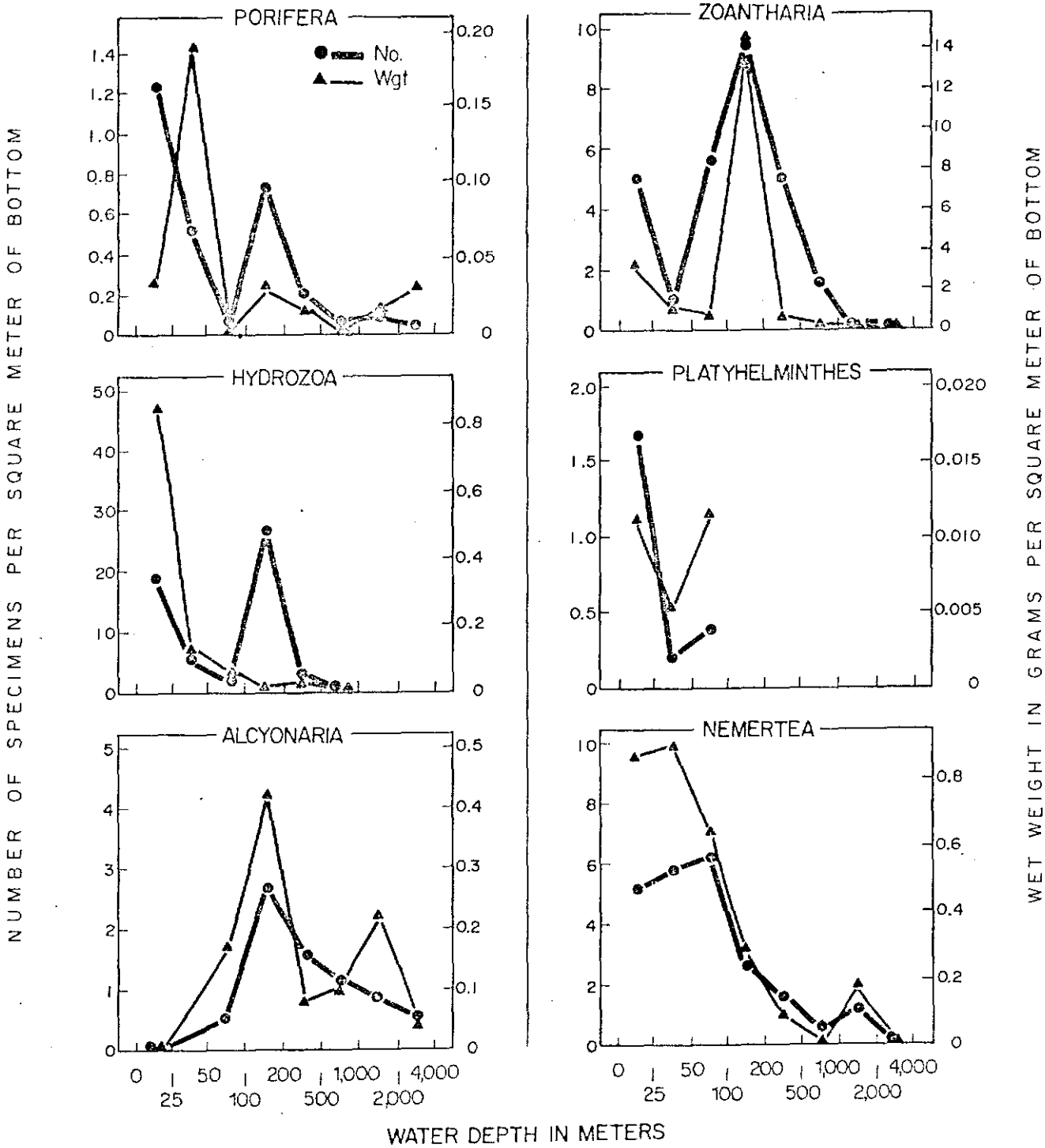


Figure 82.--Density and biomass in relation to water depth in the entire Middle Atlantic Bight Region for: Porifera, Hydrozoa, Alcyonaria, Zoantharia, Platyhelminthes, and Nemertea.

Aschelminthes (fig. 83), as presently defined by Barnes (1974), were represented entirely by Nematoda. Only the largest members of this group were retained by the sieving screen, thus only a small portion of this taxon is represented in these samples. They were present at all water depths; average densities ranged from 0.5 to 5/m^2. There was considerable irregularity in density as related to water depth, but the general trend was a higher density in shallow water and lower density in deeper water. Biomass of Nematoda was uniformly low at all depths. Quantities ranged from 0.003 to 0.01 g/m^2, without apparent correlation with density or bathymetric level.

Annelida (fig. 83), occurred in substantial numbers in all bathymetric classes sampled. They were most plentiful in shallow water and decreased markedly with increased water depth. High densities of about 472/m^2 were present in shallow water along the inner continental shelf. Their density decreased to about 238/m^2 on the outer shelf, and continued to diminish to 85/m^2 on the continental slope, and to only 6.4/m^2 on the continental rise. Biomass revealed a similar trend of decreasing amounts with increased water depth. On the continental shelf annelids averaged as much as 20 g/m^2, on the continental slope about 5 g/m^2, and on the continental rise 0.4 g/m^2.

Pogonophora (fig. 83), are a deep-water group and were present primarily at water depths ranging from 200 to 3,999 m. One exceptional group was encountered at depths between 43 and 66 m, which is much shallower than is typical for this phylum. For a group rarely reported from this region they were present in surprisingly high densities -- typically from 2.5 to 21.3/m^2. Highest densities were at mid-slope, at depths ranging from 500 to 1,000 m; moderate densities occurred on the continental rise. The unusually shallow occurrences were low (less than 0.6/m^2) in density. Biomass of these small animals ranged from less than 0.001 to 0.14 g/m^2. Largest biomass occurred at mid-slope, where the density was highest.

Sipunculida (Sipuncula) (fig. 83) were present in all bathymetric classes. Their average density ranged from $1/m^2$ to $12/m^2$. High densities were present at mid-depths, 100 to 499 m, and decreased in both shallower and deeper waters. The relationship between biomass and water depth was similar to that between density and depth. Greatest biomass (3.5 g/m^2) occurred at depths 500 to 999 m, and decreased to 0.45 g/m^2 on the continental rise, and to their smallest average quantity of 0.12 g/m^2 in shallow (0-24 m) water.

Echiura (fig. 83) were uncommon in the Region and were one of the few taxonomic groups having a disjunct depth distribution. They were present in shallow water, 0-49 m, and in very deep water, 1,000-3,999 m. They were present in low densities at all depths; in shallow water their average density was only 0.02 to $0.27/m^2$, and in deep water they were somewhat more numerous, averaging 0.35 and $0.72/m^2$. Biomass of Echiura in relation to water depth was similar to that indicated by density. Biomass in shallow water averaged 0.02 to 0.2 g/m^2 and in deep water 0.7 to 2.4 g/m^2.

Priapulida (fig. 83) were rare in the study area. Only a few specimens were obtained and they were present only in deep water, 1,000-1,999 m. The density of priapulids averaged $0.24/m^2$ and biomass averaged 0.15 g/m^2.

Mollusca were one of the more common faunal groups represented in the Middle Atlantic Bight Region; they were present in all bathymetric classes. They exhibited an irregular trend of decreasing density with increased water depth. Highest density, $911/m^2$, occurred in the shallowest depth class, 0-24 m. At deeper levels on the continental shelf their density ranged from 62 to $193/m^2$. On the continental slope their density ranged from 34 to $188/m^2$. Lowest average density, $27/m^2$, occurred on the continental rise, 2,000-3,999 m. The relationship between biomass and water depth was similar to that for density, except that changes in biomass from class-to-class were much more uniform and regular. The largest average biomass was 302 g/m^2,

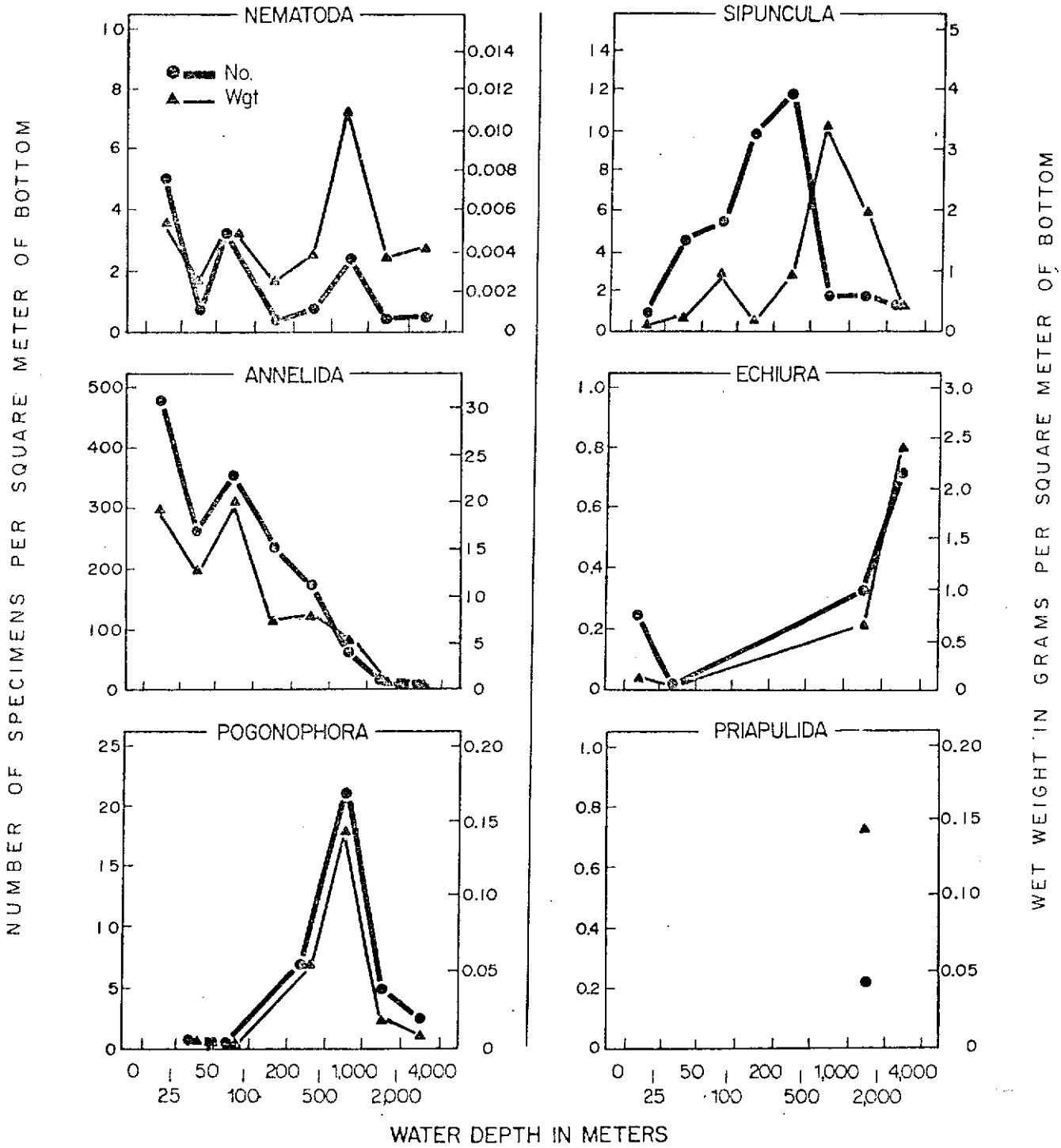


Figure 83.--Density and biomass in relation to water depth in the entire Middle Atlantic Bight Region for: Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

which occurred in the 0-24 m depth class, and the smallest average biomass was 0.23 g/m^2, which occurred in the deepest water -- 2,000-3,999 m.

Polyplacophora (fig. 84) were sparse (0.05 to 0.95/m^2 and revealed no special affinity for any particular bathymetric level. Biomass, also, was small (0.001 to 0.47 g/m^2) at all depths where they were present.

Gastropoda (fig. 84) were represented in all water-depth classes. They were present in highest densities in shallow water and decreased with slight irregularity with increased water depth. Density of gastropods at 0-24 m averaged 96/m^2. Farther out on the continental shelf their average density ranged from 12 to 14/m^2. They were slightly more abundant on the continental slope between 500 and 999 m, where they averaged 18/m^2. On the lower continental slope their density averaged 2.6/m^2, and on the continental rise 1.2/m^2. Biomass was moderately small and the quantity varied with depth in a pattern similar to their density. Largest biomass (6.8 g/m^2) was in shallow water, 0-24 m, and it decreased irregularly with increased water depth. On the continental slope the biomass of gastropods averaged only 0.1 g/m^2, and on the continental rise less than 0.01 g/m^2.

Bivalvia (fig. 84) were very abundant and were the preeminent group in terms of biomass. Their highest densities occurred in shallow water and decreased irregularly with increased water depth. In shallow water, 0-24 m, their density averaged 815/m^2. At lower levels on the continental shelf their density ranged between 47 and 172/m^2. On the continental slope the average density ranged from 30 to 161/m^2. Biomass trends in relation to bathymetric level were similar to those for density, but exhibited fewer irregularities. Largest biomass (295 g/m^2) occurred in shallow water (0-24 m). Mid-shelf biomasses ranged from 94 to 119 g/m^2; outer shelf biomass averaged

16 g/m^2. On the continental slope the average biomass was only 1 g/m^2, and on the continental rise 0.2 g/m^2.

Scaphopoda (fig. 84) were represented in all depth classes except the shallowest (0-24 m) and deepest (2,000-3,999 m). At all depths where they occurred, they were present in low densities. In relative terms they were most common on the upper and middle parts of the continental slope, where their average density was 7/m^2. Density decreased to 0.9/m^2 along the lower slope and diminished regularly inshore across the continental shelf to 0.09/m^2 in shallow water, 0-24 m. Biomass of scaphopods was small in all depths; average values ranged from less than 0.001 g/m^2 in shallow water to 0.14 g/m^2 on the upper slope, and to 0.01 g/m^2 along the lower slope.

Cephalopoda (fig. 84) were represented only by eggs deposited on the sea floor. They were taken at mid-depths -- 100 to 500 m -- where their density averaged 0.2 to 5.3/m^2. Biomass of the cephalopod eggs was very small, averaging 0.002 to 0.07 g/m^2.

Arthropoda were exceedingly common and were represented mainly by Crustacea. Only two other classes of arthropods were represented in our samples: Arachnida and Pycnogonida. Arachnida were rare; they were taken only in shallow water, 0-24 m, where they were present in low density (0.2/m^2), and their biomass was less than 0.001 g/m^2. Pycnogonida (fig. 84) were absent in samples from deep water, 200 to 3,999 m, but were represented at all bathymetric classes in the shallower areas. Average densities ranged from 0.06 to 1.3/m^2. Biomass was very small at all depths, averaging less than 0.001 to 0.009 g/m^2.

Crustacea was the most numerous taxonomic group encountered in the Region, and were present at all water depths. They occurred in highest

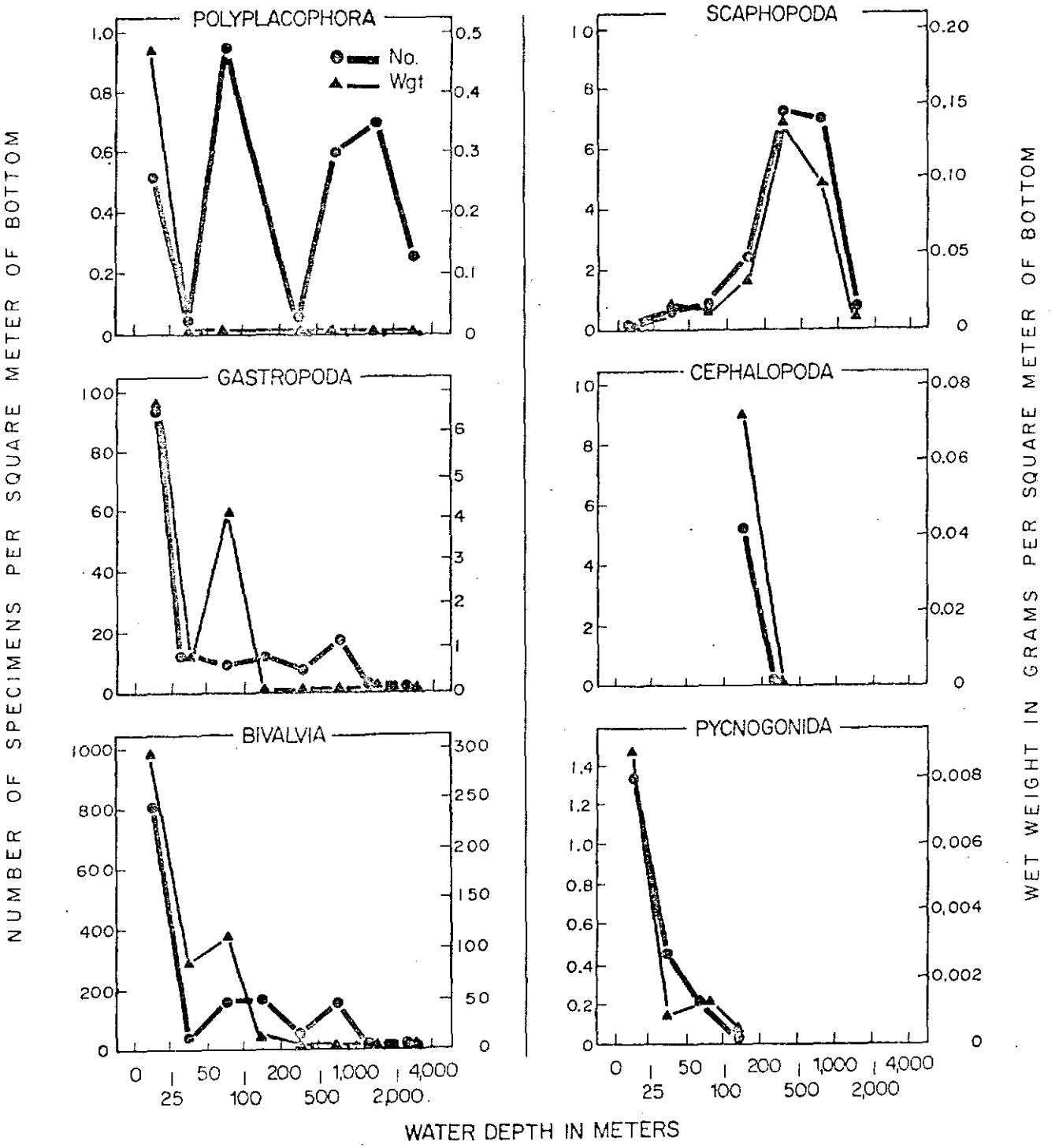


Figure 84.--Density and biomass in relation to water depth in the entire Middle Atlantic Bight Region for: Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

density (1,414/m^2) on the continental shelf at depths between 50 and 99 m, and decreased in both deeper and shallower waters. In the shallow shelf waters they averaged 552 to 802/m^2, whereas in deeper waters they averaged only 1 to 62/m^2. Biomass was rather regularly inversely related to water depth. Largest biomass (19 g/m^2) occurred in shallow water, 0-24 m, and decreased to 0.7 g/m^2 on the outer continental shelf. On the upper continental slope the biomass averaged 0.2 g/m^2, but only 0.04 g/m^2 on the lower slope. Their average biomass on the continental rise was 0.03 g/m^2.

Ostracoda (fig. 85) were only partially sampled, because of their small size. They were represented in samples from shallow (0-99 m) and very deep (2,000-3,999 m) bathymetric classes. Where present they occurred in low densities, averaging 0.02 to 0.57/m^2. Their biomass, as judged from these samples, was very small; average quantities ranged from less than 0.001 to 0.005 g/m^2.

Cirrepedia (fig. 85) were restricted to water depths from 0 to 99 m, and their density was clearly related to water depth. In shallow water (0-24 m) their average density was 102/m^2 and decreased to 0.03/m^2 at depths between 50 and 99 m. Biomass showed a similar relationship with water depth. Average biomass in shallow water was 12.8 g/m^2 and decreased to less than 0.001 g/m^2 at depths of 50 to 99 m.

Copepoda (fig. 85), because of their small size, were incompletely sampled. They occurred at mid-depths (50 to 999 m) and were present in low densities, 0.21/m^2 and less. Biomass, also, was very small, averaging 0.002 g/m^2 and less.

Nebaliacea (fig. 85) were rare; they were present at only three stations, all at water depths between 50 and 99 m. Density averaged 0.05/m^2 and biomass averaged less than 0.001 g/m^2.

Cumacea (fig. 85) were rather widely distributed bathymetrically, and were represented in all depth classes. Densities were generally low to moderate. Their center of abundance was located at mid-shelf (25 to 99 m), where their density averaged 31 to 36/m^2. Along the inner shelf (0-24 m) they averaged only 2/m^2, and on the outer shelf and upper continental slope 4.7 to 8.8/m^2. At depths below 500 m their average density ranged between 0.4 and 0.7/m^2. Biomass of cumaceans was small at all depths; average quantities ranged between 0.004 and 0.19 g/m^2. Trends in biomass were similar to those exhibited by density. Largest quantities were present at mid-shelf depths, with smaller quantities along the inner shelf and upper continental slope. Smallest quantities occurred on the lower slope and on the continental rise.

Tanaidacea (fig. 85) were uncommon and restricted to deep water. Depths at which they occurred ranged from 200 to 3,999 m. In all bathymetric classes they were present in low density, 0.06 to 0.72/m^2. Biomass averaged less than 0.001 to 0.005 g/m^2.

Isopoda (fig. 86) were common and represented in all bathymetric classes. Densities were moderately low with the highest abundance, 18 to 20/m^2, in shallow water (0-49 m). Intermediate densities occurred on the outer shelf and upper slope, 1.1 to 11.2/m^2, and low densities, 0.2 to 1.0/m^2, in deep water (500-3,999 m). Biomass of isopods reflected a trend with water depth similar to that exhibited by density. Largest biomass, 0.13 to 0.76 g/m^2, occurred on the continental shelf; intermediate amounts, 0.005 to 0.046 g/m^2, on the continental slope; and smallest quantities, 0.002 g/m^2, on the continental rise.

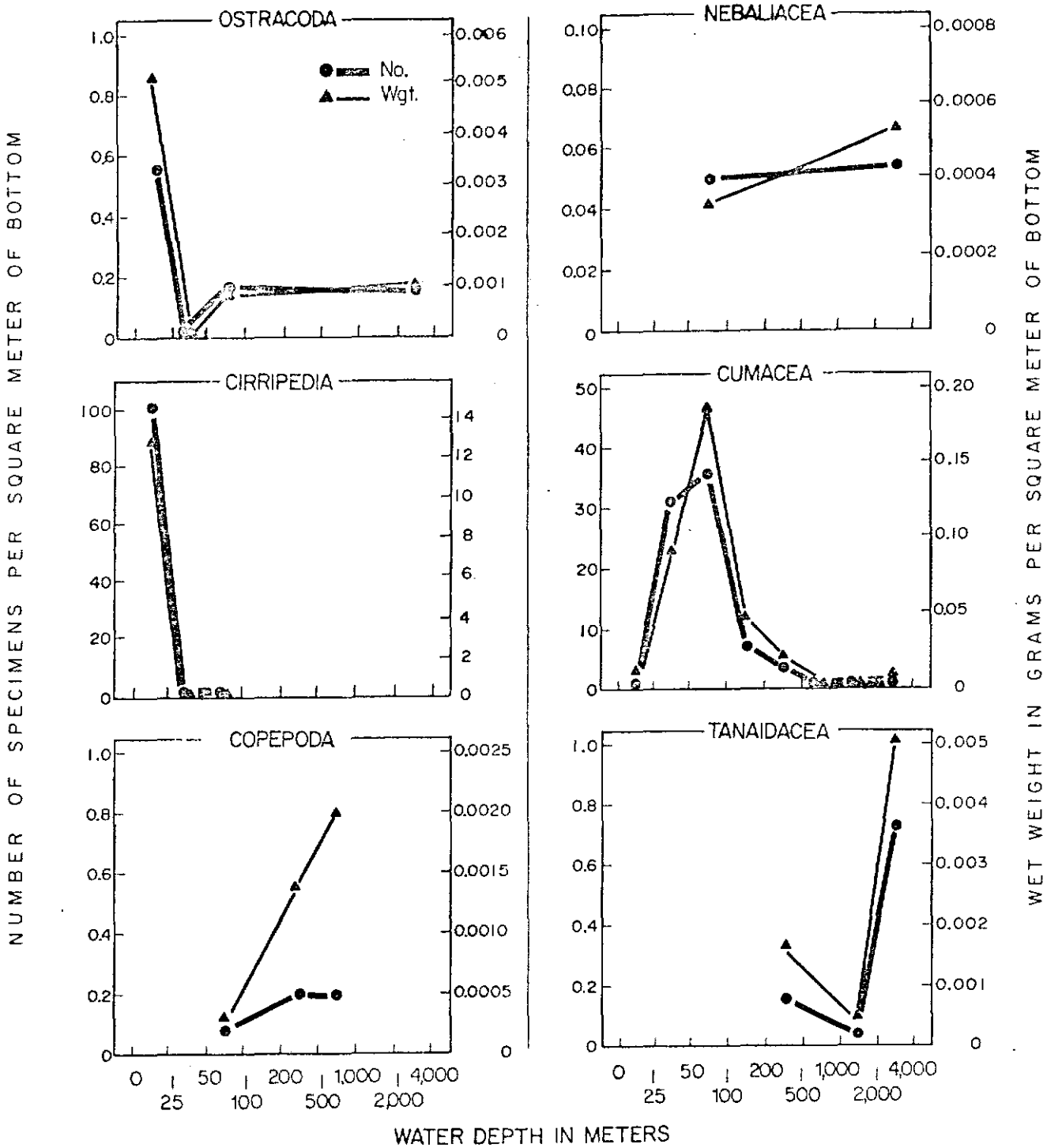


Figure 85.--Density and biomass in relation to water depth in the entire Middle Atlantic Bight Region for: Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

Amphipoda (fig. 86) were the most numerous taxonomic component in the entire benthos. They were particularly common on the continental shelf. Density was highest (1,261/m^2) at mid-shelf at depths of 50 to 99 m, and decreased in both shallower and deeper waters. Average density in shallow water (0-24 m) was 407/m^2. On the outer shelf and upper slope their density averaged 38 to 49/m^2. In deeper water (greater than 500 m) their density averaged between 0.6 and 5/m^2. Biomass of amphipods was generally quite small with largest amounts (3.5 to 6.6 g/m^2) on the middle and inner continental shelf; intermediate quantities (0.1 to 0.3 g/m^2) were present on the outer shelf and upper slope. Small quantities, less than 0.05 g/m^2, were present in water depths greater than 500 m.

Mysidacea (fig. 86) were uncommon and were represented only in the shallow and intermediate depths (less than 500 m). Density was highest, 6.9/m^2, in shallow water (0-24 m), and low, 0.02 to 0.11/m^2, at all depths greater than 25 m. Average biomass was small at all depth classes. In shallow water (0-24 m), it averaged 0.03 g/m^2, and in deeper water the average biomass ranged from less than 0.001 to 0.002 g/m^2.

Decapoda (fig. 86) were moderately common and were present in all bathymetric classes except those from 200 to 3,999 m. Density was highest, 15/m^2, in shallow water (0-24 m) and decreased to 0.06/m^2 in deep water (1,000 to 1,999 m). Biomass, also, was largest, 2.7 g/m^2, in shallow water, and decreased to 0.03 g/m^2 in deep water (1,000-1,999 m).

Bryozoa (fig. 86) were restricted to the relatively shallow bathymetric range of 0 to 199 m. Highest densities, 25 to 34/m^2, occurred in the inner shelf waters of less than 50 m. On the outer shelf at depths between 50 and 199 m the average density of bryozoans ranged between 0.15 and 3.5/m^2. Biomass exhibited a trend similar to that for density. Largest biomass, 0.6 to 0.7

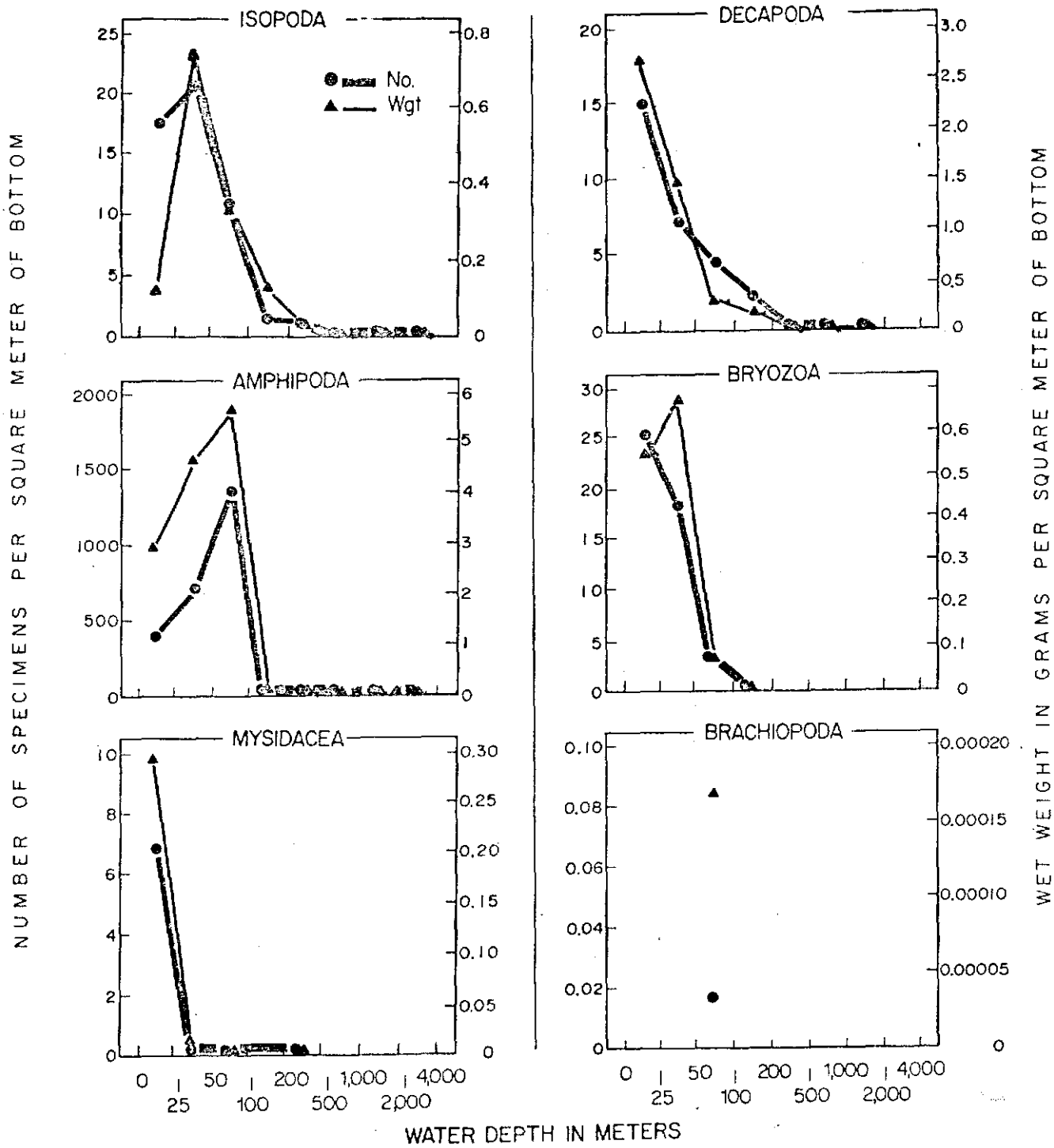


Figure 86.--Density and biomass in relation to water depth in the entire Middle Atlantic Bight Region for: Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

g/m^2, occurred in shallow water (0-49 m); intermediate quantities (0.08 g/m^2) were present at mid-shelf; and very small quantities (0.002 g/m^2) occurred along the outer shelf.

Brachiopoda (fig. 86) were rare in the Middle Atlantic Bight Region. They were present only at water depths of 50 to 99 m. Density averaged $0.02/m^2$ and biomass averaged less than 0.001 g/m^2.

Echinodermata were common components of the fauna throughout the Region. They were most common, average density of $236/m^2$, along the outer continental shelf and decreased to $43/m^2$ in shallow water (0-24 m). Biomass was moderately large at all bathymetric levels. On the continental shelf the average biomass ranged from 14 g/m^2 to 38 g/m^2; on the continental slope it ranged between 1 and 16 g/m^2; and on the continental rise the average biomass was 3.4 g/m^2.

Holothuroidea (fig. 87) were not numerous, but they occurred in all bathymetric classes and contributed substantially to the biomass. Density was highest (2 to 9 g/m^2) at mid-shelf to upper slope and decreased to $0.1/m^2$ in shallow water and to $0.4/m^2$ in deep water. Biomass trends were similar to those of density; largest biomass, 21 g/m^2, occurred at mid-shelf and decreased to 5.3 g/m^2 on the upper slope. Small quantities, 0.08 to 0.5 g/m^2, were present on the inner shelf. Small to moderate quantities, 0.03 to 2.74 g/m^2, occurred on the lower continental slope and continental rise.

Echinoidea (fig. 87) were common in shallow water and uncommon in deep water. They were present in all depth classes except one -- on the mid-slope at 500 to 999 m. Density on the inner shelf ranged from 40 to $41/m^2$; on the outer shelf it averaged 0.5 to $1.0/m^2$; and on the lower continental slope and on the rise the average density was only 0.06 to $0.17/m^2$. Biomass of echinoids was large (4 to 37 g/m^2) on the continental shelf and upper slope. On the lower continental shelf and the continental rise their average biomass was only 0.1 to 0.2 g/m^2.

Ophiuroidea (fig. 87) were present in all bathymetric classes and were abundant (average density 231/m^2) on the outer shelf. Density was low (0.4 to 0.7/m^2) on the inner shelf, but averaged 61/m^2 at mid-shelf. Density averaged 18/m^2 on the upper slope, decreased to 1.6 and 2.2/m^2 on the middle and lower slope, but averaged 5.9/m^2 on the continental rise. Biomass was largest, 14 g/m^2 on the outer shelf and decreased in both shallower and deeper waters. In shallow shelf waters the average biomass was only 0.03 to 0.26 g/m^2, whereas in deep water (200 to 3,999 m) the biomass averaged between 0.5 and 3.6 g/m^2.

Asteroidea (fig. 87) were present in all bathymetric classes and the relationship between density and water depth was irregular, but revealed a trend of higher density in shallower waters and lower density in deeper waters. Density of starfish on the continental shelf averaged between 0.3 and 2.1/m^2. On the continental slope the average density ranged from 0.2 to 0.4/m^2. Density on the continental rise averaged 0.06/m^2. Biomass trends for starfish were similar to those for density. Average biomass on the shelf ranged from 0.3 to 6.0 g/m^2. On the continental slope the biomass averaged between 0.004 and 0.12 g/m^2. On the continental rise the average biomass was less than 0.001 g/m^2.

Hemichordata (fig. 87) were sparse and revealed no conspicuous relationship in regard to bathymetric level. They were present on the continental shelf at densities averaging 0.2 to 0.4/m^2. On the mid-continental slope, their only deepwater occurrence, their density averaged 0.2/m^2. Biomass of hemichordates was small at all depths, averaging between 0.04 and 0.06 g/m^2 on the shelf and 0.002 g/m^2 on the slope.

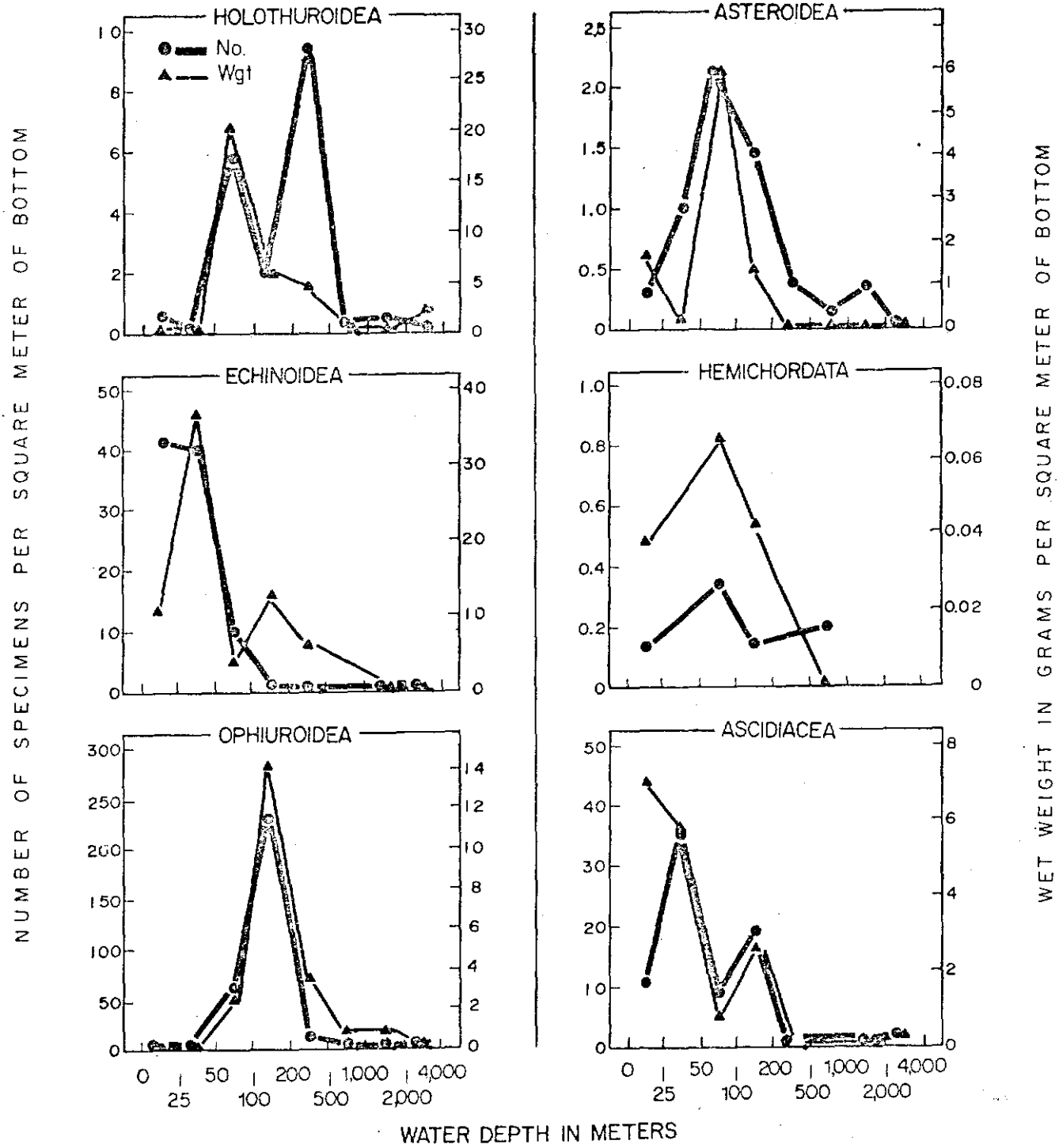


Figure 87.--Density and biomass in relation to water depth in the entire Middle Atlantic Bight Region for: Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

Chordata (Ascidiacea) (fig. 87) were present in all bathymetric classes, except at mid-slope at depths between 500 and 999 m. They occurred in substantial quantity and the densities on the shelf were highest with quantities averaging between 10 and 35/m^2. Densities on the continental slope and rise averaged 0.8 to 2.6/m^2. Biomass was moderately high on the continental shelf; average quantities ranged from 0.9 to 7.1 g/m^2. Biomass in deep water, 200 to 3,999 m, ranged from 0.004 to 0.4 g/m^2.

Subarea Differences in the Distribution of Taxonomic Groups

In this section the principal differences in bathymetric distribution of the various taxonomic groups from one subarea to another are described. Also, differences or similarities in density and biomass from one subarea to another, for each major taxonomic group, are pointed out. The quantitative values most commonly given are average densities and biomasses for a particular taxon in one bathymetric class, or average densities or biomasses of a taxon for all bathymetric classes where it occurred.

Porifera were present in nearly all bathymetric classes in Southern New England (table 13), whereas in New York Bight they were restricted to depths less than 100 m (table 15), and limited (with one exception) to depths less than 50 m in Chesapeake Bight (table 17). Density decreased from north to south; sponges averaged 0.8/m^2 in Southern New England, 0.5/m^2 in New York Bight, and 0.4/m^2 in Chesapeake Bight. Biomass was substantially greater, averaging 0.11 g/m^2 (table 14), in Southern New England than in the other subareas, where the biomass averaged 0.03 and 0.04 g/m^2, respectively (tables 16 and 18).

Coelenterata occurred in all bathymetric classes in each subarea and exhibited similar trends of quantity in relation to water depth. Coelenterates were most numerous and occurred in largest biomass in Southern New England,

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 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 inter-subarea 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 bathymetric level, in all three subareas. However, one of the main subgroups, the Alcyonacea, presented a different pattern. They were common at mid-depths and in deep water (50 to 3,999 m) in Southern New England and New York Bight, but in Chesapeake Bight they occurred 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. They were present in largest quantities, in terms of both density and biomass, 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 bathymetric level in all subareas. In terms of density, they ranked first in Southern New England with an average of $6/m^2$, ranked second in New York Bight with $2.6/m^2$, and were least abundant in Chesapeake Bight with $0.4/m^2$. Biomass values reflected the same sequential order, with average values of 0.8 g/m^2, 0.7 g/m^2, and 0.3 g/m^2.

Table 13.--Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the Southern New England subarea.

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

Table 14.--Mean biomass listed by major taxonomic groups for each bathymetric class, representing the Southern New England subarea.

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	38.950	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	0.005	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	23.006	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

Table 15.--Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the New York Bight subarea.

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	1.02	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

Table 16.--Mean biomass listed by major taxonomic groups for each bathymetric class, representing the New York Bight subarea.

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	3.955	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	0.000	0.016	-	0.006	0.007
Tanaidacea	-	-	-	-	-	-	-	0.003
Isopoda	0.075	0.874	0.394	0.234	0.076	-	0.002	2
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	0.709	-	-	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	0.146	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	-	0.194	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

Nematoda were more widely distributed bathymetrically and occurred in larger quantities in Southern New England (average density 6/m^2 and biomass 0.007 g/m^2) 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/m^2 and biomass less than 0.001 g/m^2). In Chesapeake Bight nematodes were slightly irregular in distribution and the quantity was intermediate between that in Southern New England and 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 density of annelids (1,120/m^2) 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 and 183/m^2. Biomass trends were similar to those of density; Southern New England averaged 19 g/m^2, New York Bight 13 g/m^2, and Chesapeake Bight 9 g/m^2.

Pogonophora occurred primarily in deep water (200 to 3,999 m) in all three subareas. Density and biomass were approximately equal in Southern New 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. An unusually shallow occurrence of pogonophorans was found on the continental shelf in Chesapeake Bight. Live specimens and tubes were taken as shallow as 66 meters and tubes only were present at 43 meters.

Sipunculida were widely distributed bathymetrically in all three subareas, but there was a marked difference in density and biomass. Density was highest (average about $9/m^2$) in Southern New England, intermediate ($3/m^2$) in New York Bight, and lowest ($1.5/m^2$) in Chesapeake Bight. Trends in biomass were nearly the same; largest ($1.4\ g/m^2$) in Southern New England and substantially lower (0.4 and $0.3\ g/m^2$) in New York Bight and Chesapeake Bight.

Echiura occurred in both very shallow (less than 50 m) and very deep (greater than 1,000 m) water in two subareas, New York Bight and Chesapeake 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 0.7 g/m[illegible]) 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 $0.5\ g/m^2$.

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 [illegible] and biomass less than $0.4\ g/m^2$; occurrence records were too [illegible] for comparisons.

Mollusca were abundant in [illegible] and were dominant in biomass in all three [illegible] each molluscan class, by subarea, is presented [illegible]

Polyplacophora occurred in [illegible] they were relatively more numerous in Southern New [illegible] average density was [illegible]. In New York Bight they [illegible] classes (50-99 m and 2,000-3,999 m) and their [illegible] $0.6/m^2$. In Chesapeake Bight they occurred [illegible] average density

Table 17.--Mean number of individuals listed by major taxonomic groups for each bathymetric class, representing the Chesapeake Bight subarea.

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	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

Table 18.--Mean biomass listed by major taxonomic groups for each bathymetric class, representing the Chesapeake Bight subarea.

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	0.094	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

ranged from 0.1 to 1.3/m^2. Biomass, also, was small in all areas; values ranged from 0.001 to 2.2 g/m^2 and was generally proportional to the density.

Gastropoda were one of the more common components of the Mollusca. In each subarea they exhibited a similar distribution in relation to water 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 (average 125/m^2) in New York Bight, and lowest densities (average 111/m^2) in Southern New England. Particularly high densities (1,136 and 590/m^2) in Chesapeake Bight and New York Bight occurred 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/m^2) in New York Bight, and about equal (84 and 85 g/m^2) in Chesapeake Bight and Southern New England. Decreases in biomass with increased water depth were generally similar in all subareas.

Scaphopoda occurred in moderately deep water in all subareas. They were present in highest density (5.8/m^2) in New York Bight, and about equal densities (approximately 3/m^2) in both 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 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 to 0.004 g/m^2, with the larger amount present along the outer continental shelf and the smaller amount 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 to 99 m in Southern New England, 0 to 24 m in New York Bight, and 0 to 199 m in Chesapeake Bight. Density was low ($0.2/m^2$) in New York Bight, as well as being geographically restricted there. Densities in Southern New England and Chesapeake Bight were roughly similar, with averages ranging from 2.0 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 to $2,145/m^2$. Trends of decreasing density with increased water depth were the same in all subareas. Density differences from one subarea to another were substantial; highest densities occurred in Southern New England, intermediate densities were in New York Bight, and lowest densities occurred

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; in Southern New England they averaged 16 g/m^2, in New York Bight they averaged 9 g/m^2, and in Chesapeake Bight they averaged 3 g/m^2.

Ostracoda were incompletely sampled, but exhibited 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) occurred in 0 to 24 m in New York Bight, intermediate density (107/m^2) occurred in 0 to 24 m in Southern New England, and low density (less than 1/m^2) occurred 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 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 occurred in low densities (0.18 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 occurred in both deep water (1,000-3,999 m) and at mid-depths (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 to 36/m^2, occurred in shallow water (0-49 m), intermediate densities occurred at mid-depths (50-999 m) and low densities, 0.3 to 0.2/m^2, were found in deep water (1,000 m or deeper). Biomass was small (maximum bathymetric class average was 0.6 g/m^2) in all bathymetric classes in each subarea.

Amphipoda were the most abundant taxonomic group in the Middle Atlantic Bight Region. There were major differences in their density from one subarea to another. In Southern New England they were most numerous, averaging 1,137/m^2; in New York Bight they were moderately common, averaging 396/m^2; and in Chesapeake Bight they were least numerous, averaging 192/m^2. Biomass, also, differed from one subarea to another. In Southern New England it averaged 7.0 g/m^2, in New York Bight it averaged 2.5 g/m^2, and in Chesapeake Bight it averaged only 1.5 g/m^2. Relationships of density and biomass with water depth were very similar among the three subareas.

Mysidacea, although incompletely sampled, revealed the same trend of decreasing density with increased water depth 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 to 8.6/m^2. In water depths greater than 25 m their average density ranged from 0.25 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 present 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 occurred in each bathymetric class on the continental shelf (0-199 m) and in New York Bight and Chesapeake Bight

they occurred 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 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 Bight and Chesapeake Bight.

Brachiopoda were absent in the Southern New England and New York Bight subareas; they were present only in 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 to 15/m^2) occurred along the outer continental shelf and upper slope and decreased in both shallower and deeper water. In terms of biomass the holothurians were substantially more important 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 exhibited 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 occurred across the shelf into deep water

(below 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 and 66 g/m^2. In Southern New England biomass averages on the inner shelf were 4 and 12 g/m^2, and in Chesapeake Bight were 3 and 28 g/m^2.

Ophiuroidea were distributed bathymetrically much the same in each subarea. High density (averages of 123 to 350/m^2) occurred at mid-depths, and decreased to densities of less than 1/m^2 in shallow shelf waters, and to 1 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 to 4/m^2) at mid-depths, 25 to 200 m, and low density (0.2 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 mid-depths, 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 occurred. 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 occurred 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 $7/m^2$). Biomass of ascidians behaved similarly to their density with largest quantities occurring 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 WITH BOTTOM SEDIMENTS

In this section the relationships between the quantity of fauna and the different types of bottom sediments are described. A brief description of the kinds of sediments and their distribution is presented first. This is followed by a sub-section describing the total fauna (all taxonomic groups combined) in relation to the various sediments. The third part deals with sediment relationships of each major taxonomic group.

Distribution of Sediment Types

The geographic distribution of bottom sediments in the Middle Atlantic Bight Region is shown in figure 88. 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.

Gravels were relatively rare and encountered only in Southern New England. Sand-gravel was uncommon, it occurred mainly in Southern New England and New York Bight. Shell sediments, also, were relatively rare; they were encountered only in Chesapeake Bight. Sand-shell mixtures were moderately common, especially in New York Bight and Chesapeake Bight. Although sand sediments occurred 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 occurred 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.

The bathymetric distribution of sediments throughout the entire region showed a decided decrease in particle size with increasing depth. 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 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 encountered 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 mid-slope (500 m) down to the deepest depths sampled.

Photographs of the sea bottom (figs. 89 to 94) taken with the Campbell grav photographic system show the sediment surface in a variety of different bottom types. Four of the photographs show the camera-tripping weight, which stirs up fine particles when it strikes bottom. Two of these photographs are of coarse sediments and two are of 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.

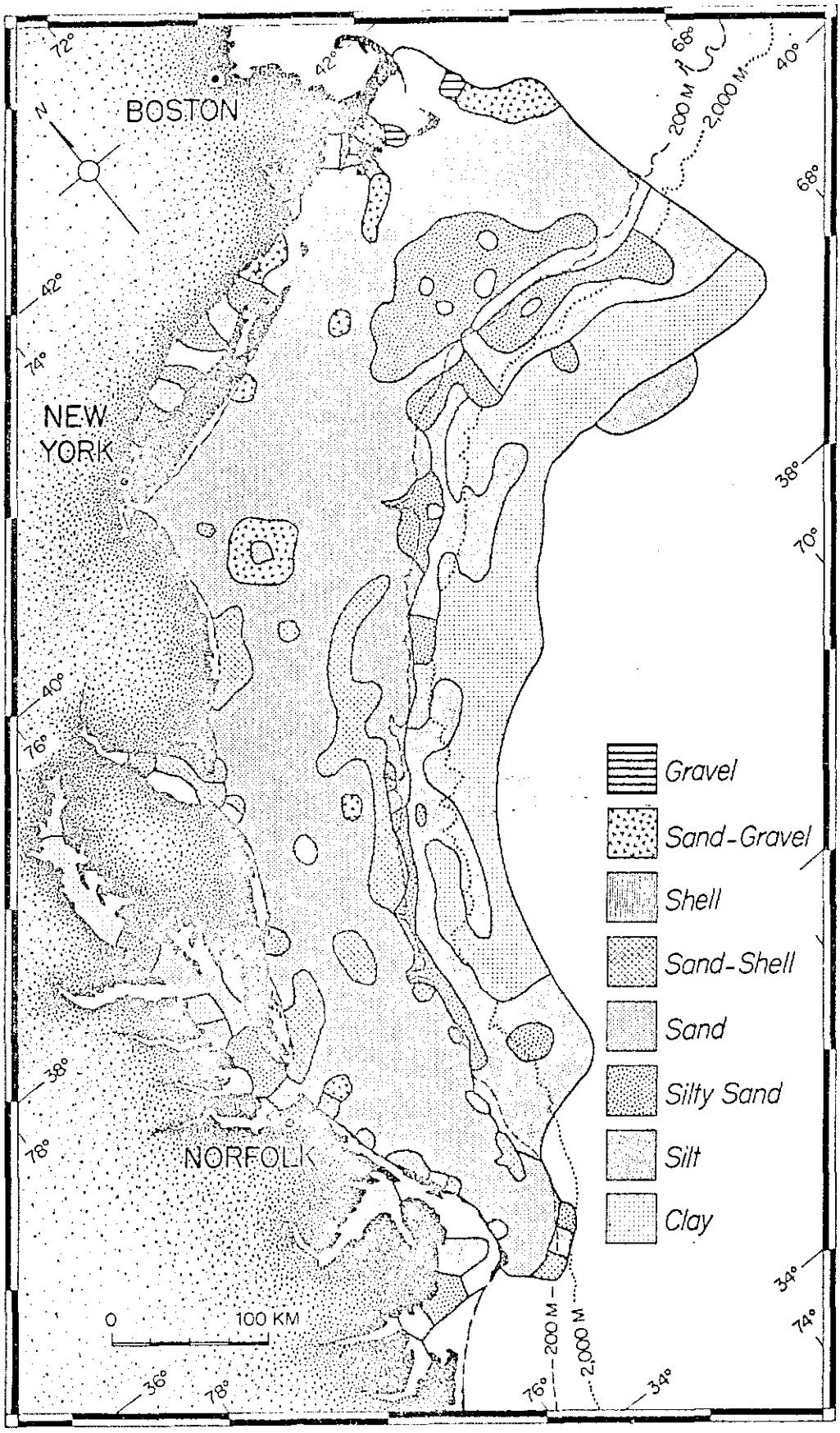


Figure 88.--Geographic distribution of bottom sediment types in the Middle Atlantic Bight Region.

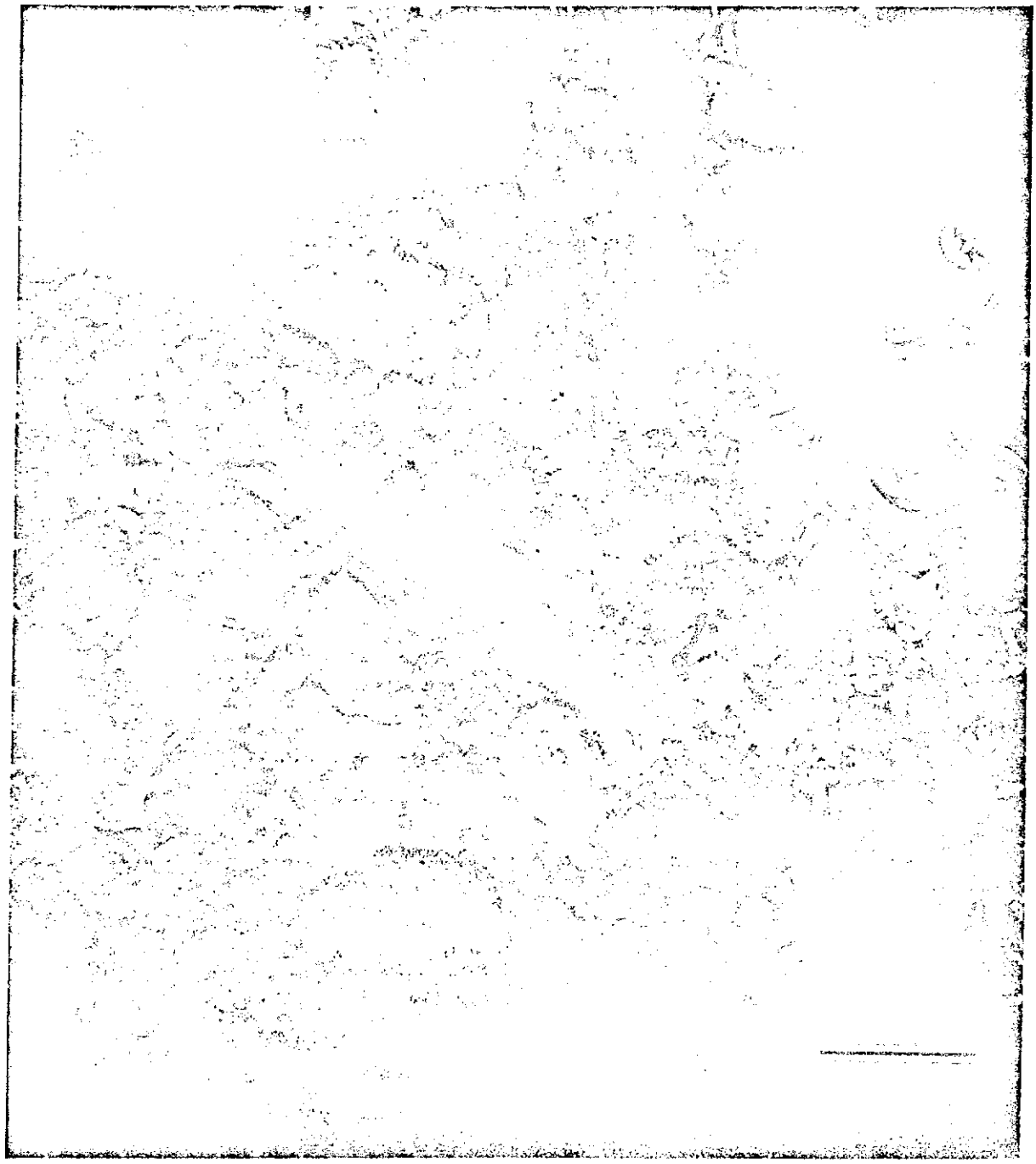


Figure 89.--Gravel bottom at a depth of 23 m in the Nantucket Shoals region, south of Cape Cod, Massachusetts. The most common gravels range in diameter from 5 to 15 cm. Camera tripping-weight is visible in the upper right-hand corner. Photograph was taken at Station 1103, located at 41°11' N. lat., 69°40' W. long. Scale bar is 10 cm.

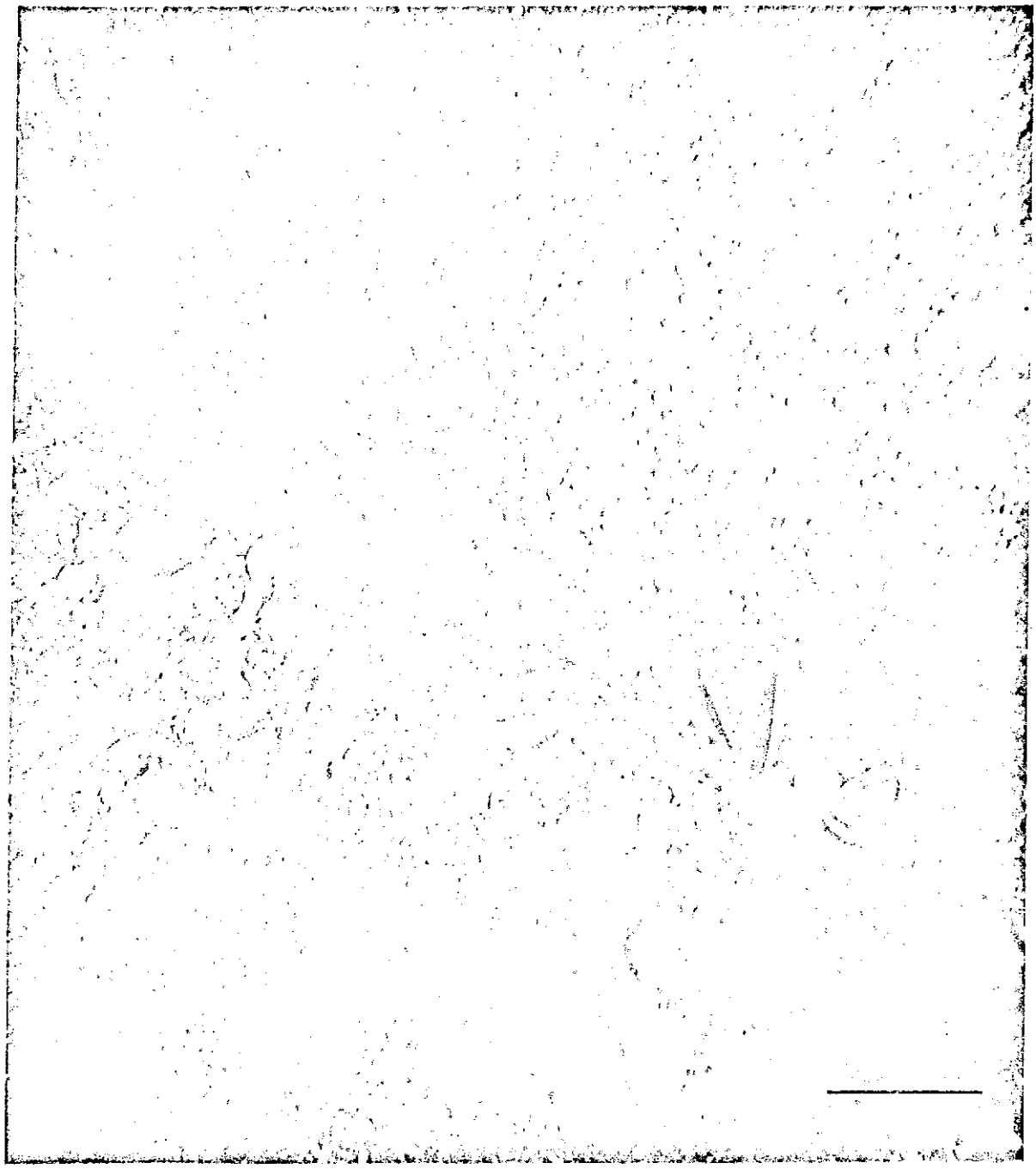


Figure 90.--Sand bottom with a small proportion of shell, located on the continental shelf northeast of Cape Charles, Virginia, at a depth of 48 m. Shell remains are mainly bivalve mollusks with a small proportion of echinoid tests and spines. Photograph was taken at Station 1421, located at 37°30' N. lat., 74°44' W. long. Scale bar is 10 cm.

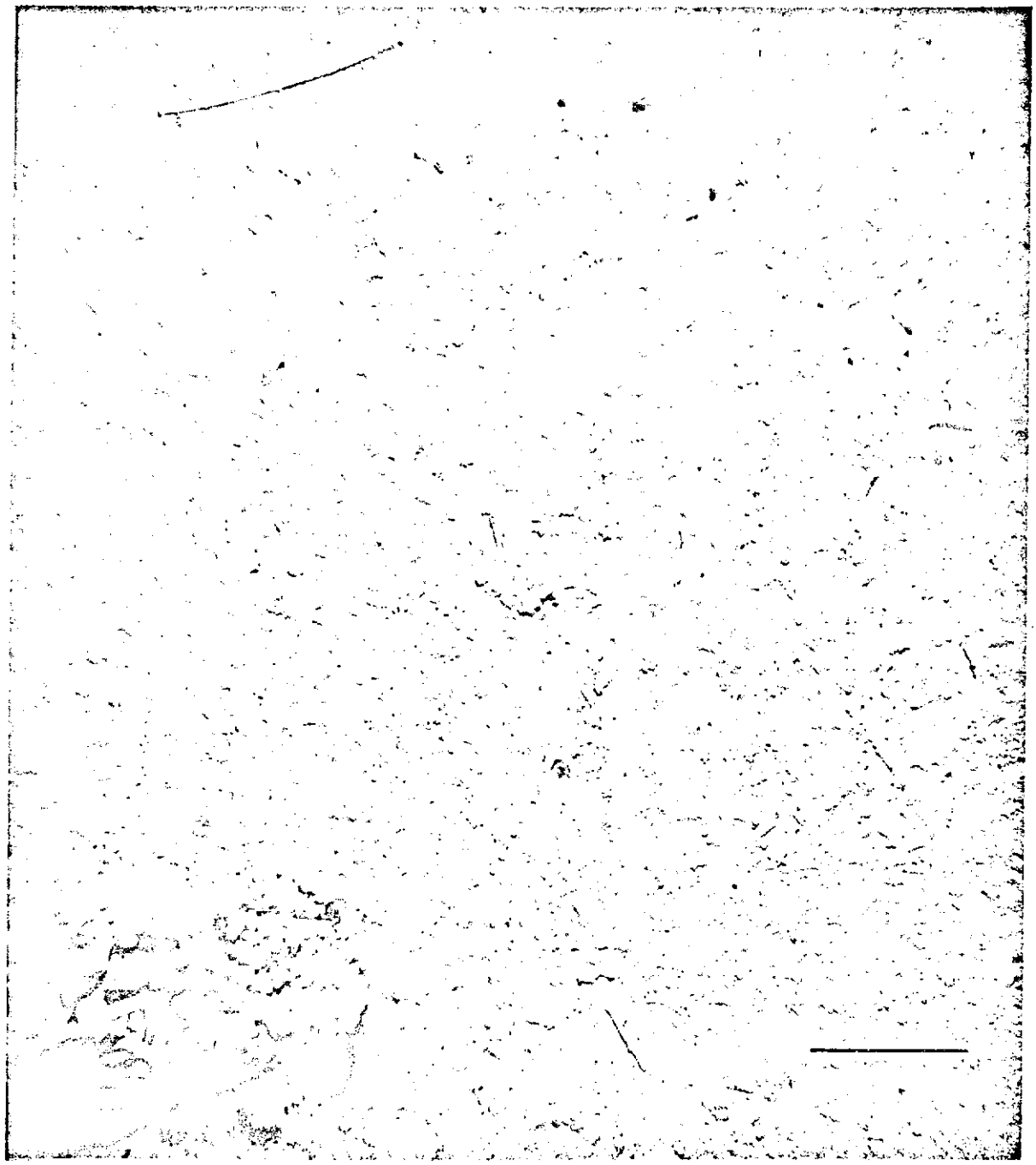


Figure 91.--Silty sand bottom at a depth of 406 m on the continental slope east of New Jersey. In the upper left is a sodastraw worm tube (*Hyalinoecia tubicola*); in the lower left is the camera tripping-weight; and the tips of brittlestar arms and numerous animal tracks are evident in other sections. Photograph was taken at Station 1335, located at 39°10' N. lat., 72°30' W. long. Scale bar is 10 cm.

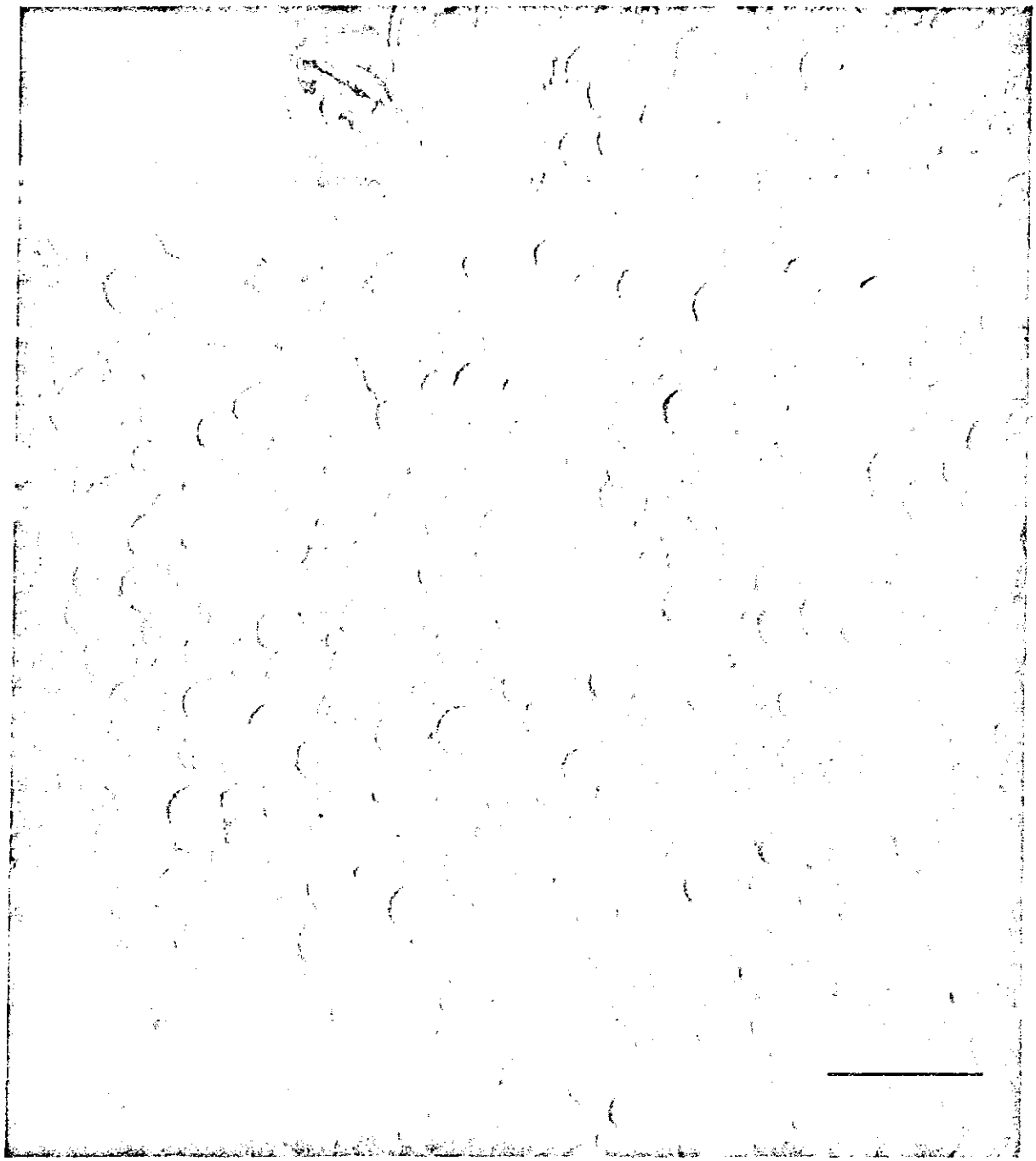


Figure 92.--Sand bottom inhabited by a dense assemblage of sand dollars (Echinarachnius parma) at a depth of 48 m near mid-shelf east of Delaware. Size of the sand dollars is 2 to 3 cm in diameter. Photograph was taken at Station 1418, located at 37°59' N. lat., 74°29' W. long. Scale bar is 10 cm.

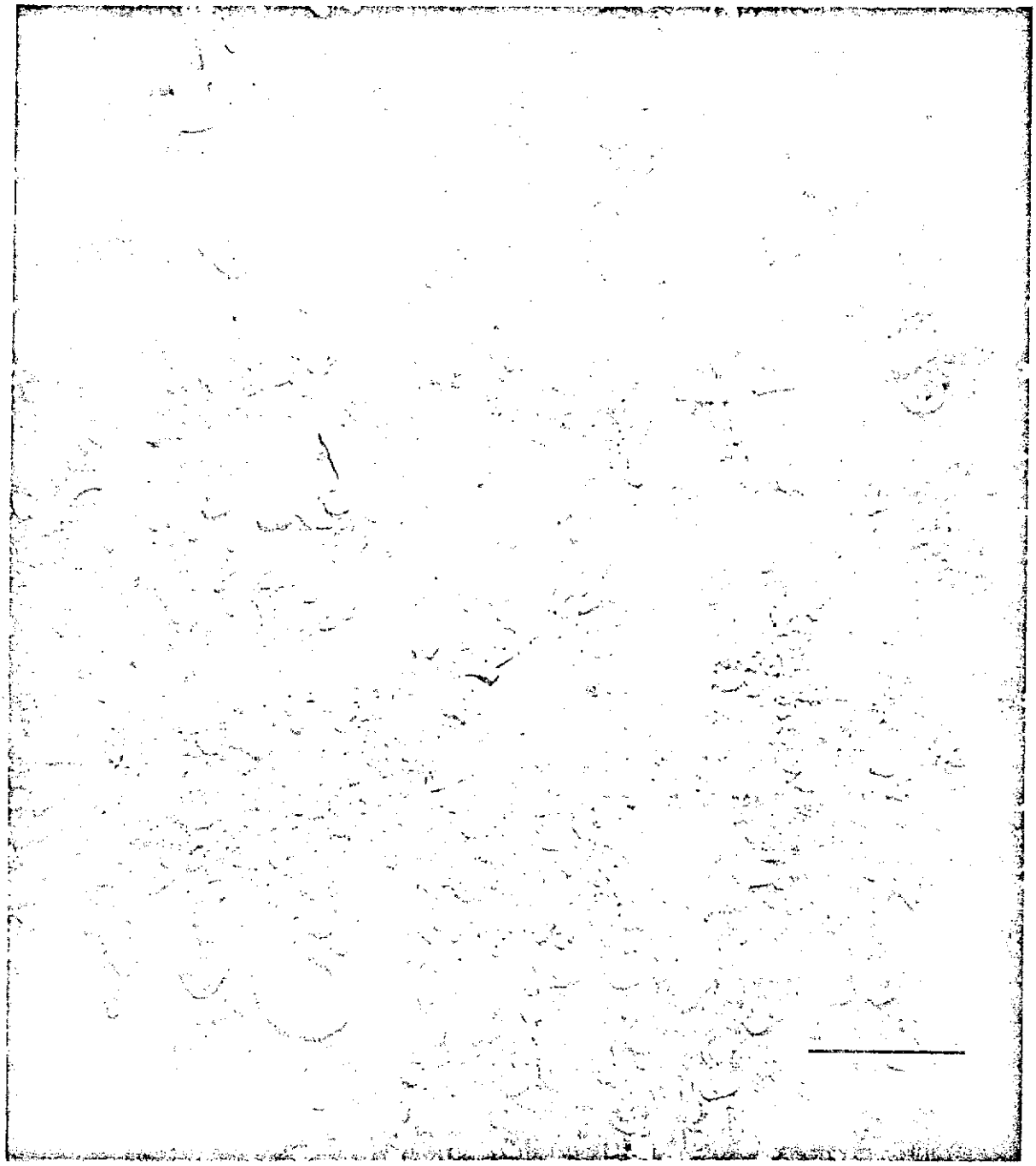


Figure 93.--Sand-shell bottom at a depth of 69 m near the outer continental shelf northeast of Cape May, New Jersey. The starfish is Astropecten; the shell remains are Placopecten, Arctica, and Astarte. Photograph was taken at Station 1360, located at 38°40' N. lat., 73°30' W. long. Scale bar is 10 cm.

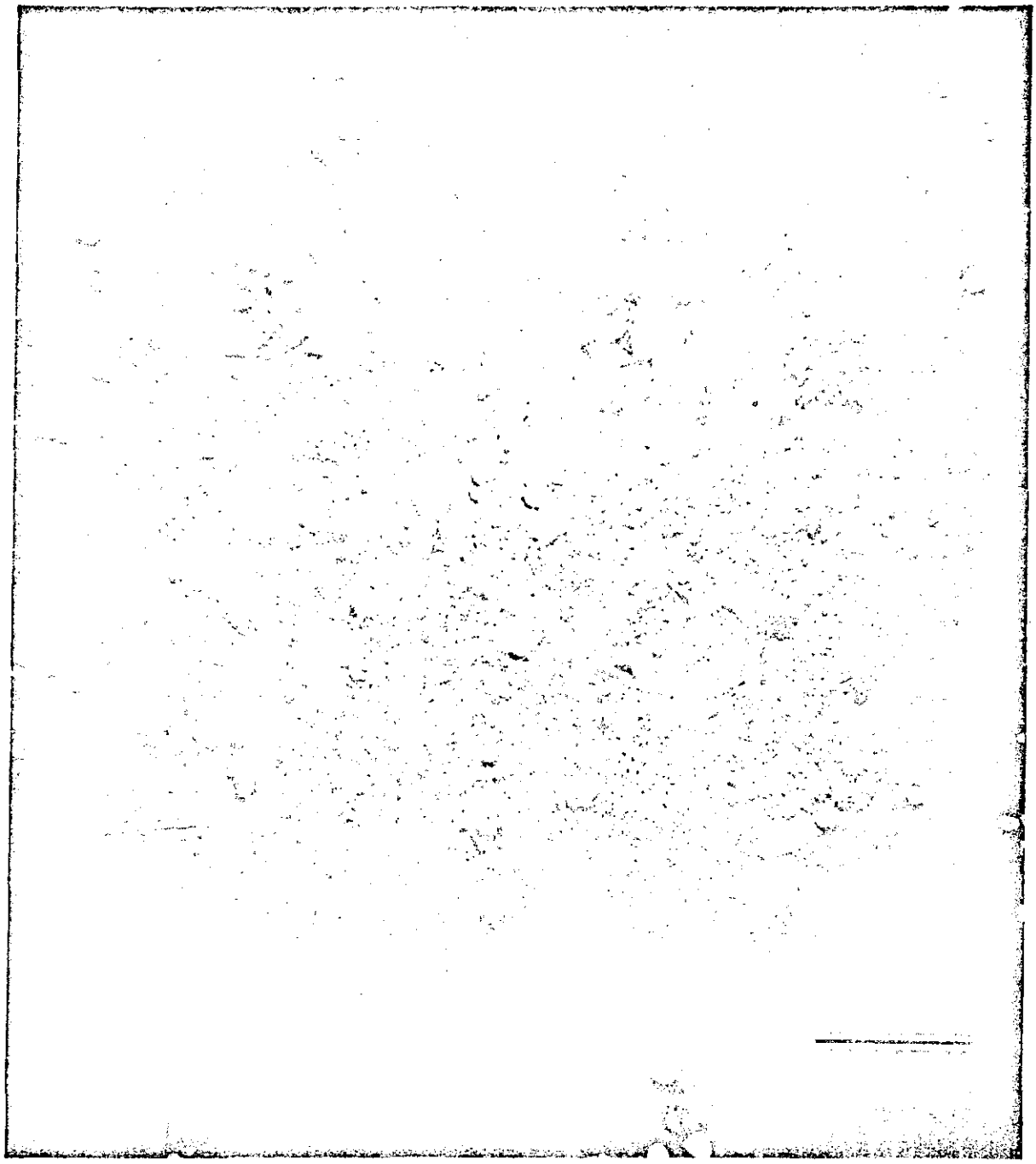


Figure 94.--Silty sand bottom at a depth of 178 m on the outer continental shelf near Hudson Canyon, southeast of New York City. Dominant animals are sea anemones (Zoantharia). Bivalve shells and polychaete tubes are moderately common. Photograph was taken at Station 1324, located at 39°20' N. lat., 72°18' W. long. Scale bar is 10 cm.

Total Macrobenthic Fauna--All Taxonomic Groups Combined

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. The trend in relation to bottom sediments was one of decreasing density with decreasing particle size (table 19, 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. Average density for sand-shell was 2,006/m^2, and sand, silty sand, and silt contained an average of 1,716; 1,286; and 486/m^2, respectively.

The mean biomass of all organisms in relation to sediments within the Middle Atlantic Bight Region (table 19, fig. 96) did not show a consistent trend of decreasing quantity with decreasing particle size, as did density. Largest biomass values occurred in shell and silty sand with 559 and 414 g/m^2, respectively. 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 exhibited a trend similar (a general decrease in density with decreasing particle size) to that described above for the entire Middle Atlantic Bight Region (fig. 97). Two exceptions are notable in this correlation with substrates. Highest density was in sand-gravel, the second coarsest sediment type, where

Table 19.--Mean number of individuals and biomass of the macrobenthic invertebrate fauna in relation to bottom sediments. Values are listed separately 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

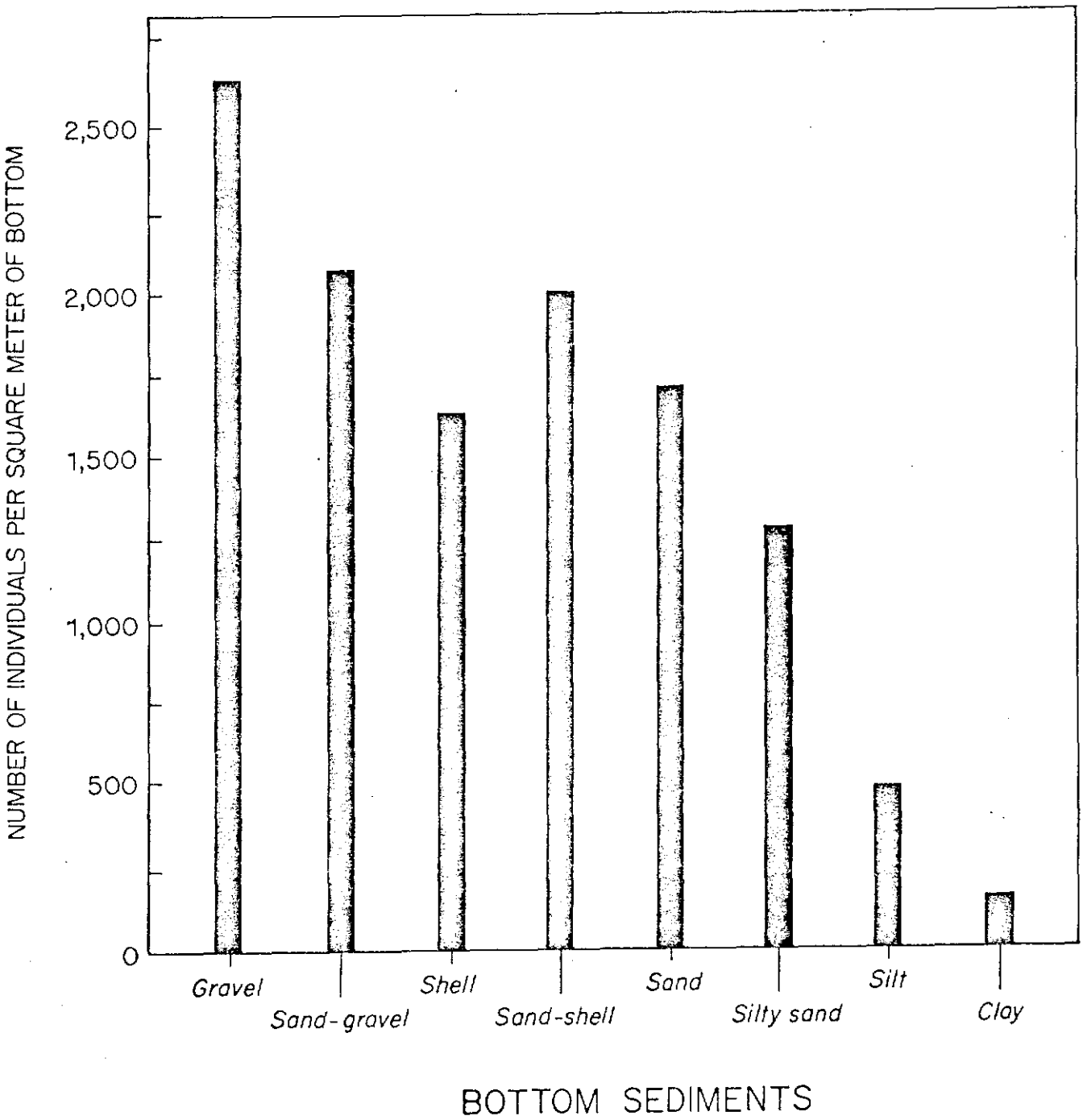


Figure 95.--Relation between number of individuals and bottom sediment types. Values represent all taxonomic groups combined for the entire Middle Atlantic Bight Region.

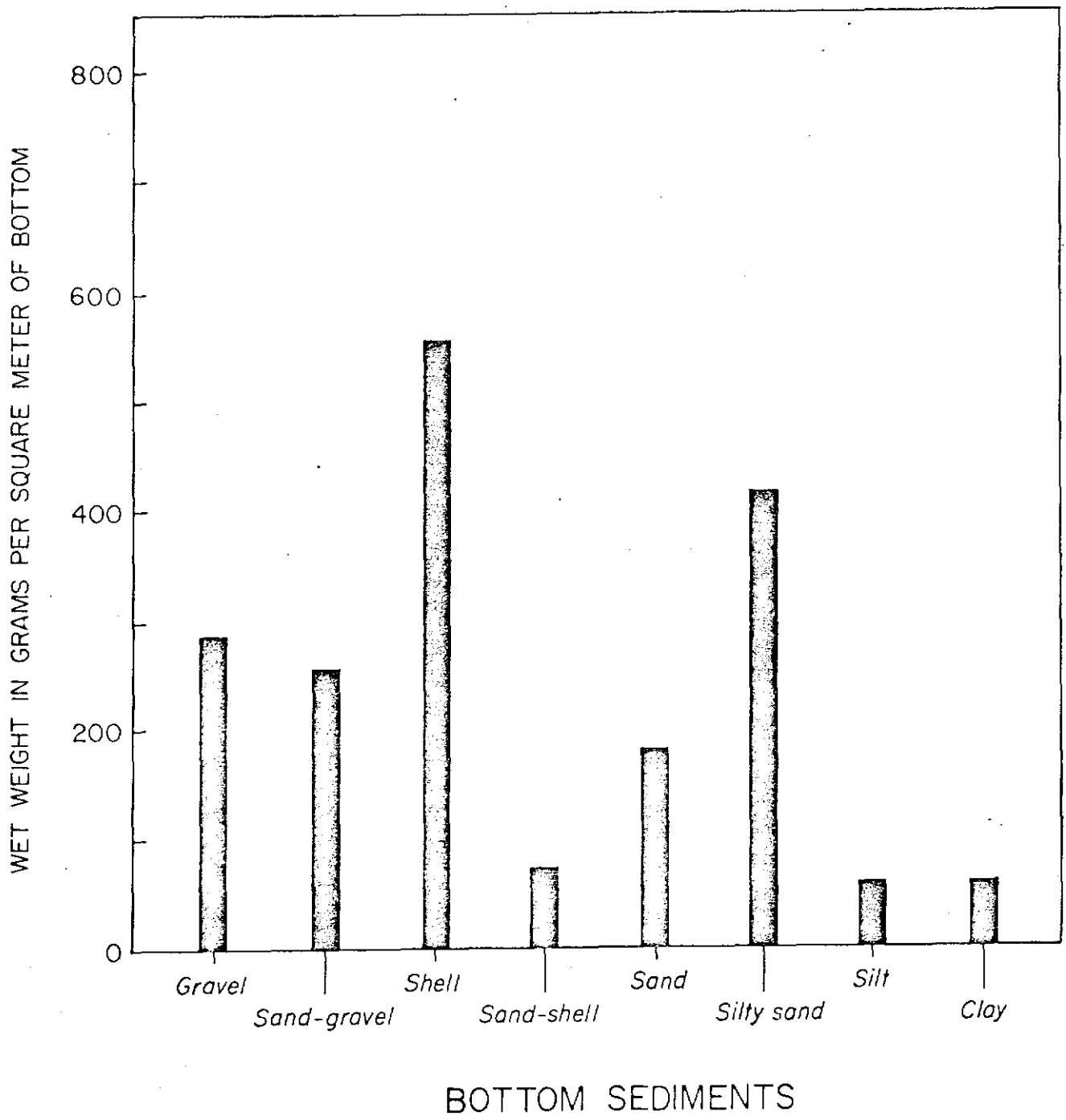


Figure 96.--Relation between biomass and bottom sediment types. Values represent all taxonomic groups combined for the entire Middle Atlantic Bight Region.

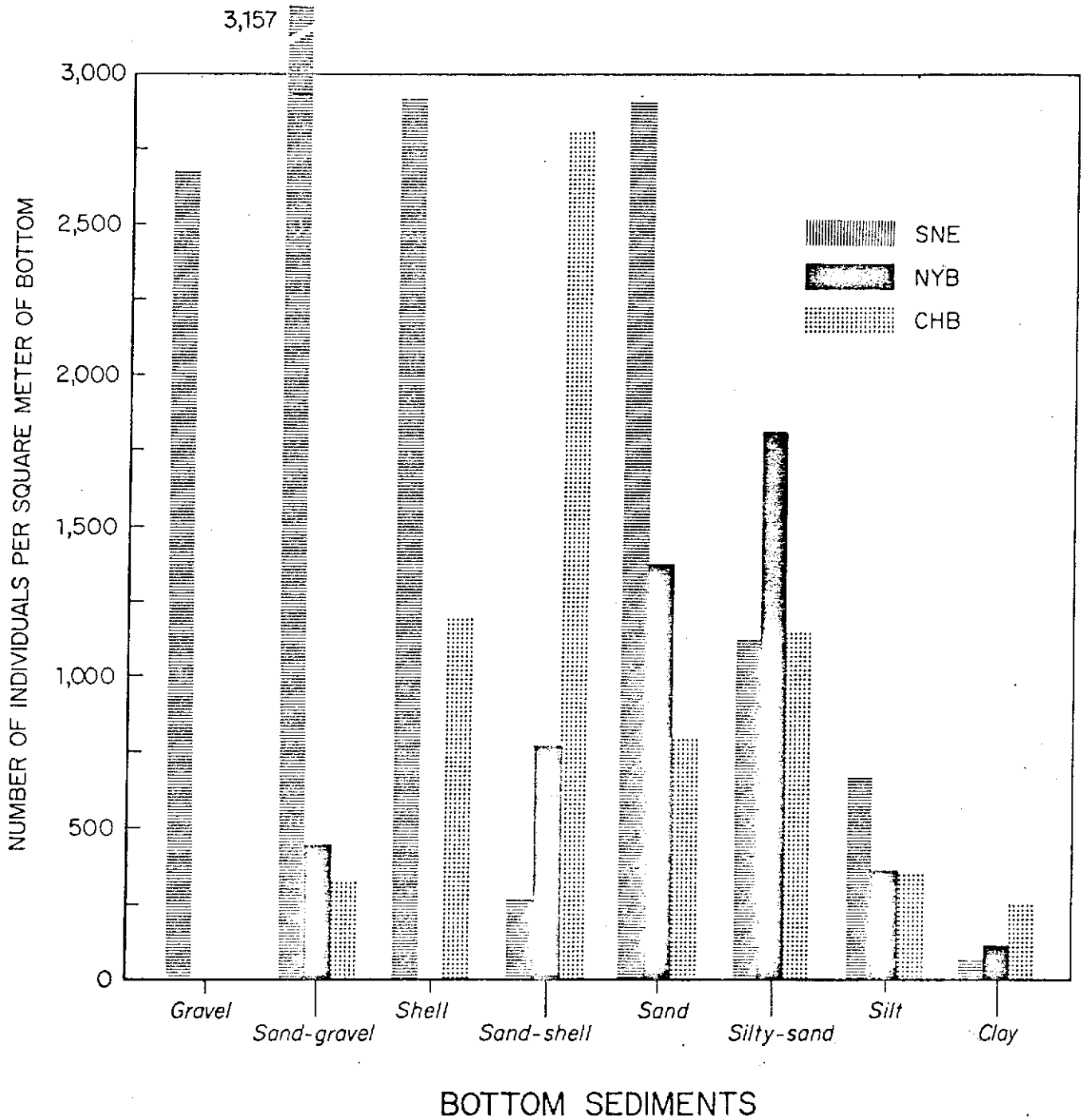


Figure 97.--Relation between number of individuals and bottom sediment types. Values represent all taxonomic groups combined for each subarea.

3,157/m^2 were found while gravel, the coarsest, contained 2,667/m^2. Sand-shell, ranked fourth in coarseness, contained the second lowest density of 259/m^2 while clay, the finest grained substrate, contained the lowest density, 62/m^2. Densities in shell, sand, silty sand, and silt were 2,925; 2,912; 1,131; 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). There was no definite linear relationship of biomass with decreasing particle size, although, in general, the coarser grained substrates contained larger biomasses than the finer grained ones. 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 subarea. The sandy substrates contained the highest densities of organisms which increased with decreasing particle size; the highest density occurred in silty sand 1,906/m^2 (fig. 97). Sand-gravel, sand-shell, and sand sediments contained densities of 448, 769, and 1,391/m^2, respectively, while silt had a density of 464 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.

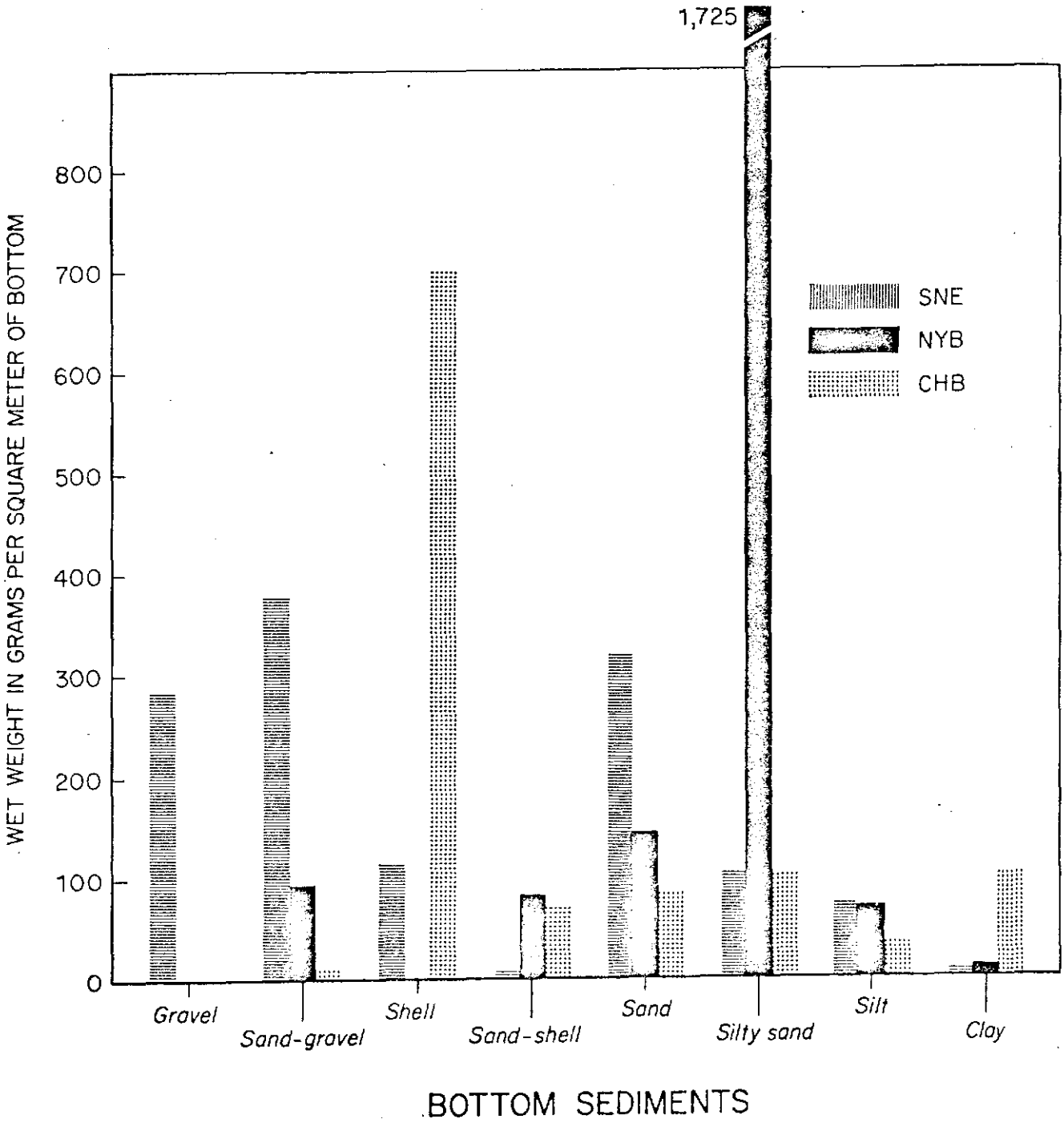


Figure 98.--Relation between biomass (wet weight) and bottom sediment types. Values represent all taxonomic groups combined for each subarea.

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/m^2. Among the finer sediments densities of 343 and 249/m^2 were found in silt and clay, respectively. Density values in the medium to moderately fine substrates tended to average approximately one thousand individuals per square meter; 989, 1,157, and 1,211/m^2 in sand, silty sand, and shell, respectively. Highest density of all organisms in the Chesapeake Bight subarea, by a significant amount, 2,804/m^2, occurred in sand-shell.

The mean biomass of all organisms in the Chespeake Bight subarea was generally lower than in either the Southern New England or New York Bight subareas. 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/m^2 in Chesapeake Bight versus 117 and 559 g/m^2 in New York Bight and Southern New England, respectively. Silty sand and clay sediments were the only other substrates whose biomasses equalled or exceeded 100 g/m^2 in this subarea. Biomasses of 85, 72, 35, and 12 g/m^2 occurred in sand, sand-shell, silt, and sand-gravel sediments, respectively.

Taxomonic 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 20 and 21, and illustrated in figures 99 through 104.

Table 20.--Mean number of individuals listed by taxonomic groups in each bottom sediment type for the entire Middle Atlantic Bight Region.

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 21.--Mean biomass of each taxonomic group listed by bottom sediment type for the entire Middle Atlantic Bight Region.

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	25.885	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	0.035	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

Porifera (fig. 99), although not an important contributor to the overall density of organisms, mainly due to the lack of suitable substrates in the study area for most types, were surprisingly ubiquitous, occurring in small quantities in all but one sediment type - shell. As might be expected from their need for attachment, density values decreased with decreasing particle size, ranging from 5 to 2/m^2 in gravel to sand-shell. Fewer than 1/m^2 occurred in sand, silty sand, silt, and clay substrates. Sponge biomass paralleled density insofar as distribution among sediment types is concerned. Overall values were low, 0.002 to 0.9 g/m^2, with higher values in the coarser grained sediments and the lower values in the fine substrates.

Coelenterata occurred in all sediment types and there were generally more of them in the coarser substrates than in the finer ones. Density values ranged from 4 to 165/m^2. Sand-gravel contained the greatest numbers and clay the least. Since the density values of Coelenterata are the combined results of contributions from sub-taxa within the phylum, and are more or less generalized, the densities of the sub-components will be dealt with below. Coelenterate biomass was moderately large for the group as a whole ranging from 19 g/m^2 in gravel to a low of about 1 g/m^2 in sand. Biomass in the other sediment types ranged from 7 to 2 g/m^2 with no definite discernible affinity to sediment particle size.

Hydrozoa (fig. 99) were found in all sediment types except clay. Highest density values tended to occur in coarser substrates with a few exceptions. Sand-gravel contained the highest density, 95/m^2, while silt contained the least, 0.03/m^2. Shell and silty sand contained moderate amounts, 29 and 15/m^2, while sand, sand-shell, and gravel had lower

densities, 6 and $4/m^2$, respectively. Hydroid biomass was more closely allied with particle size than was their density although actual values were moderately low. Sand-gravel sediments contained the largest biomass, 3 g/m^2, while silt had the lowest, <0.001 g/m^2. No hydroids were found in clay.

Anthozoa occurred in all sediment types. The general tendency in this group was for higher values to occur in coarser sediments than in the finer ones. Density values ranged from a high of 70 to a low of $3/m^2$ in sand-gravel and sand-shell, respectively. Gravel, silty sand, and shell also contributed significantly with 25, 15, and $11/m^2$, respectively. Biomass of anthozoans was moderately large where they were present but no definite trend linked to particle size was discernible, as opposed to that which occurred with density. Largest biomass occurred in gravel, 18 g/m^2, and smallest in sand and shell, 0.8 and 0.7 g/m^2, respectively.

Alcyonacea (Alcyonaria) (fig. 99), which are members of the anthozoan group, occurred only in small quantities and only in sand, silt, and clay sediments. Density values ranged from $1/m^2$ in silty sand, silt, and clay to $0.2/m^2$ in sand substrates. Biomass of alcyonaceans was moderately small, ranging from 0.5 g/m^2 in silt, to 0.02 g/m^2 in sand. Biomasses in the 0.1 g/m^2 range occurred in silty sand and clay.

Zoantharia (fig. 99), another sub-group of Anthozoa, occurred in all sediments except shell. They were most abundant in silty sand ($12/m^2$), and gravel ($10/m^2$), and least abundant in sand-gravel, sand-shell, sand, and clay ($2/m^2$); $3/m^2$ occurred in silt. Zoantharians inhabiting gravel substrates were the greatest contributors of Anthozoan and Coelenterate biomass with 17 g/m^2. Silty sand and sand-shell substrates contained significant amounts, 7 and 6 g/m^2, respectively. Biomasses ranging from 0.6 to 2.0 g/m^2 occurred in the other sediment types.

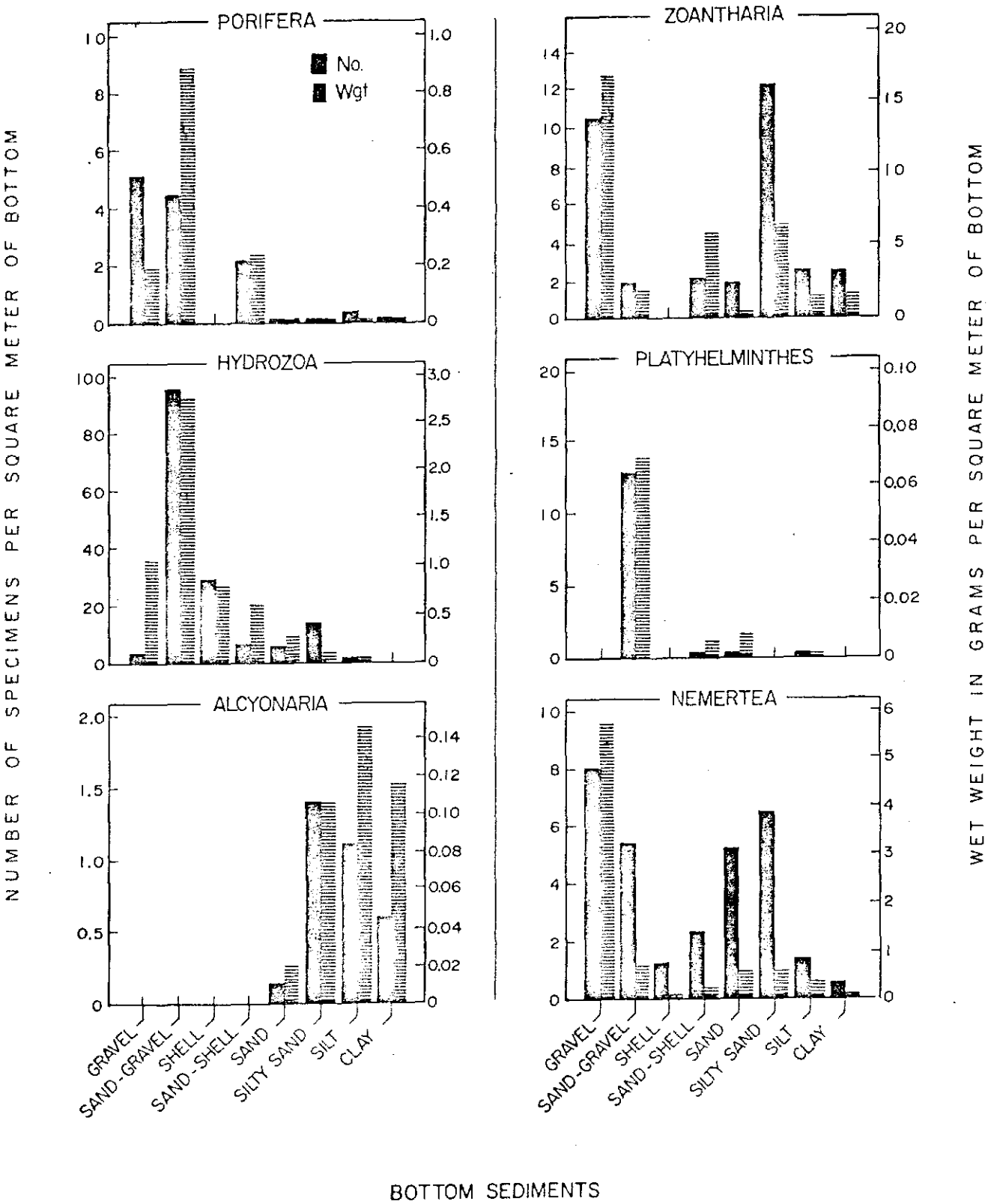


Figure 99.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Porifera, Hydrozoa, Alcyonaria, Zoantharia, Platyhelminthes, and Nemertea.

Platyhelminthes (fig. 99) occurred only in sand-gravel, sand-shell, sand, and silt. Their numbers were generally low; the only sediment type where significant quantities were detected was sand-gravel, in which the density averaged $13/m^2$. The remaining sediment types in which they were found contained fewer than $1/m^2$. The biomass of Platyhelminthes represented only by Turbellaria was small ranging from 0.07 g/m^2 in sand-gravel to 0.002 g/m^2 in silt. Sand-shell and sand contained biomasses of 0.007 and 0.008 g/m^2, respectively.

Nemertea (fig. 99) were found in all sediment types throughout the area. Density in all sediments was low, 8 to $1/m^2$. Highest densities occurred in gravel, silty sand, sand-gravel, and sand (8, 7, 6, and $5/m^2$, respectively). Lower values (3 to $1/m^2$) occurred in the finer-grained sediments. The biomass of nemerteans relative to the other taxa was larger than their density. Largest biomass occurred in gravel (5.8 g/m^2) and lowest in clay (0.006 g/m^2). Other sediment types contained biomasses which ranged from 0.74 to 0.1 g/m^2.

Nematoda (fig. 100) occurred in all sediment types. Density values were moderately low (<1 to $3/m^2$) in most substrates except sand-gravel and shell where densities of 41 and $39/m^2$ were found. The biomass of nematodes, as expected from their size, was low. Mean weight values ranged from 0.003 g/m^2 in clay to 0.072 g/m^2 in shell.

Annelida (fig. 100) were ubiquitous in their distribution in relation to sediments, and no definite relation to particle size was apparent. In terms of density, worms were one of the major taxonomic components of the entire Middle Atlantic Bight Region. Highest ($412/m^2$) and lowest ($27/m^2$) densities occurred in sand and clay, respectively. Next highest density

values occurred in sand-gravel and shell, 389 and 363/m^2, respectively, dropping to 289, 272, 174, and 91/m^2 in gravel, silty sand, sand-shell, and silt, respectively. Annelids were also major contributors to overall biomass. Fairly large biomasses were present in shell, silty sand, and gravel (28, 26, and 24 g/m^2, respectively). Sand substrates contained 14 g/m^2 of annelids while sand-gravel, sand-shell, and silt sediments yielded biomasses of 8.7, 8.6, and 6.7 g/m^2. Smallest biomass of worms occurred in clay, where they averaged 2.4 g/m^2.

Pogonophora (fig. 100) were restricted to the moderately fine to fine sediments; being found only in sand, silty sand, silt, and clay. Their density was low, ranging from 4 to less than 1/m^2. Highest density was in silt and lowest in sand. Their biomass was equally small, ranging from 0.06 to less than 0.001 g/m^2. Biomass values were distributed as in density, largest in silt and smallest in sand.

Sipunculida (Sipuncula) (fig. 100) occurred most frequently in fine and moderately fine sediments; they were absent in gravel and shell substrates. Highest density (10/m^2) occurred in sand-gravel, and lowest (0.4/m^2) in sand-shell. Densities in the fine-grained sediments ranged from 0.9 to 5/m^2. The biomass of sipunculids tended to parallel their density. Largest biomass (1.6 g/m^2) occurred in sand-gravel, lowest (0.03 g/m^2) in sand-shell. Values ranging from 0.1 to 1.3 g/m^2 were found in remaining substrate types.

Echiura (fig. 100) were more or less restricted to the finer sediment types, occurring only in sand through clay. Their density was low, less than 0.4/m^2 in sand, silt, and clay, and 0.5/m^2 was found in silty sand. The biomass of echiuroids was generally rather small. Biomasses of 1.2 and 0.7 g/m^2 occurred in silt and clay; and sand and silty sand contained <0.01 and 0.3 g/m^2.

Priapulida (fig. 100) were restricted to the finest sediments, silt and clay, and were low in density and biomass. Densities were less than $0.1/m^2$ and biomass ranged from 0.02 to 0.06 g/m^2.

Mollusca were present in all sediment types. Their density in gravel, sand-shell, silty sand, silt, and clay ranged from 96 to $1,448/m^2$, the highest among all taxonomic groups throughout the Region. Densities were moderately high (93 to $414/m^2$) in sand-gravel, shell, and sand (see table 20). Molluscan biomass ranged from 17 to 387 g/m^2 and dominated all other taxa, usually by a substantial margin, in all sediment types except gravel (see table 21). Details of their quantitative distribution are contained in the following discussion of the molluscan subcomponents.

Polyplacophora (fig. 101) were generally low in density and biomass in most sediment types and absent in shell and sand-shell sediments. Densities ranged from 0.2 to $4/m^2$, and biomass ranged from 0.004 to 0.227 g/m^2 with an unusually large biomass of 4.3 g/m^2 occurring in sand-gravel.

Gastropoda (fig. 101) were found in all sediment types. Their density in gravel was significantly higher than in all other sediment types. Density in gravel was $1,064/m^2$, whereas fewer than $100/m^2$ (range 5 to $89/m^2$) occurred in the other sediment types. Biomass more or less paralleled density in that the largest biomass (11 g/m^2) occurred in gravel and considerably lower biomasses occurred in the other substrates. One exception was silty sand, where 7 g/m^2 were recorded. Biomasses ranging from 0.02 to 3 g/m^2 occurred in the other substrate types.

Bivalvia (fig. 101) were found in all sediment types and both their density and biomass varied widely. Their densities in the various sediment types for the most part were not as high as might be expected for this

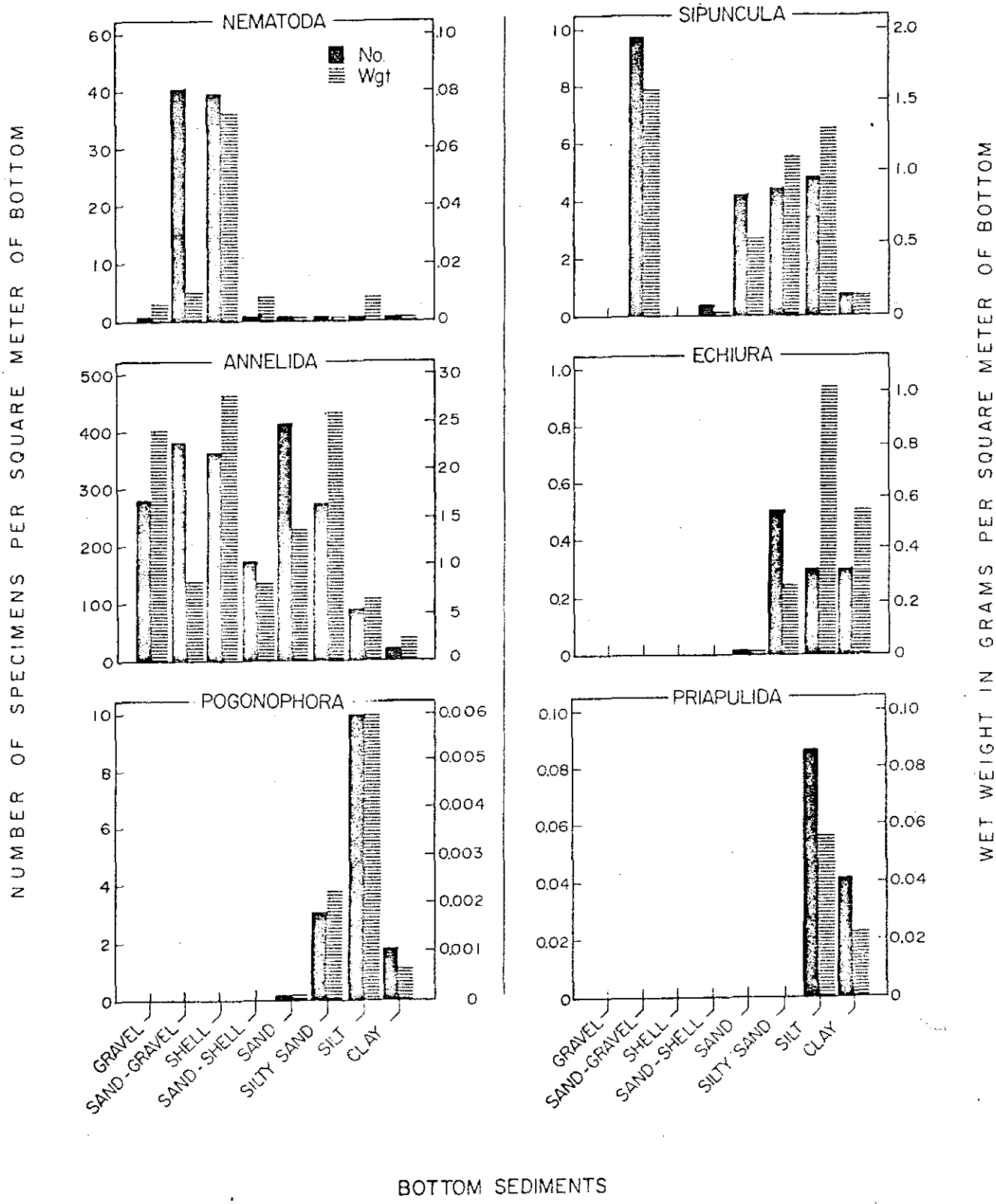


Figure 100.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

ubiquitous group. Highest density of 1,442/m^2 occurred in sand-shell while the next highest in silty sand dropped to 384/m^2. Lowest density (17/m^2) was encountered in gravel. Densities ranging from 67 to 327/m^2 occurred in the other substrates. Biomass values were relatively large in proportion to their density. Largest biomasses occurred in shell and silty sand where 386 and 336 g/m^2, respectively, were found. Sand-gravel contained 150 g/m^2 and the biomass in remaining sediment types ranged from 44 to 5 g/m^2.

Scaphopoda (fig. 101) were not found in the coarser substrates (gravel, sand-gravel, or shell) and only in low to moderately low quantities in the other substrates. Densities ranged from 0.2 to 3/m^2, and biomass ranged from 0.001 to 0.07 g/m^2.

Cephalopoda (fig. 101) eggs were found only in sand and silty sand in low abundance. Density was 0.02 and 1.9/m^2 and biomass <0.001 and 0.03 g/m^2, respectively.

Pycnogonida (phylum Arthropoda) (fig. 101) were found in sand-gravel, sand-shell, sand, silty sand, and clay, but only in small amounts. Densities ranged from 0.1 to 5/m^2, whereas biomass ranged from 0.001 to 0.02 g/m^2.

Arachnida occurred only in small amounts (fewer than 0.1/m^2 and less than 0.001 g/m^2) and were present only in sand.

Ostracoda (fig. 102), another arthropod component, were found in only small quantities. They were not found in gravel, shell, silty sand, or clay, and where they did occur were present in very small quantities. Density ranged from less than 0.1 to 1/m^2 and biomass from 0.001 to 0.01 g/m^2.

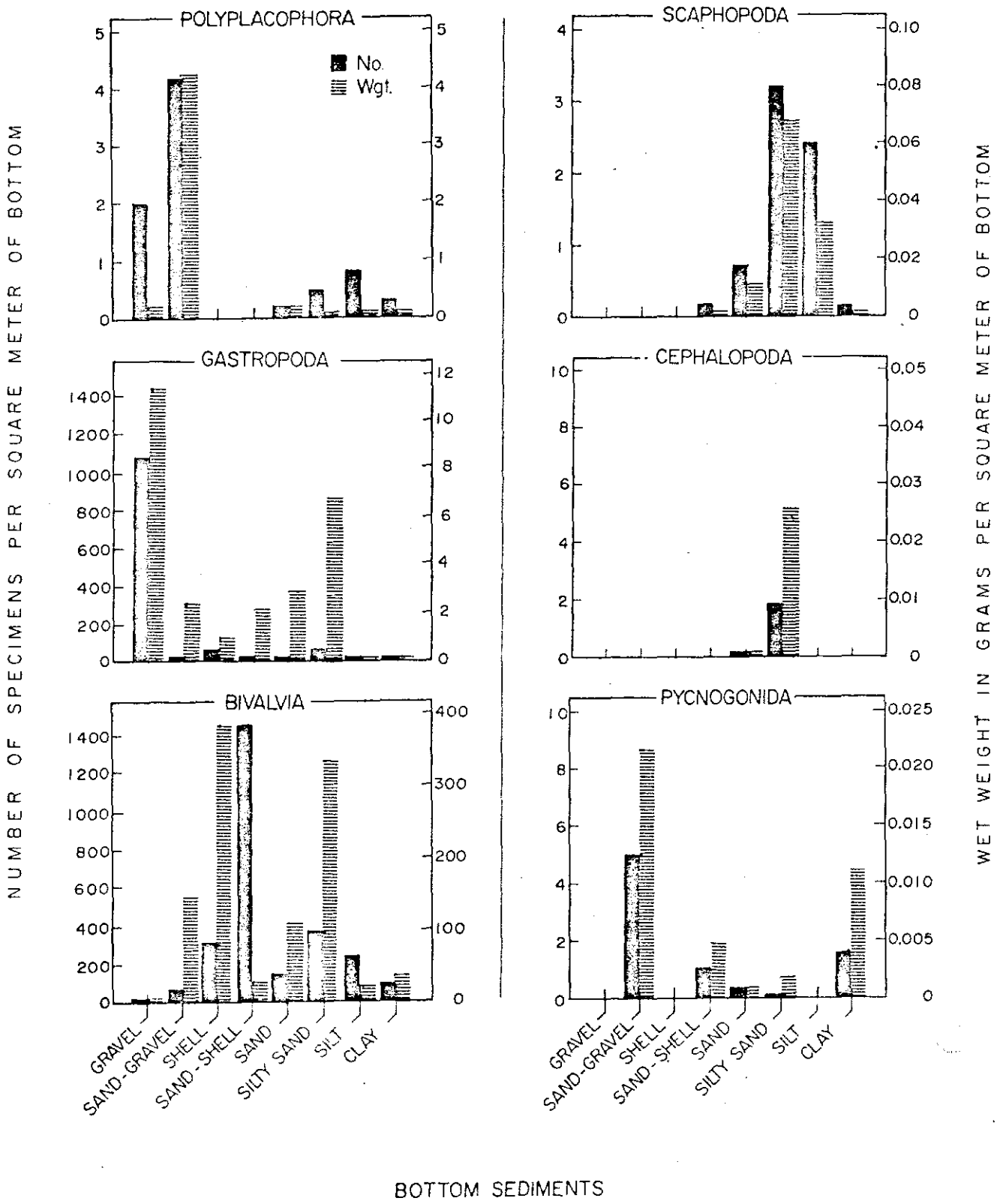


Figure 101.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

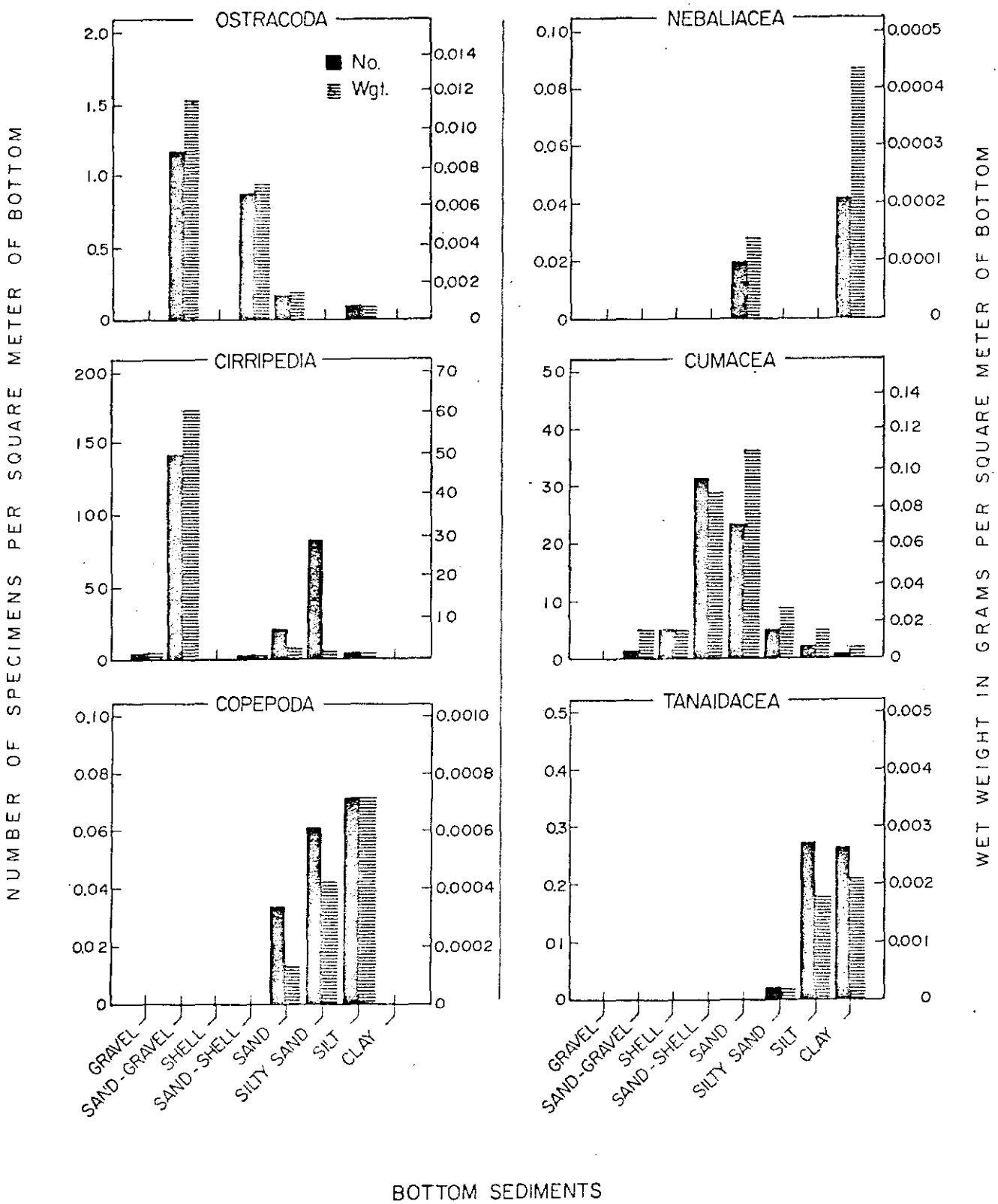


Figure 102.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

Cirripedia (fig. 102) were present in nearly all sediment types, being absent only in shell and clay substrates. However, sand-gravel, silty sand, and sand were the only sediment types which contained significant quantities in terms of both density (141, 84, and 22/m^2, respectively) and biomass (61, 2 and 3 g/m^2, respectively). In other sediments density ranged from 0.5 to 7/m^2 and biomass from 0.003 to 0.1 g/m^2.

Copepoda and Nebaliacea (fig. 102) were present only in very small to trace quantities in terms of both density and biomass. Copepods were found in sand, silty sand, and silt while nebaliaceans were encountered in sand and clay.

Cumacea (fig. 102) were absent in gravel but occurred in low to moderate quantities in the other sediment types. Sand-shell and sand appear to be the preferred sediments since greatest quantities were obtained in those substrates. Densities in sand-shell and sand averaged between 32 and 24/m^2, as compared with densities ranging from 0.5 to 6/m^2 in other sediments. Biomasses in sand and sand-shell averaged 0.11 and 0.09 g/m^2, respectively, dropping to 0.02 g/m^2 or less in the other substrates.

Tanaidacea (fig. 102) were found only in the finer sediments; silty sand, silt, and clay, in low quantities. Densities were less than 0.3/m^2 in each substrate. Biomass, although small (less than 0.001 to 0.002 g/m^2) increased with decreasing particle size.

Isopoda (fig. 103) were absent from gravel and appear to prefer sandy substrates to others. Density of isopods was low to moderate ranging from 0.1/m^2 in clay to 17/m^2 in sand. Values tended to drop from the highest value in sand, with increasing as well as decreasing particle size. Biomass of isopods was also in the small to moderate range and roughly paralleled density in distribution. Largest biomass occurred in sand (0.45 g/m^2) and smallest in clay (0.001 g/m^2). Quantities tended to fall off with decreasing particle size from sand, and also with increase in particle size, larger than sand.

Amphipoda (fig. 103) were ubiquitous and one of the major components of the Middle Atlantic Bight Region's benthic fauna in both density and biomass. Amphipod density ranged from 18/m^2 in clay to a high of 1,009/m^2 in sand-gravel. Sand was the one other sediment type containing a density in excess of three hundred individuals per square meter, with 933/m^2. Densities in other sediments, although comparatively high, did not exceed 272/m^2. Biomass of amphipods exhibited trends similar to density. Highest biomass occurred in sand and sand-gravel, 6 and 5 g/m^2, respectively. Lowest values were found in clay and silt, 0.08 and 0.15 g/m^2, respectively. Biomass in other sediments was moderately high ranging from 0.60 to 2.5 g/m^2.

Mysidacea (fig. 103) were encountered only in the sandy substrates (sand-gravel, sand-shell, sand, and silty sand). Both density (range of 0.1 to 4/m^2) and biomass (range of 0.001 to 0.02 g/m^2) were low.

Decapoda (fig. 103), another of the major faunal components, had a marked affinity for the coarser substrates. The density of decapods ranged from fewer than 1 individual per square meter in silt and clay to

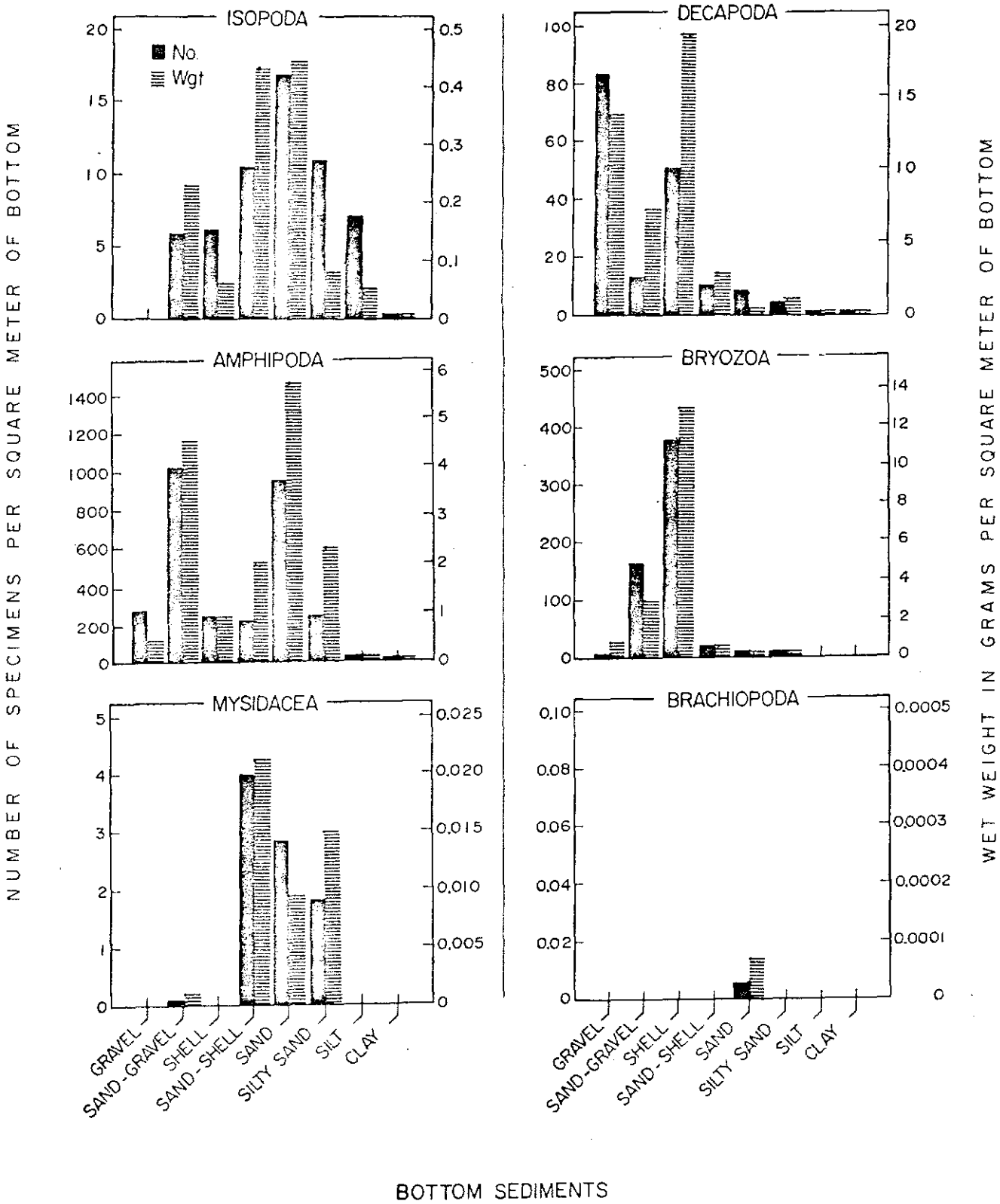


Figure 103.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

a high of 83/m^2 in gravel. Densities in shell, sand-gravel, and sand-shell were 50, 13, and 11/m^2, respectively. Densities in sand and silty sand were below 10/m^2. The biomass of decapods in the different substrata ranged from quite small to large; again, as with density, the higher values occurring in the coarser grained sediments. Largest biomasses were recorded in shell (20 g/m^2), and gravel (14 g/m^2). Values dropped drastically in sand-gravel (7 g/m^2), and sand-shell (3 g/m^2). Biomasses of 1 g/m^2 and less occurred in the finer (sand through clay) sediments.

Bryozoa (fig. 103) showed a definite preference for shell substrates and were absent from silt and clay sediments. Density of bryozoans ranged from 3/m^2 in gravel to 376 and 164/m^2 in shell and sand-gravel, respectively. Low values were encountered in remaining sediment types. Biomass was similarly distributed with largest quantities 13, 3, and 1 g/m^2 occurring in shell, sand-gravel, and gravel, respectively. Remaining sediments in which they occurred contained less than 0.6 g/m^2.

Brachiopoda (fig. 103) were found only in sand and only in trace amounts of density and biomass.

Holothuroidea (fig. 104) were not found in gravel or shell and seemed to prefer silty sand sediments. Their density was moderately low where they were found, ranging from less than 1/m^2 in sand-gravel, sand-shell, and clay, to 1/m^2 in sand and silt, and 8/m^2 in silty sand. Biomass of holothurians was moderately low in all but two sediment types. Biomass ranged between 0.2 and 0.9 g/m^2 in sand-gravel, sand-shell, silt, and clay, whereas silty sand and sand sediments contained biomasses of 15 and 2 g/m^2, respectively.

Echinoidea (fig. 104) were not found in the coarser substrates, gravel, sand-gravel, and shell. Their relative density was moderately low but biomass was moderately high. Density values in silty sand, silt, and clay were less than $1/m^2$, but in sand and sand-shell 41 and $30/m^2$, respectively, were found. Biomass of urchins was largest (24 g/m^2) in sand, about one half as large (13 g/m^2) in sand-shell, and decreased dramatically with decreasing particle size. Silty sand, silt, and clay contained biomasses of 1.2, 0.8, and 0.04 g/m^2, respectively.

Ophiuroidea (fig. 104) occurred in moderate amounts in all sediment types but gravel. Density ranged from 1 to $106/m^2$ with lowest amounts occurring in sand-gravel and sand-shell, while highest values were found in silty sand, silt, and sand. Brittle star biomass distribution among sediment types paralleled density. Range in biomass was from 0.04 to 5 g/m^2 with smallest quantities in sand-shell and shell; largest biomasses occurred in silty sand, silt, and clay.

Asteroidea (fig. 104) in the Middle Atlantic Bight Region were absent from gravel, sand-gravel, and shell sediments and were present in other sediment types in moderately low to low quantities. Density, especially, was low, ranging from fewer than $1/m^2$ in sand-shell and clay, to $1/m^2$ in sand, silty sand, and silt. The biomass of starfishes was moderate, ranging from less than 0.01 g/m^2 in clay to 3.9 g/m^2 in silty sand. Sand-shell contained 0.5 g/m^2 while silt and sand contained 2.9 and 1.8 g/m^2.

Hemichordata (fig. 104) were found only in sand, silty sand, and silt substrates. Their density was low, fewer than $1/m^2$ in each sediment type, and biomass, also, was small, 0.02, 0.11, and 0.001 g/m^2 in sand, silty sand, and silt, respectively.

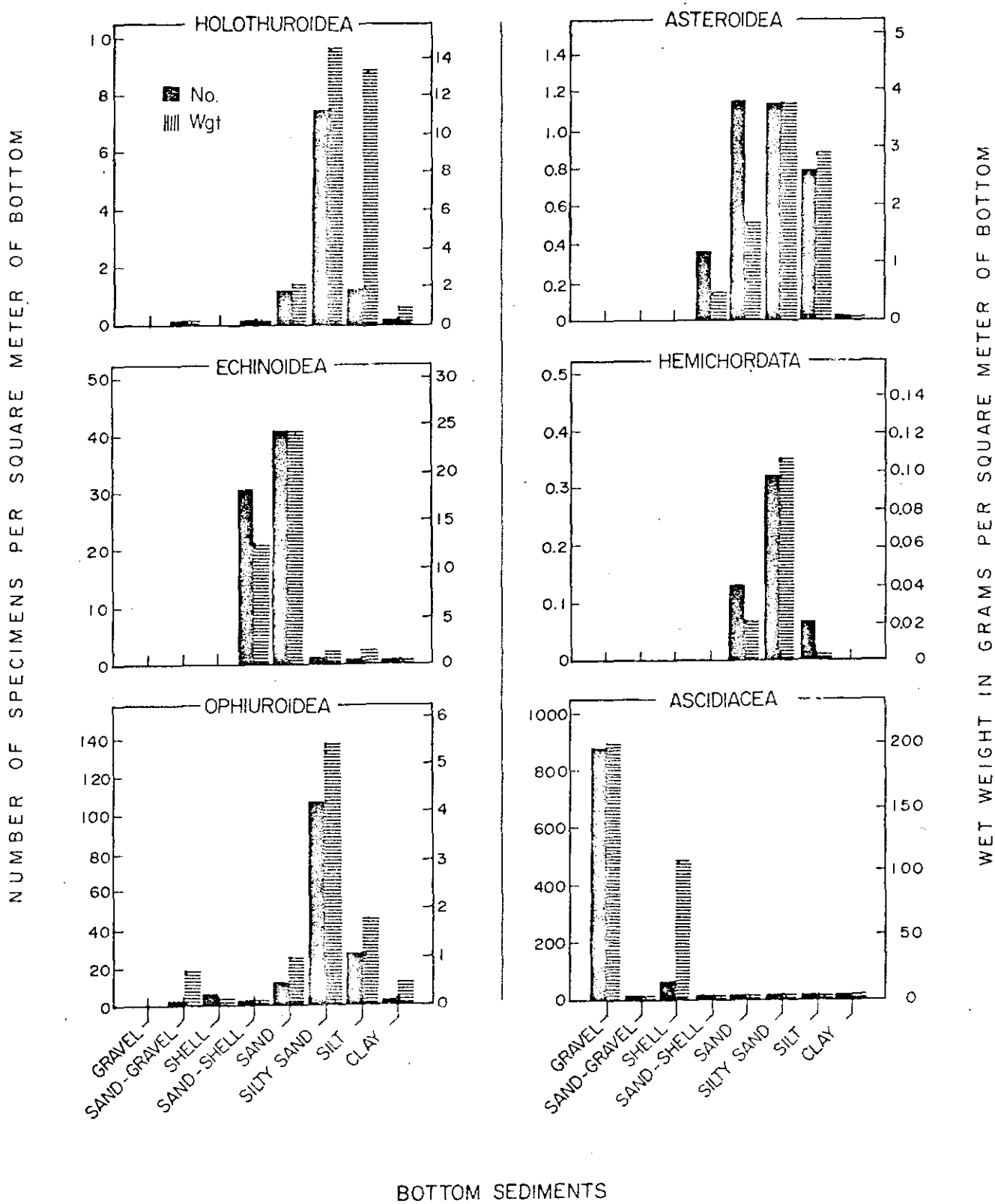


Figure 104.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

Ascidiacea (fig. 104), a ubiquitous group, were major contributors to the macrobenthic fauna of the Middle Atlantic Bight Region. The impact of ascidian density on the total fauna, although substantial, was not as great as that of their biomass. Densities ranged from $3/m^2$ in clay to $900/m^2$ in gravel. All other sediment types contained between 4 and $69/m^2$. The biomass of ascidians in gravel (204 and 109 g/m^2) and shell was especially large. Silty sand, sand, and sand-gravel contained biomasses of 3.9, 1.9, and 1.6 g/m^2, respectively. Sand-shell, silt, and clay yielded less than 1 g/m^2 of biomass.

Subareas

The following three sections deal with each taxon's density and biomass in relation to bottom sediments in each subarea of the Middle Atlantic Bight Region.

Southern New England: (tables 22 and 23)

Porifera were absent in shell, sand-shell, and silt in Southern New England and in relatively low abundance. Density tended to decrease with decreasing particle size ranging from a high of $7/m^2$ in sand-gravel to fewer than $1/m^2$ in sand, silty sand, and clay. Largest biomass, 1.5 g/m^2, occurred in sand-gravel which was substantially higher than that in other sediment types where they were found. Biomass in the other substrates ranged from 0.2 to 0.003 g/m^2.

Coelenterata abundance was low to moderate and they were absent in shell and sand-shell sediments. Density tended to be higher in the coarser sediments, highest density being found in sand-gravel ($256/m^2$) and lowest in clay ($2/m^2$). Biomass was comparatively large and less pronounced

Table 22.--Mean number of individuals listed by taxonomic group in each bottom sediment type for the Southern New England subarea.

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 23.--Mean biomass of each taxonomic group listed by bottom sediment type for the Southern New England subarea.

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

differences among sediment types were apparent. Relatively large biomasses occurred in gravel, silty sand, and sand-gravel (19, 9 and 9 g/m^2, respectively). Biomass in sand, silt, and clay ranged between 1 and 3 g/m^2.

Hydrozoa were found only in gravel, sand-gravel, sand, and silty sand. Density was moderate (less than 1 to $144/m^2$) with greatest numbers occurring in sand-gravel and sand. Biomass was moderately small (0.05 to 1.1 g/m^2) with largest biomasses occurring in sand-gravel and sand.

Anthozoa, although absent from shell and sand-shell, were the greatest contributors to total coelenterate abundance. In terms of density, higher values tended to occur in coarser sediments than in finer ones. Lowest density occurred in clay and highest in sand-gravel, 2 and $123/m^2$, respectively. Biomass of anthozoans tended to be more equitably distributed among sediment types although largest biomass was in gravel, 17.5 g/m^2; however, next highest biomass, 9.2 g/m^2, occurred in silty sand, a much finer grained substrate. Biomasses ranging from 0.7 to 5.2 g/m^2 occurred in the other substrates.

Alcyonacea were found only in the finer sediments, sand, silty sand, silt, and clay. Total abundance was low with densities ranging from fewer than 1 to only $2/m^2$ and biomass from 0.003 to 0.17 g/m^2.

Zoantharia were the major contributors to anthozoan abundance in most sediment types but were absent from shell and sand-shell substrates. Density was moderate in silty sand and gravel (13 and $10/m^2$) and low (fewer than 1 to $5/m^2$) in the other sediment types. Biomass was largest in gravel (17 g/m^2), so much so that, in this sediment type, it ranked third overall after Ascidiacea and Annelida in this subarea. Silty sand substrates also contained a significant biomass with 9 g/m^2. Biomasses in other sediment types were much smaller, ranging from 0.2 to slightly under 3 g/m^2.

Turbellaria, in Southern New England, were found only in sand-gravel, sand, and silt sediments. Both density (22 to fewer than $1/m^2$) and biomass (0.12 to less than 0.001 g/m^2) were moderately low and diminished with decreasing particle size.

Nemertea were absent from shell and clay sediments, and generally low to moderately low in abundance. Density values ranged from 3 to $8/m^2$ and were quite uniformly distributed among the various sediments in which they were found. Biomasses in gravel and sand-gravel, 5.8 and 1.1 g/m^2, respectively, were larger than in other sediment types where they ranged from 0.02 to 0.88 g/m^2.

Nematoda were not found in shell or sand-shell substrates. Abundance was low but quite uniform in all sediment types in which they were found. Density was between 1 and $2/m^2$ except in sand-gravel which contained $67/m^2$. Biomass did not exceed 0.01 nor fall below 0.005 g/m^2.

Annelida were ubiquitous with regard to sediments and were major contributors to both the average density and biomass of all benthic organisms in each sediment type. Density was high in nearly all sediment types. Greatest amounts were found in shell and sand-gravel (750 and $555/m^2$, respectively), somewhat lesser amounts in sand, silty sand, gravel, and silt (433, 331, 289, and $118/m^2$, respectively), and lowest (23 and $9/m^2$) in sand-shell and clay. Biomass was also large in nearly all sediment types. Values between 20 and 30 g/m^2 occurred in four sediment types: shell, silty sand, gravel, and sand, in order of diminishing quantities. Two sediment types contained 7 and 11 g/m^2: silt and sand-gravel, respectively, and sand-shell and clay had the smallest biomasses, 1.7 and 0.45 g/m^2.

Pogonophora were present in sand, silty sand, silt, and clay sediments in this region. They were low both in density and biomass but nevertheless present. Density ranged from fewer than 1 to only $5/m^2$ while biomasses ranged from less than 0.001 to 0.02 g/m^2. Highest density was in silt and largest biomass in silty sand.

Sipunculida (Sipuncula) were not found in gravel, shell, or sand-shell substrates. Densities were moderate to moderately low in other sediments, ranging from 1 to $16/m^2$ in clay and sand-gravel, respectively. Biomass values were moderate with some tendency of decreasing with decreasing particle size. Largest biomass occurred in sand-gravel (2.6 g/m^2) and smallest in clay (0.63 g/m^2). Biomasses in sand, silty sand, and silt were 1.3, 1.8, and .96 g/m^2, respectively.

Echiura were found only in silty sand, silt, and clay in low density and biomass. Density ranged from fewer than 0.04 to $1/m^2$, and biomass from 0.001 to 0.71 g/m^2. In both cases, values increased with decreasing particle size.

Priapulida were found only in silt. Density was low ($0.2/m^2$) and biomass was small (0.16 g/m^2).

Mollusca, with one form or another occurring in all sediment types, were a leading component of the overall density and biomass in the Southern New England subarea. Density was moderately high overall and in three sediment types, gravel, silt, and clay (1,083, 336, and $21/m^2$, respectively) molluscan density was greater than any other single group of organisms. In order of diminishing quantities the density of mollusks in other sediment types was shell, $375/m^2$; silty sand, $222/m^2$; sand-gravel, $145/m^2$; sand, $127/m^2$; and sand-shell, $76/m^2$. Biomass of mollusks varied quite widely among the various sediment types. Relatively small biomasses occurred in

shell, sand-shell, and clay where 4.3, 0.4, and 0.5 g/m^2 were found. The biomass of mollusks in sand-gravel and sand, however, were the highest of all taxa in those substrates, 223 and 252 g/m^2, respectively. Values in gravel, silty sand, and silt were intermediate, ranging from 1 to 22 g/m^2.

Polyplacophora in Southern New England were absent in shell and sand-shell sediments and not very plentiful. Density was fairly low, averaging 2 to only 7/m^2. Biomass was also small in the finer substrates, sand through clay, where 0.002 to 0.02 g/m^2 was found. The coarse substrates, however, contained a significantly larger biomass with sand-gravel containing 7 g/m^2 and gravel 0.23 g/m^2.

Gastropoda were found in all sediments in Southern New England. Their density showed a definite trend of decreasing with decreasing particle size. Gastropod density in gravel, in addition to being the highest among the various sediments within its own group, was also the highest of any other taxon in this sediment type, 1,064/m^2. Shell sediments contained 275/m^2 but sand-gravel only 34/m^2. Densities ranged from 65 to 1/m^2 in the other sediments. The biomass of gastropods did not show as close a relationship to particle size as did their density although largest and smallest biomasses occurred in gravel and clay, 11.5 and 0.03 g/m^2, respectively. Sand sediments contained 6 g/m^2 while sand-gravel and shell contained biomasses of nearly 4 g/m^2. Biomass in other sediments was below 1 g/m^2.

Bivalvia in this subarea were ubiquitous with relation to sediments and high in terms of density and biomass. The only sediment type for which bivalves showed a clear preference was silt where the highest density, 328/m^2, was found. Moderately high densities, between 100 and 200/m^2, occurred in sand-gravel, shell, sand, and silty sand substrates; and moderate densities, between 10 and 20/m^2 occurred in gravel, sand-shell,

and clay. Bivalve biomass contributed significantly to the overall benthic invertebrate biomass in Southern New England. In sand-gravel and sand they had the largest biomass of any single taxon, with 212 and 246 g/m^2, respectively. Smallest biomasses were recorded in sand-shell, clay, and shell: 0.06, 0.49, and 0.5 g/m^2, respectively. Gravel, silt, and silty sand had biomasses between 5 and 21 g/m^2.

Scaphopoda which were found only in sand, silty sand, and silt, had densities and biomasses which were, although low, fairly uniform among the three substrates. Densities ranged from 0.5 to 3/m^2 and biomass from 0.01 to 0.04 g/m^2. Both density and biomass increased with decreasing particle size.

Cephalopoda (eggs) were present in low amounts of both density and biomass in sand (0.06/m^2 weighing 0.001 g/m^2), and slightly greater amounts (3.4/m^2 weighing 0.05 g/m^2) in silty sand, the only other sediment type in which they were found.

Arthropoda as a group enjoyed the greatest density of any single group in Southern New England and were found in all sediment types. Highest densities occurred in sandy substrates (2,228 and 1,770/m^2 in sand and sand-gravel), lowest in the finest substrates (4 and 55/m^2 in clay and silt), and moderate amounts in the remaining sediment types (between 154 and 361/m^2). Biomass of arthropods, as a whole, was not as significant as density when compared to the other taxa, but was nevertheless well above the norm. Sand-gravel contained the largest biomass of arthropods by a significant amount (113 g/m^2) while shell contained the next highest biomass (31 g/m^2). Sand and gravel contained 18 and 15 g/m^2, respectively; 2.7 g/m^2 occurred in silty sand, and values below 0.6 g/m^2 were found in sand-shell, silt, and clay.

Pycnogonida occurred only in sand-gravel sediments in this subarea and in low quantities. Density was $8/m^2$, and biomass was 0.04 g/m^2.

Arachnida were not found in the Southern New England subarea.

Crustacea: due to the absence of arachnids and the scarcity of pycnogonids, crustacean abundance is similar to that already explained above for Arthropoda.

Ostracoda were found only in sand-gravel and sand and were very low in both density (2 and $0.5/m^2$, respectively) and biomass (0.02 and 0.003 g/m^2, respectively).

Cirripedia were rather restricted in distribution, being found only in gravel, sand-gravel, and sand. Density was highest in sand-gravel ($231/m^2$) and significantly lower in sand and gravel (15 and $7/m^2$). Biomass of barnacles in sand-gravel was quite large (100 g/m^2), moderate in sand (3 g/m^2), and small in gravel (0.14 g/m^2).

Copepoda were only found in very low amounts of density and biomass in sand, silty sand, and silt.

Nebaliacea were absent from the sediments of Southern New England.

Cumacea were absent from gravel, shell, and sand-shell sediments and seemed to prefer sand over other types of sediments. Density in sand was $58/m^2$ while only between 1 and $8/m^2$ was found in other substrates. Biomass distribution was similar with the largest in sand (0.26 g/m^2) and uniformly low in other sediments where present (between 0.02 and 0.04 g/m^2).

Tanaidacea were present in only small amounts in silty sand, sand, and clay. Density was less than $1/m^2$ and biomass was less than 0.01 g/m^2.

Isopoda were found in all sediment types except gravel and sand-shell. Density was moderate in shell and sand (25 and 19/m^2) and low in sand-gravel, silty sand, silt, and clay (4, 3, 1, and less than 1/m^2, respectively). Biomass of isopods was moderate (between 0.2 and 0.4 g/m^2) in sand-gravel, shell, sand, and silty sand, and small (0.01 and 0.001 g/m^2) in silt and clay.

Amphipoda were found in all sediment types in this subarea. Among the crustaceans they were the leaders in terms of density. Sand and sand-gravel contained the highest densities of amphipods (2,135 and 1,508/m^2); silty sand, gravel, shell, and sand-shell had intermediate densities (309, 272, 225, and 154/m^2, respectively); and silt and clay the lowest (47 and 2/m^2). Amphipods also contributed significantly to overall crustacean biomass. Largest biomasses occurred in sand (13 g/m^2), and sand-gravel (6.5 g/m^2); silty sand and shell provided intermediate amounts (2.3 and 1.8 g/m^2), while smaller biomasses were found in silt, gravel, and sand-shell (0.01 to 0.6 g/m^2).

Mysidacea were found only in sand and silty sand in low densities and biomass.

Decapoda were found in all sediment types except sand-shell, silt, and clay, and abundance was highest in the coarse substrates. Density ranged from moderately low (3, 10, and 14/m^2, respectively) in silty sand, sand, and sand-gravel, to moderately high (50 and 83/m^2) in shell and gravel. Biomass of decapods was largest (28.5 g/m^2) and they were major contributors to the total biomass of all organisms in shell sediments. Significant biomasses were also present in gravel and sand-gravel sediments, where 13.8 and 6.0 g/m^2 occurred. Biomass in sand and silty sand was smaller by a sizable margin, 0.53 and 0.17 g/m^2, respectively.

Bryozoa were present in all sediment types except sand-shell, silt, and clay. Density was moderately low in silty sand, sand, and gravel (0.2, 6, and 3/m^2, respectively) and high in sand-gravel (267/m^2). The most significant aspect of bryozoan distribution in Southern New England was their density and biomass in shell substrate, where they had the greatest abundance of all taxonomic groups occurring in this sediment type. Density was 1,500/m^2 and biomass 52 g/m^2. Other sediments contained substantially smaller biomasses; sand-gravel, 5.3 g/m^2; gravel, 1.2 g/m^2; and sand and silty sand, 0.4 and 0.001 g/m^2, respectively.

Brachiopoda were not found in any of the sediments in Southern New England.

Echinodermata were found primarily in the finer sediments: sand, silty sand, silt, and clay, and only in sand-shell of the coarser types. Densities were lowest in sand-shell and clay (fewer than 1 and 8/m^2, respectively), were moderate in sand and silt (59 and 81/m^2), and highest in silty sand (187/m^2). The biomass of echinoderms in Southern New England was significant in each sediment type in which they occurred. Indeed, their biomass in silt and silty sand was the highest of any taxonomic group (49 and 35 g/m^2, respectively). Their biomass in sand, sand-gravel, and clay was also relatively high (24, 1.3, and 0.76 g/m^2, respectively).

Holothuroidea were found only in the finer sediment types: sand, silty sand, silt, and clay. Their densities were moderately low; highest density occurred in silty sand (10/m^2) and lowest was in silt (fewer than 2/m^2). Densities in sand and clay were intermediate (between 3 and 4/m^2). Holothurian biomass was, unlike their density, comparatively high. Silt contained the largest biomass (35 g/m^2), and clay the smallest (0.17 g/m^2); silty sand and sand also supported substantial biomasses (22 and 7 g/m^2).

Echinoidea sediment affinities were similar to those of the holothurians in Southern New England; that is, they were found only in the finer sediments: sand, silty sand, silt, and clay. Abundance, however, was generally lower. Their density decreased with decrease in particle size with highest values occurring in sand ($22/m^2$). The other three sediment types contained fewer than $0.5/m^2$. Urchin biomass was comparatively higher than density and generally tended to decrease with particle size. Sand sediments contained the largest biomass ($0.13\ g/m^2$) and clay the smallest ($0.2\ g/m^2$). Intermediate values occurred in silty sand and silt (1.6 and $2.2\ g/m^2$, respectively).

Ophiuroidea were most commonly found in the finer sediments: sand, silty sand, silt, and clay, as were urchins, with the exception that small quantities also occurred in sand-gravel substrates. Densities were in the moderately high to low range. Greatest numbers occurred in silty sand ($180/m^2$), and lowest in sand-gravel ($0.3/m^2$). Densities in sand and silt were 30 and $76/m^2$, respectively. Biomass was comparatively high in that only one sediment type, clay, contained less than $1\ g/m^2$. Biomass in the other sediment types ranged from 1 to $9\ g/m^2$.

Asteroidea were present in surprisingly few sediment types in Southern New England. They occurred only in sand, silty sand, and silt in quite uniform densities. The range of density values was only between 1 and $3/m^2$. The biomass of starfishes was moderate and increased with decreasing particle size. Biomasses were 0.8, 2.8, and $7.9\ g/m^2$ in sand, silty sand, and silt, respectively.

Hemichordata shared with starfishes the same sediment preferences. They were present in sand, silty sand, and silt in low amounts in terms of density (0.2 to 0.4/m^2), and their biomass, also quite low, ranged from 0.002 to 0.08 g/m^2.

Ascidiacea were quite widely distributed in the Southern New England sediments, occurring in all but shell. Their densities, comparatively, were high to moderately low, with gravel substrates containing the greatest number, 885/m^2. Densities in sand-shell, silt, and clay were 7/m^2 and below, and in sand-gravel, sand, and silty sand were 20/m^2, or slightly above in each. Ascidian biomass in gravel was the largest, by a factor of nearly 10, of any taxonomic group in this sediment type; 204 g/m^2 of ascidians occurred in gravel. Smallest biomasses were found in sand-shell and clay (0.2 and 0.5 g/m^2, respectively), and moderate amounts, ranging from 2 to 6 g/m^2 in other substrates.

New York Bight

The density of major taxonomic groups in the various bottom sediments in New York Bight is listed in table 24 and their biomass is listed in table 25.

Porifera in New York Bight were present only in sand-shell, sand, and silty sand sediments. The density in sand-shell was moderately low (4/m^2), while in sand and silty sand it was low (fewer than 1/m^2). The biomass of sponges was small except in sand-shell where 0.3 g/m^2 occurred, and 0.002 and 0.007 g/m^2 occurred in sand and silty sand, respectively.

Table 24.--Mean number of individuals listed by taxonomic group in each bottom sediment type for the New York Bight subarea.

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	-	-	-	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 25.--Mean biomass of each taxonomic group listed by bottom sediment type for the New York Bight subarea.

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	0.005
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	101.895	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

Coelenterata in the New York Bight subarea occurred in all sediment types except gravel and shell. Their density was moderate to moderately low, highest ($50/m^2$) occurring in silty sand. Densities in other sediment types ranged from 2 to $9/m^2$. Biomass of Coelenterata was moderate to moderately low. Largest average biomasses occurred in silty sand, silt, and sand-gravel where 4.6, 3.9, and 1.6 g/m^2 were found, respectively. Values ranging from 0.5 to 0.8 g/m^2 occurred in other sediment types.

Hydrozoa were found in all sediment types in this region except clay. Densities and biomasses of hydroids were moderately low with highest values in each parameter occurring in silty sand. Density values in silty sand were $24/m^2$ and biomass was 0.3 g/m^2. In other sediment types density ranged from fewer than 1 to $9/m^2$ while biomass ranged from 0.001 to 0.1 g/m^2.

Anthozoa were ubiquitous in New York Bight; they occurred in all sediment types within the subarea. Densities were moderately low with highest average values ($26/m^2$) occurring in silty sand. Density values in remaining sediment types ranged from fewer than $1/m^2$ in sand-shell and sand, respectively, to $2/m^2$ in clay, and $5/m^2$ in sand-gravel and silt, respectively. The biomass of anthozoans was moderately large. Largest biomasses, 4.3, 3.9, and 1.6 g/m^2, occurred in silty sand, silt, and sand-gravel. The biomass in remaining sediment types was fairly uniform ranging from 0.4 to 0.7 g/m^2.

Alcyonacea in this subarea were found only in the finer sediment types: sand, silty sand, silt, and clay. Densities were moderately low, ranging from fewer than 1 to $3/m^2$; biomass ranged from 0.05 to 0.2 g/m^2.

Zoantharia were ubiquitous within this subarea, occurring in all sediment types. Densities were moderately low with highest values occurring in silty sand ($24/m^2$). Lowest values of density occurred in clay, and sand-shell, where fewer than $1/m^2$ were found. Somewhat higher values occurred in silt, sand-gravel, and sand where densities ranged between 1 and $4/m^2$. Largest biomasses of zoantharians were found in silt and silty sand where 3.8 and 3.7 g/m^2 were recorded. Sand-gravel contained 1.6 g/m^2, sand contained 0.6 g/m^2, sand-shell, 0.4 g/m^2, and clay, 0.2 g/m^2.

Turbellaria were found only in sand-shell and sand in very low quantities, in the New York Bight subarea. Densities were below $0.25/m^2$ and biomass was only slightly above trace quantities.

Nemertea were found in moderate amounts in all sediment types occurring in New York Bight. There was no apparent sediment preference detectable except that lowest values did tend to occur in the finer sediments. Density on the whole was rather uniform in each of the sediment types except clay ($0.14/m^2$), and in the other sediment types ranged from 1 to $4/m^2$. Biomass of nemerteans was similarly quite uniform in all sediment types except the finest, clay, where 0.001 g/m^2 occurred. Biomass ranged from 0.2 to 1.5 g/m^2 in the remaining sediment types.

Nematoda in this subarea were found only in sand, silty sand, and silt sediments in very small quantities of both density and biomass.

Annelida were ubiquitous in the New York Bight subarea occurring in all sediment types. Densities of worms, although they are a major component of the overall density in this subarea, were only moderately high. Highest values of density occurred in sand where $532/m^2$ were found, and diminished both in coarser and in finer substrates. Densities of 224 and $285/m^2$ occurred in both sand-shell and silty sand, respectively, while a low value

of 142/m^2 was recorded in sand-gravel. Lowest densities occurred in silt and clay where 49 and 11/m^2 were found. The biomass of worms paralleled that of density in that largest biomasses occurred in the sandy substrates (42.4 and 12.2 g/m^2 in silty sand and sand, respectively), and diminished in both coarser and finer grained substrates. Sand-shell contained 9.3 g/m^2 and sand-gravel 4.1 g/m^2, respectively. Smallest values of Annelida biomass occurred in clay with 1.8 g/m^2 and silt with 6.7 g/m^2.

Pogonophora were found only in the finer grained substrates: sand, silty sand, silt, and clay. Both their density and biomass values were quite low. Densities did not exceed 5/m^2 and biomass was relegated to the near trace area of 0.02 g/m^2.

Sipunculida in the New York Bight subarea occurred in sand-shell, sand, silty sand, silt, and clay. Their density was rather low, not exceeding 2/m^2 whereas biomass was comparatively high. Biomass values ranged from 0.01 g/m^2 to 0.5 g/m^2. Largest values occurring in sand and smallest in clay. Intermediate values occurred in the remaining sediment types.

Echiura were found only in the finer grained substrates: silty sand, silt, and clay. Their density in silt and clay was low (0.4 and 0.3/m^2, respectively) and increased to 1/m^2 in silty sand. Biomass values on the other hand were comparatively high in that both silty sand and silt sediments contained biomasses greater than 1 g/m^2, while clay had a biomass which was 0.1 g/m^2.

Priapulida were not found in any of the sediment types occurring in the New York Bight subarea.

Mollusca occurred in all sediment types in the New York Bight subarea and were major contributors to the overall density and biomass of all organisms. The density of Mollusca in three sediment types was highest of all taxonomic groups, these sediments were silty sand, silt, and clay where 837, 378, and 74/m^2, respectively, were found. Density values in sand, sand-shell, and sand-gravel were 142, 128, and 5/m^2, respectively. In terms of biomass, molluscs were the undisputed leaders among all of the various taxa in nearly all sediment types. The one exception was clay where 0.88 g/m^2 occurred. The biomass values in all other sediment types far exceeded that of any other single group. Silty sand sediments contained 1,640 g/m^2 of molluscs. The nearest competitor was Echinodermata with 101 g/m^2. Silt and sand-shell substrates had 55.2 and 50.5 g/m^2 of molluscs, respectively.

Polyplacophora were found only in sand, silt, and clay sediments of the New York Bight subarea. Their density was low (0.05 to 0.3/m^2) and their biomass was not significantly far above trace amounts. Largest biomass occurred in clay, where 0.009 g/m^2 was recorded. Remaining sediment types had trace amounts.

Gastropoda were found in all sediment types occurring in the New York Bight subarea with densities being in the moderate to moderately low category. The greatest number of gastropods occurred in silty sand and sand where 39 and 26/m^2 were found, respectively. Next highest density occurred in silt which contained 13/m^2. Density values in other sediment types ranged from fewer than 1 to 8/m^2. The biomass of gastropods in this subarea was moderate when compared to the biomass of the other taxonomic groups. Largest biomass occurred in silty sand and sand-shell where 8.3 and 3.8 g/m^2 occurred, respectively. Biomasses slightly above 1 g/m^2 occurred in sand and silt, whereas biomasses of less than 0.1 g/m^2 were recorded in clay and sand-gravel.

Bivalvia were found in all sediment types of the New York Bight and in terms of density and biomass were the largest contributors to overall molluscan abundance. Bivalves were most plentiful in silty sand and silt where 793 and 363/m^2 were found, respectively. Silty sand and sand substrates contained slightly over 100/m^2, whereas clay and sand-gravel substrates contained 71 and 4/m^2, respectively. Bivalves were the greatest contributors to the total biomass in the New York Bight subarea in nearly all sediment types, clay being the only exception. The mean weight of bivalves in silty sand was 1,631 g/m^2. Biomasses in sand and sand-gravel were next with 77 and 72 g/m^2, respectively. Silt sediments contained 55 g/m^2 and sand-shell 50 g/m^2 of bivalves, while clay was the lowest, with 0.9 g/m^2.

Scaphopoda in this subarea occurred in sand, silty sand, silt, and clay. Values of both density and biomass were moderately low. Highest values for each parameter occurred in silty sand, and lowest in clay. Density in silty sand was 6/m^2 and biomass was 0.13 g/m^2. The lowest values were: fewer than 1 in terms of density and 0.006 g/m^2 with regard to biomass. Intermediate values occurred in the other sediment types, ranging from 1 to 2/m^2 for density and 0.02 to 0.03 g/m^2 of biomass.

Cephalopoda did not occur in any sediments in the New York Bight subarea.

Arthropoda occurred in all sediment types found in this subarea and their total abundance was moderately high to high. They were major contributors to the entire faunal assemblage of this region. Density values of arthropods were highest in sandy substrates, silt, and clay. Highest recorded densities occurred in silty sand where 700/m^2 were found. Sand was next with 620/m^2, while sand-shell and sand-gravel contained 330 and 290/m^2, respectively. Densities in silt and clay were 15 and 2/m^2.

Biomass of arthropods in the New York Bight paralleled to some degree that of density. Largest biomass (19.8 g/m^2) occurred in silty sand. Next largest occurred in sand-gravel with 15 g/m^2. Biomasses in sand-shell and sand were 9.9 and 8.8 g/m^2, respectively. Values of biomass in silt and clay were 0.21 and 0.09 g/m^2, respectively.

Pycnogonida were found only in silty sand substrates in moderately low quantities. Density was $0.6/m^2$ and biomass 0.01 g/m^2.

Arachnida only occurred in one sediment type in this subarea, sand. Both density and biomass values were very low.

Crustacea were the major arthropod component, consequently their density and biomass are essentially those which were reported above for Arthropoda.

Ostracoda were encountered in sand-shell and sand substrates and density and biomass values were moderately low to low. Highest densities and biomass occurred in sand-shell where $3/m^2$ and 0.02 g/m^2 occurred. Lowest values were in sand where density was $0.1/m^2$, and biomass was in trace amounts.

Cirripedia in this region were found in sand, silty sand, and silt sediments in moderately low to moderate values of abundance. Highest density occurred in silty sand where $441/m^2$ were found. Intermediate values of $43/m^2$ occurred in sand and the lowest values of density occurred in silt where $2/m^2$ were found. Biomass values were moderately high. Largest biomass occurring in silty sand where 10 g/m^2 were found; sand contained 4.7 g/m^2 while silt had the smallest at 0.06 g/m^2.

Copepoda occurred in very low density and biomass, only in sand, in the New York Bight subarea.

Nebaliacea abundance was similar to that of Copepoda in that only very small amounts were recorded, in this case only in clay sediments.

Cumacea were ubiquitous in the sediment structure of the New York Bight subarea, occurring in all sediment types. Sandy substrates appeared to be preferred with a diminishing of density both as particle size increased and decreased in the sandy region. Highest density of cumaceans occurred in sand and sand-shell where 12 and 10/m^2 were found. Silty sand substrates contained 2/m^2 and clay contained 1/m^2. Both silt and sand-gravel sediments contained fewer than 1/m^2. Biomass of cumaceans was moderately small. Largest biomasses occurred in sand and sand-shell with 0.06 and 0.04 g/m^2 recorded in each. Their biomass in silty sand, sand-gravel, silt, and clay, was 0.2, <0.01, <0.01, and 0.001 g/m^2, respectively.

Tanaidacea were found in clay sediments only, in the New York Bight subarea. Both density and biomass were very low.

Isopoda were another ubiquitous crustacean occurring in all sediment types in the New York Bight subarea. These organisms seemed to prefer sandy substrates to the finer grained ones. Highest density occurred in sand and silty sand where 12/m^2 occurred in each. Sand-shell substrates contained 11/m^2 while gravel and silt contained 9 and 6/m^2, respectively. Clay substrates contained fewer than 1/m^2. The distribution of isopods biomass in the New York Bight subarea paralleled that of density in that largest biomasses occurred in sand-shell and sand with 0.48 g/m^2 recorded in each. Silty sand and sand-gravel substrates were next in amount of biomass with 0.07 and 0.05 g/m^2, respectively. Silt contained 0.04 g/m^2 while clay contained 0.01 g/m^2.

Amphipods occurred in all sediment types in the New York Bight subarea and were the major crustacean component in terms of both density and biomass. Highest density occurred in sand with values in sand-shell, sand-gravel, and silty sand diminishing gradually. Density values in these sediment types were 541, 286, 268, and 233/m^2. Densities in silt and clay were substantially lower, 7 and 0.8/m^2, respectively. Biomass of amphipods had a slight shift in distribution in relation to sediments in that the largest values occurred in silty sand as opposed to highest values of density occurring in sand. Also, biomass diminished with increasing as well as decreasing particle size from the high point in silty sand. Values of biomass for silty sand, sand, sand-shell, and sand-gravel, respectively, were 5.8, 2.8, 2.2, and 2.1 g/m^2. Substantially lower values occurred in the remaining two substrate types, silt and clay, where biomasses were 0.03 and 0.008 g/m^2, respectively.

Mysidacea were found only in sand-gravel, sand-shell, and sand sediments. Both density and biomass were rather low with density values ranging from fewer than 1 to only 3/m^2 and biomass values ranged from 0.004 to 0.02 g/m^2.

Decapoda in the New York Bight subarea were ubiquitous, occurring in all sediment types. Densities were moderately high to low with a general tendency of decreasing with decreasing particle size. Highest densities occurred in sand-shell and sand-gravel where 17 and 13/m^2 were found. There was a slight dip in density in sand to 10/m^2 and a slight rise in silty sand to 12/m^2. Low values were found in silt and clay where densities were 0.7 and 0.1/m^2, respectively. The biomass of decapods was moderately high in

this subarea. The relation of biomass to particle size was not as clear cut in this instance as it was for density. Largest biomass occurred in sand-gravel (13 g/m^2), next highest was recorded in sand-shell (7 g/m^2), and next was in silty sand (4 g/m^2). Smaller biomasses were found in sand (0.7 g/m^2), silt and clay (0.07 g/m^2, in each).

Bryozoa in the New York Bight subarea were found in four sediment types: sand-gravel, sand-shell, sand, and silty sand. Densities were moderately low in sand and silty sand (4 and $9/m^2$), highest in sand-shell ($19/m^2$), and lowest in sand-gravel ($0.4/m^2$). Biomass paralleled density in that largest biomasses were recorded in sand-shell and silty sand (0.3 and 0.2 g/m^2), were intermediate in sand (0.1 g/m^2) and smallest in sand-gravel (0.004 g/m^2).

Brachiopoda were not found in any of the sediment types occurring in the New York Bight subarea.

Echinodermata were found in all sediment types, except sand-gravel, in the New York Bight subarea. The density of this phylum ranged from moderately high to moderately low in the various sediment types. Also, a general tendency of decreasing density with decreasing particle size was noticeable. Highest density occurred in sand where $73/m^2$ was found. Next highest density occurred in sand-shell which contained $24/m^2$. Lower densities were found in silty sand, silt, and clay with 10, 2 and $4/m^2$ occurring, respectively. There was some difference in the distribution of echinoderm biomass in the New York Bight subarea when compared to density. Largest biomass occurred in silty sand where 102 g/m^2 were recorded. Next highest was sand with 44 g/m^2, diminishing to 8 g/m^2 in sand-shell. Significantly lower amounts occurred in silt and clay where biomasses of 2.4 and 2.1 g/m^2, respectively, were found.

Holothuroidea occurred in all sediment types in the New York Bight subarea except sand-gravel. Densities were moderately low to low with no significant trend in relation to particle size. As a matter of fact, with the exception of the density in silty sand ($4/m^2$), densities in the remaining four sediment types were uniformly at or near $0.5/m^2$. Holothurian biomass, unlike their density, showed a definite trend of decreasing biomass with increasing particle size. Largest biomasses occurred in the finest substrates, clay and silt, where, in each, 1.6 g/m^2 occurred. Biomasses diminished in the remaining three substrate types with 0.4, 0.3, and 0.05 g/m^2 occurring in silty sand, sand, and sand-shell, respectively.

Echinoidea were found only in sand-shell, sand, and silty sand sediments in the New York Bight subarea. Density values were moderately high to low, 21, 60, and $0.2/m^2$ in sand-shell, sand, and silty sand, respectively. Biomass was moderately large in the three sediment types. Largest biomass occurred in sand (40 g/m^2), next largest was in sand-shell (7.2 g/m^2), and smallest in silty sand (1.5 g/m^2).

Ophiuroidea were found in all sediment types except sand-gravel. Density values were moderate to low with highest values occurring in sand where $10/m^2$ were found. Both silty sand and clay sediments contained densities of $3/m^2$ while sand-shell and silt sediments contained densities of 0.8 and $1/m^2$. As with echinoids, ophiuran biomass was significantly more important than their density. Largest biomass occurred in silty sand where 88 g/m^2 were found. A substantial drop in biomass occurred in sand and silt where 0.6 and 0.7 g/m^2 were found, respectively. Even lower values occurred in clay and sand-shell which contained 0.5 and 0.008 g/m^2, respectively.

Asteroidea were found in sand-shell, sand, silty sand, and silt sediments in the New York Bight subarea. Density values were moderately low to low. Lowest values occurred in silt where $0.1/m^2$ were found, and in the remaining three sediment types densities exceeded $1/m^2$ only in silty sand. Biomass in this group was comparatively high. Largest biomass occurred in silty sand where 12 g/m^2 were found while sand and sand-shell sediments contained 3.6 and 1.2 g/m^2, respectively. Smallest biomass (0.16 g/m^2) occurred in silt.

Hemichordata in the New York Bight subarea were found only in sand sediments. Both density and biomass were low; density was $1/m^2$ while biomass was 0.009 g/m^2.

Ascidiacea occurred in all the sediment types of this subarea. Highest densities occurred in sand-shell substrates ($16/m^2$), and lowest in silty sand where $0.2/m^2$ were found. Intermediate values occurred in the remaining sediment types with density ranging from 0.6 to $6/m^2$. Ascidean biomass was moderate with largest values occurring in sand-shell where 1.3 g/m^2 were found, next largest occurred in clay where 0.5 g/m^2 was recorded. Approximately equal biomasses occurred in both sand and silt where 0.03 g/m^2 of ascidians occurred. Silty sand and sand-gravel contained the smallest biomasses with 0.03 and 0.04 g/m^2, respectively.

Chesapeake Bight

The density of major taxonomic groups in the various bottom sediments in Chesapeake Bight are listed in table 26 and their biomass is listed in table 27.

Table 26.--Mean number of individuals listed by taxonomic group in each bottom sediment type for the Chesapeake Bight subarea.

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	-	-	-	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 27.--Mean biomass of each taxonomic group listed by bottom sediment type in the Chesapeake Bight subarea.

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

The majority of sediment types, except gravel, were found in the Chesapeake Bight subarea.

Porifera in Chesapeake Bight occurred in sand-shell, sand, silty sand, silt, and clay sediments. Their density, overall, was moderately low with only small amounts occurring in sand and silty sand and only $1/m^2$ occurring in sand-shell and clay, respectively, while highest density of $11/m^2$ occurred in silt. Biomass of sponges in this subarea was also moderately small with largest biomass occurring in sand-shell where 0.23 g/m^2 occurred. The next largest biomass occurred in silty sand where 0.03 g/m^2 was found. Biomasses in silt, clay, and sand were less than 0.005 g/m^2.

Coelenterata occurred in all sediment types of this subarea. Generally, highest density occurred in the coarser substrates, sand-gravel and sand-shell, with an exception occurring in silty sand where a nearly equal density was found. Densities were 58, 53, and $47/m^2$ in sand-gravel, shell, and silty sand, respectively. Significantly lower amounts occurred in the other sediment types where the range of values was between 3 and $9/m^2$. The biomass of coelenterates was moderately large with largest biomass being recorded in sand-shell where 11 g/m^2 occurred. Biomass in clay, sand-gravel, and shell was 3.4, 2.7, and 2.1 g/m^2, respectively. Smaller biomasses occurred in sand and silt where 0.9 and 0.3 g/m^2, respectively, were found.

Hydrozoa were found in all sediment types except silt and clay. Densities tended to be higher in the coarser grained sediments than in the finer ones, with sand-gravel containing the greatest density ($58/m^2$), silty sand and shell contained nearly equal amounts (42 and $39/m^2$), while sand-shell and sand contained significantly lower amounts (5 and $2/m^2$, respectively). The biomass of hydroids showed a rather distinct tendency of decreasing with decreasing particle size. Largest biomasses occurred

in sand-gravel and shell where 2.7 and 1.1 g/m^2, respectively, were found, dropping to 0.98 g/m^2 in sand-shell. Sand and silty sand substrates contained 0.03 and 0.04 g/m^2, respectively.

Anthozoa were found in all sediment types within this subarea. Highest density occurred in shell where 14/m^2 were found and was quite equitably distributed in the other sediment types where the density ranged only from 3 to 7/m^2. The variation of biomass values among the different sediment types for this taxon was greater than that shown for density. Largest biomass occurred in sand-shell where 10 g/m^2 of anthozoans were found. Silty sand and clay each contained slightly more than 3 g/m^2. Shell contained 1 g/m^2 and biomasses in sand and silt were 0.8 and 0.3 g/m^2, respectively.

Alcyonacea were found only in silty sand, silt, and clay in this subarea. Density for the most part was low with only 0.08/m^2 being recorded in silty sand. Silt and clay contained 0.6 and 0.2/m^2. Biomass was equally small with the smallest value occurring in silty sand, 0.01 g/m^2, while silt and clay contained 0.2 and 0.1 g/m^2, respectively.

Zoantharia were found in sand-shell, sand, silty sand, and clay sediments of this subarea. Density was moderately low, ranging from 1 to 5/m^2. Biomass values were comparatively higher than those for density overall. Sand-shell substrates contained approximately 10 g/m^2 of zoantharians while silty sand and clay had 4 and 3 g/m^2, respectively. Smallest biomass was recorded in sand where 0.7 g/m^2 occurred.

Turbellaria in Chesapeake Bight were found only in sand-shell, sand, and silt sediments and both density and biomass were low. Density ranged from 0.4 to only 1/m^2 while biomass ranged from 0.004 to 0.01 g/m^2.

Nemertea were found in all sediment types in the Chesapeake Bight subarea. Density of acornworms in this subarea was moderate to low not exceeding 12/m^2, which occurred in silty sand, and ranged between 0.8 and 6/m^2 in the other sediment types. Biomass was low and in no sediment type did it exceed 0.7 g/m^2.

Nematoda occurred in all sediment types except sand-gravel. In most sediment types nematode density was quite low 0.5/m^2; however, in shell, sand-shell, and silt sediments, especially shell sediments, greater amounts were found. Shell contained 52/m^2, sand-shell contained 3/m^2, and silt 1/m^2. Biomasses of nematodes, as might be expected from their small size, was generally quite low. Nevertheless there were no trace amounts in any of the sediments, shell contained 0.1 g/m^2 and sand-shell and silt each contained 0.01 g/m^2. Smaller amounts occurred in the remaining sediment types.

Annelida were found in all sediment types of this subarea. And, as in the other two subareas, annelids were a significant contributor to the overall density and biomass. No discernible trend of density or biomass relation with particle size was observed. Densities between 100 and 200/m^2 occurred in shell, sand-shell, sand, and silty sand; whereas, sand-gravel, and silt sediments contained densities that were only slightly less than 100/m^2. Lowest density occurred in clay where 46/m^2 were found. The contribution of annelids to the total biomass was substantial. In fact, annelid biomass in sand-gravel, at 6.6 g/m^2 was the highest single biomass of any of the taxonomic groups in this sediment type. Largest overall biomass occurred in shell where 26.9 g/m^2 were found. Next largest occurred in silty sand where 14.6 g/m^2 were recorded. The remaining sediment types contained diminishing biomasses with sand, sand-shell, silt, and clay containing 9.6, 8.4, 6.1, and 3.7 g/m^2, respectively.

Pogonophora were found in the sand, silty sand, silt, and clay sediments of Chesapeake Bight. Densities were low to moderate with greatest numbers of organisms occurring in silt and silty sand sediments where 17 and 7/m^2 were found. Clay sediments contained 1 and sand contained 0.07 g/m^2, respectively. Biomass of Pogonophora was also moderate to low with largest amounts occurring in silt and silty sand where 0.12 and 0.03 g/m^2 were found, respectively. Clay sediments contained a biomass of 0.004 g/m^2 while sand sediments contained <0.001 g/m^2.

Sipunculida were found in sand-shell, sand, silty sand, silt, and clay sediments in low densities. Highest density occurred in silt where 2/m^2 were found, while 1/m^2 occurred in silty sand and clay sediments, respectively. Fewer than 1/m^2 were contained in sand-shell and sand sediments. The biomass of Sipunculida was comparatively large in this region. Biomass was largest in silt where 2.2 g/m^2 were found and also in silty sand where 0.3 g/m^2 occurred. Intermediate values were found in sand-shell and sand (0.04 and 0.02 g/m^2) and clay contained the smallest (0.006 g/m^2) biomass.

Echiura were confined to the medium and fine sediments occurring only in sand, silty sand, silt, and clay in this subarea. Densities were low in all the sediments. Biomass was moderate with silt containing the largest (1.8 g/m^2). Biomasses in clay, silty sand, and sand were 0.9 g/m^2 or less.

Priapulida in Chesapeake Bight were found only in clay sediments. Both density and biomass were low.

Mollusca were ubiquitous in all sediment types in the Chesapeake Bight subarea. They were also the single greatest contributor of total density and biomass in this region. The only sediment type in which they were not the leading contributor was sand-gravel in terms of both density and biomass. Sand-gravel substrates contained the greatest density 2,282/m^2. Silty sand sediments contained 765/m^2, shell 427/m^2, sand 349/m^2 and silt and clay contained 149 and 145/m^2, respectively. Sand-gravel substrates, the one exception, contained only 29/m^2. Molluscan superiority among the various taxa was most apparent in their biomass. A very large biomass occurred in shell where 515 g/m^2 were found. Next largest was clay which contained 91 g/m^2. Diminishing amounts, although substantial, were recorded in the remaining sediment types; silty sand and sand contained 66 and 51 g/m^2, respectively; sand-shell and silt contained 31 and 23 g/m^2. Again, the one exception, sand-gravel contained only 0.3 g/m^2 of molluscs.

Polyplacophora were found only in sand, silty sand, silt, and clay sediments of the Chesapeake Bight. Only one of these sediment types, silt, contained a density of 1/m^2, the others were below this. Biomass values were also small, ranging only from 0.001 to 0.01 g/m^2.

Gastropoda were found in all sediment types within this subarea. Their density, for the most part, was moderate to moderately high, with greatest numbers occurring in silty sand, where 247/m^2 were recorded. In the remaining sediment types density ranged from 2 to 37/m^2. Biomass paralleled density in that largest biomass was recorded in silty sand where 18.9 g/m^2 occurred. Sand-shell and sand substrates contained 1.3 and 1.8 g/m^2, respectively, whereas all other sediment types contained 1 g/m^2.

Bivalvia, occurring in all sediment types within the Chesapeake Bight subarea, was the single most important subgroup of all of the taxa in abundance. Densities were uniformly high in all sediment types with the exception of sand-gravel where only 20/m^2 were found. Density values in other sediment types were 2,279, 512, 402, 333, 136, and 109/m^2 in sand-shell, silty sand, shell, sand, clay, and silt, respectively. The biomass of bivalves was similar to density, again with the exception of sand-gravel which had an unusually small biomass, only 0.3 g/m^2. The single largest biomass occurred in shell with 514 g/m^2. Next largest biomass occurred in clay with 91 g/m^2. Two sediment types were in the 20-30 gram range; sand-shell contained 29 and silt 22 g/m^2. The remaining two sediment types, sand and silty sand, contained 49 and 47 g/m^2, respectively.

Scaphopoda in the Chesapeake Bight subarea occurred in four sediment types: sand-shell, sand, silty sand, and silt. Densities were moderately low as was biomass. Density ranged from fewer than 1/m^2 in sand-shell and sand, to between 2 and 6/m^2 in silt and silty sand, respectively. Largest biomass occurred in silty sand where 0.1 g/m^2 was found. Substantially smaller biomasses were present in silt, sand-shell, and sand.

Cephalopoda eggs were not present in samples from the Chesapeake Bight subarea.

Arthropoda with its large number of constituents was one of the major components of the overall biota in this subarea as well as being ubiquitous with regard to sediments. For the most part, arthropod density was relatively uniform in all sediment types except the finest-grades, silt and clay, where 43 and 41/m^2 were recorded, respectively. Densities ranging between 126 and 347/m^2 occurred in the remaining sediment types. Biomass values were

quite similar to those of density in that the two finer sediments, silt and clay, had the smallest values 0.2 g/m^2 in each. The one notable exception among the other sediment types was the biomass in shell which was largest at 17.3 g/m^2. The remaining sediment types had biomasses that ranged between 1 and 4 g/m^2.

Pycnogonida were encountered in only three sediment types in this subarea; sand-shell, sand, and clay. Both their density and biomass were moderately low. Density values ranged from 1 to $3/m^2$ and biomasses ranged from 0.005 to 0.02 g/m^2.

Arachnida were not found in the Chesapeake Bight subarea.

Crustacea densities and biomasses were essentially the same as those reported above for arthropoda and need not be repeated here.

Ostracoda were uncommon in Chesapeake Bight, occurring only in very small quantities in sand and silt.

Cirripedia were uncommon in the Chesapeake Bight subarea, occurring only in sand-shell and sand; their densities and biomasses were very low.

Copepoda were not encountered in the Chesapeake Bight subarea.

Nebaliacea were present only in trace amounts in terms of both density and biomass in Chesapeake Bight. They were found only in sand sediments.

Cumacea were found in five sediment types within this subarea; shell, sand-shell, sand, silty sand, and silt. Densities ranged from moderate to moderately low with greatest densities occurring in sand-shell sediments where $46/m^2$ were found. Densities in other sediment types ranged from 1 to $8/m^2$. Biomass values were parallel in distribution to those of density with largest biomass occurring in sand-shell, 0.12 g/m^2, whereas in the other sediment types the biomass ranged from 0.005 to 0.03 g/m^2.

Tanaidacea were uncommon in Chesapeake Bight occurring only in silt with density of 0.3/m^2 and biomass only 0.001 g/m^2.

Isopoda were present in all sediment types in this subarea except clay and shell. Density values of these organisms were quite uniform in all sediment types. Densities of 7, 11, and 13/m^2 occurred in sand-gravel, sand-shell, and silt, and 21 and 29/m^2 occurred in sand and silty sand, respectively. The distribution of biomass values was parallel to that of density, being moderately uniform and in moderate amounts. Biomasses of 0.1 g/m^2 occurred in sand-gravel, silty sand, and silt, and 0.4 and 0.5 g/m^2 were found in sand-shell and sand, respectively.

Amphipoda in this region were the single largest contributor of arthropod biomass and occurred in all sediment types in the subarea. Densities tended to be higher in the coarser grained substrates and lower in the finer grained ones. Highest density occurred in sand with 305/m^2 and diminished to 280, 213, and 114/m^2 in shell, sand-shell, and sand-gravel, respectively. In the finer sediments, the distribution of density was 97, 37, and 29/m^2 in silty sand, clay, and silt, respectively. Biomass of amphipods behaved similarly to that of density and were large to moderately large in terms of overall biomass. Largest values occurred in sand with 2.6 g/m^2 diminishing to 2.0, 0.9, and 0.8 g/m^2 in sand-shell, sand-gravel, and shell, respectively. In the finer substrates biomass of amphipods ranged from 0.06 g/m^2 in silt to 0.16 g/m^2 in clay, and 0.23 g/m^2 in silty sand.

Mysidacea were uncommon in Chesapeake Bight; they occurred only in sand-shell and sand sediments with moderate densities of 5 and 7/m^2, respectively. Biomass values in these sediments were 0.02 and 0.03 g/m^2.

Decapoda occurred in all sediment types, except clay. Moderately high to moderate densities and large biomasses generally prevailed. Greatest number (50/m^2) of decapods occurred in shell. Lowest density (0.4/m^2) occurred in silt. The remaining sediment types contained between 4 and 8/m^2. Biomass differed only slightly from that of density in terms of distribution and overall importance. Largest biomass (16.5 g/m^2) occurred in shell. Next largest biomass was found in silty sand where 1.7 g/m^2 occurred. Smallest biomass of decapods (0.05 g/m^2) occurred in silt. Remaining sediment types sand-gravel, and sand, contained 0.13 and 0.6 g/m^2.

Bryozoa in this subarea were found in four sediment types; shell, sand-shell sand, and silty sand. Densities were moderate with highest values (29/m^2) occurring in sand-shell. The remaining sediment types had a density range between 1 and 4/m^2. Biomass values were also in the moderate range with largest biomass (0.65 g/m^2) occurring in sand-shell. Biomass ranged between 0.01 and 0.08 g/m^2 in the remaining sediment types.

Brachiopoda in Chesapeake Bight were uncommon and occurred only in sand. In terms of density and biomass they occurred only in very small amounts.

Echinodermata, another of the major taxonomic groups, occurred in all sediment types within this subarea. Density of echinoderms was moderate, especially in sand-shell, sand, and silty sand where quite uniform amounts

of 39, 33, and 35/m^2 occurred. Significantly lower amounts were found in the other sediment types with shell containing 8/m^2 and silt 3/m^2, while both sand-gravel and clay contained 2/m^2, respectively. Biomass of echinoderms was comparatively large in this subarea. Largest biomasses occurred in sand-shell, sand, and silty sand where 17, 15, and 11 g/m^2 occurred, respectively. Significantly lower values (1.5 g/m^2 or less) occurred in sand-gravel, clay, silt, and shell.

Holothuroidea occurred in all sediment types except shell in this subarea. Values of holothurian density were moderately low in two sediment types; silty sand and sand-gravel where densities of 5 and 2/m^2 occurred. Remaining sediment types contained fewer than 0.3/m^2. Biomass of holothurians was, overall, significantly large. Largest biomass occurred in silty sand where 10 g/m^2 were found. One other sediment type, sand-gravel, contained slightly above 1 g/m^2. Remaining sediment types contained biomasses which ranged between 0.2 and 0.8 g/m^2.

Echinoidea in the Chesapeake Bight subarea were restricted in their sediment distribution, occurring only in sand and sand-shell. Densities were moderately high with 36 and 31/m^2 occurring in these sediments, respectively. Biomass was correspondingly large in both sediment types with 16 and 15 g/m^2, respectively.

Ophiuroidea in the Chesapeake Bight occurred in all sediment types except sand-gravel. Densities were low to moderate with greatest density occurring in silty sand where 30/m^2 were found. Lowest densities (0.8/m^2) occurred in sand. Intermediate values occurred in the remaining sediment types. Biomass of brittle stars in this subarea was moderate with largest biomasses occurring in silty sand, silt, and clay where 0.8, 0.6 and 0.5 g/m^2 occurred, respectively. Smaller values of biomass occurred in shell, sand-shell, and sand all of which contained 0.2 g/m^2 or less.

Asteroidea were found in five sediment types within the subarea; sand-shell, sand, silty sand, silt, and clay. They were absent from shell and sand-gravel substrates. It is interesting to note that in this subarea starfish density in all sediment types was at or near $0.1/m^2$. Biomass was also low with largest values occurring in sand-shell where $0.2\ g/m^2$ was found. Sand sediments contained $0.1\ g/m^2$ but biomass in silty sand, silt, and clay ranged from only 0.002 to $0.005\ g/m^2$.

Hemichordata were restricted to silty sand sediments in this subarea with a density of $0.5/m^2$ and a biomass of $0.24\ g/m^2$.

Ascidiacea occurred in all sediment types except sand-gravel and sand-shell. Densities were moderately high to moderate, ranging from a low in silt and shell of $1/m^2$ to a high of $10/m^2$ in sand. Intermediate values occurred in the remaining sediment types. Biomass of ascidians was surprisingly large, especially in shell sediments where $145\ g/m^2$ were found. Substantially smaller biomasses occurred in the remaining sediment types, sand contained $4\ g/m^2$, silty sand $1.7\ g/m^2$, and clay $0.9\ g/m^2$. Smallest biomass of ascidians ($0.05\ g/m^2$) occurred in silt.

RELATION WITH 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 we considered 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. Secondly we considered the converse of the preceding--the possibility that where animals were more abundant they might produce a larger amount of organic matter (fecal deposits, for example) in the sediments. In either case, 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 exhibited good correlations--some direct and some inverse--between abundance and organic content, but they were the rare exception.

The results are presented in four sub-sections: (1) geographic distribution of sediment organic content; (2) total macrobenthic fauna in relation to carbon content; (3) major taxonomic groups in the entire Middle Atlantic Bight Region in relation to carbon content; and (4) major taxonomic groups in Southern New England in relation to carbon content.

Distribution of Sediment Organic Carbon

The geographic distribution of organic carbon in the bottom sediments of the Middle Atlantic Bight Region is depicted in figure 105. Sediments blanketing almost the entire continental shelf throughout this Region contained only a small amount (0.01 to 0.49% weight class) of organic carbon. Slightly larger quantities (0.5 to 0.99%) 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 to 1.99%) 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 to 7.16%) occurred most commonly in sediments in the bays and sounds, plus 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--All Taxonomic Groups Combined

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 28 and illustrated in figures 106 and 107. The values for density range from 182/m^2 to 5,236/m^2, with no apparent trends. 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

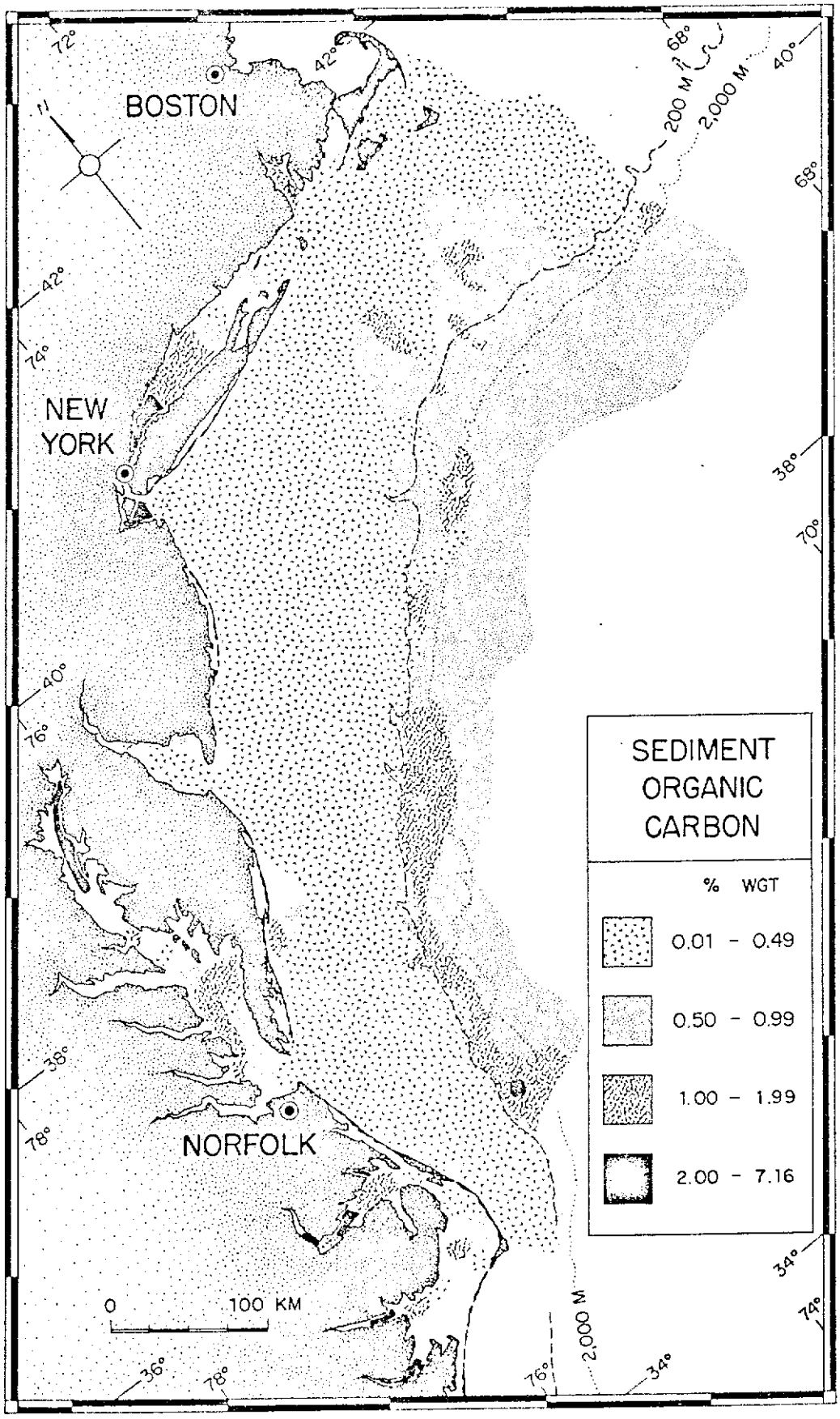


Figure 105.--Geographic distribution of sediment organic carbon in the Middle Atlantic Bight Region.

Table 28.--Mean number of individuals and biomass of the macrobenthic invertebrate fauna in relation to percent organic carbon in bottom sediments. Values are listed separately for each subarea and for the entire Middle Atlantic Bight Region.

Organic carbon	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
0.01-0.4	2643	1226	1372	1653	326	130	77	164
0.5 -0.9	903	750	623	796	80	79	143	94
1.0 -1.4	902	1208	596	841	65	2223	66	551
1.5 -1.9	2052	1061	707	1007	116	61	63	71
2.0 -2.9	5236	3126	182	2052	218	2657	14	1211
3.0 -4.9	-	-	597	597	-	-	156	156
5.0 +	-	-	2244	2244	-	-	555	555

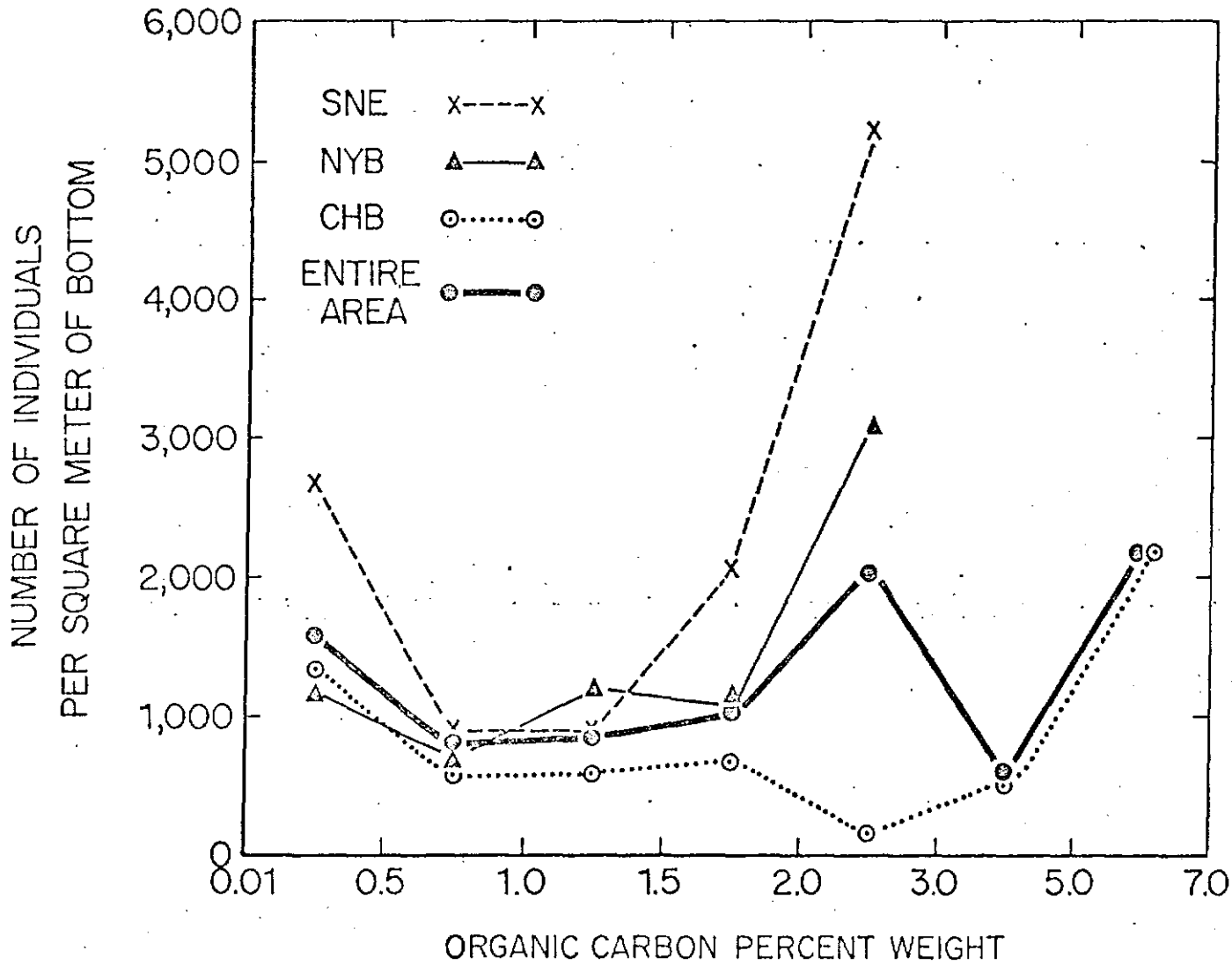


Figure 106.--Relation between number of individuals and sediment organic carbon. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight Region.

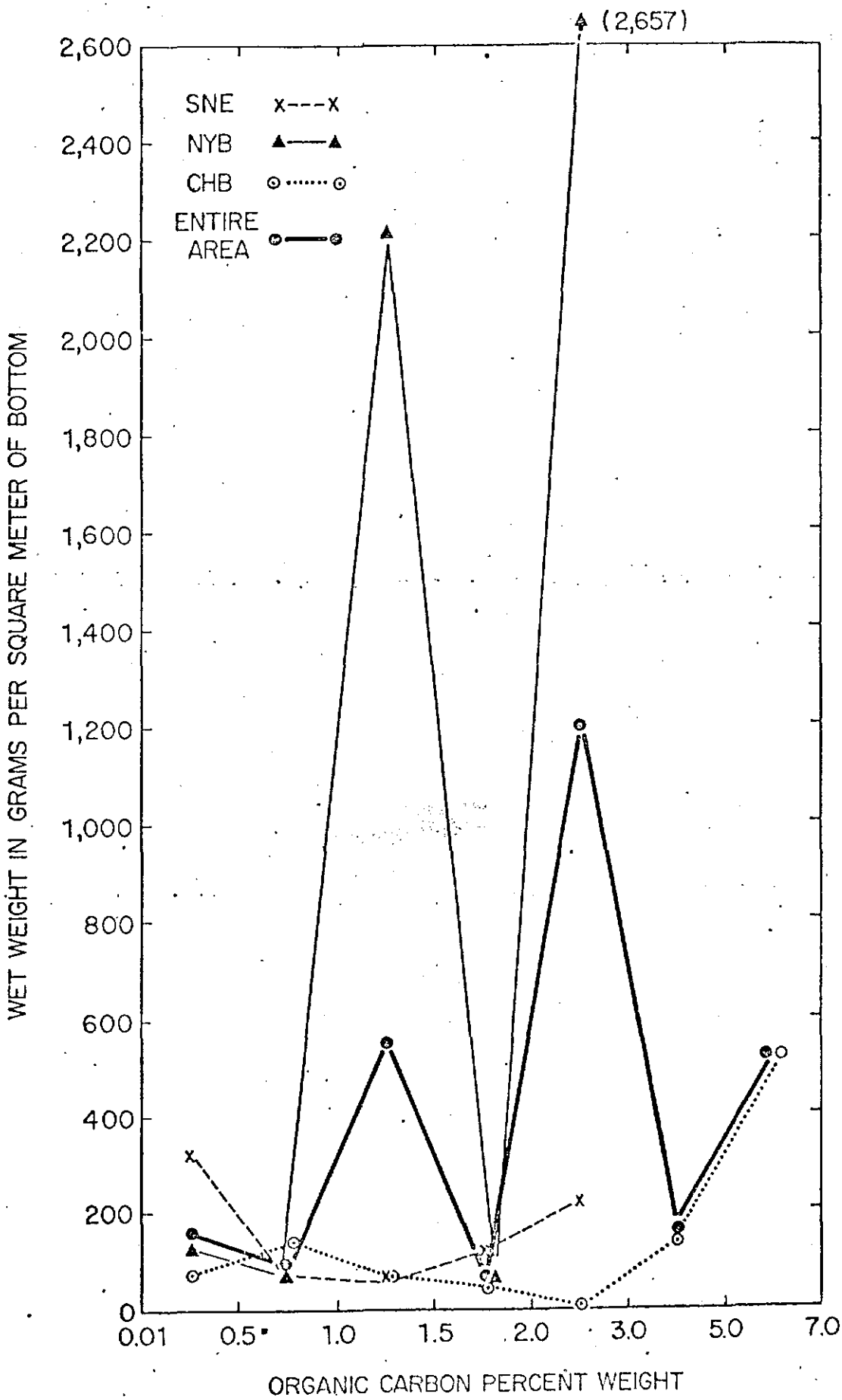


Figure 107.--Relation between biomass and sediment organic carbon. Values represent all taxonomic groups combined for each subarea and for the entire

biomasses for the seven organic carbon classes in the various subareas and the entire Region ranged from 14 g/m^2 to 2,657 g/m^2. There were no correlations 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 minimum trend 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 29 and biomass values are listed in table 30; these data are illustrated in figures 108 through 113. It is clear that neither the density nor biomass values correlated in a general way with the amount of sediment organic carbon. The majority of taxonomic groups showed erratic trends in both density and biomass in relation to carbon. However, a few individual groups revealed good correlations. In terms of density (table 29), the groups that showed a direct relation were Porifera (fig. 108), Pycnogonida (fig. 110) and Copepoda (fig. 111); Nematoda (fig. 109) revealed an inverse relation. In terms of biomass (table 30), Cirripedia (fig. 111) showed a direct relation with carbon, and Cumacea (fig. 111) and Echinoidea (fig. 113) showed an inverse relation. The weight of evidence indicates that when higher taxa (such as phyla, classes, and orders) are grouped from a broad geographical area and evaluated in terms of quantitative relationships with sediment organic carbon, there is little evidence of interdependence between the two.

Table 29.--Mean number of individuals of each taxonomic group listed by sediment organic carbon content class, representing the entire Middle Atlantic Bight Region.

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	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 30.--Mean biomass of each taxonomic group listed by sediment organic carbon content class, representing the entire Middle Atlantic Bight Region.

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

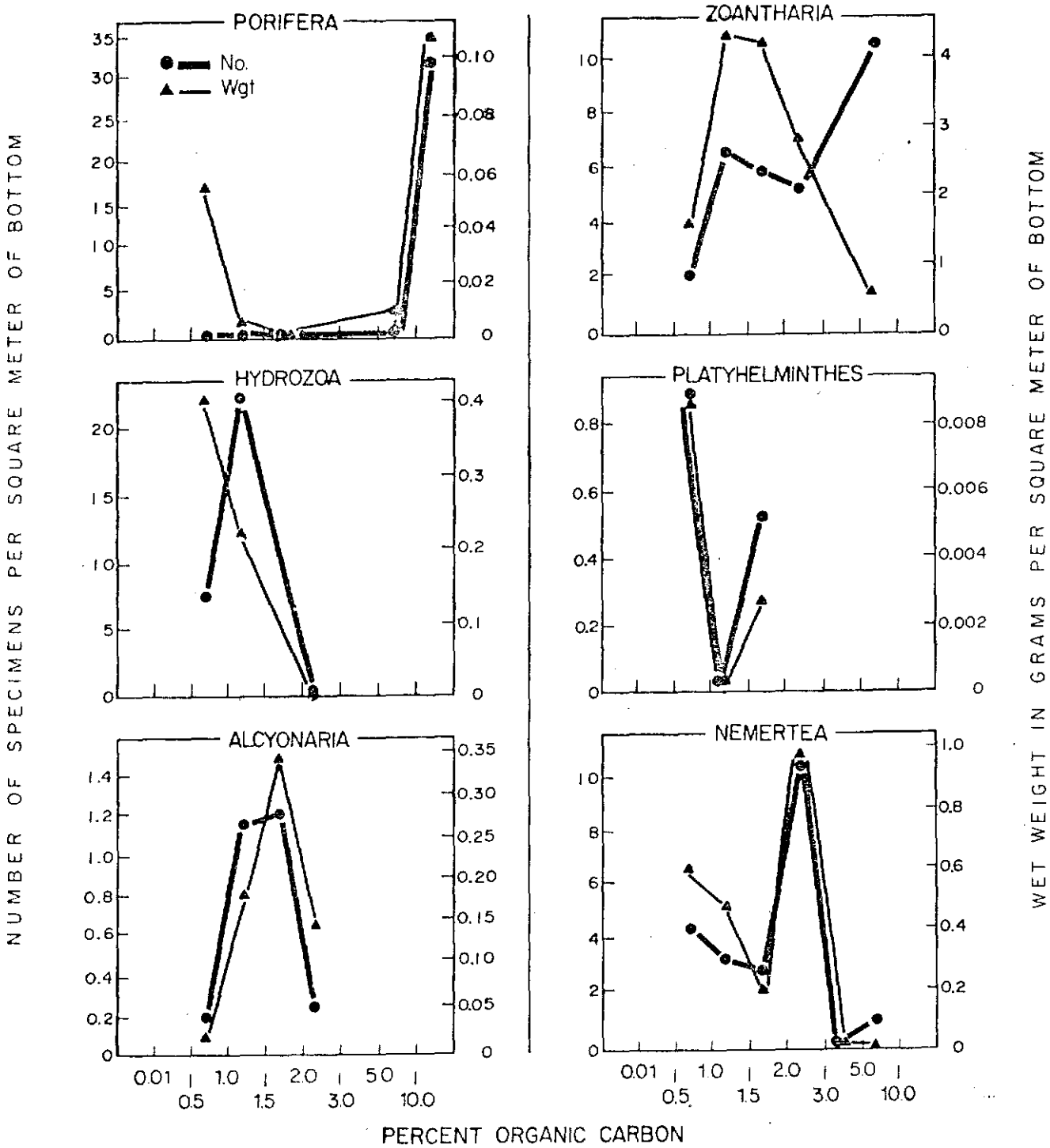


Figure 108.--Density and biomass in relation to sediment organic carbon in the entire Middle Atlantic Bight Region for: Porifera, Hydrozoa, Alcyonaria, Zoantharia, Platyhelminthes, and Nemertea.

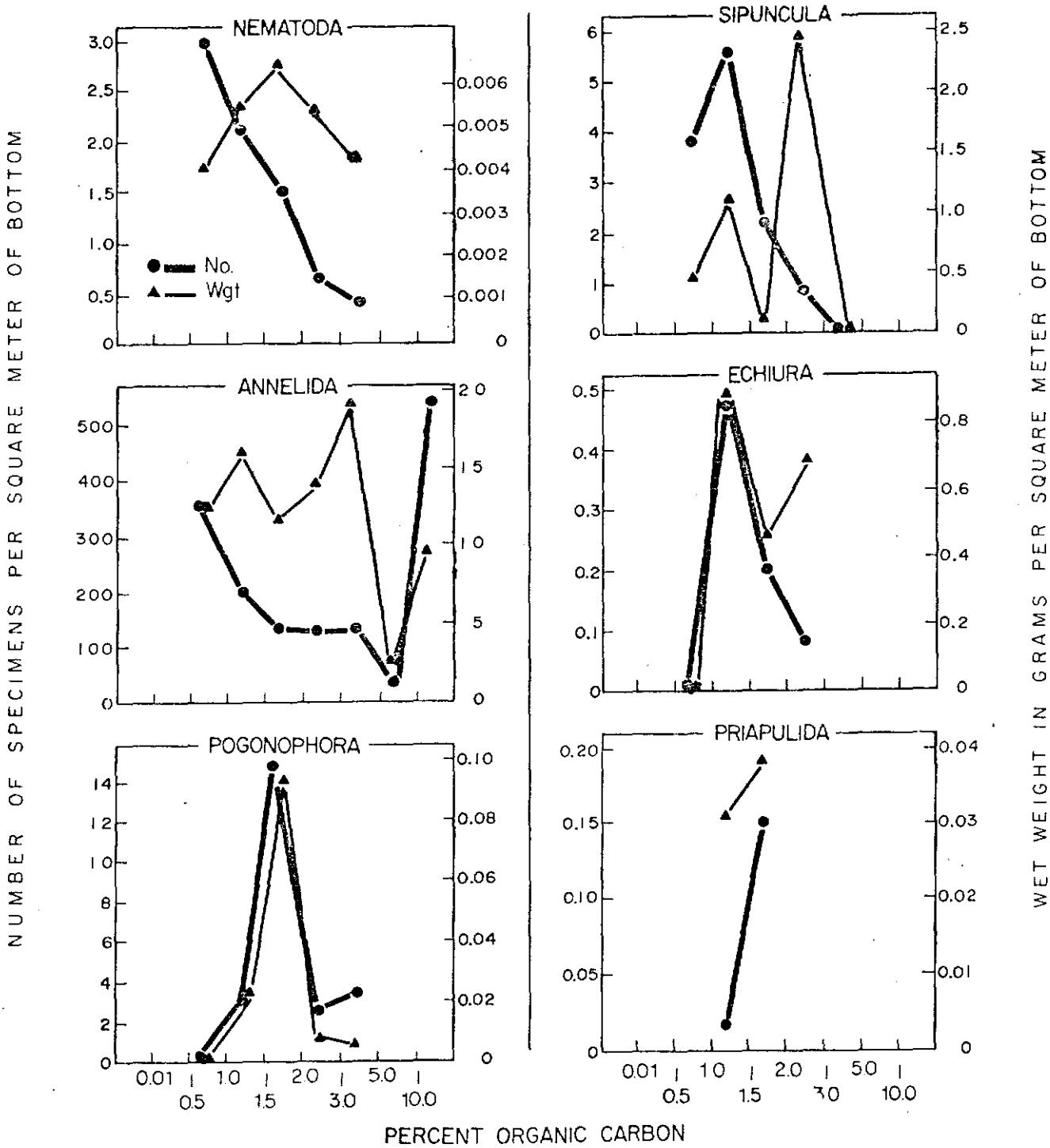


Figure 109.--Density and biomass in relation to sediment organic carbon in the entire Middle Atlantic Bight Region for: Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

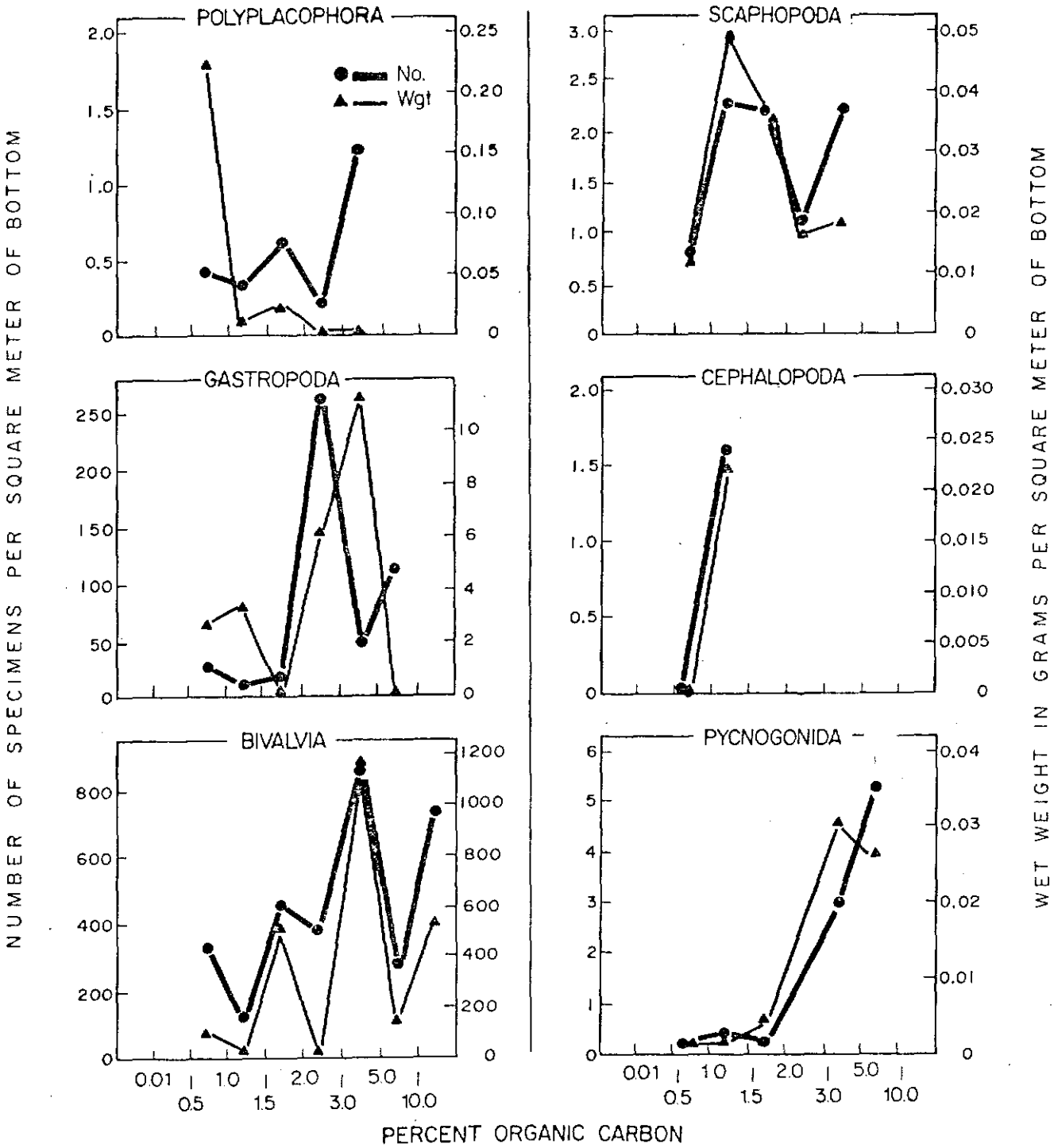


Figure 110.--Density and biomass in relation to sediment organic carbon in the entire Middle Atlantic Bight Region for: Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

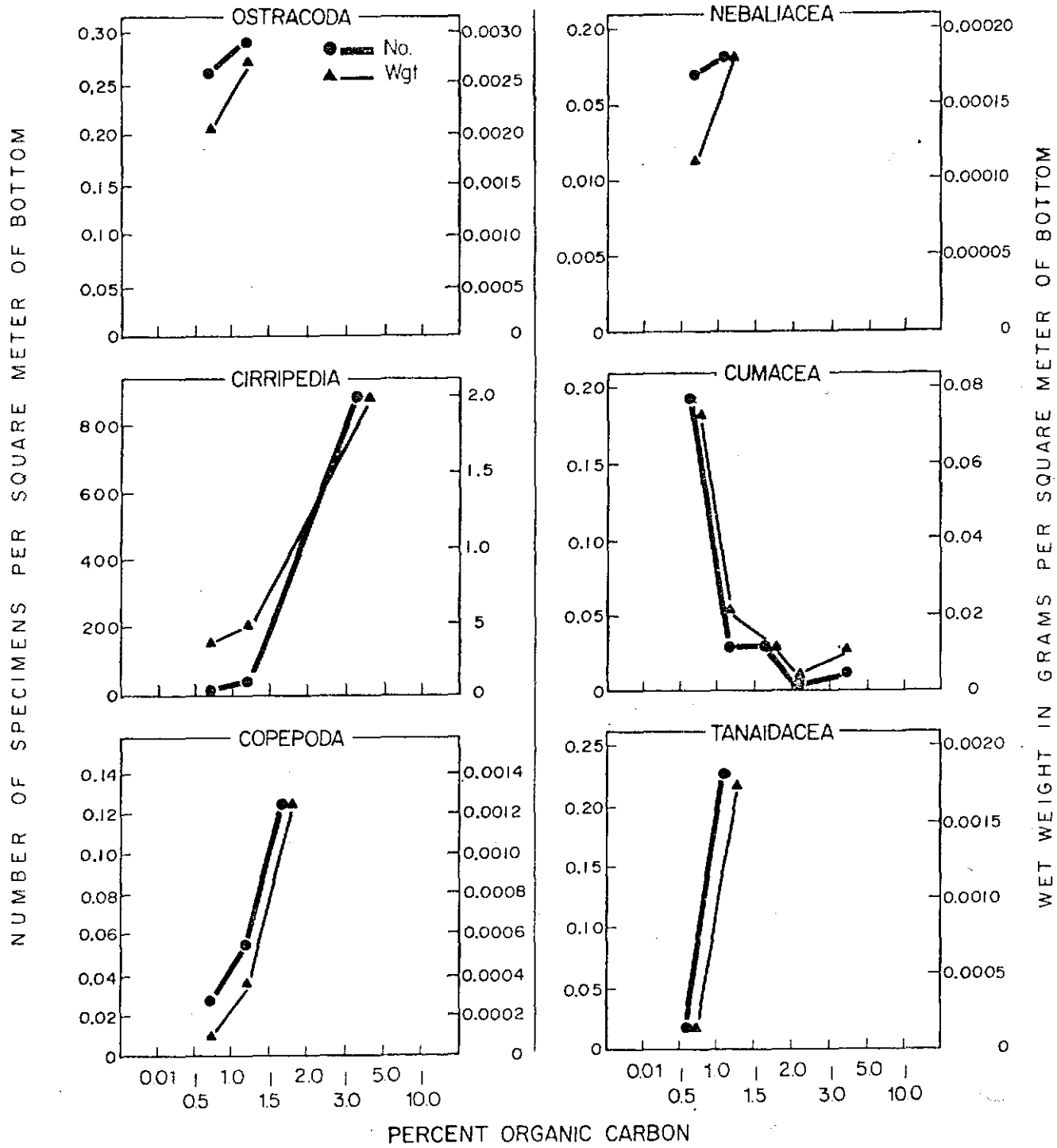


Figure 111.--Density and biomass in relation to sediment organic carbon in the entire Middle Atlantic Bight Region for: Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

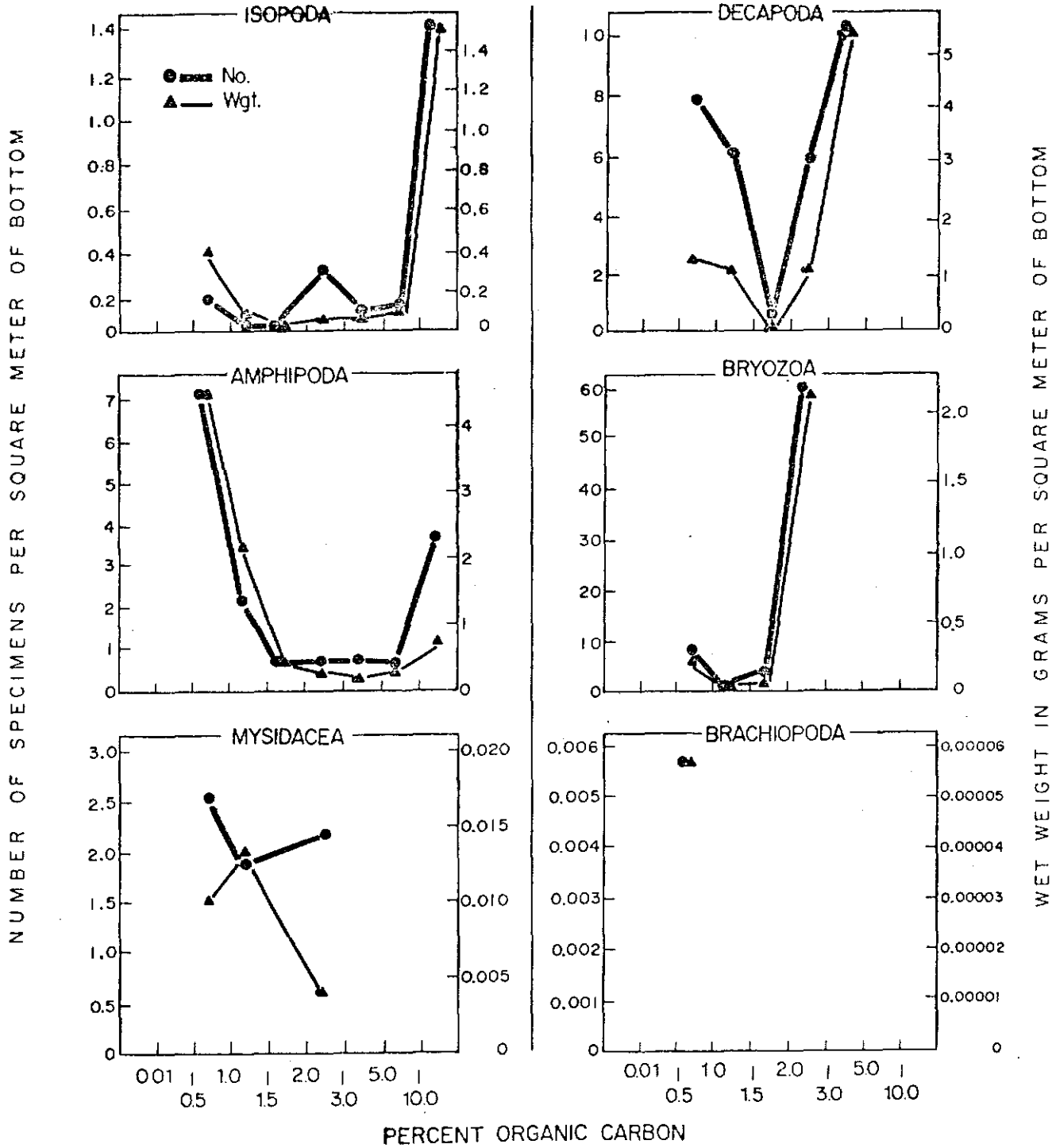


Figure 112.--Density and biomass in relation to sediment organic carbon in the entire Middle Atlantic Bight Region for: Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

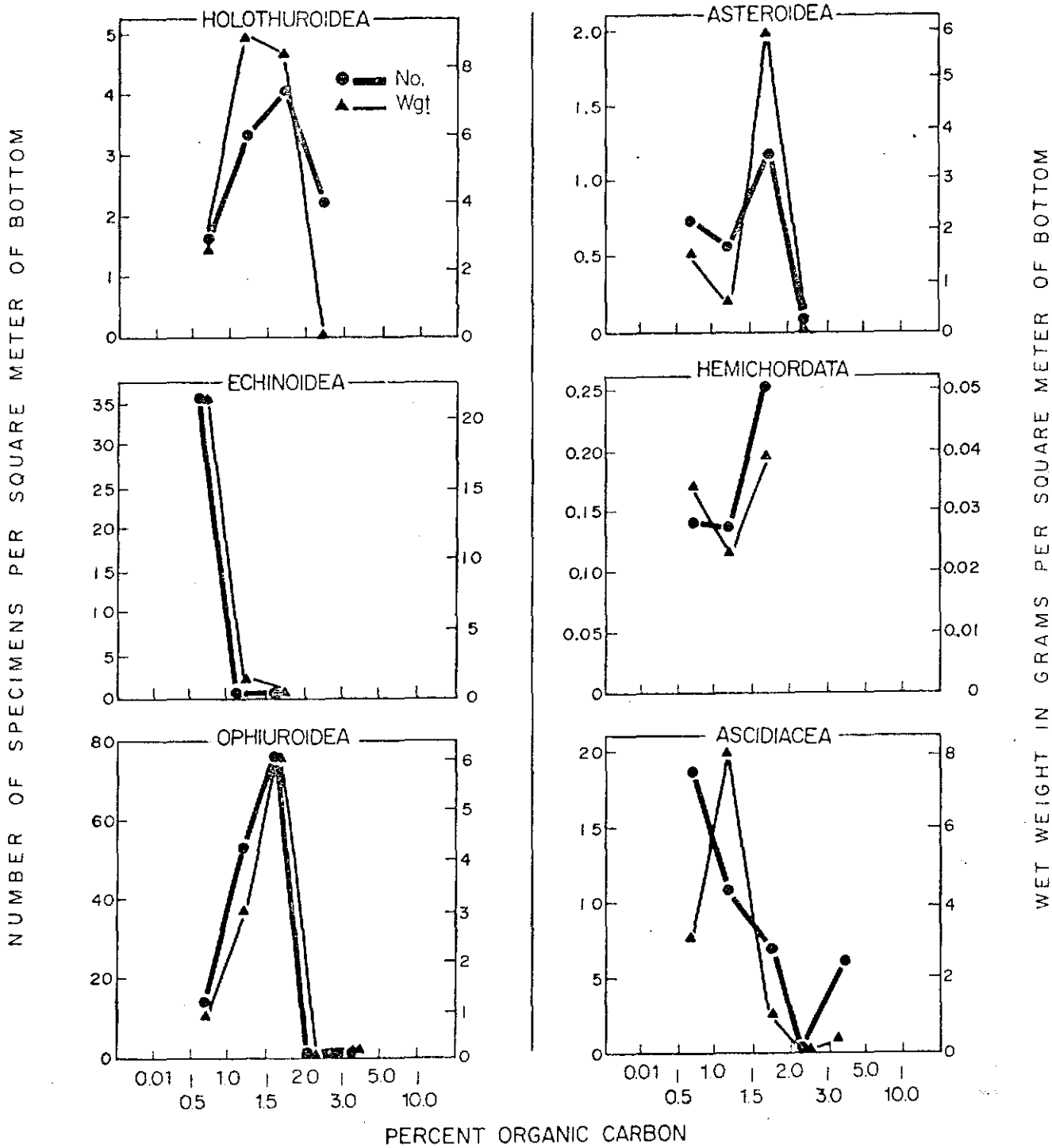


Figure 113.--Density and biomass in relation to sediment organic carbon in the entire Middle Atlantic Bight Region for: Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

In the following section we have examined the same parameters from a much smaller geographic area.

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 from the Southern New England subarea. Density values are listed in table 31, and biomass values are listed in table 32. The range of values and their fluctuations resemble those described above (table 29 and 30) for the entire Middle Atlantic Bight Region. In terms of density, one group (Copepoda) was directly correlated with quantity of organic carbon, and two groups (Sipunculida and Amphipoda) showed inverse relations with carbon content. 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 Bight and the Chesapeake Bight.

Table 31.--Mean number of individuals of each taxonomic group listed by sediment organic carbon content class, representing the Southern New England subarea.

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 32.--Mean biomass of each taxonomic group listed by sediment organic carbon content class, representing the Southern New England subarea.

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	0.090	<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	-	-	-

RELATION WITH RANGE IN BOTTOM WATER TEMPERATURE

This section deals with the relationship of 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 40). The range of temperature that normally occurs in this region is quite wide, particularly in some of the shallow, inshore locations where the actual temperatures may dip slightly below $0^{o}C$ or rise above $24^{o}C$.

Ranges 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 temperature ranges were grouped into seven classes: (1) $0\text{-}3.9^{o}$; (2) $4.0\text{-}7.9^{o}$; (3) $8.0\text{-}11.9^{o}$; (4) $12.0\text{-}15.9^{o}$; (5) $16.0\text{-}19.9^{o}$; (6) $20.0\text{-}23.9^{o}$; (7) $24.0^{o}+$. All references to temperature in this section, therefore, pertain to ranges rather than to discrete measurements.

Information regarding 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 contained in figure 114 and Appendix table A-4. 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 the major portion of the continental shelf had an annual range in temperature from 12° to $20^{o}C$. In contrast, the major portion of the continental shelf in Chesapeake Bight had a substantially wider annual range, from about 20° to $24^{o}C$. In New York Bight the temperature was intermediate between these two extremes.

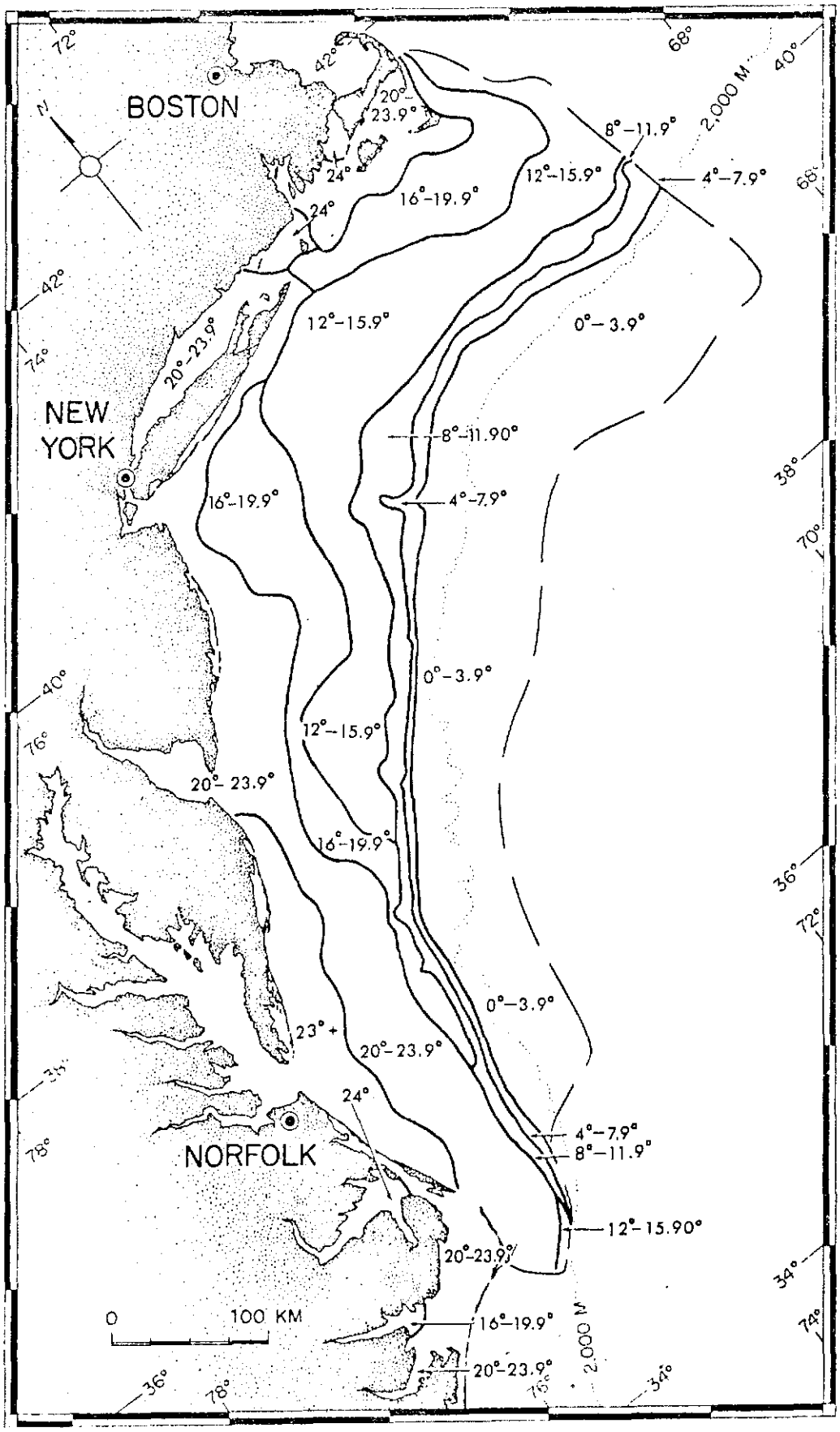


Figure 114.--Distribution of the range in bottom-water temperature for the Middle Atlantic Bight Region. Lines delimit areas of comparable temperature range; they are not isotherms.

The major effect on temperature range is that imparted by its distribution according to depth. Greatest temperature variations occurred in the shoalest water and least in the deep-water areas.

Total Macrobenthic Fauna--All Taxonomic Groups Combined

Entire Middle Atlantic Bight Region

The relation of density and biomass of all organisms to range in bottom water temperature in the Middle Atlantic Bight Region is listed in table 33 and illustrated in figures 115 and 116.

The mean density of all organisms throughout the entire Region tended to increase with increasing temperature range, at least until values of 12 to 15.9^{o}C were attained. Where temperature ranges were higher, 16-24°+C, mean densities, although high, tended to fluctuate more. Lowest mean density (133/m^2) occurred where temperature varied least (0-3.9^{o}C), increasing significantly as temperature range widened (591/m^2 in 4-7.9^{o}C and 851/m^2 in 8-11.9^{o}C), culminating in highest density (2,072/m^2) in the mid-range class of 12-15.9^{o}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 vis-a-vis range in temperature showed a definite tendency of increasing as range broadened. Smallest biomass (10 g/m^2) occurred in the narrowest range (0-3.9^{o}C), and largest values (303 and 290 g/m^2) occurred in the broadest ranges (20-23.9^{o} and 24°+C, respectively). Biomass in the intermediate temperature ranges was from 40 to 240 g/m^2.

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 occurred in the 8-11.9^{o}C class where density

Table 33.--Mean number of individuals and biomass of the macrobenthic invertebrate fauna, all taxonomic groups combined, in relation to range in bottom water temperature. Values are listed separately for each subarea and for the entire Middle Atlantic Bight Region.

Temperature range	Mean number of individuals				Mean biomass			
	SNE	NYB	CHB	Entire area	SNE	NYB	CHB	Entire area
°C	No./m^2	No./m^2	No./m^2	No./m^2	g/m^2	g/m^2	g/m^2	g/m^2
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

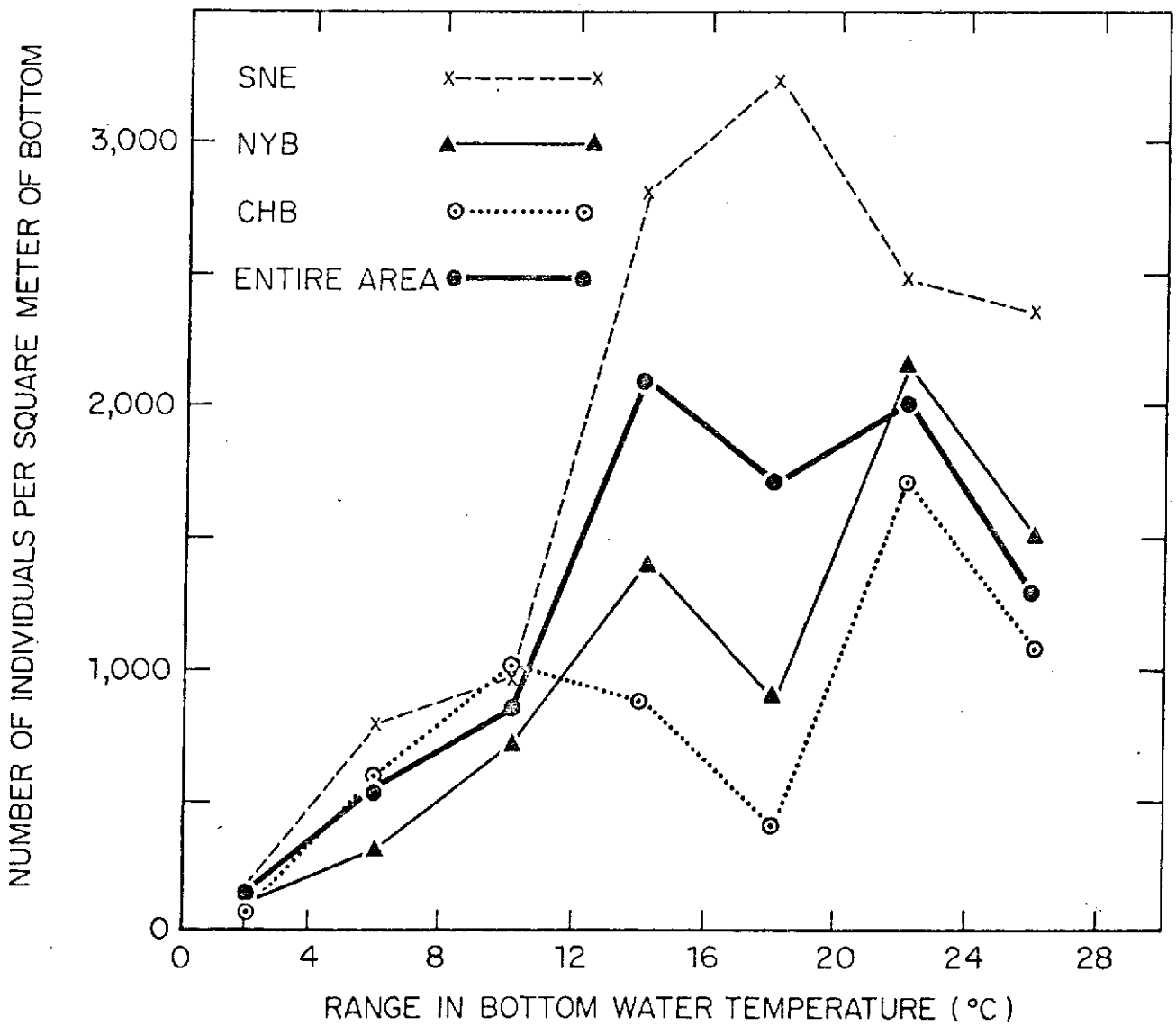


Figure 115.--Relation between number of individuals and range in bottom-water temperature. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight Region.

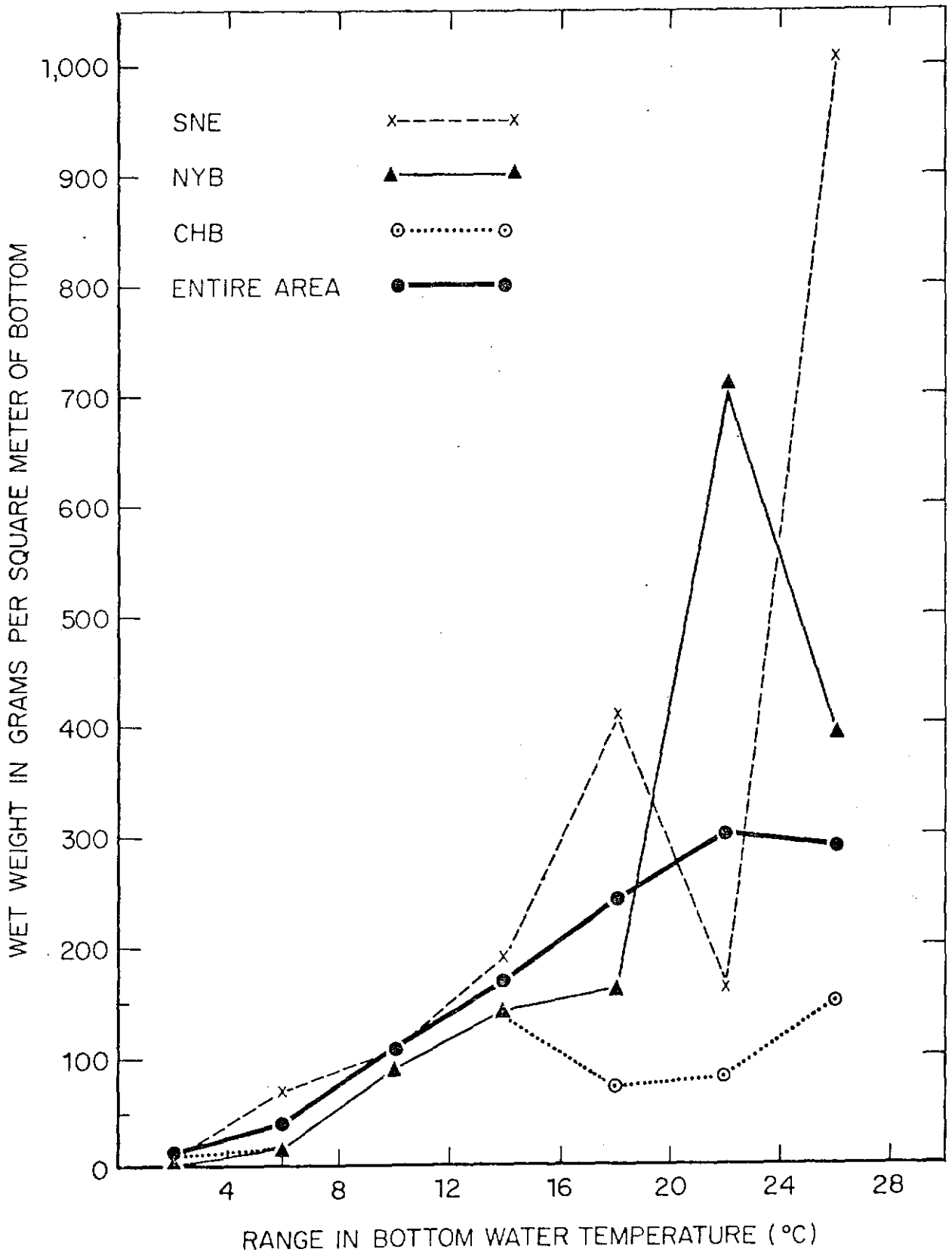


Figure 116.--Relation between biomass and range of bottom-water temperature. Values represent all taxonomic groups combined for each subarea and for the entire Middle Atlantic Bight Region.

in Chesapeake Bight slightly exceeded that in Southern New England (1,006 versus 960/m^2). The relation of density to broadening temperature range was also most consistent in this subarea. Mean values of density increased steadily (174, 769, 960, 2,797, and 3,235/m^2) with increasing range until 16-19.9^oC was reached; values then declined slightly with broadening range (2,475/m^2 in 20-23.9^oC, and 2,361/m^2 in 24°+C).

The mean biomass in Southern New England was also larger, in almost all temperature range classes, than in either New York Bight or Chesapeake Bight. In the 0-3.9^oC class, Chesapeake Bight had a slightly larger biomass (11 versus 10 g/m^2) than Southern New England, but the greatest disparity, which may simply be due to sampling variability, occurred in the 20-23.9^oC class, where the biomass in New York Bight was significantly larger than in Southern New England (704 versus 156 g/m^2). Except for the two cases just mentioned, mean biomass in Southern New England was generally larger than in New York Bight and Chesapeake Bight and tended to increase with broadening temperature range. Smallest average biomass (10 g/m^2) occurred in 0-3.9^oC, and largest (1,011 g/m^2) in the 24°+C class. Biomasses ranging between 67 and 409 g/m^2 occurred in the intermediate classes, table 33.

New York Bight

Although the general tendency of macrofaunal density in the New York Bight subarea was to increase with increasing temperature range and to be intermediate between that of Southern New England and Chesapeake Bight, some notable exceptions occurred. Density values increased in the first four temperature classes (0-3.9 to 12-15.9^oC) from 124 to 1,408/m^2, dipped to 870/m^2 in the 16-19.9^oC class, rose again to their highest point,

2,143/m^2, in the 20-23.9^oC class, then decreased again to 1,471/m^2 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^oC) was the lowest among the three subareas, with Chesapeake Bight occupying the intermediate position, but in the remaining classes was intermediate between Southern New England and Chesapeake Bight.

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^oC), ranging from 8 to 143 g/m^2, was intermediate between Southern New England and Chesapeake Bight in both the 16-19.9^o and 24°+C classes (161 and 392 g/m^2, respectively), but was largest (704 g/m^2) of any subarea in the 20-23.9^oC class.

Chesapeake Bight

The mean density and biomass of all organisms in relation to range in temperature were least consistent and generally lowest in this subarea. Densities in the first three classes tended to increase (76, 612, and 1,006/m^2) with broadening range, culminating in the greatest density, in the 8-11.9^oC class, of any of the subareas. Values between 398 to 1,692/m^2 occurred in the other temperature classes, but with no definite pattern, and were lower overall than in the other subareas.

Biomass values in the first four temperature classes (0-3.9^o to 12-15.9^o) paralleled those of Southern New England and New York Bight quite closely both in terms of the general trend of increasing with broadening temperature range as well as magnitude, ranging from 11 to 137 g/m^2. However, in the broader classes both the trend and the magnitude of biomass values fell off drastically, except in 24°+C where the largest biomass (149 g/m^2) in this subarea occurred, see figure 115 and table 33.

Taxonomic Groups

Entire Middle Atlantic Bight Region

This section deals with the relation of the mean density and biomass of each taxonomic group in the entire Middle Atlantic Bight Region to the range in bottom water temperature. Densities of each taxonomic group for the appropriate temperature class are listed in table 34. Corresponding biomass values for each taxonomic group are listed in table 35. These data are illustrated in figures 117 through 122.

Porifera (fig. 117) were found in all temperature ranges, albeit disproportionately. Their density was, in general, moderately low ranging from $0.07/m^2$ in the narrowest temperature class to $1.8/m^2$ in the broadest. Other than at the extremes, there did not appear to be any definite temperature range preference since density values rose, fell, then rose again with an increase in temperature in the intermediate ranges. One striking instance is found in the 16-19.9^{o}C class where, although the density is second lowest ($0.14/m^2$), the biomass of sponges is largest ($0.16\ g/m^2$). Next largest biomass ($0.07\ g/m^2$) occurred in the 24°+C range, as with density, while smallest biomass ($0.02\ g/m^2$) was found in the narrowest class, 0-3.9^{o}C.

Coelenterata, as a group, occurred in all temperature ranges and were significant contributors to the overall faunal density and biomass throughout the study area. The general tendency among coelenterates, especially with regard to biomass, but also, to some degree, to density, was to increase in abundance as temperature range broadened. Details of density and biomass among the different classes will be discussed below for each coelenterate subcomponent.

Table 34.--Mean number of individuals of each taxonomic group listed by temperature range class, representing the entire Middle Atlantic Bight Region.

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

Table 35.--Mean biomass of each taxonomic group listed by temperature range class, representing the entire Middle Atlantic Bight Region.

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	0.295	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	0.026	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	0.002	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

Hydrozoa (fig. 117) were present in all temperature ranges and both density and biomass tended to increase with broadening range. Density values were moderate overall but high when compared to other coelenterate subcomponents. Indeed, hydroid biomass was the greatest of any subcomponent in three classes, between 12.0 and 23.9^{o}C. Actual mean density values ranged from 0.02/m^2 in 0-3.9^{o}C to 25/m^2 in 24°+C class. Biomass of hydroids, although moderate, did not contribute as significantly to overall coelenterate biomass as did their density; it ranged from only trace amounts in 0-3.9^{o}C to 1.1 g/m^2 in the 24°+C class.

Anthozoa (fig. 117) were also present in all temperature classes and were major contributors to the overall coelenterate density and biomass. No clear-cut tendency of density or biomass vis-a-vis temperature range breadth was discernible. Anthozoan density was highest among the coelenterate subcomponents in classes 0-3.9^{o}, 4.0-7.9^{o}, 8.0-11.9^{o}, and 24°+C. Values ranged from 2.3/m^2 in 16.0-19.9^{o}C to 28/m^2 in the 24°+C class. Biomass of anthozoans, although moderate, led all other coelenterate subgroups in all temperature classes. Biomass ranged from 0.3 g/m^2 in class 16.0-19.9^{o}C to 13 g/m^2 in the 8.0-11.9^{o}C class.

Alcyonacea (Alcyonaria) (fig. 117) were restricted to low to moderate temperature range classes (0-3 to 15.9^{o}C) only. Densities were moderate and tended to decrease as temperature range broadened, ranging from 0.8/m^2 in 12-15.9^{o}C to 3/m^2 in the 4.0-7.9^{o}C class. Biomass was moderately small and showed a general tendency of increasing as temperature range broadened. Largest biomass (0.3 g/m^2) occurred where temperature range was 8.0-11.9^{o}C.

Zoantharia (fig. 117) were present in all temperature classes and were the major contributors to anthozoan density and biomass. Densities on the

whole were moderately high with greatest numbers occurring in the low to middle temperature classes (10 and 7/m^2 in the 4.0-7.9 and 12.0-15.9^{o}C classes, respectively). Lower densities (between 2 and 4/m^2) were present in the other temperature ranges with lowest density (0.9/m^2) occurring in the 0-3.9^{o}C class. Biomass of zoantharians was moderately large especially in the 8-11.9^{o}C class, where nearly 13 g/m^2 occurred. Values between 1 and 5 g/m^2 occurred in the following classes: 4.0-7.9^o, 12.0-15.9^o, 10.0-23.9^o, and 24°+C, whereas values under 1 g/m^2 were found where ranges of 0-3.9^o and 16.0-19.9^{o}C occurred.

Platyhelminthes (fig. 117) were found in regions where moderately low to high temperature ranges occurred but not in the two lowest classes. Mean densities in nearly all classes were less than 0.5/m^2, except in the 16.0-19.9^{o}C class where 3/m^2 were found. Biomass was very small, varying from 0.004 to 0.02 g/m^2.

Nemertea (fig. 117) were found in moderate quantities in all temperature ranges of the Middle Atlantic Bight Region. Density values varied from 0.7 to 7.6/m^2, tending to increase with temperature to the mid-classes (16.0-19.9^{o}C), then diminished as range broadened further. Biomass values paralleled those of density but were comparatively smaller, ranging from 0.07 to 10.2 g/m^2. Largest biomass occurred in the 20.0-23.9^{o}C class and diminished in the 24.0^o+C class.

Nematoda (fig. 118) occurred in all temperature ranges, and, as might be expected for this group of organisms, tended to be more important in terms of density than biomass. Generally densities were moderate (between 0.5 and 3/m^2) with some tendency to increase with broadening temperature range;

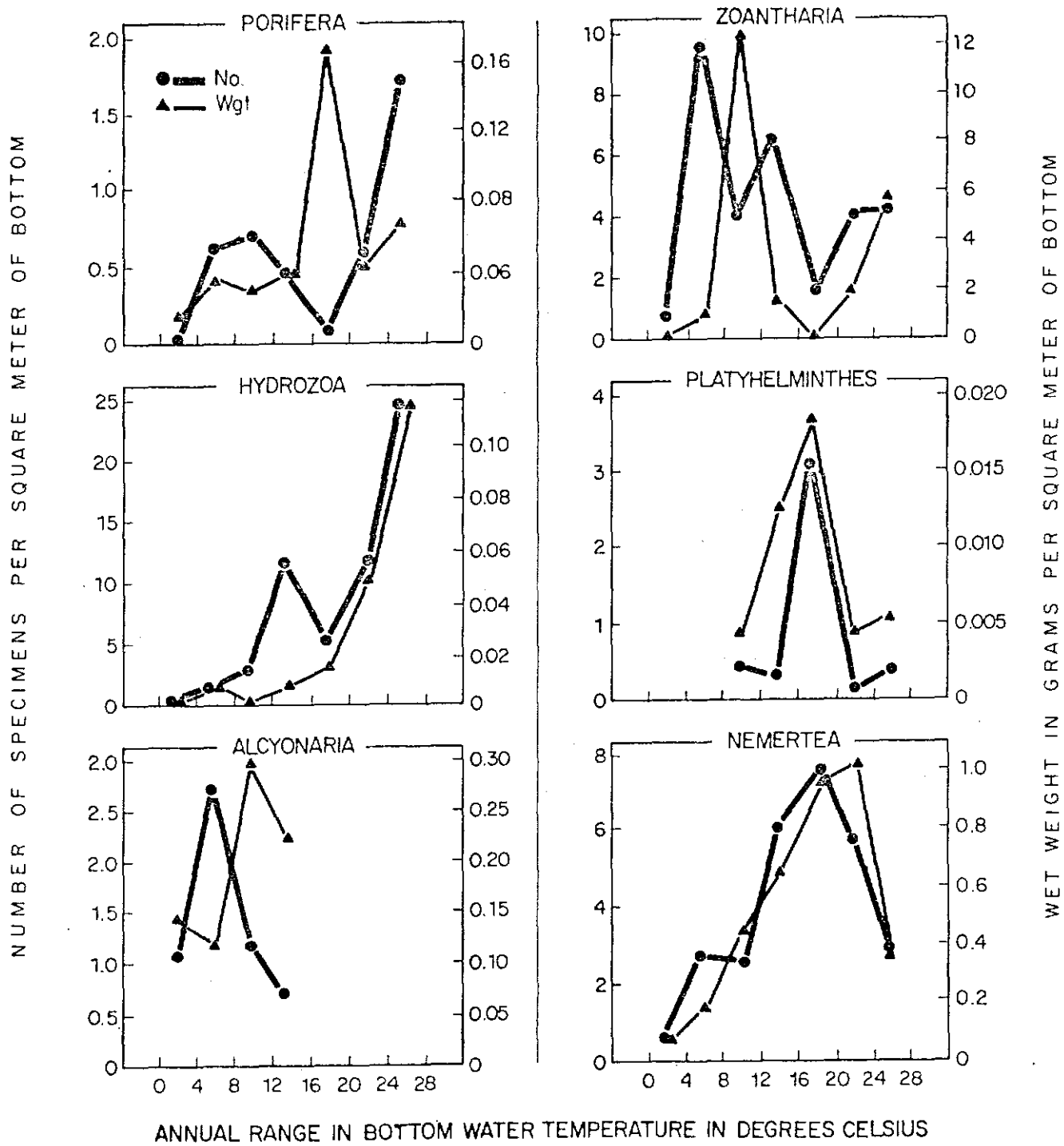


Figure 117.--Density and biomass in relation to range in bottom-water temperature in the entire Middle Atlantic Bight Region for: Porifera, Hydrozoa, Alcyonaria, Zoantharia, Platyhelminthes, and Nemertea.

however, the 16.0-19.9^{o}C class contained a relatively high abundance, 11/m^2. Largest biomass (0.01 g/m^2) occurred in the broadest range. Values of biomass in the other classes were, for the most part, slightly above trace amounts.

Annelida (fig. 118) were ubiquitous with regard to temperature range in the Middle Atlantic Bight Region and were major contributors to the overall density and biomass of the macrofauna. Density of worms was high and, in two instances, in the 0-3.9^{o}C and the 4.0-7.9^{o}C classes, their density was the highest of any other single taxon, 53 and 238/m^2, respectively. The general tendency among annelids was for their density to increase with broadening temperature range (table 34 and fig. 118). Density values in other classes varied from 189/m^2 in the 8.0-11.9^{o}C class to 470/m^2 in 20.0-23.9^{o}C. The biomass of worms was also high, but did not contribute as significantly to the overall abundance as did their density. Biomasses also tended to rise with broadening temperature range. Smallest biomass (2.6 g/m^2) was found in the narrowest class (0-3.9^{o}C) while largest weights (20 g/m^2) occurred in the mid-range class (12.0-15.9^{o}C). Biomasses between 8 and 18 g/m^2 occurred in the other temperature classes.

Pogonophora (fig. 118) tended to prefer the more stable temperatures of the deeper waters. They were present in all temperature classes below 12.0-15.9^{o}C inclusive, but were present only in the 20.0-23.9^{o}C class above this. Densities were on the whole moderately high in the preferred areas (1 to 5/m^2) and low (0.04/m^2) in the broadest range they occupied. Biomass was small in all temperature classes, trace amounts in 20.0-23.9^{o}C to 0.03 g/m^2 in both the 12.0-15.9^{o}C and 0-3.9^{o}C classes.

Sipunculida (Sipuncula) (fig. 118) occupied all temperature range classes in the region but seemed to prefer the narrower ranges to the broader ones. Densities were moderately high, generally greater than $4/m^2$ in most temperature classes, ranging from 4 to $11/m^2$, and lower in the two broadest classes, $0.5/m^2$ in 20.0-23.9°C and $2.2/m^2$ in 24.0°+C. Biomass of sipunculids was moderate to low with greatest weights, 1.8 and 1.1 g/m^2, respectively, occurring in the 0-3.9°C and 12.0-15.9°C classes. Lower values occurred in the other classes.

Echiura (fig. 118) were present in only two temperature classes, 0-3.9°C and 20.0-23.9°C, with densities fairly uniform at 0.4 and $0.3/m^2$ in each, and biomasses of 1 and 0.2 g/m^2, respectively.

Priapulida (fig. 118) were confined to the most stable temperature regions (0-3.9°C) and were present in small amounts, $0.07/m^2$ and 0.05 g/m^2 of density and biomass.

Mollusca were found in all temperature ranges in the Region and were major contributors to overall faunal abundance. In terms of ranking among the major taxonomic groups molluscan density was not as high as was their biomass. Molluscan density ranked first in only one temperature class, 20.0-23.9°C, and second in two others, 0-3.9°C and 4.0-7.9°C. The biomass of molluscs, however, ranked first in nearly all temperature classes, except the 4.0-7.9°C where it ranked third, and 0-3.9°C where it ranked seventh. Details of molluscan subcomponent relation with temperature follow.

Polyplacophora (fig. 119) were present in five of the seven temperature classes; they were absent in the 4-7.9°C and the 16.0-19.9°C classes. Densities were moderate to moderately low, varying from $0.04/m^2$ in 20.0-23.9°C to $1.3/m^2$ in the 24.0°+C class, whereas biomass was small, varying from 0.004 g/m^2 in both the 8.0-11.9°C and 20.0-23.9°C classes, to 1.2 g/m^2 in 24.0°+C.

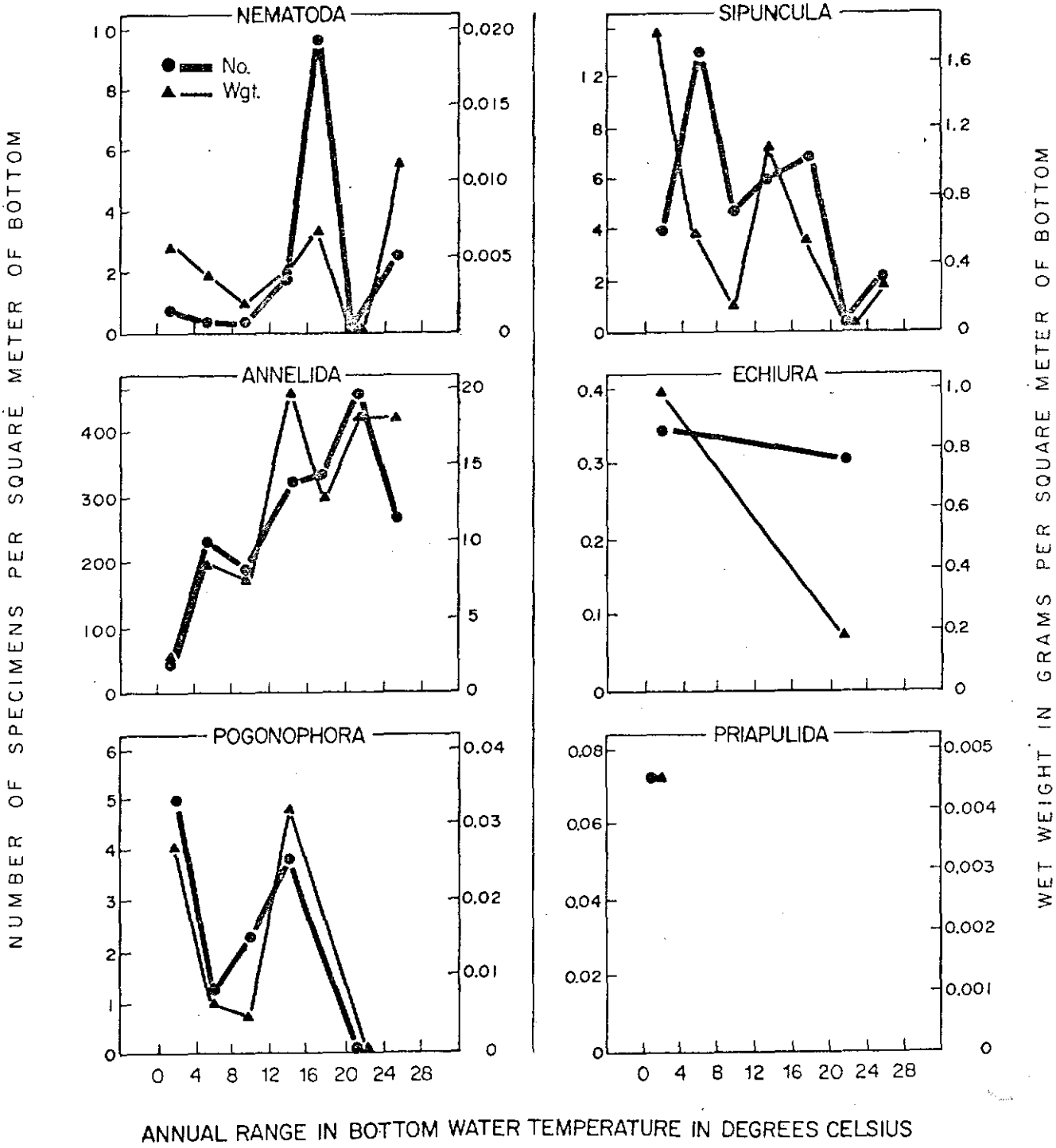


Figure 118.--Density and biomass in relation to range in bottom-water temperature in the entire Middle Atlantic Bight Region for: Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

Gastropoda (fig. 119) were present in all temperature classes. Densities were generally high with a tendency for the highest values to occur in the broadest temperature ranges. The range of density was from $3/m^2$ in 4.0-7.9^oC to $93/m^2$ in 20.0-23.9^oC; next highest concentration ($36/m^2$) occurred in the 24.0^o+C class. Densities were significantly lower in the other classes, not exceeding $14/m^2$. Biomass of gastropods was comparatively small. Largest biomass (6 g/m^2) occurred in 20.0-23.9^oC, dropping to 5 and 3 g/m^2 in the 12.0-15.9^oC and 24.0^o+C classes, respectively. All other temperature classes contained less than 1 g/m^2.

Bivalvia (fig. 119) were the leaders among the molluscs, in terms of both density and biomass. Density was very high to high with a fairly wide range (37 to $740/m^2$) of values occurring in the different temperature classes. Greatest average numbers occurred in 20.0-23.9^oC and fewest organisms were found in the narrowest range, 0-3.9^oC. Densities between 100 and $385/m^2$ occurred in the other temperature classes. Bivalve biomass ranged from small to very large and showed a definite tendency to increase with broadening temperature range. Smallest biomass (0.5 g/m^2) was encountered in the narrowest temperature class (0-3.9^oC), and largest (236 and 235 g/m^2) in the two broadest (20.0-23.9^oC and 24.0^o+C, respectively). Biomasses between 2 and 149 g/m^2 occurred in the other temperature classes.

Scaphopoda (fig. 119) occurred in all temperature ranges except the broadest. The curves for both density and biomass were nearly identical (fig. 119), both showing, at first, an increase in the first two classes, then a general decline as temperature range broadened. Densities were low to moderate (0.3 to $4.1/m^2$) and biomasses were small (less than 0.001 to 0.06 g/m^2).

Cephalopoda (fig. 119) eggs were found only in the 4.0-7.9^{o}C and 8.0-11.9^{o}C classes, in low density and small biomass.

Arthropoda, as a group, were found in all temperature ranges and were significant contributors, especially in terms of density, to the total macrofauna. Arthropod density ranked first, among all taxonomic groups, in four temperature classes, 8.0-11.9^{o}C, 12.0-15.9^{o}C, 16.0-19.9^{o}C, and 24.0^{o}+C; second in the 20.0-23.9^{o}C class; and third in the two lowest classes. The contribution of arthropods in terms of biomass to the total fauna was substantially less than was that of density, being only moderate to moderately high. Detailed treatment of the arthropod subcomponents follows.

Pycnogonida (fig. 119) were found only in the middle to upper temperature ranges and both density and biomass were low, but showed a definite increase in values with broadening temperature range.

Arachnida were present in only one temperature class, 20.0-23.9^{o}C; density was 0.17/m^2 with biomass only a trace amount.

The statements above for Arthropods apply equally to Crustacea and need not be repeated.

Ostracods (fig. 120) were present only in the narrowest (0-3.9^{o}C), the middle (12.0-15.9^{o}C), and two broadest (20.0-23.9^{o}C and 24.0^{o}+C) temperature ranges. Both density and biomass were low (0.05 to 0.47/m^2, and less than 0.001 to 0.004 g/m^2).

Cirripedia (fig. 120) were present in the moderate to broad temperature ranges, 12.0-24.0^{o}+C. Both density and biomass were low (0.2 to 0.3/m^2 and 0.004 to 0.006 g/m^2) in the narrowest and broadest ranges in which they were found. Significantly higher values of density and biomass were found in the other two classes (16.0-19.9^{o}C and 20.0-23.9^{o}C) where 45/m^2 and 17 g/m^2, and 86/m^2 and 5 g/m^2 occurred.

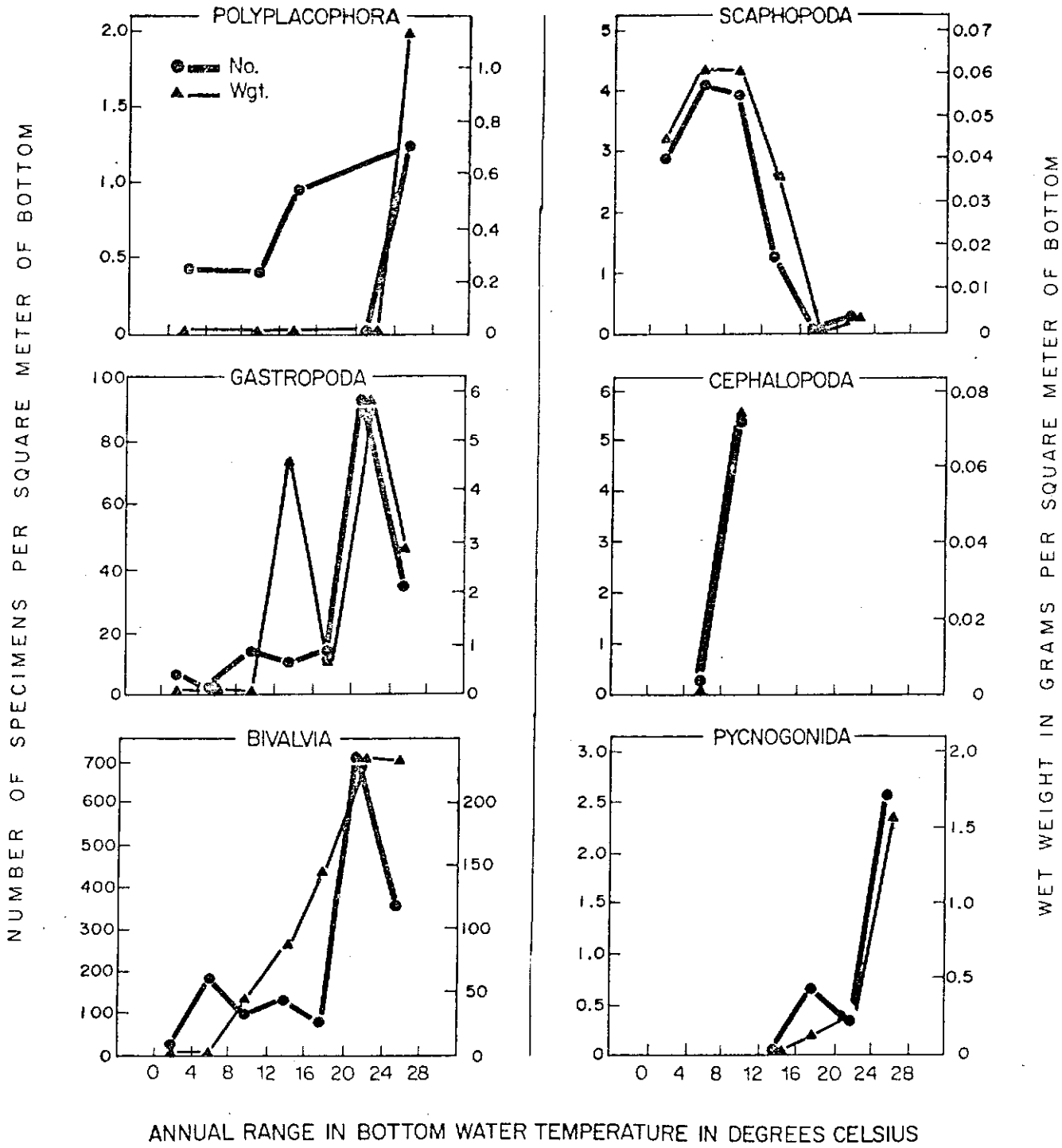


Figure 119.--Density and biomass in relation to range in bottom-water temperature in the entire Middle Atlantic Bight Region for: Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

Copepoda (fig. 120) were found in only three temperature classes, 0-3.9^{o}C, 8.0-11.9^{o}C, and 12.0-15.9^{o}C. Densities were low, ranging from 0.06 to 0.12/m^2, and biomass constituted only trace amounts.

Nebaliacea (fig. 120) also occurred in only three temperature classes, 0-3.9^{o}C, 16.0-19.9^{o}C, and 20.0-23.9^{o}C, with low (0.01 to 0.05/m^2) density and only trace amounts of biomass.

Cumacea (fig. 120) were ubiquitous with regard to temperature but showed some preference for the mid-ranges (12.0-19.9^{o}C) (fig. 120). Both density and biomass were highest in middle ranges and declined in both narrower and broader ranges. Density varied from 1 to 35/m^2 and biomass from 0.005 to 0.2 g/m^2.

Tanaidacea (fig. 120) were found only in the narrowest temperature range (0-3.9^{o}C). Density was moderately low (0.30/m^2) and biomass was low (0.002 g/m^2).

Isopoda (fig. 121) occurred in all temperature classes but showed a preference for 16.0-19.9^{o}C (fig. 121). Greatest density was 27/m^2, in the preferred class, and declined on either side of this; lowest density (0.5/m^2) was in the 0-3.9^{o}C class. On the whole density was moderately high. Biomass was distributed similarly to density. Biomass in the preferred class was 0.8 g/m^2, with smallest biomass (0.02 g/m^2) occurring, as did density, in the 0-3.9^{o}C class.

Amphipoda (fig. 121) which occurred in all temperature classes, was the single most important crustacean component in terms of both density and biomass. Although density was relatively high in all temperature classes, it was exceptionally high in two, 12.0-15.9^{o}C and 16.0-19.9^{o}C, where densities of 1,353 and 1,019/m^2 occurred. In the other classes density values were considerably lower but increased steadily with

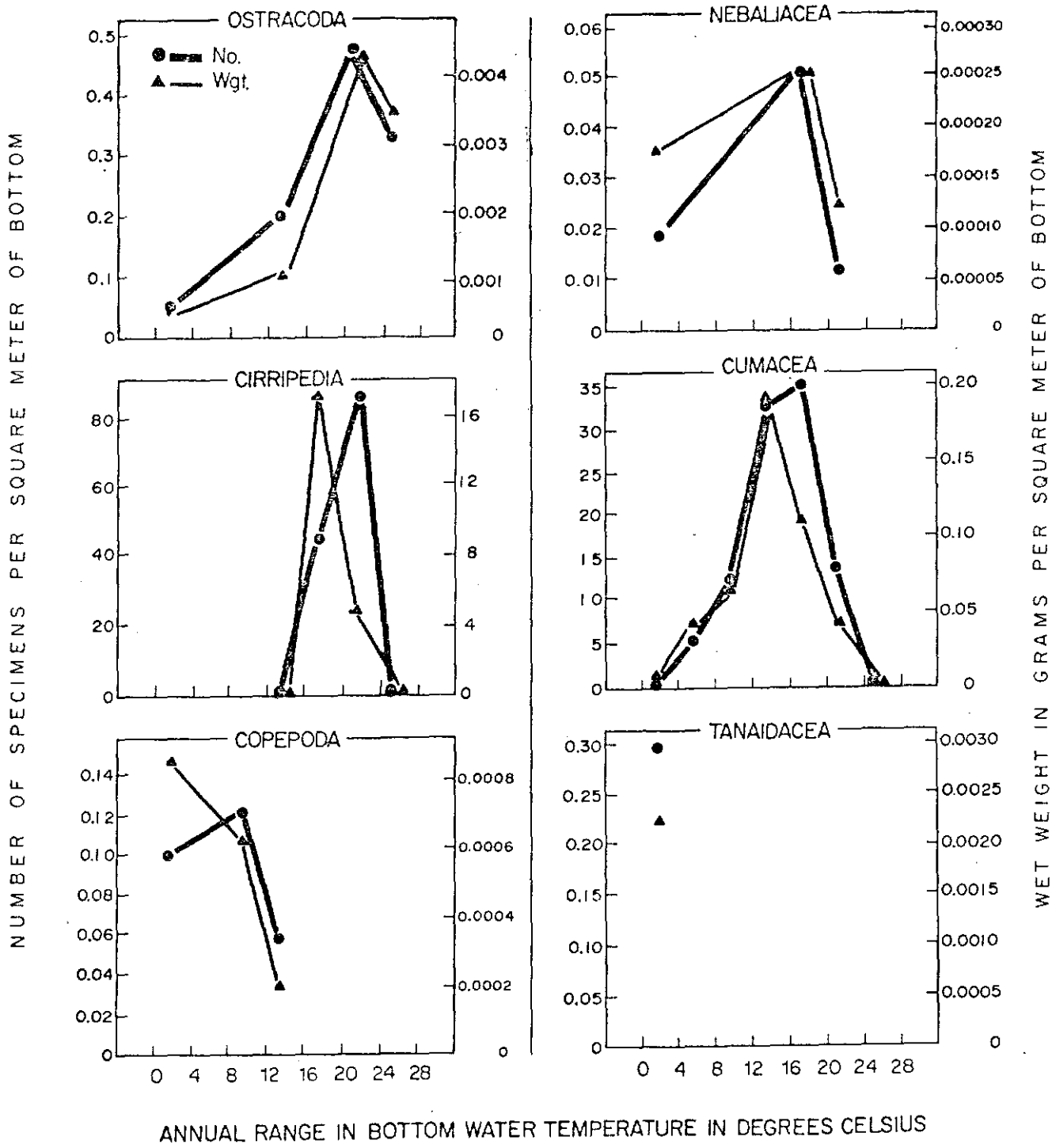


Figure 120.--Density and biomass in relation to range in bottom-water temperature in the entire Middle Atlantic Bight Region for: Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

broadening temperature range, from 5 to 424/m^2. Amphipod biomass was the largest of any other group of crustaceans in four temperature classes, 0-3.9^oC, 8.0-11.9^oC, 12.0-15.9^oC, and 24.0^o+C. Also, as with density, significantly larger biomasses (6 and 9 g/m^2) occurred in the 12.0-15.9^oC and 16.0-19.9^oC classes, respectively. In the other classes the trend for biomass was similar to that for density, generally increasing with broadening temperature range, 0.03 to 3.2 g/m^2.

Mysidacea (fig. 121) were present in nearly all temperature ranges in the region, being absent only in the 4.0-7.9^oC and 8.0-11.9^oC classes. Density values were low (0.02 to 0.06/m^2) in the narrow to middle ranges (0-3.9^oC to 16.0-19.9^oC) but substantially higher (5 to 7/m^2) in the two broadest ranges. Biomass was small (0.002 g/m^2) in the 12.0-15.9^oC class and in trace amounts in the 0-3.9^oC and 16.0-19.9^oC classes, but was moderately large (0.02 and 0.03 g/m^2) in the two broadest classes.

Decapoda (fig. 121) were ubiquitous with regard to temperature range in the Middle Atlantic Bight Region, contributing moderately to the overall density and biomass of the macrofauna. The general tendency within each parameter was to increase with broadening temperature range (fig. 121). Densities ranged from 0.1/m^2 in the 0-3.9^oC class to 15/m^2 in the 20.0-23.9^oC class. Biomass values paralleled those of density; smallest (0.01 g/m^2) in the 0-3.9^oC class and largest (2.3 g/m^2) in the 20.0-23.9^oC class.

Bryozoa (fig. 121) were present in the moderately narrow to broad temperature ranges but absent in the two narrowest (0-3.9^oC and 4.0-7.9^oC). Density of these organisms was highest (27/m^2) in the 16.0-19.9^oC class and diminished in both narrower and broader ranges. Lowest density (2/m^2) occurred in the 12.0-15.9^oC class. Biomass was moderate to small and trends with temperature range paralleled those of density. The largest biomass

(0.9 g/m^2) occurred in the 16.0-19.9^{o}C class and smallest (0.03 g/m^2) in the 12.0-15.9^{o}C class.

Brachiopoda (fig. 121) were present only in the 16.0-19.9^{o}C temperature class; their density was low (0.02/m^2) and only a trace amount of biomass was obtained.

Echinodermata occurred in all temperature ranges and, as a group with several subcomponents, were major contributors to overall macrofaunal abundance. Densities, which were moderate to moderately high in the different temperature classes, did not have the same impact on total abundance as did their biomass. The highest ranking density in this group occurred in the 8.0-11.9^{o}C class and was ranked third. Echinoderm biomass ranked first in two classes, 0-3.9^{o}C and 4.0-7.9^{o}C; second in three classes, 8.0-11.9^{o}C, 16.0-19.9^{o}C, and 20.0-23.9^{o}C; and third in one class, 12.0-15.9^{o}C.

Holothuroidea (fig. 122) were present in all temperature ranges in moderate amounts. Both density and biomass values were highest in the mid-range (12.0-15.9^{o}C) class and tended to diminish in both narrowing and broadening temperature ranges. Highest density was 7/m^2 in the aforementioned class, and lowest (0.07/m^2) in the broadest class, 24.0^o+C. Substantially higher values occurred in the narrower ranges than in the broader ones. Biomass values paralleled those of density in that the largest quantity (21 g/m^2) was in the mid-range class (12.0-15.9^{o}C) and lowest quantities (0.4 and 0.05 g/m^2) in the two broadest classes (20.0-23.9^{o}C and 24.0^o+C, respectively). Biomasses between 1 and 6 g/m^2 occurred in the other classes.

Echinoidea (fig. 122) occurred in moderately high abundance in all temperature ranges of the region. Densities were highest (14, 27 and 58/m^2, respectively) in three of the broader classes, 12.0-15.9^{o}C, 16.0-19.9^{o}C,

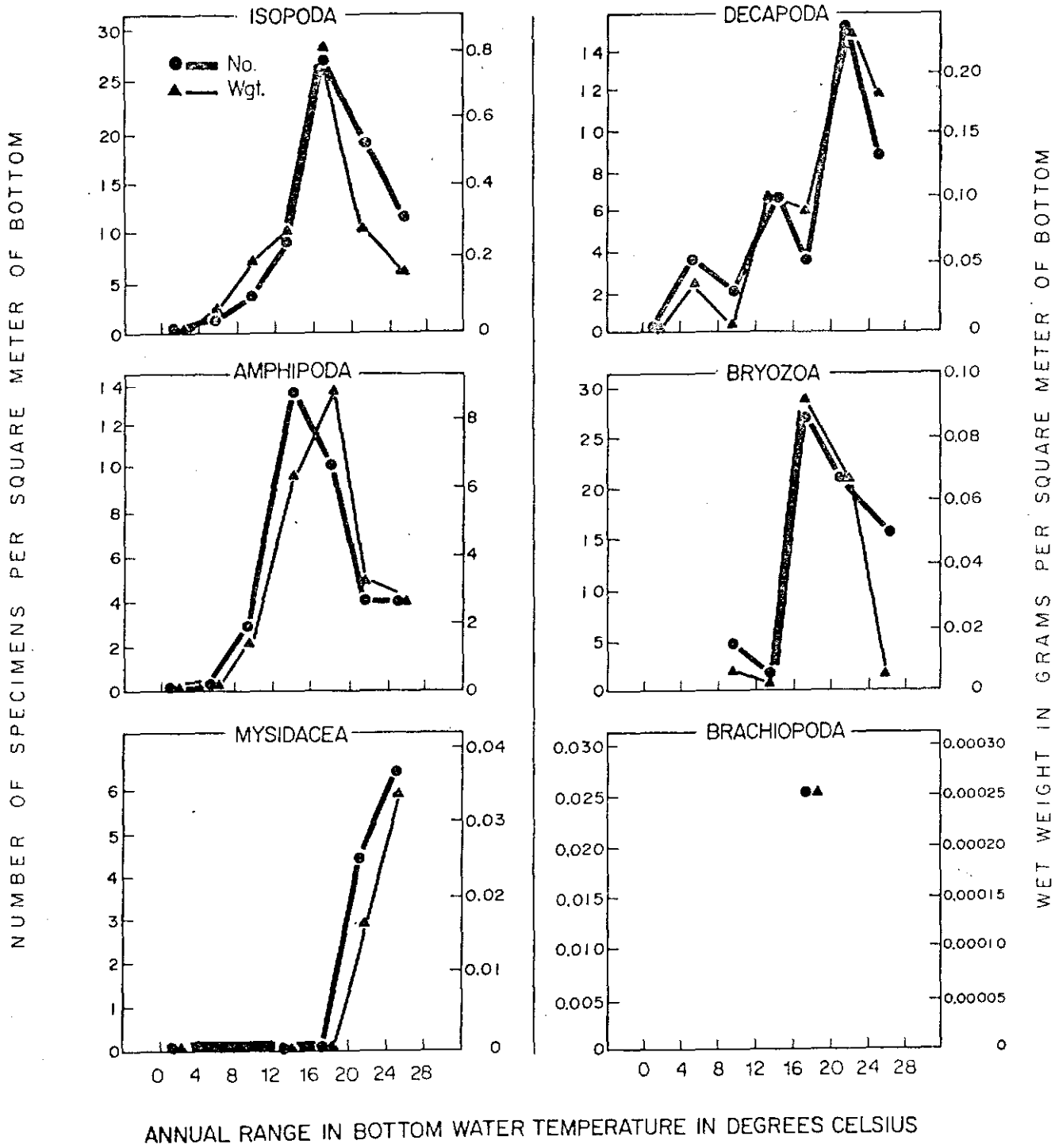


Figure 121.--Density and biomass in relation to range in bottom-water temperature in the entire Middle Atlantic Bight Region for: Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

and 20.0-23.9^{o}C, but were substantially lower (between 0.1 and 5/m^2) in the other classes. The distribution of biomass among the various classes was somewhat different than that of density. Smallest biomasses (0.2 and 0.4 g/m^2) occurred in the extreme temperature classes, 0-3.9^{o}C and 24.0^{o}+C, respectively; next smallest (7 g/m^2) in the mid-range class, 12.0-15.9^{o}C; and the largest biomass (39 g/m^2) occurred in the 16.0-19.9^{o}C class. Intermediate biomasses, ranging from 12 to 20 g/m^2, were present in the other temperature classes.

Ophiuroidea (fig. 122) occurred in all temperature ranges in the region showing a decided preference for the middle to lower ranges. Density was highest (164/m^2) in the 8.0-11.9^{o}C class by a substantial margin, and diminished in both narrower and broader classes (table 34) with lowest density (0.6/m^2) occurring in the 20.0-23.9^{o}C class. Other classes with substantial amounts were the 12.0-15.9^{o}C class with 91/m^2 and the 4.0-7.9^{o}C class with 40/m^2. Biomass paralleled density in distribution among the various temperature range classes (table 35). Largest biomass was 10 g/m^2 in 8.0-11.9^{o}C and smallest 0.02 g/m^2 in 16.0-19.9^{o}C. Moderately small biomasses (0.7, 0.2, and 0.3 g/m^2) occurred in the 0-3.9^{o}C, 20.0-23.9^{o}C, and 24.0^{o}+C classes, but were substantially higher (7.8 and 3.9 g/m^2) in the 4.0-7.9^{o}C and 12.0-15.9^{o}C classes, respectively.

Asteroidea (fig. 122) were found in all temperature ranges in the region. Density was, on the whole moderate, with greatest numbers occurring in the three classes between 8.0 and 19.9^{o}C, where between 2 and 3/m^2 were found, but fewer than 1/m^2 occurred in the other classes. Biomass was also moderate, with the largest quantities (8 and 5 g/m^2) occurring in the two classes between 8.0 and 15.9^{o}C. The 20.0-23.9^{o}C class contained 2 g/m^2, but biomasses in all other classes were below 0.5 g/m^2.

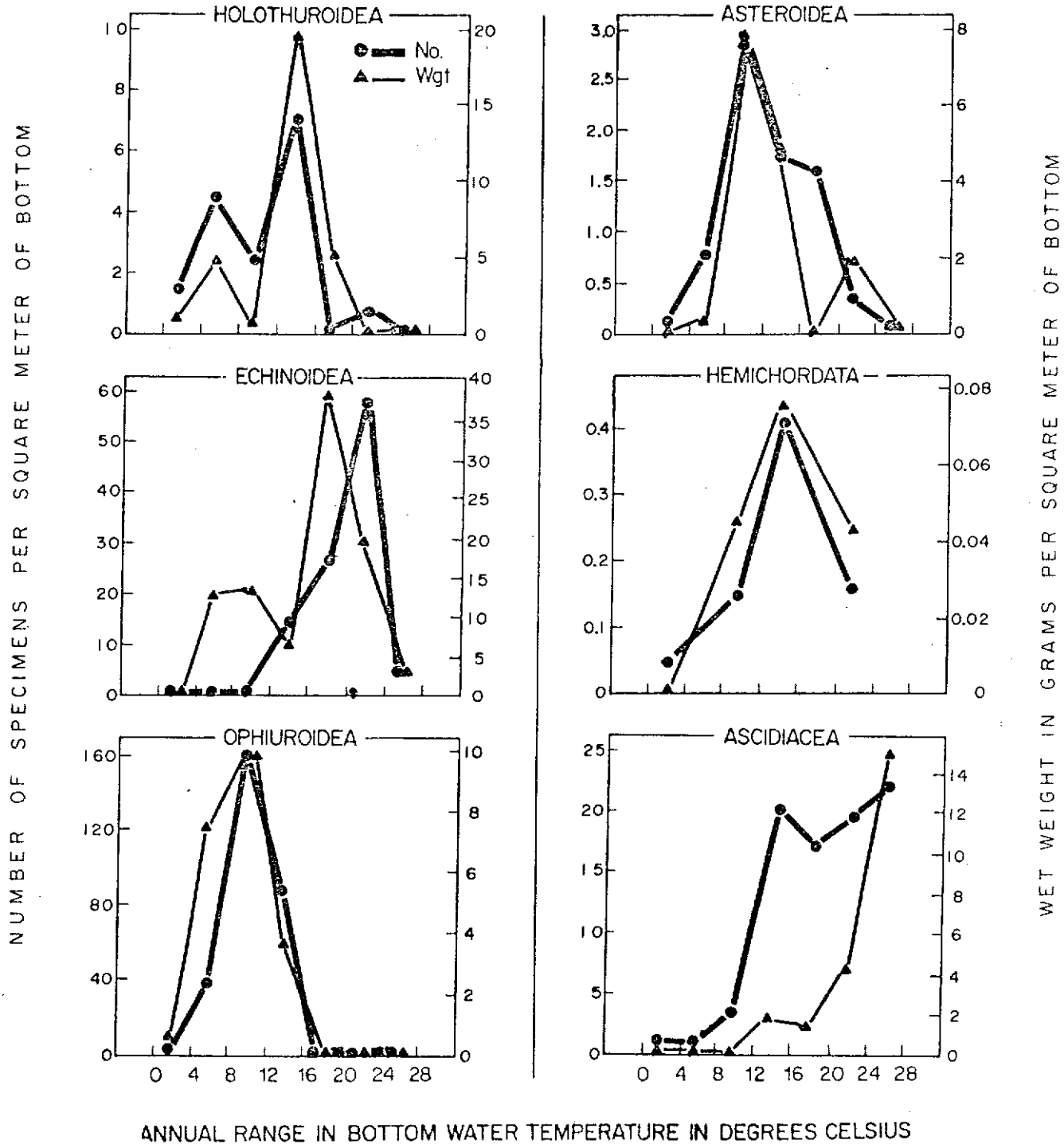


Figure 122.--Density and biomass in relation to range in bottom-water temperature in the entire Middle Atlantic Bight Region for: Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

Hemichordata (fig. 122) were found in only four temperature ranges, 0-3.9^{o}C, 8.0-11.9^{o}C, 12.0-15.9^{o}C, and 20.0-23.9^{o}C. Density values ranged from 0.05 to 0.4/m^2 and biomass ranged from trace amounts to 0.08 g/m^2. In each case the lowest values were in the 0-3.9^{o}C class and highest in the 12.0-15.9^{o}C class.

Ascidiacea (fig. 122) were present in all temperature ranges. Their density was moderate to moderately high, varying from 1 to 22/m^2 in the 4.0-7.9^{o}C and 24.0^{o}+C classes, respectively. Substantially higher densities, 17/m^2 or greater, occurred in the broader ranges (greater than 12.0^{o}C) than in the narrower ones (0-11.9^{o}C) where densities did not exceed 4/m^2. Biomass was moderate ranging from 0.07 g/m^2 in the 4.0-7.9^{o}C class to 4.4 g/m^2 in the 20.0-23.9^{o}C class. Ascidians constituted a high biomass (16 g/m^2) in only one , the 24.0^{o}+C, class.

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 in the Middle Atlantic Bight Region. Density data listed by temperature range class are presented separately for each subarea in tables 36, 37, and 38; corresponding biomass values are listed in tables 39, 40, and 41.

Porifera in the Southern New England subarea occurred in all temperature classes except 12.0^{o}-15.9^{o}C. They occurred in four classes in New York Bight being found only in the 8.0^{o}-11.9^{o}, 12.0^{o}-15.9^{o}, 20.0^{o}-23.9^{o}, and 24.0^{o}+C classes. In Chesapeake Bight they were found in only three of the temperature classes, 0°-3.9^{o}C, 20.0^{o}-23.9^{o}, and 24.0^{o}+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 to 7.5/m^2 in Southern New

Table 36.--Mean number of individuals of each taxonomic group listed by temperature range class, representing the Southern New England subarea.

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

Table 37.--Mean number of individuals of each taxonomic group listed by temperature range class, representing the New York Bight subarea.

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	56.55	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	-

Table 38.--Mean number of individuals of each taxonomic group listed by temperature range class, representing the Chesapeake Bight subarea.

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	23.70	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

Table 39.--Mean biomass of each taxonomic group listed by temperature range class, representing the Southern New England subarea.

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	0.663	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	7.72[illegible]
Gastropoda	0.042	0.014	0.018	8.496	1.791	4.407	2.59[illegible]
Bivalvia	0.596	3.479	4.256	76.731	278.021	81.710	916.58[illegible]
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	0.12[illegible]
Decapoda	0.004	-	0.008	0.238	1.868	3.883	0.95[illegible]
BRYOZOA	-	-	0.004	0.046	2.357	2.284	2.69[illegible]
BRACHIOPODA	-	-	-	-	-	-	-
ECHINODERMATA	3.280	49.097	56.991	54.862	30.305	2.707	2.69[illegible]
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	1.70[illegible]
Asteroidea	0.030	0.009	2.198	7.110	0.104	0.161	0.93[illegible]
HEMICHORDATA	0.001	-	0.126	0.150	-	-	-
CHORDATA	0.148	0.097	1.418	3.137	3.850	23.102	22.99[illegible]
Ascidacea	0.148	0.097	1.418	3.137	3.850	23.102	22.99[illegible]
UNIDENTIFIED	0.183	0.280	0.101	0.684	0.261	0.880	0.28[illegible]

Table 40.--Mean biomass of each taxonomic group listed by temperature range class, representing the New York Bight subarea.

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
Scephopoda	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	-

Table 41.--Mean biomass of each taxonomic group listed by temperature range class, representing the Chesapeake Bight subarea.

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	7.867
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

England, from 0.25 to 3.0/m^2 in New York Bight, and from 0.07 to 0.6/m^2 in Chesapeake Bight. There did not appear to be any increase in density with broadening temperature range except perhaps that the highest densities in the two northern subareas occurred in the broadest temperature range class. Biomass of sponges was small in all three subareas.

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

Hydrozoa in Southern New England were present in nearly all classes; they were absent in the 0-3.9^{o} and 8.0-11.9^{o}C classes. In New York Bight their presence was detected in nearly all classes, but in this case was absent from the 4.0-7.9^{o}C and the 24.0^{o}+C classes. In Chesapeake Bight they were present in all the broader range classes but were absent in the two narrowest (0-3.9^{o} and 4.0-7.9^{o}C). Among the three subareas mean densities were highest 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/m^2 in the 12.0-15.9^{o}C class to a high of 153/m^2 in the broadest class, 24.0^{o}+C. In New York Bight the lowest density value (0.06/m^2) was in the 0-3.9^{o} class and the highest (11/m^2) was in the 20.0-23.9^{o}C class. Chesapeake Bight contained relatively high densities, ranging from a low of 3/m^2 in the broadest temperature range to a high of 123/m^2 at mid-range. In both Southern New England and New York Bight density values were highest in the broader ranges, whereas in Chesapeake Bight highest values occurred in the mid-range classes. Biomass values for

hydroids paralleled those of density in that they were higher in both Southern New England and Chesapeake Bight than in New York Bight. Mean biomass in Southern New England was smallest (0.1 g/m^2) in the 12.0-15.9^{o}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^o class to 0.2 g/m^2 in the 20.0-23.9^{o}C class. Chesapeake Bight biomass of hydroids had a general tendency of increasing as temperature range broadened, going from 0.04 g/m^2 in the 8.0-11.9^{o}C class to 0.57 g/m^2 in the 24.0^o+C class.

Anthozoa were present in all of the temperature range classes in both the Southern New England and Chesapeake Bight subareas and in all but the 24.0^o+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. Range of densities in Southern New England was from 1/m^2 in the 16.0-19.9^{o}C class to a high of 123/m^2 in the 24.0^o+C class. Densities in New York Bight ranged from a low of 0.4/m^2 in the 12.0-15.9^{o}C class to a high of 9/m^2 in 4.0-7.9^{o}C. In Chesapeake Bight the range of density was from 2/m^2 in the 12.0-15.9^{o}C class to 13/m^2 in the 24.0^o+C class. As with density, average biomass was larger in Southern New England than in the other two subareas, ranging from a low of 0.07/m^2 in the 16.0-19.9^{o}C class to a high of 31 g/m^2 in the 8.0-11.9^{o}C class; intermediate values occurred in the other classes. In New York Bight the smallest biomass (0.19 g/m^2) occurred in the 12.0-15.9^{o}C class and largest (4 g/m^2) was in the 8.0-11.9^{o}C class. In Chesapeake Bight the smallest biomass (0.9 g/m^2) occurred in the 4.0-7.9^{o}C class and the highest, 7.2 g/m^2, in the broadest temperature range.

Alcyonacea were most prevalent in Southern New England where they occurred in four of the seven temperature classes. They occurred 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 $0.7/m^2$ in the $0\text{-}3.9^oC$ class to a high of $2/m^2$ in the $8.0\text{-}11.9^oC$ class, whereas in New York Bight slightly higher densities occurred ranging from $0.9/m^2$ in the $8.0\text{-}11.9^oC$ class to a high of $7/m^2$ in the $4.0\text{-}7.9^oC$ class. In Chesapeake Bight alcyonaceans were found only in the $0\text{-}3.9^oC$ class, where their density was $0.8/m^2$. Biomass was moderately low, ranging between 0.04 to 0.4 g/m^2 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 ($16.9\text{-}19.9^o$, $20.0\text{-}23.9^o$, and 24.0^o+C). Highest densities occurred in Southern New England where the average density ranged from nearly 1 to $23/m^2$, whereas in New York Bight they ranged from 0.2 to $8/m^2$. Chesapeake Bight contained the fewest number of individuals; densities ranged from 0.4 to $5/m^2$. Biomass was parallel to density in that largest biomasses occurred in Southern New England, were intermediate in New York Bight, and moderately low in Chesapeake Bight. Biomass values in Southern New England ranged from 0.05 to 30 g/m^2, those in New York Bight from a low of 0.004 to a high of 3.4 g/m^2, and in Chesapeake Bight the range was from 0.1 to 7 g/m^2. In Southern New England and New York Bight the largest biomass occurred in the mid-range class, $8.0\text{-}11.9^oC$. However, in Chesapeake Bight the zoantharians were restricted to the broader range categories.

Platyhelminthes distribution with regard to 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^{o}C; in New York Bight they were found in only two classes, 12.0-15.9^{o} and 20.0-23.9^{o}C; and in Chesapeake Bight they occurred in four classes, 8.0-11.9^{o}C and the three broader range classes from 16.0-24.0^{o}+C. Densities were low to moderate (0.04 to 8/m^2) with higher densities occurring 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/m^2) with both Southern New England and Chesapeake Bight containing larger biomasses, comparatively, than New York Bight.

Nemertea were ubiquitous with regard to temperature range 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 quite 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/m^2 to 1.4 g/m^2 in Southern New England, 0.003 g/m^2 to 1.8 g/m^2 in New York Bight, and from 0.07 g/m^2 to 0.6 g/m^2 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 occurred in all temperature ranges except one; in Southern New England they were absent in the 20°+C class, while in

Chesapeake Bight they were absent in the 8.0-11.9^{o}C class. In New York Bight they occurred in only four of the classes; 0-3.9^{o}C, 8.0-11.9^{o}C, 12.0-15.9^{o}C, and 16.0-19.9^{o}C. Southern New England contained the greatest density of nematodes, followed by Chesapeake Bight, and lowest densities occurred in New York Bight. Density values in Southern New England ranged from 0.2 to 27/m^2. New York Bight contained the lowest overall density, range was from 0.05 to 0.5/m^2. Chesapeake Bight density values for nematodes ranged from 0.3 to 3.7/m^2. The contribution of nematodes in terms of biomass is quite small. Biomass in Southern New England ranged from 0.002 to 0.02 g/m^2. In New York Bight biomass ranged from trace amounts to only 0.003 g/m^2, while in Chesapeake Bight the range of values was from trace amounts to 0.01 g/m^2.

Annelida were ubiquitous with regard to temperature range in each of the subareas of the Middle Atlantic Bight Region and were major contributors in terms of both density and biomass to the overall macrobenthic fauna. Overall densities tended to diminish, although not substantially, in a southerly direction through the subareas. Also, in the three subareas, there was a slight tendency for greater densities to occur in the broader temperature range groupings than in the narrower ones. Density values in Southern New England ranged from 85/m^2 in the narrowest class to 669/m^2 in the 16.0-19.9^{o}C class. In the other classes the average density ranged from greater than 200 to slightly over 500/m^2. In the New York Bight lowest density was in the 0-3.9^{o}C class where 40/m^2 were found, with a high of 962/m^2 in the 20.0-23.9^{o}C class. Another significantly high density occurred in the broadest range class in this region, 700/m^2 occurring in the 24.0^{o}+C class. Considerably lower values occurred in the other classes

in this subarea, ranging from 102 to nearly 200/m^2. Density values in Chesapeake Bight were lowest in the narrowest temperature range (15.7/m^2) and were highest, at 217/m^2, in the 20.0-23.9^oC range. Two other classes contained densities in excess of 100/m^2, the 8.0-11.9^oC and the 24.0^o+C, while under 100/m^2 occurred in the 4.0-7.9^oC, 12.0-15.9^oC, and 16.0-19.9^oC classes. Biomass of annelids also tended to diminish as one proceeded southerly across the shelf and slope with greatest overall values occurring in Southern New England where the range of biomass was from 2.1 to 37 g/m^2, occurring in the extremes of the temperature ranges. In this subarea biomass tended to increase with broadening temperature range. In New York Bight biomass of annelids behaved somewhat similarly to that in Southern New England in that the smallest biomasses occurred in the narrowest class and largest ones in the broadest (3 to 30 g/m^2). Annelid biomass in Chesapeake Bight ranged from 2 g/m^2 in the narrowest class to 15 g/m^2 in the broadest. Biomasses between 3 and 11 g/m^2 occurred in the other classes.

Pogonophora definitely preferred the southernmost reaches of the Middle Atlantic Bight Region, being most abundant in Chesapeake Bight, in terms of both density and biomass. In each of the other two subareas, they only occurred in the narrowest temperature range class. Density of pogonophorans in Southern New England was 5/m^2, and was 4/m^2 in the New York Bight. Highest densities occurred in Chesapeake Bight with average densities ranging from 4/m^2 in the 4.0-7.9^oC class to 50/m^2 in the midpoint class of 12.0-15.9^oC. In the 0-3.9^oC and the 8.0-11.9^oC classes, density values were 6 and 15/m^2, respectively. The biomass of pogonophorans in Southern New England was 0.04 g/m^2 and in New York Bight 0.02 g/m^2. In Chesapeake Bight biomass ranged from trace amounts in the 20.0-23.9^oC

class to 0.4 g/m^2 in the 12.0-15.9^{o}C class. In the narrower classes biomass ranged from 0.02 to 0.03 g/m^2.

Sipunculida were ubiquitous in Southern New England but not in the other two subareas. In New York Bight they were only present in the first four classes, while in Chesapeake Bight they were present in all but two of the classes, absent in 8.0-11.9^{o}C and 24.0^o+C. Overall, in each of the three subareas, sipunculid density was moderate. In Southern New England density values ranged from 2 to 21/m^2, while in New York Bight substantially lower quantities occurred, ranging from 3 to 7/m^2; in Chesapeake Bight even lower values occurred, from 0.24 to 3/m^2. Biomass was essentially similar to density in its distribution 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, was 0.08 to 1 g/m^2 in New York Bight, and 0.009 to 3 g/m^2 in Chesapeake Bight. No definite trend was discernible with narrowing or broadening temperature range.

Echiura were not common in any of the subareas of the Middle Atlantic Bight Region occurring in only one temperature class in Southern New England, the narrowest, where 0.3/m^2 weighing 0.2 g/m^2 occurred. 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^o class where density was 0.5/m^2 and biomass 0.5 g/m^2. In Chesapeake Bight they were present in the same classes as they were in New York Bight and in roughly the same magnitudes; 0.4/m^2 weighing 2.5 g/m^2 occurred in the narrowest class and 0.3/m^2 weighing 0.09 g/m^2 occurred in the broader class.

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

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

Polyplacophora were found more plentifully and regularly in Southern New England than in the other two subareas in the Middle Atlantic Bight Region. In Southern New England they occurred in five temperature classes, in two classes in New York Bight, and in three classes in Chesapeake Bight. In Southern New England the trend of increasing density with broadening temperature range was discernible. The highest density ($8/m^2$) occurred in the broadest class and the lowest ($0.2/m^2$) occurred in the narrowest, 0-3.9^{o}C, as well as in the 20.0-23.9^{o}C class. In New York Bight in the 0-3.9^{o}C and 8.0-11.9^{o}C classes, polyplacophoran densities were 0.2 and $0.4/m^2$, respectively, while in Chesapeake Bight their density ranged from 0.2 to $1/m^2$, with a tendency of increasing with narrowing temperature range. In this case, the lowest density occurred in 20.0-23.9^{o}C and the highest occurred in the narrowest temperature range. Chiton biomass in the Southern New England subarea tended to follow the pattern established for density in that the smallest biomass ($0.003\ g/m^2$) occurred in the narrowest range,

and the largest biomass (8 g/m^2) occurred in the broadest range. In New York Bight, in both classes in which chitons occurred, the biomass was similar at 0.004 g/m^2. Chiton biomass in Chesapeake Bight did not establish any trends with broadening or narrowing temperature range in that both the broadest and narrowest ranges had nearly identical biomasses; 0.01 g/m^2 in the narrowest, and 0.02 g/m^2 in the broadest. In mid-range the biomass was 0.004 g/m^2.

Gastropoda were found in all temperature range classes in each of the subareas of the Middle Atlantic Bight Region. Both density and biomass tended to decrease with decreasing latitude, with greatest values of both occurring in Southern New England, intermediate values in New York Bight, and lowest in Chesapeake Bight. No definite trend or pattern was discernible with regard to broadening or narrowing temperature range in any of the subareas. Gastropod density in Southern New England ranged from 1/m^2 in the 4.0-7.9^{o}C class to 174/m^2 in 20.0-23.9^{o}C. In this instance generally lower densities occurred in the narrower ranges and higher densities in the broader ranges (see table 36). In New York Bight gastropod density ranged from 1/m^2 in the 4.0-7.9^{o}C class to 57/m^2 in 20.0-23.9^{o}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^{o}C class to 87/m^2 in the adjacent class, 20.0-23.9^{o}C. Intermediate values, tending on the lower side, were present 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^{o}C and 8.0-11.9^{o}C classes, to 9 g/m^2 in 12.0-15.9^{o}C. In New York Bight gastropod biomass ranged from 0.02 g/m^2 in the 4.0-7.9^{o}C class to 7 g/m^2 in the two broadest classes. Biomasses of 1 g/m^2 or less occurred in the other classes. In Chesapeake Bight, which contained on the whole the smallest biomass of gastropods, values ranged from 0.03 g/m^2 in the 8.0-11.9^{o}C class, to 7 g/m^2 in 20.0-23.9^{o}C.

Only one other class, 24.0^{o}+C, contained biomasses in excess of 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^{o}C class in Chesapeake Bight, where 1,027/m^2 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/m^2 in the 0-3.9^{o}C class to 370/m^2 in 20.0-23.9^{o}C. Values below 100/m^2 occurred in the 16.0-19.9^{o}C class but in all other classes density values were between 100 and 200/m^2. In New York Bight, which contained the lowest overall values, density exceeded 100/m^2 in only the two broadest classes, the previously mentioned high of 528/m^2 in the 20.0-23.9^{o}C class and 354/m^2 in 24.0^{o}+C. Density values ranging from 33 to 84/m^2 occurred in the other classes in this subarea. The density of bivalves in Chesapeake Bight was 30/m^2 in 0-3.9^{o}C and, in all other classes, was in excess of 100/m^2; 147 and 163/m^2 occurred in the 16.0-19.9^{o}C, and 8.0-11.9^{o}C classes, respectively, and was in excess of 370/m^2 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, with Southern New England second. The biomass in Chesapeake Bight, notwithstanding its leadership in terms of density, was lowest among the three subareas. Average biomass

in Southern New England ranged from 0.6 g/m^2 in the 0-3.9^{o}C class to 917 g/m^2 in the broadest, the 24.0^o+C, class. In this subarea the tendency was for increasing biomass with broadening temperature range but the actual values were widely divergent. In New York Bight average bivalve biomass ranged from 0.7 g/m^2 to 597 g/m^2 occurring in the 0-3.9^{o}C class and the 20.0-23.9^{o}C class, respectively. However, a greater portion of the remaining classes contained values that approximated or exceeded 100 g/m^2, 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/m^2 in the 0-3.9^{o}C class to 102 g/m^2 in the 12.0-15.9^{o}C class. The remaining classes contained less than 100 g/m^2.

Scaphopoda were most prevalent in Chesapeake Bight occupying six of the seven temperature classes, being absent only in the broadest class. In New York Bight they occupied the narrower to mid-range classes and were absent from the broader range classes (16.0-24.0^o+C), and in Southern New England occupied the three narrower range classes (0-11.9^{o}C), were absent in the next two between 12.0 and 19.9^{o}C, were present in the 20.0-23.9^{o}C range, and absent in the broadest range, 24.0^o+C. Density values were highest in Chesapeake Bight, where mean densities ranged from 0.4/m^2 to 14/m^2. In New York Bight where densities were intermediate between the other two subareas, the range of density was from 0.6/m^2 to 6/m^2. Scaphopod densities in Southern New England ranged from 0.5/m^2 to 4/m^2. On the whole, scaphopod biomass values were largest in the Chesapeake Bight subarea. Biomass ranged from 0.004 g/m^2 to 0.4 g/m^2. In New York Bight biomass values ranged from 0.01 g/m^2 to 0.08 g/m^2. Biomass of tusk shells

in Southern New England was somewhat comparable to that in the New York Bight. Smallest biomass was 0.005 g/m^2 in the 20.0-23.9^{o}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/m^2.

Cephalopoda were found only in Southern New England and only in two of the classes in this region, the 4.0-7.9^{o}C, and the 8.0-11.9^{o}C classes. Density values were high, 0.7 and 15/m^2 in the two classes, respectively, whereas biomass values were comparatively lower, 0.007 and 0.2 g/m^2, respectively.

Arthropoda density and biomass values are summations of the subcomponents of this phylum so a detailed analysis will not be considered here since the overall density and biomass of the arthropods is reflected in the crustacean abundances which will be 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^o, the 16.0-19.9^o, and the 24.0^o+C, whereas in New York Bight they were found only in the 20.0-23.9^{o}C class, and in Chesapeake Bight were found in the three broad-range categories between 16.0+, and 24.0^o+C. Overall density was highest in Southern New England ranging from 0.2 to 4/m^2, lowest in New York Bight where only 0.2/m^2 was found and intermediate in Chesapeake Bight with a range of densities from 0.7 to 3/m^2. Pycnogonid biomass was on the whole quite low, in Southern New England the range of biomass was from 0.002 to 0.02 g/m^2. In New York Bight 0.004 g/m^2 occurred and in Chesapeake Bight the range was from 0.003 to 0.02 g/m^2.

Arachnida were very sparsely distributed, occurring only in the New York Bight subarea and in only one temperature class, 20.0-23.9^{o}C. Density was 0.5/m^2 and biomass 0.002 g/m^2.

Crustacea were major contributors to the macrofauna in the Middle Atlantic Bight Region, occurring in all temperature range classes in each of the subareas and, generally, both density and biomass diminished with southerly latitudes so that greatest abundances occurred in Southern New England, intermediate ones in New York Bight and lower abundances in Chesapeake Bight. In Southern New England crustacean densities were highest in the mid-range classes and fell off both with narrowing and broadening temperature range. The fall-off was more pronounced in the narrower classes than the broader ones where substantial densities occurred. 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 in excess of 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 with lowest density (6/m^2) occurring in the narrowest class, to 1,023/m^2 in the 12.0-15.9^{o}C class. In the classes between 8°C and 24°+C, excluding 12.0-15.9^{o}C, density values were between 300 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^{o}C class. Crustacean biomass behaved similarly to density 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^{o}C to 65 g/m^2 in 16.0-19.9^{o}C in Southern New England, with somewhat smaller biomasses (10-11/m^2) occurring in the two broadest classes diminishing sharply as temperature range narrowed. In New

York Bight essentially the same conditions prevailed with a general tendency of increasing biomass with broadening temperature range. Smallest biomass occurred in the 0-3.9^{o}C class with 0.09 g/m^2, and largest, 21 g/m^2, in the 20.0-23.9^{o}C class. The 24.0^{o}+C class biomass dropped, significantly, to 1 g/m^2. In the remaining classes biomass varied from 1 to 7 g/m^2. Crustacean biomass in Chesapeake Bight was moderately small ranging from 0.01 g/m^2 in the narrowest class to 4 g/m^2 in 24.0^{o}+C. Values of less than 1 g/m^2 occurred in the 4.0-7.9^{o} and the 12.0-15.9^{o}C classes and ranged from 2 to 3 g/m^2 in the other three classes.

Ostracoda occurred in each of the subareas with their distribution within each rather limited. They occurred in only three temperature classes in Southern New England, primarily the two broadest categories and the mid-point; in New York Bight they were relegated to one temperature class, 20.0-23.9^{o}C; and the two broadest classes of Chesapeake Bight contained ostracods. As with other groups greatest densities and biomass occurred in Southern New England and tapered off in each of the succeeding subareas. In all cases the values of biomass and density were relatively low, especially in Chesapeake Bight where only traces were found in terms of biomass and very low values in terms of density.

Cirripedia although not widely distributed in terms of temperature range, contained significant amounts, especially in Southern New England and New York Bight, in terms of both density and biomass but were relatively unimportant in the Chesapeake Bight. In Southern New England barnacles were found in temperature ranges from 12.0-24.0^{o}+C but were relegated to two classes in New York Bight, 12.0-15.9^{o}C and the 20.0-23.9^{o}C; in Chesapeake Bight they only occurred in the 20.0-23.9^{o}C class where both density and

biomass were low. Highest individual density of barnacles (251/m^2) occurred in New York Bight in the 20.0-23.9^o class. In the 12.0-15.9^{o}C class, however, the density values were quite low 0.07/m^2. In Southern New England densities ranged from 0.4 to 116/m^2 in the 12.0-15.9^{o}C and the 16.0-19.9^{o}C classes, respectively. Lower values occurred in the two broadest classes where the density ranged between 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^{o}C class. In the remaining three classes less than 1 g/m^2 occurred. In New York Bight 14 g/m^2 of barnacles occurred in 20.0-23.9^{o}C and only trace amounts were found in 12.0-15.9^{o}C.

Copepoda did not contribute greatly to the total macrofauna of the Middle Atlantic Bight Region and were sparsely distributed in two of the subareas, occurring only in Southern New England and New York Bight. In Southern New England they occurred in the narrowest temperature range class, and in the 12.0-15.9^{o}C class in low densities and small biomasses. In New York Bight they were relegated to one class, 8.0-11.9^{o}C, and occurred in low abundance.

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

Cumacea occurred in all temperature classes in both Southern New England and Chesapeake Bight subareas but were absent from the 24.0^o+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 tended to favor the middle ranges over the narrower and broader ranges and in Southern New England the average density ranged from $1/m^2$ to $84/m^2$. Densities in New York Bight were lower than they were in Southern New England ranging from 0.9 to $25/m^2$. In Cheaspeake Bight density ranged from $0.1/m^2$ to $29/m^2$. As previously stated the biomass of cumaceans was moderate to moderately low, being greatest in Southern New England and tapering off to the south. Average biomass in Southern New England ranged from 0.01 g/m^2 to 3 g/m^2. In New York Bight smallest biomass was 0.01 g/m^2 and the largest biomass was 0.1 g/m^2. In Chesapeake Bight, which contained the lowest biomass of cumaceans, the range was between 0.001 g/m^2 and 0.2 g/m^2.

Tanaidacea were restricted to the narrowest range class in each of the three subareas of the Middle Atlantic Bight Region. Greatest abundance occurred in Southern New England with the next greatest occurring in Chesapeake Bight and lowest overall abundance in New York Bight. Densities (maximum $0.46/m^2$) and biomass (maximum 0.004 g/m^2) were low in all subareas.

Isopoda occurred in all of the temperature range classes throughout the Middle Atlantic Bight Region with greatest abundance in Southern New England, next highest in Chesapeake Bight, and lowest in New York Bight. Densities of isopods in Southern New England ranged from $0.7/m^2$ to $35/m^2$. Values of density on either side of the mid-temperature 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 $0.5/m^2$ to $26/m^2$. Decrease in density also occurred as temperature range narrowed. In Chesapeake Bight the same trends prevailed. Lowest density was $0.2/m^2$ and the highest was

29/m^2. As temperature range narrowed density values decreased. As opposed to density, largest overall biomass values occurred in Chesapeake Bight, were second largest in Southern New England, and smallest in New York Bight. Largest recorded biomass occurred in the 16.0-19.9^{o}C class in Chesapeake Bight where 1 g/m^2 of organisms was found. Smallest biomass in this subarea occurred in the 0-3.9^{o}C class where only 0.002 g/m^2 was found. In the New York Bight smallest biomass (0.02 g/m^2) occurred in 0-3.9^{o}C and 4.0-7.9^{o}C. Largest biomass in this subarea (0.8 g/m^2) occurred in the 16.0-19.9^{o}C class. In Southern New England smallest biomass occurred, as in the others, in the 0-3.9^{o}C class where 0.02 g/m^2 of isopods was recorded. The largest biomass of isopods in Southern New England occurred in 16.0-19.9^{o}C, where 0.7 g/m^2 was found.

Amphipoda were ubiquitous with regard to temperature range in each of the subareas of the Middle Atlantic Bight Region. Further, especially in terms of density, amphipods were the single most numerous group among the crustaceans. Highest densities occurred in Southern New England followed by New York Bight and Chesapeake Bight. Density values in Southern New England ranged from 8/m^2 in the narrowest temperature class, to 1,987/m^2 in the 16.0-19.9^{o}C class. In this subarea the broader classes contained considerably higher densities of amphipods than did the narrower ones. Densities in the New York Bight ranged from 5/m^2 in 0-3.9^{o}C to 974/m^2 in the 12.0-15.9^{o}C class. Densities in other classes ranged from 20 to 379/m^2. Density of amphipods in Chesapeake Bight was lowest in 0-3.9^{o}C where 1/m^2 was found and highest in 8.0-11.9^{o}C where 589/m^2 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/m^2 in 0-3.9^{o}C to 18 g/m^2 in 16.0-19.9^{o}C. As with density, in this subarea, larger biomasses occurred in the broader range classes. Biomass in New York Bight ranged from 0.4 g/m^2 in the narrowest class to 5 g/m^2 in the 12.0-15.9^{o}C class. In the remaining classes amphipod biomass in Chesapeake Bight was lower than in the other two subareas, ranging from 0.006 g/m^2 in the narrowest to 3 g/m^2 in the 8.0-11.9^{o}C class. Biomasses exceeding 1 g/m^2 occurred in only two of the other classes, 20.0-23.9^{o}C, and 24.0^o+C. In the remaining classes biomasses were less than 1 g/m^2.

Mysidacea occurrence in each of the subareas within the Middle Atlantic Bight Region was relegated to the broader temperature ranges; in Southern New England they occurred in only the two broadest ranges. In New York Bight they occurred in three temperature classes, 12.0-15.9^{o}C, 16.0-19.9^{o}C, and 20.0-23.9^{o}C, and in Chesapeake Bight, again as in Southern New England, in the two broadest classes; in addition, in New York Bight, they also occurred in the narrowest class. Mysid density in Southern New England was moderately high, 1 to 5/m^2. In New York Bight mysid density ranged from 0.06/m^2 in the narrowest class, and in the remaining three classes averaged from 0.1/m^2 in the two narrower ones to 3/m^2 in the broadest. In Chesapeake Bight mysid density in the two broadest classes was 5 and 6/m^2. 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/m^2. In New York Bight smallest biomass occurred in the narrowest class where only trace amounts were found and in the remaining three classes

ranged from 0.001 to 0.02 g/m^2. In Chesapeake Bight moderately small biomasses occurred in the two broadest classes, 0.02 g/m^2 in each.

Decapoda with respect to temperature range were ubiquitous only in the New York Bight subarea; in both Southern New England and Chesapeake Bight they were absent in one class in each. 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 18/m^2. Chesapeake Bight density ranged from 0.4/m^2 to 7/m^2. With regard to biomass the New York Bight subarea just edged out Southern New England containing the largest overall biomass of any of the subareas. In Southern New England biomass ranged from 0.004 g/m^2 to 4 g/m^2. In New York Bight the situation was better, but only slightly so. 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^{o}C class. In Chesapeake Bight smallest biomass occurred in the 12.0-15.9^{o}C class with 0.01 g/m^2 and largest biomass, in 24.0^o+C, was 2.1 g/m^2.

Bryozoa were present in five temperature classes in both Southern New England and New York Bight. The classes in which they occurred were between 8.0 and 24.0^o+C, being absent from the two narrowest classes, and in Chesapeake Bight were present in three of the classes between 12.0 and 23.9^{o}C. Densities decreased with decreasing southerly latitudes. Densities in Southern New England tended to increase with broadening temperature range except in the two narrow classes where lowest densities occurred,

$0.2/m^2$; highest density was $98/m^2$. In New York Bight lowest density ($0.1/m^2$) occurred at the mid-point, 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 with broadening temperature range in the three classes in which they occurred. Densities were $8/m^2$ in both the 12.0-15.9°C and 16.0-19.9°C classes and $11/m^2$ in the 20.0-23.9°C class. Biomass of bryozoans in the three subareas of the Middle Atlantic Bight Region was moderately small and in only one of the subareas, Southern New England, did biomass values exceed 1 g/m^2. Biomass ranged from 0.004 g/m^2 to 3 g/m^2 in this subarea. 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 occurred in only one temperature class (16.0-19.9°C) in Chesapeake Bight and were absent in each of the other two subareas. Both density and biomass of brachiopods were low, with $0.1/m^2$ 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 ubiquitous with regard to temperature range in each of the subareas. As a group, echinoderms were most plentiful in terms of density in Southern New England and diminished in importance as one proceeded south so that lower values were encountered in New York Bight and still lower ones in Chesapeake Bight. However, larger biomasses occurred in New York Bight than in either of the two adjacent subareas with Southern New England biomass values being second and Chesapeake Bight third. The detailed analysis of the subcomponents of the echinoderms follows.

Holothuroidea were ubiquitous with regard to temperature range in Southern New England but not so in the other two subareas. In New York Bight they occurred in five of the seven temperature classes being absent in the 4.0-7.9^{o}C and the 24.0^{o}+C classes; in Chesapeake Bight they occurred in six of the seven, being absent in the 8.0-11.9^{o}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 in that largest biomasses occurred in Southern New England, then in Chesapeake Bight, and were 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 there was only one class which contained greater than 1 g/m^2 biomass, that was 0-3.9^{o}C where 2 g/m^2 occurred. The range of values in the remaining temperature classes increased with narrowing temperature range going from a low of 0.1 g/m^2 to a high of 0.6 g/m^2. Biomass of holothurians in Chesapeake Bight was largest in the 12.0-15.9^{o}C class with 23 g/m^2, and lowest in the 24.0^{o}+C class with a biomass of 0.05 g/m^2.

Echinoidea occurred in nearly all temperature range classes in each of the subareas, being absent only from the 24.0^{o}+C class in Southern New England, the 0-3.9^{o}C class in New York Bight, and the 0-3.9^{o}C and 4.0-7.9^{o}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 occurring in New York Bight was 108/m^2 in the 20.0-23.9^{o}C class. Next highest density in this class occurred in Chesapeake Bight

with 43/m^2, whereas Southern New England density for this class was only 7/m^2. The next highest density of echinoids occurred in the 16.0-19.9^{o}C class in New York Bight where 36/m^2 were recorded; in Chesapeake Bight in the same class, 10/m^2 were found, whereas 27/m^2 were recorded in Southern New England. Lowest overall value occurred in the 0-3.9^{o}C class in Southern New England where 0.2/m^2 was found. Biomasses of echinoids shifted somewhat in that, again as with density, greatest amounts occurred in New York Bight, but the second greatest amounts occurred in Southern New England, and smallest in Chesapeake Bight. Largest biomass occurred in the 16.0-19.9^{o}C class in New York Bight where 70 g/m^2 were found. Comparatively, 21 and 16 g/m^2 occurred in the same class in Chesapeake Bight and Southern New England, respectively. The second largest biomass occurred in the 8.0-11.9^{o}C class in Southern New England where 27 g/m^2 of organisms occurred. In the same class in New York Bight biomass was 7 g/m^2 but in Chesapeake Bight it had diminished to 0.1 g/m^2.

Ophiuroidea were found in all temperature range classes in both Southern New England and Chesapeake Bight but in only five classes in New York Bight, being absent from 16.0-19.9^{o}C and 24.0^o+C there. Highest densities by a substantial margin occurred in Southern New England where 349 and 165/m^2 were found in the 8.0-11.9^{o}C and 12.0^o-15.9^{o}C classes, respectively. In the comparable classes in Chesapeake Bight the values were 3 and 90/m^2 and in New York Bight were 76 and 0.4/m^2, respectively. High density also occurred in the 4.0-7.9^{o}C class in Southern New England where 85/m^2 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 occurred in the 8.0-11.9^{o}C class in Southern New England where 25 g/m^2 were found and 17 g/m^2 were found in the 4.0-7.9^{o}C class in the same subarea. In the comparable classes in New York Bight the values were 3 and 2 g/m^2, respectively, while in Chesapeake Bight the values were 0.04 and 0.2 g/m^2.

Asteroidea were present in all temperature ranges in Southern New England which also contained the highest densities of sea stars; whereas, in New York Bight they were present in five of the seven classes, being absent from the 16.0-19.9^{o}C and the 24.0^{o}+C classes; in Chesapeake Bight they were present in six classes being absent from the 4.0-7.9^{o}C class. Highest densities occurred in the mid-temperature classes in Southern New England where 3.9/m^2 occurred in 16.0-19.9^{o}C and 3.1/m^2 occurred in 8.0-11.9^{o}C and 12.0-15.9^{o}C. The remaining classes contained fewer than 1/m^2. Second highest density was in New York Bight, occurring in 8.0-11.9^{o}C where 3.5/m^2 were found and in the 4.0-7.9^{o}C and 20.0-23.9^{o}C classes, where 1.6 and 1/m^2 occurred, respectively. Fewer than 1/m^2 occurred in the other classes. Chesapeake Bight contained the lowest overall density of sea stars and in no temperature class did the density exceed .5/m^2. Sea star biomass was largest in the New York Bight subarea, followed by Southern New England and Chesapeake Bight. Largest biomass, 15 g/m^2, occurred in the 8.0-11.9^{o}C class in New York Bight. Next largest biomass, 7 g/m^2, occurred in Southern New England 12.0-15.9^{o}C. In Southern New England only one other temperature range class, 8.0-11.9^{o}C, contained a moderately large biomass, 2.2 g/m^2. All other classes in this subarea had biomasses smaller than 1 g/m^2. In New York Bight three classes contained biomass in

excess of 1 g/m^2, these were 4.0-7.9^{o}C, 12.0-15.9^{o}C, and 20.0-23.9^{o}C where 1, 33, and 6 g/m^2 occurred, respectively; 0.07 g/m^2 occurred in the 0-3.9^{o}C class in this subarea. Chesapeake Bight biomasses were quite small. Largest in this subarea was 0.6 g/m^2 in 16.0-19.9^{o}C and 0.4 g/m^2 in the 12.0-15.9^{o}C class. In the remaining temperature classes the biomass ranged from trace amounts to 0.008 g/m^2.

Hemichordata were sparsely distributed throughout the Middle Atlantic Bight Region. They occurred in only three temperature classes in Southern New England, with moderately low densities and biomass. Densities ranged from 0.1 to 0.8/m^2 and biomass ranged from 0.001 to 0.15 g/m^2. In New York Bight subarea hemichordates were found in only one temperature class, 20.0-23.9^{o}C, where 0.25/m^2 weighing 0.02 g/m^2 were found. In Chesapeake Bight hemichordates were found in only the 20.0-23.9^{o}C class with a density of 0.2/m^2 weighing 0.08 g/m^2.

Ascidiacea occurred in all temperature ranges in Southern New England and in nearly all ranges in New York Bight, being absent only in the broadest, 24.0^o+C; they were present in five classes in Chesapeake Bight, being absent from the 4.0-7.9^{o}C and 8.0-11.9^{o}C classes. Greatest densities and biomass occurred in Southern New England with next greatest in Chesapeake Bight and lowest in New York Bight. Average densities in Southern New England ranged from 2/m^2 in 0-3.9^{o}C to 105/m^2 in 20.0-23.9^{o}C. On the whole, in this subarea density increased with broadening temperature range to the 20.0-23.9^{o}C class and then dropped to 36/m^2 in the 24.0^o+C class. In Chesapeake Bight density ranged from 0.65/m^2 to 21/m^2. In New

York Bight densities ranged from $0.1/m^2$ to $16/m^2$. No definite trend was discernible with regard to temperature range in New York Bight. Ascidian biomass in Southern New England ranged from 0.1 g/m^2 in both the 0-3.9^oC and 4.0-7.9^oC classes to 23 g/m^2 in both the 20.0-23.9^oC and 24.0^o+C classes. In this subarea an increase in biomass with broadening temperature range was apparent. In Chesapeake Bight the same occurred, biomass increased with broadening temperature range with lowest biomass occurring in the narrowest range class, 0.07 g/m^2, to 15 g/m^2 in the broadest class. Ascidian biomass in New York Bight ranged from 0.02 g/m^2 to 1 g/m^2.

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. By combining sites having the same dominant groups, patterns of distribution become more distinct and these patterns facilitate our understanding of the faunal composition and its distribution. Again, it has been necessary to express the results in terms of both density and biomass, because of the marked differences revealed by each parameter.

In terms of numbers of individuals six taxonomic groups were dominant: Bivalvia, Annelida, Echinoidea, Ophiuroidea, Crustacea, and the Bathyal Group. All of these, 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 terms of biomass the dominant components were: Holothuroidea, Bivalvia, Annelida, Echinoidea, Ophiuroidea, and the Bathyal Group.

In the separate sections below we discuss the dominant faunal components in the following four geographic-bathymetric zones: (1) bays and sounds, (2) continental shelf, (3) continental slope, and (4) continental rise.

BAYS AND SOUNDS

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

In terms of numbers of individuals, members of three faunal groups commonly constituted the principal component, they were: 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 terms of biomass only two taxonomic groups were important as dominant components, they were: 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, Echinoidea, Ophiuroidea, and Holothuroidea. There were marked differences in the geographic location and areal distribution between number of individuals and biomass of the dominant taxon on the continental shelf.

In number of individuals, dominant taxa (fig. 123) were Bivalvia, Annelida, Echinoidea, Ophiuroidea, and Crustacea. Crustacea was by far the most important group with regard to areal coverage. This group was particularly

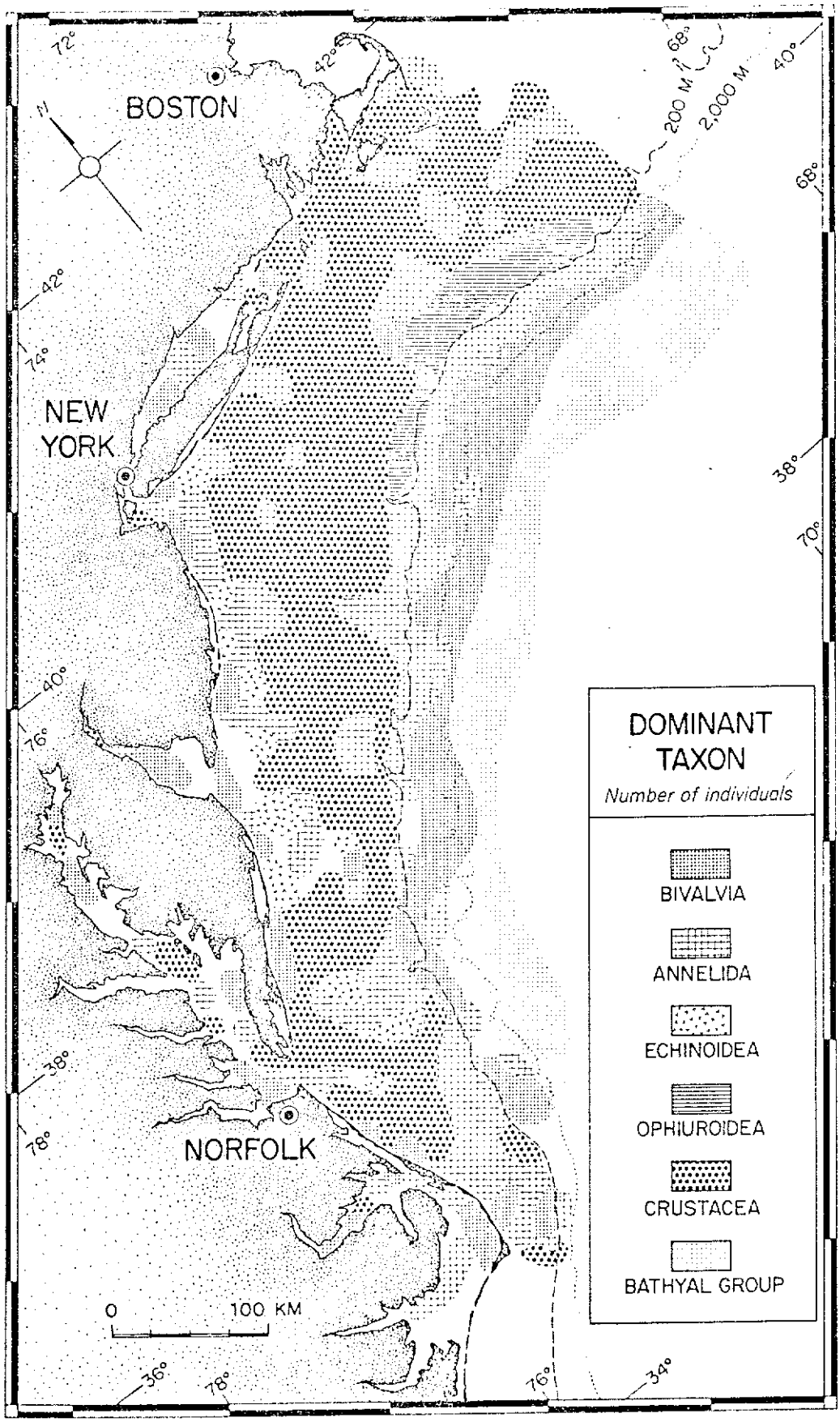


Figure 123.--Geographic distribution of the number of individuals for each dominant taxon in the entire Middle Atlantic Bight Region.

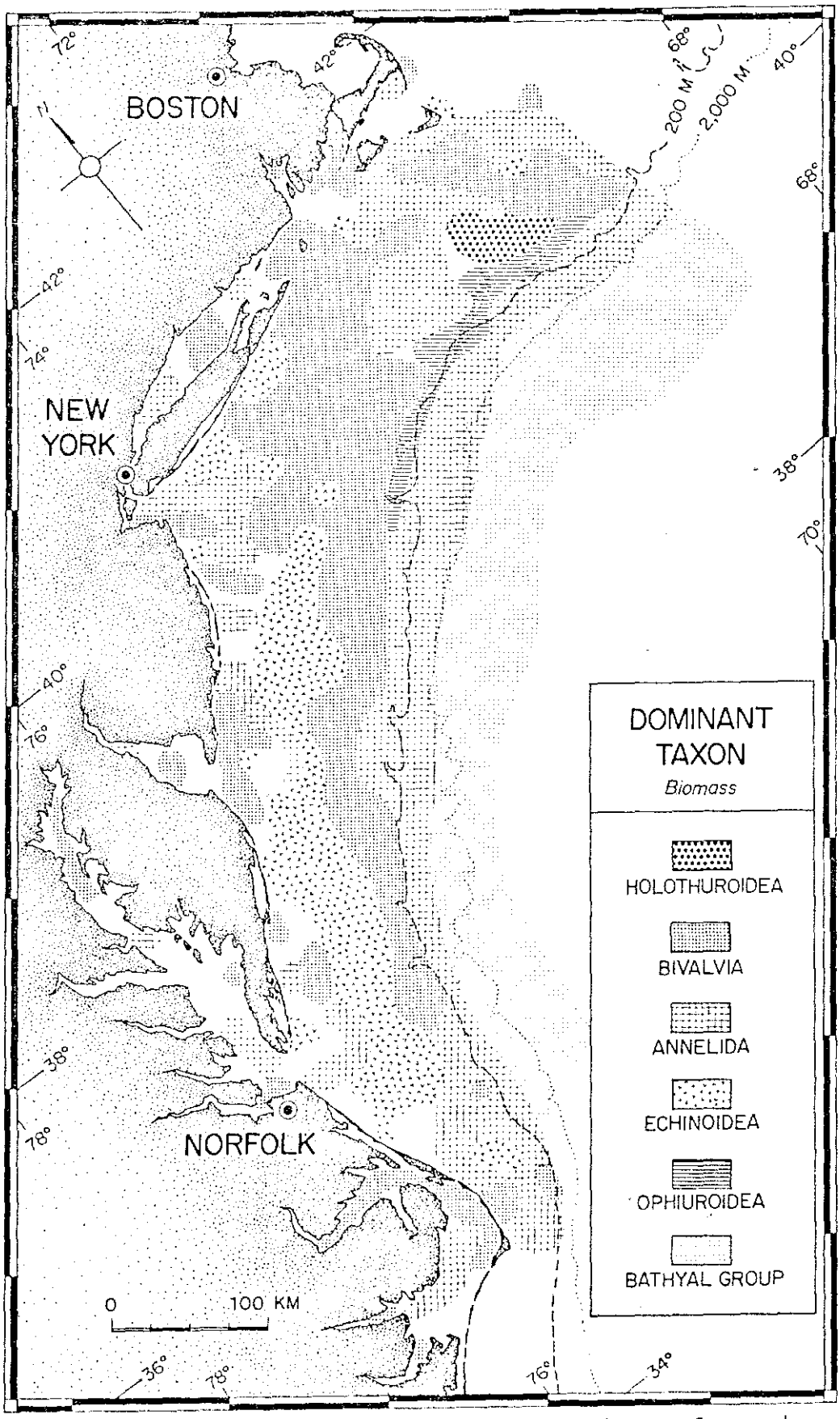


Figure 124.--Geographic distribution of the biomass for each dominant taxon in the entire Middle Atlantic Bight Region.

prominent in Southern New England and New York Bight. Even in Chesapeake Bight, Crustacea was the most widespread group but was not overwhelmingly important as it was in the two northern subareas. Annelida was dominant in moderate-size areas throughout the Middle Atlantic Bight Region. Bivalvia and Echinoidea were dominant mainly in New York Bight and Chesapeake Bight. Ophiuroidea was the principal component only in the outer-shelf area in Southern New England and northern New York Bight.

In biomass (fig. 124) the distributional pattern of dominants was strikingly different from that described above for 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 portion. Ophiuroidea dominated only in a small area along the outer 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 fauna on the continental slope in Southern New England and New York Bight was dominated by Bivalvia and Annelida, in about equal portions of the areas (fig. 123). Farther south in Chesapeake Bight, the Bathyal Group was dominant in the deeper part

of the slope. The Bathyal Group together with Bivalvia and Annelida constituted the major components in this subarea.

In terms of biomass the dominant taxa were Annelida, particularly along the upper slope, and the Bathyal Group, which was especially widespread on the lower slope (fig. 124).

CONTINENTAL RISE

Dominant taxa on the continental rise were limited to three major groups: Bivalvia, Annelida, and the Bathyal Group.

In terms of 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 portions of the rise.

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APPENDIX

Appendix Table A-1.--Number of samples within each depth range class in each subarea and for the entire Middle Atlantic Bight Region.

Depth range	Subarea			Entire region
	Southern New England	New York Bight	Chesapeake Bight	
m	No.	No.	No.	No.
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

Appendix Table A-2.--Number of samples for each bottom sediment type in each subarea and for the entire Middle Atlantic Bight Region.

Bottom sediments	Subarea			Entire region
	Southern New England	New York Bight	Chesapeake Bight	
	No.	No.	No.	No.
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

Appendix Table A-3.--Number of samples for each class of sediment organic carbon in each subarea and for the entire Middle Atlantic Bight Region.

Organic carbon	Subarea			Entire region
	Southern New England	New York Bight	Chesapeake Bight	
%	No.	No.	No.	No.
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

Appendix Table A-4.--Number of samples within each water temperature range class in each subarea and for the entire Middle Atlantic Bight Region.

Temperature range	Subarea			Entire region
	Southern New England	New York Bight	Chesapeake Bight	
°C	No.	No.	No.	No.
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