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.

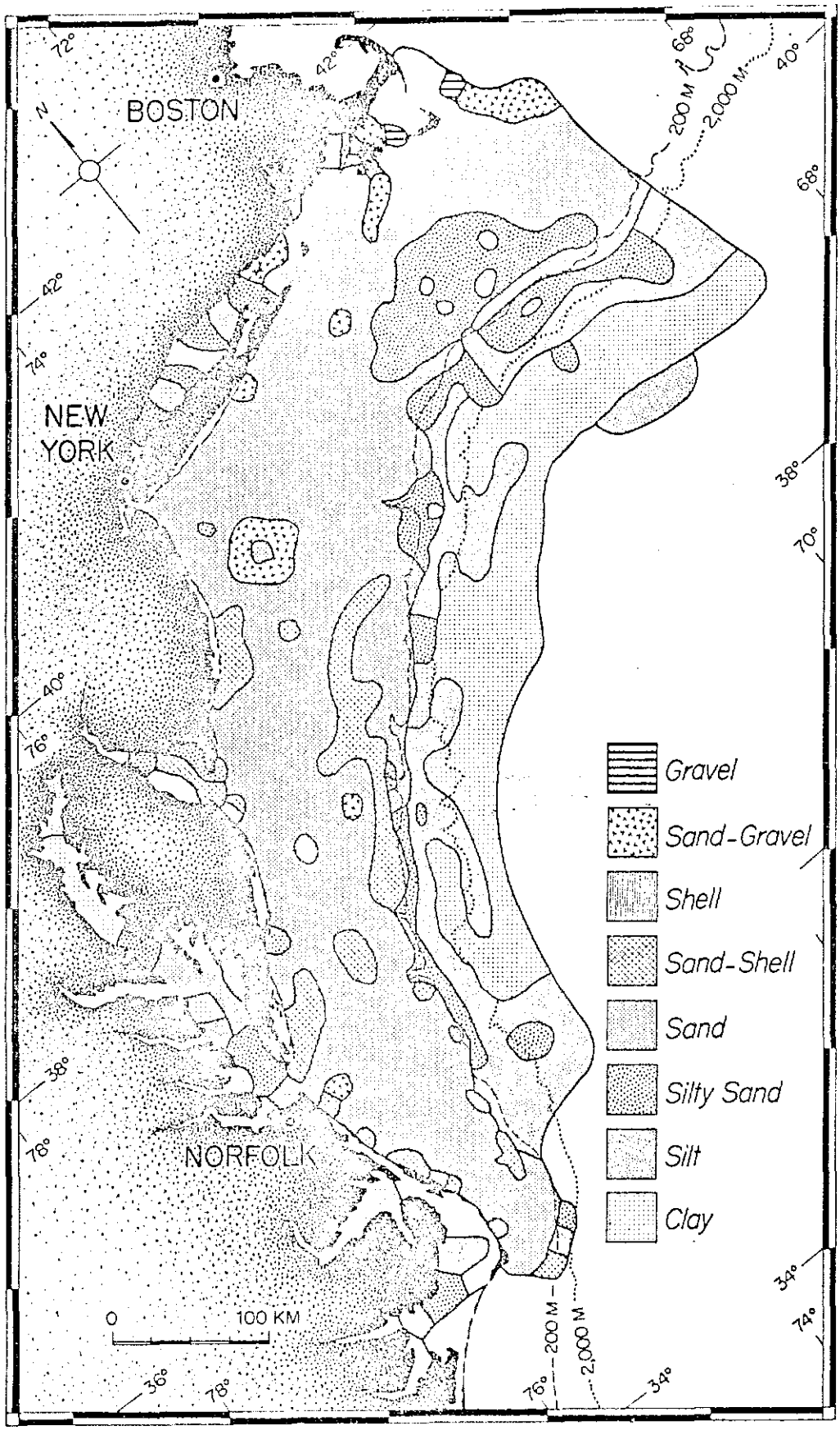

Figure 88.--Geographic distribution of bottom sediment types in the Middle Atlantic Bight Region.

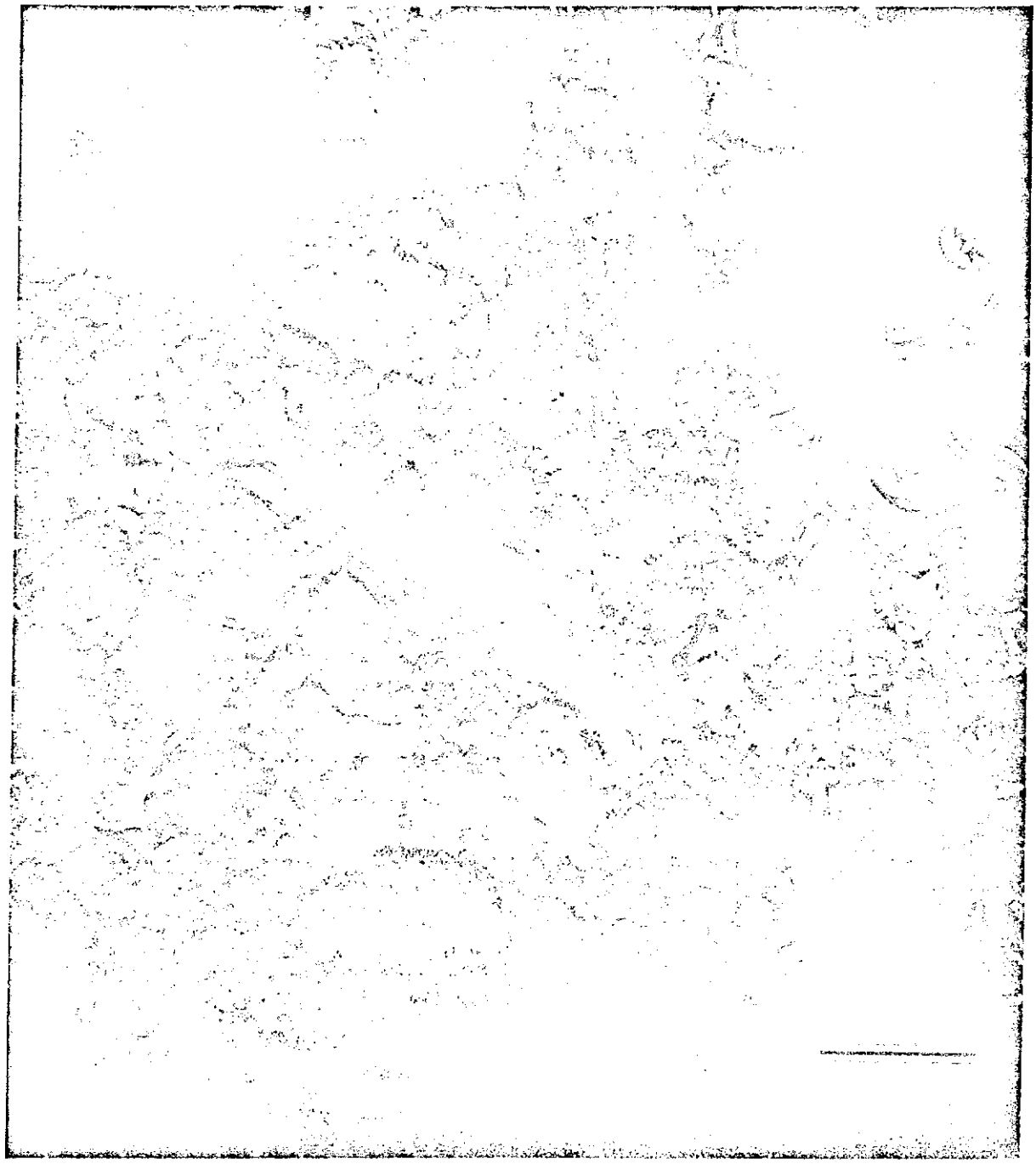

Figure 89.--Gravel bottom at a depth of 23 m in the Nantucket Shoals region, south of Cape Cod, Massachusetts. The most common gravels range in diameter from 5 to 15 cm. Camera tripping-weight is visible in the upper right-hand corner. Photograph was taken at Station 1103, located at 41°11' N. lat.,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

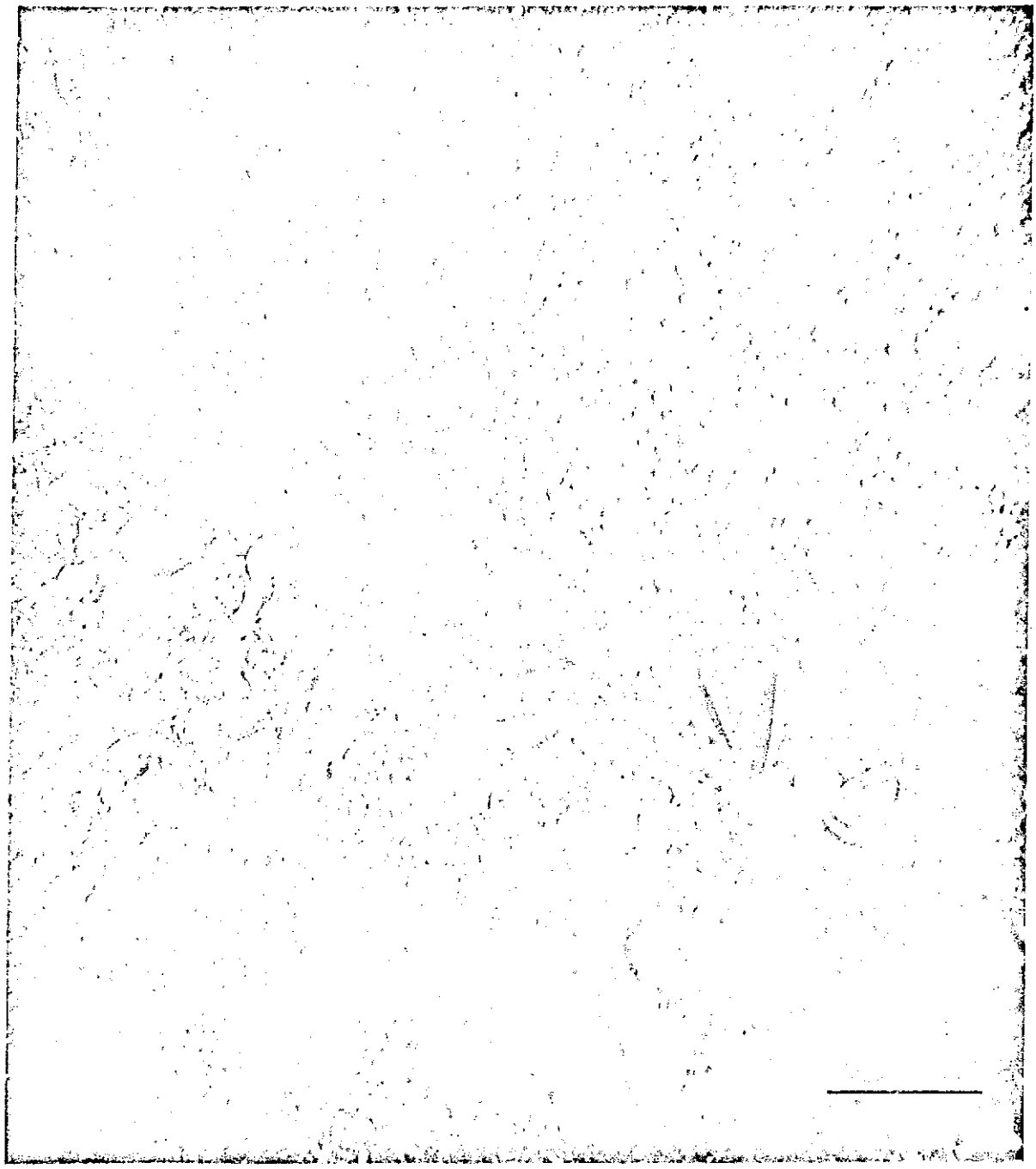

Figure 90.--Sand bottom with a small proportion of shell, located on the continental shelf northeast of Cape Charles, Virginia, at a depth of 48 m. Shell remains are mainly bivalve mollusks with a small proportion of echinoid tests and spines. Photograph was taken at Station 1421, located at 37°30' N.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

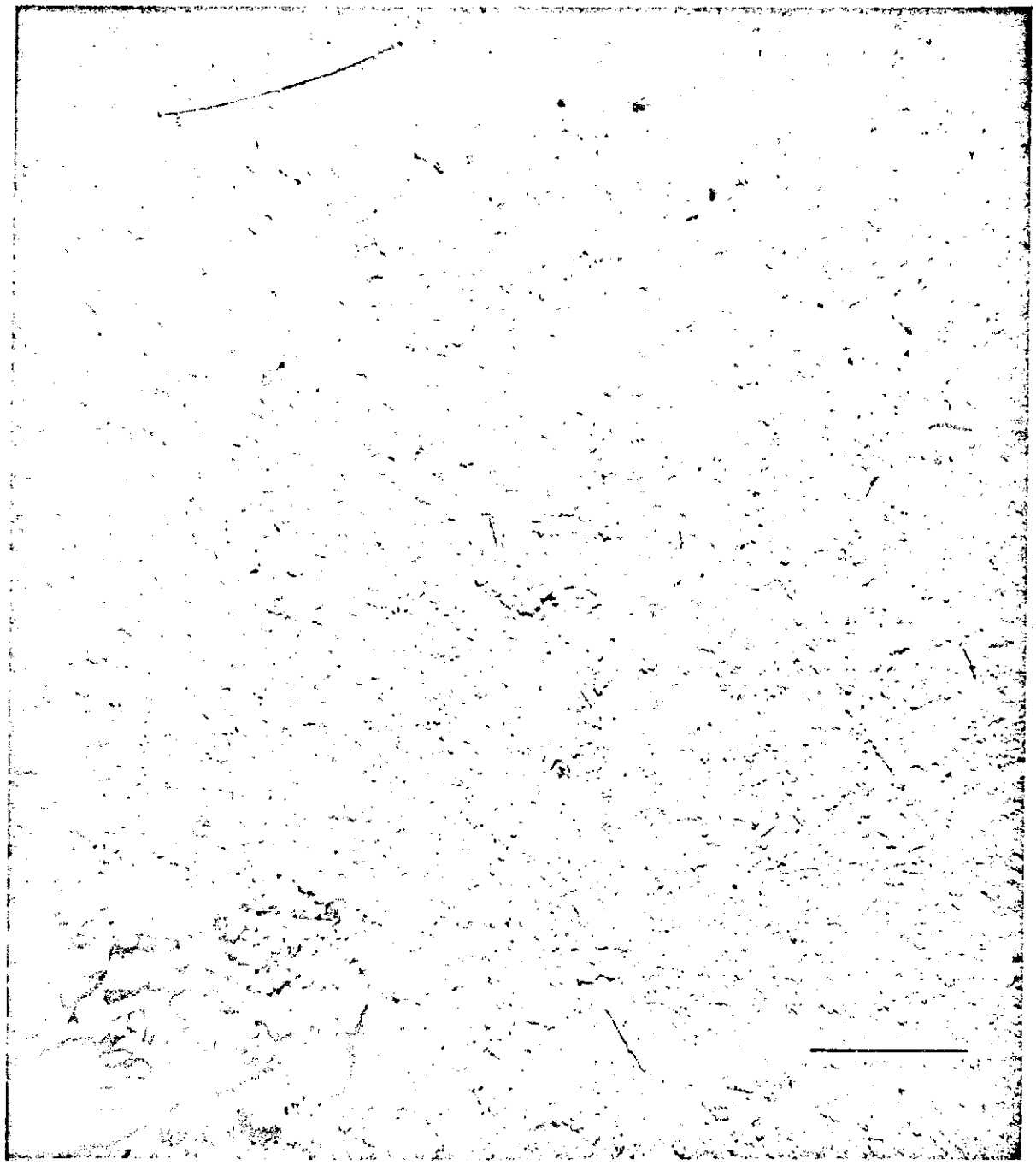

Figure 91.--Silty sand bottom at a depth of 406 m on the continental slope east of New Jersey. In the upper left is a sodastraw worm tube (Hyalinoecia tubicola); in the lower left is the camera tripping-weight; and the tips of brittlestar arms and numerous animal tracks are evident in other sections.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

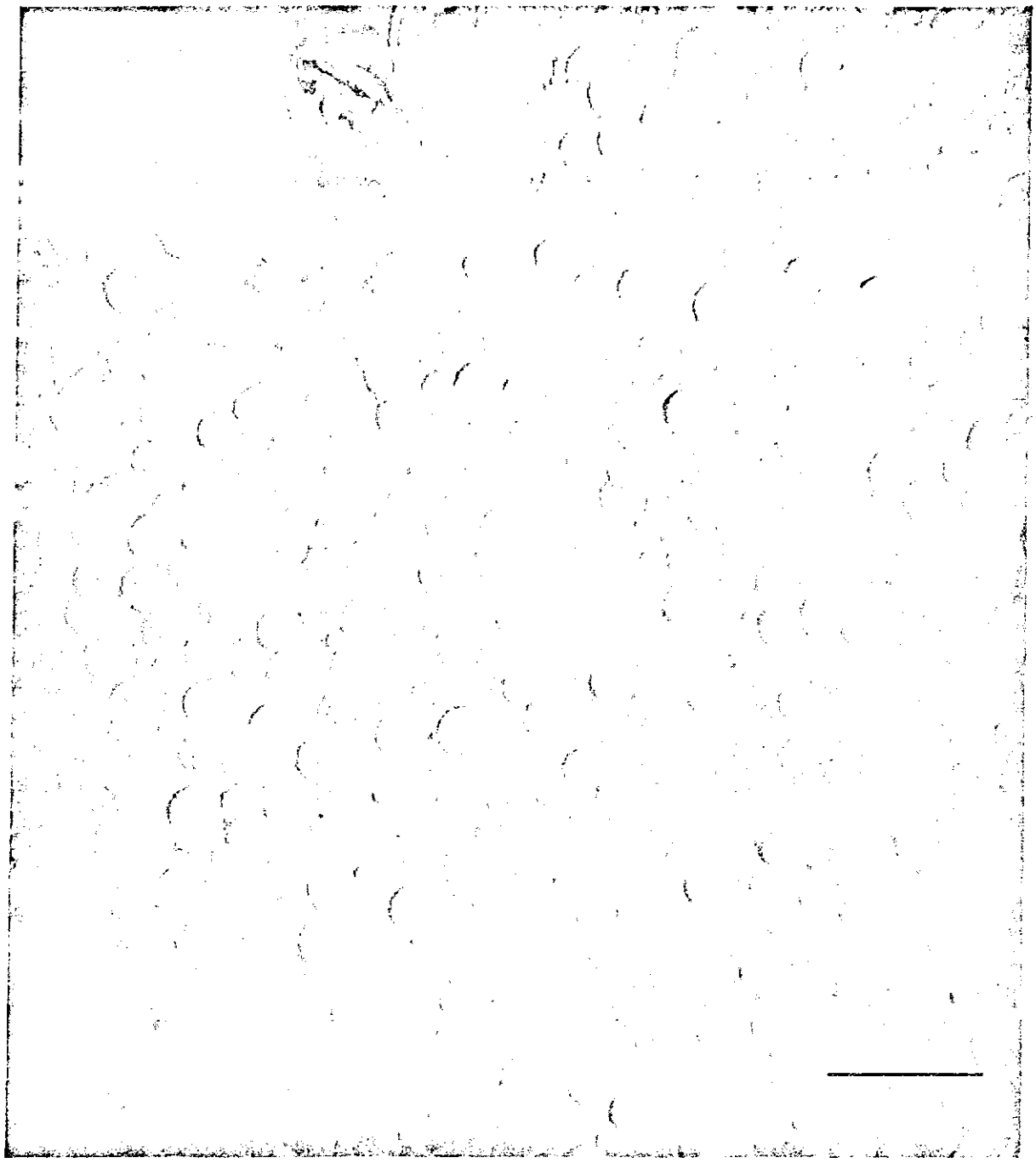

Figure 92.--Sand bottom inhabited by a dense assemblage of sand dollars (Echinarachnius parma) at a depth of 48 m near mid-shelf east of Delaware. Size of the sand dollars is 2 to 3 cm in diameter. Photograph was taken at Station 1418, located at 37°59' N. lat., 74°29' W. long. Scale bar is 10 cm.

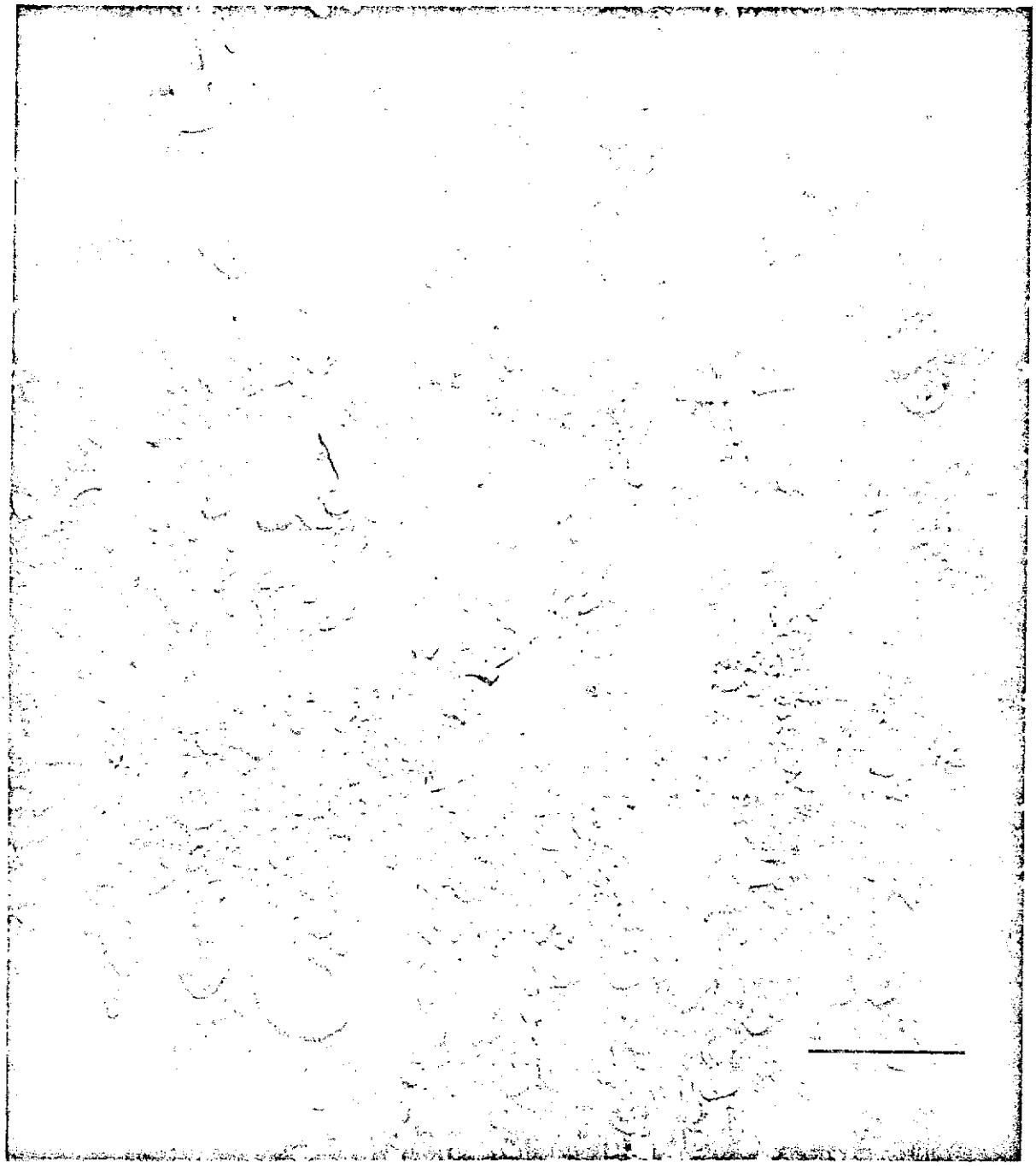

Figure 93.--Sand-shell bottom at a depth of 69 m near the outer continental shelf northeast of Cape May, New Jersey. The starfish is Astropecten; the shell remains are Placopecten, Arctica, and Astarte. Photograph was taken at Station 1360, located at 38°40' N. lat., 73°30' W. long. Scale bar is 10 cm.

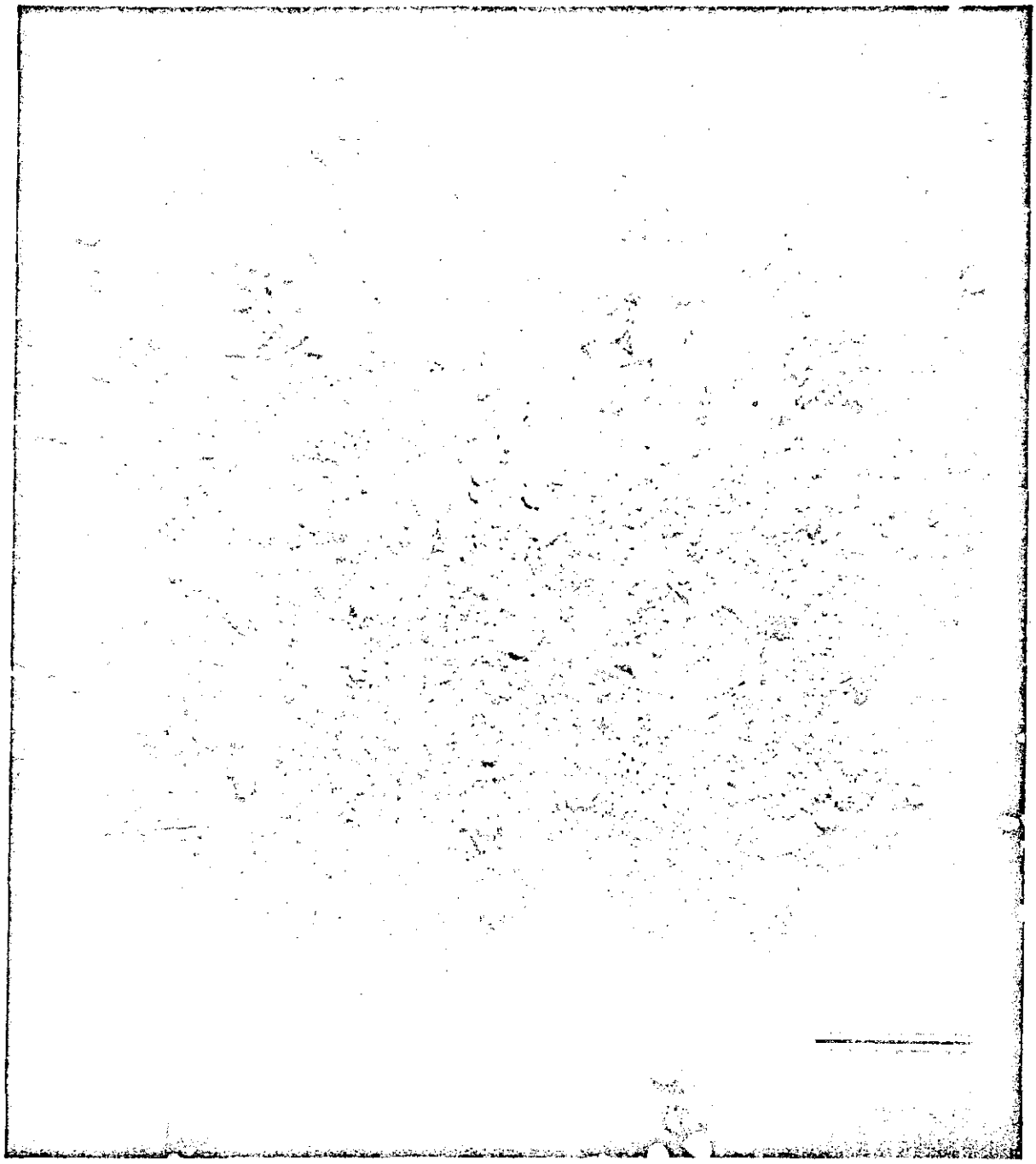

Figure 94.--Silty sand bottom at a depth of 178 m on the outer continental shelf near Hudson Canyon, southeast of New York City. Dominant animals are sea anemones (Zoantharia). Bivalve shells and polychaete tubes are moderately common. Photograph was taken at Station 1324, located at 39°20' N. lat.,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

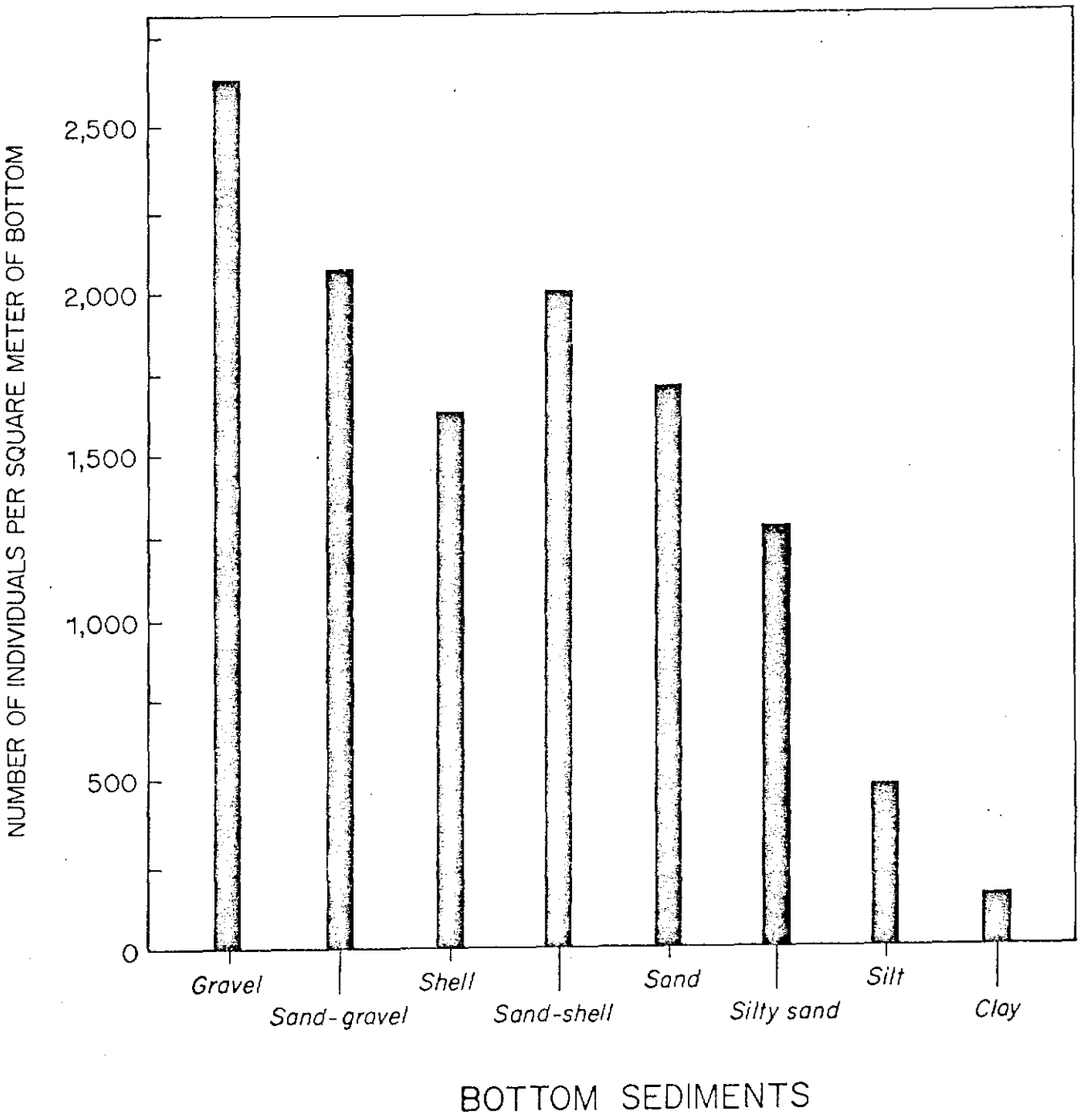

Figure 95.--Relation between number of individuals and bottom sediment types. Values represent all taxonomic groups combined for the entire Middle Atlantic Bight Region.

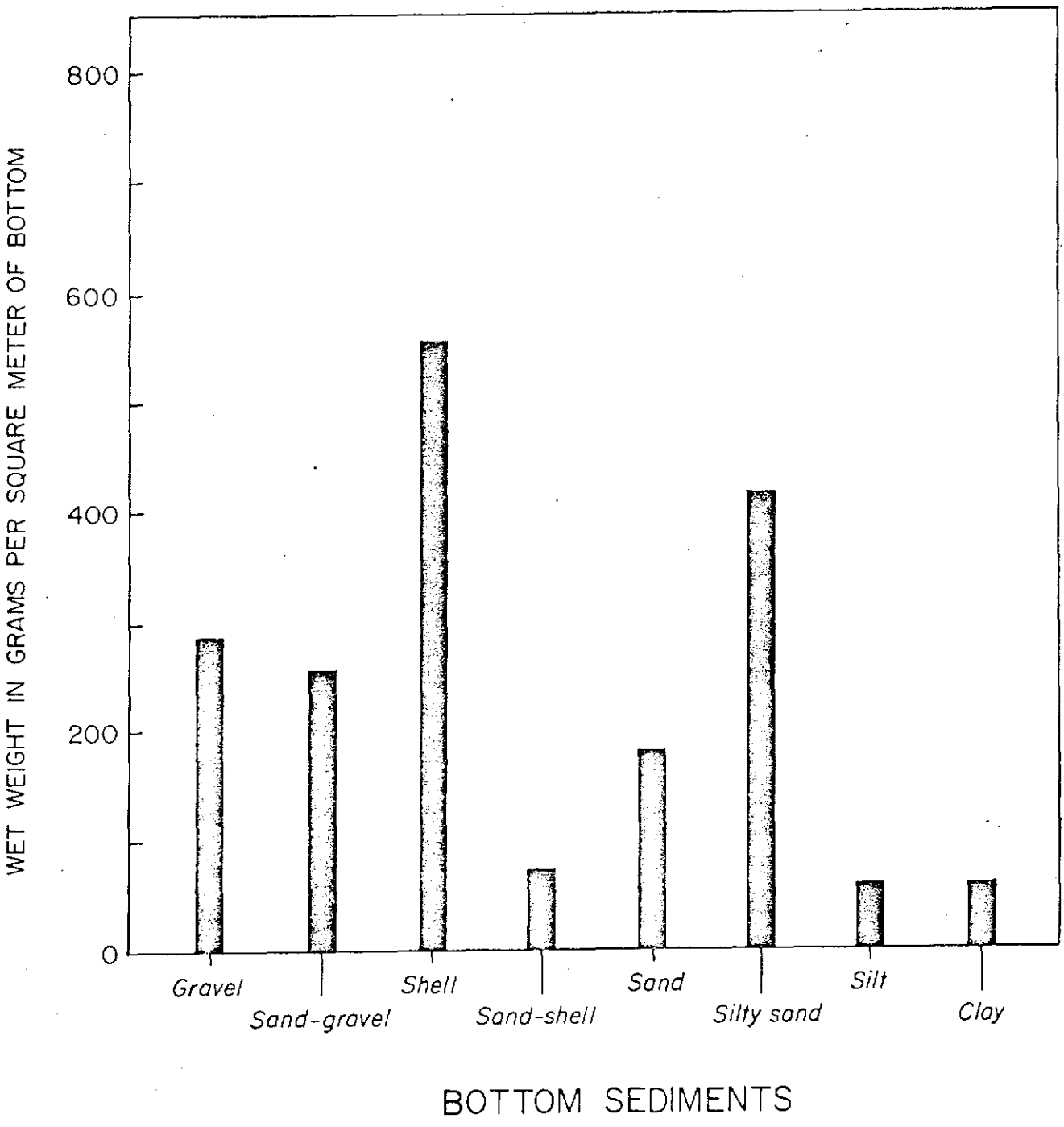

Figure 96.--Relation between biomass and bottom sediment types. Values represent all taxonomic groups combined for the entire Middle Atlantic Bight Region.

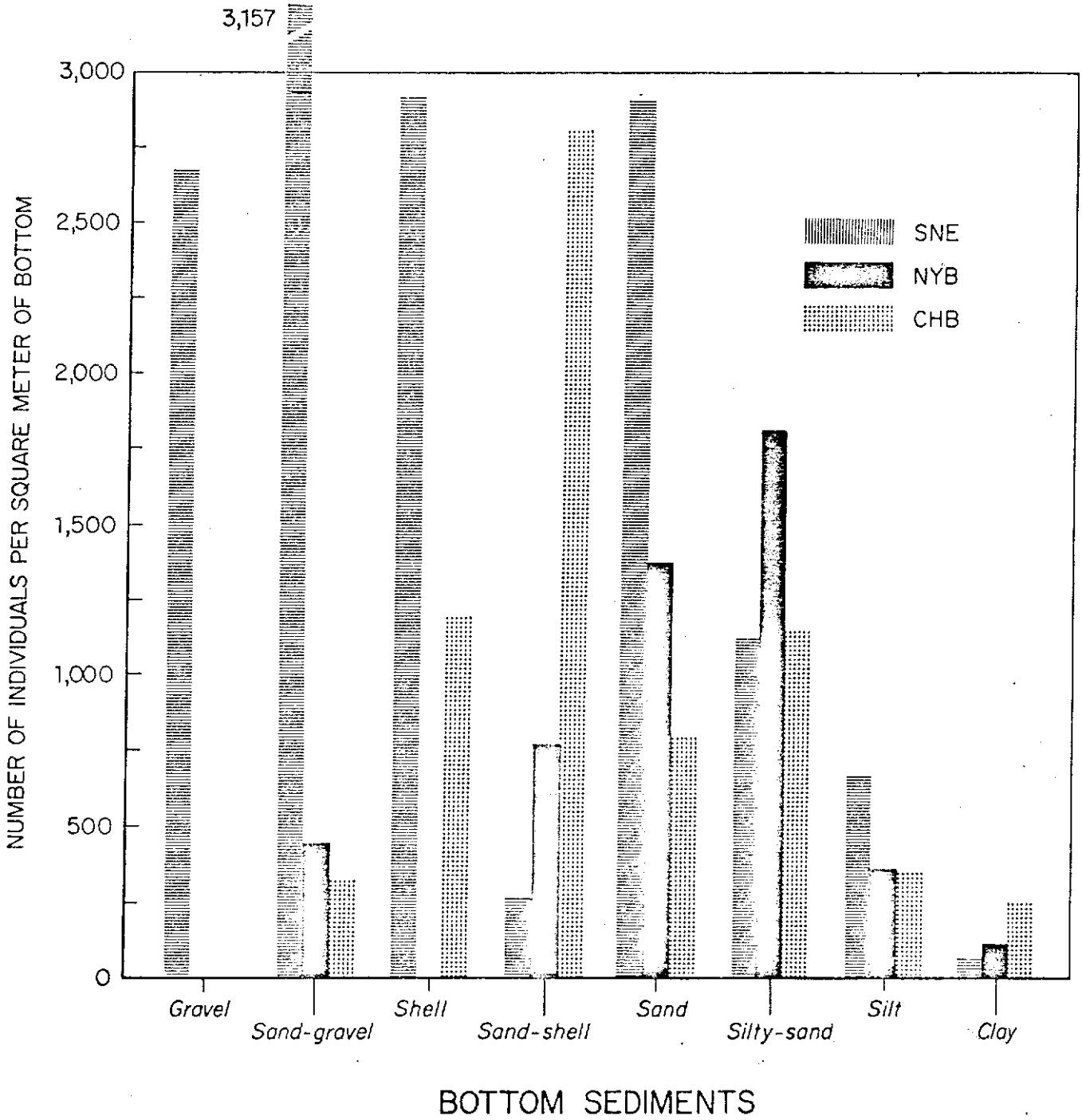

Figure 97.--Relation between number of individuals and bottom sediment types. Values represent all taxonomic groups combined for each subarea.

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.

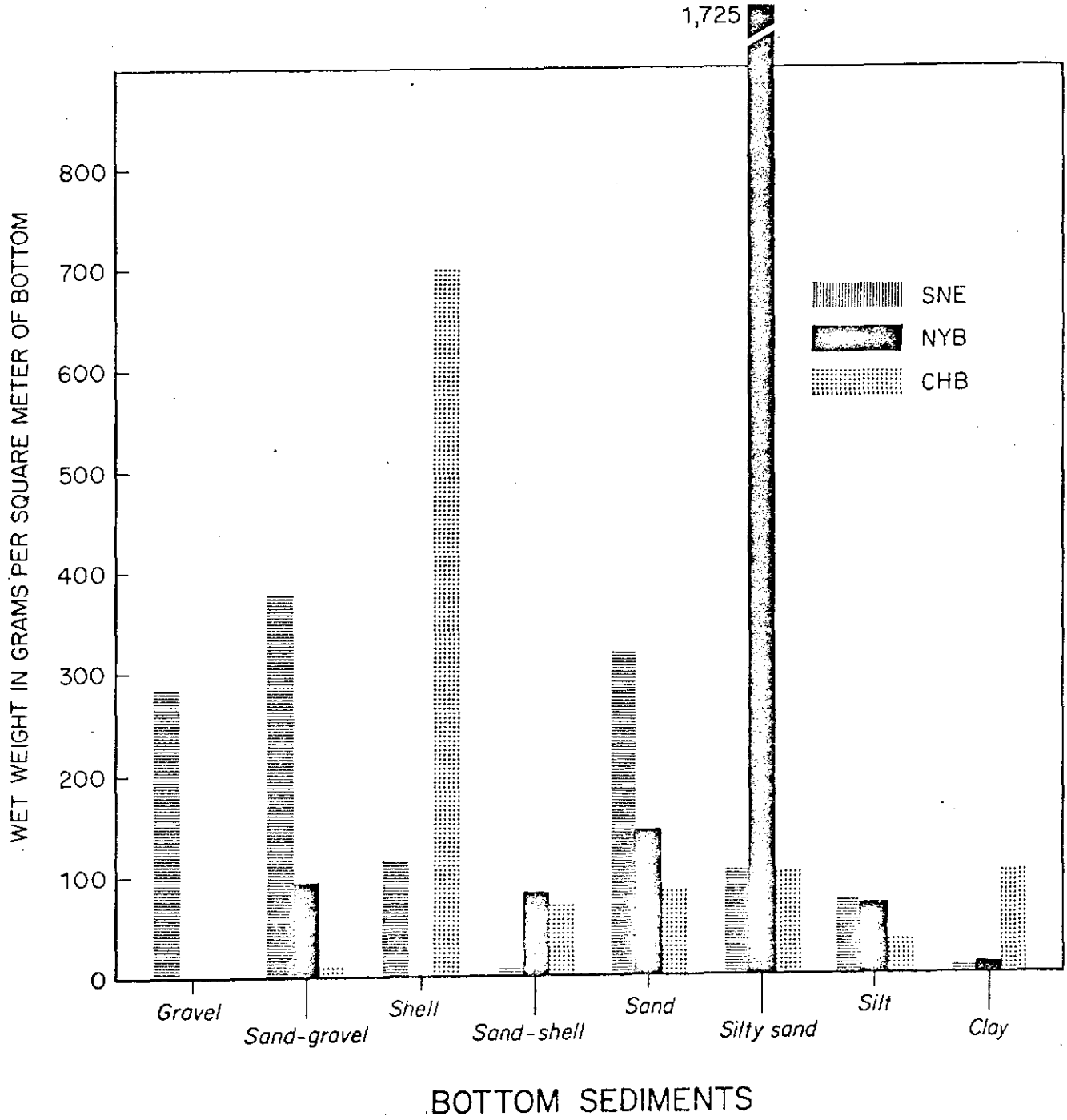

Figure 98.--Relation between biomass (wet weight) and bottom sediment types. Values represent all taxonomic groups combined for each subarea.

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/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2
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	0.093	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.

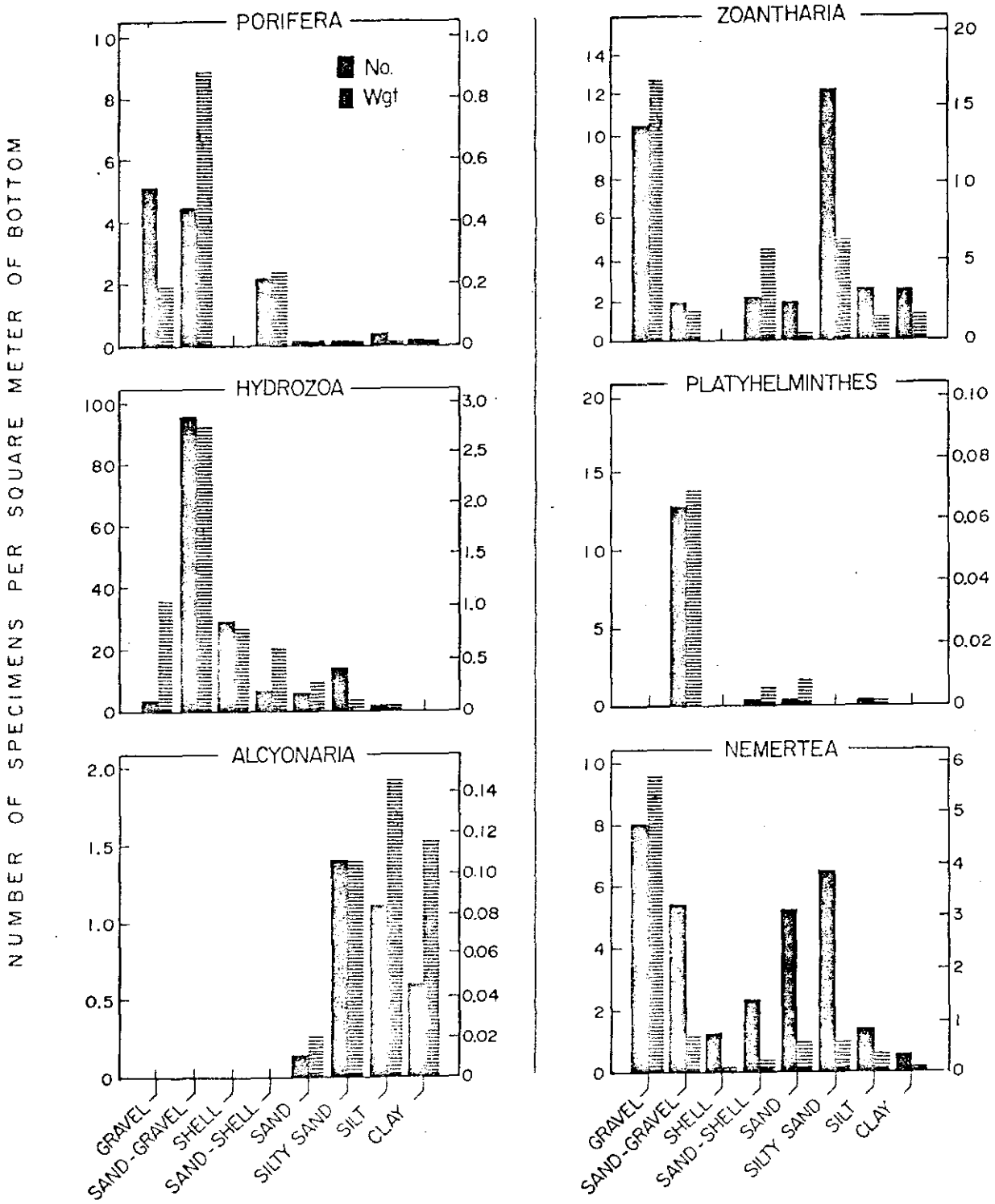

Figure 99.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Porifera, Hydrozoa, Alcyonaria, Zoantharia, Platyhelminthes, and Nemertea.

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

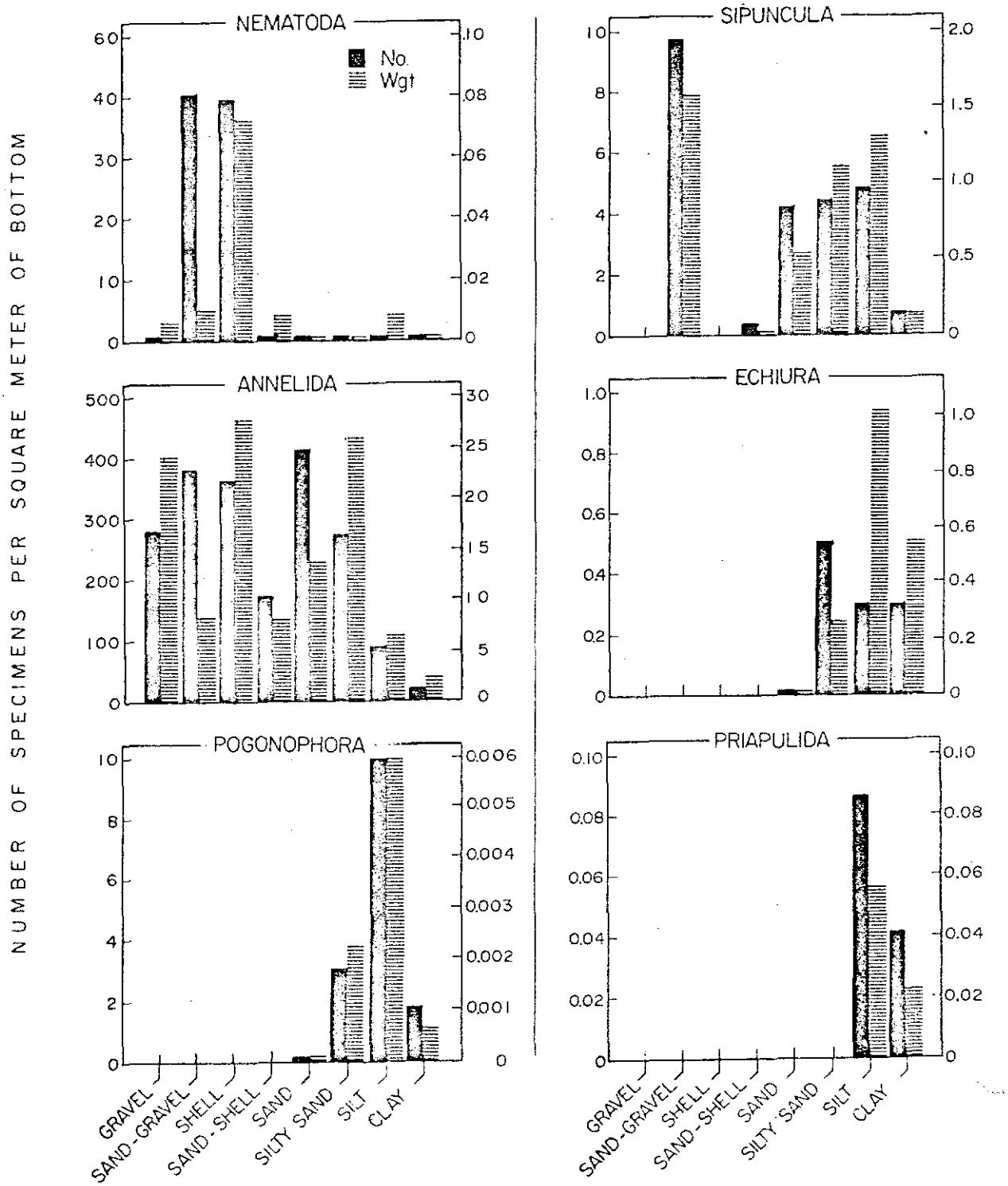

Figure 100.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Nematoda, Annelida, Pogonophora, Sipuncula, Echiura, and Priapulida.

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.

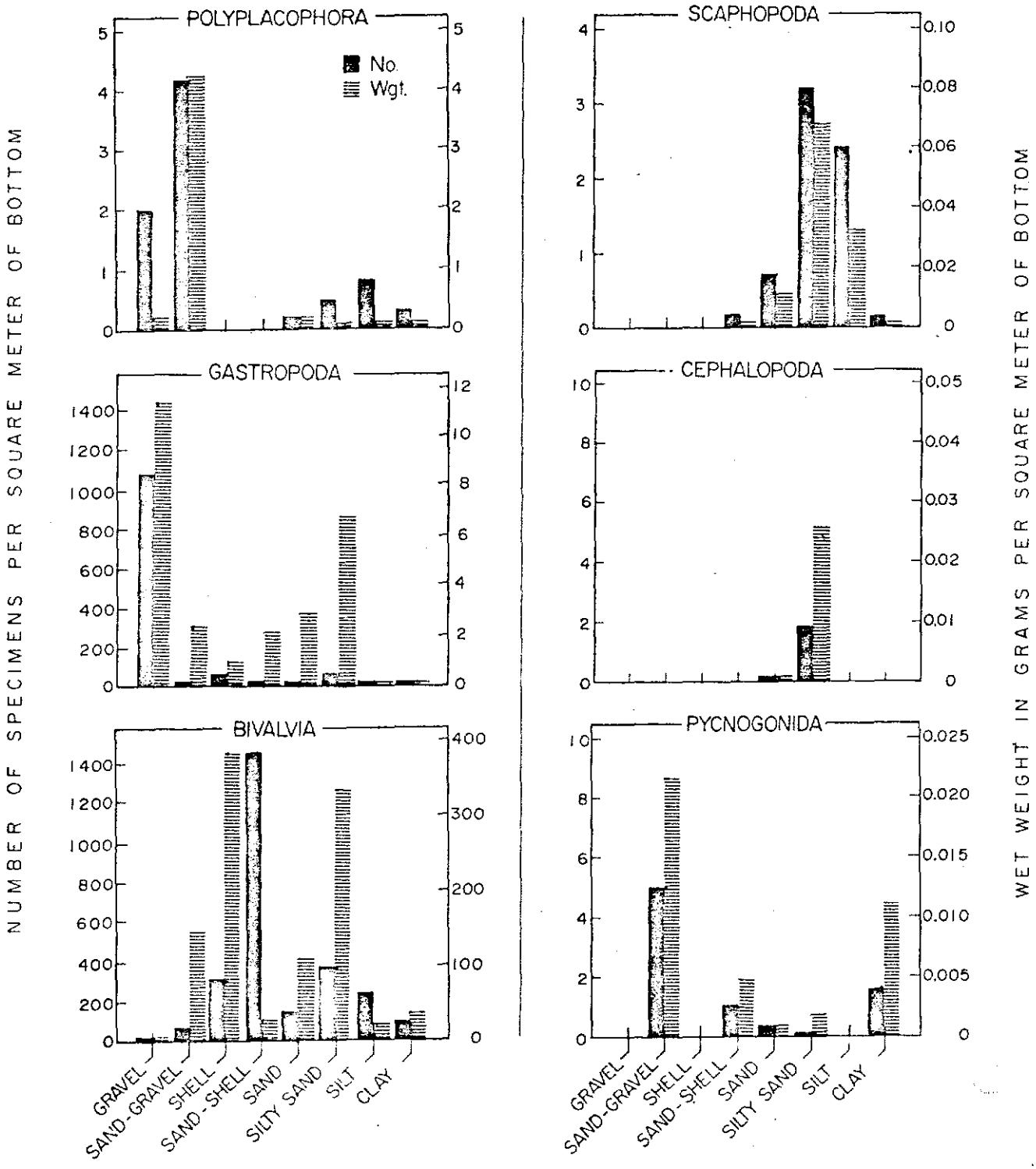

Figure 101.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Cephalopoda, and Pycnogonida.

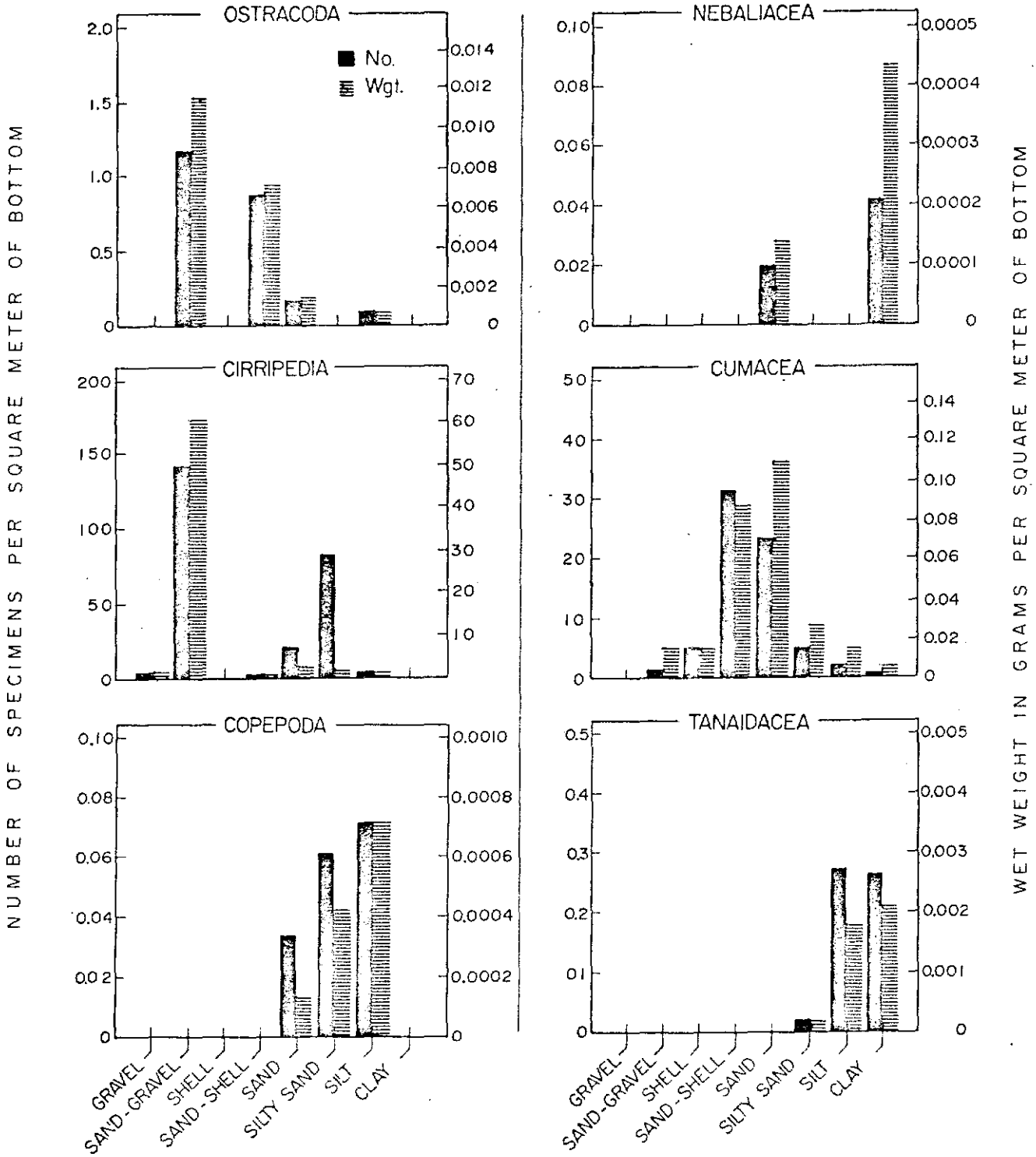

Figure 102.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Ostracoda, Cirripedia, Copepoda, Nebaliacea, Cumacea, and Tanaidacea.

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

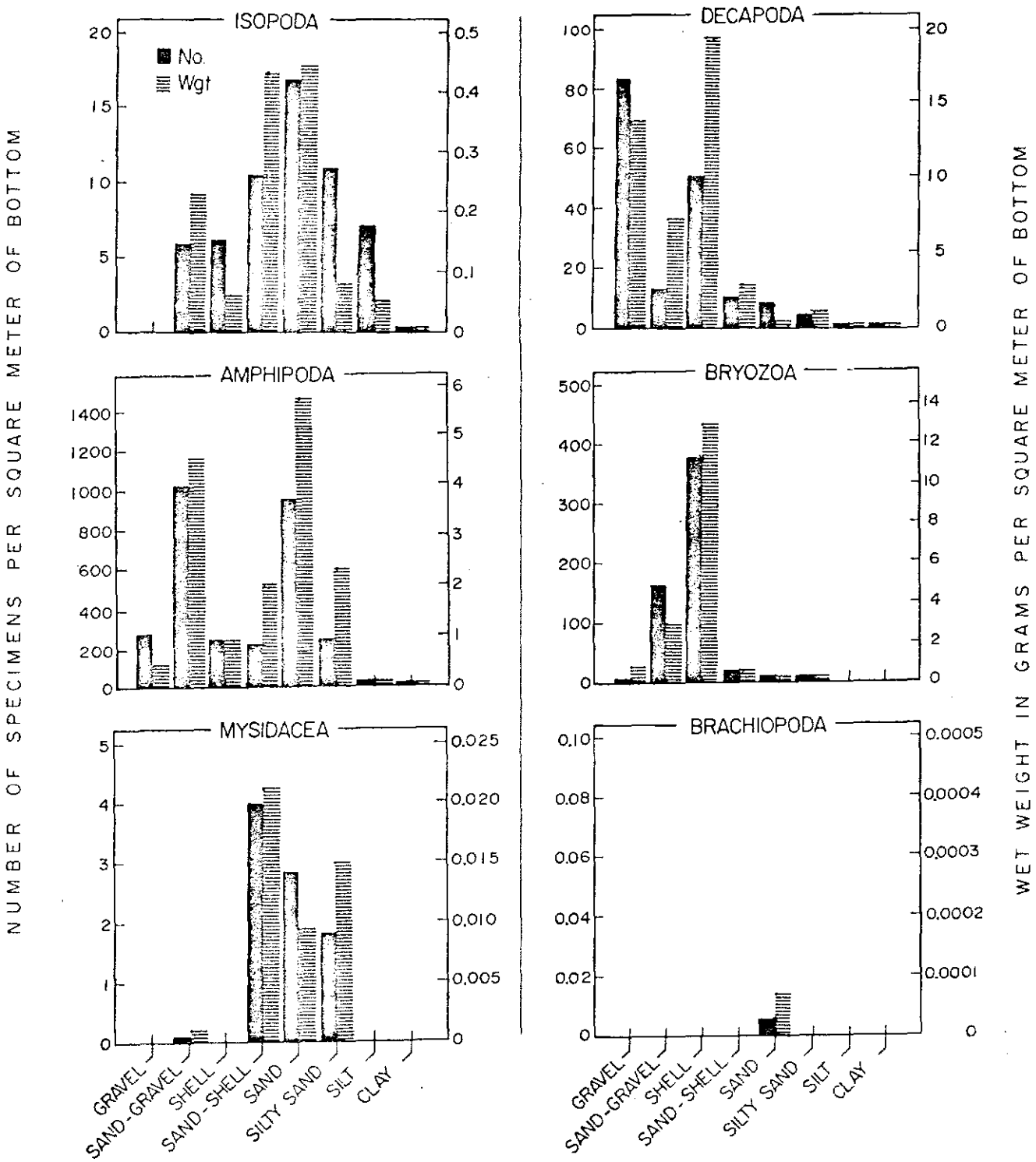

Figure 103.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Isopoda, Amphipoda, Mysidacea, Decapoda, Bryozoa, and Brachiopoda.

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.

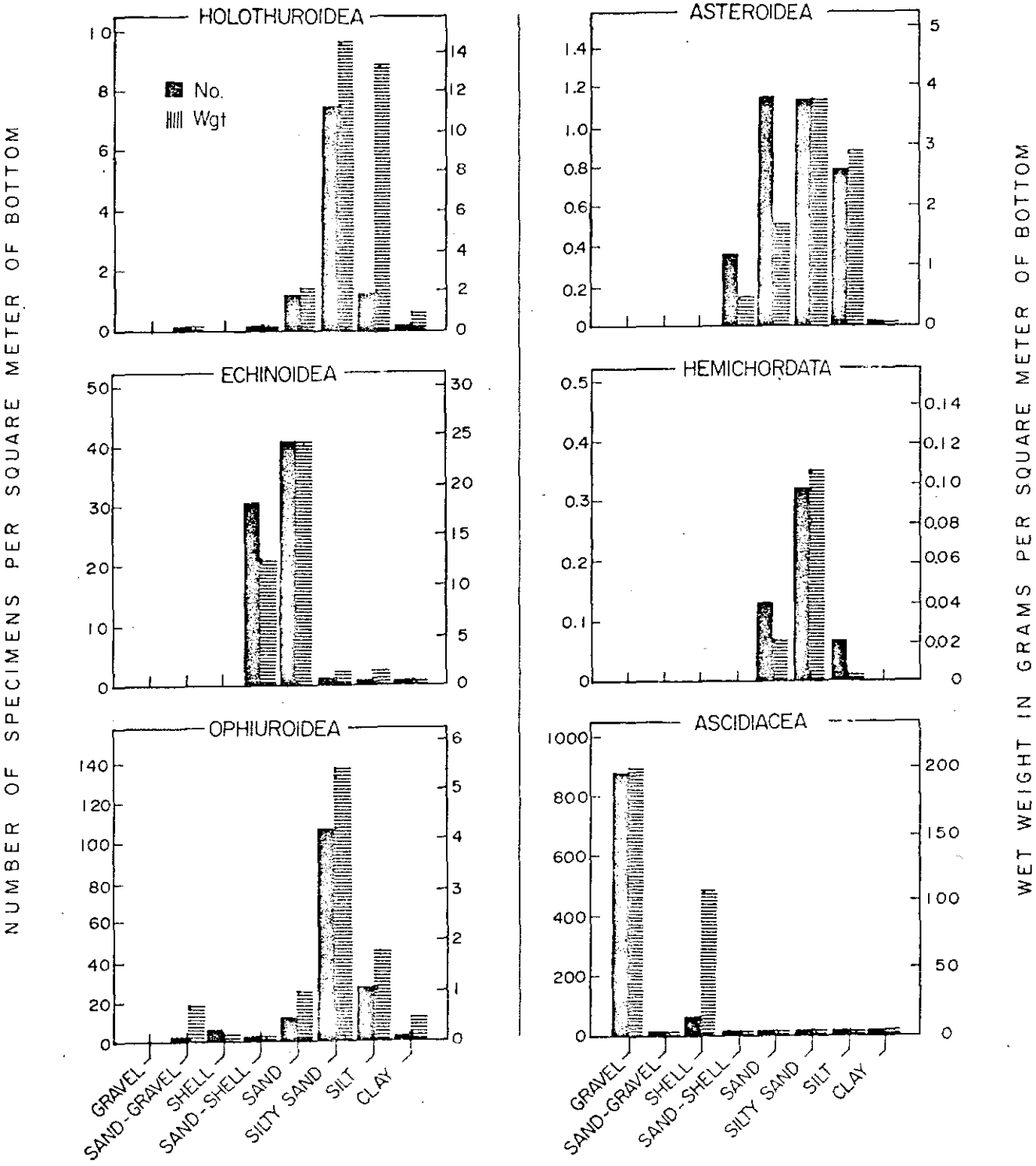

Figure 104.--Density (solid bar) and biomass (striped bar) in relation to bottom sediments in the entire Middle Atlantic Bight Region for: Holothuroidea, Echinoidea, Ophiuroidea, Asteroidea, Hemichordata, and Ascidiacea.

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/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2
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/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2
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	1640.054	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/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2	g/m^2
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.