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

Taxonomic group	Bathymetric class (meters)							
	0-24	25-49	50-99	100-199	200-499	500-999	1,000-1,999	2,000-3,999
	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²	No./m²
PORIFERA	0.82	0.17	-	-	-	-	0.15	-
COELENTERATA	10.67	14.25	11.47	154.66	18.33	1.70	6.07	1.63
Hydrozoa	1.80	11.81	9.27	154.00	13.00	-	-	-
Anthozoa	8.87	2.44	2.20	0.66	5.33	1.70	6.07	1.63
Alcyonacea	0.02	-	-	-	-	-	0.92	1.13
Zoantharia	3.89	1.15	0.27	0.33	-	-	-	-
Unidentified	4.96	1.29	1.93	0.33	5.33	1.70	5.15	0.50
PLATYHELMINTHES	0.50	0.29	1.27	-	-	-	-	-
Turbellaria	0.50	0.29	1.27	-	-	-	-	-
NEMERTEA	7.32	4.13	4.13	1.83	2.17	1.00	1.38	-
ASCHELMINTHES	2.35	1.50	-	-	0.33	2.00	0.69	1.38
Nematoda	2.35	1.50	-	-	0.33	2.00	0.69	1.38
ANNELIDA	182.73	236.48	132.73	102.83	84.00	39.40	15.00	3.63
POGONOPHORA	-	1.42	0.40	-	15.33	38.20	8.46	3.00
SIPUNCULIDA	0.02	0.04	1.33	-	1.67	2.10	3.08	2.13
ECHIURA	0.25	0.04	-	-	-	-	0.15	1.25
PRIAPULIDA	-	-	-	-	-	-	0.13	-
MOLLUSCA	1232.94	52.00	319.53	492.50	122.49	293.30	33.47	8.88
Polyplacophora	0.13	-	-	-	0.33	1.30	1.31	0.25
Gastropoda	96.82	5.52	1.40	3.00	5.33	13.60	1.54	1.63
Bivalvia	1135.99	44.54	316.93	487.50	112.33	270.30	29.54	7.00
Scaphopoda	-	1.94	1.20	2.00	4.50	8.10	1.08	-
Cephalopoda	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-
ARTHROPODA	247.89	358.40	293.80	86.99	74.83	5.40	1.15	2.00
Pycnogonida	1.96	0.42	0.93	0.33	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-
Crustacea	245.93	357.98	292.87	86.66	74.83	5.40	1.15	2.00
Ostracoda	0.02	0.04	-	-	-	-	-	0.75
Cirripedia	0.31	0.19	-	-	-	-	-	-
Copepoda	-	-	-	-	-	-	-	-
Nebaliacea	-	-	0.40	-	-	-	-	-
Cumacea	2.26	27.50	23.13	5.50	11.50	0.60	0.15	-
Tanaidacea	-	-	-	-	-	-	-	1.00
Isopoda	29.48	11.35	6.47	2.00	0.33	0.40	0.15	0.25
Amphipoda	198.23	312.90	259.67	78.83	62.67	4.20	0.85	-
Mysidacea	8.65	0.06	-	-	-	-	-	-
Decapoda	6.98	5.94	3.20	0.33	0.33	0.20	-	-
BRYOZOA	8.55	2.31	13.73	-	-	-	-	-
BRACHIOPODA	-	-	0.13	-	-	-	-	-
ECHINODERMATA	16.45	45.98	11.74	129.67	18.83	2.70	2.15	6.88
Holothuroidea	0.04	0.31	0.27	3.33	14.83	1.10	0.46	0.50
Echinoidea	15.63	45.04	9.53	-	-	-	-	-
Ophiuroidea	0.73	0.48	1.67	125.67	3.67	1.20	1.23	6.13
Asteroidea	0.05	0.15	0.27	0.67	0.33	0.40	0.46	0.25
HEMICHORDATA	0.13	-	-	-	-	-	-	-
CHORDATA	13.87	0.79	3.33	-	-	-	0.85	2.00
Ascidiacea	13.87	0.79	3.33	-	-	-	0.85	2.00
UNIDENTIFIED	17.01	4.21	1.27	0.67	12.00	1.10	2.31	7.38

(1,000–3,999 m) and at middepths (200–499 m). Biomass, also, was small at all localities (0.003 to 0.006 g/m²), and no geographic differences were apparent.

Isopoda were distributed in the same bathymetric pattern and at roughly equal densities in all subareas. In each subarea, the high densities, which ranged from 22/m² to 36/m², were found in shallow water (0–49 m); intermediate densities at middepths (50–999 m); and low densities, 0.3/m² to 0.2/m², were found in deep water (1,000 m or deeper). Biomass was small (maximum bathymetric class aver-

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

[In grams per square meter]

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

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

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

Mysidacea, although incompletely sampled, revealed the same trend of decreasing density as water depth increased in all three subareas. They were taken only at depths less than 500 m, but were most common at depths from 0 to 24 m, where their average density ranged from 3.6/m² to 8.6/m². In water

depths greater than 25 m, their average density ranged from 0.25/m² to 0.4/m². Biomass was small (maximum bathymetric class average 0.04 g/m²) in all subareas.

Decapoda revealed a bathymetric distribution pattern that was similar in each subarea. They were regularly taken at depths from 0 to 200 m, but only occasionally at greater depths. The density of decapods was about the same (8/m²) in Southern New England and New York Bight, but substantially lower (3/m²) in Chesapeake Bight. Biomass was largest (1.6 g/m²) in New York Bight, intermediate (1.1 g/m²) in Southern New England, and smallest (0.8 g/m²) in Chesapeake Bight. The trends of density and biomass in relation to water depth were similar in all subareas.

Bryozoa had much the same bathymetric distribution in all subareas. In Southern New England, they were found in each bathymetric class on the Continental Shelf (0–199 m), and in New York Bight and Chesapeake Bight, they were found at depths from 0 to 99 m. Density was much higher in Southern New England (overall average of 39/m²) than in the other subareas, where the average was about 6/m² to 8/m² in each. Biomass was relatively high in Southern New England, where it averaged 1.2 g/m², compared to an average of less than 0.2 g/m² in New York and Chesapeake Bights.

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

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

Holothuroidea were widely distributed bathymetrically as well as geographically. They were present in all depth classes from the shallowest to deepest. The pattern of density distribution in relation to depth was the same in each subarea. Highest density (1/m² to 15/m²) occurred along the Outer Continental Shelf and upper slope and decreased in both shallower and deeper water. The biomass of the holothurians was substantially greater in Southern New England than in the other subareas. On the outer shelf and upper slope off Southern New England, their average biomass ranged between 23 and 51 g/m². In New York Bight, their average biomass was less than 0.7 g/m² at these bathymetric levels. In Chesapeake Bight, their average biomass at all depths was 7 g/m² and was largest (15 to 25 g/m²) at depths between 100 and 500 m. Biomass in very deep water (greater than 1,000 m) averaged about 2 to 3 g/m² in all subareas, whereas in shallow water, 0 to 50 m, the average quantity usually was smaller than 1 g/m².

Echinoidea showed a pronounced decrease in density from shallow to deep water. This relationship between density and water depth was the same in all subareas; however, echinoids were found across the shelf into deep water (at depths greater than 2,000 m) in Southern New England, to moderate depths (500 m) in New York Bight, and to only 99 m in Chesapeake Bight. Average densities were highest (bathymetric class average up to 118/m²) in New York Bight, intermediate in Chesapeake Bight, and slightly lower in Southern New England. Echinoids accounted for a major share of the biomass, especially in New York Bight, where inner shelf quantities averaged 26 g/m² and 66 g/m². In Southern New England, biomass averages on the inner shelf were 4 g/m² and 12 g/m²; and in Chesapeake Bight, were 3 g/m² and 28 g/m².

Ophiuroidea were distributed bathymetrically much the same in each subarea. High density (averages of 123/m² to 350/m²) occurred at middepths, and decreased to densities of less than 1/m² in shallow shelf waters, and to 1/m² to 8/m² in very deep water (greater than 1,000 m). Biomass was largest, averaging up to 22 g/m², in Southern New England; intermediate in New York Bight; and smallest (0.5 to 2.7 g/m²) in Chesapeake Bight. Trends in density and biomass in relation to water depth were the same in all subareas.

Asteroidea had a rather low density and a wide bathymetric range in all subareas. The general relationship between density and water depth was a relatively high density (0.7/m² to 4/m²) at middepths, 25 to 200 m, and low density (0.2/m² to 0.5/m²) in shallower and deeper waters. Overall density was highest in Southern New England, intermediate in New York Bight, and lowest in Chesapeake Bight. Although their density was modest, asteroids constituted a substantial biomass at middepths, which was largest in Southern New England, averaging 2 to 17 g/m²; intermediate in New York Bight, averaging 0.8 to 7 g/m²; and smallest in Chesapeake Bight, averaging 0.1 to 1.2 g/m².

Hemichordata were sparse in all subareas and in all bathymetric classes (a total of 6) in which they were found. Average densities were less than 0.7/m², and average biomasses were less than 0.14 g/m². In Southern New England, their bathymetric range was from 50 to 999 m, whereas in New York Bight and

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

Chordata (Ascidiacea) were widely distributed bathymetrically and geographically. In all three subareas, density was highest on the Continental Shelf, lowest on the Continental Slope, and intermediate on the Continental Rise. Densities were substantially higher (average 32/m²) in Southern New England than in both New York Bight (average 5/m²) and Chesapeake Bight (average 7/m²). Trends in biomass of ascidians were similar to those in density; largest quantities were found in Southern New England (average 5.8 g/m²), smallest in New York Bight (average 0.3 g/m²), and intermediate quantities in Chesapeake Bight (average 2.1 g/m²).

RELATION TO BOTTOM SEDIMENTS

DISTRIBUTION OF SEDIMENT TYPES

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

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

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

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

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

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

TOTAL MACROBENTHIC FAUNA OF ALL TAXONOMIC GROUPS

ENTIRE MIDDLE ATLANTIC BIGHT REGION

The relation of density and biomass of all organisms to bottom sediments in the entire Middle Atlantic Bight region is depicted in figures 95 and 96. Density tended to decrease as particle size decreased (table 21, fig. 95). Average densities ranged from a high of 2,667/m² in gravel to a low of 165/m² in clay. Intermediate values were present in sediment types of intermediate particle sizes. Sand-gravel contained an average of 2,089/m², whereas shell contained 1,639/m². The average density for sand-shell was 2,006/m²; and sand, silty sand, and silt contained an average of 1,716/m², 1,286/m², and 486/m², respectively.

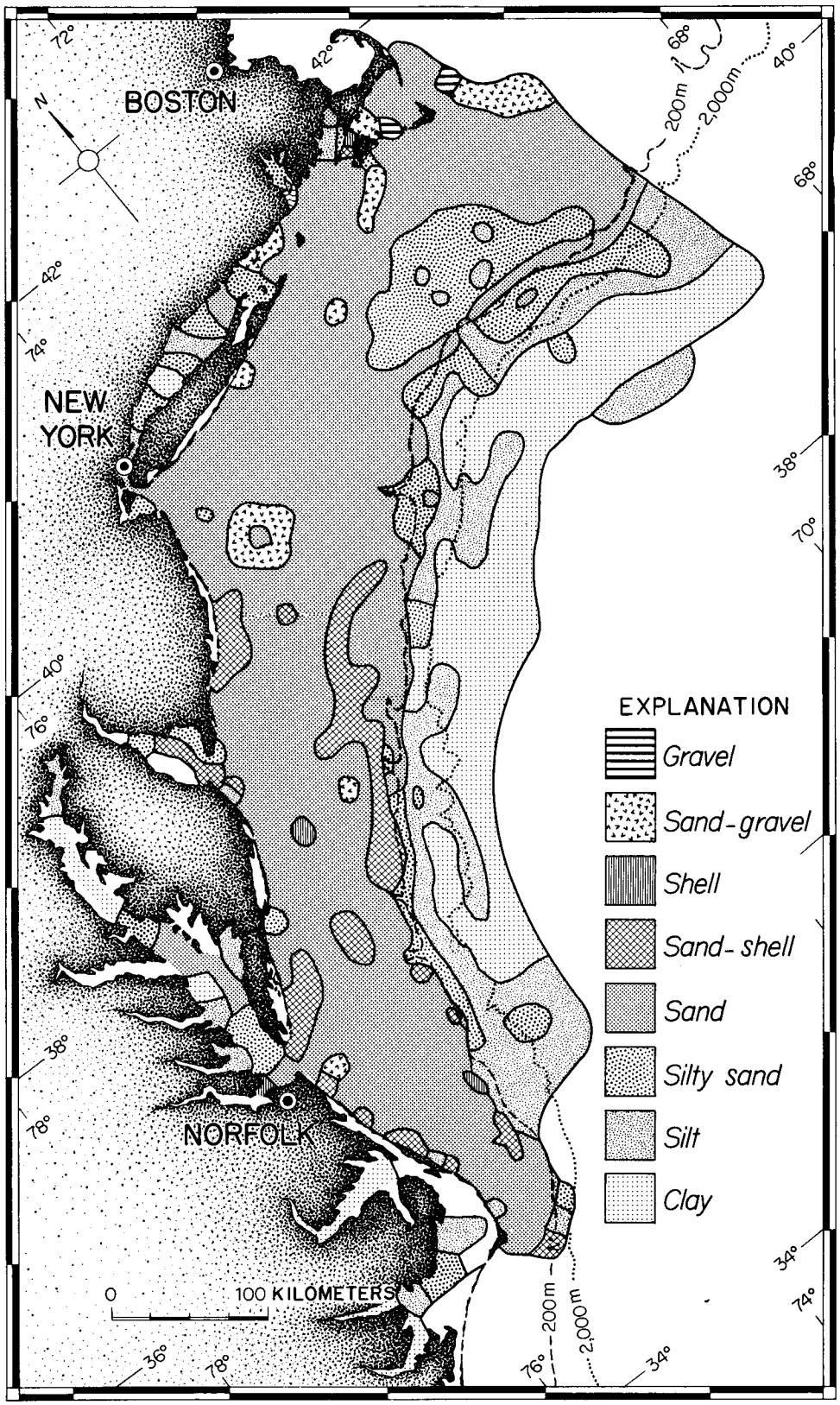

FIGURE 88.—Geographic distribution of bottom-sediment types in the Middle Atlantic Bight region.

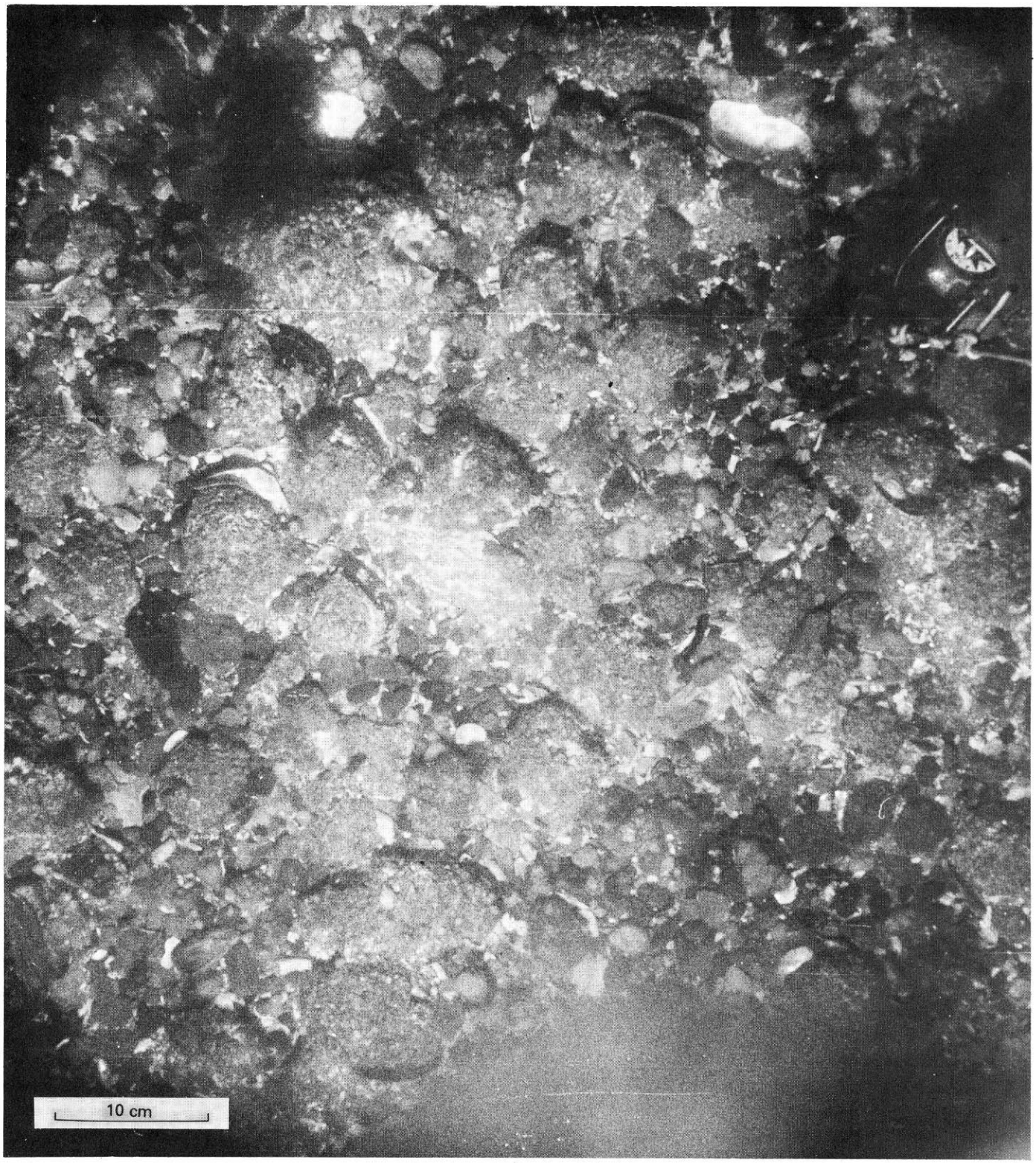

FIGURE 89.—Gravel bottom at a depth of 23 m in the Nantucket Shoals region, south of Cape Cod, Mass. The most common gravels range in diameter from 5 to 15 cm. Camera tripping-weight is visible in the upper right-hand corner. Photograph was taken at station 1103, located at lat. 41°11′ N., long. 69°40′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

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

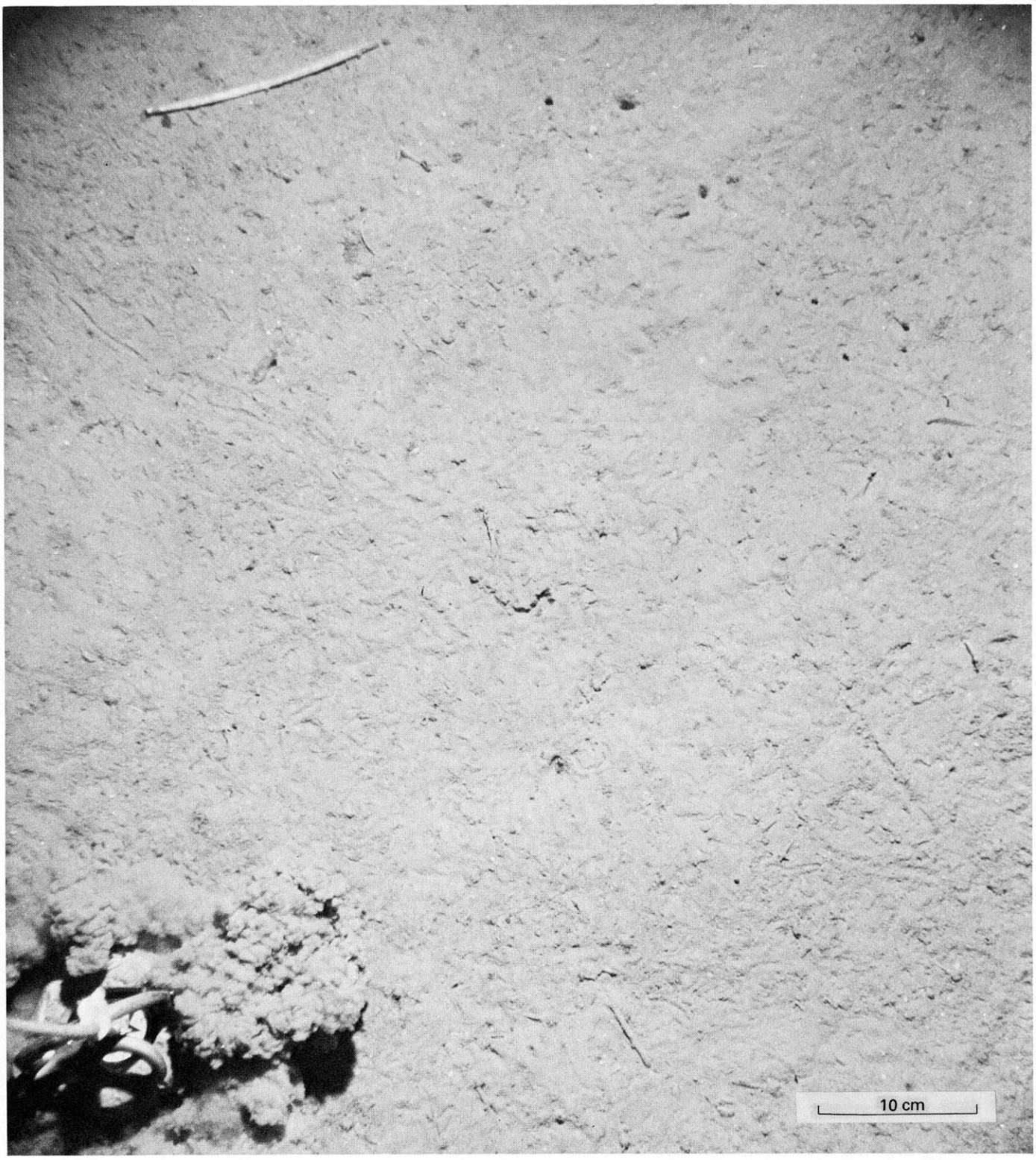

FIGURE 91.—Silty-sand bottom at a depth of 406 m on the Continental Slope east of New Jersey. In the upper left is a sodastraw worm tube (*Hyalinoecia tubicola*); in the lower left is the camera tripping-weight; the tips of brittlestar arms and numerous animal tracks are evident in other areas. Photograph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

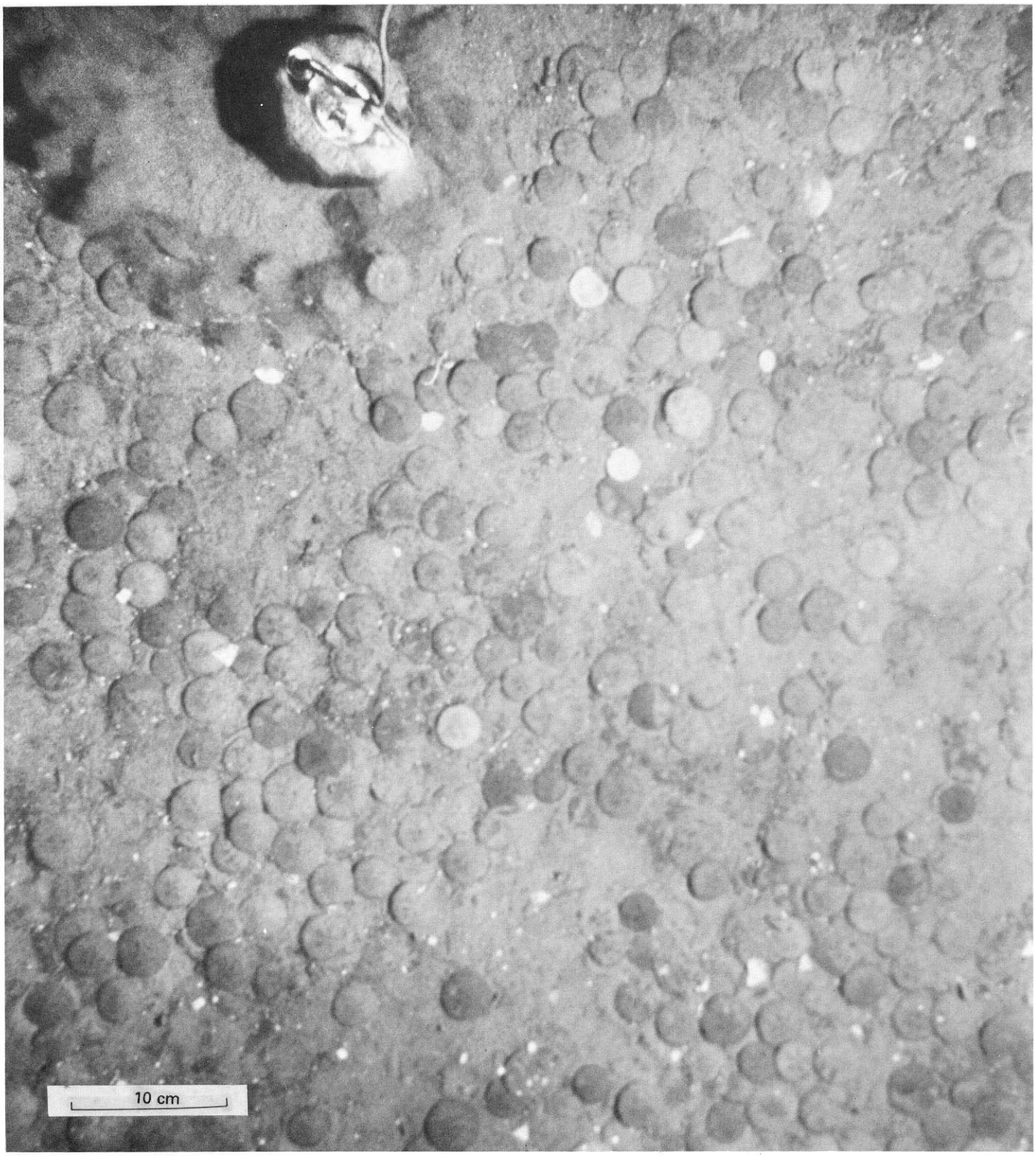

FIGURE 92.—Sand bottom inhabited by a dense assemblage of sand dollars (*Echinarchnius parma*) at a depth of 48 m near midshelf east of Delaware. The sand dollars are 2 to 3 cm in diameter. Photograph was taken at station 1418, located at lat. 37°59′ N., long. 74°29′ W.

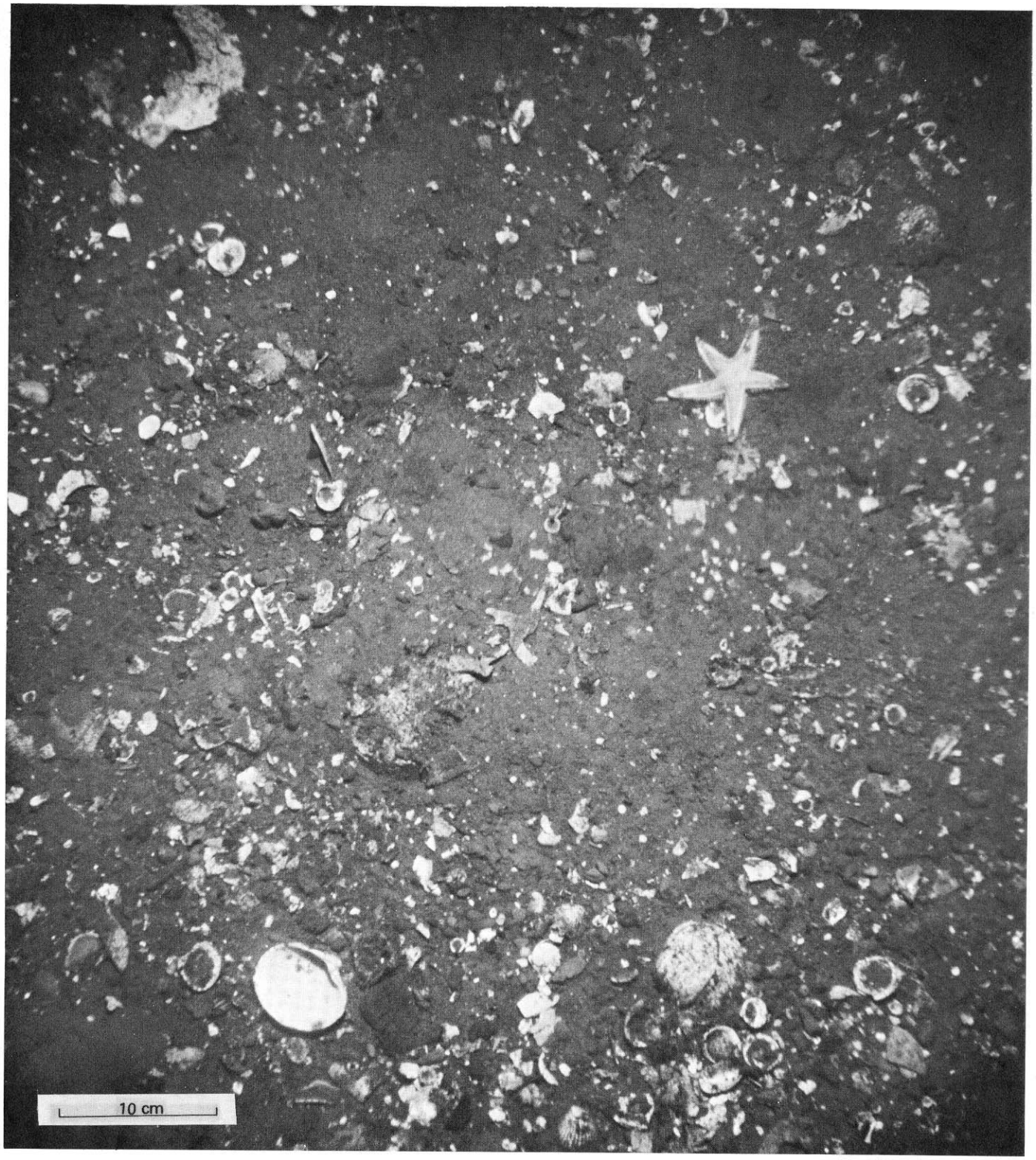

FIGURE 93.—Sand-shell bottom at a depth of 69 m near the Outer Continental Shelf northeast of Cape May, N. J. The starfish is *Astropecten*; the shell remains are *Placopecten*, *Arctica*, and *Astarte*. Photograph was taken at station 1360, located at lat. 38°40′ N., long. 73°30′ W.

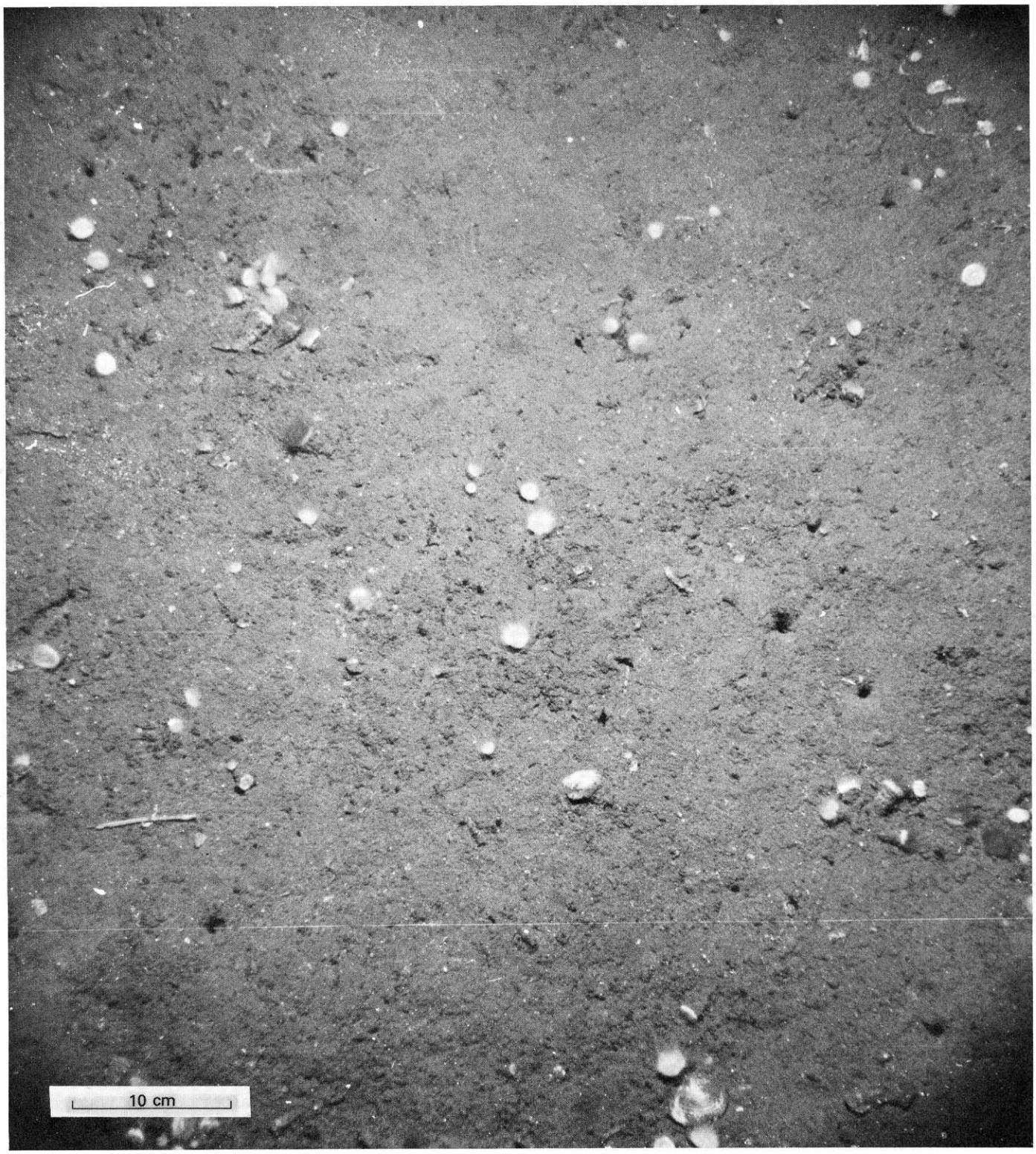

FIGURE 94.—Silty-sand bottom at a depth of 178 m on the Outer Continental Shelf near Hudson Channel, south of New York City. Dominant animals are sea anemones (Zoantharia). Bivalve shells and polychaete tubes are moderately common. Photograph was taken at station 1324, located at lat. 39°20′ N., long.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