POLYCHAETOUS ANNELIDS OF THE DELAWARE BAY REGION

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ABSTRACT

Between 1967 and the present, 1,303 quantitative and 887 qualitative samples were taken from 10 different areas in the Delaware Bay region. Four major areas were examined: Delaware Bay proper, two smaller bays, the coastal areas, and offshore on the midcontinental shelf. A total of 125 species of polychaetous annelids representing 34 families and 88 genera were identified. The greatest number of species (95) was collected at the offshore stations, which also had the highest genus to species ratio (1:1.6). Delaware Bay samples contained 83 species and the coastal areas 74 species. The smallest number of species was collected in the small bays (33). The dominant species on the midcontinental shelf were: *Goniadella gracilis, Lumbrinerides acuta, Spiophanes bombyx, Exogone hebes,* and *E. verugera.* In Delaware Bay, *Heteromastus filiformis, Nephtys picta,* and *Glycera dibranchiata* were collected most regularly. The polychaete fauna of three epifaunal assemblages (mussel bed, serpulid "reef," and oyster beds) were also examined. Increasing numbers of *Nephtys picta, Glycera dibranchiata,* and *Heteromastus filiformis* were associated with sediments containing increasing amounts of silt-clay in Delaware Bay. *Lumbrinerides acuta* and *Goniadella gracilis* were associated with poorly sorted coarse sediments (>1 mm) on the continental shelf. A zoogeographic analysis revealed this area to be the southern limit of the range for 11 species and the northern limit for 3 species. The Delaware fauna was more closely related to the northern fauna than to the southern fauna. A summary is given for some recent taxonomic changes in species present in the coastal waters of the eastern United States.

This account was prepared to review the composition, distribution, and general ecology of polychaetous annelids in the Delaware Bay region. The most comprehensive treatment of polychaetes from the northeast Atlantic off the United States was presented by Pettibone (1963a). She reported 183 species from 29 families; cited records of depth, sediment preference, and reproductive condition; and collated and reviewed the works of Webster, Benedict, Verrill, Treadwell, Moore, Hartman, and others. Since then, she has published research on paraonids, spionids, sigalionids, pilargids, and nereids from the northeast Atlantic (Pettibone 1962, 1963b, 1965, 1966, 1970a, b, 1971). Hobson (1971) has added some additional records to the polychaetes of New England. Deepwater polychaetes from the western Atlantic Ocean, including New England, were described by Hartman (1965) and Hartman and Fauchald (1971). Gosner (1971) prepared a key for invertebrates from Cape Hatteras to the Bay of Fundy and listed 213 species of polychaetes. Pratt[3] reviewed the literature on polychaetes from Nantucket to Cape Hatteras.

In nearshore waters off North Carolina, Hartman (1945) reported 104 species of polychaetes and presented information on tube building, reproductive maturity, and faunal associations. Wells and Gray (1964) listed 110 species from the Cape Hatteras area and mainly emphasized the zoogeographic affinities of the polychaetes. Day et al. (1971) analyzed distributional patterns of the benthic fauna across the continental shelf off Beaufort, N.C., from the shore to 200 m in depth. Later, Day (1973) reported 229 species of polychaetes from the shelf study and prepared a guide for the species known from North Carolina. More recently, Gardiner (1975) provided a key to 163 species of errant polychaetes from intertidal and shallow subtidal zones of North Carolina. Wass (1972) compiled a valuable list of the benthic fauna of Chesapeake Bay, including polychaetes, with annotated records of ecological data.

The earliest work on polychaetes in the Delaware Bay area was conducted by Leidy (1855) and Webster (1880, 1886). Polychaetes associated with oyster beds in Delaware were discussed by Maurer and Watling (1973). Wells (1970) and Curtis (1975) described reefs of "sand coral" (*Sabellaria vulgaris*) from the shores of Delaware.

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[3]Pratt, S. D. 1973. Benthic fauna. *In* S. B. Saila (editor), Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals, 5:1-70. Univ. R.I., Mar. Publ. Ser. 2.

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METHODS

Since 1967, a large number of quantitative (1,303) and qualitative (887) samples of benthic invertebrates have been collected throughout the Delaware Bay region. The major collecting areas are designated with letters and presented in Figure 1. Since the objectives of the various surveys differed, the sampling pattern and season, number of samples, frequency of sampling, collecting gear and sieve type, environmental data, and type of analysis also varied (Table 1). A local reference collection was established and verified with the polychaete collection in the U.S. National Museum.

ENVIRONMENTAL SETTING

The general environmental setting is discussed as four major areas: Delaware Bay proper, small bays, coastal areas, and offshore. Polychaetes were collected from a variety of habitats which have been designated as follows:

Delaware Bay area (Figure 1)
- Delaware Bay proper
  - Baywide (A)
  - Bay mouth (B)
  - Midbay (C)
    - Sandy shoals (Brown Shoal, Lower Middle Shoal, Old Bare Shoal)
    - Muddy sand bottom
    - Epifaunal-infaunal assemblages (blue mussel assemblage; calcareous serpulid assemblage)
  - Oyster beds (Delaware Bay; Broadkill, Mispillion, Murderkill, St. Jones, and Leipsic Rivers) (D)
  - Intertidal—Cape Henlopen (E)
- Small Bays
  - Rehoboth and Indian River Bays (F)
- Coastal areas
  - Bethany Beach (G)
  - Hen and Chickens Shoal (H)
  - Off mouth of Delaware Bay (I)
- Offshore
  - Midshelf site (J)

The letters in parentheses refer to letters used to designate areas in Figure 1.

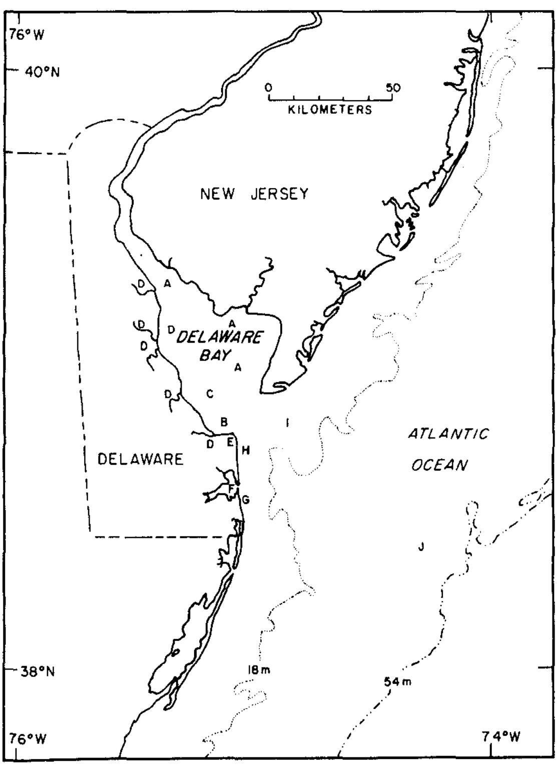

FIGURE 1.—Polychaete sampling in the Delaware Bay region. The sampling areas are: A. baywide, B. bay mouth, C. midbay, D. oyster beds, E. intertidal, F. small bays, G. Bethany Beach, H. Hen and Chickens Shoal, I. off Delaware Bay mouth, and J. midshelf site.

Delaware Bay Proper

The morphology, geology, and sediment distribution of Delaware Bay (Figure 1, A) was described by Shuster,[4] Kraft,[5] Weil (1975), and Watling and Maurer.[6] Salinity values were 5-8‰ at the northern limit of sampling and 30-31‰ near the bay mouth, with the major part of the area being polyhaline (18-30‰) (Table 1). Sediment at the bay mouth was generally medium sand (1-2ϕ), with the coarsest material in the middle of the bay (Figure 2). Sand farther up the bay became finer (2-3.5ϕ), with medium sand in the center channel. Sediments along both sides of the estuary were fine, with as much as 90% silt-clay in some samples. In sediments from the northernmost tran-

[4]Shuster, C. N. 1959. A biological evaluation of the Delaware River Estuary. Univ. Del. Mar. Lab., Inf. Ser., Publ. 3, 77 p.

[5]Kraft, J. C. 1971. A guide to the geology of Delaware's coastal environments. Univ. Del., Coll. Mar. Stud. Publ. No. 2GL039, 220 p.

[6]Watling, L., and D. Maurer (editors). 1976. Ecological studies on benthic and planktonic assemblages in lower Delaware Bay. NSF/RANN. Univ. Del., Coll. Mar. Stud. Publ., 630 p.

TABLE 1.—Summary of collecting and environmental data for Delaware Bay area polychaetous annelids (areas shown in Figure 1).

Area	Sampling pattern, number of samples, frequency of sampling	Collecting gear and processing	Salinity (‰)	Depth (m)	Substrate	Source
Baywide (A)	Transects; 207 samples; summer 1972, 1973	0.1-m² Petersen grab, 1.0-mm mesh seive	5.0-31.0	1.0-50.0	Bay mouth 1-2ϕ; midbay 2-3.5ϕ; Delaware side coarse sand; fine sediment along both shores	Watling and Maurer (see text footnote 5)
Bay mouth (B)	Random spacing; 277 samples; Dec. 1971, Mar. 1972, June 1972	0.1-m² Petersen grab, 1.0-mm mesh sieve	23.0-29.0	1.0-30.0	100% silt-clay, medium to coarse sand in northwest	Maurer et al. (see text footnote 6)
Midbay (C)	Selected stations; 170 samples; May, Aug., Nov. 1974, Feb., May 1975; 60 samples, August 1975	0.1-m² Petersen grab, 1.0-mm mesh sieve; dredges 2.0, 1.0, 0.5, 0.25 mesh sieves	21.0-29.7	3.0-35.0	Well sorted shoal sands, mud (30% silt-clay, calcareous serpulid reef, bimodal sediment with silt and coarse sand)	Watling and Maurer (see text footnote 5)
Oyster beds in rivers, bay (D)	Random spacing; ≃ 800 samples from 1967 to 1971	Oyster dredge, 1 gal/ sample, 0.25-mm mesh sieve	2.0-33.0 20.0-28.5	0.5-6.0 2.5-8.0	Hard shell bottom intercalated with mud and muddy shell bottom	Maurer and Watling (1973)
Intertidal (E)	Transects; 200 samples; monthly from 1970 to 1972	25 × 25 cm core, 1.0-mm mesh sieve	26.0-31.0		Sediment ranged from coarse sand (>0ϕ) to fine sand (<2ϕ)	Maurer (unpubl.)
Small bays: Rehoboth and Indian River (F)	Transects; 146 samples; transects; 127 samples; both summer, winter 1968-70	0.07-m² Petersen grab, 1.0-mm mesh sieve	20.1-30.8 7.5-31.9	0.6-5.8 0.5-6.7	Clean sand, sediment near creek mouths, silty-sand; coarse sand at bay mouth, silty sand increase towards river	Maurer (in press)
Coastal: Bethany Beach (G)	Transects; 144 samples; July, Oct. 1973, Jan., Apr. 1974	0.1-m² Petersen grab, 1.0-mm mesh sieve	28.5-30.7	9.0-12.0	Sediment ranged from silt sand (3.5ϕ) to gravelly sand (−0.5ϕ) finest sediment contained 30-33% silt-clay	Maurer et al. (see text footnote 8)
Hen and Chickens Shoal (H)	Transects; 144 samples; July, Oct. 1973, Jan., Apr. 1974	0.1-m² Petersen grab; 1.0-mm mesh seive	27.2-29.8	3.0-24.0	Coarse sand (>2ϕ) in deepest areas, medium sand (2-3ϕ) off shoals, well sorted sand on shoal	Maurer et al. (see text footnote 8)
Off Delaware Bay mouth (I)	Random spacing; 27 samples; 27 samples, July 1972	0.1-m² Van Veen grab, oyster dredge, 1.0-mm mesh sieve	28.2-32.5	15.2-42.5	Medium sand (2-3ϕ) with silt in depressions	Watling et al. (1974)
Offshore (J)	Random spacing; 160 samples; May, Nov. 1973, Mar. 1974	0.4-m² Shipek grab, all sediment examined or 0.25-mm mesh sieve	31.0-40.0	30.0-57.0	Medium sand, some sediment with >25% gravel	Maurer et al. (1976) Watling et al. (1974)

sects, medium sands (1.5-3.0ϕ) were restricted to the ship channel, grading rapidly into finer sediments (7.0ϕ) away from the channel.

At the interidal site (E) just inside Cape Henlopen (Figure 1), salinity ranged from 26.0 to 31.0‰, but it became higher in trapped shallow ponds during the summer. Sediment consisted of a fine sand (<2.0ϕ) at the northwest end of the flat and a coarse sand (>0ϕ) at the ocean end. Environmental data, including sediment distribution, surface and bottom temperature, salinity, and dissolved oxygen, are discussed more extensively by Maurer et al. (1971), Maurer et al.,[7] Kinner et al. (1974), and Watling and Maurer (see footnote 6).

Small Bays

Delaware has several small bays (F), which have received considerable attention in recent years (Logan and Maurer 1975; Watling 1975; Brenum 1976; Maurer in press; Jones et al.[8]). In Rehoboth Bay, salinity varied seasonally from 20.1 to 30.8‰ and the average silt-clay in the sediment was 40.3%. Salinities in Indian River Bay ranged from 27.7 to 31.9‰ at the mouth of the bay and 7.5 to 19.3‰ near the Indian River. Sediment was similar to that in Rehoboth Bay, except that the bay mouth contained coarse sand and shell fragments.

Coastal Areas

In coastal waters, collections were concentrated at three sites (Figure 1; G, H, I). The annual mean range of salinity was 28.5-30.7‰ and 27.2-29.8‰ at Bethany Beach (G) and Hen and Chickens Shoal (H), respectively. Sediment at the two sites can be characterized as medium sand. Occasional depressions and holes trapped finer grained sediment. The deeper areas of Hen and Chickens Shoal

[7]Maurer, D., R. Biggs, W. Leathem, P. Kinner, W. Treasure, M. Otley, L. Watling, and V. Klemas. 1974. Effect of spoil disposal on benthic communities near the mouth of Delaware Bay. Univ. Del., Coll. Mar. Stud. Publ., 200 p.

[8]Jones, R. D., L. D. Jensen, and R. W. Koss. 1974. Environmental responses to thermal discharges from the Indian River station, Indian River, Delaware. Rep. 12, Cooling Water Studies for Electric Power Research Institute, Res. Proj. (RP-49).

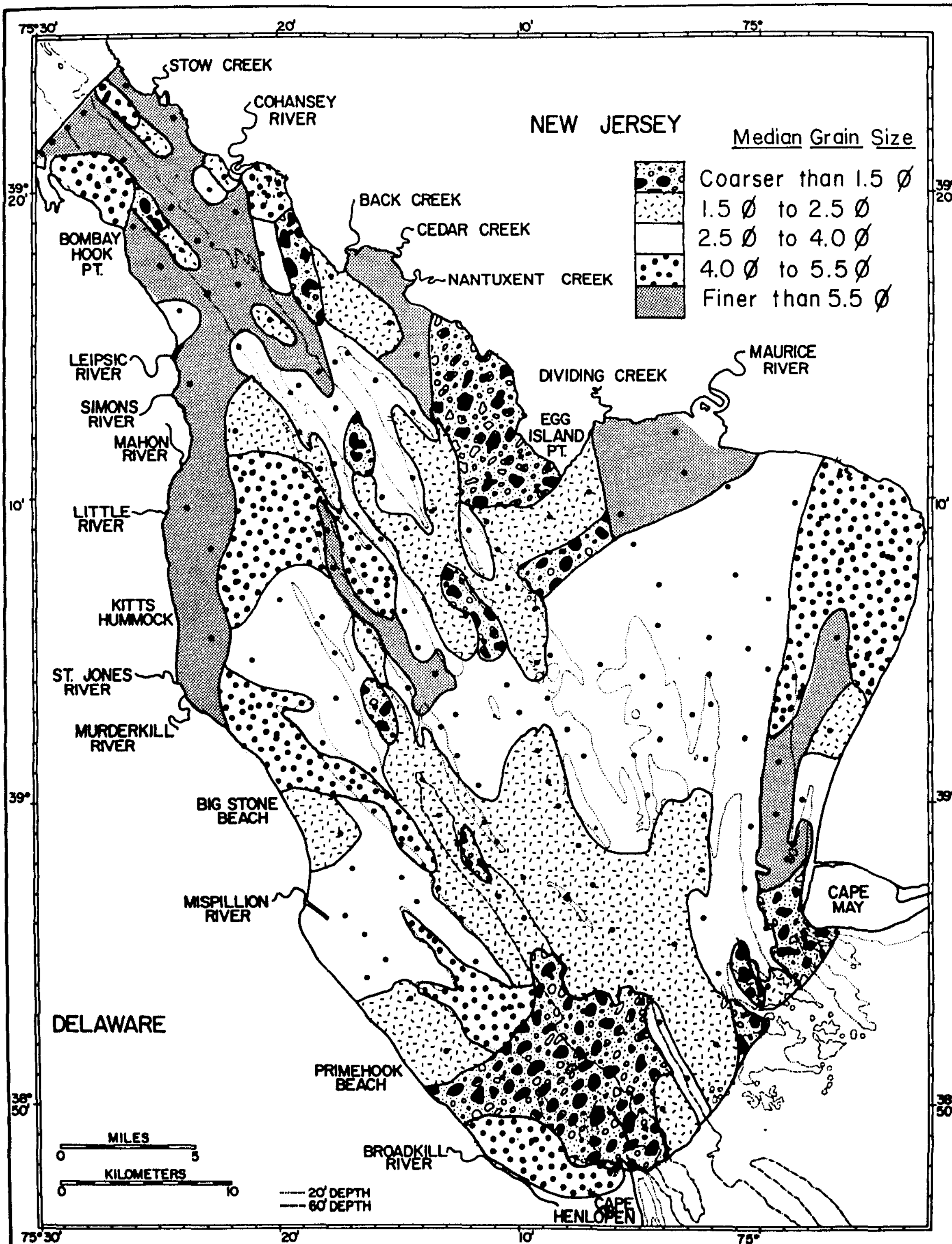

FIGURE 2.—Mean grain size for surface sediment in Delaware Bay. Dots represent the baywide (A) sampling stations.

also contained large rocks, small boulders, and mussel beds. A detailed account of these areas can be found in Maurer et al.[9] Although Area I was about 20 km off the Delaware Bay mouth, the western portion of this area appeared to be influenced by the hydrography of Delaware Bay. Salinity ranged from 28.2 to 32.5‰ and the sediment varied from silty-sand to gravelly sand. However, a few sediment samples contained black mud (30-33% silt-clay and 2.63-3.64% organic content) (Watling et al. 1974).

Offshore

The oceanic or offshore area, termed midshelf site (Figure 1, J), has been the subject of several studies. An extensive review of the hydrography and geology was presented by Bumpus et al.[10] and Milliman.[11] Salinity was 31-40.0‰ and the sediment was dominated by clean sand with some pebbles and dead shells at the collecting site. Ridge and swale microtopography influences sediment composition. Crests of the ridges contained clean sand and swales or troughs consisted of shell and flocculent material (Maurer et al. 1976).

Results and Discussion

A total of 125 species of polychaetes, representing 34 families and 88 genera, were identified from all the sampling areas. Eighty-three species and 25 families were collected within Delaware Bay proper (Table 2, columns A-E). The Delaware Bay samples usually showed less than 10 species and 250 individuals/m². However, the most species (95) were collected in the offshore samples. The number of individuals per sample was much higher at stations in the midshelf area. This was also the only collection where the polychaetes dominated the fauna. Infaunal samples in both the bay and in the nearshore areas are otherwise dominated by members of the Mollusca (Maurer et al. see footnote 7; Watling et al. 1974).

Delaware Bay

Intertidal—Cape Henlopen (E)

Eight core samples (25 cm diameter × 25 cm height) were taken each month for 25 mo on Cape Henlopen near the mouth of the bay, from 1970 to 1972 (Figure 1). The study area was on the bay side of the spit on a tidal flat with swash bars. Eighteen species of polychaetes were collected in the sampling area (Table 2, column E). The number of species decreased gradually from fine to coarse sand (Maurer unpubl. data). Large tube-building polychaetes (*Diopatra cuprea*) and burrowing infaunal species (*Lumbrineris tenuis* and *Scoloplos fragilis*) occurred in highest densities in the fine sand, whereas spionids and nephtyids were better represented where sediment grain size increased towards the ocean. Two species (*S. fragilis* and *Spio setosa*) were particularly abundant from the low to the high tide line. *Scoloplos fragilis* was most common just above the reducing layer in the sediment. *Pista palmata* was collected only in the sand flat area.

Baywide (A)

The polychaete fauna in the upper bay (5-15‰) was dominated by the deposit feeders *Heteromastus filiformis* and *Scolecolepides viridis* (Table 2, column A). *Glycera dibranchiata* was also present at a number of stations. Sediments in this area ranged from M 4.2 to 7.9ϕ (median grain size), with generally poor sorting (σ = 2.4-3.9ϕ). At all stations the numbers of individuals were very small, with four individuals being the most recorded at one time. This paucity of individuals was also evident in other groups of the benthic fauna.

Farther down the bay where salinities were 15-25‰, there was an increase in number of species and individuals. Thirty-two species were collected, including all the six species recorded in the area of 5-15‰ (Table 1). The sediment showed a much wider range of particle size (M 1.0-7.0ϕ) than in the previous zone, with a tendency toward better sorting in the larger sediment classes. *Heteromastus filiformis* was still the dominant polychaete in fine sediments, with *G. dibranchiata* important in coarser material. Deposit-feeding polychaetes predominated, particularly on the sides of the estuary in the finer sediment (Figure 2). The coarser sediments in the middle of the

[9]Maurer, D., J. Tinsman, W. Leathem, and P. Kinner. 1974. Baseline study of Sussex County, Delaware ocean outfalls. Rep. Sussex County Engineer, Sussex County Delaware. Univ. Del., Coll. Mar. Stud., 287 p.

[10]Bumpus, D. F., R. E. Lynde, and D. M. Shaw. 1973. Physical oceanography. *In* S. B. Saila (editor), Coastal and offshore environmental inventory Cape Hatteras to Nantucket Shoals, 72 p. Univ. R.I., Mar. Publ. Ser. 2.

[11]Milliman, J. D. 1974. Marine geology. *In* S. B. Saila (editor), Coastal and offshore environmental inventory Cape Hatteras to Nantucket Shoals. Univ. R.I., Mar. Publ. Ser 3.

TABLE 2.—Polychaete species in the Delaware Bay region (maximum number per square meter) and their zoogeographic distribution on the northeast coast of the United States.

[A = Baywide, B = Bay mouth, C = Midbay, D = Oyster beds, E = Intertidal—Cape Henlopen, F = Small bays, G = Bethany Beach, H = Hen and Chickens Shoal, I = Off Delaware Bay mouth, J = Midshelf site; 1 = NE United States (<200 m), 2 = Offshore (>200 m), 3 = Chesapeake Bay, 4 = North Carolina; * = species at the southern extension of their range; ** = species at the northern extension of their range.]

Polychaete species	A	B	C	D	E	F	G	H	I	J	1	2	3	4
Ampharetidae:														
Ampharete arctica Malmgren		10	20				110	10		100	x	x		
Asabellides oculata (Webster)	80	20	1,770				50	190	10	50	x		x	
Hypaniola florida (Hartman)				x		243					x		x	x
Melinna maculata Webster	40												x	x**
Amphictenidae (= Pectinariidae):														
Cistena gouldii (Verrill)	10		150	x	x	1,273					x		x	x
Aphroditidae:														
Aphrodita hastata Moore									10		x			
Arabellidae:														
Arabella iricolor (Montagu)	20					14		10	10	25	x		x	x
Driloneris longa Webster	40		20				10		10	25	x		x	x
D. magna Webster and Benedict	10		30					10	10	25	x			x
Capitellidae:														
Capitella capitata (Fabricius)	20		150			458	10	40			x		x	x
Heteromastus filiformis (Claparède)	490	220	900	x	1,659	114	10	20			x	x	x	x
Mediomastus ambiseta (Hartman)			1,500							25	x*			
Chaetopteridae:														
Spiochaetopterus oculatus Webster				x		29					x		x	x
Cirratulidae:														
Caulleriella spp.	560		40				10	130		150				
Chaetozone setosa Malmgren			30					10	10	275	x	x		x
Chaetozone spp.	10		30				20			325				
Cirratulus grandis Verrill	10							20	20	25	x		x	x
Cirriformia filigera (Delle Chiaje)						129								x
Tharyx acutus Webster and Benedict	10		30				80	960		180	x			
Tharyx sp.	180		30		x			60	20	525				
Dorvilleidae:														
Protodorvillea gaspeensis Pettibone										25	x*			
Schistomeringos caeca (Webster and Benedict)			10				40			50	x			x
S. rudolphi (Delle Chiaje)			30				160	100		50	x		x	x
Eunicidae:														
Marphysa belli (Audouin and Milne-Edwards)									10	50	x			
M. sanguinea (Montagu)	230		180			43					x		x	x
Flabelligeridae:														
Pherusa affinis (Leidy)			60				20	160	10	25	x		x	
Glyceridae:														
Glycera americana Leidy	40	10	30		x	157	10	70			x	x	x	x
G. capitata Oersted	50		100			200	270	50		125	x			x
G. dibranchiata Ehlers	80	20	50	x	42	43	100	40	40	175	x		x	x
Goniadidae:														
Glycinde solitaria (Webster)	40	20	270			257	80	10			x		x	x
Goniadella gracilis (Verrill)			40				10		110	3,950	x			x
Hesionidae:														
Gyptis vittata Webster and Benedict						29					x		x	x
Microphthalmus schzelkowii Mecznikow	10						10	10			x*			
Podarke obscura Verrill			100			72					x		x	x
Lumbrineridae:														
Lumbrinerides acuta (Verrill)	10		10				20	10	20	925	x			x
Lumbrineris coccinea (Renier)										25	x			x
L. fragilis (O.F. Müller)					x		10	10	150	75	x	x		x
L. impatiens (Claparède)										150	x			
L. latrielli (Audouin and Milne-Edwards)										425	x		x	x
L. tenuis Verrill	50	x	10		x	1,530		40	110	100	x		x	x
Magelonidae:														
Magelona sp. A	10						10			25				
Magelona sp. B (near *riojai*)	10		10				30	10			x			x
Maldanidae:														
Asychis elongata (Verrill)	10					129					x		x	x
Clymenella mucosa (Andrews)										25				x**
Clymenella spp.			30							475				
C. torquata (Leidy)	60		10			114				200	x		x	x
C. zonalis (Verrill)										250	x		x	x
Clymenura borealis (Arwidsson)										25	x	x		
Praxillella sp.										150				
Nephtyidae:														
Aglaophamus circinata Verrill										825	x			x
Nephtys bucera Ehlers	10		30		x	229	80	20	30	50	x		x	x
N. incisa Malmgren			40						100	75	x		x	x
N. picta Ehlers	60	40	150		x		270	40	110	250	x		x	x

TABLE 2.—(Continued).

Polychaete species	A	B	C	D	E	F	G	H	I	J	1	2	3	4
Nereidae:														
Nereis grayi Pettibone							11			125	x		x	x
N. succinea (Frey and Leuckart)	130	30	450	x	63	672	20	900		25	x		x	x
Onuphidae:														
Diopatra cuprea (Bosc)		10	10		x	29			10		x		x	x
Onuphis opalina (Verrill)							10			10	x			
Opheliidae:														
Ophelia bicornis Savigny	10	180					30	40		25	x		x	
O. denticulata Verrill							20		10	25	x			x
Ophelina cylindricaudata Hansen										25		x		x
Travisia carnea Verrill	30		10				380	10		75	x		x	
Orbiniidae:														
Orbinia ornata (Verrill)	20							10		25	x		x	x
O. swani Pettibone										25	x*			
Scoloplos armiger (O.F. Müller)	30		20				20			50	x			x
S. fragilis (Verrill)	60	30	130	x	3,024	858	10			25	x		x	x
S. robustus (Verrill)	40		40				10				x		x	x
Oweniidae:														
Myriowenia sp. A										25				
Owenia fusiformis Delle Chiaje				x		14					x		x	x
Paraonidae:														
Aricidea catherinae Laubier	40		90				240	180	60	350	x		x	x
A. suecica Eliason										125	x	x		x
A. wassi Pettibone										250	x		x	
Cirrophorus branchiatus Ehlers										25		x		x
Paradoneis lyra (Southern)	10						130	10		125	x	x		
Phyllodocidae:														
Eteone flava (Fabricius)										25	x*			
E. heteropoda Hartman	10		30	x				10		25	x		x	x
E. lactea Claparède	10			x		558		30		25	x		x	x
E. longa (Fabricius)	60		60								x			
E. trilineata (Webster and Benedict)										25	x*			
Eulalia bilineata (Johnston)										50	x			
Eumida sanguinea (Oersted)	40		1,240	x		143					x		x	x
Paranaitis kosteriensis (Malmgren)	10							10			x			
P. speciosa (Webster)			20			14				50	x		x	x
Phyllodoce arenae Webster	20		60			14	30	50		75	x		x	x
P. maculata Linnaeus			50				10	10		25	x*			
P. mucosa Oersted								20		25	x		x	x
Pisionidae:														
Pisione remota (Southern)							10		80					x
Polynoidae:														
Harmothoe extenuata (Grube)	240	10	790	x			30	380	20	25	x			x
Lepidametria commensalis Webster			10			72					x		x	x
Lepidonotus squamatus (Linnaeus)	20		270				10	50	10		x		x	
L. sublevis Verrill	10	30	270	x	x						x		x	x
Sabellariidae:														
Sabellaria vulgaris Verrill	70	150	2,310	x		57	720	120			x		x	x
Sabellidae:														
Chone spp.										400				
Euchone spp.										100				
Potamilla neglecta Sars										50	x		x	
P. reniformis (Leuckart)										50	x			x
Sabella microphthalma Verrill					x	14				25	x		x	x
Scalibregmidae:														
Scalibregma inflatum Rathke										150	x	x		x
Serpulidae:														
Hydroides dianthus (Verrill)	1,930	40	8,160	x	21	43	10	40		150	x		x	x
Sigalionidae:														
Pholoe minuta (Fabricius)										25	x			x
Sigalion arenicola Verrill							40	10	50	75	x			x
Sthenelais limicola (Ehlers)		10	10				20	10		50	x		x	x
S. boa (Johnston)			60				10	10		75	x		x	x
Spionidae:														
Dispio uncinata Hartman	10		10				20	10			x			x
Parapionspio pinnata (Ehlers)		10	10				10				x		x	x
Polydora caulleryi Mesnil			10				10			50	x			
P. concharum Verrill			10							75	x*			
P. ligni Webster	1,050	10	330	x		2,131		80			x		x	x
P. socialis (Schmarda)	10		440				10	200	10	25	x			x
P. websteri Hartman	20			x							x		x	x
Prionospio cristata Foster										25				x**
P. steenstrupi Malmgren										100	x	x		x
Scolecolepides viridis (Verrill)	40	20									x		x	x
Scolelepis squamata (O.F. Müller)	10	10	20		21		40	30		25	x			x
Spio setosa Verrill	10		5,450		42		150	40	40	50	x		x	x
Spiophanes bombyx (Claparède)	70		110				320	70	160	2,550	x		x	x
Streblospio benedicti Webster	160	10	590	x		86	10	120			x		x	x

TABLE 2.—(Continued).

Polychaete species	A	B	C	D	E	F	G	H	I	J	1	2	3	4
Syllidae:														
Brania clavata (Claparède)						x					x		x	x
Exogone dispar Webster										25	x	x	x	x
E. hebes (Webster and Benedict)										850	x*			
E. verugera (Claparède)	20									1,425	x			x
Paraplonosyllis longicirrata (Webster and Benedict)	10						20			1,125	x		x	x
Proceraea cornuta (Agassiz)	220		30							175	x		x	x
Sphaerosyllis erinaceus Claparède										50	x			
S. hystrix Claparède										125	x*			
Streptosyllis arenae Webster and Benedict										175	x			x
S. varians Webster and Benedict										75	x*			
Syllis cornuta Rathke									40	50	x			x
S. gracilis Grube			50								x			x
Syllides sp.							40		20	100				
Terebellidae:														
Amphitrite ornata (Leidy)			40					40			x		x	x
Pista cristata (O.F. Müller)							10				x		x	x
P. palmata (Verrill)					x						x		x	x
Polycirrus eximius (Leidy)	190		1,140					830		100	x		x	x

estuary contained larger densities of carnivores and omnivores. One station on the most southerly transect in this salinity range had the coarest sediment found to this point (M 1.0ϕ) and the most diverse fauna. Eleven species were present representing both sedentary (e.g., *H. filiformis, Streblospio benedicti,* and *Asabellides oculata*) and errant types (e.g., *Glycera dibranchiata, G. americana, Eteone heteropoda,* and *E. longa*). Since all species mentioned occurred at both higher and lower salinities, species richness may be a response to the sediment type.

Fifty-one species were collected in the estuary in salinities >25‰. The six species found in the upper bay all occurred here. Nineteen species collected in the midbay area were also found in the high-salinity samples. Twenty-six additional species found in the lower estuary were not found in salinities <25‰. They were equally divided between sedentary and errant types. The sedentary deposit-feeding species are mainly sand-dweller types, such as *Paradoneis lyra, Scolelepis squamata,* and *Spio setosa,* while the errant species consisted of phyllodocids, nephtyids, and polynoids.

Delaware Bay Temporal Studies

To examine more closely the temporal changes in assemblages in different Delaware Bay sediments, a program of quarterly sampling was undertaken in Area C (Figure 1). Three sandy shoals, three muddy sand bottoms, a polymodal sediment, and a calcareous serpulid assemblage were the selected sites (Watling and Maurer see footnote 6). At all of the stations the salinity was >25‰. In addition to the quarterly samples, 20 replicate grabs and 20 replicate dredge hauls were taken at a station representing each substrate to obtain a more accurate count of species abundances.

SANDY SHOALS.—Two of the shoal stations were located in the middle of the bay on Brown Shoal and Lower Middle Shoal. Sediments were medium-well sorted (M 1.9-2.9ϕ, σ = 0.30ϕ) sand constantly subjected to strong tidal currents. The fauna was restricted to a few species of polychaetes throughout the year: *Nephtys picta, N. bucera, Magelona* sp. 2 (near *riojai*), and *Spiophanes bombyx*. The species were always present in densities of <10 individuals/0.1 m^2. The third shoal station on Old Bare Shoal was slightly different in faunal and sedimentary characteristics. The sediment was finer (M 2.8-2.9ϕ, σ = 0.30ϕ), with sorting the same as the other shoals. The polychaete fauna was dominated throughout the year by *Glycera capitata, G. dibranchiata, Scoloplos robustus, S. fragilis,* and *Spiophanes bombyx*. The 20 replicate grabs taken at this station in the summer indicated that *G. capitata* had a density of 4.1 individuals/0.1 m^2. *Glycera dibranchiata* occurred in a density of 1.8/0.1 m^2. The dredge hauls indicated the same dominant species with the addition of *Asabellides oculata*.

MUDDY SAND BOTTOM.—The three muddy sand stations were similar in sediment composition (M 3.2-4.7ϕ, σ = 1.50ϕ) and also in polychaete distribution. One of the stations was dominated by the bivalve, *Nucula proxima*, to the exclusion of other species. *Asabellides oculata* and *Capitella capitata* were the dominant polychaetes according to the quarterly studies; however, their densities were very low all year. The 20 grab samples produced 13 specimens of *Nephtys picta*. No other species was represented by more than one or two individuals. In the 20 dredge hauls taken at the same location, *N. incisa* was present in almost all samples in densities great enough to be considered a dominant organism in the community. Sanders (1958) described a muddy sand community from Buzzards Bay as a *Nucula proxima-Nephtys incisa* group. The sampling in Delaware Bay indicated that *N. incisa* was not sufficiently dominant to be a characteristic species for this community. The other two muddy sand stations contained *N. incisa, A. oculata, Scoloplos robustus, S. fragilis, Spio setosa,* and *Glycinde solitaria* as important polychaete species throughout the year.

EPIFAUNAL-INFAUNAL ASSEMBLAGES.—The epifaunal-infaunal assemblages include a calcareous serpulid assemblage; a polymodal sediment, which contained a mussel community; and the oyster community. These epifaunal-infaunal assemblages are pooled here because certain infaunal species occurred only in samples containing the epifaunal assemblages. The latter also contributed to the formation of the sediment containing particular species of infauna.

Blue Mussel Assemblage.—The blue mussel, *Mytilus edulis*, was the primary species in an epifaunal-infaunal assemblage in lower Delaware Bay (C). The assemblage was transitory and depended on the life cycle of the mussels and physical disturbances such as storms. The substratum beneath the *Mytilus* beds consisted of a poorly sorted polymodal sediment. The mussels were first collected as juveniles in May. Their growth over the summer was accompanied by an increase in the number of species of polychaetes as well as the number of specimens. Mussels were almost absent in November samples, with a corresponding decrease in numbers of species and individuals of polychaetes. There was a reappearance of the mussel beds the following May. A total of 49 species of polychaetes were collected in the *Mytilus* beds, ranging from 5 to 22 species/sample. The most common species living on the mussels and among the byssal threads included *Harmothoe extenuata* and *Nereis succinea*. Other important members of the epifauna were *Lepidonotus squamatus, L. sublevis, Eumida sanguinea, Polydora ligni, Polycirrus eximius,* and *Eteone heteropoda*. The infaunal species were dominated by *Mediomastus ambiseta, Spio setosa* (which occurred in 60% of the samples), and *Asabellides oculata. Aricidea catherinae, Streblospio benedicti, Tharyx* spp., and *Chaetozone* spp. also contributed significantly to the infaunal community. During the winter there was a reduction in the density and number of epifaunal species. In the spring, when the young mussels were still small, *Spio setosa* composed as much as 70% of the individuals of the samples, with over 5,000 individuals/m^2. This type of opportunism by the infaunal species was observed the preceding spring to a lesser degree, when *S. setosa* made up as much as 40% of the specimens collected. Steimle and Stone (1973) described a similar *Mytilus* aggregation from off Long Island, N.Y. where *H. imbricata, H. extenuata, L. squamatus,* and *N. succinea* were the dominant polychaetes.

Serpulid Assemblage.—A second major epifaunal-infaunal assemblage in Delaware Bay was a serpulid assemblage. Geological descriptions of serpulid reefs have been reported from England (Garwood 1931; Bosence 1973). Descriptions of the biology of such assemblages formed by *Hydroides dianthus* from the east coast of the United States are unknown to us. *Hydroides dianthus* forms calcareous tubes encrusting shells and rocks, with the distal part of the tube erect, away from the substrate. *Hydroides* larvae then settle on the adult tubes forming heads of tubes. This assemblage does not form a continuous structure, but a series of heads occurring over an area of 1 km^2. Similar assemblages have also been observed in Indian River Bay and Little Assawoman Bay, but have not been studied to date.

In addition to *H. dianthus*, the dominant polychaetes of this assemblage were *Sabellaria vulgaris, Eumida sanguinea, Mediomastus ambiseta, Asabellides oculata,* and *Polydora ligni. Sabellaria vulgaris*, which forms reefs of its own in other areas of the bay (Curtis 1975), attached its sandy tubes on the *H. dianthus* tubes. *Polydora ligni* builds its muddy tubes in the crevices between the calcareous structures and in empty *H. dianthus* tubes. *Polycirrus eximius* also exploited the vacant tubes, while *Harmothoe extenuata, L. squamata,* and *L. sublevis* primarily were found wedged between the tubes. *Marphysa sanguinea*, which was collected only rarely on the *Mytilus* beds and nowhere else in the bay, was an important member of the serpulid community. *Asabellides oculata, Glycinde solitaria, Mediomastus* *ambiseta*, and *Heteromastus filiformis* were the dominant organisms in the silt-fine sands around and beneath the serpulid tubes. Other polychaetes, such as *Cistena gouldii* and *Streblospio benedicti*, inhabited the surrounding sediment.

Two seasonal changes were noted in the polychaete distributions of the *Hydroides dianthus* assemblage. Adult *Polydora ligni* were not found in the August grab samples; however, when dredge hauls were sieved through a 250-mm mesh screen, juveniles down to the eight or nine setiger stages were collected. *Harmothoe extenuata* was totally absent from the fall collections, but reappeared the following spring.

Oyster Assemblage (D)

The oyster assemblage (Figure 1) was the first of the epifaunal-infaunal communities to be sampled. Since this study was described in detail in Maurer and Watling (1973), it will only be briefly described here for purposes of comparison with the other epifaunal-infaunal groups. Twenty species of polychaetes were collected on oyster bars in Delaware Bay and in the Broadkill, Mispillion, Murderkill, St. Jones, and Leipsic Rivers. Four of the species, *Hydroides dianthus, Polydora websteri, P. ligni*, and *S. vulgaris*, were associated directly with the shell substratum. *Polydora websteri* is known to burrow into oyster shells and dissolve the shell to form U-shaped cavities lined with detritus (Zottoli and Carriker 1974). *Polydora ligni* forms silty mucous tubes which may be present in very high densities on the external surface of the oysters.

Five species of polychaetes, *Harmothoe extenuata, L. sublevis, Eteone heteropoda, E. lactea*, and *Eumida sanguinea*, were found to inhabit the mud and debris associated with the epifaunal organisms. Other species such as *Scoloplos fragilis, Spiochaetopterus oculatus, Cistena gouldii*, and *Streblospio benedicti*, were found on nearby soft bottoms. *Nereis succinea* was collected in all types of sediment.

Small Bays (F)

From 1968 to 1970, 273 samples were taken in Rehoboth and Indian River Bays (Figure 1) during summer and winter, with emphasis on the former. Seventeen polychaete species were collected in Indian River Bay in summer 1968, 14 in winter 1969, 15 in summer 1969, and 17 in winter 1970. During the same time periods, 28, 13, 20, and 14 polychaete species, respectively, were collected in Rehoboth Bay. Based on density and frequency of occurrence, the following five species of polychaetes emerged as dominants: *Capitella capitata, Glycera americana, Lumbrineris tenuis, Scoloplos fragilis*, and *Glycinde solitaria. Capitella capitata* was found in both bays in high numbers in the summer samples only. Only three of the dominant organisms, *L. tenuis, S. fragilis*, and *Glycera americana*, were present during all sampling periods. *Nereis succinea* was another important species. Logan and Maurer (1975) found that *N. succinea* and *Heteromastus filiformis* dominated monthly samples throughout the year in the upper Indian River Bay; *N. succinea* was postulated to be an indicator organism for thermal pollution.

Watling (1975) reported that *Streblospio benedicti* and *C. capitata* were the dominant benthic species in a deposit-feeding community in a small cove of Rehoboth Bay. Other species, such as *Polydora ligni* and *H. filiformis*, were also important. His study further indicated that *S. benedicti* and *C. capitata* showed opportunism and rapidly recolonized the area after a summer die-off, presumably taking advantage of available food resources. *Brania clavata, Exogone dispar*, and *H. filiformis* gradually increased in numbers as the community stabilized.

Coastal Fauna (G, H, I)

The Hen and Chickens Shoal (area H), immediately adjacent to the bay mouth, showed the greatest resemblance to the estuarine fauna. Bethany Beach (area G) and the northeast stations off the mouth of Delaware Bay (area I) appeared more like the offshore assemblages (Figure 1). The southeastern portion of area I was also estuarine in character (Watling et al. 1974). *Tharyx acutus* and *Harmothoe extenuata* were the dominant polychaetes in area H. *Tharyx acutus* occasionally occurred in the bay and frequently offshore, but never in the densities recorded in area H. *Tharyx acutus* was particularly important during January through April, when it reached densities of 960/m². *Harmothoe extenuata* was present in large numbers in Delaware Bay, but very rarely offshore. Pettibone (1963a) stated that *H. extenuata* is a highly adaptable species which occurs intertidally and at great depth on all types of bottoms. The highest density of *H. extenuata* in our studies always occurred in the epifaunal-infaunal assemblages, mentioned above. Other species that were present in significant numbers in area H, and also important in the bay but not normally found in offshore assemblages, include: *Polydora ligni, P. socialis, Asabellides oculata, Nereis succinea,* and *Sabellaria vulgaris*.

A number of species, including *Glycinde solitaria, Spio setosa,* and *Diopatra cuprea*, occurred in areas G and I, but not farther offshore. *Glycinde solitaria* was found primarily in muddy sands, both in the bay and nearshore areas, which agrees with the findings of Pettibone (1963a). The lack of mud on the inner shelf may be the primary reason why they were not found at the offshore sites. *Diopatra cuprea* and *S. setosa* were found extensively on the intertidal sand flats of Cape Henlopen. Only a few individuals of *D. cuprea* were found in lower Delaware Bay and in areas G and I. *Spio setosa* was most prevalent subtidally in the epifaunal-infaunal assemblages.

In addition to estuarine species, members of the offshore assemblages were found in areas G and I. *Lumbrinerides acuta* (an offshore dominant) and *L. fragilis* were present in sand stations in both areas. *Spiophane bombyx*, which was found occasionally in sandy sediment in the bay, was an important species in the nearshore marine areas and a dominant in offshore assemblages. The increase in density of *S. bombyx* seaward appears to be a response to increased areas of fine sand, rather than salinity, as *S. bombyx* was found in estuarine waters of 15‰.

Midcontinental Shelf Fauna (J)

Polychaetes represented 35.7% of the total individuals in samples collected in May and 54.4% in November, making them the dominant (by number of individuals) benthic group offshore (Maurer et al. 1976). In May, *Goniadella gracilis* and *Lumbrinerides acuta* were codominants among all benthic organisms. *Clymenella* spp. and *Aricidea catherinae* were also abundant. In November there was a shift in dominance, with the exception of *G. gracilis*, when *Exogone verugera* and *Spiophanes bombyx* were established as dominant forms. *Parapionosyllis longicirrata* was present in a few samples in large numbers, but was not as widely distributed as the other dominant species. The following March, *Aglaophamus circinata* became the dominant species based on the large number of juveniles collected. *Spiophanes bombyx* was the second-most important species; *Exogone hebes* and *E. verugera* were also collected extensively. The March samples contained a large number of individuals of *Euchone* spp. and *Chone* spp. This represented the first time in our offshore sampling that a suspension feeding polychaete group contributed more than an occasional rare individual, although these small sabellid species are probably not typical suspension-feeding polychaetes (M.H. Pettibone pers. commun.). *Euchone* spp. were present in 13 samples, and species of *Chone* spp. were dominant in two of the five samples in which they were collected.

Goniadella gracilis was a dominant form in all the offshore stations and in all sampling periods. It was present in more than 65% of the samples in May and November, with average occurrences of 297 individuals/m^2 and 693 individuals/m^2, respectively. In the May samples, it was reduced to 32% of the samples with fewer numbers of individuals. However, it still remained the second-most important polychaete species.

Members of the family Sigalionidae occurred more frequently and in higher densities in the offshore samples than in the bay and nearshore areas. *Sthenelais boa* and *S. limicola* occurred in Delaware Bay in salinities >25‰, as well as in the nearshore and offshore communities. *Pholoe minuta* and *Sigalion arenicola* were present only in the coastal and offshore stations. *Sigalion arenicola* occurred in 12% of the November offshore samples, with many individuals being juveniles. None of these scale worms were ever found in large numbers in any sample. The increase in sigalionids offshore was not matched by the other major scale worm family, the Polynoidae. Polynoids were extremely numerous in the bay, particularly in the epifaunal-infaunal communities. In the offshore marine areas, only *Harmothoe extenuata* was present. The absence of collections from hard substrate offshore may affect the average numbers of offshore polynoids. The Sigalionidae typically are burrowing forms and may find the fine sandy substrate more suitable than do the polynoids.

Maldanids were important in the three seasonal offshore sampling periods. Most of the individuals collected were juveniles; and thus difficult to identify. Most adult specimens were *Clymenella zonalis, C. torquata,* and *C. mucosa*.

ANIMAL-SEDIMENT RELATIONSHIPS

To describe some of the sediment associations of the dominant species of Delaware Bay, correlations were made with median grain size and percentage of silt-clay using Spearman's ρ (α = 0.05). *Nephtys picta* was collected in sediments with an unweighted mean grain size of 2.1ϕ and in 1-10% silt-clay ($\bar{x}$ = 4.7%). Increasing abundance of *N. picta* was associated with increasing amounts of silt-clay within the range in which it occurred. *Glycera dibranchiata* was found in sediment with up to 50% silt-clay ($\bar{x}$ = 13.3%), and a mean size ranging from 0.8 to 6.6ϕ ($\bar{x}$ = 2.7). There was a positive association between numbers of individuals and increasing silt-clay content. No other associations were significant.

Two of the dominant species were found primarily in muddier sands. *Heteromastus filiformis* has been described as a member of soft sediment communities in Delaware Bay (Kinner et al. 1974) as well as elsewhere (Dean and Haskin 1964). The species inhabited a wide range of sediments, M 0.08-6.5ϕ ($\bar{x}$ = 3.7), and was positively correlated with increasing silt-clay and increasing median and mean grain size. *Streblospio benedicti* occurred in sediments with a wide range of silt-clay (2.5-59.0%). The distribution of the species was not correlated with median grain size, silt-clay, or mean grain size. *Streblospio* showed an even greater affinity for the areas along the Delaware and New Jersey shoreline than did *H. filiformis*.

Correlations were also made between measures of sediment and five of the dominant polychaetes of the offshore assemblages. *Lumbrinerides acuta* (0.76-2.40ϕ) and *Goniadella gracilis* (0.76-2.49ϕ) were negatively associated (α = 0.05) with increases in median ϕ and positively correlated with an increase in the percentage of sediment >1 mm in diameter. Both species showed correlations of high density with more poorly sorted sediments. Nichols (1970) has postulated that although sorting is not well understood biologically, positive correlations with well sorted sediments may indicate niche specificity, while poor sorting suits a wider variety of needs. The larger sediment sizes probably facilitate burrowing.

Aricidea catherinae (0.34-2.64ϕ) was negatively associated with an increase in the size of the median ϕ. This deposit-feeding species builds a flexible mucous tube and is far less mobile than *L. acuta* and *G. gracilis*. Sediments containing particles >1 mm may be difficult for this fragile species.

Aglaophamus circinata was not significantly associated with any sediment parameters. However, it was found in a range of sediment (0.34-2.64ϕ) similar to that of the other species. Sediments which contained the greatest densities of *Spiophanes bombyx* were generally well sorted (σ = 0.21-0.57ϕ) with between 25% and 50% of the sediment >0ϕ. There was a negative association (α = 0.05) between *S. bombyx* and sediment >1 mm. This species was also negatively associated with an increase in the standard deviation of ϕ indicating its preference for a well-sorted sediment.

GENUS-SPECIES RELATIONSHIPS

A comparison was made of the genus to species ratios for each of the estuarine coastal and offshore areas to obtain information on diversity and speciation. The midshelf station had the highest ratio of 1.0:1.6 with the Serpulidae and *Mytilus* assemblages second (1.0:1.4). Coastal areas were next with Hen and Chickens Shoal and Bethany Beach 1.3 and off the bay mouth 1.2. The areas within Delaware Bay and the small bays were as follows: baywide (1.3), intertidal (1.3), bay mouth (1.0), oyster beds (1.2), and small bays (1.1). The epifaunal-infaunal speciation ratio does not reflect the stability of the habitat, but rather the greater number of niches due to a mixed substratum. Winter reductions in species diversity in the *Mytilus* assemblage due to storms and mussel mortality emphasize the fragile nature of the environmental stability.

TAXONOMIC NOTES

Revisions and synonymies that appear in polychaete taxonomic literature are often not included in ecological publications for a long time. Based on suggestions from Marian Pettibone, we have included a section describing some of the systematic changes that affect the east coast of the United States. We formally acknowledge her for providing us with much of the information included in this section.

Ampharetidae
Hypaniola florida (Hartman)

In a recent paper Pettibone (1977) has presented the synonomy and distribution of the estuarine species, *Hypaniola florida* (Hartman). The species was reported as *Amphicteis gunneri floridus* by Hartman in 1951 from Florida and as *Hypaniola grayi* by Pettibone (1953) from Massachusetts and by Kinner et al. (1974) from Delaware Bay. Wass (1972) listed the species as *Lysipiddes grayi* from Chesapeake Bay and Zottoli (1974) used the name *Amphicteis floridus* from New Hampshire. Pettibone stated that this species is distributed in estuaries from Maine to Florida and the Gulf of Mexico.

Amphictenidae (= Pectinariidae)

Lucus and Holthuis (1975) showed that the type-species of the well known generic name *Pectinaria* Lamarck was confused and had to be replaced by *Cistena* Leach. Since the genus *Pectinaria* is no longer valid, the widely used family name Amphictenidae is now preferred to Pectinariidae. The single east coast representative should now be referred to as *Cistena gouldii* (Verrill) new combination.

Capitellidae

Mediomastus ambiseta (Hartman) was a dominant species in the mussel and serpulid assemblages. Hartman (1947) described the species as *Capitata ambiseta* from intertidal flats in California. Hartman-Schröder (1962) later synonymized *Capitata* with *Mediomastus*, and Hobson (1971) reported it for the east coast of the United States. The species has been reported as a dominant species in Newport Bay, Calif., and Baja California by Reish (1959, 1963) and in Florida by Dauer and Simon (1975, 1976a, b). *Mediomastus californiensis* has been reported from North Carolina (Day 1973), but it differs from *M. ambiseta* in a number of characteristics. *Mediomastus californiensis* lacks a caudal process, and spinous setae in posterior segments that are represented in *M. ambiseta*, and has a different positioning of the distal teeth of the hooked setae.

Dorvilleidae

According to a recent revision of the genera of the family Dorvilleidae by Jumars (1974), the new generic name *Schistomeringos* replaces *Stauronereis* as used by Pettibone (1963a) and Wass (1972) and *Dorvillea* as used by Day (1973) for the species *Schistomeringos caeca* and *S. rudolphi*.

Protodorvillea gaspeensis, described originally by Pettibone (1961) from the Gulf of St. Lawrence, was reported from Massachusetts by Hobson (1971) and now from the midcontinental shelf off Delaware.

Magelonidae

Two species of Magelonidae have been recorded from Delaware and designated as *Magelona* sp. A and *Magelona* sp. B. Meredith Jones is currently revising this group and he informs us that *Magelona* sp. B is near *M. riojai* (Jones 1963).

Maldanidae

In a revision of three species of Maldanidae from the east coast of the United States, Mangum (1962) included three species under *Clymenella: C. torquata* (Leidy), *C. zonalis* (Verrill), and *C. mucosa* (Andrews). Day (1973) maintained the genus *Axiothella* for *C. mucosa*; however, Mangum has pointed out that this separation, based on the position of segmental collars, is not warranted because of the presence of collars scattered throughout the family. *Clymenella zonalis* was reported by Day (1973) as *Macroclymene zonalis*. The genus, *Macroclymene*, was originally erected as a subgenus by Verrill for a specimen which had a much larger number of segments than his type. The subgenus was raised to generic status by Hartman (1951) for a fragment found in the Gulf of Mexico. Mangum pointed to the great variation in segmental number even within populations and thus rejected *Maroclymene*. It has also been our experience that numbers of segments vary. We have found that juveniles particularly do not fit the characteristic segmental numbers, and as a result, have used *Clymenella* spp. and *Praxillella* sp.

Light (1974), in a comparison of Maldanidae specimens from San Francisco Bay and the east coast of the United States, followed Ardwidsson and referred Verrill's species *Maldane elongata* to *Asychis* (including the synonymy). The species has been reported from Chesapeake Bay by Wass (1972) as *Maldanopsis* and from North Carolina by Hartman (1945) and Day (1973) as *Branchioasychis americana* Hartman.

Orbiniidae

In a study involving various growth stages of *Scoloplos armiger*, Curtis (1970) has shown *S. acutus* to be a juvenile form of *S. armiger*. The characters which were used to separate these two species were the specialized thoracic hooks and the abdominal papillae. Curtis documented the appearance of first hooks, then papillae, with the increasing size of the animals. He also observed various intermediate stages with the population.

Paraonidae

In a revision of the family Paraonidae by Strelzov (1973), McIntosh's species of *Scolecolepides* (?) *jeffreysii* was shown to be an indeterminable *Aricidea* sp. The records of *A. jeffreysii* from New England (Pettibone 1963a) and from the Chesapeake Bay (Wass 1972) were referred to *A. catherinae* Laubier by Strelzov (1973:91). The record by Day (1973) of *A. cerruti* (not Laubier) from North Carolina should also be referred to *A. catherinae.* Strelzov (1973:108) also has referred *Cirrophorus lyriformis* (Annekova) to *C. branchiatus* Ehlers. The species collected in our midshelf collection thus was referred to *C. branchiatus*. Both species were recorded by Day (1973) from North Carolina. These specimens probably require further examination.

Sabellidae

Banse (1970, 1972) revised the generic descriptions of both *Chone* spp. and *Euchone* spp. emphasizing the branchial crown, setae, and anterior abdominal segments (*Euchone*).

There were many specimens of *Euchone* spp. and *Chone* spp. on the continental shelf off Delaware. We experienced difficulty in distinguishing the species because many of our specimens were juvenile forms. Our specimens of *Euchone* spp. appear to have more variability than those reported by Banse. In addition, many specimens were damaged or lacked branchial crowns so the number of radioles and the palmate membrane could not be observed. The specimens of *Euchone* compared most favorably with *E. incolor* and *E. elegans*, and the specimens of *Chone* spp. were most like *C. duneri.*

ZOOGEOGRAPHY

Some 125 species of polychaetes (and 8 other species identified only to genus) were collected in the Delaware Bay area. Based on the literature, 116 species have been collected in areas off New England (Table 2, column 1). Sixty-seven species were cited from Chesapeake Bay (Wass 1972; Table 2, column 3). The number of species common to the Chesapeake and Delaware Bay areas is lower than expected, considering their proximity. This was mainly because many of the offshore species encountered in our work were not included in Wass's list. However, work in progress on the mid-Atlantic shelf is expected to change this (D. Boesch, pers. commun.). Ninety-one of the species were common to North Carolina (Hartman 1945; Day 1973; Gardiner 1975; Table 2, column 4).

Examination of the local species revealed that for 11 of them, this was the southern extent of their range; i.e., they were reported for New England, but not from Chesapeake Bay or North Carolina (Table 2). Only three species were found to be at the northern limit of their range in the Delaware Bay area, having been found in Chesapeake Bay or North Carolina, but not New England. It appears that the polychaete fauna from the Delaware Bay area is more closely related to the northern than the southern fauna. Two of the species with their northern range in this area, *Prionospio cristata* and *Clymenella mucosa*, were offshore species. The probability of larvae being carried north into the area by the Gulf Stream is great, as Lear and Pesch[12] have shown the intrusion of this water from offshore during the winter and summer months.

Data from Hartman (1965) and Hartman and Fauchald (1971) showed that 14 species, which were collected in depths >200 m, were also found in our samples (Table 2, column 2). Seven of these species were recorded only in our offshore samples (J). The remaining seven species, *Brania clavata, Paradoneis lyra, Lumbrineris fragilis, Ampharete arctica, Heteromastus filiformis, Chaetozone setosa,* and *Glycera americana*, were also found in the estuary. It was interesting to note that of these seven species, *H. filiformis* and *C. setosa* belong to particularly difficult families taxonomically. In our work, *H. filiformis* was found in salinities as low as 5‰. The species was reported in depths of >1,000 m by Hartman (1965) and Hartman and Fauchald (1971). *Lumbrineris fragilis, L. latrielli, Aricidea suecica, Prionospio steenstrupi*, and *Exogone dispar* are other species given wide distributions in the literature (M. Pettibone pers. commun.). The distribution of species over such a

[12]Lear, D. W., and G. G. Pesch. 1975. Effects of ocean disposal activities on the mid-continental shelf environment off Delaware and Maryland. EPA Reg. III Rep., 78 p.

wide salinity and depth range appears to be highly doubtful and emphasizes the need for more definitive taxonomic work in some of the errant, and in particular, the sedentary polychaete families.

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