

Chesapeake Bay Benthic Community Assessment, August-September 1998

SUBMITTED TO

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## INTRODUCTION

The Chesapeake Bay region was sampled during August and September, 1998. One aspect of this evaluation was benthic community characterization, which was accomplished via sample collection by National Oceanic and Atmospheric Administration (NOAA) personnel and laboratory and data analysis by Barry A. Vittor & Associates, Inc. (BVA).

The Chesapeake Bay region and 1998 sampling sites are indicated in Figure 1.

## METHODS

### *Sample Collection And Handling*

A Young dredge (area = 0.04 m<sup>2</sup>) was used to collect bottom samples at each of 63 sites located in 17 strata around Chesapeake Bay. Macroinfaunal samples were sieved through a 0.5-mm mesh screen and preserved with 10% formalin on ship. Macroinfaunal samples were transported to the BVA laboratory in Mobile, Alabama.

### *Sediment Analysis*

Sediment texture was determined at half-phi intervals using the hydrometer technique for fractions smaller than 44  $\mu$ m and nested sieves for larger particle fractions. Texture parameters that were computed included percent gravel, sand, and silt /clay. Total organic carbon (TOC) content was measured as ash-free dry weight expressed as a percentage.

### *Macroinfaunal Sample Analysis*

In the laboratory of BVA, benthic samples were inventoried, rinsed gently through a 0.5 mm mesh sieve to remove preservatives and sediment, stained with Rose Bengal, and stored in 70% isopropanol solution until processing. Sample material (sediment, detritus, organisms) was placed in white enamel trays for sorting under Wild M-5A dissecting microscopes. All macroinvertebrates were carefully removed with forceps and placed in labelled glass vials containing 70% isopropanol. Each vial represented a major taxonomic group (e.g. Polychaeta, Mollusca, Arthropoda). All sorted macroinvertebrates were

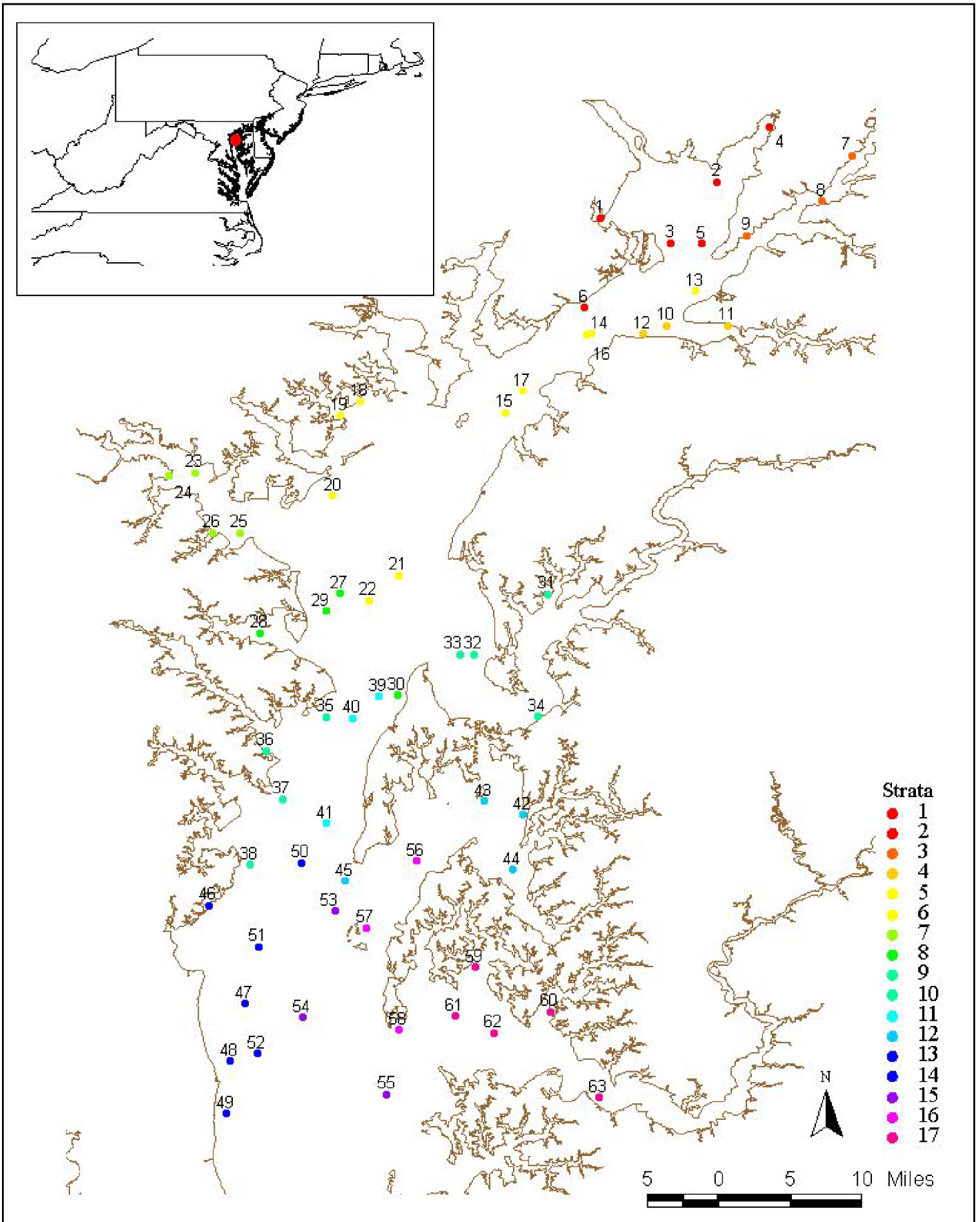


Figure 1. Area sampled for the Chesapeake Bay Stations, August-September 1998.

identified to the lowest practical identification level (LPIL), which in most cases was to species level unless the specimen was a juvenile, damaged, or otherwise unidentifiable. The number of individuals of each taxon, excluding fragments, was recorded. A voucher collection was prepared, composed of representative individuals of each species not previously encountered in samples from the region.

## **DATA ANALYSIS**

All data generated as a result of laboratory analysis of macroinfauna samples were first coded on data sheets. Enumeration data were entered for each species according to site and strata. These data were reduced to a data summary report for each site, which included a taxonomic species list and benthic community parameters information. Archive data files of species identification and enumeration were prepared.

The QA and QC reports for the Chesapeake Bay samples are given in the Appendix.

The analytical methodologies utilized for this study were similar to those used in similar benthic community characterization reports prepared for other state and federal agency surveys. Macroinfaunal characterization involves an evaluation of several biological community structure parameters (e.g., species abundance, species composition and species diversity indices) during initial data reduction, followed by pattern and classification analysis for delineation of taxa assemblages. Since species are distributed along environmental gradients, there are generally no distinct boundaries between communities. However, the relationships between habitats and species assemblages often reflect the interactions of physical and biological factors and indicate major ecological trends.

### ***Assemblage Structure***

Several numerical indices were chosen for analysis and interpretation of the macroinfaunal data. Selection was based primarily on the ability of the index to provide a meaningful summary of data, as well as the applicability of the index to the characterization of the benthic community. Infaunal abundance is reported as the total number of

individuals per site and the total number of individuals per square meter (= density). Taxa richness is reported as the total number and mean number of taxa represented in a given site collection.

Taxa diversity, which is often related to the ecological stability and environmental "quality" of the benthos, was estimated by the Shannon-Weaver Index (Pielou, 1966), according to the following formula:

$$H' = - \sum_{i=1}^S p_i (\ln p_i)$$

where, S = is the number of taxa in the sample,

i = is the i'th taxa in the sample, and

$p_i$  = is the number of individuals of the i'th taxa divided by the total number of individuals in the sample.

Taxa diversity within a given community is dependent upon the number of taxa present (taxa richness) and the distribution of all individuals among those taxa (equitability or evenness). In order to quantify and compare faunal equitability to taxa diversity for a given area, Pielou's Index J' (Pielou, 1966) was calculated as  $J' = H' / \ln S$ , where  $\ln S = H'_{\max}$  or the maximum possible diversity, when all taxa are represented by the same number of individuals; thus,  $J' = H' / H'_{\max}$ .

### **HABITAT CHARACTERISTICS**

Location and sediment data for the 63 sites are given in Table 1 and Figures 2, 3, 4, 5 and 6. Sediment composition at the 63 sites varied considerably from 99% sand at sites 18, 30, 34, 36, 53, 56 and 57 to 69% clay at site 50 (Table 1; Figure 2). Silt/clay were predominant at most sites, with gravel/sand fractions dominating the sediment at sites 2, 11, 18, 24, 30, 31, 34, 36, 37, 42, 43, 46, 53, 56 and 57 (Figures 3 and 4). The total organic carbon (TOC) fraction of the sediment ranged from 0.1 at site 18 to 10.9 at site 6 (Table 1; Figures 5 and 6).



Table 1. Summary of location and sediment data for the Chesapeake Bay Strata, August-September 1998.

Strata	Site	Latitude	Longitude	Depth	% Gravel	% Sand	% Silt	% Clay	TOC	Texture Description
1	1	39° 29.398	76° 07.448	3.0	0.00	4.33	45.16	50.51	3.96	Clay
1	2	39° 31.565	76° 00.412	4.0	0.00	95.51	0.00	0.00	8.95	Sand
1	3	39° 27.872	76° 03.210	13.0	0.00	52.10	10.04	37.86	2.22	Sandy Clay
2	4	39° 34.901	75° 57.186	10.0	0.00	1.09	39.28	59.63	2.91	Clay
2	5	39° 27.835	76° 01.288	6.0	0.00	17.21	16.44	66.35	10.99	Clay
2	6	39° 23.947	76° 08.429	16.8	0.00	4.14	26.22	69.64	3.77	Clay
3	7	39° 33.190	75° 52.189	3.5	0.00	0.89	40.14	58.97	2.94	Clay
3	8	39° 30.405	75° 54.030	9.9	0.00	38.72	31.42	29.86	0.03	Clayey Silt
3	9	39° 28.334	75° 58.567	3.9	0.00	2.86	26.29	70.84	2.23	Clay
4	10	39° 22.841	76° 03.462	11.0	0.00	2.96	44.63	52.41	3.37	Clay
4	11	39° 22.843	75° 59.715	10.0	0.00	96.60	0.00	0.00	0.35	Sand
4	12	39° 22.360	76° 04.882	10.0	0.00	16.92	20.54	62.54	3.07	Clay
5	13	39° 24.939	76° 01.698	26.2	0.00	8.14	37.70	54.16	2.63	Clay
5	14	39° 22.343	76° 08.012	20.4	0.00	20.19	22.29	57.52	4.99	Clay
5	15	39° 17.507	76° 13.239	22.0	0.00	28.89	26.52	44.59	3.97	Silty Clay
5	16	39° 22.304	76° 08.301	17.2	0.00	3.03	33.63	63.34	3.35	Clay
5	17	39° 18.848	76° 12.198	21.0	0.00	27.24	5.45	67.31	2.46	Clay
6	18	39° 18.219	76° 22.090	5.0	0.00	99.27	0.00	0.00	0.13	Sand
6	19	39° 17.341	76° 23.249	10.0	0.00	17.19	17.32	64.89	2.95	Clay
6	20	39° 12.466	76° 23.704	15.0	0.00	2.66	33.41	63.92	3.68	Clay
6	21	39° 07.627	76° 19.733	23.2	0.00	0.85	36.37	62.78	3.26	Clay
6	22	39° 06.148	76° 2.1544	22.0	-	-	-	-	-	-
7	23	39° 13.896	76° 32.095	20.0	0.00	2.59	37.10	60.31	3.14	Clay
7	24	39° 13.726	76° 33.669	6.0	4.71	94.77	0.00	0.00	0.57	Sand
7	25	39° 10.217	76° 2.9373	12.0	-	-	-	-	-	-
7	26	39° 10.229	76° 31.039	10.0	0.00	15.33	21.94	62.73	2.24	Clay
8	27	39° 06.551	76° 23.265	13.7	0.00	6.46	32.70	60.83	3.28	Clay
8	28	39° 04.143	76° 2.8182	10.0	0.00	11.75	26.77	61.48	3.90	Clay
8	29	39° 05.481	76° 24.082	15.1	0.00	7.17	32.53	60.30	3.11	Clay
8	30	39° 00.406	76° 19.761	5.0	0.00	99.29	0.00	0.00	0.12	Sand
9	31	39° 06.503	76° 1.0699	4.0	0.00	95.43	0.00	0.00	0.19	Sand
9	32	39° 02.872	76° 15.168	21.0	0.00	45.11	15.76	39.13	0.39	Sandy Clay
9	33	39° 02.864	76° 16.020	23.2	0.00	1.39	49.20	49.41	3.22	Silty Clay
9	34	38° 59.100	76° 11.280	4.0	0.00	99.66	0.00	0.00	0.34	Sand
10	35	38° 59.071	76° 24.146	26.0	0.00	3.13	41.48	55.38	2.67	Clay
10	36	38° 56.991	76° 27.802	4.0	0.00	99.87	0.00	0.00	-	Sand
10	37	38° 54.065	76° 26.795	8.0	0.00	98.18	0.00	0.00	-	Sand
10	38	38° 50.051	76° 28.759	13.0	0.00	41.89	19.01	39.11	0.67	Sandy Clay
11	39	39° 00.307	76° 20.921	47.6	0.00	19.26	24.15	56.59	2.27	Clay
11	40	38° 58.991	76° 22.550	56.0	0.00	17.91	24.43	57.66	2.36	Clay
11	41	38° 52.554	76° 24.153	85.0	0.00	3.34	45.35	51.31	2.65	Clay
12	42	38° 53.112	76° 12.178	6.0	0.00	98.64	0.00	0.00	0.37	Sand
12	43	38° 53.949	76° 14.521	2.0	0.00	98.49	0.00	0.00	0.30	Sand
12	44	38° 49.741	76° 12.803	28.0	0.00	16.12	30.02	53.86	1.85	Clay
12	45	38° 49.080	76° 22.964	51.0	0.00	12.71	36.54	50.75	1.69	Clay
13	46	38° 47.580	76° 31.280	16.0	0.00	93.72	0.00	0.00	0.41	Sand
13	47	38° 41.624	76° 29.044	33.0	0.00	5.57	51.76	42.68	3.41	Silty Clay
13	48	38° 38.132	76° 29.978	30.0	0.00	1.13	36.26	62.61	2.60	Clay
13	49	38° 34.920	76° 30.186	27.0	0.00	9.97	17.08	72.95	1.57	Clay
14	50	38° 50.185	76° 25.615	41.0	0.00	1.22	29.31	69.47	2.79	Clay
14	51	38° 45.069	76° 28.213	36.0	0.00	0.64	40.52	58.84	6.97	Clay
14	52	38° 38.561	76° 28.291	10.0	0.00	1.55	30.09	68.36	2.91	Clay
15	53	38° 47.238	76° 23.587	20.0	0.00	99.20	0.00	0.00	0.18	Sand
15	54	38° 40.779	76° 25.550	84.0	0.00	0.43	51.53	48.04	2.81	Silty Clay
15	55	38° 36.105	76° 20.434	25.0	0.00	18.50	14.57	66.93	1.34	Clay
16	56	38° 50.298	76° 18.662	20.0	0.00	99.00	0.00	0.00	0.79	Sand
16	57	38° 46.218	76° 21.705	6.0	0.00	99.97	0.00	0.00	0.26	Sand
16	58	38° 40.020	76° 19.733	9.0	0.00	50.70	10.09	39.22	0.44	Sandy Clay
17	59	38° 43.835	76° 15.076	19.0	0.00	6.13	20.18	73.69	1.59	Clay
17	60	38° 41.128	76° 10.519	8.0	0.00	7.08	34.20	58.72	1.48	Clay
17	61	38° 40.848	76° 16.320	15.0	0.00	50.28	9.22	40.50	0.53	Sandy Clay
17	62	38° 39.850	76° 13.914	22.0	0.00	1.76	48.22	50.02	1.44	Clay
17	63	38° 35.938	76° 07.539	19.0	0.00	8.14	20.01	71.84	1.72	Clay

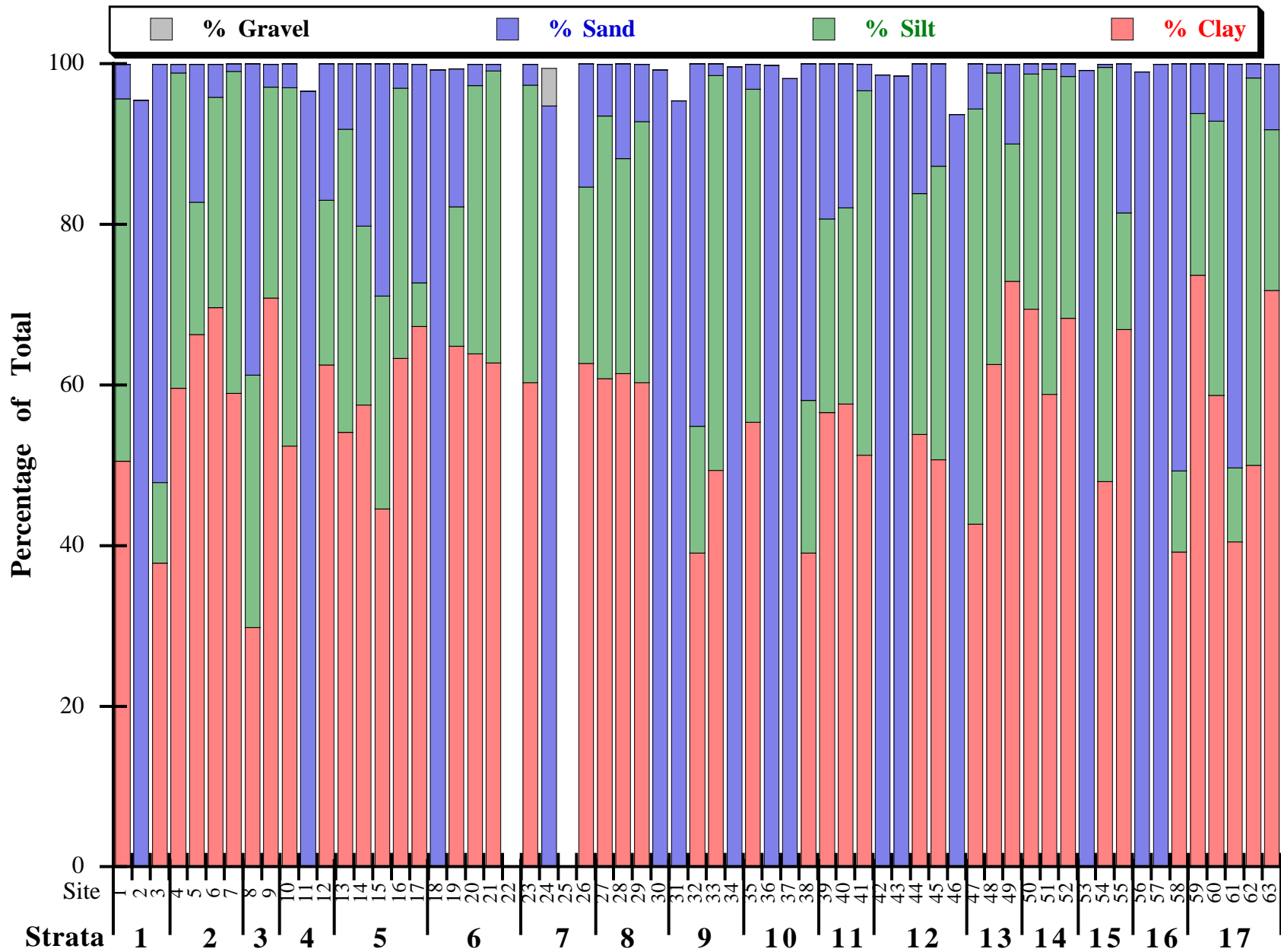


Figure 2. Sediment composition for the Chesapeake Bay Stations with strata indicated in bold, August-September 1998.

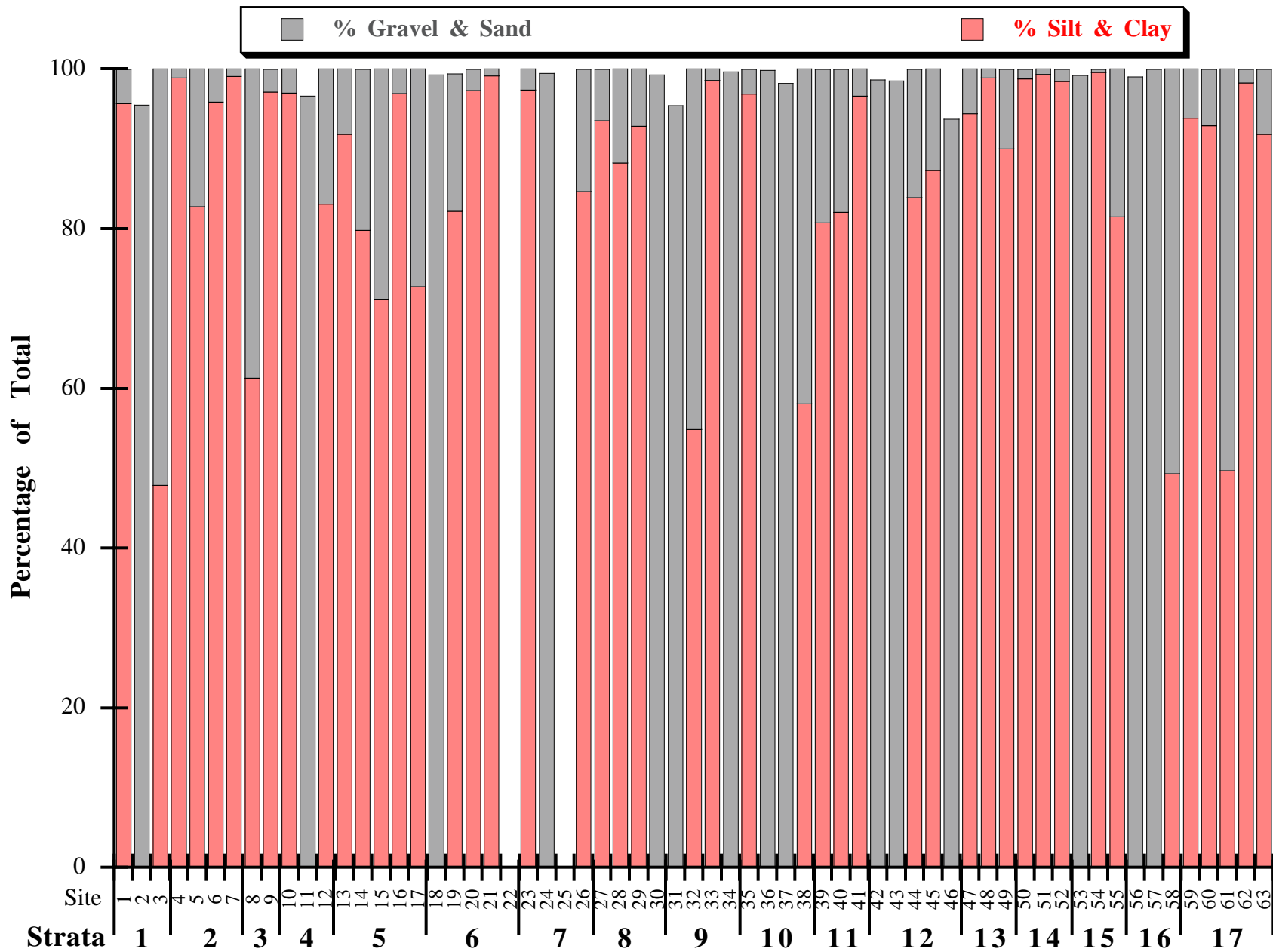


Figure 3. Percent gravel+sand and percent silt+clay content of the sediments for the Chesapeake Bay Stations with strata indicated in bold, August-September 1998.

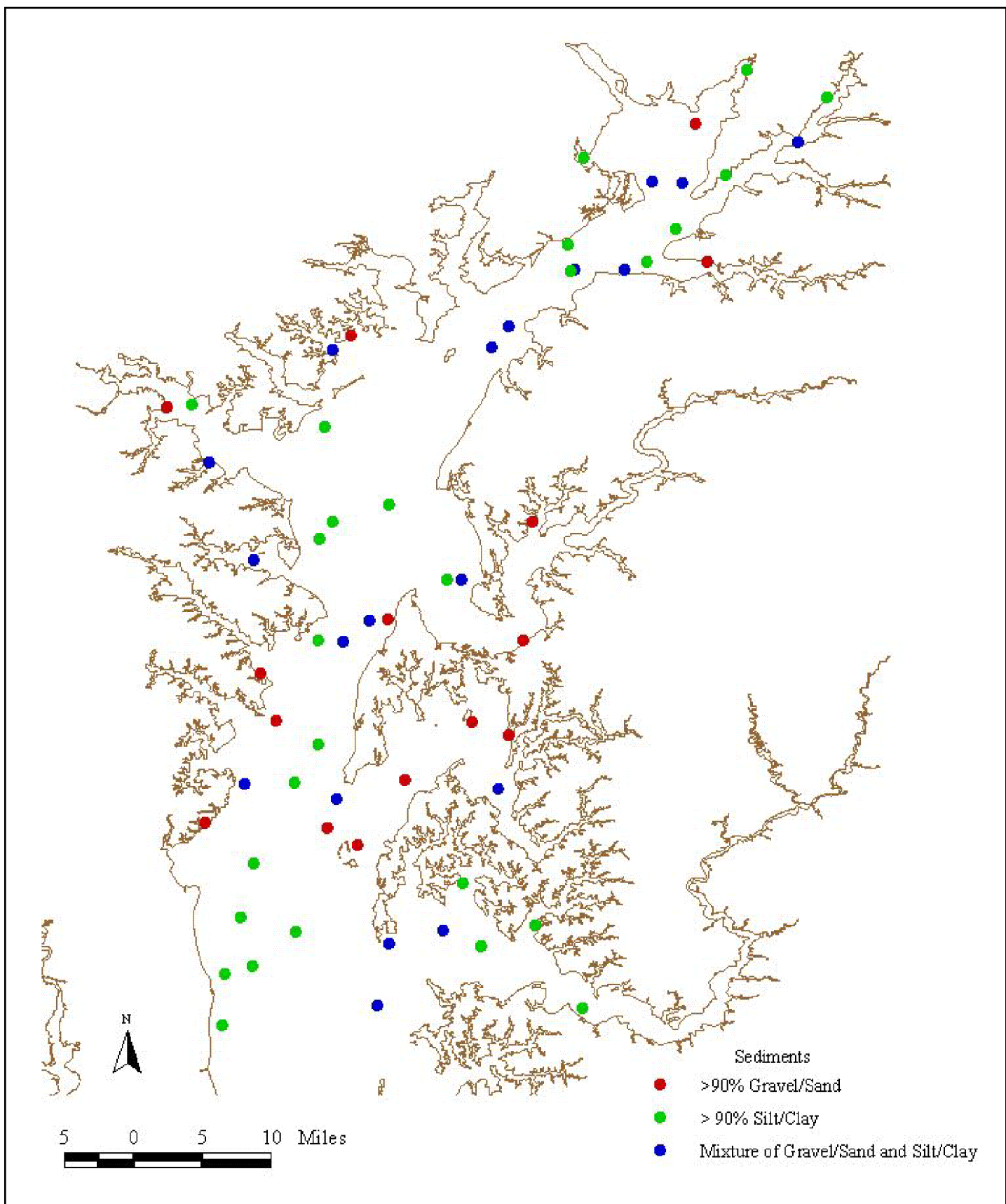


Figure 4. Map of sediment content for the Chesapeake Bay Stations, August-September 1998.

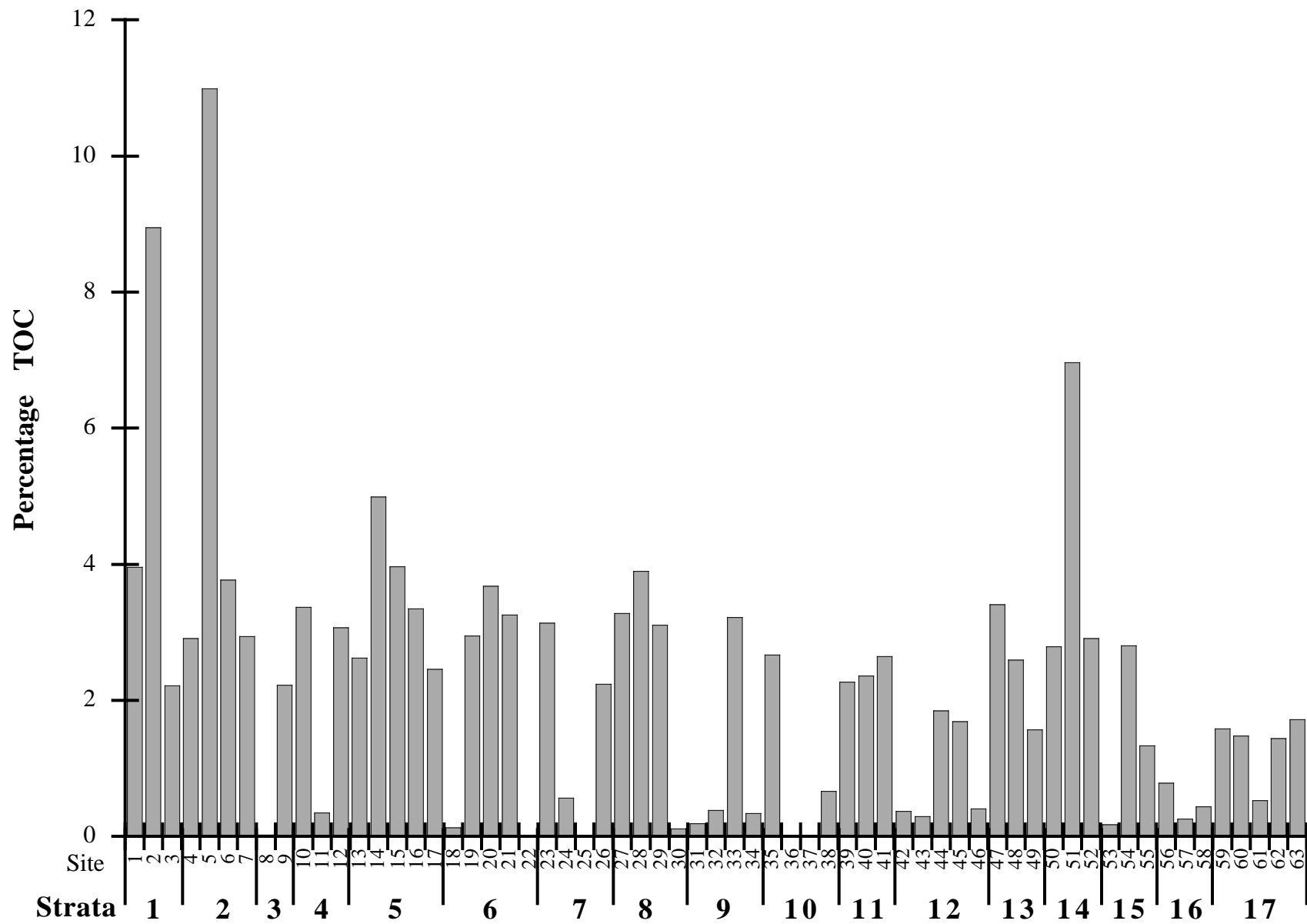


Figure 5. Percent total organic carbon (TOC) content of the sediments for the Chesapeake Bay Stations with strata indicated in bold, August- September 1998.

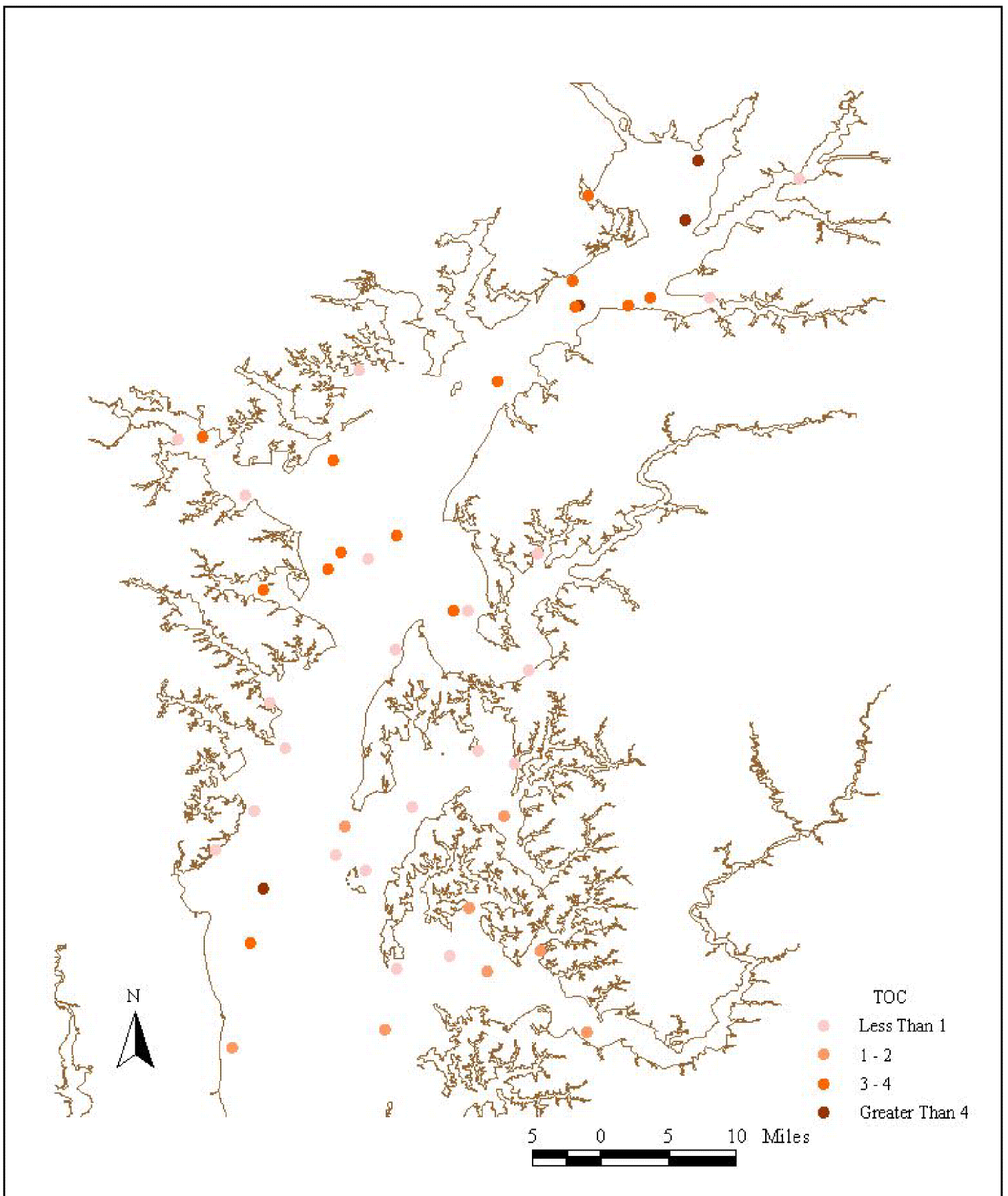


Figure 6. Map of percent total organic carbon (TOC) content of the sediments for the Chesapeake Bay Stations, August-September 1998.

## BENTHIC COMMUNITY CHARACTERIZATION

### *Faunal Composition, Abundance, And Community Structure*

Table 2 provides a complete phylogenetic listing for all sites as well as data on taxa abundance and site occurrence. Microsoft <sup>TM</sup>Excel 5.0 (Macintosh version) spreadsheets are being provided separately to NOAA which include: raw data on taxa abundance and density by site, a complete taxonomic listing with site abundance and occurrence, a major taxa table with overall taxa abundance, and an assemblage parameter table including data on number of taxa, density, taxa diversity and taxa evenness by site.

A total of 4,464 organisms, representing 86 taxa, were identified from the 63 sites (Table 3). Bivalves were the most numerous organisms present representing 33.9% of the total assemblage, followed in abundance by polychaetes (27.1%), oligochaetes (16.8%) and malacostracans (12.6%). Polychaetes represented 27.9% of the total number of taxa followed by malacostracans (24.4%), insects (19.8%) and bivalves (15.1%)(Table 3).

The abundance of major taxa by site are given in Table 4. The number of taxa per site ranged from 0 at sites 39, 41 and 44 to 18 at sites 3, 15 and 34. The number of organisms per site ranged from 0 at sites 39, 41 and 44 to 375 at site 24. The percentage abundance of the major taxa at the 63 sites is given in Figure 7 and Table 4.

The dominant taxa collected from the samples were Tubificidae (LPIL), the bivalve, *Rangia cuneata*, the polychaete, *Streblospio benedicti*, and the bivalve, *Gemma gemma* representing 12.3%, 10.9%, 10.0% and 7.2% of the total number of individuals, respectively (Table 2). Tubificids and *Streblospio benedicti* were the most widely distributed taxa being found at 54.0% and 48.0% of the sites, respectively (Table 2). The distribution of dominant taxa representing > 10% of the total assemblage at each site is given in Table 5.

Strata and site density and number of taxa data are given in Table 6 and Figures 8, 9, 10, and 11. Densities per site exhibited considerable variation and ranged from 0 organisms·m<sup>-2</sup> at sites 39, 41 and 44 to 9,375 organisms·m<sup>-2</sup> at site 24 (Table 6; Figures 8 and 9). The

Table 2. Abundance and distribution of taxa for the Chesapeake Bay Strata, August-September 1998.

Taxonomic Name	Phylum	Class	No. of Individuals	% Total	Cummulative %	Station Occurrence	Station % Occurrence
Tubificidae (LPIL)	A	Olig	551	12.34	12.34	34	54.0
<i>Rangia cuneata</i>	M	Biva	485	10.86	23.21	20	31.7
<i>Streblospio benedicti</i>	A	Poly	444	9.95	33.15	30	47.6
<i>Gemma gemma</i>	M	Biva	321	7.19	40.34	4	6.3
<i>Tellina</i> (LPIL)	M	Biva	293	6.56	46.91	15	23.8
<i>Leptocheirus plumulosus</i>	Ar	Mala	263	5.89	52.80	17	27.0
<i>Polydora cornuta</i>	A	Poly	196	4.39	57.19	9	14.3
<i>Nereis succinea</i>	A	Poly	168	3.76	60.95	24	38.1
<i>Cyathura polita</i>	Ar	Mala	137	3.07	64.02	21	33.3
<i>Mytilopsis leucophaeata</i>	M	Biva	128	2.87	66.89	1	1.6
<i>Coelotanypus</i> (LPIL)	Ar	Inse	117	2.62	69.51	15	23.8
<i>Limnodrilus hoffmeisteri</i>	A	Olig	105	2.35	71.86	10	15.9
<i>Macoma balthica</i>	M	Biva	100	2.24	74.10	12	19.0
Bivalvia (LPIL)	M	Biva	95	2.13	76.23	18	28.6
<i>Tubificoides heterochaetus</i>	A	Olig	87	1.95	78.18	14	22.2
<i>Heteromastus filiformis</i>	A	Poly	84	1.88	80.06	21	33.3
<i>Paraprionospio pinnata</i>	A	Poly	69	1.55	81.61	8	12.7
<i>Chironomus</i> (LPIL)	Ar	Inse	57	1.28	82.89	8	12.7
<i>Marenzelleria viridis</i>	A	Poly	56	1.25	84.14	21	33.3
<i>Tellina agilis</i>	M	Biva	55	1.23	85.37	5	7.9
Nereididae (LPIL)	A	Poly	44	0.99	86.36	11	17.5
<i>Laeonereis culveri</i>	A	Poly	43	0.96	87.32	5	7.9
Hydrobiidae (LPIL)	M	Gast	39	0.87	88.19	4	6.3
<i>Polypedilum halterale</i> Grou	Ar	Inse	38	0.85	89.05	4	6.3
Aoridae (LPIL)	Ar	Mala	36	0.81	89.85	6	9.5
Rhynchocoela (LPIL)	R		34	0.76	90.61	19	30.2
Chironomidae (LPIL)	Ar	Inse	34	0.76	91.38	6	9.5
Phyllodocidae (LPIL)	A	Poly	27	0.60	91.98	12	19.0
<i>Edotia triloba</i>	Ar	Mala	26	0.58	92.56	5	7.9
<i>Tanytarsus</i> (LPIL)	Ar	Inse	25	0.56	93.12	4	6.3



Table 2. Continued:

<b>Taxonomic Name</b>	<b>Phylum</b>	<b>Class</b>	<b>No. of Individuals</b>	<b>% of Total</b>	<b>Cummulative %</b>	<b>Station Occurrence</b>	<b>Station % Occurrence</b>
<i>Rheotanytarsus</i> (LPIL)	Ar	Inse	18	0.40	93.97	1	1.6
<i>Hypereteone heteropoda</i>	A	Poly	17	0.38	94.35	8	12.7
<i>Procladius</i> (LPIL)	Ar	Inse	17	0.38	94.74	5	7.9
<i>Chiridotea tuftsi</i>	Ar	Mala	15	0.34	95.07	6	9.5
<i>Odostomia</i> (LPIL)	M	Gast	12	0.27	95.34	4	6.3
Oedicerotidae (LPIL)	Ar	Mala	12	0.27	95.61	6	9.5
<i>Almyracuma proximoculi</i>	Ar	Mala	12	0.27	95.88	1	1.6
<i>Nereis</i> (LPIL)	A	Poly	11	0.25	96.12	6	9.5
Mactridae (LPIL)	M	Biva	11	0.25	96.37	4	6.3
<i>Gammarus</i> (LPIL)	Ar	Mala	11	0.25	96.62	8	12.7
<i>Glycinde solitaria</i>	A	Poly	10	0.22	96.84	6	9.5
<i>Lepidactylus dytiscus</i>	Ar	Mala	9	0.20	97.04	3	4.8
<i>Cryptochironomus</i> (LPIL)	Ar	Inse	9	0.20	97.24	5	7.9
<i>Mulinia lateralis</i>	M	Biva	8	0.18	97.42	4	6.3
Corophiidae (LPIL)	Ar	Mala	8	0.18	97.60	2	3.2
Sphaeriidae (LPIL)	M	Biva	7	0.16	97.76	2	3.2
<i>Mediomastus</i> (LPIL)	A	Poly	6	0.13	97.89	4	6.3
<i>Chaoborus</i> (LPIL)	Ar	Inse	6	0.13	98.03	2	3.2
Naididae (LPIL)	A	Olig	5	0.11	98.14	3	4.8
Haustoriidae (LPIL)	Ar	Mala	5	0.11	98.25	4	6.3
<i>Melita</i> (LPIL)	Ar	Mala	5	0.11	98.36	2	3.2
Tellinidae (LPIL)	M	Biva	4	0.09	98.45	3	4.8
<i>Dicrotendipes</i> (LPIL)	Ar	Inse	4	0.09	98.54	2	3.2
<i>Harnischia</i> (LPIL)	Ar	Inse	4	0.09	98.63	3	4.8
Lineidae (LPIL)	R	Anop	3	0.07	98.70	3	4.8
Capitellidae (LPIL)	A	Poly	3	0.07	98.77	3	4.8
<i>Leitoscoloplos</i> (LPIL)	A	Poly	3	0.07	98.84	1	1.6
<i>Tubificoides</i> (LPIL)	A	Olig	3	0.07	98.90	3	4.8
Veneridae (LPIL)	M	Biva	3	0.07	98.97	1	1.6
<i>Monoculodes</i> sp.G	Ar	Mala	3	0.07	99.04	2	3.2

Table 2. Continued:

Taxonomic Name	Phylum	Class	No. of Individuals	% of Total	Cummulative %	Station Occurrence	Station % Occurrence
<i>Monoculodes</i> (LPIL)	Ar	Mala	3	0.07	99.10	3	4.8
<i>Gammarus tigrinus</i>	Ar	Mala	3	0.07	99.17	2	3.2
<i>Melita nitida</i>	Ar	Mala	3	0.07	99.24	2	3.2
<i>Cyclaspis varians</i>	Ar	Mala	3	0.07	99.31	3	4.8
<i>Americamysis almyra</i>	Ar	Mala	3	0.07	99.37	2	3.2
<i>Polydora</i> (LPIL)	Ar	Inse	3	0.07	99.44	1	1.6
Actiniaria (LPIL)	Cn	Anth	2	0.04	99.48	2	3.2
<i>Corbicula fluminea</i>	M	Biva	2	0.04	99.53	1	1.6
Gammaridae (LPIL)	Ar	Mala	2	0.04	99.57	1	1.6
<i>Leptocheirus pinguis</i>	Ar	Mala	2	0.04	99.62	2	3.2
<i>Rhithropanopeus harrisi</i>	Ar	Mala	2	0.04	99.66	2	3.2
<i>Cricotopus</i> (LPIL)	Ar	Inse	2	0.04	99.71	1	1.6
Ampharetidae (LPIL)	A	Poly	1	0.02	99.73	1	1.6
<i>Capitella capitata</i>	A	Poly	1	0.02	99.75	1	1.6
Goniadidae (LPIL)	A	Poly	1	0.02	99.78	1	1.6
Hesionidae (LPIL)	A	Poly	1	0.02	99.80	1	1.6
<i>Podarke obscura</i>	A	Poly	1	0.02	99.82	1	1.6
Orbiniidae (LPIL)	A	Poly	1	0.02	99.84	1	1.6
<i>Sigambra tentaculata</i>	A	Poly	1	0.02	99.87	1	1.6
<i>Dipolydora socialis</i>	A	Poly	1	0.02	99.89	1	1.6
Gastropoda (LPIL)	M	Gast	1	0.02	99.91	1	1.6
<i>Clinotanypus</i> (LPIL)	Ar	Inse	1	0.02	99.93	1	1.6
<i>Tanypus</i> (LPIL)	Ar	Inse	1	0.02	99.96	1	1.6
<i>Cladotanytarsus</i> (LPIL)	Ar	Inse	1	0.02	99.98	1	1.6
<i>Lipimetta</i> (LPIL)	Ar	Inse	1	0.02	100.00	1	1.6

**Taxa Key**

A = Annelida

Olig = Oligochaeta

Poly = Polychaeta

Ar = Arthropoda

Inse = Insecta

Mala = Malacostraca

Cn = Cnidaria

Anop = Anopla

R = Rhynchocoela

M = Mollusca

Biva = Bivalvia

Gast = Gastropoda

Table 3. Summary of overall abundance of major taxonomic groups for the Chesapeake Bay Strata, August-September 1998.

<b>Taxa</b>	<b>Total No. Taxa</b>	<b>% Total</b>	<b>Total No. Individuals</b>	<b>% Total</b>
<b>ANNELIDA</b>				
<b>Polychaeta</b>	24	27.9	1209	27.1
<b>Oligochaeta</b>	5	5.8	751	16.8
<b>MOLLUSCA</b>				
<b>Bivalvia</b>	13	15.1	1512	33.9
<b>Gastropoda</b>	3	3.5	52	1.2
<b>ARTHROPODA</b>				
<b>Malacostraca</b>	21	24.4	563	12.6
<b>Insecta</b>	17	19.8	338	7.6
<b>OTHER TAXA</b>	3	3.5	39	0.9
<b>TOTAL</b>	<b>86</b>		<b>4464</b>	

Table 4. Summary of abundance of major taxonomic groups by station for the Chesapeake Bay Strata, August-September 1998.

Station	Taxa	No. of Taxa	% Total	No. of Individuals	% Total
1	Annelida	2	66.7	20	95.2
	Mollusca	0	0.0	0	0.0
	Arthropoda	1	33.3	1	4.8
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>3</b>			<b>21</b>
2	Annelida	2	13.3	54	32.1
	Mollusca	1	6.7	14	8.3
	Arthropoda	12	80.0	100	59.5
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>15</b>			<b>168</b>
3	Annelida	4	22.2	152	77.9
	Mollusca	3	16.7	9	4.6
	Arthropoda	11	61.1	34	17.4
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>18</b>			<b>195</b>
4	Annelida	2	33.3	19	51.4
	Mollusca	0	0.0	0	0.0
	Arthropoda	4	66.7	18	48.6
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>6</b>			<b>37</b>
5	Annelida	2	22.2	76	76.0
	Mollusca	3	33.3	7	7.0
	Arthropoda	4	44.4	17	17.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>9</b>			<b>100</b>
6	Annelida	3	30.0	12	9.3
	Mollusca	1	10.0	92	71.3
	Arthropoda	6	60.0	25	19.4
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>10</b>			<b>129</b>
7	Annelida	2	28.6	10	58.8
	Mollusca	1	14.3	1	5.9
	Arthropoda	4	57.1	6	35.3
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>7</b>			<b>17</b>

Table 4. Continued:

Station	Taxa	No. of Taxa	% Total	No. of Individuals	% Total
<b>8</b>	Annelida	3	50.0	6	60.0
	Mollusca	1	16.7	1	10.0
	Arthropoda	2	33.3	3	30.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>6</b>		<b>10</b>	
<b>9</b>	Annelida	5	29.4	25	30.9
	Mollusca	1	5.9	1	1.2
	Arthropoda	11	64.7	55	67.9
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>17</b>		<b>81</b>	
<b>10</b>	Annelida	5	41.7	50	40.0
	Mollusca	1	8.3	61	48.8
	Arthropoda	6	50.0	14	11.2
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>12</b>		<b>125</b>	
<b>11</b>	Annelida	5	45.5	40	33.6
	Mollusca	0	0.0	0	0.0
	Arthropoda	6	54.5	79	66.4
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>11</b>		<b>119</b>	
<b>12</b>	Annelida	4	50.0	41	33.9
	Mollusca	1	12.5	72	59.5
	Arthropoda	3	37.5	8	6.6
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>8</b>		<b>121</b>	
<b>13</b>	Annelida	4	44.4	8	17.8
	Mollusca	1	11.1	29	64.4
	Arthropoda	4	44.4	8	17.8
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>9</b>		<b>45</b>	
<b>14</b>	Annelida	2	40.0	5	8.6
	Mollusca	1	20.0	47	81.0
	Arthropoda	2	40.0	6	10.3
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>5</b>		<b>58</b>	

Table 4. Continued:

Station	Taxa	No. of Taxa	% Total	No. of Individuals	% Total
<b>15</b>	Annelida	8	44.4	56	53.3
	Mollusca	1	5.6	5	4.8
	Arthropoda	8	44.4	43	41.0
	Other Taxa	1	5.6	1	1.0
	<b>Total</b>	<b>18</b>		<b>105</b>	
<b>16</b>	Annelida	1	12.5	2	3.7
	Mollusca	1	12.5	43	79.6
	Arthropoda	5	62.5	8	14.8
	Other Taxa	1	12.5	1	1.9
	<b>Total</b>	<b>8</b>		<b>54</b>	
<b>17</b>	Annelida	7	41.2	35	52.2
	Mollusca	2	11.8	5	7.5
	Arthropoda	8	47.1	27	40.3
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>17</b>		<b>67</b>	
<b>18</b>	Annelida	0	0.0	0	0.0
	Mollusca	1	33.3	100	98.0
	Arthropoda	2	66.7	2	2.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>3</b>		<b>102</b>	
<b>19</b>	Annelida	2	28.6	2	9.5
	Mollusca	1	14.3	2	9.5
	Arthropoda	4	57.1	17	81.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>7</b>		<b>21</b>	
<b>20</b>	Annelida	3	33.3	6	33.3
	Mollusca	1	11.1	3	16.7
	Arthropoda	5	55.6	9	50.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>9</b>		<b>18</b>	
<b>21</b>	Annelida	1	50.0	2	40.0
	Mollusca	1	50.0	3	60.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>2</b>		<b>5</b>	

Table 4. Continued:

<b>Station</b>	<b>Taxa</b>	<b>No. of Taxa</b>	<b>% Total</b>	<b>No. of Individuals</b>	<b>% Total</b>
<b>22</b>	Annelida	7	63.6	38	80.9
	Mollusca	2	18.2	7	14.9
	Arthropoda	1	9.1	1	2.1
	Other Taxa	1	9.1	1	2.1
	<b>Total</b>	<b>11</b>		<b>47</b>	
<b>23</b>	Annelida	1	100.0	1	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>1</b>		<b>1</b>	
<b>24</b>	Annelida	7	53.8	227	60.5
	Mollusca	3	23.1	141	37.6
	Arthropoda	2	15.4	6	1.6
	Other Taxa	1	7.7	1	0.3
	<b>Total</b>	<b>13</b>		<b>375</b>	
<b>25</b>	Annelida	5	41.7	113	89.0
	Mollusca	3	25.0	9	7.1
	Arthropoda	3	25.0	3	2.4
	Other Taxa	1	8.3	2	1.6
	<b>Total</b>	<b>12</b>		<b>127</b>	
<b>26</b>	Annelida	5	55.6	38	84.4
	Mollusca	2	22.2	3	6.7
	Arthropoda	1	11.1	2	4.4
	Other Taxa	1	11.1	2	4.4
	<b>Total</b>	<b>9</b>		<b>45</b>	
<b>27</b>	Annelida	4	57.1	27	77.1
	Mollusca	2	28.6	6	17.1
	Arthropoda	0	0.0	0	0.0
	Other Taxa	1	14.3	2	5.7
	<b>Total</b>	<b>7</b>		<b>35</b>	
<b>28</b>	Annelida	2	66.7	33	94.3
	Mollusca	0	0.0	0	0.0
	Arthropoda	1	33.3	2	5.7
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>3</b>		<b>35</b>	

Table 4. Continued:

<b>Station</b>	<b>Taxa</b>	<b>No. of Taxa</b>	<b>% Total</b>	<b>No. of Individuals</b>	<b>% Total</b>
<b>29</b>	Annelida	7	70.0	26	63.4
	Mollusca	1	10.0	13	31.7
	Arthropoda	0	0.0	0	0.0
	Other Taxa	2	20.0	2	4.9
	<b>Total</b>	<b>10</b>		<b>41</b>	
<b>30</b>	Annelida	4	44.4	4	11.4
	Mollusca	2	22.2	26	74.3
	Arthropoda	3	33.3	5	14.3
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>9</b>		<b>35</b>	
<b>31</b>	Annelida	5	29.4	11	4.7
	Mollusca	6	35.3	207	89.2
	Arthropoda	4	23.5	11	4.7
	Other Taxa	2	11.8	3	1.3
	<b>Total</b>	<b>17</b>		<b>232</b>	
<b>32</b>	Annelida	10	71.4	116	87.2
	Mollusca	3	21.4	15	11.3
	Arthropoda	1	7.1	2	1.5
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>14</b>		<b>133</b>	
<b>33</b>	Annelida	1	100.0	3	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>1</b>		<b>3</b>	
<b>34</b>	Annelida	10	55.6	41	74.5
	Mollusca	2	11.1	2	3.6
	Arthropoda	5	27.8	11	20.0
	Other Taxa	1	5.6	1	1.8
	<b>Total</b>	<b>18</b>		<b>55</b>	
<b>35</b>	Annelida	6	75.0	70	84.3
	Mollusca	1	12.5	11	13.3
	Arthropoda	0	0.0	0	0.0
	Other Taxa	1	12.5	2	2.4
	<b>Total</b>	<b>8</b>		<b>83</b>	



Table 4. Continued:

Station	Taxa	No. of Taxa	% Total	No. of Individuals	% Total
<b>36</b>	Annelida	7	46.7	68	62.4
	Mollusca	2	13.3	23	21.1
	Arthropoda	5	33.3	17	15.6
	Other Taxa	1	6.7	1	0.9
	<b>Total</b>	<b>15</b>		<b>109</b>	
<b>37</b>	Annelida	1	25.0	1	3.7
	Mollusca	1	25.0	24	88.9
	Arthropoda	1	25.0	1	3.7
	Other Taxa	1	25.0	1	3.7
	<b>Total</b>	<b>4</b>		<b>27</b>	
<b>38</b>	Annelida	11	73.3	90	62.1
	Mollusca	3	20.0	54	37.2
	Arthropoda	0	0.0	0	0.0
	Other Taxa	1	6.7	1	0.7
	<b>Total</b>	<b>15</b>		<b>145</b>	
<b>39</b>	Annelida	0		0	
	Mollusca	0		0	
	Arthropoda	0		0	
	Other Taxa	0		0	
	<b>Total</b>	<b>0</b>		<b>0</b>	
<b>40</b>	Annelida	2	100.0	3	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>2</b>		<b>3</b>	
<b>41</b>	Annelida	0		0	
	Mollusca	0		0	
	Arthropoda	0		0	
	Other Taxa	0		0	
	<b>Total</b>	<b>0</b>		<b>0</b>	
<b>42</b>	Annelida	6	40.0	22	35.5
	Mollusca	6	40.0	24	38.7
	Arthropoda	3	20.0	16	25.8
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>15</b>		<b>62</b>	

Table 4. Continued:

<b>Station</b>	<b>Taxa</b>	<b>No. of Taxa</b>	<b>% Total</b>	<b>No. of Individuals</b>	<b>% Total</b>
<b>43</b>	Annelida	1	14.3	3	13.0
	Mollusca	3	42.9	13	56.5
	Arthropoda	3	42.9	7	30.4
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>7</b>		<b>23</b>	
<b>44</b>	Annelida	0		0	
	Mollusca	0		0	
	Arthropoda	0		0	
	Other Taxa	0		0	
	<b>Total</b>	<b>0</b>		<b>0</b>	
<b>45</b>	Annelida	2	100.0	26	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>2</b>		<b>26</b>	
<b>46</b>	Annelida	3	42.9	8	53.3
	Mollusca	3	42.9	5	33.3
	Arthropoda	1	14.3	2	13.3
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>7</b>		<b>15</b>	
<b>47</b>	Annelida	4	80.0	18	94.7
	Mollusca	1	20.0	1	5.3
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>5</b>		<b>19</b>	
<b>48</b>	Annelida	4	80.0	16	94.1
	Mollusca	1	20.0	1	5.9
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>5</b>		<b>17</b>	
<b>49</b>	Annelida	5	100.0	20	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>5</b>		<b>20</b>	

Table 4. Continued:

<b>Station</b>	<b>Taxa</b>	<b>No. of Taxa</b>	<b>% Total</b>	<b>No. of Individuals</b>	<b>% Total</b>
<b>50</b>	Annelida	4	100.0	61	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>4</b>		<b>61</b>	
<b>51</b>	Annelida	1	100.0	1	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>1</b>		<b>1</b>	
<b>52</b>	Annelida	5	100.0	49	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>5</b>		<b>49</b>	
<b>53</b>	Annelida	4	57.1	31	91.2
	Mollusca	2	28.6	2	5.9
	Arthropoda	0	0.0	0	0.0
	Other Taxa	1	14.3	1	2.9
	<b>Total</b>	<b>7</b>		<b>34</b>	
<b>54</b>	Annelida	1	100.0	9	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>1</b>		<b>9</b>	
<b>55</b>	Annelida	3	100.0	3	100.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>3</b>		<b>3</b>	
<b>56</b>	Annelida	9	56.3	54	46.6
	Mollusca	4	25.0	51	44.0
	Arthropoda	2	12.5	10	8.6
	Other Taxa	1	6.3	1	0.9
	<b>Total</b>	<b>16</b>		<b>116</b>	

Table 4. Continued:

Station	Taxa	No. of Taxa	% Total	No. of Individuals	% Total
<b>57</b>	Annelida	6	42.9	6	1.8
	Mollusca	2	14.3	290	86.3
	Arthropoda	5	35.7	39	11.6
	Other Taxa	1	7.1	1	0.3
	<b>Total</b>	<b>14</b>		<b>336</b>	
<b>58</b>	Annelida	5	45.5	27	37.5
	Mollusca	4	36.4	43	59.7
	Arthropoda	1	9.1	1	1.4
	Other Taxa	1	9.1	1	1.4
	<b>Total</b>	<b>11</b>		<b>72</b>	
<b>59</b>	Annelida	5	45.5	16	12.5
	Mollusca	2	18.2	10	7.8
	Arthropoda	3	27.3	99	77.3
	Other Taxa	1	9.1	3	2.3
	<b>Total</b>	<b>11</b>		<b>128</b>	
<b>60</b>	Annelida	6	40.0	20	13.4
	Mollusca	4	26.7	38	25.5
	Arthropoda	4	26.7	87	58.4
	Other Taxa	1	6.7	4	2.7
	<b>Total</b>	<b>15</b>		<b>149</b>	
<b>61</b>	Annelida	6	54.5	8	24.2
	Mollusca	5	45.5	25	75.8
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	<b>Total</b>	<b>11</b>		<b>33</b>	
<b>62</b>	Annelida	5	50.0	17	50.0
	Mollusca	3	30.0	11	32.4
	Arthropoda	1	10.0	4	11.8
	Other Taxa	1	10.0	2	5.9
	<b>Total</b>	<b>10</b>		<b>34</b>	
<b>63</b>	Annelida	6	46.2	14	10.9
	Mollusca	3	23.1	14	10.9
	Arthropoda	3	23.1	95	74.2
	Other Taxa	1	7.7	5	3.9
	<b>Total</b>	<b>13</b>		<b>128</b>	

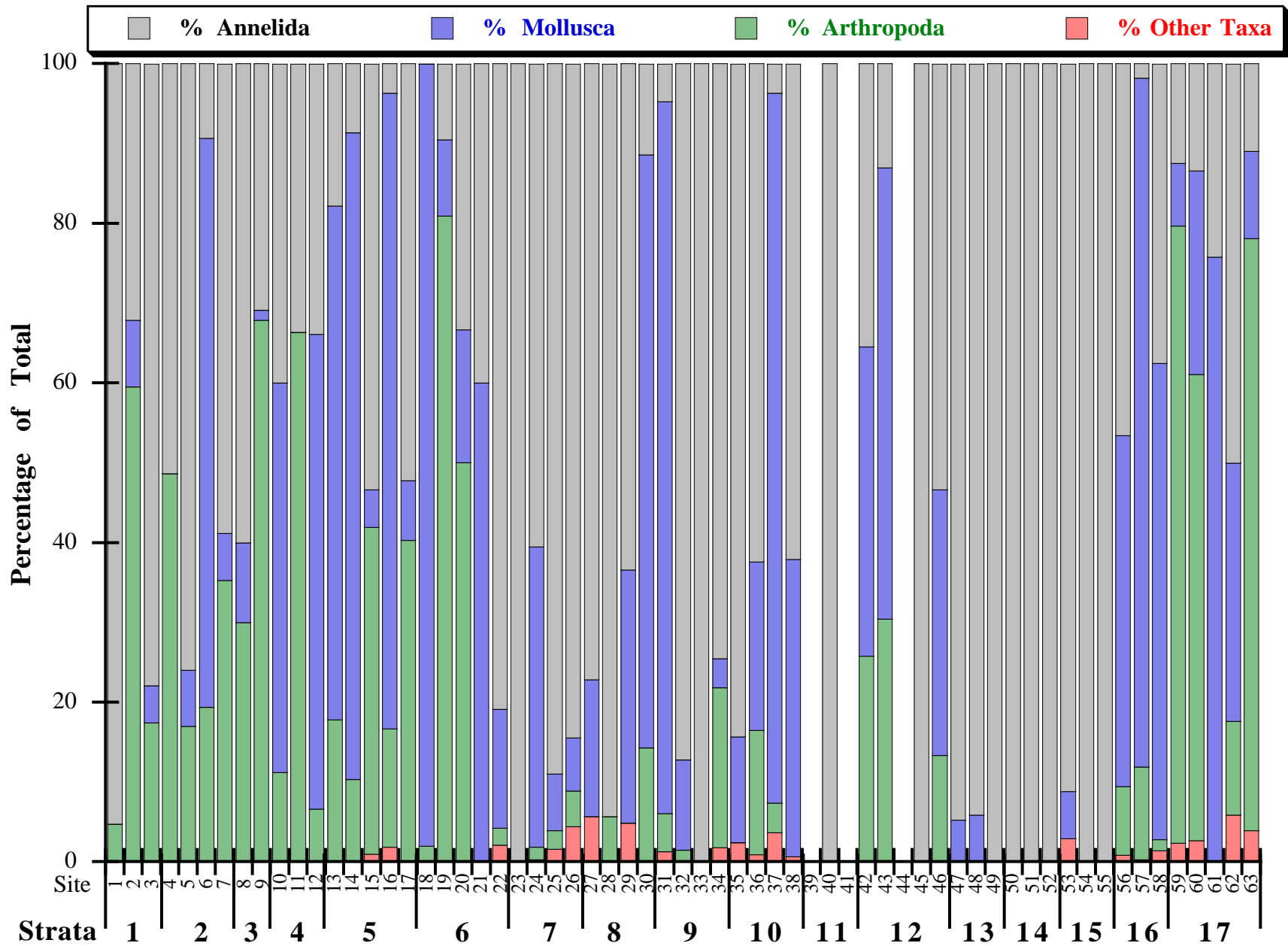


Figure 7. Percent abundance of major taxonomic groups for the Chesapeake Bay Stations with strata indicated in bold, August-September 1998.





Table 6. Summary of the benthic macroinfaunal data for the Chesapeake Bay Strata, August-September 1998.

Strata	Station	Total No. Taxa	Total No. Individuals	Density (nos/m <sup>2</sup> )	H' Diversity	J' Evenness
1	1	3	21	525	0.85	0.78
1	2	15	168	4200	2.30	0.85
1	3	18	195	4875	1.58	0.55
2	4	6	37	925	1.36	0.76
2	5	9	100	2500	1.31	0.60
2	6	10	129	3225	1.12	0.48
3	7	7	17	425	1.48	0.76
3	8	6	10	250	1.61	0.90
3	9	17	81	2025	2.36	0.83
4	10	12	125	3125	1.48	0.60
4	11	11	119	2975	1.86	0.78
4	12	8	121	3025	1.25	0.60
5	13	9	45	1125	1.32	0.60
5	14	5	58	1450	0.75	0.46
5	15	18	105	2625	2.53	0.88
5	16	8	54	1350	0.88	0.42
5	17	17	67	1675	2.29	0.81
6	18	3	102	2550	0.11	0.10
6	19	7	21	525	1.43	0.73
6	20	9	18	450	2.14	0.97
6	21	2	5	125	0.67	0.97
6	22	11	47	1175	1.92	0.80
7	23	1	1	25	0.00	-
7	24	13	375	9375	1.53	0.59
7	25	12	127	3175	0.78	0.31
7	26	9	45	1125	1.66	0.76
8	27	7	35	875	1.79	0.92
8	28	3	35	875	0.43	0.40
8	29	10	41	1025	1.85	0.80
8	30	9	35	875	1.31	0.59
9	31	17	232	5800	1.52	0.54
9	32	14	133	3325	2.04	0.77
9	33	1	3	75	0.00	0.00
9	34	18	55	1375	2.46	0.85
10	35	8	83	2075	1.17	0.56
10	36	15	109	2725	2.21	0.82
10	37	4	27	675	0.47	0.34
10	38	15	145	3625	2.08	0.77
11	39	0	0	0	-	-
11	40	2	3	75	0.64	0.92
11	41	0	0	0	-	-
12	42	15	62	1550	2.22	0.82
12	43	7	23	575	1.63	0.84
12	44	0	0	0	-	-
12	45	2	26	650	0.58	0.84
13	46	7	15	375	1.84	0.95
13	47	5	19	475	1.02	0.63
13	48	5	17	425	1.26	0.78
13	49	5	20	500	1.34	0.84
14	50	4	61	1525	0.83	0.60
14	51	1	1	25	0.00	-
14	52	5	49	1225	0.85	0.53
15	53	7	34	850	1.45	0.75
15	54	1	9	225	0.00	0.00
15	55	3	3	75	1.10	1.00
16	56	16	116	2900	2.18	0.79
16	57	14	336	8400	0.66	0.25
16	58	11	72	1800	2.02	0.84
17	59	11	128	3200	1.26	0.53
17	60	15	149	3725	1.89	0.70
17	61	11	33	825	1.95	0.81
17	62	10	34	850	1.99	0.87
17	63	13	128	3200	1.63	0.63



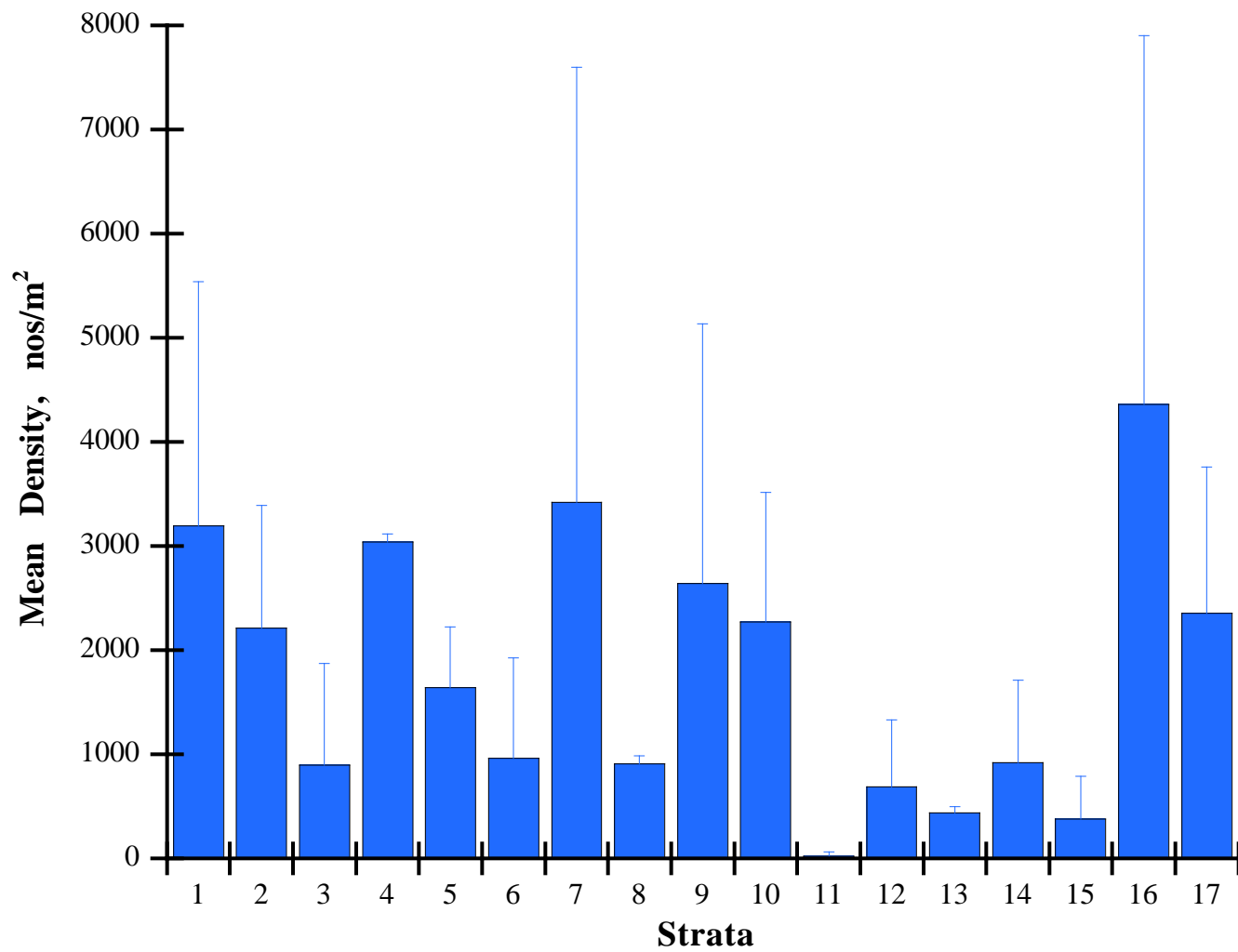


Figure 8. Mean macroinvertebrate densities for the Chesapeake Bay Strata, August- September 1998.

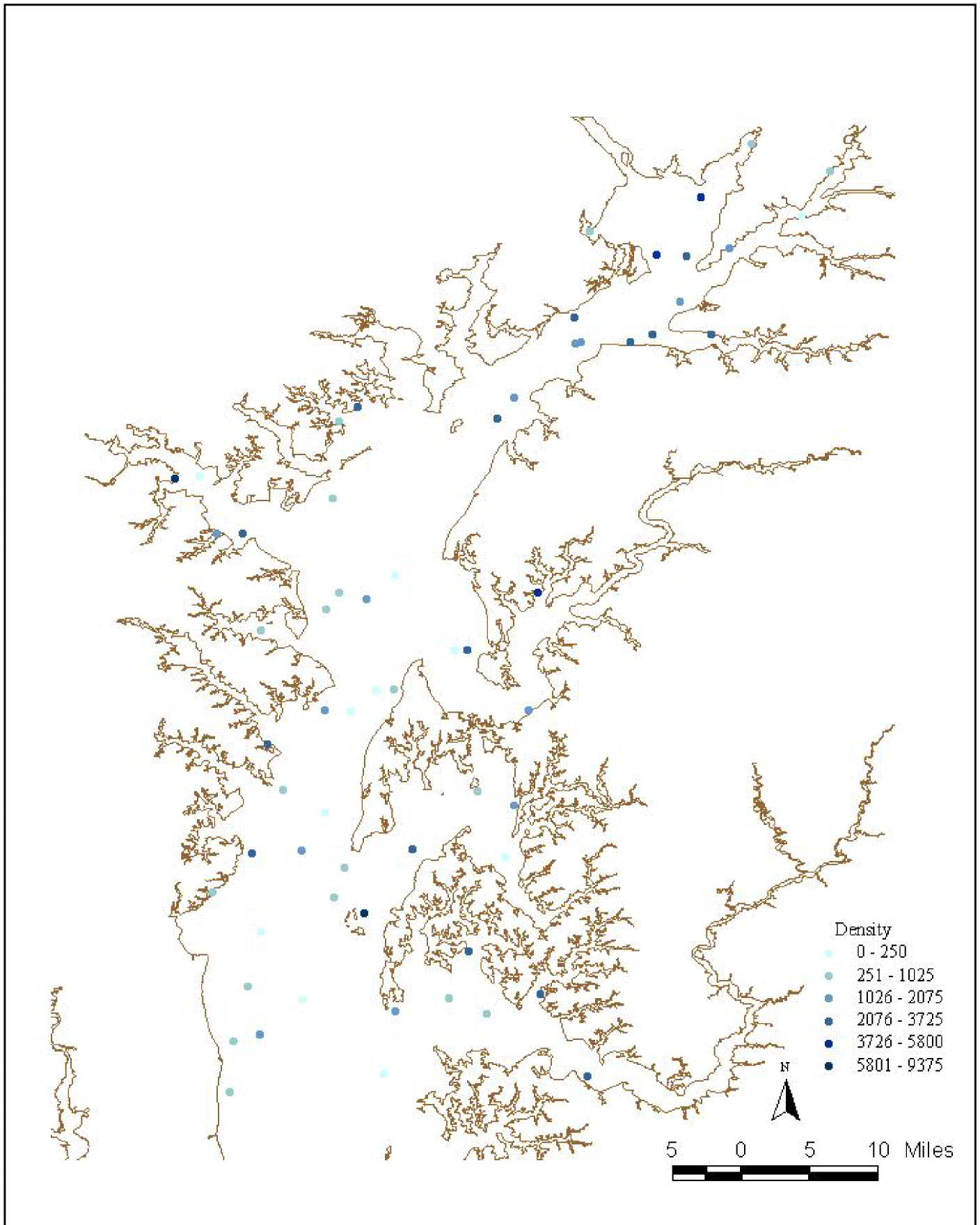


Figure 9. Map of macroinvertebrate density by station for the Chesapeake Bay Stations, August-September 1998.

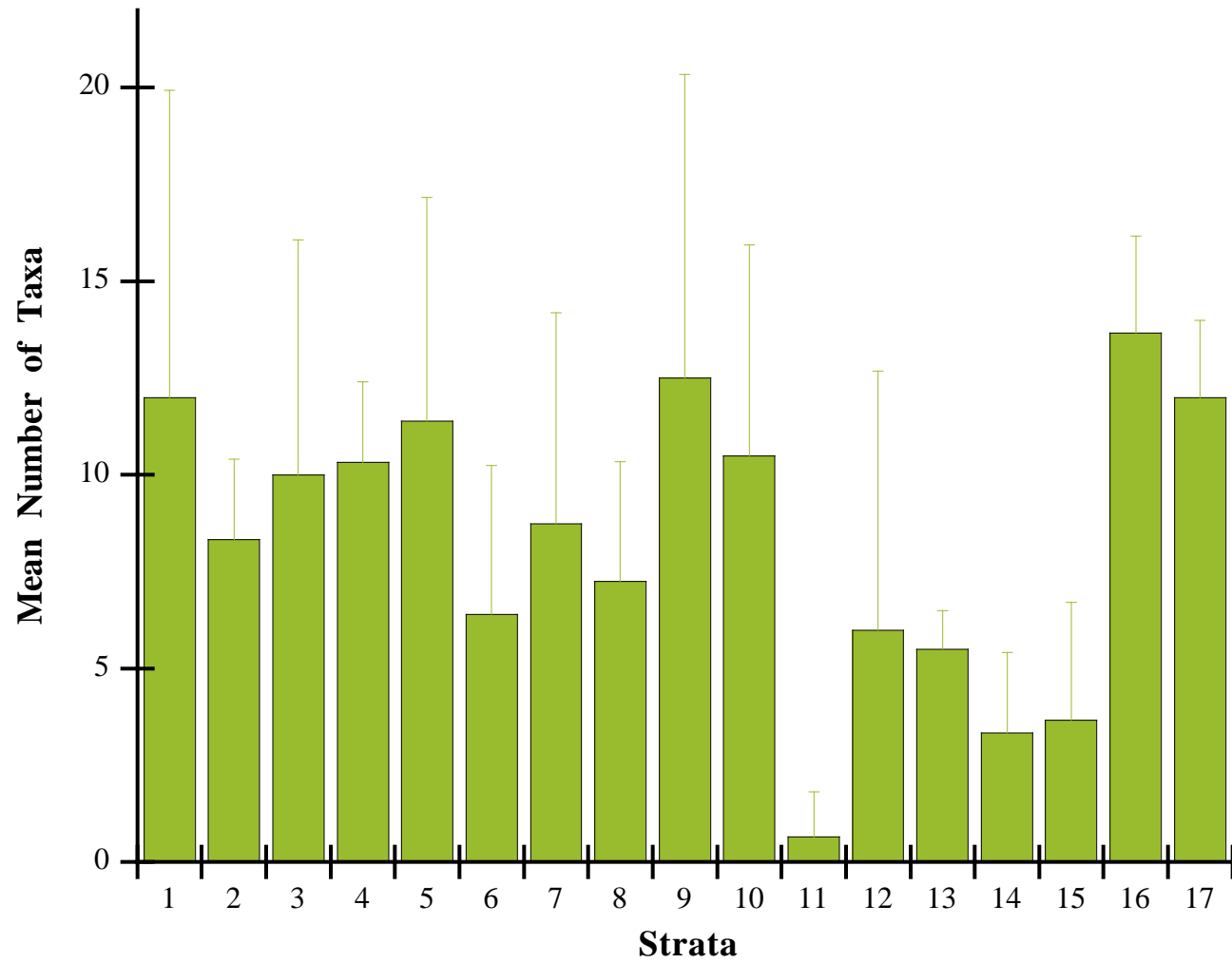


Figure 10. Mean number of macroinvertebrate taxa per site for the Chesapeake Bay Strata, August-September 1998.

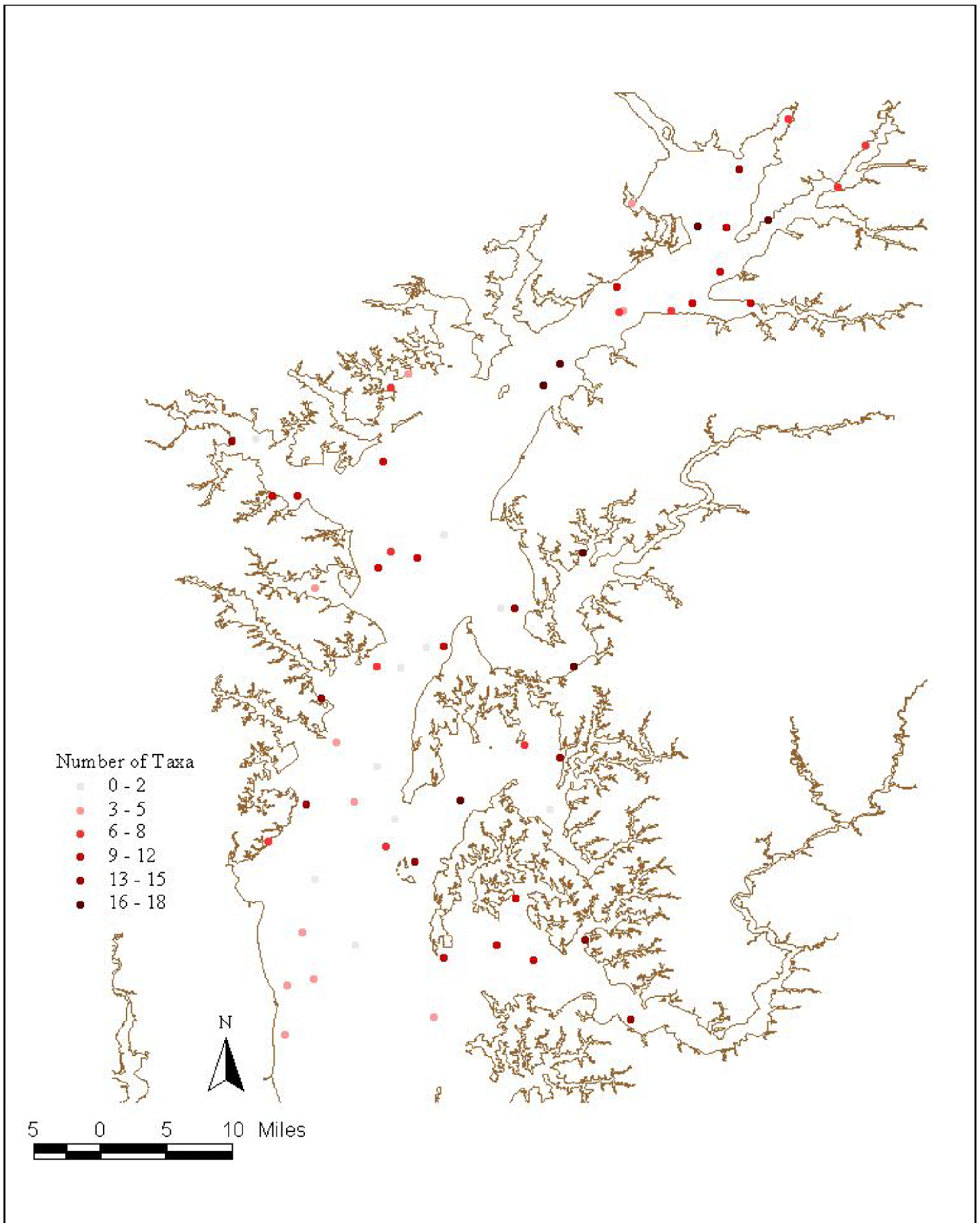


Figure 11. Map of number of taxa by station for the Chesapeake Bay Stations, August-September 1998.

number of taxa per site also varied and ranged from 0 at sites 39, 41 and 44 to 18 at sites 3, 15 and 34 (Table 6; Figures 10 and 11).

Taxa diversity and evenness are given in Table 6 and Figures 12 and 13. Mean taxa diversity ( $H'$ ) exhibited considerable variation and ranged from 0.6 at Strata 14 to 1.82 at Strata 3 (Table 6; Figure 12). Mean taxa evenness ( $J$ ) also exhibited variation and ranged from 0.5 at Strata 9 to 0.9 at Strata 11 (Table 6; Figure 13).

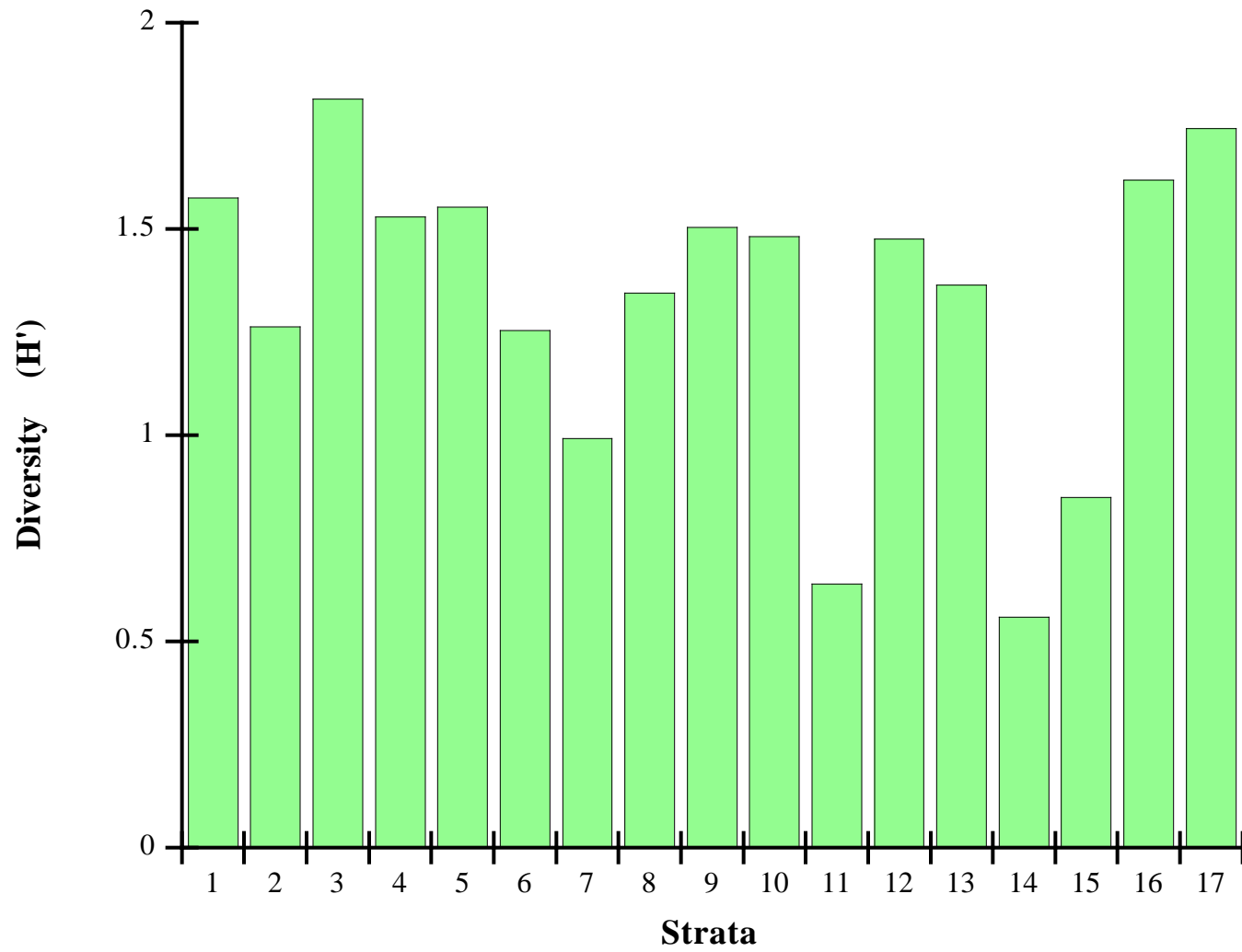


Figure 12. Mean taxa diversity ( $H'$ ) for the Chesapeake Bay Strata, August-September 1998.

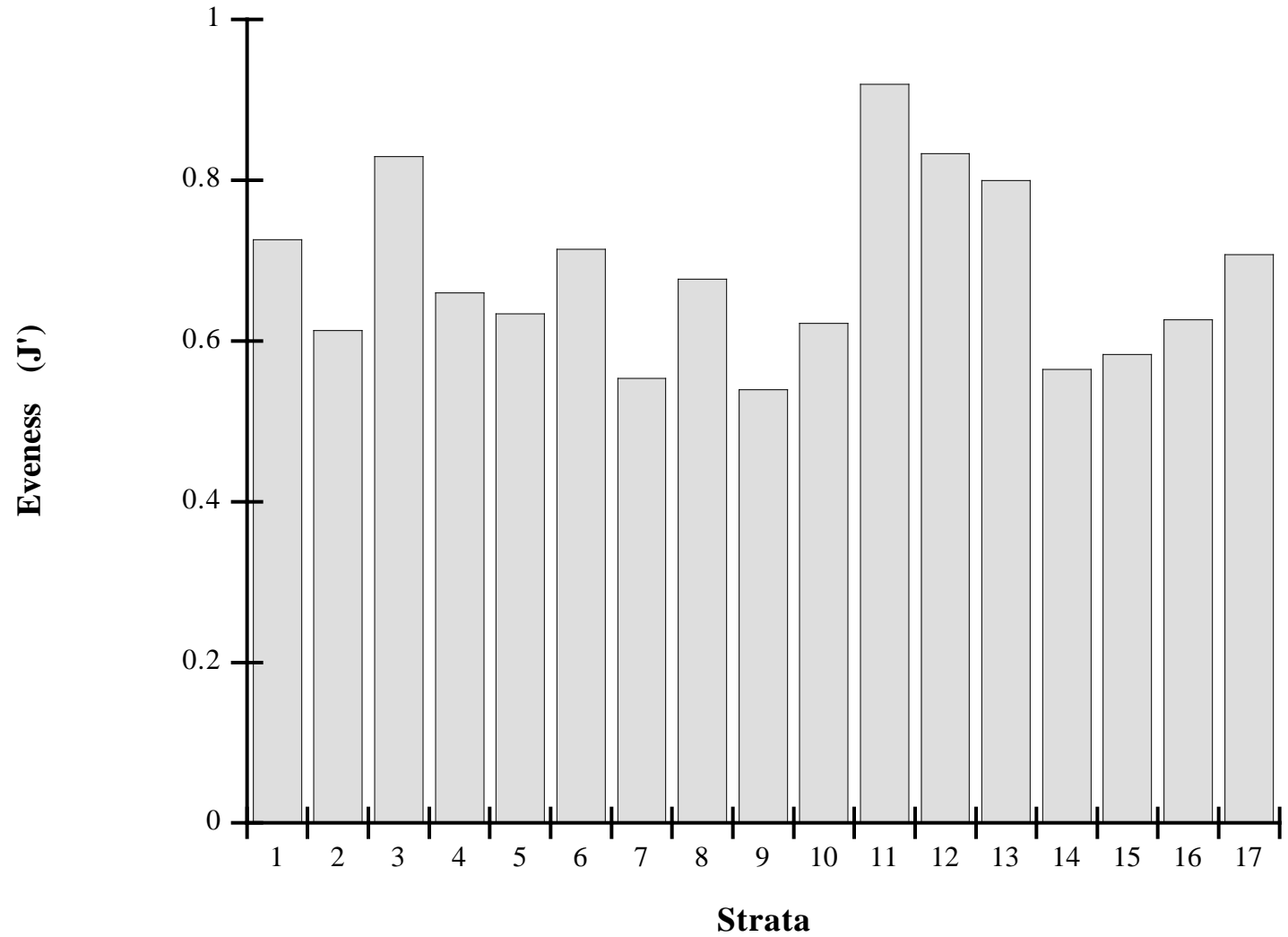


Figure 13. Mean taxa evenness (J') for the Chesapeake Bay Strata, August-September 1998.

## **LITERATURE CITED**

Pielou, E.C. 1966. The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology* 13:131-144.



## **APPENDIX**

## QUALITY ASSURANCE STATEMENT

Client/Project **NOAA**

Work Assignment Title **1998 Chesapeake Bay**

Work Assignment Number

Task Number

Description of Data Set or Deliverable: **63 Benthic macroinvertebrate samples collected August 24-September 15, 1998; Young Dredge grabs.**

Description of audit and review activities: **Judged accuracy rates were well above standard levels for sorting and taxonomy. Laboratory QC reports were completed. Copies of QC results follow (see attachment.) All taxonomic data were entered into computer and printed. This list was checked for accuracy against original taxonomic data sheets.**

Description of outstanding issues or deficiencies which may affect data quality: **None**

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Signature of QA Officer or Reviewer

Date

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Signature of Project Manager

Date

## QUALITY CONTROL REWORKS

Client/Project **NOAA**

Work Assignment Title **Chesapeake Bay**

Task Number

### Sorting Results:

Sample #	% Accuracy
21	100%
33	100%
40	100%
30	100%
19	100%
23	100%
61	100%
47	100%

### Taxonomy Results:

Sample #	Taxa	% Accuracy
31	Crust./Moll.	100%
22	Crust./Moll.	100%
15	Crust./Moll.	98%
56	Crust./Moll.	98%
21	Crust./Moll.	100%
48	Crust./Moll.	100%
15	Poly./Misc.	100%
25	Poly./Misc.	96.4%
30	Poly./Misc.	100%
34	Poly./Misc.	97.6%
51	Poly./Misc.	100%
62	Poly./Misc.	100%
2	Chironomid/Oligo	96.2%
27	Chironomid/Oligo	100%
60	Chironomid/Oligo	100%

Description of outstanding issues or deficiencies which may affect data quality: **None**

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Signature of QA Officer or Reviewer

Date