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# DELAWARE BAY AND ADJACENT WATERS BENTHIC COMMUNITY ASSESSMENT

SUBMITTED TO

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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OFFICE OF OCEAN RESOURCES CONSERVATION AND ASSESSMENT
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# INTRODUCTION

The Delaware River, Delaware Bay and adjacent waters were sampled during September, 1997. One goal of this sampling effort was benthic community characterization. National Oceanic and Atmospheric Administration (NOAA) personnel collected the samples and laboratory and data analysis were performed by Barry A. Vittor & Associates, Inc. (BVA).

# METHODS

### *Sample Collection And Handling*

A Young dredge (area = 0.04 $m^2$) was used to collect bottom samples at each of 81 sites in the Delaware River, Delaware Bay and adjacent waters. 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 μm and nested sieves for larger particle fractions. Texture parameters computed included percent gravel, sand, silt and 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 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 taxa not previously encountered 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/QCs report for the Delaware Bay and adjacent waters samples is given in the Appendix.

The analytical methodologies utilized for this study were similar to those used in other benthic community characterization reports prepared for NOAA. Macroinfaunal characterization involves an evaluation of several biological community structure parameters (e.g., taxa abundance, taxa composition and taxa diversity indices) during initial data reduction, followed by pattern and classification analysis for delineation of taxa assemblages. Since taxa are distributed along environmental gradients, there are generally no distinct boundaries between communities. However, the relationships between habitats and taxa 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 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 Pielou's 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, $J' = H'/H'_{max}$.

Macroinfaunal data were graphically and statistically analyzed to identify any differences in density between strata. Data for total density were variously transformed and tested for normality (Shapiro-Wilk W; SAS Institute, 1995). Data which could not be normalized with standard transformations [e.g. $\ln(x+1)$, $\sqrt{(x+1)}$] were analyzed using non-parametric methods (SAS Institute, 1995).

### *Faunal Similarities*

Cluster analysis was performed on the faunal data to examine between-site differences at the Delaware Bay sites and to compare faunal composition of each site within the study area. Both normal and inverse cluster analyses were used in this study. Normal analysis (sometimes called Q-analysis) treats samples as individual observations, each being composed of a number of attributes (i.e. the various taxa from a given sample). Normal analysis is instructive in helping to ascertain community structure and to infer specific ecological conditions between sampling stations from the relative distributions of species. Inverse clustering (termed R-analysis) is based on taxa as individuals, each of which is characterized by its relative abundance in the various samples. This type of analysis is commonly used to identify species groupings with particular habitats or environmental conditions.

Cluster analysis of both station collections (normal analysis) and taxa (inverse analysis) was performed using the average linkage method (SAS Institute 1997). In this method, the distance between two clusters is the average distance between pairs of observations, one in each cluster. Taxa used in these analyses were selected according to their percent abundance in the assemblage. Total densities for each of the selected taxa at a given station were ln transformed [x=ln(x+1)] before the analyses.

## HABITAT CHARACTERISTICS

Sediment data for the 81 sites and 22 strata are given in Table 1 and Figures 1, 2, 3 and 4. Sediment composition of the 81 sites varied considerably from 73% silt (sandy silt) at Site 3 to greater than 99% sand at nine sites with Site 47 at 99.97% (Table 1; Figures 1 and 2); however, the sediment at the majority of sites was predominantly silty sand (Figures 1 and 2). The total organic carbon (TOC) fraction of the sediment ranged from 0.09% at site 62 to 20.5% at site 89 (Table 1; Figures 3 and 4). In terms of strata, sand again dominated with 14 of the 22 strata composed of greater than 50% (Figure 5) however, the variability of sediment components of the sites within each stratum is high (Figures 6, 7, 8 and 9). Stratum 3 contained the highest percentage of sand at 94.45% (Table 1). Strata 21 and 22 contained the highest percentages of silt, 61.17% and 53.96% respectively and, conversely, the lowest percentages of sand, 6.41% and 4.55% (Table 2; Figure 5). Mean % TOC for all strata is displayed in Figure 10.

Table 1. Summary of water parameters and benthic macroinfaunal data for the Delaware Bay and ~~adjacent waters~~ sites ~~and corresponding~~ strata, September 1997.

| Site No. | Strata | No. of Taxa | Density (nos./m2) | H' Diversity | J' Evenness | Temp (°C) Surface | Temp (°C) Bottom | DO (mg/l) Surface | DO (mg/l) Bottom | Salinity (ppt) Surface | Salinity (ppt) Bottom | % Gravel | % Sand | % Silt | % Clay | % TOC | Textural Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 19 | 17 | 6900 | 1.74 | 0.62 | 22.8 | 22.7 | 6.7 | 6.3 | 0.1 | 0.1 | 0 | 11.76 | 55.99 | 32.24 | 1.42 | silty clay |
| 2 | 19 | 11 | 4100 | 1.49 | 0.62 | 21.7 | 21.7 | 7.0 | 5.3 | 0.1 | 0.1 | 1.24 | 96.18 | 1.56 | 0 | 1 | sand |
| 3 | 19 | 15 | 7650 | 1.79 | 0.66 | 22.3 | 22.3 | 5.7 | 4.7 | 0.1 | 0.1 | 0 | 14.99 | 73.05 | 11.96 | 1.47 | sandy silt |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 14.33 | 6216.67 | 1.67 | 0.63 | 22.3 | 22.2 | 6.5 | 5.4 | 0.1 | 0.1 | 0.41 | 40.98 | 43.53 | 14.73 | 1.30 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 3.06 | 1871.05 | | | 0.55 | 0.50 | 0.67 | 0.82 | 0 | 0 | 0.72 | 47.83 | 37.34 | 16.30 | 0.26 | |
| 4 | 20 | 16 | 19525 | 0.96 | 0.35 | 22.5 | 22.5 | 6.0 | 5.9 | 0.2 | 0.1 | 0 | 78.05 | 18.22 | 3.72 | 2.27 | silty sand |
| 5 | 20 | 6 | 1425 | 0.78 | 0.44 | 22.9 | 22.9 | 7.1 | 5.3 | 0.2 | 0.1 | 0.15 | 99.04 | 0 | 0 | 2.12 | sand |
| 6 | 20 | 10 | 3325 | 1.87 | 0.81 | 22.5 | 22.5 | 8.6 | 9.0 | 0.1 | 0.1 | 0.09 | 99.26 | 0 | 0 | 1.98 | sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 10.67 | 8091.67 | 1.20 | 0.53 | 22.6 | 22.6 | 7.2 | 6.7 | 0.1 | 0.1 | 0.08 | 92.12 | 6.07 | 1.24 | 2.12 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 5.03 | 9947.03 | | | 0.19 | 0.20 | 1.32 | 1.97 | 0.04 | 0.02 | 0.08 | 12.18 | 10.52 | 2.15 | 0.15 | |
| 7 | 1 | 18 | 13250 | 1.36 | 0.47 | 23.3 | 23.3 | 6.3 | 6.5 | 0.1 | 0.1 | 0 | 42.38 | 53.13 | 4.49 | 2.17 | sandy silt |
| 8 | 1 | 7 | 11150 | 0.42 | 0.22 | 23.4 | 23.3 | 5.6 | 4.3 | 0.2 | 0.2 | 0 | 31.35 | 62.49 | 6.16 | 2.03 | sandy silt |
| 9 | 1 | 7 | 4700 | 1.41 | 0.73 | 22.8 | 22.7 | 5.8 | 5.7 | 0.1 | 0.1 | 11.81 | 84.56 | 2.25 | 0 | 0.99 | gravelly sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 10.67 | 9700 | 1.07 | 0.47 | 23.2 | 23.1 | 5.9 | 5.5 | 0.1 | 0.1 | 3.94 | 52.76 | 39.29 | 3.55 | 1.73 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 6.35 | 4455.61 | | | 0.33 | 0.35 | 0.35 | 1.10 | 0.04 | 0.04 | 6.82 | 28.08 | 32.42 | 3.19 | 0.64 | |
| 10 | 2 | 12 | 6975 | 1.95 | 0.78 | 23.5 | 23.3 | 5.6 | 5.4 | 0.2 | 0.2 | 0 | 13.24 | 70.48 | 16.28 | 3.13 | sandy silt |
| 11 | 2 | 11 | 3775 | 1.89 | 0.79 | 23.5 | 23.3 | 5.2 | 4.8 | 0.2 | 0.2 | 0.85 | 74.72 | 18.54 | 5.89 | 0.74 | silty sand |
| 12 | 2 | 12 | 6875 | 1.74 | 0.70 | | | | | | | 15.86 | 24.08 | 32.93 | 27.12 | 3.01 | gravelly mud |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 11.67 | 5875 | 1.86 | 0.76 | 23.5 | 23.3 | 5.4 | 5.1 | 0.2 | 0.2 | 5.57 | 37.35 | 40.65 | 16.43 | 2.29 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 0.58 | 1819.34 | | | 0 | 0 | 0.28 | 0.43 | 0 | 0 | 8.92 | 32.82 | 26.82 | 10.62 | 1.35 | |
| 13 | 3 | 5 | 1875 | 1.07 | 0.67 | 23.6 | 23.6 | 5.3 | 5.3 | 0.2 | 0.2 | | | | | 1.02 | |
| 14 | 3 | 9 | 1425 | 1.72 | 0.78 | 23.4 | 23.3 | 4.0 | 5.6 | 0.2 | 0.2 | 1.53 | 89.81 | 5.51 | 0 | 2.62 | sand |
| 15 | 3 | 7 | 1475 | 1.29 | 0.66 | 23.5 | 23.6 | 5.4 | 5.3 | 0.3 | 0.2 | 0 | 99.08 | 0 | 0 | 0.34 | sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 7 | 1591.67 | 1.36 | 0.70 | 23.5 | 23.5 | 4.9 | 5.4 | 0.2 | 0.2 | 0.77 | 94.45 | 2.76 | 0 | 1.33 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 2 | 246.64 | | | 0.09 | 0.18 | 0.76 | 0.20 | 0.05 | 0.01 | 1.08 | 6.55 | 3.90 | 0 | 1.17 | |
| 16 | 4 | 13 | 12800 | 1.54 | 0.60 | | | | | | | 0 | 43.03 | 26.65 | 30.32 | 1.98 | sandy clay |
| 17 | 4 | 8 | 3300 | 1.48 | 0.71 | | | | | | | 1.09 | 95.98 | 2.05 | 0 | 0.32 | sand |
| 18 | 4 | 8 | 2325 | 1.25 | 0.60 | 23.9 | 23.7 | 6.4 | 6.4 | 0.7 | 0.7 | 0.07 | 84.57 | 12.2 | 0 | 0.46 | sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 9.67 | 6141.67 | 1.42 | 0.64 | 23.9 | 23.7 | 6.4 | 6.4 | 0.7 | 0.7 | 0.39 | 74.53 | 13.63 | 10.11 | 0.92 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 2.89 | 5786.86 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0.61 | 27.87 | 12.36 | 17.51 | 0.92 | |

Table 1. Continued

| Site No. | Strata | No. of Taxa | Density (nos./m2) | H' Diversity | J' Evenness | Temp (°C) Surface | Temp (°C) Bottom | DO (mg/l) Surface | DO (mg/l) Bottom | Salinity (ppt) Surface | Salinity (ppt) Bottom | % Gravel | % Sand | % Silt | % Clay | % TOC | Textural Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 5 | 8 | 2550 | 1.01 | 0.49 | 23.1 | 23.2 | 5.8 | 5.4 | 0.8 | 2.1 | 0.41 | 59.38 | 25.14 | 15.07 | 2.67 | silty sand |
| 20 | 5 | 7 | 5075 | 0.83 | 0.43 | 23.7 | 23.2 | 6.8 | 6.4 | 1.4 | 1.6 | 0 | 62.87 | 27.83 | 9.3 | 2.97 | silty sand |
| 21 | 5 | 2 | 400 | 0.48 | 0.70 | | | | | | | 0 | 34.42 | 40.11 | 25.48 | 0.96 | clayey silt |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 5.67 | 2675 | 0.77 | 0.54 | 23.4 | 23.2 | 6.3 | 5.9 | 1.1 | 1.9 | 0.14 | 52.22 | 31.03 | 16.62 | 2.2 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 3.21 | 2340.01 | | | 0.42 | 0 | 0.75 | 0.71 | 0.42 | 0.35 | 0.24 | 15.52 | 7.98 | 8.20 | 1.08 | |
| 22 | 6 | 7 | 1800 | 1.17 | 0.60 | 23.1 | 23.1 | 6.5 | 3.2 | 2.6 | 3.1 | 0 | 81.65 | 11.39 | 6.97 | 0.38 | sand |
| 23 | 6 | 2 | 2900 | 0.55 | 0.80 | 23.2 | 23.2 | 6.3 | 6.2 | 3.4 | 3.5 | 0 | 4.01 | 44.5 | 51.49 | 3.23 | clay |
| 24 | 6 | 2 | 75 | 0.64 | 0.92 | 23.2 | 23.1 | 7.0 | 6.5 | 3.1 | 3.1 | 0 | 11.49 | 48.87 | 39.64 | 3.11 | silty clay |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 3.67 | 1591.67 | 0.79 | 0.77 | 23.2 | 23.1 | 6.6 | 5.3 | 3.0 | 3.2 | 0 | 32.38 | 34.92 | 32.7 | 2.24 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 2.89 | 1423.98 | | | 0.06 | 0.06 | 0.35 | 1.83 | 0.40 | 0.23 | 0 | 42.83 | 20.49 | 23.06 | 1.61 | |
| 25 | 7 | 4 | 125 | 1.33 | 0.96 | | | | | | | 0 | 29.28 | 42.06 | 28.66 | 2.23 | clayey silt |
| 26 | 7 | 5 | 4550 | 0.21 | 0.13 | 19.4 | 19.2 | 7.3 | 7.0 | 4.5 | 4.5 | | | | | 1.98 | |
| 27 | 7 | 4 | 150 | 1.24 | 0.90 | 19.9 | 19.5 | 7.4 | 7.3 | 4.7 | 5.1 | 1.83 | 54.53 | 20.1 | 23.54 | 0.6 | clayey sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 4.33 | 1608.33 | 0.93 | 0.66 | 19.7 | 19.4 | 7.3 | 7.2 | 4.6 | 4.8 | 0.92 | 41.91 | 31.08 | 26.1 | 1.60 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 0.58 | 2547.59 | | | 0.35 | 0.21 | 0.05 | 0.19 | 0.14 | 0.42 | 1.29 | 17.85 | 15.53 | 3.62 | 0.88 | |
| 28 | 8 | 11 | 1650 | 1.36 | 0.57 | 19.6 | 19.4 | 7.5 | 7.5 | 6.0 | 6.0 | 0 | 61.65 | 24.18 | 14.17 | 0.74 | silty sand |
| 29 | 8 | 7 | 1800 | 1.20 | 0.62 | 19.9 | 19.5 | 7.2 | 7.1 | 7.5 | 7.5 | 0 | 18.63 | 52.03 | 29.34 | 3.28 | clayey silt |
| 30 | 8 | 14 | 2500 | 1.99 | 0.76 | 20.0 | 19.9 | 7.4 | 7.4 | 7.1 | 7.1 | 0.22 | 61.24 | 21.16 | 17.37 | 2.44 | silty sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 10.67 | 1983.33 | 1.52 | 0.65 | 19.8 | 19.6 | 7.4 | 7.3 | 6.9 | 6.9 | 0.07 | 47.17 | 32.46 | 20.29 | 2.15 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 3.51 | 453.69 | | | 0.21 | 0.26 | 0.14 | 0.17 | 0.78 | 0.78 | 0.13 | 24.72 | 17.02 | 8.00 | 1.29 | |
| 31 | 9 | 3 | 300 | 0.82 | 0.75 | 20.4 | 19.7 | 6.9 | 6.4 | 7.6 | 7.8 | 0.51 | 44.44 | 33.78 | 21.27 | 0.52 | clayey sand |
| 32 | 9 | 10 | 2925 | 1.27 | 0.55 | | | | | | | 0 | 5.77 | 50.81 | 43.42 | 2.21 | silty clay |
| 33 | 9 | 5 | 625 | 0.95 | 0.59 | | | | | | | 0 | 39.91 | 43.89 | 16.2 | 1.98 | sandy silt |
| 34 | 9 | 13 | 1800 | 2.25 | 0.88 | 20.1 | 19.8 | 6.8 | 6.7 | 11.2 | 11.7 | 0.16 | 36.04 | 44.01 | 19.79 | 1.32 | sandy silt |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 7.75 | 1412.50 | 1.32 | 0.69 | 20.3 | 19.8 | 6.8 | 6.6 | 9.4 | 9.8 | 0.17 | 31.54 | 43.12 | 25.17 | 1.51 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 4.57 | 1196.61 | | | 0.21 | 0.1 | 0.09 | 0.21 | 2.55 | 2.76 | 0.24 | 17.52 | 7.02 | 12.35 | 0.76 | |
| 35 | 10 | 4 | 300 | 1.20 | 0.86 | 19.7 | 19.7 | 7.0 | 6.9 | 8.3 | 8.3 | 0.57 | 86.76 | 8.76 | 3.92 | 0.27 | sand |
| 36 | 10 | 15 | 1450 | 2.23 | 0.82 | 21.3 | 21.3 | 7.3 | 7.0 | 12.0 | 12.1 | 0 | 43.36 | 33.06 | 23.58 | 1.5 | clayey sand |
| 37 | 10 | 16 | 4275 | 2.02 | 0.73 | 20.1 | 19.5 | 7.0 | 7.0 | 13.6 | 13.7 | 0 | 30.26 | 50.72 | 19.02 | 0.84 | sandy silt |
| 38 | 10 | 15 | 2200 | 1.96 | 0.72 | 19.7 | 19.4 | 7.2 | 7.0 | 14.9 | 14.9 | 0.25 | 66.08 | 13.47 | 20.2 | 0.75 | clayey sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 12.5 | 2056.25 | 1.85 | 0.78 | 20.2 | 20.0 | 7.1 | 7.0 | 12.2 | 12.3 | 0.21 | 56.62 | 26.50 | 0.21 | 0.84 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 5.69 | 1672.87 | | | 0.76 | 0.89 | 0.15 | 0.05 | 2.86 | 2.87 | 0.27 | 24.96 | 19.27 | 0.27 | 0.51 | |
| 39 | 11 | 7 | 1250 | 1.12 | 0.57 | 22.7 | 22.7 | 7.1 | 7.1 | 13.1 | 13.8 | 2.98 | 95.22 | 0 | 0 | 1.07 | sand |
| 40 | 11 | 16 | 7225 | 1.37 | 0.49 | | | | | | | 1.26 | 61.92 | 17.37 | 19.45 | 1.08 | silty sand |
| 41 | 11 | 19 | 3525 | 2.30 | 0.78 | 21.9 | 21.9 | 7.2 | 7.1 | 20.0 | 20.2 | 1.96 | 90.59 | 6.18 | 0 | 0.42 | sand |
| 42 | 11 | 27 | 22400 | 1.25 | 0.38 | 28.5 | 21.8 | 7.3 | 8.0 | 20.2 | 20.4 | 1.2 | 52.59 | 23.02 | 23.19 | 0.6 | clayey sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 17.25 | 8600 | 1.51 | 0.56 | 24.37 | 22.13 | 7.22 | 7.39 | 17.77 | 18.13 | 1.85 | 75.08 | 11.64 | 10.66 | 0.79 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 8.26 | 9523.81 | | | 3.60 | 0.49 | 0.11 | 0.49 | 4.04 | 3.75 | 0.83 | 21.02 | 10.45 | 12.40 | 0.33 | |

Table 1. continued

| Site No. | Strata | No. of Taxa | Density (nos./m2) | H' Diversity | J' Evenness | Temp (°C) Surface | Temp (°C) Bottom | DO (mg/l) Surface | DO (mg/l) Bottom | Salinity (ppt) Surface | Salinity (ppt) Bottom | % Gravel | % Sand | % Silt | % Clay | % TOC | Textural Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 12 | 31 | 9275 | 2.16 | 0.63 | | | | | | | 2.46 | 59.41 | 18.65 | 19.47 | 0.65 | silty sand |
| 44 | 12 | 42 | 31625 | 1.94 | 0.52 | | | | | | | 12.89 | 76.95 | 8.42 | 0 | 0.72 | gravelly sand |
| 45 | 12 | 15 | 700 | 2.41 | 0.89 | | | | | | | 0.09 | 99.09 | 0 | 0 | 0.78 | sand |
| 46 | 12 | 17 | 2100 | 2.01 | 0.71 | | | | | | | 0 | 98.97 | 0 | 0 | 0.71 | sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 26.25 | 10925.00 | 2.13 | 0.69 | | | | | | | 3.86 | 83.61 | 6.77 | 4.87 | 0.72 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 12.69 | 14302.02 | | | | | | | | | 6.13 | 19.20 | 8.86 | 9.74 | 0.05 | |
| 47 | 13 | 13 | 2300 | 1.46 | 0.57 | | | | | | | 0 | 99.97 | 0 | 0 | 0.24 | sand |
| 48 | 13 | 14 | 1075 | 2.21 | 0.84 | 21.8 | 21.8 | 7.2 | 7.5 | 27.1 | 27.1 | 0.03 | 61.18 | 6.97 | 31.82 | 0.37 | sandy clay |
| 49 | 13 | 10 | 1425 | 1.50 | 0.65 | 22.2 | 21.6 | 10.2 | 8.3 | 27.5 | 29.0 | 1.93 | 97.94 | 0 | 0 | 0.23 | sand |
| 50 | 13 | 23 | 18750 | 1.26 | 0.40 | | | | | | | 3.15 | 72.78 | 14.8 | 9.27 | 0.67 | silty sand |
| 51 | 13 | 9 | 3725 | 1.01 | 0.46 | 21.5 | 21.5 | 9.6 | 9.6 | 26.0 | 25.9 | 0 | 99.78 | 0 | 0 | 0.12 | sand |
| 52 | 13 | 16 | 850 | 2.55 | 0.92 | | | | | | | 0.57 | 98.58 | 0 | 0 | 0.19 | sand |
| 53 | 13 | 10 | 275 | 2.27 | 0.99 | 22.0 | 21.4 | 10.2 | 6.8 | 29.0 | 29.4 | 0 | 96.25 | 0 | 0 | 0.32 | sand |
| 54 | 13 | 15 | 2000 | 2.22 | 0.82 | | | | | | | 0 | 97.52 | 0 | 0 | 0.26 | sand |
| 55 | 13 | 18 | 3550 | 1.56 | 0.54 | | | | | | | 0.03 | 97.35 | 0 | 0 | 0.45 | sand |
| 56 | 13 | 15 | 8100 | 2.07 | 0.77 | 20.6 | 20.9 | 9.8 | 6.9 | 30.4 | 30.1 | 0 | 31.93 | 43.07 | 25 | 2.97 | clayey silt |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 14.30 | 4205.00 | 1.81 | 0.70 | 21.64 | 21.45 | 9.40 | 7.83 | 27.98 | 28.30 | 0.57 | 85.33 | 6.48 | 6.61 | 0.582 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 4.22 | 5578.78 | | | 0.66 | 0.36 | 1.24 | 1.17 | 1.72 | 1.74 | 1.09 | 23.00 | 13.75 | 11.96 | 0.85 | |
| 57 | 14 | 14 | 39175 | 1.49 | 0.56 | 22.0 | 22.0 | 10.7 | 10.4 | 20.9 | 20.8 | 1.85 | 90.34 | 5.74 | 0 | 1.93 | sand |
| 58 | 14 | 29 | 59700 | 1.00 | 0.30 | | | | | | | 0.35 | 91.07 | 6.6 | 0 | 2.03 | sand |
| 59 | 14 | 15 | 1175 | 2.10 | 0.78 | 21.5 | 21.5 | 10.5 | 6.8 | 26.1 | 25.8 | 0.62 | 95.71 | 0 | 0 | 0.63 | sand |
| 60 | 14 | 21 | 34200 | 0.70 | 0.23 | | | | | | | 0 | 80.67 | 13.94 | 5.39 | 1.23 | sand |
| 61 | 14 | 9 | 675 | 1.85 | 0.84 | 21.7 | 21.7 | 10.5 | 7.7 | 26.2 | 26.6 | 0.24 | 98.42 | 0 | 0 | 0.57 | sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 17.6 | 26985.00 | 1.43 | 0.54 | 21.74 | 21.75 | 10.58 | 8.29 | 24.37 | 24.38 | 0.61 | 91.24 | 5.26 | 1.08 | 1.28 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 7.67 | 25638.33 | | | 0.23 | 0.21 | 0.13 | 1.87 | 3.04 | 3.16 | 0.73 | 6.78 | 5.76 | 2.41 | 0.69 | |
| 62 | 15 | 20 | 1275 | 2.56 | 0.85 | 22.2 | 21.9 | 7.0 | 7.0 | 31.2 | 31.2 | | | | | 0.09 | |
| 63 | 15 | 32 | 4575 | 2.56 | 0.74 | | | | | | | 11.75 | 87.87 | 0 | 0 | 0.58 | gravelly sand |
| 64 | 15 | 4 | 350 | 0.90 | 0.65 | 23.6 | 23.5 | 7.1 | 6.9 | 26.6 | 27.7 | 0 | 99.07 | 0 | 0 | 0.07 | sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 18.67 | 2066.67 | 2.00 | 0.75 | 22.9 | 22.7 | 7.0 | 6.9 | 28.9 | 29.5 | 5.88 | 93.47 | 0 | 0 | 0.25 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 14.05 | 2220.97 | | | 1.01 | 1.13 | 0.09 | 0.10 | 3.27 | 2.50 | 8.31 | 7.92 | 0 | 0 | 0.29 | |
| 65 | 16 | 4 | 975 | 0.91 | 0.65 | 23 | 22.8 | 6.79 | 6.9 | 27.2 | 27.6 | 4.77 | 94.68 | 0 | 0 | 0.15 | sand |
| 66 | 16 | 41 | 17600 | 2.53 | 0.68 | | | | | | | 24.12 | 73.51 | 1.93 | 0 | 0.51 | gravelly sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 22.50 | 9287.50 | 1.72 | 0.67 | 23 | 22.8 | 6.79 | 6.9 | 27.2 | 27.6 | 14.45 | 84.10 | 0.97 | 0 | 0.33 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 26.16 | 11755.65 | | | 0 | 0 | 0 | 0 | 0 | 0 | 13.68 | 14.97 | 1.36 | 0 | 0.25 | |
| 67 | 17 | 34 | 7225 | 2.77 | 0.79 | | | | | | | 35.81 | 61.99 | 1.45 | 0 | 0.42 | sandy gravel |
| 68 | 17 | 18 | 2050 | 1.99 | 0.69 | | | | | | | 0.31 | 98.76 | 0 | 0 | 0.21 | sand |
| 69 | 17 | 14 | 1125 | 2.20 | 0.83 | | | | | | | 0 | 99.53 | 0 | 0 | 0.22 | sand |
| 70 | 17 | 9 | 1125 | 1.34 | 0.61 | | | | | | | 0 | 99.81 | 0 | 0 | 0.13 | sand |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 18.75 | 2881.25 | 2.08 | 0.73 | | | | | | | 9.03 | 90.02 | 0.36 | 0 | 0.25 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 10.81 | 2928.48 | | | | | | | | | 17.85 | 18.69 | 0.73 | 0 | 0.12 | |

Table 1. Continued

| Site No. | Strata | No. of Taxa | Density (nos./m2) | H' Diversity | J' Evenness | Temp (°C) Surface | Temp (°C) Bottom | DO (mg/l) Surface | DO (mg/l) Bottom | Salinity (ppt) Surface | Salinity (ppt) Bottom | % Gravel | % Sand | % Silt | % Clay | % TOC | Textural Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 71 | 18 | 16 | 3550 | 1.79 | 0.65 | | | | | | | 0.76 | 98.45 | 0 | 0 | 0.11 | sand |
| 72 | 18 | 30 | 3675 | 2.67 | 0.79 | | | | | | | 20.25 | 79.57 | 0 | 0 | 0.1 | gravelly sand |
| 73 | 18 | 24 | 1675 | 2.90 | 0.91 | | | | | | | | | | | 1.21 | |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 23.33 | 2966.67 | 2.46 | 0.78 | | | | | | | 10.51 | 89.01 | 0 | 0 | 0.47 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 7.02 | 1120.36 | | | | | | | | | 13.78 | 13.35 | 0 | 0 | 0.64 | |
| 84 | 21 | 10 | 2150 | 1.92 | 0.83 | 20.4 | 20.4 | 6.0 | 5.9 | 8.0 | 8.1 | 0 | 12.64 | 65.21 | 22.16 | 2.36 | clayey silt |
| 85 | 21 | 9 | 1000 | 0.99 | 0.45 | 20.6 | 20.5 | 6.6 | 6.6 | 7.4 | 7.4 | 0 | 0.17 | 57.13 | 42.7 | 5.85 | silty clay |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 9.50 | 1575.00 | 1.46 | 0.64 | 20.5 | 20.5 | 6.3 | 6.2 | 7.7 | 7.8 | 0 | 6.41 | 61.17 | 32.43 | 4.105 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 0.71 | 813.17 | | | 0.1 | 0.1 | 0.5 | 0.5 | 0.4 | 0.5 | 0 | 8.82 | 5.71 | 14.52 | 2.47 | |
| 88 | 22 | 14 | 29500 | 1.11 | 0.42 | 20.0 | 19.9 | 5.0 | 4.8 | 19.4 | 19.8 | 0.1 | 9.2 | 55.39 | 35.32 | 5.07 | silty clay |
| 89 | 22 | 8 | 1850 | 1.44 | 0.69 | 19.6 | 19.6 | 10.6 | 9.6 | 4.4 | 4.4 | 0 | 1.45 | 39.14 | 59.42 | 20.5 | clay |
| 90 | 22 | 16 | 3825 | 1.34 | 0.48 | 20.3 | 20.1 | 4.1 | 4.1 | 19.1 | 19.2 | 0 | 3.01 | 67.36 | 29.63 | 3.9 | clayey silt |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 12.67 | 11725.00 | 1.30 | 0.53 | 20.0 | 19.9 | 6.6 | 6.2 | 14.3 | 14.5 | 0.03 | 4.55 | 53.96 | 41.46 | 9.82 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 4.16 | 15425.24 | | | 0.4 | 0.3 | 3.7 | 3.0 | 8.6 | 8.7 | 0.06 | 4.10 | 14.16 | 15.81 | 9.26 | |
| 91 | – | 6 | 5550 | 0.76 | 0.42 | 20.2 | 20.0 | 7.7 | 7.4 | 6.2 | 6.2 | | | | | 3.45 | |
| 92 | – | 6 | 2900 | 0.53 | 0.30 | 25.1 | 25.0 | | | 4.1 | 4.0 | 0.58 | 89.27 | 6.95 | 0 | 5.85 | sand |
| 87 | – | 14 | 4150 | 0.99 | 0.38 | 20.5 | 20.5 | 6.2 | 6.4 | 16.6 | 16.7 | 0.1 | 7.81 | 50.96 | 41.14 | 1.75 | silty clay |
| | | Mean No. Taxa | Mean D | Mean H' | Mean J' | Mean S. Temp | Mean B. Temp | Mean S. DO | Mean B. DO | Mean S. Sal | Mean B. Sal | Mean % G | Mean % Sand | Mean %Silt | Mean % Clay | Mean % TOC | |
| | | 8.67 | 4200.00 | 0.76 | 0.37 | 21.9 | 21.8 | 6.9 | 6.9 | 8.97 | 9.0 | 0.34 | 48.54 | 28.96 | 20.57 | 3.68 | |
| | | S.D. | S.D. | | | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | S.D. | |
| | | 4.62 | 1325.71 | | | 2.75 | 2.75 | 1.0 | 0.7 | 6.69 | 6.79 | 0.34 | 57.60 | 31.12 | 29.09 | 2.06 | |

Figure 1. Sediment composition for Delaware Bay sites 1-41, September 1997.

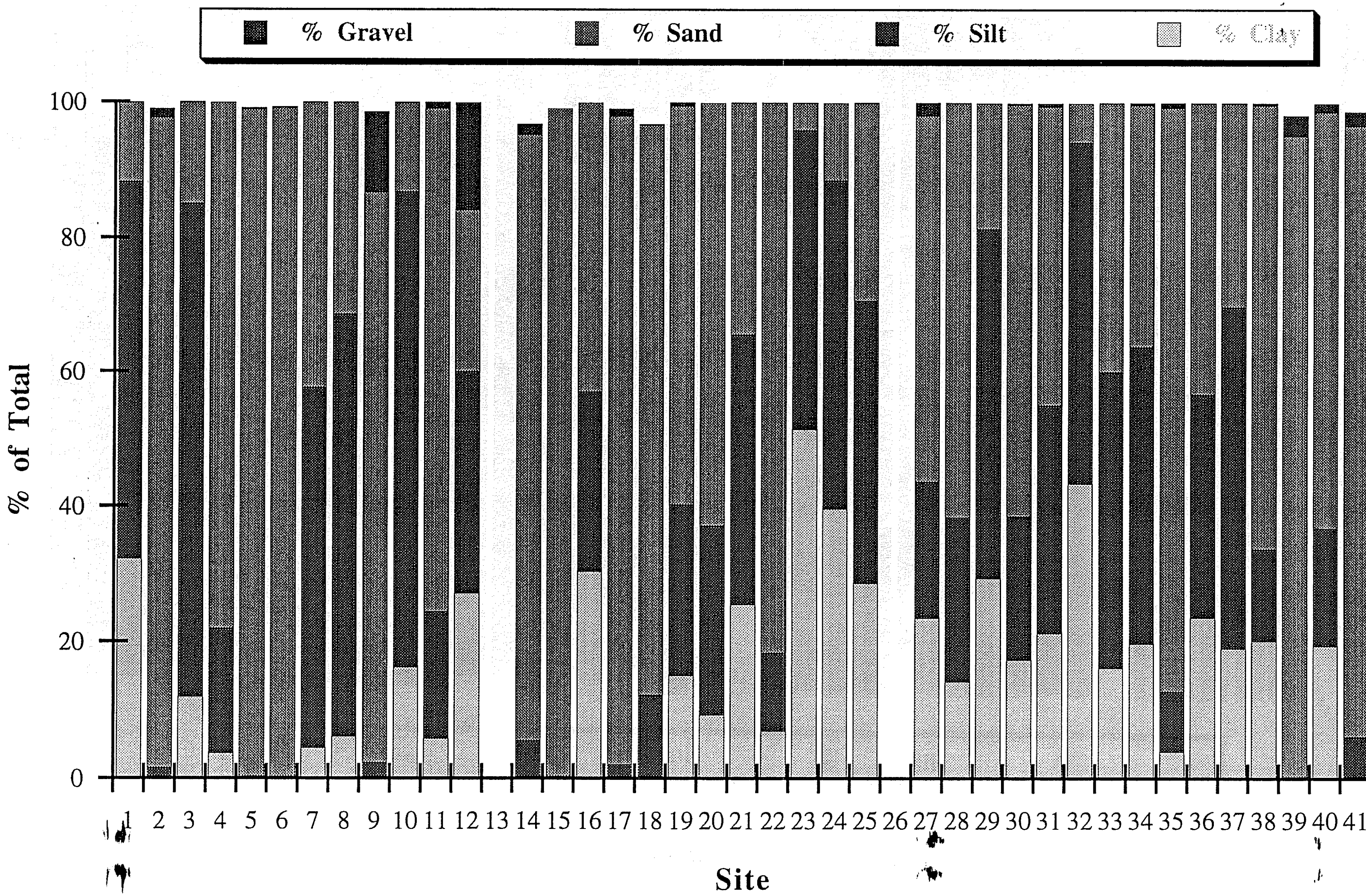


Figure 2. Sediment composition for Delaware Bay sites 42-92, September 1997.

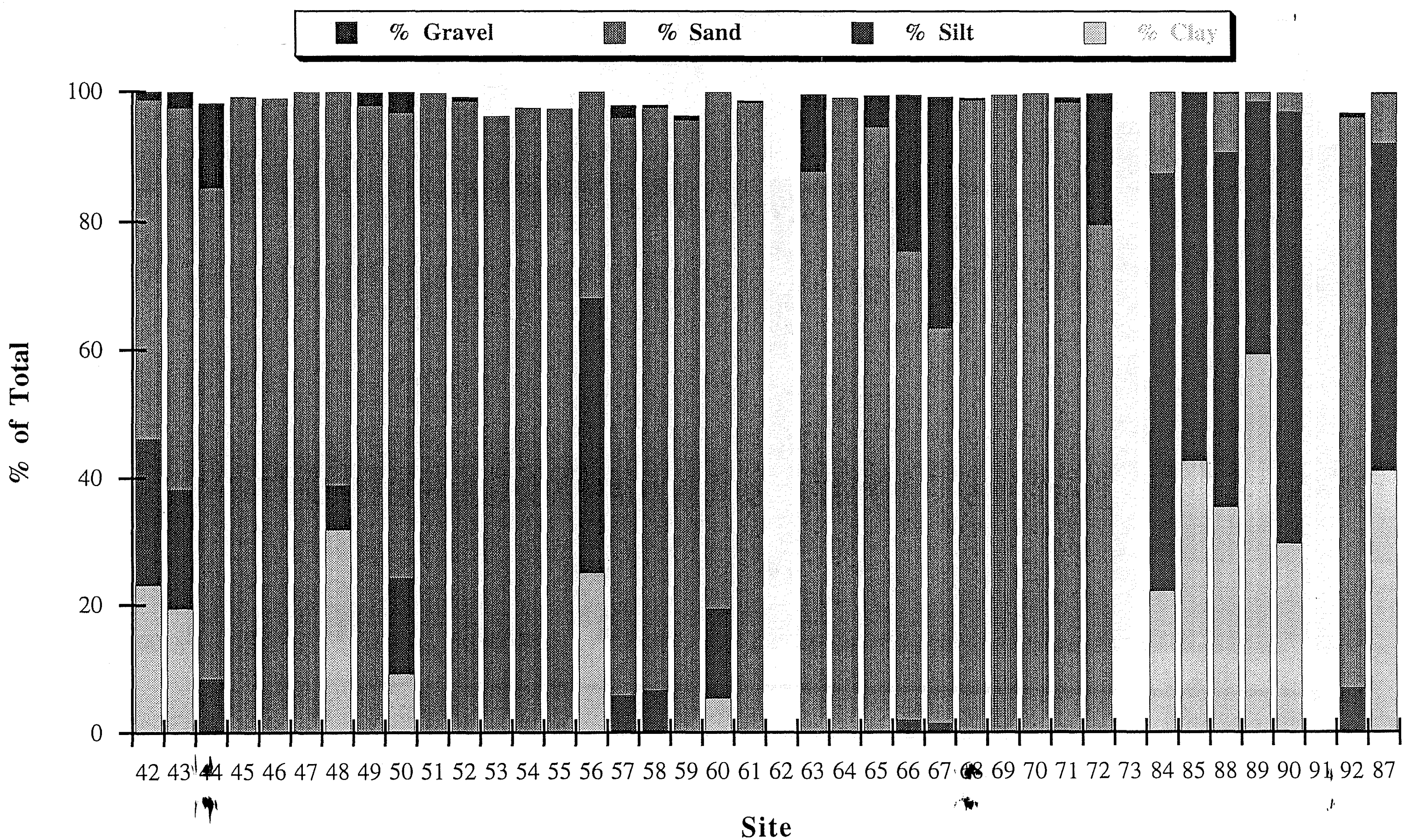


Figure 3. Percent total organic carbon (TOC) content of the sediment for Delaware Bay and adjacent waters sites 1-41, September 1997.

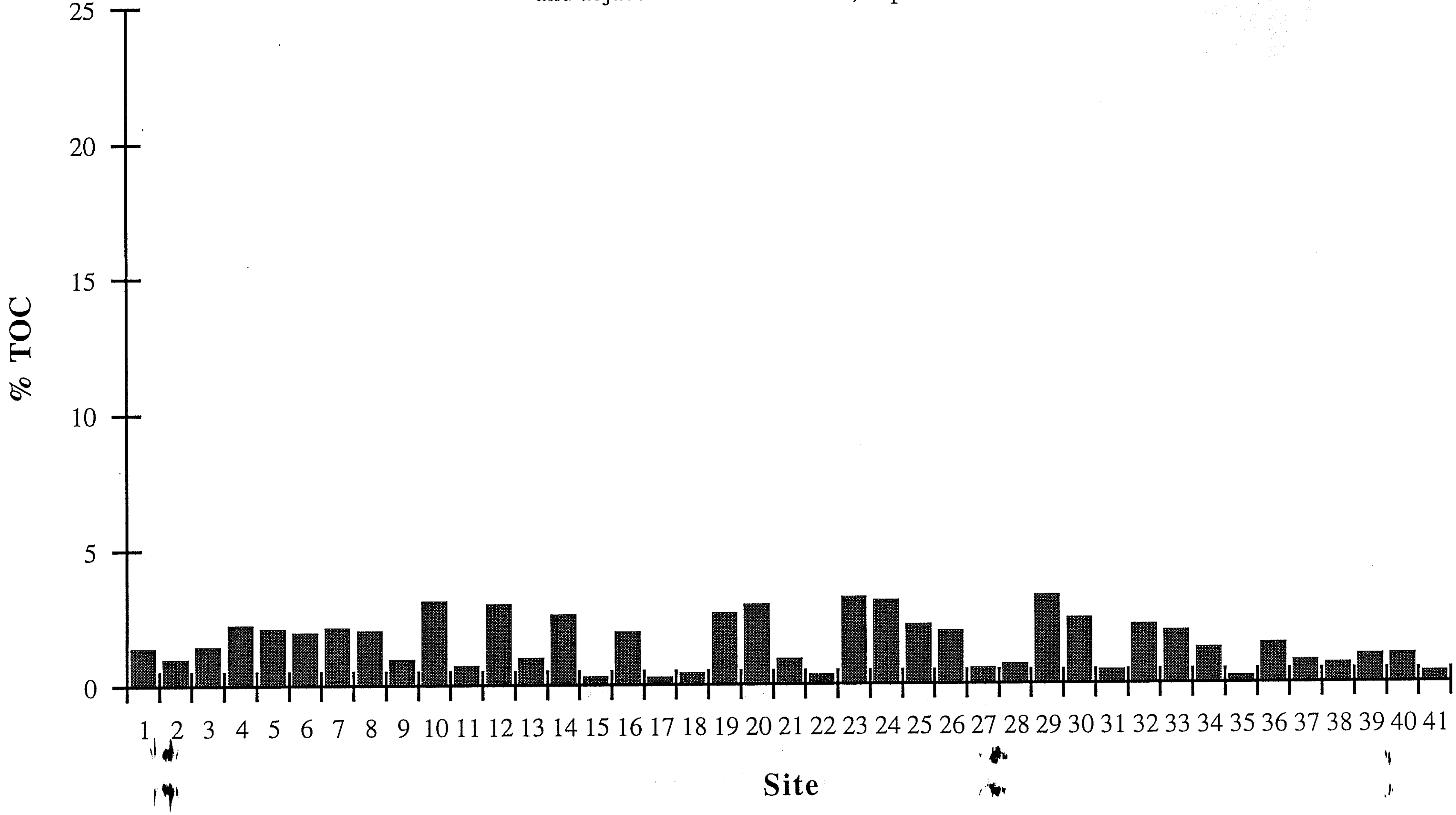


Figure 4. Percent total organic carbon (TOC) content of sediments for Delaware Bay and adjacent waters sites 42-92, September 1997.

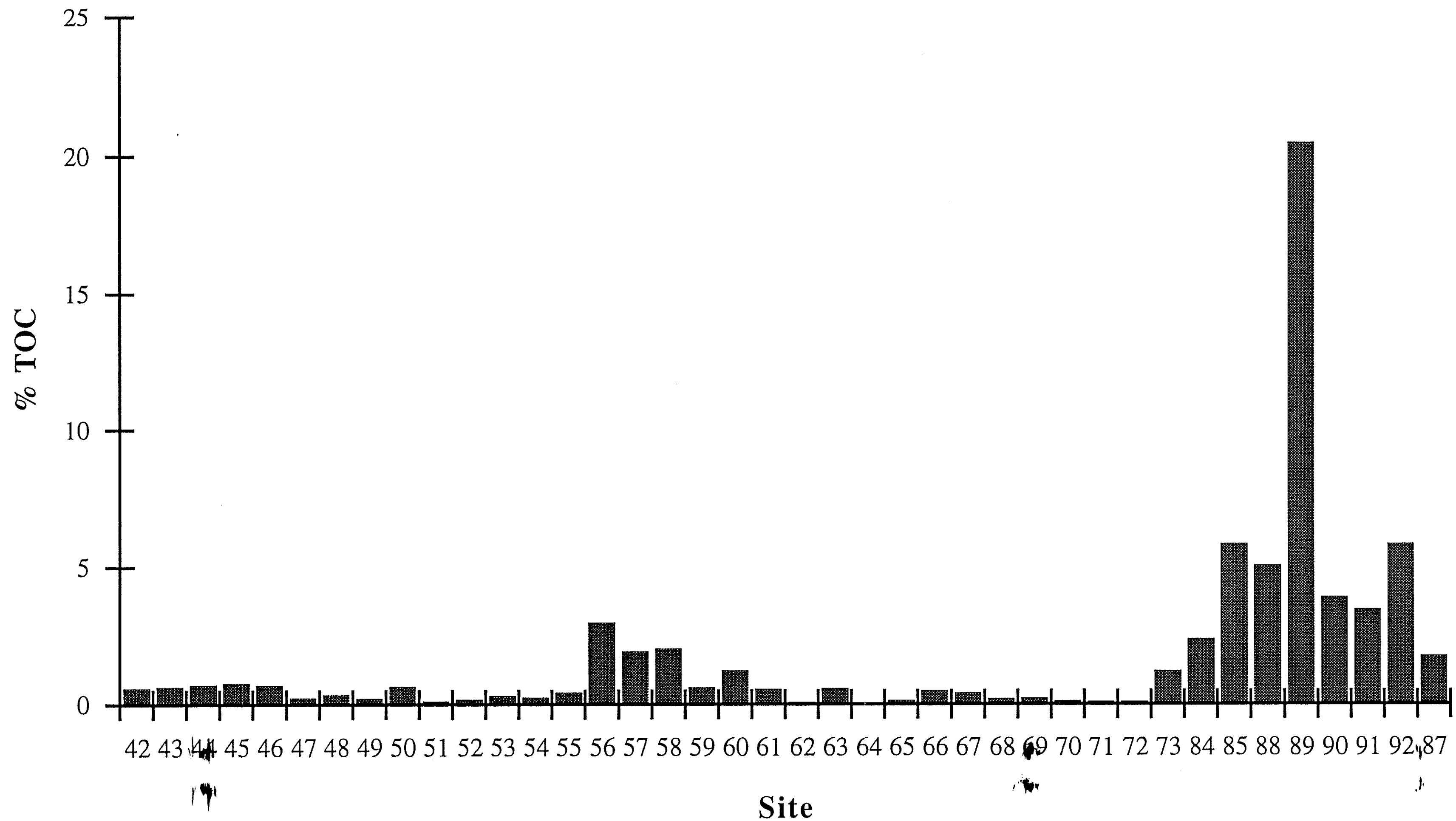


Figure 5. Sediment composition of the Delaware Bay and adjacent waters strata, September 1997.

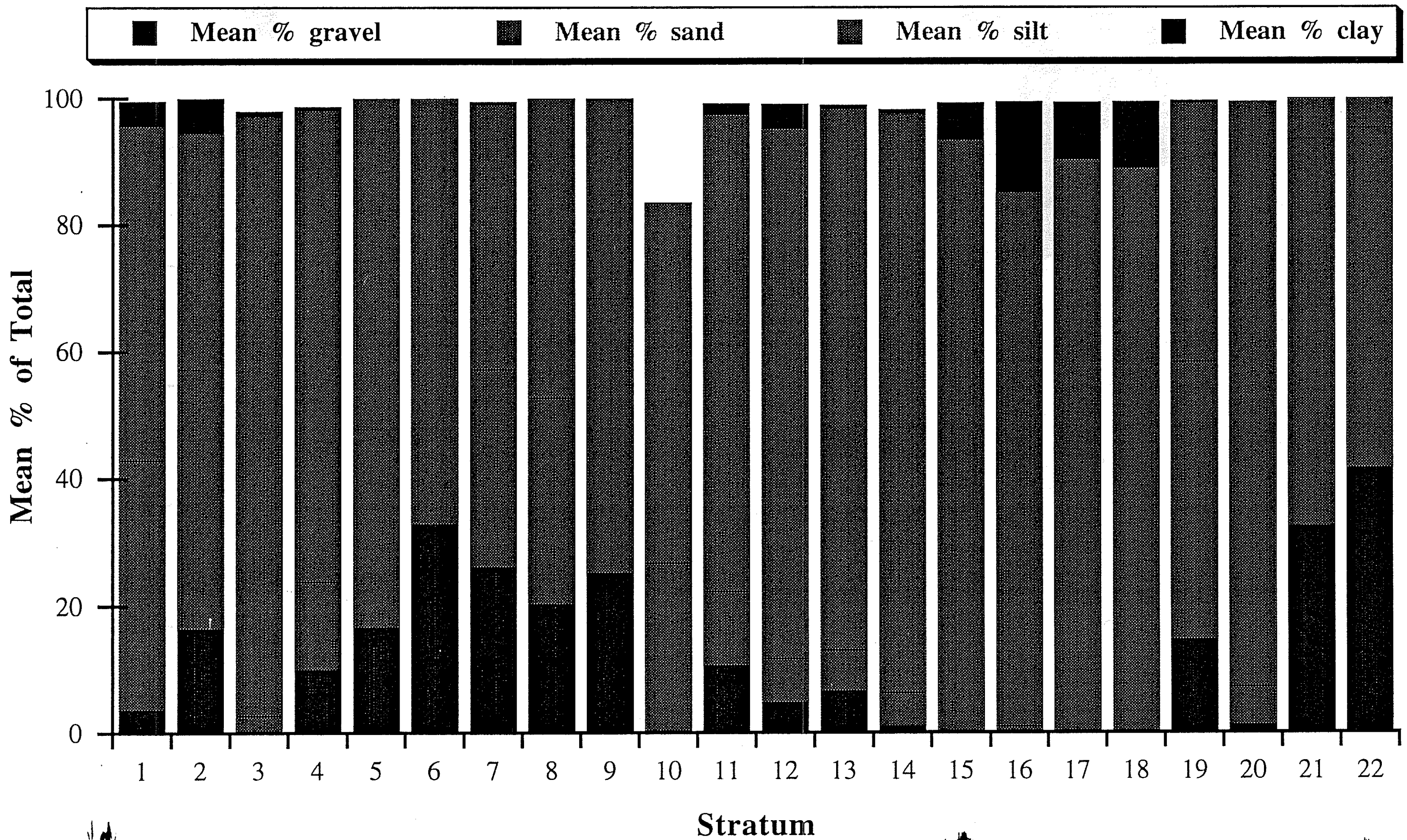


Figure 6. Mean % gravel of the Delaware Bay and adjacent waters strata, September 1997.

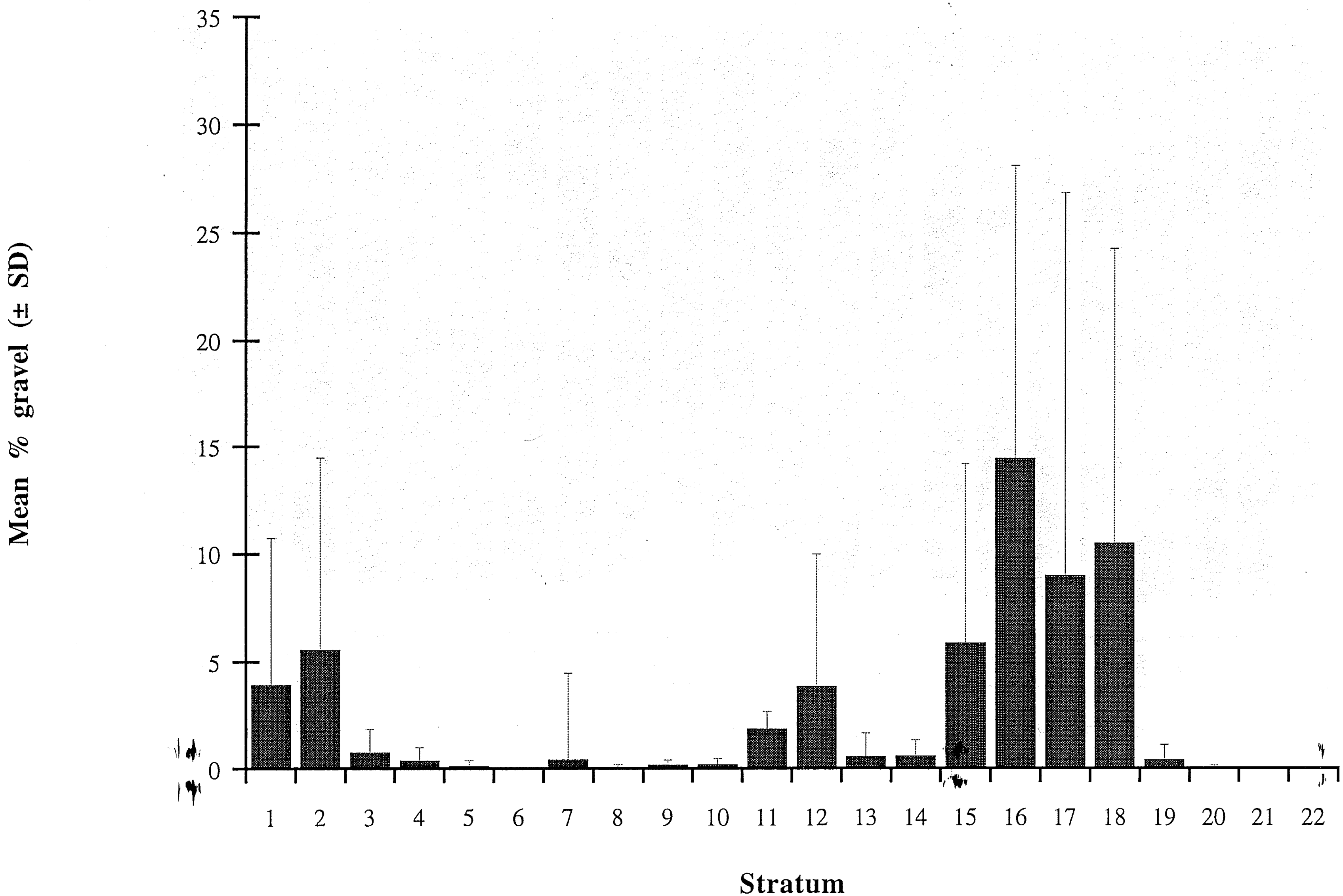


Figure 7. Mean % sand of the Delaware Bay and adjacent waters strata, September 1997.

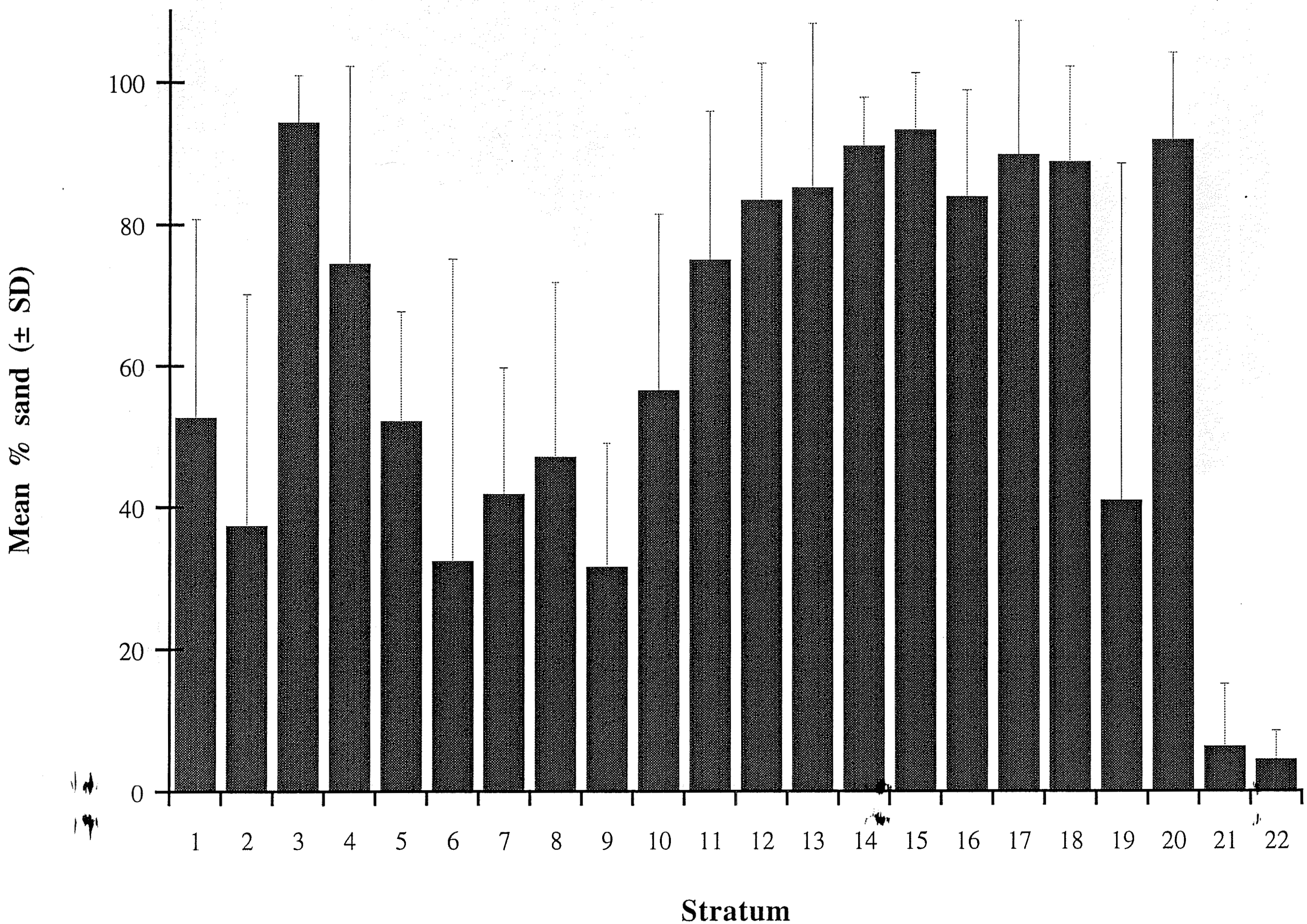


Figure 8. Mean % silt of the Delaware Bay and adjacent waters strata, September 1997.

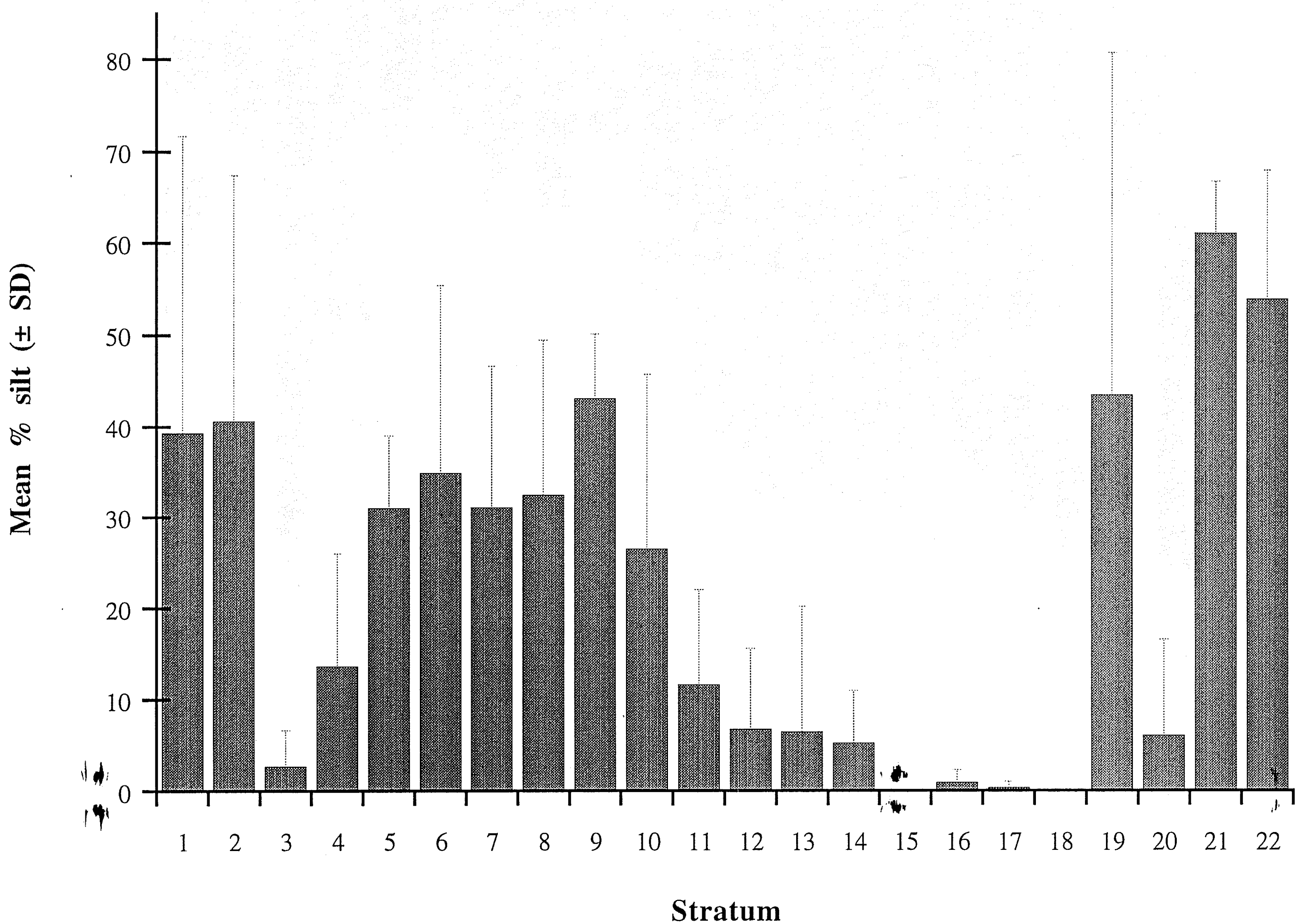


Figure 9.  Mean % clay of the Delaware Bay and adjacent waters strata, September 1997.

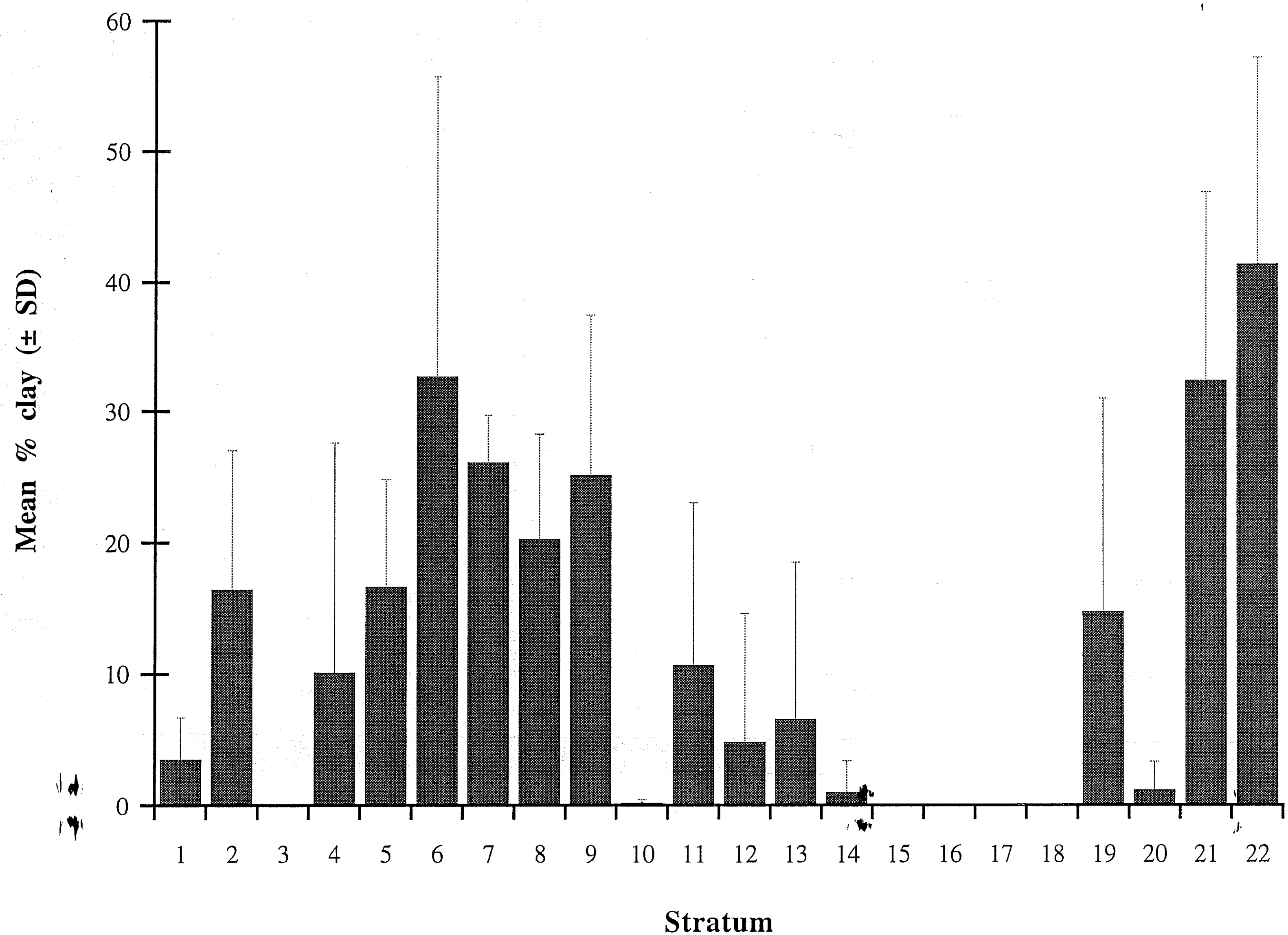


Table 2. Abundance and distribution of taxa for the Delaware Bay and adjacent waters sites, September 1997.

| Taxon Name | Phylum | Class | No. of Individuals | % Total | Cummulative % | Station Occurrence | Station % Occurrence | Comments |
|---|---|---|---|---|---|---|---|---|
| *Ampelisca abdita* | Ar | Mala | 3887 | 19.377 | 19.377 | 20 | 24.7 | |
| Tubificidae (LPIL) | A | Olig | 3587 | 17.881 | 37.258 | 50 | 61.7 | sexually immature |
| *Mediomastus* (LPIL) | A | Poly | 2090 | 10.419 | 47.677 | 22 | 27.2 | anterior portions only, probably *M. ambiseta* , pygidium needed |
| *Leucon americanus* | Ar | Mala | 1162 | 5.793 | 53.470 | 20 | 24.7 | |
| *Limnodrilus hoffmeisteri* | A | Olig | 1006 | 5.015 | 58.485 | 23 | 28.4 | |
| *Sabellaria vulgaris* | A | Poly | 969 | 4.831 | 63.315 | 8 | 9.9 | |
| *Streblospio benedicti* | A | Poly | 800 | 3.988 | 67.303 | 12 | 14.8 | |
| Oligochaeta (LPIL) | A | Olig | 389 | 1.939 | 69.242 | 19 | 23.5 | marine and some estuarine specimens only identified to class. |
| *Gammarus tigrinus* | Ar | Mala | 348 | 1.735 | 70.977 | 10 | 12.3 | |
| *Cyathura polita* | Ar | Mala | 284 | 1.416 | 72.393 | 33 | 40.7 | |
| *Glycinde solitaria* | A | Poly | 244 | 1.216 | 73.609 | 11 | 13.6 | |
| *Tellina agilis* | M | Biva | 205 | 1.022 | 74.631 | 18 | 22.2 | |
| *Chiridotea tuftsi* | Ar | Mala | 191 | 0.952 | 75.583 | 14 | 17.3 | |
| *Polydora cornuta* | A | Poly | 175 | 0.872 | 76.456 | 6 | 7.4 | |
| Chironomidae (LPIL) | Ar | Inse | 168 | 0.837 | 77.293 | 13 | 16.0 | immature and/or damaged specimen |
| *Dipolydora socialis* | A | Poly | 161 | 0.803 | 78.096 | 8 | 9.9 | |
| *Acteocina canaliculata* | M | Gast | 161 | 0.803 | 78.898 | 13 | 16.0 | |
| *Rhepoxynius hudsoni* | Ar | Mala | 154 | 0.768 | 79.666 | 14 | 17.3 | |
| *Gemma gemma* | M | Biva | 151 | 0.753 | 80.419 | 9 | 11.1 | |
| *Lysianopsis alba* | Ar | Mala | 144 | 0.718 | 81.137 | 2 | 2.5 | |
| *Polypedilum* (LPIL) | Ar | Inse | 142 | 0.708 | 81.844 | 14 | 17.3 | immature and/or damaged specimen |
| *Edotia triloba* | Ar | Mala | 138 | 0.688 | 82.532 | 15 | 18.5 | |
| *Aricidea* (LPIL) | A | Poly | 122 | 0.608 | 83.141 | 10 | 12.3 | missing identification characters |
| *Tellina* (LPIL) | M | Biva | 121 | 0.603 | 83.744 | 16 | 19.8 | due to small size, external and internal characters are not apparent. |
| *Corophium tuberculatum* | Ar | Mala | 115 | 0.573 | 84.317 | 8 | 9.9 | |
| *Almyracuma proximoculi* | Ar | Mala | 102 | 0.508 | 84.826 | 6 | 7.4 | |
| *Corbicula manilensis* | M | Biva | 98 | 0.489 | 85.314 | 6 | 7.4 | |
| *Aricidea catherinae* | A | Poly | 98 | 0.489 | 85.803 | 5 | 6.2 | |
| *Heteromastus filiformis* | A | Poly | 97 | 0.484 | 86.286 | 13 | 16.0 | |
| *Corophium lacustre* | Ar | Mala | 97 | 0.484 | 86.770 | 3 | 3.7 | |
| *Quistadrilus multisetosus* | A | Olig | 93 | 0.464 | 87.233 | 9 | 11.1 | |
| Rhynchocoela (LPIL) | R | | 93 | 0.464 | 87.697 | 26 | 32.1 | no identifible characters. |
| Cirratulidae (LPIL) | A | Poly | 87 | 0.434 | 88.131 | 15 | 18.5 | anterior fragment, posterior needed for specis ID. |
| *Crepidula plana* | M | Gast | 85 | 0.424 | 88.554 | 5 | 6.2 | |
| *Marenzellaria viridis* | A | Poly | 77 | 0.384 | 88.938 | 10 | 12.3 | |
| *Polygordius* (LPIL) | A | Poly | 71 | 0.354 | 89.292 | 13 | 16.0 | genus is lowest identification level |
| *Paracaprella tenuis* | Ar | Mala | 70 | 0.349 | 89.641 | 3 | 3.7 | |
| *Protohaustorius* sp.B | Ar | Mala | 65 | 0.324 | 89.965 | 4 | 4.9 | |
| *Mulinia lateralis* | M | Biva | 61 | 0.304 | 90.269 | 10 | 12.3 | |
| *Pisidium compressum* | M | Biva | 54 | 0.269 | 90.538 | 3 | 3.7 | |
| *Sphaerium* (LPIL) | M | Biva | 54 | 0.269 | 90.808 | 6 | 7.4 | |
| *Mitrella lunata* | M | Gast | 52 | 0.259 | 91.067 | 6 | 7.4 | |
| *Polypedilum halterale* group | Ar | Inse | 51 | 0.254 | 91.321 | 4 | 4.9 | |

Table 2. Continued

| Taxon Name | Phylum | Class | No. of Individuals | % Total | Cummulative % | Station Occurrence | Station % Occurrence | Comments |
|---|---|---|---|---|---|---|---|---|
| *Polypedilum illinoense* group | Ar | Inse | 47 | 0.234 | 91.555 | 7 | 8.6 | |
| *Nucula proxima* | M | Biva | 46 | 0.229 | 91.785 | 6 | 7.4 | |
| *Odostomia* (LPIL) | M | Gast | 43 | 0.214 | 91.999 | 8 | 9.9 | |
| Spionidae (LPIL) | A | Poly | 43 | 0.214 | 92.213 | 11 | 13.6 | |
| *Unciola serrata* | Ar | Mala | 41 | 0.204 | 92.418 | 4 | 4.9 | |
| Ascidiacea (LPIL) | C | Asci | 41 | 0.204 | 92.622 | 5 | 6.2 | |
| *Pseudunciola obliquua* | Ar | Mala | 40 | 0.199 | 92.822 | 1 | 1.2 | |
| *Tanaissus psammophilus* | Ar | Mala | 40 | 0.199 | 93.021 | 5 | 6.2 | |
| Capitellidae (LPIL) | A | Poly | 38 | 0.189 | 93.210 | 12 | 14.8 | |
| *Laeonereis culveri* | A | Poly | 35 | 0.174 | 93.385 | 4 | 4.9 | |
| *Leitoscoloplos robustus* | A | Poly | 35 | 0.174 | 93.559 | 6 | 7.4 | |
| *Astarte castanea* | M | Biva | 34 | 0.169 | 93.729 | 3 | 3.7 | |
| *Gammarus* (LPIL) | Ar | Mala | 32 | 0.160 | 93.888 | 12 | 14.8 | |
| Ampharetidae (LPIL) | A | Poly | 32 | 0.160 | 94.048 | 11 | 13.6 | |
| *Eusarsiella zostericola* | Ar | Ostr | 31 | 0.155 | 94.202 | 8 | 9.9 | |
| Bivalvia (LPIL) | M | Biva | 30 | 0.150 | 94.352 | 7 | 8.6 | |
| Ancylidae (LPIL) | M | Gast | 30 | 0.150 | 94.501 | 2 | 2.5 | |
| *Glycera* sp.D | A | Poly | 29 | 0.145 | 94.646 | 12 | 14.8 | |
| *Protohaustorius wigleyi* | Ar | Mala | 28 | 0.140 | 94.786 | 5 | 6.2 | |
| *Cyathura burbancki* | Ar | Mala | 24 | 0.120 | 94.905 | 1 | 1.2 | |
| *Rhithropanopeus harrisii* | Ar | Mala | 22 | 0.110 | 95.015 | 6 | 7.4 | |
| *Limnodrilus udekemianus* | A | Olig | 22 | 0.110 | 95.125 | 2 | 2.5 | |
| *Scoletoma tenuis* | A | Poly | 22 | 0.110 | 95.234 | 2 | 2.5 | |
| *Hypereteone heteropoda* | A | Poly | 21 | 0.105 | 95.339 | 2 | 2.5 | |
| *Lyonsia hyalina* | M | Biva | 21 | 0.105 | 95.444 | 5 | 6.2 | |
| *Leptocheirus plumulosus* | Ar | Mala | 21 | 0.105 | 95.548 | 1 | 1.2 | |
| *Ferrissia* (LPIL) | M | Gast | 21 | 0.105 | 95.653 | 5 | 6.2 | |
| *Aricidea cerrutii* | A | Poly | 20 | 0.100 | 95.753 | 1 | 1.2 | |
| *Procladius* (LPIL) | Ar | Inse | 20 | 0.100 | 95.852 | 5 | 6.2 | |
| *Leitoscoloplos* (LPIL) | A | Poly | 20 | 0.100 | 95.952 | 9 | 11.1 | |
| *Nereis succinea* | A | Poly | 19 | 0.095 | 96.047 | 8 | 9.9 | |
| *Melita* (LPIL) | Ar | Mala | 19 | 0.095 | 96.142 | 5 | 6.2 | |
| *Brania wellfleetensis* | A | Poly | 18 | 0.090 | 96.231 | 3 | 3.7 | |
| *Parasterope pollex* | Ar | Ostr | 17 | 0.085 | 96.316 | 5 | 6.2 | |
| *Polycirrus eximius* | A | Poly | 17 | 0.085 | 96.401 | 2 | 2.5 | |
| *Cerapus tubularis* | Ar | Mala | 16 | 0.080 | 96.481 | 4 | 4.9 | |
| *Cryptochironomus* (LPIL) | Ar | Inse | 16 | 0.080 | 96.560 | 8 | 9.9 | |
| *Erichthonius brasiliensis* | Ar | Mala | 15 | 0.075 | 96.635 | 4 | 4.9 | |
| *Caulleriella* sp.J | A | Poly | 15 | 0.075 | 96.710 | 6 | 7.4 | |
| *Autolytus* (LPIL) | A | Poly | 15 | 0.075 | 96.785 | 1 | 1.2 | |
| Gastropoda (LPIL) | M | Gast | 15 | 0.075 | 96.859 | 8 | 9.9 | |
| *Spiochaetopterus oculatus* | A | Poly | 14 | 0.070 | 96.929 | 10 | 12.3 | |
| *Rictaxis punctostriatus* | M | Gast | 13 | 0.065 | 96.994 | 5 | 6.2 | |
| *Hydroides protulicola* | A | Poly | 13 | 0.065 | 97.059 | 2 | 2.5 | |
| *Ampelisca* (LPIL) | Ar | Mala | 13 | 0.065 | 97.124 | 5 | 6.2 | |
| *Ancinus depressus* | Ar | Mala | 12 | 0.060 | 97.183 | 7 | 8.6 | |

Table 2. Continued

| Taxon Name | Phylum | Class | No. of Individuals | % Total | Cummulative % | Station Occurrence | Station % Occurrence | Comments |
|---|---|---|---|---|---|---|---|---|
| *Streptosyllis arenae* | A | Poly | 12 | 0.060 | 97.243 | 1 | 1.2 | |
| *Nereis* (LPIL) | A | Poly | 12 | 0.060 | 97.303 | 5 | 6.2 | |
| Phyllodocidae (LPIL) | A | Poly | 12 | 0.060 | 97.363 | 8 | 9.9 | |
| *Gillia altilis* | M | Gast | 11 | 0.055 | 97.418 | 3 | 3.7 | |
| *Ilyanassa trivittata* | M | Gast | 11 | 0.055 | 97.473 | 8 | 9.9 | |
| *Tubificoides heterochaetus* | A | Olig | 11 | 0.055 | 97.527 | 1 | 1.2 | |
| *Unciola* (LPIL) | Ar | Mala | 11 | 0.055 | 97.582 | 2 | 2.5 | |
| Terebellidae (LPIL) | A | Poly | 11 | 0.055 | 97.637 | 2 | 2.5 | |
| *Jassa falcata* | Ar | Mala | 10 | 0.050 | 97.687 | 4 | 4.9 | |
| *Asabellides oculata* | A | Poly | 10 | 0.050 | 97.737 | 7 | 8.6 | |
| *Nephtys picta* | A | Poly | 10 | 0.050 | 97.787 | 5 | 6.2 | |
| *Parahaustorius attenuatus* | Ar | Mala | 10 | 0.050 | 97.836 | 1 | 1.2 | |
| *Leptocheirus* (LPIL) | Ar | Mala | 10 | 0.050 | 97.886 | 1 | 1.2 | |
| *Phyllodoce arenae* | A | Poly | 9 | 0.045 | 97.931 | 5 | 6.2 | |
| *Spisula solidissima* | M | Biva | 9 | 0.045 | 97.976 | 2 | 2.5 | |
| *Crepidula maculosa* | M | Gast | 9 | 0.045 | 98.021 | 4 | 4.9 | |
| *Pisidium* (LPIL) | M | Biva | 9 | 0.045 | 98.066 | 3 | 3.7 | |
| Goniadidae (LPIL) | A | Poly | 9 | 0.045 | 98.111 | 4 | 4.9 | |
| Sphaeriidae (LPIL) | M | Biva | 9 | 0.045 | 98.156 | 6 | 7.4 | |
| *Parapionosyllis longicirrata* | A | Poly | 8 | 0.040 | 98.195 | 1 | 1.2 | |
| *Scoloplos rubra* | A | Poly | 8 | 0.040 | 98.235 | 1 | 1.2 | |
| *Deutella incerta* | Ar | Mala | 8 | 0.040 | 98.275 | 1 | 1.2 | |
| *Oxyurostylis smithi* | Ar | Mala | 8 | 0.040 | 98.315 | 6 | 7.4 | |
| *Ilyanassa obsoleta* | M | Gast | 8 | 0.040 | 98.355 | 3 | 3.7 | |
| *Acanthohaustorius intermedius* | Ar | Mala | 8 | 0.040 | 98.395 | 1 | 1.2 | |
| *Tharyx acutus* | A | Poly | 8 | 0.040 | 98.435 | 5 | 6.2 | |
| Echinoidea (LPIL) | E | Echi | 8 | 0.040 | 98.475 | 2 | 2.5 | |
| *Neomysis americana* | Ar | Mala | 7 | 0.035 | 98.509 | 3 | 3.7 | |
| *Ampelisca vadorum* | Ar | Mala | 7 | 0.035 | 98.544 | 1 | 1.2 | |
| *Pagurus* (LPIL) | Ar | Mala | 7 | 0.035 | 98.579 | 5 | 6.2 | |
| Ceratopogonidae (LPIL) | Ar | Inse | 7 | 0.035 | 98.614 | 4 | 4.9 | |
| Mactridae (LPIL) | M | Biva | 7 | 0.035 | 98.649 | 3 | 3.7 | |
| *Corophium* (LPIL) | Ar | Mala | 6 | 0.030 | 98.679 | 3 | 3.7 | |
| *Tubulanus* (LPIL) | R | | 6 | 0.030 | 98.709 | 3 | 3.7 | |
| Naididae (LPIL) | A | Olig | 6 | 0.030 | 98.739 | 1 | 1.2 | |
| Glyceridae (LPIL) | A | Poly | 6 | 0.030 | 98.769 | 3 | 3.7 | |
| Nephtyidae (LPIL) | A | Poly | 6 | 0.030 | 98.799 | 4 | 4.9 | |
| *Batea catharinensis* | Ar | Mala | 5 | 0.025 | 98.824 | 2 | 2.5 | |
| *Mediomastus ambiseta* | A | Poly | 5 | 0.025 | 98.848 | 1 | 1.2 | |
| *Spiophanes bombyx* | A | Poly | 5 | 0.025 | 98.873 | 4 | 4.9 | |
| *Urosalpinx cinera* | M | Gast | 5 | 0.025 | 98.898 | 3 | 3.7 | |
| *Monoculodes edwardsi* | Ar | Mala | 5 | 0.025 | 98.923 | 4 | 4.9 | |
| Serpulidae (LPIL) | A | Poly | 5 | 0.025 | 98.948 | 2 | 2.5 | |
| Actiniaria (LPIL) | Cn | Anth | 5 | 0.025 | 98.973 | 3 | 3.7 | |
| *Doridella obscura* | M | Gast | 4 | 0.020 | 98.993 | 1 | 1.2 | |
| *Nephtys bucera* | A | Poly | 4 | 0.020 | 99.013 | 3 | 3.7 | |

Table 2. Continued

| Taxon Name | Phylum | Class | No. of Individuals | % Total | Cummulative % | Station Occurrence | Station % Occurrence | Comments |
|---|---|---|---|---|---|---|---|---|
| *Kurtziella cerina* | M | Gast | 4 | 0.020 | 99.033 | 2 | 2.5 | |
| *Marginella apicina* | M | Gast | 4 | 0.020 | 99.053 | 2 | 2.5 | |
| *Harmothoe extenuata* | A | Poly | 4 | 0.020 | 99.073 | 2 | 2.5 | |
| *Macoma balthica* | M | Biva | 4 | 0.020 | 99.093 | 3 | 3.7 | |
| *Nanocladius* (LPIL) | Ar | Inse | 4 | 0.020 | 99.113 | 1 | 1.2 | |
| *Dicrotendipes* (LPIL) | Ar | Inse | 4 | 0.020 | 99.133 | 3 | 3.7 | |
| *Tanytarsus* (LPIL) | Ar | Inse | 4 | 0.020 | 99.153 | 3 | 3.7 | |
| *Branchiostoma* (LPIL) | C | Lept | 4 | 0.020 | 99.172 | 2 | 2.5 | |
| Lumbrineridae (LPIL) | A | Poly | 4 | 0.020 | 99.192 | 2 | 2.5 | |
| Nereididae (LPIL) | A | Poly | 4 | 0.020 | 99.212 | 4 | 4.9 | |
| Polynoidae (LPIL) | A | Poly | 4 | 0.020 | 99.232 | 1 | 1.2 | |
| Paguridae (LPIL) | Ar | Mala | 4 | 0.020 | 99.252 | 2 | 2.5 | |
| Xanthidae (LPIL) | Ar | Mala | 4 | 0.020 | 99.272 | 1 | 1.2 | |
| Mysidae (LPIL) | Ar | Mala | 4 | 0.020 | 99.292 | 4 | 4.9 | |
| *Lepidonotus sublevis* | A | Poly | 3 | 0.015 | 99.307 | 2 | 2.5 | |
| *Pectinaria gouldii* | A | Poly | 3 | 0.015 | 99.322 | 3 | 3.7 | |
| *Crangon septemspinosa* | Ar | Mala | 3 | 0.015 | 99.337 | 3 | 3.7 | |
| *Cassidinidea ovalis* | Ar | Mala | 3 | 0.015 | 99.352 | 2 | 2.5 | |
| *Neverita duplicata* | M | Gast | 3 | 0.015 | 99.367 | 3 | 3.7 | |
| *Ensis directus* | M | Biva | 3 | 0.015 | 99.382 | 2 | 2.5 | |
| *Microprotopus raneyi* | Ar | Mala | 3 | 0.015 | 99.397 | 2 | 2.5 | |
| *Travisia parva* | A | Poly | 3 | 0.015 | 99.412 | 2 | 2.5 | |
| *Harmothoe imbricata* | A | Poly | 3 | 0.015 | 99.427 | 1 | 1.2 | |
| *Aricidea taylori* | A | Poly | 3 | 0.015 | 99.442 | 2 | 2.5 | |
| *Cirrophorus* (LPIL) | A | Poly | 3 | 0.015 | 99.457 | 2 | 2.5 | |
| *Chironomus* (LPIL) | Ar | Inse | 3 | 0.015 | 99.472 | 2 | 2.5 | |
| Orbiniidae (LPIL) | A | Poly | 3 | 0.015 | 99.487 | 1 | 1.2 | |
| Haustoriidae (LPIL) | Ar | Mala | 3 | 0.015 | 99.501 | 2 | 2.5 | |
| *Aulodrilus pigueti* | A | Olig | 2 | 0.010 | 99.511 | 1 | 1.2 | |
| *Euceramus praelongus* | Ar | Mala | 2 | 0.010 | 99.521 | 1 | 1.2 | |
| *Echinarachnius parma* | E | Echi | 2 | 0.010 | 99.531 | 2 | 2.5 | |
| *Drilonereis longa* | A | Poly | 2 | 0.010 | 99.541 | 1 | 1.2 | |
| *Bathyporeia parkeri* | Ar | Mala | 2 | 0.010 | 99.551 | 1 | 1.2 | |
| *Sigalion arenicola* | A | Poly | 2 | 0.010 | 99.561 | 2 | 2.5 | |
| *Pinnixa chaetopterana* | Ar | Mala | 2 | 0.010 | 99.571 | 2 | 2.5 | |
| *Cyclaspis varians* | Ar | Mala | 2 | 0.010 | 99.581 | 1 | 1.2 | |
| *Hydroides dianthus* | A | Poly | 2 | 0.010 | 99.591 | 1 | 1.2 | |
| *Microphthalmus* (LPIL) | A | Poly | 2 | 0.010 | 99.601 | 1 | 1.2 | |
| *Bezzia* Complex (LPIL) | Ar | Inse | 2 | 0.010 | 99.611 | 1 | 1.2 | |
| *Monoculodes* (LPIL) | Ar | Mala | 2 | 0.010 | 99.621 | 2 | 2.5 | |
| *Pinnixa* (LPIL) | Ar | Mala | 2 | 0.010 | 99.631 | 2 | 2.5 | |
| *Crepidula* (LPIL) | M | Gast | 2 | 0.010 | 99.641 | 2 | 2.5 | |
| Maldanidae (LPIL) | A | Poly | 2 | 0.010 | 99.651 | 2 | 2.5 | |
| Paraonidae (LPIL) | A | Poly | 2 | 0.010 | 99.661 | 2 | 2.5 | |
| Syllidae (LPIL) | A | Poly | 2 | 0.010 | 99.671 | 1 | 1.2 | |
| Aoridae (LPIL) | Ar | Mala | 2 | 0.010 | 99.681 | 1 | 1.2 | |
| Melitidae (LPIL) | Ar | Mala | 2 | 0.010 | 99.691 | 2 | 2.5 | |

Table 2. Continued

| Taxon Name | Phylum | Class | No. of Individuals | % Total | Cummulative % | Station Occurrence | Station % Occurrence | Comments |
|---|---|---|---|---|---|---|---|---|
| Decapoda Reptantia (LPIL) | Ar | Mala | 2 | 0.010 | 99.701 | 2 | 2.5 | |
| Majidae (LPIL) | Ar | Mala | 2 | 0.010 | 99.711 | 2 | 2.5 | |
| Mysidacea (LPIL) | Ar | Mala | 2 | 0.010 | 99.721 | 1 | 1.2 | |
| Synaptidae (LPIL) | E | Holo | 2 | 0.010 | 99.731 | 1 | 1.2 | |
| Lineidae (LPIL) | R | | 2 | 0.010 | 99.741 | 2 | 2.5 | |
| *Placobdella papillifera* | A | Hiru | 1 | 0.005 | 99.746 | 1 | 1.2 | |
| *Apoprionospio pygmaea* | A | Poly | 1 | 0.005 | 99.751 | 1 | 1.2 | |
| *Bhawania heteroseta* | A | Poly | 1 | 0.005 | 99.756 | 1 | 1.2 | |
| *Glycera americana* | A | Poly | 1 | 0.005 | 99.761 | 1 | 1.2 | |
| *Grubeosyllis clavata* | A | Poly | 1 | 0.005 | 99.766 | 1 | 1.2 | |
| *Monticellina dorsobranchialis* | A | Poly | 1 | 0.005 | 99.771 | 1 | 1.2 | |
| *Nematonereis hebes* | A | Poly | 1 | 0.005 | 99.776 | 1 | 1.2 | |
| *Parougia caeca* | A | Poly | 1 | 0.005 | 99.781 | 1 | 1.2 | |
| *Sigambra bassi* | A | Poly | 1 | 0.005 | 99.786 | 1 | 1.2 | |
| *Americhelidium americanum* | Ar | Mala | 1 | 0.005 | 99.791 | 1 | 1.2 | |
| *Pleusymtes glaber* | Ar | Mala | 1 | 0.005 | 99.796 | 1 | 1.2 | |
| *Pagurus pollicaris* | Ar | Mala | 1 | 0.005 | 99.801 | 1 | 1.2 | |
| *Anomia simplex* | M | Biva | 1 | 0.005 | 99.806 | 1 | 1.2 | |
| *Microphthalmus hartmanae* | A | Poly | 1 | 0.005 | 99.811 | 1 | 1.2 | |
| *Neopanope sayi* | Ar | Mala | 1 | 0.005 | 99.816 | 1 | 1.2 | |
| *Laevapex fuscus* | M | Gast | 1 | 0.005 | 99.821 | 1 | 1.2 | |
| *Dero digitata* | A | Olig | 1 | 0.005 | 99.826 | 1 | 1.2 | |
| *Libinia dubia* | Ar | Mala | 1 | 0.005 | 99.831 | 1 | 1.2 | |
| *Loimia medusa* | A | Poly | 1 | 0.005 | 99.835 | 1 | 1.2 | |
| *Nephtys incisa* | A | Poly | 1 | 0.005 | 99.840 | 1 | 1.2 | |
| *Eupleura caudata* | M | Gast | 1 | 0.005 | 99.845 | 1 | 1.2 | |
| *Cirrophorus ilvana* | A | Poly | 1 | 0.005 | 99.850 | 1 | 1.2 | |
| *Cirrophorus lyra* | A | Poly | 1 | 0.005 | 99.855 | 1 | 1.2 | |
| *Aricidea wassi* | A | Poly | 1 | 0.005 | 99.860 | 1 | 1.2 | |
| *Aricidea suecica* | A | Poly | 1 | 0.005 | 99.865 | 1 | 1.2 | |
| *Magelona papillicornis* | A | Poly | 1 | 0.005 | 99.870 | 1 | 1.2 | |
| *Rheotanytarsus* (LPIL) | Ar | Inse | 1 | 0.005 | 99.875 | 1 | 1.2 | |
| *Prionospio* (LPIL) | A | Poly | 1 | 0.005 | 99.880 | 1 | 1.2 | |
| *Polydora* (LPIL) | A | Poly | 1 | 0.005 | 99.885 | 1 | 1.2 | |
| *Ovalipes* (LPIL) | Ar | Mala | 1 | 0.005 | 99.890 | 1 | 1.2 | |
| *Cerapus* (LPIL) | Ar | Mala | 1 | 0.005 | 99.895 | 1 | 1.2 | |
| *Cyathura* (LPIL) | Ar | Mala | 1 | 0.005 | 99.900 | 1 | 1.2 | |
| *Eusarsiella* (LPIL) | Ar | Ostr | 1 | 0.005 | 99.905 | 1 | 1.2 | |
| *Oecetis* (LPIL) | Ar | Inse | 1 | 0.005 | 99.910 | 1 | 1.2 | |
| *Turbonilla* (LPIL) | M | Gast | 1 | 0.005 | 99.915 | 1 | 1.2 | |
| Chaetopteridae (LPIL) | A | Poly | 1 | 0.005 | 99.920 | 1 | 1.2 | |
| Aeginellidae (LPIL) | Ar | Mala | 1 | 0.005 | 99.925 | 1 | 1.2 | |
| Amphipoda (LPIL) | Ar | Mala | 1 | 0.005 | 99.930 | 1 | 1.2 | |
| Ischyroceridae (LPIL) | Ar | Mala | 1 | 0.005 | 99.935 | 1 | 1.2 | |
| Oedicerotidae (LPIL) | Ar | Mala | 1 | 0.005 | 99.940 | 1 | 1.2 | |
| Phoxocephalidae (LPIL) | Ar | Mala | 1 | 0.005 | 99.945 | 1 | 1.2 | |
| Pleustidae (LPIL) | Ar | Mala | 1 | 0.005 | 99.950 | 1 | 1.2 | |

Table 2. Continued

| Taxon Name | Phylum | Class | No. of Individuals | % Total | Cummulative % | Station Occurrence | Station % Occurrence | Comments |
|---|---|---|---|---|---|---|---|---|
| Bodotriidae (LPIL) | Ar | Mala | 1 | 0.005 | 99.955 | 1 | 1.2 | |
| Decapoda Natantia (LPIL) | Ar | Mala | 1 | 0.005 | 99.960 | 1 | 1.2 | |
| Callianassidae (LPIL) | Ar | Mala | 1 | 0.005 | 99.965 | 1 | 1.2 | |
| Anthuridae (LPIL) | Ar | Mala | 1 | 0.005 | 99.970 | 1 | 1.2 | |
| Ostracoda (LPIL) | Ar | Ostr | 1 | 0.005 | 99.975 | 1 | 1.2 | |
| Holothuroidea (LPIL) | E | Holo | 1 | 0.005 | 99.980 | 1 | 1.2 | |
| Arcidae (LPIL) | M | Biva | 1 | 0.005 | 99.985 | 1 | 1.2 | |
| Cardiidae (LPIL) | M | Biva | 1 | 0.005 | 99.990 | 1 | 1.2 | |
| Columbellidae (LPIL) | M | Gast | 1 | 0.005 | 99.995 | 1 | 1.2 | |
| Hydrobiidae (LPIL) | M | Gast | 1 | 0.005 | 100.000 | 1 | 1.2 | |

**Taxa Key**

A = Annelida
- Hiru = Hirudinea
- Olig = Oligochaeta
- Poly = Polychaeta

Ar = Arthropoda
- Inse = Insecta
- Mala = Malacostraca
- Ostr = Ostracoda

C = Chordata
- Asci = Ascidiacea
- Lept = Leptocardia

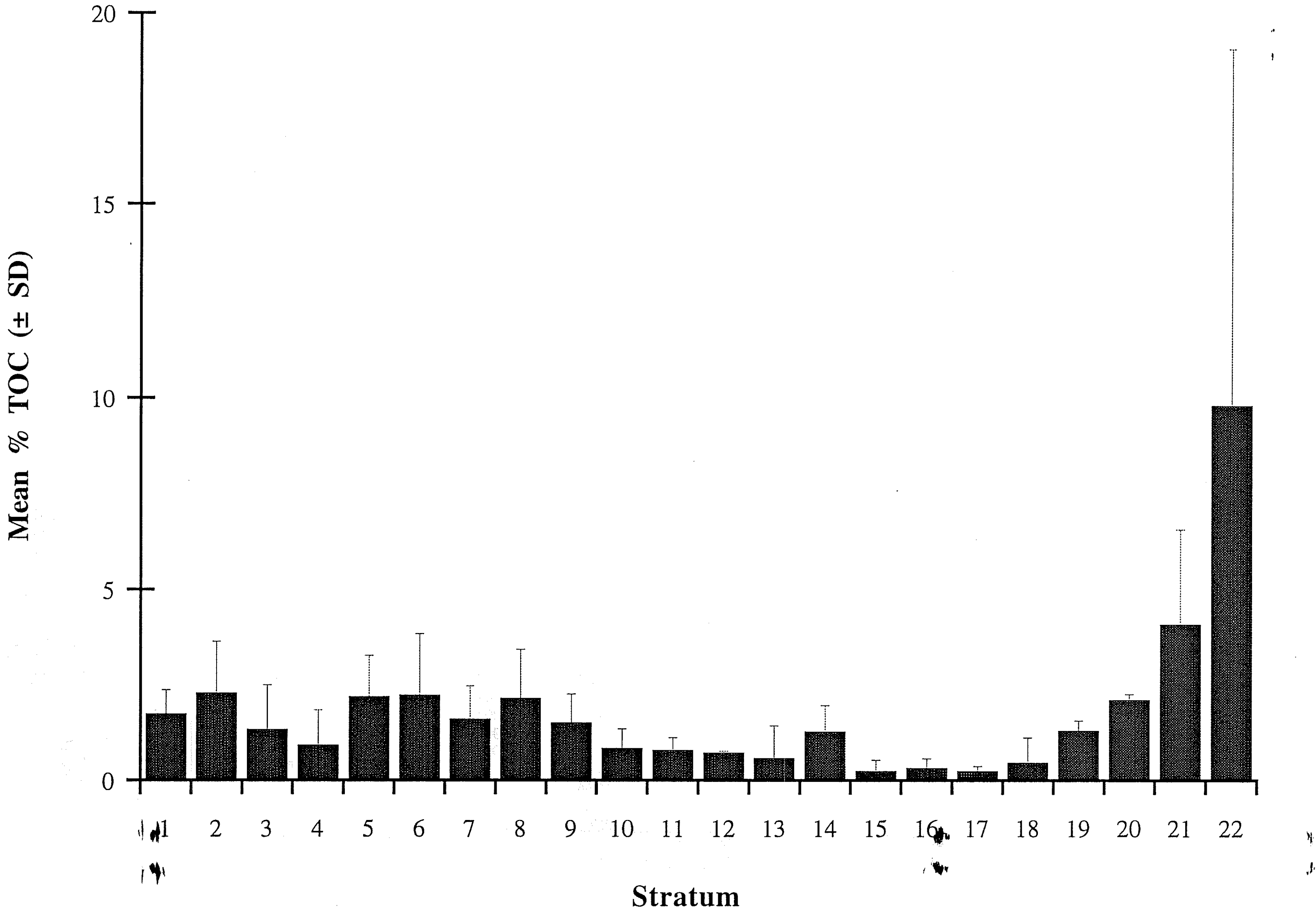
Cn = Cnidaria
- Anth = Anthozoa

E = Echinodermata
- Echi = Echinoidea
- Holo = Holothuroidea

M = Mollusca
- Biva = Bivalvia
- Gast = Gastropoda

R = Rhynchocoela

Figure 10. Mean % total organic carbon (TOC) of the Delaware Bay and adjacent waters strata, September 1997.



## 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. Four Microsoft ™Excel 5.0 (Macintosh version) spreadsheets are being provided separately to NOAA which include: raw data on taxa abundance and density by replicate, a complete taxonomic listing with station abundance and occurrence and QA/QC comments, a major taxa table with overall taxa abundance, and an assemblage parameter table including data on mean number of taxa, mean density, taxa diversity and taxa evenness by station.

A total of 20,060 organisms, representing 239 taxa, were identified from the 81 sites (Table 3). Polychaetes were the most numerous taxa present representing 34.7% of the total assemblage, followed in abundance by malacostracans (31.4%) and gastropods (9.6%). Malacostracans represented 36.1% of the total number of individuals followed by polychaetes (28.0%), oligochaetes (25.5%), and bivalves (4.6%) (Table 3).

The dominant taxa collected from the samples was the amphipod, *Ampelisca abdita* which accounted for 19.38% of all individuals, but occurred at only 24.7% of the sites (Table 2). The next most abundant taxon was the oligochaete Family Tubificidae at 17.88% of allindividuals
more sensitive to ↓ D.O. than most oligochaetes
identified (Table 2). This taxa was also the most widespread occurring at 61.7% of the sites (Table 2). The polychaete genus *Mediomastus* accounted for 10.42% of all individuals and was identified at 27.2% of the sites (Table 2). All other taxa accounted for less than 6.0% of the total number of individuals. The isopod, *Cyathura polita*, Rhynchocoela (LPIL), the oligochaete *Limnodrilus hoffmeisteri*, the cumacean *Leucon americanus* and the class Oligochaeta (LPIL) were the next most widespread occurring at 40.7%, 32.1%, 28.4%, 24.7% and 23.5% respectively (Table 3). The distribution of dominant taxa representing >10% of the total assemblage at each site is given in Table 4.

Table 3. Summary of abundance of major taxonomic groups for the Delaware Bay and adjacent waters sites, September, 1997.

| TAXA | Total No. Taxa | % Total | Total No. Individuals | % Total |
|---|---|---|---|---|
| **Annelida** | | | | |
| Polychaeta | 83 | 34.7 | 5607 | 28.0 |
| Oligochaeta | 9 | 3.8 | 5117 | 25.5 |
| Hirudinea | 1 | 0.4 | 1 | < 0.1 |
| **Arthropoda** | | | | |
| Malacostraca | 75 | 31.4 | 7246 | 36.1 |
| Insecta | 14 | 5.9 | 470 | 2.3 |
| Ostracoda | 4 | 1.7 | 50 | 0.2 |
| **Mollusca** | | | | |
| Bivalvia | 20 | 8.4 | 919 | 4.6 |
| Gastropoda | 23 | 9.6 | 486 | 2.4 |
| **Other Taxa** | 10 | 4.2 | 164 | 0.8 |
| TOTAL | 239 | | 20060 | |

Table 4. Percentage abundance of dominant taxa (>10%) for the Delaware Bay and adjacent waters sites, September 1997.

| | *Strata* | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *19* | *19* | *19* | *20* | *20* | *20* | *1* | *1* | *1* | *2* | *2* | *2* | *3* | *3* | *3* | *4* | *4* | *4* |
| | **Site No.** | | | | | | | | | | | | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** |
| **RHYNCHOCOELA** | | | | | | | | | | | | | | | | | | |
| Rhynchocoela (LPIL) | | | | | | | | | | | | | | | | | | |
| Lineidae (LPIL) | | | | | | | | | | | | | | | | | | |
| **ANNELIDA** | | | | | | | | | | | | | | | | | | |
| **Polychaeta** | | | | | | | | | | | | | | | | | | |
| Capitellidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Heteromastus filiformis* | | | | | | | | | | | | | | | | | | |
| *Mediomastus* (LPIL) | | | | | | | | | | | | | | | | | | |
| Cirratulidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Glycera* sp.D | | | | | | | | | | | | | | | | | | |
| *Glycinde solitaria* | | | | | | | | | | | | | | | | | | |
| *Laeonereis culveri* | | | | | | | | | | | | | | | | | | |
| *Aricidea catherinae* | | | | | | | | | | | | | | | | | | |
| *Aricidea cerrutii* | | | | | | | | | | | | | | | | | | |
| *Aricidea* (LPIL) | | | | | | | | | | | | | | | | | | |
| Spionidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Polydora cornuta* | | | | | | | | | | | | | | | | | | |
| *Streblospio benedicti* | | | | | | | | | | | | | | | | | | |
| *Dipolydora socialis* | | | | | | | | | | | | | | | | | | |
| *Marenzellaria viridis* | | | | | | | | | | | | | | | | | | |
| *Parapionosyllis longicirrata* | | | | | | | | | | | | | | | | | | |
| *Brania wellfleetensis* | | | | | | | | | | | | | | | | | | |
| *Polygordius* (LPIL) | | | | | | | | | | | | | | | | | | |
| *Sabellaria vulgaris* | | | | | | | | | | | | | | | | | | |
| **Oligochaeta** | | | | | | | | | | | | | | | | | | |
| Oligochaeta (LPIL) | | | | | | | | | | | | | | | | | | |
| Tubificidae (LPIL) | 45.7 | 14.0 | 36.9 | 77.3 | 80.7 | 15.0 | 59.4 | 89.0 | 31.9 | 16.1 | | 16.4 | 38.7 | | | 17.0 | 12.9 | 44.1 |
| *Limnodrilus hoffmeisteri* | 23.6 | | 25.2 | 11.5 | | 19.5 | 21.5 | | 34.6 | 33.7 | | 43.6 | 49.3 | | 10.2 | | | 40.9 |
| *Quistadrilus multisetosus* | | | 12.1 | | | | | | | | | | | | | | | |
| **MOLLUSCA** | | | | | | | | | | | | | | | | | | |
| **Bivalvia** | | | | | | | | | | | | | | | | | | |
| Bivalvia (LPIL) | | | | | | | | | | | | | | | | | | |
| *Tellina agilis* | | | | | | | | | | | | | | | | | | |
| *Tellina* (LPIL) | | | | | | | | | | | | | | | | | | |
| *Gemma gemma* | | | | | | | | | | | | | | | | | | |
| *Astarte castanea* | | | | | | | | | | | | | | | | | | |
| *Pisidium compressum* | | | 12.4 | | | | | | | | | | | | | | | |
| *Corbicula manilensis* | | 51.8 | | | | | | | | | | | | | | | | |
| **Gastropoda** | | | | | | | | | | | | | | | | | | |
| *Acteocina canaliculata* | | | | | | | | | | | | | | | | | | |
| *Crepidula plana* | | | | | | | | | | | | | | | | | | |
| **ARTHROPODA** | | | | | | | | | | | | | | | | | | |
| **Malacostraca** | | | | | | | | | | | | | | | | | | |
| *Cyathura polita* | | 18.9 | | | | 13.5 | | | | | 25.2 | | | | | | | |
| *Chiridotea tuftsi* | | | | | | | | | | | | | | | 62.7 | | 50.0 | |
| *Corophium tuberculatum* | | | | | | | | | | | | | | | | | | |
| *Corophium lacustre* | | | | | | | | | | | | | | | | 14.3 | | |
| Corophium (LPIL) | | | | | | | | | | | | | | | | | | |
| *Ampelisca abdita* | | | | | | | | | | | | | | | | | | |
| *Ampelisca vadorum* | | | | | | | | | | | | | | | | | | |
| *Gammarus tigrinus* | | | | | | | | | | | | | | | | 51.2 | | |
| *Leptocheirus plumulosus* | | | | | | | | | | | | | | | | | | |
| *Leptocheirus* (LPIL) | | | | | | | | | | | | | | | | | | |
| *Pseudunciola obliquua* | | | | | | | | | | | | | | | | | | |
| *Rhepoxynius hudsoni* | | | | | | | | | | | | | | | | | | |
| Haustoriidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Protohaustorius* sp.B | | | | | | | | | | | | | | | | | | |
| *Parahaustorius attenuatus* | | | | | | | | | | | | | | | | | | |
| *Lysianopsis alba* | | | | | | | | | | | | | | | | | | |
| *Leucon americanus* | | | | | | | | | | | | | | | | | | |
| *Almyracuma proximoculi* | | | | | | | | | | 20.1 | 25.8 | | | | | | | |
| *Tanaissus psammophilus* | | | | | | | | | | | | | | | | | | |
| **Insecta** | | | | | | | | | | | | | | | | | | |
| Ceratopogonidae (LPIL) | | | | | | | | | | | | | | | | | | |
| Chironomidae (LPIL) | | | | | | 27.1 | | | | | 17.2 | 14.9 | | 19.3 | | | 13.6 | |
| *Polypedilum halterale* group | | | | | | | | | | | | | | 33.3 | | | | |
| *Polypedilum* (LPIL) | | | | | | 15.8 | | | 23.4 | | | | | 26.3 | | | 12.9 | |

Table 4. continued

| | *Strata* | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *5* | *5* | *5* | *6* | *6* | *6* | *7* | *7* | *7* | *8* | *8* | *8* | *9* | *9* | *9* | *9* |
| | **Site No.** | | | | | | | | | | | | | | | |
| | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
| **RHYNCHOCOELA** | | | | | | | | | | | | | | | | |
| Rhynchocoela (LPIL) | | | | | | | | | | | | | | | | |
| Lineidae (LPIL) | | | | | | | | | 16.7 | | | | | | | |
| **ANNELIDA** | | | | | | | | | | | | | | | | |
| **Polychaeta** | | | | | | | | | | | | | | | | |
| Capitellidae (LPIL) | | | | | | | | | | | | | | | | |
| *Heteromastus filiformis* | | | | | | | | | | | | | | | | |
| *Mediomastus* (LPIL) | | | | | | | | | | | | | | | | |
| Cirratulidae (LPIL) | | | | | | | | | | | | | | | | |
| *Glycera* sp.D | | | | | | | | | | | | | | | | |
| *Glycinde solitaria* | | | | | | | | | | | | | | | | |
| *Laeonereis culveri* | | | | | | | | | | | | | | | | |
| *Aricidea catherinae* | | | | | | | | | | | | | | | | |
| *Aricidea cerrutii* | | | | | | | | | | | | | | | | |
| *Aricidea* (LPIL) | | | | | | | | | | | | | | | | |
| Spionidae (LPIL) | | | | | | 33.3 | | | 50.0 | | | | | | | |
| *Polydora cornuta* | | | | | | | | | | | | | | | | |
| *Streblospio benedicti* | | | | | | | | | | | | | | | | |
| *Dipolydora socialis* | | | | | | | | | | | 63.9 | | | 64.1 | 72.0 | |
| *Marenzellaria viridis* | | | | | | | 20.0 | | | | | | 25.0 | | | |
| *Parapionosyllis longicirrata* | | | | | | | | | | | | | | | | |
| *Brania wellfleetensis* | | | | | | | | | | | | | | | | |
| *Polygordius* (LPIL) | | | | | | | | | | | | | | | | |
| *Sabellaria vulgaris* | | | | | | | | | | | | | | | | |
| **Oligochaeta** | | | | | | | | | | | | | | | | |
| Oligochaeta (LPIL) | | | | | | | | | | | | | | | | |
| Tubificidae (LPIL) | 50.0 | 59.1 | 18.8 | 61.1 | 75.9 | 66.7 | 40.0 | 96.2 | | 59.1 | | 36.0 | | | | 18.1 |
| *Limnodrilus hoffmeisteri* | 43.1 | 37.9 | | 22.2 | 24.1 | | | | | | | | | | | |
| *Quistadrilus multisetosus* | | | | | | | | | | | | | | | | |
| **MOLLUSCA** | | | | | | | | | | | | | | | | |
| **Bivalvia** | | | | | | | | | | | | | | | | |
| Bivalvia (LPIL) | | | | | | | | | | | | | | | | |
| *Tellina agilis* | | | | | | | | | | | | | | | | |
| *Tellina* (LPIL) | | | | | | | | | | | | | | | | |
| *Gemma gemma* | | | | | | | | | | | | | | | | |
| *Astarte castanea* | | | | | | | | | | | | | | | | |
| *Pisidium compressum* | | | | | | | | | | | | | | | | |
| *Corbicula manilensis* | | | | | | | | | | | | | | | | |
| **Gastropoda** | | | | | | | | | | | | | | | | |
| *Acteocina canaliculata* | | | | | | | | | | | | | | | | |
| *Crepidula plana* | | | | | | | | | | | | | | | | |
| **ARTHROPODA** | | | | | | | | | | | | | | | | |
| **Malacostraca** | | | | | | | | | | | | | | | | |
| *Cyathura polita* | | | | | | | | | 16.7 | 19.7 | 13.9 | | 66.7 | | 12.0 | |
| *Chiridotea tuftsi* | | | 81.3 | | | | 20.0 | | | | | | | | | |
| *Corophium tuberculatum* | | | | | | | | | | | | | | | | |
| *Corophium lacustre* | | | | | | | | | | | | | | 16.2 | | |
| *Corophium* (LPIL) | | | | | | | | | 16.7 | | | | | | | |
| *Ampelisca abdita* | | | | | | | | | | | | | | | | |
| *Ampelisca vadorum* | | | | | | | | | | | | | | | | |
| *Gammarus tigrinus* | | | | | | | | | | | | | | | | |
| *Leptocheirus plumulosus* | | | | | | | | | | | | 21.0 | | | | |
| *Leptocheirus* (LPIL) | | | | | | | | | | | | 10.0 | | | | |
| *Pseudunciola obliquua* | | | | | | | | | | | | | | | | |
| *Rhepoxynius hudsoni* | | | | | | | | | | | | | | | | |
| Haustoriidae (LPIL) | | | | | | | | | | | | | | | | |
| *Protohaustorius* sp.B | | | | | | | | | | | | | | | | |
| *Parahaustorius attenuatus* | | | | | | | | | | | | | | | | |
| *Lysianopsis alba* | | | | | | | | | | | | | | | | |
| *Leucon americanus* | | | | | | | | | | | | | | | | 20.8 |
| *Almyracuma proximoculi* | | | | | | | | | | | | | | | | |
| *Tanaissus psammophilus* | | | | | | | | | | | | | | | | |
| **Insecta** | | | | | | | | | | | | | | | | |
| Ceratopogonidae (LPIL) | | | | | | | 20.0 | | | | | | | | | |
| Chironomidae (LPIL) | | | | | | | | | | | | | | | | |
| *Polypedilum halterale* group | | | | | | | | | | | | | | | | |
| *Polypedilum* (LPIL) | | | | | | | | | | | | | | | | |

Table 4. Continued

| Strata | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site No. | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
| **RHYNCHOCOELA** | | | | | | | | | | | | | | | | | | |
| Rhynchocoela (LPIL) | 15.3 | | | | | | | | | | 10.7 | | | | | | | |
| Lineidae (LPIL) | | | | | | | | | | | | | | | | | | |
| **ANNELIDA** | | | | | | | | | | | | | | | | | | |
| **Polychaeta** | | | | | | | | | | | | | | | | | | |
| Capitellidae (LPIL) | | | | | | | | | | | | | | 20.9 | | | | |
| *Heteromastus filiformis* | | 15.5 | | | 66.0 | | | | | | 14.3 | | | | | | | |
| *Mediomastus* (LPIL) | | | | | | | 27.0 | | | | | | | | | 59.1 | | |
| Cirratulidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Glycera* sp.D | | | | | | | | | | | | | | 14.0 | | | | |
| *Glycinde solitaria* | | | | | | | 14.9 | | | | | | | | | | | |
| *Laeonereis culveri* | | | | | | | | | | | | | | | | | | |
| *Aricidea catherinae* | | | | | | | | | | | | | | | | | | |
| *Aricidea cerrutii* | | | | | | | | | | | | | | | | | | |
| *Aricidea* (LPIL) | | | | | | | | | | | | | | | | | | |
| Spionidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Polydora cornuta* | | | | | | | | | 17.5 | | | | | | | | | |
| *Streblospio benedicti* | | | 18.1 | | | | | | | | | | | | | | | |
| *Dipolydora socialis* | | | | | | | | | | | | | | | | | | |
| *Marenzellaria viridis* | 50.0 | 17.2 | 22.2 | | | | | | | | | | | | | | | |
| *Parapionosyllis longicirrata* | | | | | | | | | | | | | | | | | | |
| *Brania wellfleetensis* | | | | | | | | | | | | | | | | | | |
| *Polygordius* (LPIL) | | | | | | | | | | | | | | | | | | 20.6 |
| *Sabellaria vulgaris* | | | | | | | | | 44.2 | 55.7 | | | | | | | | |
| **Oligochaeta** | | | | | | | | | | | | | | | | | | |
| Oligochaeta (LPIL) | | | | | | | | | | | | | | | | | | |
| Tubificidae (LPIL) | | 22.4 | 30.4 | 27.3 | | 25.6 | | | | | | | | | | | | |
| *Limnodrilus hoffmeisteri* | | | | | | | | | | | | | | | | | | |
| *Quistadrilus multisetosus* | | | | | | | | | | | | | | | | | | |
| **MOLLUSCA** | | | | | | | | | | | | | | | | | | |
| **Bivalvia** | | | | | | | | | | | | | | | | | | |
| Bivalvia (LPIL) | | | | | | | | | | | | | | | | | | |
| *Tellina agilis* | | | | | | | | | | | | 15.5 | | 20.9 | | | | 11.8 |
| *Tellina* (LPIL) | | | | | | | | | | | 10.7 | | | 16.3 | 15.8 | | | |
| *Gemma gemma* | | | | | | | | | | | | | | | | | 69.1 | |
| *Astarte castanea* | | | | 34.1 | | | | | | | | | | | | | | |
| *Pisidium compressum* | | | | | | | | | | | | | | | | | | |
| *Corbicula manilensis* | | | | | | | | | | | | | | | | | | |
| **Gastropoda** | | | | | | | | | | | | | | | | | | |
| *Acteocina canaliculata* | | | | | | | 14.2 | | | | 25.0 | | | | | | | |
| *Crepidula plana* | | | | | | | | | | | | | | | | | | |
| **ARTHROPODA** | | | | | | | | | | | | | | | | | | |
| **Malacostraca** | | | | | | | | | | | | | | | | | | |
| *Cyathura polita* | | 10.3 | | | 18.0 | | | | | | | | | | | | | |
| *Chiridotea tuftsi* | 25.0 | 13.8 | | | | | | | | | | | | | | | | |
| *Corophium tuberculatum* | | | | | | | | | | | | 42.9 | | | | | | |
| *Corophium lacustre* | | | | | | | | | | | | | | | | | | |
| *Corophium* (LPIL) | | | | | | | | | | | | | | | | | | |
| *Ampelisca abdita* | | | | | | | 12.1 | 72.5 | | | | | | | | 27.2 | | |
| Ampelisca vadorum | | | | | | | | | | | | | | | | | | |
| *Gammarus tigrinus* | | | | | | | | | | | | | | | | | | |
| *Leptocheirus plumulosus* | | | | | | | | | | | | | | | | | | |
| *Leptocheirus* (LPIL) | | | | | | | | | | | | | | | | | | |
| *Pseudunciola obliquua* | | | | | | | | | | | | | | | | | | |
| *Rhepoxynius hudsoni* | | | | | | | | | | | | | 62.0 | | | | 18.8 | 11.8 |
| Haustoriidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Protohaustorius* sp.B | | | | | | | | | | | | | 13.0 | | 56.1 | | | |
| *Parahaustorius attenuatus* | | | | | | | | | | | | | | | | | | |
| *Lysianopsis alba* | | | | | | | | | | | | | | | | | | |
| *Leucon americanus* | 16.7 | | | | | 54.7 | | | | | | | | | | | | |
| *Almyracuma proximoculi* | | | | | | | | | | | | | | | | | | |
| *Tanaissus psammophilus* | | | | | | | | | | | | | | | | | | |
| **Insecta** | | | | | | | | | | | | | | | | | | |
| Ceratopogonidae (LPIL) | | | | | | | | | | | | | | | | | | |
| Chironomidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Polypedilum halterale* group | | | | | | | | | | | | | | | | | | |
| *Polypedilum* (LPIL) | | | | | | | | | | | | | | | | | | |

Table 4. Continued

| | Strata 13 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 17 | 17 | 17 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Site No. 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| **RHYNCHOCOELA** | | | | | | | | | | | | | | | | | | |
| Rhynchocoela (LPIL) | | | | | | | | | 11.1 | | | | | | | | | |
| Lineidae (LPIL) | | | | | | | | | | | | | | | | | | |
| **ANNELIDA** | | | | | | | | | | | | | | | | | | |
| **Polychaeta** | | | | | | | | | | | | | | | | | | |
| Capitellidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Heteromastus filiformis* | | | | | | | | | | | | | | | | | | |
| *Mediomastus* (LPIL) | | 21.3 | 63.4 | 20.1 | 20.2 | 20.9 | | | | | | | | | | | | |
| Cirratulidae (LPIL) | | | | | | | | | | | 19.7 | | | | | | | |
| *Glycera* sp.D | | | | | | | | | | | | | | | | | | |
| *Glycinde solitaria* | | | | | | | | | | | | | | | | | | |
| *Laeonereis culveri* | | | | | | | | | | | | | | | | | | |
| *Aricidea catherinae* | | | | | | | | | | | | | | | 19.4 | | | |
| *Aricidea cerrutii* | | | | | | | | | | | | | | | | | | |
| *Aricidea* (LPIL) | | | | | | | | | | | | | | | 15.6 | | | |
| Spionidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Polydora cornuta* | | | | | | | | | | | | | | | | | | |
| *Streblospio benedicti* | | | | | | | | | | | | | | | | | | |
| *Dipolydora socialis* | | | | | | | | | | | | | | | | | | |
| *Marenzellaria viridis* | | | | | | | | | | | | | | | | | | |
| *Parapionosyllis longicirrata* | | | | | | | | | | 15.7 | | | | | | | | |
| *Brania wellfleetensis* | | | | | | | | | | 23.5 | | | | | | | | |
| *Polygordius* (LPIL) | | | | | | | | | | | | | | | | | 31.1 | |
| *Sabellaria vulgaris* | | | | | | | | | | | | | | | | | | |
| **Oligochaeta** | | | | | | | | | | | | | | | | | | |
| Oligochaeta (LPIL) | | | | | | | | | | | | | | 30.3 | | | | |
| Tubificidae (LPIL) | | | | | 14.1 | | | | | | | | | | | | 11.1 | |
| *Limnodrilus hoffmeisteri* | | | | | | | | | | | | | | | | | | |
| *Quistadrilus multisetosus* | | | | | | | | | | | | | | | | | | |
| **MOLLUSCA** | | | | | | | | | | | | | | | | | | |
| **Bivalvia** | | | | | | | | | | | | | | | | | | |
| Bivalvia (LPIL) | | | | | | | | | | | | | | | | | 15.6 | |
| *Tellina agilis* | | | | | | | 40.4 | | 11.1 | | | | | | | 37.8 | | 53.3 |
| *Tellina* (LPIL) | 18.2 | 16.3 | | | | | | | 40.7 | | 26.2 | | | | | | | |
| *Gemma gemma* | | | | | | | | | | | | | 30.8 | | | | | 28.9 |
| *Astarte castanea* | | | | | | | | | | | | | | | | | | |
| *Pisidium compressum* | | | | | | | | | | | | | | | | | | |
| *Corbicula manilensis* | | | | | | | | | | | | | | | | | | |
| **Gastropoda** | | | | | | | | | | | | | | | | | | |
| *Acteocina canaliculata* | | | | | | | | | | | | | | | | | | |
| *Crepidula plana* | | | | 18.5 | | | | | | | | | | | | | | |
| **ARTHROPODA** | | | | | | | | | | | | | | | | | | |
| **Malacostraca** | | | | | | | | | | | | | | | | | | |
| *Cyathura polita* | | | | | | | | | | | | | | | | | | |
| *Chiridotea tuftsi* | | | | | | | | | | | | | 61.5 | | | | | |
| *Corophium tuberculatum* | | | | | | | | | | | | | | | | | | |
| *Corophium lacustre* | | | | | | | | | | | | | | | | | | |
| *Corophium* (LPIL) | | | | | | | | | | | | | | | | | | |
| *Ampelisca abdita* | | | | | | 70.2 | | 84.9 | | | | | | | | | | |
| Ampelisca vadorum | | | | | | | 14.9 | | | | | | | | | | | |
| *Gammarus tigrinus* | | | | | | | | | | | | | | | | | | |
| *Leptocheirus plumulosus* | | | | | | | | | | | | | | | | | | |
| *Leptocheirus* (LPIL) | | | | | | | | | | | | | | | | | | |
| *Pseudunciola obliquua* | | | | | | | | | | | | | | | | | | |
| *Rhepoxynius hudsoni* | | | | | | | | | 11.1 | | | | | | | 25.6 | | |
| Haustoriidae (LPIL) | | | | | | | | | | | | 14.3 | | | | | | |
| *Protohaustorius* sp.B | | 25.0 | | | | | | | | | | | | | | | | |
| *Parahaustorius attenuatus* | | | | | | | | | | | | 71.4 | | | | | | |
| *Lysianopsis alba* | | | | | | | | | | | | | | 18.3 | | | | |
| *Leucon americanus* | | | | 23.8 | 50.1 | | | | | | | | | | | | | |
| *Almyracuma proximoculi* | | | | | | | | | | | | | | | | | | |
| *Tanaissus psammophilus* | | | | | | | | | | | | | | | | | | |
| **Insecta** | | | | | | | | | | | | | | | | | | |
| Ceratopogonidae (LPIL) | | | | | | | | | | | | | | | | | | |
| Chironomidae (LPIL) | | | | | | | | | | | | | | | | | | |
| *Polypedilum halterale* group | | | | | | | | | | | | | | | | | | |
| *Polypedilum* (LPIL) | | | | | | | | | | | | | | | | | | |

Table 4. Continued

| | Strata | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *18* | *18* | *18* | *21* | *21* | *22* | *22* | *22* | *NA* | *NA* | *NA* |
| | Site No. | | | | | | | | | | |
| | 71 | 72 | 73 | 84 | 85 | 88 | 89 | 90 | 91 | 92 | 87 |
| **RHYNCHOCOELA** | | | | | | | | | | | |
| Rhynchocoela (LPIL) | | | | | | | | | | | |
| Lineidae (LPIL) | | | | | | | | | | | |
| **ANNELIDA** | | | | | | | | | | | |
| **Polychaeta** | | | | | | | | | | | |
| Capitellidae (LPIL) | | | | | | | | | | | |
| *Heteromastus filiformis* | | | | | | | | | | | |
| *Mediomastus* (LPIL) | | | | | | 29.8 | | | | | |
| Cirratulidae (LPIL) | | | 13.4 | | | | | | | | |
| *Glycera* sp.D | | | | | | | | | | | |
| *Glycinde solitaria* | | | | | | | | | | | |
| *Laeonereis culveri* | | | | | | | | | 14.0 | | |
| *Aricidea catherinae* | | | | | | | | | | | |
| *Aricidea cerrutii* | | 13.6 | | | | | | | | | |
| *Aricidea* (LPIL) | | | | | | | | | | | |
| Spionidae (LPIL) | | | | | | | | 16.3 | | | |
| *Polydora cornuta* | | | | | | | | | | | |
| *Streblospio benedicti* | | | | | | 57.2 | | | | | |
| *Dipolydora socialis* | | | | | | | | | | | |
| *Marenzellaria viridis* | | | | | | | | | | | |
| *Parapionosyllis longicirrata* | | | | | | | | | | | |
| *Brania wellfleetensis* | | | | | | | | | | | |
| *Polygordius* (LPIL) | | | 11.9 | | | | | | | | |
| *Sabellaria vulgaris* | | | | | | | | | | | |
| **Oligochaeta** | | | | | | | | | | | |
| Oligochaeta (LPIL) | | | | 12.8 | | | | | | | |
| Tubificidae (LPIL) | | | | 12.8 | 77.5 | | 51.4 | 64.7 | 77.9 | 87.9 | |
| *Limnodrilus hoffmeisteri* | | | | | | | 18.9 | | | | |
| *Quistadrilus multisetosus* | | | | | | | | | | | |
| **MOLLUSCA** | | | | | | | | | | | |
| **Bivalvia** | | | | | | | | | | | |
| Bivalvia (LPIL) | | | | 12.8 | | | | | | | |
| *Tellina agilis* | 44.4 | | | | | | | | | | |
| *Tellina* (LPIL) | | | | | | | | | | | |
| *Gemma gemma* | | | | | | | | | | | |
| *Astarte castanea* | | | | | | | | | | | |
| *Pisidium compressum* | | | | | | | | | | | |
| *Corbicula manilensis* | | | | | | | | | | | |
| **Gastropoda** | | | | | | | | | | | |
| *Acteocina canaliculata* | | | | | | | | | | | |
| *Crepidula plana* | | | | | | | | | | | |
| **ARTHROPODA** | | | | | | | | | | | |
| **Malacostraca** | | | | | | | | | | | |
| *Cyathura polita* | | | | | | | | | | | |
| *Chiridotea tuftsi* | | | | | | | | | | | |
| *Corophium tuberculatum* | | | | | | | | | | | |
| *Corophium lacustre* | | | | | | | | | | | |
| *Corophium* (LPIL) | | | | | | | | | | | |
| *Ampelisca abdita* | | | | | | | | | | | 79.5 |
| *Ampelisca vadorum* | | | | | | | | | | | |
| *Gammarus tigrinus* | | | | | | | 13.5 | | | | |
| *Leptocheirus plumulosus* | | | | | | | | | | | |
| *Leptocheirus* (LPIL) | | | | | | | | | | | |
| *Pseudunciola obliquua* | | 27.2 | | | | | | | | | |
| *Rhepoxynius hudsoni* | | | | | | | | | | | |
| Haustoriidae (LPIL) | | | | | | | | | | | |
| *Protohaustorius* sp.B | | | | | | | | | | | |
| *Parahaustorius attenuatus* | | | | | | | | | | | |
| *Lysianopsis alba* | | | | | | | | | | | |
| *Leucon americanus* | | | | 36.0 | | | | | | | |
| *Almyracuma proximoculi* | | | | | | | | | | | |
| *Tanaissus psammophilus* | 21.1 | | | | | | | | | | |
| **Insecta** | | | | | | | | | | | |
| Ceratopogonidae (LPIL) | | | | | | | | | | | |
| Chironomidae (LPIL) | | | | | | | | | | | |
| *Polypedilum halterale* group | | | | | | | | | | | |
| *Polypedilum* (LPIL) | | | | | | | | | | | |

Station mean density and mean number of taxa data are given in Table 1 and Figures 11 and 12. Mean densities ranged from 1412.5 organisms·m$^{-2}$ at Stratum 9 to 26985.0 organisms·m$^{-2}$ at Stratum 14 (Table 1; Figure 11). The mean number of taxa per replicate ranged from 3.67 at Stratum 6 to 26.25 at Stratum 12 (Table 1; Figure 12).

ANOVA analyses were performed on natural log transformed density and taxa abundance data for the Delaware Bay and adjacent waters strata. ANOVA and post-hoc test results for these two parameters are given in Tables 5 and 6.

Density and taxa abundance data were compared to various physical parameters using non-parametric correlation analyses. There was a significant positive correlation between strata mean density data and mean taxa per strata (Table 7). Also, TOC and density showed a significant positive correlation (Table 7). There were additional significant correlations between various physical parameters: % gravel + sand was inversely correlated with TOC; and % silt + clay was positively correlated with TOC (Table 7).

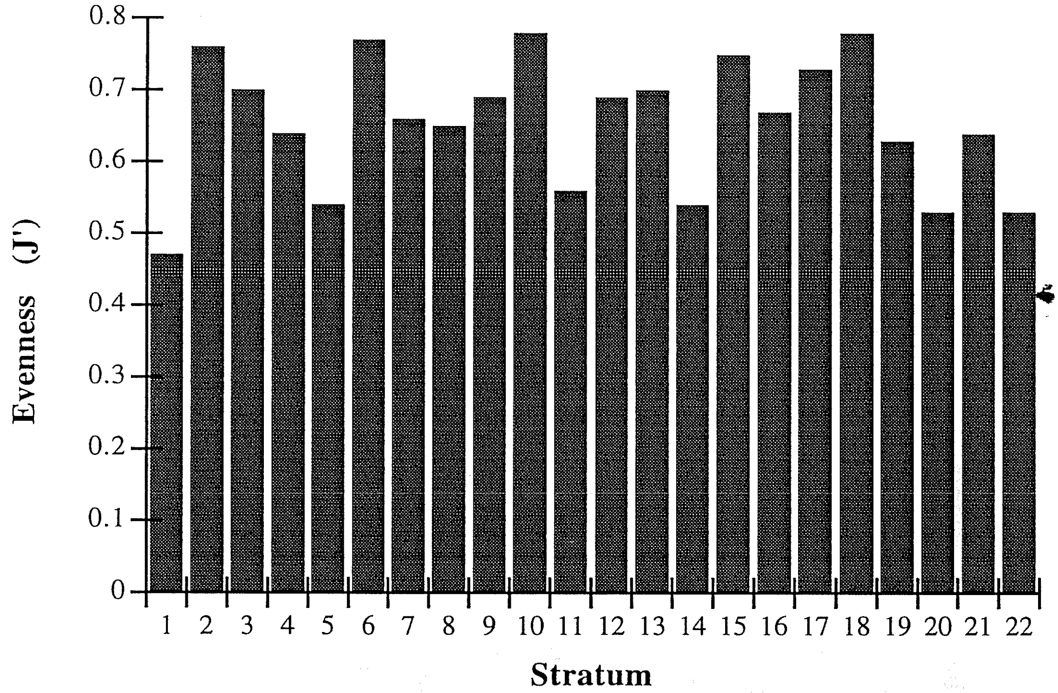
Taxa diversity and evenness are given in Table 1 and Figure 13. Taxa diversity (H') ranged from 0.77 at Stratum 5 to 2.46 at Stratum 18. Taxa evenness (J') values ranged from 0.14 at Stratum 1 to 0.78 at Strata 10 and 18 (Table 1; Figure 13).

***Cluster Analysis***

Normal (stations) and inverse (species) cluster analyses were performed on the Delaware Bay and adjacent waters data set and displayed as dendrograms (Figures 14 and 15). Selection of the species included in the analyses was based on a minimum representation of 0.3% of total individuals which encompassed 39 taxa. These taxa accounted for 90.3% of the macroinfaunal assemblage collected.

Numerical clustering of the 81 sites can be interpreted at a five-group level at a 10% level of similarity (Figure 14). One group contained only Site 64 with a macroinfaunal assemblage dominated by the amphipod, *Parahaustorius attenuatus* (Table 5). A second group contained 20

Figure 13. Taxa diversity (H') and taxa eveness (J') of the Delaware Bay and adjacent waters strata, September 1997.



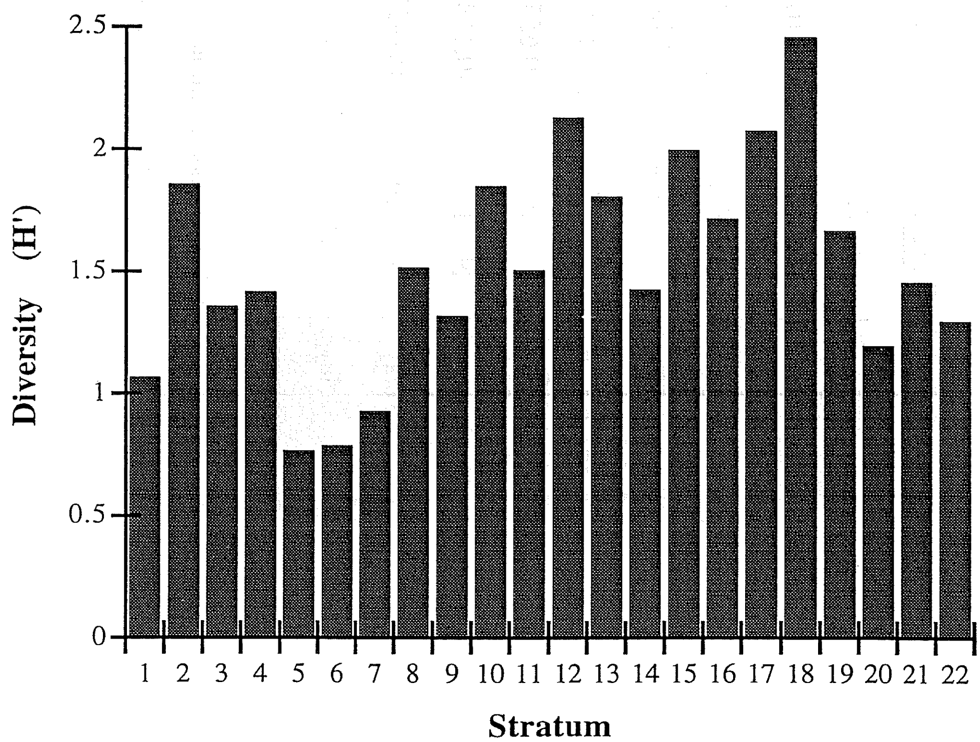



Table 7. Spearman Rho correlation coefficients for the Delaware Bay and adjacent waters sites, September 1997.

| Variable | By Variable | Correlation | Probability | sign |
|---|---|---|---|---|
| Density | No. Taxa | 0.5411 | <.0001 | * |
| TOC | No. Taxa | -0.2109 | 0.0588 | ns |
| TOC | Density | 0.2765 | 0.0125 | * |
| % gravel+sand | No. Taxa | 0.1598 | 0.1542 | ns |
| % gravel+sand | Density | -0.1240 | 0.2702 | ns |
| % gravel+sand | TOC | -0.6559 | <.0001 | * |
| % silt+clay | No. Taxa | -0.1189 | 0.2905 | ns |
| % silt+clay | Density | 0.1920 | 0.0860 | ns |
| % silt+clay | TOC | 0.6540 | <.0001 | * |

* = significant correlation; ns = not significant

taxa differences among strata

Table 6. Continued

| | 14 | 1 | 19 | 22 | 2 | 11 | 4 | 12 | 20 | 16 | 23 | 18 | 13 | 17 | 8 | 5 | 3 | 21 | 10 | 15 | 9 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **14** | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | ns | ns | ns | ns | ns | * | * | * | * | * |
| **1** | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * |
| **19** | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * |
| **22** | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * |
| **2** | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * |
| **11** | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * |
| **4** | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * |
| **12** | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * |
| **20** | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * |
| **16** | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| **23** | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * |
| **18** | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| **13** | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| **17** | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| **8** | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns |
| **5** | | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns |
| **3** | | | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns |
| **21** | | | | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns |
| **10** | | | | | | | | | | | | | | | | | | | | ns | ns | ns | ns |
| **15** | | | | | | | | | | | | | | | | | | | | | ns | ns | ns |
| **9** | | | | | | | | | | | | | | | | | | | | | | ns | ns |
| **6** | | | | | | | | | | | | | | | | | | | | | | | ns |
| **7** | | | | | | | | | | | | | | | | | | | | | | | |

*= a significant difference between strata

Table 6. ANOVA and post-hoc comparison results for taxa differences among sites for the Delaware Bay and adjacent waters samples, September 1997.

Shapiro-Wilk W test for normality

W=0.97 Prob < W=0.17

ANOVA Table

| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Model | 22 | 14.64 | 0.67 | 2.85 | 0.0008 |
| Error | 58 | 13.55 | 0.23 | | |
| Total | 80 | 28.19 | 0.35 | | |

density differences between strata

Table 5. Continued

| | 12 | 18 | 17 | 14 | 11 | 15 | 19 | 13 | 16 | 22 | 2 | 10 | 8 | 20 | 1 | 21 | 4 | 23 | 3 | 9 | 5 | 7 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **12** | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * | * | * | * | * | * | * | * | * | * |
| **18** | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | ns | * | * | * | * | * | * | * |
| **17** | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * | * | * |
| **14** | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * | * | * |
| **11** | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * | * | * |
| **15** | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * |
| **19** | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * |
| **13** | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * | * | * |
| **16** | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * |
| **22** | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * |
| **2** | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * |
| **10** | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | * | * |
| **8** | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | ns | * |
| **20** | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | ns | * |
| **1** | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | ns | * |
| **21** | | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | ns | * |
| **4** | | | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns | * |
| **23** | | | | | | | | | | | | | | | | | | | ns | ns | ns | ns | ns |
| **3** | | | | | | | | | | | | | | | | | | | | ns | ns | ns | ns |
| **9** | | | | | | | | | | | | | | | | | | | | | ns | ns | ns |
| **5** | | | | | | | | | | | | | | | | | | | | | | ns | ns |
| **7** | | | | | | | | | | | | | | | | | | | | | | | ns |
| **6** | | | | | | | | | | | | | | | | | | | | | | | |

Table 5. ANOVA and post-hoc comparison results for density differences among sites for the Delaware Bay and adjacent waters samples, September 1997.

Shapiro-Wilk W test for normality

W=0.98    Prob < W=0.55

ANOVA Table

| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Model | 22 | 47.7 | 2.17 | 1.37 | 0.17 |
| Error | 58 | 91.51 | 1.58 | | |
| Total | 80 | 139.21 | 1.74 | | |

Figure 12. Mean number of macroinvertebrate taxa of the Delaware Bay and adjacent waters strata, September 1997.

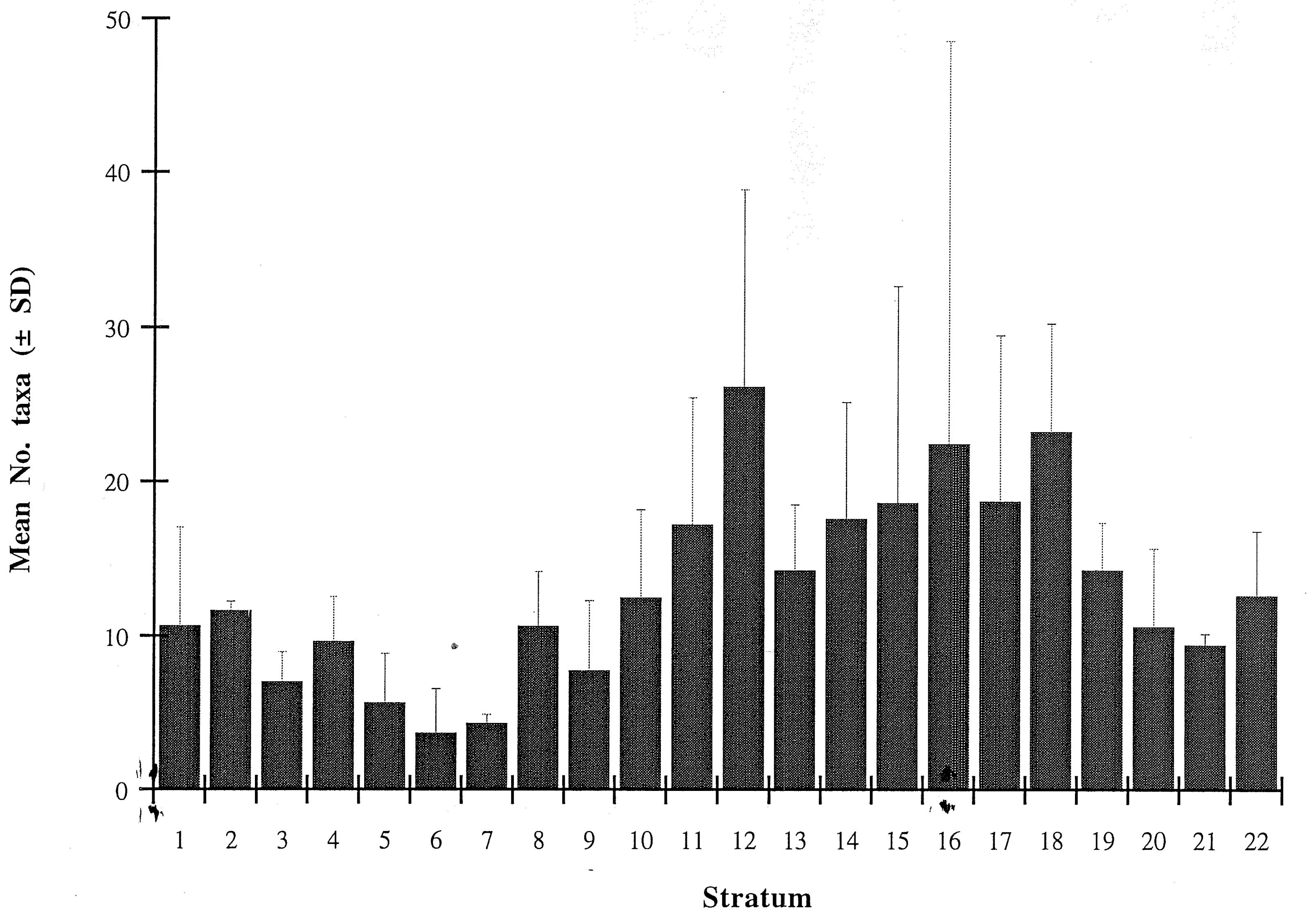
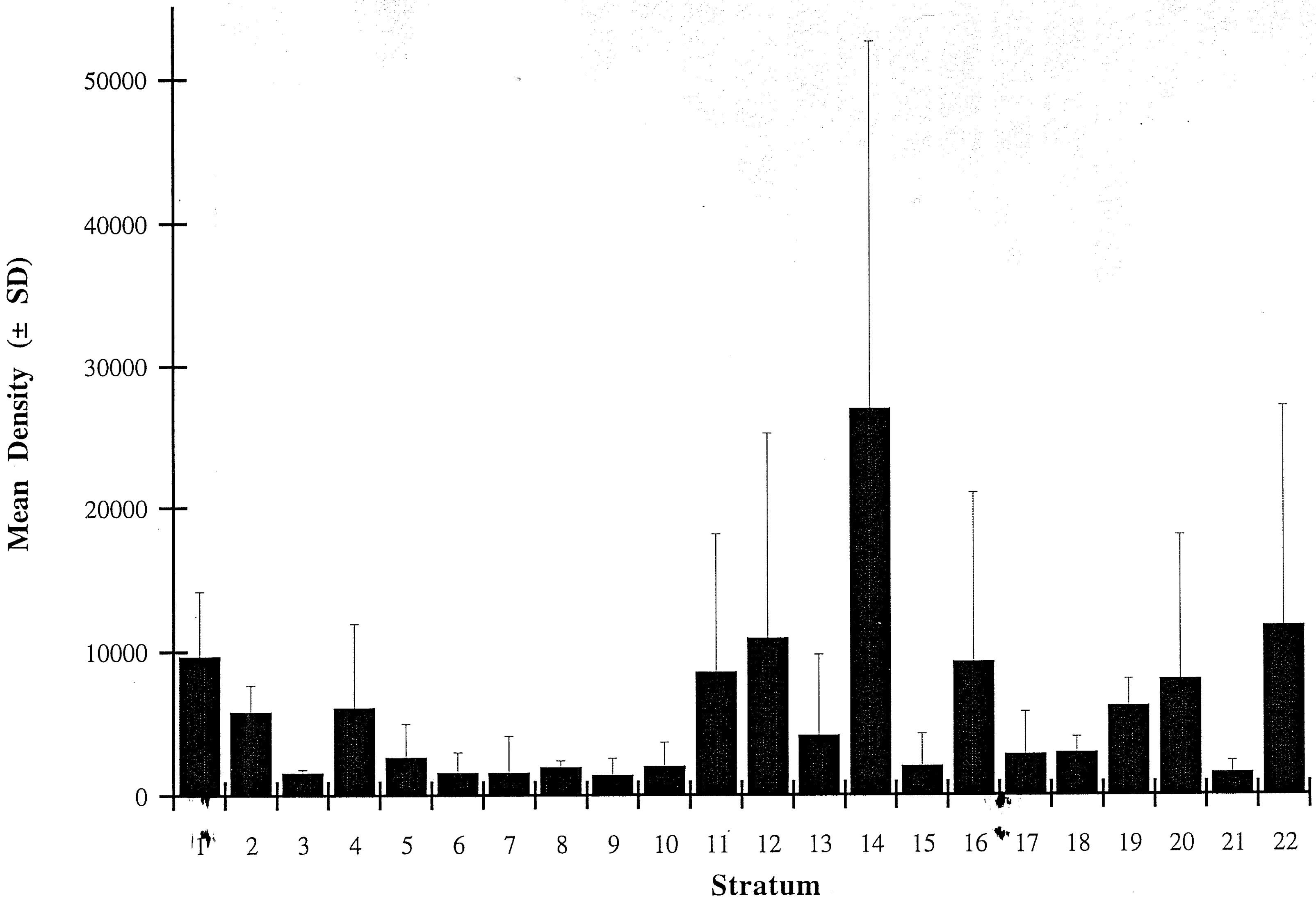


Figure 11. Mean macroinfaunal densities for the Delaware Bay and adjacent waters strata, September 1997.



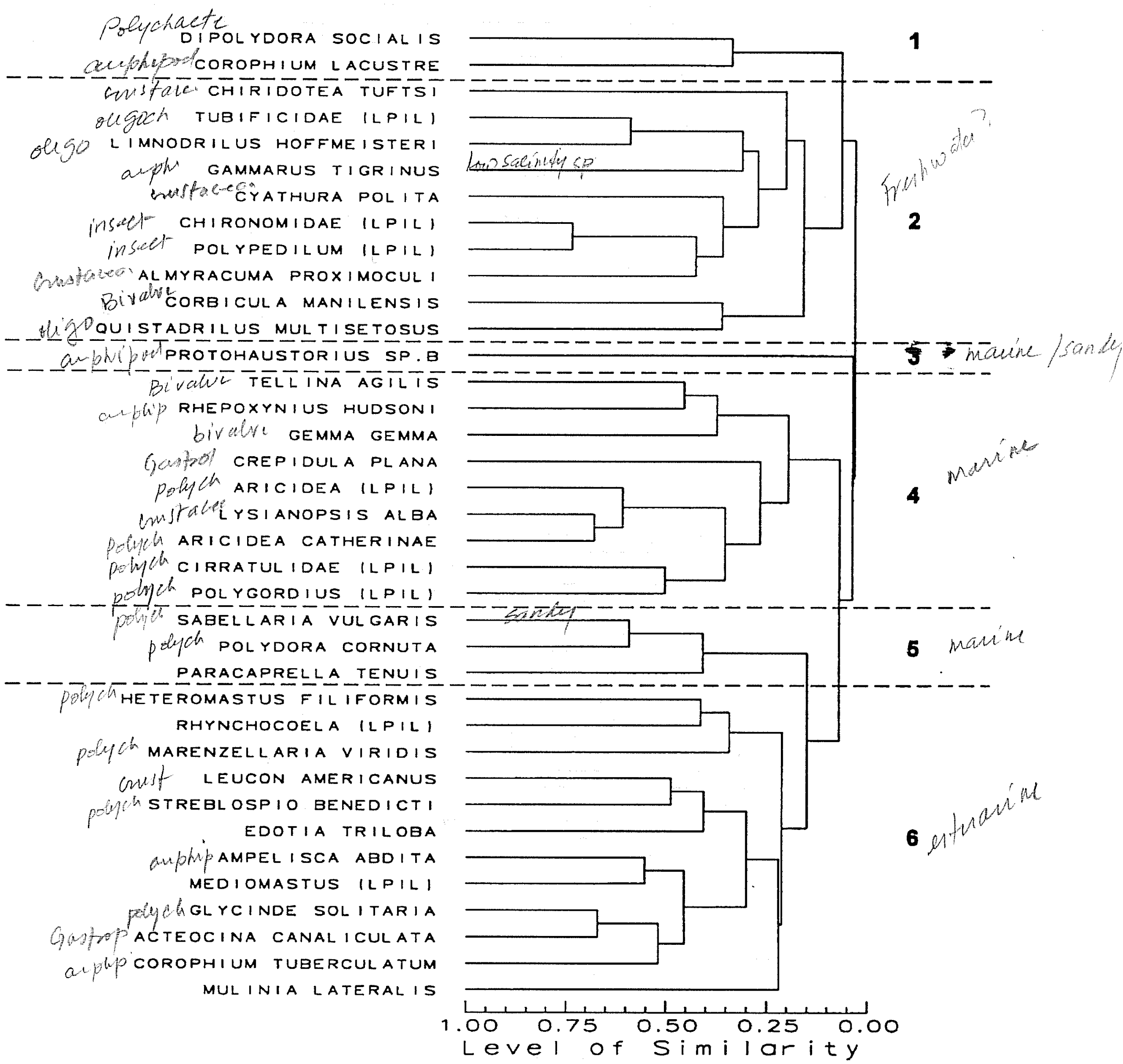



Figure 15. Inverse (taxa) classification analysis for the Delaware Bay and adjacent waters sites, September 1997. Large, bolded numbers (1, 2, 3, 4, 5, 6) denote taxa groupings.

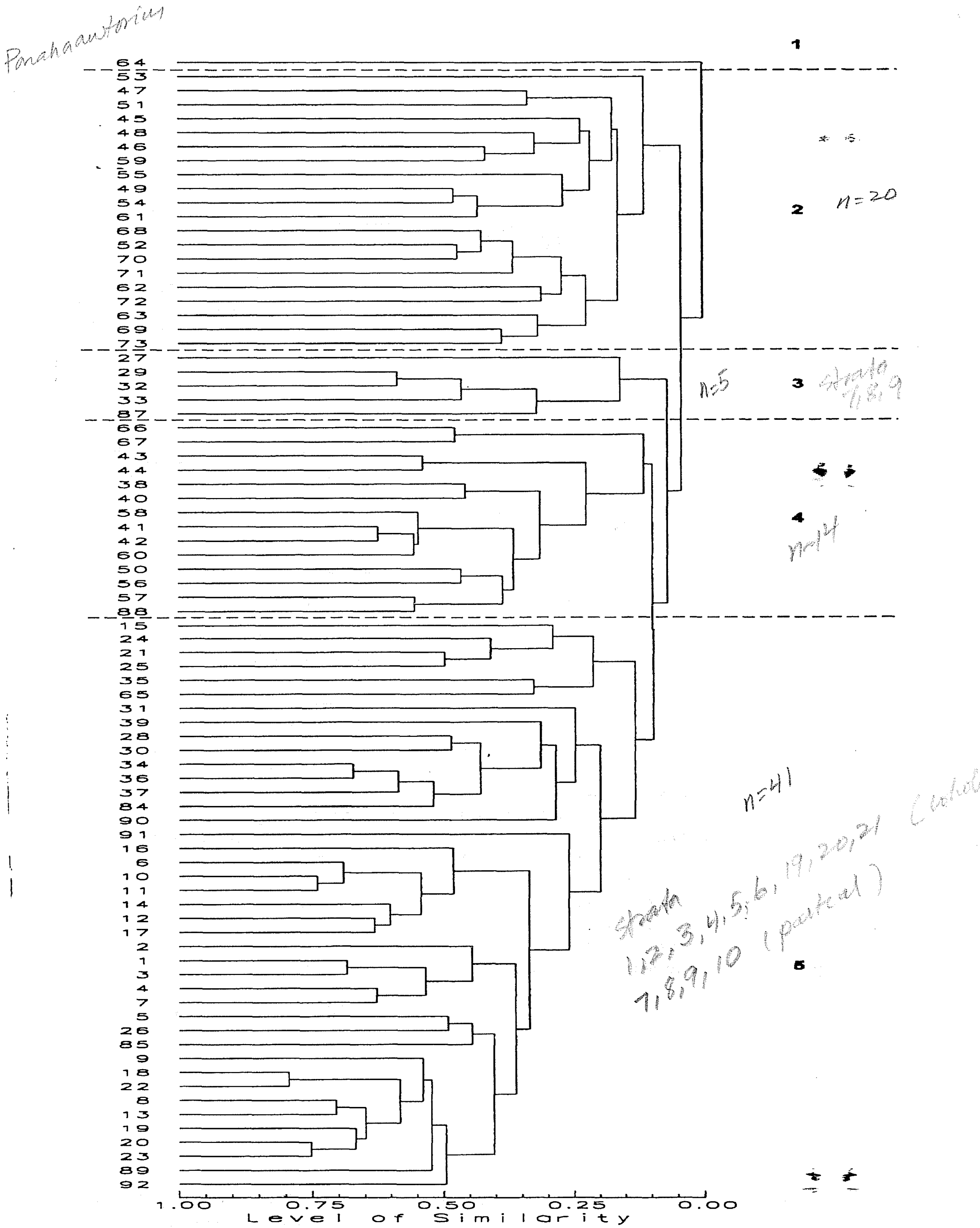



Figure 14. Normal (station) classification analysis for the Delaware Bay and adjacent waters sites, September 1997. Large, bolded numbers (1, 2, 3, 4, 5) denote site groupings.

sites, three of which accounted for 100% of the sites within Stratum 18. The remaining sites in this group were from adjacent strata. Stratum 12 was represented by two of the four sites (45 and 46), while 80% of the sites within Stratum 13 were clustered in this group (Figure 14). Stratum 14 was represented by sites 59 and 61 which accounted for only 40% of its total. Sites within Strata 15 and 17 were also in this group and account for 66.6% and 75.0% of these strata respectively. Group 3 was the smallest, containing only 5 sites which represented Strata 7, 8 and 9. These sites accounted for only 33.3%, 33.3% and 50.0% of their respective strata. Group 4 contained 14 sites, representing Strata 10, 11, 12, 13, 14, 16, 17 and 22. No Strata were represented as a whole in this group, with the highest percentage being 75.0% of the total sites of Stratum 14. Group 5 was the largest group containing 41 of the 81 sites sampled. Strata 1, 2, 3, 4, 5, 6, 19, 20 and 21 were represented by 100% of the sites within these strata. The sites within these strata were dominated by the oligochaete family Tubificidae and also contained most of the insect taxa identified in the samples. Strata 7, 8, 9 and 10 were represented by 66.6%, 66.6%, 50.0% and 75.0% of their total sites in Group 5.

Clustering of the 39 taxa at the 81 sites was interpreted at a six–group level at a 15% level of similarity (Figure 15). The three largest groups (2, 4 and 6) consisted of taxa which can be separated by salinity gradients and sediment textures. Group 2 contained 10 taxa which are predominantly found in freshwater. Three of these were the only oligochaetes represented in the analysis. This group also contained the only 2 insect taxa. The presence of these taxa is indicative of freshwater and silty sediments; this is supported by the presence of *Gammarus tigrinus*, an amphipod restricted to fresh and low salinity waters. Group 4 contained 9 taxa which could be classified as marine. The bivalve species *Tellina agilis* and *Gemma gemma* are typically found in higher salinity, sandy environments. The polychaete family Cirratulidae and the polychaete genus *Aricidea* are predominantly marine as is the archiannelid genus *Polygordius*. Group 6 contained 12 taxa which are typically found in estuaries. These taxa are able to tolerate a wide range of

salinities and prefer silty sediments. This group had a more diverse taxonomic assemblage with seven orders represented. Estuaries typically have a higher taxonomic diversity than freshwater or marine systems and are subject to varying salinities and sediment types. The remaining Groups in the analysis had 2, 1 and 3 taxa respectively. The two species in Group 1 were the polychaete *Dipolydora socialis* and the amphipod *Corophium lacustre,* both of which are esturine. Group 3 contained only *Protohaustorius* sp. B, a strictly marine amphipod that prefers sandy sediments. Group 5 contained three species which are typically marine. *Sabellairia vulgaris* is a tube-dwelling polychaete found in sandy sediments. The caprellid *Paracaprella tenuis* is usually found associated with hydroids which are typically restricted to marine systems.

sites, three of which accounted for 100% of the sites within Stratum 18. The remaining sites in this group were from adjacent strata. Stratum 12 was represented by two of the four sites (45 and 46), while 80% of the sites within Stratum 13 were clustered in this group (Figure 14). Stratum 14 was represented by sites 59 and 61 which accounted for only 40% of its total. Sites within Strata 15 and 17 were also in this group and account for 66.6% and 75.0% of these strata respectively. Group 3 was the smallest, containing only 5 sites which represented Strata 7, 8 and 9. These sites accounted for only 33.3%, 33.3% and 50.0% of their respective strata. Group 4 contained 14 sites, representing Strata 10, 11, 12, 13, 14, 16, 17 and 22. No Strata were represented as a whole in this group, with the highest percentage being 75.0% of the total sites of Stratum 14. Group 5 was the largest group containing 41 of the 81 sites sampled. Strata 1, 2, 3, 4, 5, 6, 19, 20 and 21 were represented by 100% of the sites within these strata. The sites within these strata were dominated by the oligochaete family Tubificidae and also contained most of the insect taxa identified in the samples. Strata 7, 8, 9 and 10 were represented by 66.6%, 66.6%, 50.0% and 75.0% of their total sites in Group 5.

Clustering of the 39 taxa at the 81 sites was interpreted at a six–group level at a 15% level of similarity (Figure 15). The three largest groups (2, 4 and 6) consisted of taxa which can be separated by salinity gradients and sediment textures. Group 2 contained 10 taxa which are predominantly found in freshwater. Three of these were the only oligochaetes represented in the analysis. This group also contained the only 2 insect taxa. The presence of these taxa is indicative of freshwater and silty sediments; this is supported by the presence of *Gammarus tigrinus*, an amphipod restricted to fresh and low salinity waters. Group 4 contained 9 taxa which could be classified as marine. The bivalve species *Tellina agilis* and *Gemma gemma* are typically found in higher salinity, sandy environments. The polychaete family Cirratulidae and the polychaete genus *Aricidea* are predominantly marine as is the archiannelid genus *Polygordius*. Group 6 contained 12 taxa which are typically found in estuaries. These taxa are able to tolerate a wide range of

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# APPENDIX

BARRY A. VITTOR & ASSOCIATES, INC.
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Phone (334) 633-6100 Fax (334) 633-6738

# QUALITY CONTROL REWORKS

Client/Project NOAA
Work Assignment Title Delaware Bay 1997

Work Assignment Number FE-97-18-DB Task Number 5

Sorting Results:

| Sample # | % Accuracy |
|---|---|
| 14 | 100% |
| 18 | 100% |
| 38 | 100% |
| 31 | 100% |
| 59 | 100% |
| 61 | 100% |
| 29 | 100% |
| 47 | 100% |
| 62 | 100% |
| 5 | 100% |
| 27 | 100% |

Taxonomy Results:

| Sample # | Taxa | % Accuracy |
|---|---|---|
| 38 | Crust./Moll. | 100% |
| 61 | Crust./Moll. | 100% |
| 42 | Crust./Moll. | 98% |
| 2 | Crust./Moll. | 99% |
| 25 | Crust./Moll. | 100% |
| 43-2 | Crust./Moll. | 97% |
| 14 | Crust./Moll. | 100% |
| 59 | Crust./Moll. | 97.3% |
| 67-3 | Poly./Misc. | 98.3% |
| 60 | Poly./Misc. | 98.7% |
| 33 | Poly./Misc. | 100% |
| 30 | Poly./Misc. | 100% |
| 44 | Poly./Misc. | 98.2% |
| 29 | Poly./Misc. | 98.2% |
| 65 | Poly./Misc. | 100% |

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

Carl [signature] 10/6/98

Signature of QA Officer or Reviewer Date

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# QUALITY ASSURANCE STATEMENT

Client/Project NOAA

Work Assignment Title Delaware Bay 1997

Work Assignment Number FE-97-18-DB Task Number 5

Description of Data Set or Deliverable: 81 Benthic macroinvertebrate samples collected in July and August of 1997; 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

Carl McW[illegible] 10/6/98

Signature of QA Officer or Reviewer Date

Barry A. Vittor 10-6-98

Signature of Project Manager Date

Linda Sierke
Barry A. Vittor & Associates
8060 Cottage Hill Rd.
Mobile, AL 36695
334-633-6100

Barry A. Vittor & Assoc.

# Fax

| | | | |
|---|---|---|---|
| **To:** | Ian Hartwell | **From:** | Linda Sierke |
| **Fax:** | 301-713-4388 | **Pages:** | 35 + cover |
| **Phone** | | **Date:** | 5/16/00 |
| **Re:** | QA/QC Procedures | **CC:** | |

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

● **Comments:**

Hi Ian,

The following are my QA/QC procedures for the benthic lab. If you have any questions, please call.

Sincerely,

Linda

Linda Sierke

## 1.4 Quality Assurance and Quality Control

**1.4.1** The following quality control (QC) procedures are conducted at Vittor & Associates to ensure data quality.

### 1.4.2 Sorting

**1.4.2.1 – 1.4.2.11** At a minimum, 10 percent of all samples sorted per project will be resorted. This is accomplished by re-sorts conducted on a regular basis on batches of 10 samples; no one sorter will rework their own sample. All findings in the resort are noted (*e.g.*, - 1 crustacean, 1 echinoderm fragment). The minimum acceptable sorting efficiency is 95%. If the number of animals left behind after the first sort is equal to 5 percent or more of the number of organisms found in the entire sample, a QC failure will be noted in the log book, and another sample (in addition to the mandatory 10 percent) worked by the sorter during that period is QC'd. If this is also a failure, then all samples previously sorted by that person since the last QC period are resorted. Sorting efficiency (%) will be calculated using the following formula:

$$\frac{\text{\# organisms originally sorted}}{\text{\# organisms originally sorted + additional \# found in resort}} \quad \text{X 100}$$

A QC period will be designated on a regular basis on batches of 10 samples. All individuals found in a QC resort will be identified, counted and added to the taxonomic data sheet. At the conclusion of the sorting phase of each project, a Quality Control Results form is completed. This tally forms the basis for a section summarizing the QC results of the sorting effort within the Laboratory QC Report (see 4.3).

### 1.4.3 Species Identification and Enumeration

**1.4.3.1 - 1.4.3.11** Quality control at the identification and enumeration levels of sample processing relies upon: 1) preparation of voucher material for each species identified; 2) preparation of Consistency Card Files for each species identified; 3) in-house verifications of identifications during sample processing; 4) in-house examination of sample data sheets for questionable identification and enumeration data; 5) in-house support for scientific research and publications; 6) close communication with recognized outside experts, including verification of identifications; 7) constant update of our taxonomic libraries; 8) ten percent of the samples worked by a given

taxonomist will be re-identified; These samples will be randomly selected. After reidentification, any discrepancies will be recorded, corrections made and vials returned to samples. Accuracy shall be computed in the following manner:

$$\frac{\text{total \# of organisms originally sorted}}{\text{\# organisms originally sorted + additional \# found in resort}} \quad X\ 100$$

The minimum acceptable taxonomic efficiency will be 95%. If QC failures are found, all samples worked by that taxonomist since the last QC check are re-identified. All QC checks and rechecks will be noted (name, date, initials) on the log and in the log book. All corrections to data sheets will be initialed and dated appropriately.

### 1.4.4 Taxonomic Reference Collection

**1.4.4.1 – 1.4.4.5** During sample analysis, a project-specific voucher collection will be prepared. This voucher collection is composed of representative individuals of each species encountered in the project's samples. The individuals are placed in covered vials, with the appropriate preservative (70% ethanol) and labeled. The label, written in India ink, will contain the species name, project location, station and replicate, collection date, taxonomist's name or initials, identification date, and the number of specimens present in the vial. The individual vials will then be placed inside museum jars with preservative, catalogued, and accessioned into the client's voucher collection. It is from this voucher collection that some specimens may be sent to outside taxonomic experts for verification of identifications. The Laboratory Manager is responsible for overseeing proper curating of voucher collections and recording any specimen loans to outside individuals. This collection and any documentation associated with it will be provided to the CCMA Project Manager upon completion of each project. A reference collection log will be maintained with all pertinent information recorded and will be forwarded to CCMA upon request.

### 1.5 Data Management

The Identification and Enumeration phase of laboratory analysis will generate the raw data which will be entered by each taxonomist on the data sheet in ink. Other pertinent data are also listed such as header information and comments. In the laboratory, only the taxon name, count data, and appropriate comments are listed for each replicate. The taxon number is added during data coding. If questions or problems arise during the data sheet QC, they are brought to the attention of the appropriate taxonomist for clarification and/or correction. Taxonomic data sheets are then sent to the Data Clerk for data entry, and Data Summary Report preparation. Completed data sheets will be kept in bound notebooks. The Laboratory Manager will complete a written Laboratory QC Report. This report is a summary of QC results from all phases of laboratory involvement. It also includes: 1) results of verifications of identifications by outside scientists; 2) QC problems, if any, and how these were handled; and 3) judged accuracy rates for all phases. The Laboratory QC Report and completed data sheets will be available to CCMA Project Manager.