FINAL REPORT

of

Survey of Benthos: Delaware Estuary: From the Area of the C&D Canal through Philadelphia to Trenton

DELAWARE
ESTUARY PROGRAM

ENVIRONMENTAL
CONSULTING SERVICES, INC.

FINAL REPORT

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Survey of Benthos: Delaware Estuary: From the Area of the C&D Canal through Philadelphia to Trenton

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CONTENTS

CONTENTS
(CONTINUED)

PAGI

LIST OF TABLES

CONTENTS
(continued)

CONTENTS
(continued)

LIST OF FIGURES

CONTENTS
(continued)

CONTENTS
(continued)

CONTENTS
(continued)

CONTENTS
(CONTINUED)

CONTENTS
(continued)

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EXECUTIVE SUMMARY

This report presents the results of a one-year comprehensive collection survey of the benthic macroinvertebrate communities of the Delaware River between the Chesapeake and Delaware (C&D) Canal and Trenton, NJ. A review of the regionally germane historical references was made, and comparisons were drawn to the current survey to ascertain the extent of a presumed or possible recovery within the benthic macroinvertebrate communities in response to demonstratively better water quality since the passage and implementation of the Clean Water Act of 1972. Also included are results from a demonstration project employing the Benthic Resources Assessment Technique (BRAT) as a tool to assign a more meaningful comparative value to benthic communities through their trophic linkage to important fishes.

Samples for the general survey were seasonally collected from a regionally stratified study area based on the DRBC water quality Zones 2 through 5. Seasonally some 60 samples were allocated among the four zones and three depth related substrata yielding over 220 samples during the term of the study. Samples were collected in the spring, summer and fall of 1992 and winter of 1993. Results of the survey are presented in terms of density (n/m^2) and biomass (g/m^2). Fish stomachs needed for the BRAT analysis were provided by the contractor conducting the parallel STAC sponsored fish survey.

The benthic macroinvertebrate communities in the Delaware River between the C & D Canal and Trenton, NJ were represented in this study by 129 taxa of nine phyla, but the quantitative measures of abundance, i.e., density and biomass, suggest that relatively few taxa were seasonally and regionally abundant. From the population or density perspective, the macroinvertebrate community within the study area was heavily dominated by the oligochaetes, more commonly known as sludge worms, followed by the chironomids or midge larvae. Both groups are considered pollution tolerant, and are able to live in otherwise stressful and limiting low oxygen environments. Other important groups with "better" reputations were amphipods, turbellarians, isopods, polychaetes and bivalves. In every case the larger taxonomic group is heavily dominated by a single genus or species; Limnodrilus of the oligochaetes, Polypedilum of the chironomids, Gammarus of the amphipods, Cyathura polita of the isopods, Scolecolepides viridis of the polychaetes, and Corbicula fluminea of the bivalves. In most cases these larger taxonomic groups were represented additionally by other genera and species, but their occurrence was intermittent and/or abundance was relatively low.

The benthic macroinvertebrate community in the Delaware River between the C&D Canal and Trenton, NJ was then and is now dominated by sludge worms, fly larvae, scuds, aquatic pill bugs, bristle worms as the historical database indicates, and an exotic clam. What has changed through time seems to be the scale or magnitude of dominance, and the complement of sub-dominant representatives has

grown in some cases and changed in others. Although oligochaetes are still abundant and dominant, it is to a lesser relative degree as abundance of the other taxa has increased. Changes in oligochaete species composition included the occurrence of less pollution tolerant and more oxygen sensitive genera such as Aulodrilus, Nais, Pristina and Pristinella, and the absence of highly pollution tolerant genera such as Tubifex and Potamothrix. Chironomids historically a very distant second to oligochaetes, if present at all, exhibited an increased relative abundance during the present study.

Even though the application of the BRAT in this study was far from text-book in its execution, the primary goal was accomplished in that the data produced does provide a basis for further consideration. The BRAT provides a landscape of what and where subject fish species derive their sustenance. As illustrated in the case of white perch ≤150 mm fork length in this study, the channel and shallow/intermediate substrata in Zones 3 and 4 were relatively important summer feeding grounds, and amphipods were a very important food item. The BRAT provides "current" data measured on an absolute scale allowing for the relative comparisons in areas where best or least-worse management decisions must be made.

The evidence of a recovery coincident with or resulting from improved water quality was judged simply on the premise that change was good; that what existed before was considered less than desirable, and factors contributing to this undesirable state have improved (i.e., water quality). Change within the species composition and relative abundance of the benthic macroinvertebrate communities within the study area was suggested by the results of this research effort. The existing communities would likely still be characterized as dominated by pollution tolerant species, but there are signs of improvement. Oligochaetes and chironomids, the classic standards for pollution tolerant organisms, were still dominant in the macroinvertebrate communities, but their species composition and relative abundance within the community suggests that change may be in progress. Since the mid 1980's, the addition of new families and species in the benthic macroinvertebrate communities may indicate that an element of pioneerism is in progress as improved conditions allow. A more pragmatic view might be that its too early to tell if changes are real considering the limitations of the historical database, and the snap-shot nature of the present study (one year). If the changes are real then improved water quality was likely the contributing factor. The pace of change however may be slowed by other factors related to the state of the sediments in which the benthic macroinvertebrates live. Future research efforts should include additional comprehensive surveys conducted as part of a regular management plan in order to confirm or discount the finding of this study, as well as additional studies to evaluate the linkage between the status of the sediments and resident benthic macroinvertebrate communities to provide the necessary information to support the evolving CCMP in the future.

INTRODUCTION

The Delaware Estuary Program (DELEP) was initiated in 1988 at the request of the states of Delaware, New Jersey, and Pennsylvania as part of the United States Environmental Protection Agency's (EPA) National Estuary Program. Given the five year lifespan of the Management Conference formed as the functional arm of DELEP, and the pending publication of a Comprehensive Conservation Management Plan (CCMP) at the expiration of that five year term, the Scientific/Technical Advisory Committee (STAC) was charged to identify, supervise and sponsor research to characterize the status of water quality, living resources and habitat, and to identify environmental problems, either existing or potential, that may impact these areas. Accordingly, STAC commissioned the following study of the benthic invertebrate populations in the Delaware River from the Chesapeake and Delaware Canal (C&D) to Trenton, NJ.

This research effort was predicated on the hypothesis that since water quality, especially dissolved oxygen, had dramatically improved since the early 1970's, and fish populations appeared to be improving, then it would seem to follow that benthic invertebrate populations may also improve. Lacking current data to support or disprove this hypothesis, STAC sponsored this study. The overall objectives of this project are to characterize the macro- and megabenthic invertebrate populations within the area of the estuary with the greatest documented improvements in water quality, and to integrate these new data with past information to provide input to those portions of the CCMP that will define the extent to which future improvements can be expected. To address these objectives the following tasks were performed:

Task 1. Conduct a comprehensive survey of the macro- and megabenthic invertebrate populations within the specified study area to characterize existing species composition, temporal and spatial distributions, relative abundance in density and biomass, and specific habitat/substrate affinities;

Task 2. Compare new data to historical information to empirically demonstrate the absence or presence of a recovery within the benthic community based on the premise that improved water quality will result in functional improvements in the benthic assemblages;

Task 3. Conduct a demonstration study using the Benthic Resources Assessment Technique (BRAT) to quantitatively evaluate the relative trophic support provided to the fish populations by major benthic macroinvertebrate groups;

Task 4. Provide information and analysis instrumental in the development of that portion of the CCMP which addresses these biotic communities, and to infer the extent to which and by what means future improvements might be expected.

The results of these efforts will be reported under the major headings of General Survey, Historical Comparison and BRAT.

METHODS AND MATERIALS

GENERAL SURVEY

Study Design

Study Area Stratification

To characterize the existing benthic macroinvertebrate populations a temporally and spatially stratified survey was conducted. The basic study design incorporated a stratified-random approach using a system of horizontal and vertical parameters as they reflect eco-stratification and habitat characteristics. The system chosen was very similar to that used by the Chesapeake Bay Program Living Resources Task Force (CEC, 1988), and includes water depth and salinity as primary factors influencing faunal distributions.

As a first-order stratification, the study area, which extends some 75 river miles from Trenton, NJ (Rm 133.4) to the C&D Canal (Rm 58.9), was divided horizontally into four habitat strata indicative of existing water quality and salinity levels (Fig. 1). These four strata coincide with four of the six water quality regions, i.e., Zones 2-5, established by the Delaware River Basin Commission (DRBC). The boundaries of these zones are given in Figures 2 through 5. Regarding salinity, Zones 2, 3, and 4 correspond to the tidal freshwater portion of the estuary, and Zone 5 to the transitional area between the freshwater habitats upstream and the more saline areas in the lower Delaware River and upper Bay (Najarian, 1991: Versar, 1991). Sampling was conducted only in the portion of Zone 5 extending downstream to the C&D Canal.

The four DRBC Zones were further divided into three depth strata; the intertidal, shallow/intermediate, and the navigational channel. These depth strata represent general habitat types, that as a result of their hydrological features or anthropogenic character, potentially support distinctive benthic communities. The intertidal strata, by definition, was that area between high and low tide lines which is alternately exposed and inundated. The navigational channel, as a sampling strata, was that relatively deep area marked by navigational aids which is periodically disturbed by dredging. Finally, the shallow/intermediate strata was simply the remaining submerged habitat. To facilitate the identification and random selection of sampling locations, a grid system was transposed over the study area. Within each water quality zone, grid lines were drawn at 0.5-km intervals across the depth contours (Figs. 2 through 5). Accordingly, sample locations were assigned a four character alpha-numeric designation including Zone and grid numbers and depth strata initial, i.e., I - intertidal, S - shallow/intermediate, and C - channel.

While substrate type is an important habitat consideration for benthic macroinvertebrates, a review of available information during the design phase of this study indicated a lack of identifiable regions of homogeneous sediment type that could be used as sample design sudivisions (Neiheisel, 1973; Taylor et. al., 1973; PAS, 1985; SAIC, 1986). Consequently, sediment sampling for particle size analysis was added to the original scope of study, and a characterization of each zone and comparisons between zones were made.

Collection Frequency and Sample Size

Samples were collected quarterly to describe the seasonal differences in benthic community composition and abundance. Collections were originally scheduled to be taken during April, July, October and January to reflect spring, summer, fall and winter communities. However, samples were collected in April-May, August, November and March. Delays in the collection of spring and summer quarter samples were related to contractual administrative issues; collections in November for the fall quarter reflected an acquiescence to a one-month shift in the original schedule; winter quarter collections were further delayed by chronically unsuitable weather for nautical activities in February. Actual collection dates during each quarterly sampling experience are given in Appendix Table A-1.

To estimate optimal sample size for each seasonal collection experience, temporally similar (i.e., from June and/or July), and spatially appropriate data from previous studies (Anselmini, 1974; Beck et. al., 1985; PAS, 1985; RMC, 1988) were analyzed using standard experimental design statistics relating sample data mean, standard deviation and desired level of precision (Steel and Torrie, 1960; Sokal and Rohl, 1969; AIHA, 1989).

$$N=\left(\frac{t*S}{D*X}\right)^2$$

where:

N = Number of samples
t = tabulated value at 0.05 level
S = standard deviation of samples
X = mean density of samples
D = required level of precision

The test data was highly variable temporally and spatially. Therefore, the data sets were pooled to best capture as many aspect of the inherent variance, and produce the most reliable estimate of sample size. The analysis indicated that 60 samples per quarter should be adequate to produce an estimate of density for all zones combined within ±50 percent of the true mean with 95 percent confidence intervals. Even though the analyses suggested a regionally weighted allocation of effort, the patch-work nature of the test data brought into question the reliability of such a design. Accordingly, sampling effort was allocated equally as five replicates within each of 12 sampling substrata (i.e., four zones b three depth substrata). Individual sampling locations were randoml chosen each quarter from the available grid units within each stratum.

Study Execution

Sample Collection

To sample the macroinvertebrate portion of the benthic communities, collections were taken with a standard Wildco Supply Company Ponar™ grab sampler (23 x 23 cm). This gear was chosen because of its extensive use in prior studies. Samples were taken from a 23-25 ft research vessel at anchor within the randomly selected grid unit. total of two grabs were taken at each location; one for biotic analysis, and one for sediment particle size analysis. Biotic samples were preserved in the field in a 10 percent buffered formalin/rose bengal solution. Buffered formalin was used to reduce damage to specimens with calcareous exoskeletons, and rose bengal stain was added to aid in specimen recognition during initial phases of laboratory processing. Samples taken for particle size analysis required no preservation.

At each location and with each set of grab samples, a battery of physicochemical parameters were measured and recorded. From samples of surface and bottom waters, temperature (°C) and dissolved oxygen (mg/l) were measured using the Yellow Springs Instruments (YSI) Model 51A oxygen meter, conductivity (μmhos) was measured using the YSI Model 33 S-C-T meter, and salinity was measured using American Optics temperature compensating refractometer. Water clarity was measured using a 20 cm limnological Secchi disc. All field instrumentation was operated, maintained and calibrated as per the particular manufacturer's specifications and instructions. Also at each location, water depth was measured using a "fish finder"-type sounder, and positions were recorded when possible in terms of latitude and longitude based on LORAN-C readings.

By design, quarterly sampling experiences were to run on three to five consecutive days from Trenton, NJ downstream. In practice, collection experiences ran 8-25 days punctuated by mechanical problems and bad weather. Sampling within the intertidal substrata was conducted typically during high water to allow access by vessel. A water depth of six feet or less was sought to insure that the location was indeed exposed at low tide. Over two thirds of the intertidal collections were taken in $\leq$ 2 ft of water in the upper portion of the intertidal substratum. Sampling in some intertidal grids was impossible where bulkheading had replaced intertidal habitat near more highly developed commercial/industrial shorelines. When location was unsampleable, the next most proximal acceptable intertidal location was sampled. As field documentation indicated the absence of sampleable habitat, grid numbers were omitted from future random drawings. A listing of grid numbers omitted is given in Table 1.

In the channel substrata the combination of high tidal currents, maximum water depth and hard sediments made sampling difficult. To improve the likelihood of retaining a sample in such areas, 25 pounds of additional weight was added to the standard 45-lb Ponar. Even with the added weight, combinations of the above factors made sampling impossible at some locations. In the field when repeatedly unsuccessful at a location, efforts were relocated within the grid or moved to another grid where conditions were more conducive to successful collection efforts. As a matter of perspective and as a measure of effort, it should be noted that a sampling experience, I design, included 120 grabs at 60 locations. However during the course of the study as many as 210 grabs were attempted at 89 locations during a quarterly sampling experience. As a result of these difficulties a small number of specified samples (15 of 240) were not taken.

Regarding the megabenthos, data was collected by T. Lloyd Associates (TLA) as part of the STAC sponsored and DELEP funded fisheries survey in the same study area and basic time frame as the benthos survey. A detailed description of study design and sampling method can be found in the "Scope of Work" prepared at the request of DELEP/DRBC/EPA contract officers (TLA, 1992). Synoptically, fisheries collections were taken during summer and fall of 1992 and spring 1993 at one location in each of the four DRBC water quality zones included in the specified study area. These locations in the Delaware River included and were delimited as the areas one mile up- and downstream of the mouths of the Rancocas, Big Timber and Raccoo Creeks, and the Salem River (Figs. 2-5). At each location various sizes of seines, trawls, and gill nets, as well as electro-shocking equipment, were used at standardized levels of effort to sample three basic habitat types based on water depth, i.e., shallows (<10 ft.), intermediate (10-25 ft.), and deep water (>25 ft). As specified in the fisheries Scope of Work, data were collected for blue crab and grass/sand shrimps only. Relative to blue crab, sex and carapace width were determined also. Coincident with the fisheries samples measurements of water temperature, dissolved oxygen, salinity and conductivity were made and recorded. The raw data was submitted to ECSI for tabulation and analysis. Data was collected only during the summer and fall sampling periods.

Laboratory Processing

Processing of benthic samples in the laboratory proceeded in two phases. Processing was total; no sub-sampling was performed. Phase 1 involved the removal of the macroinvertebrate specimens from the attendant sediment, and was done in two steps. First, each sample was gently washed over a 500 micron mesh standard sieve, and all material retained on the sieve was placed in a appropriately labelled container filled with 40 percent isopropyl alcohol. Second, at some later time, the contents of the container were poured into a glass tray, placed over a light-table, and all macroinvertebrate specimens and any fragments thereof were removed from remaining sediment and/or debris. Specimens were again placed in an appropriately labelled container and passed on to Phase 2 of the process.

Phase 2 involved the weighing, identification and enumeration of the macroinvertebrate specimens, not necessarily in the order. All specimens and fragments were examined under a stereo-dissecting microscope and identified to the lowest practicable taxonomic level. Factors that influenced the practicably obtainable level included specimen condition, age, the availability of taxonomically descriptive information, and time. Specimen condition was a particular problem for members of the turbellaria and nemertea groups, and resulted in the use of the "unidentifiable organism" taxon in extreme cases. Specimen age/maturity was problematic in the identification of oligochaete worms which as immature forms lack critical diagnostic characters. This resulted in the formation of two unidentified classifications of immature tubifids with (#1) and without (#2) capelliform chaetae. Taxonomic references used included Gosner (1971), Wiederholm (1983), Merritt and Cummins (1984), Brinkhurst (1986), Peckarsky et al. (1990), and Thorp & Covich (1991). The lack of available taxonomic literature was only of note relative to the enchytraeid oligochaetes. In some cases the literature was available and the procedures were known to achieve a lower taxonomic level, but the time required was disproportionate relative to the information gained given the scope of this general survey.

Most specimens were identified and counted under the magnification of a stereo-dissecting microscope, and wet-weighed by taxon on a Mettler balance to the nearest ten-thousandth (0.0001) of a gram. Relative to bivalves, shell was not included in weight if it was large enough and possible to remove from tissue. Prior to wet-weighing, specimens were actively dried by blotting between multiple sheets of absorbent material. However, since the identification of oligochaete worms and chironomids below the respective class and family levels required mounting and slide preparation, and examination under a compound microscope, the wet weight was determined prior to slide preparation at the class and family levels. After Phase 2 processing, representative museum voucher specimens were placed in a reference collection. The remainder of the sample was recomposited and returned to the labelled container, and will be retained for one year after the publication of this final report.

Quality Control and Quality Assurance

All field and laboratory activities were performed in accordance with the approved "Quality Assurance Project Plan" (ECSI, 1992) submitted at the beginning of this project. Pre-trip checklists were followed, chain-of-custody of samples was maintained throughout the process, and laboratory QA/QC procedures were followed, documented and records filed. In the laboratory, all sample processing units during both Phases 1 and 2 were subject to a one in seven chance of random second-party re-examination. During Phase 1 a processing unit was each glass tray examined, of which there could be several per sample. During Phase 2 a processing unit was the entire sample. A processing unit was considered defective if there was ≥ 5 percent variation/error. If a unit was failed, missed specimens were added to the sample and all subsequent units were inspected until eight consecutive units passed. Inspections were performed by the appropriate experienced personnel.

Sediment Particle Size Analysis

As described above, a separate Ponar grab sample was taken at each collection location for sediment particle size analysis. After collection, samples were sent to Ambric Testing and Engineering, Inc. where they were analyzed using the ASTM standard dry sieve method (D422) and categorized according to a modified Wentworth grade classification (Table 2). The modification combined the silt and clay classifications. This modification, as well as the omission of total organic carbon as an analytic parameter, was prompted by budgetary limitations. The results are presented below in terms of percent of the total by weight.

Data Analysis

Values of mean or average abundance in terms of density (n/m^2) and wet-weight biomass (g/m^2) were calculated for samples within and between substrata and among seasons by simply dividing by the number of values included in the calculation. The equal weighting given to each sample was justified and preferred over a effort-weighted formulation since the level of sampling effort was equal as determined by the constant sampling area of the grab sampler.

All diversity and evenness indices and cluster analyses were performed using a MultiVariate Statistics Package copyrighted by Kovach (1986). Species diversity and evenness were calculated using Shannon's H' and Pielou's J' on untransformed data to the log base 2. Since these indices are very sensitive to the number of taxa included and because the results of this survey produced varying levels of taxonomic certainty, only those taxa which were taxonomically unique and would reasonably represent the potential addition of at least one species was considered in the analysis. Also because these indices are sensitive to abundance as expressed in proportion of total catch, the density of those non-specific taxa which were considered redundant for purposes of this analysis was added proportionally to the representatives of that taxon included in the analysis.

To identify substrata with similar benthic assemblages, average linkage cluster analysis was performed on untransformed density data using unweighted pair group averaging and a Euclidean distance dissimilarity coefficient. Unweighted pair groups were used because the collection effort was more or less equal among substrata (Pielou, 1984). A dissimilarity coefficient was preferred because the study design offered no standard or control against which to compare (Washington, 1984). Euclidean distance was chosen over a non-metric measure because it "behaves" like a real distance, and can be plotted in a space of many dimensions with the distance between points reflecting the real dissimilarity of pair (Pielou, 1984).

To identify substrata with similar sediment compositions, average linkage cluster analysis was also used as described previously. The percent composition of each grain size grade classification (Table 2) was used as the quantitative variable.

HISTORICAL COMPARISON

Regionally appropriate literature was reviewed and data summarized to produce the best composite characterization of the historical benthic communities in terms of species composition and relative abundance. References were classified for use in one of three descriptive categories relative to the nature of the results presented, and used accordingly. Qualitative references presented information on species composition and community descriptions without estimates of relative abundance. Quantitative references presented abundance data in terms of density and/or biomass. Literature summaries were included in the review as secondary sources as they provided some additional insight into the data. References were grouped according to the DRBC water quality zones. Only those studies that were methodologically similar were used in quantitative comparisons, i.e., only those that used a Ponar grab sampler and a 0.5 mm sieve, and expressed results in terms of density (n/m^2). Biomass was not compared quantitatively because dry weight was used historically and wet weight was used in the present study. The determination of dominant taxa in a given reference was based on the author's statement, or in the absence of such a statement calculations based on the available raw data. To facilitate comparison some taxonomic pooling was done. Where appropriate, taxonomic synonyms are given.

BENTHIC RESOURCES ASSESSMENT TECHNIQUE

Design

In addition to the general survey/inventory of benthic communities described previously, biomass data from the summer quarter was analyzed to assess, for each habitat stratum, the value of benthic macroinvertebrates as the base for trophic support for important demersal and semi-demersal fishes. The value of benthic habitat was determined using a modification of the Benthic Resources Assessment Technique (BRAT). BRAT was developed by researchers with the U.S. Army Corps of Engineers to be used as a quantitative assessment tool to evaluate the comparative values of dredge and dredged-material disposal sites. The conceptual approach and practical application of the BRAT has been described by LaSalle et al. (1990), Clarke (1986), Lunz (1986), Clarke and Lunz (1985), and Lunz and Kendall (1982). Simplistically, the BRAT combines benthic samples, which estimate the epi- and infaunal availability, and finfish stomach contents or diet analysis, which determines those macroinvertebrates being consumed, to calculate a food value or relative trophic index. As Clarke and Lunz (1985) point out, this trophic food web linkage between benthic organisms and important fishes, and ultimately to society via commercial and recreational fisheries which they utilize directly, may offer resource managers a more meaningful way to assign comparative value to benthic communities. Therefore a modified BRAT was applied to data from one quarter of the general survey to demonstrate/evaluate its potential as a resource management tool in assessing the trophic support value of benthic communities within the tidal freshwater and transitional portions of the Delaware River.

Execution

Benthic Samples

Samples analyzed using the BRAT were collected as part of the general survey using the equipment, and field and laboratory procedures described previously. However, in the laboratory samples were processed additionally and specifically as per the BRAT procedures. Typically, BRAT samples are collected by box-corer in order to maintain the integrity of the sediment for vertical stratification and detailed representation of the infaunal community. However, in this study a standard Ponar grab sampler was necessarily substituted to maintain gear-compatibility with historical databases. This was the only procedural modification to the BRAT technique. Physically and analytically the vertical partitioning of the substrate sampled was lacking; therefore, the estimates of trophic support generated reflect composites of the vertical partitions which are usually analyzed separately. Without the vertical partitioning afforded by a core-type sampling device, the "availability zone", or that depth to which a predator may forage for prey organisms, could not be determined. Therefore, estimates of food value may be overestimated by the composite as the substrate was mixed and organisms not recognized as being differentially available. Even though these composites may exaggerate the absolute food value, the relative spatial comparability remains valid and useful.

In the laboratory, samples collected and processed as part of the general survey were further analyzed for BRAT. This additional analysis included: 1) sieving the macroinvertebrates through five nested sieves of the following sizes 6.30, 3.35, 2.00, 1.00, 0.50 mm (Clarke, 1986; Lunz, 1986) to establish size classes of food items available to piscine predators, 2) pooling these sized specimens into major taxonomic groups such as oligochaeta, polychaeta, amphipoda, isopoda, decapoda, and mollusca to characterize the variety of animal types available, and 3) weighing the sized and taxonomically segregated groups to determine the biomass available to predators. This yielded a matrix of biomass by taxa and size from each of the 12 study area substrata.

Fish Samples

Specimens for analysis were collected by TLA as part of their summer 1992 fisheries sampling effort. Specimens were taken only from active collection gears (eg. seines or trawls) to insure freshness of the specimens. Specimens were preserved immediately in the field in 10 percent formalin, and body cavities were opened as necessary to expedite the fixing process of the critical viscera enhancing the best possible stomach content condition.

The fish targeted as test species were white perch, striped bass and spot. They were chosen because of their recreational and commercial profile and respective life strategies. White perch is resident to the estuary, but is semi-anadromous within it. It uses the tidal freshwater portion as the primary spawning and nursery grounds during spring and summer, and the lower river and upper bay for over-wintering in the colder months. Striped bass is a truly anadromous species which uses the transitional and tidal freshwater portion of the estuary as a spawning and nursery area in spring and summer like white perch, but adults move offshore into coastal waters during the winter. Spot is an estuarine dependent coastal marine species which spawns in the ocean, but the juveniles of the species move into adjacent estuaries where the transitional and lower tidal freshwater portions of the estuary are used nursery grounds.

Each of the three species were divided into two or three length groups, measured in fork length (FL) nominally reflecting age-classes to account for ontogenetic shifts in diet: white percl - ≤150 mm FL and >150 mm FL; striped bass - ≤100 mm FL, 101-200 mm FL and >200 mm FL; and spot - ≤100 mm FL and >100 mm FL. By design, five specimens of each size class of each species from each of the 12 study area substrata were to be collected yielding as many as 4: stomachs for analysis. In the laboratory, the stomachs of a given species, size-class and substratum were removed and emptied, poolin the contents into a single representative sample. After pooling tl stomach contents, samples were analyzed the same as the benthic samples as described above producing biomass information by major invertebrate taxa and food item size indicating the prey exploitation pattern by size and type for given species and size-class of fish. The biomass data was converted to percent of total stomach contents to generate a weighting factor that reflects the actual utilization level of the prey item by the predator as that selectivity may be influenced by opportunity, age and/or feeding morphology.

Data Analysis

The end result was a trophic support value from a location (i.e., substratum) for a fish species and size-class. This value was calculated by multiplying the available invertebrate biomass by tax and size determined from sediment grabs, by the dietary weighting factor by matching taxa and size determined from stomach content analysis; then summing the cells of the matrix to reflect the total trophic support provided in terms of g/m^2.

RESULTS

GENERAL SURVEY

General Community Characterization

Taxonomic Composition

A total of 225 of the specified 240 samples were taken; during a given seasonal collection experience from 55 to 58 of the 60 specified samples were collected. These samples yielded macroinvertebrates representing at least 129 taxa of nine phyla (Table 3). The chronological listing of individual samples and results is given in Appendix Table A-1.

The total mean density (n/m^2) for all seasons, zones and substrata was 2706.5 (Table 3). In order of decreasing abundance, oligochaetes, chironomids, amphipods, turbellarians, isopods, polychaetes and bivalves comprised over 96 percent of the total mean density (Table 3; Fig. 6). The total mean density of oligochaetes was 1701.7, and as a group accounted for 62.9 percent of the total mean density. Within the group five families were represented including as many as 30 species. However the Tubificidae, including as many as 11 species, were dominant representing over 49 percent of the total mean density of all macroinvertebrates. Within the family there was a relatively abundant group classified as Unidentified Tubificid #2. These were immature forms lacking diagnostic characters to allow for a lower taxonomic determination. However, based on the characters present as well as the relative abundance of those mature forms that were identified to genus and species, it seems very likely that most these immature forms were members of the genus Limnodrilus. If the immature forms were added in proportion to the mature specimens relative abundance, the genus Limnodrilus represented over 34 percent of the total mean density of macroinvertebrates in the study area.

The total mean density of chironomids was 421.3 accounting for 15.6 percent of the total density (Table 3; Fig. 6). Within this family three sub-families were represented including at least 16 species, however the Chironominae including at least nine species were dominant representing over 14 percent of the total density. Polypedilum spp. was the most abundant taxon within the sub-family with a mean density of 266.3 accounting for almost 10 percent of the total density of macroinvertebrates.

The total mean density of amphipods was 171.8 representing 6.3 percent of the total density (Table 3; Fig. 6). A single suborder, the Gammaridea, was represented including at least four species.

The genus Gammarus was the most abundant taxon within the family with a mean density of 149.5 accounting for over 5 percent of the total density of macroinvertebrates.

The total mean density of Turbellaria, a class of free-living flatworms, was 101.7 representing 3.8 percent of the total density of macroinvertebrates (Table 3; Fig. 6). It was impossible to proceed beyond this level of classification because of specimen condition after preservation.

The total mean density of isopods was 86.1 representing 3.2 percent of the total density of macroinvertebrates (Table 3; Fig. 6). This order was represented by at least four species each from a different family. Cyathura polita was the most abundant species of isopod with a mean density of 77.7 accounting for almost 3 percent of the total density.

The total mean density of polychaetes was 68.0 representing 2.5 percent of the total density of macroinvertebrates (Table 3; Fig. 6). This class was represented by at least four species from three families. Scolecolepides viridis was the most abundant species of polychaete with a mean density of 61.1 accounting for over 2 percen of the total density.

The total mean density of bivalves was 49.0 representing 1.8 percen of the total density of macroinvertebrates (Table 3; Fig. 6). This class was represented by at least four species each from a differen family. Corbicula fluminea was the most abundant species of bivalve with a mean density of 33.4 accounting for over 1 percent or the total density.

The total mean biomass (g/m^2) for all seasons, zones and substrata was 11.6004 (Table 4). In order of decreasing abundance, bivalves, polychaetes, oligochates, isopods and amphipods comprised almost 98 percent of the total mean biomass (Table 4; Fig. 7). In aggregate, three species comprised almost 86 percent of the total mean biomass. Singularly, the Asian clam, Corbicula fluminea, accounted for over 73 percent of the total mean biomass; the polychaete, Scolecolepides viridis, and the isopod, Cyathura polita, comprised 9.6 and 2.8 percent, respectively (Table 4). Removing Corbicula from the tabulation increases the relative positions other taxa hold in the community with regard to biomass (Fig. 8), and subsequent biomass results will be framed in this "with and without" context.

Seasonal Characterization

The seasonal total mean density was relatively high and similar in spring and summer at 3,481.9 and 3,237.6, respectively (Table 3; Fig. 9). Total mean density in fall and winter declined to 2,626.1 and 1,480.4, respectively. Oligochaetes were the most abundant taxon in each of the four seasons with mean density ranging from 1,174.4 in winter to 2,091.4 in fall, and seasonally comprising from 52.2 to 79.6 percent of the total mean density of macroinvertebrates (Table 3; Fig. 10). Between seasons there were no changes in dominant oligochaete taxa; the Tubificidae was dominant family and Limnodrilus the most abundant genus.

Chironomids was the second most abundant taxon in each of the four seasons with mean density ranging from 101.1 in winter to 745.0 in summer, and seasonally comprising from 6.8 to 23.0 percent of the total mean density of macroinvertebrates (Table 3; Fig. 10). Between seasons there were no changes in major dominant chironomid taxa; the sub-family Chironominae was dominant and Polypedilum was the most abundant genus. However in summer, spikes in the densities the genera Cladotanytarsus and Cryptochironomous of 136.0 and 147.6, respectively, combined with the stable but dominant density of Polypedilum spp. resulting in the maximum seasonal abundance.

The dominance of other major taxa within the macroinvertebrate community seasonally shifted. All but bivalves showed seasonal maximum densities in spring and summer; bivalves were more or less equally abundant in summer and fall. Amphipods, ranked third overall based on annual mean densities, ranged from third in summer and fall to sixth in spring (Table 3; Fig. 10). Seasonal densities ranged from 49.4 in winter to 430.3 in summer. Gammarus spp. was the seasonally dominant amphipod except in winter when Corophium spp. was more abundant.

Turbellaria, ranked fourth overall, was third in relative abundance in spring and winter, but was essentially unranked in spring and summer. Seasonal densities ranged from 2.5 in summer to 348.1 in spring (Table 3; Fig. 10).

Isopods, ranked fifth overall based on annual mean densities, ranged from fourth in summer and fall to seventh in spring. Seasonal densities ranged from 21.3 in winter to 167.8 in summer (Table 3; Fig. 10). Cyathura polita was the seasonally dominant isopod with Chiridotea almyra showing a consistent but relative low abundance through the year.

Polychaetes, ranked sixth overall, ranged from fifth in spring to seventh in winter. The highest seasonal density of 188.4 was recorded in spring (Table 3; Fig. 10). Seasonal densities thereafter ranged from 15.5 in fall to 49.8 in summer. Scolecolepides viridis was the seasonally dominant polychaete with only the regionally popular Manayunkia speciosa showing a relatively consistent but low abundance through the year.

Bivalves, ranked seventh overall, ranged from fifth in summer, fall and winter (Table 3; Fig. 10). Their relatively low abundance in spring obviously effected the overall ranking. The "highest" seasonal densities of 60.0 and 60.2 were recorded in summer and fall, respectively. Corbicula fluminea was the seasonally dominant bivalve with Rangia cuneata showing an otherwise consistent but low abundance through the year.

The highest seasonal total mean biomass was recorded in the fall at 19.1609, with winter at 15.9724, and summer and spring at 5.9745 an 5.2939, respectively (Table 4; Fig. 11). In every season but spring, the top five dominant taxa in order of decreasing abundance were bivalves, oligochaetes, polychaetes, isopods, and amphipods. In summer the sixth most abundant taxon was ectoprocts comprising 5.28 percent of the total mean biomass; in fall and winter chironomids ranked sixth comprising 0.29 and 0.13 percent. Seasonally these six taxa comprised from 96 to 99 percent of the total mean biomass. During the spring in order of decreasing abundance, polychaetes, bivalves, oligochaetes, isopods, and chironomids comprised over 95 percent of the total biomass. Specifically, Scolecolepides viridis, a polychaete worm, represente over 57 percent of the total biomass, with Rangia cuneata and oligochaetes comprising over 13 and 12 percent, respectively. During all other seasons, Corbicula fluminea was the taxon with highest total mean biomass comprising 38.7 percent in summer, and approaching and slightly exceeding 90 percent in fall and winter, respectively.

However the seasonal characterization relative to total mean biomass is heavily influenced by the abundance of Corbicula fluminea. Subtracting the biomass of this species from each season reveals that the total mean biomass for the macroinvertebrate community without Corbicula was highest in spring at 5.1800, decreasing through summer at 3.6581, fall at 2.0690 and winter at 1.4294 (Tabl 4; Fig. 11). Without Corbicula, oligochaetes were the most abundant taxon relative to biomass in all seasons but spring when it was ranked third. Seasonally mean biomass of oligochaetes ranged from 0.6640 to 1.1515 comprising from 12.8 to 50.4 percent of the total mean biomass (Table 4; Fig. 12). Polychaetes ranked first in spring with a mean biomass of 3.0465 comprising 58.8 percent of the total mean biomass; second in summer and fall with mean biomass of 0.7196 and 0.5392, respectively, comprising 19.7 and 26.1 percent of the total, respectively; and in winter it ranked third with mean biomass of 0.1437 accounting for 10.1 percent of the total. Isopods ranked third in summer and fall and fourth in spring and winter. Mean biomass ranged 0.1200 to 0.6408 comprising from 6.7 to 17.5 percent of the total mean biomass. Bivalves, other than Corbicula, ranked second in spring and winter, and fifth in fall. Mean biomass ranged 0.0294 to 0.7551 comprising from 0.8 to 24.8 percent of the total mean biomass. Amphipods ranked fourth in summer and fall, fifth in winter and sixth in spring. Mean biomass ranged 0.0479 to 0.5896 comprising from 2.2 to 16.1 percent of the total mean biomass. Chironomids ranked sixth in all seasons but spring when it was fifth. Mean biomass ranged 0.0213 to 0.1861 comprising from 1.5 to 5.0 percent of the total mean biomass. Ectoprocts ranked fifth in summer but were otherwise seasonally unranked. All of these taxa recorded their respective peak in mean biomass either spring or summer.

Regional Characterization

The regional total mean density (n/m^2) for all seasons and substrata was highest in Zone 3 at 3,901.4 (Table 5; Fig. 13). Zones 2 and 4 were generally similar with total mean densities of 2,950.9 and 2,620.8, respectively. Oligochaetes was the most abundant taxon in each of the four zones with mean density ranging from 774.6 in Zone 5 to 2,441.5 in Zone 3, regionally comprising from 52.4 to 75.2 percent of the total mean density of macroinvertebrates (Table 5; Fig. 14). Although the mean density of oligochaetes was highest in Zone 3, the mean density in Zone 2 was only slightly lower at 2,217.8. Between zones there were no changes in dominant oligochaete taxa; the Tubificidae was dominant family and Limnodrilus the most abundant genus. However, in Zones 3 and 4 the enchytraeids were secondarily dominant with mean densities of 235.4 and 253.1, respectively.

Chironomids was the second most abundant taxon in all zones except Zone 5 with mean densities in Zones 2, 3 and 4 of 415.6, 575.0 and 616.7, respectively (Table 5; Fig. 14), comprising from 14.1 to 23.5 percent of the total mean density of macroinvertebrates in these zones. Between zones there were no changes in major dominant chironomid taxa; the sub-famliy Chironominae was dominant and Polypedilum was the most abundant genus. The genera Cladotanytarsus and Cryptochironomous were typically the second or third most abundant taxon of chironomid except in Zone 3 where Cricotopus/

Orthocladius spp. and Tanytarsus spp. were more abundant than Cladotanytarsus spp.

In Zone 2 bivalves, isopods and nematodes were the third, fourth and fifth most abundant taxa, respectively (Table 5; Fig. 14). Corbicula fluminea, Cyathura polita and Gammarus spp. were the dominant representatives of these groups. In Zone 3 turbellarians, amphipods and isopods were the third, fourth and fifth most abundar taxa, respectively. The turbellarians were somewhat uniquely abundant in Zone 3 with a mean density of 377.0 comprising almost 10 percent of the total mean density of macroinvertebrates in that zone. However, in the other zones the mean density of turbellarian did not exceed 20, and they comprised less than 1 percent of the total mean density. Isopods recorded their regional maximum mean density of 164.7 in Zone 3. In Zone 4 amphipods, isopods and polychaetes were the third, fourth and fifth most abundant taxa, respectively. Amphipods were regionally most abundant in Zone 4 with a mean density of 369.9 comprising over 14 percent of the tota mean density in that zone. The mean density of Gammarus spp. in Zone 4 was 352.9.

In Zone 5 the order of dominance in the benthic community changes. Polychaetes, taken in relatively low densities in the other zones, was the second most abundant taxon with a mean density of 172.2 comprising almost 13 percent of the total mean density in that zone (Table 5; Fig. 14). The mean density of Scolecolepides viridis was 170.8. Other taxa with increased importance in benthic community in Zone 5 were cladocerans and nemerteans being the fourth and sixth most abundant taxa, respectively. Taxa important in other zones remain relatively important in Zone 5, but with generally lower densities. Oligochaetes, bivalves, isopods and chironomids all recorded their lowest regional mean density in Zone 5. Not only di the abundance of amphipods decrease in Zone 5, but also the relative dominance of taxa within the group changed. Corophium spp. with a mean density of 62.3 was slightly more abundant than Gammarus spp. at 53.1.

The total mean density (n/m^2) for all seasons and zones in the intertidal, shallow/intermediate and channel sampling substrata was 1,486.2, 3,744.8 and 2,888.5, respectively (Table 6; Fig. 15). Oligochaetes was the most abundant taxon in all three substrata with mean densities ranging from 834.2 in the intertidal to 2,491.4 in the shallow/intermediate substratum (Table 6). Oligochaetes comprised from 56.1 to 66.5 of the total mean density in each substratum (Table 6; Fig. 16). The tubificids were the dominant family in each substratum, however the enchytraeids were reasonably well represented as the second most abundant oligochaete in the intertidal and channel substrata with mean densities of 133.2 and 321.2, respectively. Also of note in the intertidal was Nais variabilis with a mean density of 106.5. In the shallow/intermediate substratum Specaria josinae was the second most abundant oligochaete with a mean density of 125.1.

Chironomids was the second most abundant taxon in the intertidal and shallow/intermediate substrata and third in the channel with mean densities of 441.0, 539.0 and 283.9, respectively, comprising from 9.8 to 29.7 percent of the total mean density of macroinvertebrates in these substrata (Table 6; Fig. 16). Between substrata there were no changes in major dominant chironomid taxa; the sub-family Chironominae was dominant and Polypedilum was the most abundant genus in all three substrata with mean density ranging from 177.5 to 367.6. Cryptochironomous spp. was typically the second or third most abundant taxon of chironomid. Cladotanytarsus spp. was far more abundant in the intertidal substratum where mean density was 103.7, than in the shallow/intermediate and channel substrata with mean densities of 1.0 and 3.5, respectively. Cryptochironomous spp. demonstrated a similar but somewhat less abrupt trend with mean densities in the intertidal, shallow/intermediate and channel of 98.4, 63.8 and 5.7, respectively. In the shallow/intermediate substratum Tanytarsus spp. and Procladius spp. were of note with mean densities of 27.8 and 26.1, respectively. In the channel substratum no taxon of chironomid, other than Polypedilum spp., had a mean density greater than 5.7.

In the intertidal substratum, cladocerans, nematodes, amphipods and bivalves were the third through sixth most abundant taxa, respectively, and when added to the oligochaetes and chironomids discussed above accounted for over 96 percent of the total mean density in the intertidal substratum (Table 6; Fig. 16). Of these taxa, only nematodes recorded the highest density relative to substratum in the intertidal area.

In the shallow/intermediate substratum, amphipods, isopods, polychaetes and bivalves were the third through sixth most abundant taxa, respectively, and when added to the oligochaetes and chironomids discussed above accounted for over 98 percent of the total mean density in that substratum (Table 6; Fig. 16). Oligochaetes, bivalves, amphipods, isopods and chironomids all recorded the highest density relative to substratum in the shallow/intermediate area.

In the channel substratum turbellarians was the second most abundant taxon with a mean density of 291.6 comprising over 10 percent of the total mean density of macroinvertebrates in that substratum (Table

6; Fig. 16). Elsewhere they were scarce at best accounting for not more than 0.3 percent of the catch. Chironomids, amphipods, polychaetes, cladocerans and isopods were the third through seventh most abundant taxon, respectively, and when added to oligochaetes and turbellarians accounted for over 96 percent of total mean density in that substratum. Other than turbellarians as discussed above, only polychaetes and cladocerans recorded the highest density relative to substratum in the channel area.

The total mean biomass (g/m^2) for all seasons and substrata in the sampling zones ranged from 2.9099 in Zone 4 to 35.4645 in Zone 2 (Table 7; Fig. 17). However, the locally heavy incidence of the Asian clam, Corbicula fluminea, in Zone 2, accounting for over 94 percent of the total mean biomass in that zone, grossly overshadows the remainder of the invertebrate community. Although taken in Zones 3 and 4, the mean biomass of Corbicula fluminea was relatively low at 0.5892 and 0.1003, respectively. It was not collected in Zone 5. Subtracting the biomass of Corbicula taken in each zone indicates a general similarity in total mean biomass among zones ranging from 2.0888 to 2.8097 in Zones 2, 3 and 4, with Zone 5 recording the highest biomass of 4.6374.

In Zone 2 the dominant taxa relative to mean biomass (without Corbicula) in order of decreasing abundance were oligochaetes, bivalves, isopods, chironomids and amphipods accounting for over 96 percent of the total mean biomass Table 7; Fig. 18). Since oligochaetes and chironomids were weighed before speciation in the laboratory, the density data presented above should be referenced relative to species composition. The dominant bivalves, excluding Corbicula, were a relatively large group of immature individuals only identifiable to the class level, and the freshwater mussel Elliptio complanata. The dominant taxa of isopod and amphipod were Cyathura polita and Gammarus spp., respectively.

In Zone 3 the dominant taxa in order of decreasing abundance were oligochaetes, isopods, ectoprocts, amphipods, chironomids and polychaetes accounting for over 98 percent of the total mean biomass (Table 7; Fig. 18). The highest regional mean biomass was recorded in Zone 3 for oligochaetes, isopods, chironomids and ectoprocts. However in the case of oligochaetes, mean biomass in Zone 3 was only slightly higher than Zone 2. Ectoprocts were uniquely abundant in Zone 3 where they represented over 11 percent of the total mean biomass. The dominant isopod and amphipod taxa were Cyathura polita and Gammarus spp., respectively, and Scolecolepides viridis was the dominant polychaete.

In Zone 4 the dominant taxa in order of decreasing abundance were polychaetes, amphipods, oligochaetes, isopods, and chironomids accounting for over 99 percent of the total mean biomass (Table 7; Fig. 18). The highest regional mean biomass was recorded in Zone 4 for amphipods. Polychaete biomass was almost entirely represented by Scolecolepides viridis. The dominant isopod and amphipod taxa were Cyathura polita and Gammarus spp., respectively.

In Zone 5 the dominant taxa in order of decreasing abundance were polychaetes, bivalves, oligochaetes, isopods, and amphipods accounting for over 96 percent of the total mean biomass (Table 7; Fig. 18). The highest regional mean biomass was recorded in Zone 5 for polychaetes and bivalves excluding Corbicula. Polychaete biomass was almost entirely represented by Scolecolepides viridis. The dominant bivalve taxon was Rangia cuneata, and the dominant isopod and amphipod taxa were Cyathura polita and Gammarus spp.

The total mean biomass (g/m^2) for all seasons and zones in the intertidal, shallow/intermediate and channel sampling substrata was 1.1258, 18.1005 and 15.5750, respectively (Table 8; Fig. 19). However, the locally heavy incidence of the Asian clam, Corbicula fluminea, in the shallow/intermediate and channel substrata of Zone 2 clouds the character of the remainder of the invertebrate community. Although taken in the intertidal substratum, the mean biomass of Corbicula fluminea was relatively low at 0.3620. Subtracting the biomass of Corbicula taken in each substratum indicates a general similarity in total mean biomass between the shallow/intermediate and channel substrata with total mean biomass of 3.9352 and 4.5535, respectively. Total mean biomass in the intertidal substratum was 0.7637.

In the intertidal substratum the dominant taxa in order of decreasing abundance were oligochaetes, ectoprocts, chironomids, isopods, and amphipods accounting for almost 94 percent of the total mean biomass (Table 8; Fig. 20). Of the dominant taxa, only Ectoprocts recorded the highest mean biomass relative to substrata in the intertidal area where they represented 31 percent of the total mean biomass. The dominant isopod and amphipod taxa were Cyathura polita and Gammarus spp, respectively.

In the shallow/intermediate substratum the dominant taxa in order of decreasing abundance were oligochaetes, bivalves, polychaetes, isopods, amphipods and chironomids accounting for over 98 percent of the total mean biomass (Table 8; Fig. 20). The highest mean biomass among substrata was recorded in the shallow/intermediate for oligochaetes, bivalves, isopods and chironomids. However, in the case of oligochaetes, the difference between shallow/intermediate and channel substrata was not great. The dominant taxa of bivalve excluding Corbicula, was Rangia cuneata, and the dominant polychaete was Scolecolepides viridis. The dominant isopod and amphipod taxa were Cyathura polita and Gammarus spp, respectively.

In the channel substratum the dominant taxa in order of decreasing abundance were polychaetes, oligochaetes, amphipods, isopods, and chironomids accounting for over 97 percent of the total mean biomass (Table 8; Fig. 20). The highest mean biomass among substrata was recorded in the channel for polychaetes and amphipods. However, regarding amphipods, the differences among substrata were not great The dominant polychaete was Scolecolepides viridis. The dominant isopod and amphipod taxa were Cyathura polita and Gammarus spp, respectively.

Spatial and Temporal Distributions

In Zone 2 total mean density (n/m^2) was highest during summer at 3,432.0, but total mean density in spring was only slightly lower at 3,319.8 (Table 9; Fig. 21). Total mean density decreased in fall and winter to 2,810.6 and 2,241.3, respectively. The total mean density of oligochaetes, the dominant taxon during all seasons, ranged from 1,896.6 in winter to 2,559.2 in summer, accounting from 61.2 to 84.8 percent of the total mean density of macroinvertebrates. The total mean density of chironomids, the second most abundant taxon in all seasons but fall, was relatively high in spring and summer at 817.9 and 607.2, respectively, but decreased in fall and winter to 102.2 and 135.3, respectively. The total mean density of bivalves was relatively stable through the seasons ranging from 106.7 in winter to 181.2 in fall. Total mean density of isopods was highest in spring at 83.6 with an intermediate spike in seasonal abundance in fall with a density of 43.3. The mean density of amphipods was high and highest in summer and fall, respectively, when densities were 34.4 and 49.4, respectively.

In Zone 3 total mean density was highest in spring at 6,337.7, decreased through the remaining seasons (Table 9; Fig. 21). The total mean density of oligochaetes, the dominant taxa during all seasons, ranged from 1,402.9 in winter to 3,709.1 in spring, accounting from 45.5 to 90.4 percent of the total mean density of macroinvertebrates. The total mean density of chironomids, the second most abundant taxon in all seasons but spring, was high and highest in spring and summer at 736.7 and 1,376.5, respectively, but decreased in fall and winter to 90.3 and 96.3, respectively. The total mean density of amphipods and isopods was highest in summer at

592.5 and 438.2, respectively. Turbellarians were uniquely abundant in spring at a mean density of 1,304.1 and then again at a lesser level (202.8) in winter.

In Zone 4 total mean density was highest in summer at 4,308.1, and otherwise ranged from 1,046.7 in winter to 2,967.3 in fall (Table 9; Fig. 21). Oligochaetes was the dominant taxon in all seasons, but was taken in lower seasonal mean densities than in Zones 2 and 3. Total mean density of oligochaetes was high and highest in summer and spring at 1,766.7 and 1,986.8, respectively, and low and lowest in winter and spring at 929.1 and 809.3, respectively. The total mean density of chironomids, the second most abundant taxon in all seasons but summer, was highest and high in summer and fall at 957.6 and 901.3, respectively, but decreased in winter to 61.2. Seasonal total mean densities of isopods were similar in spring, summer and fall ranging from 106.3 to 185.2, but decreased to 37.5 in winter. In contrast, the total mean density of amphipods spiked in summer at 1,026.7, and were not taken in the winter. Total mean density of polychaetes was highest in spring at 198.7.

In Zone 5 seasonal total mean density was relatively high and similar in spring and fall at 2,109.0 and 1,977.1, respectively (Table 9; Fig. 21). It was low and lowest in winter and summer at 885.5 and 440.0, respectively. In summer the mean density of typically important taxa all decreased, except for isopods. The total mean density of oligochaetes, the dominant taxon in all other seasons with densities ranging from 469.0 to 1731.2, was 52.0 in summer. Polychaetes was the most abundant taxon in summer with a total mean density of 135.9, but they much more abundant in spring at 478.5. Chironomids were least abundant in summer with a total mean density of 38.8; seasonal mean densities otherwise ranged from 79.7 in spring to 111.5 in winter. Total mean densities of amphipods were low but similar in summer and fall at 67.7 and 76.2, respectively. Seasonal mean densities were higher and not dissimilar in spring and winter at 164.0 and 195.1, respectively. Isopods were most abundant in summer with seasonal total mean densities ranging from 10.0 to 31.1. Cladocerans were uniquely abundant in spring at a mean density of 446.1.

Seasonal biomass within Zones must be examined, as before, with and without Corbicula fluminea. This was a fall and winter phenomenon where with Corbicula total mean biomass in Zone 2 was 68.7860 and 60.8477, respectively, and without Corbicula it was 1.4586 and 2.8819, respectively (Table 10; Figs. 22 and 23). Without Corbicula, total mean biomass was relatively high and similar in summer and winter at 2.5119 and 2.8819, respectively. In spring and fall it was lower and similar at 1.5030 and 1.4586, respectively.

Oligochaetes was the most abundant taxon relative to biomass in all seasons but winter when bivalves were slightly higher. Oligochaete biomass seasonally ranged from 0.5465 in spring to 2.2156 in summer accounting for over 88 percent of the total mean biomass of macroinvertebrates in that season. Isopods was the second most abundant taxon in spring and fall with total mean biomass of 0.3373 and 0.2546, respectively; in summer and winter it was 0.0543 and 0.0268, respectively. Total mean biomass of chironomids was highest in spring at 0.3189, and decreased in subsequent seasons. Total mean biomass of amphipods was highest in fall at 0.1666, and it was the only season which this taxon made an appreciable contribution to the total biomass of Zone 2.

In Zone 3 total mean biomass was highest in summer at 5.2201; otherwise it ranged from 1.2122 in winter to 2.8286 in spring (Table 10; Fig. 23). Oligochaetes was the most abundant taxon based on biomass in all seasons, however in summer oligochaetes accounted forr only 28 percent of the total mean biomass. Seasonally the total mean biomass of oligochaetes ranged from 0.9265 in winter to 1.5278 in spring. In summer amphipods, isopods, chironomids and ectoprocta reached seasonal maximum levels in mean biomass at 0.6432, 1.2897, 0.4096 and 1.2628, respectively, individually accounting from 8 to 25 percent of the total mean biomass in that season. In the other seasons these taxa remained as relatively important, but were less abundant and contributed a smaller portion to the total biomass in the zone.

In Zone 4 total mean biomass was highest in spring at 4.2257; similar and relatively high in summer and fall at 3.1231 and 3.1569 respectively; and low during winter at 0.7331 (Table 10; Fig. 23). Polychaetes was the most abundant taxon in spring with a total mean biomass of 3.0696 accounting for over 72 percent of the biomass for the zone in that season. Isopods and oligochaetes were second and third most abundant with total mean biomass of 0.4293 and 0.2784, respectively. In summer amphipods was the most abundant taxa with a total mean biomass of 1.5126 accounting for over 48 percent of the total mean biomass in the zone during that season. Oligochaetes and isopods were second and third most abundant with total mean biomass of 0.8852 and 0.4784, respectively. In fall polychaetes was the most abundant taxon with a total mean biomass of 1.9266 accounting for over 61 percent of the biomass for the zone in that season. Oligochaetes and isopods were second and third most abundant with total mean biomass of 0.4309 and 0.3651, respectively. In winter oligochaetes was the most abundant taxon with a total mean biomass of 0.4976 accounting for over 67 percent of the biomass for the zone in that season. Isopods and polychaetes were second and third most abundant with total mean biomass of 0.1458 and 0.0752, respectively.

In Zone 5 seasonal total mean biomass was highest in spring at 12.1627; otherwise it ranged from 3.7774 in summer to 0.8904 in winter (Table 10; Fig. 23). Polychaetes was the most abundant taxon in all seasons but fall when oligochaetes were more abundant. In spring total mean biomass of polychaetes was 8.7753, bivalves, principally Rangia cuneata, ranked second with a total mean biomass of 2.8543, and oligochaetes ranked third at 0.3031. In summer total mean biomass of polychaetes was 2.7477, isopods ranked second with a total mean biomass of 0.7409, and amphipods ranked third at 0.1688. In fall oligochaetes were the most abundant taxon with a total mean biomass of 0.5913, bivalves were second at 0.3941, and polychaetes were fourth at 0.2302. Crangon septemspinosa was third at 0.2909, but this was the only season and zone in which it was collected. In winter polychaetes regained dominance with a total mean biomass of 0.4969, amphipods were second at 0.1745, and oligochaetes were third at 0.1236.

In the intertidal substratum the total mean density (n/m^2) was highest in summer at 2,819.1; spring and fall were similar at 1,574.2 and 1,359.3, respectively; and winter was low at 192.5 (Table 11; Fig. 24). Oligochaetes was the most abundant taxon in all seasons but summer with total mean densities in summer and fall nearly equal at 1,138.4 and 1,164.1, respectively; mean density in spring and winter were 860.2 and 174.2, respectively. Chironomids was the most abundant taxon in the intertidal substratum in summer when total mean density spiked at 1,341.1; in spring and fall they were second most abundant with total mean densities of 347.9 and 74.2, respectively; and in winter density was very low at 0.9. In spring cladocerans were third at 216.4; in summer and winter nematodes were third at 129.2 and 6.6, respectively; and in fall amphipods were third at 47.0. Total mean density of amphipods was higher in summer at 62.1 but they ranked fifth in that season.

In the shallow/intermediate substratum the total mean density (n/m^2) was high and similar in spring and fall at 4,353.0 and 4,269.4, respectively; slightly lower in summer at 3,958.3; and considerably lower in winter at 2,398.7 (Table 11; Fig. 24). Oligochaetes was the most abundant taxon in all seasons with total mean densities ranging from 2,066.7 in summer to 3,188.2 in fall seasonally accounting for from 52 to 87 percent of the total mean density in the substratum. Chironomids was the second most abundant taxa in all seasons but summer when they were third. Total mean densities ranged from 148.9 in winter to 755.2 in spring seasonally accounting for from 6 to 17 percent of the total mean density in the substratum. Isopods seasonally ranked from third to fifth in abundance with total mean densities ranging from 44.1 in winter to

399.7 in summer. Amphipods ranked second in summer and third in spring with total mean densities of 799.5 and 339.6, respectively.

In the channel substratum total mean density was highest in spring at 4,518.7, decreasing through the other seasons from 2,935.6 in summer to 2,249.8 in fall to 1,849.9 in winter (Table 11; Fig. 24). Oligochaetes was the most abundant taxon in all seasons. Total mean density was high and relatively similar in spring, summer and fall ranging from 1,869.9 to 2,068.7; total mean density in winter was 1,258.0. Oligochaetes seasonally accounting for from 46 to 85 percent of the total mean density in the substrata. Turbellarians was the second most abundant taxon in spring with a mean density of 1,007.7; they were also second in winter with a much lower density of 154.0. Seasonally, chironomids was second or third most abundant taxon with total mean densities ranging 79.8 in fall to 532.7 in spring. Amphipods was ranked second in summer when total mean density spiked at 429.4. Other notable seasonal spikes in density were polychaetes and cladocerans in spring at 348.3 and 335.5, respectively.

Seasonal biomass within the substrata must be examined, as before, with and without Corbicula fluminea. This was a fall and winter phenomenon in Zone 2. However its influence carries over into the substrata and discussed separately below. In the intertidal substratum, with or without Corbicula, seasonal total mean biomass was highest in summer at 2.5662 and 1.7820, respectively (Table 12; Figs. 25 and 26). Without Corbicula, seasonal total mean biomass in spring and fall were similar at 0.6050 and 0.5689, respectively; with or without Corbicula biomass in winter was unchanged and low at 0.0990. Without Corbicula, oligochaetes was the most abundant taxon in all seasons but summer. In summer the ectoprocts were uniquely abundant in the intertidal substratum with a mean biomass of 0.9453 comprising over 53 percent of the total mean biomass in that season. Total mean biomass of oligochaetes was also highest in summer at 0.4017; otherwise biomass ranged from 0.0815 in winter to 0.2995 in spring. Isopods exhibited some seasonal fluctuations in total mean biomass when in spring and fall it ranked second at 0.1230 and 0.1784, respectively; while in summer and winter biomass was 0.0133 and 0.0020, respectively. Notable seasonal spikes in biomass were chironomids in summer at 0.2797, and amphipods in fall at 0.1215.

In the shallow/intermediate substratum with Corbicula, total mean biomass was highest in fall at 30.7076 and relative high in winter at 24.6752 (Table 12; Fig. 25). Without Corbicula total mean biomass was highest in spring at 6.4103, lower in summer at 4.2596, and lowest and similar in fall and winter at 2.4591 and 2.6117, respectively (Table 12; Fig. 26). In the spring without Corbicula fluminea, polychaetes and bivalves, principally Rangia cuneata, were the first and second most abundant taxa with total mean biomass of 2.3641 and 2.1645, respectively. Isopods, oligochaetes and chironomids were third, fourth and fifth with total mean biomass of 0.6570, 0.4817 and 0.3705, respectively. In the remaining seasons oligochaetes were the most abundant taxon with total mean biomass ranging from 1.1747 in winter to 1.6956 in summer. In summer isopods and amphipods ranked second and third with total mean biomass at seasonal maximum levels of 1.5699 and 0.4410, respectively. In fall isopods and bivalves (Rangia) ranked second and third with total mean biomass of 0.3664 and 0.3144, respectively. In winter bivalves, principally Elliptio complanata, and isopods reversed rankings with total mean biomass of 1.0617 and 0.2243, respectively. Polychaetes ranked fourth summer through winter as biomass declined from the spring peak to 0.2924 in summer, to 0.1555 in fall and to 0.0618 in winter. Chironomids were ranked fifth in all seasons with total mean biomass ranging from 0.0396 in winter to 0.3705 in spring.

In the channel substratum with Corbicula, total mean biomass was high and similar in fall and winter at 25.5633 and 23.1431, respectively (Table 12; Fig. 25). Without Corbicula total mean biomass was highest in spring at 8.5246, decreasing in summer to 4.9328, to 3.1791 in fall and to 1.5776 in winter (Table 12; Fig. 26). Polychaetes and oligochaetes were the first and second ranked taxa in all seasons but winter. Seasonally, total mean biomass of polychaetes ranged from 0.3659 in winter to 6.7594 in spring; biomass of oligochaetes ranged from 0.8825 in fall to 1.3574 in summer. Seasonally, isopods ranked third or fourth with total mean biomass ranging from 0.1337 in winter to 0.3393 in summer. Amphipods ranked third in summer when total biomass spiked at 1.2644; in fall amphipods remained third but at 0.3620. In winter oligochaetes ranked first and polychaetes second with isopods and amphipods third and fourth, respectively.

Megabenthos

Data on megabenthos, which within the scope of this study included only blue crab, grass shrimp and sand shrimp, was collected by TLA during two collection periods in 1992. Regrettably, "summer" and "fall" sampling was conducted in the consecutive months of September and October with only four to six weeks separating efforts at the sampling locations. Water temperature ranged from 14.5 to 23.2 °C during the September sampling and from 10.4 to 16.3 °C during October, but showed a decrease of from 7.9 to 11.5 °C at respective stations between sampling periods. Salinity was 0.0 ppt in Zones 2 and 3 in both September and October. In Zone 4 salinity was 0.0 in October, but a trace was measured in September, i.e., 0.5 - 0.9 ppt In Zone 5 salinity ranged from 4.7 to 10.0 ppt in September, and from 3.5 to 6.2 ppt in October.

A total of 255 blue crab was taken during the two sampling periods; 185 in September and 70 in October (Table 13). Blue crab were taken in all Zones during both collection periods. In September, 141 specimens or 76.2 percent of the total catch were taken in Zone 5. In October the catches in Zones 3 and 5 were essentially equal representing 35.7 and 34.3 percent of the total, respectively. Sex ratio generally indicated more male crabs than female. In Zone 5 during the September sampling effort, the only time and location with a reliably large catch, the ratio was 2.0 males/females. Carapace width (CW) ranged from 8 to 173 mm (Table 14). During September in Zones 2, 3, and 4 over 70 percent of the crabs taken were >100 mm CW, while in Zone 5 essentially the inverse was true, i.e., over 67 percent were <100 mm CW. Relatively small individuals, 8-23 mm CW, were taken in Zones 3 and 4, but were isolated singular occurrences. However, in October small immature specimens dominated the catches in all Zones with over 88 percent of the specimens taken being ≤48 mm CW.

A total of 1,991 grass shrimp (Palaemonetes spp.) was taken during the two sampling periods; 1,732 in September and 259 in October (Table 13). Grass shrimp were taken in Zones 3, 4 and 5 in September, and in all zones during October. In September, 1,670 specimens or 96.4 percent of the total catch were taken in Zone 5. In October the catches in Zones 4 and 5 comprised over 82 percent of the total with grass shrimp being slightly more abundant in Zone 4.

A total of 1,406 sand shrimp (Crangon spp.) was taken during the two sampling periods; 781 in September and 625 in October (Table 13). Grass shrimp were taken only in Zone 5 in September, and in Zones 4 and 5 during October. In October only two specimens were taken in Zone 4.

Community Parameters

Shannon's Diversity Index (H') was calculated using the density values of taxa from each season, zone and substratum, and the individual values of H' are given in Table 15 and shown in Figure 27. To gain a sense of overview, individual values were pooled by seasonal, regional and depth-related criteria, and median values were calculated. They are also given in Table 15. Pooling all seasons, zones and substrata yielded a median H' of 2.5333 with a range from 0.2528 to 3.8069. Seasonally, the median H' ranged from 2.7533 in spring to 2.2212 in fall. Regionally, the median H' ranged from 2.6815 in Zone 2 to 2.3164 in Zone 4. Relative to depth-related substrata, the median H' in the intertidal, shallow/intermediate and channel was 2.5400, 2.6702 and 2.3746, respectively. The greatest difference between median values calculated from data pooled according the descriptive criteria above was 0.5321. This suggests that in the overview there are no striking trends in diversity relative season, zones or substrata.

Pielou's Evenness Index (J') was also calculated using the density values of taxa from each season, zone and substratum, and the individual values of J' are given in Table 15 and shown in Figure 28. Like diversity, individual values were pooled by seasonal, regional and depth-related criteria, and median values were calculated. They are also given in Table 15. Pooling all seasons, zones and substrata yielded a median J' of 0.6041 with a range from 0.1264 to 0.9670. Seasonally, the median J' ranged from 0.6489 in spring to 0.5858 in winter. Regionally, the median J' ranged from 0.6227 in Zone 2 to 0.5638 in Zone 4. Relative to depth-related substrata, the median J' in the intertidal, shallow/intermediate and channel was 0.6591, 0.5712 and 0.5783, respectively. The greatest difference between median values calculated from data pooled according the descriptive criteria above was 0.0879. This also suggests that in the overview there are no striking trends in evenness relative seasons, zones or substrata.

Alternatively, if the individual values of H' and J' from each season, zone and substratum are viewed relative to seasonal extremes and magnitude of those seasonal changes, a sense of community dynamics and stability may be achieved. All but one substrata achieved their maximum seasonal diversity in spring (seven substrata) or summer (four); diversity in Zone 2 - intertidal was highest in fall (Table 15). Seasonal minimum diversity occurred evenly, i.e. four in each of three seasons, among the substrata in summer, fall and winter with no regional or depth-related pattern. Regarding evenness, 7 of 12 seasonal maximums in H' coincided with seasonal maximums in J', and 9 of 12 seasonal minimums in H' coincided with seasonal minimums in J'. In 8 of 12 substrata, seasonal maximums in H' were immediately followed by seasonal minimums. This "boom to crash" relative to diversity occurred in all three substrata in Zones 2 and 5, as well as in Zone 3 - channel and Zone 4 - shallow/intermediate. The largest range in seasonal diversity was recorded in Zone 3 - intertidal with a 2.9831 decrease from summer high to winter low. All of these decreases, by definition, involve a reduction in the of taxa taken or in a change in the "evenness" in which they occurred. In the case of Zone 3 -

intertidal, the number of taxa dropped from 30 in summer including 18 oligochaete and chironomid taxa to four in winter including three oligochaetes and a copepod. Examining the "boom to crash" cases, all but two involved a substantial decrease in taxa taken, and they all exhibited a decrease in evenness. Generally, oligochaetes seem to be the constant base supporting the diversity of the communities and chironomids, bivalves, polychaetes, amphipods and isopods are the variable components that effect diversity with their dynamic seasonal changes in abundance. In the case of Zone 5 - shallow/intermediate, the "boom to crash" scenario, summer to fall, coincided with an uncharacteristic increase in the number of taxa taken, which was heavily countered by a spike in oligochaete abundance causing a decrease in the evenness index from 0.7450 to 0.3501

Average linkage cluster analysis was performed on seasonal density data from the 12 substrata to identify locations with similar benthic abundance. The analysis using spring data indicated two clusters with relatively low average dissimilarity (Fig. 29). Grouped were the intertidals from Zones 2, 5 and 4, and the channel from Zone 2 and 4. In the case of the intertidals, they recorded similarly low densities and with relatively few taxa represented. The channel substrata reflect the next echelon with regard to relative abundance and number of taxa present. At the other end of the spectrum, Zone 3 - channel was vastly dissimilar from rest as reflected in the average dissimilarity value relative to its nearest neighbor, Zone 2 - shallow/intermediate. Zone 2 - shallow/intermediate was also quite dissimilar from the other substrata. These two substrata recorded the highest densities for the season, and those densities were markedly higher than the rest. The substrata layered in between reflect general similarity or lack of sufficient dissimilarity to form clusters as gradients of abundance and number of taxa represented were more subtle.

The analysis of the summer data indicated two clusters, one with relatively low average dissimilarity and the other with relative high (Fig. 30). Grouped were the three substrata of Zone 5 where seasonal densities were very low relative to the other substrata and fewer taxa were taken. The second group included Zone 2 - shallow/intermediate and Zone 4 - channel which were not that similar to one another as indicated by the average dissimilarity at the point of their fusion, but were very dissimilar from the other substrata also indicated by the point of fusion. These substrata had the first and third highest densities but only a moderate number of taxa were taken. The remaining substrata reflect unremarkable shades of similarity/dissimilarity.

The analysis of fall data also indicated two distinctive clusters and one or possibly two outliers (Fig. 31). The first group included the intertidals from Zones 2, 3 and 5 and the channels from Zones 4 and 5, second included the shallow/intermediates from Zones 2, 3 and 5 and the channels from Zones 2 and 3. These groups generally reflect substrata of relatively low and high abundance, respectively. The obvious outlier was Zone 4 - shallow/intermediate by virtue of its singular position and average dissimilarity at the point of fusion. While the density and number of taxa taken in this substrata were similar to Zone 3 shallow/intermediate which was clustered with the other shallow/intermediate substrata, the relative dominance of taxa was different. In Zone 3 - shallow/intermediate chironomids were uniquely dominant over oligochaetes which were dominant in all other substrata. The second outlier was Zone 4 - intertidal which was grouped with the other intertidals, but was fused at such a point that the similarity was marginal.

The analysis of the winter data indicated three clusters, the most distinctive of which included shallow/intermediates from Zones 2 and 3 (Fig. 32). These substrata were the locations of the highest seasonal density and where the most taxa were taken, though oligochaetes were heavily dominant. The group including the channels from Zones 2 and 4 do not reflect great similarity to one another as indicated by the average dissimilarity at the point of fusion, but do represent the next echelon in abundance. Within the larger major cluster, the group including the intertidals from all four zones reflects the lowest seasonal densities and fewest number of taxa taken.

Water Quality Summary

Mean surface and bottom water temperatures measured in each of four sampling zones during seasonal collection experiences are given in Table 16 and shown in Figure 33. During spring water temperature in all samples ranged from 12.5 to 17.5 °C; mean temperature in surface and bottom waters ranged from 13.3 to 15.6 °C. Surface and bottom means were lowest in Zone 2 and highest in Zone 5. During summer water temperature in all samples ranged from 22.5 to 28.0 °C; mean temperature in surface and bottom waters ranged from 23.8 to 25.7 °C. Surface and bottom means were highest in Zone 2. During fall water temperature in all samples ranged from 7.5 to 12.5 °C; mean temperature in surface and bottom waters ranged from 9.4 to 11.3 °C. Surface and bottom means were lowest in Zone 2, and highest in Zone 5. During winter water temperature in all samples ranged from 2.0 to 6.5 °C; mean temperature in surface and bottom waters ranged from

2.5 to 5.8 °C. Surface and bottom means were lowest in Zone 5, and highest in Zone 2. In all but one case, Zone 2 - fall, mean temperature was higher in surface waters than bottom.

Mean surface and bottom salinity measured in the four sampling zones during seasonal collection experiences are given in Table 16 and shown in Figure 33. Salinity was only detected in Zone 5. In spring salinity ranged from 0.0 to 1.0 ppt with means in surface and bottom waters of 0.0 and 0.1 ppt. In summer salinity in all samples in Zone 5 ranged from 0.0 to 4.0 ppt with means in surface and bottom waters of 1.7 and 2.4 ppt. In fall salinity in Zone 5 ranged from 0.0 to 4.0 ppt with means in surface and bottom waters of 1.3 and 1.7 ppt. In winter salinity in Zone 5 ranged from 0.0 to 2.0 ppt with means in surface and bottom waters of 0.4 and 0.7 ppt. In all cases but spring mean salinity was higher in bottom waters.

Mean surface and bottom conductivity measured in each of four sampling zones during seasonal collection experiences are given in Table 16 and shown in Figure 33. During spring conductivity in all samples ranged from 90 to 900 µmhos; mean values in surface and bottom waters ranged from 98 to 293 µmhos. During summer conductivity in all samples ranged from 180 to 6,000 µmhos; mean values in surface and bottom waters ranged from 187 to 3,433 µmhos. During fall conductivity in all samples ranged from 100 to 6,000 µmhos; mean values in surface and bottom waters ranged from 125 to 1,788 µmhos. During winter conductivity in all samples ranged from 110 to 2,200 µmhos; mean values in surface and bottom waters ranged from 110 to 815 µmhos. Seasonally, surface and bottom means were lowest in Zone 2 and highest in Zone 5. Mean values in Zones 3 and 4 were much more similar to Zone 2 than Zone 5, but were progressively higher moving downstream. Seasonally, Zone 5 exhibited the greatest range in conductivity. Surface and bottom values within a zone were similar.

Mean surface and bottom dissolved oxygen measured in each of four sampling zones during seasonal collection experiences are given in Table 16 and shown in Figure 33. During spring dissolved oxygen in all samples ranged from 7.4 to 11.4 mg/l; mean values in surface and bottom waters ranged from 8.8 to 9.7 mg/l. Surface and bottom means were lowest in Zone 3. During summer dissolved oxygen in all samples ranged from 4.3 to 8.6 mg/l; mean values in surface and bottom waters ranged from 5.3 to 7.1 mg/l. Surface and bottom means were lowest in Zone 4. During fall dissolved oxygen in all samples ranged from 7.9 to 10.5 mg/l; mean values in surface and bottom waters ranged from 8.5 to 10.1 mg/l. Surface and bottom means were lowest in Zone 4, and highest in Zone 2. During winter dissolved oxygen in all samples ranged from 11.8 to 13.2 mg/l; mean values in surface and bottom waters ranged from 12.3 to 12.6 mg/l. Surface and bottom means were lowest in Zone 3. Mean values of dissolved oxygen were typically lower in bottom waters.

Sediment Particle Size Analysis

A total of 218 grab samples were analyzed and the average percent composition by grain size classification for the study area, each of the zones, and in each of the 12 substrata is given in Table 17. For the study area in general, the silt/clay component of the sediment comprised 31.4 percent by weight and was the highest single classification group. Coarse to fine sands ranged from 10.2 to 16.8 percent, and pebbles and very fine sand were 11.5 and 9.1 percent, respectively. Within each zone, silt/clay was again the highest classification group comprising from 19.6 to 45.0 percent of the sediment by weight. Medium sand was the second highest component in all zones but Zone 2, where medium and fine sands were essentially equal. Medium sand comprised from 12.3 to 20.2 percent of the sediment by weight. In the channel and shallow/intermediate substrata, the silt/clay classification was the highest group in all zones but Zone 4 where in the channel substratum medium sand was highest. Silt/clay comprised from 23.9 to 63.9 percent of the sediment by weight in these substrata. In all zones but Zone 4, the classifications of medium to very fine sand were the second highest groups in the channel and shallow/intermediate substrata comprising 14.0 to 21.0 percent. In the intertidal substrata, no grain size classification comprised >28 percent. Medium sand was the highest classification comprising from 19.3 to 27.8 percent; second highest component of the sediment in intertidal substrata was pebbles, coarse sand or slit/clay depending on the zone. These components ranged from 18.6 to 23.3 percent of the sediment by weight.

An average linkage cluster analysis was performed using the sediment particle size data to identify substrata with similarities in sediment composition. The analysis indicated three clusters roughly aligned by substrata (Fig. 34). The group including the intertidals from all zones and Zone 4 - channel share the general characteristics of relatively low silt/clay and high pebbles with similarities in the coarse to fine sand content. The group including the shallow/intermediates from Zones 3, 4 and 5 and Zone 5 - channel were the substrata with highest silt/clay content. The group including the channels Zones 2 and 3 and Zone 2 shallow/intermediate were not strongly similar as indicated by the average dissimilarity at the point of fusion, but do share the characteristic of a relatively moderate silt/clay content.

HISTORICAL COMPARISON

The references included in the review and comparisons are listed chronologically by DRBC zone in Table 18. Also listed are the stud design features such as location, dates, collection frequency, gear type and nature of reported results. The available references span some 20 years, and cluster roughly in two time periods, the early 1970's and the mid 1980's. Species lists from all references were pooled to produce a cumulative list of reported benthic macroinvertebrate taxa collected in the study area (Table 19).

General Community Characterization and Comparisons

Benthic macroinvertebrates from nine phyla have been reported in th available literature: Porifera (sponges), Cnidaria (jellyfish and hydroids), Platyhelminthes (flatworms), Nemertea (ribbon worms), Nematoda (round worms), Annelida (clam worms, leeches and aquatic earthworms), Mollusca (clams and snails), Arthropoda (insects, crustaceans and arachnids), and Ectoprocta (moss animals). In the present study representatives of all phyla but Porifera were collected. When pooled into higher taxa to match the format of the present study, members of the class Oligochaeta (aquatic earthworms or sludge worms), the fly family Chironomidae (midges), the order Amphipoda (scuds or sideswimmers), the order Isopoda (aquatic pill bugs),and the class Polychaeta (bristle worms) were reported as predominant taxa based on density in various combinations through the years and within different zones (Table 20). Oligochaetes were the most abundant taxa in all zones and all studies through the mid 1980's. However in surveys conducted by RMC (1988) and USEPA (1990) in Zone 5 amphipods and polychaetes were the most abundant taxa, respectively. The dominant taxa in the historical databases were also found to be dominant taxa in the present study. There were also similarities between the historical and present studies with regard to the most abundant genus and/or species within the dominant pooled taxa. Among the oligochaetes Limnodrilus spp., and more specifically L. hoffmeisteri and L. udekemianus, was historically and during the present study the most abundant genus and/or species. Cyathura polita remains the most abundant isopod and Gammarus spp. the most abundant amphipod. Corbicula fluminea continues to be the most abundant bivalve in the study area.

While the dominant pooled taxa and their most abundant members have not changed through the period of review, changes in the occurrence and abundance of some other component genera and species have occurred. This is particularly true for the oligochaetes and chironomids. Taxa not reported until or after the mid 1980's include: the oligochaete taxa, Enchytraeidae, Megascolecidae, the Naidae genera Arcteonais, Chaetogaster, Nais, Paranais, Piguetiella, Pristina, Pristinella, and Specaria, and the Tubificidae genera Aulodrilus, Haber, and Isochaetides. Conversely, taxa reported in the historical literature but not collected in the present study include the oligochaetes Aeolosoma hemprichi, Stylaria lacustris, Branchiura sowerbyi, Limnodrilus angustipenis, L. cervix, L. profundicola, Potamothrix moldaviensis, Psammoryctides curvisetosus, and Tubifex spp. Except for Elliptio complanata, no other Unionidae clams were identified in the present study. Other notable taxa not taken in the present study include the sponges (Porifera), barnacles (Cirripedia), emergent insects such as mayflies (Ephemeroptera) and dragonflies (Odonata), and snails (Gastropoda) with the exception of freshwater limpets (Ancylidae).

On a regional level there were records of first occurrence or possibly extensions of local distributions for selected taxa noted during the present study. The polychaete Scolecolepides viridis, an endemic estuarine species, was historically reported in Zone 5 of the study area; it was first collected in Zones 4 during mid 1980's; and during the present study it was collected in Zones 2 and 3 as well. Other estuarine taxa taken in areas further upstream than previously reported were the Cumacea (small shrimplike crustaceans) collected in Zones 2 and 4, the amphipods Corophium spp. and Monoculodes edwardsi in Zone 4, and the isopods Cassidisca lunifrons and Chirodotea almyra in Zone 2. Nemertea, generally an estuarine and marine phyla with one known freshwater species, were recorded for the first time in Zones 2 and 3.

Regional Characterizations and Comparisons

Zone 2

Comparable historical references were only available at the extremes of the review period; 1971 through 1973 (Anselmini, 1974; Crumb, 1976 and 1977) and 1990 (USEPA, 1990). In all years including the present study as well, oligochaetes and chironomids were the dominant taxa in the benthic invertebrate community. Crumb (1976 and 1977) reported Corbicula fluminea for the first time in September 1971, and commented on the coincidental reduction in abundance of endemic unionid clams. The predominance of Corbicula in the present study was described at length previously. During the 1971 through 1973 studies the oligochaete Limnodrilus hoffmeisteri comprised over 90 percent of the benthic macroinvertebrate community based on density data. In the present study the entire class of Oligochaeta represented slightly over 75 percent of the total mean density in Zone 2 and included several more genera and species thar during the early 1970's. Using data from October 1971 and fall data from the present study, respective densities of L. hoffmeisteri were similar at 1,370 and 1,429. Calculations from the present study included the appropriate proportion of unidentified tubificids #2 a L. hoffmeisteri. Crumb (1977) reported the highest density of L. hoffmeisteri in June at 3,215 and 4,552 during both 1972 and 1973, respectively. During the present study the seasonal maximum was recorded in summer as well but at the lower value of 1,634.

Regarding the chironomids, the family remained a dominant part of community but the dominant and secondary representative members have changed. Crumb (1977) reported only three taxa of chironomids, and Procladius culiciformis was the heavily dominant species. In the present study at least 13 taxa were collected, including Procladius, but Polypedilum spp. was the singularly dominant taxa, followed by Cladotanytarsus spp. and Cryptochironomous spp. In summer 1972 Crumb (1977) reported the density of Procladius culiciformis ranged from 209 to 281. In the present during the summer quarter, the mean density of Procladius spp.in Zone 2 was 20.3, while densities of Cladotanytarsus spp. and Polypedilum spp. were 273.1 and 215.5, respectively.

Zone 3

Available references were limited to two, PAS (1985) and USEPA (1990). PAS (1985) data was collected during the summer of 1985, and it was semi-quantitative in that density was calculated for some but not all taxa. It appears that the most abundant taxa were oligochaetes, represented by Limnodrilus spp., L. hoffmeisteri and Pristina spp., and the isopod Cyathura polita. In the summer of 1990 oligochaetes comprised over 98 percent of the total macroinvertebrates (USEPA, 1990), represented by Limnodrilus hoffmeisteri, L. udekemianus and unidentified immature tubificids without capelliform chaetae (unidentified tubificids #2 in the present study). In present study in order of decreasing abundance, the dominant taxa were oliochaetes, chironomids, amphipods and isopods in aggregate comprising over 96 percent of the total mean density of benthic macroinvertebrates. Relative to oligochaete taxa the present study compares favorably with the USEPA (1990) data except Nais variabilis was abundant in the present study.

Zone 4

Available references were limited to three qualitative and three quantitative studies. References from the early to mid 1970's were qualitative; Bason (1971) stated that benthos in the area was "very limited" with only three groups represented, leeches, tubificid worms and several fingernail clams, Potter and Harmon (1973) stated that tubificid worms were abundant and few other organisms were collected, and Harmon and Smith (1975) reported that slightly over 50 percent of the taxa were Oligochaeta (primarily Tubificidae) and Hirudinea (leeches). It appears in the mid 1970's tubificid oligochaetes were the dominant taxa. In the mid to late 1980's the list of dominant taxa expands to include not only oligochaetes but also amphipods and isopods (PAS, 1985; VJSA, 1986; RMC, 1988). In all studies oligochaetes were the most abundant taxa, and in PAS (1985) singularly so. Isopods and amphipods trade second and third positions in relative dominance as reported in VJSA (1986) and RMC (1988). The studies conducted in the 1980's were seasonally restricted to the fall. Fall data from the present study shows that in order of decreasing abundance, the dominant taxa were oligochaetes, chironomids, isopods and amphipods representing over 96 percent of the total mean density of macroinvertebrates in Zone 4.

Zone 5

References describing the benthic macroinvertebrate community cover the 20 year span of available literature reasonably well (Table 20). In the early to mid 1970's studies generally agree that oligochaetes and seasonally amphipods, represented by Gammarus spp., were the dominant taxa. Oligochaetes were not identified below class. In 1979 and 1980 Rogalsky and Collier (1981) also reported that oligochaetes were most abundant, and chironomids were first mentioned as a dominant taxa. During the mid 1980's through 1990 some combination of oligochaetes, polychaetes, isopods and amphipods were listed as dominant taxa. Chironomids were listed with oligochaetes and polychaetes by Beck et al. (1985). Although polychaetes, represented by Scolecolepides viridis, were collected in Zone 5 during the early 1970's, it was not specifically reported as a dominant species until the mid 1980's. During the present study in order of decreasing abundance, the dominant taxa were oligochaetes, polychates, amphipods, cladocerans, chironomids, isopods and nemerteans representing over 96 percent of the total mean density of macroinvertebrates in Zone 5.

BENTHIC RESOURCE ASSESSMENT TECHNIQUE

A total of 55 grab samples collected during the summer of 1992 were processed as described previously for the BRAT. The benthic macroinvertebrates taken in these samples were taxonomically grouped into six major categories and five specimen size classes. The average biomass by taxon and size class from each of the 12 sampling substrata is given in the top portions of Tables 21 through 25. Those taxa collected in sediment samples, but did not occur in the stomachs of the test fish were not included in the data tabulation. These biomass values represent the potential trophic support from the benthic invertebrate community available within each substratum.

A total of 128 fish of the design 420 specimens were collected by TLA during September 1992, and the stomach contents analyzed as described previously for the BRAT. By design the BRAT matrix of dietary information was to have been seven fish species and size groups by 12 sampling substrata, yielding 84 cells of data. The 128 specimens taken, filled 32 of those data cells. Spot were rare to non-existent in the Delaware estuary in the summer of 1992, and their absence results in 24 empty cells. White perch and striped bass were taken with greater success. For white perch 19 of 24 possible cells were represented. However, for striped bass only 13 of 36 possible cells were represented. The lack of success, particularly with striped bass, most likely reflects the behavioral preferences of the species for certain habitat over others, as well as some collection gear selectivity. It is not surprising that relatively large striped bass (>200 mmFL) were not present in the intertidal areas of any zone; equally expected was that relatively small specimens (<200 mmFL) were not available in any the channel areas. These represent 12 empty cells. The absence of information in the other cells should be viewed as just bad sampling luck, and not construed to mean the fish do not use those areas as feeding habitat.

By design each data cell was to contain the pooled dietary information from five specimens, and that was achieved in 20 of 32 cases. Those cells with less than five stomachs include three with four, one with three, five with two, and three with one. Obviously those cells with one stomach must be viewed with caution as to how representative that individual was of the size group, but the data was retained for demonstration and discussion purposes.

The benthic macroinvertebrates found in the stomachs of each of two species and five size classes of fish were taxonomically grouped into the same six major categories and five food item size classes as the grab samples above. The pooled biomass by taxon and size class from each of the 12 sampling substrata was converted to a proportion of total stomach contents, and is given in the middle portions of Tables 21 through 25. These proportions represent the apparent exploitation and selectivity pattern of each species and size group as they gain trophic support from the benthic invertebrate community available within each substratum.

As described above there are a number of missing data cells because the fish specimens were not available, and they are so indicated in the tabular presentations. Additionally, there are three cells empty because the pooled stomach contents did not match any of the macroinvertebrate taxa by food item size categories taken in the sediment grab samples in the respective substratum. In the cells where values of trophic support were calculated, there are examples of partial information resulting from the occurrence of food item in the stomach with no reciprocal number in the sediment data. To quantify and evaluate this, a "Coincidence Efficiency" (CE) factor was calculated based on the number of matches that occurred between sediment and stomach samples divided by the total number of food items categories identified. For the entire sample of 128 stomachs, regardless of fish species or size, the CE was 0.7422, or the stomach contents had reciprocal values from the sediment data 74.2 percent of the times. To quantify and evaluate the level of lost dietary/trophic support information resulting from the "misses" described above, a "Dietary Coverage" (DC) factor was calculated based on the average proportion of stomach contents missed or not considered in the tropic support value. It was calculated by summing the proportion of stomach content missed when there was no match and dividing by the number of misses, then subtracting that number from one. For the entire sample, DC was 0.7824, or 78.2 percent of the aggregate dietary composition was reflected in the reciprocal sediment grab samples. Values for CE and DC were different for each species and size class, and will be addressed below as appropriate.

For white perch ≤150 mm FL, the data matrix was nearly complete with 10 of 12 cells filled; the best representation of all five fish size classes. The CE and DC were also the highest with values of 0.8113 and 0.8481, respectively. Predatory exploitation patterns on macroinvertebrates by this group as measured by stomach contents were based on five stomachs in 7 of 10 cells, four stomachs in one cell and two stomachs in two cells.

Total trophic support (g/m^2) by zone and substrata ranged from 0.0057 in the shallow/intermediate substratum of Zone 2 to 0.7645 in the channel of Zone 4 (Table 21; Fig. 35). In Zones 3 and 4 where all three substrata are fully represented, the shallow/intermediate and channel substrata provided higher trophic support than the respective intertidal areas. Along the upstream-downstream axis of the river, Zones 3 and 4 seem to offer greater support than the respective counterparts in Zones 2 and 5. White perch ≤150 mm FL utilized all food taxa except mollusca; but fed most heavily on amphipods in all zones and substrata.

For white perch >150 mm FL, the data matrix included 7 of 12 cells. The CE and DC were 0.7059 and 0.8421, respectively. Predatory exploitation patterns on macroinvertebrates were based on five stomachs in 4 of 7 cells, and on four, three and two stomachs, respectively, in each of the three remaining cells.

Total trophic support (g/m^2) by zone and substrata ranged from 0.0083 in the intertidal substratum of Zone 5 to 0.1918 in the shallow/intermediate substratum of Zone 3 (Table 22; Fig. 36). In Zone 5, the only zone where all three substrata are fully represented, the shallow/intermediate and channel substrata provided higher trophic support than the intertidal area. In the shallow/intermediate substrata of Zones 3 and 4, the total trophic support values were very similar and comparable to those recorded in these substrata for white perch ≤150 mm FL. Along the upstream-downstream axis of the river, there is a suggestion in the data that Zones 3 and 4 may offer greater support than the respective counterparts in Zones 2 and 5. White perch >150 mm FL utilized oligochaetes, amphipods and isopods; but fed most heavily on amphipods in all zones and substrata from which data was available.

For striped bass ≤100 mm FL, the data matrix included 5 of 12 cells. The CE and DC were 0.6957 and 0.7481, respectively. Predatory exploitation patterns on macroinvertebrates was based on five stomachs in 4 of 5 cells, and one stomach in the remaining cell.

Total trophic support (g/m^2) by zone and substrata ranged from 0.0208 in the intertidal substratum of Zone 4 to 0.1797 in the shallow/intermediate substratum of Zone 4 (Table 23). In Zone 4, the only zone where two substrata were represented, the shallow/intermediate substratum provided higher trophic support than the intertidal area. Since the data is patchy at best, no other comparisons are prudent, except that the values recorded for striped bass ≤100 mm FL were very similar to those recorded for white perch in analogous locations. Striped bass ≤100 mm FL utilized all food taxa except mollusca; but fed most heavily on amphipods and isopods.

For striped bass 101-200 mm FL, the data matrix included 4 of 12 cells. The CE and DC were 0.5385 and 0.6137, respectively.

Predatory exploitation patterns on macroinvertebrates was based on five stomachs in 2 of 4 cells, and four stomachs and one stomach the two remaining cells. Total trophic support (g/m^2) by zone and substrata ranged from 0.0000 to 0.0061; only values from intertidal substrata from each of the four zones was available (Table 24).

For striped bass >200 mm FL, the data matrix included 3 of 12 cells. The CE and DC were 1.0000 and 1.0000, respectively. Predatory exploitation patterns on macroinvertebrates was based on one stomach in 2 of 3 cells, and two stomachs in the remaining cell. Total trophic support (g/m^2) by zone and substrata were 0.0184 in the channel of Zone 5, and 0.2045 and 0.2105 in the shallow/intermediate and channel substrata, respectively, of Zone 4 (Table 25). Of note is that the values recorded in Zone 4 are comparable to other values in those areas.

SUMMARY

GENERAL SURVEY

The benthic macroinvertebrate community or communities in the Delaware River between the C & D Canal and Trenton, NJ was or were represented in this study by 129 taxa of nine phyla, but the quantitative measures of abundance, i.e., density and biomass, suggest that relatively few taxa were seasonally and regionally dominant. From the population perspective as measured by density, the macroinvertebrate community was heavily dominated by the oligochaetes more commonly known as sludge worms, followed by the chironomids or midge larvae. Both groups are considered pollution tolerant and are able to live in otherwise stressful and limiting low oxygen environments. Other important groups with "better" reputations were amphipods, turbellarians, isopods, polychaetes and bivalves. In every case the larger group is heavily dominated by a single genus or species; Limnodrilus of the oligochaetes, Polypedilum of the chironomids, Gammarus of the amphipods, Cyathura polita of the isopods, Scolecolepides viridis of the polychaetes, and Corbicula fluminea of the bivalves. In most cases these larger taxonomic groups were represented additionally by other genera and species, but their occurrence was intermittent and/or abundance was relatively low. The implications and significance of the occurrence of the other genera and species will be discussed below relative to species diversity and historical status and trends.

From a seasonal perspective, benthic macroinvertebrate community obtained similarly high aggregate or total densities in spring and summer. With regard to individual dominant taxa, seasonal mean densities support this trend with two exceptions. Seasonal mean density of oligochaetes peaked in fall, and bivalves obtained similarly high mean densities in fall and winter. From a regional perspective, benthic macroinvertebrate community obtained highest total density in Zone 3; Zones 2 and 4 were intermediately similar, and Zone 5 was lowest. Relative to dominant taxa most did not follow this general trend. The regional mean density of bivalves was highest in Zone 2; chironomids and amphipods peaked in Zone 4, and polychaetes in Zone 5. Oligochaetes, turbellarians and isopods did record the highest regional densities in Zone 3, and the abundance of oligochaetes and turbellarians (virtually absent in other zones) influenced the total density. Relative to the habitat type or depth, the benthic macroinvertebrate community obtained the highest total mean density in the shallow/intermediate substratum, followed in order by the channel and intertidal substrata. Most dominant taxa followed this general trend, except polychaetes and turbellarians which peaked in the channel substrata.

Relative to biomass, the benthic macroinvertebrate community was dominated by three taxa: bivalves, essentially all the Asian clam, Corbicula fluminea, polychaetes, almost exclusively Scolecolepides viridis , and oligochaetes, mostly Limnodrilus spp. Corbicula fluminea, was singularly dominant. Its abundance was seasonally and regionally concentrated in Zone 2 during fall and winter complicating the characterization of the remaining macroinvertebrate community. Accordingly, the results presented earlier were couched in a "with and without" Corbicula context. Without Corbicula for all seasons combined, the order of importance or dominance changes to place polychaetes, almost exclusively Scolecolepides viridis, in the position of most abundant, followed closely by oligochaetes, mostly Limnodrilus spp. and somewhat more distantly by isopods, almost exclusively Cyathura polita. Interestingly, the abundance of Scolecolepides viridis was also somewhat seasonally and regionally restricted. Although taken in other seasons and zones, this polychaete was decidedly most abundant in Zone 5 during the spring. Underlying the seasonally episodic abundances of Corbicula and Scolecolepides was that of the oligochaetes. They were taken in all seasons and zones, however seasonally, maximum biomass was recorded in either Zone 2 or 3. Within zones and between seasons oligochaete biomass was relatively stable compared to the two previous species which exhibited definite seasonal and regional spikes in abundance. Amphipods were taken in all seasons and zones but Zone 4 in winter. Seasonally, maximum biomass was recorded in Zone 4 except obviously in winter. Isopods were taken in all seasons and zones; seasonally biomass was highest in Zone 3.

Relative to descriptive community parameters of species diversity and evenness, the results indicated no striking trends with regard median values within primary design categories like seasons, zones or substrata. Median values of diversity ranged from 2.2212 to 2.7533, and evenness ranged from 0.5783 to 0.6591. However, viewing the raw values for patterns of maximum and minimums, and the magnitude and timing of those changes does yield a few general points. Diversity typically peaked in spring or summer, but the seasonal minimums occurred in summer, fall or winter with no regional or substrata related pattern. Diversity appears to be a seasonally fragile measure in that in 8 of 12 substrata seasonal maximums were followed immediately by seasonal minimums. The largest change was recorded in the intertidal substrata of Zone 3 where the diversity dropped 2.9831 from a summer high to a winter low decreasing from 30 to 4 taxa collected.

Cluster analysis performed on seasonal data from the zones and substrata yielded suggestions of similarity between locations which rarely persisted season to season. The most telling result was that in a given season substrata were layered one onto another suggesting a general similarity or lack of sufficient dissimilarity to form a distinctive cluster. This was particularly obvious in the spring and summer analyses. Those clusters that were formed reflected the seasonal extremes of species composition and relative abundance as was previously described.

HISTORICAL COMPARISON

The benthic macroinvertebrate community in the Delaware River between the C and D Canal and Trenton, NJ was then and is now dominated by sludge worms, fly larvae, scuds, aquatic pill bugs, bristle worms and an exotic clam. What has changed through time seems to be the scale or magnitude of dominance, and the complement of sub-dominant representatives has grown in some cases and changed in others. Although oligochaetes are still abundant and dominant, it is to a lesser relative degree as abundance of the other taxa has increased. Historical sources from the early to mid 1970's reported oligochaetes as being singularly dominant with relative abundance approaching or surpassing 90 percent of the total benthic macroinvertebrate community. During the present study oligochaetes comprised 57 to 75 percent of the community based on annual mean densities by zones. Changes in oligochaete species composition include the occurrence of less pollution tolerant and more oxygen sensitive genera such as Aulodrilus, Nais, Pristina and Pristinella, and the absence of highly pollution tolerant genera such as Tubifex and Potamothrix. Chironomids historically a very distant second tc oligochaetes, if present at all, exhibited an increase relative abundance during the present study where it comprised 6 to 24 percent of the macroinvertebrate community based on annual densitie by zones.

BENTHIC RESOURCES ASSESSMENT TECHNIQUE

As stated previously, the goal of the BRAT is to assign a more meaningful comparative value to benthic communities through their trophic linkage to important fishes. The goal of performing the BRAT as a demonstration study within the larger benthic survey was to evaluate it as a possible technique for future monitoring and/or management uses. Even though the application of the BRAT in this study was far from text-book in its execution, the primary goal was accomplished in that the data produced does provide a basis for further consideration.

The BRAT provides a landscape of what and where subject fish specie: derive their sustenance. As illustrated in the case of white perch ≤150 mm FL in this study, the channel and shallow/intermediate substrata in Zones 3 and 4 were relatively important summer feeding grounds, and amphipods were a very important food item. Although less complete, the information on white perch >150 mm FL at least suggested the particular importance of the shallow/intermediate substrata in Zones 3 and 4. These facts may be well known to local fisheries experts through their experience and familiarity with the body of fisheries literature, but this knowledge is renewed or updated in a fragmentary fashion as independent studies of specific fishes or macroinvertebrate communities are performed and digested by the scientific community. The BRAT provides current and coincident data measured on an absolute scale allowing the relative comparisons in areas where best or least-worse management decisions must be made.

Obviously, the BRAT has interesting potential if employed as part of a long-term management strategy. If conducted on a regular basis, eg., every five to ten years, the BRAT could provide a standardized database upon which to appraise the relative importance of regions or habitats, as well as certain macroinvertebrates, to critical fish species. It could also be used on a broader scale to periodically inventory the benthic macroinvertebrate communities, if the studies were done at a more discriminating level, i.e., identification below major taxa.

With the future in mind, certain lessons were learned and recommendations can be made relative to critical design criteria. Regarding the selection of fish species to study, guidance will be forthcoming from the STAC/Habitat Task Force when it finalizes its list of important species. Its obvious now that catfish would have been a better choice than spot for this study. Future BRAT efforts should include a seasonal element to account for changes in fish distribution as well as opportunistic dietary shifts that may occur as a function of the seasonality of specific macroinvertebrates. Finally, the coincidence of macroinvertebrate and fisheries sampling is very important. In this study despite the best efforts of both contractors involved, there was nearly a month separating the two sampling experiences. Given this timing gap, the Coincidence and Dietary Coverage Factors were reasonable, but they would only improve if this gap was smaller or non-existent. A smaller gap would also increase the probability that food items found in fish stomachs were in fact captured in the area in question.

CONCLUSIONS

The comprehensive survey of the benthic macroinvertebrate communities in the Delaware River between the C and D Canal and Trenton, NJ performed as a part of this study and reported herein provides at a minimum a thorough characterization of the communities as they existed in the spring, summer and fall of 1992 and winter of 1993. This survey will serve as a baseline for future surveys, and will provide the comprehensive database to be used in the investigation of more specific questions beyond the scope of this study. The questions this study does answer are: what is there, when is it there, how many are there, and where there is. The question of "is what is there better than before" is not so easily answered, because the definition of "better" is an elusive entity, the particulars of which are and will be debated no matter what is put forth as a standard. Therefore, for purposes of this study "better" will judged simply of the premise that change is good, as what existed before was considered less than desirable, and factors contributing to this undesirable state have improved (i.e., water quality).

Change within the species composition and relative abundance of the benthic macroinvertebrate communities within the study area was suggested by the results of this research effort. The existing communities would likely still be characterized as dominated by pollution tolerant species, but there are signs of improvement. Oligochaetes and chironomids, the classic standards for pollution tolerant organisms, were still dominant in the macroinvertebrate communities, but their species composition and relative abundance within the community suggests change in progress. Since the mid 1980's, the addition of new families of oligochaetes, i.e., enchytraeids and naidids, the species diversification within the chironomids, and the ascension to dominance by polychaetes in the lower study area and occurrence in the upper have all lessened the relative level of community dominance formerly maintained by the tubificid oligochaetes. This may indicate that an element of pioneerism is in progress as improved conditions allow. A more pragmatic view might be that its too early to tell if changes are real considering the limitations of the historical database and the snap-shot nature of the present study (one year). What is clear is that comprehensive surveys like this one must be conducted as part of a regular management plan in order to confirm or discount the finding of this study and to provide the necessary information to support the evolving CCMP in the future.

An interesting aside regarding the direction of the CCMP relative to the benthic macroinvertebrate communities, language in the request for proposals for this study indicated a desire to "establish the extent of the recovery of this portion of the estuary has progressed toward developing a fully functional assemblage of organisms." This is not unlike the question of "what is better". Therefore, the question of "what is fully functional" must be addressed to establish some clear management goals. To that end, a clear function of the benthic macroinvertebrate communities is to provide trophic support to higher levels in the food chain, and defining its function relative to visible tangible resources like fish would likely produce popular support and understanding for future actions to enhance and protect this segment of the living resources. Future research should therefore consider a BRAT-type approach to monitoring the benthic communities with a trophically linked goal-oriented management focus.

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Table 1. Collection grids omitted from random selection because they contained no sampleable habitat.

No Sample							
2		3		4		5	
PA	NJ	PA	NJ	PA	NJ	DE	NJ
1 – 13	3 – 8	2 – 26	1 – 27	5 – 19	2 – 5	21 – 24	13 – 18
16 – 23	12 – 14	29 – 46	30 – 34	22 – 26	10	31 – 36	57 – 63
29 – 30	18 – 19			33 – 44	35 – 37	38 – 44	
33 – 35	21 – 27			46 – 52	49 – 52	60 – 63	
56 – 58	29 – 36						
62 – 70	65 – 70						
73 – 75	73 – 75						
78 – 84	78 – 84						

Table 2. Sediment particle size classes, modified Wentworth grade classification.

Particle	Grade Limits	
	millimeters	microns
Pebble	> 4.0	
Granule	4.0 – 2.0	
Very coarse sand	2.0 – 1.0	2000 – 1000
Coarse sand	1.0 – 0.5	1000 – 500
Medium sand	0.5 – 0.25	500 – 250
Fine sand	0.25 – 0.125	250 – 125
Very fine sand	0.125 – 0.062	125 – 62
Silt/ clay	< 0.062	< 62

Table 3. Annual and seasonal mean density (n/m²) of benthic macroinvertebrates taken in the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SEASON	SPRING	SUMMER	FALL	WINTER	ALL
ZONE	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL
HYDROZOA		0.3	1.2		0.4
HYDRIDAE		0.4			0.1
TURBELLARIA	348.1	2.5	2.8	53.5	101.7
NEMERTEA	1.6	17.6	1.9	0.6	5.4
NEMATODA	21.8	50.8	10.2	10.0	23.2
OLIGOCHAETA	43.5	7.6	14.7	0.9	16.7
LUMBRICULIDAE		0.3			0.1
ENCHYTRAEIDAE	158.0	253.7	91.0	110.8	153.4
MEGASCOLECIDAE	1.6				0.4
NAIDIDAE	9.5	6.0	7.2	0.3	5.8
ALLONAIS PECTINATA				0.3	0.1
AMPHICHAETA LEYDIGI				5.0	1.3
ARCTEONAIS LOMONDI	14.1	3.5	1.3	18.2	9.3
CHAETOGASTER SPP.	0.3				0.1
CHAETOGASTER DIAPHANUS	1.5				0.4
NAIS SPP.	53.6				13.4
NAIS BEHNINGI	48.5		1.2		12.4
NAIS BRETSCHERI	0.3				0.1
NAIS COMMUNIS	36.0	6.8	6.3	0.3	12.4
NAIS ELINGUIS	0.6	0.3	0.3		0.3
NAIS VARIABILIS	0.3	139.9	3.1	0.3	35.9
PARANAIS SPP.			0.3	0.6	0.2
PARANAIS FRICI	49.6		4.7	41.2	23.9
PARANAIS LITORALIS	47.2	1.9	6.6	1.2	14.2
PIGUETIELLA MICHIGANENSIS	18.6	18.3		2.5	9.8
PRISTINA SPP.	14.2	21.7	1.2		9.3
PRISTINELLA SPP.			2.5	0.3	0.7
SLAVINA APPENDICULATA	7.9			0.6	2.1
SPECARIA JOSINAE		97.6	67.2	13.2	44.5
TUBIFICIDAE	11.6	2.7	0.3	0.3	3.7
UNIDENTIFIED TUBIFICID #1	90.6	93.9	184.5	39.1	102.0
UNIDENTIFIED TUBIFICID #2	806.9	727.0	1465.7	710.9	927.6
UNIDENTIFIED TUBIFICID #3	99.6				24.9
UNIDENTIFIED TUBIFICID #4			0.3		0.1
AULODRILUS LIMNOBIUS	3.1				0.8
AULODRILUS PIGUETI	11.0	10.2	62.0		20.8
AULODRILUS PLURISETA	0.5				0.1
HABER SPECIOSUS	4.4	0.9			1.3
ILYODRILUS TEMPLETONI			1.9	8.2	2.5
ISOCHAETIDES FREYI	4.1	18.6	3.2	5.3	7.8
LIMNODRILUS SPP.	3.0		0.3	7.6	2.7
LIMNODRILUS CLAPAREDIANUS				3.1	0.8
LIMNODRILUS HOFFMEISTERI	146.1	229.2	45.9	116.4	134.4
LIMNODRILUS UDEKEMIANUS	127.1	41.2	97.4	34.0	74.9
QUISTADRILUS MULTISETOSUS				53.8	13.5
QUISTADRILUS/SPIROSPERMA SPP.	36.1	10.3	22.4		17.2
HIRUDINEA	0.3		0.3		0.2
HELOBDELLA SPP.			1.3		0.3
HELOBDELLA STAGNALLIS				0.3	0.1
PISCICOLIDAE	0.3				0.1
CYSTOBRANCHUS SPP.	1.3				0.3
PISCICOLA PUNCTATA	0.3			0.3	0.2
POLYCHAETA	5.3	0.9		0.3	1.6
NEREIS SUCCINEA				0.3	0.1
MANAYUNKIA SPECIOSA	2.6	13.2		2.8	4.6

Table 3: (continued).

SEASON	SPRING	SUMMER	FALL	WINTER	ALL
ZONE	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL
SPIONIDAE	1.1		0.8		0.5
POLYDORA SPP.				0.3	0.1
SCOLECOLEPIDES VIRIDIS	179.4	35.7	14.7	14.5	61.1
BIVALVIA	7.5	34.2	5.0	1.5	12.0
CORBICULA FLUMINEA	35.7	24.3	47.8	25.8	33.4
RANGIA CUNEATA	0.9	1.5	0.6	0.9	1.0
SPHAERIIDAE	0.9				0.2
PISIDIUM SPP.	2.2		6.9		2.3
ELLIPTIO COMPLANATA				0.3	0.1
ANCYLIDAE	0.6	1.5	0.3	0.3	0.7
LAEVAPEX SPP.	0.3			2.2	0.6
AMNICOLA LIMOSA				0.3	0.1
PHYSIDAE			4.1		1.0
ARTHROPODA		0.3			0.1
ACARIFORMES				0.3	0.1
CLADOCERA	193.0	0.3	0.6		48.5
LEPTODORA KINDTI		1.1			0.3
COPEPODA	14.8	1.0	4.4	2.4	5.6
AMPHIPODA	0.3	0.6			0.2
GAMMARIDEA			0.3		0.1
COROPHIUM SPP.	14.4	5.1	10.1	46.6	19.1
COROPHIUM LACUSTRE	1.5				0.4
GAMMARUS SPP.	113.6	424.0	57.4	2.8	149.5
MONOCULODES EDWARDSI	9.7	0.6	0.3		2.6
CYCLASPIS VARIANS		0.3			0.1
ALMYRACUMA PROXIMOCULI			1.9	0.3	0.5
ISOPODA	3.1				0.8
CYATHURA POLITA	84.3	158.2	48.6	19.4	77.7
ASELLIDAE	0.3				0.1
CAECIDOTEA SPP.	0.3				0.1
CASSIDISCA LUNIFRONS	1.6		4.1	0.6	1.6
CHIRIDOTEA ALMYRA	5.3	9.6	7.6	1.2	5.9
NEOMYSIS AMERICANA		3.2	1.6		1.2
CRANGON SEPTEMSPINOSA			0.5		0.1
EPHEMEROPTERA		0.3			0.1
HEMIPTERA		0.3			0.1
HETEROPTERA	2.5				0.6
OPTIOSERVUS SPP.				0.3	0.1
BEROSUS SPP.	0.3				0.1
TRICHOPTERA	0.6				0.2
LEUCOTRICHIA SPP.				0.3	0.1
LEPIDOPTERA				0.3	0.1
DIPTERA	1.9	0.3			0.6
CERATOPOGONIDAE	5.1	4.1	0.6	2.2	3.0
TIPULIDAE	0.3	0.3			0.2
LIMONIA SPP.	2.2				0.6
ORMOSIA SPP.	3.8				0.9
CHIRONOMIDAE	11.1	1.4	1.8	0.3	3.6
CHIRONOMINAE	2.2	0.3	3.1		1.4
TANYTARSINI	0.9	0.6	0.3		0.5
CLADOTANYTARSUS SPP.	7.6	136.0	0.6		36.0
MICROPSECTRA SPP.		11.5			2.9
RHEOTANYTARSUS SPP.	8.8	0.6	0.6		2.5
TANYTARSUS SPP.	8.5	28.9		0.3	9.4

Table 3: (continued).

SEASON	SPRING	SUMMER	FALL	WINTER	ALL
ZONE	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL
CHIRONOMINI		3.6	0.3	3.0	1.7
CHIRONOMOUS SPP.	0.3	0.4		0.6	0.3
DICROTENDIPES SPP.	2.8	6.9	1.6	0.6	3.0
GLYPTOTENDIPES SPP.				0.3	0.1
POLYPEDILUM SPP.	383.0	342.6	256.2	83.3	266.3
CRYPTOCHIRONOMOUS SPP.	53.9	147.6	14.0	8.4	56.0
ORTHOCLADIINAE	11.0	5.8		0.6	4.4
CRICOTOPUS/ ORTHOCLADIUS SPP.	1.5	50.1	6.6		14.6
NANOCLADIUS SPP.	6.6				1.7
SMITTIA SPP.	0.3				0.1
TANYPODINAE		2.2			0.6
ABLABESMYIA (EXCEPT ANNULATA)	3.8				0.9
ABLABESMYIA SPP.	0.8				0.2
APSECTROTANYPUS SPP.	8.8				2.2
PROCLADIUS SPP.	33.4	6.6	8.8	3.7	13.1
ECTOPROCTA	1.3	0.6			0.5
UNIDENTIFIABLE ORGANISM		0.6	0.6		0.3
UNIDENTIFIED ORGANISM	4.7			9.5	3.5
UNIDENTIFIED ORGANISM 1	12.3	7.4	4.3	4.7	7.2
UNIDENTIFIED ORGANISM 3			0.3		0.1
Total mean density n/m²	3481.9	3237.6	2626.1	1480.4	2706.5
POOLED TAXA					
TURBELLARIA	348.1	2.5	2.8	53.5	101.7
NEMERTEA	1.6	17.6	1.9	0.6	5.4
NEMATODA	21.8	50.8	10.2	10.0	23.2
OLIGOCHAETA	1849.4	1691.6	2091.4	1174.4	1701.7
HIRUDINEA	2.2		1.6	0.6	1.1
POLYCHAETA	188.4	49.8	15.5	18.2	68.0
BIVALVIA	47.2	60.0	60.2	28.5	49.0
GASTROPODA	0.9	1.5	4.4	2.8	2.4
CLADOCERA	193.0	1.4	0.6		48.7
AMPHIPODA	139.6	430.3	68.1	49.4	171.8
CUMACEA		0.3	1.9	0.3	0.6
ISOPODA	94.9	167.8	60.3	21.3	86.1
CHIRONOMIDAE	545.3	745.0	293.8	101.1	421.3
OTHER TAXA	49.7	19.1	13.5	19.9	25.6
PERCENT OF TOTAL					
TURBELLARIA	10.0	0.1	0.1	3.6	3.8
NEMERTEA	0.0	0.5	0.1	0.0	0.2
NEMATODA	0.6	1.6	0.4	0.7	0.9
OLIGOCHAETA	53.1	52.2	79.6	79.3	62.9
HIRUDINEA	0.1		0.1	0.0	0.0
POLYCHAETA	5.4	1.5	0.6	1.2	2.5
BIVALVIA	1.4	1.9	2.3	1.9	1.8
GASTROPODA	0.0	0.0	0.2	0.2	0.1
CLADOCERA	5.5	0.0	0.0		1.8
AMPHIPODA	4.0	13.3	2.6	3.3	6.3
CUMACEA		0.0	0.1	0.0	0.0
ISOPODA	2.7	5.2	2.3	1.4	3.2
CHIRONOMIDAE	15.7	23.0	11.2	6.8	15.6
OTHER TAXA	1.4	0.6	0.5	1.3	0.9

Table 4 Annual and seasonal mean biomass (g/m^2) of benthic macroinvertebrates taken in the Delaware River between the C & D canal and Trenton, NJ, during 1992 and 1993.

SEASON	SPRING	SUMMER	FALL	WINTER	ALL
ZONE	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL
HYDROZOA		0.0003	0.0001		0.0001
HYDRIDAE		0.0002			0.0000
TURBELLARIA	0.0052	0.0005	0.0010	0.0023	0.0023
NEMERTEA	0.0055	0.0070	0.0130	0.0002	0.0064
NEMATODA	0.0004	0.0089	0.0001	0.0007	0.0025
OLIGOCHAETA	0.6640	1.1515	0.8050	0.7204	0.8352
HIRUDINEA	0.0001		0.0003		0.0001
HELOBDELLA SPP.			0.0063		0.0016
HELOBDELLA STAGNALIS				0.0030	0.0007
PISCICOLIDAE	0.0003				0.0001
CYSTOBRANCHUS SPP.	0.0010				0.0003
PISCICOLA PUNCTATA	0.0006			0.0014	0.0005
POLYCHAETA	0.0057	0.0029		0.0004	0.0023
NEREIS SUCCINEA				0.0002	0.0001
MANAYUNKIA SPECIOSA	0.0003	0.0011		0.0008	0.0005
SPIONIDAE	0.0036		0.0003		0.0010
POLYDORA SPP.				0.0000	0.0000
SCOLECOLEPIDES VIRIDIS	3.0369	0.7156	0.5389	0.1422	1.1084
BIVALVIA	0.0361	0.0178	0.0014	0.2539	0.0773
CORBICULA FLUMINEA	0.1139	2.3164	17.0919	14.5430	8.5163
RANGIA CUNEATA	0.7116	0.0116	0.0985	0.0017	0.2059
SPHAERIIDAE	0.0012				0.0003
PISIDIUM SPP.	0.0062		0.0087		0.0037
ELLIPTIO COMPLANATA				0.0989	0.0247
ANCYLIDAE	0.0003	0.0001	0.0001	0.0003	0.0002
LAEVAPEX SPP.	0.0003			0.0030	0.0008
AMNICOLA LIMOSA				0.0011	0.0003
PHYSIDAE			0.0072		0.0018
ARTHROPODA		0.0013			0.0003
ACARIFORMES				0.0010	0.0003
CLADOCERA	0.0156				0.0039
LEPTODORA KINDTI		0.0000			0.0000
COPEPODA	0.0003	0.0000	0.0000	0.0002	0.0002
AMPHIPODA	0.0001	0.0003			0.0001
GAMMARIDEA			0.0017		0.0004
COROPHIUM SPP.	0.0162	0.0032	0.0101	0.0233	0.0132
COROPHIUM LACUSTRE	0.0011				0.0003
GAMMARUS SPP.	0.0892	0.5856	0.1827	0.0246	0.2205
MONOCULODES EDWARDSI	0.0049	0.0005	0.0007		0.0015
CYCLASPIS VARIANS		0.0001			0.0000
ALMYRACUMA PROXIMOCULI			0.0006	0.0001	0.0002
ISOPODA	0.0002				0.0000
CYATHURA POLITA	0.3276	0.6283	0.2250	0.1106	0.3229
ASELLIDAE	0.0000				0.0000
CAECIDOTEA SPP.	0.0001				0.0000
CASSIDISCA LUNIFRONS	0.0022		0.0043	0.0007	0.0018
CHIRIDOTEA ALMYRA	0.0153	0.0125	0.0287	0.0087	0.0163
NEOMYSIS AMERICANA		0.0033	0.0017		0.0012
CRANGON SEPTEMSPINOSA			0.0727		0.0182
EPHEMEROPTERA		0.0002			0.0001
HEMIPTERA					0.0000
HETEROPTERA	0.0004				0.0001
OPTIOSERVUS SPP.				0.0004	0.0001
BEROSUS SPP.	0.0015				0.0004
TRICHOPTERA	0.0002				0.0000
LEUCOTRICHIA SPP.				0.0007	0.0002
LEPIDOPTERA				0.0022	0.0005
DIPTERA	0.0004				0.0001
CERATOPOGONIDAE	0.0013	0.0005	0.0001	0.0007	0.0006
TIPULIDAE	0.0001	0.0009			0.0003
LIMONIA SPP.	0.0125				0.0031
ORMOSIA SPP.	0.0007				0.0002
CHIRONOMIDAE	0.1861	0.1832	0.0552	0.0213	0.1115
ECTOPROCTA	0.0036	0.3157			0.0798
UNIDENTIFIABLE ORGANISM		0.0004	0.0005		0.0002
UNIDENTIFIED ORGANISM	0.0045			0.0006	0.0013
UNIDENTIFIED ORGANISM 1	0.0165	0.0044	0.0042	0.0038	0.0072
UNIDENTIFIED ORGANISM 3					0.0000
Total mean biomass g/m^2	5.2939	5.9745	19.1609	15.9724	11.6004

Table 4: (continued).

POOLED TAXA	DEPTH SUBSTRATUM / ZONE / QUARTER	SPRING	SUMMER	FALL	WINTER	ALL
	ZONE	ALL	ALL	ALL	ALL	ALL
	DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL
TURBELLARIA		0.0052	0.0005	0.0010	0.0023	0.0023
NEMERTEA		0.0055	0.0070	0.0130	0.0002	0.0064
NEMATODA		0.0004	0.0089	0.0001	0.0007	0.0025
OLIGOCHAETA		0.6640	1.1515	0.8050	0.7204	0.8352
HIRUDINEA		0.0021		0.0066	0.0044	0.0033
POLYCHAETA		3.0465	0.7196	0.5392	0.1437	1.1123
BIVALVIA		0.8690	2.3458	17.2005	14.8975	8.8282
GASTROPODA		0.0007	0.0001	0.0072	0.0044	0.0031
CLADOCERA		0.0156				0.0039
AMPHIPODA		0.1115	0.5896	0.1952	0.0479	0.2361
CUMACEA			0.0001	0.0006	0.0001	0.0002
ISOPODA		0.3454	0.6408	0.2579	0.1200	0.3410
CHIRONOMIDAE		0.1861	0.1832	0.0552	0.0213	0.1115
OTHER TAXA		0.0418	0.3273	0.0793	0.0095	0.1145
PERCENT OF TOTAL						
TURBELLARIA		0.10	0.01	0.01	0.01	0.02
NEMERTEA		0.10	0.12	0.07	0.00	0.06
NEMATODA		0.01	0.15	0.00	0.00	0.02
OLIGOCHAETA		12.54	19.27	4.20	4.51	7.20
HIRUDINEA		0.04		0.03	0.03	0.03
POLYCHAETA		57.55	12.04	2.81	0.90	9.59
BIVALVIA		16.42	39.26	89.77	93.27	76.10
GASTROPODA		0.01	0.00	0.04	0.03	0.03
CLADOCERA		0.29				0.03
AMPHIPODA		2.11	9.87	1.02	0.30	2.03
CUMACEA			0.00	0.00	0.00	0.00
ISOPODA		6.52	10.73	1.35	0.75	2.94
CHIRONOMIDAE		3.52	3.07	0.29	0.13	0.96
OTHER TAXA		0.79	5.48	0.41	0.06	0.99
WITHOUT CORBICULA FLUMINEA						
TURBELLARIA		0.0052	0.0005	0.0010	0.0023	0.0023
NEMERTEA		0.0055	0.0070	0.0130	0.0002	0.0064
NEMATODA		0.0004	0.0089	0.0001	0.0007	0.0025
OLIGOCHAETA		0.6640	1.1515	0.8050	0.7204	0.8352
HIRUDINEA		0.0021		0.0066	0.0044	0.0033
POLYCHAETA		3.0465	0.7196	0.5392	0.1437	1.1123
BIVALVIA		0.7551	0.0294	0.1086	0.3545	0.3119
GASTROPODA		0.0007	0.0001	0.0072	0.0044	0.0031
CLADOCERA		0.0156				0.0039
AMPHIPODA		0.1115	0.5896	0.1952	0.0479	0.2361
CUMACEA			0.0001	0.0006	0.0001	0.0002
ISOPODA		0.3454	0.6408	0.2579	0.1200	0.3410
CHIRONOMIDAE		0.1861	0.1832	0.0552	0.0213	0.1115
OTHER TAXA		0.0418	0.3273	0.0793	0.0095	0.1145
	Total mean biomass g/m²	5.1800	3.6581	2.0690	1.4294	3.0841
PERCENT OF TOTAL (w/o CORBICULA)						
TURBELLARIA		0.10	0.01	0.05	0.16	0.07
NEMERTEA		0.11	0.19	0.63	0.01	0.21
NEMATODA		0.01	0.24	0.01	0.05	0.08
OLIGOCHAETA		12.82	31.48	38.90	50.40	27.08
HIRUDINEA		0.04		0.32	0.31	0.11
POLYCHAETA		58.81	19.67	26.06	10.06	36.06
BIVALVIA		14.58	0.80	5.25	24.80	10.11
GASTROPODA		0.01	0.00	0.35	0.31	0.10
CLADOCERA		0.30				0.13
AMPHIPODA		2.15	16.12	9.44	3.35	7.65
CUMACEA			0.00	0.03	0.01	0.01
ISOPODA		6.67	17.52	12.47	8.39	11.06
CHIRONOMIDAE		3.59	5.01	2.67	1.49	3.61
OTHER TAXA		0.81	8.95	3.83	0.67	3.71

Table 5. Annual mean density (n/m²) of benthic macroinvertebrates collected in Zones 2, 3, 4 and 5 in the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SEASON	ALL	ALL	ALL	ALL
ZONE	2	3	4	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL
HYDROZOA		0.3	0.9	0.3
HYDRIDAE		0.4		
TURBELLARIA	18.6	377.0	1.8	9.4
NEMERTEA	0.4	0.6		20.7
NEMATODA	27.2	20.6	36.5	8.4
OLIGOCHAETA	27.2	18.5	16.9	4.1
LUMBRICULIDAE				0.3
ENCHYTRAEIDAE	94.7	235.4	253.1	30.3
MEGASCOLECIDAE	1.6			
NAIDIDAE	14.9	3.2	4.4	0.6
ALLONAIS PECTINATA	0.3			
AMPHICHAETA LEYDIGI	4.1	0.3		0.6
ARCTEONAIS LOMONDI	7.9	27.4	1.5	0.3
CHAETOGASTER SPP.			0.3	
CHAETOGASTER DIAPHANUS		0.3		1.2
NAIS SPP.		47.4	5.7	0.6
NAIS BEHNINGI	0.3	34.1	15.4	
NAIS BRETSCHERI				0.3
NAIS COMMUNIS	3.8	28.4	16.6	0.6
NAIS ELINGUIS	0.3		0.9	
NAIS VARIABILIS	11.0	129.5	2.8	0.3
PARANAIS SPP.	0.3		0.6	
PARANAIS FRICI		68.8	26.7	
PARANAIS LITORALIS	2.5	9.1	39.4	5.9
PIGUETIELLA MICHIGANENSIS		24.2	14.8	0.3
PRISTINA SPP.	35.0	0.3	1.9	
PRISTINELLA SPP.		0.3	2.5	
SLAVINA APPENDICULATA		8.5		
SPECARIA JOSINAE	110.6	33.3	34.0	
TUBIFICIDAE	3.5	6.9	3.9	0.6
UNIDENTIFIED TUBIFICID #1	94.4	179.3	63.9	70.5
UNIDENTIFIED TUBIFICID #2	1328.8	1212.8	682.5	486.5
UNIDENTIFIED TUBIFICID #3				99.6
UNIDENTIFIED TUBIFICID #4				0.3
AULODRILUS LIMNOBIUS	2.5		0.6	
AULODRILUS PIGUETI	26.6	34.0	7.3	15.4
AULODRILUS PLURISETA	0.5			
HABER SPECIOSUS	0.9			4.4
ILYODRILUS TEMPLETONI	8.2	1.9		
ISOCHAETIDES FREYI	10.0	17.9		3.2
LIMNODRILUS SPP.	0.8	7.5	0.3	2.2
LIMNODRILUS CLAPAREDIANUS	3.1			
LIMNODRILUS HOFFMEISTERI	250.0	128.5	119.8	39.3
LIMNODRILUS UDEKEMIANUS	64.5	171.0	57.0	7.2
QUISTADRILUS MULTISETOSUS	42.2	11.7		
QUISTADRILUS/SPIROSPERMA SPP.	67.3	1.3	0.3	
HIRUDINEA	0.3		0.3	
HELOBDELLA SPP.	1.3			
HELOBDELLA STAGNALIS	0.3			
PISCICOLIDAE		0.3		
CYSTOBRANCHUS SPP.	1.0		0.3	
PISCICOLA PUNCTATA	0.3			0.3
POLYCHAETA	4.7	0.9	0.6	0.3
NEREIS SUCCINEA			0.3	
MANAYUNKIA SPECIOSA	2.5	15.8	0.3	

Table 5: (continued).

SEASON	ALL	ALL	ALL	ALL
ZONE	2	3	4	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL
SPIONIDAE		1.1		0.8
POLYDORA SPP.				0.3
SCOLECOLEPIDES VIRIDIS	2.2	9.4	62.0	170.8
BIVALVIA	25.5	14.9	6.2	1.5
CORBICULA FLUMINEA	115.9	13.1	4.4	
RANGIA CUNEATA				4.0
SPHAERIIDAE	0.9			
PISIDIUM SPP.	1.6	5.6	1.9	
ELLIPTIO COMPLANATA	0.3			
ANCYLIDAE	0.6		2.1	
LAEVAPEX SPP.	2.2		0.3	
AMNICOLA LIMOSA	0.3			
PHYSIDAE	4.1			
ARTHROPODA		0.3		
ACARIFORMES	0.3			
CLADOCERA	1.6	73.9	6.9	111.5
LEPTODORA KINDTI	0.3	0.8		
COPEPODA	3.6	4.4	4.4	10.3
AMPHIPODA			0.9	
GAMMARIDEA				0.3
COROPHIUM SPP.			15.4	60.8
COROPHIUM LACUSTRE				1.5
GAMMARUS SPP.	24.8	167.0	352.9	53.1
MONOCULODES EDWARDSI			0.6	10.0
CYCLASPIS VARIANS			0.3	
ALMYRACUMA PROXIMOCULI	0.3		1.9	
ISOPODA		2.8	0.3	
CYATHURA POLITA	34.0	156.4	107.2	13.0
ASELLIDAE			0.3	
CAECIDOTEA SPP.	0.3			
CASSIDISCA LUNIFRONS	3.2		3.1	
CHIRIDOTEA ALMYRA	0.3	5.5	10.6	7.3
NEOMYSIS AMERICANA				4.8
CRANGON SEPTEMSPINOSA				0.5
EPHEMEROPTERA				0.3
HEMIPTERA		0.3		
HETEROPTERA	2.5			
OPTIOSERVUS SPP.	0.3			
BEROSUS SPP.	0.3			
TRICHOPTERA	0.6			
LEUCOTRICHIA SPP.	0.3			
LEPIDOPTERA				0.3
DIPTERA	1.5	0.7		
CERATOPOGONIDAE	8.5	2.1	0.9	0.3
TIPULIDAE			0.3	0.3
LIMONIA SPP.		2.2		
ORMOSIA SPP.	3.8			
CHIRONOMIDAE	4.3	1.5	7.1	1.6
CHIRONOMINAE	0.3	4.4	0.9	
TANYTARSINI	0.3	0.6	0.9	
CLADOTANYTARSUS SPP.	70.5	10.7	62.7	0.4
MICROPSECTRA SPP.	3.9	6.0	1.6	
RHEOTANYTARSUS SPP.	7.6		2.5	
TANYTARSUS SPP.	8.5	25.5	3.4	0.3

Table 5: (continued).

SEASON	ALL	ALL	ALL	ALL
ZONE	2	3	4	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL
CHIRONOMINI	1.2	3.5	1.3	0.9
CHIRONOMOUS SPP.	0.3	0.6	0.4	
DICROTENDIPES SPP.	4.7	6.0	1.2	
GLYPTOTENDIPES SPP.			0.3	
POLYPEDILUM SPP.	190.5	400.6	410.3	63.6
CRYPTOCHIRONOMOUS SPP.	56.8	55.7	103.6	7.7
ORTHOCLADIINAE	9.4	5.7	2.3	
CRICOTOPUS/ ORTHOCLADIUS SPP.	3.2	40.9	14.1	
NANOCLADIUS SPP.	5.0	0.4	1.2	
SMITTIA SPP.				0.3
TANYPODINAE		2.2		
ABLABESMYIA (EXCEPT ANNULATA)	3.8			
ABLABESMYIA SPP.	0.8			
APSECTROTANYPUS SPP.	8.8			
PROCLADIUS SPP.	35.9	10.7	2.8	3.1
ECTOPROCTA		1.0	0.9	
UNIDENTIFIABLE ORGANISM	0.6	0.6		
UNIDENTIFIED ORGANISM	1.3	1.9	1.5	9.5
UNIDENTIFIED ORGANISM 1	18.8	5.2	4.7	
UNIDENTIFIED ORGANISM 3	0.3			
Total mean density n/m²	2950.9	3901.4	2620.8	1352.9

POOLED TAXA

TURBELLARIA	18.6	377.0	1.8	9.4
NEMERTEA	0.4	0.6		20.7
NEMATODA	27.2	20.6	36.5	8.4
OLIGOCHAETA	2217.8	2441.5	1373.0	774.6
HIRUDINEA	3.2	0.3	0.6	0.3
POLYCHAETA	9.3	27.1	63.2	172.2
BIVALVIA	144.3	33.6	12.5	5.5
GASTROPODA	7.2		2.4	
CLADOCERA	1.9	74.7	6.9	111.5
AMPHIPODA	24.8	167.0	369.9	125.7
CUMACEA	0.3		2.2	
ISOPODA	37.8	164.7	121.5	20.3
CHIRONOMIDAE	415.6	575.0	616.7	77.9
OTHER TAXA	42.6	19.3	13.7	26.6

PERCENT OF TOTAL

TURBELLARIA	0.6	9.7	0.1	0.7
NEMERTEA	0.0	0.0		1.5
NEMATODA	0.9	0.5	1.4	0.6
OLIGOCHAETA	75.2	62.6	52.4	57.3
HIRUDINEA	0.1	0.0	0.0	0.0
POLYCHAETA	0.3	0.7	2.4	12.7
BIVALVIA	4.9	0.9	0.5	0.4
GASTROPODA	0.2		0.1	
CLADOCERA	0.1	1.9	0.3	8.2
AMPHIPODA	0.8	4.3	14.1	9.3
CUMACEA	0.0		0.1	
ISOPODA	1.3	4.2	4.6	1.5
CHIRONOMIDAE	14.1	14.7	23.5	5.8
OTHER TAXA	1.4	0.5	0.5	2.0

Table 6. Annual mean density (n/m²) of benthic macroinvertebrates collected in the intertidal (I), shallow/intermediate (S), and channel (C) substrata in the Delaware River between the C & D Canal and Trenton, NJ during 1992 and 1993.

SEASON	ALL	ALL	ALL
ZONE	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C
HYDROZOA		0.7	0.5
HYDRIDAE			0.3
TURBELLARIA	1.1	12.4	291.6
NEMERTEA		3.3	12.9
NEMATODA	41.4	14.4	13.7
OLIGOCHAETA	16.2	17.3	16.5
LUMBRICULIDAE	0.2		
ENCHYTRAEIDAE	133.2	5.6	321.2
MEGASCOLECIDAE	1.2		
NAIDIDAE	8.5	5.2	3.7
ALLONAIS PECTINATA	0.2		
AMPHICHAETA LEYDIGI	0.7	3.1	
ARCTEONAIS LOMONDI	7.8	19.5	0.6
CHAETOGASTER SPP.			0.2
CHAETOGASTER DIAPHANUS	0.2	0.2	0.7
NAIS SPP.	0.7	36.0	3.5
NAIS BEHNINGI	0.5	35.9	0.9
NAIS BRETSCHERI		0.2	
NAIS COMMUNIS	7.5	10.3	19.2
NAIS ELINGUIS	0.2	0.7	
NAIS VARIABILIS	106.5	1.2	
PARANAIS SPP.	0.2	0.5	
PARANAIS FRICI	0.9	70.3	0.5
PARANAIS LITORALIS	6.3	30.2	6.1
PIGUETIELLA MICHIGANENSIS	0.2	2.6	26.7
PRISTINA SPP.	17.0	10.1	0.8
PRISTINELLA SPP.	1.9	0.2	
SLAVINA APPENDICULATA	5.9	0.5	
SPECARIA JOSINAE	0.2	125.1	8.1
TUBIFICIDAE	0.2	8.7	2.2
UNIDENTIFIED TUBIFICID #1	84.5	177.8	43.7
UNIDENTIFIED TUBIFICID #2	370.4	1489.5	923.0
UNIDENTIFIED TUBIFICID #3		74.7	
UNIDENTIFIED TUBIFICID #4		0.2	
AULODRILUS LIMNOBIUS		2.4	
AULODRILUS PIGUETI	16.3	29.4	16.8
AULODRILUS PLURISETA			0.4
HABER SPECIOSUS	4.0		
ILYODRILUS TEMPLETONI		4.0	3.5
ISOCHAETIDES FREYI	2.4	14.2	6.8
LIMNODRILUS SPP.	0.7	5.9	1.5
LIMNODRILUS CLAPAREDIANUS		2.1	0.2
LIMNODRILUS HOFFMEISTERI	13.6	186.1	203.5
LIMNODRILUS UDEKEMIANUS	25.0	64.6	135.1
QUISTADRILUS MULTISETOSUS		20.1	20.3
QUISTADRILUS/SPIROSPERMA SPP.	0.7	37.2	13.8
HIRUDINEA		0.2	0.2
HELOBDELLA SPP.		0.9	
HELOBDELLA STAGNALLIS		0.2	
PISCICOLIDAE	0.2		
CYSTOBRANCHUS SPP.		0.2	0.8
PISCICOLA PUNCTATA			0.5
POLYCHAETA	0.5	4.2	0.2
NEREIS SUCCINEA	0.2		
MANAYUNKIA SPECIOSA	0.5	13.2	0.2

Table 6: (continued).

SEASON	ALL	ALL	ALL
ZONE	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C
SPIONIDAE	0.2	0.8	0.4
POLYDORA SPP.			0.2
SCOLECOLEPIDES VIRIDIS	0.7	64.7	117.9
BIVALVIA	19.1	12.1	5.0
CORBICULA FLUMINEA	12.4	54.7	33.0
RANGIA CUNEATA		3.0	
SPHAERIIDAE		0.7	
PISIDIUM SPP.	0.5	4.0	2.4
ELLIPTIO COMPLANATA		0.2	
ANCYLIDAE	0.2	0.7	1.1
LAEVAPEX SPP.		1.4	0.5
AMNICOLA LIMOSA			0.2
PHYSIDAE	1.4	1.6	
ARTHROPODA	0.2		
ACARIFORMES			0.2
CLADOCERA	54.8	6.8	83.9
LEPTODORA KINDTI	0.2		0.6
COPEPODA	10.8	4.5	1.7
AMPHIPODA		0.5	0.2
GAMMARIDEA	0.2		
COROPHIUM SPP.		16.5	40.7
COROPHIUM LACUSTRE		0.2	0.9
GAMMARUS SPP.	32.9	280.8	134.7
MONOCULODES EDWARDSI	0.7	6.3	0.9
CYCLASPIS VARIANS	0.2		
ALMYRACUMA PROXIMOCULI	0.5	1.2	
ISOPODA	0.2		2.1
CYATHURA POLITA	14.5	173.1	45.3
ASELLIDAE		0.2	
CAECIDOTEA SPP.		0.2	
CASSIDISCA LUNIFRONS	2.4	2.3	
CHIRIDOTEA ALMYRA	1.2	5.3	11.3
NEOMYSIS AMERICANA	0.2	1.2	2.2
CRANGON SEPTEMSPINOSA			0.4
EPHEMEROPTERA	0.2		
HEMIPTERA	0.2		
HETEROPTERA	1.9		
OPTIOSERVUS SPP.			0.2
BEROSUS SPP.	0.2		
TRICHOPTERA		0.5	
LEUCOTRICHIA SPP.		0.2	
LEPIDOPTERA	0.2		
DIPTERA	0.2	0.3	1.1
CERATOPOGONIDAE	3.7	2.8	2.5
TIPULIDAE	0.5		
LIMONIA SPP.	1.7		
ORMOSIA SPP.	2.8		
CHIRONOMIDAE	0.5	6.8	3.7
CHIRONOMINAE		0.9	3.3
TANYTARSINI	0.5	0.9	
CLADOTANYTARSUS SPP.	103.7	1.0	3.5
MICROPSECTRA SPP.	4.2	4.4	
RHEOTANYTARSUS SPP.	0.5	7.1	
TANYTARSUS SPP.	0.2	27.8	0.2

Table 6: (continued).

SEASON	ALL	ALL	ALL
ZONE	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C
CHIRONOMINI	0.2	3.5	1.4
CHIRONOMOUS SPP.		0.7	0.3
DICROTENDIPES SPP.	5.6	3.2	
GLYPTOTENDIPES SPP.		0.2	
POLYPEDILUM SPP.	177.5	367.6	253.7
CRYPTOCHIRONOMOUS SPP.	98.4	63.8	5.7
ORTHOCLADIINAE	4.0	5.9	3.2
CRICOTOPUS/ ORTHOCLADIUS SPP.	37.8	5.6	0.3
NANOCLADIUS SPP.		2.2	2.8
SMITTIA SPP.	0.2		
TANYPODINAE		1.7	
ABLABESMYIA (EXCEPT ANNULATA)		2.8	
ABLABESMYIA SPP.		0.2	0.4
APSECTROTANYPUS SPP.		6.6	
PROCLADIUS SPP.	7.8	26.1	5.5
ECTOPROCTA	0.5	0.7	0.2
UNIDENTIFIABLE ORGANISM	0.9		
UNIDENTIFIED ORGANISM	0.2	1.9	8.5
UNIDENTIFIED ORGANISM 1	0.5	15.1	5.9
UNIDENTIFIED ORGANISM 3		0.2	
Total mean density n/m²	1486.2	3744.8	2888.5
POOLED TAXA			
TURBELLARIA	1.1	12.4	291.6
NEMERTEA		3.3	12.9
NEMATODA	41.4	14.4	13.7
OLIGOCHAETA	834.2	2491.4	1779.6
HIRUDINEA	0.2	1.6	1.4
POLYCHAETA	2.0	82.9	118.9
BIVALVIA	31.9	74.7	40.3
GASTROPODA	1.6	3.7	1.8
CLADOCERA	55.0	6.8	84.4
AMPHIPODA	33.8	304.2	177.5
CUMACEA	0.7	1.2	
ISOPODA	18.3	181.2	58.7
CHIRONOMIDAE	441.0	539.0	283.9
OTHER TAXA	24.9	28.0	23.7
PERCENT OF TOTAL			
TURBELLARIA	0.1	0.3	10.1
NEMERTEA		0.1	0.4
NEMATODA	2.8	0.4	0.5
OLIGOCHAETA	56.1	66.5	61.6
HIRUDINEA	0.0	0.0	0.0
POLYCHAETA	0.1	2.2	4.1
BIVALVIA	2.1	2.0	1.4
GASTROPODA	0.1	0.1	0.1
CLADOCERA	3.7	0.2	2.9
AMPHIPODA	2.3	8.1	6.1
CUMACEA	0.0	0.0	
ISOPODA	1.2	4.8	2.0
CHIRONOMIDAE	29.7	14.4	9.8
OTHER TAXA	1.7	0.7	0.8

Table 7 Annual mean biomass (g/m²) of benthic macroinvertebrates collected in Zones 2, 3, 4 and 5 in the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SEASON	ALL	ALL	ALL	ALL
ZONE	2	3	4	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL
HYDROZOA		0.0003	0.0001	
HYDRIDAE		0.0002		
TURBELLARIA	0.0038	0.0036	0.0001	0.0016
NEMERTEA	0.0001	0.0002		0.0254
NEMATODA	0.0057	0.0013	0.0024	0.0007
OLIGOCHAETA	1.2555	1.3028	0.5231	0.2595
HIRUDINEA	0.0003		0.0001	
HELOBDELLA SPP.	0.0063			
HELOBDELLA STAGNALIS	0.0030			
PISCICOLIDAE		0.0003		
CYSTOBRANCHUS SPP.	0.0008		0.0002	
PISCICOLA PUNCTATA	0.0014			0.0006
POLYCHAETA	0.0055	0.0031	0.0001	0.0004
NEREIS SUCCINEA			0.0002	
MANAYUNKIA SPECIOSA	0.0007	0.0014	0.0001	
SPIONIDAE		0.0036		0.0003
POLYDORA SPP.				0.0000
SCOLECOLEPIDES VIRIDIS	0.0043	0.0889	1.2787	3.0618
BIVALVIA	0.2969	0.0064	0.0039	0.0020
CORBICULA FLUMINEA	33.3756	0.5892	0.1003	
RANGIA CUNEATA				0.8234
SPHAERIIDAE	0.0012			
PISIDIUM SPP.	0.0060	0.0069	0.0020	
ELLIPTIO COMPLANATA	0.0989			
ANCYLIDAE	0.0004		0.0004	
LAEVAPEX SPP.	0.0030		0.0003	
AMNICOLA LIMOSA	0.0011			
PHYSIDAE	0.0072			
ARTHROPODA		0.0013		
ACARIFORMES	0.0010			
CLADOCERA	0.0001	0.0055	0.0004	0.0095
LEPTODORA KINDTI	0.0000			
COPEPODA	0.0001	0.0001	0.0001	0.0003
AMPHIPODA			0.0005	
GAMMARIDEA				0.0017
COROPHIUM SPP.			0.0194	0.0334
COROPHIUM LACUSTRE				0.0011
GAMMARUS SPP.	0.0549	0.2262	0.5102	0.0908
MONOCULODES EDWARDSI			0.0004	0.0056
CYCLASPIS VARIANS			0.0001	
ALMYRACUMA PROXIMOCULI	0.0001		0.0006	
ISOPODA		0.0001	0.0001	
CYATHURA POLITA	0.1604	0.5958	0.3320	0.2033
ASELLIDAE			0.0000	
CAECIDOTEA SPP.	0.0001			
CASSIDISCA LUNIFRONS	0.0032		0.0040	
CHIRIDOTEA ALMYRA	0.0047	0.0278	0.0186	0.0143
NEOMYSIS AMERICANA				0.0050
CRANGON SEPTEMSPINOSA				0.0727
EPHEMEROPTERA				0.0002
HEMIPTERA				
HETEROPTERA	0.0004			
OPTIOSERVUS SPP.	0.0004			
BEROSUS SPP.	0.0015			
TRICHOPTERA	0.0002			
LEUCOTRICHIA SPP.	0.0007			
LEPIDOPTERA				0.0022
DIPTERA	0.0002	0.0003		
CERATOPOGONIDAE	0.0019	0.0001	0.0004	0.0001
TIPULIDAE			0.0009	0.0001
LIMONIA SPP.		0.0125		
ORMOSIA SPP.	0.0007			
CHIRONOMIDAE	0.1314	0.1875	0.1062	0.0208
ECTOPROCTA		0.3179	0.0014	
UNIDENTIFIABLE ORGANISM	0.0005	0.0004		
UNIDENTIFIED ORGANISM	0.0043	0.0001	0.0001	0.0006
UNIDENTIFIED ORGANISM 1	0.0201	0.0062	0.0026	
UNIDENTIFIED ORGANISM 3				
Total mean biomass g/m²	35.4645	3.3898	2.9099	4.6374

Table 7 (continued).

POOLED TAXA	SEASON / ZONE / DEPTH SUBSTRATUM	ALL / 2 / ALL	ALL / 3 / ALL	ALL / 4 / ALL	ALL / 5 / ALL
TURBELLARIA		0.0038	0.0036	0.0001	0.0016
NEMERTEA		0.0001	0.0002		0.0254
NEMATODA		0.0057	0.0013	0.0024	0.0007
OLIGOCHAETA		1.2555	1.3028	0.5231	0.2595
HIRUDINEA		0.0119	0.0003	0.0003	0.0006
POLYCHAETA		0.0106	0.0970	1.2790	3.0625
BIVALVIA		33.7787	0.6025	0.1061	0.8255
GASTROPODA		0.0116		0.0007	
CLADOCERA		0.0001	0.0055	0.0004	0.0095
AMPHIPODA		0.0549	0.2262	0.5305	0.1326
CUMACEA		0.0001		0.0007	
ISOPODA		0.1683	0.6237	0.3546	0.2176
CHIRONOMIDAE		0.1314	0.1875	0.1062	0.0208
OTHER TAXA		0.0320	0.3393	0.0057	0.0811
PERCENT OF TOTAL					
TURBELLARIA		0.01	0.11	0.00	0.03
NEMERTEA		0.00	0.00		0.55
NEMATODA		0.02	0.04	0.08	0.02
OLIGOCHAETA		3.54	38.43	17.97	5.60
HIRUDINEA		0.03	0.01	0.01	0.01
POLYCHAETA		0.03	2.86	43.95	66.04
BIVALVIA		95.25	17.78	3.65	17.80
GASTROPODA		0.03		0.02	
CLADOCERA		0.00	0.16	0.02	0.21
AMPHIPODA		0.15	6.67	18.23	2.86
CUMACEA		0.00		0.02	
ISOPODA		0.47	18.40	12.19	4.69
CHIRONOMIDAE		0.37	5.53	3.65	0.45
OTHER TAXA		0.09	10.01	0.19	1.75
WITHOUT CORBICULA FLUMINEA					
TURBELLARIA		0.0038	0.0036	0.0001	0.0016
NEMERTEA		0.0001	0.0002		0.0254
NEMATODA		0.0057	0.0013	0.0024	0.0007
OLIGOCHAETA		1.2555	1.3028	0.5231	0.2595
HIRUDINEA		0.0119	0.0003	0.0003	0.0006
POLYCHAETA		0.0106	0.0970	1.2790	3.0625
BIVALVIA		0.4030	0.0133	0.0058	0.8255
GASTROPODA		0.0116		0.0007	
CLADOCERA		0.0001	0.0055	0.0004	0.0095
AMPHIPODA		0.0549	0.2262	0.5305	0.1326
CUMACEA		0.0001		0.0007	
ISOPODA		0.1683	0.6237	0.3546	0.2176
CHIRONOMIDAE		0.1314	0.1875	0.1062	0.0208
OTHER TAXA		0.0320	0.3393	0.0057	0.0811
	Total mean biomass g/m^2	2.0888	2.8006	2.8097	4.6374
PERCENT OF TOTAL (w/o CORBICULA)					
TURBELLARIA		0.18	0.13	0.00	0.03
NEMERTEA		0.00	0.01		0.55
NEMATODA		0.27	0.05	0.09	0.02
OLIGOCHAETA		60.11	46.52	18.62	5.60
HIRUDINEA		0.57	0.01	0.01	0.01
POLYCHAETA		0.51	3.46	45.52	66.04
BIVALVIA		19.29	0.47	0.21	17.80
GASTROPODA		0.56		0.03	
CLADOCERA		0.01	0.20	0.02	0.21
AMPHIPODA		2.63	8.08	18.88	2.86
CUMACEA		0.00		0.02	
ISOPODA		8.05	22.27	12.62	4.69
CHIRONOMIDAE		6.29	6.69	3.78	0.45
OTHER TAXA		1.53	12.11	0.20	1.75

Table 8 Annual mean biomass (g/m²) of benthic macroinvertebrates collected in the intertidal (I), shallow/intermediate (S), and channel (C) substrata in the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SEASON	ALL	ALL	ALL
ZONE	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C
HYDROZOA		0.0003	0.0000
HYDRIDAE			0.0001
TURBELLARIA	0.0005	0.0027	0.0036
NEMERTEA		0.0177	0.0016
NEMATODA	0.0061	0.0012	0.0004
OLIGOCHAETA	0.2572	1.1596	1.0889
HIRUDINEA		0.0002	0.0001
HELOBDELLA SPP.		0.0047	
HELOBDELLA STAGNALLIS		0.0022	
PISCICOLIDAE	0.0003		
CYSTOBRANCHUS SPP.		0.0001	0.0006
PISCICOLA PUNCTATA			0.0015
POLYCHAETA	0.0004	0.0062	0.0002
NEREIS SUCCINEA	0.0002		
MANAYUNKIA SPECIOSA	0.0004	0.0012	
SPIONIDAE	0.0004	0.0025	
POLYDORA SPP.			0.0000
SCOLECOLEPIDES VIRIDIS	0.0035	0.7085	2.6133
BIVALVIA	0.0115	0.1938	0.0266
CORBICULA FLUMINEA	0.3620	14.1653	11.0215
RANGIA CUNEATA		0.6176	
SPHAERIIDAE		0.0009	
PISIDIUM SPP.	0.0001	0.0082	0.0029
ELLIPTIO COMPLANATA		0.0742	
ANCYLIDAE		0.0004	0.0002
LAEVAPEX SPP.		0.0022	0.0003
AMNICOLA LIMOSA			0.0008
PHYSIDAE	0.0016	0.0037	
ARTHROPODA	0.0009		
ACARIFORMES			0.0008
CLADOCERA	0.0041	0.0004	0.0072
LEPTODORA KINDTI	0.0000		
COPEPODA	0.0002	0.0002	0.0001
AMPHIPODA		0.0003	0.0001
GAMMARIDEA	0.0013		
COROPHIUM SPP.		0.0186	0.0210
COROPHIUM LACUSTRE		0.0001	0.0007
GAMMARUS SPP.	0.0490	0.1867	0.4259
MONOCULODES EDWARDSI	0.0008	0.0034	0.0004
CYCLASPIS VARIANS	0.0001		
ALMYRACUMA PROXIMOCULI	0.0003	0.0002	
ISOPODA	0.0000		0.0001
CYATHURA POLITA	0.0761	0.6805	0.2120
ASELLIDAE		0.0000	
CAECIDOTEA SPP.		0.0000	
CASSIDISCA LUNIFRONS	0.0024	0.0030	
CHIRIDOTEA ALMYRA	0.0007	0.0208	0.0275
NEOMYSIS AMERICANA	0.0003	0.0018	0.0016
CRANGON SEPTEMSPINOSA			0.0545
EPHEMEROPTERA	0.0002		
HEMIPTERA			
HETEROPTERA	0.0003		
OPTIOSERVUS SPP.			0.0003
BEROSUS SPP.	0.0012		
TRICHOPTERA		0.0001	
LEUCOTRICHIA SPP.		0.0005	
LEPIDOPTERA	0.0016		
DIPTERA		0.0002	0.0001
CERATOPOGONIDAE	0.0007	0.0002	0.0009
TIPULIDAE	0.0007		
LIMONIA SPP.	0.0094		
ORMOSIA SPP.	0.0005		
CHIRONOMIDAE	0.0933	0.1851	0.0560
ECTOPROCTA	0.2367	0.0022	0.0006
UNIDENTIFIABLE ORGANISM	0.0007		
UNIDENTIFIED ORGANISM	0.0000	0.0033	0.0005
UNIDENTIFIED ORGANISM 1	0.0001	0.0195	0.0021
UNIDENTIFIED ORGANISM 3			
Total mean biomass g/m²	1.1258	18.1005	15.5750

Table 8: (continued).

POOLED TAXA	SEASON / ZONE / DEPTH SUBSTRATUM	ALL / ALL / I	ALL / ALL / S	ALL / ALL / C
TURBELLARIA		0.0005	0.0027	0.0036
NEMERTEA			0.0177	0.0016
NEMATODA		0.0061	0.0012	0.0004
OLIGOCHAETA		0.2572	1.1596	1.0889
HIRUDINEA		0.0003	0.0073	0.0023
POLYCHAETA		0.0049	0.7184	2.6135
BIVALVIA		0.3737	15.0600	11.0509
GASTROPODA		0.0016	0.0063	0.0013
CLADOCERA		0.0041	0.0004	0.0072
AMPHIPODA		0.0511	0.2091	0.4480
CUMACEA		0.0004	0.0002	
ISOPODA		0.0791	0.7044	0.2396
CHIRONOMIDAE		0.0933	0.1851	0.0560
OTHER TAXA		0.2536	0.0281	0.0618
PERCENT OF TOTAL				
TURBELLARIA		0.04	0.01	0.02
NEMERTEA			0.10	0.01
NEMATODA		0.54	0.01	0.00
OLIGOCHAETA		22.84	6.41	6.99
HIRUDINEA		0.02	0.04	0.01
POLYCHAETA		0.44	3.97	16.78
BIVALVIA		33.20	83.20	70.95
GASTROPODA		0.14	0.03	0.01
CLADOCERA		0.37	0.00	0.05
AMPHIPODA		4.53	1.16	2.88
CUMACEA		0.03	0.00	
ISOPODA		7.03	3.89	1.54
CHIRONOMIDAE		8.29	1.02	0.36
OTHER TAXA		22.52	0.16	0.40
WITHOUT CORBICULA FLUMINEA				
TURBELLARIA		0.0005	0.0027	0.0036
NEMERTEA			0.0177	0.0016
NEMATODA		0.0061	0.0012	0.0004
OLIGOCHAETA		0.2572	1.1596	1.0889
HIRUDINEA		0.0003	0.0073	0.0023
POLYCHAETA		0.0049	0.7184	2.6135
BIVALVIA		0.0116	0.8946	0.0294
GASTROPODA		0.0016	0.0063	0.0013
CLADOCERA		0.0041	0.0004	0.0072
AMPHIPODA		0.0511	0.2091	0.4480
CUMACEA		0.0004	0.0002	
ISOPODA		0.0791	0.7044	0.2396
CHIRONOMIDAE		0.0933	0.1851	0.0560
OTHER TAXA		0.2536	0.0281	0.0618
	Total mean biomass g/m²	0.7637	3.9352	4.5535
PERCENT OF TOTAL (w/o CORBICULA)				
TURBELLARIA		0.06	0.07	0.08
NEMERTEA			0.45	0.04
NEMATODA		0.79	0.03	0.01
OLIGOCHAETA		33.67	29.47	23.91
HIRUDINEA		0.03	0.19	0.05
POLYCHAETA		0.64	18.26	57.39
BIVALVIA		1.53	22.73	0.65
GASTROPODA		0.21	0.16	0.03
CLADOCERA		0.54	0.01	0.16
AMPHIPODA		6.68	5.31	9.84
CUMACEA		0.05	0.01	
ISOPODA		10.36	17.90	5.26
CHIRONOMIDAE		12.22	4.70	1.23
OTHER TAXA		33.20	0.72	1.36

Table 9. Seasonal mean density (n/m^2) of benthic macroinvertebrates collected in Zones 2,3,4 and 5 in the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SEASON	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
ZONE	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
HYDROZOA						1.2					3.6				1.2	
HYDRIDAE						1.5										
TURBELLARIA	54.6	1.2	10.1	8.5	1304.1	1.2		202.8	3.7	1.2		2.5	30.0	6.3	1.2	
NEMERTEA		1.5						2.4					6.3	68.9	7.5	
NEMATODA	24.8	51.7	3.6	28.7	36.3	28.8	8.7	8.7	15.0	104.8	25.1	1.2	11.2	18.1	3.2	1.2
OLIGOCHAETA	40.8	22.0	43.3	2.5	65.7	7.1	1.2		57.7		10.1		9.9	1.2	4.1	1.2
LUMBRICULIDAE														1.2		
ENCHYTRAEIDAE	30.1	35.4	67.9	245.5	521.8	234.8	1.2	183.8	18.6	731.4	258.3	4.1	61.5	13.2	36.5	10.0
MEGASCOLECIDAE	6.3															
NAIDIDAE	26.8	20.1	12.5		7.5	3.9		1.2	1.2		16.3		2.5			
ALLONAIS PECTINATA				1.2												
AMPHICHAETA LEYDIGI				16.3				1.2								2.5
ARCTEONAIS LOMONDI	12.5	14.1		5.0	41.5		5.0	62.9	1.2			4.9	1.2			
CHAETOGASTER SPP.									1.2							
CHAETOGASTER DIAPHANUS					1.2								4.9			
NAIS SPP					189.5				22.6				2.5			
NAIS BEHNINGI			1.2		136.2				57.9		3.7					
NAIS BRETSCHERI													1.2			
NAIS COMMUNIS	4.1	11.0			99.8	13.8			37.7	2.4	25.2	1.2	2.5			
NAIS ELINGUIS			1.2						2.5	1.2						
NAIS VARIABILIS		44.1				514.1	3.7			1.2	8.8	1.2	1.2			
PARANAIS SPP			1.2									2.5				
PARANAIS FRICI					180.8		18.9	75.4	17.5			89.4				
PARANAIS LITORALIS		6.3	2.5	1.2	30.2	1.2	5.0		151.1		6.3		7.4		12.6	3.7
PIGUETIELLA MICHIGANENSIS					74.3	13.8		8.6		59.4						1.2
PRISTINA SPP	55.8	81.9	2.5			1.2			1.2	3.7	2.5					
PRISTINELLA SPP.								1.2			10.1					
SLAVINA APPENDICULATA					31.5			2.5								
SPECARIA JOSINAE		371.8	54.6	16.3		2.5	128.4	2.4		16.3	85.6	33.9				
TUBIFICIDAE	13.8				26.4			1.2	6.3	9.4				1.2	1.2	
UNIDENTIFIED TUBIFICD #1	49.9	117.9	142.2	67.8	49.4	246.1	353.9	67.9	161.1	11.8	67.9	14.5	101.9		173.8	6.2
UNIDENTIFIED TUBIFICD #2	1293.0	1236.5	1743.0	1042.9	1674.7	839.3	1520.8	816.3	135.8	799.6	1224.3	570.2	124.3	32.7	1374.6	414.3
UNIDENTIFIED TUBIFICD #3													398.2			
UNIDENTIFIED TUBIFICD #4															1.2	
AULODRILUS LIMNOBIUS	10.1								2.5							
AULODRILUS PIGUETI		9.3	96.9		35.3	11.2	89.5		8.7	20.4					61.7	
AULODRILUS PLURISETA	2.0															
HABER SPECIOSUS		3.7											17.6			
ILYODRILUS TEMPLETONI				32.7			7.5									
ISOCHAETIDES FREYI	12.6	12.6		15.0	3.7	61.7		6.3							12.6	
LIMNODRILUS SPP.	3.2				6.2			23.9			1.2		2.5			6.3
LIMNODRILUS CLAPAREDIANUS				12.5												
LIMNODRILUS HOFFMEISTERI	211.1	502.4	53.8	232.7	219.7	112.0	90.7	91.7	47.8	300.0	13.8	117.4	105.7	2.5	25.2	23.7
LIMNODRILUS UDEKEMIANUS	117.9	34.2	69.8	36.3	313.7	100.7	259.5	10.1	75.5	29.8	32.7	89.8	1.2		27.7	
QUISTADRILUS MULTISETOSUS				168.7				46.6								
QUISTADRILUS/SPIROSPERMA SPP.	143.4	36.0	89.7			5.2			1.2							
HIRUDINEA			1.2						1.2							
HELOBDELLA SPP.			5.0													
HELOBDELLA STAGNALLIS				1.2												
PISCICOLIDAE					1.2											
CYSTOBRANCHUS SPP.	4.1								1.2							
PISCICOLA PUNCTATA				1.2									1.2			
POLYCHAETA	18.7				1.2	2.5			1.2	1.2						1.2
NEREIS SUCCINEA												1.2				
MANAYUNKIA SPECIOSA				9.9	10.2	52.9						1.2				

Table 9. (continued).

SEASON	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
ZONE	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
SPIONIDAE					4.3										3.2	
POLYDORA SPP.																1.2
SCOLECOLEPIDES VIRIDIS	8.6				33.1	4.3			197.5	2.5	37.7	10.4	478.5	135.9	21.0	47.5
BIVALVIA	5.2	89.5	3.7	3.7	18.6	37.5	2.5	1.2	1.2	8.7	13.8	1.2	4.9	1.2		
CORBICULA FLUMINEA	141.6	42.9	177.4	101.9	1.2	37.6	13.7			16.6		1.2				
RANGIA CUNEATA													3.7	6.1	2.4	3.7
SPHAERIIDAE	3.7															
PISIDIUM SPP.	6.3				2.5		19.9				7.5					
ELLIPTIO COMPLANATA				1.2												
ANCYLIDAE	1.2			1.2					1.2	5.9	1.2					
LAEVAPEX SPP.				8.7					1.2							
AMNICOLA LIMOSA				1.2												
PHYSIDAE			16.3													
ARTHROPODA						1.2										
ACARIFORMES				1.2												
CLADOCERA	6.2				294.4	1.2			25.1		2.5		446.1			
LEPTODORA KINDTI		1.2				3.1										
COPEPODA	10.3	1.5	1.2	1.2	10.2	2.4	2.5	2.4	17.5				21.3		13.8	6.1
AMPHIPODA									1.2	2.5						
GAMMARIDEA															1.2	
COROPHIUM SPP.									55.3		6.3		2.4	20.4	34.2	166.4
COROPHIUM LACUSTRE													6.1			
GAMMARUS SPP.	14.1	34.4	49.4	1.2	17.7	592.5	56.6	1.2	303.4	1024.3	64.1		119.3	44.9	39.6	8.7
MONOCULODES EDWARDSI									2.5				36.2	2.5	1.2	
CYCLASPIS VARIANS										1.2						
ALMYRACUMA PROXIMOCULI				1.2							7.5					
ISOPODA					11.3				1.2							
CYATHURA POLITA	81.2	16.8	30.7	7.5	110.2	433.5	54.0	27.7	143.4	157.6	94.1	33.8	2.5	25.0	15.7	8.8
ASELLIDAE									1.2							
CAECIDOTEA SPP.	1.2															
CASSIDISCA LUNIFRONS			12.6						6.2		3.7	2.5				
CHIRIDOTEA ALMYRA	1.2				2.4	4.7	12.5	2.4	5.0	27.6	8.5	1.2	12.4	6.1	9.4	1.2
NEOMYSIS AMERICANA														12.8	6.5	
CRANGON SEPTEMSPINOSA															2.0	
EPHEMEROPTERA														1.2		
HEMIPTERA						1.2										
HETEROPTERA	10.1															
OPTIOSERVUS SPP.				1.2												
BEROSUS SPP.	1.2															
TRICHOPTERA	2.5															
LEUCOTRICHIA SPP.				1.2												
LEPIDOPTERA																1.2
DIPTERA	6.1				1.5	1.2										
CERATOPOGONIDAE	12.8	12.7		8.6	7.4		1.2			3.7					1.2	
TIPULIDAE										1.2			1.2			
LIMONIA SPP.					8.8											
ORMOSIA SPP.	15.0															
CHIRONOMIDAE	14.5	1.5	1.2		4.9			1.2	22.4	2.5	3.7		2.5	1.5	2.4	
CHIRONOMINAE			1.2		8.8		8.8			1.2	2.5					
TANYTARSINI	1.2					2.5			2.5		1.2					
CLADOTANYTARSUS SPP.	6.3	273.1	2.5		1.5	41.3			22.7	227.9				1.5		
MICROPSECTRA SPP.		15.6				23.8				6.3						
RHEOTANYTARSUS SPP.	30.2								4.9	2.5	2.5					
TANYTARSUS SPP.	33.9					102.0				13.7						1.2
CHIRONOMINI			1.2	3.7		11.3		2.5		3.1		2.0				3.7

Table 9. (continued).

SEASON	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
ZONE	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
DEPTH SUBSTRATA	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
CHIRONOMOUS SPP.	1.2							2.5		1.5						
DICROTENDIPES SPP.	11.2		6.3	1.2		22.6		1.2		4.9						
GLYPTOTENDIPES SPP.												1.2				
POLYPEDILUM SPP.	408.3	215.5	36.2	101.9	615.4	839.0	62.7	85.3	455.8	279.9	857.7	46.0	52.5	35.8	68.0	98.1
CRYPTOCHIRONOMOUS SPP.	114.0	72.0	23.6	17.5	64.1	136.3	18.8	3.7	14.9	382.1	7.4	10.0	22.4		6.1	2.4
ORTHOCLADIINAE	35.2			2.4	2.7	20.1			6.2	3.1						
CRICOTOPUS/ ORTHOCLADIUS SPP.	3.7	9.0			1.2	162.5			1.2	28.9	26.4					
NANOCLADIUS SPP.	20.1				1.5				4.9							
SMITTIA SPP.													1.2			
TANYPODINAE						8.8										
ABLABESMYIA (EXCEPT ANNULATA)	15.1															
ABLABESMYIA SPP.	3.2															
APSECTROTANYPUS SPP.	35.3															
PROCLADIUS SPP.	84.6	20.3	30.1	8.7	36.5	6.2			11.3				1.2		4.9	6.1
ECTOPROCTA					1.5	2.4			3.6							
UNIDENTIFIABLE ORGANISM			2.5			2.5										
UNIDENTIFIED ORGANISM	5.0				7.5				6.1							37.8
UNIDENTIFIED ORGANISM 1	32.9	12.3	11.2	18.7	6.3	12.1	2.4		10.1	5.2	3.7					
UNIDENTIFIED ORGANISM 3			1.2													
Total mean density n/m²	3319.6	3432.0	2810.6	2241.3	6337.7	4770.5	2749.5	1748.0	2161.2	4308.1	2967.3	1046.7	2109.0	440.0	1977.1	885.5
POOLED TAXA																
TURBELLARIA	54.6	1.2	10.1	8.5	1304.1	1.2		202.8	3.7	1.2		2.5	30.0	6.3	1.2	
NEMERTEA		1.5						2.4					6.3	68.9	7.5	
NEMATODA	24.8	51.7	3.6	28.7	36.3	28.8	8.7	8.7	15.0	104.6	25.1	1.2	11.2	18.1	3.2	1.2
OLIGOCHAETA	2033.3	2559.2	2382.3	1896.6	3709.1	2168.7	2465.3	1402.9	809.3	1986.8	1766.7	929.1	846.1	52.0	1731.2	469.0
HIRUDINEA	4.1		6.2	2.4	1.2				2.4				1.2			
POLYCHAETA	27.4			9.9	48.8	59.6			198.7	3.7	37.7	12.8	478.5	135.9	24.2	49.9
BIVALVIA	156.8	132.4	181.2	106.7	22.2	75.1	36.1	1.2	1.2	25.2	21.3	2.4	8.5	7.3	2.4	3.7
GASTROPODA	1.2		16.3	11.1					2.4	5.9	1.2					
CLADOCERA	6.2	1.2			294.4	4.3			25.1		2.5		446.1			
AMPHIPODA	14.1	34.4	49.4	1.2	17.7	592.5	56.6	1.2	362.4	1026.7	90.3		164.0	67.7	76.2	195.1
CUMACEA				1.2						1.2	7.5					
ISOPODA	83.6	16.8	43.3	7.5	124.0	438.2	66.5	30.1	157.0	185.2	106.3	37.5	14.9	31.1	25.1	10.0
CHIRONOMIDAE	817.9	607.2	102.2	135.3	736.7	1376.5	90.3	96.3	546.8	957.6	901.3	61.2	79.7	38.8	81.4	111.5
OTHER TAXA	95.9	26.5	16.1	32.1	43.2	25.7	6.1	2.4	37.3	10.1	7.3		22.5	14.0	24.7	45.1
PERCENT OF TOTAL																
TURBELLARIA	1.6	0.0	0.4	0.4	20.6	0.0		11.6	0.2	0.0		0.2	1.4	1.4	0.1	
NEMERTEA		0.0						0.1					0.3	15.7	0.4	
NEMATODA	0.7	1.5	0.1	1.3	0.6	0.6	0.3	0.5	0.7	2.4	0.8	0.1	0.5	4.1	0.2	0.1
OLIGOCHAETA	61.2	74.6	84.8	84.6	58.5	45.5	90.4	80.3	37.4	46.1	59.5	88.8	40.1	11.8	87.6	53.0
HIRUDINEA	0.1		0.2	0.1	0.0				0.1				0.1			
POLYCHAETA	0.8			0.4	0.8	1.3			9.2	0.1	1.3	1.2	22.7	30.9	1.2	5.6
BIVALVIA	4.7	3.9	6.4	4.8	0.4	1.6	1.3	0.1	0.1	0.6	0.7	0.2	0.4	1.7	0.1	0.4
GASTROPODA	0.0		0.6	0.5					0.1	0.1	0.0					
CLADOCERA	0.2	0.0			4.6	0.1			1.2		0.1		21.2			
AMPHIPODA	0.4	1.0	1.8	0.1	0.3	12.4	2.1	0.1	16.8	23.8	3.0		7.8	15.4	3.9	22.0
CUMACEA				0.1						0.0	0.3					
ISOPODA	2.5	0.5	1.5	0.3	2.0	9.2	2.4	1.7	7.3	4.3	3.6	3.6	0.7	7.1	1.3	1.1
CHIRONOMIDAE	24.6	17.7	3.6	6.0	11.6	28.9	3.3	5.5	25.3	22.2	30.4	5.8	3.8	8.8	4.1	12.6
OTHER TAXA	2.9	0.8	0.6	1.4	0.7	0.5	0.2	0.1	1.7	0.2	0.2		1.1	3.2	1.2	5.1

Table 10. Seasonal mean biomass (g/m²) of benthic macroinvertebrates collected in Zones 2, 3, 4 and 5 in the Delaware River between the C & D Canal and Trenton, NJ during 1992 and 1993.

SEASON	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
ZONE	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
HYDROZOA						0.0013					0.0005					
HYDRIDAE						0.0008										
TURBELLARIA	0.0080	0.0006	0.0038	0.0027	0.0068	0.0014		0.0062	0.0001			0.0004	0.0059	0.0001	0.0001	
NEMERTEA		0.0003						0.0006					0.0221	0.0277	0.0520	
NEMATODA	0.0010	0.0196		0.0023	0.0003	0.0048		0.0003	0.0002	0.0089	0.0005	0.0001	0.0002	0.0024		0.0001
OLIGOCHAETA	0.5465	2.2156	0.9259	1.3340	1.5278	1.4853	1.2717	0.9265	0.2784	0.8852	0.4309	0.4976	0.3031	0.0200	0.5913	0.1236
HIRUDINEA			0.0013						0.0005							
HELOBDELLA SPP.			0.0252													
HELOBDELLA STAGNALLIS				0.0120												
PISCICOLIDAE					0.0014											
CYSTOBRANCHUS SPP.	0.0034								0.0006							
PISCICOLA PUNCTATA				0.0057									0.0025			
POLYCHAETA	0.0220				0.0009	0.0115				0.0002						0.0018
NEREIS SUCCINEA												0.0009				
MANAYUNKIA SPECIOSA				0.0029	0.0011	0.0044						0.0004				
SPIONIDAE					0.0143										0.0011	
POLYDORA SPP.																0.0001
SCOLECOLEPIDES VIRIDIS	0.0173				0.2855	0.0702			3.0696	0.0445	1.9266	0.0739	8.7753	2.7477	0.2291	0.4950
BIVALVIA	0.1338	0.0396	0.0006	1.0137	0.0026	0.0220	0.0006	0.0004	0.0002	0.0093	0.0043	0.0016	0.0079	0.0001		
CORBICULA FLUMINEA	0.4276	7.7818	67.3274	57.9658	0.0280	1.2888	1.0402			0.1948		0.2062				
RANGIA CUNEATA													2.8464	0.0465	0.3941	0.0068
SPHAERIIDAE	0.0048															
PISIDIUM SPP.	0.0241				0.0008		0.0268				0.0079					
ELLIPTIO COMPLANATA				0.3955												
ANCYLIDAE	0.0004			0.0013					0.0010	0.0003	0.0002					
LAEVAPEX SPP.				0.0121					0.0014							
AMNICOLA LIMOSA				0.0043												
PHYSIDAE			0.0286													
ARTHROPODA						0.0050										
ACARIFORMES				0.0040												
CLADOCERA	0.0005				0.0219				0.0018				0.0382			
LEPTODORA KINDTI		0.0001														
COPEPODA	0.0006					0.0001		0.0001	0.0004				0.0004		0.0001	0.0007
AMPHIPODA									0.0005	0.0014						
GAMMARIDEA															0.0069	
COROPHIUM SPP.									0.0633		0.0145		0.0016	0.0129	0.0260	0.0930
COROPHIUM LACUSTRE													0.0043			
GAMMARUS SPP.	0.0030	0.0338	0.1666	0.0160	0.0114	0.6432	0.2493	0.0009	0.2551	1.5113	0.2745		0.0870	0.1540	0.0406	0.0815
MONOCULODES EDWARDSI									0.0016				0.0180	0.0019	0.0026	
CYCLASPIS VARIANS										0.0004						
ALMYRACUMA PROXIMOCULI				0.0004							0.0024					
ISOPODA					0.0004				0.0002							
CYATHURA POLITA	0.3184	0.0543	0.2420	0.0268	0.5696	1.2767	0.3011	0.2358	0.4193	0.4489	0.3292	0.1305	0.0030	0.7333	0.0277	0.0491
ASELLIDAE									0.0001							
CAECIDOTEA SPP.	0.0002															
CASSIDISCA LUNIFRONS			0.0126						0.0089		0.0045	0.0026				
CHIRIDOTEA ALMYRA	0.0186				0.0291	0.0131	0.0537	0.0150	0.0008	0.0295	0.0314	0.0126	0.0129	0.0075	0.0296	0.0071
NEOMYSIS AMERICANA														0.0131	0.0087	
CRANGON SEPTEMSPINOSA															0.2909	

Table 10: (continued).

SEASON	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
ZONE	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
EPHEMEROPTERA														0.0009		
HEMIPTERA																
HETEROPTERA	0.0015															
OPTIOSERVUS SPP				0.0016												
BEROSUS SPP	0.0062															
TRICHOPTERA	0.0008															
LEUCOTRICHIA SPP				0.0026												
LEPIDOPTERA																0.0087
DIPTERA	0.0006				0.0011											
CERATOPOGONIDAE	0.0046	0.0005		0.0026	0.0004					0.0015					0.0002	
TIPULIDAE										0.0038			0.0002			
LIMONIA SPP					0.0499											
ORMOSIA SPP	0.0026															
CHIRONOMIDAE	0.3189	0.1434	0.0372	0.0260	0.2765	0.4096	0.0375	0.0263	0.1155	0.1708	0.1261	0.0124	0.0336	0.0091	0.0201	0.0205
ECTOPROCTA					0.0090	1.2628			0.0055							
UNIDENTIFIABLE ORGANISM			0.0021			0.0016										
UNIDENTIFIED ORGANISM	0.0171				0.0004				0.0005							0.0023
UNIDENTIFIED ORGANISM 1	0.0482	0.0041	0.0127	0.0154	0.0176	0.0064	0.0006			0.0071	0.0034					
UNIDENTIFIED ORGANISM 3																
Total mean biomass g/m²	1.9305	10.2937	68.7660	60.8477	2.8565	6.5089	2.9815	1.2122	4.2257	3.3179	3.1569	0.9393	12.1627	3.7774	1.7193	0.8904
POOLED TAXA																
TURBELLARIA	0.0080	0.0008	0.0038	0.0027	0.0068	0.0014		0.0062	0.0001			0.0004	0.0059	0.0001	0.0001	
NEMERTEA		0.0003						0.0006					0.0221	0.0277	0.0520	
NEMATODA	0.0010	0.0196		0.0023	0.0003	0.0046		0.0003	0.0002	0.0089	0.0005	0.0001	0.0002	0.0024		0.0001
OLIGOCHAETA	0.5465	2.2156	0.9259	1.3340	1.5278	1.4853	1.2717	0.9265	0.2784	0.8852	0.4309	0.4976	0.3031	0.0200	0.5913	0.1236
HIRUDINEA	0.0034		0.0265	0.0176	0.0014				0.0011				0.0025			
POLYCHAETA	0.0393			0.0029	0.3018	0.0861			3.0696	0.0447	1.9266	0.0752	8.7753	2.7477	0.2302	0.4969
BIVALVIA	0.5902	7.8214	67.3280	59.3750	0.0313	1.3109	1.0676	0.0004	0.0002	0.2042	0.0122	0.2078	2.8543	0.0466	0.3941	0.0068
GASTROPODA	0.0004		0.0286	0.0176					0.0024	0.0003	0.0002					
CLADOCERA	0.0005				0.0219				0.0018				0.0362			
AMPHIPODA	0.0030	0.0338	0.1666	0.0160	0.0114	0.6432	0.2493	0.0009	0.3205	1.5126	0.2890		0.1109	0.1688	0.0762	0.1745
CUMACEA				0.0004						0.0004	0.0024					
ISOPODA	0.3373	0.0543	0.2546	0.0268	0.5991	1.2897	0.3547	0.2510	0.4293	0.4784	0.3651	0.1458	0.0159	0.7409	0.0573	0.0562
CHIRONOMIDAE	0.3189	0.1434	0.0372	0.0260	0.2765	0.4096	0.0375	0.0263	0.1155	0.1708	0.1261	0.0124	0.0336	0.0091	0.0201	0.0205
OTHER TAXA	0.0821	0.0047	0.0149	0.0263	0.0783	1.2780	0.0006	0.0001	0.0064	0.0124	0.0039		0.0006	0.0140	0.2980	0.0117
PERCENT OF TOTAL																
TURBELLARIA	0.41	0.01	0.01	0.00	0.24	0.02		0.51	0.00			0.04	0.05	0.00	0.01	
NEMERTEA		0.00						0.05					0.18	0.73	3.03	
NEMATODA	0.05	0.19		0.00	0.01	0.07		0.02	0.01	0.27	0.01	0.01	0.00	0.06		0.01
OLIGOCHAETA	28.31	21.52	1.35	2.19	53.48	22.82	42.65	76.43	6.59	26.68	13.65	52.98	2.49	0.53	34.39	13.88
HIRUDINEA	0.17		0.04	0.03	0.05				0.03				0.02			
POLYCHAETA	2.04			0.00	10.57	1.32			72.64	1.35	61.03	8.00	72.15	72.74	13.39	55.81
BIVALVIA	30.57	75.98	97.88	97.58	1.10	20.14	35.81	0.03	0.01	6.15	0.39	22.12	23.47	1.23	22.92	0.76
GASTROPODA	0.02		0.04	0.03					0.06	0.01	0.01					
CLADOCERA	0.03				0.77				0.04				0.31			
AMPHIPODA	0.16	0.33	0.24	0.03	0.40	9.88	8.36	0.07	7.59	45.59	9.15		0.91	4.47	4.43	19.60
CUMACEA				0.00						0.01	0.08					
ISOPODA	17.47	0.53	0.37	0.04	20.97	19.81	11.90	20.71	10.16	14.42	11.56	15.52	0.13	19.61	3.33	6.31
CHIRONOMIDAE	16.52	1.39	0.05	0.04	9.68	6.29	1.26	2.17	2.73	5.15	3.99	1.32	0.28	0.24	1.17	2.30
OTHER TAXA	4.25	0.05	0.02	0.04	2.74	19.63	0.02	0.01	0.15	0.37	0.12		0.00	0.37	17.33	1.31

Table 10: (continued).

WITHOUT CORBICULA FLUMINEA	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
SEASON	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
ZONE	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
DEPTH SUBSTRATUM	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
TURBELLARIA	0.0060	0.0006	0.0038	0.0027	0.0068	0.0014		0.0062	0.0001			0.0004	0.0059	0.0001	0.0001	
NEMERTEA		0.0003						0.0006					0.0221	0.0277	0.0520	
NEMATODA	0.0010	0.0196		0.0023	0.0003	0.0048		0.0003	0.0002	0.0089	0.0005	0.0001	0.0002	0.0024		0.0001
OLIGOCHAETA	0.5465	2.2156	0.9259	1.3340	1.5278	1.4853	1.2717	0.9265	0.2784	0.8852	0.4309	0.4976	0.3031	0.0200	0.5913	0.1236
HIRUDINEA	0.0034		0.0265	0.0176	0.0014				0.0011				0.0025			
POLYCHAETA	0.0393			0.0029	0.3018	0.0861			3.0696	0.0447	1.9266	0.0752	8.7753	2.7477	0.2302	0.4969
BIVALVIA	0.1627	0.0398	0.0006	1.4092	0.0033	0.0220	0.0275	0.0004	0.0002	0.0093	0.0122	0.0016	2.8543	0.0466	0.3941	0.0068
GASTROPODA	0.0004		0.0286	0.0176					0.0024	0.0003	0.0002					
CLADOCERA	0.0005				0.0219				0.0018				0.0382			
AMPHIPODA	0.0030	0.0338	0.1666	0.0160	0.0114	0.6432	0.2493	0.0009	0.3205	1.5126	0.2890		0.1109	0.1688	0.0762	0.1745
CUMACEA				0.0004						0.0004	0.0024					
ISOPODA	0.3373	0.0543	0.2546	0.0268	0.5991	1.2897	0.3547	0.2510	0.4293	0.4784	0.3651	0.1458	0.0159	0.7409	0.0573	0.0562
CHIRONOMIDAE	0.3189	0.1434	0.0372	0.0260	0.2765	0.4096	0.0375	0.0263	0.1155	0.1708	0.1261	0.0124	0.0336	0.0091	0.0201	0.0205
OTHER TAXA	0.0821	0.0047	0.0149	0.0263	0.0783	1.2780	0.0006	0.0001	0.0064	0.0124	0.0039		0.0006	0.0140	0.2980	0.0117
Total mean biomass g/m	1.5030	2.5119	1.4586	2.8819	2.8286	5.2201	1.9413	1.2122	4.2257	3.1231	3.1569	0.7331	12.1627	3.7774	1.7193	0.8904
PERCENT OF TOTAL (w/o CORBICULA)																
TURBELLARIA	0.53	0.03	0.26	0.09	0.24	0.03		0.51	0.00			0.05	0.05	0.00	0.01	
NEMERTEA		0.01						0.05					0.18	0.73	3.03	
NEMATODA	0.06	0.78		0.06	0.01	0.09		0.02	0.01	0.29	0.01	0.02	0.00	0.06		0.01
OLIGOCHAETA	36.36	88.20	63.48	46.29	54.01	26.45	65.51	76.43	6.59	28.35	13.65	67.88	2.49	0.53	34.39	13.88
HIRUDINEA	0.22		1.81	0.61	0.05				0.03				0.02			
POLYCHAETA	2.62			0.10	10.67	1.65			72.64	1.43	61.03	10.25	72.15	72.74	13.39	55.81
BIVALVIA	10.82	1.58	0.04	48.90	0.12	0.42	1.41	0.03	0.01	0.30	0.39	0.22	23.47	1.23	22.92	0.76
GASTROPODA	0.02		1.96	0.61					0.06	0.01	0.01					
CLADOCERA	0.03				0.78				0.04				0.31			
AMPHIPODA	0.20	1.35	11.42	0.56	0.40	12.32	12.84	0.07	7.59	48.43	9.15		0.91	4.47	4.43	19.60
CUMACEA				0.01						0.01	0.08					
ISOPODA	22.44	2.16	17.46	0.93	21.18	24.71	18.27	20.71	10.16	15.32	11.56	19.88	0.13	19.61	3.33	6.31
CHIRONOMIDAE	21.22	5.71	2.55	0.90	9.77	7.65	1.93	2.17	2.73	5.47	3.99	1.70	0.26	0.24	1.17	2.30
OTHER TAXA	5.46	0.19	1.02	0.91	2.77	24.48	0.03	0.01	0.15	0.40	0.12		0.00	0.37	17.33	1.31

Table 11. Seasonal mean density (n/m²) of benthic macroinvertebrates collected in the intertidal (I), shallow/intermediate (S), and channel (C) substrata of the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SEASON	SPRING	SPRING	SPRING	SUMMER	SUMMER	SUMMER	FALL	FALL	FALL	WINTER	WINTER	WINTER
ZONE	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C	I	S	C	I	S	C	I	S	C
HYDROZOA					0.9			1.8	1.8			
HYDRIDAE						1.1						
TURBELLARIA	0.9	35.7	1007.7	2.7		4.7		8.5		0.9	5.5	154.0
NEMERTEA		4.7			2.0	50.8		5.6			0.9	0.9
NEMATODA	24.4	19.6	21.4	129.2	9.2	14.0	5.5	11.2	13.8	6.6	17.6	5.5
OLIGOCHAETA	63.1	49.1	16.4	1.9	17.4	3.5		2.8	41.3			2.8
LUMBRICULIDAE				0.9								
ENCHYTRAEIDAE	68.6	6.6	396.6	366.5	7.5	387.3	79.3	0.9	192.8	18.7	5.6	308.1
MEGASCOLECIDAE	4.7											
NAIDIDAE	5.7	9.4	13.5	16.0	0.9	1.1	12.3	9.4			0.9	
ALLONAIS PECTINATA										0.9		
AMPHICHAETA LEYDIGI										2.8	12.3	
ARCTEONAIS LOMONDI	31.2	11.2			8.3	2.3		3.8			54.7	
CHAETOGASTER SPP.			0.9									
CHAETOGASTER DIAPHANUS	0.9	0.9	2.8									
NAIS SPP.	2.8	144.0	14.1									
NAIS BEHNINGI	0.9	141.0	3.7				0.9	2.8				
NAIS BRETSCHERI		0.9										
NAIS COMMUNIS	1.9	29.4	76.8	9.4	11.0		18.9				0.9	
NAIS ELINGUIS		1.9			0.9		0.9					
NAIS VARIABILIS		0.9		419.6			6.6	2.8			0.9	
PARANAIS SPP.							0.9				1.9	
PARANAIS FRICI	0.9	147.0	0.9					14.2		2.8	119.9	0.9
PARANAIS LITORALIS	3.8	116.2	21.7	4.7	0.9		16.0	3.8		0.9		2.8
PIGUETIELLA MICHIGANENSIS			55.8	0.9	10.4	43.6						7.4
PRISTINA SPP.		39.7	3.1	64.2	0.9		3.7					
PRISTINELLA SPP.							7.6				0.9	
SLAVINA APPENDICULATA	23.6										1.9	
SPECARIA JOSINAE				0.9	287.2	4.7		174.7	26.8		38.6	0.9
TUBIFICIDAE		33.9	0.9		0.9	7.1	0.9					0.9
UNIDENTIFIED TUBIFICID #1	174.7	83.2	13.8	149.2	64.3	68.4	14.1	454.4	84.9		109.4	8.0
UNIDENTIFIED TUBIFICID #2	368.2	1067.1	985.5	67.7	1283.2	830.2	903.2	2201.8	1292.1	142.5	1408.1	584.1
UNIDENTIFIED TUBIFICID #3		298.7										
UNIDENTIFIED TUBIFICID #4								0.9				
AULODRILUS LIMNOBIUS		9.4										
AULODRILUS PIGUETI	27.4	5.7			15.4	15.3	37.8	96.4	51.9			
AULODRILUS PLURISETA			1.5									
HABER SPECIOSUS	13.2			2.8								
ILYODRILUS TEMPLETONI								5.7			10.4	14.2
ISOCHAETIDES FREYI			12.2		55.8		9.5				0.9	15.1
LIMNODRILUS SPP.	2.8	0.9	5.2						0.9		22.7	
LIMNODRILUS CLAPAREDIANUS											8.5	0.9
LIMNODRILUS HOFFMEISTERI	13.2	230.9	194.2	6.5	273.8	407.4	29.3	55.7	52.7	5.7	183.9	159.7
LIMNODRILUS UDEKEMIANUS	52.0	86.9	242.5	27.4	21.9	74.3	20.7	118.9	152.6		31.0	71.1
QUISTADRILUS MULTISETOSUS											80.3	81.3
QUISTADRILUS/SPIROSPERMA SPP.	0.9	103.0	4.6		6.3	24.6	1.8	39.6	25.9			
HIRUDINEA			0.9					0.9				
HELOBDELLA SPP.								3.8				
HELOBDELLA STAGNALLIS											0.9	
PISCICOLIDAE	0.9											
CYSTOBRANCHUS SPP.		0.9	3.1									
PISCICOLA PUNCTATA			0.9									0.9
POLYCHAETA	0.9	14.1	0.9		2.8					0.9		
NEREIS SUCCINEA										0.9		
MANAYUNKIA SPECIOSA	0.9	5.9	0.9		39.7					0.9	7.5	

Table 11: (continued).

SEASON ZONE DEPTH SUBSTRATUM	SPRING ALL I	SPRING ALL S	SPRING ALL C	SUMMER ALL I	SUMMER ALL S	SUMMER ALL C	FALL ALL I	FALL ALL S	FALL ALL C	WINTER ALL I	WINTER ALL S	WINTER ALL C
SPIONIDAE	0.9	2.3						0.9	1.5			
POLYDORA SPP.												0.9
SCOLECOLEPIDES VIRIDIS	2.7	189.1	346.5		43.3	63.7		11.2	32.9		15.0	28.5
BIVALVIA	1.9	14.8	5.8	73.5	15.1	14.1		15.0		0.9	3.7	
CORBICULA FLUMINEA	0.9	71.7	34.5	41.3	29.2	2.3	7.6	83.0	52.8		34.9	42.5
RANGIA CUNEATA		2.8			4.6			1.8			2.8	
SPHAERIIDAE		2.8										
PISIDIUM SPP.	1.9	4.7						11.2	9.4			
ELLIPTIO COMPLANATA											0.9	
ANCYLIDAE		0.9	0.9	0.9		3.5		0.9			0.9	
LAEVAPEX SPP.		0.9									4.7	1.9
AMNICOLA LIMOSA												0.9
PHYSIDAE							5.7	6.6				
ARTHROPODA				0.9								
ACARFORMES												0.9
CLADOCERA	216.4	27.0	335.5	0.9			1.9					
LEPTODORA KINDTI				0.9		2.3						
COPEPODA	26.2	12.3	4.0	1.8	1.1		10.4	2.8		2.7	1.8	2.8
AMPHIPODA			0.9		1.9							
GAMMARIDEA							0.9					
COROPHIUM SPP.		43.3			14.2	1.1		8.4	21.9			139.8
COROPHIUM LACUSTRE		0.9	3.7									
GAMMARUS SPP.	24.5	272.0	44.4	62.1	781.7	428.3	45.2	65.8	61.3		3.7	4.7
MONOCULODES EDWARDSI	1.9	23.5	3.7		1.9		0.9					
CYCLASPIS VARIANS				0.9								
ALMYRACUMA PROXIMOCULI							1.9	3.8			0.9	
ISOPODA	0.9		8.5									
CYATHURA POLITA	24.4	168.6	60.0	6.3	397.9	70.5	26.4	85.7	33.8	0.9	40.5	17.0
ASELLIDAE		0.9										
CAECIDOTEA SPP.		0.9										
CASSIDISCA LUNIFRONS		4.7					9.5	2.8			1.9	
CHIRIDOTEA ALMYRA	3.8	8.4	3.8		1.9	27.0	0.9	9.3	12.7		1.8	1.8
NEOMYSIS AMERICANA					3.8	5.8	0.9	0.9	3.1			
CRANGON SEPTEMSPINOSA									1.5			
EPHEMEROPTERA				0.9								
HEMIPTERA				0.9								
HETEROPTERA	7.6											
OPTIOSERVUS SPP.												0.9
BEROSUS SPP.	0.9											
TRICHOPTERA		1.9										
LEUCOTRICHIA SPP.											0.9	
LEPIDOPTERA										0.9		
DIPTERA		1.1	4.6	0.9								
CERATOPOGONIDAE	0.9	6.4	7.8	11.2		1.1	0.9	0.9		1.9	3.7	0.9
TIPULIDAE	0.9			0.9								
LIMONIA SPP.	6.6											
ORMOSIA SPP.	11.3											
CHIRONOMIDAE		22.5	10.8		1.9	2.3	1.8	1.8	1.9		0.9	
CHIRONOMINAE			6.6		0.9			2.8	6.6			
TANYTARSINI		2.8		1.9				0.9				
CLADOTANYTARSUS SPP	21.7	1.1		391.2	2.8	14.0	1.9					
MICROPSECTRA SPP				17.0	17.4							
RHEOTANYTARSUS SPP		26.4			1.9		1.9					
TANYTARSUS SPP	0.9	24.8			86.8							0.9

Table 11. (continued).

SEASON	SPRING	SPRING	SPRING	SUMMER	SUMMER	SUMMER	FALL	FALL	FALL	WINTER	WINTER	WINTER
ZONE	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C	I	S	C	I	S	C	I	S	C
CHIRONOMINI					8.5	2.3	0.9				5.5	3.4
CHIRONOMOUS SPP.		0.9				1.1					1.9	
DICROTENDIPES SPP.	0.9	7.5		17.0	3.7		4.7				1.8	
GLYPTOTENDIPES SPP.											0.9	
POLYPEDILUM SPP.	272.8	399.0	477.2	379.6	324.8	323.3	57.5	644.3	66.8		102.6	147.4
CRYPTOCHIRONOMOUS SPP.	19.7	133.8	8.1	367.5	66.2	9.2	5.6	31.8	4.6	0.9	23.4	0.9
ORTHOCLADIINAE	0.9	22.8	9.4	15.1		2.3					0.9	0.9
CRICOTOPUS/ORTHOCLADIUS SPP.	1.8	2.8		149.2		1.1		19.8				
NANOCLADIUS SPP.		8.6	11.3									
SMITTIA SPP.	0.9											
TANYPODINAE					6.6							
ABLABESMYIA (EXCEPT ANNULATA)		11.3										
ABLABESMYIA SPP.		0.9	1.5									
APSECTROTANYPUS SPP.		26.5										
PROCLADIUS SPP.	28.3	64.1	7.8	2.8	3.0	14.1		26.3			11.1	
ECTOPROCTA	0.9	2.0	0.9	0.9	0.9							
UNIDENTIFIABLE ORGANISM				1.9			1.9					
UNIDENTIFIED ORGANISM	0.9	7.5	5.7									28.4
UNIDENTIFIED ORGANISM 1		26.3	10.6	0.9	15.6	5.8	0.9	10.3	1.8		8.4	5.6
UNIDENTIFIED ORGANISM 3								0.9				
Total mean density n/m²	1574.2	4353.0	4518.7	2819.1	3958.3	2935.6	1359.3	4269.4	2249.8	192.5	2398.7	1849.9
POOLED TAXA												
TURBELLARIA	0.9	35.7	1007.7	2.7		4.7		8.5		0.9	5.5	154.0
NEMERTEA		4.7			2.0	50.8		5.6			0.9	0.9
NEMATODA	24.4	19.6	21.4	129.2	9.2	14.0	5.5	11.2	13.8	6.6	17.8	5.5
OLIGOCHAETA	860.2	2619.5	2068.7	1138.4	2066.7	1869.9	1164.1	3188.2	1921.8	174.2	2091.2	1258.0
HIRUDINEA	0.9	0.9	4.9					4.7			0.9	0.9
POLYCHAETA	5.4	211.4	348.3		85.7	63.7		12.1	34.4	2.7	22.5	29.4
BIVALVIA	4.6	96.7	40.3	114.7	48.9	16.4	7.6	111.0	62.2	0.9	42.2	42.5
GASTROPODA		1.8	0.9	0.9		3.5	5.7	7.5			5.6	2.8
CLADOCERA	216.4	27.0	335.5	1.8		2.3	1.9					
AMPHIPODA	26.4	339.6	52.7	62.1	799.5	429.4	47.0	74.2	83.2		3.7	144.5
CUMACEA				0.9			1.9	3.8			0.9	
ISOPODA	29.1	183.4	72.1	6.3	399.7	97.5	36.8	97.7	46.5	0.9	44.1	18.8
CHIRONOMIDAE	347.9	755.2	532.7	1341.1	524.3	369.7	74.2	727.5	79.8	0.9	148.9	153.5
OTHER TAXA	58.1	57.5	33.6	21.2	22.3	13.8	14.9	17.6	8.2	5.5	14.8	39.4
PERCENT OF TOTAL												
TURBELLARIA	0.1	0.8	22.3	0.1		0.2		0.2		0.5	0.2	8.3
NEMERTEA		0.1			0.1	1.7		0.1			0.0	0.0
NEMATODA	1.6	0.5	0.5	4.6	0.2	0.5	0.4	0.3	0.6	3.4	0.7	0.3
OLIGOCHAETA	54.6	60.2	45.8	40.4	52.2	63.7	85.6	74.7	85.4	90.5	87.2	68.0
HIRUDINEA	0.1	0.0	0.1					0.1			0.0	0.0
POLYCHAETA	0.3	4.9	7.7		2.2	2.2		0.3	1.5	1.4	0.9	1.6
BIVALVIA	0.3	2.2	0.9	4.1	1.2	0.6	0.6	2.6	2.8	0.5	1.8	2.3
GASTROPODA		0.0	0.0	0.0		0.1	0.4	0.2			0.2	0.1
CLADOCERA	13.7	0.6	7.4	0.1		0.1	0.1					
AMPHIPODA	1.7	7.8	1.2	2.2	20.2	14.6	3.5	1.7	3.7		0.2	7.8
CUMACEA				0.0			0.1	0.1			0.0	
ISOPODA	1.8	4.2	1.6	0.2	10.1	3.3	2.7	2.3	2.1	0.5	1.8	1.0
CHIRONOMIDAE	22.1	17.3	11.8	47.6	13.2	12.6	5.5	17.0	3.5	0.5	6.2	8.3
OTHER TAXA	3.7	1.3	0.7	0.8	0.6	0.5	1.1	0.4	0.4	2.8	0.6	2.1

Table 12 Seasonal mean biomass (g/m²) of benthic macroinvertebrates collected in the intertidal (I), shallow/intermediate (S), and channel (C) substrata of the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SEASON	SPRING	SPRING	SPRING	SUMMER	SUMMER	SUMMER	FALL	FALL	FALL	WINTER	WINTER	WINTER
ZONE	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C	I	S	C	I	S	C	I	S	C
HYDROZOA					0.0010			0.0002	0.0002			
HYDRIDAE						0.0006						
TURBELLARIA		0.0060	0.0096	0.0015		0.0001		0.0029		0.0004	0.0018	0.0048
NEMERTEA		0.0166			0.0146	0.0064		0.0390			0.0005	
NEMATODA	0.0007	0.0006		0.0224	0.0033	0.0012		0.0002	0.0002	0.0011	0.0007	0.0003
OLIGOCHAETA	0.2995	0.4817	1.2107	0.4017	1.6956	1.3574	0.2460	1.2864	0.8825	0.0815	1.1747	0.9051
HIRUDINEA			0.0004					0.0010				
HELOBDELLA SPP								0.0189				
HELOBDELLA STAGNALIS											0.0090	
PISCICOLIDAE	0.0010											
CYSTOBRANCHUS SPP		0.0005	0.0025									
PISCICOLA PUNCTATA			0.0019									0.0043
POLYCHAETA	0.0004	0.0162	0.0007		0.0088					0.0013		
NEREIS SUCCINEA										0.0007		
MANAYUNKIA SPECIOSA	0.0001	0.0007			0.0033					0.0016	0.0008	
SPIONIDAE	0.0014	0.0093						0.0009				
POLYDORA SPP.												0.0001
SCOLECOLEPIDES VIRIDIS	0.0142	2.3380	6.7587		0.2803	1.8685		0.1546	1.4622		0.0610	0.3658
BIVALVIA	0.0003	0.0061	0.1001	0.0440	0.0031	0.0063		0.0042		0.0018	0.7600	
CORBICULA FLUMINEA	0.0210	0.2139	0.1068	0.7842	6.1355	0.0294	0.6430	28.2485	22.3842		22.0635	21.5655
RANGIA CUNEATA		2.1348			0.0349			0.2956			0.0051	
SPHAERIIDAE		0.0036										
PISIDIUM SPP.	0.0006	0.0181						0.0147	0.0114			
ELLIPTIO COMPLANATA											0.2966	
ANCYLIDAE		0.0003	0.0008			0.0002		0.0002			0.0010	
LAEVAPEX SPP.		0.0010									0.0079	0.0011
AMNICOLA LIMOSA												0.0032
PHYSIDAE							0.0065	0.0149				
ARTHROPODA				0.0038								
ACARIFORMES												0.0030
CLADOCERA	0.0165	0.0017	0.0286									
LEPTODORA KINDTI				0.0001								
COPEPODA	0.0004	0.0005	0.0002	0.0001			0.0001			0.0002	0.0002	0.0003
AMPHIPODA			0.0004		0.0010							
GAMMARIDEA							0.0052					
COROPHIUM SPP.		0.0487			0.0089	0.0008		0.0170	0.0134			0.0698
COROPHIUM LACUSTRE		0.0005	0.0027									
GAMMARUS SPP.	0.0180	0.2151	0.0345	0.0636	0.4298	1.2636	0.1143	0.0852	0.3487		0.0170	0.0568
MONOCULODES EDWARDSI	0.0012	0.0120	0.0015		0.0014		0.0020					
CYCLASPIS VARIANS				0.0003								
ALMYRACUMA PROXIMOCULI							0.0012	0.0006			0.0003	
ISOPODA	0.0002		0.0003									
CYATHURA POLITA	0.1222	0.6329	0.2277	0.0133	1.5672	0.3043	0.1668	0.3144	0.1938	0.0020	0.2075	0.1222
ASELLIDAE		0.0001										
CAECIDOTEA SPP.		0.0002										
CASSIDISCA LUNIFRONS		0.0067					0.0095	0.0034			0.0020	
CHIRIDOTEA ALMYRA	0.0006	0.0171	0.0284		0.0027	0.0350	0.0021	0.0487	0.0352		0.0148	0.0115
NEOMYSIS AMERICANA					0.0060	0.0039	0.0011	0.0012	0.0027			
CRANGON SEPTEMSPINOSA									0.2182			
EPHEMEROPTERA				0.0007								
HEMIPTERA												
HETEROPTERA	0.0011											
OPTIOSERVUS SPP												0.0012
BEROSUS SPP	0.0046											
TRICHOPTERA		0.0005										
LEUCOTRICHIA SPP											0.0020	
LEPIDOPTERA										0.0065		
DIPTERA		0.0008	0.0005									
CERATOPOGONIDAE	0.0002	0.0003	0.0033	0.0015			0.0002			0.0010	0.0005	0.0005
TIPULIDAE	0.0002			0.0028								
LIMONIA SPP.	0.0374											
ORMOSIA SPP.	0.0020											
CHIRONOMIDAE	0.0806	0.3705	0.1073	0.2797	0.1872	0.0828	0.0123	0.1432	0.0103	0.0009	0.0396	0.0235
ECTOPROCTA	0.0017	0.0069	0.0023	0.9453	0.0018							
UNIDENTIFIABLE ORGANISM				0.0012			0.0016					
UNIDENTIFIED ORGANISM	0.0002	0.0130	0.0003									0.0017
UNIDENTIFIED ORGANISM 1		0.0478	0.0016	0.0002	0.0091	0.0039	0.0001	0.0120	0.0005		0.0090	0.0026
UNIDENTIFIED ORGANISM 3												
Total mean biomass g/m²	0.6260	6.6242	8.6314	2.5662	10.3951	4.9622	1.2119	30.7076	25.5633	0.0990	24.6752	23.1431

Table 12 (continued)

SEASON	SPRING	SPRING	SPRING	SUMMER	SUMMER	SUMMER	FALL	FALL	FALL	WINTER	WINTER	WINTER
ZONE	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
DEPTH SUBSTRATUM	I	S	C	I	S	C	I	S	C	I	S	C
TURBELLARIA		0.0060	0.0096	0.0015		0.0001		0.0029		0.0004	0.0018	0.0048
NEMERTEA		0.0166			0.0146	0.0064		0.0390			0.0005	
NEMATODA	0.0007	0.0006		0.0224	0.0033	0.0012		0.0002	0.0002	0.0011	0.0007	0.0003
OLIGOCHAETA	0.2995	0.4817	1.2107	0.4017	1.6956	1.3574	0.2460	1.2864	0.8825	0.0815	1.1747	0.9051
HIRUDINEA	0.0010	0.0005	0.0048					0.0199			0.0090	0.0043
POLYCHAETA	0.0161	2.3641	6.7594		0.2924	1.8665		0.1555	1.4622	0.0036	0.0618	0.3659
BIVALVIA	0.0218	2.3784	0.2069	0.8282	6.1735	0.0357	0.6430	28.5628	22.3956	0.0018	23.1252	21.5655
GASTROPODA		0.0013	0.0008			0.0002	0.0065	0.0151			0.0089	0.0043
CLADOCERA	0.0165	0.0017	0.0286									
AMPHIPODA	0.0192	0.2762	0.0391	0.0636	0.4410	1.2644	0.1215	0.1023	0.3620		0.0170	0.1266
CUMACEA				0.0003			0.0012	0.0006			0.0003	
ISOPODA	0.1230	0.6570	0.2563	0.0133	1.5699	0.3393	0.1784	0.3664	0.2290	0.0020	0.2243	0.1337
CHIRONOMIDAE	0.0806	0.3705	0.1073	0.2797	0.1872	0.0626	0.0123	0.1432	0.0103	0.0009	0.0396	0.0235
OTHER TAXA	0.0477	0.0698	0.0060	0.9556	0.0178	0.0084	0.0031	0.0134	0.2215	0.0078	0.0116	0.0093
PERCENT OF TOTAL												
TURBELLARIA		0.09	0.11	0.06		0.00		0.01		0.38	0.01	0.02
NEMERTEA		0.25			0.14	0.13		0.13			0.00	
NEMATODA	0.12	0.01		0.87	0.03	0.02		0.00	0.00	1.14	0.00	0.00
OLIGOCHAETA	47.84	7.27	14.03	15.65	16.31	27.35	20.30	4.19	3.45	82.37	4.76	3.91
HIRUDINEA	0.16	0.01	0.06					0.06			0.04	0.02
POLYCHAETA	2.56	35.69	78.31		2.81	37.61		0.51	5.72	3.61	0.25	1.56
BIVALVIA	3.49	35.90	2.40	32.27	59.39	0.72	53.06	93.02	87.61	1.62	93.72	93.18
GASTROPODA		0.02	0.01			0.00	0.54	0.05			0.04	0.02
CLADOCERA	2.63	0.03	0.33									
AMPHIPODA	3.06	4.17	0.45	2.48	4.24	25.48	10.02	0.33	1.42		0.07	0.55
CUMACEA				0.01			0.10	0.00			0.00	
ISOPODA	19.64	9.92	2.97	0.52	15.10	6.84	14.72	1.19	0.90	2.00	0.91	0.58
CHIRONOMIDAE	12.87	5.59	1.24	10.90	1.80	1.67	1.01	0.47	0.04	0.86	0.16	0.10
OTHER TAXA	7.62	1.05	0.09	37.24	0.17	0.17	0.26	0.04	0.87	7.83	0.05	0.04
WITHOUT CORBICULA FLUMINEA												
TURBELLARIA		0.0060	0.0096	0.0015		0.0001		0.0029		0.0004	0.0018	0.0048
NEMERTEA		0.0166			0.0146	0.0064		0.0390			0.0005	
NEMATODA	0.0007	0.0006		0.0224	0.0033	0.0012		0.0002	0.0002	0.0011	0.0007	0.0003
OLIGOCHAETA	0.2995	0.4817	1.2107	0.4017	1.6956	1.3574	0.2460	1.2864	0.8825	0.0815	1.1747	0.9051
HIRUDINEA	0.0010	0.0005	0.0048					0.0199			0.0090	0.0043
POLYCHAETA	0.0161	2.3641	6.7594		0.2924	1.8665		0.1555	1.4622	0.0036	0.0618	0.3659
BIVALVIA	0.0009	2.1645	0.1001	0.0440	0.0380	0.0062		0.3144	0.0114	0.0018	1.0617	
GASTROPODA		0.0013	0.0008			0.0002	0.0065	0.0151			0.0089	0.0043
CLADOCERA	0.0165	0.0017	0.0286									
AMPHIPODA	0.0192	0.2762	0.0391	0.0636	0.4410	1.2644	0.1215	0.1023	0.3620		0.0170	0.1266
CUMACEA				0.0003			0.0012	0.0006			0.0003	
ISOPODA	0.1230	0.6570	0.2563	0.0133	1.5699	0.3393	0.1784	0.3664	0.2290	0.0020	0.2243	0.1337
CHIRONOMIDAE	0.0806	0.3705	0.1073	0.2797	0.1872	0.0628	0.0123	0.1432	0.0103	0.0009	0.0396	0.0235
OTHER TAXA	0.0477	0.0668	0.0060	0.9556	0.0178	0.0084	0.0031	0.0134	0.2215	0.0078	0.0116	0.0093
Total mean biomass g/m²	0.6050	6.4103	8.5246	1.7820	4.2596	4.9328	0.5689	2.4591	3.1791	0.0990	2.6117	.5776
PERCENT OF TOTAL (w/o CORBICULA)												
TURBELLARIA		0.09	0.11	0.08		0.00		0.12		0.38	0.07	0.30
NEMERTEA		0.26			0.34	0.13		1.59			0.02	
NEMATODA	0.12	0.01		1.26	0.08	0.02		0.01	0.01	1.14	0.03	0.02
OLIGOCHAETA	49.50	7.51	14.20	22.54	39.81	27.52	43.24	52.31	27.76	82.37	44.98	57.37
HIRUDINEA	0.17	0.01	0.06					0.81			0.34	0.27
POLYCHAETA	2.65	36.88	79.29		6.86	37.84		6.32	45.99	3.61	2.37	23.19
BIVALVIA	0.14	33.77	1.17	2.47	0.89	0.13		12.78	0.36	1.82	40.65	
GASTROPODA		0.02	0.01			0.00	1.15	0.61			0.34	0.27
CLADOCERA	2.72	0.03	0.34									
AMPHIPODA	3.17	4.31	0.46	3.57	10.35	25.63	21.35	4.16	11.39		0.65	8.02
CUMACEA				0.02			0.22	0.02			0.01	
ISOPODA	20.32	10.25	3.01	0.75	36.85	6.88	31.35	14.90	7.20	2.00	8.59	8.47
CHIRONOMIDAE	13.32	5.78	1.26	15.69	4.40	1.68	2.16	5.82	0.32	0.86	1.52	1.49
OTHER TAXA	7.89	1.09	0.09	53.63	0.42	0.17	0.54	0.54	6.97	7.83	0.44	0.56

Table 13. Numbers of blue crab, grass shrimp, and sand shrimp taken in fisheries collections in Zones 2, 3, 4 and 5 in the Delaware River between the C & D canal and Trenton, NJ during September and October 1992.

Zone	2			3			4			5			All		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Blue Crab															
September	7	1	8	9	1	10	21	5	26	94	47	141	121	54	185
October	9	3	12	21	4	25	5	4	9	14	10	24	49	21	70
Totals	16	4	20	30	5	35	26	9	35	108	57	165	170	75	255
Grass Shrimp															
September			0			1			61			1670			1732
October			7			38			117			97			259
Totals			7			39			178			1767			1991
Sand Shrimp															
September			0			0			0			781			781
October			0			0			2			623			625
Totals			0			0			2			1404			1406

Table 14. Length frequency of blue crab taken in fishery collections in Zones 2, 3, 4 and 5 in the Delaware River between the C & D Canal and Trenton, NJ during September and October, 1992.

	September					October				
	Zone					Zone				
Length, mm.	2	3	4	5	ALL	2	3	4	5	ALL
5.1 – 10.0			1	4	5		2		1	3
10.1 – 15.0		1		17	18		1		2	3
15.1 – 20.0		1		19	20	1	6	3	5	15
20.1 – 25.0			2	18	20		2	2	4	8
25.1 – 30.0				7	7	5	5		4	14
30.1 – 35.0				6	6	1	2	1		4
35.1 – 40.0				3	3	2	1	2	1	6
40.1 – 45.0				2	2	2	4	1	1	8
45.1 – 50.0				1	1				1	1
50.1 – 55.0				1	1					
55.1 – 60.0				3	3					
60.1 – 65.0				1	1	1				1
65.1 – 70.0				3	3				1	1
70.1 – 75.0				1	1				1	1
75.1 – 80.0										
80.1 – 85.0		1			1					
85.1 – 90.0				4	4				1	1
90.1 – 95.0				2	2				1	1
95.1 – 100.0	1			2	3					
100.1 – 105.0				3	3					
105.1 – 110.0	1	2		5	8					
110.1 – 115.0	2	2	4		8		1			1
115.1 – 120.0	1		1		2					
120.1 – 125.0	1			3	4					
125.1 – 130.0		1	2	1	4				1	1
130.1 – 135.0	1			5	6					
135.1 – 140.0				7	7					
140.1 – 145.0			4	6	10		1			1
145.1 – 150.0				7	7					
150.1 – 155.0			2	4	6					
155.1 – 160.0		1	6	2	9					
160.1 – 165.0	1	1	1	1	4					
165.1 – 170.0			2	3	5					
170.1 – 175.0			1		1					
Total	8	10	26	141	185	12	25	9	24	70

Table 15. Diversity and evenness indices for benthic macroinvertebrates collected in the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

SHANNON'S DIVERSITY INDEX

Zone	Depth Substratum	Season: Spring	Summer	Fall	Winter
2	Intertidal	2.7951	3.0802	3.2315	1.9906
	Shallow/intermediate	3.4916	2.0917	2.6620	2.6783
	Channel	3.5841	1.9250	2.2116	2.6847
3	Intertidal	3.1657	3.2359	0.7155	0.2528
	Shallow/intermediate	3.4594	3.2005	2.5370	2.6013
	Channel	2.6020	2.7307	1.7349	2.3846
4	Intertidal	2.7115	2.5070	1.6420	1.3569
	Shallow/intermediate	3.8069	1.8279	2.2308	2.7878
	Channel	2.4610	2.3646	2.2681	1.3970
5	Intertidal	2.6528	1.4474	2.5730	2.2454
	Shallow/intermediate	2.6855	2.7569	1.4870	1.6470
	Channel	1.9936	2.5990	1.8016	2.5296
	Median	2.7533	2.5530	2.2212	2.3150
		Zone 2	Zone 3	Zone 4	Zone 5
	Median	2.6815	2.6017	2.3164	2.3875
		Intertidal	Shallow/ Intermediate	Channel	All
	Median	2.5400	2.6702	2.3746	2.5333

PIELOU'S EVENNESS INDEX

Zone	Depth Substratum	Season: Spring	Summer	Fall	Winter
2	Intertidal	0.6838	0.7387	0.7247	0.5754
	Shallow/intermediate	0.6475	0.4840	0.6061	0.5571
	Channel	0.7455	0.4710	0.6393	0.6020
3	Intertidal	0.6390	0.6595	0.7155	0.1264
	Shallow/intermediate	0.7196	0.6588	0.5776	0.5602
	Channel	0.5603	0.6681	0.4688	0.5962
4	Intertidal	0.6502	0.5708	0.3938	0.8561
	Shallow/intermediate	0.7254	0.4229	0.5079	0.6563
	Channel	0.5519	0.5567	0.6327	0.4976
5	Intertidal	0.7169	0.5599	0.6586	0.9670
	Shallow/intermediate	0.5648	0.7450	0.3501	0.4761
	Channel	0.4877	0.7023	0.5208	0.6189
	Median	0.6489	0.6148	0.5919	0.5858
		Zone 2	Zone 3	Zone 4	Zone 5
	Median	0.6227	0.6176	0.5638	0.5919
		Intertidal	Shallow/ Intermediate	Channel	All
	Median	0.6591	0.5712	0.5783	0.6041

Table 16. Minimum, maximum and mean measurements of temperature, salinity, conductivity and dissolved oxygen taken in the Delaware River between the C & D Canal and Trenton, NJ during 1992 and 1993.

			Zone															
			2				3				4				5			
		Season	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Temperature (°C)	Surface	Minimum	12.5	22.5	7.5	5.0	13.5	23.0	9.5	2.5	13.5	23.5	10.0	2.0	15.0	24.5	10.5	2.0
		Maximum	15.0	28.0	11.0	6.5	17.0	26.5	10.5	6.0	17.5	25.0	12.0	4.5	17.0	26.0	12.5	5.0
		Mean	14.1	25.7	9.4	5.8	15.0	24.6	9.8	4.9	14.9	24.1	10.7	3.5	15.6	24.9	11.3	2.9
	Bottom	Minimum	12.5	24.5	8.0	4.0	14.0	23.0	9.0	2.5	13.5	24.0	10.0	2.0	15.0	24.0	10.5	2.0
		Maximum	14.0	26.0	10.5	6.0	15.0	25.5	10.0	5.0	15.5	24.0	10.5	3.5	16.0	24.5	11.5	3.0
		Mean	13.3	25.2	9.6	4.8	14.5	23.8	9.7	4.3	14.4	24.0	10.4	3.1	15.5	24.3	10.8	2.5
Salinity (ppt)	Surface	Minimum	0	0				0			0	0	0	0	0	0	0	0
		Maximum	0	0			0	0			0	0	0	0	1	4	4	2
		Mean	0.0	0.0			0.0	0.0			0.0	0.0	0.0	0.0	0.1	1.7	1.3	0.4
	Bottom	Minimum		0			0	0			0	0		0	0	0	0	0
		Maximum		0			0	0			0	0		0	0	4	4	2
		Mean		0.0			0.0	0.0			0.0	0.0		0.0	0.0	2.4	1.7	0.7
Conductivity (umhos)	Surface	Minimum	90	180	105	110	109	185	140	110	100	240	185	170	90	500	185	180
		Maximum	115	205	150	150	145	235	185	175	225	375	400	195	900	5500	6000	2050
		Mean	102	189	125	122	120	197	156	122	154	296	229	179	293	2518	1788	654
	Bottom	Minimum	90	180	100	110	109	185	145	110	125	245	185	165	160	1300	245	180
		Maximum	105	195	140	120	140	235	180	175	165	310	280	195	850	6000	4000	2200
		Mean	98	187	125	114	120	199	164	124	153	281	222	177	291	3433	1543	815
Dissolved oxygen (ppm)	Surface	Minimum	8.0	5.8	9.0	12.1	8.1	4.6	8.1	12.0	8.4	4.7	7.9	11.8	8.2	6.3	8.1	11.8
		Maximum	11.2	7.7	10.5	13.1	9.6	8.6	9.9	12.6	11.4	7.0	9.1	12.8	10.4	8.1	9.7	13.2
		Mean	9.6	6.8	10.1	12.5	8.9	6.1	9.1	12.3	9.7	5.7	8.5	12.5	9.3	7.1	9.2	12.5
	Bottom	Minimum	9.0	5.8	9.5	12.2	8.1	4.3	8.5	12.2	7.4	4.7	8.1	12.2	8.4	6.2	8.4	11.9
		Maximum	10.2	7.4	10.4	12.7	9.5	6.1	10.1	12.7	10.0	5.9	8.8	12.7	9.4	7.2	9.8	13.2
		Mean	9.6	6.6	10.0	12.4	8.8	5.3	9.1	12.4	9.2	5.3	8.5	12.4	8.8	6.6	9.3	12.6

Table 17. Percent composition by grade classification of sediment collected in the Delaware River between the C & D Canal and Trenton, NJ during 1992 and 1993.

Zone	Depth Substratum	Mean Percent Composition							
		Pebble	Granule	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt/ Clay
2	Channel	5.9	1.7	3.1	9.6	15.3	21.0	11.2	32.2
	Shallow/ Intermediate	13.8	1.7	1.9	3.5	12.0	20.9	22.4	23.9
	Intertidal	20.1	6.3	6.3	13.8	23.3	14.5	5.2	10.5
	Combined	14.6	3.6	4.1	9.4	17.8	18.5	12.5	19.6
3	Channel	11.7	2.0	2.0	10.0	18.9	10.1	3.6	41.7
	Shallow/ Intermediate	2.0	1.5	1.7	2.6	11.3	14.7	20.6	45.6
	Intertidal	16.4	5.3	8.9	23.3	27.8	15.0	2.3	1.2
	Combined	10.2	2.6	4.1	12.7	20.2	13.5	8.4	28.2
4	Channel	20.9	3.9	3.9	7.9	26.8	13.7	3.7	19.3
	Shallow/ Intermediate	8.6	1.8	1.5	2.2	5.0	9.1	14.0	57.8
	Intertidal	14.3	6.7	6.1	14.4	22.5	10.7	6.5	18.7
	Combined	14.4	4.6	4.2	8.3	17.2	10.8	8.3	32.3
5	Channel	1.4	1.8	4.3	9.9	14.8	7.0	3.8	57.1
	Shallow/ Intermediate	0.1	0.4	2.2	2.8	3.3	11.1	16.2	63.9
	Intertidal	18.6	7.5	9.2	18.5	19.3	8.7	1.8	16.3
	Combined	7.1	3.3	5.3	10.4	12.3	9.1	7.5	45.0
	Study area	11.5	3.5	4.4	10.2	16.8	12.9	9.1	31.4

Table 18: List of benthic macroinvertebrate studies conducted in the Delaware River between the C & D canal and Trenton, NJ during the period 1970 and 1990.

DRBC Zone	Approximate Location	Sampling Dates	Sampling Interval	Number of sampling sites	Gear type	Replicates	Seive Size	Results	Reference
2	Trenton, NJ – Burlington NJ	Aug 1970 – Oct 1973	Monthly	4 Perpendicular Zones (majority of study)	Ponar Peterson	8 – 60 random	1.0 and 0.5 mm	density dry wt. biomass	Anselmini (1974) Crumb (1976) Crumb (1977)
4	Eddystone, PA	Nov 1971	One total	8 sites	Ponar	?	0.5 mm	species composition	Beson (1971)
4	Eddystone, PA	June – Nov 1971	?	?	Ponar	?	0.5 mm	species composition	Potter & Harmon (1973)
4	Eddystone, PA	Feb – Nov 1974	Quarterly	3 stations	Ponar	2	0.5 mm	species composition	Harmon & Smith (1975)
4 – 5	Naamans creek, DE	Oct – Nov 1985	Monthly	4 transects and 2 stations strat random	Ponar	3	0.5 mm	density	VJSA (1986)
4 – 5	Horseshoe bend – Bulkhead bar range	Sept, Oct, Nov 1987	Once	10 Transects sites 1 – 10	Ponar	5 – 17	3.2 and 0.592 mm	density	RMC (1988)
5	Delaware Memorial Bridge – C and D Canal	Mar 1971 – Dec 1972	Quarterly	12 stations	Van Veen, Peterson, Menzies trawl, Biol. dredge	3	?	n/station dry wt. biomass	Taylor et al. (1973)
5	C and D Canal	June – Sept 1971	Monthly	2 Sites	Ponar	3	0.5 mm	density dry wt. biomass	Smith (1974)
5	C and D Canal	April – Oct 1972	Bimonthly	2 Sites	Ponar	3	0.5 mm	density dry wt. biomass	Connelly (1974)
5	Edgemoor, DE	July – Sept 1972	Monthly	9 stations	Ponar	2	0.5 mm	density dry wt. biomass	Lindsay & Smith (1973)
5	Edgemoor, DE	Oct – Nov 1973	Monthly	9 stations	Ponar	2	0.5 mm	density dry wt. biomass	Orris (1974a)
5	Edgemoor, DE	Jan – May 1974	Monthly	9 stations	Ponar	2	0.5 mm	density	Orris (1974b)
5	Edgemoor, DE	July – Nov 1974	Bimonthly	9 stations	Ponar	2	0.5 mm	density dry wt. biomass	Browell (1975)
5	Edgemoor, DE	Jan – Sept 1975	Bimonthly	9 stations	Ponar	2	0.5 mm	density dry wt. biomass	Browell (1976)
5	Wilmington Harbor, DE	May – Oct 1974	Three total	2 stations strat random	Ponar	2	0.5 mm	density	Beck et al (1985)
5	Christina River, DE	Aug 1979 – July 1980	Two total	2 stations	?	2	?	n/grab	Rogalsky & Collier(1981)
5	Logan Township, NJ	None	None	None	None	None	None	summary species composition	BioSystems (1990)
2 – 5	Trenton, NJ – C and D Canal	Summer – Fall 1972	Once	154 total stations	?	?	?	species composition	Walton & Patrick (1973)
2 – 5	Trenton, NJ – C and D Canal	None	None	None	None	None	None	summary species composition	Ashton et al. (1975)
2 – 5	Trenton, NJ – C and D Canal	None	None	None	None	None	None	summary species composition	Betz (1975)
2 – 5	Trenton, NJ – C and D Canal	None	None	None	None	None	None	summary species composition	Tyrawski (1979)
2 – 5	Trenton, NJ – C and D Canal	July 1985	One total	8 Transects sites 5 – 13	Ekman Ponar	5 – 9	?	density species composition	PAS (1985)
2 – 5	Trenton, NJ – C and D Canal	June – Sept 1990	Once	?	?	1 – 5	0.5 mm	n/grab biomass	USEPA (1990)
2 – 5	Trenton, NJ – C and D Canal	None	None	None	None	None	None	summary species composition	Frithsen et al (1991)
3 – 5	Philadelphia, PA – C and D Canal	None	None	None	None	None	None	summary species composition	ANSP (1989)
3 – 5	Philadelphia, PA – C and D Canal	None	None	None	None	None	None	species composition	USACE (1990)

Table 19 Composite species list of benthic macroinvertebrates collected from the Delaware River between the C & D canal and Trenton, NJ, 1970 through 1993 HP= historically present, PS= present study

	ZONE 2						ZONE 3								ZONE 4								ZONE 5 (PARTIAL)											
TAXON	HP	70-73	72	85	90	PS	72	75	76	81	85	87	90	PS	71	72	73	74	85	87	90	PS	71	72	73	74	75	79	80	84	85	87	90	PS
PORIFERA																																		
SPONGILLA LACUSTRIS		•																																
MICROCIONA SPP.																								•										
MICROCIONA PROLIFERA																								•										
CNIDARIA																																		
HYDROZOA														•								•				•	•							•
BLACKFORDIA VIRGINICA																							•	•										
CORDYLOPHORA SPP.																								•	•									
CORDYLOPHORA CASPIA																								•		•								
GARVEIA SPP.																								•										
GARVEIA FRANCISCANA																			•				•	•							•			
HARTLAUBELLA GELATINOSA																								•										
SERTULARIA SPP																								•										
SERTULARIA ARGENTEA																								•										
HYDRIDAE														•																				
PLATYHELMINTHES																								•										
TURBELLARIA			•	•	•	•	•							•						•		•												•
DUGESIA TIGRINA		•																																
PHAGOCATA SPP		•																																
NEMERTEA (=NEMERTINEA, RHYNCHOCOELA)					•	•								•																	•	•	•	•
NEMATODA					•	•							•	•							•	•	•										•	•
ANNELIDA																																		
OLIGOCHAETA			•		•	•	•						•	•		•			•			•		•	•	•	•			•	•		•	•
AEOLOSOMATIDAE																																		
AEOLOSOMA HEMPRICHI		•																																
ENCHYTRAEIDAE						•								•							•	•												•
LUMBRICIDAE (EARTHWORMS)		•																																
LUMBRICULIDAE																		•																•
LUMBRICULUS INCONSTANS		•																																
MEGASCOLECIDAE						•																												
NAIDIDAE					•	•								•								•								•				•
ALLONAIS PECTINATA						•																												
AMPHICHAETA LEYDIGI						•								•																				•
ARCTEONAIS LOMONDI					•	•								•								•								•				•
CHAETOGASTER SPP.																						•												
CHAETOGASTER DIAPHANUS														•																				•
NAIS SPP.														•						•		•												•
NAIS BEHNINGI						•								•								•												•
NAIS BRETCHERI																																		•
NAIS COMMUNIS						•								•								•											•	•
NAIS ELINGUIS						•								•								•												
NAIS VARIABILIS						•								•								•												
PARANAIS SPP						•								•								•												•
PARANAIS FRICI (=WAPSA MOBILIS)														•								•								•				
PARANAIS LITORALIS						•								•								•	•	•										•
PIGUETIELLA MICHIGANENSIS														•								•												•

Table 19 (continued)

TAXON	ZONE 2 HP	70-73	72	85	90	PS	ZONE 3 72	75	76	81	85	87	90	PS	ZONE 4 71	72	73	74	85	87	90	PS	ZONE 5 (PARTIAL) 71	72	73	74	75	79	80	84	85	87	90	PS
PRISTINA SPP				•		•					•			•					•			•												
PRISTINELLA SPP														•								•												
SLAVINIA APPENDICULATA														•																				
SPECARIA JOSINAE					•	•								•								•												
STYLARIA LACUSTRIS		•																																
TUBIFICIDAE						•				•				•	•							•	•									•		•
AULODRILUS LIMNOBIUS					•	•										•	•					•												
AULODRILUS PIGUETI					•	•							•	•								•												•
AULODRILUS PLURISETA						•																												
BRANCHIURA SOWERBYI		•			•													•																
BRATISLAVIA UNIDENTADA																																	•	
HABER SPECIOSUS						•																												•
ILYODRILUS TEMPLETONI		•			•	•							•	•																				•
ISOCHAETIDES FREYI						•							•	•																				•
LIMNODRILUS SPP				•		•					•			•					•				•	•				•			•			•
LIMNODRILUS ANGUSTIPENIS		•																•																
LIMNODRILUS CERVIX		•										•				•	•	•		•														
LIMNODRILUS CLAPAREDIANUS						•						•				•	•			•														
LIMNODRILUS HOFFMEISTERI		•		•	•	•					•	•	•	•		•	•	•	•	•	•	•		•						•	•	•	•	•
LIMNODRILUS PROFUNDICOLA		•														•	•																	
LIMNODRILUS UDEKEMIANUS		•			•	•							•	•			•	•		•		•											•	•
POTAMOTHRIX MOLDAVIENSIS																•																		
PSAMMORYCTIDES CURVISETOSUS		•															•																	
QUISTADRILUS SPP (=PELOSCOLEX)				•		•					•							•	•	•											•			
QUISTADRILUS MULTISETOSUS		•			•	•						•	•	•		•	•			•	•													
QUISTADRILUS/ SPIROSPERMA SPP						•								•								•												
SPIROSPERMA FEROX (=PELOSCOLEX FEROX)		•														•	•																	
TUBIFEX SPP																												•						
TUBIFEX TUBIFEX																	•												•					
TUBIFICOIDES HETEROCHAETUS																																	•	
UNIDENTIFIED OLIGOCHAETE #1					•	•							•	•							•	•											•	•
UNIDENTIFIED OLIGOCHAETE #2					•	•								•								•											•	•
UNIDENTIFIED OLIGOCHAETE #3																																		•
UNIDENTIFIED OLIGOCHAETE #4																																		•
HIRUDINEA			•		•	•	•								•	•						•		•	•	•				•				
GLOSSIPHONIA COMPLANATA		•																																
HELOBDELLA SPP				•		•					•																							
HELOBDELLA ELONGATA		•														•		•						•		•	•							
HELOBDELLA FUSCA		•															•																	
HELOBDELLA STAGNALIS		•	•			•	•									•	•	•					•	•		•	•							
PLACOBDELLA SPP				•							•																							
PLACOBDELLA ORNATA		•																																
ERPOBDELLIDAE																		•																
DINA PARVA (=ERPOBDELLA PARVAE)																•																		
ERPOBDELLA PUNCTATA (=DINA LATERALIS)		•														•	•	•		•				•		•								
MOOREOBDELLA SPP											•																							
MOOREOBDELLA FERVIDA																•	•	•		•														
PISCICOLIDAE														•																				
CYSTOBRANCHUS SPP						•																•												
MYZOBDELLA LUGUBRIS (=ILLINOBDELLA SPP)																	•																	
PISCICOLA PUNCTATA						•																												•

Table 19. (continued).

TAXON	ZONE 2						ZONE 3								ZONE 4								ZONE 5 (PARTIAL)											
	HP	70-73	72	85	90	PS	72	75	76	81	85	87	90	PS	71	72	73	74	85	87	90	PS	71	72	73	74	75	79	80	84	85	87	90	PS
POLYCHAETA						•								•						•		•				•						•	•	•
HYPANIOLA FLORIDA (=H. GRAYI)																															•			
MANAYUNKIA AESTUARINA					•																													
MANAYUNKIA SPECIOSA		•		•		•								•			•					•												
MEDIOMASTUS AMBISETA																																	•	
NEREIDAE																				•														
NEREIS (=NEANTHES) SUCCINEA					•																	•	•	•							•		•	
SPIONIDAE														•												•	•							•
BOCCARDIELLA LIGERICA																																	•	
SCOLECOEPIDES (=MARENZELLERIA) VIRIDIS						•								•					•	•		•	•	•						•	•	•	•	•
POLYDORA SPP.																															•			•
MOLLUSCA																																		
BIVALVIA						•								•					•			•			•	•	•				•			•
ANADARA OVALIS																							•	•										
CONGERIA CONRADI																															•			
CORBICULA FLUMINEA		•	•	•	•	•	•				•	•		•					•	•	•	•				•								
MACOMA SPP																																•		
MACOMA BALTHICA																							•	•							•			
MERCENARIA MERCENARIA																										•								
MODIOLUS SPP.																								•										
MULINIA LATERALIS																													•		•			
RANGIA CUNEATA																							•	•							•			•
TELLINA SPP																															•			
SPHAERIIDAE ("FINGERNAIL CLAMS")						•				•					•																			
MUSCULIUM SPP				•	•								•						•	•														
PISIDIUM SPP		•			•	•								•								•												
PISIDIUM cf. COMPRESSUM																										•								
PISIDIUM CASERTANUM												•					•			•														
SPHAERIUM SPP																		•																
SPHAERIUM TRANSVERSUM		•																																
SPHAERIUM STRIATINUM																	•																	
UNIONIDAE ("FRESHWATER MUSSELS")			•																															
ANODONTA SPP.				•																														
ANODONTA CATARACTA		•																						•										
ELLIPTIO COMPLANATA		•				•																												
LAMPSILIS OCHRACEA		•																																
LAMPSILIS CARIOSA	•																																	
LIGUMIA NASUTA		•																																
GASTROPODA			•				•																											
AMNICOLA LIMOSA					•	•																												
CAMPELOMA SPP		•																																
GYRAULUS SPP																		•																
HELIZOMA SPP. (=PLANORBELLA SPP in part)		•																																
LYMNAEA SPP		•																•																
PHYSA SPP		•										•								•														
PHYSA INTEGRA																	•																	
VALVATA SPP		•																																
VIVIPARUS SPP				•																														
ANCYLIDAE						•														•		•				•	•							
FERRISSIA SPP		•			•																•													
FERRISSIA RIVULARIS																				•														
FERRISSIA TARDA																•	•																	

Table 19 (continued)

TAXON	ZONE 2						ZONE 3								ZONE 4								ZONE 5 (PARTIAL)											
	HP	70-73	72	85	90	PS	72	75	76	81	85	87	90	PS	71	72	73	74	85	87	90	PS	71	72	73	74	75	79	80	84	85	87	90	PS
LAEVAPEX SPP				•		•																•												
HYDROBIIDAE																					•													
CINCINNATIA WINKLEYI					•																													
PHYSIDAE						•																												
ARTHROPODA														•																				
ACARIFORMES						•																												
HYDRACARINA		•			•																•											•		
CRUSTACEA																																		
CLADOCERA						•								•								•												•
ILYOCRYPTUS SORDIDUS		•																																
LEPTODORA SPP											•																							
LEPTODORA KINDTII						•								•																				
COPEPODA						•								•								•												•
CIRRIPEDIA																																		
BALANUS SPP																								•										
BALANUS BALANOIDES																								•										
BALANUS IMPROVISUS																							•								•	•		
AMPHIPODA																						•										•		
GAMMARIDEA																																		•
COROPHIUM SPP										•												•		•	•							•		•
COROPHIUM ACUTUM																															•			
COROPHIUM LACUSTRE																			•				•	•		•	•						•	•
LEMBOS SPP																			•															
LEPTOCHEIRUS PINGUIS																							•											
LEPTOCHEIRUS PLUMULOSUS																								•						•	•		•	
MONOCULODES EDWARDSI																			•			•		•							•	•		•
MONOCULODES SP 1 (WATLING)																																	•	
GAMMARIDAE																							•					•				•		
GAMMARUS SPP			•	•	•	•	•				•	•	•	•					•	•	•	•	•	•		•	•		•	•	•	•	•	•
GAMMARUS DAIBERI					•																•		•	•	•	•							•	
GAMMARUS FASCIATUS		•			•												•	•						•										
GAMMARUS MUCRONATUS																															•			
MELITA SPP																															•			
MELITA APPENDICOLATA																															•			
MELITA NITIDA																																	•	
CUMACEA				•																														
ALMYRACUMA PROXIMOCULI						•																•												
CYCLASPIS VARIANS					•																	•												
LEUCON AMERICANUS																								•										
ISOPODA														•								•		•								•		
AEGATHOA MEDIALIS																															•			
CASSIDISCA LUNIFRONS						•														•		•									•			
CHIRIDOTEA ALMYRA						•						•		•					•	•	•	•	•	•	•	•	•			•	•	•	•	•
CYATHURA POLITA		•	•	•	•	•					•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•
EDOTEA TRILOBA					•																			•							•			
IDOTEA SPP											•																							
ASELLIDAE																						•												
CAECIDOTEA SPP (=ASELLUS SPP)						•												•						•	•									
ASELLUS COMMUNIS																•	•																	
ASELLUS MILITARIS		•																								•	•							

Table 19 (continued)

TAXON	ZONE 2						ZONE 3								ZONE 4								ZONE 5 (PARTIAL)											
	HP	70-73	72	85	90	PS	72	75	76	81	85	87	90	PS	71	72	73	74	85	87	90	PS	71	72	73	74	75	79	80	84	85	87	90	PS
"ASELLOTE ISOPOD"			•				•									•																		
MYSIDACEA																																		
MYSIDAE																																•		
MYSIDOPSIS BIGELOWI																															•			
NEOMYSIS AMERICANA																							•	•	•		•			•	•	•		•
DECAPODA																																		
CALLINECTES SAPIDUS								•	•						•									•	•						•			
CRANGON SEPTEMSPINOSA																							•	•	•						•			•
ORONECTES LIMOSUS		•																																
PALAEMONETES PALUDOSUS																	•																	
PALAEMONETES PUGIO															•									•							•			
XANTHIDAE																																•		
RHITHROPANOPEUS HARRISI																			•				•	•	•	•	•				•	•	•	
INSECTA			•																					•	•	•								
EPHEMEROPTERA																																		•
BAETIS SPP		•																																
CAENIS SPP	•				•																												•	
STENONEMA (BIPUNCTATUS GROUP) SPP	•																																	
STENONEMA poss HETEROTARSALE	•																																	
TRICORYTHODES SPP					•																													
ODONATA																																		
ARGIA SPP		•																																
LESTES SPP		•																																
DIDYMOPS SPP		•																																
GOMPHUS SPP	•	•																																
MACROMIA SPP		•																																
HEMIPTERA														•						•														
HETEROPTERA						•																												
NOTONECTA SPP		•																																
RANATRA SPP		•																																
COLEOPTERA																																		
BEROSUS SPP		•				•																												
ELMIDAE		•																																
OPTIOSERVUS SPP						•																												
STENELMIS SPP																				•														
TRICOPTERA				•		•																												
CHEUMATOPSYCHE SPP	•	•																																
HESPEROPHYLAX SPP		•																																
HYDROPSYCHE SPP		•																•																
HYDROPSYCHE (bifida group) SPP	•																																	
HYDROPSYCHE PHALERATA	•																																	
HYDROPTILA SPP		•																																
LEUCOTRICHIA SPP						•																												
NEUROCLIPSIS SPP	•																																	
OECETIS SPP					•																													
LEPIDOPTERA																																		•
CATACLYSTA SPP		•																																
DIPTERA						•								•										•		•			•					
STRATIOMYS SPP		•																																
CHAORBORUS SPP																							•											
CHAOBORUS PUNCTIPENNIS																															•			

Table 19: (continued)

TAXON	ZONE 2						ZONE 3								ZONE 4								ZONE 5 (PARTIAL)											
	HP	70-73	72	85	90	PS	72	75	76	81	85	87	90	PS	71	72	73	74	85	87	90	PS	71	72	73	74	75	79	80	84	85	87	90	PS
PSYCHODA SPP																	•																	
TELMATOSCOPUS ALBIPUNCTATUS																	•																	
CERATOPOGONIDAE		•				•								•								•					•							•
CULICIDAE																											•							
TIPULIDAE																						•												•
LIMNOMIA SPP														•																				
LIMNOPHORA DISCRETA		•																																
ORMOSIA SPP						•																												
TIPULA SPP		•																																
CHIRONOMIDAE			•	•	•	•	•							•							•	•	•	•		•	•		•	•	•	•	•	•
CHIRONOMINAE						•								•								•								•				
TANYTARSINI					•	•								•							•	•												
CLADOTANYTARSUS						•								•								•												•
MICROPSECTRA						•								•								•												
RHEOTANYTARSUS SPP						•						•								•		•										•		
TANYTARSUS SPP	•					•						•		•						•	•	•												•
CHIRONOMINI						•								•								•												•
CHIRONOMOUS SPP	•			•		•					•			•			•	•				•												
CHIRONOMOUS RIPARIUS		•																																
CRYPTOCHIRONOMUS SPP		•		•	•	•					•		•	•			•	•	•			•	•	•						•	•			•
CRYPTOCHIRONOMUS FULVUS					•							•								•														
DICROTENDIPES SPP						•					•			•				•			•	•												
DICROTENDIPES NERVOSUS					•							•								•	•											•		
GLYPTOTENDIPES SPP					•															•	•	•												
HARNISCHIA SPP					•																													
POLYPEDILUM SPP						•								•			•	•				•								•				•
POLYPEDILUM SCALAENUM												•								•												•		
POLYPEDILUM TRIPODURA					•								•																				•	
PSEUDOCHIRONOMUS SPP																					•												•	
ORTHOCLADIINAE						•								•								•												
ACRICOTOPUS SPP (=TRICHOCLADIUS SPP)																	•																	
CRICOTOPUS SPP																	•																	
CRICOTOPUS/ ORTHOCLADIUS SPP						•								•								•												
NANOCLADIUS SPP						•								•								•												
NANOCLADIUS DISTINCTUS																				•														
SMITTIA SPP																																		•
PSECTROCLADIUS SPP																	•																	
TANYPODINAE														•																				
ABLABESMYIA SPP						•											•																	
ABLABESMYIA (EXCEPT ANNULATA) GROUP						•																												
APSECTROTANYPUS SPP						•																												
COELOTANYPUS SPP					•																										•			
PENTANEURA SPP																	•																	
PROCLADIUS SPP				•		•					•			•			•		•			•								•	•			•
PROCLADIUS CULICIFORMIS		•																																
PROCLADIUS SUBLETTI					•							•								•														
TANYPUS SPP																	•													•	•			
ECTOPROCTA (=BRYOZOA)			•				•							•		•						•												
AMATHIA VIDOVICI																							•	•										
PECTINATELLA MAGNIFICA		•																																
PLUMATELLA SPP		•																																

Table 20. Dominant taxa of benthic macroinvertebrates, by density, collected in the Delaware River between the C & D Canal and Trenton, NJ, from 1971 to 1990, as reported in, or calculated from, cited studies.

ZONE	YEAR	DOMINANT TAXON	AUTHOR
2	1971	Oligochaeta, Chironomidae	Anselmini (1974)
	1972	Oligochaeta, Chironomidae	Crumb (1976)
	1973	Oligochaeta, Chironomidae	Crumb (1977)
	1990	Oligochaeta	USEPA (1990)
3	1985	Oligochaeta	PAS (1985)
	1990	Oligochaeta	USEPA (1990)
4	1971	Oligochaeta	Potter & Harmon (1973)
	1974	Oligochaeta, Hirudinea	Harmon & Smith (1975)
	1985	Oligochaeta, Isopoda, Amphipoda	VJSA (1986)
	1985	Oligochaeta	PAS (1985)
	1987	Oligochaeta, Amphipoda, Isopoda	RMC (1988)
	1990	Amphipoda, Isopoda	USEPA (1990)
5	1971	Oligochaeta, Amphipoda	Smith (1974)
	1972	Oligochaeta	Taylor et al. (1973)
	1972	Oligochaeta, Amphipoda	Connelly (1974)
	1972	Oligochaeta, Amphipoda	Lindsay & Smith (1973)
	1973	Oligochaeta, Amphipoda	Orris (1974a)
	1974	Oligochaeta, Amphipoda	Browell (1975), Orris (1974b)
	1975	Oligochaeta, Amphipoda	Browell (1976)
	1980	Oligochaeta, Chironomidae	Rogalsky & Collier (1981)
	1984	Oligochaeta, Polychaeta, Chironomidae	Beck et al. (1985)
	1985	Oligochaeta, Polychaeta	VJSA (1986)
	1985	Oligochaeta, Amphipoda, Polychaeta	PAS (1985)
	1987	Amphipoda, Isopoda, Polychaeta	RMC (1988)
	1990	Polychaeta, Oligochaeta	USEPA (1990)

Table 21. Total trophic support values (g/m²) for white perch ≤ 150 mm fork length determined using the Benthic Resources Assessment Technique during summer 1992 in the Delaware River between the C & D canal and Trenton, NJ.

ZONE	2					2					2				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0343	0.0438		0.1093	0.6367	0.8620	0.8343	0.0772	0.4165	0.6560	0.5896	0.1894
Polychaeta															
Amphipoda									0.0154	0.0022			0.0139	0.0299	0.0083
Isopoda				0.0006			0.0271	0.0561	0.0249						
Chironomidae			0.0343	0.0987	0.1500				0.0265	0.0154				0.0009	0.0176
Mollusca			0.0416	2.0555	0.0388	13.8469	0.0457	0.0135	0.0003	0.0013				0.0101	0.0066
Proportion of Stomach contents															
Oligochaeta															
Polychaeta															
Amphipoda				1.0000				0.0156	0.1697	0.7478			0.0363	0.4998	0.4588
Isopoda									0.0371				0.0037	0.0008	0.0005
Chironomidae									0.0076	0.0022					
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda									0.0029	0.0016			0.0005	0.0150	0.0029
Isopoda									0.0009						
Chironomidae									0.0002	0.0000					
Mollusca															
Total trophic support g/m²										0.0057					0.0184

ZONE	3					3					3				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta			0.0350	0.0369	0.2259	0.1398	0.3765	0.8106	0.7911	0.2906	0.0028	0.0753	0.2319	0.3192	0.1764
Polychaeta							0.0539	0.0287	0.0025	0.0085			0.0606	0.0365	
Amphipoda			0.0356	0.0822	0.0154		0.0416	0.1219	0.2256	0.1137			0.0621	0.3573	0.0514
Isopoda				0.0120			0.4619	1.3938	0.4260	0.2054		0.0951	0.2316	0.0485	0.0315
Chironomidae			0.0375	0.1424	0.1393		0.0104	0.0397	0.1330	0.2895			0.0066	0.0611	0.0686
Mollusca	0.1919	0.0258	0.1452	0.0977	0.0217	2.6928	0.0986			0.0041					
Proportion of Stomach contents															
Oligochaeta		0.0166			0.0037										
Polychaeta															
Amphipoda			0.4310	0.4239	0.0837		0.0163	0.4138	0.3739	0.1567			0.2284	0.4660	0.3056
Isopoda				0.0380			0.0386		0.0002	0.0005					
Chironomidae					0.0030										
Mollusca															
Trophic support value															
Oligochaeta					0.0008										
Polychaeta															
Amphipoda			0.0153	0.0349	0.0013		0.0007	0.0505	0.0844	0.0178			0.0142	0.1665	0.0157
Isopoda				0.0005			0.0178		0.0001	0.0001					
Chironomidae					0.0004										
Mollusca															
Total trophic support g/m²					0.0532					0.1713					0.1964

Table 21: (continued).

ZONE	4					4					4				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta		0.2692	0.2921	0.3409	0.0419				0.0964	0.0517	0.0120	0.0334	0.1002	0.3686	0.3674
Polychaeta							0.0422	0.0321	0.0372	0.0003					
Amphipoda			0.0146	0.0069	0.0206		0.0520	0.1572	0.1934	0.2505		0.5060	1.7464	0.2105	0.0054
Isopoda			0.0214		0.0104		0.2372	0.2524	0.1474	0.0173			0.0132	0.0473	
Chironomidae	0.0069	0.0173	0.0356	0.1330	0.1165				0.0192	0.0465				0.0145	0.0255
Mollusca		0.1033	0.0082	0.0110	0.0041		0.0989	0.1626	0.0161	0.0044		0.0784		0.0003	0.0003
Proportion of Stomach contents															
Oligochaeta				0.3052	0.1628										
Polychaeta															
Amphipoda				0.4951	0.0078				0.6094	0.3734			0.3607	0.6393	
Isopoda				0.0078											
Chironomidae					0.0194					0.0172					
Mollusca															
Trophic support value															
Oligochaeta				0.1044	0.0068										
Polychaeta															
Amphipoda				0.0034	0.0002				0.1179	0.0935			0.6300	0.1345	
Isopoda															
Chironomidae					0.0023					0.0008					
Mollusca															
Total trophic support g/m²					0.1171					0.2123					0.7645

ZONE	5					5					5				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0006				0.0146	0.0230	0.0050				0.0016	0.0041
Polychaeta						0.4461	1.0142	0.8242	0.2215		0.9537	2.6903	0.8557	0.3563	0.0249
Amphipoda			0.0145	0.0353	0.0016		0.1156	0.1118	0.0287	0.0202			0.0400	0.0290	0.0066
Isopoda							0.1301	0.0413	0.0110	0.0085			0.0050	0.0202	0.0028
Chironomidae				0.0082	0.0123										0.0019
Mollusca								0.1141	0.0022	0.0003					
Proportion of Stomach contents															
Oligochaeta															
Polychaeta							0.0379			0.0069					
Amphipoda			NO	DATA			0.2534	0.1440	0.2629	0.2681	0.0412	0.4262		0.3254	0.1671
Isopoda										0.0267				0.0201	
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta							0.0385								
Amphipoda							0.0293	0.0161	0.0075	0.0054				0.0094	0.0012
Isopoda										0.0002				0.0004	
Chironomidae															
Mollusca															
Total trophic support g/m²										0.0970					0.0111

Table 22. Total trophic support values (g/m²) for white perch > 150 mm fork length determined using the Benthic Resources Assessment Technique during summer 1992 in the Delaware River between the C & D canal and Trenton, NJ.

ZONE	2					2					2				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0343	0.0438		0.1093	0.6367	0.8620	0.8343	0.0772	0.4165	0.6560	0.5898	0.1694
Polychaeta															
Amphipoda									0.0154	0.0022			0.0139	0.0299	0.0063
Isopoda				0.0006			0.0271	0.0561	0.0249						
Chironomidae			0.0343	0.0967	0.1500				0.0265	0.0154				0.0009	0.0176
Mollusca			0.0416	2.0555	0.0368	13.8469	0.0457	0.0135	0.0003	0.0013				0.0101	0.0066
Proportion of **Stomach contents**															
Oligochaeta															
Polychaeta															
Amphipoda	0.0118	0.0126	0.3005	0.5848	0.0901			NO	DATA			0.0192	0.2752	0.5212	0.1842
Isopoda													0.0002		
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda													0.0038	0.0156	0.0012
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m²															0.0206

ZONE	3					3					3				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta			0.0350	0.0369	0.2259	0.1396	0.3765	0.8106	0.7911	0.2936	0.0026	0.0753	0.2319	0.3192	0.1764
Polychaeta							0.0539	0.0267	0.0025	0.0085			0.0608	0.0365	
Amphipoda			0.0356	0.0622	0.0154		0.0416	0.1219	0.2258	0.1137			0.0621	0.3573	0.0514
Isopoda				0.0120			0.4619	1.3938	0.4260	0.2054		0.0961	0.2316	0.0465	0.0315
Chironomidae			0.0375	0.1424	0.1393		0.0104	0.0397	0.1330	0.2695			0.0056	0.0611	0.0668
Mollusca	0.1919	0.0258	0.1452	0.0077	0.0217	2.6926	0.0986			0.0041					
Proportion of **Stomach contents**															
Oligochaeta															
Polychaeta															
Amphipoda			NO	DATA			0.0234	0.2599	0.6939	0.0229			NO	DATA	
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda							0.0010	0.0317	0.1565	0.0026					
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m²										0.1916					

Table 22: (continued).

ZONE	4					4					4				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta		0.2892	0.2921	0.3409	0.0419				0.0964	0.0517	0.0120	0.0334	0.1002	0.3686	0.3674
Polychaeta							0.0422	0.0321	0.0372	0.0003					
Amphipoda			0.0148	0.0089	0.0208		0.0520	0.1572	0.1934	0.2505		0.5080	1.7464	0.2105	0.0054
Isopoda			0.0214		0.0104		0.2372	0.2524	0.1474	0.0173			0.0132	0.0473	
Chironomidae	0.0089	0.0173	0.0356	0.1330	0.1185				0.0192	0.0485				0.0145	0.0255
Mollusca		0.1033	0.0082	0.0110	0.0041		0.0989	0.1626	0.0161	0.0044		0.0784		0.0003	0.0003
Proportion of Stomach contents															
Oligochaeta			0.2090												
Polychaeta															
Amphipoda				0.5075				0.6759	0.2407	0.0833			NO	DATA	
Isopoda				0.2239	0.0597										
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta			0.0610												
Polychaeta															
Amphipoda				0.0035				0.1063	0.0466	0.0209					
Isopoda					0.0006										
Chironomidae															
Mollusca															
Total trophic support g/m²					0.0652					0.1737					

ZONE	5					5					5				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0006				0.0148	0.0230	0.0050				0.0016	0.0041
Polychaeta						0.4461	1.0142	0.8242	0.2215		0.9537	2.6903	0.8557	0.3563	0.0249
Amphipoda			0.0145	0.0353	0.0016		0.1156	0.1118	0.0287	0.0202			0.0400	0.0290	0.0066
Isopoda							0.1301	0.0413	0.0110	0.0085			0.0050	0.0202	0.0028
Chironomidae				0.0082	0.0123										0.0019
Mollusca								0.1141	0.0022	0.0003					
Proportion of Stomach contents															
Oligochaeta															
Polychaeta															
Amphipoda	0.0651	0.2704	0.0717	0.1889	0.4039			0.4409	0.3870	0.1631			0.0018	0.4381	0.5434
Isopoda													0.0053	0.0115	
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda			0.0010	0.0067	0.0006			0.0503	0.0111	0.0033			0.0001	0.0127	0.0036
Isopoda													0.0000	0.0002	
Chironomidae															
Mollusca															
Total trophic support g/m²					0.0083					0.0647					0.0166

Table 23. Total trophic support values (g/m²) for striped bass ≤ 100 mm fork length determined using the Benthic Resources Assessment Technique during summer 1992 in the Delaware River between the C & D canal and Trenton, NJ.

ZONE	2					2					2				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0343	0.0438		0.1093	0.6367	0.6620	0.6343	0.0772	0.4165	0.6560	0.5698	0.1694
Polychaeta															
Amphipoda									0.0154	0.0022			0.0139	0.0299	0.0063
Isopoda				0.0006			0.0271	0.0561	0.0249						
Chironomidae			0.0343	0.0987	0.1500				0.0265	0.0154				0.0009	0.0176
Mollusca			0.0416	2.0555	0.0368	13.6469	0.0457	0.0135	0.0003	0.0013				0.0101	0.0066
Proportion of **Stomach contents**															
Oligochaeta															
Polychaeta															
Amphipoda			0.1550	0.0750	0.0417			NO	DATA				NO	DATA	
Isopoda			0.0783	0.3950											
Chironomidae				0.1633	0.0917										
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda															
Isopoda				0.0002											
Chironomidae				0.0158	0.0137										
Mollusca															
Total trophic support g/m²					0.0296										

ZONE	3					3					3				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta			0.0350	0.0369	0.2259	0.1396	0.3765	0.6106	0.7911	0.2936	0.0026	0.0753	0.2319	0.3192	0.1764
Polychaeta							0.0539	0.0267	0.0025	0.0085			0.0606	0.0365	
Amphipoda			0.0356	0.0822	0.0154		0.0416	0.1219	0.2256	0.1137			0.0621	0.3573	0.0514
Isopoda				0.0120			0.4619	1.3938	0.4260	0.2054		0.0961	0.2316	0.0465	0.0315
Chironomidae			0.0375	0.1424	0.1393		0.0104	0.0397	0.1330	0.2695			0.0056	0.0611	0.0868
Mollusca	0.1919	0.0258	0.1452	0.0977	0.0217	2.6926	0.0986			0.0041					
Proportion of **Stomach contents**															
Oligochaeta			0.1240	0.0950	0.1161										
Polychaeta															
Amphipoda				0.1293	0.3219			NO	DATA				NO	DATA	
Isopoda				0.0660	0.0165										
Chironomidae					0.1293										
Mollusca															
Trophic support value															
Oligochaeta			0.0043	0.0035	0.0262										
Polychaeta															
Amphipoda				0.0106	0.0050										
Isopoda				0.0008											
Chironomidae					0.0180										
Mollusca															
Total trophic support g/m²					0.0685										

Table 23: (continued).

ZONE	4					4					4				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta		0.2892	0.2921	0.3409	0.0419				0.0984	0.0517	0.0120	0.0334	0.1002	0.3686	0.3674
Polychaeta							0.0422	0.0321	0.0372	0.0003					
Amphipoda			0.0148	0.0069	0.0208		0.0520	0.1572	0.1934	0.2505		0.5080	1.7464	0.2105	0.0054
Isopoda			0.0214		0.0104		0.2372	0.2524	0.1474	0.0173			0.0132	0.0473	
Chironomidae	0.0059	0.0173	0.0358	0.1330	0.1185				0.0192	0.0485				0.0145	0.0255
Mollusca		0.1033	0.0082	0.0110	0.0041		0.0989	0.1626	0.0161	0.0044		0.0784		0.0003	0.0003
Proportion of Stomach contents															
Oligochaeta															
Polychaeta															
Amphipoda					1.0000				0.5106	0.0851			NO	DATA	
Isopoda									0.4043						
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda					0.0208				0.0988	0.0213					
Isopoda									0.0596						
Chironomidae															
Mollusca															
Total trophic support g/m²					0.0208					0.1797					

ZONE	5					5					5				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0006				0.0148	0.0230	0.0050				0.0016	0.0041
Polychaeta						0.4461	1.0142	0.8242	0.2215		0.9537	2.6903	0.8557	0.3563	0.0249
Amphipoda			0.0145	0.0353	0.0016		0.1156	0.1118	0.0287	0.0202			0.0400	0.0290	0.0068
Isopoda							0.1301	0.0413	0.0110	0.0085			0.0050	0.0202	0.0028
Chironomidae				0.0082	0.0123										0.0019
Mollusca								0.1141	0.0022	0.0003					
Proportion of Stomach contents															
Oligochaeta															
Polychaeta	1.0000														
Amphipoda								0.3196	0.5155	0.1649			NO	DATA	
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda								0.0357	0.0148	0.0033					
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m²										0.0538					

Table 24. Total trophic support values (g/m²) for striped bass 101 – 200 mm fork length determined using the Benthic Resources Assessment Technique during summer 1992 in the Delaware River between the C & D canal and Trenton, NJ.

ZONE	2					2					2				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0343	0.0436		0.1093	0.6367	0.8620	0.8343	0.0772	0.4165	0.6560	0.5898	0.1894
Polychaeta															
Amphipoda									0.0154	0.0022			0.0139	0.0299	0.0063
Isopoda				0.0006			0.0271	0.0561	0.0249						
Chironomidae			0.0343	0.0987	0.1500				0.0265	0.0154				0.0009	0.0176
Mollusca			0.0416	2.0555	0.0366	13.8469	0.0457	0.0135	0.0003	0.0013				0.0101	0.0066
Proportion of **Stomach contents**															
Oligochaeta					0.0153										
Polychaeta															
Amphipoda					0.0456			NO	DATA				NO	DATA	
Isopoda			0.4504	0.4865											
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta					0.0007										
Polychaeta															
Amphipoda															
Isopoda				0.0003											
Chironomidae															
Mollusca															
Total trophic support g/m²					0.0010										

ZONE	3					3					3				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta			0.0350	0.0369	0.2259	0.1396	0.3765	0.8106	0.7911	0.2936	0.0028	0.0753	0.2319	0.3192	0.1764
Polychaeta							0.0539	0.0267	0.0025	0.0085			0.0606	0.0365	
Amphipoda			0.0356	0.0822	0.0154		0.0416	0.1219	0.2256	0.1137			0.0621	0.3573	0.0514
Isopoda				0.0120			0.4619	1.3938	0.4280	0.2054		0.0961	0.2316	0.0465	0.0315
Chironomidae			0.0375	0.1424	0.1393		0.0104	0.0397	0.1330	0.2695			0.0066	0.0611	0.0668
Mollusca	0.1919	0.0258	0.1452	0.0077	0.0217	2.6928	0.0986			0.0041					
Proportion of **Stomach contents**															
Oligochaeta				0.0084											
Polychaeta															
Amphipoda		0.0705			0.0062			NO	DATA				NO	DATA	
Isopoda			0.4099	0.3667	0.1286										
Chironomidae				0.0078	0.0017										
Mollusca															
Trophic support value															
Oligochaeta				0.0003											
Polychaeta															
Amphipoda					0.0001										
Isopoda				0.0044											
Chironomidae				0.0011	0.0002										
Mollusca															
Total trophic support g/m²					0.0061										

Table 24: (continued).

ZONE	4					4					4				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta		0.2692	0.2921	0.3409	0.0419				0.0984	0.0517	0.0120	0.0334	0.1002	0.3686	0.3674
Polychaeta							0.0422	0.0321	0.0372	0.0003					
Amphipoda			0.0148	0.0069	0.0208		0.0520	0.1572	0.1934	0.2505		0.5060	1.7464	0.2105	0.0054
Isopoda			0.0214		0.0104		0.2372	0.2524	0.1474	0.0173			0.0132	0.0473	
Chironomidae	0.0069	0.0173	0.0356	0.1330	0.1185				0.0192	0.0465				0.0145	0.0255
Mollusca		0.1033	0.0082	0.0110	0.0041		0.0969	0.1626	0.0161	0.0044		0.0764		0.0003	0.0003
Proportion of Stomach contents															
Oligochaeta															
Polychaeta					0.7917										
Amphipoda					0.2083			NO	DATA				NO	DATA	
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda					0.0043										
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m²					0.0043										

ZONE	5					5					5				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0006				0.0148	0.0230	0.0050				0.0016	0.0041
Polychaeta						0.4461	1.0142	0.8242	0.2215		0.9537	2.6903	0.8557	0.3563	0.0249
Amphipoda			0.0145	0.0353	0.0016		0.1156	0.1118	0.0287	0.0202			0.0400	0.0290	0.0056
Isopoda							0.1301	0.0413	0.0110	0.0085			0.0050	0.0202	0.0028
Chironomidae				0.0082	0.0123										0.0019
Mollusca								0.1141	0.0022	0.0003					
Proportion of Stomach contents															
Oligochaeta															
Polychaeta															
Amphipoda								NO	DATA				NO	DATA	
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda															
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m²					0.0000										

Table 25. Total trophic support values (g/m^2) for striped bass > 200 mm fork length determined using the Benthic Resources Assessment Technique during summer 1992 in the Delaware River between the C & D canal and Trenton, NJ.

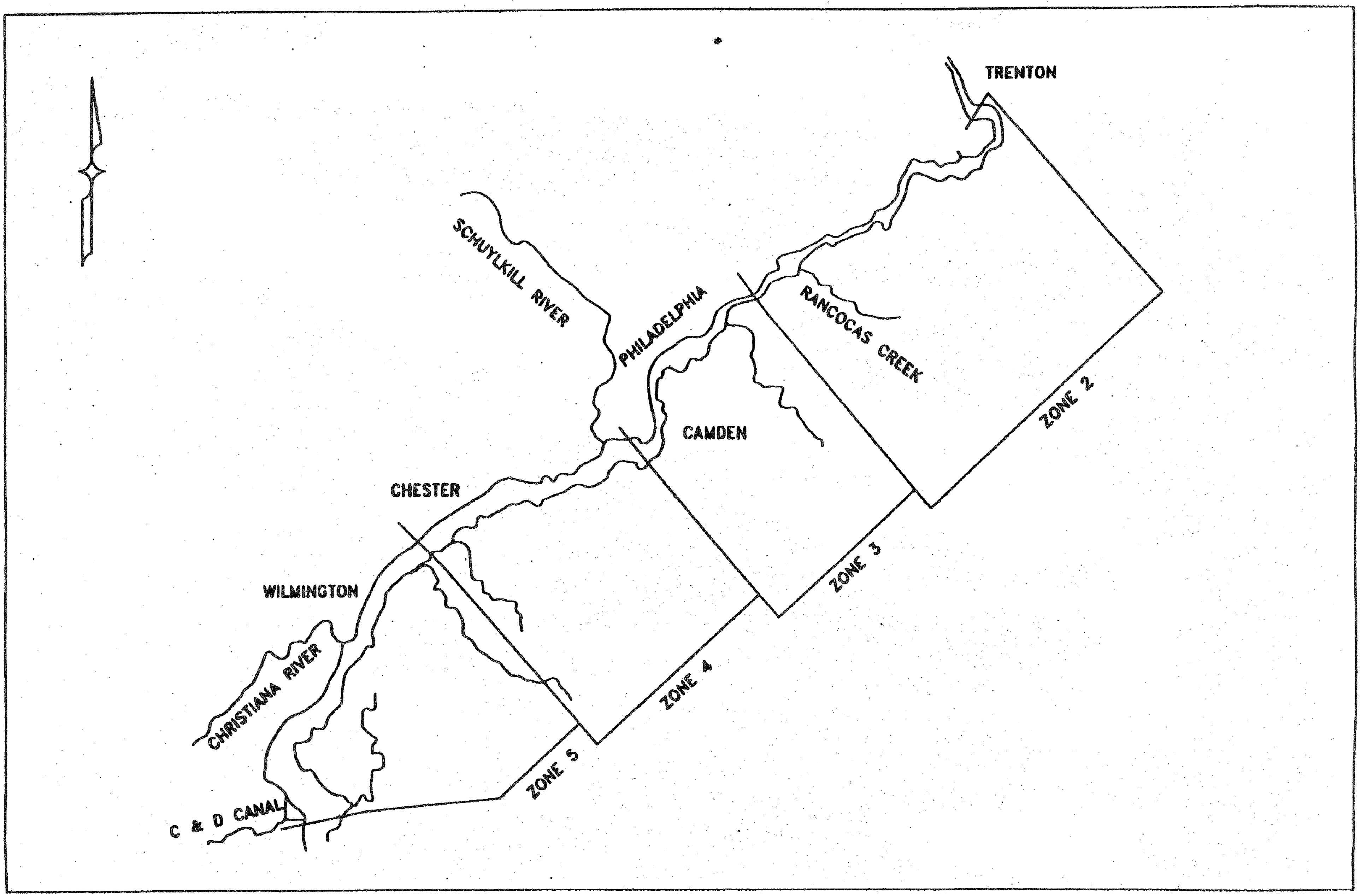
ZONE	2					2					2				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m^2															
Oligochaeta				0.0343	0.0438		0.1093	0.6367	0.6620	0.8343	0.0772	0.4165	0.6560	0.5698	0.1894
Polychaeta															
Amphipoda									0.0154	0.0022			0.0139	0.0299	0.0063
Isopoda				0.0006			0.0271	0.0561	0.0249						
Chironomidae			0.0343	0.0967	0.1500				0.0265	0.0154				0.0009	0.0176
Mollusca			0.0416	2.0555	0.0366	13.6469	0.0457	0.0135	0.0003	0.0013				0.0101	0.0066
Proportion of **Stomach contents**															
Oligochaeta															
Polychaeta															
Amphipoda			NO	DATA				NO	DATA				NO	DATA	
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda															
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m^2															

ZONE	3					3					3				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m^2															
Oligochaeta			0.0350	0.0369	0.2259	0.1396	0.3765	0.8106	0.7911	0.2936	0.0026	0.0753	0.2319	0.3192	0.1764
Polychaeta							0.0539	0.0287	0.0025	0.0085			0.0608	0.0365	
Amphipoda			0.0356	0.0822	0.0154		0.0416	0.1219	0.2256	0.1137			0.0621	0.3573	0.0514
Isopoda				0.0120			0.4619	1.3938	0.4260	0.2054		0.0961	0.2316	0.0465	0.0315
Chironomidae			0.0375	0.1424	0.1393		0.0104	0.0397	0.1330	0.2695			0.0066	0.0611	0.0668
Mollusca	0.1919	0.0258	0.1452	0.0977	0.0217	2.6928	0.0986			0.0041					
Proportion of **Stomach contents**															
Oligochaeta															
Polychaeta															
Amphipoda			NO	DATA				NO	DATA				NO	DATA	
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda															
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m^2															

Table 25: (continued).

ZONE	4					4					4				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta		0.2892	0.2921	0.3409	0.0419				0.0964	0.0517	0.0120	0.0334	0.1002	0.3686	0.3674
Polychaeta							0.0422	0.0321	0.0372	0.0003					
Amphipoda			0.0146	0.0059	0.0208		0.0520	0.1572	0.1934	0.2505		0.5080	1.7464	0.2105	0.0054
Isopoda			0.0214		0.0104		0.2372	0.2524	0.1474	0.0173			0.0132	0.0473	
Chironomidae	0.0059	0.0173	0.0356	0.1330	0.1185				0.0192	0.0485				0.0145	0.0255
Mollusca		0.1033	0.0082	0.0110	0.0041		0.0989	0.1626	0.0161	0.0044		0.0784		0.0003	0.0003
Proportion of **Stomach contents**															
Oligochaeta															
Polychaeta															
Amphipoda			NO	DATA					0.8065	0.1935				1.0000	
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda									0.1560	0.0485				0.2105	
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m²										0.2045					0.2105

ZONE	5					5					5				
SUBSTRATUM	Intertidal					Shallow/ Intermediate					Channel				
SIZE CLASS (mm)	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50	6.30	3.35	2.00	1.00	0.50
Sediment biomass g/m²															
Oligochaeta				0.0006				0.0148	0.0230	0.0050				0.0016	0.0041
Polychaeta						0.4461	1.0142	0.8242	0.2215		0.9537	2.6903	0.6557	0.3563	0.0249
Amphipoda			0.0145	0.0353	0.0016		0.1156	0.1118	0.0287	0.0202			0.0400	0.0290	0.0086
Isopoda							0.1301	0.0413	0.0110	0.0085			0.0050	0.0202	0.0028
Chironomidae				0.0082	0.0123										0.0019
Mollusca								0.1141	0.0022	0.0003					
Proportion of **Stomach contents**															
Oligochaeta															
Polychaeta															
Amphipoda			NO	DATA				NO	DATA					0.5250	0.4750
Isopoda															
Chironomidae															
Mollusca															
Trophic support value															
Oligochaeta															
Polychaeta															
Amphipoda														0.0152	0.0031
Isopoda															
Chironomidae															
Mollusca															
Total trophic support g/m²															0.0184

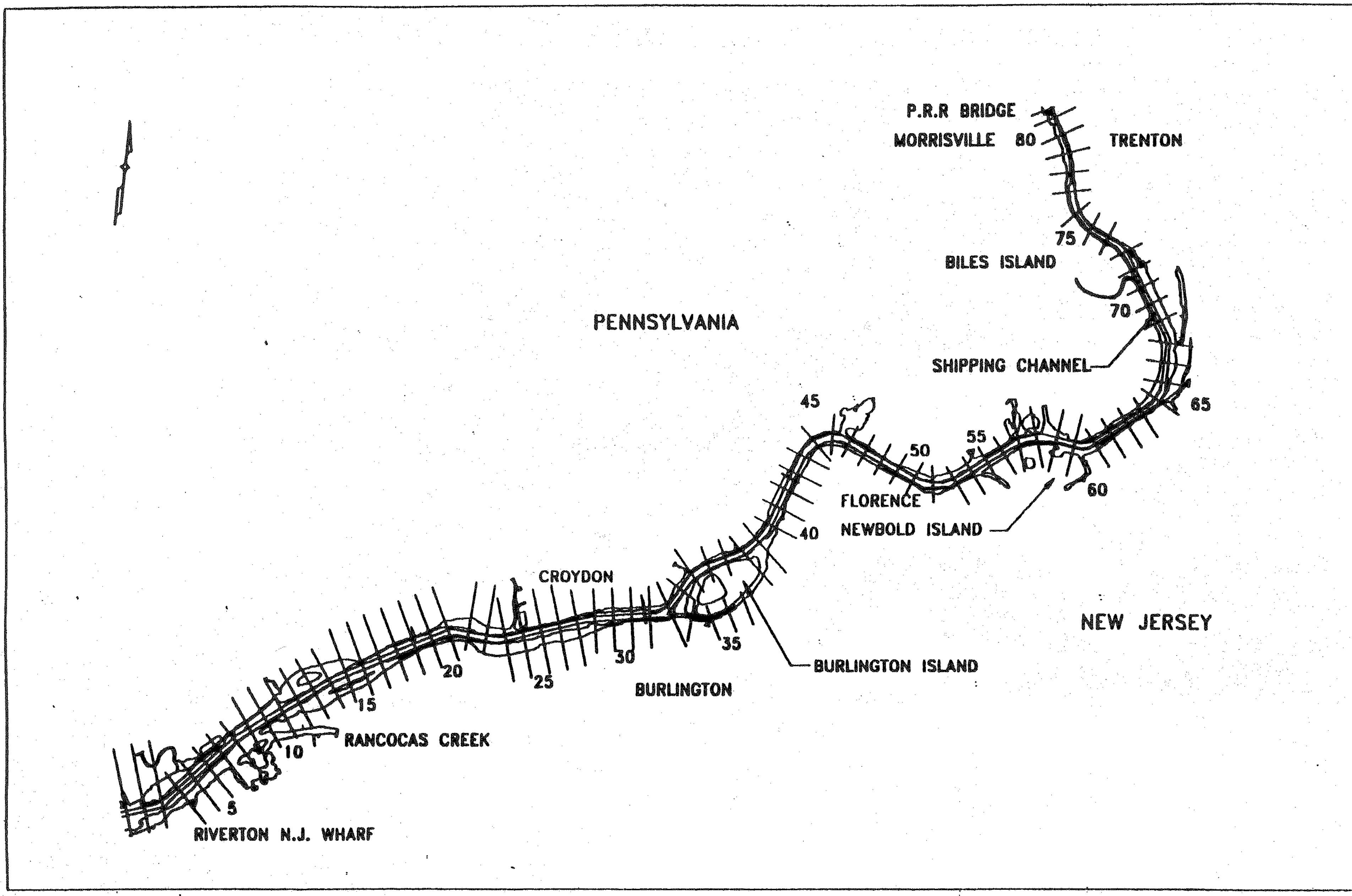


DELAWARE ESTUARY PROGRAM

STUDY AREA WITH DRBC WATER QUALITY ZONES.

FIGURE 1

ENVIRONMENTAL CONSULTING SERVICES INC.

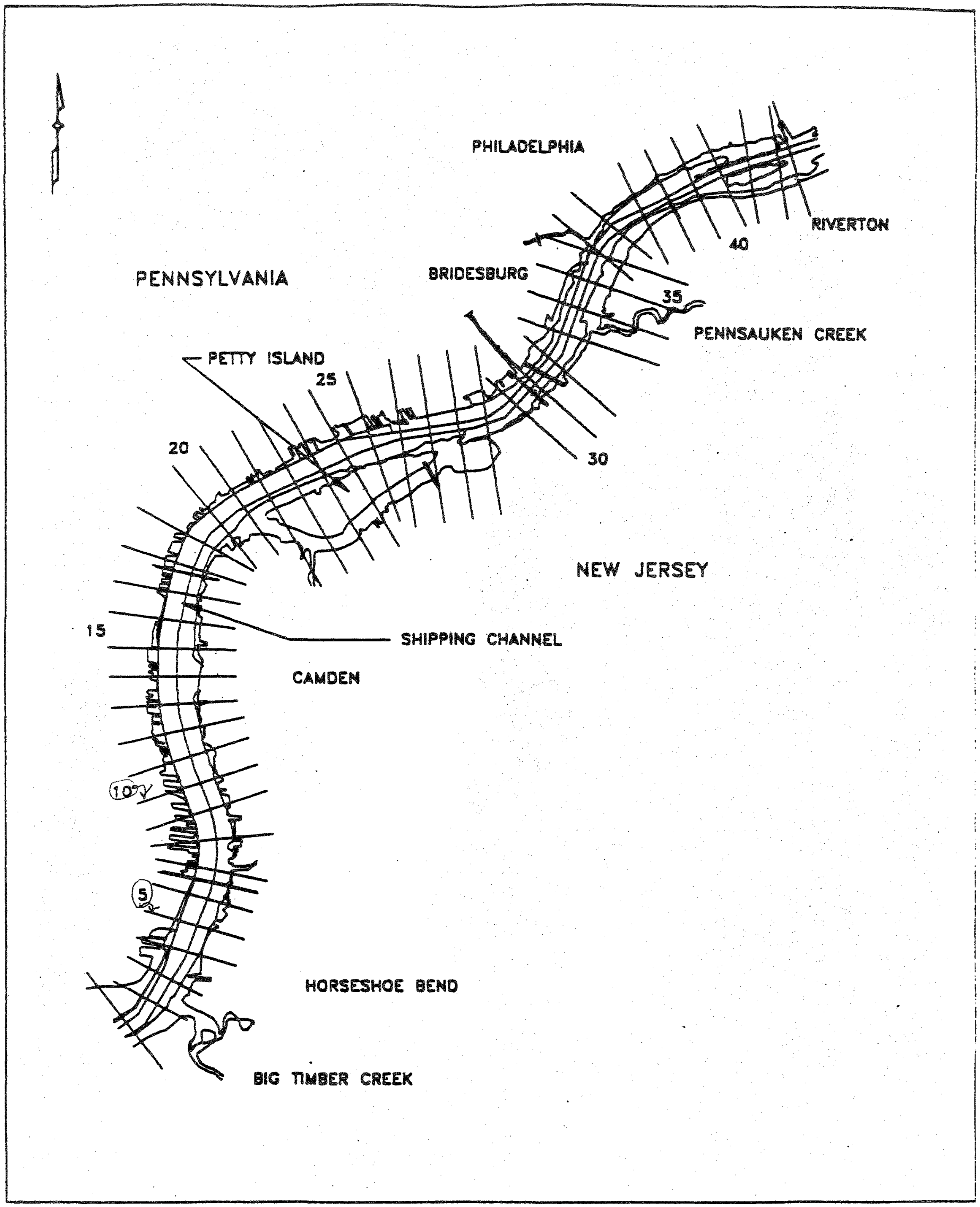


DELAWARE ESTUARY PROGRAM

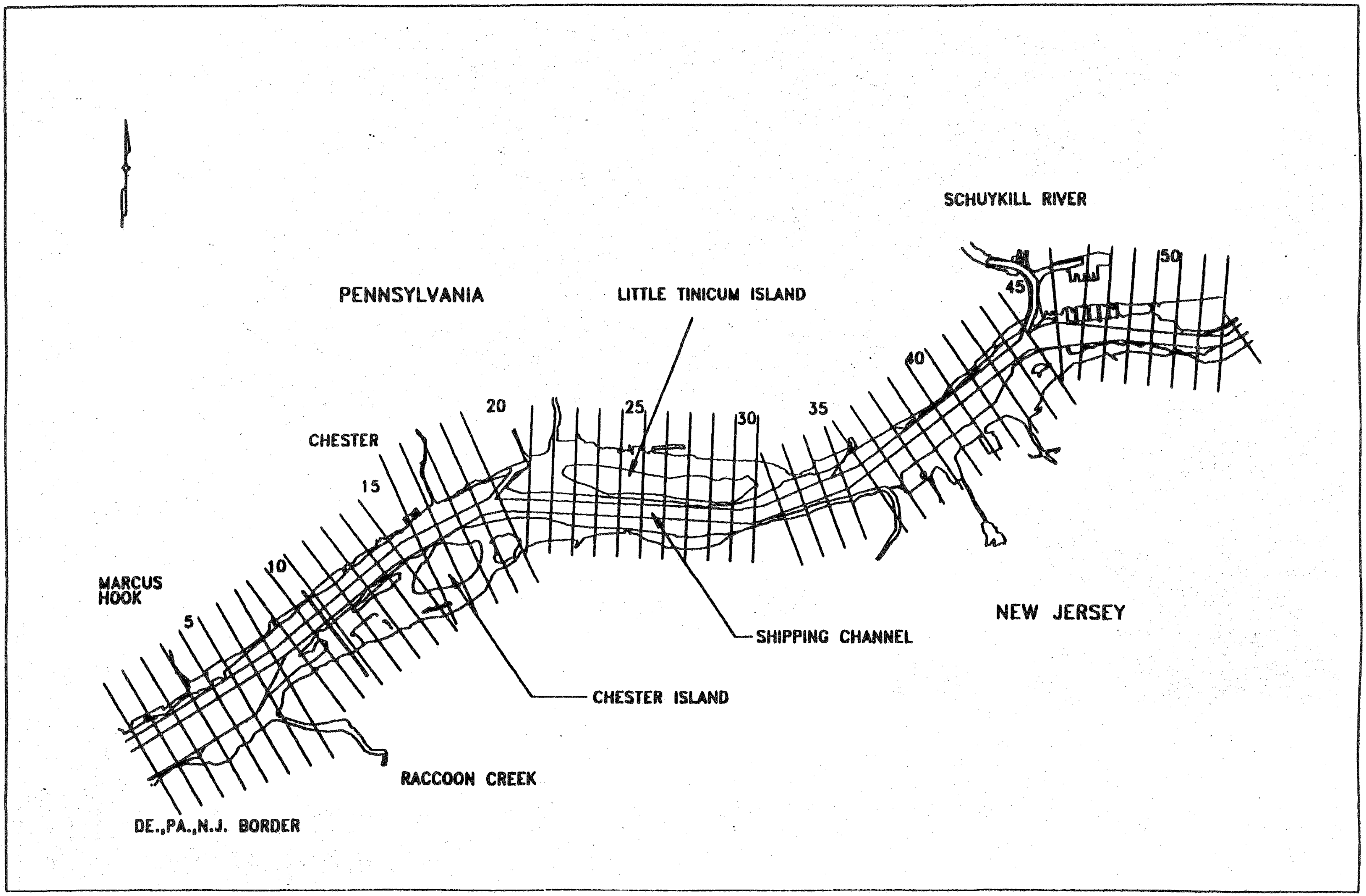
DELEP SURVEY OF BENTHOS ZONE 2 IN THE DELAWARE RIVER
FROM RIVERTON WHARF, NJ TO MORRISVILLE, PA
WITH SUBSTRATA GRID LINES SHOWN AT 0.5 KM INTERVALS.

FIGURE 2

ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	DELEP SURVEY OF BENTHOS ZONE 3 IN THE DELAWARE RIVER FROM THE CENTER OF HORSESHOE BEND TO RIVERTON WHARF, NJ WITH SUBSTRATA GRID LINES SHOWN AT 0.5 KM INTERVALS.
	FIGURE 3 ENVIRONMENTAL CONSULTING SERVICES INC.

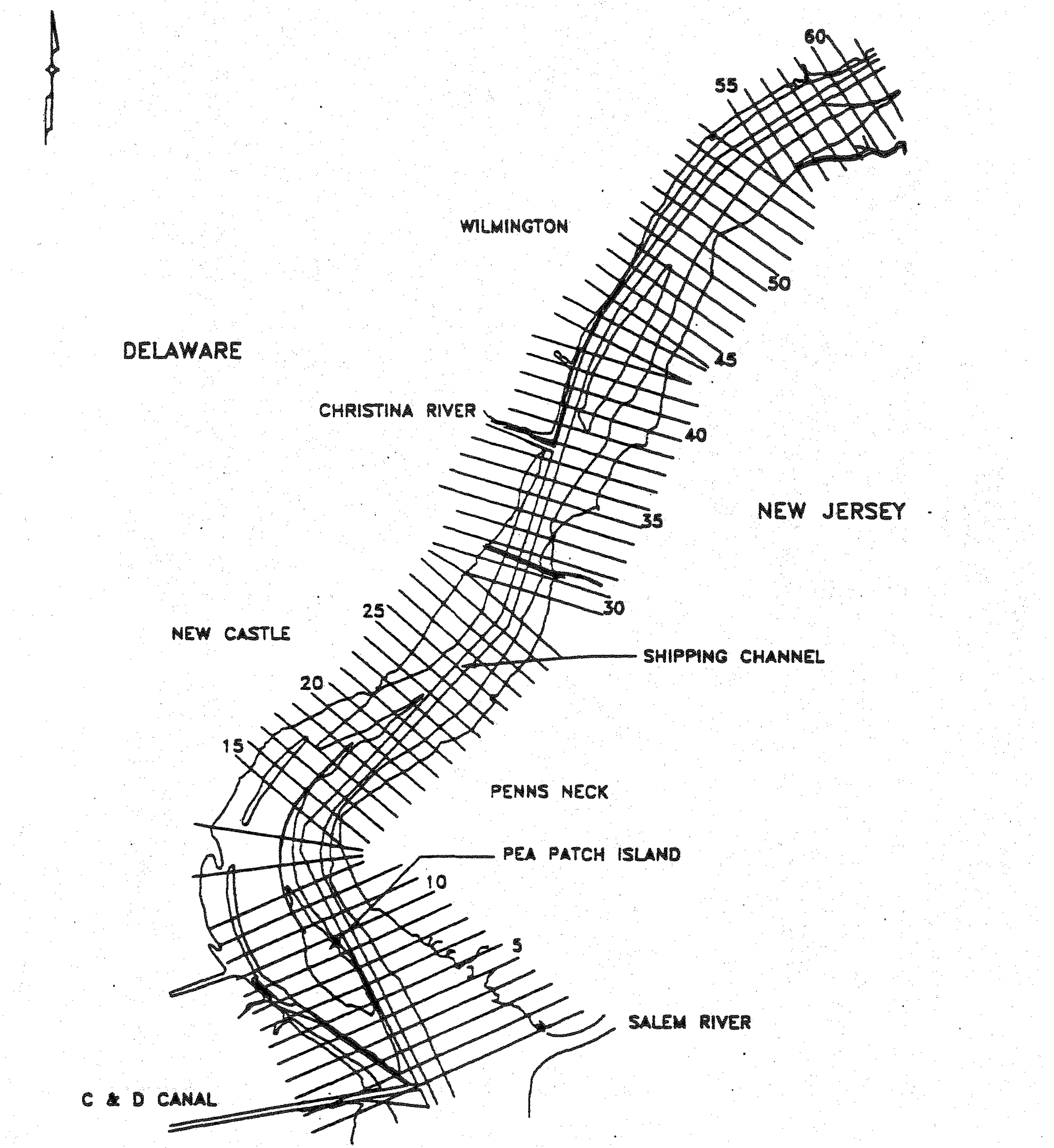


DELAWARE ESTUARY PROGRAM

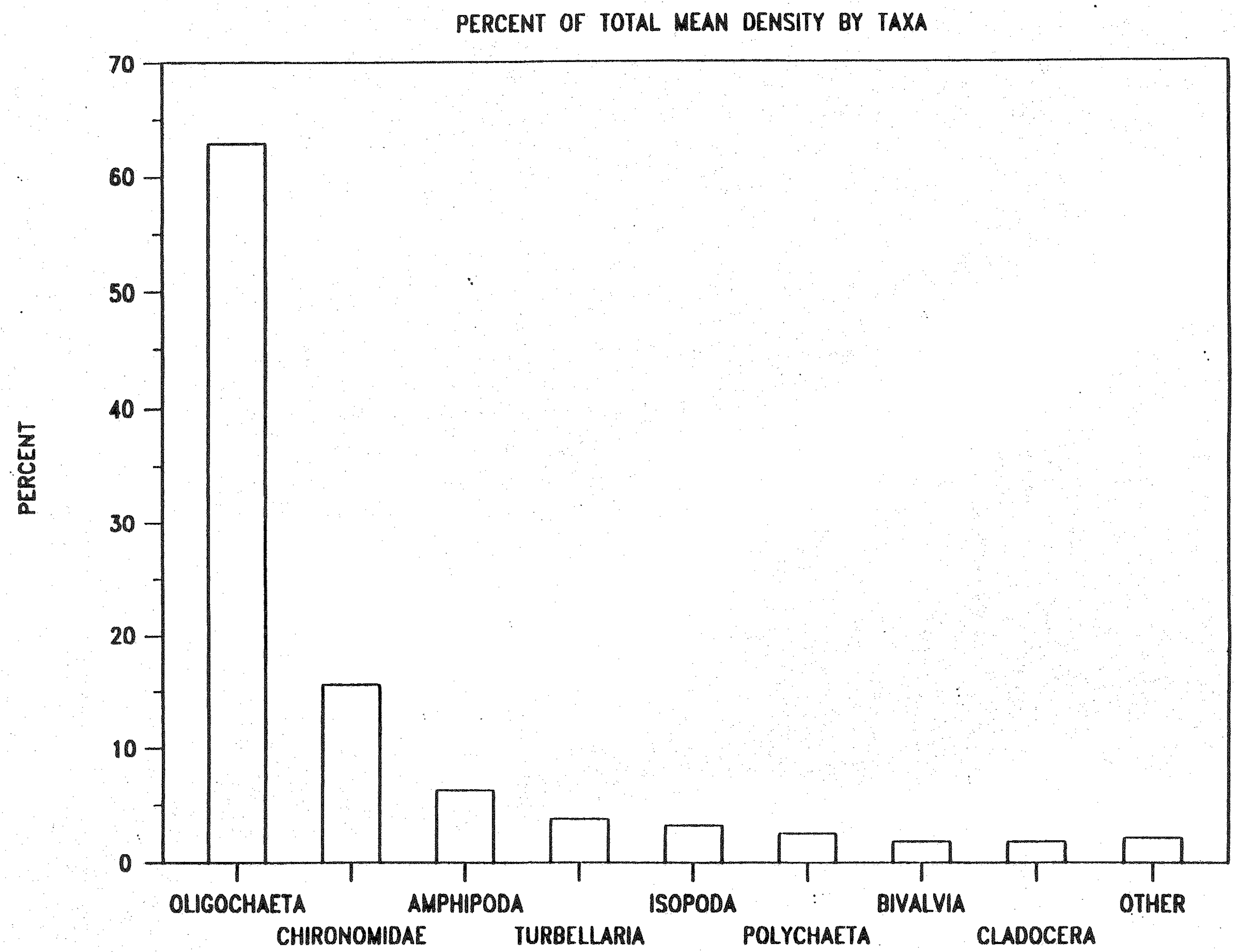
DELEP SURVEY OF BENTHOS ZONE 4 IN THE DELAWARE RIVER
FROM DE, PA, NJ BORDER TO THE CENTER OF HORSESHOE BEND
WITH SUBSTRATA GRID LINES SHOWN AT 0.5 KM INTERVALS.

FIGURE 4

ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	DELEP SURVEY OF BENTHOS ZONE 5 IN THE DELAWARE RIVER FROM THE C AND D CANAL TO DE, PA, NJ, BORDER WITH SUBSTRATA GRID LINES SHOWN AT 0.5 KM INTERVALS.
	FIGURE 5 ENVIRONMENTAL CONSULTING SERVICES INC.

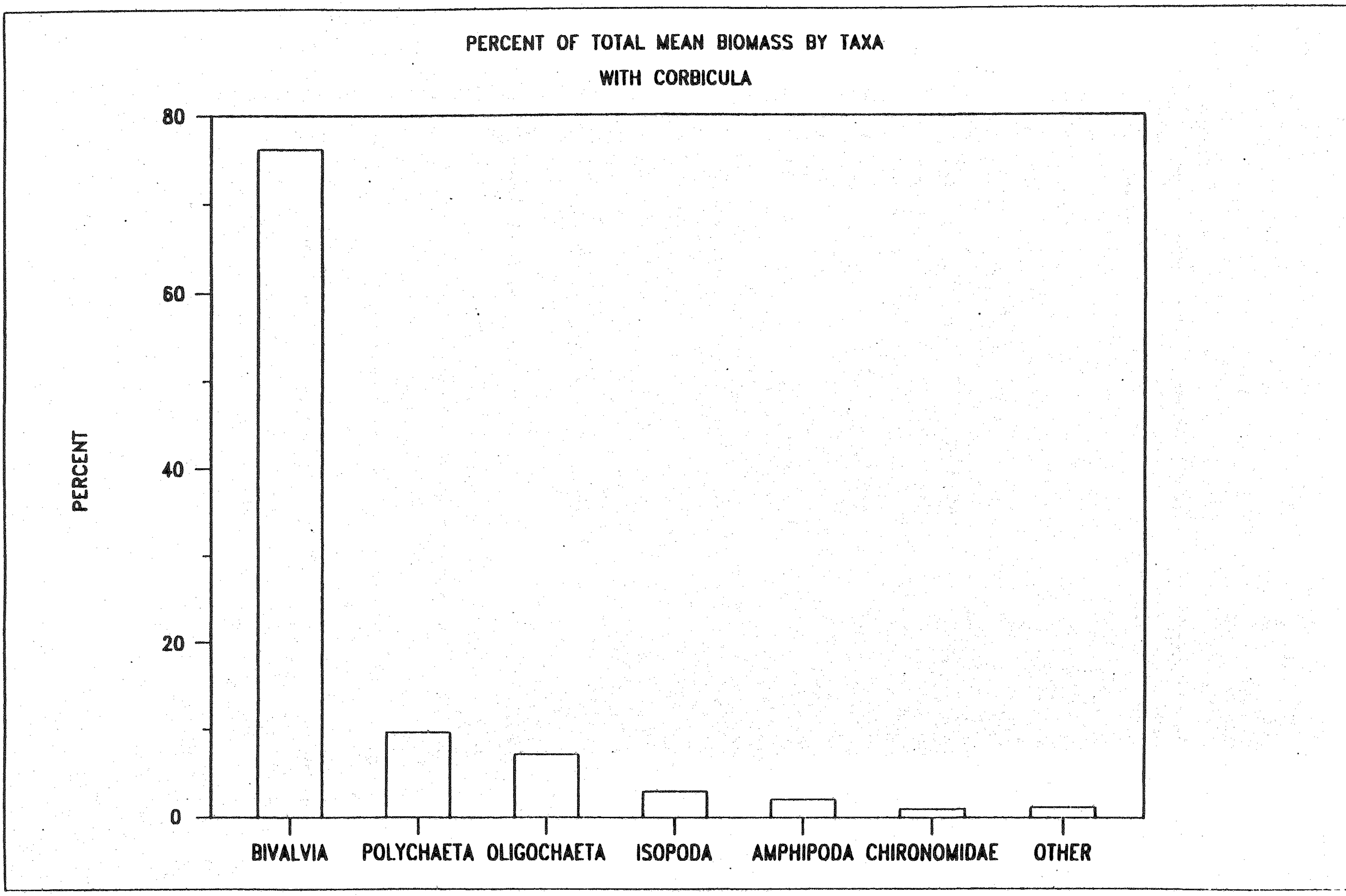


DELAWARE ESTUARY PROGRAM

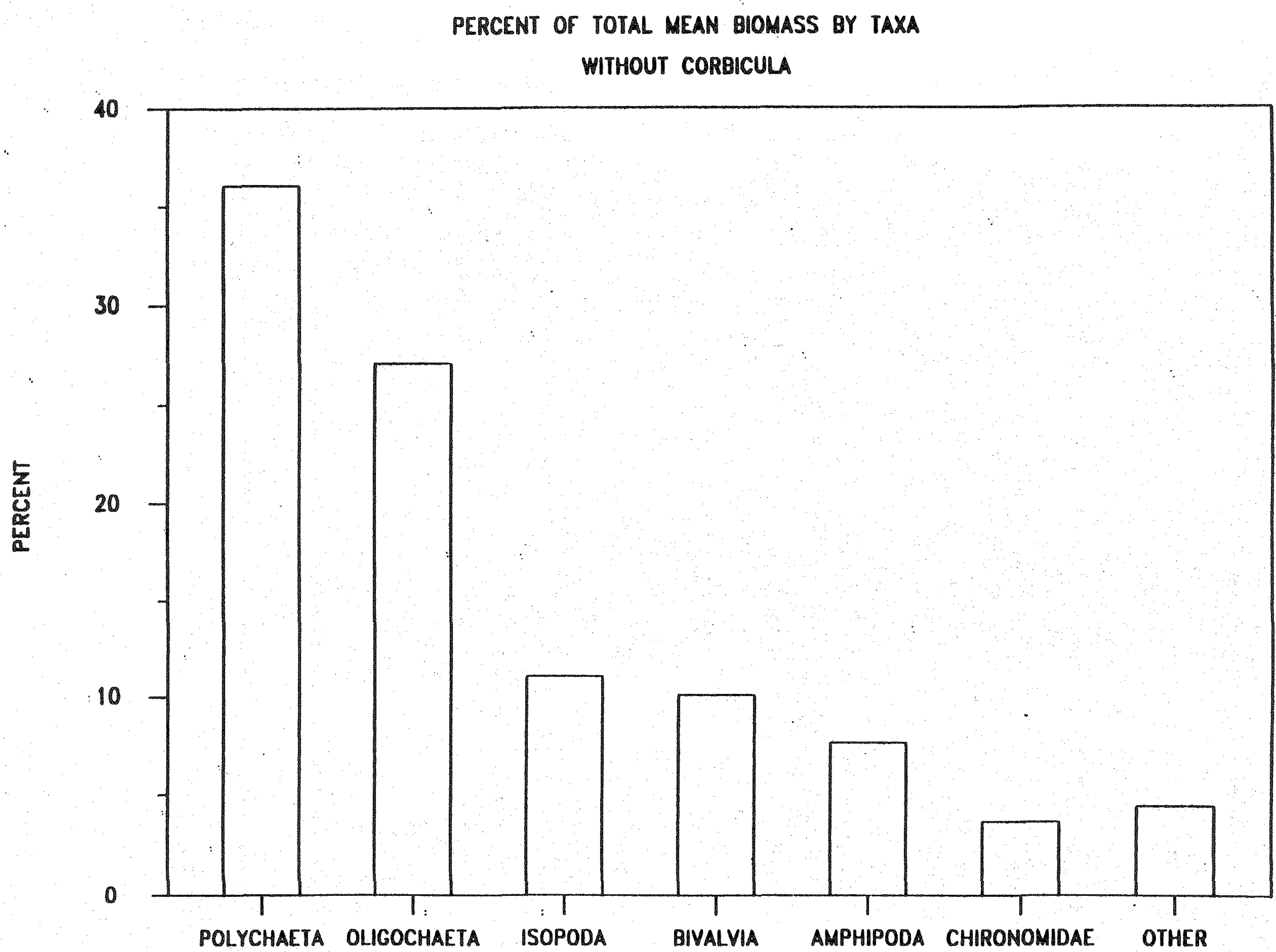
PERCENT OF ANNUAL TOTAL MEAN DENSITY BY POOLED TAXA OF BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.

FIGURE 8

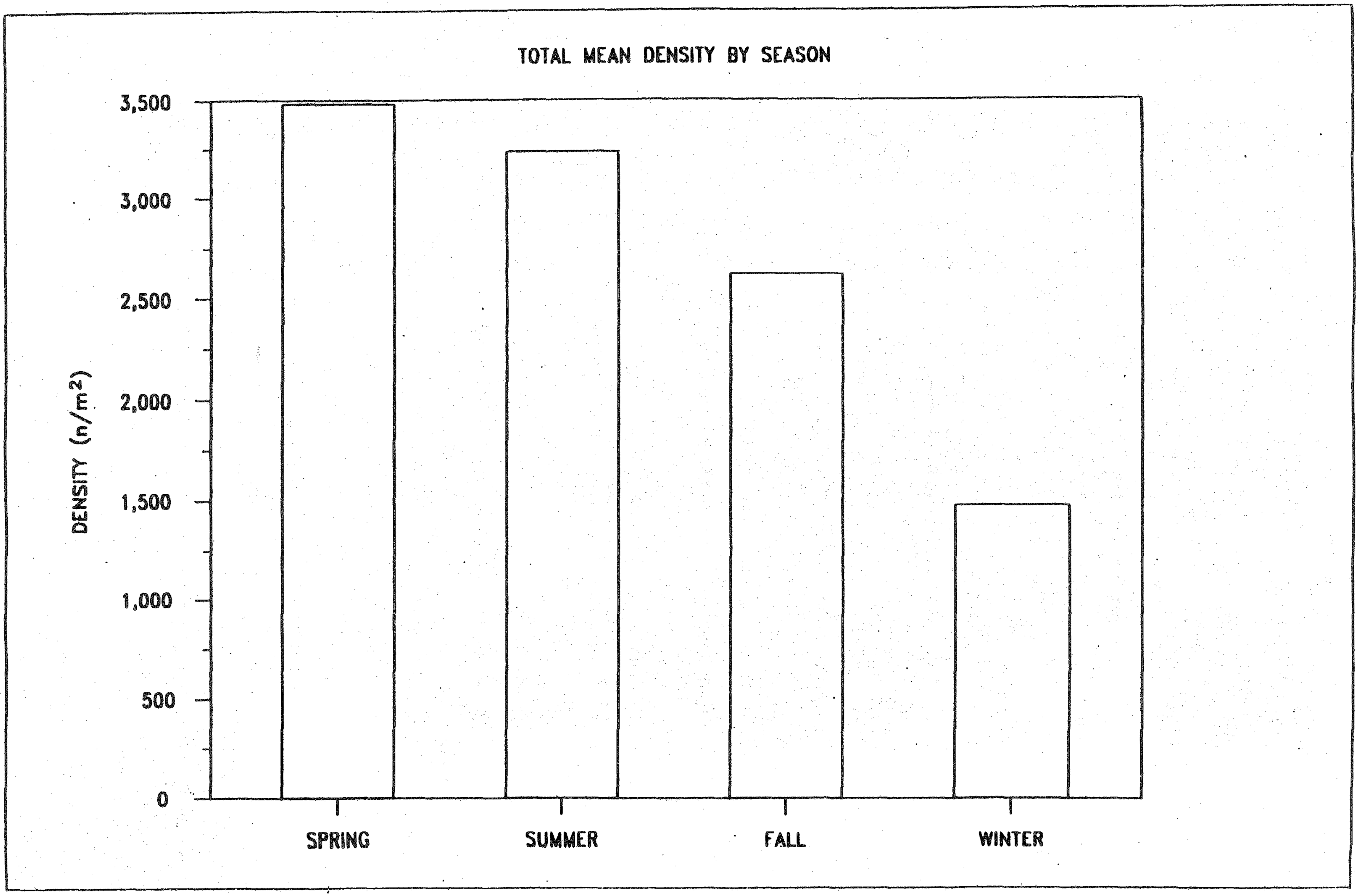
ENVIRONMENTAL CONSULTING SERVICES INC.



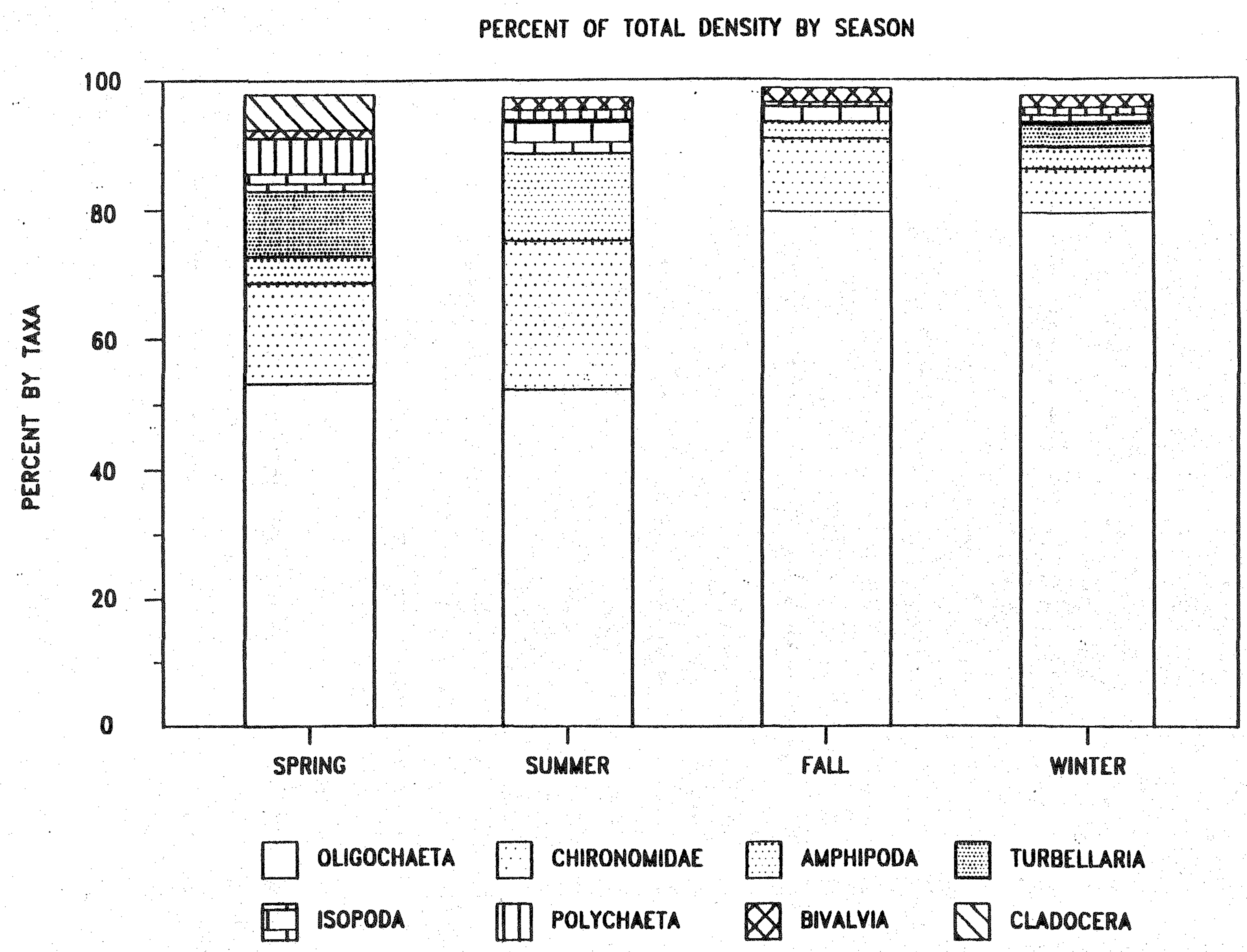
DELAWARE ESTUARY PROGRAM	PERCENT OF ANNUAL TOTAL MEAN BIOMASS BY POOLED TAXA OF BENTHIC MACROINVERTEBRATES, INCLUDING CORBICULA, COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 7 — ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	PERCENT OF ANNUAL TOTAL MEAN BIOMASS BY POOLED TAXA OF BENTHIC MACROINVERTEBRATES, EXCLUDING <u>CORBICULA</u>, COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 8 ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	TOTAL MEAN DENSITY BY SEASON OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES AND SUBSTRATA IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 9 ENVIRONMENTAL CONSULTING SERVICES INC.



113

DELAWARE ESTUARY PROGRAM	PERCENT OF SEASONAL TOTAL MEAN DENSITY BY POOLED TAXA OF BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
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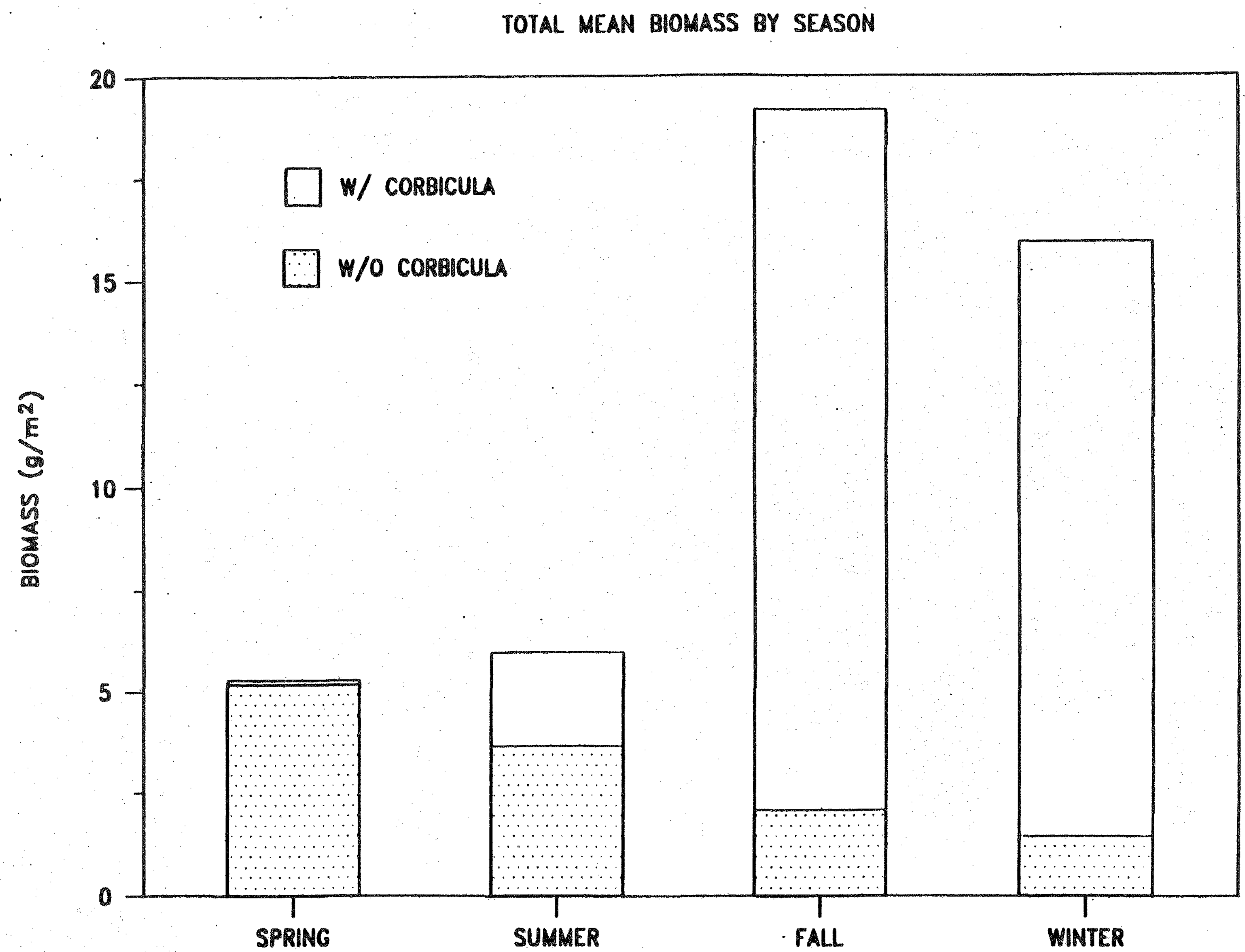
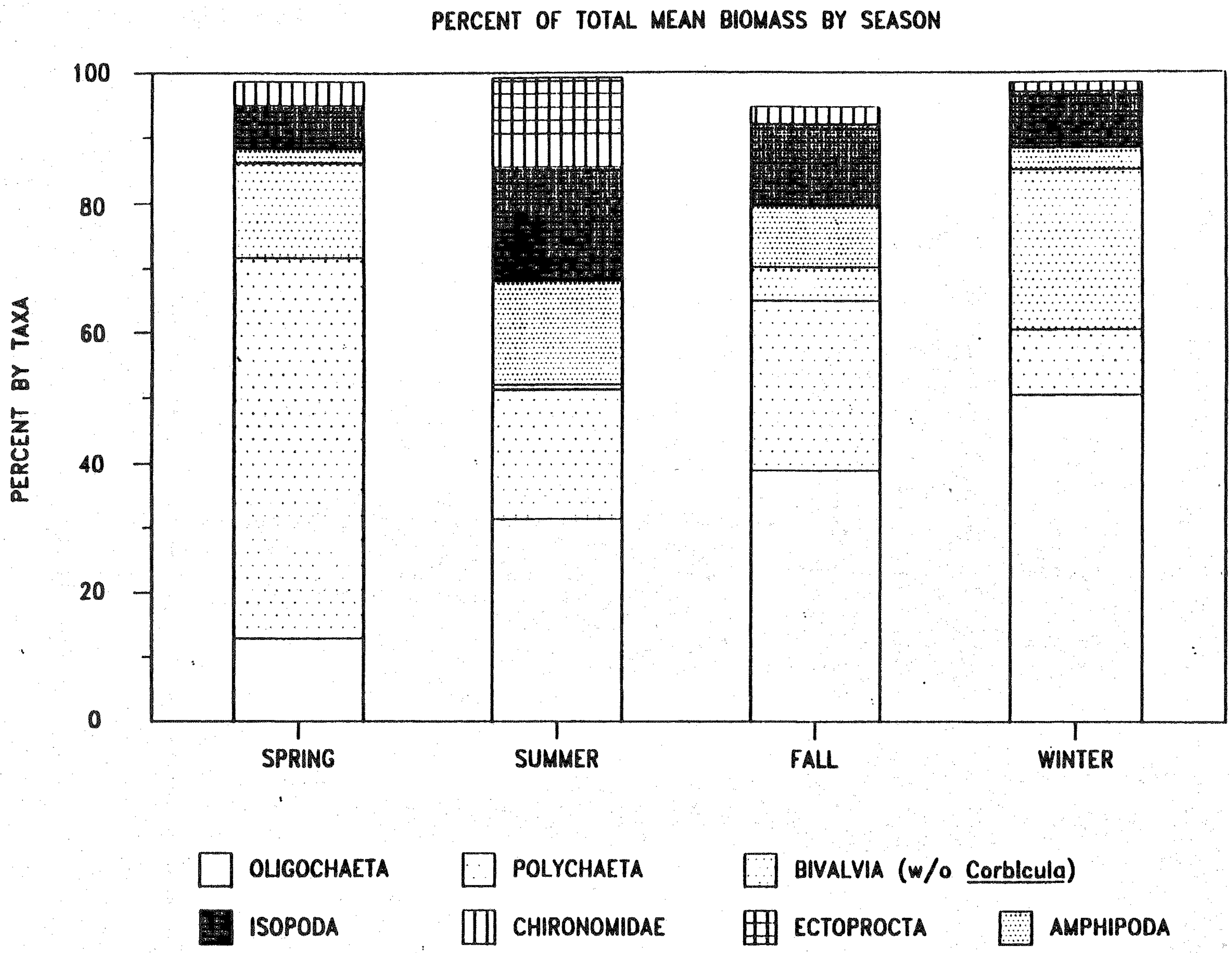


DELAWARE ESTUARY PROGRAM	TOTAL MEAN BIOMASS BY SEASON OF BENTHIC MACROINVERTEBRATES, INCLUDING AND EXCLUDING CORBICULA, COLLECTED IN ALL ZONES AND SUBSTRATA IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 11 — ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	PERCENT OF SEASONAL MEAN BIOMASS BY POOLED TAXA OF BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
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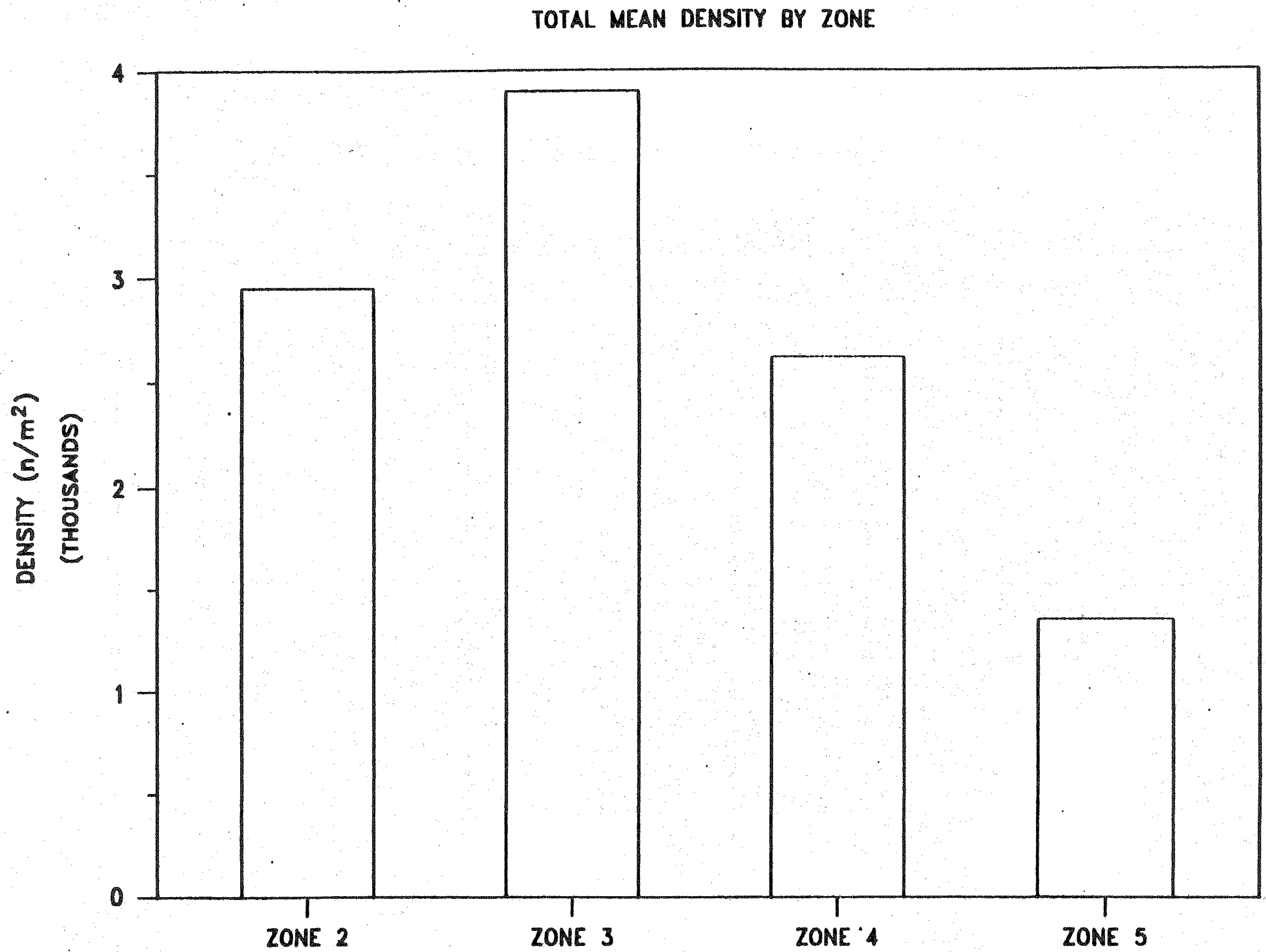
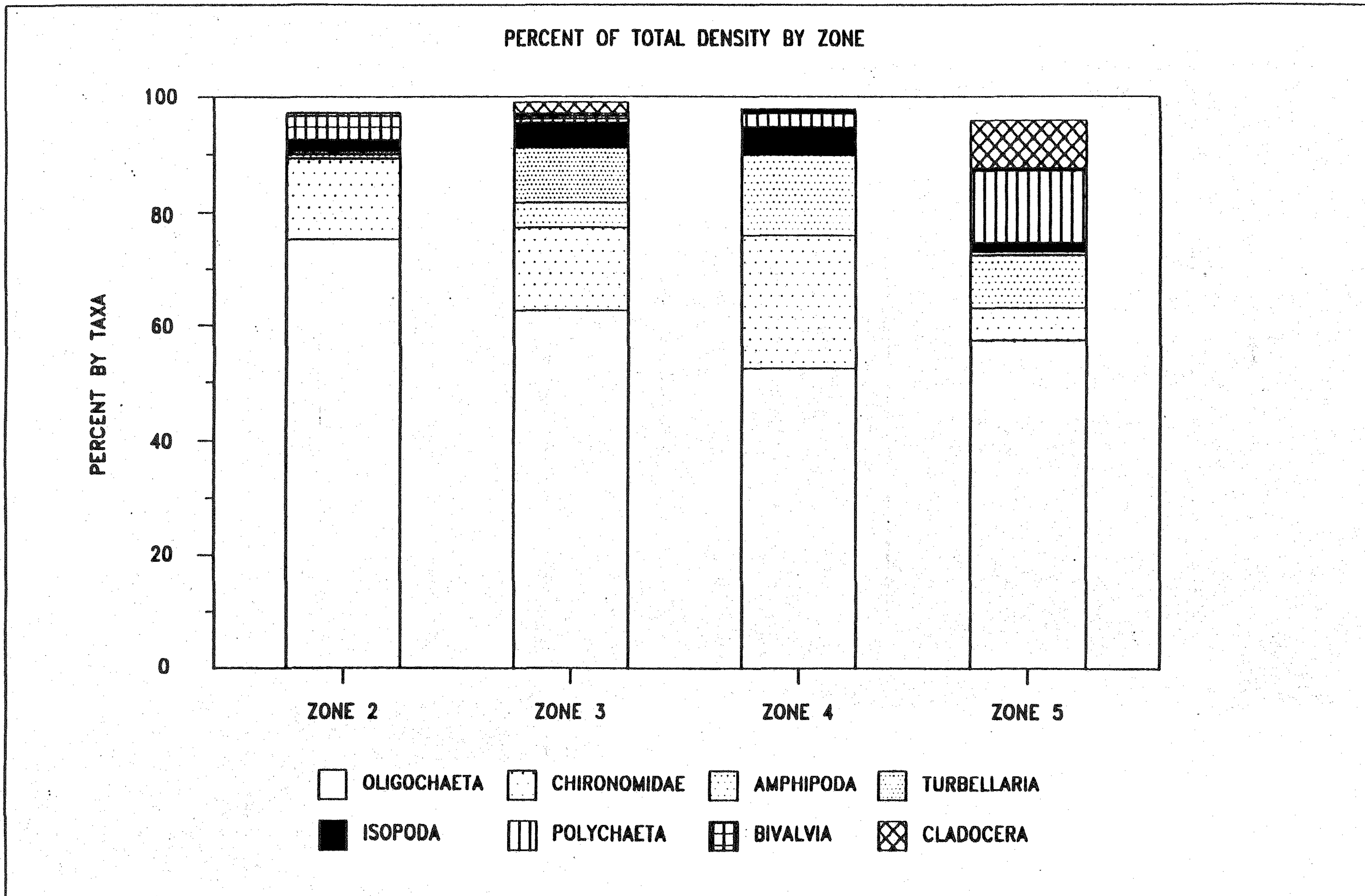


DELAWARE ESTUARY PROGRAM	TOTAL MEAN DENSITY BY ZONE OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL SEASONS AND SUBSTRATA IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 13 — ENVIRONMENTAL CONSULTING SERVICES INC.

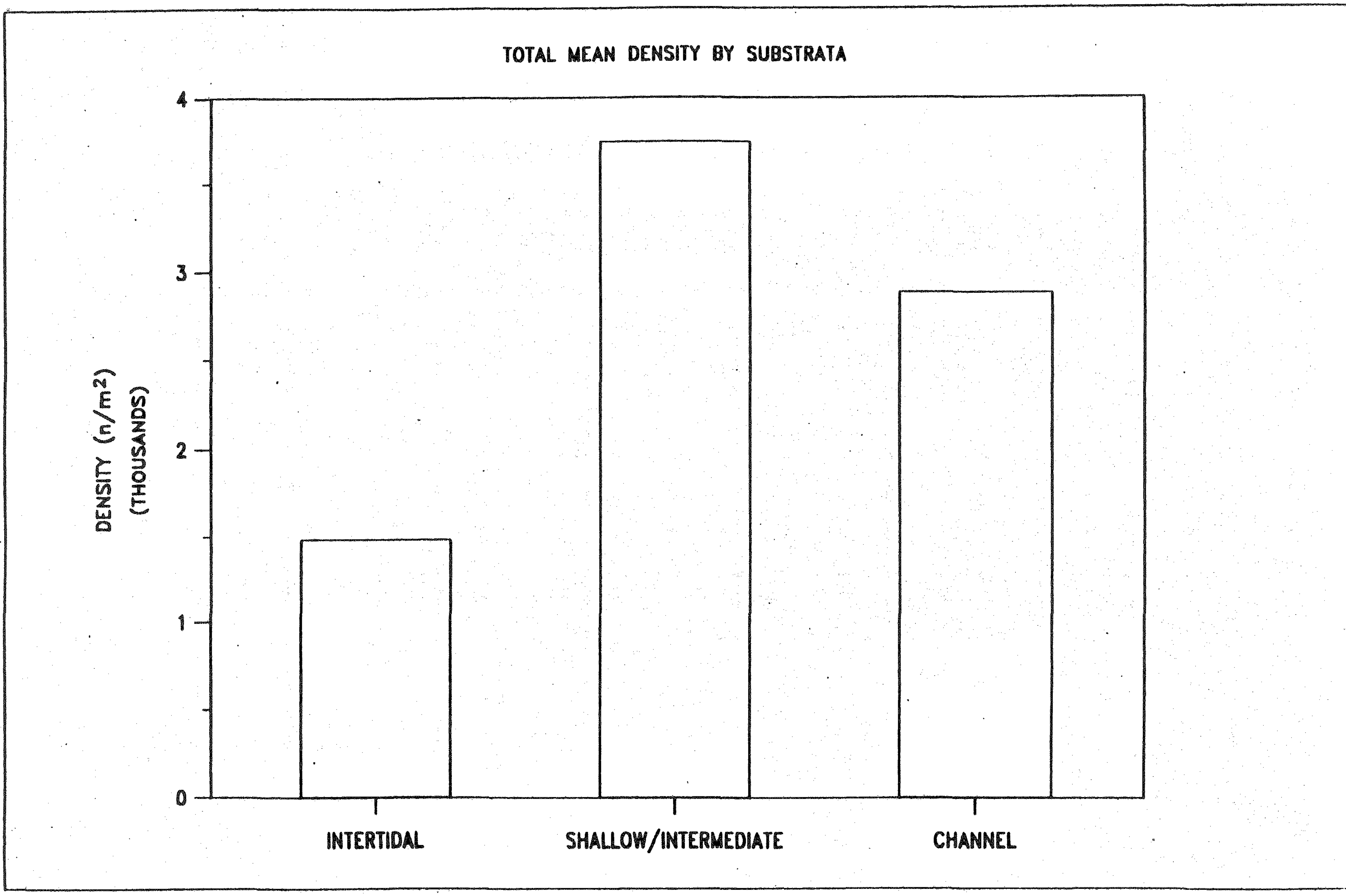


DELAWARE ESTUARY PROGRAM

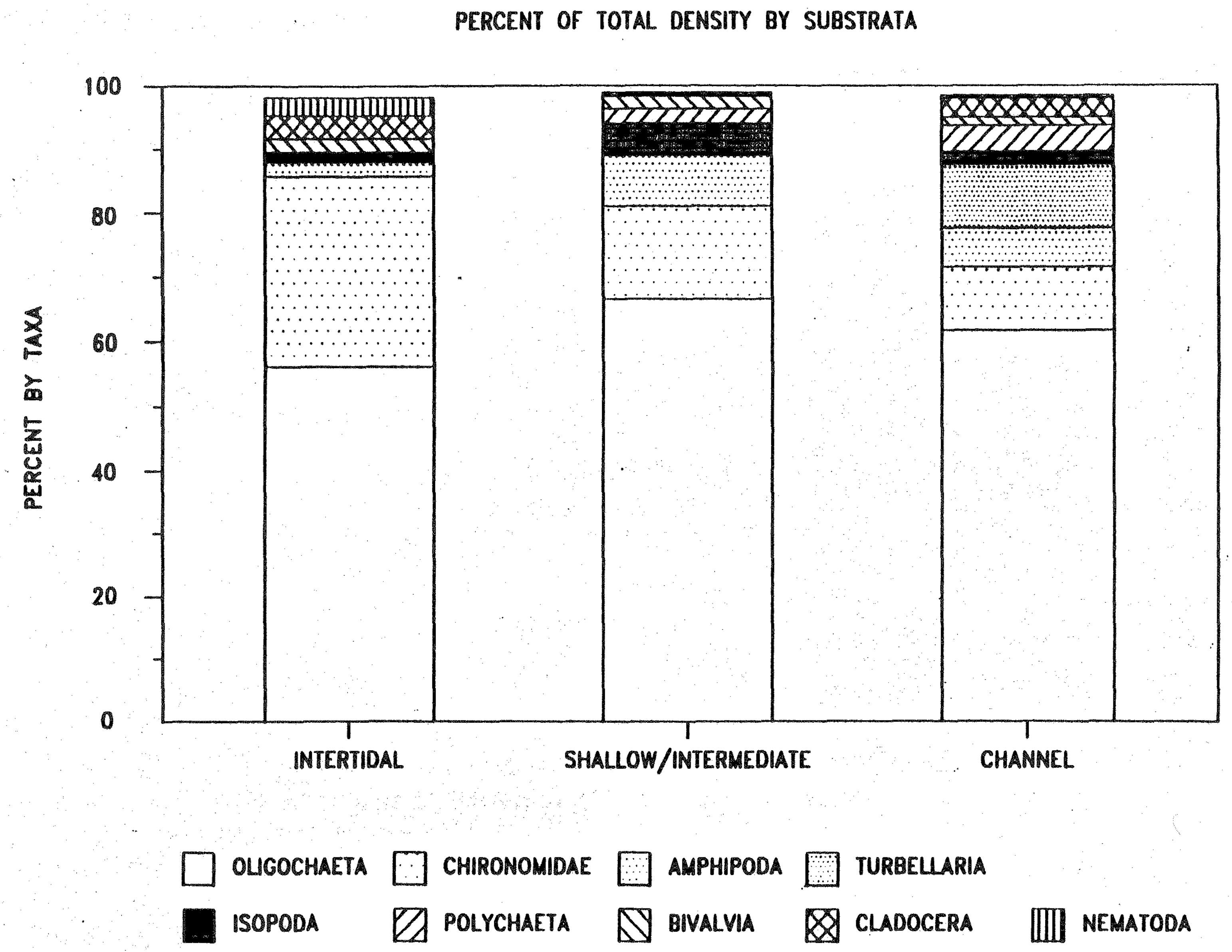
PERCENT OF TOTAL MEAN DENSITY BY ZONE FOR POOLED TAXA OF BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.

FIGURE 14

ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	TOTAL MEAN DENSITY BY SUBSTRATA OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES AND SEASONS IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 15 — ENVIRONMENTAL CONSULTING SERVICES INC.

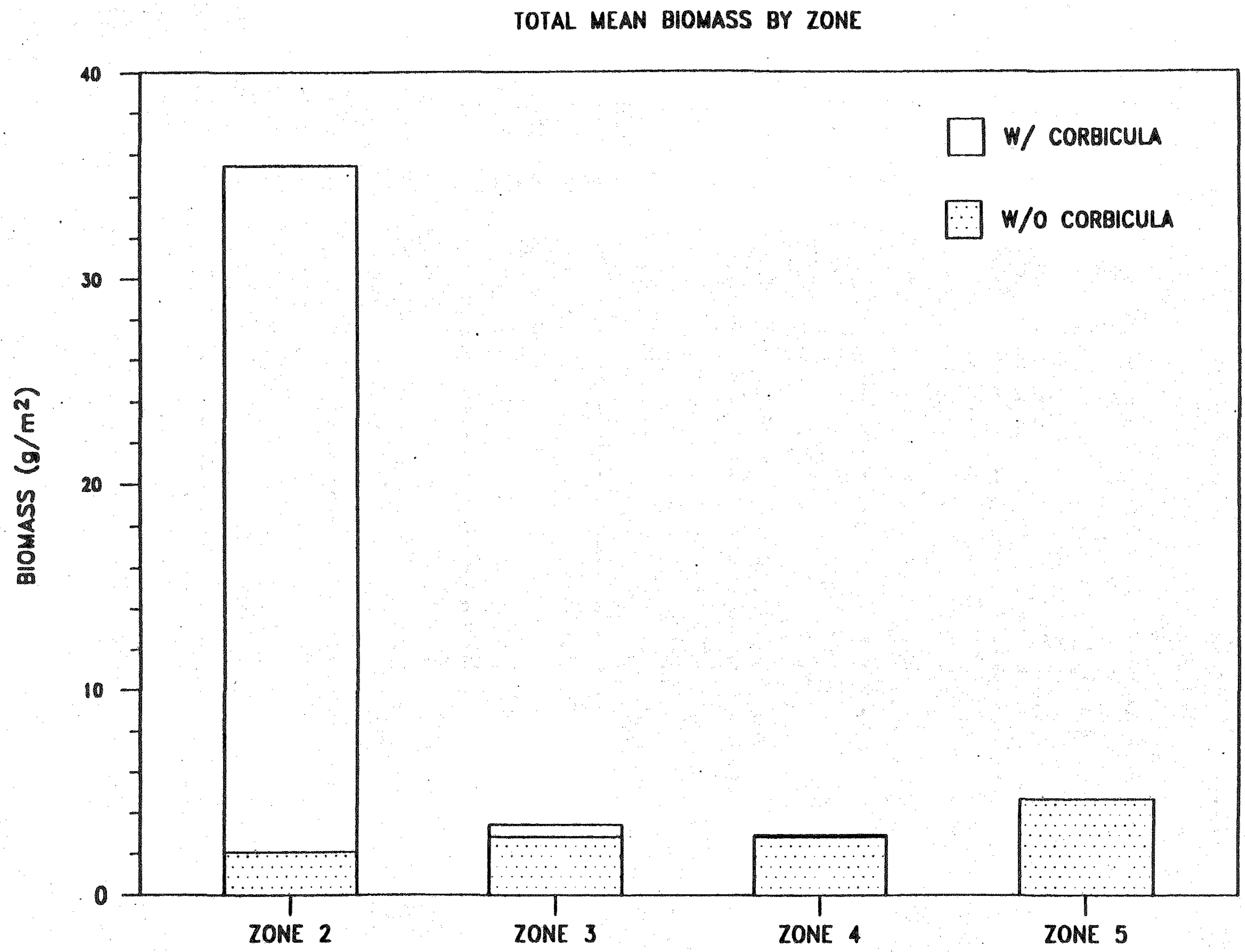


DELAWARE ESTUARY PROGRAM

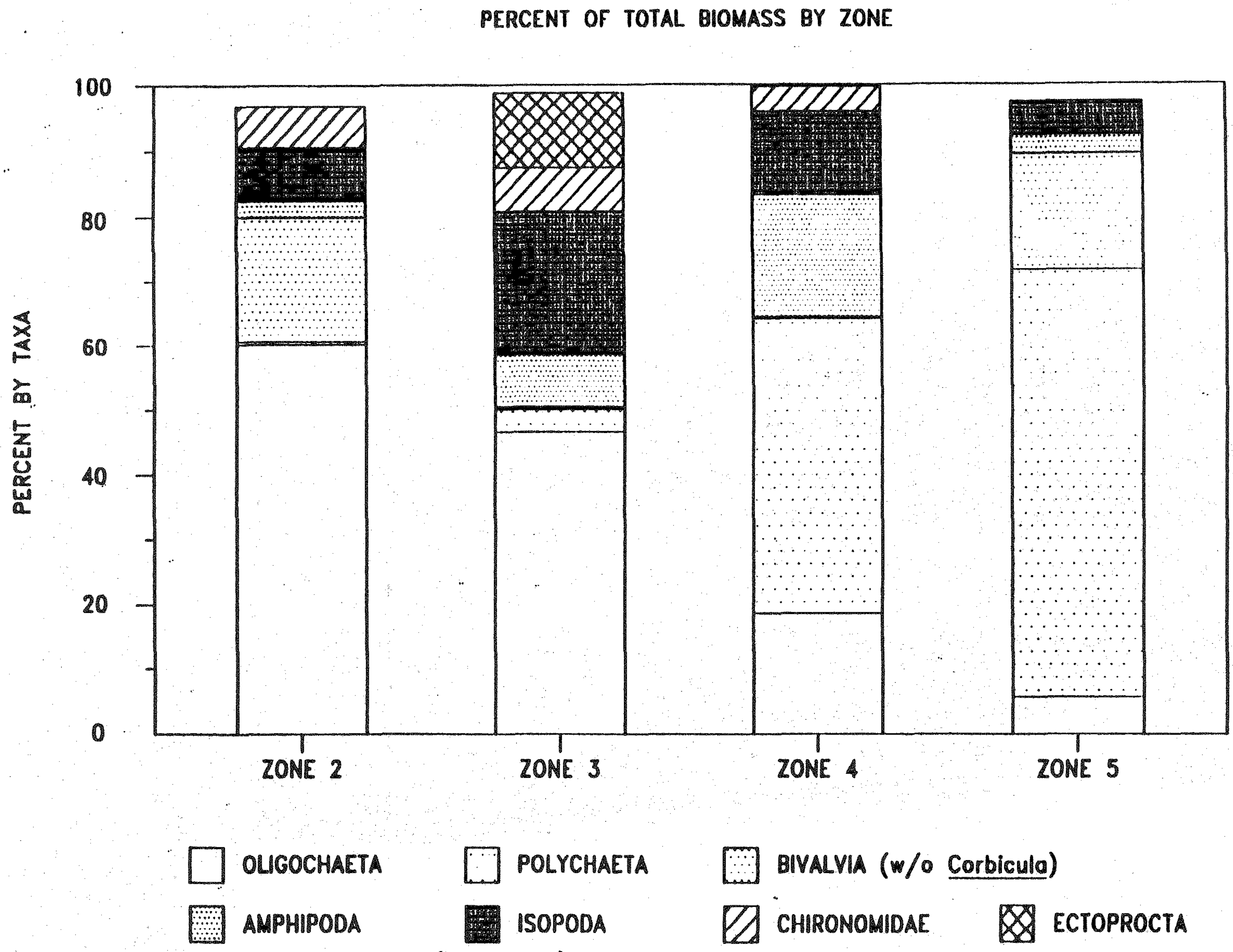
PERCENT OF TOTAL MEAN DENSITY BY SUBSTRATA FOR POOLED TAXA OF BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.

FIGURE 16

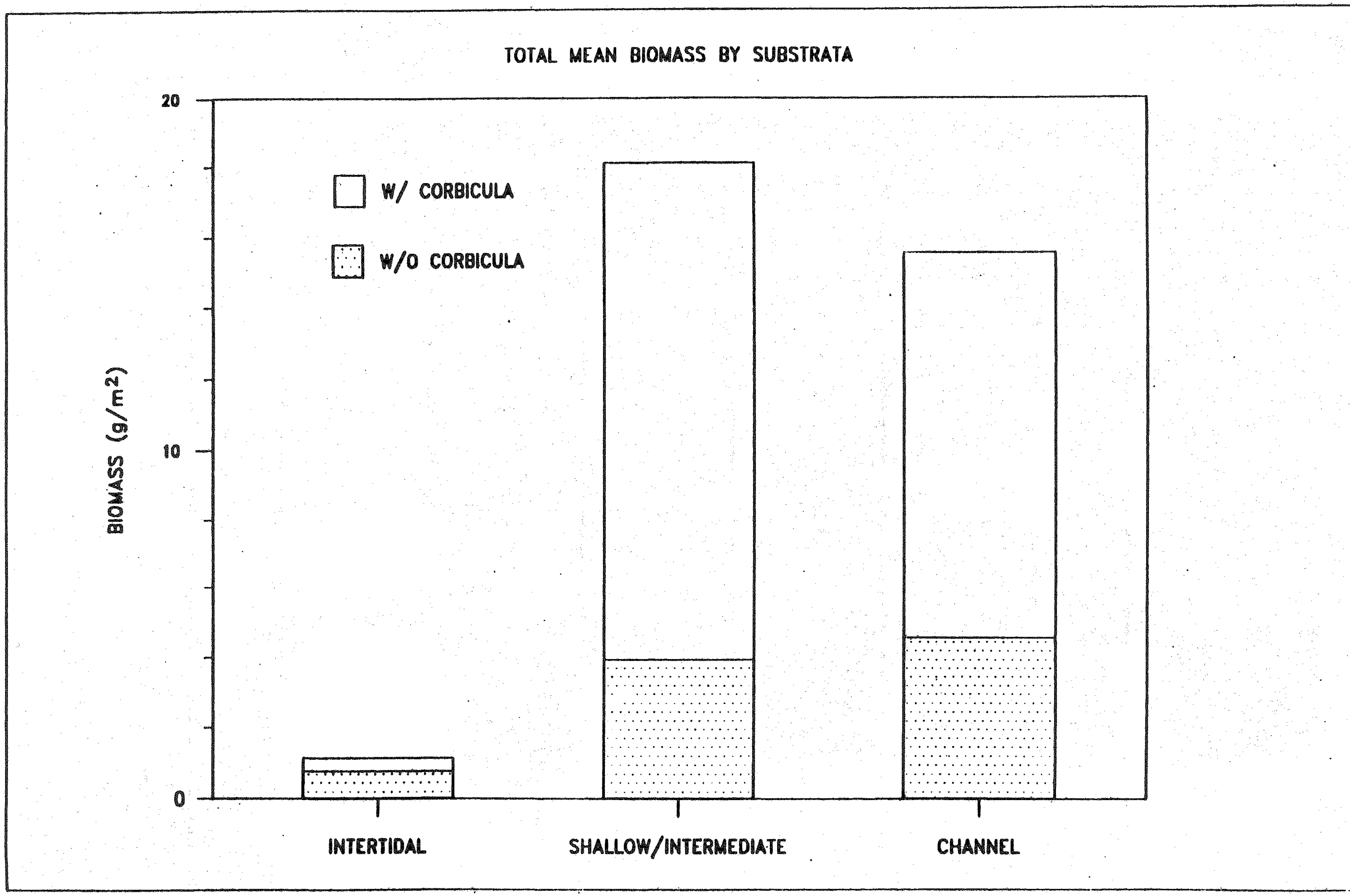
ENVIRONMENTAL CONSULTING SERVICES INC.



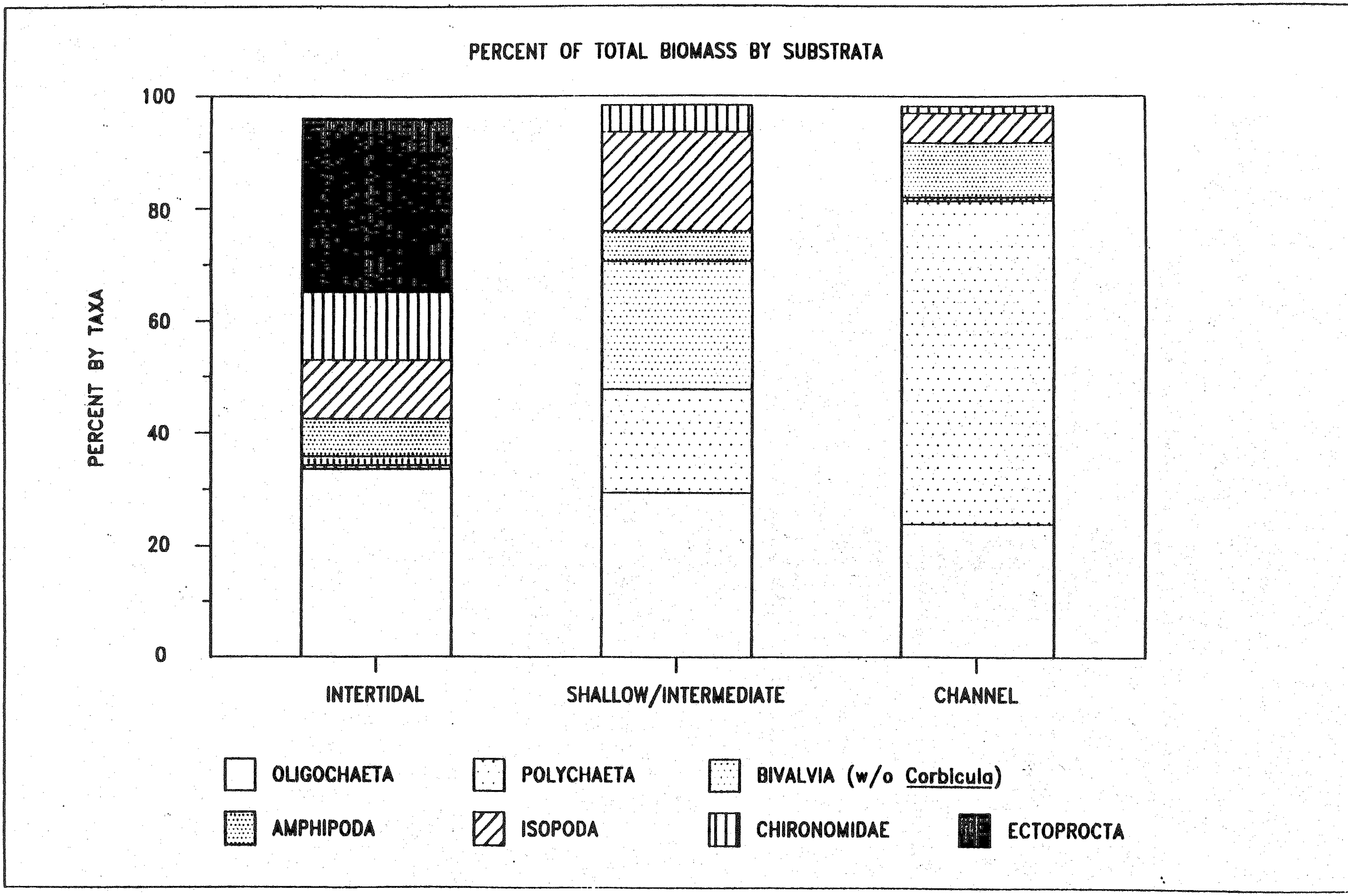
DELAWARE ESTUARY PROGRAM	TOTAL MEAN BIOMASS BY ZONE OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL SEASONS AND SUBSTRATA IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 17 ENVIRONMENTAL CONSULTING SERVICES INC.



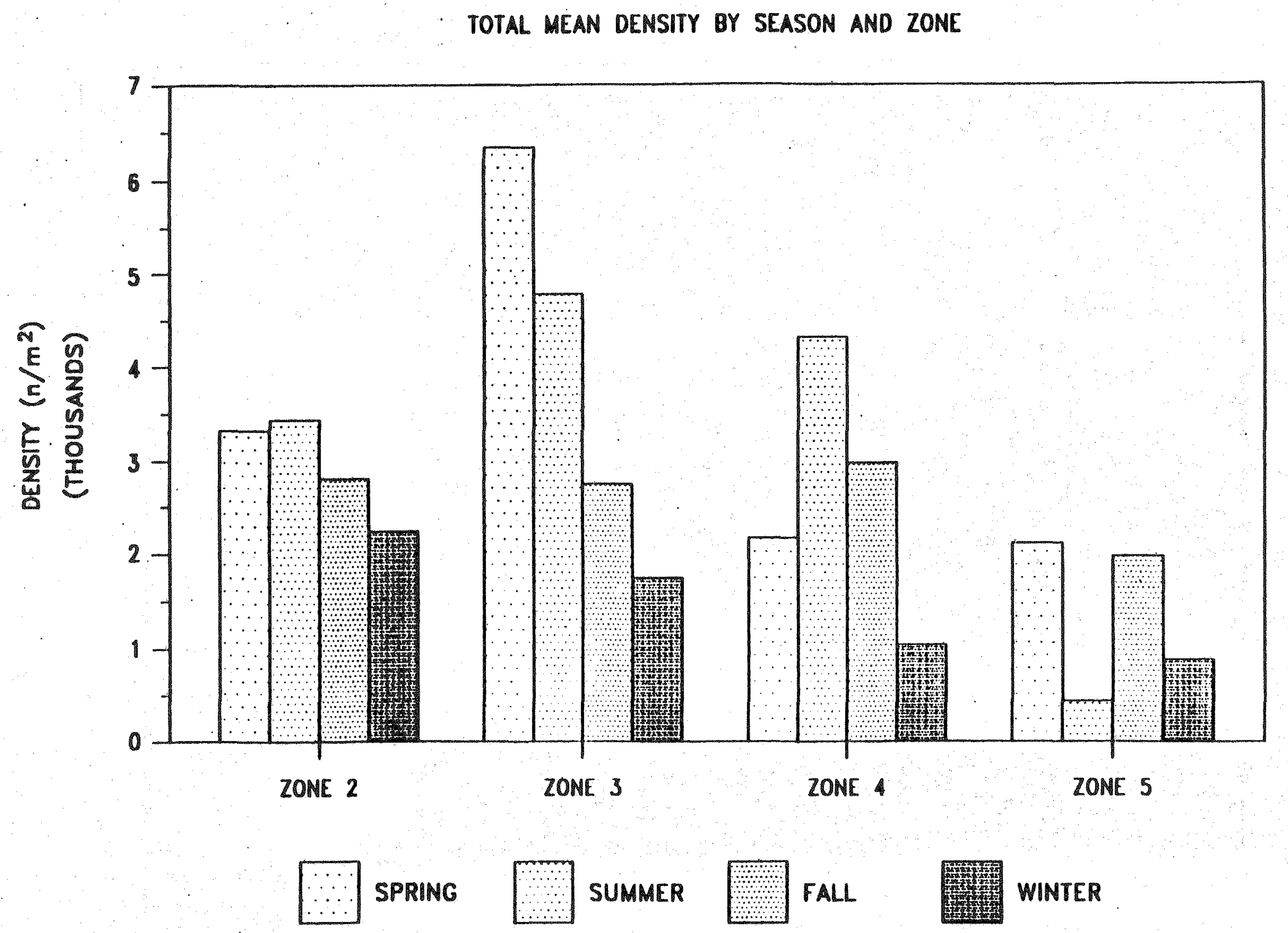
DELAWARE ESTUARY PROGRAM	PERCENT OF TOTAL MEAN BIOMASS BY ZONE FOR POOLED TAXA OF BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 18 ENVIRONMENTAL CONSULTING SERVICES INC



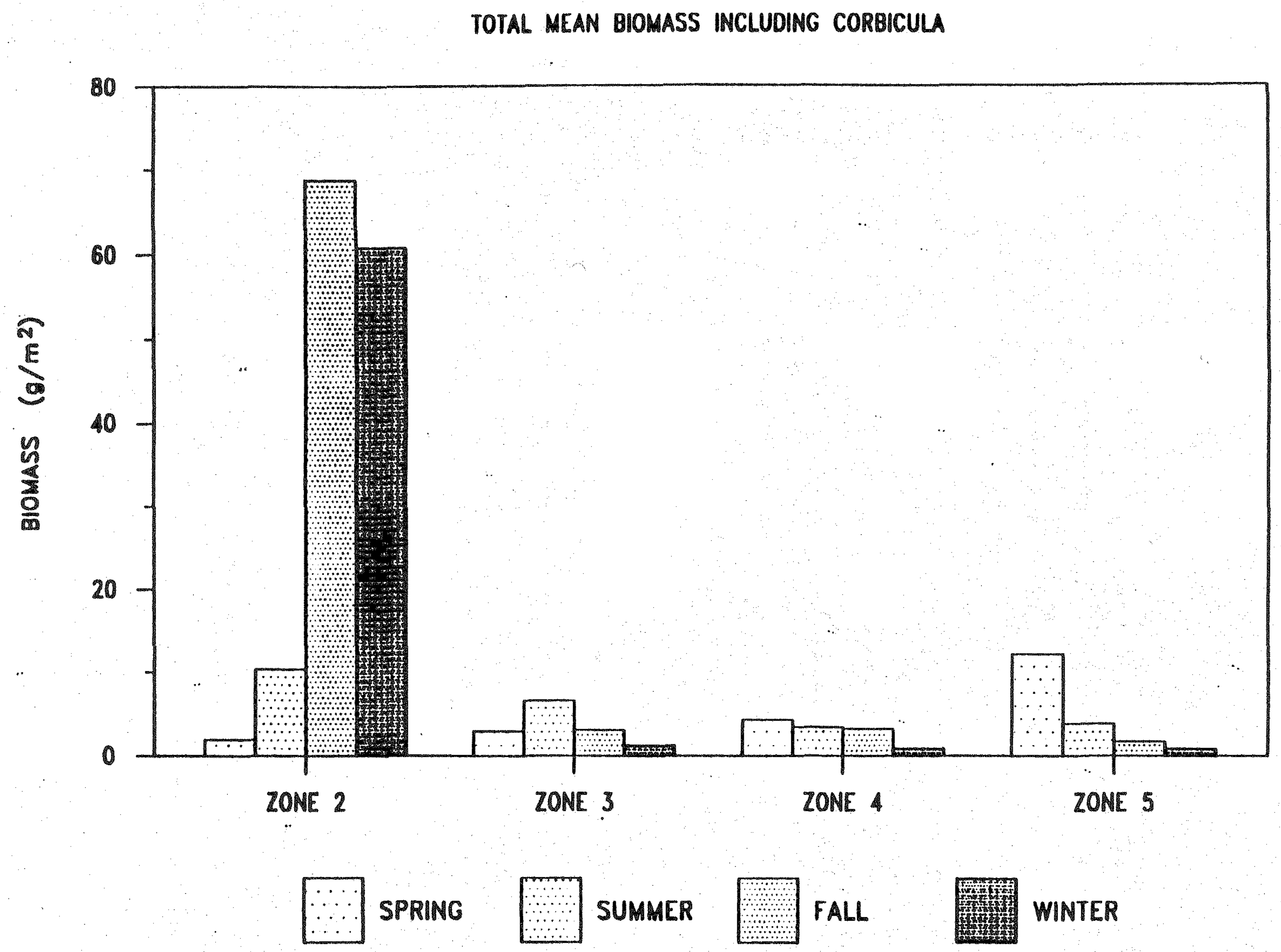
DELAWARE ESTUARY PROGRAM	TOTAL MEAN BIOMASS BY SUBSTRATA OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES AND SEASONS IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 19 — ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	PERCENT OF TOTAL MEAN BIOMASS BY SUBSTRATA FOR POOLED TAXA OF BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 20 — ENVIRONMENTAL CONSULTING SERVICES INC



DELAWARE ESTUARY PROGRAM	TOTAL MEAN DENSITY BY SEASON AND ZONE OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES AND SUBSTRATA IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 21 — ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	TOTAL MEAN BIOMASS BY SEASON AND ZONE OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES AND SUBSTRATA IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
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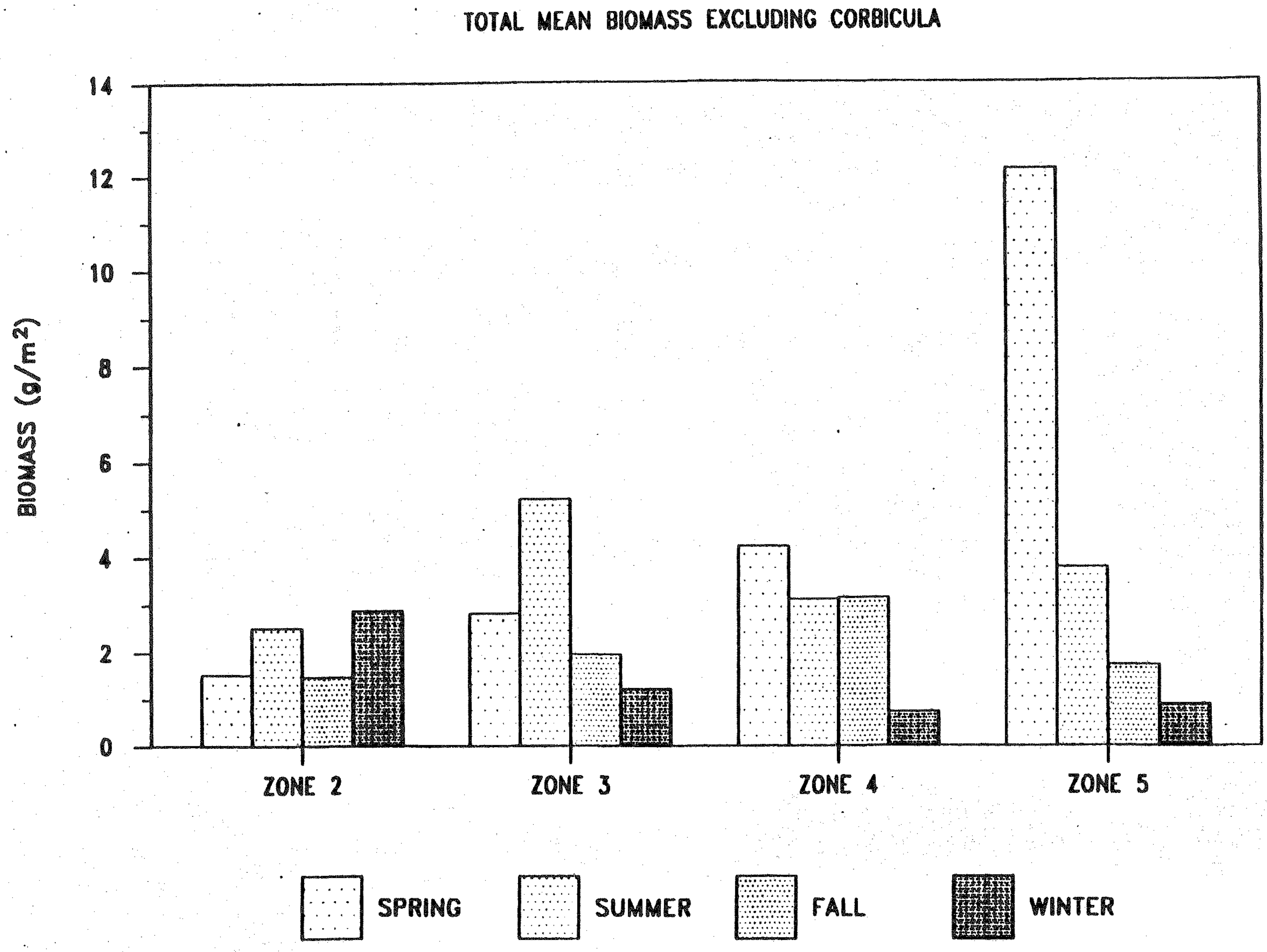
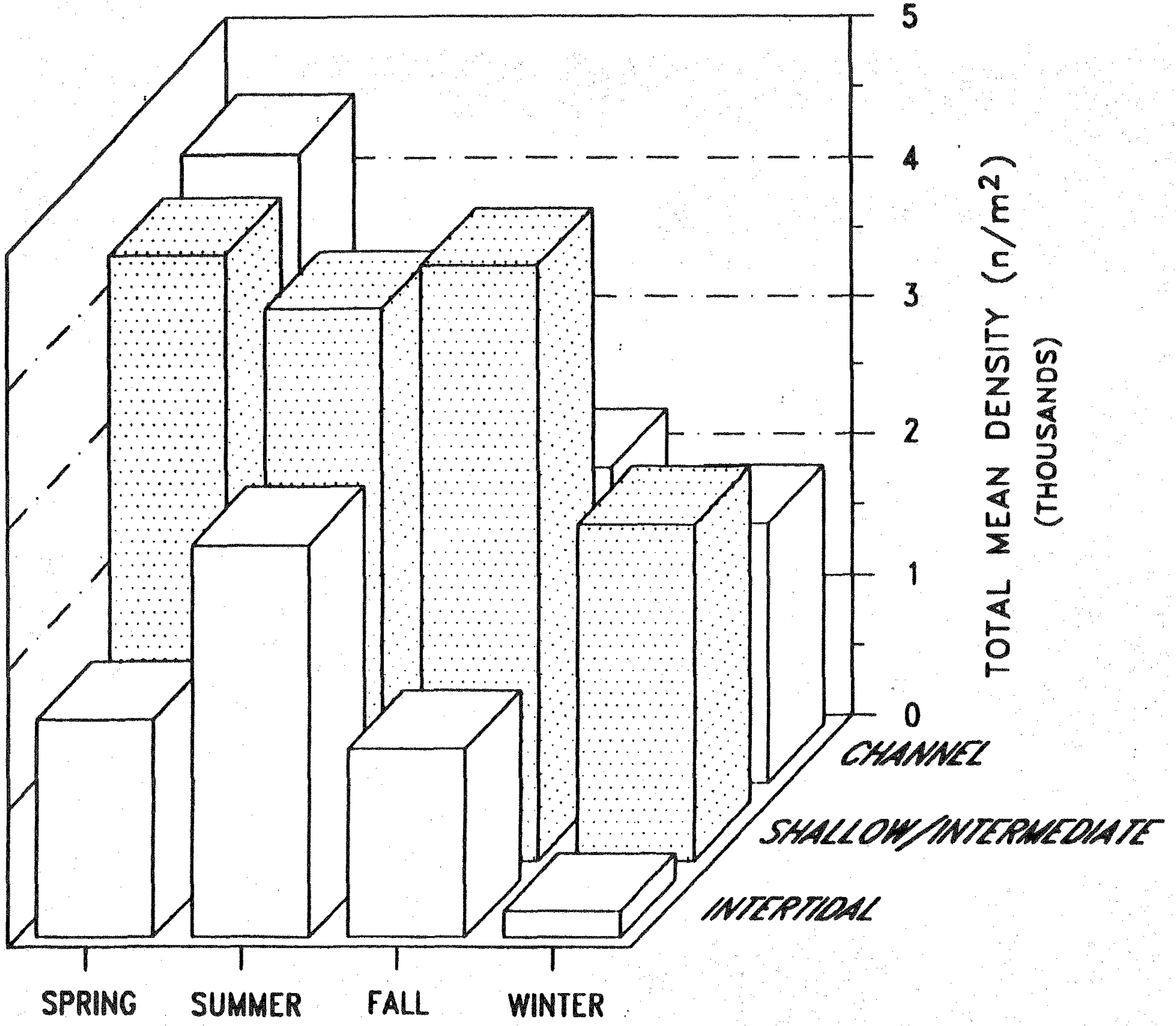
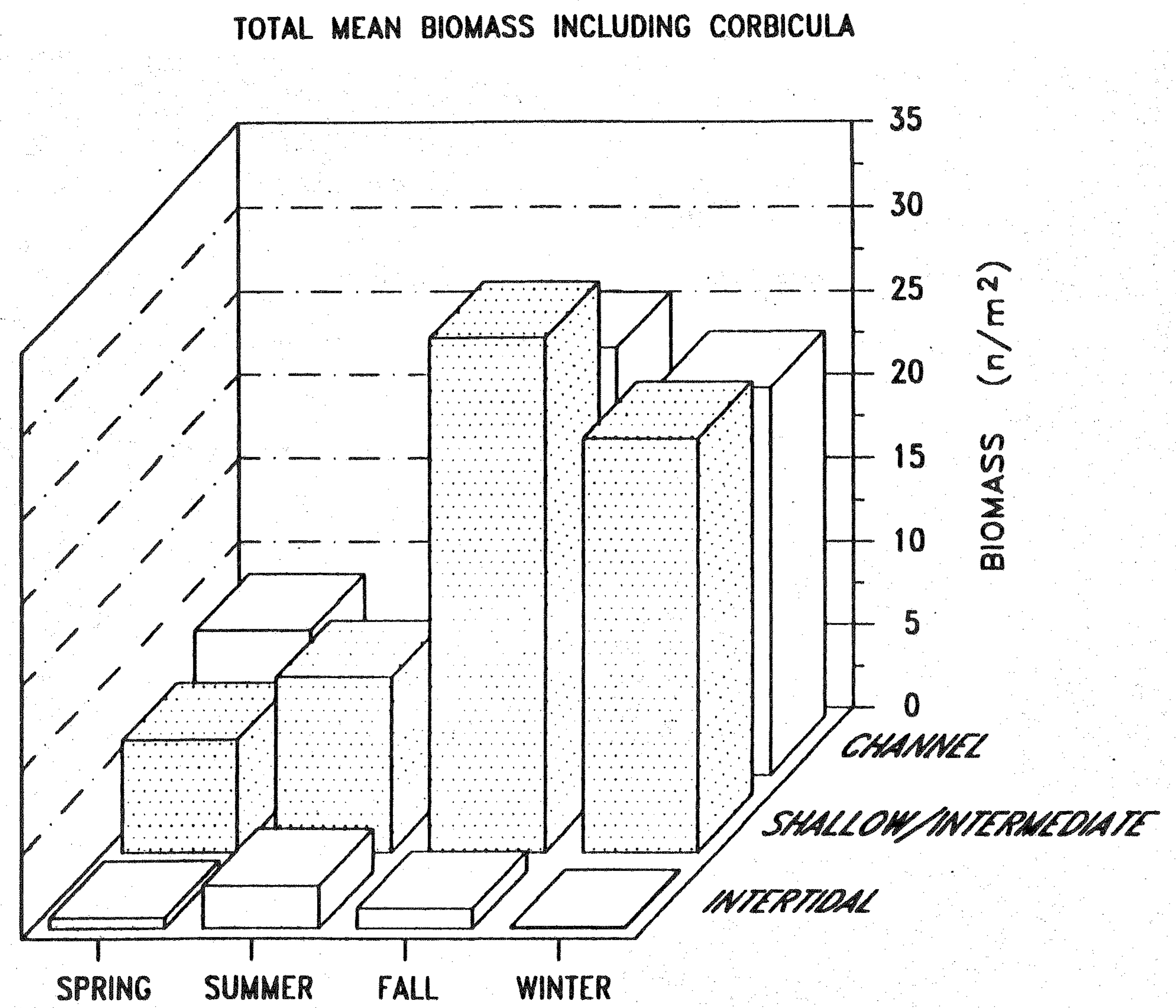


DELAWARE ESTUARY PROGRAM	TOTAL MEAN BIOMASS BY SEASON AND ZONE OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES AND SUBSTRATA IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 23 ENVIRONMENTAL CONSULTING SERVICES INC.

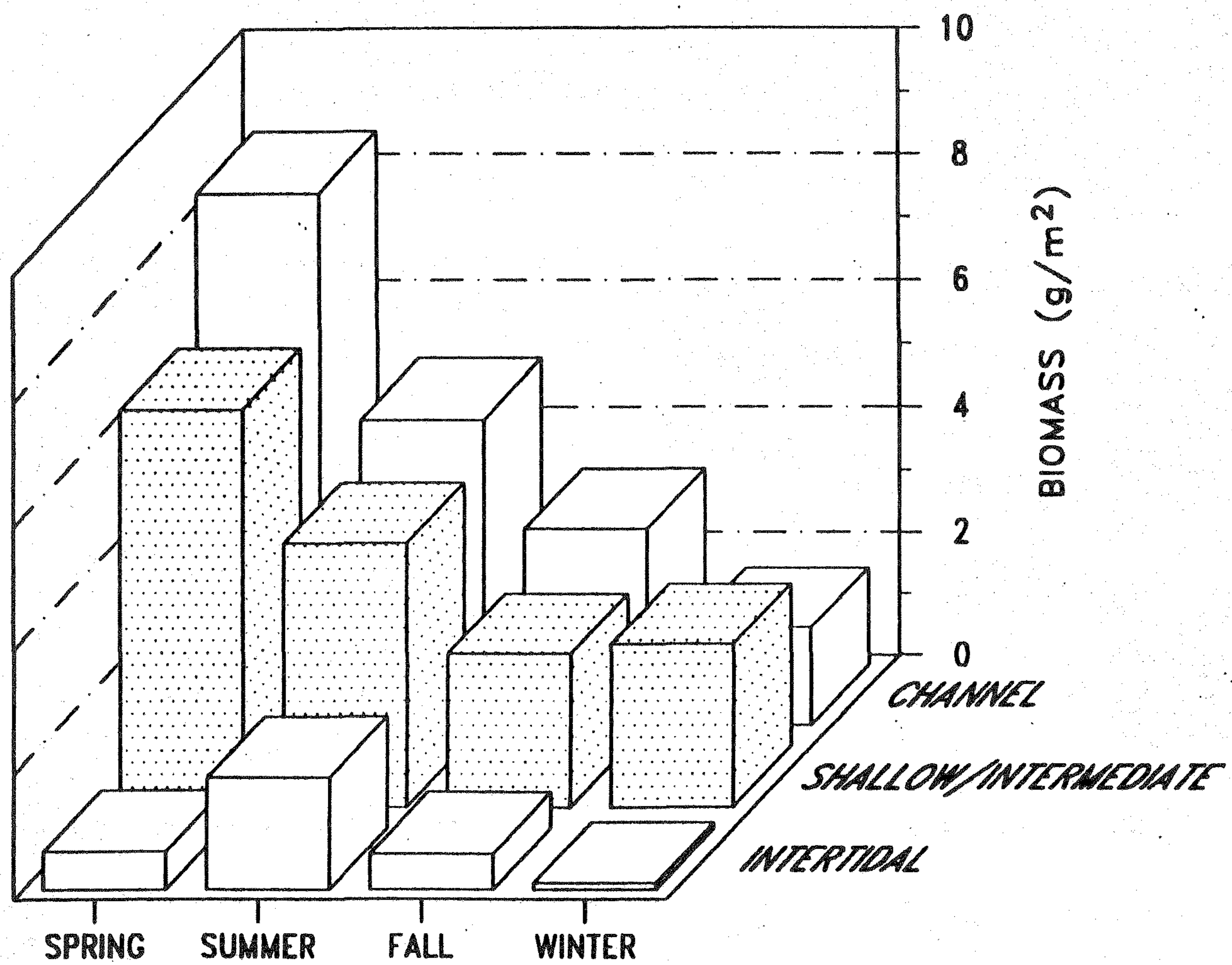


DELAWARE ESTUARY PROGRAM	TOTAL MEAN DENSITY BY SEASON AND SUBSTRATA OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	GUR 4 — E...ONM...AL C...ULTI... SERV...S INC.

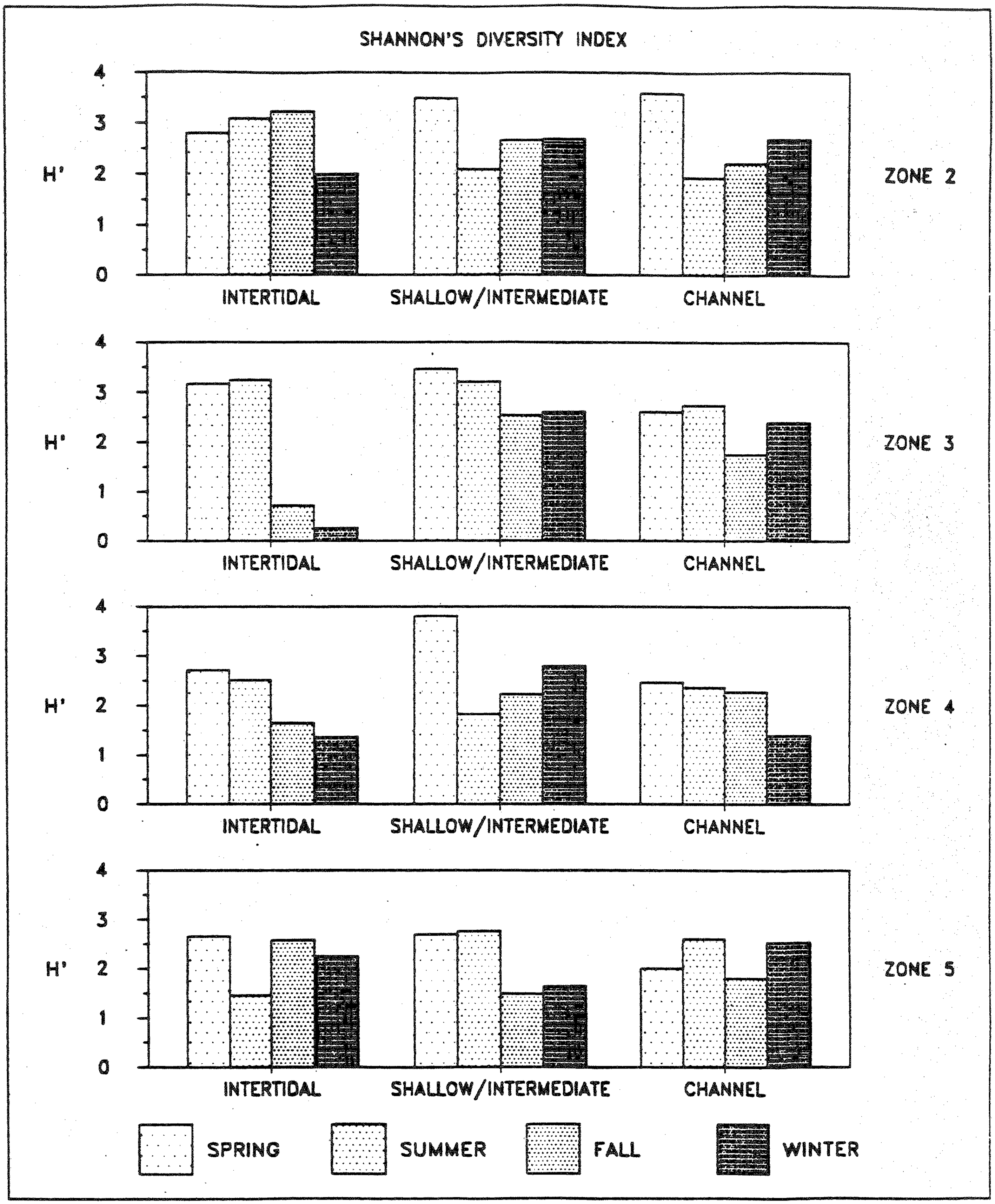


DELAWARE ESTUARY PROGRAM	TOTAL MEAN BIOMASS BY SEASON AND SUBSTRATA OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE 25 — ENVIRONMENTAL CONSULTING SERVICES INC.

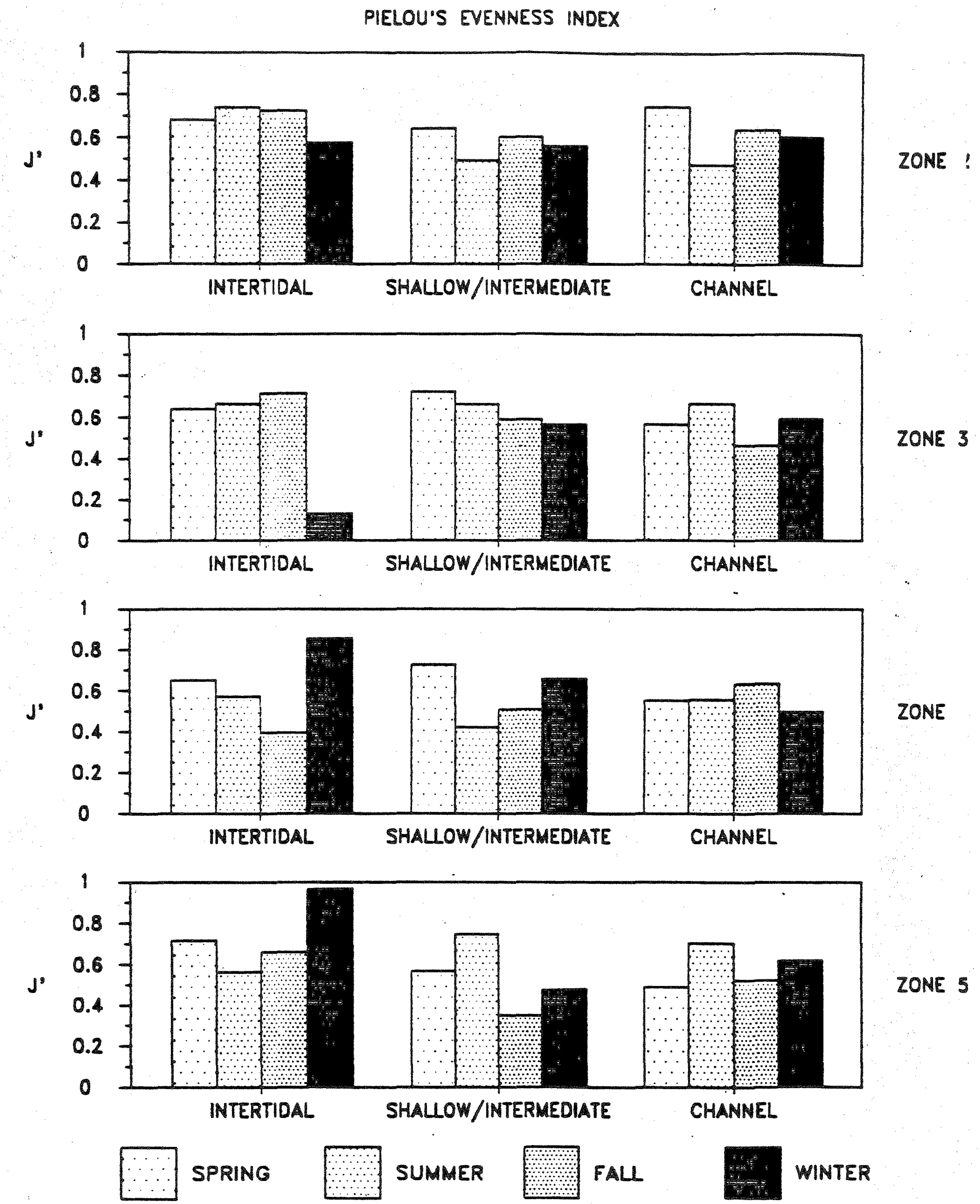
TOTAL MEAN BIOMASS EXCLUDING CORBICULA



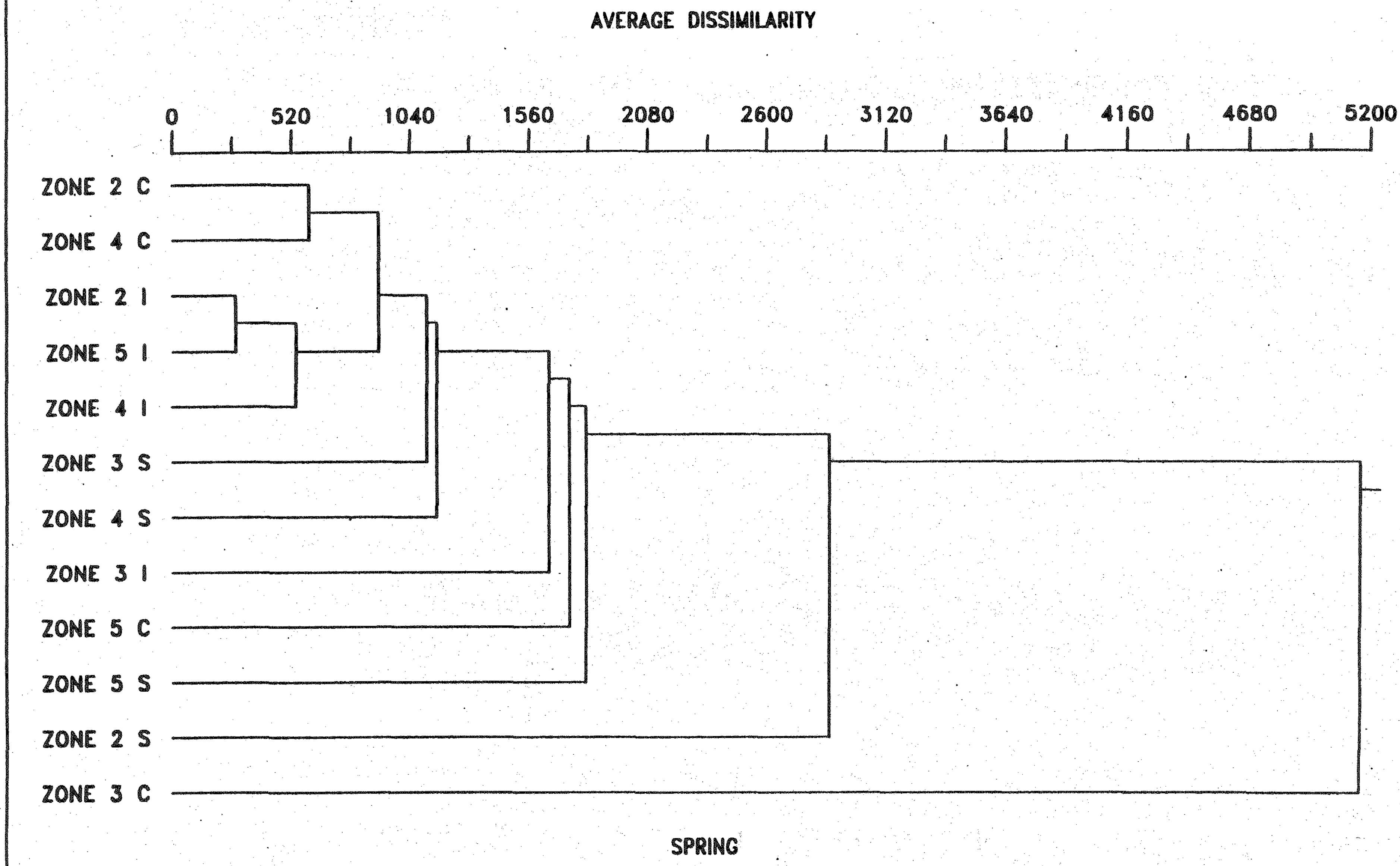
DELAWARE ESTUARY PROGRAM	TOTAL MEAN BIOMASS BY SEASON AND SUBSTRATA OF BENTHIC MACROINVERTEBRATES COLLECTED IN ALL ZONES IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIGURE [illegible]6 E[illegible]RONM[illegible]AL [illegible]SULT[illegible] SER[illegible]ES II



DELAWARE ESTUARY PROGRAM	SHANNON'S DIVERSITY INDEX BY SEASON, SUBSTRATA AND ZONE FOR BENTHIC MACROINVERTEBRATES COLLECTED IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON NJ. DURING 1992 AND 1993
	FIGURE 27 ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	PIELOU'S EVENNESS INDEX BY SEASON, SUBSTRATA A D ZONE FOR BENTHIC MACROINVERTEBRATES COLLECTE IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON NJ. DURING 1992 AND 1993
	FIGURE 28 ENVIRONMENTAL CONSULTING SERVICES INC

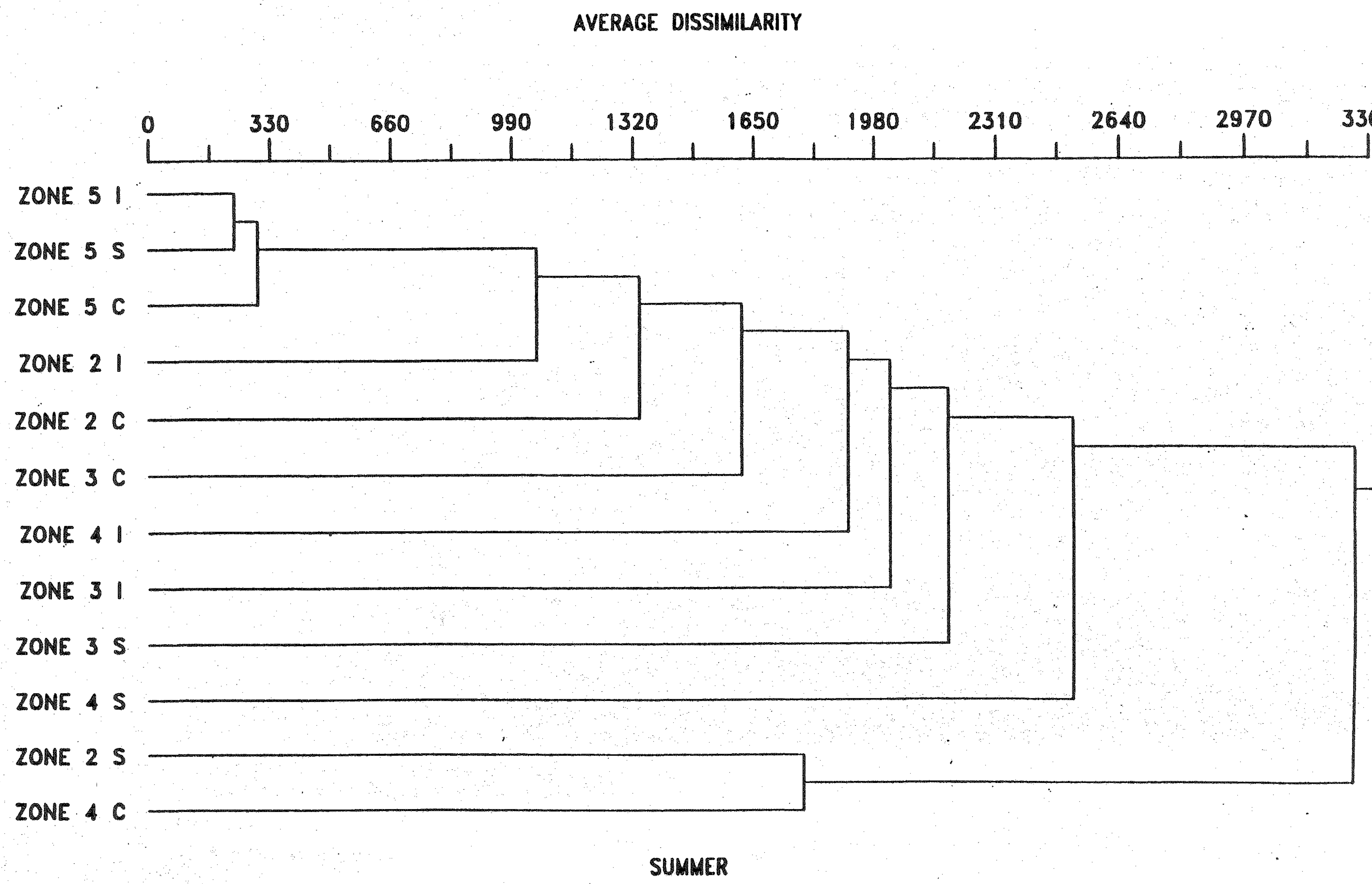


DELAWARE ESTUARY PROGRAM

AVERAGE LINKAGE CLUSTER ANALYSIS BY ZONE AND SUBSTRATA FOR BENTHIC MACROINVERTEBRATES COLLECTED DURING SPRING IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.

FIG. 29

ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM

AVERAGE LINKAGE CLUSTER ANALYSIS BY ZONE AND SUBSTRATA FOR BENTHIC MACROINVERTEBRATES COLLECTED DURING SUMMER IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.

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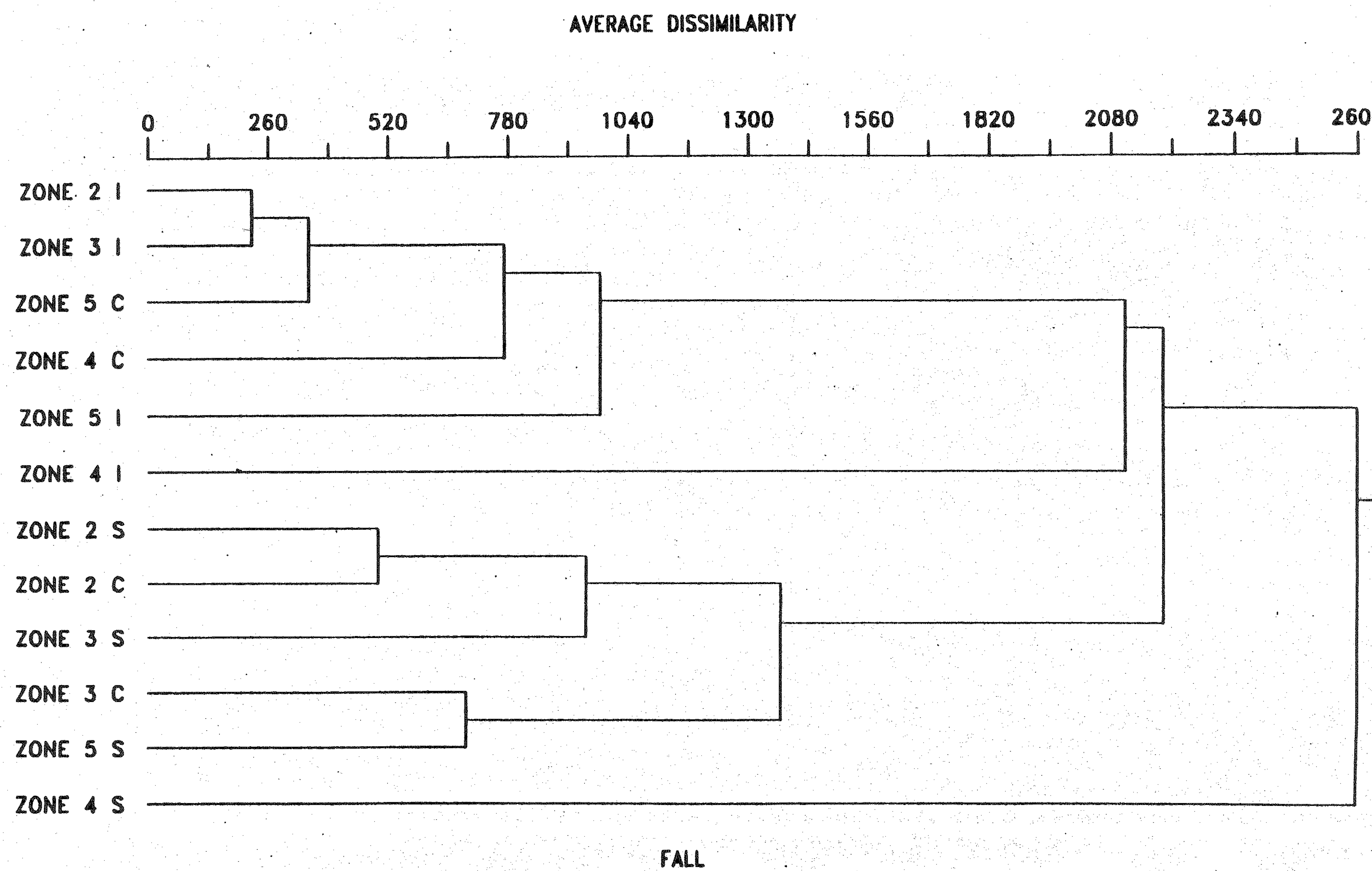
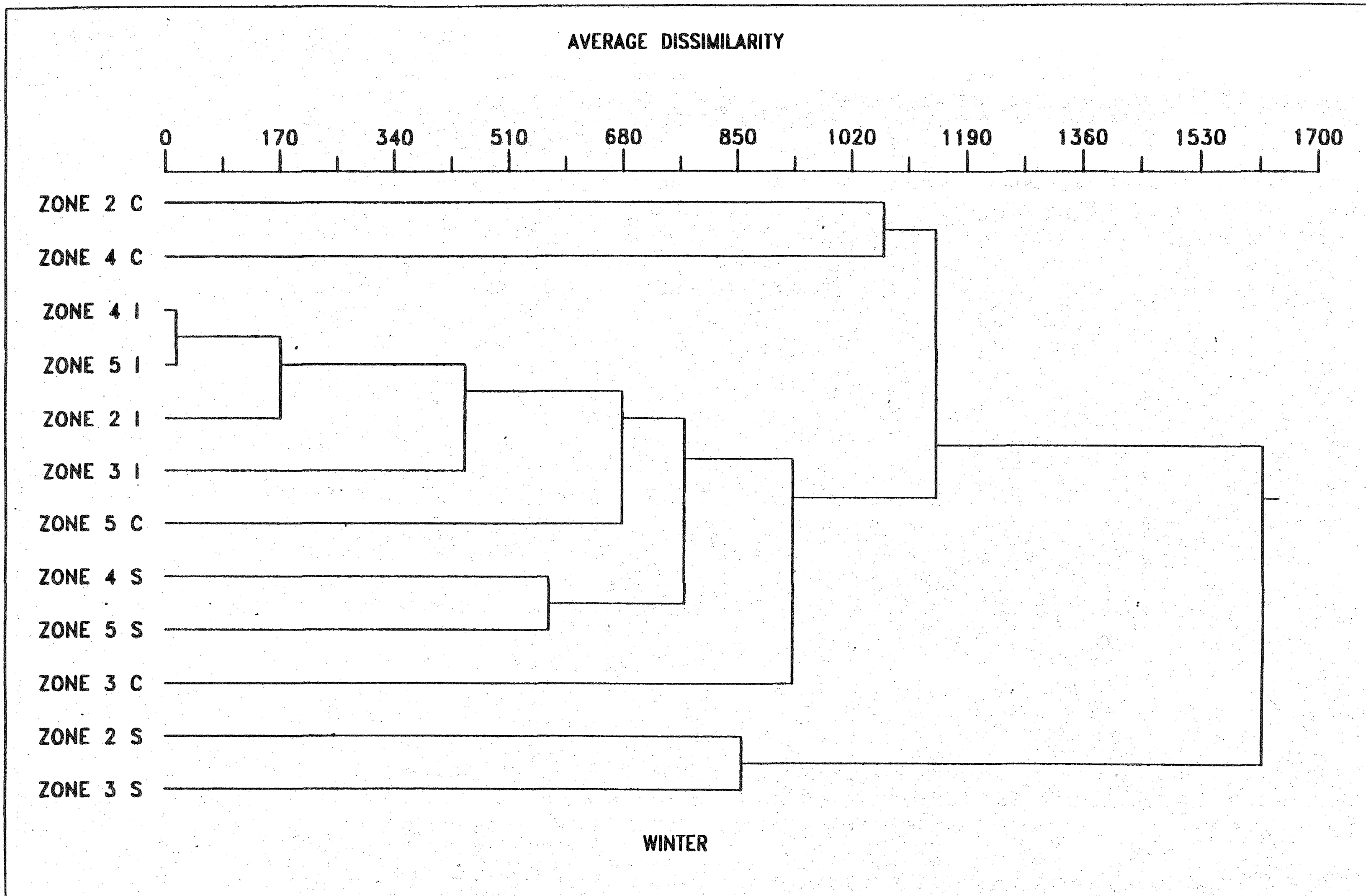
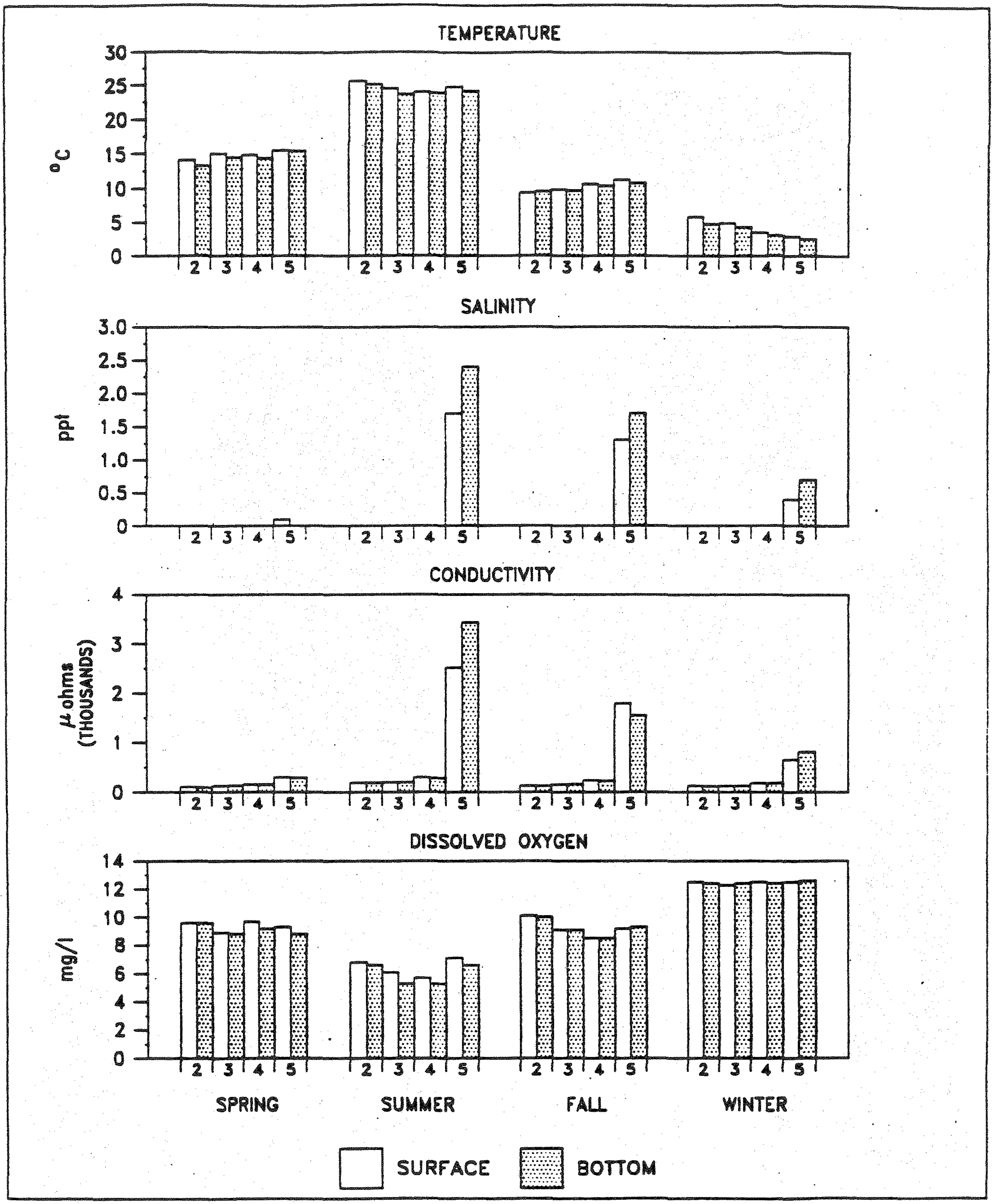


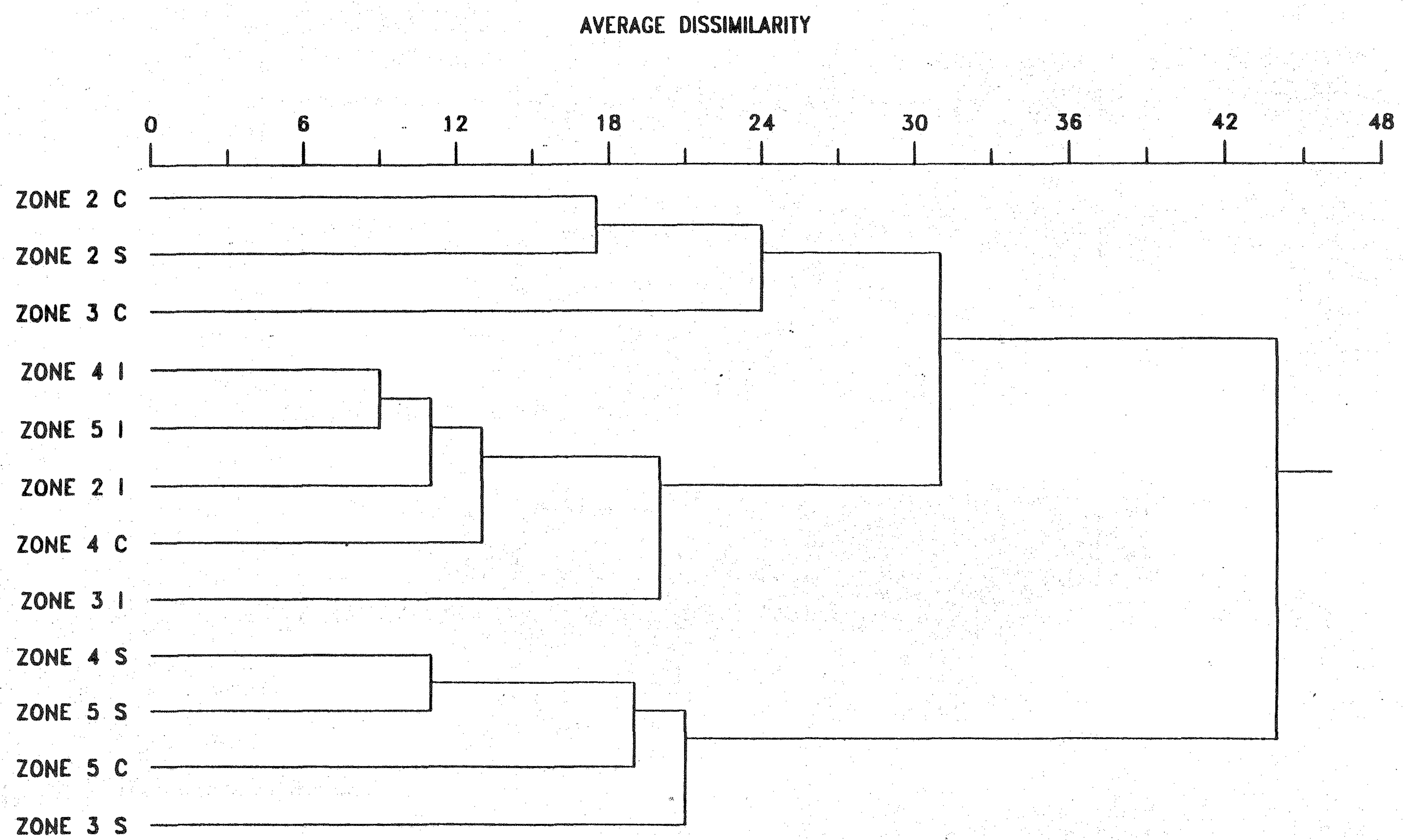
DELAWARE ESTUARY PROGRAM	AVERAGE LINKAGE CLUSTER ANALYSIS BY ZONE AND SUBSTRATA FOR BENTHIC MACROINVERTEBRATES COLLECTED DURING FALL IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIG. 31 ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	AVERAGE LINKAGE CLUSTER ANALYSIS BY ZONE AND SUBSTRATA FOR BENTHIC MACROINVERTEBRATES COLLECTED DURING WINTER IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIG. 32 ENVIRONMENTAL CONSULTING SERVICES INC.



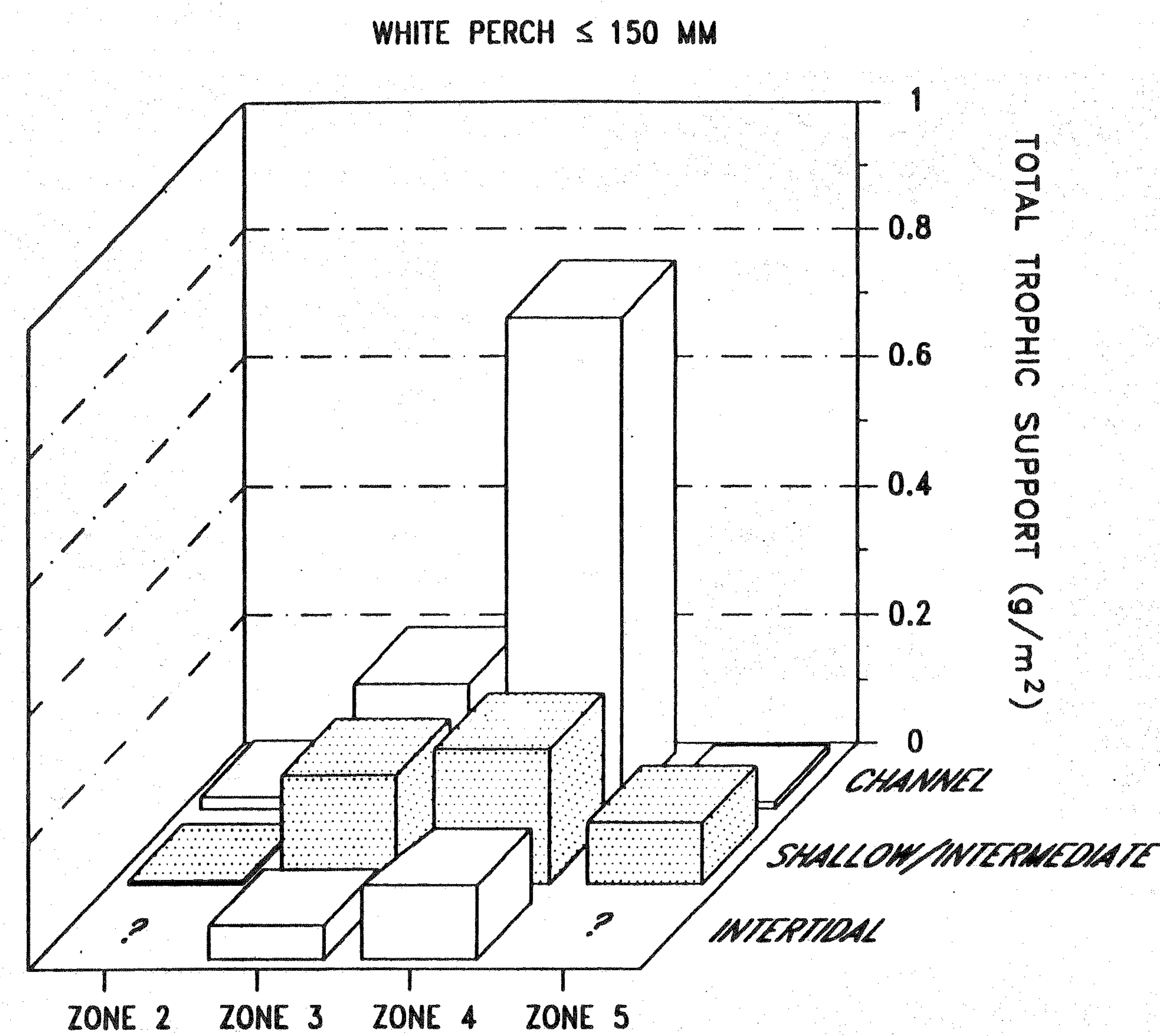
DELAWARE ESTUARY PROGRAM	SUMMARY OF PHYSIOCHEMICAL PARAMETERS MEASURED IN SURFACE AND BOTTOM WATERS BY SEASON AND ZONE IN THE DELAWARE RIVER BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING 1992 AND 1993.
	FIG. 33 ENVIRONMENTAL CONSULTING SERVICES INC.



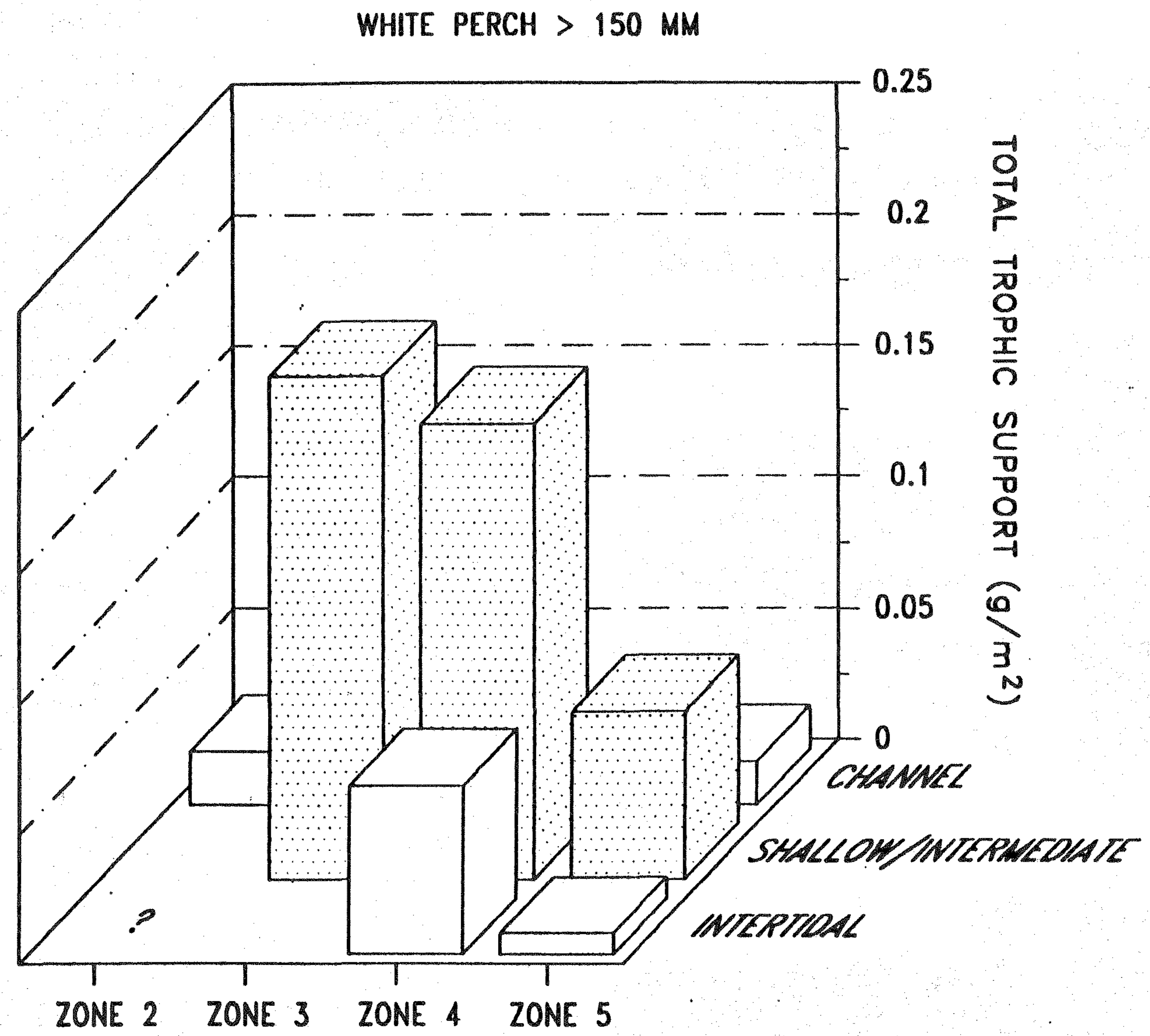
DELAWARE ESTUARY PROGRAM

AVERAGE LINKAGE CLUSTER ANALYSIS BY ZONE AND SUBSTRATA
FOR SEDIMENT PARTICLE SIZE IN THE DELAWARE RIVER
BETWEEN THE C & D CANAL AND TRENTON, NJ.

FIG. 34 ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	TOTAL TROPHIC SUPPORT BY ZONE AND SUBSTRATA PROVIDED BY BENTHIC MACROINVERTEBRATES TO WHITE PERCH ≤150mm IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING SUMMER 1992.
	FIGURE 35 ENVIRONMENTAL CONSULTING SERVICES INC.



DELAWARE ESTUARY PROGRAM	TOTAL TROPHIC SUPPORT BY ZONE AND SUBSTRATA PROVIDED BY BENTHIC MACROINVERTEBRATES TO WHITE PERCH > 150mm IN THE DELAWARE RIVER, BETWEEN THE C & D CANAL AND TRENTON, NJ. DURING SUMMER 1992.
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APPENDIX A-1

Appendix Table A-1: Chronological listing of physicochemical data, and number and density of benthic macroinvertebrates collected by Ponar grab in Zones 2, 3, 4 and 5 in the Delaware River between the C & D canal and Trenton, NJ during 1992 and 1993.

Date		4/28/92		4/28/92		4/28/92		4/28/92	
Time		1020		1130		1215		1300	
Location		S333		I336		I340		I201	
Tide		Flood 2		Flood Slack		Flood Slack		Ebb 1	
Temp.(C) Air		12.5		13.0		12.0		16.0	
Surface		14.0		13.5		14.0		14.5	
Bottom		14.0		14.0		-		-	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		-		-	
Cond. Surface		122		109		-		110	
Bottom		118		109		-		-	
D.O.(ppm) Surface		8.1		8.3		8.2		8.1	
Bottom		8.1		8.3		-		-	
Depth(feet)		18 TO 20		4 TO 6		4 TO 5		3 TO 4	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	0.0	0	37.8	2	0.0	0
OLIGOCHAETA		0.0	0	0.0	0	75.6	4	0.0	0
PARANAIS LITORALIS		0.0	0	0.0	0	75.6	4	0.0	0
UNIDENTIFIED TUBIFICID #2		1039.7	55	37.8	2	132.3	7	207.9	11
LIMNODRILUS HOFFMEISTERI		170.1	9	18.9	1	0.0	0	0.0	0
PISCICOLIDAE		0.0	0	18.9	1	0.0	0	0.0	0
SPIONIDAE		37.8	2	18.9	1	0.0	0	0.0	0
CORBICULA FLUMINEA		0.0	0	18.9	1	0.0	0	0.0	0
GAMMARUS SPP.		18.9	1	0.0	0	0.0	0	0.0	0
CYATHURA POLITA		56.7	3	18.9	1	75.6	4	0.0	0
DIPTERA	PUPAE	18.9	1	0.0	0	0.0	0	0.0	0
CERATOPOGONIDAE	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	132.3	7	37.8	2	207.9	11	37.8	2
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
ORTHOCLADIINAE	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1

Appendix Table A-1: (continued).

		4/28/92		4/29/92		4/29/92		4/29/92	
Time		1350		915		1015		1245	
Location		I219		C215		C236		I276	
Tide		Ebb 1		Flood 1		Flood 1		Flood 2	
Temp.(C) Air		18.5		11.0		12.0		17.0	
Surface		15.0		13.0		12.5		13.5	
Bottom		-		13.0		12.5		-	
Sal.(ppt) Surface		0.0		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		115		100		95		110	
Bottom		-		100		95		-	
D.O.(ppm) Surface		8.0		9.3		9.3		11.2	
Bottom		-		9.0		9.9		-	
Depth(feet)		4 TO 5		47 TO 48		-		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	0.0	0	491.5	26	0.0	0
NEMATODA		18.9	1	0.0	0	37.8	2	0.0	0
OLIGOCHAETA		0.0	0	0.0	0	75.6	4	0.0	0
ENCHYTRAEIDAE		0.0	0	0.0	0	0.0	0	56.7	3
MEGASCOLECIDAE		0.0	0	0.0	0	0.0	0	94.5	5
NAIDIDAE		0.0	0	0.0	0	151.2	8	0.0	0
UNIDENTIFIED TUBIFICID #1		37.8	2	0.0	0	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		415.9	22	245.7	13	1096.4	58	0.0	0
ISOCHAETIDES FREYI		0.0	0	0.0	0	113.4	6	0.0	0
LIMNODRILUS HOFFMEISTERI		245.7	13	0.0	0	245.7	13	0.0	0
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	245.7	13	0.0	0
QUISTADRILUS/SPIROSPERMA SPP.		0.0	0	0.0	0	18.9	1	0.0	0
CYSTOBRANCHUS SPP.		0.0	0	0.0	0	37.8	2	0.0	0
POLYCHAETA		18.9	1	0.0	0	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		0.0	0	0.0	0	56.7	3	0.0	0
BIVALVIA		0.0	0	0.0	0	18.9	1	0.0	0
CORBICULA FLUMINEA		0.0	0	18.9	1	397.0	21	0.0	0
COPEPODA		0.0	0	0.0	0	37.8	2	0.0	0
CYATHURA POLITA		18.9	1	0.0	0	472.6	25	0.0	0
HETEROPTERA		0.0	0	0.0	0	0.0	0	151.2	8
DIPTERA	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
DIPTERA	PUPAE	0.0	0	0.0	0	37.8	2	0.0	0
CERATOPOGONIDAE	LARVAE	0.0	0	0.0	0	94.5	5	0.0	0
ORMOSIA SPP.	LARVAE	0.0	0	0.0	0	0.0	0	94.5	5
CLADOTANYTARSUS SPP.	LARVAE	94.5	5	0.0	0	0.0	0	0.0	0
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1
POLYPEDILUM SPP.	LARVAE	18.9	1	0.0	0	1909.3	101	0.0	0
ORTHOCLADIINAE	LARVAE	0.0	0	0.0	0	113.4	6	0.0	0
NANOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	113.4	6	0.0	0
UNIDENTIFIED ORGANISM 1		0.0	0	0.0	0	37.8	2	0.0	0

Appendix Table A-1: (continued).

Date			4/29/92		4/29/92		4/29/92		4/29/92	
Time			1535		1600		1620		1655	
Location			S229		S222		S218		S209	
Tide			Ebb 1		Ebb 1		Ebb 1		Ebb 1	
Temp.(C)	Air		18.0		19.0		20.0		18.0	
	Surface		14.0		14.0		14.0		14.5	
	Bottom		14.0		14.0		14.0		14.0	
Sal.(ppt)	Surface		-		-		-		-	
	Bottom		-		-		-		-	
Cond.	Surface		100		105		100		105	
	Bottom		100		105		100		101	
D.O.(ppm)	Surface		9.5		9.6		9.4		9.8	
	Bottom		9.9		9.4		9.6		9.5	
Depth(feet)			18 TO 19		11 TO 12		23 TO 24		28 TO 29	
			n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA			113.4	6	37.8	2	18.9	1	0.0	0
OLIGOCHAETA			283.6	15	18.9	1	0.0	0	0.0	0
NAIDIDAE			0.0	0	151.2	8	0.0	0	0.0	0
ARCTEONAIS LOMONDI			151.2	8	0.0	0	0.0	0	0.0	0
PRISTINA SPP.			0.0	0	0.0	0	775.0	41	0.0	0
TUBIFICIDAE			0.0	0	170.1	9	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1			151.2	8	340.3	18	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2			1890.4	100	5293.0	280	7088.8	375	0.0	0
AULODRILUS LIMNOBIUS			151.2	8	0.0	0	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI			0.0	0	1077.5	57	907.4	48	529.3	28
LIMNODRILUS UDEKEMIANUS			151.2	8	0.0	0	321.4	17	888.5	47
QUISTADRILUS/SPIROSPERMA SPP.			0.0	0	0.0	0	1966.0	104	0.0	0
POLYCHAETA			0.0	0	0.0	0	245.7	13	18.9	1
SCOLECOLEPIDES VIRIDIS			0.0	0	18.9	1	18.9	1	0.0	0
BIVALVIA			0.0	0	0.0	0	18.9	1	0.0	0
CORBICULA FLUMINEA			0.0	0	453.7	24	94.5	5	37.8	2
PISIDIUM SPP.			94.5	5	0.0	0	0.0	0	0.0	0
ANCYLIDAE			0.0	0	0.0	0	0.0	0	18.9	1
CLADOCERA			37.8	2	0.0	0	56.7	3	0.0	0
COPEPODA			56.7	3	0.0	0	0.0	0	0.0	0
GAMMARUS SPP.			0.0	0	56.7	3	0.0	0	0.0	0
CYATHURA POLITA			0.0	0	226.8	12	113.4	6	75.6	4
CHIRIDOTEA ALMYRA			0.0	0	0.0	0	0.0	0	18.9	1
CERATOPOGONIDAE		LARVAE	18.9	1	18.9	1	0.0	0	0.0	0
CHIRONOMIDAE		LARVAE	37.8	2	0.0	0	0.0	0	0.0	0
TANYTARSINI		LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
RHEOTANYTARSUS SPP.		LARVAE	0.0	0	453.7	24	0.0	0	0.0	0
TANYTARSUS SPP.		LARVAE	0.0	0	113.4	6	0.0	0	0.0	0
DICROTENDIPES SPP.		LARVAE	0.0	0	132.3	7	0.0	0	0.0	0
POLYPEDILUM SPP.		LARVAE	75.6	4	1701.3	90	415.9	22	453.7	24
CRYPTOCHIRONOMOUS SPP.		LARVAE	75.6	4	132.3	7	226.8	12	0.0	0
ORTHOCLADIINAE		LARVAE	0.0	0	340.3	18	0.0	0	0.0	0
NANOCLADIUS SPP.		LARVAE	0.0	0	113.4	6	0.0	0	0.0	0
ABLABESMYIA (EXCEPT ANNULATA)		LARVAE	0.0	0	226.8	12	0.0	0	0.0	0
PROCLADIUS SPP.		LARVAE	226.8	12	113.4	6	245.7	13	0.0	0
UNIDENTIFIED ORGANISM			75.6	4	0.0	0	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1			56.7	3	321.4	17	37.8	2	0.0	0

Appendix Table A-1: (continued).

Date		4/29/92		4/29/92		4/29/92		4/29/92	
Time		1335		1350		1420		1455	
Location		I272		C269		S268		I249	
Tide		Flood 2		Flood Slack		Ebb 1		Ebb 1	
Temp.(C) Air		18.0		18.0		20.0		19.0	
Surface		14.0		14.0		15.0		15.0	
Bottom		-		12.5		12.5		-	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		100		100		90		100	
Bottom		-		90		93		-	
D.O.(ppm) Surface		10.5		10.0		10.2		10.1	
Bottom		-		9.6		10.2		-	
Depth(feet)		1 TO 2		29 TO 30		12 TO 13		1 TO 2	
		n/m2	n	n m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	18.9	1	94.5	5	0.0	0
OLIGOCHAETA		37.8	2	56.7	3	56.7	3	0.0	0
ENCHYTRAEIDAE		321.4	17	0.0	0	0.0	0	75.6	4
ARCTEONAIS LOMONDI		0.0	0	0.0	0	37.8	2	0.0	0
NAIS COMMUNIS		0.0	0	37.8	2	0.0	0	0.0	0
PRISTINA SPP.		0.0	0	37.8	2	0.0	0	0.0	0
TUBIFICIDAE		0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	132.3	7	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	283.6	15	1758.0	93	37.8	2
AULODRILUS PLURISETA		0.0	0	18.9	1	0.0	0	0.0	0
LIMNODRILUS SPP.		0.0	0	18.9	1	18.9	1	0.0	0
QUISTADRILUS/SPIROSPERMA SPP.		0.0	0	37.8	2	94.5	5	0.0	0
BIVALVIA		0.0	0	18.9	1	0.0	0	0.0	0
CORBICULA FLUMINEA		0.0	0	0.0	0	850.7	45	0.0	0
SPHAERIIDAE		0.0	0	0.0	0	56.7	3	0.0	0
COPEPODA		0.0	0	0.0	0	37.8	2	0.0	0
GAMMARUS SPP.		0.0	0	37.8	2	94.5	5	0.0	0
CAECIDOTEA SPP.		0.0	0	0.0	0	18.9	1	0.0	0
BEROSUS SPP.	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
TRICHOPTERA	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
ORMOSIA SPP.	LARVAE	56.7	3	0.0	0	0.0	0	75.6	4
CHIRONOMIDAE	LARVAE	0.0	0	18.9	1	151.2	8	0.0	0
TANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	378.1	20	18.9	1
CHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	113.4	6	37.8	2	18.9	1
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	18.9	1	1247.6	66	0.0	0
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
ABLABESMYIA SPP.	LARVAE	0.0	0	18.9	1	18.9	1	0.0	0
APSECTROTANYPUS SPP.	LARVAE	0.0	0	0.0	0	529.3	28	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	94.5	5	510.4	27	18.9	1
UNIDENTIFIED ORGANISM 1		0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date		4/30/92		4/30/92		4/30/92		4/30/92	
Time		910		945		1030		1100	
Location		S422		S424		S429		C433	
Tide		Flood 1		Flood 2		Flood 2		Flood 2	
Temp.(C) Air		17.5		17.5		17.0		18.0	
Surface		13.5		13.5		13.5		13.8	
Bottom		13.5		13.5		13.5		13.5	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		-	
Cond. Surface		160		155		150		145	
Bottom		165		155		150		150	
D.O.(ppm) Surface		9.5		9.1		9.4		9.9	
Bottom		9.9		9.1		9.4		9.5	
Depth(feet)		17 TO 18		20 TO 21		15 TO 16		43 TO 44	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	0.0	0	0.0	0	37.8	2
OLIGOCHAETA		18.9	1	0.0	0	0.0	0	0.0	0
ENCHYTRAEIDAE		0.0	0	0.0	0	132.3	7	0.0	0
ARCTEONAIS LOMONDI		0.0	0	0.0	0	18.9	1	0.0	0
CHAETOGASTER SPP.		0.0	0	0.0	0	0.0	0	18.9	1
NAIS BEHNINGI		0.0	0	0.0	0	0.0	0	56.7	3
NAIS COMMUNIS		37.8	2	56.7	3	0.0	0	0.0	0
PARANAIS FRICI		0.0	0	0.0	0	56.7	3	18.9	1
PRISTINA SPP.		0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	132.3	7	1172.0	62	37.8	2
AULODRILUS LIMNOBIUS		0.0	0	37.8	2	0.0	0	0.0	0
AULODRILUS PIGUETI		0.0	0	0.0	0	113.4	6	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	0.0	0	245.7	13	0.0	0
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	359.2	19	18.9	1
SCOLECOLEPIDES VIRIDIS		0.0	0	0.0	0	113.4	6	37.8	2
BIVALVIA		0.0	0	18.9	1	0.0	0	0.0	0
ANCYLIDAE		0.0	0	0.0	0	0.0	0	18.9	1
CLADOCERA		0.0	0	207.9	11	170.1	9	0.0	0
COPEPODA		0.0	0	0.0	0	37.8	2	0.0	0
GAMMARUS SPP.		37.8	2	0.0	0	18.9	1	0.0	0
CYATHURA POLITA		510.4	27	888.5	47	0.0	0	302.5	16
ASELLIDAE		0.0	0	18.9	1	0.0	0	0.0	0
CASSIDISCA LUNIFRONS		0.0	0	18.9	1	0.0	0	0.0	0
CHIRONOMIDAE	LARVAE	18.9	1	37.8	2	56.7	3	75.6	4
RHEOTANYTARSUS SPP.	LARVAE	37.8	2	37.8	2	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	56.7	3	189.0	10	18.9	1	1001.9	53
CRYPTOCHIRONOMOUS SPP.	LARVAE	18.9	1	18.9	1	170.1	9	0.0	0
ORTHOCLADIINAE	LARVAE	18.9	1	75.6	4	0.0	0	0.0	0
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
NANOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	37.8	2	37.8	2
PROCLADIUS SPP.	LARVAE	75.6	4	0.0	0	94.5	5	0.0	0
UNIDENTIFIED ORGANISM		0.0	0	0.0	0	56.7	3	0.0	0

Appendix Table A-1: (continued).

Date		5/ 1/92		5/ 1/92		5/ 1/92		5/ 1/92	
Time		915		1025		1205		1235	
Location		C419		C448		S301		I444	
Tide		Flood 1		Flood 1		Flood 2		Flood 2	
Temp.(C) Air		14.0		16.0		20.5		17.0	
Surface		15.0		14.5		15.0		17.5	
Bottom		14.0		15.5		15.0		-	
Sal.(ppt) Surface		0.0		-		-		0.0	
Bottom		0.0		-		-		-	
Cond. Surface		100		125		125		225	
Bottom		145		125		125		-	
D.O.(ppm) Surface		9.9		9.4		9.6		9.2	
Bottom		9.2		10.0		9.1		-	
Depth(feet)		45 TO 46		46 TO 47		29 TO 30		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	0.0	0	56.7	3	0.0	0
OLIGOCHAETA		18.9	1	132.3	7	283.6	15	0.0	0
ENCHYTRAEIDAE		56.7	3	18.9	1	0.0	0	0.0	0
NAIDIDAE		0.0	0	18.9	1	113.4	6	0.0	0
ARCTEONAIS LOMONDI		0.0	0	0.0	0	623.8	33	0.0	0
NAIS SPP.		0.0	0	0.0	0	56.7	3	0.0	0
PARANAIS FRICI		0.0	0	0.0	0	18.9	1	0.0	0
SLAVINA APPENDICULATA		0.0	0	0.0	0	472.6	25	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	94.5	5	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	18.9	1	5066.2	268	0.0	0
AULODRILUS PIGUETI		0.0	0	0.0	0	529.3	28	0.0	0
LIMNODRILUS SPP.		0.0	0	0.0	0	56.7	3	0.0	0
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	283.6	15	0.0	0
MANAYUNKIA SPECIOSA		0.0	0	0.0	0	18.9	1	0.0	0
SCOLECOLEPIDES VIRIDIS		321.4	17	113.4	6	18.9	1	0.0	0
BIVALVIA		0.0	0	0.0	0	37.8	2	0.0	0
PISIDIUM SPP.		0.0	0	0.0	0	37.8	2	0.0	0
CLADOCERA		0.0	0	0.0	0	4328.9	229	0.0	0
COPEPODA		0.0	0	0.0	0	113.4	6	0.0	0
AMPHIPODA		0.0	0	18.9	1	0.0	0	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	359.2	19	0.0	0
POLYPEDILUM SPP.	LARVAE	56.7	3	1947.1	103	4896.0	259	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	340.3	18	0.0	0
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	0.0	0	548.2	29	0.0	0
ECTOPROCTA		0.0	0	18.9	1	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		5/ 1/92		5/ 1/92		5/ 1/92		5/ 1/92	
Time		1255		1315		1420		1450	
Location		I445		I450		I321		I322	
Tide		Flood 2		Flood Slack		Flood 2		Flood 1	
Temp.(C) Air		18.5		18.0		19.5		20.0	
Surface		15.5		17.0		17.0		17.0	
Bottom		-		-		-		-	
Sal.(ppt) Surface		-		0.0		0.0		-	
Bottom		-		-		0.0		-	
Cond. Surface		145		-		120		120	
Bottom		-		-		-		-	
D.O.(ppm) Surface		10.4		9.9		9.6		8.9	
Bottom		7.4		-		-		-	
Depth(feet)		1 TO 2		8 TO 9		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	0.0	0	56.7	3	0.0	0
OLIGOCHAETA		18.9	1	0.0	0	132.3	7	0.0	0
ENCHYTRAEIDAE		18.9	1	37.8	2	264.7	14	18.9	1
CHAETOGASTER DIAPHANUS		0.0	0	0.0	0	0.0	0	18.9	1
NAIS BEHNINGI		0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	529.3	28	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	0.0	0	1190.9	63	18.9	1
AULODRILUS PIGUETI		18.9	1	0.0	0	0.0	0	0.0	0
COPEPODA		18.9	1	0.0	0	0.0	0	0.0	0
LIMONIA SPP.	LARVAE	0.0	0	0.0	0	132.3	7	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
ORTHOCLADIINAE	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date		5/ 1/92		5/ 5/92		5/ 5/92		5/ 5/92	
Time		1525		1130		1225		1300	
Location		S325		S319		C317		C315	
Tide		Ebb 1		Ebb 1		Ebb Slack		Flood 1	
Temp.(C) Air		19.0		13.5		12.0		13.0	
Surface		15.5		14.5		14.5		15.0	
Bottom		15.0		14.5		14.5		14.5	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		115		110		110		115	
Bottom		115		110		110		115	
D.O.(ppm) Surface		9.1		9.3		9.3		9.0	
Bottom		8.6		9.2		8.8		9.0	
Depth(feet)		24 TO 25		19 TO 20		49 TO 50		39 TO 40	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		207.9	11	0.0	0	18828.0	996	75.6	4
NEMATODA		0.0	0	0.0	0	283.6	15	0.0	0
OLIGOCHAETA		0.0	0	18.9	1	0.0	0	0.0	0
ENCHYTRAEIDAE		0.0	0	18.9	1	6748.6	357	529.3	28
NAIS SPP.		0.0	0	56.7	3	0.0	0	0.0	0
NAIS BEHNINGI		0.0	0	56.7	3	0.0	0	0.0	0
NAIS COMMUNIS		0.0	0	18.9	1	0.0	0	0.0	0
PARANAIS LITORALIS		0.0	0	0.0	0	378.1	20	0.0	0
PIGUETIELLA MICHIGANENSIS		0.0	0	0.0	0	1115.3	59	0.0	0
UNIDENTIFIED TUBIFICID #1		94.5	5	0.0	0	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		189.0	10	0.0	0	189.0	10	56.7	3
ISOCHAETIDES FREYI		0.0	0	0.0	0	0.0	0	56.7	3
LIMNODRILUS HOFFMEISTERI		94.5	5	0.0	0	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		37.8	2	0.0	0	18.9	1	37.8	2
BIVALVIA		37.8	2	94.5	5	0.0	0	18.9	1
COPEPODA		18.9	1	0.0	0	0.0	0	0.0	0
GAMMARUS SPP.		37.8	2	0.0	0	0.0	0	0.0	0
ISOPODA		0.0	0	0.0	0	0.0	0	170.1	9
CYATHURA POLITA		37.8	2	0.0	0	0.0	0	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	0.0	0	18.9	1
CERATOPOGONIDAE	LARVAE	56.7	3	0.0	0	0.0	0	0.0	0
CHIRONOMIDAE	LARVAE	0.0	0	0.0	0	56.7	3	18.9	1
POLYPEDILUM SPP.	LARVAE	1228.7	65	37.8	2	56.7	3	340.3	18
CRYPTOCHIRONOMOUS SPP.	LARVAE	302.5	16	0.0	0	0.0	0	0.0	0
ECTOPROCTA		0.0	0	18.9	1	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		5/ 5/92		5/ 5/92		5/ 5/92		5/ 5/92	
Time		1325		1355		1440		1535	
Location		S315		C313		C309		C303	
Tide		Flood 1		Flood 2		Flood 1		Flood 2	
Temp.(C) Air		13.0		13.0		13.0		13.0	
Surface		15.0		15.0		15.0		15.0	
Bottom		14.5		14.5		14.5		15.0	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		120		120		125		145	
Bottom		120		125		130		140	
D.O.(ppm) Surface		9.3		8.6		8.7		8.8	
Bottom		9.5		8.8		8.9		8.9	
Depth(feet)		13 TO 14		44 TO 45		44 TO 45		41 TO 42	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		321.4	17	0.0	0	0.0	0	0.0	0
NEMATODA		75.6	4	0.0	0	0.0	0	18.9	1
OLIGOCHAETA		378.1	20	0.0	0	0.0	0	0.0	0
ENCHYTRAEIDAE		0.0	0	0.0	0	245.7	13	0.0	0
NAIS SPP.		2173.9	115	0.0	0	0.0	0	0.0	0
NAIS BEHNINGI		1550.1	82	0.0	0	18.9	1	0.0	0
NAIS COMMUNIS		0.0	0	0.0	0	0.0	0	1474.5	78
PARANAIS FRICI		2155.0	114	0.0	0	0.0	0	0.0	0
TUBIFICIDAE		302.5	16	18.9	1	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		604.9	32	0.0	0	18.9	1	16124.8	853
LIMNODRILUS SPP.		0.0	0	37.8	2	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	0.0	0	0.0	0	2949.0	156
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	0.0	0	4423.4	234
POLYCHAETA		0.0	0	0.0	0	18.9	1	0.0	0
MANAYUNKIA SPECIOSA		94.5	5	18.9	1	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		0.0	0	18.9	1	0.0	0	359.2	19
BIVALVIA		18.9	1	0.0	0	0.0	0	37.8	2
CLADOCERA		56.7	3	18.9	1	0.0	0	0.0	0
COPEPODA		0.0	0	0.0	0	0.0	0	18.9	1
GAMMARUS SPP.		113.4	6	0.0	0	0.0	0	56.7	3
CYATHURA POLITA		794.0	42	0.0	0	0.0	0	94.5	5
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	18.9	1	0.0	0
CERATOPOGONIDAE	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
CHIRONOMINAE	LARVAE	0.0	0	0.0	0	0.0	0	132.3	7
CLADOTANYTARSUS SPP.	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	245.7	13	453.7	24	75.6	4	1115.3	59
CRYPTOCHIRONOMOUS SPP.	LARVAE	75.6	4	0.0	0	0.0	0	132.3	7
NANOCLADIUS SPP.	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
UNIDENTIFIED ORGANISM		0.0	0	0.0	0	113.4	6	0.0	0
UNIDENTIFIED ORGANISM 1		75.6	4	0.0	0	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date			5/ 5/92		5/ 5/92		5/ 5/92		5/ 5/92	
Time			1650		1735		1800		1830	
Location			C425		I418		S418		I415	
Tide			Ebb 1		Ebb 1		Ebb 1		Ebb 1	
Temp.(C)	Air		13.0		12.0		11.5		11.0	
	Surface		15.0		14.5		15.0		14.5	
	Bottom		15.0		-		15.0		-	
Sal.(ppt)	Surface		-		-		-		-	
	Bottom		-		-		-		-	
Cond.	Surface		160		155		160		155	
	Bottom		160		-		160		-	
D.O.(ppm)	Surface		9.3		11.4		10.1		11.0	
	Bottom		9.4		-		9.5		-	
Depth(feet)			49 TO 50		1 TO 2		32 TO 33		1 TO 2	
			n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA			0.0	0	18.9	1	0.0	0	0.0	0
NEMATODA			0.0	0	189.0	10	18.9	1	0.0	0
OLIGOCHAETA			0.0	0	661.6	35	18.9	1	0.0	0
NAIS SPP.			245.7	13	0.0	0	0.0	0	0.0	0
NAIS BEHNINGI			0.0	0	0.0	0	245.7	13	0.0	0
NAIS COMMUNIS			0.0	0	0.0	0	94.5	5	0.0	0
NAIS ELINGUIS			0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #1			0.0	0	2173.9	115	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2			18.9	1	0.0	0	0.0	0	37.8	2
LIMNODRILUS UDEKEMIANUS			0.0	0	756.1	40	0.0	0	0.0	0
QUISTADRILUS/SPIROSPERMA SPP.			0.0	0	0.0	0	0.0	0	18.9	1
HIRUDINEA			18.9	1	0.0	0	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS			94.5	5	0.0	0	37.8	2	18.9	1
COPEPODA			0.0	0	0.0	0	0.0	0	207.9	11
COROPHIUM SPP.			0.0	0	0.0	0	37.8	2	0.0	0
GAMMARUS SPP.			37.8	2	0.0	0	226.8	12	472.6	25
MONOCULODES EDWARDSI			0.0	0	0.0	0	0.0	0	37.8	2
ISOPODA			0.0	0	0.0	0	0.0	0	18.9	1
CYATHURA POLITA			18.9	1	18.9	1	56.7	3	0.0	0
CHIRIDOTEA ALMYRA			0.0	0	0.0	0	0.0	0	75.6	4
TANYTARSINI		LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
CLADOTANYTARSUS SPP.		LARVAE	0.0	0	340.3	18	0.0	0	0.0	0
POLYPEDILUM SPP.		LARVAE	472.6	25	0.0	0	378.1	20	18.9	1
ECTOPROCTA			0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED ORGANISM			0.0	0	0.0	0	0.0	0	18.9	1

Appendix Table A-1: (continued).

Date		5/11/92	5/11/92	5/11/92	5/11/92
Time		845	900	945	1015
Location		I515	I518	I544	I551
Tide		Ebb 1	Ebb 1	Ebb 1	Ebb 1
Temp.(C)	Air	16.0	17.0	18.0	19.5
	Surface	16.0	15.5	16.0	15.5
	Bottom	-	-	-	-
Sal.(ppt)	Surface	0.0	0.0	0.0	0.0
	Bottom	-	-	-	-
Cond.	Surface	90	850	200	200
	Bottom	-	-	-	-
D.O.(ppm)	Surface	9.5	9.6	9.3	10.4
	Bottom	-	-	-	-
Depth(feet)		1 TO 2	1 TO 2	1 TO 2	1 TO 2

		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	0.0	0	0.0	0	132.3	7
OLIGOCHAETA		0.0	0	56.7	3	0.0	0	0.0	0
ENCHYTRAEIDAE		434.8	23	37.8	2	18.9	1	94.5	5
NAIS COMMUNIS		0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	0.0	0	661.6	35
UNIDENTIFIED TUBIFICID #2		0.0	0	56.7	3	18.9	1	151.2	8
HABER SPECIOSUS		0.0	0	0.0	0	0.0	0	264.7	14
SCOLECOLEPIDES VIRIDIS		0.0	0	0.0	0	0.0	0	18.9	1
COPEPODA		0.0	0	0.0	0	226.8	12	0.0	0
GAMMARUS SPP.		0.0	0	0.0	0	18.9	1	0.0	0
TIPULIDAE	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1
POLYPEDILUM SPP.	LARVAE	0.0	0	0.0	0	37.8	2	170.1	9
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
SMITTIA SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date		5/11/92		5/11/92		5/11/92		5/11/92	
Time		1045		1140		1245		1325	
Location		I562		S409		C404		S558	
Tide		Ebb 1		Ebb 1		Ebb 2		Ebb 2	
Temp.(C) Air		19.5		20.0		19.5		22.0	
Surface		15.5		15.0		15.0		15.5	
Bottom		-		15.5		15.5		15.5	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		-		0.0		0.0		0.0	
Cond. Surface		150		160		160		160	
Bottom		-		160		155		170	
D.O.(ppm) Surface		10.4		8.4		9.0		8.6	
Bottom		-		9.2		8.8		8.5	
Depth(feet)		1 TO 2		29 TO 30		44 TO 45		25 TO 26	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	18.9	1	0.0	0	0.0	0
ENCHYTRAEIDAE		0.0	0	0.0	0	18.9	1	18.9	1
CHAETOGASTER DIAPHANUS		0.0	0	0.0	0	0.0	0	18.9	1
NAIS SPP.		0.0	0	94.5	5	0.0	0	0.0	0
NAIS BEHNINGI		0.0	0	567.1	30	0.0	0	0.0	0
NAIS BRETSCHERI		0.0	0	0.0	0	0.0	0	18.9	1
NAIS COMMUNIS		0.0	0	378.1	20	0.0	0	0.0	0
NAIS VARIABILIS		0.0	0	0.0	0	0.0	0	18.9	1
PARANAIS FRICI		0.0	0	189.0	10	0.0	0	0.0	0
PARANAIS LITORALIS		0.0	0	2249.5	119	18.9	1	18.9	1
TUBIFICIDAE		0.0	0	94.5	5	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	189.0	10	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	189.0	10	434.8	23	18.9	1
LIMNODRILUS HOFFMEISTERI		0.0	0	283.6	15	189.0	10	0.0	0
CYSTOBRANCHUS SPP.		0.0	0	18.9	1	0.0	0	0.0	0
POLYCHAETA		0.0	0	18.9	1	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		0.0	0	794.0	42	1436.7	76	37.8	2
LAEVAPEX SPP.		0.0	0	18.9	1	0.0	0	0.0	0
COROPHIUM SPP.		0.0	0	794.0	42	0.0	0	18.9	1
GAMMARUS SPP.		0.0	0	3610.6	191	151.2	8	113.4	6
MONOCULODES EDWARDSI		0.0	0	0.0	0	0.0	0	18.9	1
CYATHURA POLITA		0.0	0	359.2	19	0.0	0	0.0	0
CASSIDISCA LUNIFRONS		0.0	0	75.6	4	0.0	0	0.0	0
CHIRONOMIDAE	LARVAE	0.0	0	113.4	6	37.8	2	0.0	0
POLYPEDILUM SPP.	LARVAE	18.9	1	2173.9	115	529.3	28	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1
ECTOPROCTA		0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED ORGANISM		0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		0.0	0	0.0	0	151.2	8	0.0	0

Appendix Table A-1: (continued).

Date		5/11/92		5/11/92		5/11/92		5/12/92	
Time		1420		1615		1645		1125	
Location		C555		S548		S536		C553	
Tide		Ebb 2		Ebb Slack		Flood 1		Ebb 1	
Temp.(C) Air		20.5		19.5		20.0		17.0	
Surface		15.5		17.0		15.0		15.5	
Bottom		15.5		16.0		15.0		15.0	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		0.0	
Cond. Surface		160		180		180		175	
Bottom		160		170		175		180	
D.O.(ppm) Surface		9.1		10.0		9.6		9.1	
Bottom		8.7		8.7		9.4		8.8	
Depth(feet)		44 TO 45		17 TO 18		11 TO 12		49 TO 50	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	0.0	0	18.9	1	0.0	0
OLIGOCHAETA		0.0	0	0.0	0	56.7	3	0.0	0
NAIDIDAE		0.0	0	37.8	2	0.0	0	0.0	0
ARCTEONAIS LOMONDI		0.0	0	18.9	1	0.0	0	0.0	0
PARANAIS LITORALIS		37.8	2	0.0	0	56.7	3	0.0	0
UNIDENTIFIED TUBIFICID #1		18.9	1	207.9	11	642.7	34	0.0	0
UNIDENTIFIED TUBIFICID #2		56.7	3	189.0	10	964.1	51	0.0	0
LIMNODRILUS SPP.		37.8	2	0.0	0	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		321.4	17	510.4	27	737.2	39	0.0	0
LIMNODRILUS UDEKEMIANUS		0.0	0	18.9	1	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		453.7	24	415.9	22	1153.1	61	0.0	0
BIVALVIA		0.0	0	0.0	0	37.8	2	0.0	0
RANGIA CUNEATA		0.0	0	0.0	0	18.9	1	0.0	0
COPEPODA		0.0	0	0.0	0	37.8	2	0.0	0
COROPHIUM SPP.		0.0	0	0.0	0	18.9	1	0.0	0
COROPHIUM LACUSTRE		56.7	3	18.9	1	0.0	0	0.0	0
GAMMARUS SPP.		189.0	10	207.9	11	567.1	30	56.7	3
MONOCULODES EDWARDSI		37.8	2	18.9	1	0.0	0	0.0	0
CYATHURA POLITA		0.0	0	37.8	2	0.0	0	0.0	0
CHIRIDOTEA ALMYRA		18.9	1	0.0	0	18.9	1	0.0	0
CHIRONOMIDAE	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
POLYPEDILUM SPP.	LARVAE	18.9	1	18.9	1	302.5	16	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	207.9	11	75.6	4	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		5/12/92		5/12/92		5/12/92		5/12/92	
Time		1200		1220		1255		1325	
Location		C549		C548		S528		C519	
Tide		Ebb 1		Ebb 1		Ebb 1		Ebb 2	
Temp.(C) Air		21.0		22.0		20.0		19.5	
Surface		15.5		15.5		15.5		15.5	
Bottom		15.5		15.5		15.5		15.5	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		0.0	
Cond. Surface		205		205		440		900	
Bottom		205		205		500		850	
D.O.(ppm) Surface		8.2		8.2		9.1		9.1	
Bottom		8.4		8.4		9.0		8.8	
Depth(feet)		49 TO 50		49 TO 50		24 TO 25		49 TO 50	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		397.0	21	0.0	0	18.9	1	0.0	0
NEMATODA		0.0	0	18.9	1	0.0	0	18.9	1
OLIGOCHAETA		0.0	0	0.0	0	37.8	2	0.0	0
ENCHYTRAEIDAE		321.4	17	0.0	0	0.0	0	0.0	0
CHAETOGASTER DIAPHANUS		0.0	0	0.0	0	0.0	0	56.7	3
NAIS SPP.		37.8	2	0.0	0	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		18.9	1	18.9	1	359.2	19	18.9	1
LIMNODRILUS HOFFMEISTERI		0.0	0	18.9	1	0.0	0	0.0	0
PISCICOLA PUNCTATA		18.9	1	0.0	0	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		1701.3	90	2249.5	119	604.9	32	0.0	0
BIVALVIA		0.0	0	0.0	0	18.9	1	0.0	0
CLADOCERA		6691.9	354	0.0	0	0.0	0	0.0	0
COROPHIUM LACUSTRE		18.9	1	0.0	0	0.0	0	0.0	0
GAMMARUS SPP.		207.9	11	94.5	5	37.8	2	37.8	2
MONOCULODES EDWARDSI		0.0	0	37.8	2	18.9	1	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	18.9	1	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	75.6	4	0.0	0	75.6	4	37.8	2
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date		5/12/92		8/12/92		8/12/92		8/12/92	
Time		1355		1050		1130		1220	
Location		S514		S344		C336		I334	
Tide		Ebb 2		Flood 1		Flood 1		Flood 1	
Temp.(C) Air		21.0		22.5		29.0		27.0	
Surface		15.5		26.0		25.5		25.5	
Bottom		16.0		25.5		25.0		-	
Sal.(ppt) Surface		1.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		0.0	
Cond. Surface		-		185		190		190	
Bottom		-		185		190		-	
D.O.(ppm) Surface		9.0		5.9		5.8		6.7	
Bottom		9.2		6.1		6.1		-	
Depth(feet)		19 TO 20		21 TO 22		46 TO 47		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
HYDRIDAE		0.0	0	0.0	0	18.9	1	0.0	0
TURBELLARIA		18.9	1	0.0	0	0.0	0	0.0	0
NEMERTEA		94.5	5	0.0	0	0.0	0	0.0	0
NEMATODA		0.0	0	0.0	0	0.0	0	113.4	6
OLIGOCHAETA		0.0	0	0.0	0	0.0	0	37.8	2
ENCHYTRAEIDAE		0.0	0	0.0	0	2117.2	112	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	5727.8	303	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #3		5973.5	316	0.0	0	0.0	0	0.0	0
ISOCHAETIDES FREYI		0.0	0	926.3	49	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	75.6	4	0.0	0	0.0	0
QUISTADRILUS/SPIROSPERMA SPP.		0.0	0	0.0	0	18.9	1	0.0	0
SCOLECOLEPIDES VIRIDIS		548.2	29	0.0	0	0.0	0	0.0	0
BIVALVIA		18.9	1	18.9	1	0.0	0	18.9	1
CORBICULA FLUMINEA		0.0	0	0.0	0	0.0	0	56.7	3
RANGIA CUNEATA		37.8	2	0.0	0	0.0	0	0.0	0
COPEPODA		56.7	3	0.0	0	0.0	0	0.0	0
GAMMARUS SPP.		264.7	14	718.3	38	2495.3	132	0.0	0
MONOCULODES EDWARDSI		415.9	22	0.0	0	0.0	0	0.0	0
CYATHURA POLITA		0.0	0	18.9	1	18.9	1	18.9	1
CHIRIDOTEA ALMYRA		132.3	7	0.0	0	0.0	0	0.0	0
HEMIPTERA		0.0	0	0.0	0	0.0	0	18.9	1
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	226.8	12
POLYPEDILUM SPP.	LARVAE	37.8	2	926.3	49	869.6	46	75.6	4
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	75.6	4	0.0	0
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	75.6	4
PROCLADIUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	56.7	3
UNIDENTIFIABLE ORGANISM		0.0	0	0.0	0	0.0	0	37.8	2

Appendix Table A-1: (continued).

Date		8/12/92		8/12/92		8/12/92		8/12/92	
Time		1245		1300		1315		1330	
Location		I335		I340		I341		I343	
Tide		Flood 1		Flood 2		Flood 2		Flood 2	
Temp.(C) Air		26.0		25.5		26.5		26.5	
Surface		25.0		26.0		26.0		26.5	
Bottom		-		-		-		-	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		-		-	
Cond. Surface		190		195		200		195	
Bottom		-		-		-		-	
D.O.(ppm) Surface		6.6		8.4		8.0		8.6	
Bottom		-		-		-		-	
Depth(feet)		1 TO 2		1 TO 2		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	0.0	0	0.0	0	18.9	1
NEMATODA		0.0	0	0.0	0	264.7	14	37.8	2
ENCHYTRAEIDAE		0.0	0	56.7	3	264.7	14	0.0	0
NAIDIDAE		0.0	0	0.0	0	0.0	0	18.9	1
NAIS COMMUNIS		0.0	0	0.0	0	0.0	0	170.1	9
NAIS VARIABILIS		0.0	0	0.0	0	7712.7	408	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	2930.1	155	18.9	1
UNIDENTIFIED TUBIFICID #2		18.9	1	18.9	1	794.0	42	75.6	4
LIMNODRILUS HOFFMEISTERI		18.9	1	0.0	0	0.0	0	0.0	0
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	529.3	28	0.0	0
BIVALVIA		75.6	4	113.4	6	207.9	11	113.4	6
CORBICULA FLUMINEA		132.3	7	151.2	8	18.9	1	170.1	9
ARTHROPODA		0.0	0	0.0	0	0.0	0	18.9	1
CLADOCERA		0.0	0	0.0	0	18.9	1	0.0	0
COPEPODA		0.0	0	0.0	0	18.9	1	18.9	1
GAMMARUS SPP.		0.0	0	56.7	3	642.7	34	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	18.9	1	18.9	1
DIPTERA	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
TANYTARSINI	LARVAE	0.0	0	0.0	0	0.0	0	37.8	2
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	283.6	15	0.0	0
MICROPSECTRA SPP.	LARVAE	0.0	0	0.0	0	302.5	16	37.8	2
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	283.6	15	56.7	3
POLYPEDILUM SPP.	LARVAE	18.9	1	18.9	1	2646.5	140	321.4	17
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	888.5	47	113.4	6
ORTHOCLADIINAE	LARVAE	0.0	0	0.0	0	302.5	16	0.0	0
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	2362.9	125	0.0	0
ECTOPROCTA		0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED ORGANISM 1		0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date		8/12/92		8/12/92		8/12/92		8/12/92	
Time		1400		1425		1450		1515	
Location		I209		I216		I218		I231	
Tide		Flood 2		Flood 2		Flood 2		Flood 2	
Temp.(C) Air		17.0		26.0		27.0		26.0	
Surface		22.5		26.5		26.0		25.5	
Bottom		-		-		-		-	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		-		-	
Cond. Surface		185		180		185		190	
Bottom		-		-		-		-	
D.O.(ppm) Surface		6.9		7.5		7.7		6.7	
Bottom		-		-		-		-	
Depth(feet)		1 TO 2		1 TO 2		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		18.9	1	0.0	0	0.0	0	0.0	0
NEMATODA		0.0	0	623.8	33	37.8	2	0.0	0
ENCHYTRAEIDAE		132.3	7	359.2	19	0.0	0	18.9	1
NAIDIDAE		0.0	0	302.5	16	0.0	0	0.0	0
NAIS VARIABILIS		0.0	0	661.6	35	0.0	0	0.0	0
PARANAIS LITORALIS		0.0	0	94.5	5	0.0	0	0.0	0
PRISTINA SPP.		0.0	0	1228.7	65	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	245.7	13	56.7	3	56.7	3
HABER SPECIOSUS		0.0	0	56.7	3	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	56.7	3	0.0	0	18.9	1
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	18.9	1	0.0	0
BIVALVIA		0.0	0	113.4	6	737.2	39	0.0	0
CORBICULA FLUMINEA		18.9	1	0.0	0	207.9	11	18.9	1
LEPTODORA KINDTI		18.9	1	0.0	0	0.0	0	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	18.9	1	0.0	0
CERATOPOGONIDAE	LARVAE	0.0	0	37.8	2	113.4	6	18.9	1
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	567.1	30	3459.4	183	0.0	0
POLYPEDILUM SPP.	LARVAE	37.8	2	340.3	18	2268.4	120	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	340.3	18	434.8	23	0.0	0
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	113.4	6	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		8/12/92		8/12/92		8/12/92		8/12/92	
Time		1535		1640		1700		1715	
Location		I233		C272		S272		C270	
Tide		Flood Slack		Ebb 1		Ebb 1		Ebb 1	
Temp.(C)	Air	26.5		30.0		30.0		29.5	
	Surface	25.5		26.0		26.0		28.0	
	Bottom	-		24.5		24.5		25.0	
Sal.(ppt)	Surface	0.0		0.0		0.0		0.0	
	Bottom	-		0.0		0.0		0.0	
Cond.	Surface	185		190		190		205	
	Bottom	-		180		180		190	
D.O.(ppm)	Surface	6.7		7.7		7.7		7.2	
	Bottom	-		7.4		7.4		7.2	
Depth(feet)		1 TO 2		24 TO 25		19 TO 20		26 TO 27	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	0.0	0	18.9	1	0.0	0
ARCTEONAIS LOMONDI		0.0	0	0.0	0	132.3	7	37.8	2
NAIS COMMUNIS		0.0	0	0.0	0	132.3	7	0.0	0
SPECARIA JOSINAE		0.0	0	75.6	4	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	529.3	28	170.1	9	37.8	2
UNIDENTIFIED TUBIFICID #2		0.0	0	1682.4	89	378.1	20	642.7	34
AULODRILUS PIGUETI		0.0	0	0.0	0	37.8	2	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	548.2	29	0.0	0	378.1	20
QUISTADRILUS/SPIROSPERMA SPP.		0.0	0	226.8	12	56.7	3	113.4	6
BIVALVIA		0.0	0	37.8	2	0.0	0	0.0	0
GAMMARUS SPP.		0.0	0	18.9	1	0.0	0	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	207.9	11	18.9	1	0.0	0

Appendix Table A-1: (continued).

		8/12/92		8/13/92		8/13/92		8/13/92	
Date		8/12/92		8/13/92		8/13/92		8/13/92	
Time		1845		1045		1111		1210	
Location		C249		C241		S239		S229	
Tide		Ebb 2		Ebb Slack		Ebb Slack		Flood 1	
Temp.(C) Air		25.0		25.5		27.0		25.0	
Surface		26.0		26.0		26.0		25.0	
Bottom		26.0		26.0		25.5		25.0	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		0.0	
Cond. Surface		190		195		195		185	
Bottom		195		195		185		185	
D.O.(ppm) Surface		6.4		6.0		6.0		5.9	
Bottom		6.7		6.1		6.2		6.0	
Depth(feet)		41 TO 42		41 TO 42		10 TO 11		14 TO 15	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	18.9	1	0.0	0	56.7	3
OLIGOCHAETA		0.0	0	0.0	0	0.0	0	132.3	7
ENCHYTRAEIDAE		18.9	1	0.0	0	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		151.2	8	0.0	0	226.8	12	18.9	1
UNIDENTIFIED TUBIFICID #2		415.9	22	94.5	5	2325.1	123	321.4	17
AULODRILUS PIGUETI		0.0	0	0.0	0	75.6	4	0.0	0
ISOCHAETIDES FREYI		0.0	0	0.0	0	151.2	8	0.0	0
LIMNODRILUS HOFFMEISTERI		1077.5	57	321.4	17	1020.8	54	18.9	1
LIMNODRILUS UDEKEMIANUS		0.0	0	151.2	8	245.7	13	0.0	0
QUISTADRILUS/SPIROSPERMA SPP.		37.8	2	0.0	0	0.0	0	0.0	0
BIVALVIA		132.3	7	56.7	3	18.9	1	0.0	0
CORBICULA FLUMINEA		0.0	0	0.0	0	75.6	4	94.5	5
COPEPODA		0.0	0	0.0	0	0.0	0	18.9	1
GAMMARUS SPP.		189.0	10	94.5	5	75.6	4	18.9	1
CYATHURA POLITA		0.0	0	0.0	0	37.8	2	37.8	2
CERATOPOGONIDAE	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
CHIRONOMIDAE	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	56.7	3	0.0	0	0.0	0
MICROPSECTRA SPP.	LARVAE	0.0	0	0.0	0	0.0	0	189.0	10
POLYPEDILUM SPP.	LARVAE	0.0	0	18.9	1	151.2	8	56.7	3
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		0.0	0	18.9	1	18.9	1	56.7	3

Appendix Table A-1: (continued).

Date		8/13/92		8/17/92		8/17/92		8/17/92	
Time		1245		1030		1115		1140	
Location		S227		S324		S318		C319	
Tide		Flood 1		Ebb 2		Ebb 2		Ebb 2	
Temp.(C) Air		25.0		22.0		22.0		22.0	
Surface		25.0		23.0		23.0		23.5	
Bottom		25.0		23.0		23.0		23.5	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		0.0	
Cond. Surface		185		195		190		185	
Bottom		185		195		190		185	
D.O.(ppm) Surface		5.8		5.4		5.1		5.2	
Bottom		5.8		5.4		5.2		5.1	
Depth(feet)		9 TO 10		11 TO 12		19 TO 20		39 TO 40	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMERTEA		18.9	1	0.0	0	0.0	0	0.0	0
NEMATODA		0.0	0	18.9	1	0.0	0	0.0	0
ENCHYTRAEIDAE		0.0	0	0.0	0	113.4	6	340.3	18
NAIDIDAE		0.0	0	0.0	0	18.9	1	18.9	1
NAIS COMMUNIS		0.0	0	37.8	2	0.0	0	0.0	0
PARANAIS LITORALIS		0.0	0	0.0	0	18.9	1	0.0	0
PIGUETIELLA MICHIGANENSIS		0.0	0	0.0	0	189.0	10	0.0	0
PRISTINA SPP.		0.0	0	0.0	0	18.9	1	0.0	0
SPECARIA JOSINAE		4347.8	230	0.0	0	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		283.6	15	283.6	15	0.0	0	56.7	3
UNIDENTIFIED TUBIFICID #2		8695.7	460	1001.9	53	378.1	20	869.6	46
AULODRILUS PIGUETI		0.0	0	0.0	0	18.9	1	0.0	0
LIMNODRILUS HOFFMEISTERI		2608.7	138	37.8	2	37.8	2	18.9	1
LIMNODRILUS UDEKEMIANUS		0.0	0	37.8	2	0.0	0	0.0	0
POLYCHAETA		0.0	0	0.0	0	37.8	2	0.0	0
SCOLECOLEPIDES VIRIDIS		0.0	0	0.0	0	18.9	1	0.0	0
BIVALVIA		151.2	8	0.0	0	0.0	0	0.0	0
CORBICULA FLUMINEA		151.2	8	37.8	2	0.0	0	0.0	0
GAMMARUS SPP.		18.9	1	794.0	42	1285.4	68	264.7	14
CYATHURA POLITA		113.4	6	2759.9	146	1001.9	53	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	0.0	0	56.7	3
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	56.7	3
TANYTARSUS SPP.	LARVAE	0.0	0	1134.2	60	0.0	0	0.0	0
CHIRONOMINI	LARVAE	0.0	0	0.0	0	170.1	9	0.0	0
POLYPEDILUM SPP.	LARVAE	245.7	13	245.7	13	2816.6	149	1209.8	64
CRYPTOCHIRONOMOUS SPP.	LARVAE	245.7	13	340.3	18	245.7	13	0.0	0
TANYPODINAE	LARVAE	0.0	0	132.3	7	0.0	0	0.0	0
ECTOPROCTA		0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		56.7	3	94.5	5	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		8/17/92		8/17/92		8/17/92		8/17/92	
Time		1155		1225		1305		1335	
Location		C318		S315		S305		C303	
Tide		Ebb 2		Flood 1		Flood 1		Flood 1	
Temp.(C) Air		22.0		22.5		22.5		23.0	
Surface		23.5		23.5		23.5		24.0	
Bottom		23.5		23.5		23.5		24.0	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		0.0	
Cond. Surface		185		200		220		235	
Bottom		185		205		220		235	
D.O.(ppm) Surface		5.2		5.6		4.9		4.6	
Bottom		5.1		5.3		5.1		4.3	
Depth(feet)		46 TO 47		19 TO 20		13 TO 14		46 TO 47	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
HYDROZOA		0.0	0	0.0	0	18.9	1	0.0	0
OLIGOCHAETA		0.0	0	0.0	0	0.0	0	56.7	3
ENCHYTRAEIDAE		0.0	0	0.0	0	18.9	1	0.0	0
PIGUETIELLA MICHIGANENSIS		0.0	0	0.0	0	18.9	1	0.0	0
SPECARIA JOSINAE		0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #1		151.2	8	37.8	2	94.5	5	56.7	3
UNIDENTIFIED TUBIFICID #2		775.0	41	983.0	52	718.3	38	623.8	33
AULODRILUS PIGUETI		0.0	0	37.8	2	113.4	6	0.0	0
LIMNODRILUS HOFFMEISTERI		397.0	21	623.8	33	18.9	1	283.6	15
LIMNODRILUS UDEKEMIANUS		0.0	0	94.5	5	0.0	0	680.5	36
QUISTADRILUS/SPIROSPERMA SPP.		0.0	0	56.7	3	0.0	0	0.0	0
MANAYUNKIA SPECIOSA		0.0	0	0.0	0	794.0	42	0.0	0
SCOLECOLEPIDES VIRIDIS		37.8	2	0.0	0	0.0	0	0.0	0
BIVALVIA		0.0	0	0.0	0	18.9	1	0.0	0
LEPTODORA KINDTI		0.0	0	0.0	0	0.0	0	37.8	2
GAMMARUS SPP.		888.5	47	56.7	3	378.1	20	264.7	14
CYATHURA POLITA		378.1	20	415.9	22	1266.5	67	397.0	21
CLADOTANYTARSUS SPP.	LARVAE	18.9	1	18.9	1	0.0	0	0.0	0
MICROPSECTRA SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
TANYTARSUS SPP.	LARVAE	0.0	0	207.9	11	189.0	10	0.0	0
POLYPEDILUM SPP.	LARVAE	661.6	35	680.5	36	189.0	10	983.0	52
CRYPTOCHIRONOMOUS SPP.	LARVAE	18.9	1	207.9	11	113.4	6	18.9	1
PROCLADIUS SPP.	LARVAE	0.0	0	37.8	2	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		0.0	0	0.0	0	0.0	0	56.7	3

Appendix Table A-1: (continued).

Date		8/17/92		8/17/92		8/17/92		8/17/92	
Time		1430		1505		1550		1615	
Location		S450		C448		C445		S444	
Tide		Flood 2		Flood 2		Flood 2		Flood 2	
Temp.(C)	Air	24.0		24.0		24.0		24.0	
	Surface	24.0		24.0		24.0		24.0	
	Bottom	24.0		24.0		24.0		24.0	
Sal.(ppt)	Surface	0.0		0.0		0.0		0.0	
	Bottom	0.0		0.0		0.0		0.0	
Cond.	Surface	240		255		260		270	
	Bottom	245		255		265		270	
D.O.(ppm)	Surface	5.3		4.7		4.7		4.7	
	Bottom	5.3		5.2		4.8		4.7	
Depth(feet)		18 TO 19		49 TO 50		49 TO 50		15 TO 16	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		37.8	2	0.0	0	0.0	0	18.9	1
ENCHYTRAEIDAE		0.0	0	3591.7	190	0.0	0	0.0	0
NAIS ELINGUIS		18.9	1	0.0	0	0.0	0	0.0	0
PIGUETIELLA MICHIGANENSIS		0.0	0	0.0	0	623.8	33	0.0	0
SPECARIA JOSINAE		226.8	12	0.0	0	0.0	0	0.0	0
TUBIFICIDAE		0.0	0	0.0	0	113.4	6	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	113.4	6	0.0	0
UNIDENTIFIED TUBIFICID #2		1115.3	59	0.0	0	2117.2	112	56.7	3
LIMNODRILUS HOFFMEISTERI		18.9	1	0.0	0	170.1	9	18.9	1
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	56.7	3	0.0	0
SCOLECOLEPIDES VIRIDIS		37.8	2	0.0	0	0.0	0	0.0	0
CORBICULA FLUMINEA		37.8	2	0.0	0	37.8	2	37.8	2
GAMMARUS SPP.		1285.4	68	56.7	3	113.4	6	6597.4	349
CYATHURA POLITA		642.7	34	0.0	0	18.9	1	207.9	11
CHIRONOMINAE	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	75.6	4	0.0	0	0.0	0
RHEOTANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	37.8	2
TANYTARSUS SPP.	LARVAE	94.5	5	0.0	0	0.0	0	94.5	5
CHIRONOMINI	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
CHIRONOMOUS SPP.	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1
POLYPEDILUM SPP.	LARVAE	359.2	19	397.0	21	812.9	43	37.8	2
CRYPTOCHIRONOMOUS SPP.	LARVAE	94.5	5	18.9	1	18.9	1	0.0	0
ORTHOCLADIINAE	LARVAE	0.0	0	37.8	2	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		18.9	1	0.0	0	18.9	1	37.8	2

Appendix Table A-1: (continued).

Date		8/17/92		8/17/92		8/17/92		8/17/92	
Time		1645		1720		1745		1805	
Location		I436		C427		S424		S422	
Tide		Flood Slack		Flood Slack		Ebb 1		Ebb 1	
Temp.(C) Air		23.5		23.0		22.5		22.5	
Surface		24.0		24.0		24.0		24.0	
Bottom		-		24.0		24.0		-	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		0.0		0.0	
Cond. Surface		375		295		295		290	
Bottom		-		300		295		-	
D.O.(ppm) Surface		5.6		5.7		5.4		6.7	
Bottom		-		5.4		5.4		-	
Depth(feet)		1 TO 2		44 TO 45		7 TO 8		17 TO 18	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		75.6	4	18.9	1	0.0	0	1077.5	57
ENCHYTRAEIDAE		6408.3	339	0.0	0	0.0	0	18.9	1
NAIS COMMUNIS		0.0	0	0.0	0	0.0	0	18.9	1
SPECARIA JOSINAE		0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED TUBIFICID #2		0.0	0	5935.7	314	0.0	0	56.7	3
AULODRILUS PIGUETI		0.0	0	245.7	13	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	3327.0	176	0.0	0	0.0	0
LIMNODRILUS UDEKEMIANUS		0.0	0	302.5	16	0.0	0	0.0	0
BIVALVIA		0.0	0	0.0	0	37.8	2	37.8	2
CORBICULA FLUMINEA		0.0	0	0.0	0	18.9	1	37.8	2
ANCYLIDAE		0.0	0	56.7	3	0.0	0	18.9	1
GAMMARUS SPP.		56.7	3	2211.7	117	3402.6	180	113.4	6
CYATHURA POLITA		18.9	1	226.8	12	264.7	14	18.9	1
CERATOPOGONIDAE	LARVAE	0.0	0	0.0	0	0.0	0	56.7	3
TIPULIDAE	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
CHIRONOMIDAE	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	37.8	2	2986.8	158
TANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
POLYPEDILUM SPP.	LARVAE	18.9	1	170.1	9	94.5	5	1266.5	67
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	5557.7	294
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	434.8	23

Appendix Table A-1: (continued).

Date		8/17/92		8/17/92		8/17/92		8/18/92	
Time		1820		1845		1855		1015	
Location		C419		S418		S418		S415	
Tide		Ebb 1		Ebb 1		Ebb 1		Ebb 2	
Temp.(C)	Air	22.0		22.0		22.0		26.0	
	Surface	24.0		23.5		24.0		24.0	
	Bottom	24.0		-		24.0		24.0	
Sal.(ppt)	Surface	0.0		0.0		0.0		0.0	
	Bottom	0.0		0.0		0.0		0.0	
Cond.	Surface	315		295		305		285	
	Bottom	310		-		305		285	
D.O.(ppm)	Surface	5.7		6.5		5.9		5.2	
	Bottom	5.9		-		5.9		5.2	
Depth(feet)		49 TO 50		17 TO 18		7 TO 8		17 TO 18	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NAIS COMMUNIS		0.0	0	0.0	0	18.9	1	0.0	0
PIGUETIELLA MICHIGANENSIS		75.6	4	18.9	1	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		94.5	5	37.8	2	0.0	0	548.2	29
LIMNODRILUS HOFFMEISTERI		0.0	0	37.8	2	0.0	0	56.7	3
POLYCHAETA		0.0	0	0.0	0	0.0	0	18.9	1
BIVALVIA		0.0	0	56.7	3	0.0	0	0.0	0
CORBICULA FLUMINEA		0.0	0	18.9	1	18.9	1	37.8	2
AMPHIPODA		0.0	0	0.0	0	0.0	0	37.8	2
GAMMARUS SPP.		56.7	3	18.9	1	604.9	32	132.3	7
CYCLASPIS VARIANS		0.0	0	18.9	1	0.0	0	0.0	0
CYATHURA POLITA		18.9	1	18.9	1	529.3	28	340.3	18
CHIRIDOTEA ALMYRA		302.5	16	0.0	0	0.0	0	37.8	2
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	302.5	16	0.0	0	0.0	0
MICROPSECTRA SPP.	LARVAE	0.0	0	0.0	0	94.5	5	0.0	0
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
POLYPEDILUM SPP.	LARVAE	18.9	1	94.5	5	245.7	13	340.3	18
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		8/18/92		8/18/92		8/18/92		8/18/92	
Time		1155		1210		1245		1310	
Location		I408		I407		I558		I555	
Tide		Flood 1		Flood 1		Flood 1		Flood 1	
Temp.(C) Air		25.0		25.0		23.5		25.0	
Surface		25.0		25.0		26.0		25.5	
Bottom		-		-		-		-	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		-		-		-	
Cond. Surface		330		330		500		550	
Bottom		-		-		-		-	
D.O.(ppm) Surface		7.0		6.8		7.2		8.1	
Bottom		-		-		-		-	
Depth(feet)		1 TO 2		1 TO 2		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	18.9	1	0.0	0	0.0	0
NEMATODA		264.7	14	75.6	4	0.0	0	18.9	1
LUMBRICULIDAE		0.0	0	0.0	0	18.9	1	0.0	0
ENCHYTRAEIDAE		56.7	3	0.0	0	0.0	0	0.0	0
NAIS VARIABILIS		18.9	1	0.0	0	0.0	0	0.0	0
PRISTINA SPP.		56.7	3	0.0	0	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		18.9	1	0.0	0	0.0	0	0.0	0
GAMMARUS SPP.		56.7	3	56.7	3	18.9	1	226.8	12
EPHEMEROPTERA	NYMPH	0.0	0	0.0	0	0.0	0	18.9	1
POLYPEDILUM SPP.	LARVAE	0.0	0	0.0	0	0.0	0	491.5	26

Appendix Table A-1: (continued).

Date	8/18/92		8/18/92		8/18/92		8/18/92	
Time	1330		1355		1415		1525	
Location	I549		I548		C545		S536	
Tide	Flood 1		Flood 2		Flood 2		Flood Slack	
Temp.(C) Air	25.5		25.5		26.5		28.0	
Surface	25.5		25.0		24.5		25.0	
Bottom	-		-		24.5		24.0	
Sal.(ppt) Surface	0.0		0.0		0.0		2.0	
Bottom	-		-		0.0		2.0	
Cond. Surface	700		800		1250		2150	
Bottom	-		-		1300		2700	
D.O.(ppm) Surface	7.9		7.7		6.3		6.8	
Bottom	-		-		6.2		6.4	
Depth(feet)	1 TO 2		1 TO 2		44 TO 45		21 TO 22	
	n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMERTEA	0.0	0	0.0	0	0.0	0	18.9	1
ENCHYTRAEIDAE	18.9	1	0.0	0	18.9	1	0.0	0
SCOLECOLEPIDES VIRIDIS	0.0	0	0.0	0	0.0	0	189.0	10
RANGIA CUNEATA	0.0	0	0.0	0	0.0	0	18.9	1
GAMMARUS SPP.	0.0	0	0.0	0	18.9	1	0.0	0
CHIRIDOTEA ALMYRA	0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date	8/18/92		8/18/92		8/18/92		8/19/92	
Time	1620		1635		1705		935	
Location	S522		I518		C518		S503	
Tide	Flood Slack		Ebb 1		Ebb 1		Ebb 2	
Temp.(C) Air	26.0		27.0		26.0		27.0	
Surface	24.5		25.0		25.0		25.0	
Bottom	24.5		-		24.0		24.5	
Sal.(ppt) Surface	2.0		2.0		4.0		4.0	
Bottom	2.0		-		4.0		4.0	
Cond. Surface	3400		3400		5000		5500	
Bottom	3400		-		6000		5500	
D.O.(ppm) Surface	7.2		7.5		7.4		6.9	
Bottom	7.2		-		7.0		6.6	
Depth(feet)	9 TO 10		1 TO 2		46 TO 47		13 TO 14	
	n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA	0.0	0	0.0	0	75.6	4	0.0	0
NEMATODA	0.0	0	0.0	0	0.0	0	18.9	1
OLIGOCHAETA	18.9	1	0.0	0	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS	0.0	0	0.0	0	151.2	8	75.6	4
RANGIA CUNEATA	0.0	0	0.0	0	0.0	0	37.8	2
GAMMARUS SPP.	0.0	0	0.0	0	18.9	1	37.8	2
MONOCULODES EDWARDSI	37.8	2	0.0	0	0.0	0	0.0	0
CYATHURA POLITA	0.0	0	0.0	0	18.9	1	75.6	4
CHIRIDOTEA ALMYRA	0.0	0	0.0	0	37.8	2	0.0	0
NEOMYSIS AMERICANA	0.0	0	0.0	0	75.6	4	0.0	0

Appendix Table A-1: (continued).

Date			8/19/92		8/19/92		8/19/92		8/19/92	
Time			1030		1100		1125		1205	
Location			S505		C513		C515		S518	
Tide			Ebb 2		Ebb Slack		Flood 1		Flood 1	
Temp.(C)	Air		27.0		27.0		29.5		28.5	
	Surface		24.5		24.5		24.5		24.5	
	Bottom		24.5		24.0		24.0		24.5	
Sal.(ppt)	Surface		4.0		2.0		2.0		2.0	
	Bottom		4.0		2.0		2.0		2.0	
Cond.	Surface		5000		2500		2500		2000	
	Bottom		5000		2500		2500		2000	
D.O.(ppm)	Surface		7.1		6.6		6.3		6.7	
	Bottom		6.7		6.5		6.3		6.7	
Depth(feet)			13 TO 14		44 TO 45		44 TO 45		11 TO 12	
			n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMERTEA			0.0	0	510.4	27	302.5	16	0.0	0
NEMATODA			0.0	0	37.8	2	151.2	8	0.0	0
ENCHYTRAEIDAE			0.0	0	56.7	3	56.7	3	18.9	1
TUBIFICIDAE			0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED TUBIFICID #2			75.6	4	0.0	0	0.0	0	415.9	22
LIMNODRILUS HOFFMEISTERI			37.8	2	0.0	0	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS			491.5	26	567.1	30	264.7	14	56.7	3
BIVALVIA			18.9	1	0.0	0	0.0	0	0.0	0
RANGIA CUNEATA			37.8	2	0.0	0	0.0	0	0.0	0
COROPHIUM SPP.			283.6	15	18.9	1	0.0	0	0.0	0
GAMMARUS SPP.			151.2	8	37.8	2	75.6	4	56.7	3
CYATHURA POLITA			189.0	10	56.7	3	0.0	0	18.9	1
CHIRIDOTEA ALMYRA			0.0	0	0.0	0	18.9	1	0.0	0
NEOMYSIS AMERICANA			75.6	4	18.9	1	0.0	0	0.0	0
CHIRONOMIDAE		LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
CLADOTANYTARSUS SPP.		LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
POLYPEDILUM SPP.		LARVAE	0.0	0	37.8	2	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date			11/ 5/92		11/ 5/92		11/ 5/92		11/ 5/92	
Time			910		950		1015		1045	
Location			I508		I519		I533		I549	
Tide			Ebb 1		Ebb 1		Ebb 1		Ebb 2	
Temp.(C)	Air		11.6		10.3		10.3		11.0	
	Surface		12.0		12.5		12.5		12.0	
	Bottom		-		-		-		-	
Sal.(ppt)	Surface		4.0		4.0		2.0		2.0	
	Bottom		-		-		-		-	
Cond.	Surface		6000		3600		2350		900	
	Bottom		-		-		-		-	
D.O.(ppm)	Surface		9.5		9.4		9.6		9.4	
	Bottom		-		-		-		-	
Depth(feet)			1 TO 2		1 TO 2		1 TO 2		2 TO 3	
			n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA			0.0	0	0.0	0	18.9	1	0.0	0
ENCHYTRAEIDAE			0.0	0	548.2	29	0.0	0	0.0	0
PARANAIS LITORALIS			0.0	0	0.0	0	189.0	10	0.0	0
TUBIFICIDAE			0.0	0	18.9	1	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1			0.0	0	0.0	0	189.0	10	0.0	0
UNIDENTIFIED TUBIFICID #2			0.0	0	0.0	0	6030.2	319	151.2	8
AULODRILUS PIGUETI			0.0	0	0.0	0	756.1	40	0.0	0
ISOCHAETIDES FREYI			0.0	0	0.0	0	189.0	10	0.0	0
LIMNODRILUS HOFFMEISTERI			0.0	0	0.0	0	378.1	20	0.0	0
LIMNODRILUS UDEKEMIANUS			0.0	0	0.0	0	378.1	20	0.0	0
COPEPODA			0.0	0	0.0	0	189.0	10	0.0	0
GAMMARIDEA			0.0	0	0.0	0	18.9	1	0.0	0
GAMMARUS SPP.			0.0	0	75.6	4	264.7	14	56.7	3
MONOCULODES EDWARDSI			0.0	0	0.0	0	18.9	1	0.0	0
CERATOPOGONIDAE		LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
CHIRONOMIDAE		LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
CRYPTOCHIRONOMOUS SPP.		LARVAE	0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date		11/ 5/92		11/ 5/92		11/ 5/92		11/ 5/92	
Time		1115		1145		1220		1555	
Location		I553		I407		I422		S204	
Tide		Ebb 2		Ebb 2		Ebb 2		Ebb 2	
Temp.(C) Air		11.0		10.3		9.8		7.9	
Surface		12.0		12.0		12.0		11.0	
Bottom		-		-		-		-	
Sal.(ppt) Surface		-		0.0		0.0		-	
Bottom		-		-		-		-	
Cond. Surface		1100		400		265		150	
Bottom		-		-		-		-	
D.O.(ppm) Surface		9.3		9.0		8.6		9.0	
Bottom		-		-		-		-	
Depth(feet)		2 TO 3		1 TO 2		1 TO 2		16 TO 17	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
ENCHYTRAEIDAE		0.0	0	18.9	1	0.0	0	0.0	0
NAIDIDAE		0.0	0	0.0	0	56.7	3	56.7	3
NAIS COMMUNIS		0.0	0	0.0	0	378.1	20	0.0	0
NAIS VARIABILIS		0.0	0	0.0	0	132.3	7	0.0	0
PARANAIS LITORALIS		0.0	0	0.0	0	94.5	5	0.0	0
PRISTINA SPP.		0.0	0	0.0	0	37.8	2	0.0	0
PRISTINELLA SPP.		0.0	0	0.0	0	151.2	8	0.0	0
SPECARIA JOSINAE		0.0	0	0.0	0	0.0	0	151.2	8
UNIDENTIFIED TUBIFICID #2		207.9	11	18.9	1	794.0	42	2325.1	123
AULODRILUS PIGUETI		0.0	0	0.0	0	0.0	0	56.7	3
CORBICULA FLUMINEA		0.0	0	0.0	0	0.0	0	18.9	1
GAMMARUS SPP.		151.2	8	0.0	0	18.9	1	18.9	1
CYATHURA POLITA		0.0	0	0.0	0	264.7	14	226.8	12
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	18.9	1	0.0	0
NEOMYSIS AMERICANA		18.9	1	0.0	0	0.0	0	0.0	0
RHEOTANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	0.0	0	37.8	2	94.5	5
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	56.7	3

Appendix Table A-1: (continued).

Date			11/ 6/92		11/ 6/92		11/ 6/92		11/ 6/92	
Time			825		910		935		1100	
Location			S270		S260		I260		S247	
Tide			Flood 1		Flood 1		Flood 1		Flood 2	
Temp.(C)	Air		6.3		10.2		7.2		-	
	Surface		9.0		9.5		9.5		10.5	
	Bottom		-		9.5		-		10.5	
Sal.(ppt)	Surface		-		-		-		-	
	Bottom		-		-		-		-	
Cond.	Surface		110		120		125		140	
	Bottom		-		120		-		140	
D.O.(ppm)	Surface		10.5		10.2		9.5		9.7	
	Bottom		-		10.0		-		10.0	
Depth(feet)			5 TO 6		17 TO 18		1 TO 2		14 TO 15	
			n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA			151.2	8	0.0	0	0.0	0	0.0	0
NEMATODA			18.9	1	0.0	0	0.0	0	0.0	0
OLIGOCHAETA			0.0	0	37.8	2	0.0	0	0.0	0
NAIDIDAE			132.3	7	0.0	0	0.0	0	0.0	0
NAIS ELINGUIS			0.0	0	0.0	0	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #1			245.7	13	321.4	17	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #2			5085.1	269	1966.0	104	75.6	4	1663.5	88
AULODRILUS PIGUETI			1115.3	59	0.0	0	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI			0.0	0	0.0	0	0.0	0	151.2	8
LIMNODRILUS UDEKEMIANUS			0.0	0	0.0	0	0.0	0	226.8	12
QUISTADRILUS/SPIROSPERMA SPP.			378.1	20	75.6	4	18.9	1	0.0	0
HIRUDINEA			18.9	1	0.0	0	0.0	0	0.0	0
HELOBDELLA SPP.			0.0	0	75.6	4	0.0	0	0.0	0
BIVALVIA			56.7	3	0.0	0	0.0	0	0.0	0
CORBICULA FLUMINEA			1361.1	72	189.0	10	0.0	0	0.0	0
PHYSIDAE			37.8	2	94.5	5	0.0	0	0.0	0
COPEPODA			0.0	0	0.0	0	18.9	1	0.0	0
GAMMARUS SPP.			340.3	18	56.7	3	0.0	0	37.8	2
CHIRONOMIDAE		LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
CHIRONOMINAE		LARVAE	0.0	0	0.0	0	0.0	0	18.9	1
POLYPEDILUM SPP.		LARVAE	37.8	2	0.0	0	0.0	0	0.0	0
CRYPTOCHIRONOMOUS SPP.		LARVAE	113.4	6	18.9	1	0.0	0	37.8	2
PROCLADIUS SPP.		LARVAE	378.1	20	18.9	1	0.0	0	56.7	3
UNIDENTIFIABLE ORGANISM			0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED ORGANISM 1			132.3	7	0.0	0	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		11/ 6/92		11/ 6/92		11/ 6/92		11/ 9/92	
Time		1140		1215		1315		915	
Location		I247		C240		I235		C227	
Tide		Flood 2		Ebb 1		Ebb 1		Flood 1	
Temp.(C)	Air	8.0		9.0		7.9		-	
	Surface	10.0		10.5		10.5		8.0	
	Bottom	-		10.5		-		8.0	
Sal.(ppt)	Surface	-		-		-		-	
	Bottom	-		-		-		-	
Cond.	Surface	135		140		140		105	
	Bottom	-		140		-		100	
D.O.(ppm)	Surface	10.2		10.0		9.9		10.2	
	Bottom	-		9.5		-		10.4	
Depth(feet)		1 TO 2		42 TO 43		1 TO 2		43 TO 44	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	0.0	0	18.9	1	0.0	0
OLIGOCHAETA		0.0	0	245.7	13	0.0	0	0.0	0
ENCHYTRAEIDAE		75.6	4	0.0	0	926.3	49	0.0	0
SPECARIA JOSINAE		0.0	0	207.9	11	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	529.3	28	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		18.9	1	3856.3	204	37.8	2	1228.7	65
AULODRILUS PIGUETI		0.0	0	113.4	6	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	207.9	11	0.0	0	18.9	1
LIMNODRILUS UDEKEMIANUS		18.9	1	321.4	17	0.0	0	0.0	0
QUISTADRILUS/SPIROSPERMA SPP.		0.0	0	207.9	11	18.9	1	0.0	0
CORBICULA FLUMINEA		0.0	0	151.2	8	0.0	0	264.7	14
GAMMARUS SPP.		0.0	0	18.9	1	0.0	0	0.0	0
CYATHURA POLITA		0.0	0	18.9	1	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	37.8	2	0.0	0	113.4	6
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	37.8	2	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		11/ 9/92		11/ 9/92		11/ 9/92		11/ 9/92	
Time		955		1010		1025		1215	
Location		S227		I227		I228		S344	
Tide		Flood 1		Flood 1		Flood 1		Flood 2	
Temp.(C) Air		-		-		-		-	
Surface		8.0		7.5		8.5		9.5	
Bottom		-		-		-		9.5	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		110		110		110		140	
Bottom		-		-		-		150	
D.O.(ppm) Surface		10.4		10.5		10.5		9.5	
Bottom		-		-		-		9.3	
Depth(feet)		8 TO 9		1 TO 2		1 TO 2		19 TO 20	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	18.9	1	0.0	0	0.0	0
OLIGOCHAETA		0.0	0	0.0	0	0.0	0	18.9	1
ENCHYTRAEIDAE		0.0	0	18.9	1	0.0	0	0.0	0
NAIS BEHNINGI		0.0	0	0.0	0	18.9	1	0.0	0
PARANAIS SPP.		0.0	0	18.9	1	0.0	0	0.0	0
PARANAIS LITORALIS		0.0	0	37.8	2	0.0	0	0.0	0
PRISTINA SPP.		0.0	0	37.8	2	0.0	0	0.0	0
SPECARIA JOSINAE		151.2	8	0.0	0	0.0	0	18.9	1
UNIDENTIFIED TUBIFICID #1		151.2	8	75.6	4	0.0	0	75.6	4
UNIDENTIFIED TUBIFICID #2		2230.6	118	37.8	2	0.0	0	189.0	10
LIMNODRILUS HOFFMEISTERI		94.5	5	0.0	0	0.0	0	0.0	0
QUISTADRILUS/SPIROSPERMA SPP.		56.7	3	0.0	0	0.0	0	0.0	0
CORBICULA FLUMINEA		56.7	3	0.0	0	0.0	0	0.0	0
PHYSIDAE		0.0	0	0.0	0	113.4	6	0.0	0
GAMMARUS SPP.		0.0	0	0.0	0	245.7	13	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	189.0	10	0.0	0
CASSIDISCA LUNIFRONS		0.0	0	0.0	0	189.0	10	0.0	0
CLADOTANYTARSUS SPP.	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
CHIRONOMINI	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	94.5	5	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	0.0	0	37.8	2	207.9	11
CRYPTOCHIRONOMOUS SPP.	LARVAE	37.8	2	0.0	0	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		18.9	1	0.0	0	18.9	1	0.0	0
UNIDENTIFIED ORGANISM 3		18.9	1	0.0	0	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		11/ 9/92		11/ 9/92		11/ 9/92		11/ 9/92	
Time		1235		1320		1335		1345	
Location		C344		I339		I338		I337	
Tide		Flood 1		Flood 2		Flood Slack		Flood Slack	
Temp.(C)	Air	-		-		-		-	
	Surface	9.5		9.5		9.5		9.5	
	Bottom	9.5		-		-		-	
Sal.(ppt)	Surface	-		-		-		-	
	Bottom	-		-		-		-	
Cond.	Surface	145		140		140		140	
	Bottom	145		-		-		-	
D.O.(ppm)	Surface	8.6		9.9		9.9		9.9	
	Bottom	10.1		-		-		-	
Depth(feet)		50 TO 51		2 TO 3		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
UNIDENTIFIED TUBIFICID #2		661.6	35	0.0	0	0.0	0	0.0	0
CORBICULA FLUMINEA		18.9	1	0.0	0	0.0	0	0.0	0
PISIDIUM SPP.		113.4	6	0.0	0	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		18.9	1	0.0	0	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		11/ 9/92		11/ 9/92		11/ 9/92		11/10/92	
Time		1405		1420		1545		850	
Location		I336		I335		I322		S316	
Tide		Ebb 1		Ebb 1		Ebb 1		Ebb Slack	
Temp.(C) Air		-		-		-		4.2	
Surface		10.0		10.0		9.5		9.5	
Bottom		-		-		-		9.0	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		140		140		150		150	
Bottom		-		-		-		150	
D.O.(ppm) Surface		9.6		9.6		9.0		9.5	
Bottom		-		-		-		9.4	
Depth(feet)		1 TO 2		1 TO 2		4 TO 5		19 TO 20	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
ARCTEONAIS LOMONDI		0.0	0	0.0	0	0.0	0	75.6	4
NAIS VARIABILIS		0.0	0	0.0	0	56.7	3	0.0	0
PARANAIS LITORALIS		0.0	0	0.0	0	0.0	0	75.6	4
SPECARIA JOSINAE		0.0	0	0.0	0	151.2	8	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	151.2	8	151.2	8
UNIDENTIFIED TUBIFICID #2		37.8	2	0.0	0	907.4	48	3327.0	176
ILYODRILUS TEMPLETONI		0.0	0	0.0	0	113.4	6	0.0	0
LIMNODRILUS HOFFMEISTERI		0.0	0	0.0	0	0.0	0	283.6	15
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	1285.4	68	75.6	4
CORBICULA FLUMINEA		151.2	8	0.0	0	18.9	1	0.0	0
PISIDIUM SPP.		0.0	0	0.0	0	56.7	3	37.8	2
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	0.0	0	56.7	3
CERATOPOGONIDAE	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	207.9	11	0.0	0

Appendix Table A-1: (continued).

		11/10/92		11/10/92		11/10/92		11/10/92	
Date		11/10/92		11/10/92		11/10/92		11/10/92	
Time		915		1025		1110		1135	
Location		S315		S304		C303		C304	
Tide		Flood 1		Flood 1		Flood 2		Flood 2	
Temp.(C) Air		4.2		8.7		11.0		11.0	
Surface		9.5		10.0		10.0		10.0	
Bottom		9.3		10.0		10.0		10.0	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		150		175		180		180	
Bottom		150		175		175		175	
D.O.(ppm) Surface		9.5		8.4		8.6		8.6	
Bottom		9.4		8.5		9.0		9.0	
Depth(feet)		14 TO 15		30 TO 31		51 TO 52		47 TO 48	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		75.6	4	0.0	0	0.0	0	0.0	0
ENCHYTRAEIDAE		0.0	0	18.9	1	0.0	0	0.0	0
PARANAIS FRICI		283.6	15	0.0	0	0.0	0	0.0	0
SPECARIA JOSINAE		1739.1	92	0.0	0	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #1		4612.5	244	0.0	0	283.6	15	0.0	0
UNIDENTIFIED TUBIFICID #2		7504.7	397	56.7	3	94.5	5	9981.1	528
AULODRILUS PIGUETI		586.0	31	0.0	0	0.0	0	756.1	40
LIMNODRILUS HOFFMEISTERI		586.0	31	0.0	0	0.0	0	491.5	26
LIMNODRILUS UDEKEMIANUS		283.6	15	0.0	0	0.0	0	2249.5	119
BIVALVIA		37.8	2	0.0	0	0.0	0	0.0	0
CORBICULA FLUMINEA		18.9	1	0.0	0	0.0	0	0.0	0
PISIDIUM SPP.		18.9	1	0.0	0	0.0	0	75.6	4
COPEPODA		37.8	2	0.0	0	0.0	0	0.0	0
GAMMARUS SPP.		0.0	0	18.9	1	737.2	39	0.0	0
CYATHURA POLITA		132.3	7	207.9	11	453.7	24	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	18.9	1	113.4	6
CHIRONOMINAE	LARVAE	0.0	0	0.0	0	132.3	7	0.0	0
POLYPEDILUM SPP.	LARVAE	132.3	7	415.9	22	94.5	5	56.7	3
CRYPTOCHIRONOMOUS SPP.	LARVAE	75.6	4	0.0	0	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

		11/10/92		11/10/92		11/10/92		11/10/92	
Date		11/10/92		11/10/92		11/10/92		11/10/92	
Time		1215		1250		1315		1355	
Location		I447		I426		I429		C302	
Tide		Flood 2		Flood 2		Flood 2		Flood Slack	
Temp.(C) Air		12.0		12.0		11.4		11.2	
Surface		10.0		10.5		10.5		10.5	
Bottom		-		-		-		10.0	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		190		200		200		185	
Bottom		-		-		-		180	
D.O.(ppm) Surface		9.0		8.8		8.4		8.1	
Bottom		-		-		-		8.5	
Depth(feet)		1 TO 2		1 TO 2		3 TO 4		47 TO 48	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	0.0	0	56.7	3	0.0	0
NAIDIDAE		0.0	0	0.0	0	189.0	10	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	0.0	0	37.8	2
UNIDENTIFIED TUBIFICID #2		75.6	4	75.6	4	10510.4	556	56.7	3
LIMNODRILUS HOFFMEISTERI		0.0	0	0.0	0	207.9	11	0.0	0
LIMNODRILUS UDEKEMIANUS		18.9	1	0.0	0	0.0	0	0.0	0
CLADOCERA		0.0	0	0.0	0	37.8	2	0.0	0
GAMMARUS SPP.		0.0	0	0.0	0	94.5	5	0.0	0
ALMYRACUMA PROXIMOCULI		0.0	0	0.0	0	37.8	2	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	75.6	4	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	18.9	1	1058.6	56	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	75.6	4	0.0	0

Appendix Table A-1: (continued).

Date		11/10/92	11/10/92	11/10/92	11/11/92
Time		1425	1500	1550	1025
Location		C301	S449	S444	C434
Tide		Flood Slack	Ebb 1	Ebb 1	Flood 1
Temp.(C)	Air	11.2	10.7	10.6	13.0
	Surface	10.5	10.0	10.0	10.5
	Bottom	10.0	10.0	-	10.5
Sal.(ppt)	Surface	-	-	-	-
	Bottom	-	-	-	-
Cond.	Surface	185	185	190	190
	Bottom	180	185	-	190
D.O.(ppm)	Surface	8.1	8.6	9.1	8.4
	Bottom	8.5	8.6	-	8.7
Depth(feet)		58 TO 59	16 TO 17	6 TO 7	50 TO 51

		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		56.7	3	94.5	5	0.0	0	0.0	0
NAIS BEHNINGI		0.0	0	0.0	0	56.7	3	0.0	0
SPECARIA JOSINAE		0.0	0	1266.5	67	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	945.2	50	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #2		0.0	0	5690.0	301	132.3	7	170.1	9
LIMNODRILUS UDEKEMIANUS		0.0	0	472.6	25	0.0	0	0.0	0
BIVALVIA		0.0	0	207.9	11	0.0	0	0.0	0
PISIDIUM SPP.		0.0	0	113.4	6	0.0	0	0.0	0
ANCYLIDAE		0.0	0	0.0	0	18.9	1	0.0	0
GAMMARUS SPP.		94.5	5	37.8	2	132.3	7	113.4	6
ALMYRACUMA PROXIMOCULI		0.0	0	75.6	4	0.0	0	0.0	0
CYATHURA POLITA		18.9	1	264.7	14	170.1	9	56.7	3
CASSIDISCA LUNIFRONS		0.0	0	0.0	0	56.7	3	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	18.9	1	56.7	3
POLYPEDILUM SPP.	LARVAE	37.8	2	10491.5	555	264.7	14	378.1	20
CRICOTOPUS/ ORTHOCLADIUS SPP.	LARVAE	0.0	0	397.0	21	0.0	0	0.0	0
UNIDENTIFIED ORGANISM 1		0.0	0	56.7	3	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		11/11/92		11/11/92		11/11/92		11/11/92	
Time		1115		1155		1245		1310	
Location		C429		C424		S424		C419	
Tide		Flood 1		Flood 2		Flood 2		Flood 2	
Temp.(C) Air		13.0		13.8		13.2		13.2	
Surface		10.5		11.0		10.5		10.5	
Bottom		10.5		10.5		-		10.5	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		200		210		215		240	
Bottom		200		210		-		240	
D.O.(ppm) Surface		7.9		8.2		7.9		8.3	
Bottom		8.3		8.3		-		8.1	
Depth(feet)		43 TO 44		52 TO 53		7 TO 8		50 TO 51	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
HYDROZOA		18.9	1	0.0	0	18.9	1	0.0	0
NEMATODA		0.0	0	189.0	10	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	56.7	3	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		18.9	1	302.5	16	226.8	12	18.9	1
LIMNODRILUS SPP.		0.0	0	18.9	1	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		0.0	0	0.0	0	0.0	0	321.4	17
GAMMARUS SPP.		18.9	1	189.0	10	0.0	0	0.0	0
CYATHURA POLITA		37.8	2	37.8	2	37.8	2	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	18.9	1	0.0	0	18.9	1
POLYPEDILUM SPP.	LARVAE	56.7	3	302.5	16	170.1	9	37.8	2

Appendix Table A-1: (continued).

Date		11/11/92		11/11/92		11/11/92		11/11/92	
Time		1340		1415		1440		1515	
Location		S418		C415		S415		S562	
Tide		Flood Slack		Flood Slack		Ebb 1		Ebb 1	
Temp.(C) Air		12.3		12.0		12.4		11.2	
Surface		10.5		11.0		10.5		11.0	
Bottom		10.5		10.5		10.5		10.5	
Sal.(ppt) Surface		-		-		-		0.0	
Bottom		-		-		-		0.0	
Cond. Surface		230		280		235		415	
Bottom		230		280		240		465	
D.O.(ppm) Surface		8.3		8.1		8.5		8.1	
Bottom		8.8		8.7		8.6		8.4	
Depth(feet)		10 TO 11		54 TO 55		18 TO 19		18 TO 19	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
HYDROZOA		0.0	0	18.9	1	0.0	0	0.0	0
NEMATODA		37.8	2	0.0	0	0.0	0	0.0	0
OLIGOCHAETA		0.0	0	151.2	8	0.0	0	0.0	0
ENCHYTRAEIDAE		0.0	0	3856.3	204	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	0.0	0	113.4	6
UNIDENTIFIED TUBIFICID #2		0.0	0	321.4	17	18.9	1	1398.9	74
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	0.0	0	37.8	2
SCOLECOLEPIDES VIRIDIS		0.0	0	245.7	13	0.0	0	0.0	0
COROPHIUM SPP.		0.0	0	0.0	0	94.5	5	0.0	0
GAMMARUS SPP.		18.9	1	0.0	0	642.7	34	0.0	0
CYATHURA POLITA		453.7	24	0.0	0	18.9	1	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	0.0	0	0.0	0	18.9	1
CHIRONOMIDAE	LARVAE	0.0	0	37.8	2	18.9	1	0.0	0
CHIRONOMINAE	LARVAE	37.8	2	0.0	0	0.0	0	0.0	0
TANYTARSINI	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	37.8	2	0.0	0	18.9	1	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1

Appendix Table A-1: (continued).

Date		11/12/92		11/12/92		11/12/92		11/12/92	
Time		655		750		810		845	
Location		S515		S540		S536		C530	
Tide		Ebb 2		Ebb Slack		Ebb Slack		Flood 1	
Temp. (C) Air		11.3		10.6		10.6		13.7	
Surface		10.5		10.5		10.5		11.0	
Bottom		10.5		-		-		10.5	
Sal. (ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		2.0		-		-		0.0	
Cond. Surface		185		750		750		750	
Bottom		245		-		-		1250	
D.O. (ppm) Surface		9.3		9.1		9.1		9.0	
Bottom		9.4		-		-		9.6	
Depth (feet)		14 TO 15		4 TO 5		5 TO 6		46 TO 47	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
HYDROZOA		0.0	0	0.0	0	18.9	1	0.0	0
TURBELLARIA		0.0	0	0.0	0	18.9	1	0.0	0
NEMERTEA		94.5	5	18.9	1	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	1115.3	59	1190.9	63	0.0	0
UNIDENTIFIED TUBIFICID #2		1304.3	69	6880.9	364	3024.6	160	0.0	0
UNIDENTIFIED TUBIFICID #4		18.9	1	0.0	0	0.0	0	0.0	0
AULODRILUS PIGUETI		0.0	0	170.1	9	0.0	0	0.0	0
SPIONIDAE		18.9	1	0.0	0	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		37.8	2	132.3	7	37.8	2	37.8	2
RANGIA CUNEATA		0.0	0	18.9	1	18.9	1	0.0	0
COPEPODA		0.0	0	18.9	1	0.0	0	0.0	0
COROPHIUM SPP.		18.9	1	56.7	3	0.0	0	56.7	3
GAMMARUS SPP.		0.0	0	18.9	1	0.0	0	0.0	0
CYATHURA POLITA		0.0	0	56.7	3	132.3	7	0.0	0
CHIRIDOTEA ALMYRA		0.0	0	18.9	1	0.0	0	0.0	0
NEOMYSIS AMERICANA		18.9	1	0.0	0	0.0	0	0.0	0
CHIRONOMIDAE	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	321.4	17	699.4	37	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	37.8	2	37.8	2	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1. (continued).

		11/12/92		11/12/92		11/12/92		3/ 3/93	
Date		11/12/92		11/12/92		11/12/92		3/ 3/93	
Time		915		935		1045		1100	
Location		S524		C525		C518		S527	
Tide		Flood 1		Flood 1		Flood 1		Ebb 2	
Temp.(C) Air		13.8		13.8		15.7		8.0	
Surface		10.5		11.0		11.0		2.5	
Bottom		10.5		11.0		11.5		2.5	
Sal.(ppt) Surface		2.0		2.0		0.0		2.0	
Bottom		2.0		2.0		4.0		2.0	
Cond. Surface		1500		1450		3500		2050	
Bottom		1500		1800		4000		2200	
D.O.(ppm) Surface		9.3		9.2		9.7		13.2	
Bottom		9.3		9.4		9.8		13.1	
Depth(feet)		10 TO 11		47 TO 48		47 TO 48		16 TO 17	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	18.9	1	0.0	0	0.0	0
OLIGOCHAETA		0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #2		113.4	6	907.4	48	0.0	0	2816.6	149
LIMNODRILUS HOFFMEISTERI		0.0	0	0.0	0	0.0	0	56.7	3
SPIONIDAE		0.0	0	0.0	0	18.9	1	0.0	0
SCOLECOLEPIDES VIRIDIS		18.9	1	18.9	1	0.0	0	94.5	5
COROPHIUM SPP.		0.0	0	37.8	2	170.1	9	0.0	0
GAMMARUS SPP.		0.0	0	0.0	0	18.9	1	37.8	2
CYATHURA POLITA		18.9	1	0.0	0	18.9	1	0.0	0
CHIRIDOTEA ALMYRA		75.6	4	0.0	0	18.9	1	0.0	0
NEOMYSIS AMERICANA		0.0	0	0.0	0	37.8	2	0.0	0
CRANGON SEPTEMSPINOSA		0.0	0	0.0	0	18.9	1	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1
PROCLADIUS SPP.	LARVAE	37.8	2	0.0	0	0.0	0	37.8	2

Appendix Table A-1: (continued).

Date		3/ 3/93		3/ 3/93		3/ 3/93		3/ 3/93	
Time		1145		1210		1250		1420	
Location		S531		S530		C529		S560	
Tide		Ebb 2		Ebb 2		Ebb 2		Ebb 2	
Temp.(C) Air		8.0		8.0		8.5		9.5	
Surface		2.0		2.0		2.5		3.0	
Bottom		2.0		2.0		2.0		2.5	
Sal.(ppt) Surface		2.0		2.0		0.0		0.0	
Bottom		2.0		2.0		0.0		0.0	
Cond. Surface		1750		1700		900		215	
Bottom		1850		1800		1050		210	
D.O.(ppm) Surface		13.1		13.0		13.1		12.4	
Bottom		13.2		13.2		13.1		12.6	
Depth(feet)		14 TO 15		19 TO 20		40 TO 41		12 TO 13	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
ENCHYTRAEIDAE		0.0	0	0.0	0	113.4	6	0.0	0
PARANAIS LITORALIS		0.0	0	0.0	0	56.7	3	0.0	0
PIGUETIELLA MICHIGANENSIS		0.0	0	0.0	0	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #2		567.1	30	359.2	19	491.5	26	151.2	8
LIMNODRILUS HOFFMEISTERI		18.9	1	0.0	0	18.9	1	37.8	2
SCOLECOLEPIDES VIRIDIS		75.6	4	113.4	6	151.2	8	0.0	0
RANGIA CUNEATA		37.8	2	18.9	1	0.0	0	0.0	0
COPEPODA		18.9	1	0.0	0	0.0	0	0.0	0
COROPHIUM SPP.		0.0	0	0.0	0	2778.8	147	0.0	0
GAMMARUS SPP.		0.0	0	0.0	0	75.6	4	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	132.3	7	0.0	0
CHIRONOMINI	LARVAE	18.9	1	37.8	2	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	132.3	7	75.6	4	0.0	0	37.8	2
PROCLADIUS SPP.	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0

Appendix Table A-1: (continued).

		3/ 3/93		3/ 3/93		3/ 8/93		3/ 8/93	
Date		3/ 3/93		3/ 3/93		3/ 8/93		3/ 8/93	
Time		1600		1710		855		925	
Location		C401		S549		I524		I531	
Tide		Ebb Slack		Flood 1		Flood 1		Flood 1	
Temp.(C) Air		7.5		7.0		6.5		6.5	
Surface		2.0		2.5		3.0		3.0	
Bottom		2.0		2.0		-		-	
Sal.(ppt) Surface		0.0		0.0		0.0		0.0	
Bottom		0.0		0.0		-		-	
Cond. Surface		195		305		800		320	
Bottom		195		310		-		-	
D.O.(ppm) Surface		12.8		12.8		12.8		12.5	
Bottom		12.7		12.9		-		-	
Depth(feet)		47 TO 48		11 TO 12		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
UNIDENTIFIED TUBIFICID #1		0.0	0	75.6	4	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		18.9	1	1361.1	72	0.0	0	0.0	0
LIMNODRILUS SPP.		0.0	0	94.5	5	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		18.9	1	226.8	12	0.0	0	0.0	0
SCOLECOLEPIDES VIRIDIS		0.0	0	18.9	1	0.0	0	0.0	0
COPEPODA		0.0	0	18.9	1	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	18.9	1	75.6	4	0.0	0	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	18.9	1	0.0	0	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	37.8	2	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		3/ 8/93		3/ 8/93		3/ 8/93		3/ 8/93	
Time		955		1045		1120		1215	
Location		I542		I407		I417		S427	
Tide		Flood 1		Flood 2		Flood 2		Flood 2	
Temp.(C)	Air	6.5		6.5		6.5		8.5	
	Surface	3.5		3.0		3.0		4.0	
	Bottom	-		-		-		3.5	
Sal.(ppt)	Surface	0.0		0.0		0.0		0.0	
	Bottom	-		-		-		0.0	
Cond.	Surface	235		195		185		180	
	Bottom	-		-		-		180	
D.O.(ppm)	Surface	12.6		12.7		-		12.6	
	Bottom	-		-		-		12.6	
Depth(feet)		1 TO 2		1 TO 2		1 TO 2		9 TO 10	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	0.0	0	0.0	0	37.8	2
ARCTEONAIS LOMONDI		0.0	0	0.0	0	0.0	0	18.9	1
NAIS COMMUNIS		0.0	0	0.0	0	0.0	0	18.9	1
NAIS VARIABILIS		0.0	0	0.0	0	0.0	0	18.9	1
PARANAIS SPP.		0.0	0	0.0	0	0.0	0	37.8	2
SPECARIA JOSINAE		0.0	0	0.0	0	0.0	0	113.4	6
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED TUBIFICID #2		0.0	0	0.0	0	0.0	0	207.9	11
LIMNODRILUS UDEKEMIANUS		0.0	0	0.0	0	0.0	0	37.8	2
NEREIS SUCCINEA		0.0	0	0.0	0	18.9	1	0.0	0
BIVALVIA		0.0	0	0.0	0	0.0	0	18.9	1
CYATHURA POLITA		0.0	0	0.0	0	0.0	0	18.9	1
LEPIDOPTERA	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	0.0	0	0.0	0	75.6	4
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1

Appendix Table A-1: (continued).

Date		3/ 8/93		3/ 8/93		3/ 8/93		3/ 8/93	
Time		1245		1315		1335		1350	
Location		S428		S429		I429		I428	
Tide		Flood 2		Flood 2		Flood 2		Flood 2	
Temp.(C) Air		10.0		10.5		10.0		9.5	
Surface		4.0		3.5		4.5		4.5	
Bottom		3.5		3.0		-		-	
Sal.(ppt) Surface		0.0		-		-		-	
Bottom		0.0		-		-		-	
Cond. Surface		180		175		180		180	
Bottom		180		175		-		-	
D.O.(ppm) Surface		12.6		11.8		12.5		12.5	
Bottom		12.6		12.2		-		-	
Depth(feet)		12 TO 13		9 TO 10		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMATODA		0.0	0	18.9	1	0.0	0	0.0	0
ARCTEONAIS LOMONDI		0.0	0	56.7	3	0.0	0	0.0	0
PARANAIS FRICI		0.0	0	1285.4	68	0.0	0	56.7	3
SPECARIA JOSINAE		0.0	0	397.0	21	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	170.1	9	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		1247.6	66	1115.3	59	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		170.1	9	113.4	6	0.0	0	0.0	0
LIMNODRILUS UDEKEMIANUS		18.9	1	0.0	0	0.0	0	0.0	0
CYATHURA POLITA		0.0	0	397.0	21	18.9	1	0.0	0
POLYPEDILUM SPP.	LARVAE	18.9	1	283.6	15	0.0	0	0.0	0
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	132.3	7	0.0	0	0.0	0

Appendix Table A-1: (continued).

		3/ 8/93		3/ 8/93		3/21/93		3/21/93	
Date		3/ 8/93		3/ 8/93		3/21/93		3/21/93	
Time		1500		1524		945		1020	
Location		S447		I447		I512		I520	
Tide		Ebb 1		Ebb 1		Flood 2		Flood 2	
Temp.(C)	Air	11.0		11.0		6.5		7.5	
	Surface	3.5		4.0		5.0		3.5	
	Bottom	3.5		-		-		-	
Sal.(ppt)	Surface	-		-		0.0		0.0	
	Bottom	-		-		-		-	
Cond.	Surface	170		170		500		300	
	Bottom	170		-		-		-	
D.O.(ppm)	Surface	12.3		12.7		11.8		12.7	
	Bottom	12.2		-		-		-	
Depth(feet)		17 TO 18		1 TO 2		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
AMPHICHAETA LEYDIGI		0.0	0	0.0	0	0.0	0	37.8	2
UNIDENTIFIED TUBIFICID #2		0.0	0	0.0	0	0.0	0	18.9	1
POLYCHAETA		0.0	0	0.0	0	0.0	0	18.9	1
COPEPODA		0.0	0	0.0	0	18.9	1	0.0	0
CHIRIDOTEA ALMYRA		18.9	1	0.0	0	0.0	0	0.0	0

Appendix Table A-1: (continued).

Date		3/21/93		3/21/93		3/21/93		3/21/93	
Time		1130		1225		1300		1355	
Location		S307		S301		S444		C440	
Tide		Flood 2		Flood 2		Flood Slack		Ebb 1	
Temp.(C) Air		7.5		8.0		9.5		9.0	
Surface		2.5		2.5		3.0		3.0	
Bottom		2.5		2.5		3.0		3.0	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		175		160		170		170	
Bottom		175		160		165		170	
D.O.(ppm) Surface		12.6		12.4		12.3		12.7	
Bottom		12.5		12.5		12.4		12.6	
Depth(feet)		24 TO 25		14 TO 15		24 TO 25		46 TO 47	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
NEMERTEA		18.9	1	0.0	0	0.0	0	0.0	0
NEMATODA		94.5	5	0.0	0	0.0	0	0.0	0
ARCTEONAIS LOMONDI		869.6	46	75.6	4	0.0	0	0.0	0
PARANAIS FRICI		1058.6	56	0.0	0	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #1		529.3	28	378.1	20	0.0	0	0.0	0
UNIDENTIFIED TUBIFICID #2		5633.3	298	3081.3	163	0.0	0	3572.8	189
LIMNODRILUS SPP.		359.2	19	0.0	0	0.0	0	0.0	0
LIMNODRILUS HOFFMEISTERI		699.4	37	604.9	32	0.0	0	869.6	46
LIMNODRILUS UDEKEMIANUS		0.0	0	151.2	8	0.0	0	775.0	41
QUISTADRILUS MULTISETOSUS		699.4	37	0.0	0	0.0	0	0.0	0
MANAYUNKIA SPECIOSA		0.0	0	0.0	0	18.9	1	0.0	0
CORBICULA FLUMINEA		0.0	0	0.0	0	18.9	1	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	75.6	4	0.0	0
CASSIDISCA LUNIFRONS		0.0	0	0.0	0	37.8	2	0.0	0
CHIRONOMIDAE	LARVAE	18.9	1	0.0	0	0.0	0	0.0	0
CHIRONOMINI	LARVAE	0.0	0	37.8	2	0.0	0	18.9	1
CHIRONOMOUS SPP.	LARVAE	0.0	0	37.8	2	0.0	0	0.0	0
GLYPTOTENDIPES SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
POLYPEDILUM SPP.	LARVAE	75.6	4	75.6	4	0.0	0	94.5	5
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	37.8	2	0.0	0	0.0	0

3/21/93	3/21/93
1635	1705
C539	C528
Ebb 2	Ebb 2
9.5	9.5
3.0	3.0
3.0	3.0
0.0	0.0
0.0	0.0
180	180
180	180
11.8	12.0
12.1	12.1
47 TO 48	47 TO 48

n/m2	n	n/m2	n
3.9	1	0.0	0
0.0	0	0.0	0
.0	0	0.0	0
.5	5	264.7	14
0.0	0	18.9	1
9.0	0	37.8	2
.0	0	18.9	1
3.9	1	0.0	0
3.0	0	18.9	1
.0	0	0.0	0

/26/93	3/26/93
1310	1335
S260	I260
lood 1	Flood 1
15.0	15.5
5.0	6.0
4.5	-
-	-
-	-
115	130
115	-
.2.5	13.1
.2.7	-
TO 12	1 TO 2

2	n	n/m2	n
	0	18.9	1
	0	113.4	6
	0	0.0	0
	0	37.8	2
	0	18.9	1
	0	18.9	1
	7	0.0	0
	44	604.9	32
	0	0.0	0
	0	0.0	0
	8	113.4	6
	2	0.0	0
	24	0.0	0
	1	0.0	0
	0	18.9	1
	0	18.9	1
	4	0.0	0
	0	0.0	0
	0	0.0	0
	5	0.0	0
	0	18.9	1
	0	37.8	2
	0	0.0	0
	0	18.9	1
	0	0.0	0
	1	0.0	0

3/26/93
1510
S229
Flood Slack
16.0
5.5
5.0
-
-
115
115
12.2
12.2
11 TO 12

n/m2	n
18.9	1
0.0	0
0.0	0
0.0	0
37.8	2
18.3	38
0.0	0
18.9	1
0.0	0
18.9	1
18.9	1
0.0	0
13.4	6
18.9	1
18.9	1
94.5	5
0.0	0
18.9	1
18.9	1
18.9	1
15.9	22
75.6	4
75.6	4
0.0	0

Appendix Table A-1: (continued).

Date		3/26/93		3/26/93		3/26/93		3/26/93	
Time		1535		1550		1610		1645	
Location		I229		I228		S228		C344	
Tide		Ebb 1		Ebb 1		Ebb 1		Ebb 1	
Temp.(C) Air		20.0		18.0		17.5		15.0	
Surface		6.5		6.5		6.0		5.5	
Bottom		-		-		5.5		4.5	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		130		130		125		115	
Bottom		-		-		120		115	
D.O.(ppm) Surface		12.8		12.6		12.4		12.3	
Bottom		-		-		12.4		12.7	
Depth(feet)		1 TO 2		1 TO 2		21 TO 22		49 TO 50	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	0.0	0	18.9	1	0.0	0
NEMATODA		0.0	0	0.0	0	226.8	12	0.0	0
ENCHYTRAEIDAE		75.6	4	170.1	9	0.0	0	0.0	0
AMPHICHAETA LEYDIGI		0.0	0	0.0	0	245.7	13	0.0	0
PIGUETIELLA MICHIGANENSIS		0.0	0	0.0	0	0.0	0	18.9	1
SPECARIA JOSINAE		0.0	0	0.0	0	245.7	13	0.0	0
TUBIFICIDAE		0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	226.8	12	18.9	1
UNIDENTIFIED TUBIFICID #2		0.0	0	0.0	0	5557.7	294	548.2	29
ISOCHAETIDES FREYI		0.0	0	0.0	0	0.0	0	94.5	5
LIMNODRILUS HOFFMEISTERI		0.0	0	0.0	0	113.4	6	37.8	2
BIVALVIA		0.0	0	0.0	0	37.8	2	0.0	0
GAMMARUS SPP.		0.0	0	0.0	0	18.9	1	0.0	0
CERATOPOGONIDAE	LARVAE	0.0	0	0.0	0	56.7	3	0.0	0
POLYPEDILUM SPP.	LARVAE	0.0	0	0.0	0	491.5	26	75.6	4
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	151.2	8	0.0	0
PROCLADIUS SPP.	LARVAE	0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED ORGANISM 1		0.0	0	0.0	0	132.3	7	0.0	0

Appendix Table A-1: (continued).

		3/26/93		3/27/93		3/27/93		3/27/93	
Time		1730		835		900		940	
Location		C204		C327		C328		C329	
Tide		Ebb 1		Ebb 1		Ebb 1		Ebb 2	
Temp.(C) Air		15.0		11.0		11.0		11.0	
Surface		5.0		4.5		4.5		4.5	
Bottom		4.5		4.5		4.5		4.5	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		115		120		120		115	
Bottom		110		115		115		115	
D.O.(ppm) Surface		12.3		12.4		12.4		12.4	
Bottom		12.4		12.3		12.3		12.3	
Depth(feet)		49 TO 50		49 TO 50		44 TO 45		44 TO 45	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		56.7	3	2098.3	111	586.0	31	0.0	0
NEMERTEA		0.0	0	18.9	1	0.0	0	0.0	0
NEMATODA		0.0	0	0.0	0	18.9	1	18.9	1
ENCHYTRAEIDAE		3327.0	176	132.3	7	1852.6	98	18.9	1
PARANAIS FRICI		0.0	0	0.0	0	0.0	0	18.9	1
PIGUETIELLA MICHIGANENSIS		0.0	0	0.0	0	75.6	4	18.9	1
SPECARIA JOSINAE		0.0	0	0.0	0	0.0	0	18.9	1
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	0.0	0	56.7	3
UNIDENTIFIED TUBIFICID #2		56.7	3	0.0	0	37.8	2	434.8	23
LIMNODRILUS HOFFMEISTERI		0.0	0	0.0	0	0.0	0	18.9	1
ACARIFORMES		18.9	1	0.0	0	0.0	0	0.0	0
COPEPODA		0.0	0	0.0	0	18.9	1	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	0.0	0	189.0	10
POLYPEDILUM SPP.	LARVAE	0.0	0	37.8	2	340.3	18	245.7	13
CRYPTOCHIRONOMOUS SPP.	LARVAE	0.0	0	0.0	0	0.0	0	18.9	1

Appendix Table A-1: (continued).

		3/27/93		3/27/93		3/27/93		3/27/93	
Date		3/27/93		3/27/93		3/27/93		3/27/93	
Time		1005		1120		1155		1215	
Location		S328		C334		S334		S338	
Tide		Ebb 2		Ebb 2		Ebb Slack		Flood 1	
Temp.(C) Air		11.5		11.5		12.0		12.0	
Surface		5.0		5.0		5.0		5.0	
Bottom		4.5		5.0		5.0		5.0	
Sal.(ppt) Surface		-		-		-		-	
Bottom		-		-		-		-	
Cond. Surface		110		115		110		110	
Bottom		110		115		110		110	
D.O.(ppm) Surface		12.3		12.4		12.5		12.4	
Bottom		12.3		12.4		12.6		12.2	
Depth(feet)		19 TO 20		44 TO 45		17 TO 18		14 TO 15	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
TURBELLARIA		0.0	0	340.3	18	18.9	1	0.0	0
ENCHYTRAEIDAE		94.5	5	604.9	32	18.9	1	0.0	0
NAIDIDAE		0.0	0	0.0	0	18.9	1	0.0	0
PARANAIS FRICI		18.9	1	0.0	0	37.8	2	0.0	0
PIGUETIELLA MICHIGANENSIS		0.0	0	18.9	1	0.0	0	0.0	0
PRISTINELLA SPP.		0.0	0	0.0	0	18.9	1	0.0	0
SLAVINA APPENDICULATA		0.0	0	0.0	0	37.8	2	0.0	0
SPECARIA JOSINAE		0.0	0	0.0	0	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #1		0.0	0	0.0	0	37.8	2	0.0	0
UNIDENTIFIED TUBIFICID #2		189.0	10	18.9	1	113.4	6	18.9	1
LIMNODRILUS HOFFMEISTERI		18.9	1	0.0	0	0.0	0	0.0	0
BIVALVIA		0.0	0	0.0	0	0.0	0	18.9	1
GAMMARUS SPP.		0.0	0	0.0	0	18.9	1	0.0	0
CYATHURA POLITA		0.0	0	0.0	0	132.3	7	94.5	5
CHIRIDOTEA ALMYRA		18.9	1	18.9	1	0.0	0	0.0	0
DICROTENDIPES SPP.	LARVAE	0.0	0	0.0	0	18.9	1	0.0	0
POLYPEDILUM SPP.	LARVAE	18.9	1	151.2	8	94.5	5	170.1	9

Appendix Table A-1: (continued).

Date		3/27/93		3/27/93		3/27/93		3/27/93	
Time		1235		1245		1300		1315	
Location		I334		I336		I337		I338	
Tide		Flood 1		Flood 1		Flood 1		Flood 1	
Temp.(C)	Air	12.0		12.0		12.0		13.0	
	Surface	6.0		6.0		6.0		6.0	
	Bottom	-		-		-		-	
Sal.(ppt)	Surface	-		-		-		-	
	Bottom	-		-		-		-	
Cond.	Surface	115		115		115		115	
	Bottom	-		-		-		-	
D.O.(ppm)	Surface	12.1		12.1		12.1		12.1	
	Bottom	-		-		-		-	
Depth(feet)		1 TO 2		1 TO 2		1 TO 2		1 TO 2	
		n/m2	n	n/m2	n	n/m2	n	n/m2	n
ENCHYTRAEIDAE		0.0	0	0.0	0	18.9	1	0.0	0
UNIDENTIFIED TUBIFICID #2		2173.9	115	0.0	0	0.0	0	0.0	0
COPEPODA		0.0	0	0.0	0	18.9	1	0.0	0

Appendix Table A-1: (continued).

Date		3/27/93
Time		1330
Location		I339
Tide		Flood 1
Temp.(C)	Air	13.0
	Surface	6.0
	Bottom	-
Sal.(ppt)	Surface	-
	Bottom	-
Cond.	Surface	115
	Bottom	-
D.O.(ppm)	Surface	12.0
	Bottom	-
Depth(feet)		1 TO 2

	n/m2	n
ENCHYTRAEIDAE	18.9	1
AMPHICHAETA LEYDIGI	18.9	1