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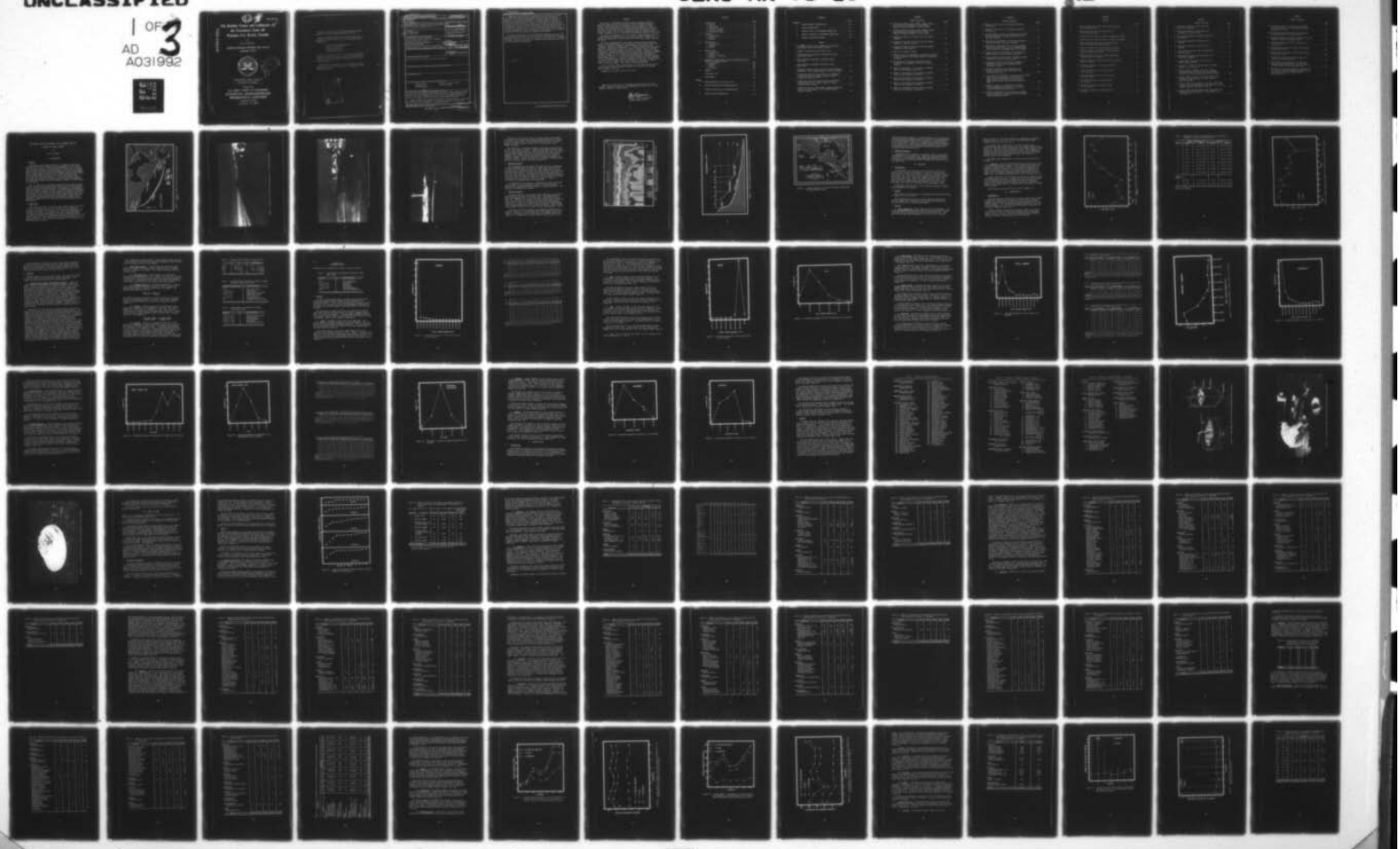

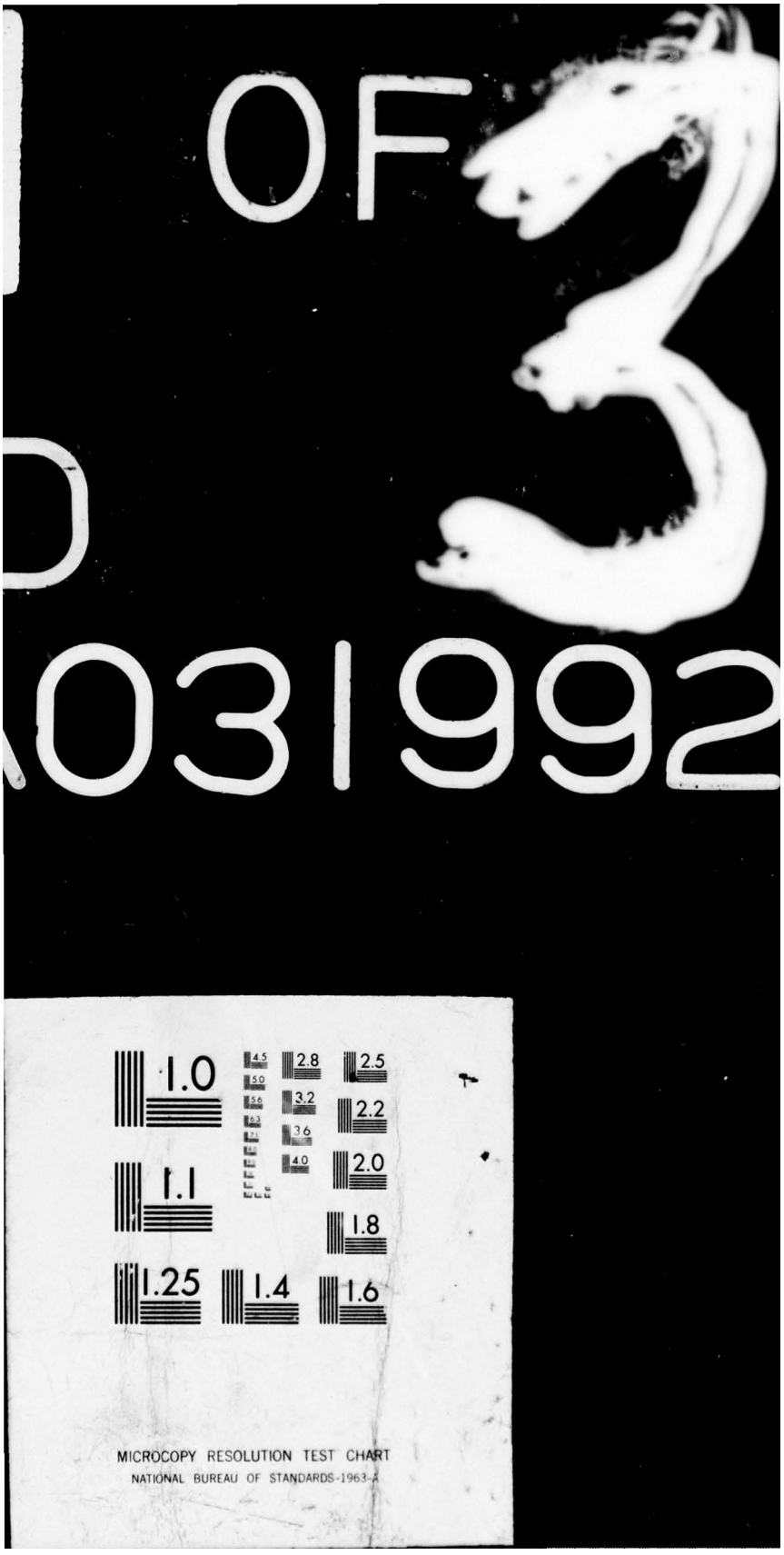
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MR 76-10

The Benthic Fauna and Sediments of the Nearshore Zone off Panama City Beach, Florida

by

Carl H. Saloman

MISCELLANEOUS REPORT NO. 76-10
AUGUST 1976

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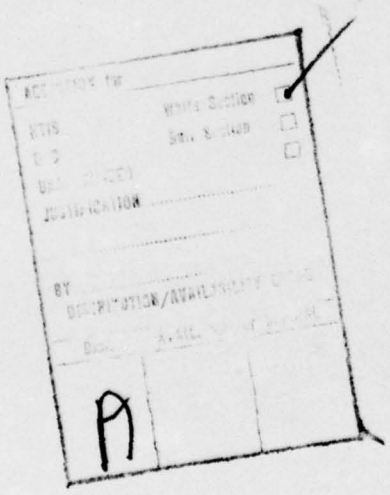

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This study presents basic scientific data on the benthic fauna and surface sediments of the nearshore zone of Panama City Beach, Florida, before restoration of the beach, and (2) the results of a study on the effect of Hurricane Eloise on the benthic fauna in the swash zone of Panama City Beach.

Surface sediments were analyzed for particle-size distribution, percent carbon, organic carbon and carbonate, and statistical factors. The surface sediments exhibited uniformity over time and location. (Continued)

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The benthic invertebrates were represented by 170 species in 26 major taxa. The taxon with the most abundant species (69) was the phylum Polychaeta. The fauna was dominated by 14 species which constituted 80 percent of the collected individuals. The number of species and the diversity index were lowest in the swash zone and highest at the offshore stations at a depth of 30 feet. Number of individuals was highest in May and August and lowest in November and February. Of the invertebrate species, 21 may be new to science; 15 of the 21 are amphipods and 4 of these are among the most abundant species occurring in the nearshore zone. Correlation of animal abundance to selected sedimentological parameters was low. Mean grain size was the most significant sediment factor tested.

The effect of Hurricane Eloise on Panama City Beach was extensive. The beach and primary sand dune were severely eroded. The number of individuals continued to increase for 6 days following the storm; thereafter, it decreased. The number of species increased also, reaching a peak on the third day after the storm, and then it decreased.

PREFACE

This report is published to provide coastal engineers with basic scientific data on the benthic fauna and surface sediments collected during a 12-month period in the nearshore zone of Panama City Beach, Florida, before restoration of the beach, and the results of a study on the effect of Hurricane Eloise on the benthic fauna of the swash zone of Panama City Beach. The work was carried out under the coastal ecology research program of the U.S. Army Coastal Engineering Research Center (CERC).

The report was prepared by Carl H. Saloman, Fishery Research Biologist, National Marine Fisheries Service, Gulf Fisheries Center, Panama City Laboratory, Panama City, Florida, under CERC Interservice Support Agreement No. 75-28.

The author acknowledges the assistance received from the following experts on the identification and verification of the various animal taxa collected: Raymond B. Manning, National Museum of Natural History, Smithsonian Institution, Washington, D.C. (caridean shrimp and stomatopods); Edward B. Culter, Utica College of Syracuse University, Utica, New York (sipunculid); Herbert Boschung, University of Alabama, Tuscaloosa, Alabama (lancelets); Les Watling, University of Delaware, Lewes, Delaware (cumacean); Richard W. Heard, Jr., Gulf Coast Research Laboratory, Ocean Springs, Mississippi (isopods); E.L. Bousfield, National Museum of Canada, Ontario, Canada (amphipods); J.R. Pickavance, Memorial University of New Foundland, St. Johns, New Foundland, Canada (oligochaetes); John Hall, National Marine Fisheries Service, Panama City, Florida (mollusk); and John L. Taylor, Taylor Biological Company, Lynn Haven, Florida (polychaetes).

Mr. R.M. Yancey, Chief, Ecology Branch, was the CERC contract monitor for the report, under the general supervision of the Mr. R.P. Savage, Chief, Research Division.

Comments on this publication are invited.

Approved for publication in accordance with Public Law 166, 79th Congress, approved 31 July 1945, as supplemented by Public Law 172, 88th Congress, approved 7 November 1963.

JOHN H. COUSINS
Colonel, Corps of Engineers
Commander and Director

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THE BENTHIC FAUNA AND SEDIMENTS OF THE NEARSHORE ZONE OFF PANAMA CITY BEACH, FLORIDA

by

Carl H. Saloman

I. INTRODUCTION

1. General.

Continuing erosion along the beaches of Panama City Beach has caused concern to the resident and transit populations that inhabit and utilize the beaches. Erosion has rendered many of the structures along the beach vulnerable to storm damage. To alleviate the problem, the U.S. Army, Corps of Engineers has proposed to restore the damaged beaches and periodically nourish them to offset erosion (Wilson, 1975). On 23 September 1975, Hurricane Eloise caused considerably more erosion to the Panama City beaches. In many areas, particularly at the western end of Panama City Beach, the storm eroded the primary sand dune and left many structures damaged or exposed to future damage by storm waves.

The U.S. Army Coastal Engineering Research Center (CERC) provided funds to the National Marine Fisheries Service for the collection and analysis of data on the benthic fauna and sediments of the nearshore zone off Panama City Beach, Florida. This report describes the benthic fauna and surface sediments of this nearshore zone before restoration of the beach. Also included are the effect of Hurricane Eloise on the benthic fauna of the swash zone and a bibliography of published and unpublished information pertinent to the physical, chemical, and biological aspects of the St. Andrew Bay system and adjacent Gulf of Mexico area.

2. Study Area.

The study area, which is located on the northern shore of the Gulf of Mexico, about 90 miles (166.7 kilometers) east of Pensacola, Florida, lies between the entrance to St. Andrew Bay (West Pass) and Phillips Inlet (Fig. 1), a length of 18.5 miles (34.3 kilometers). The area is a popular summer resort area and is undergoing rapid development for tourism. Condominiums and motels have been built along much of the beach. The natural beach and sand dunes remain at St. Andrews State Park (Fig. 2), while the remainder of the beach has been developed (Figs. 3 and 4).

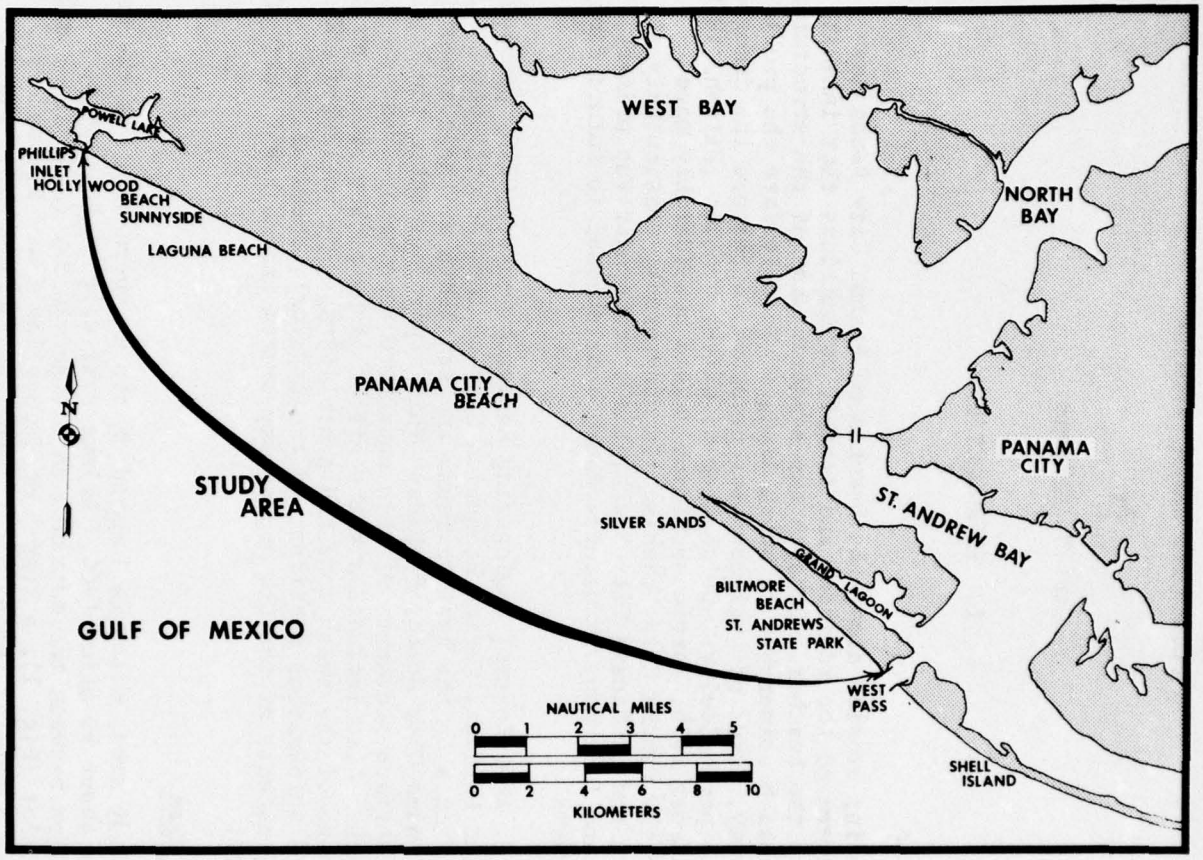

Figure 1. Specific study area (West Pass to Phillips Inlet) and surrounding areas.

Figure 2. Westward view of beach and sand dunes of St. Andrews State Park.

Figure 3. Westward view of beach and motels on Panama City Beach.

Figure 4. Eastward view of beach and motels on Panama City Beach.

Subareas of the beach are known as Biltmore Beach, Silver Sands, Panama City Beach, Laguna Beach, Sunnyside Beach, and Hollywood Beach. St. Andrews State Park is at the eastern end of the beach. In this report, the entire stretch of beach will collectively be called Panama City Beach.

The shoreline is relatively straight and the beach averages about 85 feet (25.9 meters) in width. A dune at elevations of 10 to 15 feet (3 to 4.6 meters) above mean sea level (Wilson, 1975) backs the beach. An interrupted sandbar lies from 50 to 200 feet (15.2 to 61 meters) offshore, and a second sandbar lies about 800 feet (243.8 meters) offshore. Seaward of the second sandbar the slope is irregular and increases rapidly. Depths at 1 mile (1.85 kilometers) offshore range from 51 to 65 feet (15.5 to 19.8 meters) (Fig. 5).

3. Restoration Plans.

The recommended plans for Panama City Beach call for restoration of sand to the beach and creation of a primary dune and berm in the 18.5-mile (34.3 kilometers) study area. The artificially created dune would have a width of 25 feet (7.6 meters) with a crest elevation of 12 feet (3.6 meters). The seaward face of the dune would have a slope of 1 foot (0.3 meter) vertical to 5 feet (1.5 meters) horizontal from the 12-foot (3.6 meters) elevation to a 30-foot-wide (9.1 meters) storm berm at an elevation of 7 feet (2.1 meters). Figure 6 illustrates the proposed beach restoration plan.

To accomplish this restoration, 3,999,000 cubic yards (3,057,435 cubic meters) of sand are needed initially, plus an additional 910,000 cubic yards (695,740 cubic meters) at 10-year intervals. The sand will be obtained from offshore.

4. Station Locations.

Forty-five stations were located on nine transects in the Gulf of Mexico between West Pass and Phillips Inlet. The transects were positioned perpendicular to shore and each contained five stations (Fig. 7). Station 1 is located in the swash zone; station 2 is on the first sandbar; station 3 is between the first and second sandbar; station 4 is on the second sandbar; and station 5 is located seaward of the second sandbar in 10 feet (3 meters) of water. Station A and B are located in 30 feet (9.1 meters) of water off transects 5 and 8.

Locations of the nine transects along Panama City Beach are as follows: Transect 1 is located 300 yards (274.3 meters) west of the jetty at the entrance of St. Andrew Bay in St. Andrews State Park; transect 2 is located 100 feet (30.5 meters) east of the pier in St.

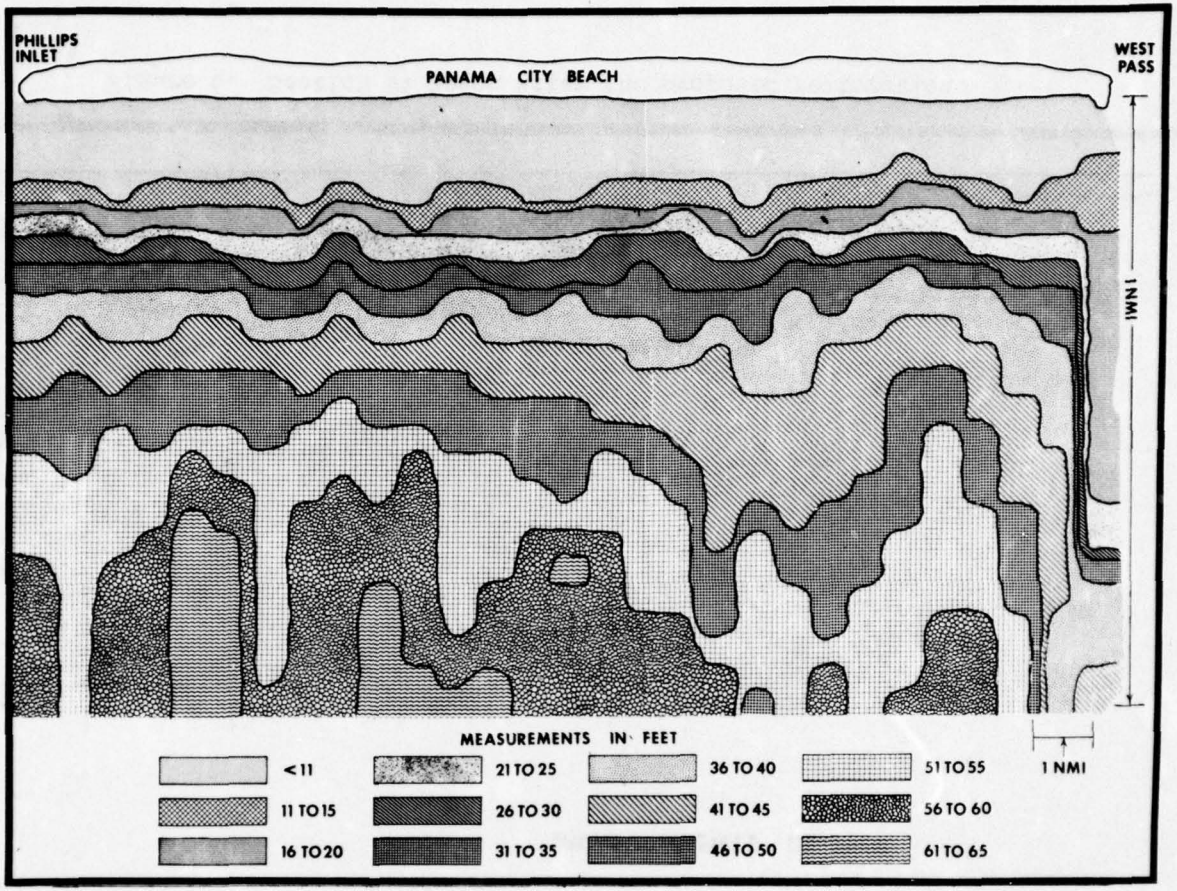

Figure 5. Depth contours between West Pass and Phillips Inlet off Panama City Beach, Florida.

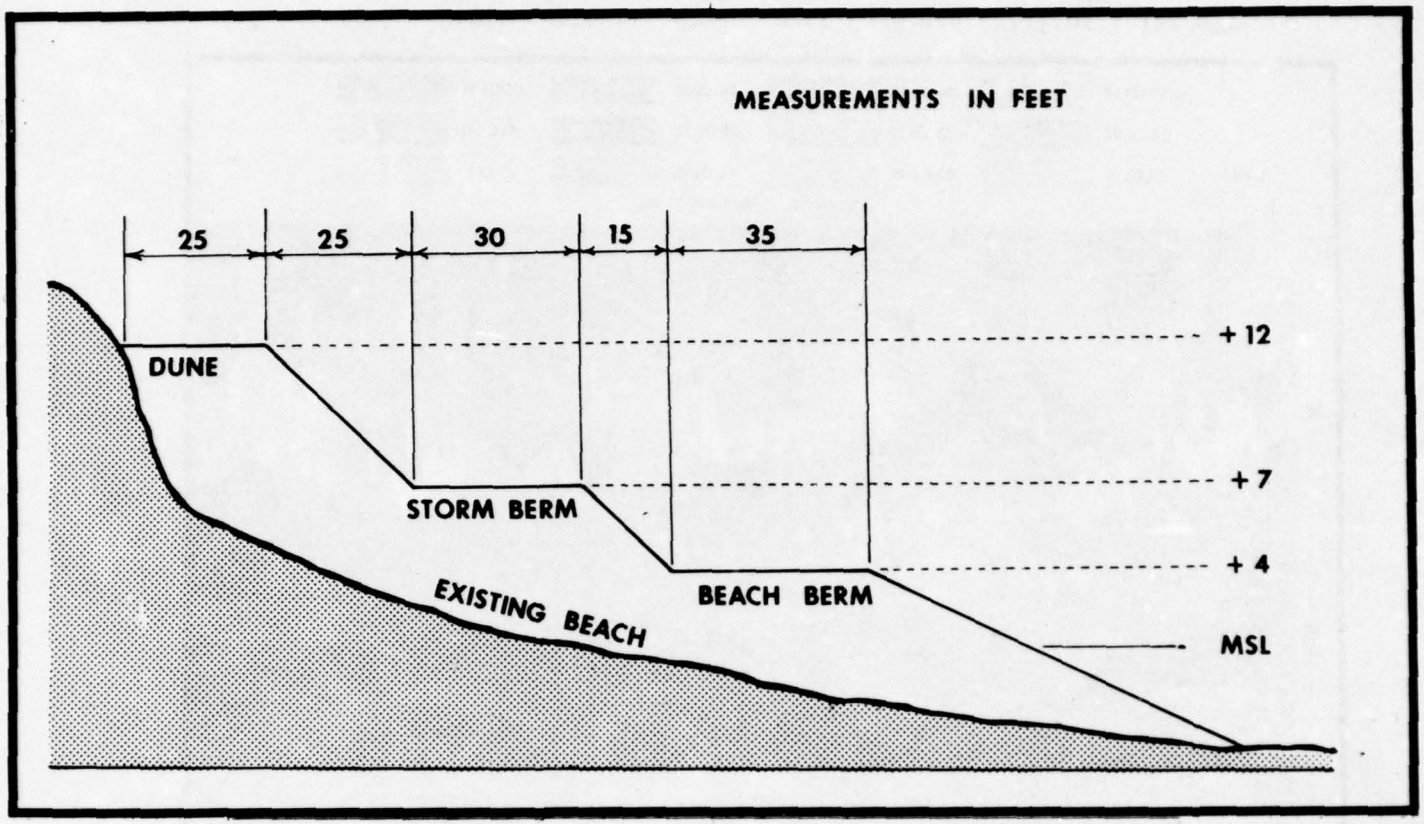

Figure 6. Section of beach after the proposed restoration.

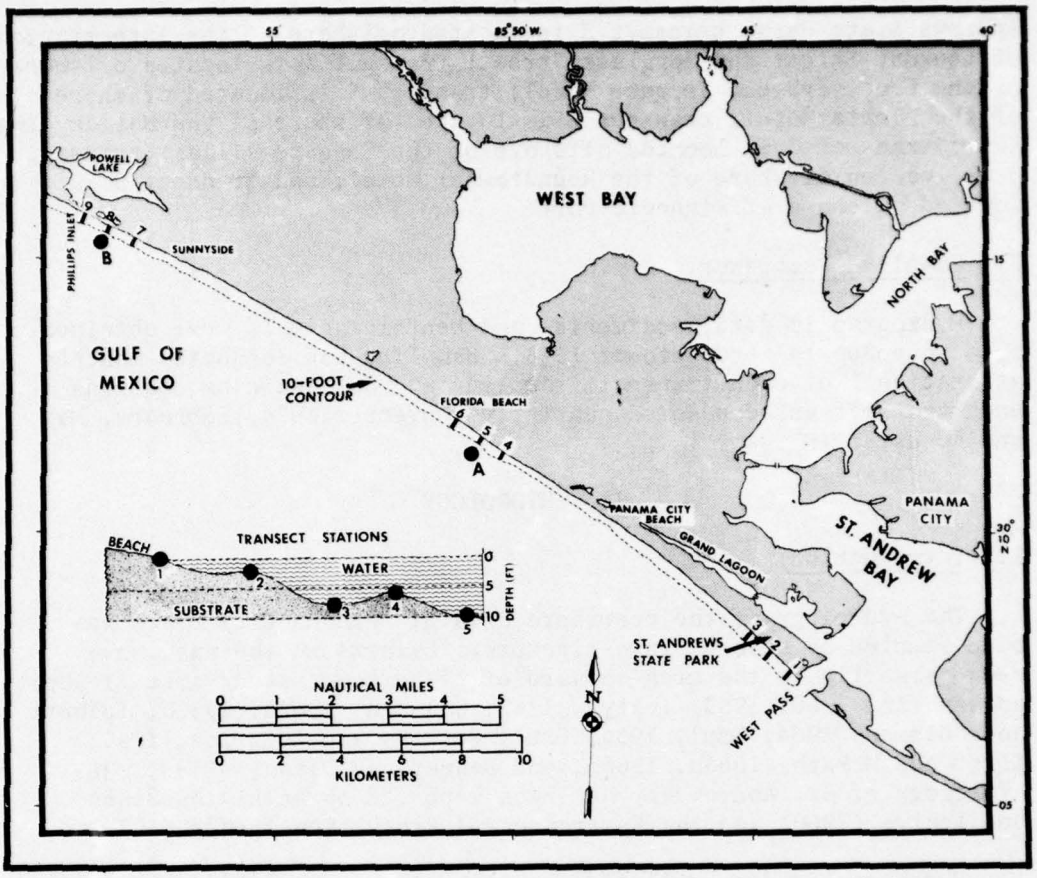

Figure 7. Station locations in the Gulf of Mexico between West Pass and Phillips Inlet.

Andrews State Park; transect 3 is located offshore of the intersection of Lookout Street and Spyglass Street; transect 4 is located offshore of the Fountainbleau Terrace Motel; transect 5 is located offshore of the Fiesta Motel; transect 6 is located offshore of the Holiday Inn West; transect 7 is located offshore of the Seagate Villas; transect 8 is located offshore of the Roundtowner Motel; and transect 9 is located offshore of Pinnacle Port.

5. Sampling Frequency.

Hydrographic data, sediments, and benthic animals were obtained from November 1974 to October 1975. Sampling was conducted monthly at station 1 of each transect; sampling at the remaining stations of each transect was conducted quarterly (November 1974, February, May, and August 1975).

II. HYDROLOGY

1. Introduction.

The hydrology of the nearshore area off Panama City Beach has been studied by several investigators. Efforts in the past have been primarily in the area seaward of the present study area (Tolbert and Austin, 1956, 1959; Ichiye, 1962; Salsman, 1962a, 1962b; Tolbert and Salsman, 1964; Gaul, 1966; Gaul, Boykin, and Letzring, 1966; Kirst and McMath, 1966a, 1966b; and Bennet and Olsen, 1971). The hydrology of St. Andrew Bay has been reported on mainly by Jones and Ichiye (1960) and the Environmental Protection Agency (1975).

Hydrographic data collected in this study were limited to surface water temperature and salinity.

2. Methods.

Water samples were collected on each sampling trip and were limited to stations 1, 3, 5, A, and B.

Water temperatures were measured with a hand-held thermometer. Salinity samples were collected in a plastic jar and results were later determined with a Goldberg refractometer.

3. Results.

a. Water Temperature. Water temperatures varied seasonally. The lowest average monthly temperature from all stations was 14.2° Celsius in December 1974; the highest was 30.9° Celsius in July 1975. The range of individual water temperatures was 13.3° to 32.1° Celsius

(Fig. 8; Table 1). The widest variation in temperatures occurred in November 1974 (13.9° to 21.8° Celsius); June 1975 had the least variation (27.6° to 28.6° Celsius).

The average water temperatures on the nine transects were essentially the same on each transect for the 12-month sampling period (Table 1). The data indicate temperatures were slightly higher at the eastern end (West Pass) than near Phillips Inlet. Since sampling on any particular day was usually started in the morning at the western end of the study area and proceeded eastward, this disparity is probably due to time of sampling.

Individual water temperatures are listed by station and date in Appendix A.

b. Salinity. Salinities fluctuated during the year from a low of 23.67 parts per thousand in August 1975 to a high of 35.39 parts per thousand in December 1974 (Table 1). The highest average monthly salinity occurred in December 1974 (35.03 parts per thousand); the lowest average monthly salinity (28.44 parts per thousand) was in August 1975. The highest variation within a month also occurred in August 1975; the following September had the least variation (Fig. 9).

Average salinities on each transect for the entire sampling period were approximately the same. A slight increase in salinity was noted at the transects near the western end of the study area (Table 1). Since the eastern end receives discharge from the St. Andrew Bay complex, this slight increase is probably due to the paucity of freshwater discharge.

Salinities by station and date are listed in Appendix A.

III. SEDIMENTOLOGY

1. Introduction.

Since the abundance and diversity of benthic animals are a measure and function of the type of substrate, the collection of surface sediments was done primarily to describe their association with the benthic animals. Also, if hydraulic dredging takes place, it is the surface sediments that will be altered by siltation or placement of sand with a different grain size.

Sediment analysis included the percentage weight of the gravel, sand, silt, and clay-size fractions, carbonate, total carbon, and organic carbon. Statistical factors of mean grain size, standard deviation, skewness, and kurtosis were also determined.

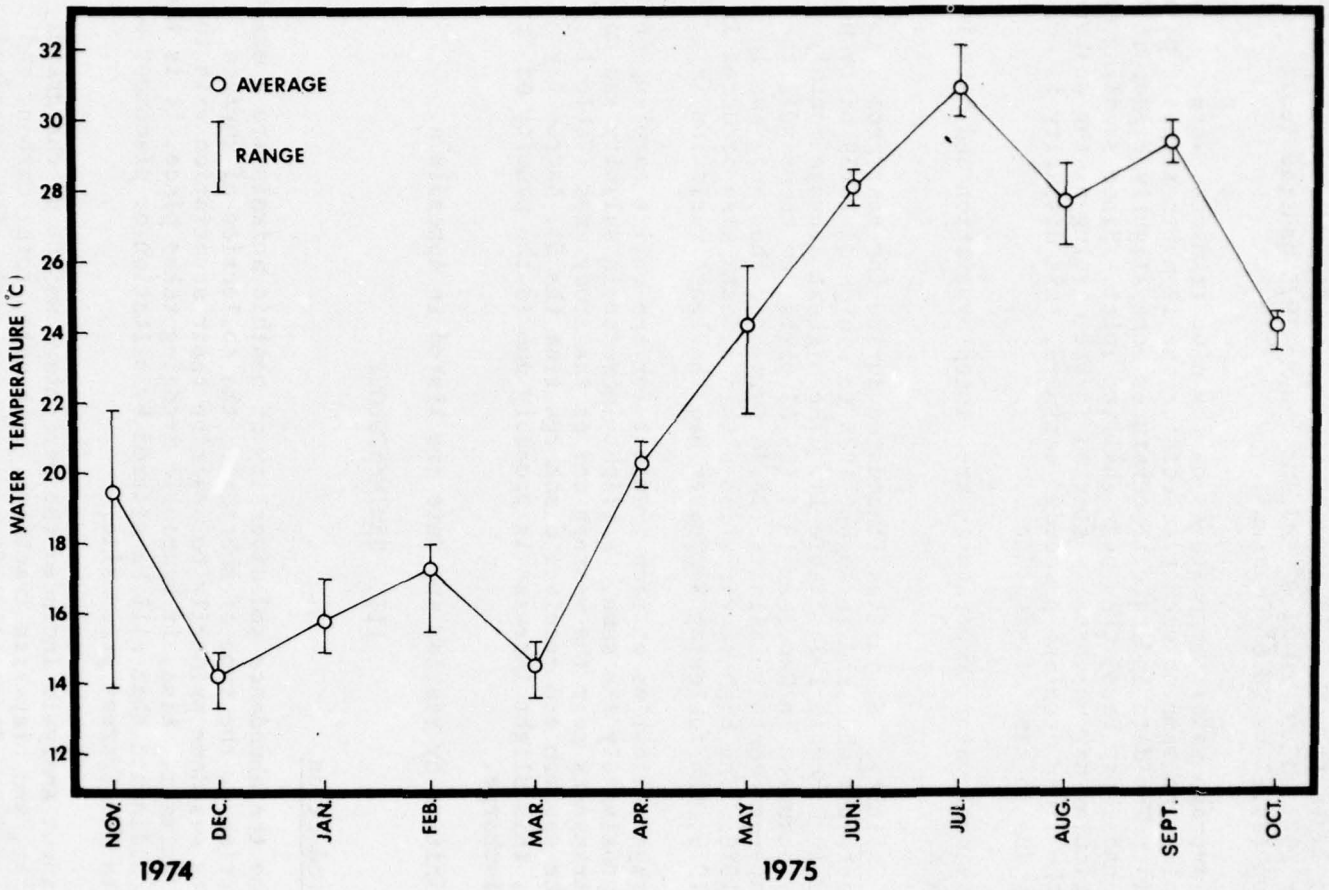

Figure 8. Monthly average and range of water temperatures collected from all stations.

Table 1. Average and range of water temperature and salinity on transects 1 to 9 and stations A and B.

Transect	Water Temperature (°C)		Salinity[1]	
	Average	Range	Average	Range
1	22.5	14.9 to 32.1	31.77	24.22 to 34.94
2	23.0	14.7 to 32.0	32.01	24.61 to 35.39
3	22.4	14.6 to 31.3	31.59	23.67 to 35.39
4	22.0	13.9 to 31.0	32.07	24.67 to 35.33
5	22.0	14.1 to 30.9	32.37	26.61 to 35.33
6	22.0	13.6 to 30.8	32.42	26.33 to 35.33
7	22.2	13.9 to 30.1	32.38	25.50 to 35.17
8	22.1	13.8 to 30.2	32.46	25.56 to 35.28
9	22.0	13.3 to 30.1	32.25	25.44 to 35.28
Station				
A	23.2	17.4 to 28.3	31.83	26.22 to 34.50
B	23.2	17.5 to 28.5	31.63	26.11 to 34.33

[1]Parts per thousand

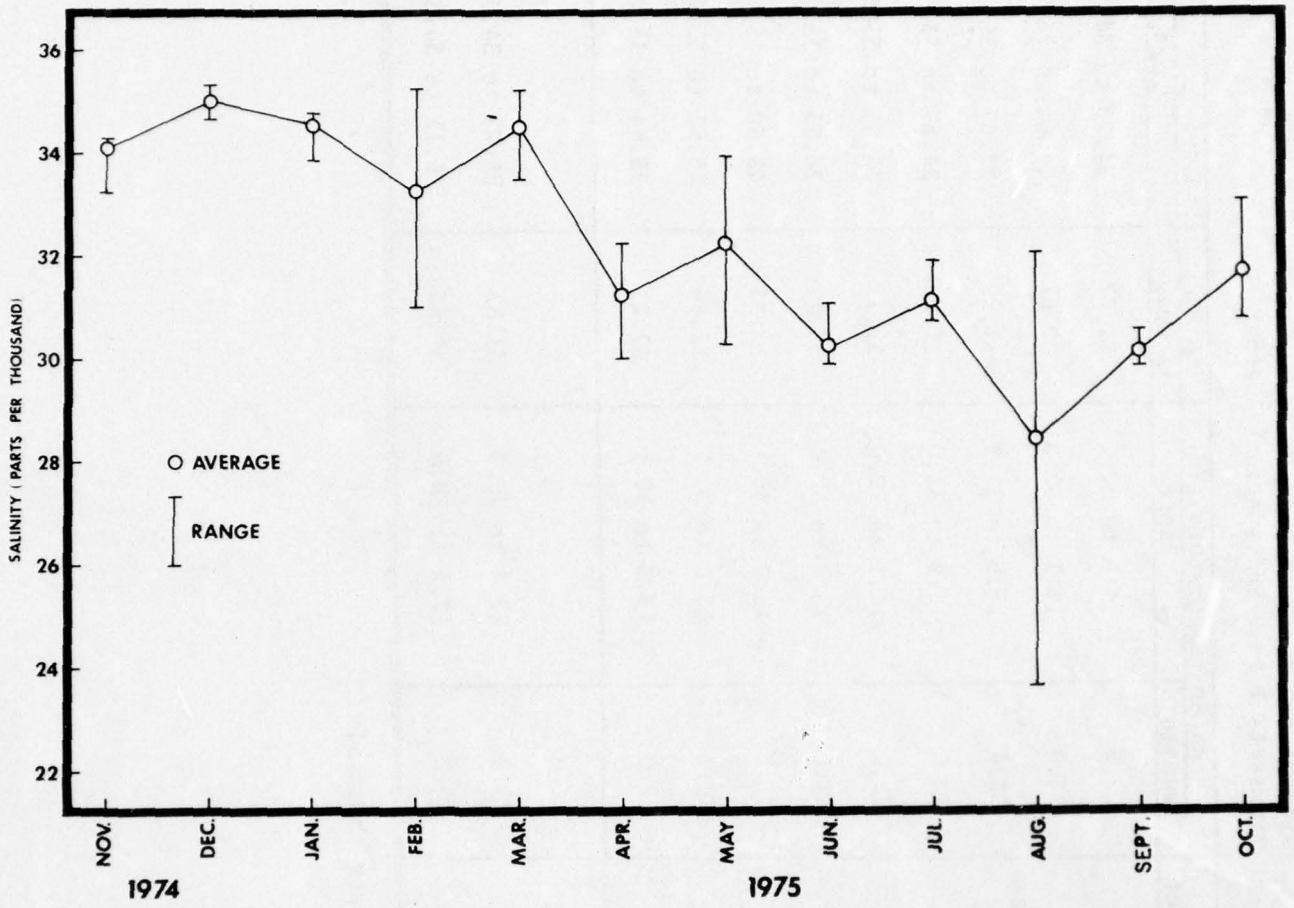

Figure 9. Monthly average and range of salinities collected from all stations.

Beach sediments in the study area have been studied by Cummings and von Oesen (1973) and Balsillie (1975). Other reports from the general area of northwest Florida with information applicable to the study area include Stewart and Gorsline (1962), Koefoed and Gorsline (1963), Gorsline (1964, 1966), and Stapor (1973).

2. Methods.

Sediment samples were collected in 8-ounce jars which were pushed at least 4 inches into the substratum, removed, and capped. The samples were frozen and stored until time for analysis.

a. Particle Size, Carbon, and Carbonate Analysis. Samples for sediment analysis were removed from the freezer and air dried overnight. Using a microsplitter on a mechanical shaker, 15 to 20 grams were separated for particle-size analyses. Another 4 grams were separated to be ground for geochemical analyses. The split for particle-size analysis was soaked in acetone, treated for 15 minutes in an ultrasonic cleaner, and then rinsed. If the sand grains showed any significant aggregation, the sample was carefully rubbed to disperse the grains. The sample was then put through a series of 3-inch sieves of 1 phi unit intervals by agitation for 15 minutes on the shaker. Each separated fraction on the sieves was weighed to the closest milligram. From these data a frequency distribution was compiled and other textural parameters computed. Since the silt-clay fraction of the sands was less than 1 percent, no pipette analyses were necessary.

The analyses for total carbon and organic carbon content of the beach sands were run on a Leco 750-100 90-second carbon analyzer. The sediment split for chemical analyses was ground sufficiently to pass through a 62-micrometer screen and then dried in an oven. To determine total carbon content, approximately 0.2-gram samples were scooped out, weighed to the nearest 0.1 milligram, and transferred to Leco crucibles. The sediment was then combusted in a high-frequency induction furnace at temperatures exceeding 1,600° Celsius. The carbon dioxide driven off was carried off by dry, carbon dioxide-free oxygen into a cylinder where the thermal conductivity of the gas mixture was measured. A catalytic furnace in the oxygen train converted any carbon monoxide to carbon dioxide. Readout was directly in percent carbon. All samples and standards were run in triplicate. After 12 combustions a high and a low standard were run and the bridge balance checked. After about 110 combustions the tubing, sulphur and dust traps, and combustion tube were cleaned. To determine the percent of organic carbon, 0.2-gram samples were dried, weighed, treated with six drops each of a 10-percent solution of hydrochloric acid, and warmed in a Leco crucible. After removal of the soluble carbonate the residues

were run through the carbon analyzer. The difference between the total carbon content and the carbon remaining after treatment with weak acid was the carbonate content of the sediment.

b. Statistical Analysis. The following four statistical parameters were calculated for each sample: Mean grain size, standard deviation, skewness, and kurtosis. The formulas used were from Folk and Ward (1957).

(1) Mean Grain Size. The mean grain size is the mean calculated by the formula $(\phi 16 + \phi 50 + \phi 84)/3$. The three phi ($\phi$) units are percentiles taken from a plotted cumulative curve (Tyle standard screen scale). Corresponding size limits in phi units and millimeters in relation to particle-size classification are shown in Table 2.

(2) Standard Deviation. The standard deviation is a measure of the average spread of the curve about its central tendency and indicates the degree of sorting of particles in the sample. The formula expressing this value is:

$$\frac{\phi 84 - \phi 16}{4} + \frac{\phi 95 - \phi 5}{6.6} .$$

This formula includes 90 percent of the distribution and, therefore, provides a wide-ranging measure of sorting. Folk (1964) identified various standard deviations in relation to the degree of sorting (Table 3).

(3) Skewness. Skewness indicates the displacement of the median from the mean, and is independent of sorting. For example, a symmetrical curve would have a skewness of zero; with an excess of fine material, the sample would be skewed right or positive; a sample with an excess of coarse sediments would be skewed left or negative (Table 4). The formula is:

$$\frac{\phi 16 + \phi 84 - 2\phi 50}{2(\phi 84 - \phi 16)} + \frac{\phi 5 + \phi 95 + 2\phi 50}{2(\phi 95 - \phi 5)}$$

(4) Kurtosis. Kurtosis is a measure of the ratio of the sorting in the extremes of the distribution compared with sorting in the central part (Folk and Ward, 1957). If the data can be plotted as a straight line on probability paper, a normal distribution with a kurtosis value of 1 is indicated. A departure from the straight line indicates a departure from normality and changes the kurtosis. If the central part is better sorted than the tails, the curve is excessively peaked or leptokurtic; if the tails are better sorted than the central part, the curve is flattened or platykurtic. The formula

Table 2. Sediment classification by particle size.

	Phi	Millimeters
Gravel	-6.0 to 0.0	64.0 to 1.0
Sand	0.0 to 4.0	1.0 to 0.0625
Silt	4.0 to 8.0	0.0625 to 0.0039
Clay	>8.0	<0.0039

Table 3. Classification of sediment sorting by standard deviations (after Folk, 1964).

Standard Deviation (ϕ)	Classification
<0.35	Very well sorted
0.35 to 0.50	Well-sorted
0.50 to 0.71	Moderately well sorted
0.71 to 1.0	Moderately sorted
1.0 to 2.0	Poorly sorted
2.0 to 4.0	Very poorly sorted
>4.0	Extremely poorly sorted

Table 4. Classification of sediment by skewness (after Folk, 1964).

Skewness	Classification
-1.00 to -0.30	Strongly coarse-skewed
-0.30 to -0.10	Coarse-skewed
-0.10 to 0.10	Near-symmetrical
0.10 to 0.30	Fine-skewed
0.30 to 1.00	Strongly fine-skewed

is:

$$\frac{\phi 95 - \phi 5}{2.44\ (\phi 75 - \phi 25)}\ .$$

Classification of sediments by kurtosis is given in Table 5.

Table 5. Classification of sediment by kurtosis (after Folk, 1964).

Kurtosis	Classification
<0.67	Very platykurtic
0.67 to 0.90	Platykurtic
0.90 to 1.11	Mesokurtic
1.11 to 1.50	Leptokurtic
1.50 to 3.00	Very leptokurtic
>3.00	Extremely leptokurtic

3. Results.

A total of 255 sediment samples was analyzed for particle-size distribution, percent carbon, organic carbon, carbonate, and statistical factors. Since very little variation was noted in any of the factors at any station or within the geographical boundaries of the study area, surface sediments exhibited uniformity over time and location.

The percentage of sample weight for each particle size (gravel, sand, silt, and clay) for each station is listed in Appendix B, and for each transect in Appendix C. The percentage of sample weight of total carbon, organic carbon, and carbonate for each station is listed in Appendix D, and for each transect in Appendix E.

a. Gravel. Sediments in the survey area ranged from 0 to 7 percent of the total sample weight in the gravel fraction. This size fraction consisted mainly of carbonate particles. Over 90 percent of the stations had less than 0.51 percent of the total sample weight in the gravel fraction (Fig. 10).

The average percent of the total sample weight of this size fraction at all transect stations was 0.197. Station 1, located in the swash zone, had the highest average percentage of this size fraction; station 4, located on the second sandbar, had the least (Table 6). The weight percent of this size fraction was also low at stations A and B (Table 7).

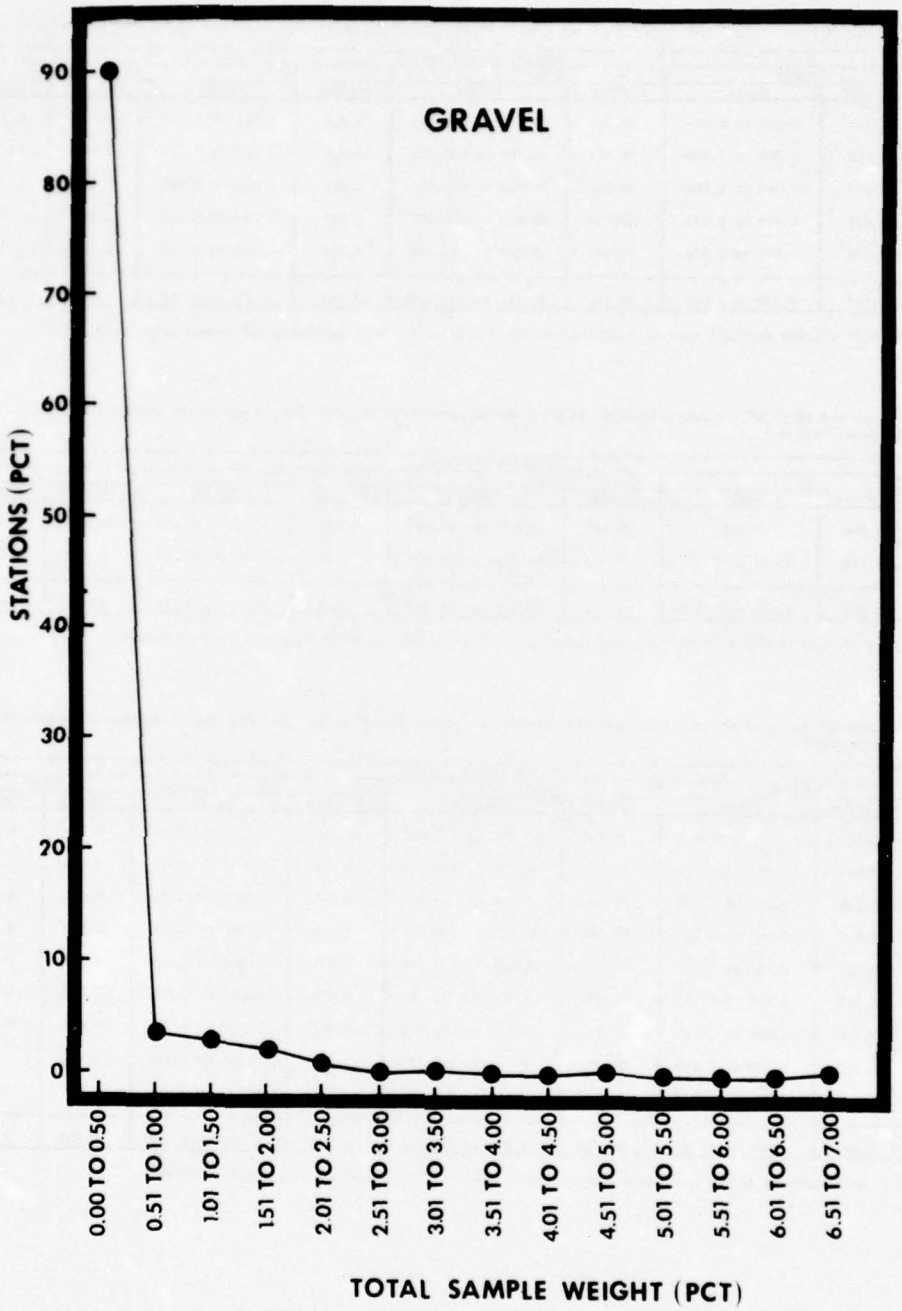

Figure 10. Percentage frequency of the gravel fraction at all stations.

Table 6. Average and range of the particle-size distribution as percentage of total sample weight of surface sediments.[1]

Station	Grain-size classes							
	Gravel		Sand		Silt		Clay	
	Average	Range	Average	Range	Average	Range	Average	Range
1	0.315	0.000 to 6.967	99.649	93.014 to 100.000	0.036	0.000 to 0.217	0.000	0.000
2	0.139	0.000 to 3.240	99.813	96.730 to 100.000	0.048	0.000 to 0.214	0.000	0.000
3	0.163	0.000 to 2.209	99.771	97.762 to 100.000	0.066	0.000 to 0.164	0.000	0.000
4	0.028	0.000 to 1.053	99.896	98.859 to 100.000	0.076	0.000 to 0.136	0.000	0.000
5	0.098	0.000 to 1.570	99.833	98.414 to 99.996	0.069	0.000 to 0.155	0.000	0.000
Yearly avg. and range	0.197	0.000 to 6.967	99.752	93.014 to 100.000	0.048	0.000 to 0.217	0.000	0.000

[1]Collected at each station from all transects in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

Table 7. Average and range of the particle-size distribution as percentage of total sample weight of surface sediments, stations A and B.[1]

Station	Grain-size classes							
	Gravel		Sand		Silt		Clay	
	Average	Range	Average	Range	Average	Range	Average	Range
A	0.000	0.000	99.860	99.826 to 99.892	0.140	0.108 to 0.174	0.000	0.000
B	0.126	0.000 to 0.502	99.775	99.341 to 100.000	0.100	0.000 to 0.157	0.000	0.000
Yearly avg. and range	0.072	0.000 to 0.502	99.811	99.341 to 100.000	0.117	0.000 to 0.174	0.000	0.000

[1]Collected from stations A and B in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

Table 8. Average and range of the particle-size distribution as percentage of total sample weight of surface sediments on each transect.[1]

Transect	Grain-size classes							
	Gravel		Sand		Silt		Clay	
	Average	Range	Average	Range	Average	Range	Average	Range
1	0.340	0.000 to 4.868	99.620	95.059 to 100.000	0.041	0.000 to 0.136	0.000	0.000
2	0.288	0.000 to 3.240	99.664	96.730 to 100.000	0.048	0.000 to 0.214	0.000	0.000
3	0.256	0.000 to 2.209	99.686	97.762 to 99.988	0.059	0.000 to 0.155	0.000	0.000
4	0.445	0.000 to 6.967	99.504	93.014 to 100.000	0.051	0.000 to 0.164	0.000	0.000
5	0.081	0.000 to 1.428	99.878	98.522 to 100.000	0.041	0.000 to 0.133	0.000	0.000
6	0.119	0.000 to 1.039	99.837	98.959 to 99.995	0.044	0.000 to 0.105	0.000	0.000
7	0.048	0.000 to 1.035	99.905	98.903 to 100.000	0.047	0.000 to 0.157	0.000	0.000
8	0.141	0.000 to 1.672	99.810	98.308 to 100.000	0.050	0.000 to 0.134	0.000	0.000
9	0.066	0.000 to 1.053	99.863	98.859 to 100.000	0.051	0.000 to 0.217	0.000	0.000
Yearly avg. and range	0.197	0.000 to 6.967	99.752	93.014 to 100.000	0.048	0.000 to 0.217	0.000	0.000

[1]Collected on each transect in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

The distribution of this size fraction varied only slightly from one end of the study area to the other. Sediments on transects 1 to 4 had an average of two to three times more gravel than sediments on transect 5 to 9 (Table 8). This difference could possibly be attributed to a higher erosion rate near West Pass causing the smaller sized particles to be eroded away. This section of the beach near West Pass also received spoil from dredging in Grand Lagoon in January 1972. The spoil probably had numerous particles larger than the existing beach sand.

b. Sand. Surface sediments in the nearshore ranged from 93 to 100 percent of the total sample weight in the sand fraction. Over 87 percent of the stations had weight percentages of the sand fraction in the 99- to 99.9-percent range. Almost 6 percent of the stations consisted of 100-percent sand (Fig. 11).

The average percent of the total sample weight of this size fraction at all transect stations was 99.752. Station 1 had the lowest average weight percentage of sand; station 4 had the highest (Table 6). The average weight percentage of sand at stations A and B in 30 feet of water was 99.911 percent (Table 7).

The distribution of this size fraction varied slightly over the study area. Lower percentages of sand were present at transects 1 to 4 and higher percentages of sand were present on transects 5 to 9 (Table 8).

c. Silt. Surface sediments in the study area ranged from 0 to 0.217 percent of the total sample weight in the silt fraction. Almost 50 percent of the stations had weight percentages of the silt-size fraction in the 0.001- to 0.050-percent range. Over 9 percent of the stations had 0 percent of silt present (Fig. 12).

The average weight percent of this size fraction at all transect stations was 0.048. Station 1 had the lowest weight percent of silt; station 4 had the highest (Table 6). The percent of silt at stations A and B was 0.117 (Table 7).

The distribution of this size fraction remained fairly constant throughout the study area. Average values for each transect only ranged from 0.041 to 0.059 percent of the total sample weight (Table 8).

d. Clay. This size fraction was absent from all stations in the study area (Tables 6, 7, and 8).

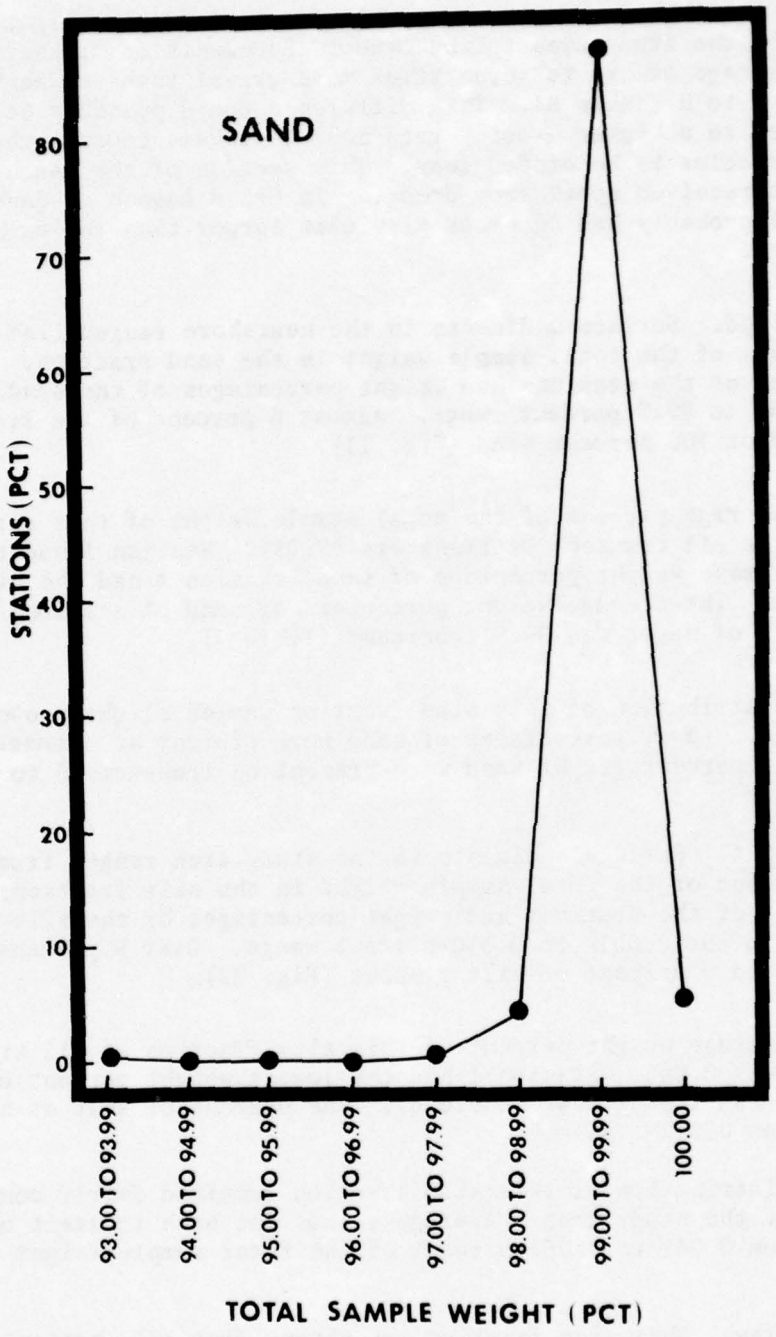

Figure 11. Percentage frequency of the sand fraction at all stations.

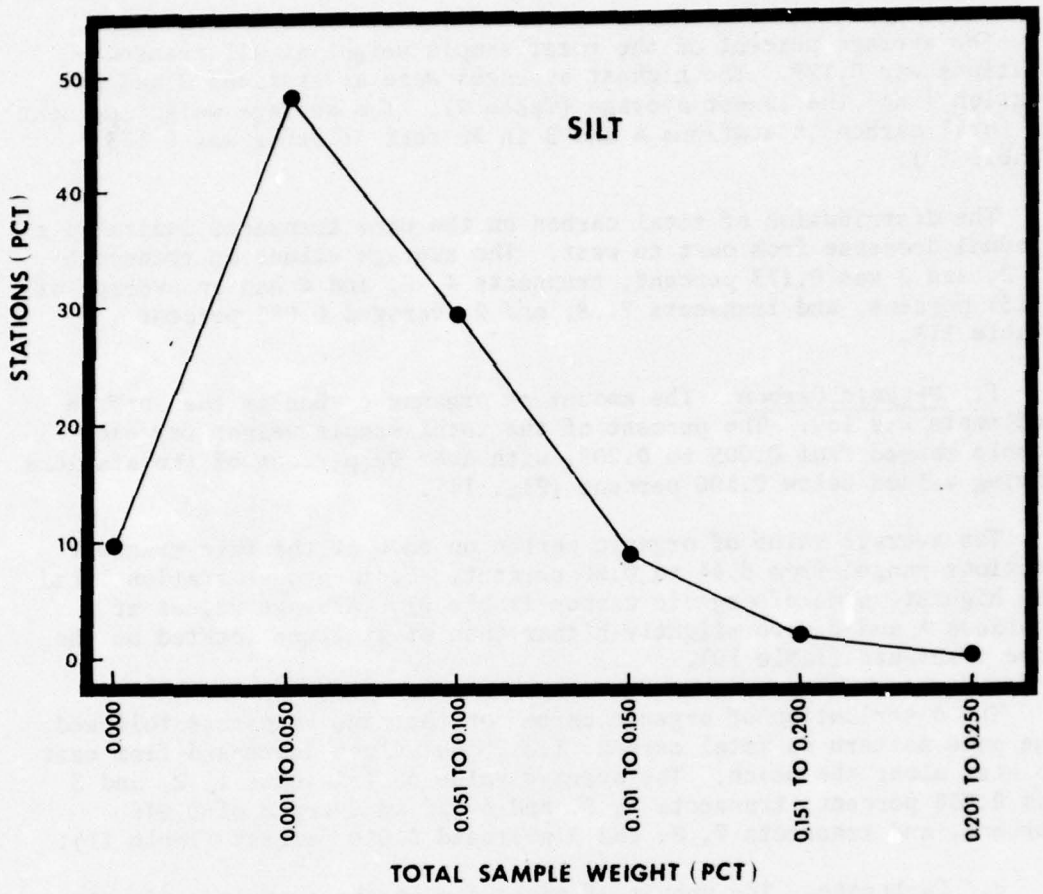

Figure 12. Percentage frequency of the silt fraction at all stations.

e. Total Carbon. The amount of total carbon in the surface sediments of this nearshore zone was low. The percentage of the total sample weight for each sample ranged from 0.010 to 1.761 percent, with 80 percent of the stations having a percentage of total carbon below 0.151 percent (Fig. 13).

The average percent of the total sample weight at all transect stations was 0.129. The highest averages were at stations 2 and 5; station 4 had the lowest average (Table 9). The average weight percent of total carbon at stations A and B in 30 feet of water was 0.133 (Table 10).

The distribution of total carbon on the nine transects indicated a gradual decrease from east to west. The average values on transects 1, 2, and 3 was 0.173 percent; transects 4, 5, and 6 had an average of 0.131 percent, and transects 7, 8, and 9 averaged 0.083 percent (Table 11).

f. Organic Carbon. The amount of organic carbon in the surface sediments was low. The percent of the total sample weight for each sample ranged from 0.005 to 0.208, with over 92 percent of the stations having values below 0.100 percent (Fig. 14).

The average value of organic carbon on each of the five transect stations ranged from 0.44 to 0.50 percent. Sediments at station 1 had the highest value of organic carbon (Table 9). Average values at stations A and B were slightly higher than at stations located on the nine transects (Table 10).

The distribution of organic carbon on the nine transects followed the same pattern as total carbon, i.e., the values decreased from east to west along the beach. The average value on transects 1, 2, and 3 was 0.058 percent; transects 4, 5, and 6 had an average of 0.045 percent, and transects 7, 8, and 9 averaged 0.040 percent (Table 11).

g. Carbonate. The amount of carbonate in the surface sediments was very low. The range of the percentage of the total sample weight for each sample was 0.000 to 1.697 percent with almost 92 percent of the stations having carbonate values below 0.200 percent (Fig. 15). Only two samples had carbonate values above 1 percent.

The average value of carbonate on each of the five transect stations ranged from 0.051 to 0.106 percent. Carbonates were highest at stations 2 and 5, and the lowest at station 4 (Table 9). At stations A and B, the level of carbonate in the samples was about the same as the stations located on the transects (Table 10).

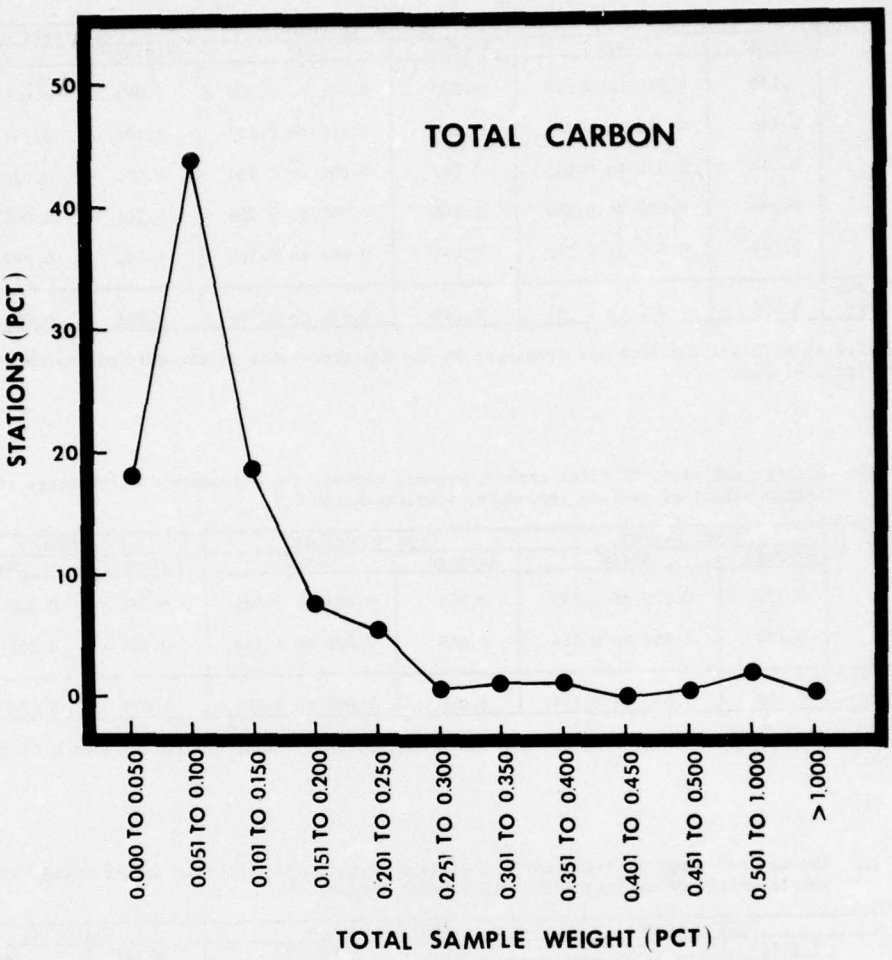

Figure 13. Percentage frequency of total carbon at all stations.

Table 9. Average and range of total carbon, organic carbon, and carbonate as percentage of total sample weight of surface sediments.[1]

Station	Total Carbon		Organic Carbon		Carbonate	
	Average	Range	Average	Range	Average	Range
1	0.134	0.010 to 0.839	0.050	0.006 to 0.200	0.085	0.001 to 0.796
2	0.148	0.025 to 1.761	0.044	0.010 to 0.197	0.106	0.001 to 0.697
3	0.113	0.021 to 0.803	0.047	0.008 to 0.154	0.065	0.000 to 0.760
4	0.093	0.029 to 0.389	0.046	0.005 to 0.208	0.051	0.001 to 0.196
5	0.148	0.032 to 1.096	0.045	0.006 to 0.169	0.106	0.002 to 0.481
Yearly avg. and range	0.129	0.010 to 1.761	0.048	0.005 to 0.208	0.083	0.001 to 1.697

[1]Collected at each station from all transects in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

Table 10. Average and range of total carbon, organic carbon, and carbonate as percentage of total sample weight of surface sediments, stations A and B.[1]

Station	Total Carbon		Organic Carbon		Carbonate	
	Average	Range	Average	Range	Average	Range
A	0.102	0.070 to 0.144	0.051	0.024 to 0.081	0.051	0.020 to 0.120
B	0.174	0.082 to 0.334	0.069	0.008 to 0.114	0.105	0.022 to 0.220
Yearly avg. and range	0.133	0.070 to 0.334	0.058	0.008 to 0.114	0.074	0.020 to 0.220

[1]Collected from stations A and B in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

Table 11. Average and range of total carbon, organic carbon, and carbonate as percentage of total sample weight of surface sediments on each transect.[1]

Station	Total Carbon		Organic Carbon		Carbonate	
	Average	Range	Average	Range	Average	Range
1	0.138	0.017 to 0.389	0.074	0.008 to 0.208	0.065	0.002 to 0.212
2	0.257	0.021 to 1.761	0.054	0.014 to 0.197	0.211	0.004 to 1.697
3	0.125	0.039 to 0.489	0.047	0.011 to 0.124	0.081	0.006 to 0.455
4	0.131	0.025 to 0.729	0.036	0.008 to 0.086	0.097	0.002 to 0.700
5	0.153	0.027 to 0.803	0.052	0.011 to 0.149	0.104	0.003 to 0.760
6	0.109	0.025 to 0.284	0.047	0.006 to 0.177	0.060	0.001 to 0.237
7	0.074	0.026 to 0.148	0.047	0.005 to 0.117	0.026	0.001 to 0.062
8	0.108	0.010 to 0.643	0.042	0.006 to 0.160	0.066	0.000 to 0.481
9	0.066	0.019 to 0.171	0.031	0.007 to 0.080	0.035	0.004 to 0.124
Yearly avg. and range	0.129	0.010 to 1.761	0.048	0.005 to 0.208	0.083	0.000 to 1.697

[1]Collected on each transect in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

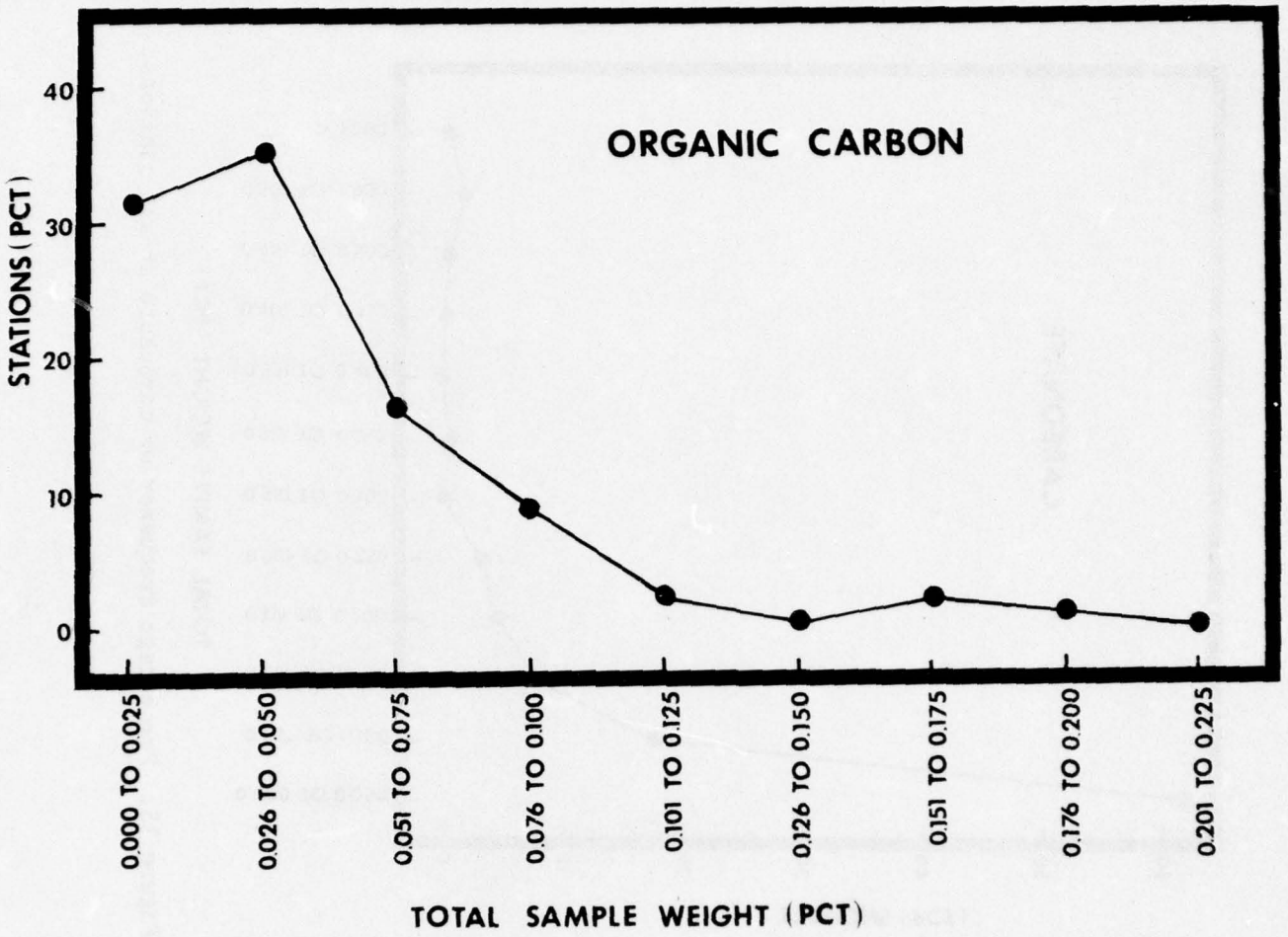

Figure 14. Percentage frequency of organic carbon at all stations.

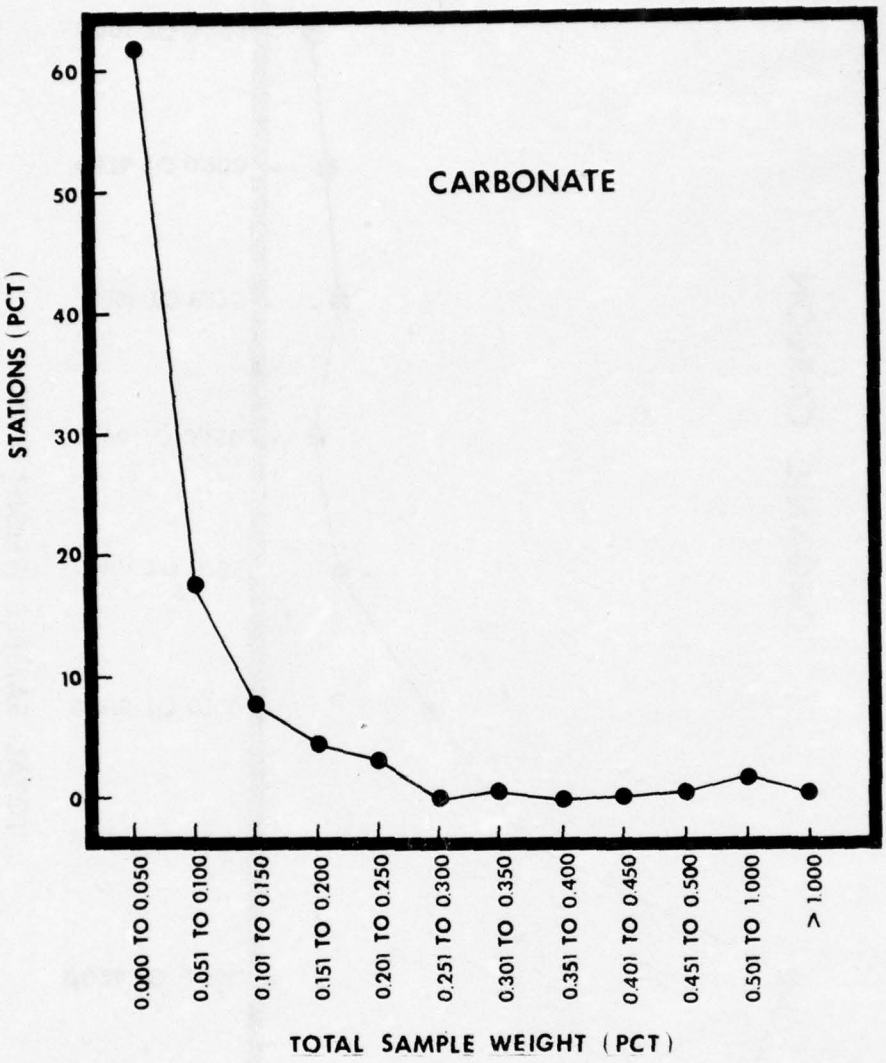

Figure 15. Percentage frequency of carbonate at all stations.

The distribution of carbonate on the nine transects followed the same pattern as total carbon and organic carbon. There was a decrease in values from east to west. The average value on transects 1, 2, and 3 was 0.119 percent; transects 4, 5, and 6 had an average of 0.087 percent, and transects 7, 8, and 9 averaged 0.042 percent (Table 11).

h. Mean Grain Size. The average mean grain size from all transect stations was 1.918 phi (0.273 millimeter) (Table 9). Sediments with these mean grain sizes were classified as sand (Table 2). The range of mean grain-size values was 0.777 to 2.488 phi (0.178 to 0.584 millimeter). Over 87 percent of stations occurred in the range of 1.51 to 2.50 phi (Fig. 16); 96 percent of the stations had a mean grain size between 0.11 to 0.4 millimeter (Fig. 17).

The mean grain size of the surface sediments gradually decreased as distance from shore increased. An exception was at station 3, where the sediments averaged slightly smaller than stations 4 and 5 (Table 12). Sediments at stations A and B had average mean grain sizes smaller than the transect stations (Table 13).

The average mean grain size of sediments on each of the nine transects ranged from 1.814 to 2.004 phi (0.253 to 0.297 millimeter) (Table 14). There was a slight decrease in mean grain sizes from transects 1, 2, and 3 and then an increase in values from transects 3 to 9.

i. Standard Deviation. Surface sediments at all transect stations had an average standard deviation of 0.608 phi (Table 9) and were classified as moderately well sorted (Table 3). The range of values from transect stations varied from 0.321 to 1.119 phi. Over 64 percent of the stations occurred in the bracket classified as moderately well sorted; almost 17 percent of the stations were present in each of the well-sorted and moderately sorted classifications (Fig. 18; Table 3).

The average of all samples taken at each of the five transect stations was in the moderately well sorted classification. Sediments at station 3 were better sorted than the remaining stations; station 2 had the poorest sorting of sediments (Table 12). Sediments at stations A and B were also moderately well sorted with an average of 0.638 phi (Table 13).

The average standard deviations on each of the nine transects ranged from 0.566 to 0.669 phi. Transects 1, 2, and 3 had sediments that had higher standard deviations than the remaining transects and, therefore, were slightly less sorted (Table 14).

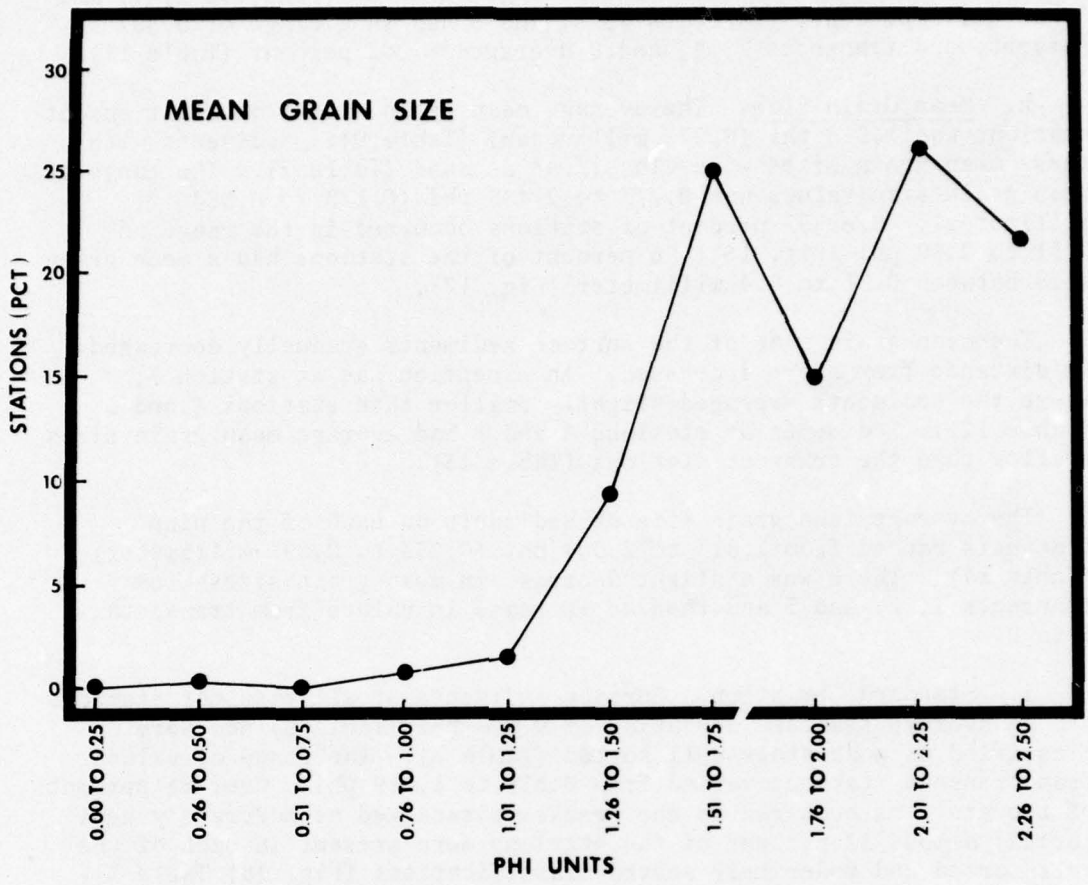

Figure 16. Percentage frequency of mean grain size (phi) at all stations.

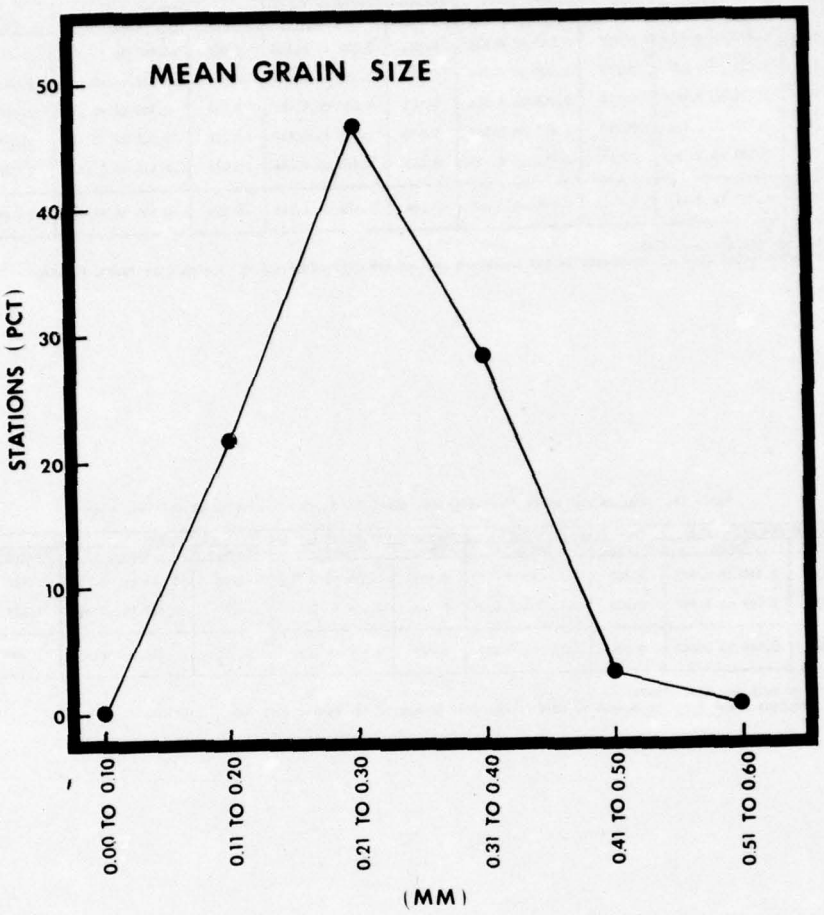

Figure 17. Percentage frequency of mean grain size (millimeters) at all stations.

Table 12. Average and range of statistical data[1] for surface sediments.[2]

Station	Mean Grain Size (phi)		Mean Grain Size (mm)		Standard Deviation (phi)		Skewness		Kurtosis	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
1	1.606	0.777 to 2.451	0.332	0.183 to 0.584	0.620	0.321 to 1.119	+0.018	-0.468 to +0.297	1.100	0.584 to 2.026
2	1.890	1.314 to 2.323	0.273	0.200 to 0.402	0.648	0.522 to 0.861	-0.031	-0.266 to +0.247	0.923	0.741 to 1.366
3	2.234	1.709 to 2.440	0.214	0.183 to 0.306	0.562	0.433 to 0.781	-0.189	-0.345 to +0.248	1.014	0.745 to 1.247
4	2.215	1.729 to 2.488	0.217	0.178 to 0.302	0.579	0.351 to 0.832	-0.201	-0.315 to +0.116	1.007	0.754 to 1.214
5	2.217	1.193 to 2.477	0.217	0.180 to 0.437	0.595	0.410 to 0.848	-0.270	-0.416 to 0.151	1.061	0.762 to 1.273
Yearly avg. and range	1.918	0.777 to 2.488	0.273	0.178 to 0.584	0.608	0.321 to 1.119	-0.085	-0.468 to +0.297	1.043	0.584 to 2.026

[1]Using formulas by Folk and Ward (1957).
[2]Collected at each station from all transects in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

Table 13. Average and range of statistical data[1] for surface sediments at stations A and B.[2]

Station	Mean Grain Size (phi)		Mean Grain Size (mm)		Standard Deviation (phi)		Skewness		Kurtosis	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
A	2.310	2.203 to 2.433	0.202	0.185 to 0.217	0.603	0.499 to 0.715	-0.200	-0.246 to -0.156	1.128	1.014 to 1.227
B	2.289	2.169 to 2.447	0.205	0.183 to 0.222	0.665	0.554 to 0.802	-0.237	-0.382 to -0.089	1.237	1.134 to 1.376
Yearly avg. and range	2.298	2.169 to 2.447	0.204	0.183 to 0.222	0.638	0.499 to 0.802	-0.221	-0.382 to -0.089	1.190	1.014 to 1.376

[1]Using formulas by Folk and Ward (1957).
[2]Collected at stations A and B in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

Table 14. Average and range of statistical data[1] for surface sediments on each transect.[2]

Station	Mean Grain Size (phi)		Mean Grain Size (mm)		Standard Deviation (phi)		Skewness		Kurtosis	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
1	1.899	1.121 to 2.400	0.276	0.190 to 0.460	0.669	0.467 to 0.991	-0.117	-0.358 to +0.247	0.999	0.738 to 1.296
2	1.913	0.896 to 2.418	0.274	0.187 to 0.538	0.663	0.343 to 0.900	-0.110	-0.416 to +0.297	1.005	0.743 to 1.380
3	2.004	1.442 to 2.440	0.253	0.184 to 0.368	0.637	0.445 to 1.043	-0.146	-0.468 to +0.123	1.026	0.584 to 1.357
4	1.938	1.491 to 2.488	0.269	0.178 to 0.356	0.591	0.351 to 1.119	-0.103	-0.397 to +0.184	1.067	0.741 to 2.026
5	1.983	1.544 to 2.426	0.258	0.186 to 0.343	0.592	0.472 to 0.791	-0.055	-0.381 to +0.251	1.054	0.738 to 1.344
6	1.920	0.777 to 2.459	0.275	0.182 to 0.584	0.566	0.407 to 0.743	-0.062	-0.314 to +0.245	1.068	0.746 to 1.368
7	1.890	1.335 to 2.458	0.277	0.185 to 0.396	0.567	0.321 to 0.742	-0.036	-0.331 to +0.248	1.039	0.738 to 1.267
8	1.896	1.171 to 2.451	0.279	0.183 to 0.444	0.579	0.431 to 0.748	-0.104	-0.315 to +0.248	1.039	0.750 to 1.400
9	1.814	1.148 to 2.432	0.297	0.185 to 0.451	0.613	0.332 to 0.832	-0.127	-0.331 to +0.109	1.088	0.738 to 1.337
Yearly avg. and range	1.918	0.777 to 2.488	0.273	0.178 to 0.584	0.608	0.321 to 1.119	-0.085	-0.468 to +0.297	1.043	0.584 to 2.026

[1]Using formulas by Folk and Ward (1957).
[2]Collected on each transect in the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida.

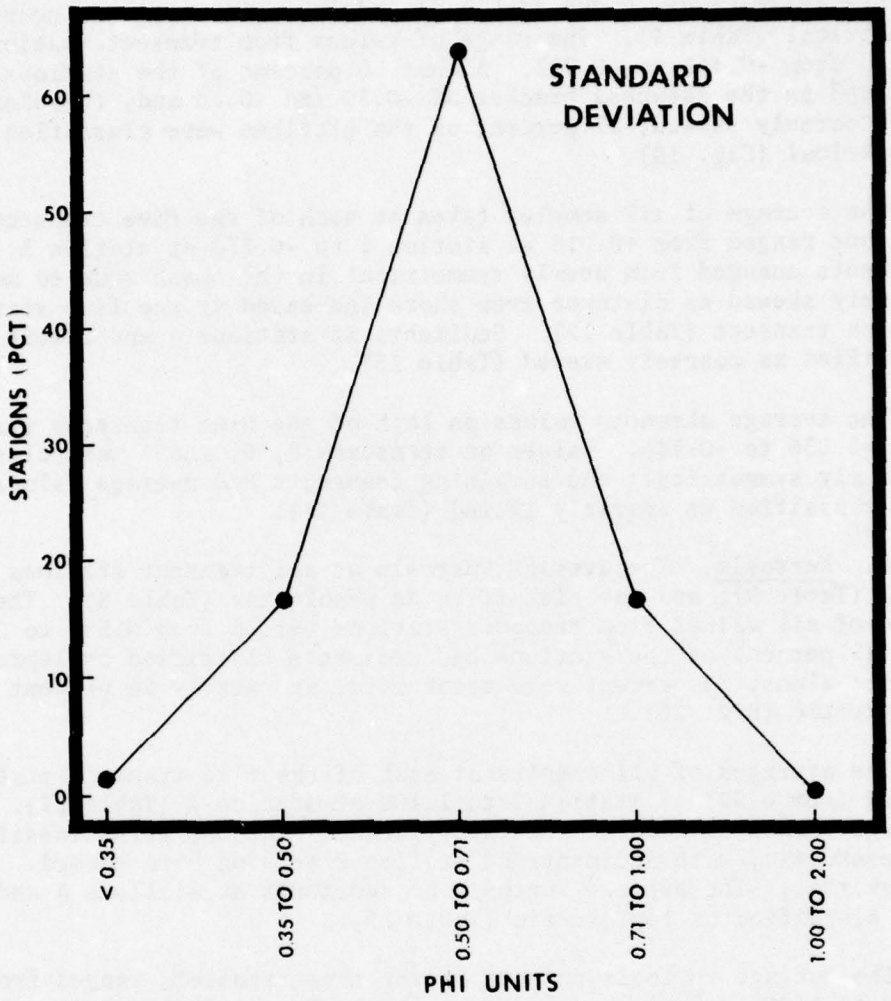

Figure 18. Percentage frequency of standard deviation at all stations.

j. Skewness. Surface sediments at all transect stations had an average skewness of -0.085 (Table 9) and were classified as nearly symmetrical (Table 4). The range of values from transect stations varied from -0.468 to +0.297. Almost 50 percent of the stations occurred in the skewness bracket of -0.30 and -0.10 and, therefore, were coarsely skewed; 27 percent of the stations were classified as symmetrical (Fig. 19).

The average of all samples taken at each of the five transect stations ranged from +0.018 at station 1 to -0.270 at station 5. Sediments changed from nearly symmetrical in the swash zone to more coarsely skewed as distance from shore increased at the five stations on each transect (Table 12). Sediments at stations A and B were also classified as coarsely skewed (Table 13).

The average skewness values on each of the nine transects ranged from -0.036 to -0.146. Values on transects 5, 6, and 7 were classified as nearly symmetrical; the remaining transects had average values that were classified as coarsely skewed (Table 14).

k. Kurtosis. The average kurtosis at all transect stations was 1.043 (Table 9), and was classified as mesokurtic (Table 5). The range of all values from transect stations varied from 0.584 to 2.026. Over 41 percent of the stations had sediments classified as leptokurtic; almost 32 percent were mesokurtic, and nearly 26 percent platykurtic (Fig. 20).

The averages of all samples at each of the five transect stations ranged from 0.923 at station 2 to 1.100 at station 1 (Table 12). The average values at each of the five transect stations were classified as mesokurtic, with sediments at station 2 tending more toward platykurtic. The average kurtosis of sediments at stations A and B were classified as leptokurtic (Table 13).

The average kurtosis on each of the nine transects ranged from 0.999 to 1.088. Sediments on transects 1, 2, and 3 tended more toward platykurtic than on the remaining transects (Table 14).

IV. BENTHIC FAUNA

1. Introduction.

The abundance and diversity of the benthic invertebrates in this nearshore zone are a measure of the quality of the benthic environment. Determination of the faunal characteristics of this environment is required before beach restoration takes place to determine the effects of removing sand from offshore and creating a new beach.

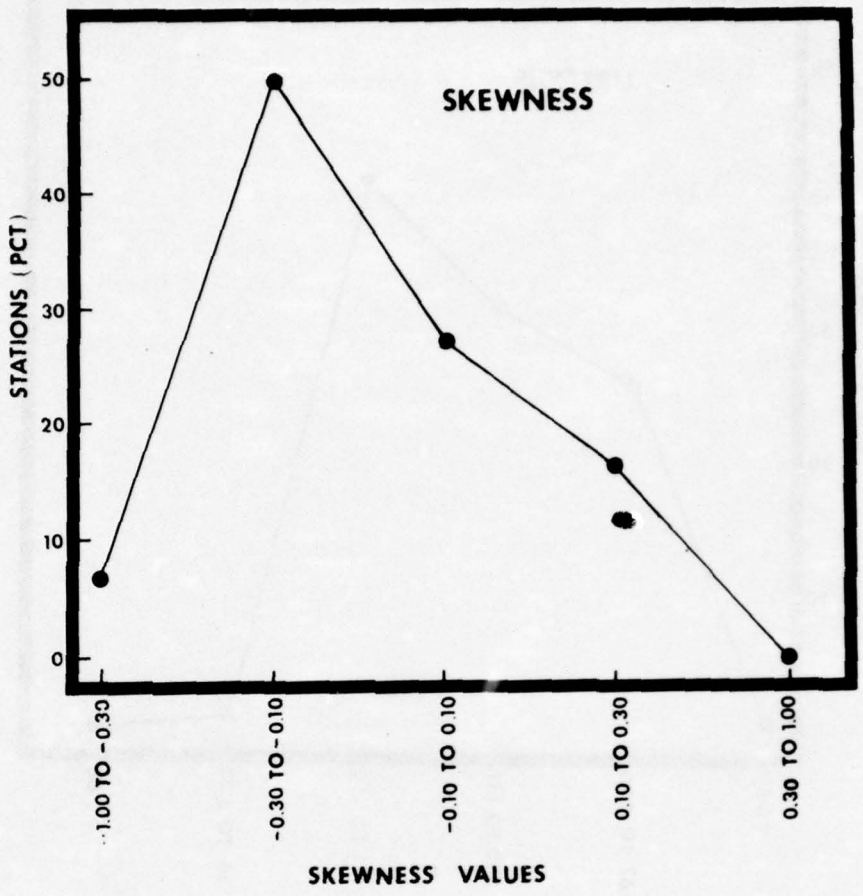

Figure 19. Percentage frequency of skewness at all stations.

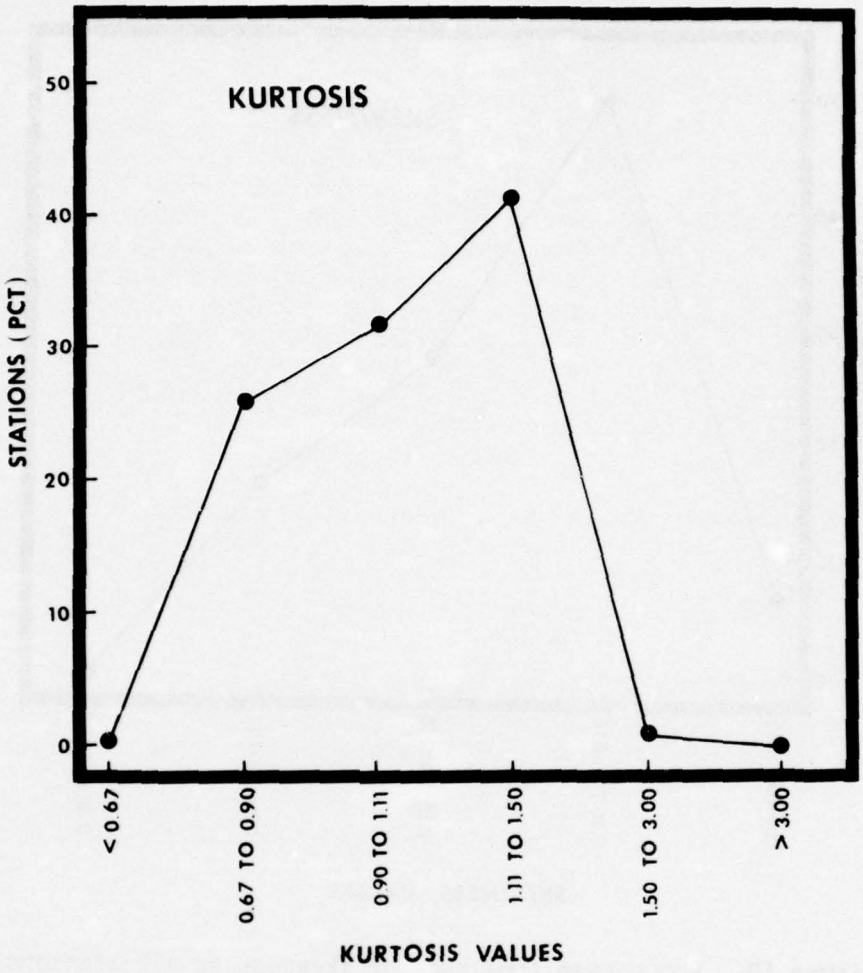

Figure 20. Percentage frequency of kurtosis at all stations.

This report is the first to describe quantitatively the benthic macroinvertebrates of this nearshore area. Included in the list of animals are several new species, some of which comprise a significant part of the fauna (Table 15).

The benthic fauna of the nearshore zone of the Gulf of Mexico off Panama City Beach, Florida, is practically unknown. Hulings (1961) listed 53 species of barnacles and decapod crustaceans collected on one transect perpendicular to the beach with trawls, scallop dredges, and aqualung diving. Salsman and Tolbert (1965) made observations on the populations of the sand dollar, *Mellita quinquiesperforata*. In waters adjacent to the nearshore zone, Culpepper and Pequegnat (1969) studied the gammarid amphipods on artificial substrates, and Little (1963) surveyed the sponge fauna offshore of Panama City.

The ostracods were examined from the Panama City area by Puri and Hulings (1957) and from St. Andrew Bay by Waller (1961). The plankton of St. Andrew Bay was reported by Hopkins (1966).

The fish fauna of the Panama City area has been reported by Caldwell (1959), Allison (1961), Vick (1964), Haburay, Crooke, and Hastings (1969), Klima and Wickham (1971), Hastings (1972), Wickham, Watson, and Ogren (1973), and Ogren (1975).

2. Methods.

The benthic fauna was sampled with a stainless steel plug sampler (Fig. 21) that covers an area 1/64 square meter and penetrates to a depth of 23 centimeters. It has handles for ease in handling, and the top is covered with a stainless steel mesh (0.701 square millimeter). In operation the plug sampler is pushed into the bottom, the substrate on one side is removed by hand, and the sampler is tilted and lifted out with a hand covering the bottom. In water depths greater than 4 feet (1.2 meters), the sampler is pushed in by a diver and removed as previously stated. During ascent, the open end is securely held against the diver's body to prevent sample loss.

Four plug samples were taken at each station. Samples collected on the beach were extruded into pans, divided into equal top and bottom parts (Fig. 22), placed in a stainless steel sieve (Fig. 21) with a mesh of 0.701 square millimeter, and sieved. The remnant part in the sieve was stained with Rose Bengal and preserved in 10-percent Formalin-seawater solution. Samples collected offshore at stations 2 to 5 were placed in a large metal tub inside an inner tube (Fig. 23). The samples were brought to shore and processed as previously stated. At stations A and B, an outboard motorboat was used as the sampling platform and the samples were processed identically.

Table 15. Checklist of benthic animals.

ACTINIARIA (Sea anemones)
Unidentified sp.

TURBELLARIA (Flatworms)
Unidentified sp.

NEMERTINEA (Ribbon worms)
Unidentified sp.

NEMATODA (Round worms)
1. Unidentified sp. A
2. Unidentified sp. B

POLYCHAETA (Marine worms)
1. *Agloaghamus verrilli*
2. Ampharetid sp.
3. *Anaitides erythrophyllus*
4. *Apoprionospio pygmaea*
5. *Aricidea* sp.
6. *Aricidea fragilis*
7. *Armandia maculata*
8. *Brania clavata*
9. *Brania wellfleetensis*
10. Unidentified capitellid
11. *Caulleriella*
12. *Ceratonereis irritabilis*
13. Unidentified cirratulid
14. *Diopatra cuprea*
15. *Dispio uncinata*
16. *Eteone heteropoda*
17. *Glycera oxycephala*
18. *Guptis vittata*
19. *Heteromastus filiformis*
20. *Loimia virdis*
21. *Lumbrineris* sp.
22. *Lumbrineris paravapedata*
23. *Magelona* sp.
24. *Magelona obockensis*
25. *Magelona riojai*
26. *Mediomastus californiensis*
27. *Mesochaetopterus* sp.
28. *Micronephtys* sp.
29. *Micronephtys minuta*
30. *Minuspio* sp.
31. *Nephtys* sp.
32. *Nephtys bucera*
33. *Nephtys picta*
34. *Nereis acumulata*
35. *Notomastus hemipodus*
36. *Onuphis eremita oculata*
37. *Ophelia* sp.
38. *Ophelina* sp.
39. *Orbiniid* sp.
40. *Owenia fusiformis*
41. *Paranaites speciosa*
42. *Paraonides* sp.
43. *Paraonides lyra*
44. *Paraonis fulgens*
45. *Paraprionospio pinnata*
46. *Pectinaria gouldia*
47. *Phyllodoce arenae*
48. *Phyllodoce* sp.
49. *Podarmus* sp.
50. *Poecilochaetus johnsoni*
51. *Polydora* sp.
52. *Prionospio cirrifera*
53. *Prionospio cristata*
54. *Scolelepis* sp.
55. *Scolelepis squamata*
56. *Scolelepis texana*
57. *Scoloplos foliosus*
58. *Scoloplos fragilis*
59. *Scoloplos robustus*
60. *Scoloplos rubta*
61. *Sigambra bassi*
62. *Spiochaetopterus oculatus*
63. Unidentified spionid
64. *Spio pettiboneae*
65. *Spiophanes bombyx*
66. *Sthenelais* sp.
67. *Syllides setosa*
68. *Travisia* sp.
69. *Trochochaeta* sp.

Table 15. Checklist of benthic animals.--Continued

OLIGOCHAETA (Marine "earth" worms)
Unidentified sp.

GASTROPODA (Snails)
1. *Acteocina candei*
2. *Acteon punctostriatus*
3. *Creseis acicula*
4. *Diastoma varium*
5. *Hastula salleana*
6. *Nassarius acutus*
7. *Natica pusilla*
8. *Oliva sayana*
9. *Olivella dealbata*
10. *Olivella mutica*
11. *Polinices duplicatus*
12. *Terebra dislocata*

PELECYPODA (Clams)
1. *Anadara floridana*
2. *Barbatia* sp.
3. *Chione cancellata*
4. *Chione grus*
5. *Cuna dalli*
6. *Donax texasianus*
7. *Ervilia concentrica*
8. *Lepton* sp.
9. *Lucina multilineata*
10. *Periploma inequale*
11. *Pitar simpsoni*
12. *Strigilla mirabilis*
13. *Tellina versicolor*
14. Unidentified venerid (nr. *Gouldia*)

PYCNOGONIDA (Sea spiders)
Unidentified sp.

OSTRACODA (Ostracods)
Unidentified sp.

STOMATOPODA (Mantis shrimps)
Coronis excavatrix

CUMACEA (Cumacea)
1. *Cyclaspis varians*
2. *Mancocuma* n. sp.
3. *Oxyruostylis smithi*
4. Unidentified sp.

ISOPODA (Pill bugs)
1. *Ancinus depressus*
2. *Chiridotea excavata*
3. *Scyphacella arenicola*

AMPHIPODA (Sand hoppers)
1. *Acanthohaustorius*
2. *Ampelisca* n. sp. A
3. *Ampelisca* sp. B
4. *Batea catharinensis*
5. Unidentified caprellid sp. A
6. Unidentified caprellid sp. B
7. *Ericthonius* n. sp.
8. *Haustorius* n. sp.
9. *Listriella* n. sp.
10. *Lysianopsis* sp.
11. *Monoculodes* n. sp.
12. *Monoculodes nyei*
13. *Nototropis* n. sp.
14. *Parahaustorius* n. sp. A
15. *Parahaustorius* n. sp. B
16. *Protohaustorius* n. sp.
17. *Pseudohaustorius* n. sp.
18. *Pseudoplatyischnopus* n. sp. A
19. *Pseudoplatyischnopus* n. sp. B
20. *Synchelidium* n. sp.
21. *Talorchestia* n. sp.
22. *Tiron* sp.

PENAEIDEA (Swimming shrimp)
1. *Penaeus duorarum*
2. *Sicyonia brevirostris*
3. *Trachypenaeus constrictus*

Table 15: Checklist of benthic animals.--Continued

CARIDEA
1. *Ambidexter symmetricus*
2. *Ogyrides alphaerostris*
3. *Processa hemphilli*
4. *Processa vicina*
5. *Tozeuma cornutum*

CALLIANASSIDAE (Mud shrimps)
Unidentified sp.

ANOMURA (Crabs)
1. *Albunea paratii*
2. *Emerita benedicti*
3. *Emerita talpoida*
4. *Lepidopa benedicti*
5. *Pagurus longicarpus*

BRACHYURA (True crabs)
1. *Arenaeus cribrarius*
2. *Dissodactylus mellitae*
3. *Ovalipes ocellatus*
4. *Pinnixa cristata*
5. *Pinnixa sayana*
6. *Pinnixa lunzi*
7. *Pinnotheres maculatus*
8. *Portunus gibbesii*
9. *Portunus spinimanus*
10. *Ranilia muricata*
11. Unidentified xanthid

SIPUNCULIDA (Sipunculids)
Sipunculus longipapillosus

ASTEROIDEA (Starfish)
Astropecten articilatus

OPHIUROIDEA (Brittle stars)
1. *Amphipolis squamata*
2. *Ophiophragnus filograneus*
3. *Ophiophragnus wurdemanni*
4. Unidentified sp. A
5. Unidentified sp. B

ECHINOIDEA (Heart urchins)
1. *Mellita quinquiesperforata*
2. Unidentified sp.

HOLOTHUROIDEA (Sea cucumbers)
Unidentified sp.

HEMICHORDATA (Acorn worms)
Unidentified sp.

CEPHALOCHORDATA (Lancelets)
Branchiostoma floridae

PISCES (Fishes)
1. *Anchoa* sp.
2. *Cynoscion nebulosus*
3. *Eucinostomus* sp.
4. *Hemipteronotus novacula*
5. *Leiostomus xanthurus*
6. *Microgobius carri*
7. *Myrophis punctatus*
8. Unidentified ophidiid
9. *Symphurus plaguisa*

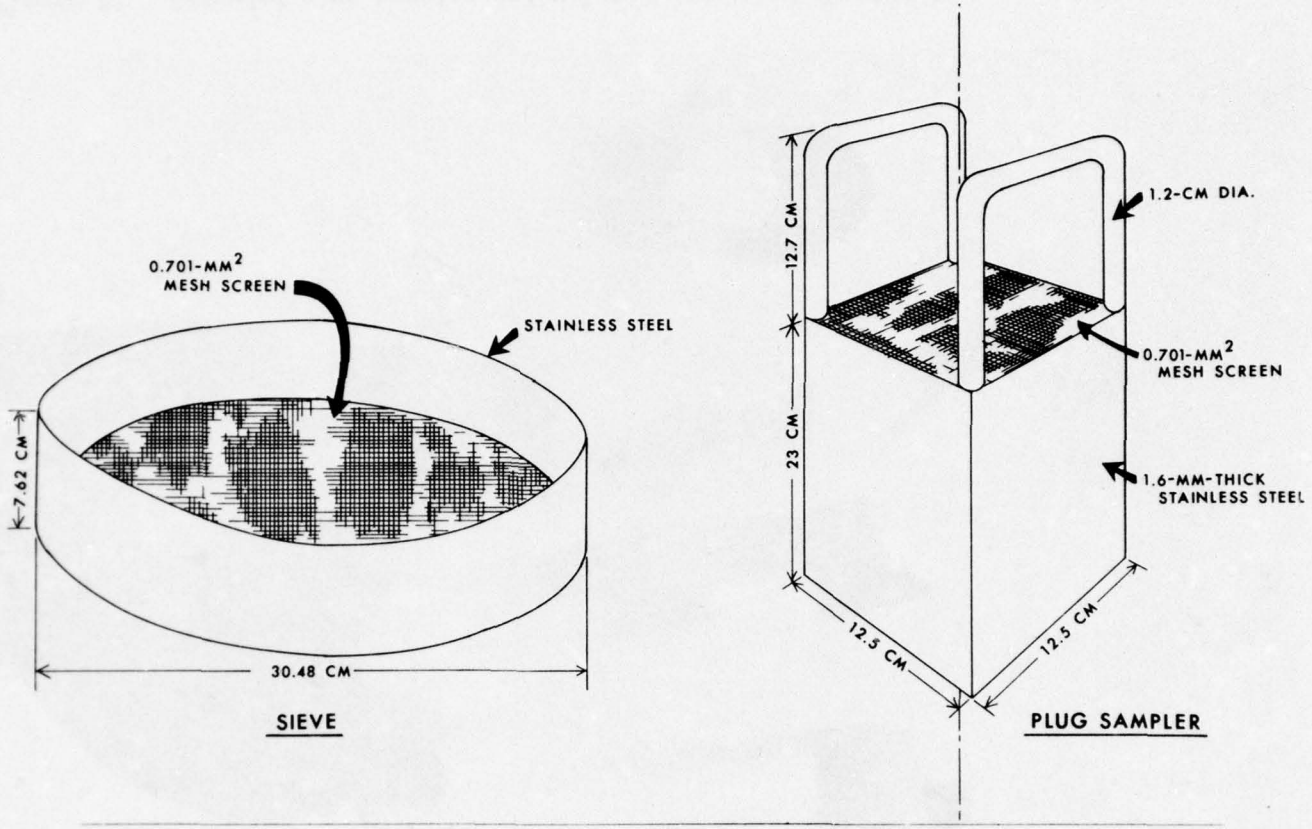

Figure 21. Plug sampler and sieve used for quantitative benthic studies.

Figure 22. Extruded plug samples and related gear used for benthic sampling.

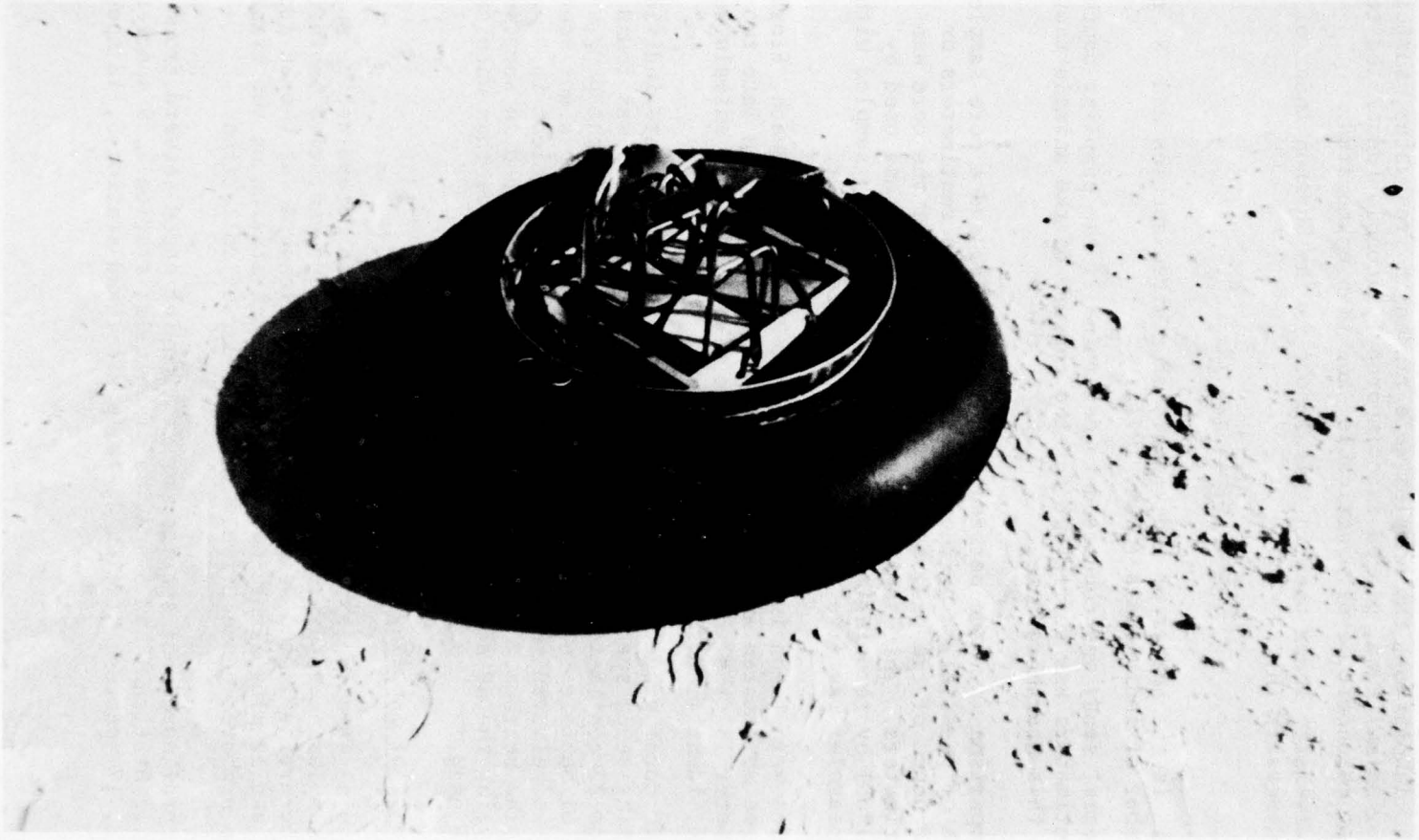

Figure 23. A large inner tube and tub with four plug samplers before sampling.

At the laboratory, the samples were rinsed in freshwater, sorted into major animal taxa, placed into isopropyl alcohol, identified to the lowest taxonomic level practicable, and then enumerated.

The diversity index used in this report is the Shannon index of general diversity ($\bar{H}$):

$$\bar{H} = -\Sigma\left(\frac{ni}{N}\right) \log \left(\frac{ni}{N}\right)$$

where ni is the number of individuals of a given species and N the total number of individuals (Odum, 1971).

A special study was conducted to determine if the sampling depth of of 23 centimeters was sufficient for the capture of the animals that lived in this nearshore zone.

A comparison was made between the plug sampler and a core sampler. The depth of penetration by the core sampler was 46 centimeters or twice the depth of the plug sampler. The diameter of the core was 6.35 centimeters. This sampler was modified from the one used by Taylor (1965) by removing the flange. The surface area sampled with the plug sampler was five times that of the core sampler.

Samples were taken in the swash zone of Panama City Beach, Florida. Forty cores were taken and each extracted core was divided into two 23-centimeter lengths. The contents were sieved, and the animals were preserved, identified, and enumerated.

The 40 cores produced a total of 38 benthic invertebrate individuals representing seven species. Only 1 of the 38 individuals was found in the bottom 23-centimeter part of the core sample. The eight plug samples produced 61 benthic invertebrate individuals representing eight species. Thus, it is believed that the plug sampler is more efficient in sampling the benthos. Also, the time and effort expended in sampling and analyzing the 40 cores are about five times greater than when eight plugs are used.

3. Adequacy of Sampling.

A special sampling experiment was conducted to determine the number of plug samples necessary to obtain a list of representative benthic species occurring in the sampling area. One transect was chosen for sampling and 12 plug samples were taken at each station on the transect. They were numbered consecutively in the order of collection.

The total number of species per station increased seaward from station 1. Station 1 had 5 species of animals; station 2, 9 species; station 3, 17 species; station 4, 18 species; and station 5, 18 species.

The accumulative number of species was plotted against the number of samples (Fig. 24). The percentages of the total number of species occurring in the first four samples for each station were: Station 1, 100 percent; station 2, 88.9 percent; station 3, 70.6 percent; station 4, 88.9 percent; and station 5, 94.4 percent. In all cases, the additional species occurring in samples 5 to 12 were represented by a single individual.

The percentage of individuals collected in the first four samples at stations 2 to 5 was about 33 percent of the total. At station 1, the percentage of individuals occurring in the first four samples was only 15 percent. This is probably due to the low diversity of animals and the clumping of the abundant animals.

Based on the above information, four plug samples per station were deemed sufficient to determine species composition and their abundance.

4. Results.

Benthic plug sampling in the nearshore zone of the Gulf of Mexico produced 26 major macroinvertebrate taxa and 170 species. In addition, nine species of fish were also taken in the samples (Table 15). The most abundant taxon in terms of species was the polychaetes with 69 species. Other abundant taxa in decreasing order were Amphipoda (22 species); Pelecypoda (14 species); Gastropoda (12 species); and Brachyura (11 species). Thirteen major taxa were represented by a single species (Table 15).

Analysis of the benthic animals will be divided into several sections. The numbers of species and individuals vary by distance from shore, by season, and to a lesser extent by transect.

The numbers of individuals of each species caught per sampling trip at each station are listed by station in Appendix F. Numbers are totals of four plug samples taken during each station visit.

a. Distance From Shore. The number of species occurring at the six different sites in relation to distance from shore varied considerably. Station 1, located in the swash zone, had the least number of species; station 5 had the highest (Table 16). Stations A and B, located in 30 feet of water, had the highest average number of individuals per sample.

The benthic macroinvertebrate fauna in the nearshore zone from the swash zone out to the 10-foot depth consists principally of 14 species. These 14 species constitute at least 80 percent of the individuals occurring at stations 1 to 5 on the nine transect lines sampled. Each

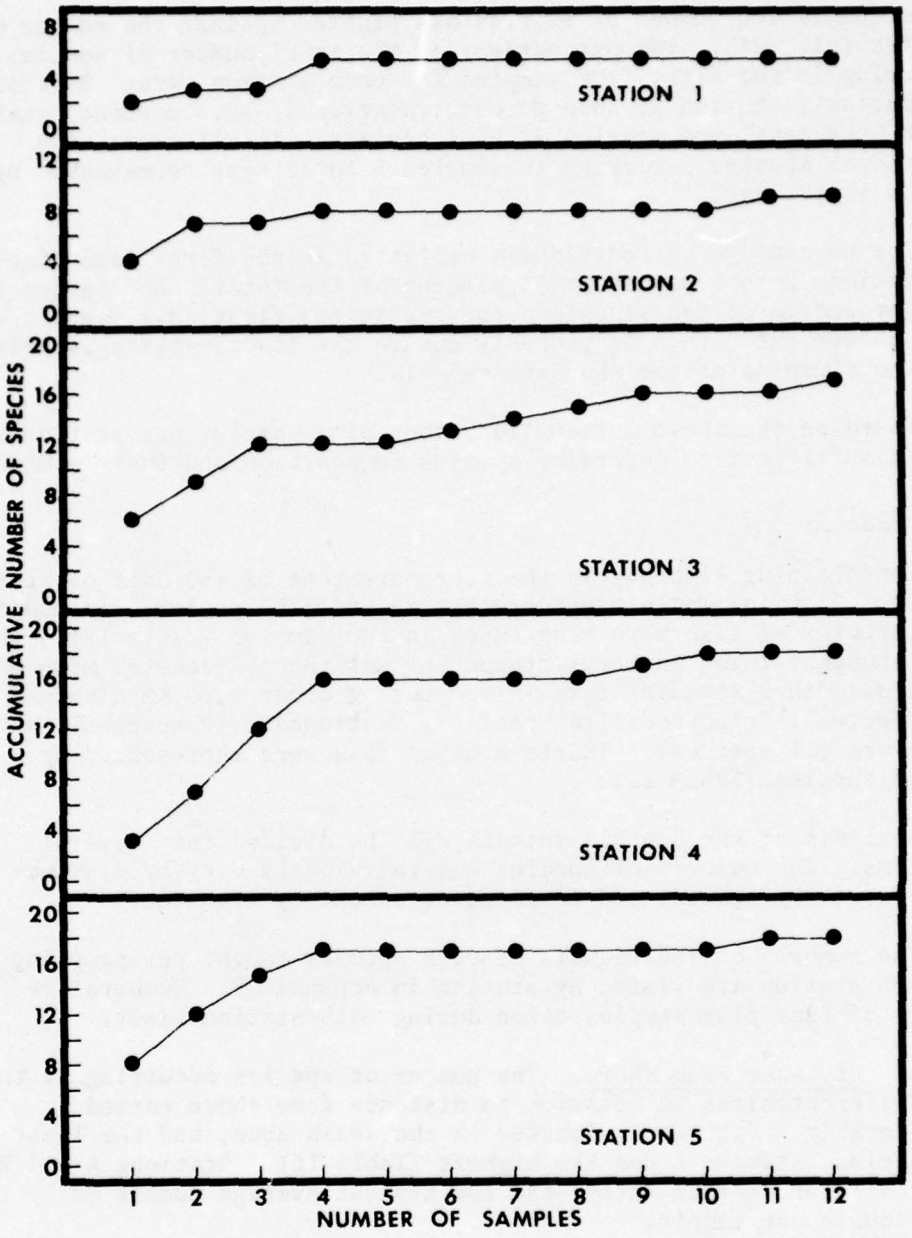

Figure 24. Accumulative number of species taken in 12 plug samples at five stations.

Table 16. Number of species, individuals, and samples collected at each station and the average number of individuals per sample.[1]

Station	Location	Species	Individuals	Samples	Individuals per sample (avg.)
1	Swash zone	26	18,127	108	168
2	First sandbar	33	6,047	48	126
3	Between first and second sandbar	88	8,106	48	169
4	Second sandbar	78	4,905	48	102
5	10-foot depth seaward of second sandbar	89	5,371	48	112
A	30-foot depth	78	862	4	216
B	30-foot depth	80	1,158	4	290
Total or average		179	44,576	308	145

[1]At each station (1 to 5) the data represent the sum from all nine transects.

of the five stations represents different habitats in the sampling area, and at each station the abundance of species changes. There are several species abundant at more than one station, but no single species was the dominant one at all five stations (Table 17). The following is a detailed composition of benthic macroinvertebrates at each of the five transect stations, plus the two sites (A and B) in 30 feet of water.

(1) Station 1. This station, located in the swash zone, produced 25 species of macroinvertebrates plus one species of fish in 12 months of sampling (Table 18). Four species dominated the catch, constituting over 99 percent of the individuals. The most abundant animal was the polychaete, *Scolelepis squamata*, representing 44.2 percent of the individuals. The common pelecypod, *Donax texasianus*, ranked second with 41 percent; the anomuran, *Emerita talpoida*, was third with 8.6 percent; and an amphipod, *Haustorius* n. sp., was fourth in abundance representing 5.5 percent of the individuals.

The number of species in the major animal groups varied from a high of six for amphipods, four of which are new species, to nine taxa which were represented by a single species (Table 18).

Seasonally, the highest number of individuals occurred during May and June (68 percent of the individuals) with a secondary peak in February. The month of least abundance was November, followed by December, August, September, and October. The number of species was highest in July and August, and lowest in November and January (Table 18).

(2) Station 2. This station was located on the first sandbar and was represented by 31 species of macroinvertebrates and 2 species of fish (Tables 16 and 19). It was sampled quarterly on all nine transects. Four species dominated the catch. They constituted 94 percent of the individuals. Three of the four species were also abundant at station 1. The pelecypod, *D. texasianus*, was clearly the dominant animal, representing 72.2 percent of the individuals. The other three species in decreasing order of abundance (Table 19) were: *Haustorius* n. sp. (8.8 percent); *S. squamata* (7.8 percent); and the cumacean, *Mancocuma* sp. Ten of the 31 macroinvertebrate species were represented by only one specimen at station 2.

The number of species in the major animal groups varied from seven for polychaetes and amphipods to one for each of 10 other major taxa (Table 19). Six of the seven species of amphipods at station 2 were new species.

Seasonally, the highest number of individuals (85 percent) occurred

Table 17. Percentage of the species comprising over 80 percent of the individuals at the five transect stations.

Species	Stations				
	1	2	3	4	5
POLYCHAETA					
Dispio uncinata	----	----	----	6.4	----
Magelona riojai	----	----	----	----	2.9
Paraonis fulgens	----	----	----	5.3	----
Scolelepis squamata	44.2	7.8	----	----	----
Spio pettiboneae	----	----	4.9	----	6.8
PELECYPODA					
Donax texasianus	41.0	72.2	28.0	17.1	----
Ervilia concentrica	----	----	----	----	5.8
CUMACEA					
Mancocuma sp.	----	5.2	----	----	----
AMPHIPODA					
Acanthohaustorius n. sp.	----	----	30.7	37.9	28.4
Haustorius n. sp.	5.5	8.8	----	----	----
Protohaustorius n. sp.	----	----	10.9	8.6	18.7
Pseudohaustorius n. sp.	----	----	7.0	7.9	10.0
ANOMURA					
Emerita talpoida	8.6	----	----	----	----
CEPHALOCHORDATA					
Branchiostoma floridae	----	----	----	----	7.7
TOTAL	99.3	94.0	81.5	83.2	80.3

Table 18. Number of individuals of each species collected from the nine transects at station 1.

Species	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
NEMERTINEA													
Unidentified sp.	-	2	-	-	-	-	1	-	-	-	-	-	3
NEMATODA													
Unidentified sp. A	-	-	-	-	-	-	1	-	-	1	-	-	2
POLYCHAETA													
Paraonis fulgens	3	27	-	7	-	-	-	-	1	-	-	-	38
Prionospio cristata	-	-	-	-	2	-	-	-	-	-	-	-	2
Scolelepis squamata	-	-	3	4	1	41	4,231	3,188	374	87	20	60	8,009
GASTROPODA													
Creseis acicula	-	-	-	-	-	-	-	-	-	1	-	-	1
PELECYPODA													
Barbatia sp.	-	-	-	-	-	-	-	-	1	-	-	-	1
Chione gnus	-	-	-	-	-	-	-	-	1	-	-	-	1
Cuna dalli	-	-	-	-	-	-	-	1	-	-	-	-	1
Donax texasiana	56	297	835	1,045	157	389	2,827	1,545	240	18	17	10	7,436
PYCNOGONIDA													
Unidentified sp.	-	-	-	-	-	-	-	-	-	1	-	-	1
CUMACEA													
Mancocuma sp.	-	-	-	1	-	-	16	-	-	-	-	-	17
ISOPODA													
Scyphacella arenicola	-	-	-	-	-	-	-	-	-	-	1	-	1
AMPHIPODA													
Batea catharinensis	-	-	-	-	-	-	-	-	1	-	-	-	1
Eriothonius n. sp.	-	-	-	-	-	-	-	-	1	33	-	-	34
Haustorius n. sp.	24	14	20	64	234	169	88	11	42	81	82	164	993
Nototropis n. sp.	-	-	-	-	-	-	-	-	-	5	-	-	5
Pseudohaustorius n. sp.	-	-	-	-	1	-	-	-	-	-	-	-	1
Unidentified caprellid sp. B	-	-	-	-	-	-	-	-	1	1	-	-	2
ANOMURA													
Emerita talpoida	3	83	109	37	44	41	218	202	72	256	303	187	1,555
Lepidopa benedicti	-	1	-	9	-	1	1	-	2	1	1	1	17
BRACHYURA													
Pinnixa cristata	-	-	-	-	-	-	1	-	-	-	-	-	1
Pinnotheres maculatus	-	-	-	-	-	1	-	-	-	-	-	-	1
OPHIUROIDEA													
Ophiophragmus wurdemanni	-	1	-	-	-	-	-	-	-	-	-	-	1
CEPHALOCHORDATA													
Branchiostoma floridae	-	-	-	-	-	-	-	-	-	1	-	-	1
PISCES													
Leiostomus xanthurus	-	-	-	2	-	-	-	-	-	-	-	-	2
TOTAL	86	425	967	1,169	439	642	7,384	4,947	736	486	424	422	18,127

Table 19. Number of individuals of each species collected from the nine transects at station 2.

Species	Nov.	Feb.	May	Aug.	Total
NEMERTINEA					
Unidentified sp.	3	-	7	6	16
NEMATODA					
Unidentified sp.	-	-	2	3	5
POLYCHAETA					
Dispio uncinata	-	-	-	5	5
Lumberineris paravapedata	-	1	-	-	1
Nephtyid sp.	-	-	1	-	1
Nephtys bucera	-	-	1	-	1
Paraonis fulgens	8	46	53	22	129
Scolelepis squamata	-	62	289	119	470
Spionid sp.	-	-	-	1	1
GASTROPODA					
Creseis acicula	-	-	-	7	7
Diastoma varium	-	-	-	6	6
Hastula salleana	-	-	2	-	2
PELECYPODA					
Donax texasianus	135	46	4,134	52	4,367
Ervilia concentrica	1	-	-	-	1
CUMACEA					
Mancocuma sp.	-	10	294	10	314
ISOPODA					
Ancinus depressus	-	5	10	2	17
AMPHIPODA					
Acanthohaustorius n. sp.	-	-	-	3	3
Ericthonius n. sp.	-	-	-	78	78
Haustorius n. sp.	48	152	284	51	535
Nototropis n. sp.	-	-	-	19	19
Parahaustorius n. sp.	-	1	6	9	16
Pseudohaustorius n. sp.	-	-	2	-	2
Talorchestia inexpectata	-	-	-	1	1
PENAEIDEA					
Penaeus duorarum	-	-	-	4	4

Table 19. Number of individuals of each species collected from the nine transects at station 2.--Continued

Species	Nov.	Feb.	May	Aug.	Total
CARIDEA					
Tozeuma cornutum	-	-	-	1	1
ANOMURA					
Emerita talpoida	2	6	16	1	25
Lepidopa benedicti	-	-	1	-	1
BRACHYURA					
Pinnixa cristata	-	-	11	-	11
OPHIUROIDEA					
Ophiophragnus wurdemanni	-	1	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	1	1	-	-	2
PISCES					
Cynoscion nebulosus	-	-	-	1	1
Leiostomus xanthurus	-	3	-	-	3
TOTAL	198	334	5,113	402	6,047

in May. The great abundance of *D. texasianus* in May was the principal factor. November samples had the least number of individuals. The number of species gradually increased from a low of 7 in November to a high of 22 in August (Table 19).

(3) Station 3. Station 3 was located between the first and second sandbars, and was represented by 85 species of macroinvertebrates and 3 species of fish. This station was also sampled quarterly on all nine transects and produced the highest number of individuals per sample of the five stations on transects (Table 16). The number of species was nearly triple the numbers from stations 1 and 2. Five species were abundant at this station, and accounted for 81.5 percent of the individuals. The pelecypod, *D. texasianus*, again was one of the most abundant species with 28 percent of the individuals. The species with the next highest number of individuals was another new species of amphipod, *Acanthohaustorius* n. sp. It represented 31 percent of the individuals. The two species ranked third and fourth in abundance were also new species of amphipods. Collectively, the three amphipods species accounted for almost 49 percent of the individuals. The other two new species of amphipods were *Protohaustorius* n. sp., and *Pseudohaustorius* n. sp. Ranked fifth in abundance was a polychaete, *Spio pettiboneae*, representing 5 percent of the individuals. The polychaete, *S. squamata*, which was abundant at stations 1 and 2, occurred only in the February samples and represented only 0.09 percent of the total catch or 0.8 percent of the polychaetes (Table 20). Twenty-three of the 85 species of macroinvertebrates were represented by only one specimen at station 3.

The number of species in the major animal groups varied from 25 species per taxon (Polychaeta) to 1 per taxon; 12 major taxa were represented only by a single species (Table 20). Three of the 25 species of polychaetes (*S. pettiboneae*, *Dispio uncinata*, and *Paraonis fulgens*) accounted for 85.6 percent of the polychaetes. Nine of the 13 species of amphipods were new species; collectively, these 9 species accounted for 99.6 percent of the amphipods and 49.6 percent of the total individuals at station 3. Since *D. texasianus* was clearly the dominant bivalve, accounting for 94 percent of the pelecypods (Table 20), the number of species of pelecypods increased substantially to 10.

Seasonally, the highest number of individuals occurred in May. The two most abundant animals were *D. texasianus* and *Acanthohaustorius* n. sp. The month with the least number of individuals was February. The month of August again had the highest number of species; February had the least at station 3 (Table 20).

(4) Station 4. Station 4 was located on the second sandbar,

Table 20. Number of individuals of each species collected from the nine transects at station 3.

Species	Nov.	Feb.	May	Aug.	Total
ACTINIARIA					
Unidentified sp.	-	-	-	1	1
TURBELLARIA					
Unidentified sp.	-	1	-	-	1
NEMERTINEA					
Unidentified sp.	9	9	24	12	54
NEMATODA					
Unidentified sp. A	-	5	2	3	10
POLYCHAETA					
Armandia maculata	-	-	1	-	1
Brania wellfleetensis	-	1	-	-	1
Bravia clavata	-	1	-	-	1
Dispio uncinata	-	1	15	239	255
Eteone heteropoda	-	-	1	-	1
Magelona riojai	1	1	25	19	46
Micronephtys sp.	-	1	-	-	1
Micronephtys minuta	-	-	2	-	2
Nephtyid sp.	-	-	-	2	2
Nephtys bucera	-	-	7	9	16
Ophelia sp.	2	-	-	-	2
Ophelina sp.	-	-	-	1	1
Orbiniid sp.	-	-	-	1	1
Paraonis fulgens	31	37	15	35	118
Phyllodoce arenae	-	-	-	2	2
Podarmus sp.	-	-	1	-	1
Prionospio cristata	2	-	-	-	2
Scolelepis squamata	-	7	-	-	7
Scolelepis texana	-	2	-	1	3
Scoleplos fragilis	-	-	-	3	3
Scolopolos feliosus	-	-	-	5	5
Spionid sp.	-	-	1	5	6
Spio pettiboneae	-	-	224	176	400
Spiophanes bombyx	-	-	19	2	21
Syllides setosa	5	-	-	-	5
OLIGOCHAETA					
Unidentified sp.	-	3	1	4	8

Table 20. Number of individuals of each species collected from the nine transects at station 3.--Continued

Species	Nov.	Feb.	May	Aug.	Total
GASTROPODA					
Oliva sayana	1	1	-	-	2
Olivella mutica	-	-	1	3	4
Polinices duplicatus	-	-	-	3	3
PELECYPODA					
Anadara floridana	-	-	-	1	1
Chione grus	1	-	-	1	2
Cuna dalli	4	12	5	3	24
Donax texasianus	23	34	2,210	1	2,268
Ervilia concentrica	72	2	8	-	82
Lucina multineata	-	-	-	1	1
Pitar simpsoni	2	-	-	-	2
Strigilla mirabilis	-	-	-	2	2
Tellina versicolor	-	-	-	2	2
Unidentified venerid (nr. *Gouldia*)	-	18	12	-	30
STOMATOPODA					
Coronis excavatrix	-	-	8	-	8
CUMACEA					
Cyclaspis varians	-	-	-	1	1
Mancocuma sp.	-	-	2	4	6
Unidentified sp.	-	-	-	10	10
ISOPODA					
Ancinus depressus	6	2	2	8	18
Chiridotea excavata	1	-	2	2	5
AMPHIPODA					
Acanthohaustorius n. sp.	451	516	1,016	502	2,485
Batea catharinensis	-	1	-	-	1
Unidentified caprellid sp. A	-	5	2	-	7
Erichthonius n. sp.	-	-	-	4	4
Haustorius n. sp.	5	1	5	-	11
Monoculodes n. sp.	1	-	-	-	1
Monoculodes nyei	-	-	2	3	5
Parahaustorius n. sp.	4	4	6	3	17
Parahaustorius sp.	1	-	-	-	1
Protohaustorius n. sp.	68	149	397	270	884

Table 20. Number of individuals of each species collected from the nine transects at station 3.--Continued

Species	Nov.	Feb.	May	Aug.	Total
AMPHIPODA					
Pseudohaustorius n. sp.	165	143	105	156	569
Pseudoplatyischnopus n. sp. A	1	-	-	-	1
Synchelidium n. sp.	10	8	23	5	46
CARIDEA					
Ambidexter symmetricus	-	-	-	1	1
Ogyrides alphaerostris	5	-	47	25	77
Processa hemphilli	-	-	4	-	4
CALLIANASSIDAE					
Unidentified sp.	-	-	36	7	43
ANOMURA					
Emerita benedicti	1	-	-	-	1
Emerita talpoida	-	2	-	-	2
Lepidopa benedicti	-	-	2	1	3
Pagurus longicarpus	-	-	5	7	12
BRACHYURA					
Dissodactylus mellitae	-	-	2	1	3
Pinnixa cristata	-	-	13	9	22
Pinnixa lunzi	-	-	-	1	1
Pinnotheres maculatus	-	-	10	-	10
Portunus gibbesii	-	-	4	2	6
SIPUNCULIDA					
Sipunculus longipapillosus	19	2	-	1	22
OPHIUROIDEA					
Amphipholis squamata	3	-	-	-	3
Ophiophragnus filograneus	-	-	-	1	1
Ophiophragnus wurdemanni	-	1	-	-	1
Unidentified sp. A	1	-	-	-	1
Unidentified sp. B	3	-	-	-	3
ECHINOIDEA					
Mellita quinquiesperforata	22	7	73	40	142
HOLOTHUROIDEA					
Unidentified sp.	1	-	3	1	5

Table 20. Number of individuals of each species collected from the nine transects at station 3.--Continued

Species	Nov.	Feb.	May	Aug.	Total
HEMICHORDATA					
Unidentified sp.	6	8	7	1	22
CEPHALOCHORDATA					
Branchiostoma floridae	196	37	1	3	237
PISCES					
Eucinostomus sp.	1	-	-	-	1
Myrophis punctatus	1	-	-	-	1
Unidentified ophidiid	-	-	1	1	2
TOTAL	1,125	1,022	4,352	1,607	8,106

and was represented by 78 macroinvertebrate species. This station was also sampled quarterly on all nine transects and produced the lowest average number of individuals per sample (Table 16). The five most abundant species accounted for 77.9 percent of the individuals. The dominant animal was a new species of amphipod, *Acanthohaustorius* n. sp., representing 38 percent of the individuals. The other abundant species in decreasing order were the pelecypod, *D. texasianus* (17 percent), amphipods, *Protohaustorius* n. sp. (9 percent) and *Pseudohaustorius* n. sp. (8 percent), and a polychaete, *D. uncinata* (6 percent). Collectively, the three species of amphipods accounted for over 54 percent of the individuals (Table 21). The dominant polychaete at this station was different than at the three shoreward stations; however, both *S. squamata* and *S. pettiboneae* were present at station 4.

Polychaeta was the most diverse animal taxon with 26 species. Other major taxa with numerous species were Pelecypoda, Amphipoda, and Brachyura with nine, eight, and seven species, respectively. Eleven of the major taxa were represented by a single species (Table 21). Two of the polychaete species (*D. uncinata* and *P. fulgens*) accounted for 73 percent of the polychaetes. Seven of the eight amphipod species were new species; collectively, they accounted for 99.6 percent of the amphipods and 55.7 percent of the total individuals at station 4. *Donax texasianus* remained the dominant bivalve and represented 96.4 percent of the pelecypods (Table 21).

Seasonally, the highest number of individuals occurred in May. The two most abundant animals were *D. texasianus* and *Acanthohaustorius* n. sp. These two were also the dominant animals at station 3 during May. February was the month with the least individuals. The month of May was also represented by the highest number of species. At all shoreward stations, August had the highest number of species. The lowest number of species occurred during February (Table 21).

(5) Station 5. Station 5 was located seaward of the second sandbar in 10 feet of water. It was represented by 86 macroinvertebrate species and 3 species of fish. This station was also sampled quarterly and had the second lowest average number of individuals per sample (Table 16). The five most abundant species accounted for 71.5 percent of the individuals. The dominant species was a new amphipod species, *Acanthohaustorius* n. sp., representing 28 percent of the total individuals. This species was also the dominant animal at stations 3 and 4. Two other new species of amphipods (*Protohaustorius* n. sp. and *Pseudohaustorius* n. sp.) were ranked second and third in abundance with 19 and 10 percent of the total individuals, respectively. Collectively, the three new species of amphipods accounted for 57 percent of the total individuals at station 5. The fourth ranked species was the lancelet, *Branchiostoma floridae*, with 8 percent of the

Table 21. Number of individuals of each species collected from the nine transects at station 4.

Species	Nov.	Feb.	May	Aug.	Total
TURBELLARIA					
Unidentified sp.	-	-	1	-	1
NEMERTINEA					
Unidentified sp.	4	3	18	11	36
NEMATODA					
Unidentified sp. A	10	2	-	5	17
Unidentified sp. B	-	-	1	-	1
POLYCHAETA					
Armandia maculata	-	-	1	-	1
Bravia clavata	-	-	-	1	1
Dispio uncinata	-	-	15	300	315
Glycera oxycephala	-	-	-	1	1
Gyptis vittata	1	-	-	-	1
Locinea viridis	-	1	-	-	1
Lumbrineris sp.	-	1	-	-	1
Magelona obockensis	-	-	2	-	2
Magelona riojai	3	2	10	29	44
Magelona sp.	-	-	-	2	2
Micronephtys minuta	-	-	1	-	1
Micronephtys sp.	-	-	1	-	1
Nephtys bucera	-	-	4	10	14
Nephtys sp.	-	-	-	1	1
Onuphis eremita oculata	-	-	-	2	2
Ophelia sp.	3	-	-	-	3
Orbiniid sp.	-	-	-	1	1
Paraonis fulgens	6	24	77	155	262
Prionospio cristata	8	-	1	-	9
Scolelepis squamata	-	28	17	3	48
Scoleplos fragilis	-	-	-	2	2
Scolopolos foliosus	-	-	1	1	2
Spionid sp.	-	-	1	3	4
Spio pettiboneae	-	-	19	29	48
Spiophanes bombyx	-	-	4	-	4
Syllides setosa	17	-	-	-	17
OLIGOCHAETA					
Unidentified sp.	2	1	-	-	3

Table 21. Number of individuals of each species collected from the nine transects at station 4.--Continued

Species	Nov.	Feb.	May	Aug.	Total
GASTROPODA					
Natica pusilla	-	-	-	1	1
Oliva sayana	1	-	-	-	1
Olivella mutica	-	1	-	4	5
Polinices duplicatus	-	-	1	-	1
PELECYPODA					
Cuna dalli	7	1	-	1	9
Donax texasianus	4	16	818	-	838
Ervilia concentrica	2	3	2	1	8
Lepton sp.	1	-	-	-	1
Lucina multilineata	-	-	-	2	2
Pitar simpsoni	1	2	-	-	3
Strigilla mirabilis	-	-	4	-	4
Tellina versicolor	1	-	-	-	1
Unidentified venerid (nr. *Gouldia*)	-	1	2	-	3
STOMATOPODA					
Coronis excavatrix	-	1	-	-	1
CUMACEA					
Cyclaspis varians	-	-	-	2	2
Mancocuma sp.	-	-	3	1	4
Unidentified sp.	-	-	1	30	31
ISOPODA					
Ancinus depressus	10	3	27	4	44
Chiridotea excavata	4	-	8	-	12
AMPHIPODA					
Acanthohaustorius n. sp.	362	228	821	449	1,860
Ericthonius n. sp.	-	-	-	1	1
Haustorius n. sp.	6	-	4	-	10
Monoculodes nyei	-	-	2	9	11
Parahaustorius n. sp.	-	8	13	-	21
Protohaustorius n. sp.	35	10	160	215	420
Pseudohaustorius n. sp.	90	68	30	198	386
Synchelidium n. sp.	1	10	15	9	35

Table 21. Number of individuals of each species collected from the nine transects at station 4.--Continued

Species	Nov.	Feb.	May	Aug.	Total
CARIDEA					
Ogyrides alphaerostris	1	-	7	25	33
Processa vicina	-	-	1	-	1
CALLIANASSIDAE					
Unidentified sp.	-	-	11	-	11
ANOMURA					
Emerita benedicti	-	2	-	-	2
Emerita talpoida	1	-	6	1	8
Lepidopa benedicti	-	-	-	1	1
Pagurus longicarpus	-	-	1	2	3
BRACHYURA					
Arenaeus cribrarius	-	-	-	1	1
Dissodactylus mellitae	-	-	-	2	2
Ovalipes ocellatus	-	-	1	-	1
Pinnixa cristata	-	1	13	11	25
Pinnixa lunzi	-	-	-	1	1
Pinnotheres maculatus	-	-	3	-	3
Portunus gibbesii	-	-	4	-	4
SIPUNCULIDA					
Sipunculus longipapillosus	4	-	-	-	4
OPHIUROIDEA					
Unidentified sp. A	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	2	2	10	36	50
HOLOTHUROIDEA					
Unidentified sp.	-	-	5	2	7
HEMICHORDATA					
Unidentified sp.	1	1	1	-	3
CEPHALOCHORDATA					
Branchiostoma floridae	177	2	1	3	183
TOTAL	766	422	2,149	1,568	4,905

individuals. The polychaete, *S. pettiboneae*, was fifth in abundance representing 7 percent of the total individuals (Table 22).

Polychaeta was the most diverse animal taxon with 34 species. The other major taxa with numerous species were Amphipoda, Pelecypoda, Gastropoda, and Brachyura with eight, eight, six, and six species, respectively. Thirteen of the major taxa were represented by a single species (Table 22). The dominant species of polychaetes were represented by four species, accounting for 83 percent of the polychaete individuals. These species in decreasing order of abundance were *S. pettiboneae*, *Magelona riojai*, *Bravia clavata*, and *P. fulgens*. Six of the eight amphipod species were new species; collectively, they accounted for 98.8 percent of the amphipods and 58 percent of the total individuals at station 5. The dominant pelecypod was *Ervilia concentrica* which accounted for 74.7 percent of the bivalves (Table 22). This was the first station where the lancelet, *B. floridae*, became a major species in the total species composition.

Seasonally, the numbers of individuals increased from November through August. The dominant animals in August were the three new species of amphipods. August was also the month with the highest number of species. The 62 species at station 5 in August was the highest for any of the five stations located on the transects. The lowest number of species occurred during February (Table 22).

(6) Station A. Station A was located in 30 feet of water off transect 5 (Fig. 11). It was sampled quarterly and produced 76 macroinvertebrate species and 2 species of fish. Station A had the second highest average number of individuals per sample (Table 16). Unlike the stations located on transects, a particular species was not dominant. The polychaete, *Prionospio cristata*, was the most abundant species but comprised only 15.3 percent of the total individuals. Polychaeta were the dominant animal taxon with 37 species and 43.3 percent of the total individuals. Other species with more than 50 individuals were the lancelet, *B. floridae*, and an amphipod, *Protohaustorius* n. sp. (Table 23).

The number of individuals was highest in May and lowest in November. Numbers of species increased from November through August (Table 23).

(7) Station B. Station B was located in 30 feet of water off transect 8 (Fig. 11). It was sampled quarterly and produced 70 species of macroinvertebrates and 1 species of fish. This station had the highest average of individuals per sample (Table 16). Station B was similar to station A in regards to species dominance. The most abundant species was *P. cristata* which comprised 18.1 percent of the total individuals. Second to *P. cristata* in abundance was the lancelet,

Table 22. Number of individuals of each species collected from the nine transects at station 5.

Species	Nov.	Feb.	May	Aug.	Total
TURBELLARIA					
Unidentified sp.	-	-	1	-	1
NEMERTINEA					
Unidentified sp.	21	40	41	25	127
NEMATODA					
Unidentified sp. A	-	8	5	4	17
POLYCHAETA					
Apoprionospio pygmacea	-	-	1	1	2
Armandia maculata	-	2	5	2	9
Brania wellfleetensis	1	-	-	2	3
Bravia clavata	-	-	-	8	8
Dispio uncinata	-	-	8	135	143
Eteone heteropoda	-	-	-	1	1
Glycera oxycephala	-	-	1	-	1
Magelona obockensis	-	1	-	-	1
Magelona riojai	4	5	56	92	157
Magelona sp.	-	-	-	2	2
Mesochaetopterus sp.	-	-	-	1	1
Micronephtys minuta	-	-	2	-	2
Micronephtys sp.	-	1	-	-	1
Nephtys bucera	-	-	12	12	24
Nephtys picta	-	-	5	-	5
Nephtys sp.	-	-	-	2	2
Nereis acuminata	-	-	-	1	1
Onuphis eremita oculata	-	-	-	3	3
Ophelia sp.	1	-	-	-	1
Paraonis fulgens	2	9	50	54	115
Pectinaria gouldi	1	-	-	-	1
Phyllodoce arenae	-	-	-	1	1
Phyllodoce sp.	1	-	-	-	1
Polydora sp.	-	1	-	-	1
Prionospio cristata	12	-	-	6	18
Scolelepis squamata	-	6	1	1	8
Scolelepis texana	-	3	2	-	5
Scoloplos robustus	-	1	-	-	1
Sigambra bassi	-	-	-	1	1
Unidentified spionid	-	1	-	1	2
Spio pettiboneae	-	-	212	152	364

Table 22. Number of individuals of each species collected from the nine transects at station 5.--Continued

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA					
Spiophanes bombyx	-	-	51	1	52
Sthenelais sp.	-	1	-	-	1
Syllides setosa	-	-	1	-	1
OLIGOCHAETA					
Unidentified sp.	1	2	1	1	5
GASTROPODA					
Hastula salleana	1	3	-	-	4
Nassarius acutus	-	-	-	2	2
Natica pusilla	-	-	-	3	3
Oliva sayana	1	-	1	1	3
Olivella mutica	1	1	-	2	4
Polinices duplicatus	-	-	2	1	3
PELECYPODA					
Cuna dalli	1	-	-	1	2
Donax texasianus	2	3	3	-	8
Ervilia concentrica	8	271	30	1	310
Lepton sp.	-	-	1	-	1
Lucina multilineata	-	-	-	1	1
Strigilla mirabilis	8	1	9	21	39
Tellina versicolor	1	-	2	12	15
Unidentified venerid (nr. *Gouldia*)	1	-	2	12	15
OSTRACODA					
Unidentified sp.	-	-	-	1	1
STOMATOPODA					
Coronis excavatrix	-	1	-	-	1
CUMACEA					
Cyclaspis varians	-	-	3	9	12
Unidentified sp.	-	-	2	29	31
ISOPODA					
Ancinus depressus	3	4	-	2	9
Chiridotea excavata	9	-	20	13	42
Scyphacella arenicola	-	-	-	1	1

Table 22. Number of individuals of each species collected from the nine transects at station 5.--Continued

Species	Nov.	Feb.	May	Aug.	Total
AMPHIPODA					
Acanthohaustorius n. sp.	121	396	496	510	1,523
Haustorius n. sp.	1	1	-	-	2
Monoculodes nyei	4	-	13	21	38
Protohaustorius n. sp.	80	71	432	422	1,005
Pseudohaustorius n. sp.	119	55	107	256	537
Pseudoplatyischnopus n. sp. B	-	-	6	3	9
Synchelidium n. sp.	4	7	30	2	43
Tiron sp.	-	-	1	-	1
CARIDEA					
Ambidexter symmetricus	1	-	-	-	1
Ogyrides alphaerostris	3	6	-	7	16
Processa hemphilli	1	1	11	1	14
CALLIANASSIDAE					
Unidentified sp.	-	-	6	2	8
ANOMURA					
Emerita talpoida	-	-	-	2	2
Lepidopa benedicti	-	-	3	2	5
Pagurus longicarpus	-	-	10	4	14
BRACHYURA					
Dissodactylus mellitae	-	-	-	2	2
Ovalipes ocellatus	-	-	1	-	1
Pinnixa cristata	5	-	9	14	28
Pinnotheres maculatus	-	-	2	-	2
Portunus gibbesii	-	-	5	6	11
Unidentified xanthid	-	-	1	-	1
SIPUNCULIDA					
Sipunculus longipapillosus	1	-	-	-	1
ASTEROIDEA					
Astropecten articulatus	-	-	1	-	1
ECHINOIDEA					
Mellita quinquiesperforata	8	20	9	27	64
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	2	2

Table 22. Number of individuals of each species collected from the nine transects at station 5.--Continued

Species	Nov.	Feb.	May	Aug.	Total
HEMICHORDATA					
Unidentified sp.	1	-	-	1	2
CEPHALOCHORDATA					
Branchiostoma floridae	160	190	41	21	412
PISCES					
Anchoa sp.	-	-	-	1	1
Unidentified ophidiid	-	-	1	2	3
Symphurus plaguisa	-	-	-	1	1
TOTAL	588	1,121	1,743	1,919	5,371

Table 23. Number of individuals of each species collected at station A.

Species	Nov.	Feb.	May	Aug.	Total
TURBELLARIA					
Unidentified sp.	-	-	4	1	5
NEMERTINEA					
Unidentified sp.	1	4	7	8	20
NEMATODA					
Unidentified sp. A	-	19	-	18	37
Unidentified sp. B	-	-	7	-	7
POLYCHAETA					
Apoprionospio pygmaea	-	1	1	3	5
Aricidea sp.	2	2	-	-	4
Armandia maculata	5	2	18	4	29
Brania wellfleetensis	-	-	2	4	6
Bravia clavata	-	-	-	1	1
Unidentified capitellid	-	2	-	-	2
Diopatra cuprea	-	1	-	-	1
Dispio uncinata	-	-	-	1	1
Eteone heteropoda	-	-	1	7	8
Glycera oxycephala	-	-	1	4	5
Lumbrineris sp.	-	-	-	11	11
Magelona riojai	-	-	1	-	1
Magelona sp.	-	-	1	-	1
Mesochaetopterus sp.	-	-	1	-	1
Micronephtys sp.	-	2	-	-	2
Minuspio sp.	-	1	-	-	1
Nephtys picta	-	-	7	6	13
Nephtys sp.	-	-	-	2	2
Onuphis eremita oculata	1	-	-	-	1
Paranites speciosa	-	-	-	1	1
Paraonides lyra	19	5	-	1	25
Paraonides sp.	2	-	-	-	2
Paraprionospio pinnata	17	1	3	-	21
Phyllodoce arenae	-	-	4	-	4
Phyllodoce sp.	-	-	5	-	5
Poecilochaetus johnsoni	-	-	1	-	1
Prionospio cirrifera	-	-	1	-	1
Prionospio cristata	47	76	4	5	132
Scolelepis sp.	2	-	-	-	2
Scolelepis texana	-	4	5	-	9
Scoloplos foliosus	-	-	-	1	1

Table 23. Number of individuals of each species collected at station A.--Continued.

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Scoloplos robustus	-	1	-	-	1
Scoloplos rubra	-	1	-	-	1
Sigambra bassi	-	1	1	2	4
Spiochaetopterus oculatus	1	-	-	-	1
Spio pettiboneae	7	5	9	1	22
Spiophanes bombyx	-	1	42	2	45
OLIGOCHAETA					
Unidentified sp.	22	35	5	3	65
GASTROPODA					
Acteocina candei	-	-	-	1	1
Acteon punctostriatus	-	-	-	1	1
Natica pusilla	-	-	-	2	2
Olivella mutica	-	-	-	2	2
Polinices duplicatus	-	-	2	-	2
Terebra dislocata	-	-	1	-	1
PELECYPODA					
Ervilia concentrica	-	-	1	1	2
Lucina multilineata	-	2	2	4	8
Periploma inequale	-	1	-	-	1
Strigilla mirabilis	-	-	2	10	12
Tellina versicolor	-	-	1	19	20
OSTRACODA					
Unidentified sp.	-	-	-	8	8
CUMACEA					
Cyclaspis varians	-	-	-	1	1
Oxyurostylis smithi	-	-	3	-	3
Unidentified sp.	-	-	-	2	2
AMPHIPODA					
Acanthohaustorius n. sp.	-	-	8	2	10
Lysianopsis sp.	-	-	1	-	1
Protohaustorius n. sp.	-	12	58	15	85
Pseudohaustorius n. sp.	-	3	4	3	10
Pseudoplatyischnopus n. sp. B	1	2	2	16	21
Synchelidium n. sp.	-	2	3	-	5

Table 23. Number of individuals of each species collected at station A.--Continued

Species	Nov.	Feb.	May	Aug.	Total
PENAEIDEA					
Sicyonia brevirostris	-	1	-	-	1
CARIDEA					
Processa hemphilli	-	-	7	-	7
Processa vicina	-	-	-	1	1
ANOMURA					
Albunea paratii	1	-	-	-	1
BRACHYURA					
Pinnixa cristata	-	-	-	1	1
Pinnotheres maculatus	-	-	2	-	2
Portunus gibbesii	-	-	-	1	1
Portunus spinimanus	1	-	-	-	1
Ranilia muricata	-	-	-	2	2
ECHINOIDEA					
Mellita quinquiesperforata	-	-	-	45	45
Unidentified sp.	-	-	11	-	11
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	3	3
CEPHALOCHORDATA					
Branchiostoma floridae	-	1	59	19	79
PISCES					
Halichoeres maculipinna	-	-	-	1	1
Unidentified ophidiid	-	-	1	-	1
TOTAL	129	188	299	246	862

B. floridae, representing 17.6 percent of the total individuals (Table 24).

At station B, the month of May had the highest numbers of individuals; November had the least. Numbers of species were highest in August and lowest in February (Table 24).

b. Transects. The distribution of macroinvertebrates along the beach on the nine transects varied slightly over the 12-month sampling period. Twenty-eight samplings were made on each transect, 12 at station 1 and 4 each at stations 2 to 5. The average number of species ranged from a low of 8.4 per station on transect 1 to a high of 10 per station on transect 2 (Table 25). The number of individuals fluctuated to a greater extent than the number of species. The lowest average number of individuals per station was 96.7 on transect 3; the highest average per station was 218.9 on transect 9 (Table 25).

Table 25. Average number of species and individuals collected per station over the 12-month sampling period at the nine transects.

Transect	Species	Individuals
1	8.4	200.2
2	10.0	169.5
3	9.3	96.7
4	8.5	175.1
5	8.6	186.8
6	9.5	161.2
7	9.0	156.2
8	8.7	155.4
9	9.1	218.9
Average	9.0	168.9

The similarity of benthic animal distribution and abundance is further reflected in the distribution of the 14 most abundant species on the nine transects. The accumulative total percentage of these 14 species on each of the nine transects varied from 90.1 to 95.9 percent (Table 26). Individuals of two species (*E. concentrica* and *Mancocuma* sp.) were concentrated on single transects; the distribution of the other 12 species was more uniform on the nine transects.

c. Depth Distribution. In this study, each plug sample was divided into a top and bottom part of 11.5 centimeters each. Each part

Table 24. Number of individuals of each species collected at station B.

Species	Nov.	Feb.	May	Aug.	Total
ACTINIARIA					
Unidentified sp.	-	-	-	2	2
TURBELLARIA					
Unidentified sp.	-	-	2	1	3
NEMERTINEA					
Unidentified sp.	-	3	6	7	16
NEMATODA					
Unidentified sp. A	-	18	1	11	30
Unidentified sp. B	-	-	11	-	11
POLYCHAETA					
Aglaophamus verrilli	1	-	-	-	1
Ampharetid sp.	1	-	-	-	1
Anaitides erytheophyllus	-	-	1	-	1
Apoprionospio pgymaea	-	-	2	-	2
Aricidea fragilis	1	-	-	1	2
Armandia maculata	11	13	24	1	49
Brania wellfleetensis	4	1	1	3	9
Unidentified capitellid	1	-	-	-	1
Caulleriella sp.	-	-	-	2	2
Ceratonereis irritabilis	-	-	-	2	2
Unidentified cirratulid	-	1	-	-	1
Dispio uncinata	-	-	-	1	1
Eteone heteropoda	-	-	1	4	5
Glycera oxycephala	-	-	-	3	3
Gyptis vittata	4	1	-	-	5
Heteromastus filiformus	3	-	-	-	3
Lumbrineris sp.	-	-	-	2	2
Magelona sp.	1	-	-	-	1
Mediomastus californiensis	-	-	-	1	1
Mesochaetopterus sp.	-	-	-	3	3
Micronephtys minuta	-	-	2	-	2
Nephtys sp.	-	-	-	1	1
Nephtys bucera	-	-	1	-	1
Nephtys picta	-	-	4	3	7
Notomastus hemipodus	-	-	-	2	2
Ophelia sp.	9	-	-	5	14
Ophelina sp.	-	3	-	-	3

Table 24. Number of individuals of each species collected at station B.--Continued

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Owenia fusiformis	1	-	-	-	1
Paraonides lyra	3	3	-	1	7
Paraonis fulgens	-	3	-	-	3
Paraprionospio pinnata	10	1	-	-	11
Phyllodoce arenae	-	-	2	-	2
Phyllodoce sp.	-	-	2	-	2
Prionospio cirrifera	-	1	-	-	1
Prionospio cristata	134	55	3	18	210
Scolelepis sp.	1	1	-	-	2
Scolelepis texana	-	3	11	-	14
Scoloplos fragilis	-	1	-	-	1
Scoloplos rubra	-	2	-	-	2
Unidentified spionid	2	-	-	-	2
Spio pettiboneae	9	1	22	5	37
Spiophanes bombyx	-	-	29	7	36
Travesia sp.	-	-	-	3	3
Trochocaeta sp.	-	1	-	-	1
OLIGOCHAETA					
Unidentified sp.	18	26	1	10	55
GASTROPODA					
Acteocina candei	-	-	-	6	6
PELECYPODA					
Chione cancellata	-	1	-	-	1
Ervilia concentrica	-	-	2	1	3
Strigilla mirabilis	-	1	7	74	82
Tellina versicolor	-	-	-	28	28
OSTRACODA					
Unidentified sp.	-	-	-	3	3
CUMACEA					
Cyclaspis varians	-	-	-	2	2
Unidentified sp.	-	-	-	3	3

Table 24. Number of individuals of each species collected at station B.--Continued

Species	Nov.	Feb.	May	Aug.	Total
AMPHIPODA					
Acanthohaustorius n. sp.	-	6	16	7	29
Ampelisca n. sp. A	1	-	-	-	1
Ampelisca **sp.** B	-	-	-	1	1
Listriella sp.	-	-	-	3	3
Monoculodes nyei	-	-	-	1	1
Protohaustorius n. sp.	-	29	100	8	137
Pseudohaustorius n. sp.	-	-	1	1	2
Pseudoplatyischnopus n. sp. B	1	4	3	11	19
Synchelidium n. sp.	3	-	6	1	10
PENAEIDEA					
Trachypenaeus constrictus	1	-	-	-	1
CARIDEA					
Processa hemphilli	1	-	1	11	13
Processa vicina	-	-	-	1	1
BRACHYURA					
Pinnixa cristata	-	-	1	-	1
Pinnixa sayana	-	-	-	6	6
Ranilia muricata	-	-	-	2	2
SIPUNCULIDA					
Sipunculus longipapillosus	-	1	-	-	1
OPHIUROIDEA					
Ophiophragnus filograneus	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	5	-	-	6	11
Unidentified sp.	-	-	7	-	7
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	10	69	74	51	204
PISCES					
Microgobius carri	1	-	-	-	1
TOTAL	238	249	344	327	1,158

Table 26. Percentage of individuals of the 14 most abundant species occurring on the nine transects.

Species	Transects								
	1	2	3	4	5	6	7	8	9
POLYCHAETA									
Dispio uncinata	5.9	2.4	7.0	7.6	6.8	3.4	22.6	21.3	23.0
Magelona riojai	15.0	9.3	10.1	12.6	10.5	23.1	9.3	4.4	5.7
Paraonis fulgens	17.1	21.0	18.5	18.0	7.4	8.6	3.0	3.9	2.7
Scolelepis squamata	30.4	17.7	2.6	9.9	11.7	8.4	4.4	8.2	6.8
Spio pettiboneae	1.8	17.6	11.1	21.7	8.0	11.3	12.1	5.4	11.0
PELECYPODA									
Donax texasianus	7.0	9.3	5.7	10.9	15.8	10.2	9.9	9.8	21.5
Ervilia concentrica	68.9	9.5	0.5	3.0	12.5	4.0	0.5	0.8	0.5
CUMACEA									
Mancocuma sp.	0.3	5.3	1.8	5.3	6.7	15.5	4.4	8.5	52.2
AMPHIPODA									
Acanthohaustorius n. sp.	10.1	5.9	6.9	15.3	9.5	8.4	15.2	16.1	12.6
Haustorius n. sp.	10.5	13.5	13.7	9.0	10.4	11.6	14.9	8.4	8.0
Protohaustorius n. sp.	6.7	8.6	7.9	18.6	13.2	15.1	11.2	7.5	11.3
Pseudohaustorius n. sp.	9.6	12.3	9.2	10.5	11.6	20.2	7.5	9.7	9.4
ANOMURA									
Emerita talpoida	10.1	6.7	7.3	10.6	9.8	11.3	13.8	17.2	13.2
CEPHALOCHORDATA									
Branchiostoma floridae	9.1	20.8	8.8	6.6	9.2	6.7	10.1	12.9	15.9
TOTAL	95.9	93.8	91.0	95.5	95.8	90.1	90.2	95.0	95.2

was handled separately. This procedure was done to determine the depth in the substrate at which the animals in this nearshore zone lived. Results of other benthic investigations have stated that most benthic invertebrates live in the top 10 centimeters of the substrate (Holme and McIntyre, 1971).

In the study area, 179 species were taken and 66 (36.9 percent) of these occurred only in the top 11.5-centimeter part of the sample. Also 19 (10.6 percent) species occurred only in the bottom 11.5-centimeter part of the sample. The species that occurred only in the bottom part were represented by one or two individuals per species. The percentage of total individuals occurring in the top 11.5-centimeter part of the sample was 75 percent.

The number of species, individuals, number of individuals per square meter, and the diversity index at each station for benthic animals collected in the top 11.5 centimeters, bottom 11.5 centimeters, and both parts combined are presented in Appendixes G, H, and I.

(1) Species. The average number of species from the top and bottom part of the samples for each station gradually increased as distance from shore increased, except at station 4 where the number of species decreased. The disparity between the average number of species in the top and bottom parts of the sample generally increased as the distance from shore increased (Fig. 25).

The average number of species from the top and bottom parts of the samples on the nine transects fluctuated between 8.4 and 10 species. The average number of species in the top 11.5 centimeters varied more than the average number of species in the bottom 11.5-centimeter part of the sample on each transect (Fig. 26).

(2) Individuals. The average number of individuals from the top and bottom parts of the sample fluctuated with distance from shore. Most of the fluctuation occurred in the top part of the sample. The average number of individuals occurring in the bottom part of the samples showed less variation (Fig. 27).

The average number of individuals per transect for the entire sample (top and bottom) was highest at both ends of the sampling area. Again, most of the fluctuations occurred in the top 11.5-centimeter part of the sample. The average number of individuals in the bottom part on each transect remained fairly constant on transects 3 to 9 (Fig. 28).

(3) Abundant Species. Individuals of each of the 14 most abundant species occurred in both the top and bottom parts of the

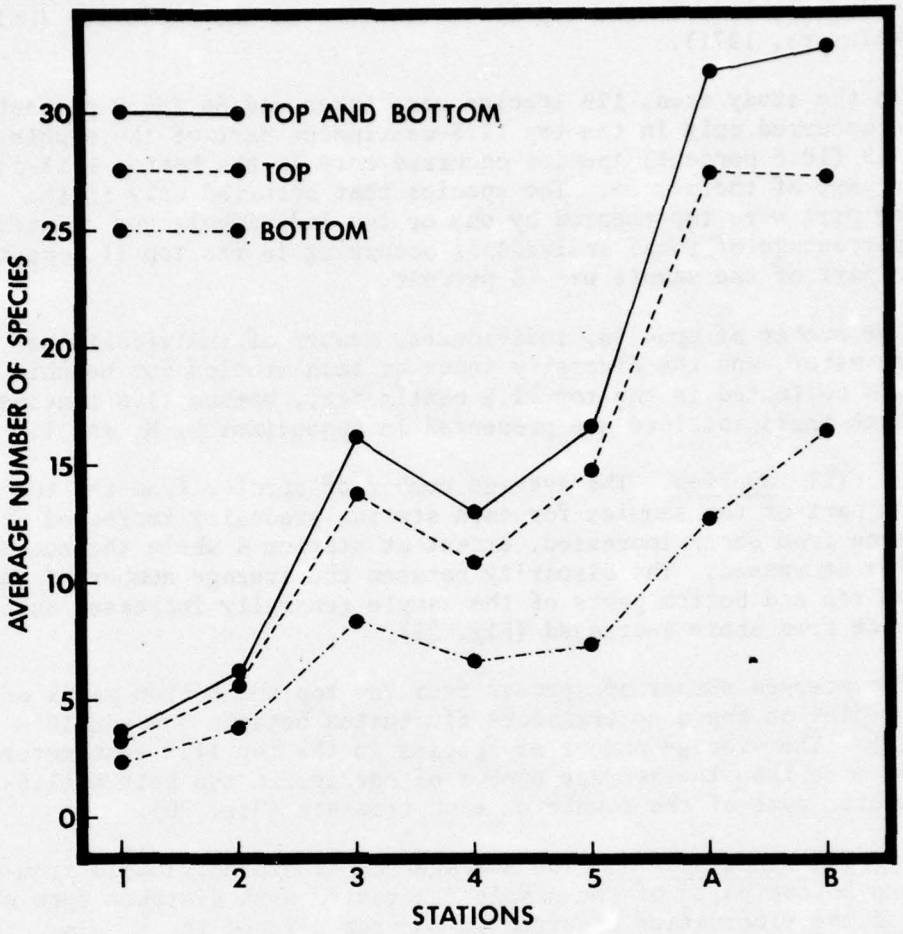

Figure 25. Average number of species in the top, bottom, and combined top and bottom parts of the sample at the five transect stations and stations A and B.

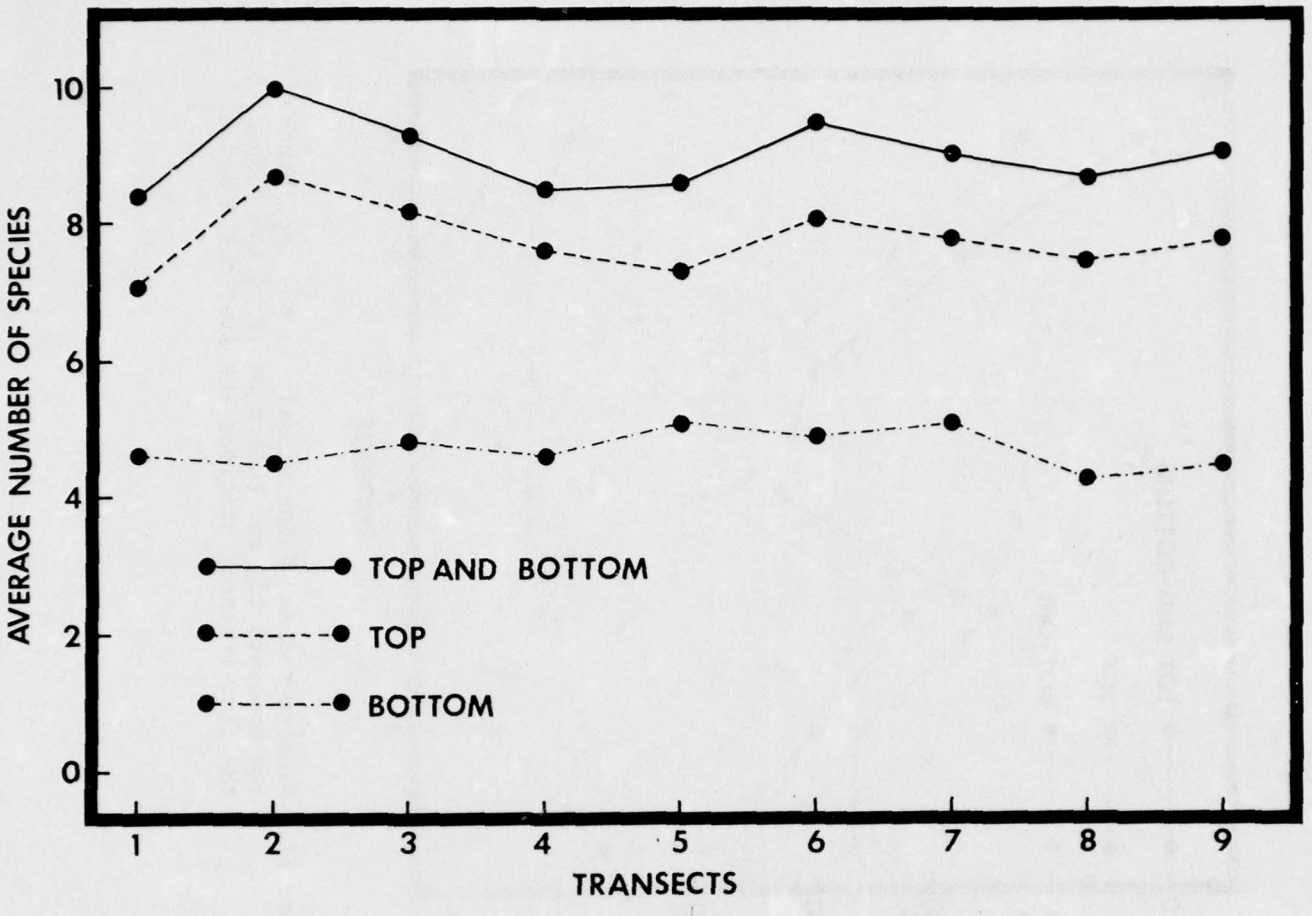

Figure 26. Average number of species in the top, bottom, and combined top and bottom parts of the sample on the nine transects.

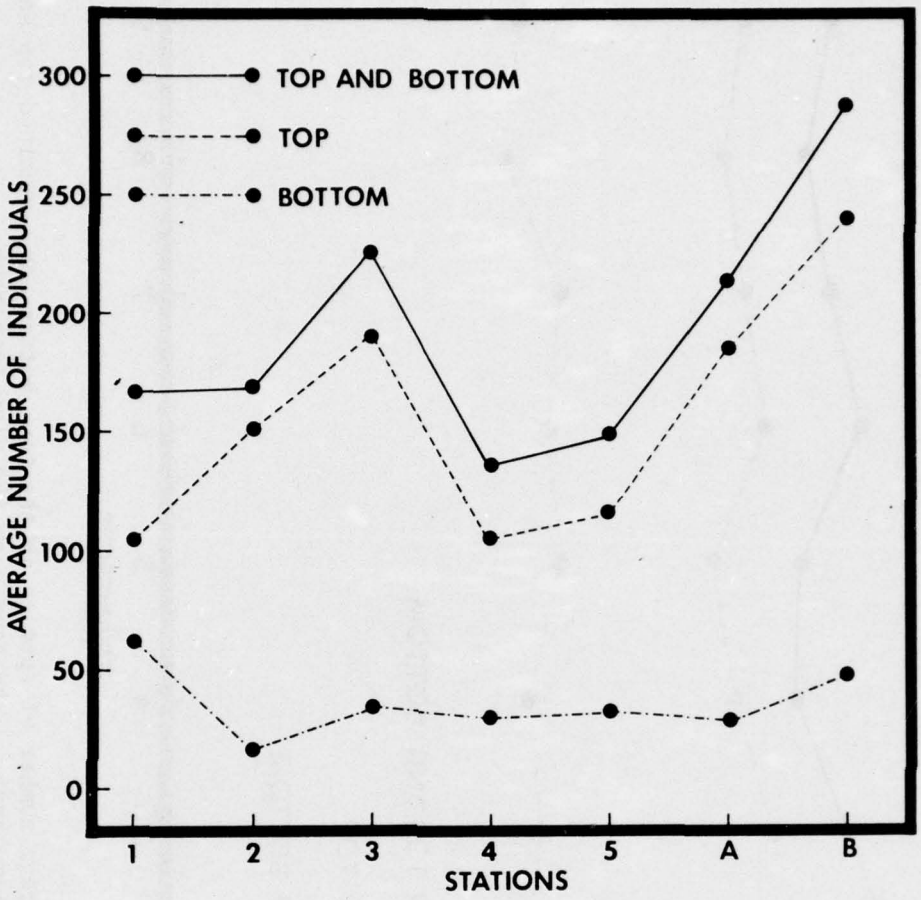

Figure 27. Average number of individuals in the top, bottom, and combined top and bottom parts of the sample at the five transect stations and stations A and B.

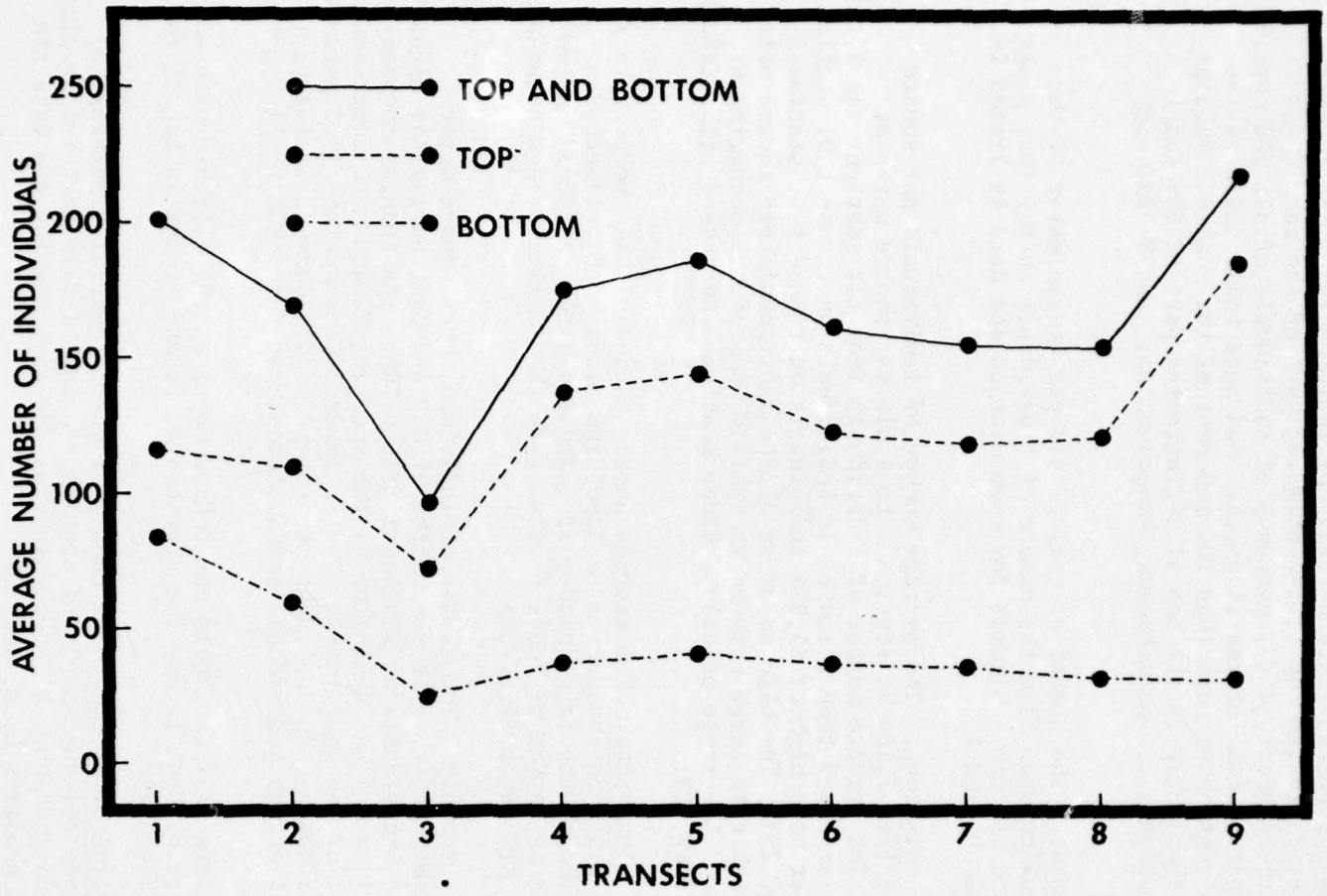

Figure 28. Average number of individuals in the top, bottom, and combined top and bottom parts of the sample on the nine transects.

sample. The percentage (74.4 percent) of individuals of the 14 most abundant species in the top 11.5-centimeter part of the sample was similar to the percentage (75 percent) of individuals of all 179 species in the top part. Four of the 14 species had more individuals in the bottom 11.5-centimeter part than the top part of the sample. Species found most abundantly in the top 11.5-centimeter part of the sample were *D. texasianus*, *S. pettiboneae*, *Mancocuma* sp., and *E. talpoida* (Table 27).

c. Biomass. The number of individuals per square meter of the bottom was calculated from the number of individuals in the four plugs taken at each station. Biomass for each station and date is listed in Appendixes G, H, and I.

(1) Stations. The average number of individuals per square meter varied from 2,180 at station 3 to 4,636 per square meter at station B. The average number of individuals from all stations was 2,744. The range fluctuated from a low of 48 individuals on transect 9, station 1 in December to a high of 35,504 individuals on transect 9, station 2, in May (Fig. 29). The high value of 35,504 individuals per square meter was attributable to large numbers of small *D. texasianus* occurring at this station. The range of values after station 2 decreased with distance from shore (Fig. 29).

(2) Transects. The average number of individuals per square meter varied from 1,547 on transect 3 to 3,503 individuals on transect 9. Transect 3 lacked the large number of individuals that occurred on the other transects in May or June, resulting in the smallest range of values of the nine transects (Fig. 30).

(3) Monthly. The number of individuals per square meter fluctuated seasonally, with the months of May and June having the highest abundance of individuals at station 1 (Table 28). The species composition at station 1 in May was dominated by two species; *S. squamata* comprised 57.3 percent of the individuals, and *D. texasianus* comprised 38.3 percent of the individuals. In June, the percentage of *S. squamata* increased to 64.4 percent of the individuals and *D. texasianus* decreased to 31.2 percent (Table 18).

The numbers of individuals per square meter at the offshore transect stations were highest in May for stations 2, 3, and 4, and in August for station 5 (Table 28).

e. Species Diversity. The Shannon Index of general diversity ($\bar{H}$) was calculated for the number of species and individuals in the four plugs taken at each station. Diversity indexes for each station and date are listed in Appendixes G, H, and I.

(1) Stations. The average diversity indexes at the five

Table 27. Percentage of individuals of the 14 most abundant species occurring in the top 11.5-centimeter part and the bottom 11.5-centimeter part of the sample.

Species	Top	Bottom
Polychaeta		
Dispio uncinata	81.7	18.3
Magelona riojai	48.8	51.2
Paraonis fulgens	56.7	43.3
Scolelepis squamata	32.3	67.7
Spio pettiboneae	95.6	4.4
Pelecypoda		
Donax texasianus	97.6	2.4
Ervilia concentrica	88.1	11.9
Cumacea		
Mancocuma sp.	95.3	4.7
Amphipoda		
Acanthohaustorius n. sp.	82.4	17.6
Haustorius n. sp.	34.5	65.5
Protohaustorius n. sp.	86.2	13.8
Pseudohaustorius n. sp.	35.2	64.8
Anomura		
Emerita talpoida	92.8	7.2
Cephalochordata		
Branchiostoma floridae	85.9	14.1
Total	74.4	25.6

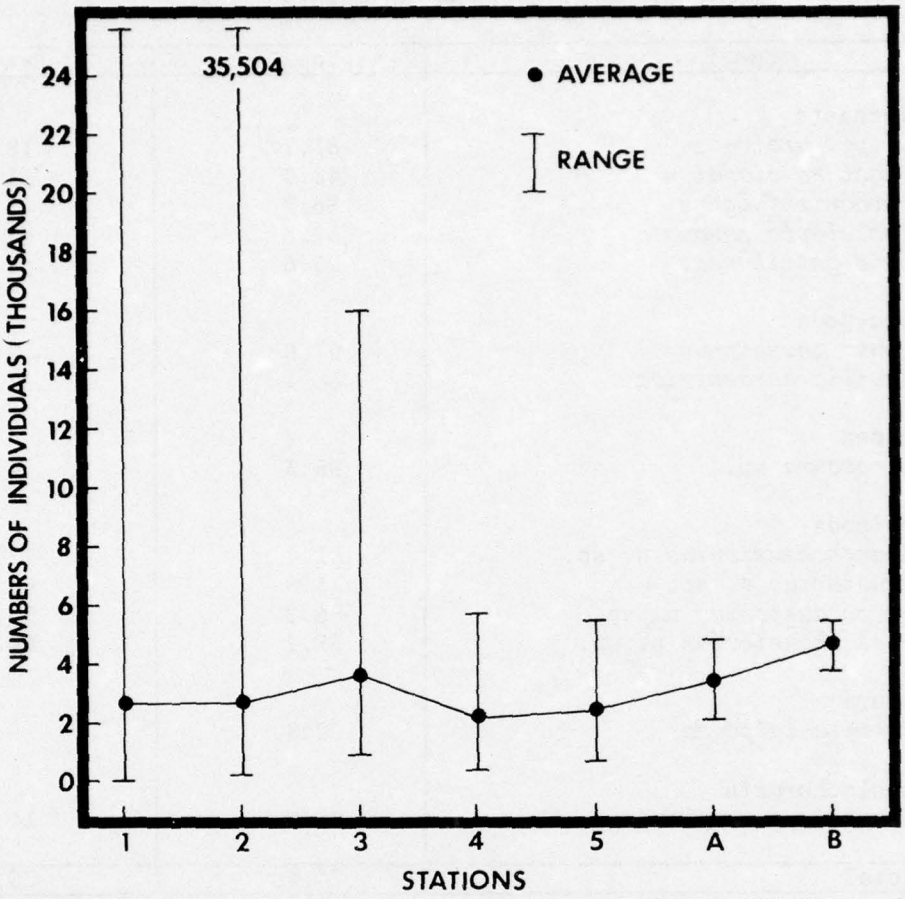

Figure 29. Average and range of the number of individuals per square meter at the five transect stations and stations A and B.

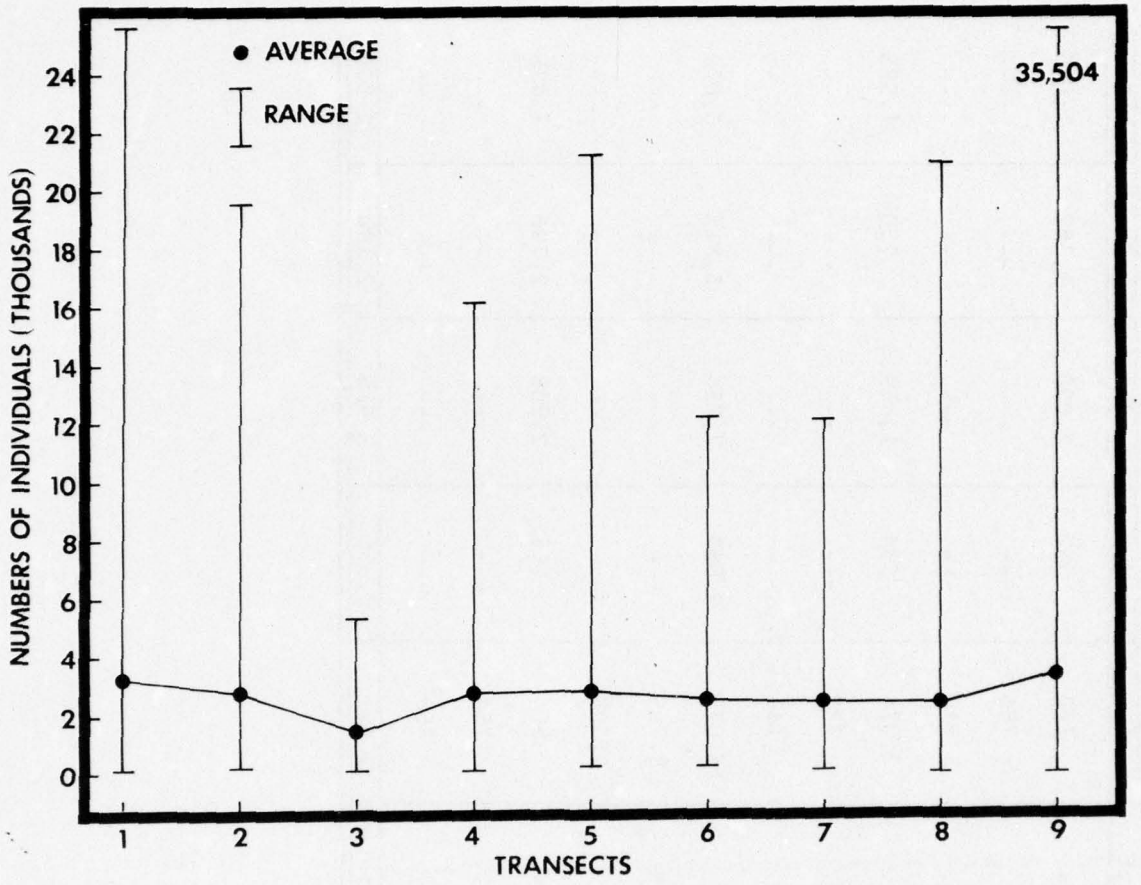

Figure 30. Average and range of the number of individuals per square meter on the nine transects.

Table 28. Monthly average of the number of individuals per square meter at the five transect stations.

Month	Stations				
	1	2	3	4	5
Nov.	153	352	2,000	1,362	1,045
Dec.	756	---	---	---	---
Jan.	1,719	---	---	---	---
Feb.	2,078	594	1,819	750	1,995
Mar.	780	---	---	---	---
Apr.	1,141	---	---	---	---
May	13,079	9,090	7,733	3,813	3,079
June	8,795	---	---	---	---
July	1,308	---	---	---	---
Aug.	864	715	2,908	2,796	3,435
Sept.	754	---	---	---	---
Oct.	750	---	---	---	---
Average	2,681	2,688	3,615	2,180	2,389

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THE BENTHIC FAUNA AND SEDIMENTS OF THE NEARSHORE ZONE OFF PANAM--ETC(U)
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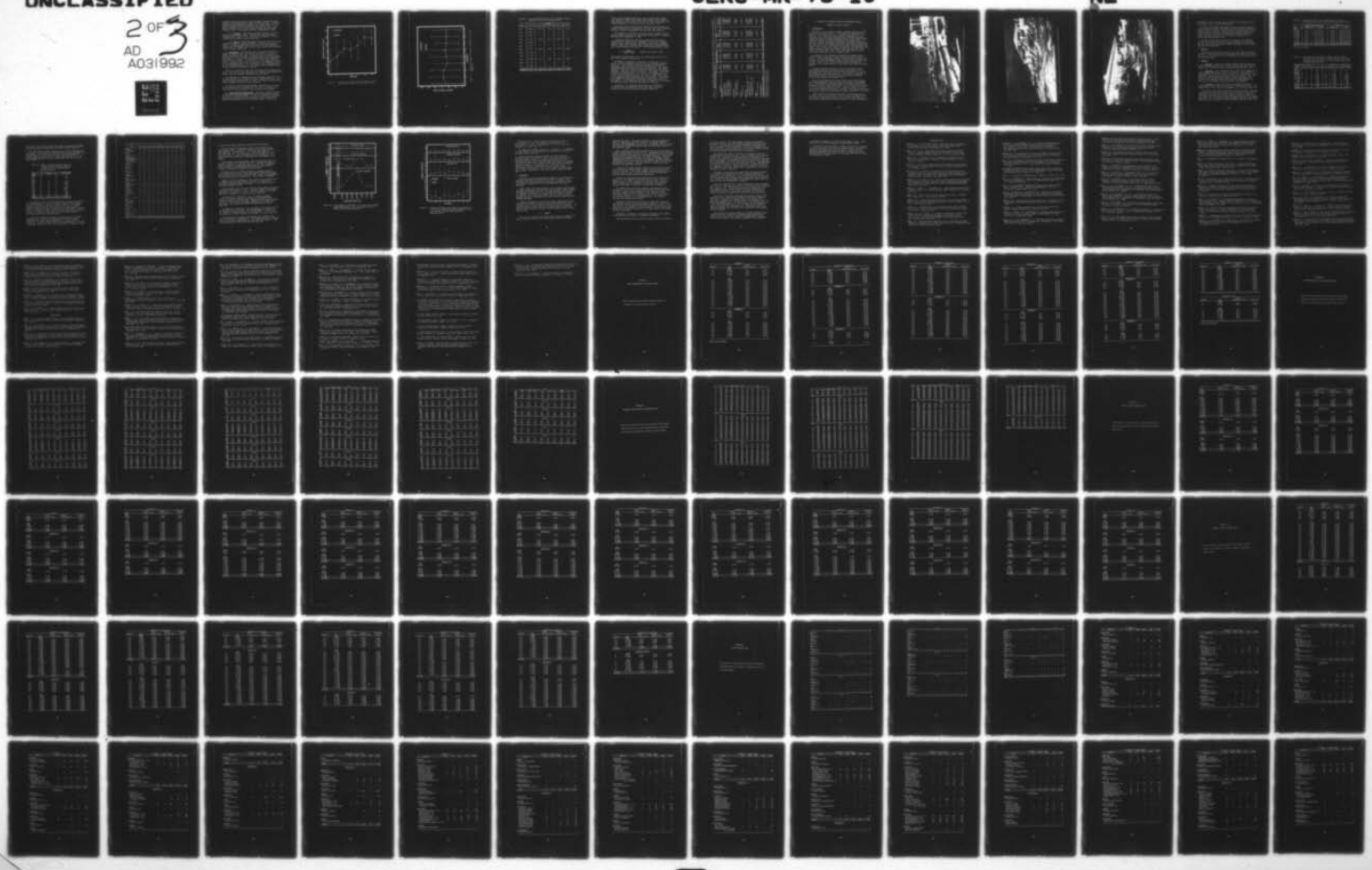

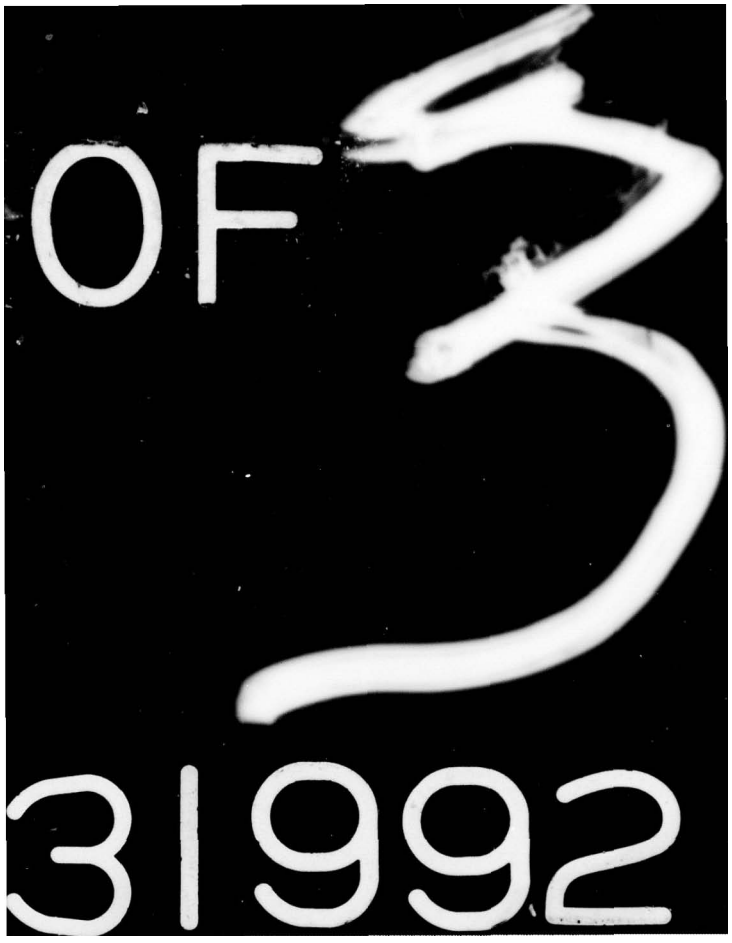
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transect stations and stations A and B generally followed the same pattern as the distribution of species at these stations. A general increasing trend seaward from station 1 was evident (Fig. 31). The range of individual indexes fluctuated from 0.000 to 3.141. Zero values occurred only at station 1 and the highest indexes were at stations A and B. The average index for all stations was 1.245.

(2) Transects. The average diversity indexes at the nine transects were fairly constant. Average values on each transect fluctuated from 1.090 to 1.354, with values on transects 1, 2, and 3 higher than the other transects (Fig. 32).

(3) Monthly. The average monthly diversity index at all five transect stations was highest in August. Low indexes occurred at station 1 in January and February; stations 2 and 4 had the lowest average index in November, and stations 3 and 5 had the lowest average index in February (Table 29).

f. New Species. The nearshore zone of the Gulf of Mexico off Panama City Beach is one of the coastal areas where very little benthic research has been done. Evidence of this was shown by the discovery of several new species of invertebrates, some of which were very abundant. A total of 170 invertebrate species was identified (Table 15) in this study. Of this total, 21 (12 percent) are or may be new. Fifteen of the possible 21 new species are amphipods, and 4 of these (*Acanthohaustorius* n. sp., *Haustorius* n. sp., *Protohaustorius* n. sp., and *Pseudohaustorius* n. sp.) are among the most abundant species in this nearshore zone (Tables 17 and 26).

There is a possibility that three new species of Oligochaeta were found. They are not listed separately, but combined under unidentified species until more specific determinations can be made.

The cumaceans are represented by one new species (*Mancocuma* n. sp.) and the possibility of a second new species (Unidentified sp.). The remaining possible new species is a clam in the family Veneridae which closely resembles those in the genus *Gouldia*.

In several of the major animal groups, identification to species was not attempted due to insufficient time, lack of literature, or inability to locate an expert willing to examine the specimens.

g. Animal-Sediment Relationships. The role of surface sediments in the distribution and abundance of benthic invertebrates has been established by numerous authors. In fact, the substrate is probably the single most important factor determining the distribution of benthic invertebrates (Collard and D'Asaro, 1973). Correlations

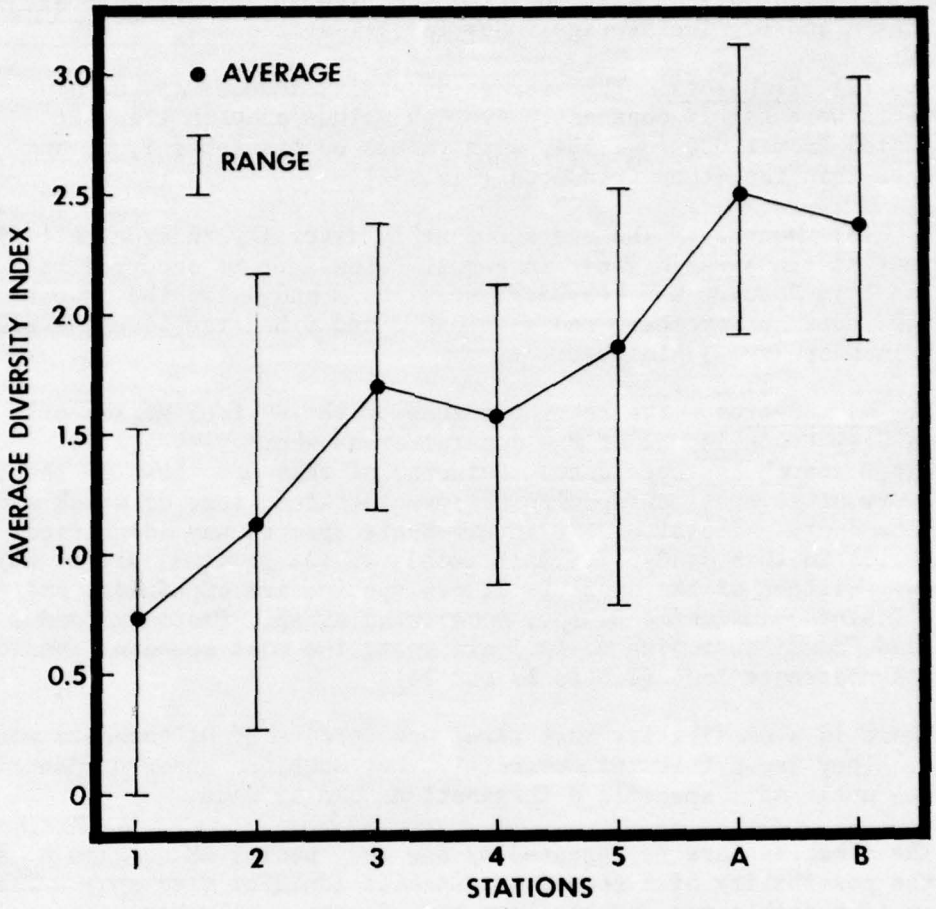

Figure 31. Average and range of diversity indexes at the five transect stations and stations A and B.

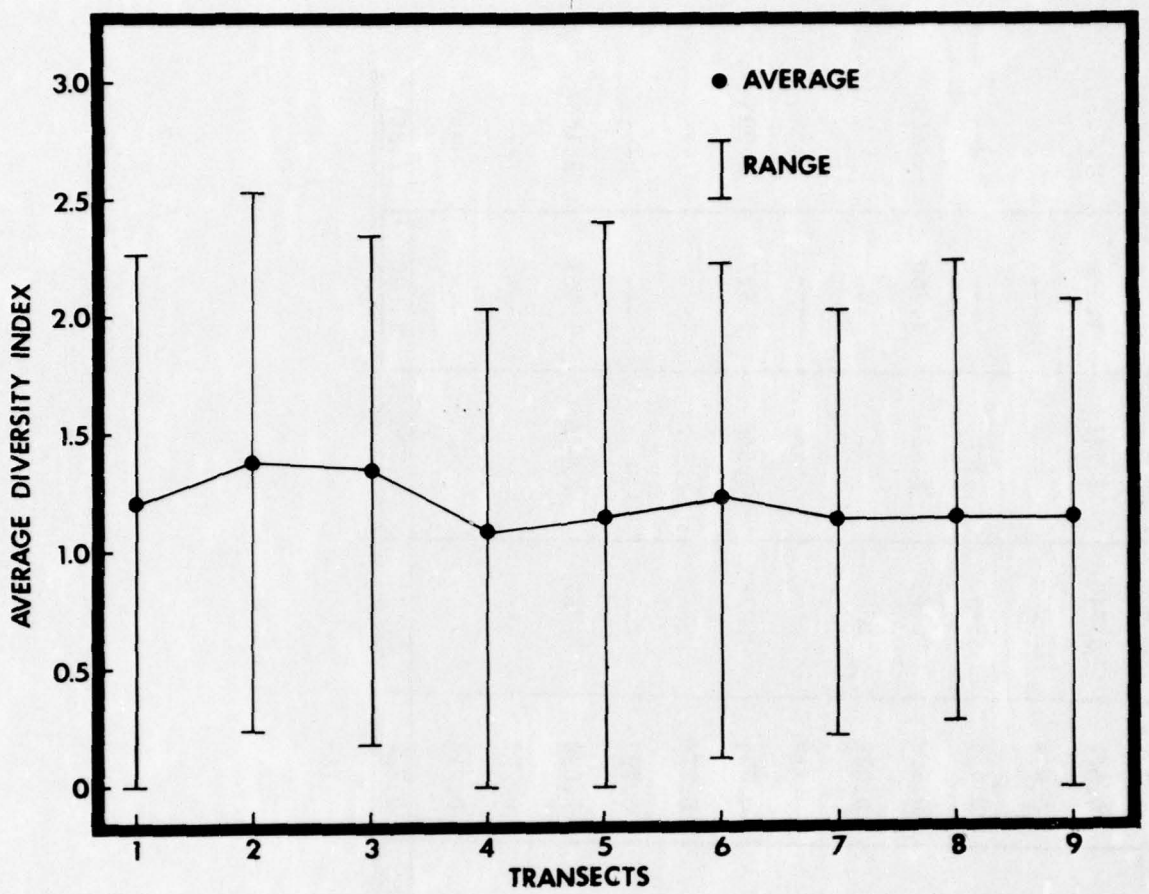

Figure 32. Average and range of diversity indexes on the nine transects.

Table 29. Average monthly diversity index of benthic animals collected at the five transect stations.

Month	Stations				
	1	2	3	4	5
Nov.	0.641	0.740	1.741	1.379	1.725
Dec.	0.821	---	---	---	---
Jan.	0.434	---	---	---	---
Feb.	0.569	1.195	1.537	1.460	1.461
Mar.	0.622	---	---	---	---
Apr.	0.719	---	---	---	---
May	0.751	0.835	1.546	1.527	2.093
June	0.736	---	---	---	---
July	0.792	---	---	---	---
Aug.	1.088	1.767	1.976	1.963	2.166
Sept.	0.707	---	---	---	---
Oct.	0.814	---	---	---	---
Average	0.724	1.134	1.700	1.582	1.861

between species abundance and one or more sedimentological factors were reported in Bader, 1954; Parker, 1956; Thorson, 1957; Sanders, 1958; McNulty, Work, and Moore, 1962; Taylor, Hall, and Saloman, 1971; Young and Rhoads, 1971; and Bloom, Simon, and Hunter, 1972.

Other major factors affecting the distribution and abundance of benthic invertebrates are temperature, salinity, wave shock, turbidity, pollution, currents, geographical barriers, and tidal exposure.

The sediments in this study are fairly similar alongshore and at similar distances from shore. Fluctuations in the physical, chemical, and statistical components are small.

Correlation coefficients (r) were calculated between several sedimentological factors and the abundance of the 14 most abundant species in this nearshore zone. The factors tested were percentage weight of sand, silt, and total carbon, mean grain size (millimeter), and standard deviations (phi units). The following formula was used:

$$r = \frac{\Sigma x_1 x_2}{(\Sigma x_1^2)\ (\Sigma x_2^2)}$$ (Snedecor and Cochran, 1967).

The degrees of freedom used to test the significance levels of r at the 5- and 1-percent level was 255.

The number of significant correlations at either the 5- or 1-percent levels was limited to three of the five sediment parameters (Table 30). The correlation of animal abundance in relation to percentage weight and total carbon was not significant. The highest significant relationship existed between mean grain size and animal abundance. Since all r values are positive, the number of individuals increases as the mean grain size increases. The highest r value was 0.5282 for *Acanthohaustorius* n. sp. The level of significance was 0.164 at the 1-percent level and 0.125 at the 5-percent level, based on 255 degrees of freedom (Snedecor and Cochran, 1967). Correlation with standard deviation values indicated a relationship exists for some species. As the number of individuals increases, the distribution of sediment particle size around the mean also increases.

Two species, *E. concentrica* and *Mancocuma* sp., exhibited no correlation with the parameters tested; four species showed a correlation with only one sediment parameter (Table 30).

Table 30. Correlation coefficients between the number of individuals of the 14 most abundant benthic invertebrate species.

Species	Weight percent			Mean grain size (mm)	Standard deviation
	Sand	Silt	Total carbon		
POLYCHAETA					
Dispio uncinata	0.0264	0.0436	0.0652	0.3409[2]	0.1949[2]
Magelona riojai	0.0218	0.0060	0.0284	0.3210[2]	0.1484[1]
Paraonis fulgens	0.0303	0.0187	0.0418	0.2986[2]	0.0988
Scolelepis squamata	0.0360	0.1126	0.1061	0.2326[2]	0.0658
Spio pettiboneae	0.0147	0.2614[2]	0.0712	0.3173[2]	0.1991[2]
PELECYPODA					
Donax texasianus	0.0278	0.0981	0.0213	0.1313[1]	0.0010
Ervilia concentrica	0.0161	0.0600	0.0513	0.1236	0.0016
CUMACEA					
Mancocuma sp.	0.0340	0.0030	0.0487	0.0519	0.0808
AMPHIPODA					
Acanthohaustorius n. sp.	0.0782	0.2078[2]	0.1048	0.5282[2]	0.2707[2]
Haustorius n. sp.	0.0852	0.2051[2]	0.0512	0.1969[2]	0.0312
Protohaustorius n. sp.	0.0851	0.1235	0.0220	0.4935[2]	0.0008
Pseudohaustorius n. sp.	0.0902	0.1028	0.0349	0.4308[2]	0.1865[2]
ANOMURA					
Emerita talpoida	0.0183	0.2314[2]	0.0172	0.5095[2]	0.0819
CEPHALOCHORDATA					
Branchiostoma floridae	0.0032	0.2673[2]	0.0097	0.2343[2]	0.0720

[1]Significance at 5-percent level.
[2]Significance at 1-percent level.

V. INFLUENCE OF HURRICANE ELOISE ON THE BENTHIC FAUNA OF PANAMA CITY BEACH, FLORIDA

1. Introduction.

The effects of hurricanes or storms on aquatic animals have been documented by numerous authors. The concensus of most published reports is that damage does occur to aquatic fauna and flora. The principal causes were mainly the deposition of sediments causing suffocation, high turbidities affecting fish and larval forms, oxygen depletion caused by increased decomposition of exposed organic sediments, erosion of substrates, prolonged low salinities caused by excessive rainfall and runoff, stranding of individuals caused by wind and tidal action, and the influence of cold water caused by upwelling (Rogick, 1940; Archer, 1947; Engle, 1948; Robins, 1957; Burbanck, 1961; Thomas, Moore, and Work, 1961; Breder, 1962; Tabb and Jones, 1962; Keith and Hulings, 1965; Croker, 1968; Stone and Azarovitz, 1968; Harger and Landenberger, 1971; and Munden, 1975).

Information on the influence of hurricanes on benthic animals along the beaches fronting the open ocean or the Gulf of Mexico is limited. Croker (1968) made a study in Georgia after Hurricanes Cleo and Dora, and Keith and Hulings (1965) in Texas after Hurricane Cindy in 1963. Ansell, et al. (1972) observed factors affecting the macrofauna on two sandy beaches in India before and during the monsoon season.

Seventeen hurricanes reached land in the northeastern Gulf of Mexico between 1873 and 1970 (Sugg, Pardue, and Carrodus, 1971). The damage from these storms and others that occurred in the Gulf of Mexico amounts to millions of dollars. An estimate of damage by 14 memorable hurricanes in the United States since 1926 was $6,820 million (Sugg, Pardue, and Carrodus, 1971).

The eye of Hurricane Eloise passed over the gulf beach between Fort Walton Beach and Panama City Beach before dawn on 23 September 1975. Wind velocities were approximately 130 miles per hour (209.2 kilometers per hour), and seas had risen to 10 to 15 feet with 15-foot (4.6 meters) waves pounding the beach. Damage on Panama City Beach alone was estimated at $50 million. Erosion of the beach and sand dune and damage to seawalls and buildings are shown in Figures 33, 34, and 35.

Serious erosion occurred along the beach, removing most of the foredune. Before the hurricane, a plan for beach nourishment called for 3,999,000 cubic yards of sand to build a dune, storm berm, and beach, plus an additional 910,000 cubic yards at 10-year intervals for

Figure 33. Westward view of erosion of beach and sand dune by Hurricane Eloise.

Figure 34. Westward view of erosion of beach and sand dune by Hurricane Eloise.

Figure 35. Erosion of beach and sand dune and damage to a residence by Hurricane Eloise.

maintenance. After the hurricane, the amount of fill needed to meet the specifications increased substantially.

A study of the benthic macrofauna on the beach and the nearshore zone of the Gulf of Mexico off Panama City Beach had been underway for 11 months before the storm. When notified of the possibility of the storm's arrival at Panama City Beach, special benthic sampling was initiated in the swash zone 1 day before (22 September 1975) the storm. Sampling continued on the day after the storm and on a decreasing frequency for 28 days.

This part of the report presents the findings on the number of species and individuals, diversity index, and number of individuals per unit area in the swash zone on Panama City Beach, Florida, before and after Hurricane Eloise.

2. Methods.

The sampling methods and the gear used are the same as previously described. The only exception was that eight plug samples were taken at each site instead of four, and the samples were not subdivided into top and bottom parts.

3. Results.

a. Sediments. Samples for sediment analysis were not collected for this special study; however, surface sediments had been collected monthly for 11 months before the hurricane at the same nine sites.

b. Hydrology. Water temperature and salinity in the sampling area did not change substantially after the hurricane. Total rainfall associated with the storm was only 0.66 inch (1.7 centimeters). Water temperatures decreased, and salinities increased slightly (Table 31). Due to the lack of substantial changes in water temperature and salinity, the influence of these two factors on the abundance and diversity of the benthic macroinvertebrates was negligible.

c. Macrofauna. Benthic macrofauna collections were made on 8 separate days, 1 day before the storm and 7 different days after. The dates were 22, 24, 25, 26, and 29 September, 2, 7, and 21 October 1975.

The number of individuals gradually increased from 465 at the nine stations on the first day after the storm to a high of 1,358 individuals 6 days after the storm; 9 days after the storm, the number of individuals decreased and continued dropping through the last sampling date (Table 32). The number of species caught at the nine sites nearly doubled the day following the storm and remained high for 6 days after

Table 31. Average and range of water temperature and salinity collected at nine sites before and after Hurricane Eloise.

Date	Water Temperature (°C)		Salinity[1]	
	Average	Range	Average	Range
1975				
22 Sept.	26.5	26.0 to 27.2	30.36	29.83 to 30.94
24 Sept.	25.4	24.8 to 25.8	30.54	28.56 to 31.89
25 Sept.	24.7	22.9 to 27.5	31.97	30.83 to 33.06
26 Sept.	20.5	19.9 to 21.9	31.23	29.44 to 32.00
29 Sept.	25.6	24.5 to 26.5	33.70	32.06 to 34.33
2 Oct.	24.2	23.5 to 24.6	31.73	30.83 to 33.11
7 Oct.	24.1	23.5 to 24.9	30.73	29.33 to 31.56
21 Oct.	22.1	20.1 to 23.9	31.49	29.78 to 32.83
Average	24.2	19.9 to 27.5	31.47	28.56 to 34.33

[1]Parts per thousand.

Table 32. Total number of individuals, species, and the average diversity index and number of individuals per square meter calculated from nine sites for eight sampling dates before and after Hurricane Eloise.

Sampling date	Days after storm	Individuals	Species	Diversity index (avg.)	Individuals per m^2 (avg.)
1975					
22 Sept.	--	491	9	0.799	873
Storm					
24 Sept.	1	465	17	1.437	827
25 Sept.	2	677	16	1.288	1,204
26 Sept.	3	1,047	21	1.047	1,862
29 Sept.	6	1,358	15	1.024	2,415
2 Oct.	9	817	5	1.089	1,453
7 Oct.	14	465	6	1.125	827
21 Oct.	28	429	13	1.561	763
Total	--	5,616	43	---	---
Average	--	702	5.4	1.171	1,278

the storm; 9 days after the storm, the number of species also dropped and did not increase substantially for almost 3 weeks (Table 32).

The large number of species found after the storm is abnormal for this habitat. In 11 months of sampling before the storm (November 1974 to September 1975) at the same nine sites, the average number of species caught per month for the 11-month period was only 7.1. The highest number of species during a single month from the nine sites was 12 (Table 33).

Table 33. Number of species and individuals of benthic macroinvertebrates collected at nine sites for 11 months before Hurricane Eloise.

Date	Species	Individuals
1974		
Nov.	4	86
Dec.	7	425
1975		
Jan.	4	967
Feb.	8	1,169
Mar.	6	439
Apr.	6	642
May	9	7,384
June	5	4,947
July	11	736
Aug.	12	486
Sept.	6	424
Total	26	17,705

The diversity index on the day before the storm was the lowest of the 8 sampling days. It was only slightly higher than the average value for 12 months at station 1 (Tables 29 and 32). The highest diversity index was on the first day after the storm and then it decreased through the 6 days following Eloise, and gradually increased again. All diversity indexes after Eloise were above one. During the 12 months of sampling at the same sites, only August exceeded a diversity index of one (Tables 29 and 32).

A total of 43 species was taken at the nine sites on the eight sampling trips. Three species represented 92.8 percent of the individuals; 18 species were represented by a single individual (Table 34). The three abundant species were an anomuran, *E. talpoida;* an amphipod, *Haustorius* n. sp.; and a polychaete, *S. squamata*. *Donax*

Table 34. Number of individuals of each species of benthic macroinvertebrates collected at nine sites before and after Hurricane Eloise.

Species	Stations									Total
	1	2	3	4	5	6	7	8	9	
NEMERTINEA										
Unidentified sp. A	5	6	11	6	4	4	1	2	2	41
Unidentified sp. B	---	---	---	---	---	---	---	---	1	1
NEMATODA										
Unidentified sp.	---	---	---	---	---	---	---	---	2	2
POLYCHAETA										
Ceratoneris irritabilis	---	---	---	---	---	1	---	---	---	1
Diopio uncinata	3	1	---	2	1	2	7	4	---	20
Glycera oxycephala	1	---	---	---	---	---	---	---	---	1
Lumbrineris paravapedata	---	---	---	---	---	---	---	1	---	1
Onuphis eremita oculata	---	---	---	1	---	---	---	---	---	1
Paraonis fulgens	34	3	1	2	3	2	---	---	---	45
Scolelepis squamata	62	114	41	77	32	113	127	66	118	750
PELECYPODA										
Cuna dalli	---	1	---	---	---	---	---	---	---	1
Donax texasianus	19	31	7	9	12	5	19	10	29	141
PYCNOGONIDA										
Unidentified sp.	---	---	---	---	1	---	---	---	---	1
CUMACEA										
Mancocuma sp.	1	---	---	---	4	---	---	---	9	14
Unidentified sp.	2	---	1	1	---	---	---	---	---	4
TANAIDACEA										
Unidentified sp. A	---	---	---	---	2	---	---	---	---	2
Unidentified sp. B	---	---	---	---	1	---	---	---	---	1
ISOPODA										
Ancinus depressus	2	5	---	2	---	---	---	---	9	18
Scyphacella arenicola	---	---	---	---	---	---	---	---	3	3
Unidentified sp.	---	---	---	---	---	---	---	---	1	1
AMPHIPODA										
Acanthohaustorius n. sp.	1	---	2	---	---	---	---	---	---	3
Erichthonius n. sp.	1	---	---	2	---	---	1	1	---	5
Haustorius n. sp.	70	110	216	108	253	209	160	136	59	1,321
Listriella sp.	---	---	---	---	1	1	---	---	---	2
Maera sp.	---	---	---	---	1	1	2	---	---	4
Maera sp. 2	---	---	---	---	1	---	2	---	---	3
Microprotupus sp.	---	---	---	1	1	---	---	---	---	2
Netamelita sp.	---	---	---	---	1	---	1	---	---	2
Nototropis sp.	---	---	---	---	---	---	---	2	---	2
Protohaustorius n. sp.	---	---	---	---	---	---	---	1	---	1
Talorchestia n. sp.	---	---	1	---	---	---	---	---	---	1
Tiron sp.	---	---	---	1	---	---	---	---	---	1
Unidentified sp.	---	---	---	1	---	---	---	---	---	1
CARIDEA										
Periclimenes longicaudatus	---	---	---	---	---	---	---	---	1	1
ANOMURA										
Emerita benedicti	3	---	---	---	---	---	---	---	---	3
Emerita talpoida	156	315	101	415	330	264	499	280	779	3,139
Lepidopa Benedicti	3	4	5	8	9	6	8	5	6	54
Pagurus impressus	---	---	---	---	---	---	1	---	---	1
BRACHYURA										
Pinnixa cristata	---	---	1	---	---	---	11	3	---	15
Pinnixa sayana	---	---	---	---	---	---	3	---	---	3
ASTEROIDEA										
Astropecten articulatus	---	---	1	---	---	---	---	---	---	1
OPHIUROIDEA										
Ophiophragmus filograneus	---	---	1	---	---	---	---	---	---	1
CEPHALOCHORDATA										
Branchiostoma floridae	---	---	---	1	---	---	---	---	---	1
TOTAL	363	590	389	637	657	608	842	511	1,019	5,616

texasianus, the common pelecypod, ranked fourth in abundance.

The total number of individuals caught at each station in the eight sampling trips was higher at the stations near the west end of the study area. On transects 1, 2, and 3 the total number of individuals was 1,342; on transects 4, 5, and 6 the number was 1,902; and on transects 7, 8, and 9 the number was 2,372 (Table 34). The western end of the study area is also where the storm damage was the highest.

The increase in individuals after the storm was mainly due to an increase in number of *E. talpoida* (Fig. 36). Although the number of species increased, the number per species was very low. Population levels fluctuate to a great degree in this habitat (Table 33) as spawning, recruitment of young, and mortality occur.

The small size of *E. talpoida* indicates a spawning occurred a short time before the storm. These recruitments increased the number of individuals for the 6 days after the storm. There is no explanation for the rapid decrease in numbers of *E. talpoida* after 29 September.

Emerita talpoida was present at each station on all sampling trips. Its abundance was the lowest before the storm. The numbers of individuals increased through 29 September, 6 days after the storm, and then decreased (Fig. 36).

The distribution of *E. talpoida* along the beach gradually increased from east to west (stations 1 to 9). The total number of individuals equaled 572 on transects 1, 2, and 3; 1,009 on transects 4, 5, and 6; and 1,558 on transects 7, 8, and 9 (Table 34; Fig. 37).

The new species, *Haustorius* n. sp., is a dominant amphipod inhabiting the swash zone that was present at 86 percent of the stations during the 8 sampling days. Abundance was the highest before the storm. After Eloise, its numbers decreased until 6 days after Eloise when they increased and almost reached pre-storm numbers (Fig. 36).

The numbers of *Haustorius* n. sp. were higher in the center part of the transects than at the ends. The average number of *Haustorius* n. sp. caught per sampling trip was 16.6 on transects 1, 2, and 3; 23.7 on transects 4, 5, and 6; and 14.8 on transects 7, 8, and 9 (Fig. 37).

The polychaete, *S. squamata*, was present at 86 percent of the stations during the 8 sampling days. Its abundance gradually increased from a low of three individuals on the day before the storm to a high of 192 individuals 14 days after the storm (Fig. 36).

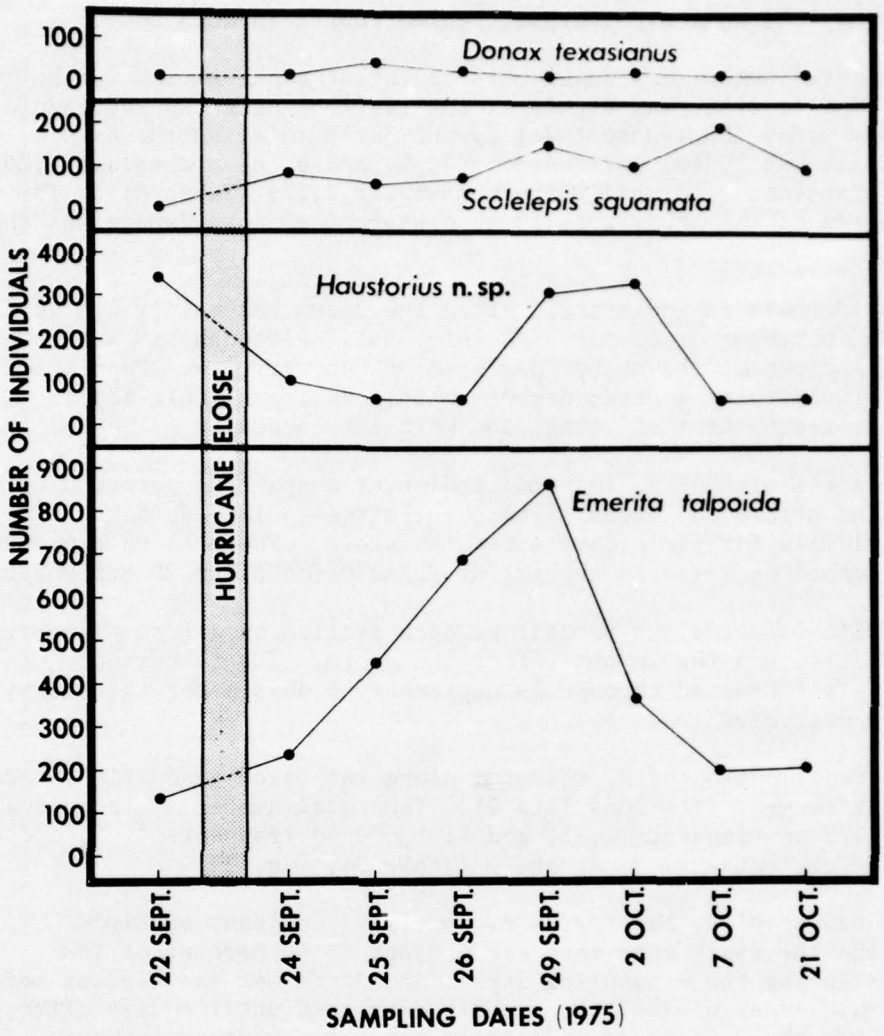

Figure 36. Total number of individuals of the four most abundant macroinvertebrates at the nine transect stations before and after Hurricane Eloise.

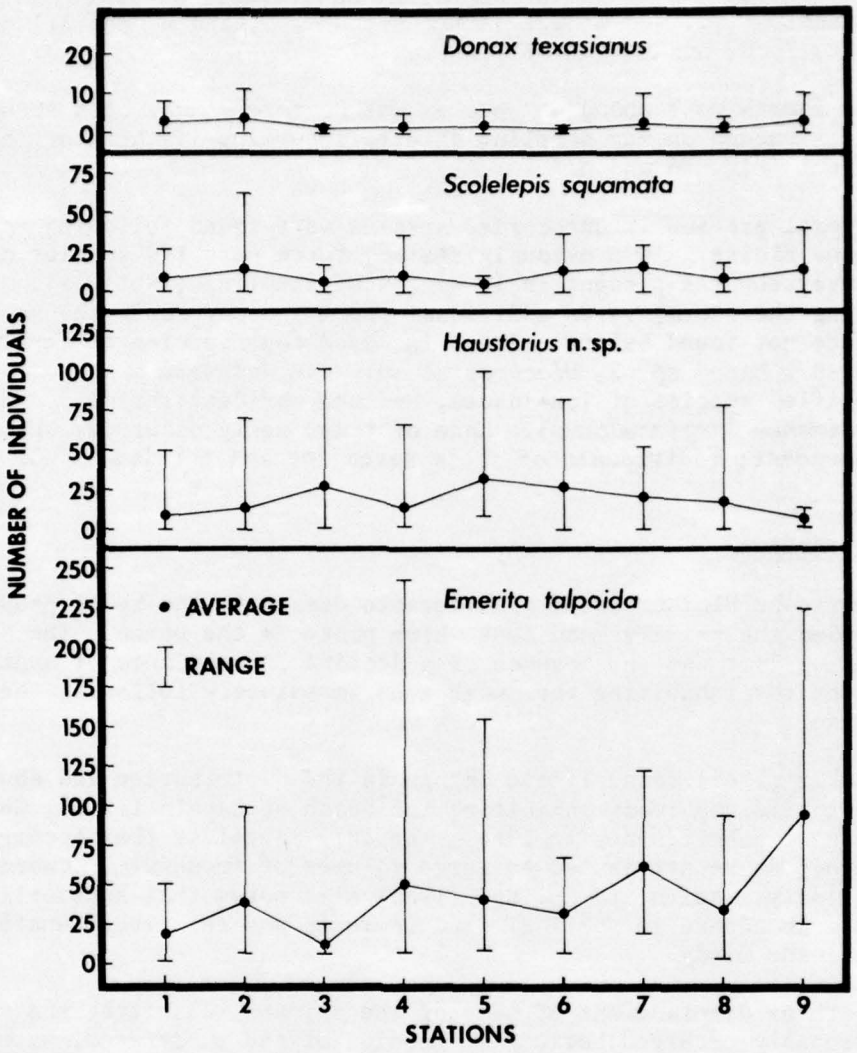

Figure 37. Average and range of the number of individuals of the four most abundant macroinvertebrates at the nine transect stations before and after Hurricane Eloise.

The numbers of *S. squamata* gradually increased from east to west (transects 1 to 9). The number of individuals was 217 on transects 1, 2, and 3; 222 on transects 4, 5, and 6, and 311 on transects 7, 8, and 9 (Fig. 37).

The fourth most abundant species was *D. texasianus*. Its abundance was never enough on any sampling date to determine if the storm had any effect (Fig. 36 and 37).

Several previously unrecorded species were found following Hurricane Eloise. As previously stated, there were 170 species of macroinvertebrates present in 12 months of sampling (Table 15). Following the storm, seven additional species occurred in the samples that were not found before. These included four species of amphipods (*Maera* sp., *Maera* sp. 2, *Microprotus* sp., and *Netamelita* sp.), two unidentified species of Tanaidacea, and one caridean shrimp (*Periclimenes longicaudatus*). None of these newly occurring species were abundant; individuals of these seven species totaled 15 (Table 34).

4. Discussion.

Hurricane Eloise caused considerable damage to the beach property and eroded the primary sand dune which protects the beach. The surprising fact was the absence of a decline in abundance of benthic invertebrates inhabiting the swash zone immediately following the hurricane.

Croker (1968) found little change in the distribution and abundance of haustoriid amphipods inhabiting the beach of Sapelo Island, Georgia, following two hurricanes in 1964. The only mortality that occurred to the amphipods he attributed to large volumes of freshwater lowering the salinity. Keith and Hulings (1965) also noted that haustoriid amphipod abundance in subtidal sand in Texas was relatively unaffected by Hurricane Cindy.

Death or displacement of some of the animals inhabiting the swash zone probably occurred because of erosion of the substrates, water movement, and the energy exerted on the beach during the hurricane. The long-term effects of this storm on the benthic fauna are uncertain; however, due to the short life cycles of the dominant species, recovery could be fast.

VI. SUMMARY

The beach and nearshore zone of the Gulf of Mexico off Panama City Beach, Florida, consist of white sandy beaches backed by naturally

vegetated sand dunes. The tourist industry is quickly changing the beach by removing the protective sand dune and placing seawalls, buildings, and condominiums on the beach. In September 1975, Hurricane Eloise caused considerable property damage and additional erosion of the Panama City Beach.

Water temperature fluctuated seasonally with the lowest average in December and the highest average in July. Temperatures were essentially uniform throughout the study area on any particular day and the average for each of the nine transects was also nearly identical. Salinities remained high throughout the year. The range of individual values fluctuated from 23.67 to 35.39 parts per thousand. Monthly averages ranged from a low of 28.44 parts per thousand in August to 35.03 parts per thousand in December. Average salinities on each of the nine transects were also about the same.

A total of 255 surface sediment samples was analyzed for particle-size distribution, percent carbon, organic carbon, carbonate, and statistical factors. The surface sediments exhibited uniformity over time and location; very little variation was noted in any of the factors at any station or within the study area.

The benthic invertebrates were represented by 170 species in 26 major taxa. Nine species of fish were also collected. The most abundant taxon in terms of species was Polychaeta with 69 species. Other abundant taxa were Amphipoda (22 species); Pelecypoda (14 species); Gastropoda (12 species); and Brachyura (11 species).

The benthic fauna on the nine transects was dominated by the following 14 species which constituted 80 percent of the individuals collected: *Dispio uncinata, Magelona rioja, Paraonis fulgens, Scolelepis squamata, Spio pettiboneae, Donax texasianus, Ervilia concentrica, Mancocuma* sp., *Acanthohaustorius* n. sp., *Haustorius* n. sp., *Protohaustorius* n. sp., *Pseudohaustorius* n. sp., *Emerita talpoida,* and *Branchiostoma floridae.*

The number of species was lowest in the swash zone (station 1) and highest seaward of the second sandbar (station 5). Each of the five stations on the transects represented different habitats, and at each station, the abundance of species changed. Several species were abundant at more than one station, but no single species was dominant at all five stations.

Seasonally, the numbers of individuals and species were highest in May and August, and lowest in November and February.

The distribution of species along the beach on the nine transects

was fairly uniform. The average number of species collected per station on a transect over the 12-month sampling period varied from 8.4 to 10. The similarity of animal distribution and abundance is further reflected in the distribution of the 14 most abundant species. The accumulative total percentage these 14 species contributed to each of the nine transects varied from 90 to 95.9 percent.

Plug samples were taken to a depth of 23 centimeters and were divided into a top and bottom part. Sixty-six species, (36.9 percent) occurred only in the top 11.5-centimeter part of the samples; 19 species (10.6 percent) were present only in the bottom 11.5-centimeter part of the sample. The species that occurred only in the bottom part were represented by one or two individuals per species. The percentage of the total individuals occurring in the top 11.5-centimeter part of the sample was 75 percent. Species found most abundantly in the top 11.5-centimeter part of the sample were *D. texasianus*, *S. pettiboneae*, *Mancocuma* sp., and *E. talpoida*.

The number of individuals per square meter fluctuated seasonally, with the months of May and June having the highest abundance of individuals. The average number of individuals from all stations was 2,744 per square meter, and the range at individual stations was from 48 to 35,504. The average number of individuals per square meter was lowest at station 3 and highest at station B.

There was a general trend of increasing diversity indexes seaward from station 1. The range of indexes at individual stations fluctuated from 0.000 to 3.141. The average index for all stations was 1.245. The average diversity indexes on each of the nine transects were approximately the same. Seasonally, the highest index (greatest diversity) occurred in August and the lowest in the colder months.

The scarcity of previous knowledge of the benthic fauna in this nearshore zone is indicated by the number of new species found in this study. Twenty-one invertebrate species (12 percent of all species) are possibly new. Fifteen of the 21 are amphipods, and 4 of these (*Acanthohaustorius* n. sp., *Haustorius* n. sp., *Protohaustorius* n. sp., and *Pseudohaustorius* n. sp.) are among the most abundant species occurring in the nearshore zone. In the other major taxa, there are possibly three new species of oligochaetes, two cumaceans, and one pelecypod.

The correlation of animal abundance to selected sedimentological parameters was low, indicating an abundance and distribution of benthic animals not directly related to sedimentological factors. This was also related to the relative uniformity of the sediments.

A correlation coefficient of 0.5282 was the highest r value. Mean grain size was the most significant sediment factor tested.

The effect of Hurricane Eloise on Panama City Beach was extensive. The beach and primary sand dune were severely eroded. The number of species and individuals increased following the storm and then gradually decreased 9 days after the storm. Following the storm, seven additional species occurred in the samples that were not found in the previous 11 months.

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APPENDIX A

WATER TEMPERATURE AND SALINITY DATA

Water temperatures and salinities for stations on transects 1 to 9 and stations A and B.

Station	Date	Water temperature (°C)	Salinity[1]
	TRANSECT 1		
	1974		
1-1	12 Nov.	18.5	34.28
1-3	22 Nov.	19.2	34.17
1-5	19 Nov.	20.9	33.50
1-1	3 Dec.	14.9	34.94
	1975		
1-1	6 Jan.	17.0	34.28
1-1	4 Feb.	18.0	32.72
1-3	6 Feb.	17.6	31.11
1-5	21 Feb.	17.5	34.33
1-1	5 Mar.	15.2	34.44
1-1	2 Apr.	20.9	31.06
1-1	2 May	24.2	31.22
1-3	6 May	22.0	32.00
1-5	12 May	25.2	31.83
1-1	4 June	28.6	30.67
1-1	2 July	32.1	31.89
1-1	4 Aug.	27.3	24.22
1-3	7 Aug.	27.4	30.94
1-5	13 Aug.	28.2	25.00
1-1	2 Sept.	30.0	30.28
1-1	2 Oct.	24.6	32.44
	TRANSECT 2		
	1974		
2-1	12 Nov.	18.8	34.00
2-3	21 Nov.	18.7	34.22
2-5	19 Nov.	20.9	33.72
2-1	3 Dec.	14.7	35.39
	1975		
2-1	6 Jan.	16.9	33.89
2-1	4 Feb.	17.9	32.06
2-3	6 Feb.	17.8	31.00
2-5	21 Feb.	17.5	34.11
2-1	5 Mar.	15.0	34.44
2-1	2 Apr.	20.9	30.94
2-1	2 May	24.3	32.06
2-3	6 May	23.0	32.11
2-5	12 May	25.1	32.06

[1]Parts per thousand

TRANSECT 2 (Continued)

Station	Date	Water temperature (°C)	Salinity[1]
	1975		
2-1	4 June	28.3	31.06
2-1	2 July	32.0	31.33
2-1	4 Aug.	27.5	24.61
2-3	7 Aug.	27.4	30.94
2-5	13 Aug.	28.5	29.94
2-1	2 Sept.	29.9	30.44
2-1	2 Oct.	24.1	31.94
	TRANSECT 3		
	1974		
3-1	12 Nov.	18.5	34.17
3-3	21 Nov.	18.0	34.17
3-5	19 Nov.	20.9	34.33
3-1	3 Dec.	14.6	35.39
	1975		
3-1	6 Jan.	16.5	34.06
3-1	4 Feb.	17.6	31.17
3-3	6 Feb.	18.0	31.28
3-5	21 Feb.	17.2	33.67
3-1	5 Mar.	14.8	33.50
3-1	2 Apr.	20.9	31.06
3-1	2 May	25.0	31.33
3-3	6 May	23.2	31.89
3-5	12 May	25.2	32.11
3-1	4 June	28.4	30.56
3-1	2 July	31.3	31.00
3-1	4 Aug.	27.8	23.67
3-3	7 Aug.	27.6	30.83
3-5	11 Aug.	28.2	25.72
3-1	2 Sept.	29.9	30.28
3-1	2 Oct.	24.2	31.67
	TRANSECT 4		
	1974		
4-1	11 Nov.	21.7	34.17
4-3	26 Nov.	13.9	33.72
4-5	19 Nov.	20.8	34.00
4-1	3 Dec.	14.1	34.89
	1975		
4-1	6 Jan.	15.2	34.72

TRANSECT 4 (Continued)

Station	Date	Water temperature (°C)	Salinity[1]
	1975		
4-1	4 Feb.	17.9	31.78
4-3	10 Feb.	15.5	34.17
4-5	21 Feb.	17.0	35.33
4-1	5 Mar.	14.0	34.50
4-1	2 Apr.	20.2	30.00
4-1	5 May	21.8	33.72
4-3	19 May	25.8	32.28
4-5	12 May	24.8	31.94
4-1	4 June	28.1	30.11
4-1	2 July	31.0	30.94
4-1	4 Aug.	28.2	31.94
4-3	7 Aug.	27.5	26.72
4-5	11 Aug.	27.5	24.67
4-1	2 Sept.	29.7	29.89
4-1	2 Oct.	24.2	31.94
	TRANSECT 5		
	1974		
5-1	11 Nov.	21.8	34.17
5-3	26 Nov.	15.2	33.89
5-5	19 Nov.	20.7	34.22
5-1	3 Dec.	14.1	35.33
	1975		
5-1	6 Jan.	15.9	34.56
5-1	4 Feb.	17.9	31.33
5-3	10 Feb.	15.7	34.17
5-5	21 Feb.	17.0	34.57
5-1	5 Mar.	14.2	34.22
5-1	2 Apr.	20.1	30.83
5-1	5 May	22.0	33.72
5-3	19 May	25.8	32.50
5-5	12 May	24.9	32.17
5-1	4 June	28.0	30.22
5-1	2 July	30.9	30.78
5-1	4 Aug.	28.2	26.61
5-3	7 Aug.	27.6	31.94
5-5	8 Aug.	26.8	31.00
5-1	2 Sept.	29.4	30.17
5-1	2 Oct.	24.1	31.00

Station	Date	Water temperature (°C)	Salinity[1]
	TRANSECT 6		
	1974		
6-1	11 Nov.	21.7	34.33
6-3	26 Nov.	14.6	33.33
6-5	19 Nov.	20.8	34.17
6-1	3 Dec.	14.2	34.72
	1975		
6-1	6 Jan.	15.2	34.72
6-1	4 Feb.	18.0	31.50
6-3	10 Feb.	15.9	34.17
6-5	21 Feb.	16.9	35.33
6-1	5 Mar.	13.6	34.33
6-1	2 Apr.	20.0	31.28
6-1	5 May	22.2	33.94
6-3	19 May	25.0	32.39
6-5	13 May	25.9	31.06
6-1	4 June	28.0	30.33
6-1	2 July	30.8	31.11
6-1	4 Aug.	27.9	26.33
6-3	7 Aug.	27.6	31.89
6-5	8 Aug.	26.5	30.28
6-1	2 Sept.	29.6	30.17
6-1	2 Oct.	24.6	33.11
	TRANSECT 7		
	1974		
7-1	11 Nov.	21.1	34.11
7-3	22 Nov.	19.0	34.17
7-5	19 Nov.	20.9	34.39
7-1	3 Dec.	13.9	35.17
	1975		
7-1	6 Jan.	14.9	34.56
7-1	5 Feb.	17.9	32.06
7-3	11 Feb.	17.0	34.33
7-5	20 Feb.	18.0	33.35
7-1	5 Mar.	13.9	34.56
7-1	2 Apr.	20.0	32.22
7-1	5 May	21.7	33.94
7-3	22 May	25.4	33.33
7-5	13 May	25.9	30.94
7-1	4 June	27.8	30.11
7-1	2 July	30.1	30.94

Station	Date	Water temperature (°C)	Salinity[1]
	TRANSECT 7 (Continued)		
	1975		
7-1	4 Aug.	27.9	25.50
7-3	7 Aug.	27.2	31.89
7-5	14 Aug.	28.8	30.67
7-1	2 Sept.	28.8	30.00
7-1	2 Oct.	24.0	31.33
	TRANSECT 8		
	1974		
8-1	11 Nov.	21.0	34.22
8-3	22 Nov.	18.5	34.17
8-5	18 Nov.	21.0	34.33
8-1	3 Dec.	13.8	34.83
	1975		
8-1	6 Jan.	15.3	34.56
8-1	5 Feb.	18.0	32.11
8-3	11 Feb.	16.5	34.56
8-5	20 Feb.	16.9	34.50
8-1	5 Mar.	14.8	35.28
8-1	2 Apr.	19.9	32.22
8-1	5 May	21.7	33.72
8-3	22 May	25.6	33.06
8-5	13 May	25.2	30.67
8-1	4 June	27.8	30.17
8-1	2 July	30.2	30.89
8-1	4 Aug.	27.8	25.56
8-3	7 Aug.	27.1	31.94
8-5	14 Aug.	28.6	30.94
8-1	2 Sept.	28.8	30.22
8-1	2 Oct.	23.5	31.33
	TRANSECT 9		
	1974		
9-1	11 Nov.	20.9	34.28
9-3	22 Nov.	17.9	34.28
9-5	18 Nov.	21.2	34.39
9-1	3 Dec.	13.3	34.61
	1975		
9-1	6 Jan.	15.0	34.67
9-1	5 Feb.	18.0	32.17
9-3	11 Feb.	15.9	35.11

TRANSECT 9 (Continued)

Station	Date	Water temperature (°C)	Salinity[1]
	1975		
9-5	20 Feb.	17.2	34.67
9-1	5 Mar.	14.8	35.28
9-1	2 Apr.	19.6	32.39
9-1	5 May	21.7	33.72
9-3	22 May	25.4	32.61
9-5	13 May	25.2	30.39
9-1	4 June	27.6	29.89
9-1	2 July	30.1	31.00
9-1	4 Aug.	27.8	25.44
9-3	7 Aug.	27.1	32.06
9-5	12 Aug.	28.6	26.72
9-1	2 Sept.	28.8	30.56
9-1	2 Oct.	24.2	30.83

STATIONS A and B

Station	Date	Water temperature (°C)	Salinity[1]
	1974		
A	18 Nov.	21.0	34.50
B	18 Nov.	20.8	34.33
	1975		
A	20 Feb.	17.4	34.39
B	20 Feb.	17.5	33.89
A	20 May	26.2	32.22
B	20 May	26.0	32.17
A	12 Aug.	28.3	26.22
B	12 Aug.	28.5	26.11

[1]Parts per thousand

APPENDIX B

STATION PARTICLE-SIZE DISTRIBUTION DATA

Particle-size distribution as percentage of total sample weight and statistical data using formulas by Folk and Ward (1957) for sediments collected at each station.

STATION 1-1

Date	Grain-size classes: Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size (phi)	Mean Grain Size (mm)	Standard Deviation (phi)	Skewness	Kurtosis
1974									
12 Nov.	4.868	95.059	0.073	0.000	1.834	0.281	0.991	-0.248	1.296
3 Dec.	0.044	99.890	0.066	0.000	1.978	0.254	0.635	-0.011	0.738
1975									
6 Jan.	0.000	99.973	0.027	0.000	1.570	0.337	0.467	+0.164	1.099
4 Feb.	0.000	99.998	0.002	0.000	1.658	0.317	0.513	+0.232	1.095
5 Mar.	0.138	99.860	0.002	0.000	1.691	0.310	0.749	+0.044	1.089
2 Apr.	0.136	99.864	0.000	0.000	1.774	0.292	0.573	+0.247	0.945
2 May	0.000	99.929	0.071	0.000	2.075	0.237	0.623	-0.145	0.757
4 June	0.000	99.963	0.037	0.000	1.667	0.314	0.830	-0.033	0.939
2 July	0.000	99.940	0.060	0.000	1.121	0.460	0.826	+0.020	0.915
4 Aug.	0.000	99.944	0.056	0.000	1.423	0.370	0.825	-0.030	1.122
2 Sept.	0.000	99.978	0.023	0.000	1.643	0.320	0.837	-0.034	0.947
2 Oct.	---	---	---	---	---	---	---	---	---
Average	0.471	99.491	0.038	0.000	1.676	0.317	0.715	+0.019	0.995

STATION 1-2

1974									
12 Nov.	0.115	99.800	0.085	0.000	1.598	0.330	0.861	-0.047	1.017
1975									
4 Feb.	0.000	99.960	0.040	0.000	2.098	0.234	0.635	-0.218	0.790
2 May	0.113	99.878	0.009	0.000	1.734	0.301	0.739	+0.046	1.051
7 Aug.	0.000	99.959	0.041	0.000	2.323	0.200	0.522	-0.258	1.143
Average	0.057	99.899	0.044	0.000	1.938	0.266	0.689	-0.119	1.000

STATION 1-3

1974									
22 Nov.	0.000	99.887	0.113	0.000	2.311	0.202	0.529	-0.270	1.156
1975									
6 Feb.	0.000	99.954	0.046	0.000	2.400	0.190	0.473	-0.196	1.156
6 May	0.000	99.984	0.016	0.000	2.278	0.206	0.548	-0.270	1.110
13 Aug.	1.683	98.300	0.017	0.000	2.244	0.211	0.586	-0.305	1.160
Average	0.421	99.531	0.048	0.000	2.308	0.202	0.534	-0.260	1.146

STATION 1-4

1974									
21 Nov.	0.000	99.864	0.136	0.000	2.270	0.207	0.601	-0.305	1.176
1975									
6 Feb.	0.000	99.931	0.069	0.000	2.218	0.215	0.613	-0.299	1.041
6 May	0.000	100.000	0.000	0.000	1.892	0.269	0.629	+0.116	0.755
13 Aug.	0.000	99.982	0.018	0.000	2.115	0.231	0.631	-0.209	0.792
Average	0.000	99.944	0.056	0.000	2.124	0.231	0.619	-0.174	0.941

STATION 1-5

1974									
19 Nov.	0.314	99.649	0.037	0.000	1.958	0.257	0.817	-0.279	0.944
1975									
21 Feb.	0.175	99.825	0.000	0.000	1.193	0.437	0.599	-0.269	0.925
12 May	0.000	99.954	0.046	0.000	2.164	0.223	0.609	-0.241	0.849
13 Aug.	1.570	98.414	0.016	0.000	2.029	0.245	0.808	-0.358	0.977
Average	0.515	99.461	0.025	0.000	1.836	0.291	0.708	-0.287	0.924

STATION 2-1

1974									
12 Nov.	0.182	99.732	0.085	0.000	1.912	0.266	0.741	-0.093	0.906
3 Dec.	0.048	99.931	0.021	0.000	1.896	0.269	0.752	-0.091	0.933
1975									
6 Jan.	1.898	98.056	0.045	0.000	1.625	0.324	0.900	-0.100	0.951
4 Feb.	0.000	99.990	0.010	0.000	1.845	0.278	0.624	+0.163	0.782
5 Mar.	0.317	99.683	0.000	0.000	1.475	0.360	0.552	-0.041	1.380
2 Apr.	0.000	100.000	0.000	0.000	1.523	0.348	0.343	+0.045	0.810
2 May	0.247	99.739	0.014	0.000	1.423	0.370	0.666	-0.059	1.309
4 June	0.000	100.000	0.000	0.000	0.896	0.538	0.745	+0.297	0.917
2 July	0.000	99.944	0.055	0.000	1.684	0.311	0.846	-0.061	0.995
4 Aug.	1.188	98.801	0.011	0.000	1.470	0.361	0.836	-0.030	1.138
2 Sept.	0.186	99.722	0.093	0.000	1.864	0.275	0.790	-0.129	0.905
2 Oct.	0.163	99.831	0.006	0.000	1.617	0.326	0.705	+0.054	1.284
Average	0.352	99.619	0.028	0.000	1.603	0.336	0.708	-0.004	1.026

STATION 2-2

1974									
12 Nov.	0.000	99.786	0.214	0.000	2.114	0.231	0.617	-0.205	0.791
1975									
4 Feb.	0.000	99.978	0.022	0.000	2.017	0.247	0.642	-0.105	0.743
2 May	0.000	99.987	0.013	0.000	2.059	0.240	0.640	-0.166	0.759
7 Aug.	3.240	96.730	0.030	0.000	1.960	0.257	0.771	-0.204	0.973
Average	0.810	99.120	0.070	0.000	2.038	0.244	0.668	-0.170	0.817

STATION 2-3

1974									
19 Nov.	0.131	99.730	0.139	0.000	2.062	0.240	0.698	-0.269	0.878
1975									
6 Feb.	0.000	99.953	0.047	0.000	2.410	0.188	0.470	-0.185	1.152
6 May	0.000	99.962	0.038	0.000	2.412	0.188	0.454	-0.176	1.137
13 Aug.	0.000	99.904	0.096	0.000	2.248	0.210	0.568	-0.267	1.059
Average	0.033	99.887	0.080	0.000	2.283	0.207	0.548	-0.090	1.057

Date	Grain-size classes: Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size (phi)	Mean Grain Size (mm)	Standard Deviation (phi)	Skewness	Kurtosis
STATION 2-4									
1974									
21 Nov.	0.091	99.870	0.040	0.000	1.856	0.276	0.710	+0.020	0.924
1975									
6 Feb.	0.040	99.947	0.013	0.000	1.890	0.270	0.638	+0.111	0.754
6 May	0.000	99.986	0.014	0.000	1.941	0.260	0.746	-0.169	0.877
13 Aug.	0.000	99.945	0.055	0.000	2.418	0.187	0.468	-0.190	1.189
Average	0.033	99.937	0.031	0.000	2.026	0.248	0.641	-0.057	0.936
STATION 2-5									
1974									
19 Nov.	0.084	99.870	0.046	0.000	2.001	0.250	0.848	-0.416	1.005
1975									
21 Feb.	0.247	99.597	0.155	0.000	2.323	0.200	0.595	-0.247	1.229
12 May	0.000	99.967	0.033	0.000	2.227	0.214	0.627	-0.328	1.190
13 Aug.	0.000	99.954	0.046	0.000	2.384	0.192	0.516	-0.230	1.165
Average	0.083	99.847	0.070	0.000	2.234	0.214	0.647	-0.305	1.147
STATION 3-1									
1974									
12 Nov.	0.673	99.227	0.100	0.000	1.814	0.284	0.644	+0.146	0.871
3 Dec.	0.000	99.950	0.050	0.000	1.643	0.320	0.680	+0.059	1.357
1975									
6 Jan.	0.484	99.483	0.033	0.000	1.781	0.291	0.776	-0.016	0.999
4 Feb.	0.247	99.597	0.155	0.000	2.322	0.200	0.595	-0.247	1.229
3 May	0.081	99.919	0.000	0.000	1.623	0.325	0.614	+0.089	1.301
2 Apr.	0.024	99.976	0.000	0.000	1.442	0.368	0.462	-0.163	1.097
2 May	0.000	99.985	0.015	0.000	1.578	0.335	0.655	+0.051	1.324
4 June	0.278	99.622	0.101	0.000	1.714	0.305	1.043	-0.468	0.584
2 July	1.235	98.743	0.023	0.000	1.618	0.326	0.829	-0.027	1.053
4 Aug.	0.000	99.988	0.012	0.000	1.606	0.328	0.803	+0.001	1.037
2 Sept.	0.043	99.892	0.065	0.000	1.687	0.310	0.636	+0.123	1.233
2 Oct.	0.460	99.528	0.012	0.000	2.014	0.248	0.675	-0.161	0.799
Average	0.294	99.659	0.047	0.000	1.737	0.303	0.701	-0.051	1.074
STATION 3-2									
1974									
12 Nov.	1.043	98.849	0.107	0.000	2.000	0.250	0.753	-0.233	0.946
1975									
4 Feb.	0.378	99.497	0.124	0.000	1.807	0.286	0.719	+0.041	0.969
2 May	0.000	99.928	0.072	0.000	2.106	0.232	0.613	-0.178	0.776
7 Aug.	0.000	99.988	0.012	0.000	2.174	0.222	0.606	-0.266	0.892
Average	0.355	99.566	0.079	0.000	2.022	0.248	0.673	-0.159	0.896
STATION 3-3									
1974									
21 Nov.	0.000	99.885	0.115	0.000	2.421	0.187	0.491	-0.194	1.172
1975									
6 Feb.	0.000	99.876	0.124	0.000	2.440	0.184	0.445	-0.176	1.140
6 May	0.000	99.925	0.075	0.000	2.413	0.188	0.454	-0.172	0.125
11 Aug.	2.209	97.762	0.029	0.000	2.058	0.240	0.781	-0.345	1.030
Average	0.552	99.362	0.086	0.000	2.333	0.200	0.543	-0.222	1.117
STATION 3-4									
1974									
21 Nov.	0.000	99.918	0.082	0.000	2.167	0.223	0.609	-0.268	0.884
1975									
6 Feb.	0.000	99.934	0.066	0.000	2.193	0.219	0.600	-0.258	0.904
6 May	0.000	99.978	0.022	0.000	2.154	0.225	0.602	-0.231	0.832
11 Aug.	0.000	99.968	0.032	0.000	2.433	0.185	0.456	-0.184	1.166
Average	0.000	99.950	0.051	0.000	2.237	0.213	0.567	-0.235	0.947
STATION 3-5									
1974									
19 Nov.	0.000	99.928	0.072	0.000	2.106	0.232	0.644	-0.228	0.799
1975									
21 Feb.	0.000	99.970	0.030	0.000	2.331	0.199	0.525	-0.263	1.168
12 May	0.000	99.966	0.034	0.000	2.197	0.218	0.589	-0.259	0.916
11 Aug.	0.000	99.920	0.080	0.000	2.323	0.200	0.547	-0.262	1.134
Average	0.000	99.946	0.054	0.000	2.239	0.212	0.576	-0.253	1.004
STATION 4-1									
1974									
11 Nov.	0.000	99.961	0.039	0.000	1.557	0.340	0.559	+0.026	1.364
3 Dec.	2.305	97.663	0.031	0.000	1.491	0.356	0.461	-0.187	1.273
1975									
6 Jan.	1.943	98.005	0.053	0.000	1.569	0.337	0.647	+0.002	1.473
4 Feb.	0.000	99.920	0.080	0.000	1.832	0.281	0.618	+0.184	0.800
5 Mar.	0.000	99.997	0.003	0.000	1.617	0.326	0.531	+0.168	1.157
2 Apr.	0.000	100.000	0.000	0.000	1.517	0.349	0.417	+0.103	1.029
5 May	0.759	99.244	0.000	0.000	1.524	0.348	0.547	+0.003	1.385
4 June	0.000	100.000	0.000	0.000	1.552	0.341	0.501	+0.089	1.219
2 July	0.000	99.970	0.030	0.000	1.716	0.304	0.727	+0.063	1.064
4 Aug.	0.000	99.958	0.042	0.000	1.577	0.335	0.646	+0.051	1.324
2 Sept.	---	---	---	---	---	---	---	---	---
2 Oct.	6.967	93.014	0.020	0.000	1.216	0.430	1.119	-0.376	2.026
Average	1.089	98.885	0.027	0.000	1.524	0.341	0.616	+0.011	1.283

STATION 4-2

Date	Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size (phi)	(mm)	Standard Deviation (phi)	Skewness	Kurtosis
1974									
11 Nov.	0.000	99.862	0.138	0.000	1.928	0.263	0.633	+0.076	0.744
1975									
4 Feb.	0.038	99.911	0.052	0.000	2.031	0.245	0.623	-0.074	0.741
5 May	0.000	99.934	0.066	0.000	2.038	0.244	0.624	-0.092	0.744
7 Aug.	0.000	99.977	0.023	0.000	2.156	0.224	0.615	-0.264	0.867
Average	0.010	99.921	0.070	0.000	2.038	0.244	0.624	-0.089	0.774

STATION 4-3

1974									
26 Nov.	0.000	99.960	0.040	0.000	1.920	0.264	0.639	+0.077	0.745
1975									
10 Feb.	0.000	99.856	0.144	0.000	2.190	0.219	0.605	-0.257	0.896
19 May	0.000	99.933	0.067	0.000	2.449	0.183	0.433	-0.162	1.093
11 Aug.	0.000	99.836	0.164	0.000	2.196	0.218	0.590	-0.256	0.908
Average	0.000	99.896	0.104	0.000	2.189	0.221	0.567	-0.150	0.911

STATION 4-4

1974									
26 Nov.	0.000	99.956	0.044	0.000	2.209	0.216	0.594	-0.272	0.960
1975									
10 Feb.	0.000	99.974	0.026	0.000	2.202	0.217	0.592	-0.263	0.929
19 May	0.000	99.967	0.033	0.000	2.221	0.214	0.582	-0.267	1.003
11 Aug.	0.000	99.970	0.030	0.000	2.488	0.178	0.351	-0.048	0.816
Average	0.000	99.967	0.033	0.000	2.280	0.206	0.530	-0.213	0.927

STATION 4-5

1974									
26 Nov.	0.000	99.902	0.098	0.000	2.292	0.204	0.580	-0.299	1.190
1975									
10 Feb.	0.000	99.888	0.112	0.000	2.125	0.229	0.749	-0.397	1.012
19 May	0.000	99.993	0.007	0.000	2.231	0.213	0.570	-0.260	0.990
11 Aug.	0.000	99.970	0.030	0.000	2.477	0.180	0.410	-0.151	1.056
Average	0.000	99.938	0.062	0.000	2.281	0.207	0.577	-0.277	1.062

STATION 5-1

1974									
11 Nov.	0.000	99.922	0.078	0.000	1.627	0.324	0.624	+0.078	1.344
3 Dec.	0.000	99.946	0.054	0.000	1.878	0.272	0.634	+0.123	0.759
1975									
6 Jan.	1.428	98.522	0.050	0.000	1.729	0.302	0.791	-0.004	1.074
4 Feb.	0.576	99.392	0.032	0.000	1.719	0.304	0.553	+0.251	1.063
5 Mar.	0.000	99.966	0.034	0.000	1.774	0.292	0.591	+0.233	0.905
2 Apr.	0.000	99.974	0.026	0.000	1.686	0.311	0.545	+0.244	1.074
5 May	0.000	100.000	0.000	0.000	1.681	0.312	0.554	+0.230	1.075
4 June	0.177	99.820	0.004	0.000	1.549	0.342	0.518	+0.063	1.272
2 July	0.000	99.867	0.133	0.000	1.726	0.302	0.609	+0.187	1.077
4 Aug.	0.000	99.984	0.016	0.000	1.544	0.343	0.564	+0.024	1.338
2 Sept.	0.000	99.989	0.011	0.000	1.630	0.323	0.635	+0.088	1.290
2 Oct.	---	---	---	---	---	---	---	---	---
Average	0.198	99.762	0.040	0.000	1.686	0.311	0.555	+0.137	1.115

STATION 5-2

1974									
11 Nov.	0.000	99.946	0.054	0.000	1.894	0.269	0.633	+0.107	0.753
1975									
4 Feb.	0.000	99.916	0.084	0.000	2.180	0.221	0.595	-0.246	0.872
5 May	0.000	100.000	0.000	0.000	2.004	0.249	0.624	-0.032	0.738
7 Aug.	0.000	99.988	0.012	0.000	1.682	0.312	0.723	+0.066	1.135
Average	0.000	99.963	0.037	0.000	1.940	0.262	0.643	-0.026	0.874

STATION 5-3

1974									
26 Nov.	0.000	99.941	0.059	0.000	2.119	0.230	0.637	-0.235	0.810
1975									
10 Feb.	0.000	99.924	0.076	0.000	2.175	0.221	0.604	-0.244	0.862
19 May	0.000	99.943	0.057	0.000	2.349	0.196	0.498	-0.232	1.122
8 Aug.	0.000	99.995	0.005	0.000	2.051	0.241	0.644	-0.158	0.756
Average	0.000	99.951	0.049	0.000	2.162	0.222	0.595	-0.217	0.887

STATION 5-4

1974									
26 Nov.	0.000	99.883	0.117	0.000	2.359	0.195	0.534	-0.259	1.204
1975									
10 Feb.	0.000	99.930	0.070	0.000	2.414	0.188	0.479	-0.196	1.214
19 May	0.000	100.000	0.000	0.000	2.147	0.226	0.609	-0.237	0.832
8 Aug.	0.000	99.961	0.039	0.000	2.426	0.186	0.472	-0.186	1.174
Average	0.000	99.944	0.056	0.000	2.336	0.198	0.523	-0.219	1.106

STATION 5-5

1974									
19 Nov.	0.000	99.951	0.049	0.000	2.294	0.204	0.572	-0.294	1.183
1975									
21 Feb.	0.018	99.967	0.016	0.000	2.159	0.224	0.712	-0.381	1.146
12 May	0.000	99.996	0.004	0.000	2.317	0.201	0.527	-0.253	1.113
8 Aug.	0.000	99.976	0.024	0.000	2.425	0.186	0.496	-0.210	1.273
Average	0.004	99.973	0.020	0.000	2.298	0.203	0.576	-0.284	1.178

Date	Grain-size classes: Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size (phi)	Mean Grain Size (mm)	Standard Deviation (phi)	Skewness	Kurtosis
STATION 6-1									
1974									
11 Nov.	0.000	99.977	0.023	0.000	1.510	0.351	0.407	+0.065	1.007
3 Dec.	0.229	99.730	0.041	0.000	1.616	0.326	0.493	+0.206	1.101
1975									
6 Jan.	0.553	99.428	0.018	0.000	0.777	0.584	0.598	+0.245	0.919
4 Feb.	0.011	99.973	0.015	0.000	1.669	0.314	0.525	+0.238	1.086
5 Mar.	0.000	99.954	0.046	0.000	1.724	0.303	0.658	+0.122	1.115
2 Apr.	1.039	98.959	0.002	0.000	1.513	0.350	0.531	+0.002	1.358
5 May	0.384	99.617	0.000	0.000	1.703	0.307	0.638	+0.130	1.212
4 June	0.078	99.901	0.021	0.000	1.378	0.385	0.491	-0.212	1.118
2 July	0.000	99.942	0.058	0.000	1.746	0.298	0.585	+0.238	0.961
4 Aug.	0.755	99.227	0.018	0.000	1.478	0.359	0.743	-0.030	0.273
2 Sept.	0.000	99.984	0.016	0.000	1.519	0.349	0.545	+0.088	1.368
2 Oct.	0.000	99.942	0.058	0.000	1.898	0.268	0.617	+0.138	0.761
Average	0.254	99.720	0.026	0.000	1.544	0.349	0.569	+0.102	1.106
STATION 6-2									
1974									
11 Nov.	0.052	99.916	0.032	0.000	1.683	0.312	0.542	+0.241	1.072
1975									
4 Feb.	0.000	99.954	0.046	0.000	2.037	0.244	0.632	-0.114	0.746
5 May	0.000	99.921	0.079	0.000	2.121	0.230	0.608	-0.191	0.787
7 Aug.	0.000	99.994	0.006	0.000	1.810	0.285	0.665	+0.112	0.912
Average	0.013	99.946	0.043	0.000	1.912	0.267	0.611	+0.012	0.879
STATION 6-3									
1974									
26 Nov.	0.000	99.908	0.092	0.000	2.100	0.233	0.644	-0.204	0.784
1975									
10 Feb.	0.000	99.906	0.094	0.000	2.324	0.200	0.533	-0.265	1.158
19 May	0.000	99.965	0.035	0.000	2.439	0.184	0.448	-0.169	1.113
8 Aug.	0.000	99.995	0.005	0.000	2.162	0.224	0.628	-0.285	0.900
Average	0.000	99.944	0.056	0.000	2.256	0.210	0.563	-0.230	0.988
STATION 6-4									
1974									
26 Nov.	0.000	99.940	0.060	0.000	2.320	0.200	0.544	-0.265	1.142
1975									
10 Feb.	0.000	99.925	0.075	0.000	2.273	0.207	0.575	-0.301	1.179
19 May	0.000	99.990	0.010	0.000	2.214	0.216	0.586	-0.269	0.966
8 Aug.	0.000	99.984	0.016	0.000	2.314	0.201	0.567	-0.279	1.163
Average	0.000	99.960	0.040	0.000	2.280	0.206	0.568	-0.278	1.112
STATION 6-5									
1974									
19 Nov.	0.000	99.902	0.098	0.000	2.252	0.210	0.560	-0.303	1.165
1975									
21 Feb.	0.000	99.939	0.061	0.000	2.459	0.182	0.435	-0.179	1.149
13 May	0.057	99.842	0.101	0.000	2.275	0.207	0.582	-0.314	1.217
8 Aug.	0.168	99.728	0.105	0.000	2.439	0.184	0.454	-0.188	1.181
Average	0.056	99.853	0.091	0.000	2.356	0.195	0.507	-0.246	1.178
STATION 7-1									
1974									
11 Nov.	0.000	99.918	0.082	0.000	1.490	0.356	0.321	0.000	0.738
3 Dec.	0.000	99.946	0.054	0.000	1.711	0.306	0.563	+0.245	1.052
1975									
6 Jan.	1.035	98.903	0.062	0.000	1.727	0.302	0.737	+0.044	1.128
5 Feb.	0.151	99.839	0.010	0.000	1.792	0.289	0.588	+0.234	0.885
5 Mar.	0.027	99.933	0.040	0.000	1.517	0.349	0.619	+0.012	1.534
2 Apr.	0.000	100.000	0.000	0.000	1.469	0.361	0.428	-0.148	1.048
5 May	0.000	100.000	0.000	0.000	1.659	0.317	0.656	+0.096	1.265
4 June	0.000	99.968	0.032	0.000	1.583	0.334	0.458	+0.169	1.115
2 July	0.000	99.926	0.074	0.000	1.876	0.272	0.611	+0.170	0.778
4 Aug.	0.000	99.989	0.011	0.000	1.335	0.396	0.642	-0.118	1.267
2 Sept.	0.116	99.878	0.006	0.000	1.397	0.380	0.566	-0.111	1.264
2 Oct.	0.000	99.982	0.018	0.000	0.576	0.336	0.460	+0.166	1.106
Average	0.111	99.857	0.032	0.000	1.594	0.333	0.554	+0.063	1.081
STATION 7-2									
1974									
11 Nov.	0.000	99.972	0.028	0.000	1.695	0.309	0.595	+0.173	1.168
1975									
5 Feb.	0.000	99.951	0.049	0.000	1.743	0.299	0.570	+0.247	1.009
5 May	0.000	99.991	0.009	0.000	2.072	0.238	0.619	-0.134	0.754
7 Aug.	0.000	99.974	0.026	0.000	1.825	0.282	0.617	+0.189	0.806
Average	0.000	99.972	0.028	0.000	1.833	0.282	0.600	+0.118	0.934
STATION 7-3									
1974									
22 Nov.	0.000	99.940	0.060	0.000	2.083	0.236	0.646	-0.191	0.773
1975									
11 Feb.	0.000	99.935	0.065	0.000	1.709	0.306	0.552	+0.248	1.065
22 May	0.000	99.843	0.157	0.000	2.433	0.185	0.443	-0.169	1.113
14 Aug.	0.000	99.960	0.040	0.000	2.254	0.210	0.607	-0.331	1.247
Average	0.000	99.920	0.080	0.000	2.119	0.234	0.562	-0.110	1.049

STATION 7-4

Date	Grain-size classes: Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size: (phi)	(mm)	Standard Deviation (phi)	Skewness	Kurtosis
1974									
22 Nov.	0.000	99.966	0.034	0.000	1.993	0.251	0.742	-0.201	0.912
1975									
11 Feb.	0.000	99.949	0.051	0.000	2.162	0.223	0.624	-0.268	0.876
22 May	0.000	99.901	0.099	0.000	2.332	0.199	0.516	-0.247	1.123
14 Aug.	0.000	99.975	0.025	0.000	2.422	0.187	0.467	-0.184	1.166
Average	0.000	99.948	0.052	0.000	2.227	0.215	0.587	-0.225	1.019

STATION 7-5

1974									
19 Nov.	0.000	99.930	0.070	0.000	2.228	0.213	0.586	-0.298	1.103
1975									
20 Feb.	0.005	99.962	0.033	0.000	2.064	0.239	0.645	-0.171	0.762
13 May	0.000	99.857	0.143	0.000	2.458	0.182	0.435	-0.161	1.088
14 Aug.	0.000	99.953	0.047	0.000	2.318	0.201	0.562	-0.275	1.151
Average	0.001	99.926	0.073	0.000	2.267	0.208	0.557	-0.225	1.026

STATION 8-1

1974									
11 Nov.	0.000	99.916	0.084	0.000	1.512	0.351	0.572	-0.007	1.400
3 Dec.	0.000	99.916	0.084	0.000	1.795	0.288	0.606	+0.216	0.852
1975									
6 Jan.	0.101	99.834	0.065	0.000	1.364	0.389	0.674	-0.115	1.354
5 Feb.	0.000	99.903	0.097	0.000	2.069	0.238	0.618	-0.131	0.753
5 Mar.	0.000	99.986	0.014	0.000	1.499	0.354	0.672	-0.009	1.313
2 Apr.	0.000	100.000	0.000	0.000	2.451	0.183	0.442	-0.160	1.084
5 May	0.000	100.000	0.000	0.000	1.433	0.370	0.447	-0.168	1.110
4 June	0.991	99.009	0.000	0.000	1.474	0.360	0.459	-0.125	1.175
2 July	0.000	99.940	0.060	0.000	1.510	0.351	0.572	+0.005	1.362
4 Aug.	0.000	99.975	0.025	0.000	1.171	0.444	0.678	-0.095	0.885
2 Sept.	0.000	99.966	0.034	0.000	1.276	0.413	0.578	-0.245	1.039
2 Oct.	0.067	99.860	0.073	0.000	1.689	0.310	0.554	+0.248	1.079
Average	0.097	99.859	0.044	0.000	1.603	0.337	0.572	-0.048	1.117

STATION 8-2

1974									
11 Nov.	0.000	99.954	0.046	0.000	1.901	0.268	0.634	+0.099	0.750
1975									
5 Feb.	0.000	99.946	0.054	0.000	1.795	0.288	0.605	+0.217	0.854
5 May	0.000	99.997	0.003	0.000	1.780	0.291	0.599	+0.228	0.884
7 Aug.	0.000	99.994	0.006	0.000	1.479	0.359	0.578	-0.016	1.366
Average	0.000	99.973	0.027	0.000	1.738	0.301	0.604	+0.132	0.963

STATION 8-3

1974									
22 Nov.	1.672	98.308	0.020	0.000	2.169	0.222	0.629	-0.269	0.884
1975									
11 Feb.	0.000	99.913	0.087	0.000	2.420	0.187	0.460	-0.182	1.162
22 May	0.000	99.995	0.005	0.000	2.181	0.220	0.594	-0.234	0.857
14 Aug.	0.000	99.942	0.058	0.000	2.218	0.215	0.594	-0.284	1.009
Average	0.418	99.540	0.042	0.000	2.247	0.211	0.569	-0.242	0.978

STATION 8-4

1974									
22 Nov.	0.216	99.745	0.039	0.000	2.055	0.241	0.748	-0.315	0.953
1975									
11 Feb.	0.000	99.924	0.076	0.000	2.073	0.238	0.633	-0.167	0.763
22 May	0.000	99.866	0.134	0.000	2.448	0.183	0.431	-0.164	1.098
14 Aug.	0.000	99.917	0.083	0.000	2.422	0.187	0.452	-0.174	1.132
Average	0.054	99.863	0.083	0.000	2.249	0.212	0.566	-0.205	0.986

STATION 8-5

1974									
18 Nov.	0.885	99.046	0.070	0.000	2.165	0.223	0.637	-0.281	0.895
1975									
20 Feb.	0.002	99.925	0.073	0.000	2.260	0.209	0.568	-0.268	1.086
13 May	0.000	99.946	0.054	0.000	2.184	0.220	0.600	-0.239	0.865
14 Aug.	0.000	99.947	0.053	0.000	2.301	0.203	0.568	-0.275	1.134
Average	0.222	99.716	0.062	0.000	2.227	0.213	0.593	-0.265	0.995

STATION 9-1

1974									
11 Nov.	0.000	99.903	0.097	0.000	1.520	0.349	0.424	+0.109	1.057
3 Dec.	0.000	99.975	0.025	0.000	1.360	0.390	0.650	-0.112	1.321
1975									
6 Jan.	0.000	99.964	0.036	0.000	1.169	0.445	0.666	-0.155	0.865
5 Feb.	0.000	99.998	0.002	0.000	2.251	0.210	0.573	-0.284	1.116
5 Mar.	0.000	100.000	0.000	0.000	1.357	0.390	0.640	-0.108	1.296
2 Apr.	0.000	99.998	0.002	0.000	1.464	0.362	0.537	-0.036	1.316
5 May	0.061	99.939	0.000	0.000	1.148	0.452	0.627	-0.172	0.785
4 June	0.000	100.000	0.000	0.000	1.491	0.346	0.332	0.000	0.738
2 July	0.089	99.694	0.217	0.000	1.614	0.327	0.645	-0.074	1.337
4 Aug.	0.000	99.967	0.033	0.000	1.281	0.411	0.703	-0.095	1.124
2 Sept.	---	---	---	---	---	---	---	---	---
2 Oct.	0.000	99.971	0.029	0.000	1.682	0.312	0.676	+0.092	1.256
Average	0.014	99.946	0.040	0.000	1.485	0.363	0.588	-0.062	1.110

Date	Grain-size classes: Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size (phi)	Mean Grain Size (mm)	Standard Deviation (phi)	Skewness	Kurtosis
STATION 9-2									
1974									
11 Nov.	0.000	99.933	0.067	0.000	1.747	0.298	0.687	+0.094	1.086
1975									
5 Feb.	0.009	99.981	0.010	0.000	1.648	0.319	0.659	+0.089	1.274
5 May	0.000	99.945	0.055	0.000	1.510	0.351	0.778	-0.004	1.193
7 Aug.	0.000	99.986	0.014	0.000	1.314	0.402	0.750	-0.086	1.133
Average	0.002	99.961	0.036	0.000	1.554	0.342	0.718	+0.023	1.171
STATION 9-3									
1974									
22 Nov.	0.163	99.788	0.049	0.000	2.145	0.226	0.638	-0.248	0.836
1975									
11 Feb.	0.005	99.932	0.063	0.000	1.912	0.266	0.729	-0.073	0.871
22 May	0.000	99.943	0.057	0.000	2.358	0.195	0.494	-0.226	1.126
12 Aug.	0.000	99.960	0.040	0.000	2.432	0.185	0.443	-0.178	1.146
Average	0.042	99.906	0.052	0.000	2.211	0.218	0.576	-0.181	0.994
STATION 9-4									
1974									
22 Nov.	0.397	99.483	0.120	0.000	1.729	0.302	0.832	-0.048	0.976
1975									
11 Feb.	1.053	98.859	0.088	0.000	2.179	0.221	0.647	-0.331	1.041
22 May	0.000	99.890	0.110	0.000	2.359	0.195	0.497	-0.228	1.129
12 Aug.	0.000	99.979	0.021	0.000	2.437	0.185	0.474	-0.194	1.207
Average	0.363	99.553	0.084	0.000	2.176	0.225	0.612	-0.200	1.088
STATION 9-5									
1974									
18 Nov.	0.000	99.922	0.078	0.000	2.249	0.210	0.593	-0.293	1.131
1975									
20 Feb.	0.000	99.949	0.051	0.000	2.175	0.221	0.636	-0.292	0.929
13 May	0.000	99.900	0.100	0.000	2.254	0.210	0.570	-0.256	1.031
12 Aug.	0.000	99.981	0.019	0.000	2.201	0.218	0.650	-0.321	1.054
Average	0.000	99.938	0.062	0.000	2.219	0.214	0.612	-0.290	1.036
STATION A									
1974									
18 Nov.	0.000	99.861	0.139	0.000	2.203	0.217	0.715	-0.156	1.014
1975									
20 Feb.	0.000	99.892	0.108	0.000	2.294	0.204	0.595	-0.246	1.145
20 May	0.000	99.826	0.174	0.000	2.433	0.185	0.499	-0.199	1.227
12 Aug.	---	---	---	---	---	---	---	---	---
Average	0.000	99.860	0.140	0.000	2.310	0.202	0.603	-0.200	1.128
STATION B									
1974									
18 Nov.	0.000	99.871	0.129	0.000	2.213	0.216	0.802	-0.236	1.262
1975									
20 Feb.	0.502	99.341	0.157	0.000	2.169	0.222	0.744	-0.382	1.177
20 May	0.000	100.000	0.000	0.000	2.330	0.199	0.562	-0.243	1.134
12 Aug.	0.000	99.886	0.114	0.000	2.447	0.183	0.554	-0.089	1.376
Average	0.126	99.775	0.100	0.000	2.289	0.205	0.665	-0.237	1.237

APPENDIX C

TRANSECT PARTICLE-SIZE DISTRIBUTION DATA

Particle-size distribution as percentage of total sample weight and statistical data using formulas by Folk and Ward (1957) for sediments collected on each transect.

Station	Date	Grain-size classes				Mean Grain Size		Standard Deviation	Skewness	Kurtosis
		Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	(phi)	(mm)	(phi)		
	1974									
1-1	12 Nov.	4.868	95.059	0.073	0.000	1.834	0.281	0.991	-0.248	1.296
1-2	12 Nov.	0.115	99.800	0.085	0.000	1.598	0.330	0.861	-0.047	1.017
1-3	22 Nov.	0.000	99.887	0.113	0.000	2.311	0.202	0.529	-0.270	1.156
1-4	21 Nov.	0.000	99.864	0.136	0.000	2.270	0.207	0.601	-0.305	1.176
1-5	19 Nov.	0.314	99.649	0.037	0.000	1.958	0.257	0.817	-0.279	0.944
1-1	3 Dec.	0.044	99.890	0.066	0.000	1.978	0.254	0.635	-0.011	0.738
	1975									
1-1	6 Jan.	0.000	99.973	0.027	0.000	1.570	0.337	0.467	+0.164	1.099
1-1	4 Feb.	0.000	99.998	0.002	0.000	1.658	0.317	0.513	+0.232	1.095
1-2	4 Feb.	0.000	99.960	0.040	0.000	2.098	0.234	0.635	-0.218	0.790
1-3	6 Feb.	0.000	99.954	0.046	0.000	2.400	0.190	0.473	-0.196	1.156
1-4	6 Feb.	0.000	99.931	0.069	0.000	2.218	0.215	0.613	-0.299	1.041
1-5	21 Feb.	0.175	99.825	0.000	0.000	1.193	0.437	0.599	-0.269	0.925
1-1	5 Mar.	0.138	99.860	0.002	0.000	1.691	0.310	0.749	+0.044	1.089
1-1	2 Apr.	0.136	99.864	0.000	0.000	1.774	0.292	0.573	+0.247	0.943
1-1	2 May	0.000	99.929	0.071	0.000	2.075	0.237	0.623	-0.145	0.757
1-2	2 May	0.113	99.878	0.009	0.000	1.734	0.301	0.739	+0.046	1.051
1-3	6 May	0.000	99.984	0.016	0.000	2.278	0.206	0.548	-0.270	1.110
1-4	6 May	0.000	100.000	0.000	0.000	1.892	0.269	0.629	+0.116	0.755
1-5	12 May	0.000	99.954	0.046	0.000	2.164	0.223	0.609	-0.241	0.849
1-1	4 June	0.000	99.963	0.037	0.000	1.669	0.314	0.830	-0.033	0.939
1-1	2 July	0.000	99.940	0.060	0.000	1.121	0.460	0.826	+0.020	0.915
1-1	4 Aug.	0.000	99.944	0.056	0.000	1.423	0.370	0.825	-0.030	1.122
1-2	7 Aug.	0.000	99.959	0.041	0.000	2.323	0.200	0.522	-0.258	1.143
1-3	13 Aug.	1.683	98.300	0.017	0.000	2.244	0.211	0.586	-0.305	1.160
1-4	13 Aug.	0.000	99.982	0.018	0.000	2.115	0.231	0.631	-0.209	0.792
1-5	13 Aug.	1.570	98.414	0.016	0.000	2.029	0.245	0.808	-0.358	0.977
1-1	2 Sept.	0.000	99.978	0.023	0.000	1.643	0.320	0.837	-0.034	0.947
1-1	2 Oct.	---	---	---	---	---	---	---	---	---
Average		0.340	99.620	0.041	0.000	1.899	0.276	0.669	-0.117	0.999
					TRANSECT 2					
	1974									
2-1	17 Nov.	0.182	99.732	0.085	0.000	1.912	0.266	0.741	-0.093	0.906
2-2	12 Nov.	0.000	99.786	0.214	0.000	2.114	0.231	0.617	-0.205	0.791
2-3	19 Nov.	0.131	99.730	0.139	0.000	2.062	0.240	0.698	-0.269	0.878
2-4	21 Nov.	0.091	99.870	0.040	0.000	1.856	0.276	0.710	+0.020	0.924
2-5	19 Nov.	0.084	99.870	0.046	0.000	2.001	0.250	0.848	-0.416	1.005
2-1	3 Dec.	0.048	99.931	0.021	0.000	1.896	0.269	0.752	-0.091	0.933
	1975									
2-1	6 Jan.	1.898	98.056	0.045	0.000	1.625	0.324	0.900	-0.100	0.951
2-1	4 Feb.	0.000	99.990	0.010	0.000	1.845	0.278	0.624	+0.163	0.782
2-2	4 Feb.	0.000	99.978	0.022	0.000	2.017	0.247	0.642	-0.105	0.743
2-3	6 Feb.	0.000	99.953	0.047	0.000	2.410	0.188	0.470	-0.185	1.152
2-4	6 Feb.	0.040	99.947	0.013	0.000	1.890	0.270	0.638	+0.111	0.754
2-5	21 Feb.	0.247	99.597	0.155	0.000	2.323	0.200	0.595	-0.247	1.229
2-1	5 Mar.	0.317	99.683	0.000	0.000	1.475	0.360	0.552	-0.041	1.380
2-1	2 Apr.	0.000	100.000	0.000	0.000	1.523	0.348	0.343	+0.045	0.810
2-1	2 May	0.247	99.739	0.014	0.000	1.432	0.370	0.666	-0.059	1.309
2-2	2 May	0.000	99.987	0.013	0.000	2.059	0.240	0.640	-0.166	0.759
2-3	6 May	0.000	99.962	0.038	0.000	2.412	0.188	0.454	-0.176	1.137
2-4	6 May	0.000	99.986	0.014	0.000	1.941	0.260	0.746	-0.169	0.877
2-5	12 May	0.000	99.967	0.033	0.000	2.227	0.214	0.627	-0.328	1.190
2-1	4 June	0.000	100.000	0.000	0.000	0.896	0.538	0.745	+0.297	0.917
2-1	2 July	0.000	99.944	0.055	0.000	1.684	0.311	0.846	-0.061	0.995
2-1	4 Aug.	1.188	98.801	0.011	0.000	1.470	0.361	0.836	-0.030	1.158
2-2	7 Aug.	3.240	96.730	0.030	0.000	1.960	0.257	0.771	-0.204	0.973
2-3	13 Aug.	0.000	99.904	0.096	0.000	2.248	0.210	0.568	-0.267	1.059
2-4	13 Aug.	0.000	99.945	0.055	0.000	2.418	0.187	0.468	-0.190	1.189
2-5	13 Aug.	0.000	99.954	0.046	0.000	2.384	0.192	0.516	-0.230	1.165
2-1	2 Sept.	0.186	99.722	0.093	0.000	1.864	0.275	0.790	-0.129	0.905
2-1	2 Oct.	0.163	99.831	0.006	0.000	1.617	0.326	0.705	+0.054	1.284
Average		0.288	99.664	0.048	0.000	1.913	0.274	0.663	-0.110	1.005
					TRANSECT 3					
	1974									
3-1	12 Nov.	0.673	99.227	0.100	0.000	1.814	0.284	0.644	+0.146	0.871
3-2	12 Nov.	1.043	98.849	0.107	0.000	2.000	0.250	0.753	-0.233	0.946
3-3	21 Nov.	0.000	99.885	0.115	0.000	2.421	0.187	0.491	-0.194	1.172
3-4	21 Nov.	0.000	99.918	0.082	0.000	2.167	0.223	0.609	-0.266	0.884
3-5	19 Nov.	0.000	99.928	0.072	0.000	2.106	0.232	0.644	-0.228	0.799
3-1	3 Dec.	0.000	99.950	0.050	0.000	1.643	0.320	0.680	+0.059	1.357
	1975									
3-1	6 Jan.	0.484	99.483	0.033	0.000	1.781	0.291	0.776	-0.016	0.999
3-1	4 Feb.	0.247	99.597	0.155	0.000	2.322	0.200	0.595	-0.247	1.229
3-2	4 Feb.	0.378	99.497	0.124	0.000	1.807	0.286	0.719	+0.041	0.969
3-3	6 Feb.	0.000	99.876	0.124	0.000	2.440	0.184	0.445	-0.176	1.140
3-4	6 Feb.	0.000	99.934	0.066	0.000	2.193	0.219	0.600	-0.258	0.904
3-5	21 Feb.	0.000	99.970	0.030	0.000	2.331	0.199	0.525	-0.263	1.168
3-1	5 Mar.	0.081	99.919	0.000	0.000	1.623	0.325	0.614	+0.089	1.301
3-1	2 Apr.	0.024	99.976	0.000	0.000	1.442	0.368	0.462	-0.163	1.097
3-1	2 May	0.000	99.985	0.015	0.000	1.578	0.335	0.655	+0.051	1.324
3-2	2 May	0.000	99.928	0.072	0.000	2.106	0.232	0.613	-0.178	0.776
3-3	6 May	0.000	99.925	0.075	0.000	2.413	0.188	0.454	-0.172	1.125
3-4	6 May	0.000	99.978	0.022	0.000	2.154	0.225	0.602	-0.231	0.832
3-5	12 May	0.000	99.966	0.034	0.000	2.197	0.218	0.589	-0.259	0.916
3-1	4 June	0.278	99.622	0.101	0.000	1.714	0.305	1.043	-0.468	0.584
3-1	2 July	1.235	98.743	0.023	0.000	1.618	0.326	0.829	-0.027	1.053
3-1	4 Aug.	0.000	99.988	0.012	0.000	0.606	0.328	0.803	+0.001	1.037
3-2	7 Aug.	0.000	99.988	0.012	0.000	2.174	0.222	0.606	-0.266	0.892
3-3	11 Aug.	2.209	97.762	0.029	0.000	2.058	0.240	0.781	-0.345	1.030
3-4	11 Aug.	0.000	99.968	0.032	0.000	2.433	0.185	0.456	-0.184	1.166

TRANSECT 3 (Continued)

Station	Date	Grain-size classes: Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size: (phi)	(mm)	Standard Deviation (phi)	Skewness	Kurtosis
	1975									
3-5	11 Aug.	0.000	99.920	0.080	0.000	2.323	0.200	0.547	-0.262	1.134
3-1	2 Sept.	0.043	99.892	0.065	0.000	1.687	0.310	0.636	+0.123	1.233
3-1	2 Oct.	0.460	99.528	0.012	0.000	2.014	0.248	0.675	-0.161	0.799
Average		0.256	99.686	0.059	0.000	2.004	0.253	0.637	-0.146	1.026
					TRANSECT 4					
	1974									
4-1	11 Nov.	0.000	99.961	0.039	0.000	1.557	0.340	0.559	+0.026	1.364
4-2	11 Nov.	0.000	99.862	0.138	0.000	1.928	0.263	0.633	+0.076	0.744
4-3	26 Nov.	0.000	99.960	0.040	0.000	1.920	0.264	0.639	+0.077	0.745
4-4	26 Nov.	0.000	99.956	0.044	0.000	2.209	0.216	0.594	-0.272	0.960
4-5	19 Nov.	0.000	99.902	0.098	0.000	2.292	0.204	0.580	-0.299	1.190
4-1	3 Dec.	2.305	97.663	0.031	0.000	1.491	0.356	0.461	-0.187	1.273
	1975									
4-1	6 Jan.	1.943	98.005	0.053	0.000	1.569	0.337	0.647	+0.002	1.473
4-1	4 Feb.	0.000	99.920	0.080	0.000	0.832	0.281	0.618	+0.184	0.800
4-2	4 Feb.	0.038	99.911	0.052	0.000	2.031	0.245	0.623	-0.074	0.741
4-3	10 Feb.	0.000	99.856	0.144	0.000	2.190	0.219	0.605	-0.257	0.896
4-4	10 Feb.	0.000	99.974	0.026	0.000	2.202	0.217	0.592	-0.263	0.929
4-5	21 Feb.	0.000	99.888	0.112	0.000	2.125	0.229	0.749	-0.397	1.012
4-1	5 Mar.	0.000	99.997	0.003	0.000	1.617	0.326	0.531	+0.168	1.157
4-1	2 Apr.	0.000	100.000	0.000	0.000	1.517	0.349	0.417	+0.103	1.029
4-1	5 May	0.759	99.244	0.000	0.000	1.524	0.348	0.547	+0.003	1.385
4-2	5 May	0.000	99.934	0.066	0.000	2.038	0.244	0.624	-0.092	0.744
4-3	19 May	0.000	99.933	0.067	0.000	2.449	0.183	0.433	-0.162	1.093
4-4	19 May	0.000	99.967	0.033	0.000	2.221	0.214	0.582	-0.276	1.003
4-5	12 May	0.000	99.993	0.007	0.000	2.231	0.213	0.570	-0.260	0.990
4-1	4 June	0.000	100.000	0.000	0.000	1.552	0.341	0.501	+0.089	1.219
4-1	2 July	0.000	99.970	0.030	0.000	1.716	0.304	0.727	+0.063	1.064
4-1	4 Aug.	0.000	99.958	0.042	0.000	1.577	0.335	0.646	+0.051	1.324
4-2	7 Aug.	0.000	99.977	0.023	0.000	2.156	0.224	0.615	-0.264	0.867
4-3	11 Aug.	0.000	99.836	0.164	0.000	2.196	0.218	0.590	-0.256	0.908
4-4	11 Aug.	0.000	99.970	0.030	0.000	2.488	0.178	0.351	-0.048	0.816
4-5	11 Aug.	0.000	99.970	0.030	0.000	2.477	0.180	0.410	-0.151	1.056
4-1	2 Sept.	---	---	---	---	---	---	---	---	---
4-1	2 Oct.	6.967	93.014	0.020	0.000	1.216	0.430	1.119	-0.376	2.026
Average		0.445	99.504	0.051	0.000	1.938	0.269	0.591	-0.103	1.067
					TRANSECT 5					
	1974									
5-1	11 Nov.	0.000	99.922	0.078	0.000	1.627	0.324	0.624	+0.078	1.344
5-2	11 Nov.	0.000	99.946	0.054	0.000	1.894	0.269	0.633	+0.107	0.753
5-3	26 Nov.	0.000	99.941	0.059	0.000	2.119	0.230	0.637	-0.235	0.810
5-4	26 Nov.	0.000	99.883	0.117	0.000	2.359	0.195	0.534	-0.259	1.204
5-5	19 Nov.	0.000	99.951	0.049	0.000	2.294	0.204	0.572	-0.294	1.183
5-1	3 Dec.	0.000	99.946	0.054	0.000	1.878	0.272	0.634	+0.123	0.759
	1975									
5-1	6 Jan.	1.428	98.522	0.050	0.000	1.729	0.302	0.791	-0.004	1.074
5-1	4 Feb.	0.576	99.392	0.032	0.000	1.719	0.304	0.553	+0.251	1.063
5-2	4 Feb.	0.000	99.916	0.084	0.000	2.180	0.221	0.595	-0.246	0.872
5-3	10 Feb.	0.000	99.924	0.076	0.000	2.175	0.221	0.604	-0.244	0.862
5-4	10 Feb.	0.000	99.930	0.070	0.000	2.414	0.188	0.479	-0.196	1.214
5-5	21 Feb.	0.018	99.967	0.016	0.000	2.159	0.244	0.712	-0.381	1.146
5-1	5 Mar.	0.000	99.966	0.034	0.000	1.774	0.292	0.591	+0.233	0.905
5-1	2 Apr.	0.000	99.974	0.026	0.000	1.686	0.311	0.545	+0.244	1.074
5-1	5 May	0.000	100.000	0.000	0.000	1.681	0.312	0.554	+0.230	1.075
5-2	5 May	0.000	100.000	0.000	0.000	2.004	0.249	0.624	-0.032	0.738
5-3	19 May	0.000	99.943	0.057	0.000	2.349	0.196	0.498	-0.232	1.122
5-4	19 May	0.000	100.000	0.000	0.000	2.147	0.226	0.609	-0.237	0.832
5-5	12 May	0.000	99 996	0.004	0.000	2.317	0.201	0.527	-0.253	1.113
5-1	4 June	0.177	99.820	0.004	0.000	1.549	0.342	0.518	+0.063	1.272
5-1	2 July	0.000	99.867	0.133	0.000	1.726	0.302	0.609	+0.187	1.077
5-1	4 Aug.	0.000	99.984	0.016	0.000	1.544	0.343	0.564	+0.024	1.338
5-2	7 Aug.	0.000	99.988	0.012	0.000	1.682	0.312	0.723	+0.066	1.135
5-3	8 Aug.	0.000	99.995	0.005	0.000	2.051	0.241	0.644	-0.158	0.756
5-4	8 Aug.	0.000	99.961	0.039	0.000	2.426	0.186	0.472	-0.186	1.174
5-5	8 Aug.	0.000	99.976	0.024	0.000	2.425	0.186	0.496	-0.210	1.273
5-1	2 Sept.	0.000	99.989	0.011	0.000	1.630	0.323	0.635	+0.088	1.290
5-1	2 Oct.	---	---	---	---	---	---	---	---	---
Average		0.081	99.878	0.041	0.000	1.983	0.258	0.592	-0.055	1.054
					TRANSECT 6					
	1974									
6-1	11 Nov.	0.000	99.977	0.023	0.000	1.510	0.351	0.407	+0.065	1.007
6-2	11 Nov.	0.052	99.916	0.032	0.000	1.683	0.312	0.542	+0.241	1.072
6-3	26 Nov.	0.000	99.908	0.092	0.000	2.100	0.233	0.644	-0.204	0.784
6-4	26 Nov.	0.000	99.940	0.060	0.000	2.320	0.200	0.544	-0.265	1.142
6-5	19 Nov.	0.000	99.902	0.098	0.000	2.252	0.210	0.560	-0.303	1.165
6-1	3 Dec.	0.229	99.730	0.041	0.000	1.616	0.326	0.493	+0.206	1.101
	1975									
6-1	6 Jan.	0.553	99.428	0.018	0.000	0.777	0.584	0.598	+0.245	0.919
6-1	4 Feb.	0.011	99.973	0.015	0.000	1.669	0.314	0.525	+0.238	1.086
6-2	4 Feb.	0.000	99.954	0.046	0.000	2.037	0.244	0.632	-0.114	0.746
6-3	10 Feb.	0.000	99.906	0.094	0.000	2.324	0.200	0.533	-0.265	1.158
6-4	10 Feb.	0.000	99.925	0.075	0.000	2.273	0.207	0.575	-0.301	1.179
6-5	21 Feb.	0.000	99.939	0.061	0.000	2.459	0.182	0.435	-0.179	1.149
6-1	5 Mar.	0.000	99.954	0.046	0.000	1.724	0.303	0.658	+0.122	1.115
6-1	2 Apr.	1.039	98.959	0.002	0.000	1.513	0.350	0.531	+0.002	1.358
6-1	5 May	0.384	99.617	0.000	0.000	1.703	0.307	0.638	+0.130	1.212
6-2	5 May	0.000	99.921	0.079	0.000	2.121	0.230	0.608	-0.191	0.787

TRANSECT 6 (Continued)

Station	Date	Grain-size classes: Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	Mean Grain Size (phi)	Mean Grain Size (mm)	Standard Deviation (phi)	Skewness	Kurtosis
	1975									
6-3	19 May	0.000	99.965	0.035	0.000	2.439	0.184	0.448	-0.169	1.113
6-4	19 May	0.000	99.990	0.010	0.000	2.214	0.216	0.586	-0.269	0.966
6-5	13 May	0.057	99.842	0.101	0.000	2.275	0.207	0.582	-0.314	1.217
6-1	4 June	0.078	99.901	0.021	0.000	1.378	0.385	0.491	-0.212	1.118
6-1	2 July	0.000	99.942	0.058	0.000	1.746	0.298	0.585	+0.238	0.961
6-1	4 Aug.	0.755	99.227	0.018	0.000	1.478	0.359	0.743	-0.030	1.273
6-2	7 Aug.	0.000	99.994	0.006	0.000	1.810	0.285	0.665	+0.112	0.901
6-3	8 Aug.	0.000	99.995	0.005	0.000	2.162	0.224	0.628	-0.285	0.900
6-4	8 Aug.	0.000	99.984	0.016	0.000	2.314	0.201	0.567	-0.279	1.163
6-5	8 Aug.	0.168	99.728	0.105	0.000	2.439	0.184	0.454	-0.188	1.181
6-1	2 Sept.	0.000	99.984	0.016	0.000	1.519	0.349	0.545	+0.088	1.368
6-1	2 Oct.	0.000	99.942	0.058	0.000	1.898	0.268	0.617	+0.138	0.761
Average		0.119	99.837	0.044	0.000	1.920	0.275	0.566	-0.062	1.068
				TRANSECT 7						
	1974									
7-1	11 Nov.	0.000	99.918	0.082	0.000	1.490	0.356	0.321	0.000	0.738
7-2	11 Nov.	0.000	99.972	0.028	0.000	1.695	0.309	0.595	+0.173	1.168
7-3	22 Nov.	0.000	99.940	0.060	0.000	2.083	0.236	0.646	-0.191	0.773
7-4	22 Nov.	0.000	99.966	0.034	0.000	1.993	0.251	0.742	-0.201	0.912
7-5	19 Nov.	0.000	99.930	0.070	0.000	2.228	0.213	0.586	-0.298	1.103
7-1	3 Dec.	0.000	99.946	0.054	0.000	1.711	0.306	0.563	+0.245	1.052
	1975									
7-1	6 Jan.	1.035	98.903	0.062	0.000	1.727	0.302	0.737	+0.044	1.128
7-1	5 Feb.	0.151	99.839	0.010	0.000	1.792	0.289	0.588	+0.234	0.885
7-2	5 Feb.	0.000	99.951	0.049	0.000	1.743	0.299	0.570	+0.247	1.009
7-3	11 Feb.	0.000	99.935	0.065	0.000	1.709	0.306	0.552	+0.248	1.065
7-4	11 Feb.	0.000	99.949	0.051	0.000	2.162	0.223	0.624	-0.268	0.876
7-5	20 Feb.	0.005	99.962	0.033	0.000	2.064	0.239	0.645	-0.171	0.762
7-1	5 Mar.	0.027	99.933	0.040	0.000	1.517	0.349	0.619	+0.012	1.334
7-1	2 Apr.	0.000	100.000	0.000	0.000	1.469	0.361	0.428	-0.148	1.048
7-1	5 May	0.000	100.000	0.000	0.000	1.659	0.317	0.656	+0.096	1.265
7-2	5 May	0.000	99.991	0.009	0.000	2.072	0.238	0.619	-0.134	0.754
7-3	22 May	0.000	99.843	0.157	0.000	2.433	0.185	0.443	-0.169	1.113
7-4	22 May	0.000	99.901	0.099	0.000	2.332	0.199	0.516	-0.247	1.123
7-5	13 May	0.000	99.857	0.143	0.000	2.458	0.182	0.435	-0.161	1.088
7-1	4 June	0.000	99.968	0.032	0.000	1.583	0.334	0.458	+0.169	1.115
7-1	2 July	0.000	99.926	0.074	0.000	1.876	0.272	0.611	+0.170	0.778
7-1	4 Aug.	0.000	99.989	0.011	0.000	1.335	0.396	0.642	-0.118	1.267
7-2	7 Aug.	0.000	99.974	0.026	0.000	1.825	0.282	0.617	+0.189	0.806
7-3	14 Aug.	0.000	99.960	0.040	0.000	2.254	0.210	0.607	-0.331	1.247
7-4	14 Aug.	0.000	99.975	0.025	0.000	2.422	0.187	0.467	-0.184	1.166
7-5	14 Aug.	0.000	99.953	0.047	0.000	2.318	0.201	0.562	-0.273	1.151
7-1	2 Sept.	0.116	99.878	0.006	0.000	1.397	0.380	0.566	-0.111	1.264
7-1	2 Oct.	0.000	99.982	0.018	0.000	0.576	0.336	0.460	+0.166	1.106
Average		0.048	99.905	0.047	0.000	1.890	0.277	0.567	-0.036	1.039
				TRANSECT 8						
	1974									
8-1	11 Nov.	0.000	99.916	0.084	0.000	1.512	0.351	0.572	-0.007	1.400
8-2	11 Nov.	0.000	99.954	0.046	0.000	1.901	0.268	0.634	+0.099	0.750
8-3	22 Nov.	1.672	98.308	0.020	0.000	2.169	0.222	0.629	-0.269	0.884
8-4	22 Nov.	0.216	99.745	0.039	0.000	2.055	0.241	0.748	-0.315	0.953
8-5	18 Nov.	0.885	99.046	0.070	0.000	2.165	0.223	0.637	-0.281	0.895
8-1	3 Dec.	0.000	99.916	0.084	0.000	1.795	0.288	0.606	+0.216	0.852
	1975									
8-1	6 Jan.	0.101	99.834	0.065	0.000	1.364	0.389	0.674	-0.115	1.354
8-1	5 Feb.	0.000	99.903	0.097	0.000	2.069	0.238	0.618	-0.131	0.753
8-2	5 Feb.	0.000	99.946	0.054	0.000	1.795	0.288	0.605	+0.217	0.854
8-3	11 Feb.	0.000	99.913	0.087	0.000	2.420	0.187	0.460	-0.182	1.162
8-4	11 Feb.	0.000	99.924	0.076	0.000	2.073	0.238	0.633	-0.167	0.763
8-5	20 Feb.	0.002	99.925	0.073	0.000	2.260	0.209	0.568	-0.268	1.086
8-1	5 Mar.	0.000	99.986	0.014	0.000	1.499	0.354	0.672	-0.009	1.313
8-1	2 Apr.	0.000	100.000	0.000	0.000	2.451	0.183	0.442	-0.160	1.084
8-1	5 May	0.000	100.000	0.000	0.000	1.433	0.370	0.447	-0.168	1.110
8-2	5 May	0.000	99.997	0.003	0.000	1.780	0.291	0.599	+0.228	0.884
8-3	22 May	0.000	99.995	0.005	0.000	2.181	0.220	0.594	-0.234	0.857
8-4	22 May	0.000	99.866	0.134	0.000	2.448	0.183	0.431	-0.164	1.098
8-5	13 May	0.000	99.946	0.054	0.000	2.184	0.220	0.600	-0.239	0.865
8-1	4 June	0.991	99.009	0.000	0.000	1.474	0.360	0.459	-0.125	1.175
8-1	2 July	0.000	99.940	0.060	0.000	1.510	0.351	0.572	+0.005	1.362
8-1	4 Aug.	0.000	99.975	0.025	0.000	1.171	0.444	0.678	-0.095	0.885
8-2	7 Aug.	0.000	99.994	0.006	0.000	1.479	0.359	0.578	-0.016	1.366
8-3	14 Aug.	0.000	99.942	0.058	0.000	2.218	0.215	0.594	-0.284	1.009
8-4	14 Aug.	0.000	99.917	0.083	0.000	2.422	0.187	0.452	-0.174	1.132
8-5	14 Aug.	0.000	99.947	0.053	0.000	2.301	0.203	0.568	-0.275	1.134
8-1	2 Sept.	0.000	99.966	0.034	0.000	1.276	0.413	0.578	-0.245	1.039
8-1	2 Oct.	0.067	99.860	0.073	0.000	1.689	0.310	0.554	+0.248	1.079
Average		0.141	99.810	0.050	0.000	1.896	0.279	0.579	-0.104	1.039

TRANSECT 9

Station	Date	Grain-size classes				Mean Grain Size		Standard Deviation	Skewness	Kurtosis
		Gravel (pct)	Sand (pct)	Silt (pct)	Clay (pct)	(phi)	(mm)	(phi)		
	1974									
9-1	11 Nov.	0.000	99.903	0.097	0.000	1.520	0.349	0.424	+0.109	1.057
9-2	11 Nov.	0.000	99.933	0.067	0.000	1.747	0.298	0.687	+0.094	1.086
9-3	22 Nov.	0.163	99.788	0.049	0.000	2.145	0.226	0.638	-0.248	0.836
9-4	22 Nov.	0.397	99.483	0.120	0.000	1.729	0.302	0.832	-0.048	0.976
9-5	18 Nov.	0.000	99.922	0.078	0.000	2.249	0.210	0.593	-0.293	1.131
9-1	3 Dec.	0.000	99.975	0.025	0.000	1.360	0.390	0.650	-0.112	1.321
	1975									
9-1	6 Jan.	0.000	99.964	0.036	0.000	1.169	0.445	0.666	-0.155	0.865
9-1	5 Feb.	0.000	99.998	0.002	0.000	2.251	0.210	0.573	-0.284	1.116
9-2	5 Feb.	0.009	99.981	0.010	0.000	1.648	0.319	0.659	+0.089	1.274
9-3	11 Feb.	0.005	99.932	0.063	0.000	1.912	0.266	0.729	-0.073	0.871
9-4	11 Feb.	1.053	98.859	0.088	0.000	2.179	0.221	0.647	-0.331	1.041
9-5	20 Feb.	0.000	99.949	0.051	0.000	2.175	0.221	0.636	-0.292	0.929
9-1	5 Mar.	0.000	100.000	0.000	0.000	1.357	0.390	0.640	-0.108	1.296
9-1	2 Apr.	0.000	99.998	0.002	0.000	1.464	0.362	0.537	-0.036	1.316
9-1	5 May	0.061	99.939	0.000	0.000	1.148	0.451	0.627	-0.172	0.785
9-2	5 May	0.000	99.945	0.055	0.000	1.510	0.351	0.778	-0.004	1.193
9-3	22 May	0.000	99.943	0.057	0.000	2.358	0.195	0.494	-0.226	1.126
9-4	22 May	0.000	99.890	0.110	0.000	2.359	0.195	0.497	-0.228	1.129
9-5	13 May	0.000	99.900	0.100	0.000	2.254	0.210	0.570	-0.256	1.031
9-1	4 June	0.000	100.000	0.000	0.000	1.491	0.356	0.332	0.000	0.738
9-1	2 July	0.089	99.694	0.217	0.000	1.614	0.327	0.645	-0.074	1.337
9-1	4 Aug.	0.000	99.967	0.033	0.000	1.281	0.411	0.703	-0.095	1.124
9-2	7 Aug.	0.000	99.986	0.014	0.000	1.314	0.402	0.750	-0.086	1.133
9-3	12 Aug.	0.000	99.960	0.040	0.000	2.432	0.185	0.443	-0.178	1.146
9-4	12 Aug.	0.000	99.979	0.021	0.000	2.437	0.185	0.474	-0.194	0.207
9-5	12 Aug.	0.000	99.981	0.019	0.000	2.201	0.218	0.650	-0.321	1.054
9-1	2 Sept.	---	---	---	---	---	---	---	---	---
9-1	2 Oct.	0.000	99.971	0.029	0.000	1.682	0.312	0.676	+0.092	1.256
Average		0.066	99.863	0.051	0.000	1.814	0.297	0.613	-0.127	1.088

STATIONS A AND B

	1974									
A	18 Nov.	0.000	99.861	0.139	0.000	2.203	0.217	0.715	-0.156	1.014
B	18 Nov.	0.000	99.871	0.129	0.000	2.213	0.216	0.802	-0.236	1.262
	1975									
A	20 Feb.	0.000	99.892	0.108	0.000	2.294	0.204	0.595	-0.246	1.145
B	20 Feb.	0.502	99.341	0.157	0.000	2.169	0.222	0.744	-0.382	1.177
A	20 May	0.000	99.826	0.174	0.000	2.433	0.185	0.499	-0.199	1.227
B	20 May	0.000	100.000	0.000	0.000	2.330	0.199	0.562	-0.243	1.134
A	12 Aug.	---	---	---	---	---	---	---	---	---
B	12 Aug.	0.000	99.886	0.114	0.000	2.447	0.183	0.554	-0.089	1.376
Average		0.215	99.811	0.117	0.000	2.298	0.204	0.639	-0.222	1.191

APPENDIX D

STATION SURFACE SEDIMENT DATA

The percentage of sample weight of total carbon, organic carbon, and carbonate for surface sediments collected at each station.

STATION 1-1

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
1974			
12 Nov.	---	---	---
3 Dec.	0.017	0.008	0.010
1975			
6 Jan.	0.024	0.015	0.009
4 Feb.	0.206	0.191	0.015
5 Mar.	0.118	0.054	0.064
2 Apr.	0.101	0.087	0.014
2 May	0.123	0.010	0.113
4 June	0.161	0.022	0.139
2 July	0.382	0.200	0.182
4 Aug.	0.085	0.040	0.045
2 Sept.	0.060	0.019	0.044
2 Oct.	---	---	---
Average	0.128	0.065	0.064

STATION 1-2

1974			
12 Nov.	0.085	0.059	0.026
1975			
4 Feb.	0.203	0.177	0.026
2 May	0.237	0.025	0.212
8 July	0.055	0.047	0.008
Average	0.145	0.077	0.068

STATION 1-3

1974			
22 Nov.	0.066	0.038	0.027
1975			
6 Feb.	0.162	0.154	0.008
6 May	0.089	0.078	0.011
13 Aug.	0.135	0.066	0.069
Average	0.113	0.084	0.029

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
STATION 1-4			
1974			
21 Nov.	0.071	0.040	0.031
1975			
6 Feb.	0.389	0.208	0.181
6 May	0.102	0.062	0.040
13 Aug.	0.083	0.011	0.072
Average	0.161	0.080	0.081
STATION 1-5			
1974			
19 Nov.	0.146	0.092	0.054
1975			
21 Feb.	0.171	0.169	0.002
12 May	0.155	0.022	0.133
13 Aug.	0.168	0.017	0.151
Average	0.160	0.075	0.085
STATION 2-1			
1974			
12 Nov.	0.839	0.043	0.796
3 Dec.	0.036	0.022	0.014
1975			
6 Jan.	0.105	0.017	0.088
4 Feb.	0.184	0.155	0.029
5 Mar.	0.184	0.031	0.153
2 Apr.	0.100	0.080	0.020
2 May	0.284	0.164	0.120
4 June	0.232	0.054	0.178
2 July	0.176	0.050	0.126
4 Aug.	0.024	0.008	0.016
2 Sept.	0.070	0.020	0.050
2 Oct.	0.102	0.030	0.072
Average	0.195	0.056	0.138

STATION 2-2

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
1974			
12 Nov.	0.147	0.036	0.110
1975			
4 Feb.	0.201	0.197	0.004
2 May	0.130	0.034	0.096
7 Aug.	1.761	0.064	1.697
Average	0.560	0.083	0.477

STATION 2-3

1974			
19 Nov.	0.177	0.024	0.153
1975			
6 Feb.	0.156	0.025	0.131
6 May	0.021	0.014	0.007
13 Aug.	0.159	0.097	0.062
Average	0.128	0.040	0.088

STATION 2-4

1974			
21 Nov.	0.066	0.056	0.010
1975			
6 Feb.	0.068	0.035	0.033
6 May	0.224	0.028	0.196
13 Aug.	0.049	---	---
Average	0.102	0.040	0.080

STATION 2-5

1974			
19 Nov.	0.249	0.041	0.208
1975			
21 Feb.	0.125	0.076	0.049
12 May	0.223	0.025	0.198
13 Aug.	1.096	0.026	1.070
Average	0.423	0.042	0.381

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
STATION 3-1			
1974			
12 Nov.	0.124	0.058	0.066
3 Dec.	0.039	0.033	0.006
1975			
6 Jan.	0.383	0.080	0.302
4 Feb.	0.082	0.045	0.037
5 Mar.	0.100	0.061	0.039
2 Apr.	0.100	0.080	0.020
2 May	0.134	0.124	0.010
4 June	0.232	0.030	0.202
2 July	0.489	0.034	0.455
4 Aug.	0.111	0.016	0.095
2 Sept.	0.040	0.016	0.024
2 Oct.	0.049	0.017	0.032
Average	0.157	0.050	0.107
STATION 3-2			
1974			
12 Nov.	0.068	0.033	0.035
1975			
4 Feb.	0.094	0.011	0.083
2 May	0.125	0.032	0.093
7 Aug.	0.100	0.036	0.064
Average	0.097	0.028	0.069
STATION 3-3			
1974			
21 Nov.	0.064	0.041	0.023
1975			
6 Feb.	0.072	0.046	0.026
6 May	0.074	0.050	0.024
11 Aug.	0.153	0.049	0.104
Average	0.091	0.047	0.044

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
STATION 3-4			
1974			
21 Nov.	0.081	0.048	0.033
1975			
6 Feb.	0.181	0.055	0.126
6 May	0.060	0.047	0.013
11 Aug.	0.125	0.071	0.054
Average	0.112	0.055	0.132
STATION 3-5			
1974			
19 Nov.	0.152	0.029	0.123
1975			
21 Feb.	0.118	0.070	0.048
12 May	0.052	---	---
11 Aug.	0.099	0.048	0.051
Average	0.105	0.049	0.074
STATION 4-1			
1974			
11 Nov.	0.043	0.019	0.024
3 Dec.	0.240	0.086	0.154
1975			
6 Jan.	0.455	0.028	0.427
4 Feb.	0.025	0.023	0.002
5 Mar.	0.080	---	---
2 Apr.	0.102	0.063	0.039
5 May	0.729	0.029	0.700
4 June	0.146	0.043	0.103
2 July	0.148	0.035	0.113
4 Aug.	0.059	0.019	0.040
2 Sept.	---	---	---
2 Oct.	0.067	0.019	0.048
Average	0.190	0.036	0.165

STATION 4-2

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
1974			
11 Nov.	0.025	0.012	0.013
1975			
4 Feb.	0.094	0.032	0.062
5 May	0.090	0.028	0.062
7 Aug.	0.081	0.018	0.063
Average	0.073	0.023	0.050

STATION 4-3

1974			
26 Nov.	0.054	0.051	0.004
1975			
10 Feb.	0.085	0.046	0.039
19 May	0.072	0.031	0.041
11 Aug.	0.088	0.011	0.077
Average	0.075	0.035	0.040

STATION 4-4

1974			
26 Nov.	0.078	0.072	0.006
1975			
10 Feb.	0.077	0.062	0.015
19 May	0.051	0.026	0.025
11 Aug.	0.098	0.049	0.049
Average	0.076	0.052	0.024

STATION 4-5

1974			
19 Nov.	0.039	0.013	0.027
1975			
21 Feb.	0.100	0.081	0.019
12 May	0.314	0.008	0.306
11 Aug.	0.094	0.021	0.073
Average	0.137	0.031	0.106

STATION 5-1

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
1974			
11 Nov.	0.082	0.071	0.010
3 Dec.	0.122	0.054	0.069
1975			
6 Jan.	0.684	0.112	0.572
4 Feb.	0.242	0.023	0.217
5 Mar.	0.102	0.093	0.009
2 Apr.	0.122	0.066	0.056
5 May	0.315	0.149	0.166
4 June	0.179	0.065	0.114
2 July	0.208	0.018	0.190
4 Aug.	0.074	0.020	0.054
2 Sept.	0.066	0.058	0.008
2 Oct.	---	---	---
Average	0.200	0.066	0.133

STATION 5-2

1974			
11 Nov.	0.027	0.015	0.013
1975			
4 Feb.	0.070	0.029	0.041
5 May	0.048	0.035	0.013
7 Aug.	0.070	0.018	0.052
Average	0.054	0.024	0.030

STATION 5-3

1974			
26 Nov.	0.803	0.043	0.760
1975			
10 Feb.	0.055	0.011	0.044
19 May	0.077	0.037	0.040
8 Aug.	0.088	0.081	0.007
Average	0.256	0.043	0.213

STATION 5-4

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
1974			
26 Nov.	0.080	0.072	0.008
1975			
10 Feb.	0.072	---	---
19 May	0.072	0.030	0.042
8 Aug.	0.096	0.024	0.072
Average	0.080	0.042	0.041

STATION 5-5

1974			
19 Nov.	0.051	0.038	0.013
1975			
21 Feb.	0.127	0.120	0.007
12 May	0.047	0.044	0.003
8 Aug	0.146	0.013	0.133
Average	0.093	0.054	0.039

STATION 6-1

1974			
11 Nov.	0.041	0.037	0.004
3 Dec.	0.054	0.031	0.023
1975			
6 Jan.	0.248	0.047	0.202
4 Feb.	0.071	0.055	0.016
5 Mar.	0.101	0.096	0.005
2 Apr.	0.131	0.127	0.004
5 May	0.127	0.035	0.092
4 June	0.187	0.177	0.010
2 July	0.156	0.036	0.120
4 Aug.	0.224	0.008	0.216
2 Sept.	0.045	0.021	0.024
2 Oct.	0.025	0.006	0.019
Average	0.113	0.056	0.061

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
STATION 6-2			
1974			
11 Nov.	0.075	0.057	0.018
1975			
4 Feb.	0.073	0.057	0.016
5 May	0.025	0.018	0.007
7 Aug.	0.091	0.032	0.059
Average	0.066	0.041	0.025
STATION 6-3			
1974			
26 Nov.	0.080	0.066	0.014
1975			
10 Feb.	0.072	0.043	0.029
19 May	0.284	0.047	0.237
8 Aug.	0.108	0.008	0.100
Average	0.136	0.041	0.095
STATION 6-4			
1974			
26 Nov.	0.073	0.072	0.001
1975			
10 Feb.	0.118	0.021	0.097
19 May	0.141	0.039	0.102
8 Aug.	0.088	0.016	0.072
Average	0.105	0.037	0.068
STATION 6-5			
1974			
19 Nov.	0.079	0.026	0.053
1975			
21 Feb.	0.116	0.104	0.012
13 May	0.100	0.047	0.053
8 Aug.	0.105	0.019	0.086
Average	0.100	0.049	0.051

STATION 7-1

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
1974			
11 Nov.	0.048	0.023	0.024
3 Dec.	0.055	0.025	0.030
1975			
6 Jan.	0.028	0.026	0.002
5 Feb.	0.098	0.082	0.016
5 Mar.	0.093	---	---
2 Apr.	0.087	0.063	0.024
5 May	0.056	0.024	0.032
4 June	---	0.034	---
2 July	0.089	0.073	0.016
4 Aug.	0.111	0.055	0.056
2 Sept.	0.049	0.021	0.028
2 Oct.	0.026	0.006	0.020
Average	0.067	0.039	0.025

STATION 7-2

1974			
11 Nov.	0.045	0.040	0.004
1975			
5 Feb.	0.127	0.087	0.040
5 May	0.087	0.086	0.001
7 Aug.	0.065	0.046	0.019
Average	0.081	0.065	0.016

STATION 7-3

1974			
22 Nov.	0.078	0.035	0.044
1975			
11 Feb.	0.118	0.098	0.020
22 May	0.055	0.008	0.047
14 Aug.	0.085	0.075	0.010
Average	0.084	0.054	0.030

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
STATION 7-4			
1974			
22 Nov.	0.058	0.039	0.019
1975			
11 Feb.	0.111	0.075	0.036
22 May	0.046	0.005	0.041
14 Aug.	0.081	0.019	0.062
Average	0.074	0.035	0.040
STATION 7-5			
1974			
19 Nov.	0.063	0.053	0.010
1975			
20 Feb.	0.148	0.117	0.031
13 May	0.045	0.008	0.037
14 Aug.	0.050	0.041	0.009
Average	0.077	0.055	0.022
STATION 8-1			
1974			
11 Nov.	0.010	0.008	0.001
3 Dec.	0.124	0.010	0.114
1975			
6 Jan.	0.061	*0.060*	0.001
5 Feb.	0.088	---	---
5 Mar.	0.077	0.076	0.001
2 Apr.	0.076	0.057	0.019
5 May	0.040	0.037	0.003
4 June	0.195	0.160	0.035
2 July	0.087	0.044	0.043
4 Aug.	0.131	0.062	0.069
2 Sept.	0.048	0.012	0.036
2 Oct.	0.057	0.036	0.021
Average	0.083	0.051	0.031

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
STATION 8-2			
1974			
11 Nov.	0.643	0.042	0.601
1975			
5 Feb.	0.064	0.024	0.040
5 May	0.038	0.010	0.028
7 Aug.	0.072	0.037	0.035
Average	0.204	0.028	0.176
STATION 8-3			
1974			
22 Nov.	0.059	0.033	0.026
1975			
11 Feb.	0.092	0.089	0.003
22 May	0.050	0.050	0.000
14 Aug.	0.070	0.033	0.037
Average	0.068	0.051	0.017
STATION 8-4			
1974			
22 Nov.	0.058	0.027	0.030
1975			
11 Feb.	0.110	0.028	0.082
22 May	0.040	0.012	0.028
14 Aug.	0.055	0.052	0.003
STATION 8-5			
1974			
18 Nov.	0.511	0.030	0.481
1975			
20 Feb.	0.091	0.068	0.023
13 May	0.032	0.006	0.026
14 Aug.	0.047	0.043	0.004
Average	0.170	0.037	0.134

STATION 9-1

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
1974			
11 Nov.	0.050	0.031	0.018
3 Dec.	0.027	0.014	0.013
1975			
6 Jan.	0.040	0.016	0.024
5 Feb.	0.095	0.077	0.018
5 Mar.	0.095	0.021	0.074
2 Apr.	0.064	0.056	0.008
5 May	0.028	0.022	0.006
4 June	0.171	0.047	0.124
2 July	0.101	0.047	0.054
4 Aug.	0.068	0.018	0.050
2 Sept.	---	---	---
2 Oct.	0.043	0.028	0.015
Average	0.071	0.034	0.037

STATION 9-2

1974			
11 Nov.	0.035	0.017	0.018
1975			
5 Feb.	0.075	---	---
5 May	0.056	0.012	0.044
7 Aug.	0.055	0.045	0.010
Average	0.055	0.025	0.024

STATION 9-3

1974			
22 Nov.	0.070	0.027	0.042
1975			
11 Feb.	0.106	0.064	0.042
22 May	0.019	0.008	0.011
12 Aug.	0.060	0.028	0.032
Average	0.064	0.032	0.032

Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
STATION 9-4			
1974			
22 Nov.	0.061	0.041	0.019
1975			
11 Feb.	0.091	0.080	0.011
22 May	0.029	0.025	0.004
12 Aug.	0.063	0.007	0.056
Average	0.061	0.038	0.023
STATION 9-5			
1974			
18 Nov.	0.062	0.013	0.048
1975			
20 Feb.	0.098	0.032	0.066
13 May	0.074	0.008	0.066
12 Aug.	0.050	0.014	0.036
Average	0.071	0.017	0.054
STATION A			
1974			
18 Nov.	0.113	0.081	0.032
1975			
20 Feb.	0.144	0.024	0.120
20 May	0.080	0.047	0.033
12 Aug.	0.070	0.050	0.020
Average	0.102	0.051	0.051
STATION B			
1974			
18 Nov.	0.106	0.084	0.022
1975			
20 Feb.	0.334	0.114	0.220
20 May	0.082	0.008	0.074
12 Aug.	---	---	---
Average	0.174	0.069	0.105

APPENDIX E

TRANSECT SURFACE SEDIMENT DATA

The percentage of sample weight of total carbon, organic carbon, and carbonate for surface sediments collected on each transect.

TRANSECT 1

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1974			
1-1	12 Nov.	---	---	---
1-2	12 Nov.	0.085	0.059	0.026
1-3	22 Nov.	0.066	0.038	0.027
1-4	21 Nov.	0.071	0.040	0.031
1-5	19 Nov.	0.146	0.092	0.054
1-1	3 Dec.	0.017	0.008	0.010
	1975			
1-1	6 Jan.	0.024	0.015	0.009
1-1	4 Feb.	0.206	0.191	0.015
1-2	4 Feb.	0.203	0.177	0.026
1-3	6 Feb.	0.162	0.154	0.008
1-4	6 Feb.	0.389	0.208	0.181
1-5	21 Feb.	0.171	0.169	0.002
1-1	5 Mar.	0.118	0.054	0.064
1-1	2 Apr.	0.101	0.087	0.014
1-1	2 May	0.123	0.010	0.113
1-2	2 May	0.237	0.025	0.212
1-3	6 May	0.089	0.078	0.011
1-4	6 May	0.102	0.062	0.040
1-5	12 May	0.155	0.022	0.133
1-1	4 June	0.161	0.022	0.139
1-1	2 July	0.382	0.200	0.182
1-1	4 Aug.	0.085	0.040	0.045
1-2	7 Aug.	0.055	0.047	0.008
1-3	13 Aug.	0.135	0.066	0.069
1-4	13 Aug.	0.083	0.011	0.072
1-5	13 Aug.	0.168	0.017	0.151
1-1	2 Sept.	0.060	0.019	0.044
1-1	2 Oct.	---	---	---
Average		0.138	0.074	0.065

TRANSECT 2

	1974			
2-1	12 Nov.	0.839	0.043	0.796
2-2	12 Nov.	0.147	0.036	0.110
2-3	19 Nov.	0.177	0.024	0.153
2-4	21 Nov.	0.066	0.056	0.010
2-5	19 Nov.	0.249	0.041	0.208
2-1	3 Dec.	0.036	0.022	0.014

TRANSECT 2 (Continued)

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1975			
2-1	6 Jan.	0.105	0.017	0.088
2-1	4 Feb.	0.184	0.155	0.029
2-2	4 Feb.	0.201	0.197	0.004
2-3	6 Feb.	0.156	0.025	0.131
2-4	6 Feb.	0.068	0.035	0.033
2-5	21 Feb.	0.125	0.076	0.049
2-1	5 Mar.	0.184	0.031	0.153
2-1	2 Apr.	0.100	0.080	0.020
2-1	2 May	0.284	0.164	0.120
2-2	2 May	0.130	0.034	0.096
2-3	6 May	0.021	0.014	0.007
2-4	6 May	0.224	0.028	0.196
2-5	12 May	0.223	0.025	0.198
2-1	6 June	0.232	0.054	0.178
2-1	2 July	0.176	0.050	0.126
2-1	4 Aug.	0.024	0.008	0.016
2-2	7 Aug.	1.761	0.064	1.697
2-3	13 Aug.	0.159	0.097	0.062
2-4	13 Aug.	0.049	---	---
2-5	13 Aug.	1.096	0.026	1.070
2-1	2 Sept.	0.070	0.020	0.050
2-1	2 Oct.	0.102	0.030	0.072
Average		0.257	0.054	0.211
		TRANSECT 3		
	1974			
3-1	12 Nov.	0.124	0.058	0.066
3-2	12 Nov.	0.068	0.033	0.035
3-3	21 Nov.	0.064	0.041	0.023
3-4	21 Nov.	0.081	0.048	0.033
3-5	19 Nov.	0.152	0.029	0.123
3-1	3 Dec.	0.039	0.033	0.006
	1975			
3-1	6 Jan.	0.383	0.080	0.302
3-1	4 Feb.	0.082	0.045	0.037
3-2	4 Feb.	0.094	0.011	0.083
3-3	6 Feb.	0.072	0.046	0.026
3-4	6 Feb.	0.181	0.055	0.126
3-5	21 Feb.	0.118	0.070	0.048
3-1	5 Mar.	0.100	0.061	0.039
3-1	2 Apr.	0.100	0.080	0.020
3-1	2 May	0.134	0.124	0.010

TRANSECT 3 (Continued)

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1975			
3-2	2 May	0.125	0.032	0.093
3-3	6 May	0.074	0.050	0.024
3-4	6 May	0.060	0.047	0.013
3-5	12 May	0.052	---	---
3-1	4 June	0.232	0.030	0.202
3-1	2 July	0.489	0.034	0.455
3-1	4 Aug.	0.111	0.016	0.095
3-2	7 Aug.	0.100	0.036	0.064
3-3	11 Aug.	0.153	0.049	0.104
3-4	11 Aug.	0.125	0.071	0.054
3-5	11 Aug.	0.099	0.048	0.051
3-1	2 Sept.	0.040	0.016	0.024
3-1	2 Oct.	0.049	0.017	0.032
Average		0.125	0.047	0.081

TRANSECT 4

	1974			
4-1	11 Nov.	0.043	0.019	0.024
4-2	11 Nov.	0.025	0.012	0.013
4-3	26 Nov.	0.054	0.051	0.004
4-4	26 Nov.	0.078	0.072	0.006
4-5	19 Nov.	0.039	0.013	0.027
4-1	3 Dec.	0.240	0.086	0.154
	1975			
4-1	6 Jan.	0.455	0.028	0.427
4-1	4 Feb.	0.025	0.023	0.002
4-2	4 Feb.	0.094	0.032	0.062
4-3	10 Feb.	0.085	0.046	0.039
4-4	10 Feb.	0.077	0.062	0.015
4-5	21 Feb.	0.100	0.081	0.019
4-1	5 Mar	0.080	---	---
4-1	2 Apr.	0.102	0.063	0.039
4-1	5 May	0.729	0.029	0.700
4-2	5 May	0.090	0.028	0.062
4-3	19 May	0.072	0.031	0.041
4-4	19 May	0.051	0.026	0.025
4-5	12 May	0.314	0.008	0.306
4-1	4 June	0.146	0.043	0.103
4-1	2 July	0.148	0.035	0.113
4-1	4 Aug.	0.059	0.019	0.040
4-2	7 Aug.	0.081	0.018	0.063

TRANSECT 4 (Continued)

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1975			
4-3	11 Aug.	0.088	0.011	0.077
4-4	11 Aug.	0.098	0.049	0.049
4-5	11 Aug.	0.094	0.021	0.073
4-1	2 Sept.	---	---	---
4-1	2 Oct.	0.067	0.019	0.048
Average		0.131	0.036	0.097

TRANSECT 5

	1974			
5-1	11 Nov.	0.082	0.071	0.010
5-2	11 Nov.	0.027	0.015	0.013
5-3	26 Nov.	0.803	0.043	0.760
5-4	26 Nov.	0.080	0.072	0.008
5-5	19 Nov.	0.051	0.038	0.013
5-1	3 Dec.	0.122	0.054	0.069
	1975			
5-1	6 Jan.	0.684	0.112	0.572
5-1	4 Feb.	0.242	0.023	0.217
5-2	4 Feb.	0.070	0.029	0.041
5-3	10 Feb.	0.055	0.011	0.044
5-4	10 Feb.	0.072	---	---
5-5	21 Feb.	0.127	0.120	0.007
5-1	5 Mar.	0.102	0.093	0.009
5-1	2 Apr.	0.122	0.066	0.056
5-1	5 May	0.315	0.149	0.166
5-2	5 May	0.048	0.035	0.013
5-3	19 May	0.077	0.037	0.040
5-4	19 May	0.072	0.030	0.042
5-5	12 May	0.047	0.044	0.003
5-1	4 June	0.179	0.065	0.114
5-1	2 July	0.208	0.018	0.190
5-1	4 Aug.	0.074	0.020	0.054
5-2	7 Aug.	0.070	0.018	0.052
5-3	8 Aug.	0.088	0.081	0.007
5-4	8 Aug.	0.096	0.024	0.072
5-5	8 Aug.	0.146	0.013	0.133
5-1	2 Sept.	0.066	0.058	0.008
5-1	2 Oct.	---	---	---
Average		0.153	0.052	0.104

TRANSECT 6

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1974			
6-1	11 Nov.	0.041	0.037	0.004
6-2	11 Nov.	0.075	0.057	0.018
6-3	26 Nov.	0.080	0.066	0.014
6-4	26 Nov.	0.073	0.072	0.001
6-5	19 Nov.	0.079	0.026	0.053
6-1	3 Dec.	0.054	0.031	0.023
	1975			
6-1	6 Jan.	0.248	0.047	0.202
6-1	4 Feb.	0.071	0.055	0.016
6-2	4 Feb.	0.073	0.057	0.016
6-3	10 Feb.	0.072	0.043	0.029
6-4	10 Feb.	0.118	0.021	0.097
6-5	21 Feb.	0.116	0.104	0.012
6-1	4 Mar.	0.101	0.096	0.005
6-1	2 Apr.	0.131	0.127	0.004
6-1	5 May	0.127	0.035	0.092
6-2	5 May	0.025	0.018	0.007
6-3	19 May	0.284	0.047	0.237
6-4	19 May	0.141	0.039	0.102
6-5	13 May	0.100	0.047	0.053
6-1	5 June	0.187	0.177	0.010
6-1	2 July	0.156	0.036	0.120
6-1	4 Aug.	0.224	0.008	0.216
6-2	7 Aug.	0.091	0.032	0.059
6-3	8 Aug.	0.108	0.008	0.100
6-4	8 Aug.	0.088	0.016	0.072
6-5	8 Aug.	0.105	0.019	0.086
6-1	2 Sept.	0.045	0.021	0.024
6-1	2 Oct.	0.025	0.006	0.019
Average		0.109	0.047	0.060

TRANSECT 7

	1974			
7-1	11 Nov.	0.048	0.023	0.024
7-2	11 Nov.	0.045	0.040	0.004
7-3	22 Nov.	0.078	0.035	0.044
7-4	22 Nov.	0.058	0.039	0.019
7-5	19 Nov.	0.063	0.053	0.010
7-1	3 Dec.	0.055	0.025	0.030

TRANSECT 7 (Continued)

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1975			
7-1	6 Jan.	0.028	0.026	0.002
7-1	5 Feb.	0.098	0.082	0.016
7-2	5 Feb.	0.127	0.087	0.040
7-3	11 Feb.	0.118	0.098	0.020
7-4	11 Feb.	0.111	0.075	0.036
7-5	20 Feb.	0.148	0.117	0.031
7-1	5 Mar.	0.093	---	---
7-1	2 Apr.	0.087	0.063	0.024
7-1	5 May	0.056	0.024	0.032
7-2	5 May	0.087	0.086	0.001
7-3	22 May	0.055	0.008	0.047
7-4	22 May	0.046	0.005	0.041
7-5	13 May	0.045	0.008	0.037
7-1	4 June	---	0.034	---
7-1	2 July	0.089	0.073	0.016
7-1	4 Aug.	0.111	0.055	0.056
7-2	7 Aug.	0.065	0.046	0.019
7-3	14 Aug.	0.085	0.075	0.010
7-4	14 Aug.	0.081	0.019	0.062
7-5	14 Aug.	0.050	0.041	0.009
7-1	2 Sept.	0.049	0.021	0.028
7-1	2 Oct.	0.026	0.006	0.020
Average		0.074	0.047	0.026

TRANSECT 8

	1974			
8-1	11 Nov.	0.010	0.008	0.001
8-2	11 Nov.	0.643	0.042	0.601
8-3	22 Nov.	0.059	0.033	0.026
8-4	22 Nov.	0.058	0.027	0.030
8-5	18 Nov.	0.511	0.030	0.481
8-1	3 Dec.	0.124	0.010	0.114
	1975			
8-1	6 Jan.	0.061	0.060	0.001
8-1	5 Feb.	0.088	---	---
8-2	5 Feb.	0.064	0.024	0.040
8-3	11 Feb.	0.092	0.089	0.003
8-4	11 Feb.	0.110	0.028	0.082
8-5	20 Feb.	0.091	0.068	0.023
8-1	5 Mar.	0.077	0.076	0.001
8-1	2 Apr.	0.076	0.057	0.019
8-1	5 May	0.040	0.037	0.003

TRANSECT 8 (Continued

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1975			
8-2	5 May	0.038	0.010	0.028
8-3	22 May	0.050	0.050	0.000
8-4	22 May	0.040	0.012	0.028
8-5	13 May	0.032	0.006	0.026
8-1	4 June	0.195	0.160	0.035
8-1	7 July	0.087	0.044	0.043
8-1	4 Aug.	0.131	0.062	0.069
8-2	7 Aug.	0.072	0.037	0.035
8-3	14 Aug.	0.070	0.033	0.037
8-4	14 Aug.	0.055	0.052	0.003
8-5	14 Aug.	0.047	0.043	0.004
8-1	2 Sept.	0.048	0.012	0.036
8-1	2 Oct.	0.057	0.036	0.021
Average		0.108	0.042	0.066

TRANSECT 9

	1974			
9-1	11 Nov.	0.050	0.031	0.018
9-2	11 Nov.	0.035	0.017	0.018
9-3	22 Nov.	0.070	0.027	0.042
9-4	22 Nov.	0.061	0.041	0.019
9-5	18 Nov.	0.062	0.013	0.048
9-1	3 Dec.	0.027	0.014	0.013
	1975			
9-1	6 Jan.	0.040	0.016	0.024
9-1	5 Feb.	0.095	0.077	0.018
9-2	5 Feb.	0.075	---	---
9-3	11 Feb.	0.106	0.064	0.042
9-4	11 Feb.	0.091	0.080	0.011
9-5	20 Feb.	0.098	0.032	0.066
9-1	5 Mar.	0.095	0.021	0.074
9-1	2 Apr.	0.064	0.056	0.008
9-1	5 May	0.028	0.022	0.006
9-2	5 May	0.056	0.012	0.044
9-3	22 May	0.019	0.008	0.011
9-4	22 May	0.029	0.025	0.004
9-5	13 May	0.074	0.008	0.066
9-1	4 June	0.171	0.047	0.124
9-1	2 July	0.101	0.047	0.054
9-1	4 Aug.	0.068	0.018	0.050
9-2	7 Aug.	0.055	0.045	0.010

TRANSECT 9 (Continued)

Station	Date	Total Carbon (pct)	Organic Carbon (pct)	Carbonate (pct)
	1975			
9-3	12 Aug.	0.060	0.028	0.032
9-4	12 Aug.	0.063	0.007	0.056
9-5	12 Aug.	0.050	0.014	0.036
9-1	2 Sept.	---	---	---
9-1	2 Oct.	0.043	0.028	0.015
Average		0.066	0.031	0.035

STATIONS A AND B

	1974			
A	18 Nov.	0.113	0.081	0.032
B	18 Nov.	0.106	0.084	0.022
	1975			
A	20 Feb.	0.144	0.024	0.120
B	20 Feb.	0.334	0.114	0.220
A	20 May	0.080	0.047	0.033
B	20 May	0.082	0.008	0.074
A	12 Aug.	0.070	0.050	0.020
B	12 Aug.	---	---	---
Average		0.133	0.058	0.074

APPENDIX F

STATION SPECIES DATA

The number of individuals of each species caught per sampling trip at each station. Numbers are totals of four plug samples.

STATION 1-1

Species	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
NEMERTINEA													
Unidentified sp.	-	-	-	-	-	-	1	-	-	-	-	-	1
POLYCHAETA													
Paraonis fulgens	-	3	-	-	-	-	-	-	-	-	-	-	3
Scolelepis squamata	-	-	1	-	-	1	1,208	1,232	69	13	3	13	2,540
PELECYPODA													
Barbatia sp.	-	-	-	-	-	-	-	-	1	-	-	-	1
Chione grus	-	-	-	-	-	-	-	-	1	-	-	-	1
Donax texasianus	14	28	37	9	7	7	115	311	6	4	4	4	546
PYCNOGONIDA													
Unidentified sp.	-	-	-	-	-	-	-	-	-	1	-	-	1
AMPHIPODA													
Haustorius n sp.	-	-	10	5	28	36	-	-	7	18	24	1	129
ANOMURA													
Emerita talpoida	-	2	1	6	14	1	3	49	2	25	26	30	159
Lepidopa benedicti	-	-	-	-	-	-	-	-	-	-	1	-	1
CEPHALOCHORDATA													
Branchiostoma floridae	-	-	-	-	-	-	-	-	-	1	-	-	1
TOTAL	14	33	49	20	49	45	1,327	1,592	86	62	58	48	3,383

STATION 2-1

NEMERTINEA													
Unidentified sp.	-	1	-	-	-	-	-	-	-	-	-	-	1
POLYCHAETA													
Paraonis fulgens	2	6	-	7	-	-	-	-	-	-	-	-	15
Scolelepis squamata	-	-	-	-	-	19	177	1,070	70	5	10	10	1,361
PELECYPODA													
Donax texasianus	4	5	89	7	6	4	239	136	7	6	2	1	506
CUMACEA													
Mancocuma sp.	-	-	-	-	-	-	1	-	-	-	-	-	1
AMPHIPODA													
Ericthonius n. sp.	-	-	-	-	-	-	-	-	-	3	-	-	3
Haustorius n. sp.	1	1	2	5	45	13	7	-	4	44	12	15	149
ANOMURA													
Emerita talpoida	-	1	3	5	3	-	6	27	11	19	22	7	104
Lepidopa benedicti	-	-	-	-	-	-	-	-	2	-	-	-	2
TOTAL	7	14	94	24	54	36	430	1,233	94	77	46	33	2,142

STATION 3-1

NEMERTINEA													
Unidentified sp.	-	1	-	-	-	-	-	-	-	-	-	-	1
POLYCHAETA													
Paraonis fulgens	1	3	-	-	-	-	-	-	-	-	-	-	4
Scolelepis squamata	-	-	1	-	-	-	23	107	49	6	-	1	187
PELECYPODA													
Donax texasianus	3	2	34	25	-	4	95	198	11	1	3	1	377
AMPHIPODA													
Haustorius n. sp.	-	1	-	4	21	68	6	7	-	5	15	26	153
ANOMURA													
Emerita talpoida	-	2	14	5	1	3	4	20	13	23	25	6	116
Lepidopa benedicti	-	-	-	-	-	1	-	-	-	-	-	-	1
TOTAL	4	9	49	34	22	76	128	332	73	35	43	34	839

STATION 4-1

POLYCHAETA													
Paraonis fulgens	-	5	-	-	-	-	-	-	-	-	-	-	5
Scolelepis squamata	-	-	1	-	-	-	656	67	54	27	-	4	809
PELECYPODA													
Cuna dalli	-	-	-	-	-	-	-	1	-	-	-	-	1
Donax texasianus	5	48	52	1	-	38	326	109	5	-	1	-	585
AMPHIPODA													
Ericthonius n. sp.	-	-	-	-	-	-	-	-	-	3	-	-	3
Haustorius n. sp.	1	7	-	23	41	25	16	-	-	2	2	1	118
ANOMURA													
Emerita talpoida	1	18	3	-	-	8	19	-	2	13	94	10	168
TOTAL	7	78	56	24	41	71	1,017	177	61	45	97	15	1,689

STATION 5-1

Species	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
NEMATODA													
Unidentified sp. A	-	-	-	-	-	-	-	-	-	1	-	-	1
POLYCHAETA													
Paraonis fulgens	-	6	-	-	-	-	-	-	-	-	-	-	6
Scolelepis squamata	-	-	-	1	-	-	797	139	13	3	-	2	955
PELECYPODA													
Donax texasianus	9	100	316	352	2	78	501	207	-	2	-	-	1,567
CUMACEA													
Mancocuma sp.	-	-	-	-	-	-	4	-	-	-	-	-	4
AMPHIPODA													
Ericthonius n. sp.	-	-	-	-	-	-	-	-	-	4	-	-	4
Haustorius n. sp.	1	5	8	-	17	11	5	-	-	-	3	50	100
ANOMURA													
Emerita talpoida	-	12	37	7	2	1	33	20	-	12	26	4	154
OPHIUROIDEA													
Ophiophragmus wardenanni	-	1	-	-	-	-	-	-	-	-	-	-	1
TOTAL	10	124	361	360	21	90	1,340	366	13	22	29	56	2,792

STATION 6-1

POLYCHAETA													
Paraonis fulgens	-	2	-	-	-	-	-	-	-	-	-	-	2
Prionospio cristata	-	-	-	-	1	-	-	-	-	-	-	-	1
Scolelepis squamata	-	-	-	1	-	-	415	182	48	10	-	7	663
GASTROPODA													
Cresseis acicula	-	-	-	-	-	-	-	-	-	1	-	-	1
PELECYPODA													
Donax texasianus	5	94	90	387	45	109	339	48	15	-	2	1	1,135
AMPHIPODA													
Batea catharinensis	-	-	-	-	-	-	-	-	1	-	-	-	1
Ericthonius n. sp.	-	-	-	-	-	-	-	-	-	1	-	-	1
Haustorius n. sp.	8	-	-	1	41	1	2	-	5	4	20	41	123
ANOMURA													
Emerita talpoida	1	21	15	7	-	2	7	5	18	28	52	21	177
Lepidopa benedicti	-	-	-	-	-	-	-	-	-	-	-	1	1
BRACHYURA													
Pinnixa cristata	-	-	-	-	1	-	-	-	-	-	-	-	1
TOTAL	14	117	105	396	87	112	764	235	87	44	74	71	2,106

STATION 7-1

POLYCHAETA													
Prionospio cristata	-	-	-	-	1	-	-	-	-	-	-	-	1
Scolelepis squamata	-	-	-	-	-	20	6	247	57	4	-	5	339
PELECYPODA													
Donax texasianus	7	11	78	124	27	124	219	135	65	2	1	1	794
CUMACEA													
Mancocuma sp.	-	-	-	1	-	-	-	-	-	-	-	-	1
ISOPODA													
Scyphacella arenicola	-	-	-	-	-	-	-	-	-	-	1	-	1
AMPHIPODA													
Ericthonius n. sp.	-	-	-	-	-	-	-	-	-	9	-	-	9
Haustorius n. sp.	3	-	-	2	32	2	26	-	-	-	1	26	92
Unidentified caprellid sp. B	-	-	-	-	-	-	-	-	1	-	-	-	1
ANOMURA													
Emerita talpoida	-	11	7	1	14	14	6	18	5	73	15	43	207
Lepidopa benedicti	-	1	-	1	-	-	-	-	-	-	-	-	2
TOTAL	10	23	85	129	74	160	257	400	128	88	18	75	1,447

STATION 8-1

Species	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
NEMATODA													
Unidentified sp. A	-	-	-	-	-	-	1	-	-	-	-	-	1
POLYCHAETA													
Paraonis fulgens	-	2	-	-	-	-	-	-	-	-	-	-	2
Scolelepis squamata	-	-	-	2	1	-	596	35	12	3	-	1	650
PELECYPODA													
Donax texasianus	2	9	110	87	42	16	614	208	13	-	2	1	1,104
CUMACEA													
Mancocuma sp.	-	-	-	-	-	-	10	-	-	-	-	-	10
AMPHIPODA													
Erichthonius n. sp.	-	-	-	-	-	-	-	-	1	11	-	-	12
Haustorius n. sp.	4	-	-	23	8	5	24	-	3	-	-	3	70
Nototropis n. sp.	-	-	-	-	-	-	-	-	-	4	-	-	4
Unidentified caprellid sp. B	-	-	-	-	-	-	-	-	-	1	-	-	1
ANOMURA													
Emerita talpoida	1	13	25	-	6	3	96	25	6	47	23	26	271
Lepidopa benedicti	-	-	-	8	-	-	-	-	-	-	-	-	8
BRACHYURA													
Pinnotheres maculatus	-	-	-	-	-	1	-	-	-	-	-	-	1
PISCES													
Leiostomus xanthurus	-	-	-	2	-	-	-	-	-	-	-	-	2
TOTAL	7	24	135	122	57	25	1,341	268	35	66	25	31	2,136

STATION 9-1

POLYCHAETA													
Paraonis fulgens	-	-	-	-	-	-	-	-	1	-	-	-	1
Scolelepis squamata	-	-	-	-	-	1	353	109	2	16	7	17	505
PELECYPODA													
Donax texasianus	7	-	29	53	28	9	379	193	118	3	2	1	822
CUMACEA													
Mancocuma sp.	-	-	-	-	-	-	1	-	-	-	-	-	1
AMPHIPODA													
Erichthonius n. sp.	-	-	-	-	-	-	-	-	-	2	-	-	2
Haustorius n. sp.	6	-	-	1	1	8	2	4	23	8	5	1	59
Nototropis n. sp.	-	-	-	-	-	-	-	-	-	1	-	-	1
Pseudohaustorius n. sp.	-	-	-	-	1	-	-	-	-	-	-	-	1
ANOMURA													
Emerita talpoida	-	3	4	6	4	9	44	38	15	16	20	40	199
Lepidopa benedicti	-	-	-	-	-	-	1	-	-	1	-	-	2
TOTAL	13	3	33	60	34	27	780	344	159	47	34	59	1,593

STATION 1-2

Species	Nov.	Feb.	May	Aug.	Total
NEMERTINEA					
Unidentified sp.	-	-	2	1	3
POLYCHAETA					
Paraonis fulgens	1	17	16	2	36
Scolelepis squamata	-	3	31	9	43
GASTROPODA					
Creseis acicula	-	-	-	3	3
Diastoma varium	-	-	-	4	4
PELECYPODA					
Donax texasianus	2	3	39	13	57
CUMACEA					
Mancocuma sp.	-	-	-	1	1
AMPHIPODA					
Ericthonius n. sp.	-	-	-	8	8
Haustorius n. sp.	3	11	12	3	29
Nototropis n. sp.	-	-	-	2	2
ANOMURA					
Emerita talpoida	-	1	-	-	1
TOTAL	6	35	100	46	187

STATION 2-2

NEMATODA					
Unidentified sp. A	-	-	-	1	1
POLYCHAETA					
Dispio uncinata	-	-	-	1	1
Nephtys bucera	-	-	1	-	1
Paraonis fulgens	2	6	4	7	19
Scolelepis squamata	-	3	134	4	141
Spionid sp.	-	-	-	1	1
GASTROPODA					
Creseis acicula	-	-	-	1	1
PELECYPODA					
Donax texasianus	4	2	676	5	687

STATION 2-2 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CUMACEA					
Mancocuma sp.	-	1	15	-	16
ISOPODA					
Ancinus depressus	-	-	9	-	9
AMPHIPODA					
Acanthohaustorius n. sp.	-	-	-	1	1
Ericthonius n. sp.	-	-	-	14	14
Haustorius n. sp.	4	9	36	9	58
Nototropis n. sp.	-	-	-	1	1
Parahaustorius n. sp.	-	-	-	4	4
ANOMURA					
Emerita talpoida	-	-	-	1	1
ECHINOIDEA					
Mellitae quinquiesperforata	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	-	1	-	-	1
TOTAL	10	22	875	51	958

STATION 3-2

NEMERTINEA					
Unidentified sp.	1	-	1	3	5
NEMATODA					
Unidentified sp. A	-	-	1	1	2
POLYCHAETA					
Paraonis fulgens	3	0	7	1	20
Scolelepis squamata	-	10	6	3	19
GASTROPODA					
Creseis acicula	-	-	-	1	1
Hastula salleana	-	-	1	-	1
PELECYPODA					
Donax texasianus	28	2	280	8	318

STATION 3-2 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CUMACEA					
Mancocuma sp.	-	1	2	3	6
ISOPODA					
Ancinus depressus	-	4	-	1	5
AMPHIPODA					
Ericthonius n. sp.	-	-	-	4	4
Haustorius n. sp.	4	3	39	11	57
Nototropis n. sp.	-	-	-	3	3
Pseudohaustorius n. sp.	-	-	1	-	1
ANOMURA					
Lepidopa benedicti	-	-	1	-	1
PISCES					
Cynoscion nebulosus	-	-	-	1	1
TOTAL	36	29	339	40	444

STATION 4-2

NEMERTINEA					
Unidentified sp.	-	-	2	1	3
POLYCHAETA					
Dispio uncinata	-	-	-	1	1
Paraonis fulgens	-	4	3	9	16
Scolelepis squamata	-	-	23	10	33
PELECYPODA					
Donax texasianus	23	2	308	8	341
CUMACEA					
Mancocuma sp.	-	-	17	1	18
AMPHIPODA					
Acanthohaustorius n. sp.	-	-	-	1	1
Ericthonius n. sp.	-	-	-	1	1
Haustorius n. sp.	4	12	5	-	21
Nototropis n. sp.	-	-	-	3	3
Parahaustorius n. sp.	-	-	-	2	2
TOTAL	27	18	358	37	440

Species	Nov.	Feb.	May	Aug.	Total
STATION 5-2					
POLYCHAETA					
Paraonis fulgens	-	3	6	1	10
Scolelepis squamata	-	11	8	18	37
PELECYPODA					
Donax texasianus	10	19	257	5	291
CUMACEA					
Mancocuma sp.	-	3	15	-	18
AMPHIPODA					
Ericthonius n. sp.	-	-	-	3	3
Haustorius n. sp.	14	13	22	10	59
Nototropis n. sp.	-	-	-	1	1
Parahaustorius n. sp.	-	1	2	-	3
Pseudohaustorius n. sp.	-	-	1	-	1
TOTAL	24	50	311	38	423
STATION 6-2					
NEMERTINEA					
Unidentified sp.	2	-	-	1	3
NEMATODA					
Unidentified sp. A	-	-	1	-	1
POLYCHAETA					
Lumbrineris parvapedata	-	1	-	-	1
Paraonis fulgens	2	6	14	1	23
Scolelepis squamata	-	24	13	13	50
GASTROPODA					
Diastoma varium	-	-	-	1	1
PELECYPODA					
Donax texasianus	25	3	225	2	255
Ervilia concentrica	1	-	-	-	1
CUMACEA					
Mancocuma sp.	-	-	53	-	53
ISOPODA					
Ancinus depressus	-	-	1	1	2

STATION 6-2 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
AMPHIPODA					
Acanthohaustorius n. sp.	-	-	-	1	1
Ericthonius n. sp.	-	-	-	5	5
Haustorius n. sp.	8	4	30	12	54
Nototropis n. sp.	-	-	-	4	4
Parahaustorius n. sp.	-	-	4	3	7
PENAEIDEA					
Penaeus duorarum	-	-	-	3	3
OPHIUROIDEA					
Ophiophragnus wurdemanni	-	1	-	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	1	-	-	-	1
TOTAL	39	39	341	47	466

STATION 7-2

POLYCHAETA					
Dispio uncinata	-	-	-	1	1
Nephtyid sp.	-	-	1	-	1
Paraonis fulgens	-	-	2	-	2
Scolelepis squamata	-	-	8	24	32
PELECYPODA					
Donax texasianus	14	3	182	1	200
CUMACEA					
Mancocuma sp.	-	2	0	3	14
AMPHIPODA					
Ericthonius n. sp.	-	-	-	25	25
Haustorius n. sp.	5	17	112	2	136
Nototropis n. sp.	-	-	-	2	2
CARIDEA					
Tozeuma cornutum	-	-	-	1	1
ANOMURA					
Emerita talpoida	2	5	1	-	8

STATION 7-2 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
BRACHYURA					
Pinnixa cristata	-	-	2	-	2
TOTAL	21	27	317	59	424

STATION 8-2

NEMERTINEA					
Unidentified sp.	-	-	1	-	1
NEMATODA					
Unidentified sp.	-	-	-	1	1
POLYCHAETA					
Dispio uncinata	-	-	-	1	1
Paraonis fulgens	-	-	-	1	1
Scolelepis squamata	-	4	22	19	45
GASTROPODA					
Creseis acicula	-	-	-	2	2
Diastoma varium	-	-	-	1	1
PELECYPODA					
Donax texasianus	12	7	189	8	216
CUMACEA					
Mancocuma sp.	-	1	12	2	15
ISOPODA					
Ancinus depressus	-	1	-	-	1
AMPHIPODA					
Ericthonius n. sp.	-	-	-	17	17
Haustorius n. sp.	1	29	26	1	57
Nototropis n. sp.	-	-	-	1	1
PENAEIDEA					
Penaeus duorarum	-	-	-	1	1
ANOMURA					
Emerita talpoida	-	-	3	-	3

STATION 8-2 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
PISCES					
Leiostomus xanthurus	-	1	-	-	1
TOTAL	13	43	253	55	364

STATION 9-2

NEMERTINEA					
Unidentified sp.	-	-	1	-	1
POLYCHAETA					
Dispio uncinata	-	-	-	1	1
Paraonis fulgens	-	1	1	-	2
Scolelepis squamata	-	7	44	19	70
GASTROPODA					
Hastula salleana	-	-	1	-	1
PELECYPODA					
Donax texasianus	17	5	1,978	2	2,002
CUMACEA					
Mancocuma sp.	-	2	171	-	173
AMPHIPODA					
Ericthonius n. sp.	-	-	-	1	1
Haustorius n. sp.	5	54	2	3	64
Nototropis n. sp.	-	-	-	2	2
Talorchestia inexpectata	-	-	-	1	1
ANOMURA					
Emerita talpoida	-	-	12	-	12
BRACHYURA					
Pinnixa cristata	-	-	9	-	9
PISCES					
Leiostomus xanthurus	-	2	-	-	2
TOTAL	22	71	2,219	29	2,341

Species	STATION 1-3 Nov.	Feb.	May	Aug.	Total
NEMATODA					
Unidentified sp. A	-	1	-	-	1
POLYCHAETA					
Brania wellfleetensis	-	1	-	-	1
Dispio uncinata	-	-	-	29	29
Magelona riojai	-	1	3	1	5
Nephtys bucera	-	-	-	1	1
Paraonis fulgens	8	25	11	12	56
Scolelepis squamata	-	2	-	-	2
Spio pettiboneae	-	-	2	2	4
Spiophanes bombyx	-	-	1	-	1
Unidentified spionid sp.	-	-	-	3	3
OLICOCHAETA					
Unidentified sp.	-	-	1	-	1
PELECYPODA					
Chione grus	-	-	-	1	1
Donax texasianus	1	-	233	-	234
Strigilla mirabilis	-	-	-	1	1
STOMATOPODA					
Coronis excavatrix	-	-	1	-	1
ISOPODA					
Ancinus depressus	1	-	-	4	5
Chiridotea excavata	-	-	1	-	1
AMPHIPODA					
Acanthohaustorius n. sp.	35	49	81	93	258
Haustorius n. sp.	3	-	1	-	4
Monoculodes n. sp.	1	-	-	-	1
Monoculodes nyei	-	-	-	1	1
Protohaustorius n. sp.	2	11	24	28	65
Pseudohaustorius n. sp.	9	33	13	9	64
Synchelidium n. sp.	1	-	2	-	3
Unidentified caprellid sp. A	-	-	2	-	2
CARIDEA					
Ambidexter symmetricus	-	-	-	1	1

STATION 1-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
ANOMURA					
Pagurus longicarpus	-	-	3	-	3
SIPUNCULIDA					
Sipunculus longipapillosus	-	-	-	1	1
OPHIUROIDEA					
Ophiophragnus filograneus	-	-	-	1	1
ECHINOIDEA					
Mellita quinquiesperforata	-	-	3	5	8
HOLOTHUROIDEA					
Unidentified sp.	1	-	-	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	24	2	-	-	26
TOTAL	86	125	382	193	786

STATION 2-3

NEMERTINEA					
Unidentified sp.	-	-	3	3	6
NEMATODA					
Unidentified sp. A	-	2	-	-	2
POLYCHAETA					
Armandia maculata	-	-	1	-	1
Dispio uncinata	-	1	-	7	8
Magelona riojai	-	-	7	2	9
Micronephtys minuta	-	-	1	-	1
Nephtys bucera	-	-	2	-	2
Ophelia sp.	1	-	-	-	1
Paraonis fulgens	12	1	-	1	14
Phyllodoce arenae	-	-	-	1	1
Scolelepis texana	-	1	-	-	1
Spio pettiboneae	-	-	78	20	98
Spiophanes bombyx	-	-	5	1	6
Syllides setosa	2	-	-	-	2
OLIGOCHAETA					
Unidentified sp.	-	1	-	-	1

STATION 2-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
GASTROPODA					
Olivella mutica	-	-	-	1	1
Polinices duplicatus	-	-	-	1	1
PELECYPODA					
Anadara floridana	-	-	-	1	1
Chione grus	1	-	-	-	1
Cuna dalli	1	-	2	3	6
Donax texasianus	-	7	28	-	35
Ervilia concentrica	11	1	-	-	12
Lucina multilineata	-	-	-	1	1
Pitar simpsoni	1	-	-	-	1
Unidentified venerid sp. (nr. *Gouldia*)	-	-	2	-	2
STOMATOPODA					
Coronis excavatrix	-	-	1	-	1
CUMACEA					
Mancocuma sp.	-	-	-	1	1
Unidentified sp.	-	-	-	1	1
ISOPODA					
Ancinus depressus	1	2	-	-	3
Chiridotea excavata	1	-	-	-	1
AMPHIPODA					
Acanthohaustorius n. sp.	19	43	38	29	129
Monoculodes nyei	-	-	2	1	3
Protohaustorius n. sp.	-	9	24	26	59
Pseudohaustorius n. sp.	4	5	5	5	19
Synchelidium n. sp.	-	1	-	-	1
CARIDEA					
Ogyrides alphaerostris	-	-	2	3	5
Processa hemphilli	-	-	1	-	1
ANOMURA					
Pagurus longicarpus	-	-	-	5	5
BRACHYURA					
Pinnixa cristata	-	-	-	2	2
Portunus gibbesii	-	-	-	1	1

Species	Nov.	Feb.	May	Aug.	Total
STATION 2-3 (Continued)					
OPHIUROIDEA					
Unidentified sp. A	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	-	-	2	2	4
CEPHALOCHORDATA					
Branchiostoma floridae	25	4	-	1	30
PISCES					
Eucinostomus sp.	1	-	-	-	1
TOTAL	81	78	204	119	482
STATION 3-3					
TURBELLARIA					
Unidentified sp.	-	1	-	-	1
NEMERTINEA					
Unidentified sp.	-	-	2	4	6
POLYCHAETA					
Dispio uncinata	-	-	1	24	25
Magelona riojai	1	-	4	4	9
Nephtys bucera	-	-	1	2	3
Paraonis fulgens	3	4	-	4	11
Scolelepis squamata	-	1	-	-	1
Spio pettiboneae	-	-	42	18	60
Spiophanes bombyx	-	-	8	1	9
OLIGOCHAETA					
Unidentified sp.	-	1	-	1	2
GASTROPODA					
Oliva sayana	-	1	-	-	1
Olivella mutica	-	-	-	1	1
PELECYPODA					
Cuna dalli	-	1	-	-	1
Donax texasianus	1	3	49	-	53
Unidentified venerid sp. (nr. *Gouldia*)	-	-	6	-	6

STATION 3-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CUMACEA					
Unidentified sp.	-	-	-	2	2
ISOPODA					
Chiridotea excavata	-	-	-	1	1
AMPHIPODA					
Acanthohaustorius n. sp.	33	53	19	39	144
Batea catharinensis	-	1	-	-	1
Ericthonius n. sp.	-	-	-	1	1
Parahaustorius n. sp.	1	-	1	-	2
Protohaustorius n. sp.	2	12	31	21	66
Pseudohaustorius n. sp.	4	5	6	10	25
Synchelidium n. sp.	1	-	3	1	5
Unidentified caprellid sp. A	-	5	-	-	5
CARIDEA					
Ogyrides alphaerostris	1	-	-	6	7
CALLIANASSIDAE					
Unidentified sp.	-	-	-	1	1
ANOMURA					
Pagurus longicarpus	-	-	2	-	2
SIPUNCULIDA					
Sipunculus longipapillosus	2	-	-	-	2
ECHINOIDEA					
Mellita quinquiesperforata	1	-	1	4	6
HEMICHORDATA					
Unidentified sp.	1	-	-	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	6	16	-	-	22
TOTAL	57	104	176	145	482

STATION 4-3

ACTINIARIA					
Unidentified sp.	-	-	-	1	1

STATION 4-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
NEMERTINEA					
Unidentified sp.	4	3	4	-	11
NEMATODA					
Unidentified sp. A	-	1	1	-	2
POLYCHAETA					
Dispio uncinata	-	-	4	7	11
Eteone heteropoda	-	-	1	-	1
Magelona riojai	-	-	2	-	2
Micronephtys sp.	-	1	-	-	1
Micronephtys minuta	-	-	1	-	1
Nephtys bucera	-	-	1	1	2
Orbiniid sp.	-	-	-	1	1
Paraonis fulgens	3	3	2	10	18
Phyllodoce arenae	-	-	-	1	1
Spio pettiboneae	-	-	54	80	134
Spiophanes bombyx	-	-	3	-	3
GASTROPODA					
Olivella mutica	-	-	-	1	1
Polinices duplicatus	-	-	-	1	1
PELECYPODA					
Cuna dalli	-	1	-	-	1
Donax texasianus	4	2	600	1	607
Ervilia concentrica	7	-	5	-	12
Tellina versicolor	-	-	-	1	1
Unidentified venerid sp. (nr. *Gouldia*)	-	10	3	-	13
CUMACEA					
Unidentified sp.	-	-	-	2	2
AMPHIPODA					
Acanthohaustorius n. sp.	46	99	180	123	448
Parahaustorius n. sp.	-	2	-	-	2
Protohaustorius n. sp.	10	39	98	60	207
Pseudohaustorius n. sp.	26	22	10	5	63
Synchelidium n. sp.	1	1	1	1	4
CARIDEA					
Ogyrides alphaerostris	1	-	2	3	6
Processa hemphilli	-	-	2	-	2

STATION 4-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CALLIANASSIDAE					
Unidentified sp.	-	-	6	-	6
BRACHYURA					
Dissodactylus mellitae	-	-	2	1	3
Pinnixa cristata	-	-	1	1	2
Pinnotheres maculatus	-	-	7	-	7
SIPUNCULIDA					
Sipunculus longipapillosus	6	2	-	-	8
ECHINOIDEA					
Mellita quinquiesperforata	3	2	8	6	19
HEMICHORDATA					
Unidentified sp.	1	1	2	-	4
CEPHALOCHORDATA					
Branchiostoma floridae	12	4	1	2	19
TOTAL	124	193	1,001	309	1,627

STATION 5-3

NEMERTINEA					
Unidentified sp.	-	3	3	-	6
POLYCHAETA					
Dispio uncinata	-	-	5	6	11
Magelona riojai	-	-	3	-	3
Paraonis fulgens	1	1	1	1	4
Prionospio cristata	1	-	-	-	1
Spio pettiboneae	-	-	10	12	22
Spiophanes bombyx	-	-	1	-	1
OLIGOCHAETA					
Unidentified sp.	-	-	-	3	3
GASTROPODA					
Oliva sayana	1	-	-	-	1
Olivella mutica		-	1	-	1

STATION 5-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
PELECYPODA					
Cuna dalli	1	1	-	-	2
Donax texasianus	-	1	462	-	463
Ervilia concentrica	39	1	2	-	42
Unidentified venerid sp. (nr. *Gouldia*)	-	7	1	-	8
STOMATOPODA					
Coronis excavatrix	-	-	3	-	3
CUMACEA					
Unidentified sp.	-	-	-	1	1
ISOPODA					
Ancinus depressus	-	-	1	-	1
AMPHIPODA					
Acanthohaustorius n. sp.	59	50	107	37	253
Haustorius n. sp.	-	-	2	-	2
Parahaustorius n. sp.	2	2	-	2	6
Parahaustorius sp.	1	-	-	-	1
Protohaustorius n. sp.	25	20	57	9	111
Pseudohaustorius n. sp.	36	27	6	13	82
Pseudoplatyischnopus n. sp. A	1	-	-	-	1
Synchelidium n. sp.	1	1	-	-	2
CARIDEA					
Ogyrides alphaerostris	-	-	2	1	3
CALLIANASSIDAE					
Unidentified sp.	-	-	4	1	5
ANOMURA					
Lepidopa benedicti	-	-	1	-	1
BRACHYURA					
Pinnixa cristata	-	-	3	1	4
SIPUNCULIDA					
Sipunculus longipapillosus	6	-	-	-	6

STATION 5-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
OPHIUROIDEA					
Amphipholis squamata	3	-	-	-	3
Ophiophragmus wurdemanni	-	1	-	-	1
Unidentified ophiuroid sp. B	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	4	1	5	11	21
HEMICHORDATA					
Unidentified sp.	3	1	2	-	6
CEPHALOCHORDATA					
Branchiostoma floridae	22	-	-	-	22
TOTAL	207	117	682	98	1,104

STATION 6-3

NEMERTINEA					
Unidentified sp.	3	2	1	1	7
POLYCHAETA					
Dispio uncinata	-	-	2	6	8
Magelona riojai	-	-	1	2	3
Nephtys bucera	-	-	-	1	1
Ophelia sp.	1	-	-	-	1
Paraonis fulgens	2	1	-	1	4
Podarmus sp.	-	-	1	-	1
Prionospio cristata	1	-	-	-	1
Scolelepis texana	-	1	-	1	2
Spionid sp.	-	-	-	2	2
Spio pettiboneae	-	-	19	23	42
OLIGOCHAETA					
Unidentified sp.	-	1	-	-	1
PELECYPODA					
Cuna dalli	-	2	-	-	2
Donax texasianus	1	3	107	-	111
Ervilia concentrica	12	-	-	-	12
STOMATOPODA					
Coronis excavatrix	-	-	1	-	1

Species	STATION 6-3 (Continued) Nov.	Feb.	May	Aug.	Total
CUMACEA					
Unidentified sp.	-	-	-	1	1
ISOPODA					
Ancinus depressus	-	-	-	1	1
AMPHIPODA					
Acanthohaustorius n. sp.	102	65	114	24	305
Haustorius n. sp.	1	-	-	-	1
Parahaustorius n. sp.	1	-	5	1	7
Protohaustorius n. sp.	10	43,	86	7	146
Pseudohaustorius n. sp.	64	20	14	48	146
Synchelidium n. sp.	1	-	4	-	5
CARIDEA					
Ogyrides alphaerostris	1	-	2	2	5
CALLIANASSIDAE					
Unidentified sp.	-	-	8	-	8
ANOMURA					
Pagurus longicarpus	-	-	-	1	1
BRACHYURA					
Pinnixa cristata	-	-	2	-	2
Pinnotheres maculatus	-	-	3	-	3
Portunus gibbesii	-	-	2	-	2
SIPUNCULIDA					
Sipunculus longipapillosus	3	-	-	-	3
OPHIUROIDEA					
Unidentified sp. B	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	8	1	4	7	20
HOLOTHUROIDEA					
Unidentified sp.	-	-	3	-	3
HEMICHORDATA					
Unidentified sp.	1	5	2	1	9

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THE BENTHIC FAUNA AND SEDIMENTS OF THE NEARSHORE ZONE OFF PANAM--ETC(U)
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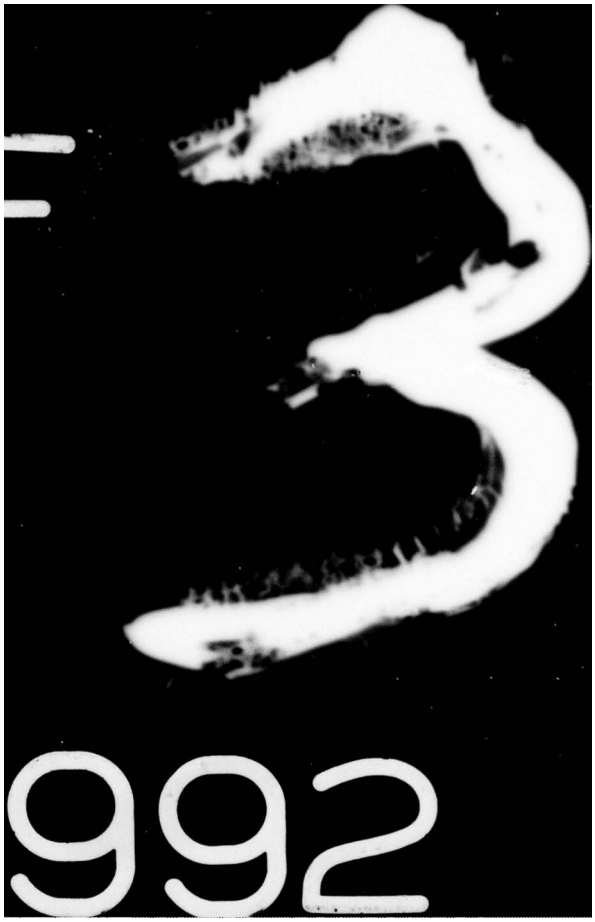
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Species	Nov.	Feb.	May	Aug.	Total
STATION 6-3 (Continued)					
CEPHALOCHORDATA					
Branchiostoma floridae	16	2	-	-	18
PISCES					
Ophidiidae sp.	-	-	-	1	1
TOTAL	229	146	381	131	887
STATION 7-3					
NEMERTINEA					
Unidentified sp.	-	-	6	1	7
NEMATODA					
Unidentified sp. A	-	-	1	-	1
POLYCHAETA					
Bravia clavata	-	1	-	-	1
Dispio uncinata	-	-	-	69	69
Magelona riojai	-	-	4	7	11
Nephtys bucera	-	-	3	1	4
Ophelina sp.	-	-	-	1	1
Paraonis fulgens	1	1	-	1	3
Scolopolos foliosus	-	-	-	1	1
Spionid sp.	-	-	1	-	1
Spio pettiboneae	-	-	10	6	16
Spiophanes bombyx	-	-	1	-	1
PELECYPODA					
Cuna dalli	1	5	2	-	8
Donax texasianus	8	15	420	-	443
Ervilia concentrica	-	-	1	-	1
Pitar simpsoni	1	-	-	-	1
Tellina versicolor	-	-	-	1	1
STOMATOPODA					
Coronis excavatrix	-	-	2	-	2
CUMACEA					
Unidentified sp.	-	-	-	1	1
ISOPODA					
Ancinus depressus	1	-	-	1	2

STATION 7-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
AMPHIPODA					
Acanthohaustorius n. sp.	37	73	184	30	324
Haustorius n. sp.	-	-	1	-	1
Protohaustorius n. sp.	6	12	44	24	86
Pseudohaustorius n. sp.	4	9	30	24	67
Synchelidium n. sp.	3	2	3	1	9
CARIDEA					
Ogyrides alphaerostris	1	-	9	5	15
CALLIANASSIDAE					
Unidentified sp.	-	-	10	1	11
ANOMURA					
Emerita talpoida	-	2	-		2
Pagurus longicarpus	-	-	-	1	1
BRACHYURA					
Pinnixa cristata	-	-	4	-	4
Portunus gibbesii	-	-	1	1	2
SIPUNCULIDA					
Sipunculus longipapillosus	2	-	-	-	2
ECHINOIDEA					
Mellita quinquiesperforata	3	1	29	-	33
HEMICHORDATA					
Unidentified sp.	-	-	1	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	16	2	-	-	18
TOTAL	84	123	767	177	1,151

STATION 8-3

NEMERTINEA					
Unidentified sp.	-	-	2	2	4
NEMATODA					
Unidentified sp. A	-	1	-	-	1

STATION 8-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA					
Dispio uncinata	-	-	1	45	46
Magelona riojai	-	-	-	1	1
Nephtys bucera	-	-	-	1	1
Paraonis fulgens	1	-	-	1	2
Scoleplos fragilis	-	-	-	1	1
Scolopolos foliosus	-	-	-	3	3
Spio pettiboneae	-	-	2	11	13
Syllides setosa	3	-	-	-	3
GASTROPODA					
Polinices duplicatus	-	-	-	1	1
PELECYPODA					
Cuna dalli	1	1	1	-	3
Donax texasianus	5	2	33	-	40
Ervilia concentrica	1	-	-	-	1
Strigilla mirabilis	-	-	-	1	1
CUMACEA					
Mancocuma sp.	-	-	-	3	3
Unidentified sp.	-	-	-	2	2
ISOPODA					
Ancinus depressus	-	-	1	2	3
AMPHIPODA					
Acanthohaustorius n. sp.	68	58	162	89	377
Ericthonius n. sp.	-	-	-	1	1
Haustorius n. sp.	1	1	-	-	2
Monoculodes nyei	-	-	-	1	1
Protohaustorius n. sp.	-	3	26	31	60
Pseudohaustorius n. sp.	16	17	19	6	58
Synchelidium n. sp.	-	1	4	2	7
CARIDEA					
Ogyrides alphaerostris	-	-	7	4	11
CALLIANASSIDAE					
Unidentified sp.	-	-	6	3	9
ANOMURA					
Emerita benedicti	1	-	-	-	1

STATION 8-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
BRACHYURA					
Pinnixa lunzi	-	-	-	1	1
Portunus gibbesii	-	-	1	-	1
OPHIUROIDEA					
Unidentified sp. B	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	1	2	17	-	20
HEMICHORDATA					
Unidentified sp.	-	1	-	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	46	5	-	-	51
PISCES					
Myruphis punctatus	1	-	-	-	1
TOTAL	146	92	282	212	732

STATION 9-3

NEMERTINEA					
Unidentified sp.	2	1	3	1	7
NEMATODA					
Unidentified sp. A	-	-	-	3	3
POLYCHAETA					
Dispio uncinata	-	-	2	75	77
Magelona riojai	-	-	1	2	3
Nephtyid sp.	-	-	-	2	2
Nephtys bucera	-	-	-	2	2
Paraonis fulgens	-	1	1	4	6
Scolelepis squamata	-	4	-	-	4
Scoleplos fragilis	-	-	-	2	2
Scolopolos foliosus	-	-	-	1	1
Spio pettiboneae	-	-	7	4	11

STATION 9-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
PELECYPODA					
Cuna dalli	-	1	-	-	1
Donax texasianus	3	1	278	-	282
Ervilia concentrica	2	-	-	-	2
Unidentified venerid sp. (nr. *Gouldia*)	-	1	-	-	1
CUMACEA					
Cyclaspis varians	-	-	-	1	1
Mancocuma sp.	-	-	2	-	2
ISOPODA					
Ancinus depressus	3	-	-	-	3
Chiridotea excavata	-	-	1	1	2
AMPHIPODA					
Acanthohaustorius n. sp.	52	26	131	38	247
Ericthonius n. sp.	-	-	-	2	2
Haustorius n. sp.	-	-	1	-	1
Protohaustorius n. sp.	13	-	7	64	84
Pseudohaustorius n. sp.	2	5	2	36	45
Synchelidium n. sp.	2	2	6	-	10
CARIDEA					
Ogyrides alphaerostris	1	-	23	1	25
Processa hemphilli	-	-	1	-	1
CALLIANASSIDAE					
Unidentified sp.	-	-	2	1	3
ANOMURA					
Lepidopa benedicti	-	-	1	1	2
BRACHYURA					
Pinnixa cristata	-	-	3	5	8
ECHINOIDEA					
Mellita quinquiesperforata	2	-	4	5	11
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	1	1

STATION 9-3 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CEPHALOCHORDATA					
Branchiostoma floridae	29	2	-	-	31
PISCES					
Unidentified ophidiid sp.	-	-	1	-	1
TOTAL	111	44	477	252	884

STATION 1-4

NEMERTINEA					
Unidentified sp.	-	1	1	3	5
POLYCHAETA					
Dispio uncinata	-	-	-	7	7
Glycera oxycephala	-	-	-	1	1
Magelona riojai	1	2	2	-	5
Paraonis fulgens	-	6	7	28	41
Scolelepis squamata	-	7	3	-	10
Scolopolos foliosus	-	-	-	1	1
Spionid sp.	-	-	-	1	1
PELECYPODA					
Cuna dalli	-	-	-	1	1
Donax texasianus	-	-	208	-	208
Ervilia concentrica	-	-	1	-	1
Pitar simpsoni	-	1	-	-	1
CUMACEA					
Unidentified sp.	-	-	-	6	6
ISOPODA					
Ancinus depressus	1	-	1	-	2
AMPHIPODA					
Acanthohaustorius n. sp.	18	19	121	23	181
Ericthonius n. sp.	-	-	-	1	1
Haustorius n. sp.	-	-	1	-	1
Monoculodes nyei	-	-	-	1	1
Parahaustorius n. sp.	-	1	1	-	2
Protohaustorius n. sp.	6	-	10	2	18
Pseudohaustorius n. sp.	-	5	1	20	26
Synchelidium n. sp.	-	-	1	-	1

STATION 1-4 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CARIDEA					
Ogyrides alphaerostris	-	-	-	6	6
Processa vicina	-	-	1	-	1
BRACHYURA					
Pinnixa cristata	-	-	-	1	1
OPHIUROIDEA					
Unidentified sp. A	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	-	-	2	-	2
CEPHALOCHORDATA					
Branchiostoma floridae	9	1	-	-	10
TOTAL	36	43	361	102	542

STATION 2-4

NEMERTINEA					
Unidentified sp.	-	1	1	2	4
NEMATODA					
Unidentified sp. A	-	-	-	1	1
POLYCHAETA					
Bravia clavata	-	-	-	1	1
Dispio uncinata	-	-	-	6	6
Locinea viridis	-	1	-	-	1
Magelona riojai	2	-	1	2	5
Magelona sp.	-	-	-	1	1
Nephtys bucera	-	-	1	4	5
Paraonis fulgens	2	1	44	21	68
Scolelepis squamata	-	6	4	-	10
Spio pettiboneae	-	-	3	-	3
Spiophanes bombyx	-	-	1	-	1
GASTROPODA					
Olivella mutica	-	1	-	1	2
PELECYPODA					
Donax texasianus	-	1	155	-	156
Ervilia concentrica	-	-	-	1	1

STATION 2-4 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CUMACEA					
Cyclaspis varians	-	-	-	1	1
Unidentified sp.	-	-	-	4	4
ISOPODA					
Ancinus depressus	2	1	1	1	5
Chiridotea excavata	-	-	2	-	2
AMPHIPODA					
Acanthohaustorius n. sp.	12	16	31	38	97
Haustorius n. sp.	1	-	-	-	1
Monoculodes nyei	-	-	-	4	4
Parahaustorius n. sp.	-	1	1	-	2
Protohaustorius n. sp.	-	1	4	21	26
Pseudohaustorius n. sp.	-	2	-	59	61
CARIDEA					
Ogyrides alphaerostris	-	-	-	1	1
ANOMURA					
Emerita talpoida	-	-	1	-	1
Pagurus longicarpus	-	-	-	2	2
BRACHYURA					
Pinnixa cristata	-	-	-	6	6
ECHINOIDEA					
Mellita quinquiesperforata	-	-	-	3	3
CEPHALOCHORDATA					
Branchiostoma floridae	2	-	-	-	2
TOTAL	21	32	250	180	483

STATION 3-4

NEMERTINEA					
Unidentified sp.	1	-	2	-	3
POLYCHAETA					
Dispio uncinata	-	-	-	20	20
Lumbrineris sp.	-	1	-	-	1
Magelona riojai	-	-	1	-	1

Species	STATION 3-4 (Continued) Nov.	Feb.	May	Aug.	Total
POLYCHAETA (Continued)					
Nephtys bucera	-	-	-	1	1
Onuphis eremita oculata	-	-	-	1	1
Ophelia sp.	1	-	-	-	1
Paraonis fulgens	1	6	16	40	63
Scolelepis squamata	-	6	6	1	13
Spio pettiboneae	-	-	1	-	1
Spiophanes bombyx	-	-	1	-	1
OLIGOCHAETA					
Unidentified sp.	1	1	-	-	2
GASTROPODA					
Olivella mutica	-	-	-	1	1
PELECYPODA					
Cuna dalli	4	-	-	-	4
Donax texasianus	-	1	100	-	101
Ervilia concentrica	2	-	-	-	2
Lepton sp.	1	-	-	-	1
Lucina multilineata	-	-	-	2	2
Pitar simpsoni	1	1	-	-	2
Tellina versicolor	11	-	-	-	11
CUMACEA					
Unidentified sp.	-	-	-	1	1
ISOPODA					
Ancinus depressus	-	1	2	-	3
Chiridotea excavata	1	-	1	-	2
AMPHIPODA					
Acanthohaustorius n. sp.	31	9	32	32	104
Haustorius n. sp.	-	-	3	-	3
Parahaustorius n. sp.	-	1	6	-	7
Protohaustorius n. sp.	11	1	3	26	41
Pseudohaustorius n. sp.	2	9	1	10	22
Synchelidium n. sp.	-	-	-	3	3
CARIDEA					
Ogyrides alphaerostris	-	-	-	2	2

STATION 3-4 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
BRACHYURA					
Pinnixa cristata	-	-	1	-	1
Pinnixa lunzi	-	-	-	1	1
ECHINOIDEA					
Mellita quinquiesperforata	-	-	1	7	8
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	15	-	-	-	15
TOTAL	73	37	177	149	436

STATION 4-4

NEMERTINEA					
Unidentified sp.	2	1	3	1	7
POLYCHAETA					
Dispio uncinata	-	-	1	35	36
Gyptis vittata	1	-	-	-	1
Magelona obockensis	-	-	1	-	1
Magelona riojai	-	-	3	2	5
Orbiniid sp.	-	-	-	1	1
Paraonis fulgens	1	2	3	32	38
Spio pettiboneae	-	-	4	11	15
Spiophanes bombyx	-	-	2	-	2
Syllides setosa	6	-	-	-	6
GASTROPODA					
Oliva sayana	1	-	-	-	1
Olivella mutica	-	-	-	2	2
PELECYPODA					
Cuna dalli	-	1	-	-	1
Donax texasianus	-	-	103	-	103
Unidentified venerid sp. (nr. *Gouldia*)	-	-	2	-	2
CUMACEA					
Unidentified sp.	-	-	-	1	1

Species	Nov.	Feb.	May	Aug.	Total
STATION 4-4 (Continued)					
ISOPODA					
Ancinus depressus	-	-	1	-	1
AMPHIPODA					
Acanthohaustorius n. sp.	53	5	87	46	191
Parahaustorius n. sp.	-	1	1	-	2
Protohaustorius n. sp.	4	-	37	30	71
Pseudohaustorius n. sp.	17	19	5	9	50
CARIDEA					
Ogyrides alphaerostris	1	-	-	2	3
CALLIANASSIDAE					
Unidentified sp.	-	-	1	-	1
BRACHYURA					
Pinnixa cristata	-	-	-	1	1
Pinnotheres maculata	-	-	1	-	1
SIPUNCULIDA					
Sipunculus longipapillosus	2	-	-	-	2
ECHINOIDEA					
Mellita quinquiesperforata	-	2	-	5	7
CEPHALOCHORDATA					
Branchiostoma floridae	11	-	-	-	11
TOTAL	99	31	255	178	563
STATION 5-4					
NEMERTINEA					
Unidentified sp.	1	-	-	1	2
POLYCHAETA					
Dispio uncinata	-	-	-	22	22
Magelona riojai	-	-	-	2	2
Nephtys bucera	-	-	1	2	3
Onuphis eremita oculata	-	-	-	1	1
Ophelia sp.	1	-	-	-	1
Paraonis fulgens	-	2	1	6	9
Prionospio cristata	1	-	-	-	1

STATION 5-4 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Scolelepis squamata	-	1	-	2	3
Spio pettiboneae	-	-	2	4	6
PELECYPODA					
Donax texasianus	-	4	37	-	41
Ervilia concentrica	-	-	1	-	1
CUMACEA					
Mancocuma sp.	-	-	1	-	1
ISOPODA					
Ancinus depressus	1	-	3	1	5
AMPHIPODA					
Acanthohaustorius n. sp.	44	20	76	24	164
Parahaustorius n. sp.	-	1	2	-	3
Protohaustorius n. sp.	5	1	29	10	45
Pseudohaustorius n. sp.	17	4	5	13	39
Synchelidium n. sp.	1	-	-	1	2
CARIDEA					
Ogyrides alphaerostris	-	-	1	2	3
ANOMURA					
Emerita talpoida	-	-	2	-	2
BRACHYURA					
Pinnixa cristata	-	1	1	-	2
Pinnotheres maculatus	-	-	1	-	1
SIPUNCULIDA					
Sipunculus longipapillosus	2	-	-	-	2
ECHINOIDEA					
Mellita quinquiesperforata	-	-	1	-	1
HOLOTHUROIDEA					
Unidentified sp.	-	-	3	-	3

Species	Nov.	Feb.	May	Aug.	Total
STATION 5-4 (Continued)					
HEMICHORDATA					
Unidentified sp.	1	1	-	-	2
CEPHALOCHORDATA					
Branchiostoma floridae	10	-	-	-	10
TOTAL	84	35	167	91	377
STATION 6-4					
NEMERTINEA					
Unidentified sp.	-	-	2	-	2
NEMATODA					
Unidentified sp.	-	-	-	1	1
POLYCHAETA					
Dispio uncinata	-	-	1	5	6
Magelona riojai	-	-	2	16	18
Micronephtys sp.	-	-	1	-	1
Nephtys sp.	-	-	-	1	1
Nephtys bucera	-	-	2	3	5
Paraonis fulgens	1	3	2	7	13
Prionospio cristata	-	-	1	-	1
Scolelepis squamata	-	2	2	-	4
Spio pettiboneae	-	-	-	10	10
PELECYPODA					
Donax texasianus	-	4	23	-	27
Ervilia concentrica	-	3	-	-	3
Unidentified venerid sp. (nr. *Gouldia*)	-	1	-	-	1
STOMATOPODA					
Coronis excavatrix	-	1	-	-	1
CUMACEA					
Unidentified sp.	-	-	-	4	4
ISOPODA					
Ancinus depressus	-	-	4	2	6

STATION 6-4 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
AMPHIPODA					
Acanthohaustorius n. sp.	56	35	63	83	237
Haustorius n. sp.	2	-	-	-	2
Monoculodes nyei	-	-	-	2	2
Parahaustorius n. sp.	-	-	2	-	2
Protohaustorius n. sp.	7	2	22	29	60
Pseudohaustorius n. sp.	51	7	-	12	70
Synchelidium n. sp.	-	1	-	-	1
ANOMURA					
Emerita talpoida	1	-	2	-	3
BRACHYURA					
Dissodactylus mellitae	-	-	-	1	1
Pinnixa cristata	-	-	1	-	1
Pinnotheres maculatus	-	-	1	-	1
ECHINOIDEA					
Mellita quinquiesperforata	1	-	1	15	17
HOLOTHUROIDEA					
Unidentified sp.	-	-	2	-	2
HEMICHORDATA					
Unidentified sp.	-	-	1	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	6	-	-	-	6
TOTAL	125	59	135	191	510

STATION 7-4

TURBELLARIA					
Unidentified sp.	-	-	1	-	1
NEMERTINEA					
Unidentified sp.	-	-	2	1	3
POLYCHAETA					
Dispio uncinata	-	-	2	81	83
Magelona riojai	-	-	1	2	3
Magelona sp.	-	-	-	1	1

Species	STATION 7-4 (Continued) Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Paraonis fulgens	-	2	2	6	10
Scolelepis squamata	-	2	2	-	4
Scoleplos fragilis	-	-	-	1	1
Scolopolos foliosus	-	-	1	-	1
Spio pettiboneae	-	-	1	3	4
PELECYPODA					
Donax texasianus	-	4	42	-	46
CUMACEA					
Cyclaspis varians	-	-	-	1	1
Unidentified sp.	-	-	-	5	5
ISOPODA					
Ancinus depressus	-	1	8	-	9
Chiridotea excavata	1	-	1	-	2
AMPHIPODA					
Acanthohaustorius n. sp.	61	36	89	96	282
Ericthonius n. sp.	-	-	-	1	1
Haustorius n. sp.	2	-	-	-	2
Monoculodes nyei	-	-	2	-	2
Protohaustorius n. sp.	-	-	9	28	37
Pseudohaustorius n. sp.	2	5	9	21	37
Synchelidium n. sp.	-	2	4	1	7
CARIDEA					
Ogyrides alphaerostris	-	-	1	5	6
CALLIANIASSIDAE					
Unidentified sp.	-	-	7	-	7
ANOMURA					
Emerita benedicti	-	2	-	-	2
Emerita talpoida	-	-	1	1	2
Lepidopa benedicti	-	-	-	1	1
BRACHYURA					
Dissodactylus mellitae	-	-	-	1	1
Ovalipes ocellatus	-	-	1	-	1
Pinnixa cristata	-	-	8	3	11
Portunus gibbesii	-	-	1	-	1

Species	Nov.	Feb.	May	Aug.	Total
STATION 7-4 (Continued)					
ECHINOIDEA					
Mellita quinquiesperforata	-	-	3	1	4
CEPHALOCHORDATA					
Branchiostoma floridae	55	-	-	1	56
TOTAL	121	54	198	261	634
STATION 8-4					
NEMERTINEA					
Unidentified sp.	-	-	3	3	6
NEMATODA					
Unidentified sp. B	-	-	1	-	1
POLYCHAETA					
Dispio uncinata	-	-	8	42	50
Magelona riojai	-	-	-	1	1
Micronephtys minuta	-	-	1	-	1
Paraonis fulgens	1	1	2	11	15
Scolelepis squamata	-	2	-	-	2
Scoleplos fragilis	-	-	-	1	1
Spionid sp.	-	-	-	1	1
Spio pettiboneae	-	-	4	-	4
OLIGOCHAETA					
Unidentified sp.	1	-	-	-	1
PELECYPODA					
Donax texasianus	-	-	50	-	50
CUMACEA					
Mancocuma sp.	-	-	-	1	1
Unidentified sp.	-	-	1	1	2
ISOPODA					
Ancinus depressus	3	-	3	-	6
Chiridotea excavata	-	-	2	-	2

STATION 8-4 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
AMPHIPODA					
Acanthohaustorius n. sp.	35	41	200	65	341
Haustorius n. sp.	1	-	-	-	1
Monoculodes nyei	-	-	-	1	1
Parahaustorius n. sp.	-	1	-	-	1
Protohaustorius n. sp.	2	-	27	26	55
Pseudohaustorius n. sp.	1	13	2	21	37
Synchelidium n. sp.	-	5	8	1	14
CARIDEA					
Ogyrides alphaerostris	-	-	-	4	4
ANOMURA					
Pagurus longicarpus	-	-	1	-	1
BRACHYURA					
Arenaeus cribrarius	-	-	-	1	1
ECHINOIDEA					
Mellita quinquiesperforata	-	-	1	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	17	-	1	-	18
TOTAL	61	63	315	180	619

STATION 9-4

NEMERTINEA					
Unidentified sp.	-	-	4	-	4
NEMATODA					
Unidentified sp. A	10	2	-	3	15
POLYCHAETA					
Armandia maculata	-	-	1	-	1
Dispio uncinata	-	-	3	82	85
Magelona obockensis	-	-	1	-	1
Magelona riojai	-	-	-	4	4
Ophelia sp.	1	-	-	-	1
Paraonis fulgens	-	1	-	4	5
Prionospio cristata	7	-	-	-	7
Scolelepis squamata	-	2	-	-	2
Spionid sp.	-	-	1	1	2

Species	STATION 9-4 (Continued) Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Spio pettiboneae	-	-	4	1	5
Syllides setosa	11	-	-	-	11
GASTROPODA					
Natica pusilla	-	-	-	1	1
Polinices duplicatus	-	-	1	-	1
PELECYPODA					
Cuna dalli	3	-	-	-	3
Donax texasianus	4	2	100	-	106
Strigilla mirabilis	-	-	4	-	4
CUMACEA					
Mancocuma sp.	-	-	2	-	2
Unidentified sp.	-	-	-	8	8
ISOPODA					
Ancinus depressus	3	-	4	-	7
Chiridotea excavata	2	-	2	-	4
AMPHIPODA					
Acanthohaustorius n. sp.	52	47	122	42	263
Monoculodes nyei	-	-	-	1	1
Parahaustorius n. sp.	-	2	-	-	2
Protohaustorius n. sp.	-	5	19	43	67
Pseudohaustorius n. sp.	-	4	7	33	44
Synchelidium n. sp.	-	2	2	3	7
CARIDEA					
Ogyrides alphaerostris	-	-	5	3	8
CALLIANASSIDAE					
Unidentified sp.	-	-	3	-	3
BRACHYURA					
Pinnixa cristata	-	-	2	-	2
Portunus gibbesii	-	-	3	-	3
ECHINOIDEA					
Mellita quinquiesperforata	1	-	1	5	7

STATION 9-4 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	52	1	-	2	55
TOTAL	146	68	291	237	742

STATION 1-5

NEMERTINEA					
Unidentified sp.	4	1	6	2	13
NEMATODA					
Unidentified sp. A	-	3	-	-	3
POLYCHAETA					
Brania wellfleetensis	1	-	-	-	1
Dispio uncinata	-	-	3	5	8
Magelona riojai	1	-	12	14	27
Nephtys bucera	-	-	1	2	3
Ophelia sp.	1	-	-	-	1
Paraonis fulgens	-	1	12	12	25
Polydora sp.	-	1	-	-	1
Scolelepis texana	-	1	-	-	1
Spio pettiboneae	-	-	7	4	11
Spiophanes bombyx	-	-	3	-	3
OLIGOCHAETA					
Unidentified sp.	-	-	1	-	1
GASTROPODA					
Oliva sayana	1	-	-	-	1
PELECYPODA					
Cuna dalli	-	-	-	1	1
Donax texasianus	-	1	1	-	2
Ervilia concentrica	2	271	1	-	274
Strigilla mirabilis	3	-	-	1	4
Unidentified venerid sp. (nr. *Gouldia*)	-	-	3	-	3

STATION 1-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
ISOPODA					
Ancinus depressus	2	-	-	1	3
Chiridotea excavata	1	-	7	7	15
Scyphacella arenicola	-	-	-	1	1
AMPHIPODA					
Acanthohaustorius n. sp.	12	27	42	51	132
Monoculodes nyei	-	-	3	1	4
Protohaustorius n. sp.	3	4	30	34	71
Pseudohaustorius n. sp.	43	1	1	-	45
Synchelidium n. sp.	1	-	3	-	4
CARIDEA					
Ambidexter symmetricus	1	-	-	-	1
Ogyrides alphaerostris	-	1	-	-	1
CALLIANASSIDAE					
Unidentified sp.	-	-	-	1	1
ANOMURA					
Emerita talpoida	-	-	-	1	1
Pagurus longicarpus	-	-	1	-	1
BRACHYURA					
Ovalipes ocellatus	-	-	1	-	1
Pinnixa cristata	3	-	-	1	4
ECHINOIDEA					
Mellita quinquiesperforata	-	-	2	1	3
CEPHALOCHORDATA					
Branchiostoma floridae	8	27	-	1	36
TOTAL	87	339	140	141	707

STATION 2-5

NEMERTINEA					
Unidentified sp.	-	2	6	7	15
NEMATODA					
Unidentified sp.	-	-	1	1	2

STATION 2-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA					
Armandia maculata	-	2	1	-	3
Dispio uncinata	-	-	1	2	3
Eteone heteropoda	-	-	-	1	1
Magelona obockensis	-	1	-	-	1
Magelona riojai	-	-	8	1	9
Magelona sp.	-	-	-	1	1
Mesochaetopterus sp.	-	-	-	1	1
Nephtys bucera	-	-	-	2	2
Nephtys sp.	-	-	-	2	2
Nereis caudata	-	-	-	1	1
Paraonis fulgens	1	3	5	-	9
Pectinaria gouldi	1	-	-	-	1
Prionospio cristata	1	-	-	6	7
Scolelepis texana	-	-	1	-	1
Sigambra bassi	-	-	-	1	1
Spio pettiboneae	-	-	40	2	42
Spiophanes bombyx	-	-	7	-	7
Unidentified spionid sp.	-	-	-	1	1
OLIGOCHAETA					
Unidentified sp.	-	1	-	1	2
GASTROPODA					
Hastula salleana	1	-	-	-	1
Nassarius acutus	-	-	-	2	2
Natica pusilla	-	-	-	2	2
Olivella mutica	-	-	-	2	2
PELECYPODA					
Donax texasianus	-	-	1	-	1
Ervilia concentrica	4	-	21	-	25
Strigilla mirabilis	3	1	-	11	15
Tellina versicolor	-	-	-	7	7
Unidentified venerid sp. (nr. *Gouldia*)	-	5	23	-	28
OSTRACODA					
Unidentified sp.	-	-	-	1	1
CUMACEA					
Unidentified sp.	-	-	1	1	2

STATION 2-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
ISOPODA					
Ancinus depressus	-	2	-	-	2
Chiridotea excavata	1	-	-	-	1
AMPHIPODA					
Acanthohaustorius n. sp.	3	38	39	29	109
Haustorius n. sp.	1	1	-	-	2
Monoculodes nyei	-	-	-	7	7
Protohaustorius n. sp.	8	14	56	35	113
Pseudohasutorius n. sp.	30	8	5	50	93
Pseudoplatyischnopus n. sp.	-	-	-	1	1
Synchelidium n. sp.	-	2	4	-	6
CARIDEA					
Processa hemphilli	-	1	-	-	1
ANOMURA					
Lepidopa benedicti	-	-	1	-	1
BRACHYURA					
Pinnixa cristata	-	-	-	3	3
Portunus gibbesii	-	-	-	3	3
ECHINOIDEA					
Mellita quinquiesperforata	4	1	-	1	6
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	54	72	6	2	134
PISCES					
Anchoa sp.	54	72	6	2	134

STATION 3-5

TURBELLARIA					
Unidentified sp.	-	-	1	-	1
NEMERTINEA					
Unidentified sp.	4	9	7	4	24

STATION 3-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
NEMATODA					
Unidentified sp. A	-	1	1	-	2
POLYCHATEA					
Brania wellfleetensis	-	-	-	2	2
Bravia clavata	-	-	-	4	4
Dispio uncinata	-	-	3	4	7
Magelona riojai	2	1	3	9	15
Micronephtys minuta	-	-	1	-	1
Nephtys bucera	-	2	3	-	5
Paraonis fulgens	1	3	3	5	12
Prionospio cristata	5	-	-	-	5
Scolelepis squamata	-	1	1	-	2
Scolelepis texana	-	1	-	-	1
Spio pettiboneae	-	-	13	16	29
Spiophanes bombyx	-	-	8	-	8
OLIGOCHAETA					
Unidentified sp.	1	1	-	-	2
GASTROPODA					
Polinices duplicatus	-	-	1	-	1
PELECYPODA					
Lepton sp.	-	-	1	-	1
Lucina multilineata	-	-	-	1	1
Strigilla mirabilis	2	-	-	1	3
Unidentified venerid sp. (nr. *Gouldia*)	-	2	2	-	4
CUMACEA					
Cyclaspis varians	-	-	2	-	2
Unidentified sp.	-	-	-	4	4
ISOPODA					
Ancinus depressus	-	1	-	-	1
Chiridotea excavata	1	-	7	-	8
AMPHIPODA					
Acanthohaustorius n. sp.	8	32	55	46	141
Monoculodes nyei	1	-	5	3	9
Protohaustorius n. sp.	8	12	25	31	76
Pseudohaustorius n. sp.	5	3	23	50	81
Synchelidium n. sp.	1	1	1	-	3

Species	Nov.	Feb.	May	Aug.	Total
STATION 3-5 (Continued)					
CARIDEA					
Processa hemphilli	-	-	4	-	4
ANOMURA					
Pagurus longicarpus	-	-	1	-	1
BRACHYURA					
Pinnixa cristata	-	-	-	4	4
Portunus gibbesii	-	-	-	1	1
Unidentified xanthid sp.	-	-	1	-	1
ECHINOIDEA					
Mellita quinquiesperforata	-	3	-	3	6
CEPHALOCHORDATA					
Branchiostoma floridae	9	25	-	-	34
STATION 4-5					
NEMERTINEA					
Unidentified sp.	4	6	3	-	13
NEMATODA					
Unidentified sp.	-	-	1	1	2
POLYCHAETA					
Armandia maculata	-	-	-	1	1
Bravia clavata	-	-	-	1	1
Dispio uncinata	-	-	-	9	9
Magelona riojai	-	1	9	14	24
Magelona sp.	-	-	-	1	1
Nephtys bucera	-	-	1	2	3
Onuphis eremita oculata	-	-	-	1	1
Paraonis fulgens	-	-	17	13	30
Spio pettiboneae	-	-	9	18	27
Spiophanes bombyx	-	-	3	-	3
GASTROPODA					
Hastula salleana	-	1	-	-	1
Oliva sayana	-	-	-	1	1
Olivella mutica	1	-	-	-	1

STATION 4-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
STOMATOPODA					
Coronis excavatrix	-	1	-	-	1
CUMACEA					
Unidentified sp.	-	-	-	2	2
ISOPODA					
Ancinus depressus	-	-	-	1	1
Chiridotea excavata	1	-	-	-	1
AMPHIPODA					
Acanthohaustorius n. sp.	24	71	62	69	226
Monoculodes nyei	-	-	1	2	3
Protohaustorius n. sp.	20	15	48	69	152
Pseudohaustorius n. sp.	3	5	4	23	35
Pseudoplatyischwopus n. sp. B	-	-	1	-	1
Synchelidium n. sp.	-	3	1	-	4
CARIDEA					
Ogyrides alphaerostris	-	-	-	1	1
ANOMURA					
Lepidopa benedicti	-	-	-	1	1
Pagurus longicarpus	-	-	4	1	5
ECHINOIDEA					
Mellita quinquiesperforata	2	3	1	2	8
CEPHALOCHORDATA					
Branchiostoma floridae	9	13	-	1	23
PISCES					
Unidentified ophidiid sp.	-	-	-	1	1
STATION 5-5					
NEMERTINEA					
Unidentified sp.	6	2	6	2	16
NEMATODA					
Unidentified sp.	-	2	-	-	2

STATION 5-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA					
Apoprionospio pygmaea	-	-	1	-	1
Bravia clavata	-	1	-	1	2
Dispio uncinata	-	-	-	18	18
Magelona riojai	-	1	7	13	21
Nephtys bucera	-	-	3	1	4
Paraonis fulgens	-	-	4	11	15
Prionospio cristata	2	-	-	-	2
Scelelepis squamata	-	-	-	1	1
Scolelepis texana	-	-	1	-	1
Spio pettiboneae	-	-	19	18	37
Spiophanes bombyx	-	-	7	1	8
Syllides setosa	-	-	1	-	1
GASTROPODA					
Polinices duplicatus	-	-	-	1	1
PELECYPODA					
Cuna dalli	1	-	-	-	1
Ervilia concentrica	-	-	7	-	7
Strigilla mirabilis	-	-	-	1	1
Tellina versicolor	1	-	-	-	1
CUMACEA					
Unidentified sp.	-	-	-	5	5
ISOPODA					
Ancinus depressus	1	-	-	-	1
AMPHIPODA					
Acanthohaustorius n. sp.	2	50	39	30	121
Monoculodes nyei	1	-	1	-	2
Protohaustorius n. sp.	11	8	96	33	148
Pseudohaustorius n. sp.	1	18	16	6	41
Pseudoplatyischnopus n. sp. B	-	-	1	-	1
Synchelidium n. sp.	-	-	5	-	5
CARIDEA					
Ogyrides alphaerostris	2	2	-	3	7
Processa hemphilli	-	-	2	-	2
ANOMURA					
Lepidopa benedicti	-	-	2	-	2

STATION 5-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
BRACHYURA					
Dissodactylus mellitae		-	-	1	1
Pinnixa cristata	1	-	1	3	5
SIPUNCULIDA					
Sipunculus longipapillosus	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	-	2	-	7	9
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	1	1
HEMICHORDATA					
Unidentified sp.	1	-	-	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	13	20	7	2	42
TOTAL	44	106	226	159	535

STATION 6-5

NEMERTINEA					
Unidentified sp.	2	2	2	1	7
POLYCHAETA					
Armandia maculata	-	-	1	1	2
Bravia clavata	-	-	-	1	1
Dispio uncinata	-	-	-	11	11
Magelona riojai	1	2	8	25	36
Nephtys bucera	-	-	1	1	2
Onuphis eremita oculata	-	-	-	1	1
Paraonis fulgens	-	-	7	4	11
Polydora sp.	-	-	-	1	1
Prionospio cristata	1	-	-	-	1
Scelelopis squamata	-	1	-	-	1
Spio pettiboneae	-	-	10	30	40
Spiophanes bombyx	-	-	4	-	4
GASTROPODA					
Hastula salleana	-	2	-	-	2
Olivella mutica	-	1	-	-	1

STATION 6-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
PELECYPODA					
Donax texasianus	-	-	1	-	1
Ervilia concentrica	1	-	-	-	1
Strigilla mirabilis	-	-	-	1	1
Unidentified venerid sp. (nr. *Gouldia*)	-	1	1	-	2
CUMACEA					
Unidentified sp.	-	-	-	2	2
ISOPODA					
Chiridotea excavata	1	-	1	1	3
AMPHIPODA					
Acanthohaustorius n. sp.	25	40	45	26	136
Monoculodes nyei	1	-	1	-	2
Protohaustorius n. sp.	12	13	78	39	142
Pseudohaustorius n. sp.	1	4	17	46	68
Synchelidium n. sp.	-	1	2	-	3
CARIDEA					
Ogyrides alphaerostris	1	3	-	-	4
Processa hemphilli	1	-	1	-	2
ANOMURA					
Pagurus longicarpus	-	-	3	1	4
BRACHYURA					
Pinnixa cristata	1	-	3	2	6
ECHINOIDEA					
Mellita quinquiesperforata	1	9	-	7	17
HEMICHORDATA					
Unidentified sp.	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	19	7	1	2	29
PISCES					
Symphurus plaguisa	-	-	-	1	1
TOTAL	68	86	187	205	546

STATION 7-5

Species	Nov.	Feb.	May	Aug.	Total
NEMERTINEA					
Unidentified sp.	-	5	4	3	12
NEMATODA					
Unidentified sp. A	-	-	1	1	2
POLYCHAETA					
Armandia maculata	-	-	2	-	2
Dispio uncinata	-	-	-	16	16
Glycera oxycephala	-	-	1	-	1
Magelona riojai	-	-	2	7	9
Nephtys bucera	-	-	2	-	2
Onuphis eremita oculata	-	-	-	1	1
Paraonis fulgens	-	2	1	-	3
Phyllodoce sp.	1	-	-	-	1
Prionospio cristata	2	-	-	-	2
Scolelepis squamata	-	1	-	-	1
Spio pettiboneae	-	-	47	31	78
Spiophanes bombyx	-	-	2	-	2
GASTROPODA					
Polinices duplicatus	-	-	1	-	1
PELECYPODA					
Ervilia concentrica	1	-	-	-	1
Strigilla mirabilis	-	-	9	-	9
Tellina versicolor	-	-	2	-	2
Unidentified venerid sp. (nr. *Gouldia*)	-	-	1	-	1
CUMACEA					
Cyclaspis varians	-	-	-	6	6
Unidentified sp.	-	-	1	4	5
ISOPODA					
Chiridotea excavata	3	-	3	1	7
AMPHIPODA					
Acanthohaustorius n. sp.	4	42	88	125	259
Monoculodes nyei	-	-	-	3	3
Protohaustorius n. sp.	10	3	54	69	136
Pseudohaustorius n. sp.	15	3	8	65	91
Pseudoplatyischnopus n. sp. B	-	-	1	-	1
Synchelidium n. sp.	-	-	6	1	7

STATION 7-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CARIDEA					
Ogyrides alphaerostris	-	-	-	1	1
Processa hemphilli	-	-	3	1	4
CALLIANASSIDAE					
Unidentified sp.	-	-	2	1	3
ANOMURA					
Emerita talpoida	-	-	-	1	1
Lepidopa benedicti	-	-	-	1	1
BRACHYURA					
Pinnixa cristata	-	-	2	-	2
Pinnotheres maculatus	-	-	1	-	1
Portunus gibbesii	-	-	4	1	5
ASTEROIDEA					
Astropecten articulatus	-	-	1	-	1
ECHINOIDEA					
Mellita quinquiesperforata	-	1	-	-	1
CEPHALOCHORDATA					
Branchiostoma floridae	12	9	12	4	37
TOTAL	48	66	261	343	718

STATION 8-5

NEMERTINEA					
Unidentified sp.	-	7	3	1	11
NEMATODA					
Unidentified sp. A	-	2	-	-	2
POLYCHAETA					
Apoprionospio pygmacea	-	-	-	1	1
Armandia maculata	-	-	1	-	1
Dispio uncinata	-	-	1	61	62
Magelona riojai	-	-	4	5	9
Micronephtys sp.	-	1	-	-	1
Nephtys picta	-	-	3	-	3
Paraonis fulgens	-	-	1	2	3
Scolelepis squamata	-	3	-	-	3

STATION 8-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Spio pettiboneae	-	-	22	5	27
Spiophanes bombyx	-	-	9	-	9
Sthenelais sp.	-	1	-	-	1
Unidentified spionid sp.	-	1	-	-	1
GASTROPODA					
Oliva sayana	-	-	1	-	1
PELECYPODA					
Donax texasianus	2	1	-	-	3
Ervilia concentrica	-	-	1	1	2
Strigilla mirabilis	-	-	-	2	2
Tellina versicolor	-	-	-	3	3
Unidentified venerid sp. (nr. *Gouldia*)	-	1	-	-	1
CUMACEA					
Cyclaspis varians	-	-	-	2	2
Unidentified sp.	-	-	-	2	2
ISOPODA					
Ancinus depressus	-	1	-	-	1
Chiridotea excavata	-	-	1	2	3
AMPHIPODA					
Acanthohaustorius n. sp.	17	64	71	44	196
Monoculodes nyei	1	-	1	2	4
Protohaustorius n. sp.	-	-	24	34	58
Pseudohaustorius n. sp.	-	8	25	8	41
Pseudoplatyischnopus n. sp. B	-	-	3	-	3
Synchelidium n. sp.	2	-	7	-	9
Tiron sp.	-	-	1	-	1
CARIDEA					
Ogyrides alphaerostris	-	-	-	2	2
CALLIANASSIDAE					
Unidentified sp.	-	-	3	-	3
ANOMURA					
Pagurus longicarpus	-	-	1	1	2

STATION 8-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
BRACHYURA					
Dissodactylus mellitae	-	-	-	1	1
Pinnixa cristata	-	-	2	-	2
Portunus gibbesii	-	-	-	1	1
ECHINOIDEA					
Mellita quinquiesperforata	1	1	6	5	13
CEPHALOCHORDATA					
Branchiostoma floridae	9	15	9	2	35
PISCES					
Unidentified ophidiid sp.	-	-	-	1	1
TOTAL	32	106	200	188	526

STATION 9-5

NEMERTINEA					
Unidentified sp.	1	6	4	5	16
NEMATODA					
Unidentified sp. A	-	-	1	1	2
POLYCHAETA					
Bravia clavata	-	-	-	1	1
Dispio uncinata	-	-	-	9	9
Magelona riojai	-	-	3	4	7
Micronephtys minuta	-	-	1	-	1
Nephtys bucera	-	-	2	1	3
Nephtys picta	-	-	2	-	2
Ophelina sp.	-	-	-	1	1
Paraonis fulgens	-	-	-	7	7
Phyllodoce arenae	-	-	-	1	1
Prionospio cristata	1	-	-	-	1
Scolelepis texana	-	1	-	-	1
Scoloplos robustus	-	1	-	-	1
Spio pettiboneae	-	-	45	28	73
Spiophanes bombyx	-	-	8	-	8
GASTROPODA					
Natica pusilla	-	-	-	1	1

STATION 9-5 (Continued)

Species	Nov.	Feb.	May	Aug.	Total
PELECYPODA					
Donax texasianus	-	1	-	-	1
Strigilla mirabilis	-	-	-	4	4
Tellina versicolor	-	-	-	2	2
CUMACEA					
Cyclaspis varians	-	-	1	1	2
Unidentified sp.	-	-	-	9	9
ISOPODA					
Chiridotea excavata	1	-	1	2	4
AMPHIPODA					
Acanthohaustorius n. sp.	26	32	55	90	203
Monoculodes nyei	-	-	1	3	4
Protohaustorius n. sp.	8	2	21	78	109
Pseudohaustorius n. sp.	21	5	8	8	42
Pseudoplatyischnopus n. sp. B	-	-	-	2	2
Synchelidium n. sp.	-	-	1	1	2
CARIDEA					
Processa hemphilli	-	-	1	-	1
CALLIANASSIDAE					
Unidentified sp.	-	-	1	-	1
ANOMURA					
Pagurus longicarpus	-	-	-	1	1
BRACHYURA					
Pinnixa cristata	-	-	1	1	2
Pinnotheres maculatus	-	-	1	-	1
Portunus gibbesii	-	-	1	-	1
ECHINOIDEA					
Mellita quinquiesperforata	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	27	2	6	7	42
PISCES					
Unidentified ophidiid sp.	-	-	1	-	1
TOTAL	85	50	166	269	570

Species	STATION A Nov.	Feb.	May	Aug.	Total
TURBELLARIA					
Unidentified sp.	-	-	4	1	5
NEMERTINEA					
Unidentified sp.	1	4	7	8	20
NEMATODA					
Unidentified sp. A	-	19	-	18	37
Unidentified sp. B	-	-	7	-	7
POLYCHAETA					
Apoprionospio pygmaea	-	1	1	3	5
Aricidea sp.	2	2	-	-	4
Armandia maculata	5	2	18	4	29
Brania wellfleetensis	-	-	2	4	6
Bravia clavata	-	-	-	1	1
Diopatra cuprea	-	1	-	-	1
Dispio uncinata	-	-	-	1	1
Eteone heteropoda	-	-	1	7	8
Glycera oxycephala	-	-	1	4	5
Lumbrineris sp.	-	-	-	11	11
Magelona riojai	-	-	1	-	1
Magelona sp.	-	-	1	-	1
Mesochaetopterus sp.	-	-	1	-	1
Micronephtys sp.	-	2	-	-	2
Minuspio sp.	-	1	-	-	1
Nephtys picta	-	-	7	6	13
Nephtys sp.	-	-	-	2	2
Onuphis eremita oculata	1	-	-	-	1
Paranites speciosa	-	-	-	1	1
Paraonides lyra	19	5	-	1	25
Paraonides sp.	2	-	-	-	2
Paraprionospio pinnata	17	1	3	-	21
Phyllodoce arenae	-	-	4	-	4
Phyllodoce sp.	-	-	5	-	5
Poecilochaetus johnsoni	-	-	1	-	1
Prionospio cirrifera	-	-	1	-	1
Prionospio cristata	47	76	4	5	132
Scolelepis sp.	2	-	-	-	2
Scolelepis texana	-	4	5	-	9
Scoloplos foliosus	-	-	-	1	1
Scoloplos robustus	-	1	-	-	1
Scoloplos rubra	-	1	-	-	1

Species	STATION A (Continued) Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Sigambra bassi	-	1	1	2	4
Spiochaetopterus oculatus	1	-	-	-	1
Spio pettiboneae	7	5	9	1	22
Spiophanes bombyx	-	1	42	2	45
Unidentified capitellid sp.	-	2	-	-	2
OLIGOCHAETA					
Unidentified sp.	22	35	5	3	65
GASTROPODA					
Acteocina candei	-	-	-	1	1
Acteon punctostriatus	-	-	-	1	1
Natica pusilla	-	-	-	2	2
Olivella mutica	-	-	-	2	2
Polinices duplicatus	-	-	2	-	2
Terebra dislocata	-	-	1	-	1
PELECYPODA					
Ervilia concentrica	-	-	1	1	2
Lucina multilineata	-	2	2	4	8
Periploma inequale	-	1	-	-	1
Strigilla mirabilis	-	-	2	10	12
Tellina versicolor	-	-	1	19	20
OSTRACODA					
Unidentified sp.	-	-	-	8	8
CUMACEA					
Cyclaspis varians	-	-	-	1	1
Oxyurostylis smithi	-	-	3	-	3
Unidentified sp.	-	-	-	2	2
AMPHIPODA					
Acanthohaustorius n. sp.	-	-	8	2	10
Lysianopsis sp.	-	-	1	-	1
Protohaustorius n. sp.	-	12	58	15	85
Pseudohaustorius n. sp.	-	3	4	3	10
Pseudoplatyischnopus n. sp. B	1	2	2	16	21
Synchelidium n. sp.	-	2	3	-	5
PENAEIDEA					
Sicyonia brevirostris	-	1	-	-	1

Species	Nov.	Feb.	May	Aug.	Total
STATION A (Continued)					
CARIDEA					
Processa hemphilli	-	-	7	-	7
Processa vicina	-	-	-	1	1
ANOMURA					
Albunea paratii	1	-	-	-	1
BRACHYURA					
Pinnixa cristata	-	-	-	1	1
Pinnotheres maculatus	-	-	2	-	2
Portunus gibbesii	-	-	-	1	1
Portunus spinimanus	1	-	-	-	1
Ranilia muricata	-	-	-	2	2
ECHINOIDEA					
Mellita quinquiesperforata	-	-	-	45	45
Unidentified sp.	-	-	11	-	11
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	3	3
CEPHALOCHORDATA					
Branchiostoma floridae	-	1	59	19	79
PISCES					
Hemipteronotus novacula	-	-	-	1	1
Unidentified ophidiid sp.	-	-	1	-	1
TOTAL	129	188	299	246	862
STATION B					
ACTINIARIA					
Unidentified sp.	-	-	-	2	2
TURBELLARIA					
Unidentified sp.	-	-	2	1	3
NEMERTINEA					
Unidentified sp.	-	3	6	7	16

STATION B (Continued)

Species	Nov.	Feb.	May	Aug.	Total
NEMATODA					
Unidentified sp. A	-	18	1	11	30
Unidentified sp. B	-	-	1	-	11
POLYCHAETA					
Aglaophamus verrilli	1	-	-	-	1
Ampharetid sp.	1	-	-	-	1
Anaitides erytheophyllus	-	-	1	-	1
Apoprionospio pgymaea	-	-	2	-	2
Aricidea fragilis	1	-	-	1	2
Armandia maculata	11	13	24	1	49
Brania wellfleetensis	4	1	1	3	9
Caulleriella sp.	-	-	-	2	2
Ceratonereis irritabilis	-	-	-	2	2
Dispio uncinata	-	-	-	1	1
Eteone heteropoda	-	-	1	4	5
Glycera oxycephala	-	-	-	3	3
Gyptis vittata	4	1	-	-	5
Heteromastus filiformus	3	-	-	-	3
Lumbrineris sp.	-	-	-	2	2
Magelona sp.	1	-	-	-	1
Mediomastus californiensis	-	-	-	1	1
Mesochaetopterus sp.	-	-	-	3	3
Micronephtys minuta	-	-	2	-	2
Nephtys sp.	-	-	-	1	1
Nephtys bucera	-	-	1	-	1
Nephtys picta	-	-	4	3	7
Notomastus hemipodus	-	-	-	2	2
Ophelia sp.	9	-	-	5	14
Ophelina sp.	-	3	-	-	3
Owenia fusiformis	1	-	-	-	1
Paraonides lyra	3	3	-	1	7
Paraonis fulgens	-	3	-	-	3
Paraprionospio pinnata	10	1	-	-	11
Phyllodoce arenae	-	-	2	-	2
Phyllodoce sp.	-	-	2	-	2
Prionospio cirrifera	-	1	-	-	1
Prionospio cristata	134	55	3	18	210
Scolelepis sp.	1	1	-	-	2
Scolelepis texana	-	3	11	-	14
Scoloplos fragilis	-	1	-	-	1
Scoloplos rubra	-	2	-	-	2
Spio pettiboneae	9	1	22	5	37

Species	STATION B (Continued) Nov.	Feb.	May	Aug.	Total
POLYCHAETA (continued)					
Spiophanes bombyx	-	-	29	7	36
Travesia sp.	-	-	-	3	3
Trochocaeta sp.	-	1	-	-	1
Unidentified capitellid sp.	1	-	-	-	1
Unidentified cirratulid sp.	-	1	-	-	1
Unidentified spionid sp.	2	-	-	-	2
OLIGOCHAETA					
Unidentified sp.	18	26	1	10	55
GASTROPODA					
Acteocina candei	-	-	-	6	6
PELECYPODA					
Chione cancellata	-	1	-	-	1
Ervilia concentrica	-	-	2	1	3
Strigilla mirabilis	-	1	7	74	82
Tellina versicolor	-	-	-	28	28
OSTRACODA					
Unidentified sp.	-	-	-	3	3
CUMACEA					
Cyclaspis varians	-	-	-	2	2
Unidentified sp.	-	-	-	3	3
AMPHIPODA					
Acanthohaustorius n. sp.	-	6	16	7	29
Ampelisca n. sp. A	1	-	-	-	1
Ampelisca sp. B	-	-	-	1	1
Listriella sp.	-	-	-	3	3
Monoculodes nyei	-	-	-	1	1
Protohaustorius n. sp.	-	29	100	8	137
Pseudohaustorius n. sp.	-	-	1	1	2
Pseudoplatyischnopus n. sp. B	1	4	3	11	19
Synchelidium n. sp.	3	-	6	1	10
PENAEIDEA					
Trachypeneus constrictus	1	-	-	-	1

STATION B (Continued)

Species	Nov.	Feb.	May	Aug.	Total
CARIDEA					
Processa hemphilli	1	-	1	11	13
Processa vicina	-	-	-	1	1
BRACHYURA					
Pinnixa cristata	-	-	1	-	1
Pinnixa sayana	-	-	-	6	6
Ranilia muricata	-	-	-	2	2
SIPUNCULIDA					
Sipunculus longipapillosus	-	1	-	-	1
OPHIUROIDEA					
Ophiophragnus filograneus	1	-	-	-	1
ECHINOIDEA					
Mellita quinquiesperforata	5	-	-	6	11
Unidentified sp.	-	-	7	-	7
HOLOTHUROIDEA					
Unidentified sp.	-	-	-	1	1
CEPHALOCHORDATA					
Branchiostoma floridae	10	69	74	51	204
PISCES					
Microgobius carri	1	-	-	-	1
TOTAL	238	249	344	327	1,158

APPENDIX G

SPECIES IN TOP 11.5-CENTIMETER SAMPLE PART

The number of species, individuals, number of individuals per square meter, and the diversity index of benthic animals collected in the top 11.5-centimeter part of the sample at all stations.

TRANSECT 1

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
1-1	12 Nov.	1	14	224	0.000
1-2	12 Nov.	3	4	664	1.040
1-3	22 Nov.	9	67	1,072	1.534
1-4	21 Nov.	3	23	368	1.061
1-5	19 Nov.	14	46	736	2.230
1-1	3 Dec.	3	30	480	0.389
	1975				
1-1	6 Jan.	4	44	704	0.565
1-1	4 Feb.	3	18	288	1.037
1-2	4 Feb.	5	27	432	1.342
1-3	6 Feb.	7	91	1,456	1.405
1-4	6 Feb.	7	33	528	1.339
1-5	21 Feb.	8	282	4,512	0.681
1-1	5 Mar.	3	26	416	1.004
1-1	2 Apr.	4	15	240	1.083
1-1	2 May	4	604	9,664	0.452
1-2	2 May	4	68	1,088	0.968
1-3	6 May	14	291	4,656	1.007
1-4	6 May	12	293	4,688	0.947
1-5	12 May	18	129	2,064	2.183
1-1	4 June	3	609	9,744	0.908
1-1	2 July	4	17	272	0.955
1-1	4 Aug.	5	29	464	0.996
1-2	7 Aug.	7	25	400	1.485
1-3	13 Aug.	14	174	2,784	1.595
1-4	13 Aug.	12	83	1,328	1.995
1-5	13 Aug.	18	127	2,032	1.922
1-1	2 Sept.	5	33	528	0.788
1-1	2 Oct.	4	42	672	0.961
			TRANSECT 2		
	1974				
2-1	12 Nov.	1	4	64	0.000
2-2	12 Nov.	3	7	112	0.956
2-3	19 Nov.	9	50	800	1.613
2-4	21 Nov.	5	10	160	1.471
2-5	19 Nov.	12	79	1,264	1.456
2-1	3 Dec.	3	8	128	0.900

TRANSECT 2 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
2-1	6 Jan.	3	92	1,472	0.203
2-1	4 Feb.	4	17	272	1.232
2-2	4 Feb.	6	16	256	1.440
2-3	6 Feb.	10	66	1,056	1.436
2-4	6 Feb.	9	23	368	1.639
2-5	21 Feb.	15	119	1,904	1.657
2-1	5 Mar.	3	18	288	1.011
2-1	2 Apr.	3	18	288	1.037
2-1	2 May	4	300	4,800	0.628
2-2	2 May	7	839	13,424	0.674
2-3	6 May	17	174	2,784	1.807
2-4	6 May	11	204	3,264	1.028
2-5	12 May	17	204	3,264	2.182
2-1	4 June	3	300	4,800	0.922
2-1	2 July	3	28	448	1.081
2-1	4 Aug.	5	42	672	1.328
2-2	7 Aug.	13	44	704	2.169
2-3	13 Aug.	21	106	1,696	2.256
2-4	13 Aug.	20	114	1,824	2.278
2-5	13 Aug.	29	144	2,304	2.571
2-1	2 Sept.	4	28	448	0.855
2-1	2 Oct.	4	19	304	1.238
		TRANSECT 3			
	1974				
3-1	12 Nov.	2	4	64	0.562
3-2	12 Nov.	3	33	528	0.527
3-3	21 Nov.	11	33	528	1.557
3-4	21 Nov.	10	47	752	1.650
3-5	19 Nov.	13	41	656	2.246
3-1	3 Dec.	3	5	80	1.055
	1975				
3-1	6 Jan.	3	44	704	0.687
3-1	4 Feb.	3	33	528	0.714
3-2	4 Feb.	6	13	208	1.631
3-3	6 Feb.	13	96	1,536	1.566
3-4	6 Feb.	9	26	416	1.828
3-5	21 Feb.	11	70	1,120	1.800
3-1	5 Mar.	2	12	192	0.287
3-1	2 Apr.	3	8	128	0.974
3-1	2 May	4	80	1,280	0.681
3-2	2 May	8	312	4,992	0.506

TRANSECT 3 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
3-3	6 May	14	149	2,384	1.891
3-4	6 May	13	155	2,480	1.298
3-5	12 May	24	127	2,032	2.235
3-1	4 June	3	230	3,680	0.602
3-1	2 July	3	30	480	1.068
3-1	4 Aug.	3	24	384	0.544
3-2	7 Aug.	11	28	448	2.137
3-3	11 Aug.	15	118	1,888	2.039
3-4	11 Aug.	16	107	1,712	2.025
3-5	11 Aug.	17	129	2,064	2.114
3-1	2 Sept.	3	32	512	0.728
3-1	2 Oct.	4	21	336	0.902
		TRANSECT 4			
	1974				
4-1	11 Nov.	3	7	112	0.796
4-2	11 Nov.	2	19	304	0.336
4-3	26 Nov.	12	92	1,472	1.867
4-4	26 Nov.	9	65	1,040	1.320
4-5	19 Nov.	7	48	768	1.495
4-1	3 Dec.	4	64	1,024	0.730
	1975				
4-1	6 Jan.	3	56	896	0.297
4-1	4 Feb.	2	8	128	0.377
4-2	4 Feb.	2	11	176	0.474
4-3	10 Feb.	12	158	2,528	1.433
4-4	10 Feb.	6	23	368	1.189
4-5	21 Feb.	9	78	1,248	1.510
4-1	5 Mar.	1	10	160	0.000
4-1	2 Apr.	3	43	688	0.624
4-1	5 May	4	641	10,256	0.870
4-2	5 May	6	345	5,520	0.488
4-3	19 May	25	914	14,624	1.259
4-4	19 May	13	229	3,664	1.342
4-5	12 May	14	150	2,400	1.711
4-1	4 June	2	132	2,112	0.474
4-1	2 July	3	13	208	0.898
4-1	4 Aug.	3	16	256	0.831
4-2	7 Aug.	7	28	448	1.647
4-3	11 Aug.	20	285	4,560	1.608
4-4	11 Aug.	13	144	2,304	1.897

TRANSECT 4 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
4-5	11 Aug.	22	195	3,120	1.912
4-1	2 Sept.	2	91	1,456	0.060
4-1	2 Oct.	3	14	224	0.759

TRANSECT 5

	1974				
5-1	11 Nov.	1	7	112	0.000
5-2	11 Nov.	2	13	208	0.690
5-3	26 Nov.	16	156	2,496	1.855
5-4	26 Nov.	9	65	1,040	1.297
5-5	19 Nov.	10	35	560	1.829
5-1	3 Dec.	4	114	1,824	0.504
	1975				
5-1	6 Jan.	3	338	5,408	0.362
5-1	4 Feb.	3	357	5,712	0.116
5-2	4 Feb.	6	40	640	1.436
5-3	10 Feb.	11	81	1,296	1.566
5-4	10 Feb.	8	28	448	1.527
5-5	21 Feb.	9	45	720	1.488
5-1	5 Mar.	3	8	128	0.900
5-1	2 Apr.	2	74	1,184	0.072
5-1	5 May	5	837	13,392	0.841
5-2	5 May	6	292	4,672	0.522
5-3	19 May	19	628	10,048	1.031
5-4	19 May	13	148	2,368	1.459
5-5	12 May	19	193	3,088	1.929
5-1	4 June	3	237	3,792	0.488
5-1	2 July	1	4	64	0.000
5-1	4 Aug.	3	13	208	0.687
5-2	7 Aug.	5	15	240	1.512
5-3	8 Aug.	10	82	1,312	1.718
5-4	8 Aug.	12	60	960	1.865
5-5	8 Aug.	18	132	2,112	2.241
5-1	2 Sept.	1	26	416	0.000
5-1	2 Oct.	3	26	416	0.586

TRANSECT 6

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
6-1	11 Nov.	3	7	112	0.956
6-2	11 Nov.	6	31	496	0.981
6-3	26 Nov.	14	164	2,624	1.570
6-4	26 Nov.	7	76	1,216	1.144
6-5	19 Nov.	10	46	736	1.633
6-1	3 Dec.	3	115	1,840	0.559
	1975				
6-1	6 Jan.	2	101	1,616	0.420
6-1	4 Feb.	3	395	6,320	0.107
6-2	4 Feb.	4	33	528	0.992
6-3	10 Feb.	12	127	2,032	1.431
6-4	10 Feb.	9	49	784	1.357
6-5	21 Feb.	13	52	832	1.935
6-1	5 Mar.	2	47	752	0.176
6-1	2 Apr.	3	109	1,744	0.144
6-1	5 May	4	499	7,984	0.700
6-2	5 May	8	301	4,816	0.859
6-3	19 May	17	344	5,504	1.655
6-4	19 May	16	119	1,904	1.651
6-5	13 May	18	166	2,656	1.707
6-1	4 June	3	75	1,200	0.779
6-1	2 July	3	48	768	1.095
6-1	4 Aug.	4	31	496	0.687
6-2	7 Aug.	9	39	624	1.814
6-3	8 Aug.	14	89	1,424	2.008
6-4	8 Aug.	14	156	2,496	1.698
6-5	8 Aug.	20	144	2,304	2.229
6-1	2 Sept.	3	50	800	0.265
6-1	2 Oct.	4	39	624	0.947
		TRANSECT 7			
	1974				
7-1	11 Nov.	1	7	112	0.000
7-2	11 Nov.	2	14	224	0.257
7-3	22 Nov.	12	48	768	1.920
7-4	22 Nov.	5	84	1,344	0.840
7-5	19 Nov.	8	29	464	1.764
7-1	3 Dec.	2	21	336	0.692
	1975				
7-1	6 Jan.	2	79	1,264	0.299
7-1	5 Feb.	3	126	2,016	0.093

TRANSECT 7 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
7-2	5 Feb.	4	12	192	1.309
7-3	11 Feb.	8	97	1,552	1.261
7-4	11 Feb.	5	35	560	0.815
7-5	20 Feb.	8	51	816	1.246
7-1	5 Mar.	4	52	832	1.078
7-1	2 Apr.	4	130	2,080	0.511
7-1	5 May	4	240	3,840	0.414
7-2	5 May	7	232	3,712	0.750
7-3	22 May	17	699	11,184	1.304
7-4	22 May	22	160	2,560	1.778
7-5	13 May	24	214	3,424	1.928
7-1	4 June	3	203	3,248	0.814
7-1	2 July	4	81	1,296	0.692
7-1	4 Aug.	4	81	1,296	0.443
7-2	7 Aug.	8	42	672	1.339
7-3	14 Aug.	18	126	2,016	1.798
7-4	14 Aug.	13	161	2,576	1.591
7-5	14 Aug.	20	252	4,032	1.883
7-1	2 Sept.	3	17	272	0.444
7-1	2 Oct.	4	58	928	0.836
		TRANSECT 8			
	1974				
8-1	11 Nov.	3	7	112	0.956
8-2	11 Nov.	1	12	192	0.000
8-3	22 Nov.	12	111	1,776	1.456
8-4	22 Nov.	7	48	768	1.260
8-5	18 Nov.	6	18	288	1.542
8-1	3 Dec.	3	23	368	0.919
	1975				
8-1	6 Jan.	2	133	2,128	0.472
8-1	5 Feb.	5	96	1,536	0.432
8-2	5 Feb.	6	25	400	1.285
8-3	11 Feb.	8	60	960	1.004
8-4	11 Feb.	4	47	752	0.838
8-5	20 Feb.	10	82	1,312	1.190
8-1	5 Mar.	3	50	800	0.635
8-1	2 Apr.	3	20	320	0.613
8-1	5 May	5	910	14,560	0.933
8-2	5 May	6	239	3,824	0.789
8-3	22 May	12	255	4,080	1.355
8-4	22 May	17	275	4,400	1.313

TRANSECT 8 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
8-5	13 May	21	158	2,528	2.084
8-1	4 June	3	240	3,840	0.550
8-1	2 July	4	21	336	1.084
8-1	4 Aug.	5	46	736	0.762
8-2	7 Aug.	7	38	608	1.537
8-3	14 Aug.	18	186	2,976	1.782
8-4	14 Aug.	14	147	2,352	1.657
8-5	14 Aug.	20	155	2,480	1.970
8-1	2 Sept.	2	25	400	0.279
8-1	2 Oct.	3	26	416	0.325

TRANSECT 9

	1974				
9-1	11 Nov.	2	11	176	0.655
9-2	11 Nov.	2	17	272	0.466
9-3	22 Nov.	9	91	1,456	1.381
9-4	22 Nov.	10	110	1,760	1.708
9-5	18 Nov.	6	51	816	1.148
9-1	3 Dec.	1	3	48	0.000
	1975				
9-1	6 Jan.	2	29	464	0.401
9-1	5 Feb.	3	60	960	0.408
9-2	5 Feb.	5	36	576	1.170
9-3	11 Feb.	9	29	464	1.382
9-4	11 Feb.	9	54	864	1.138
9-5	20 Feb.	6	31	496	1.193
9-1	5 Mar.	3	23	368	0.632
9-1	2 Apr.	3	19	304	0.863
9-1	5 May	5	534	8,544	0.817
9-2	5 May	8	2,205	35,280	0.425
9-3	22 May	17	447	7,152	1.207
9-4	22 May	18	235	3,760	1.637
9-5	13 May	19	151	2,416	1.891
9-1	4 June	3	262	4,192	0.758
9-1	2 July	4	114	1,824	0.416
9-1	4 Aug.	5	19	304	1.129
9-2	7 Aug.	5	13	208	1.044
9-3	12 Aug.	19	208	3,328	1.844
9-4	12 Aug.	14	192	3,072	1.822
9-5	12 Aug.	24	240	3,840	1.987
9-1	2 Sept.	3	24	384	0.778
9-1	2 Oct.	3	46	736	0.446

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	STATION A				
	1974				
A	18 Nov.	12	105	1,680	1.711
	1975				
A	20 Feb.	24	150	2,400	2.069
A	20 May	37	279	4,464	2.699
A	20 Aug.	37	212	3,392	2.954
	STATION B				
	1974				
B	18 Nov.	21	214	3,424	1.689
	1975				
B	20 Feb.	21	165	2,640	2.189
B	20 May	28	313	5,008	2.387
B	12 Aug.	39	272	4,352	2.854

APPENDIX H

SPECIES IN BOTTOM 11.5-CENTIMETER SAMPLE PART

The number of species, individuals, number of individuals per square meter, and the diversity index of benthic animals collected in the bottom 11.5-centimeter part of the sample at all stations.

TRANSECT 1

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
1-1	12 Nov.	0	0	0	0.000
1-2	12 Nov.	1	2	32	0.000
1-3	22 Nov.	7	19	304	1.539
1-4	21 Nov.	6	13	208	1.285
1-5	19 Nov.	6	41	656	0.848
1-1	3 Dec.	2	3	48	0.637
	1975				
1-1	6 Jan.	1	5	80	0.000
1-1	4 Feb.	2	2	32	0.693
1-2	4 Feb.	2	8	128	0.562
1-3	6 Feb.	6	34	544	1.341
1-4	6 Feb.	5	10	160	1.471
1-5	21 Feb.	8	57	912	1.164
1-1	5 Mar.	2	23	368	0.295
1-1	2 Apr.	1	30	480	0.000
1-1	2 May	2	723	11,568	0.168
1-2	2 May	6	32	512	1.308
1-3	6 May	9	91	1,456	1.629
1-4	6 May	9	68	1,088	1.323
1-5	12 May	6	11	176	1.421
1-1	4 June	3	983	15,728	0.052
1-1	2 July	6	69	1,104	0.645
1-1	4 Aug.	4	33	528	1.118
1-2	7 Aug.	9	21	336	1.814
1-3	13 Aug.	9	19	304	1.983
1-4	13 Aug.	5	19	304	1.187
1-5	13 Aug.	6	15	240	1.414
1-1	2 Sept.	3	25	400	0.443
1-1	2 Oct.	2	6	96	0.637
		TRANSECT 2			
	1974				
2-1	12 Nov.	2	3	48	0.637
2-2	12 Nov.	1	3	48	0.000
2-3	19 Nov.	9	31	496	1.764
2-4	21 Nov.	3	11	176	0.760
2-5	19 Nov.	5	33	528	0.975
2-1	3 Dec.	3	6	96	0.868

TRANSECT 2 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
2-1	6 Jan.	2	2	32	0.693
2-1	4 Feb.	2	7	112	0.410
2-2	4 Feb.	2	6	96	0.451
2-3	6 Feb.	7	12	192	1.792
2-4	6 Feb.	5	9	144	1.303
2-5	21 Feb.	6	35	560	1.449
2-1	5 Mar.	1	36	576	0.000
2-1	2 Apr.	2	18	288	0.687
2-1	2 May	4	130	2,080	0.393
2-2	2 May	3	36	576	0.752
2-3	6 May	9	30	480	1.660
2-4	6 May	7	46	736	1.231
2-5	12 May	8	23	368	1.641
2-1	4 June	2	933	14,928	0.015
2-1	2 July	3	66	1,056	0.363
2-1	4 Aug.	2	35	560	0.293
2-2	7 Aug.	5	7	112	1.550
2-3	13 Aug.	8	13	208	1.992
2-4	13 Aug.	8	66	1,056	1.042
2-5	13 Aug.	11	45	720	1.593
2-1	2 Sept.	3	18	288	0.958
2-1	2 Oct.	2	14	224	0.598
		TRANSECT 3			
	1974				
3-1	12 Nov.	0	0	0	0.000
3-2	12 Nov.	2	3	48	0.637
3-3	21 Nov.	8	23	368	1.482
3-4	21 Nov.	8	26	416	1.582
3-5	19 Nov.	5	7	112	1.550
3-1	3 Dec.	3	4	64	1.040
	1975				
3-1	6 Jan.	2	5	80	0.673
3-1	4 Feb.	1	1	16	0.000
3-2	4 Feb.	3	16	256	0.882
3-3	6 Feb.	5	8	128	1.494
3-4	6 Feb.	6	11	176	1.642
3-5	21 Feb.	9	26	416	1.810
3-1	5 Mar.	1	10	160	0.000
3-1	2 Apr.	2	68	1,088	0.077
3-1	2 May	2	18	288	0.349

TRANSECT 3 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
3-2	2 May	5	27	432	0.903
3-3	6 May	8	27	432	1.560
3-4	6 May	10	22	352	1.972
3-5	12 May	8	44	704	1.591
3-1	4 June	3	102	1,632	0.563
3-1	2 July	2	43	688	0.110
3-1	4 Aug.	3	11	176	1.090
3-2	7 Aug.	5	12	192	1.234
3-3	11 Aug.	12	27	432	2.185
3-4	11 Aug.	6	42	672	1.226
3-5	11 Aug.	11	62	992	1.458
3-1	2 Sept.	2	11	176	0.305
3-1	2 Oct.	2	13	208	0.271
		TRANSECT 4			
	1974				
4-1	11 Nov.	0	0	0	0.000
4-2	11 Nov.	2	8	128	0.562
4-3	26 Nov.	9	33	528	1.830
4-4	26 Nov.	9	34	544	1.524
4-5	19 Nov.	4	16	256	1.234
4-1	3 Dec.	4	14	224	1.240
	1975				
4-1	6 Jan.	0	0	0	0.000
4-1	4 Feb.	1	16	256	0.000
4-2	4 Feb.	2	7	112	0.683
4-3	10 Feb.	11	35	560	1.945
4-4	10 Feb.	4	8	128	1.213
4-5	21 Feb.	5	41	656	0.991
4-1	5 Mar.	1	31	496	0.000
4-1	2 Apr.	3	28	448	0.559
4-1	5 May	4	376	6,016	0.137
4-2	5 May	5	13	208	1.413
4-3	19 May	15	88	1,408	1.519
4-4	19 May	8	25	400	1.743
4-5	12 May	6	15	240	1.691
4-1	4 June	3	45	720	0.213
4-1	2 July	2	48	768	0.101
4-1	4 Aug.	3	29	464	0.497
4-2	7 Aug.	6	8	128	1.733
4-3	11 Aug.	7	24	384	1.700
4-4	11 Aug.	6	34	544	1.613

TRANSECT 4 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
4-5	11 Aug.	7	40	640	1.650
4-1	2 Sept.	2	6	96	0.637
4-1	2 Oct.	1	1	16	0.000
			TRANSECT 5		
	1974				
5-1	11 Nov.	2	3	48	0.637
5-2	11 Nov.	2	11	176	0.655
5-3	26 Nov.	9	51	816	1.608
5-4	26 Nov.	7	21	336	1.402
5-5	19 Nov.	8	9	144	2.043
5-1	3 Dec.	4	10	160	1.280
	1975				
5-1	6 Jan.	3	23	368	0.918
5-1	4 Feb.	1	3	48	0.000
5-2	4 Feb.	4	10	160	1.194
5-3	10 Feb.	8	36	576	1.572
5-4	10 Feb.	3	8	128	0.736
5-5	2 Feb.	6	61	976	1.285
5-1	5 Mar.	2	13	208	0.271
5-1	2 Apr.	2	16	256	0.621
5-1	5 May	5	503	8,048	0.091
5-2	5 May	6	19	304	1.531
5-3	19 May	14	54	864	1.911
5-4	19 May	9	19	304	2.028
5-5	12 May	11	27	432	2.009
5-1	4 June	3	129	2,064	0.267
5-1	2 July	1	9	144	0.000
5-1	4 Aug.	4	9	144	1.273
5-2	7 Aug.	3	23	368	0.777
5-3	8 Aug.	6	16	256	1.363
5-4	8 Aug.	8	31	496	1.569
5-5	8 Aug.	8	27	432	1.864
5-1	2 Sept.	1	3	48	0.000
5-1	2 Oct.	2	30	480	0.146

TRANSECT 6

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
6-1	11 Nov.	2	7	112	0.410
6-2	11 Nov.	4	8	128	1.255
6-3	26 Nov.	10	65	1,040	1.260
6-4	26 Nov.	4	49	784	0.633
6-5	19 Nov.	8	22	352	1.643
6-1	3 Dec.	1	2	32	0.000
	1975				
6-1	6 Jan.	1	4	64	0.000
6-1	4 Feb.	1	1	16	0.000
6-2	4 Feb.	5	6	96	1.561
6-3	10 Feb.	6	20	320	1.614
6-4	10 Feb.	5	10	160	1.471
6-5	21 Feb.	8	34	544	1.383
6-1	5 Mar.	2	40	640	0.117
6-1	2 Apr.	1	3	48	0.000
6-1	5 May	4	266	4,256	0.113
6-2	5 May	5	39	624	1.194
6-3	19 May	10	37	592	1.908
6-4	19 May	10	16	256	2.096
6-5	13 May	8	21	336	1.391
6-1	4 June	2	160	2,560	0.067
6-1	2 July	3	39	624	0.499
6-1	4 Aug.	4	13	208	1.032
6-2	7 Aug.	6	8	128	1.733
6-3	8 Aug.	8	42	672	1.110
6-4	8 Aug.	8	35	560	1.676
6-5	8 Aug.	7	55	880	1.107
6-1	2 Sept.	2	24	384	0.512
6-1	2 Oct.	3	32	512	0.567
			TRANSECT 7		
	1974				
7-1	11 Nov.	1	3	48	0.000
7-2	11 Nov.	3	7	112	0.796
7-3	22 Nov.	7	36	576	1.333
7-4	22 Nov.	4	37	592	0.681
7-5	19 Nov.	4	19	304	1.194
7-1	3 Dec.	2	2	32	0.693

TRANSECT 7 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
7-1	6 Jan.	1	6	96	0.000
7-1	5 Feb.	3	3	48	1.099
7-2	5 Feb.	1	15	240	0.000
7-3	11 Feb.	9	26	416	1.794
7-4	11 Feb.	5	19	304	1.334
7-5	20 Feb.	4	15	240	0.988
7-1	5 Mar.	2	22	352	0.536
7-1	2 Apr.	4	30	480	1.007
7-1	5 May	3	18	288	0.557
7-2	5 May	6	84	1,344	0.416
7-3	22 May	16	68	1,088	2.136
7-4	22 May	7	38	608	1.578
7-5	13 May	10	36	576	1.786
7-1	4 June	2	197	3,152	0.079
7-1	2 July	3	47	752	0.278
7-1	4 Aug.	3	7	112	1.004
7-2	7 Aug.	3	17	272	0.444
7-3	14 Aug.	6	51	816	1.476
7-4	14 Aug.	16	100	1,600	1.919
7-5	14 Aug.	15	102	1,632	1.978
7-1	2 Sept.	1	1	16	0.000
7-1	2 Oct.	3	17	272	1.028
		TRANSECT 8			
	1974				
8-1	11 Nov.	1	2	32	0.000
8-2	11 Nov.	1	1	16	0.000
8-3	22 Nov.	4	35	560	1.023
8-4	22 Nov.	3	13	208	0.536
8-5	18 Nov.	2	14	224	0.520
8-1	3 Dec.	1	1	16	0.000
	1975				
8-1	6 Jan.	2	2	32	0.693
8-1	5 Feb.	4	26	416	0.484
8-2	5 Feb.	2	18	288	0.349
8-3	11 Feb.	5	33	528	1.027
8-4	11 Feb.	5	16	256	1.249
8-5	20 Feb.	7	24	384	1.524
8-1	5 Mar.	3	7	112	1.004
8-1	2 Apr.	1	5	80	0.000
8-1	5 May	5	404	6,464	0.264
8-2	5 May	2	14	224	0.683

TRANSECT 8 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
8-3	22 May	7	27	432	1.303
8-4	22 May	7	40	640	1.174
8-5	13 May	11	42	672	1.620
8-1	4 June	2	28	448	0.562
8-1	2 July	4	14	224	0.991
8-1	4 Aug.	4	20	320	1.106
8-2	7 Aug.	7	17	272	1.397
8-3	14 Aug.	9	26	416	1.885
8-4	14 Aug.	7	33	528	1.365
8-5	14 Aug.	10	33	528	1.864
8-1	2 Sept.	0	0	0	0.000
8-1	2 Oct.	3	5	80	1.055
			TRANSECT 9		
	1974				
9-1	11 Nov.	1	2	32	0.000
9-2	11 Nov.	2	5	80	0.673
9-3	22 Nov.	7	19	302	1.658
9-4	22 Nov.	6	38	608	0.963
9-5	18 Nov.	4	34	544	1.041
9-1	3 Dec.	0	0	0	0.000
	1975				
9-1	6 Jan.	1	4	64	0.000
9-1	5 Feb.	0	0	0	0.000
9-2	5 Feb.	3	35	560	0.347
9-3	10 Feb.	5	15	240	1.229
9-4	11 Feb.	6	14	224	1.352
9-5	20 Feb.	4	19	304	0.898
9-1	5 Mar.	2	11	176	0.305
9-1	2 Apr.	2	8	128	0.377
9-1	5 May	5	246	3,936	0.282
9-2	5 May	6	14	224	1.631
9-3	22 May	8	30	480	1.501
9-4	22 May	7	56	896	1.239
9-5	13 May	6	15	240	1.529
9-1	4 June	2	82	1,312	0.195
9-1	2 July	4	45	720	1.011
9-1	4 Aug.	5	28	448	1.221
9-2	7 Aug.	4	14	224	0.895
9-3	12 Aug.	9	44	704	1.515
9-4	12 Aug.	10	49	784	1.816

TRANSECT 9 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
9-5	12 Aug.	11	29	464	2.116
9-1	2 Sept.	3	10	160	1.030
9-1	2 Oct.	2	13	208	0.271
		STATION A			
	1974				
A	18 Nov.	9	24	384	1.768
	1975				
A	20 Feb.	11	38	608	1.957
A	20 May	11	16	256	2.253
A	12 Aug.	20	34	544	2.869
		STATION B			
	1974				
B	18 Nov.	16	24	384	2.579
	1975				
B	20 Feb.	13	84	1,344	2.064
B	20 May	10	32	512	1.818
B	12 Aug.	27	55	880	3.009

APPENDIX I

SPECIES IN THE ENTIRE SAMPLE

The number of species, individuals, number of individuals per square meter, and the diversity index of benthic animals collected in the entire sample at all stations.

TRANSECT 1

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
1-1	12 Nov.	1	14	224	0.000
1-2	12 Nov.	3	6	96	1.011
1-3	22 Nov.	11	86	1,376	1.643
1-4	21 Nov.	6	36	576	1.290
1-5	19 Nov.	16	87	1,392	1.864
1-1	3 Dec.	3	33	528	0.527
	1975				
1-1	6 Jan.	4	49	784	0.695
1-1	4 Feb.	3	20	320	1.067
1-2	4 Feb.	5	35	560	1.237
1-3	6 Feb.	9	125	2,000	1.503
1-4	6 Feb.	9	43	688	1.674
1-5	21 Feb.	12	339	5,424	0.797
1-1	5 Mar.	3	49	784	0.956
1-1	2 Apr.	4	45	720	0.637
1-1	2 May	4	1,327	21,232	0.317
1-2	2 May	5	100	1,600	1.356
1-3	6 May	16	382	6,112	1.296
1-4	6 May	15	361	5,776	1.088
1-5	12 May	20	140	2,240	2.267
1-1	4 June	3	1,592	25,472	0.625
1-1	2 July	6	86	1,376	0.758
1-1	4 Aug.	6	62	992	1.363
1-2	7 Aug.	10	46	736	1.988
1-3	13 Aug.	17	193	3,088	1.738
1-4	13 Aug.	15	102	1,632	2.026
1-5	13 Aug.	19	142	2,272	2.008
1-1	2 Sept.	5	58	928	1.132
1-1	2 Oct.	4	48	768	0.935
			TRANSECT 2		
	1974				
2-1	12 Nov.	3	7	112	0.956
2-2	12 Nov.	3	10	160	1.055
2-3	19 Nov.	14	81	1,296	1.931
2-4	21 Nov.	6	21	336	1.361
2-5	19 Nov.	13	112	1,792	1.578
2-1	3 Dec.	5	14	224	1.296
	1975				
2-1	6 Jan.	3	94	1,504	-.244
2-1	4 Feb.	4	24	384	1.372

TRANSECT 2 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
2-2	4 Feb.	6	22	352	1.491
2-3	6 Feb.	13	78	1,248	1.645
2-4	6 Feb.	11	32	512	1.700
2-5	21 Feb.	16	154	2,464	1.682
2-1	5 Mar.	3	54	864	0.552
2-1	2 Apr.	3	36	576	0.949
2-1	2 May	5	430	6,880	0.833
2-2	2 May	7	875	14,000	0.767
2-3	6 May	18	204	3,264	1.941
2-4	6 May	14	250	4,000	1.240
2-5	12 May	19	227	3,632	2.230
2-1	4 June	3	1,233	19,728	0.450
2-1	2 July	5	94	1,504	0.880
2-1	4 Aug.	5	77	1,232	1.168
2-2	7 Aug.	14	51	816	2.177
2-3	13 Aug.	24	119	1,904	2.375
2-4	13 Aug.	21	180	2,880	2.125
2-5	13 Aug.	33	189	3,024	2.526
2-1	2 Sept.	4	46	736	1.171
2-1	2 Oct.	4	33	528	1.155
		TRANSECT 3			
	1974				
3-1	12 Nov.	2	4	64	0.562
3-2	12 Nov.	4	36	576	0.746
3-3	21 Nov.	13	57	912	1.626
3-4	21 Nov.	14	73	1,168	1.800
3-5	19 Nov.	13	48	768	2.257
3-1	3 Dec.	5	9	144	1.523
	1975				
3-1	6 Jan.	3	49	784	0.691
3-1	4 Feb.	3	34	544	0.760
3-2	4 Feb.	6	29	464	1.539
3-3	6 Feb.	13	104	1,664	1.668
3-4	6 Feb.	11	37	592	1.961
3-5	21 Feb.	15	96	1,536	1.937
3-1	5 Mar.	2	22	352	0.185
3-1	2 Apr.	4	76	1,216	0.439
3-1	2 May	4	128	2,048	0.781
3-2	2 May	10	339	5,424	0.674
3-3	6 May	15	176	2,816	1.990
3-4	6 May	16	177	2,832	1.523

TRANSECT 3 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
3-5	12 May	24	171	2,736	2.347
3-1	4 June	4	332	5,312	0.924
3-1	2 July	3	73	1,168	0.860
3-1	4 Aug.	4	35	560	0.958
3-2	7 Aug.	12	40	640	2.145
3-3	11 Aug.	19	145	2,320	2.261
3-4	11 Aug.	16	149	2,384	2.012
3-5	11 Aug.	18	191	3,056	2.167
3-1	2 Sept.	3	43	688	0.868
3-1	2 Oct.	4	34	544	0.719
			TRANSECT 4		
	1974				
4-1	11 Nov.	3	7	112	0.796
4-2	11 Nov.	2	27	432	0.419
4-3	26 Nov.	13	124	1,984	1.952
4-4	26 Nov.	11	99	1,584	1.524
4-5	19 Nov.	8	64	1,024	1.562
4-1	3 Dec.	4	78	1,248	1.030
	1975				
4-1	6 Jan.	3	56	896	0.297
4-1	4 Feb.	2	24	384	0.173
4-2	4 Feb.	3	18	288	0.849
4-3	10 Feb.	16	193	3,088	1.602
4-4	10 Feb.	7	31	496	1.280
4-5	21 Feb.	10	119	1,904	1.401
4-1	5 Mar.	1	41	656	0.000
4-1	2 Apr.	3	71	1,136	0.948
4-1	5 May	4	1,017	16,272	0.787
4-2	5 May	6	358	5,728	0.579
4-3	19 May	26	1,001	16,016	1.379
4-4	19 May	16	255	4,080	1.519
4-5	12 May	15	165	2,640	1.790
4-1	4 June	3	177	2,832	0.696
4-1	2 July	3	61	976	0.425
4-1	4 Aug.	4	45	720	0.984
4-2	7 Aug.	10	37	592	1.878
4-3	11 Aug.	21	309	4,944	1.689
4-4	11 Aug.	14	178	2,848	1.969
4-5	11 Aug.	23	235	3,760	2.038
4-1	2 Sept.	3	97	1,552	0.159
4-1	2 Oct.	3	15	240	0.803

TRANSECT 5

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
5-1	11 Nov.	2	10	160	0.325
5-2	11 Nov.	2	24	384	0.679
5-3	26 Nov.	18	207	3,312	2.023
5-4	26 Nov.	11	84	1,344	1.489
5-5	19 Nov.	14	44	704	2.088
5-1	3 Dec.	5	124	1,984	0.714
	1975				
5-1	6 Jan.	3	361	5,776	0.434
5-1	4 Feb.	3	360	5,760	0.115
5-2	4 Feb.	6	50	800	1.467
5-3	10 Feb.	14	117	1,872	1.661
5-4	10 Feb.	9	35	560	1.487
5-5	21 Feb.	10	106	1,696	1.553
5-1	5 Mar.	3	21	336	0.619
5-1	2 Apr.	3	90	1,440	0.431
5-1	5 May	5	1,340	21,440	0.806
5-2	5 May	7	311	4,976	0.712
5-3	19 May	22	682	10,880	1.189
5-4	19 May	17	167	2,672	1.650
5-5	12 May	20	226	3,616	2.030
5-1	4 June	3	366	5,856	0.849
5-1	7 July	1	13	208	0.000
5-1	4 Aug.	5	22	352	1.271
5-2	7 Aug.	6	38	608	1.364
5-3	8 Aug.	13	98	1,568	1.949
5-4	8 Aug.	14	91	1,456	2.066
5-5	8 Aug.	21	159	2,544	2.409
5-1	2 Sept.	2	29	464	0.333
5-1	2 Oct.	3	56	896	0.409
			TRANSECT 6		
	1974				
6-1	11 Nov.	3	14	224	0.876
6-2	11 Nov.	6	39	624	1.103
6-3	26 Nov.	18	229	3,664	1.679
6-4	26 Nov.	8	125	2,000	1.215
6-5	19 Nov.	14	68	1,088	1.754
6-1	3 Dec.	3	117	1,872	0.554
	1975				
6-1	6 Jan.	2	105	1,680	0.410
6-1	4 Feb.	4	396	6,336	0.124

TRANSECT 6 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
6-2	4 Feb.	6	39	624	1.205
6-3	10 Feb.	12	146	2,336	1.501
6-4	10 Feb.	10	59	944	1.485
6-5	21 Feb.	13	86	1,376	1.811
6-1	5 Mar.	3	87	1,392	0.747
6-1	2 Apr.	3	112	1,792	0.140
6-1	5 May	5	764	12,224	0.759
6-2	5 May	8	341	5,456	1.120
6-3	19 May	20	381	6,096	1.835
6-4	19 May	19	135	2,160	1.811
6-5	13 May	19	187	2,992	1.876
6-1	4 June	3	235	3,760	0.604
6-1	7 July	5	87	1,392	1.173
6-1	4 Aug.	5	44	704	1.014
6-2	7 Aug.	12	47	752	2.047
6-3	8 Aug.	19	131	2,096	2.002
6-4	8 Aug.	15	191	3,056	1.925
6-5	8 Aug.	22	205	3,280	2.221
6-1	2 Sept.	3	74	1,184	0.699
6-1	2 Oct.	5	71	1,136	1.026
		TRANSECT 7			
	1974				
7-1	11 Nov.	2	10	160	0.611
7-2	11 Nov.	3	21	336	0.836
7-3	22 Nov.	13	84	1,344	1.825
7-4	22 Nov.	5	121	1,936	0.879
7-5	19 Nov.	8	48	768	1.711
7-1	3 Dec.	3	23	368	0.842
	1975				
7-1	6 Jan.	2	85	1,360	0.284
7-1	5 Feb.	5	129	2,064	0.216
7-2	5 Feb.	4	27	432	1.041
7-3	11 Feb.	11	123	1,968	1.433
7-4	11 Feb.	8	54	864	1.246
7-5	20 Feb.	8	66	1,056	1.269
7-1	5 Mar.	4	74	1,184	1.104
7-1	2 Apr.	4	160	2,560	0.725
7-1	5 May	4	257	4,112	0.544
7-2	5 May	8	317	5,072	0.980
7-3	22 May	22	767	12,272	1.480
7-4	22 May	23	198	3,168	1.962

TRANSECT 7 (Continued)

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1975				
7-5	13 May	25	250	4,000	2.027
7-1	4 June	3	400	6,400	0.804
7-1	2 July	4	128	2,048	0.869
7-1	4 Aug.	4	88	1,408	0.615
7-2	2 Aug.	8	59	944	1.313
7-3	14 Aug.	19	177	2,832	1.904
7-4	14 Aug.	21	261	4,176	1.786
7-5	14 Aug.	23	354	5,664	1.968
7-1	2 Sept.	4	18	288	0.634
7-1	2 Oct.	4	75	1,200	0.924

TRANSECT 8

	1974				
8-1	11 Nov.	3	7	112	0.956
8-2	11 Nov.	2	13	208	0.271
8-3	22 Nov.	13	146	2,336	1.431
8-4	22 Nov.	8	61	976	1.205
8-5	18 Nov.	6	32	512	1.256
8-1	3 Dec.	3	24	384	0.907
	1975				
8-1	6 Jan.	2	135	2,160	0.479
8-1	5 Feb.	5	122	1,952	0.869
8-2	5 Feb.	6	43	688	1.044
8-3	11 Feb.	12	93	1,488	1.331
8-4	22 Feb.	6	63	1,008	1.047
8-5	30 Feb.	13	106	1,696	1.440
8-1	5 Mar.	4	57	912	0.809
8-1	2 Apr.	4	25	400	0.991
8-1	5 May	6	1,314	21,024	1.025
8-2	5 May	6	253	4,048	0.883
8-3	22 May	14	282	4,512	1.525
8-4	22 May	17	315	5,040	1.328
8-5	13 May	23	200	3,200	2.241
8-1	4 June	3	268	4,288	0.684
8-1	2 July	5	35	560	1.349
8-1	4 Aug.	5	66	1,056	0.914
8-2	7 Aug.	12	55	880	1.762
8-3	14 Aug.	22	212	3,392	1.888
8-4	14 Aug.	15	180	2,880	1.792
8-5	14 Aug.	23	188	3,008	2.086
8-1	2 Sept.	2	25	400	0.279
8-1	2 Oct.	4	31	496	0.595

TRANSECT 9

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
9-1	11 Nov.	2	13	208	0.690
9-2	11 Nov.	2	22	352	0.536
9-3	22 Nov.	11	111	1,776	1.557
9-4	22 Nov.	11	146	2,336	1.645
9-5	18 Nov.	7	85	1,360	1.451
9-1	3 Dec.	1	3	48	0.000
	1975				
9-1	6 Jan.	2	33	528	0.369
9-1	5 Feb.	3	60	960	0.408
9-2	5 Feb.	6	71	1,136	0.885
9-3	11 Feb.	10	44	704	1.487
9-4	11 Feb.	10	68	1,088	1.257
9-5	20 Feb.	8	50	800	1.263
9-1	5 Mar.	4	34	544	0.619
9-1	2 Apr.	4	27	432	1.215
9-1	5 May	6	780	12,480	0.904
9-2	5 May	9	2,219	35,504	0.445
9-3	22 May	20	477	7,632	1.281
9-4	22 May	20	287	4,592	1.631
9-5	13 May	22	166	2,656	2.032
9-1	4 June	4	344	5,504	0.984
9-1	2 July	5	159	2,544	0.811
9-1	4 Aug.	7	47	752	1.509
9-2	7 Aug.	7	29	464	1.229
9-3	12 Aug.	22	252	4,032	1.979
9-4	12 Aug.	18	241	3,856	1.966
9-5	12 Aug.	26	269	4,304	2.070
9-1	2 Sept.	4	34	544	1.086
9-1	2 Oct.	4	59	944	0.760
		STATION A			
	1974				
A	18 Nov.	15	129	2,064	1.923
	1975				
A	20 Feb.	27	188	3,008	2.154
A	20 May	41	299	4,784	2.801
A	12 Aug.	44	246	3,936	3.141

STATION B

Station	Date	Species	Individuals	Individuals per m^2	Diversity Index
	1974				
B	18 Nov.	27	238	3,808	1.898
	1975				
B	20 Feb.	26	249	3,984	2.247
B	20 May	31	345	5,520	2.402
B	12 May	47	327	5,232	2.995

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