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EFFECTS OF TOXAPHENE CONTAMINATION
ON ESTUARINE ECOLOGY

by
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Abstract

A three-year research program was conducted to consider toxaphene contamination and estuarine ecology. Samples of environmental fauna, flora, sediment and water were analyzed for toxaphene content. The major study area was a salt marsh watershed adjacent to a toxaphene production plant in coastal Georgia. Another salt marsh watershed, free of any contamination or pollution, was utilized as a control. The purpose of the research was to quantify potential effects of toxaphene effluent on the estuarine fauna and flora and monitor quantitative changes in the ecosystem that might be associated with a toxaphene pollution abatement program initiated during the study period.

Toxaphene concentrations in the manufacturing plant effluent decreased over one order of magnitude during the study period (>180 ppb toxaphene to <10 ppb). There was also a concurrent increase in the number of organisms and the number of different kinds of organisms found in the watershed adjacent to the toxaphene effluent (three different species of pelagic organisms the first year, to seventeen different species of pelagic organisms during the third year). Species diversity index, H' , a measure of the evenness of distribution of organisms, was contrasted at monthly intervals from all study sites. In the first year, the species diversity index in the stream adjacent to the toxaphene effluent was 0.70 while for the same period, the index for the control stream was 1.88. During the third year, the index for the stream adjacent to the toxaphene effluent was 1.72 while the control stream was 1.80. This significant increase in diversity was concurrent with the simultaneous decrease in apparent toxaphene content of plant effluent.

Toxaphene content in organisms collected in the toxaphene contaminated marsh area also decreased significantly during the three-year period. The salt marsh cordgrass toxaphene content decreased from 45 ppm (1970-1971) to <2.5 ppm (1972-1973). Toxaphene content in anchovies decreased from 43 ppm (1970-1971) to 6 ppm (1972-1973).

In summary, the toxaphene content of the plant effluent decreased simultaneously with the toxaphene content of fauna, flora and sediments. Concurrent with this was a significant increase in species diversity. The quantitative results indicate a significant improvement in the health and diversity of the ecosystem. For further details the reader is referred to the attached report.

Acknowledgments

We wish to recognize the sustained interactions we have shared with Hercules, Inc. during this research. We are especially grateful to Mr. Charles Dunn, Synthetics Department, Wilmington, and Mr. Fred Huebner and Mr. Millard Dusenbury, Brunswick Operations, Hercules, Inc. Their financial and intellectual support and stimulation have been invaluable. The National Science Foundation, Office of Oceanographic Facilities and Support, provided ship support for this project. Our sincere thanks is also expressed to the University of Georgia Marine Institute staff for their assistance in collecting and analyzing the environmental material. Special recognition goes to: Jeannette Durant, for her reliable pesticide analyses; Tracy Walker and George Walker, for their untiring hours of research vessel operation; Sarita Marland, for her secretarial and fiscal services. Acknowledgments are also due the Sapelo Island Research Foundation, Inc. for providing support facilities necessary to the conduct of the project.

Introduction

This report summarizes the research findings of a program designed to evaluate the effects of toxaphene contamination on estuarine ecology. The three year study was funded by a grant from Hercules, Inc. to the University of Georgia Marine Institute. The details in this report represent a final synthesis of the research. Although an effort has been made to recapitulate the data from the first two years of the study, reference is made to Technical Report Series No. 72-2, Survey of Toxaphene Levels in Georgia Estuaries, and No. 72-8, Monitoring Toxaphene Contamination in a Georgia Estuary, Georgia Marine Science

Center, Skidaway Island, Georgia. Copies of these two preceding reports may be obtained by writing the address given on the frontispiece of this report.

This research has focused on the interactions between toxaphene contamination and estuarine ecology. The stream effluent from a toxaphene manufacturing plant drained directly into a tidal stream. The plant, producing toxaphene for the past two decades, had released significant toxaphene in its effluent so that a national estuarine shellfish pesticide monitoring program detected high levels of toxaphene in shellfish some ten miles downstream. With the inception of more vigorous pollution abatement procedures, the quantity of toxaphene effluent has significantly diminished (several orders of magnitude) during the past three years. This research quantifies the toxaphene content of fauna, flora, sediment and water from the estuarine system receiving the toxaphene wastes. Ecological comparisons based on species diversity indices are made between this contaminated system (experimental) and a pristine (control) area.

Methods

Field sampling centered in marshes east of Brunswick, Georgia and west of Sapelo Island, Georgia. The marshes and streams near Terry Creek (Brunswick) were selected because of the potential contamination from a nearby toxaphene manufacturing plant, the effluent from which drained into Terry Creek. The Duplin Estuarine Marsh near Sapelo was utilized as a control, i.e. a salt marsh ecosystem not influenced by any type of known contaminant. Field sampling was conducted in ten randomly established quadrats in the Brunswick marsh area (Figure 1)

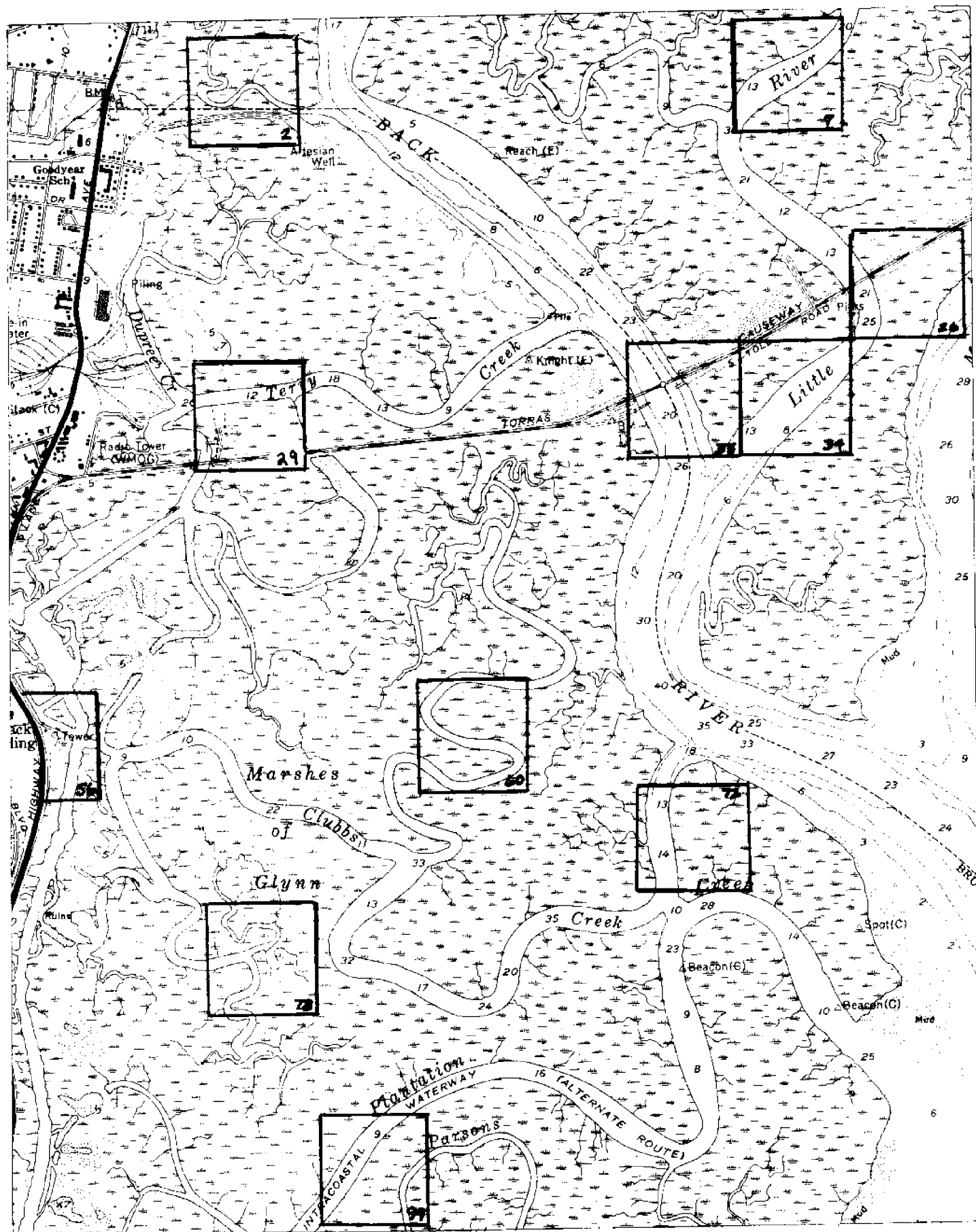


Figure 1. Collection sites in Brunswick marsh area.

and ten adjacent quadrats in the Duplin Estuary (Figure 2). Collecting intervals were monthly during the study period.

Pelagic organisms were collected with an otter trawl, 32 mm mesh in bag and 3 meters wide at mouth of net towed from the R/V Striker. Surface marsh fauna, flora and sediment were collected by hand. All samples were iced, returned to the laboratory and immediately frozen.

Toxaphene analyses were conducted according to procedures established by Wilson (1969), Durant and Reimold (1972), and Reimold and Durant (1973). All concentrations are expressed in parts per million (ppm) wet weight except Spartina alterniflora which is expressed on a dry weight basis. The relative recovery of toxaphene from oysters was 85%; from sediment, 90%. Data are not corrected for recovery error and concentrations below 0.25 ppm were considered insignificant with the exception of that included in water.

The catch from each trawl was sorted by species, the number of individuals were counted, and their biomass measured. The total length of each finfish was measured to establish size/age classes. The trawl data was then recorded on punch cards. Computations of species diversity indices were completed using an IBM 360-65 computer. Three different species diversity indices were computed.

1. The Shannon-Wiener index:

$$\bar{H} = -\sum P_i \log P_i$$

where P_i = proportion of the number of individuals in the i -th species to the total number of individuals.

This index, used by Dahlberg and Odum (1970) for estuarine fish diversity, increases as a function of increase in species number and increase

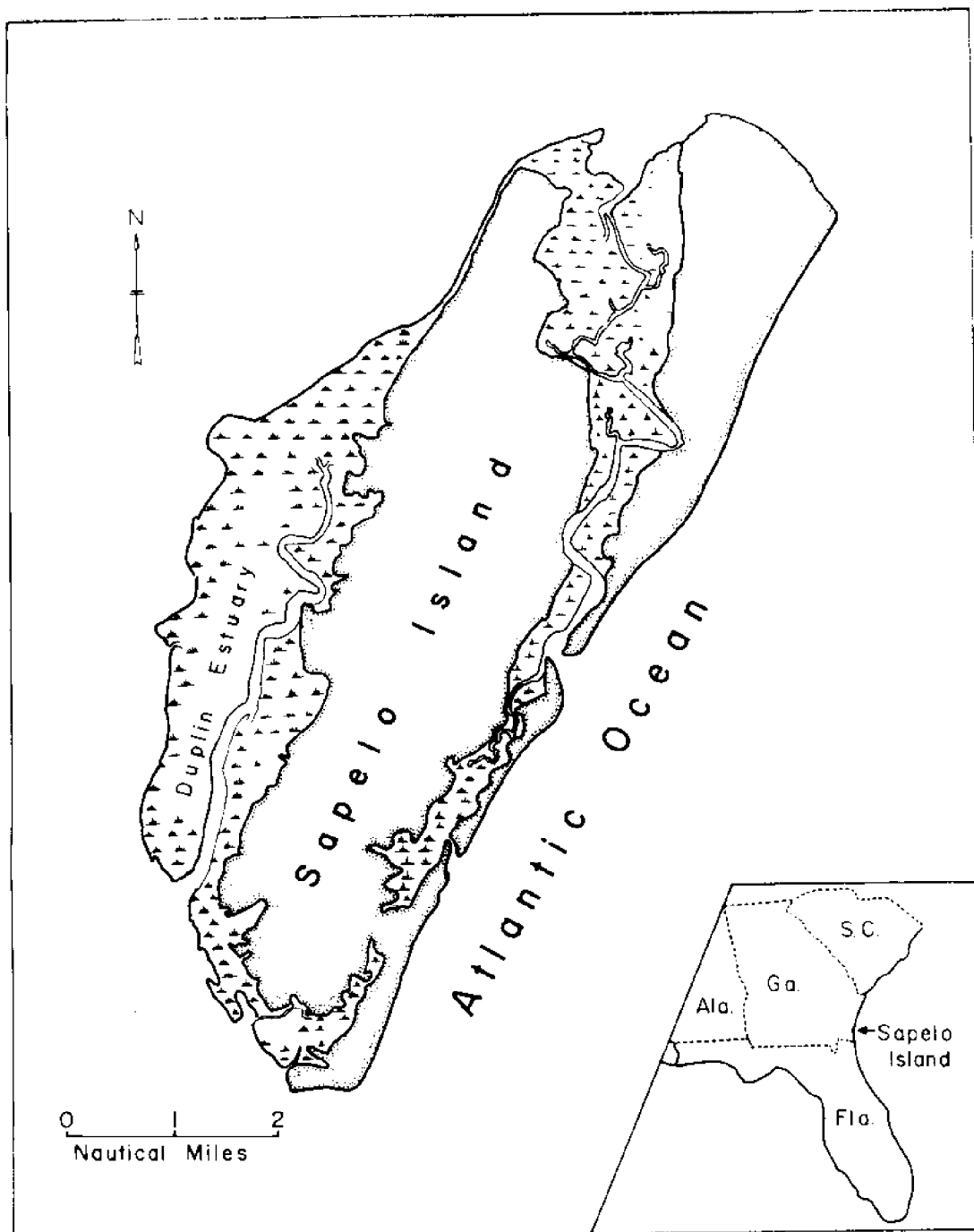


FIGURE 2 DUPLIN ESTUARY, SAPELO ISLAND, GEORGIA

in equitability of species abundance. Its maximum value is found when the distribution is even and its minimum value when the distribution is extremely skewed.

2. Index of "evenness" according to Pielou (1966):

$$J = \bar{H} / \log S$$

where S is the maximum possible value of $\bar{H}$ or the maximum diversity possible, and $\bar{H}$ is the Shannon-Wiener index discussed above. J is a scaled value of $\bar{H}$ in terms of logs with a value of 1 equal to the most even population and a value of 0 equal to the most skewed population.

3. Number of "moves" index, NM , as proposed by Fager (1972):

$$NM = \frac{N(S+1)}{2} - \sum R_i N_i$$

where N = total number of individuals

N_i = number of individuals in the i -th species

S = total number of species

R_i = rank of species i

The latter index is based on the number of "moves" necessary to convert an observed distribution of individuals among species into an even distribution. The values for NM are on a scale of 0 to 1 with 1 being the most even distribution and 0 being the most skewed.

The three diversity indices (above) were computed not only from the number of individuals collected (the usual data base for such computation) but were also based on biomass. The later "biomass diversity" indices provide insight for comparisons on a weight rather than an individual basis.

Computer analyses also provided a listing of the number of individuals and numbers of species for each comparison made. Statistical reliability of the species diversity index $\bar{H}$ was determined according to Hutchinson (1970). Significant differences are reported for $\bar{H}$ at the 95.0%, 99.0% and 99.9% confidence interval levels.

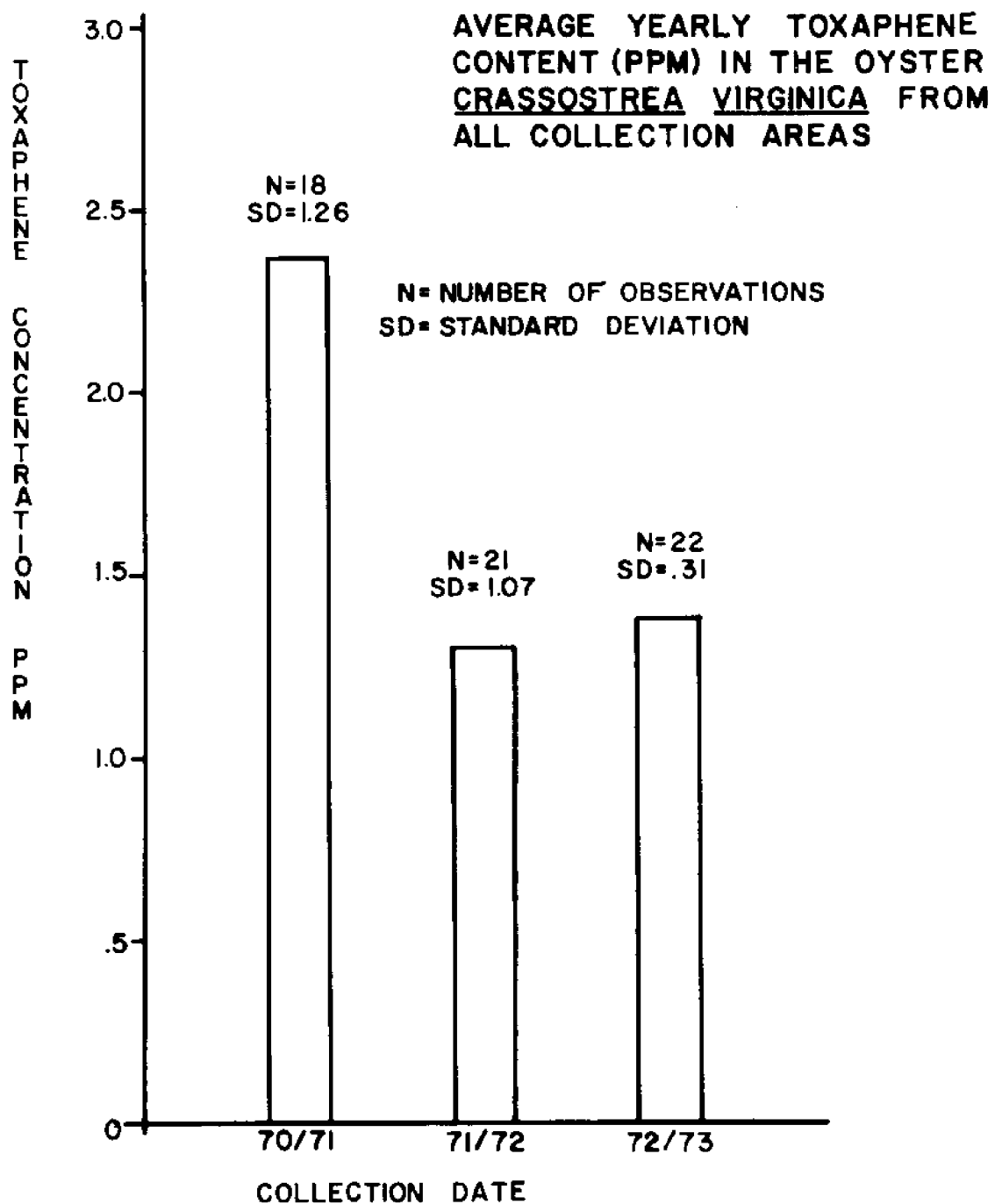
Results

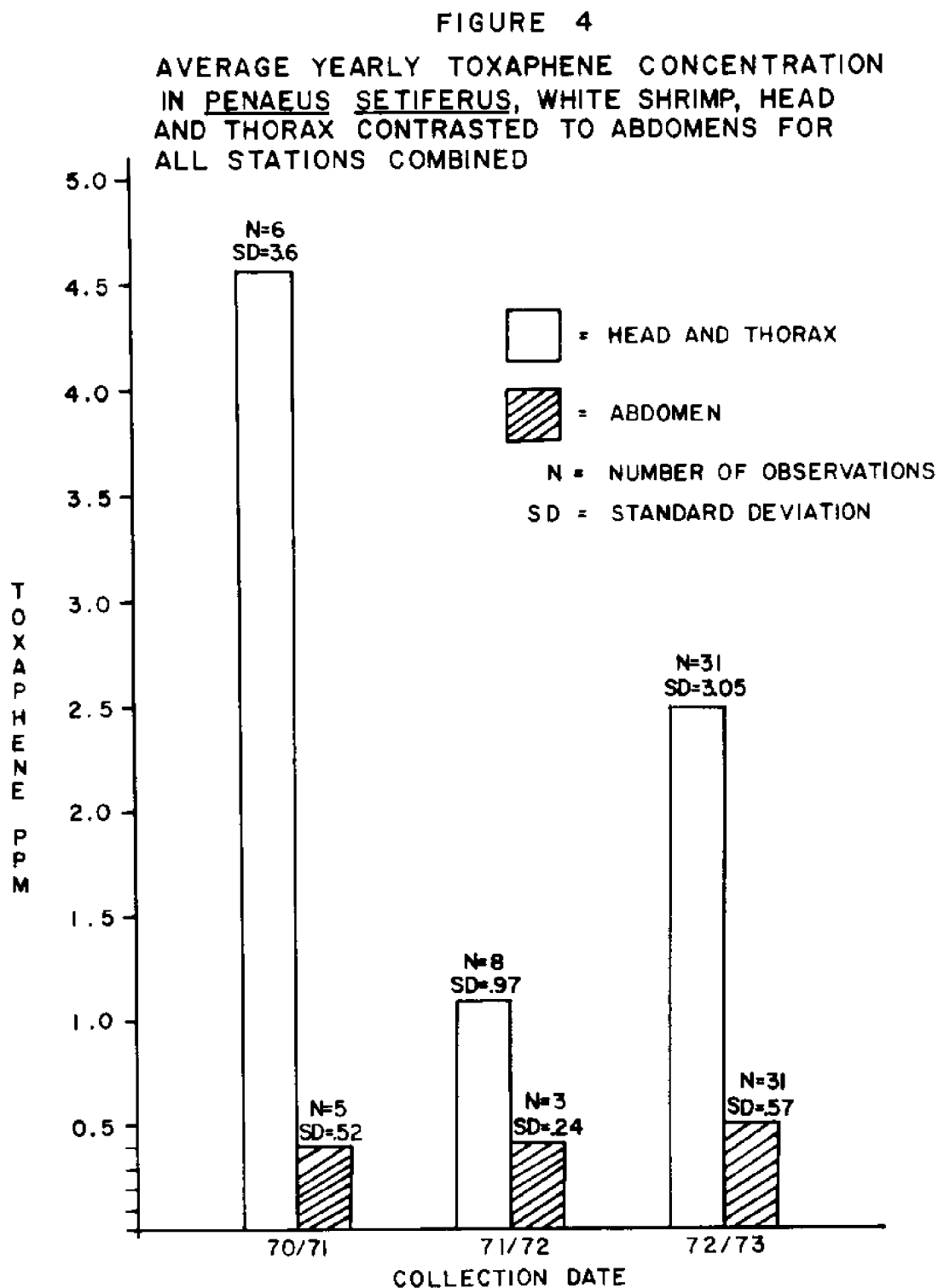
The complete tabulation of all toxaphene analyses over the three year period is listed in Appendix I. During the period from 1 August 1970 to 30 June 1973, over 530 analyses for toxaphene were completed. In the early part of the study, toxaphene in excess of 500 ppm was found in the Lesser Scaup and Pied-billed Grebe (January 1971). Sediment toxaphene content prior to dredging (fall 1972) frequently exceeded 1800 ppm. The American oyster, considered to be a good biological monitor (Butler, 1969), never demonstrated toxaphene concentrations in excess of 3.9 ppm. Other estuarine organisms such as the salt marsh cordgrass, Spartina alterniflora, had toxaphene concentrations in excess of 65 ppm during 1970-1971. The killifish, Fundulus sp., also demonstrated toxaphene concentrations in excess of 80 ppm.

In general, toxaphene concentrations in estuarine organisms collected during 1970 ranged from 0 to 500 ppm. During the last six months of this study, January-June 1973, toxaphene concentrations in excess of 3 ppm were measured only twice, once each in killifish and white shrimp.

Figures 3 through 7 summarize data depicting yearly average toxaphene concentrations of selected organisms. In Figures 6 and 7, data from Terry Creek, the source of toxaphene plant effluent, were separated from all other collection sites.

FIGURE 3





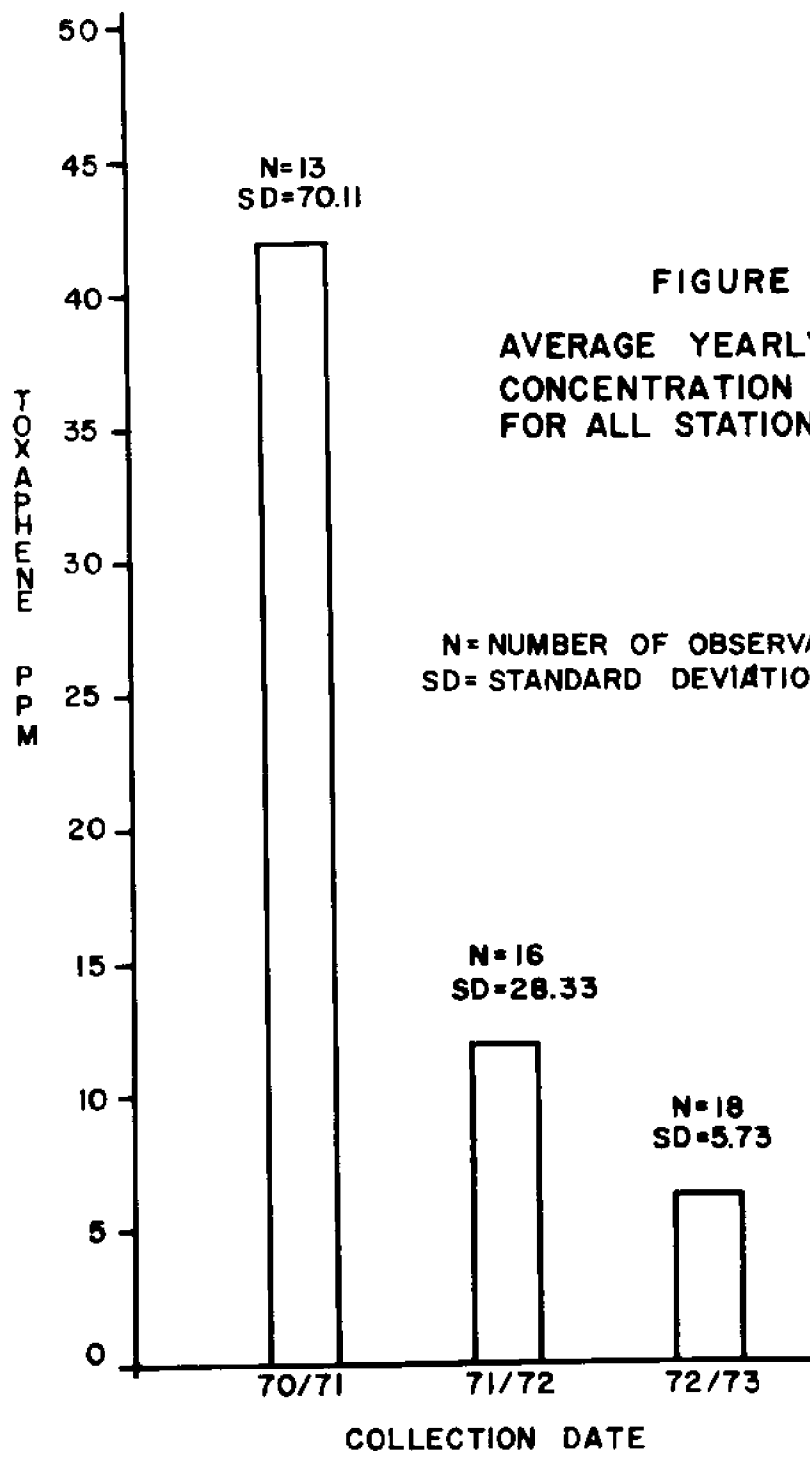


FIGURE 5
AVERAGE YEARLY TOXAPHENE
CONCENTRATION IN ANCHOVY
FOR ALL STATIONS COMBINED.

N= NUMBER OF OBSERVATIONS
SD= STANDARD DEVIATION

FIGURE 6

AVERAGE YEARLY TOXAPHENE CONCENTRATION IN
FUNDULUS FOR TERRY CREEK AND FOR ALL
OTHER STATIONS COMBINED.

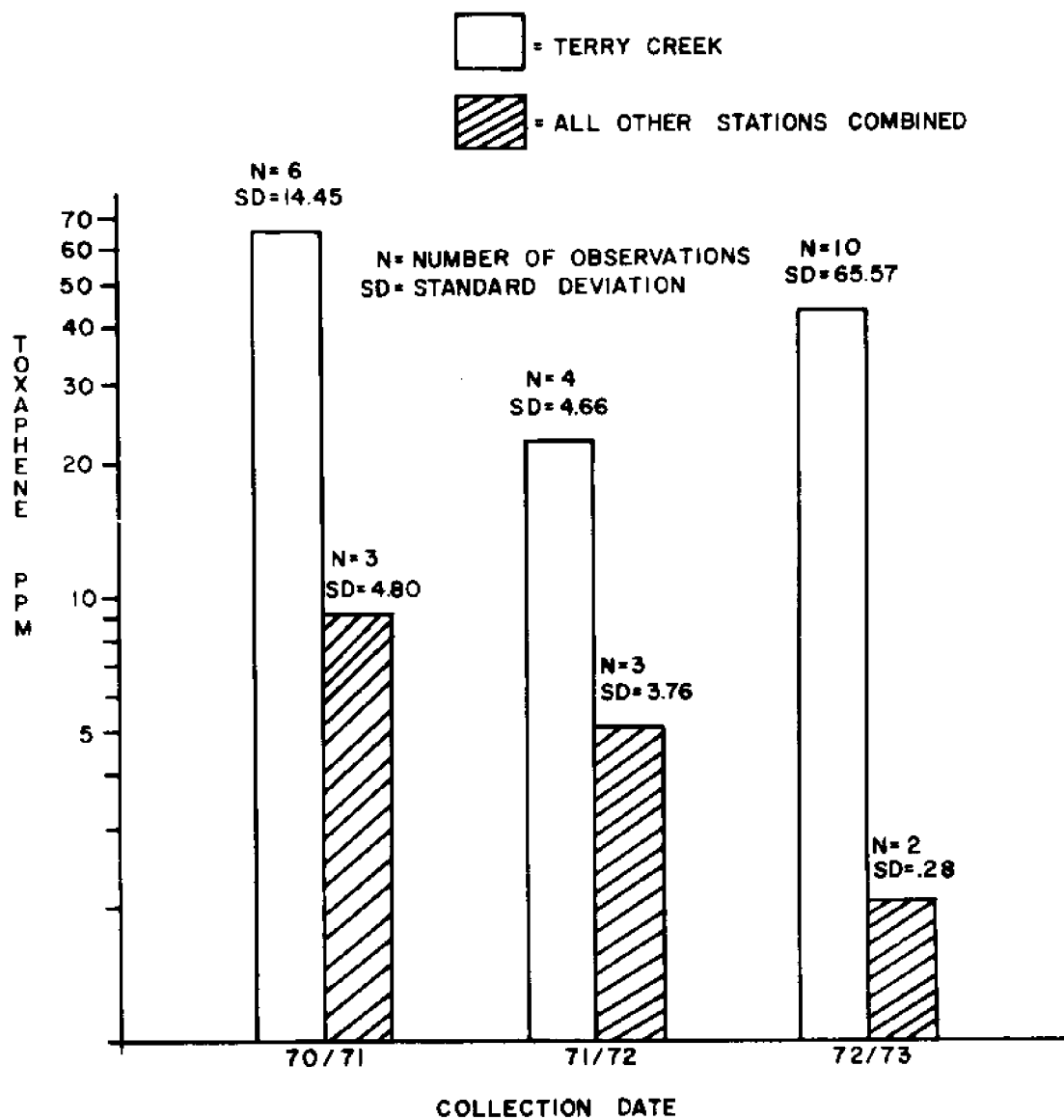
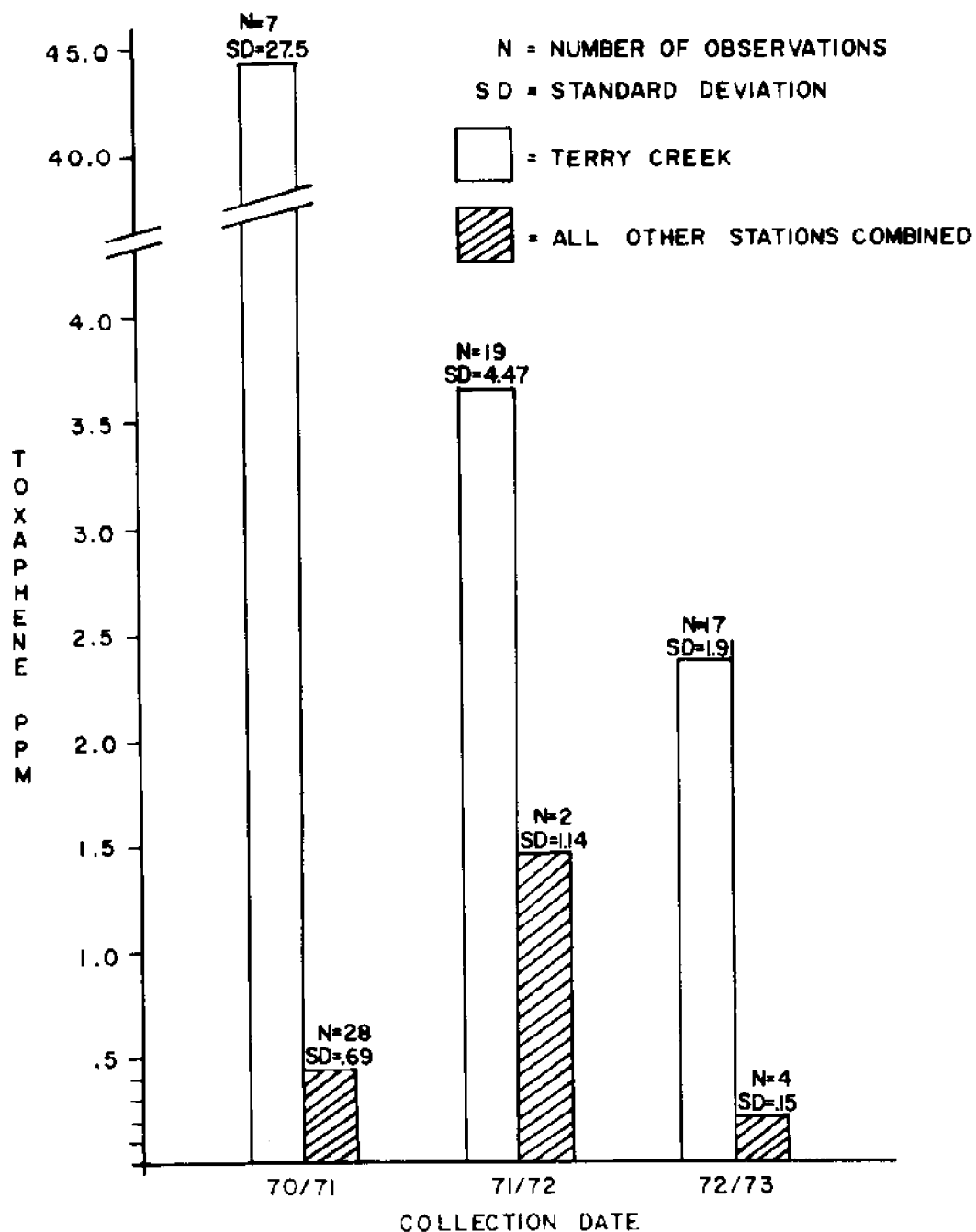


FIGURE 7

AVERAGE YEARLY TOXAPHENE CONCENTRATION (PPM)
IN SPARTINA ALTERNIFLORA FOR TERRY CREEK
CONTRASTED WITH ALL OTHER STATIONS COMBINED



The yearly average toxaphene content of the American oyster for all collection sites combined is shown in Figure 3. The average content never exceeded 2.4 ppm. The yearly concentrations decreased during the three year period; however, there is no significant difference between 1971-1972 and 1972-1973.

In the white shrimp Penaeus setiferus, the head and thorax were always analyzed separate from the abdomen (Figure 4). The abdomen, representing the edible portion of the shrimp, showed no significant difference between the three yearly averages, ranging between 0.4 and 0.5 ppm. The head and thorax conversely showed significant differences between each of the three year periods with concentrations during 1970-1971 exceeding 4.5 ppm.

Figure 5 shows that there was a significant decrease of toxaphene in anchovies during each year of the study.

The killifish, Fundulus sp., were found to be the most sensitive estuarine fauna to changes in toxaphene levels. Figure 6 depicts the yearly average content of killifish from Terry Creek contrasted with all other collection sites in the Brunswick marsh area. There was a significant yearly decrease in toxaphene of killifish from all collection sites except Terry Creek. In Terry Creek there was a significant decrease between 1970-1971 and 1971-1972 but no further decrease between 1971-1972 and 1972-1973. This might be explained by the dredging activities in Terry Creek during fall 1972 (Reimold and Durant, 1973).

The salt marsh cordgrass, Spartina alterniflora, accumulated large quantities of toxaphene during the first year of the study (Figure 7). Significant reduction in quantities of toxaphene were recorded during

each of the three years of the study.

To integrate the potential effect of toxaphene and its resultant decrease in abundance of finfish, Figure 8 was prepared. Any decrease in biomass of trawl samples, or any increase in toxaphene content of trawl samples, causes an increase in this index of toxaphene influence. During the three year period the index decreased significantly for all stations other than Terry Creek, the effluent stream. Terry Creek maintained a high index during the first year which significantly decreased by August of 1972. The sudden increase in the index in March and April of 1973 was associated with a significant increase in toxaphene content of the manufacturing plant effluent. This resulted when ditches draining the plant were cleaned and new culverts installed. Figure 9 depicts the monthly average apparent toxaphene content of Hercules, Inc. plant effluent from the Brunswick operations and during March and April of 1973 when the changeover to full-scale waste abatement facilities were completed.

Trawl collections in the marsh areas of Brunswick resulted in an inventory of the numbers and biomass of at least one important commercial fishery, the white shrimp. Figure 10 displays the seasonal variation in numbers and biomass from all collection sites except Terry Creek. During 1970-1971, the apparent toxaphene pollution affected all the surrounding stations and consequently severely depressed the number and biomass of white shrimp. This is also confirmed by the high average toxaphene content of white shrimp during 1970-1971 (Figure 4). The white shrimp were absent from Terry Creek until February 1972 (Figure 11), and have been on the seasonal increase during spring 1973.

FIGURE 8

COMPARISON OF AVERAGE TOXAPHENE CONTENT ($\bar{x}$) OF ORGANISMS IN TRAWL DIVIDED BY TOTAL BIOMASS OF TRAWL (TB) ON A MONTHLY BASIS. — = TERRY CREEK, ---- = ALL OTHER SAMPLING STATIONS COMBINED.

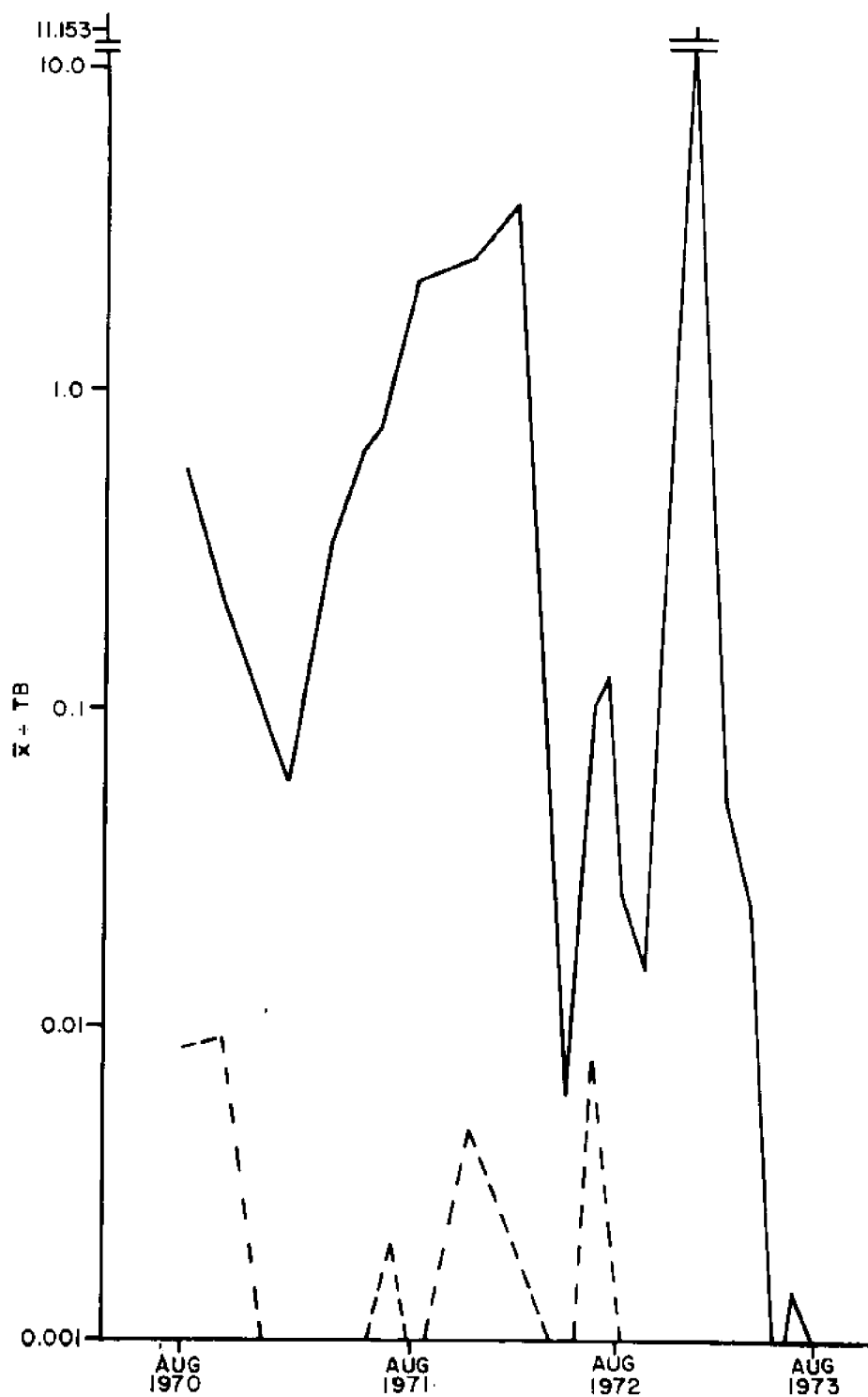
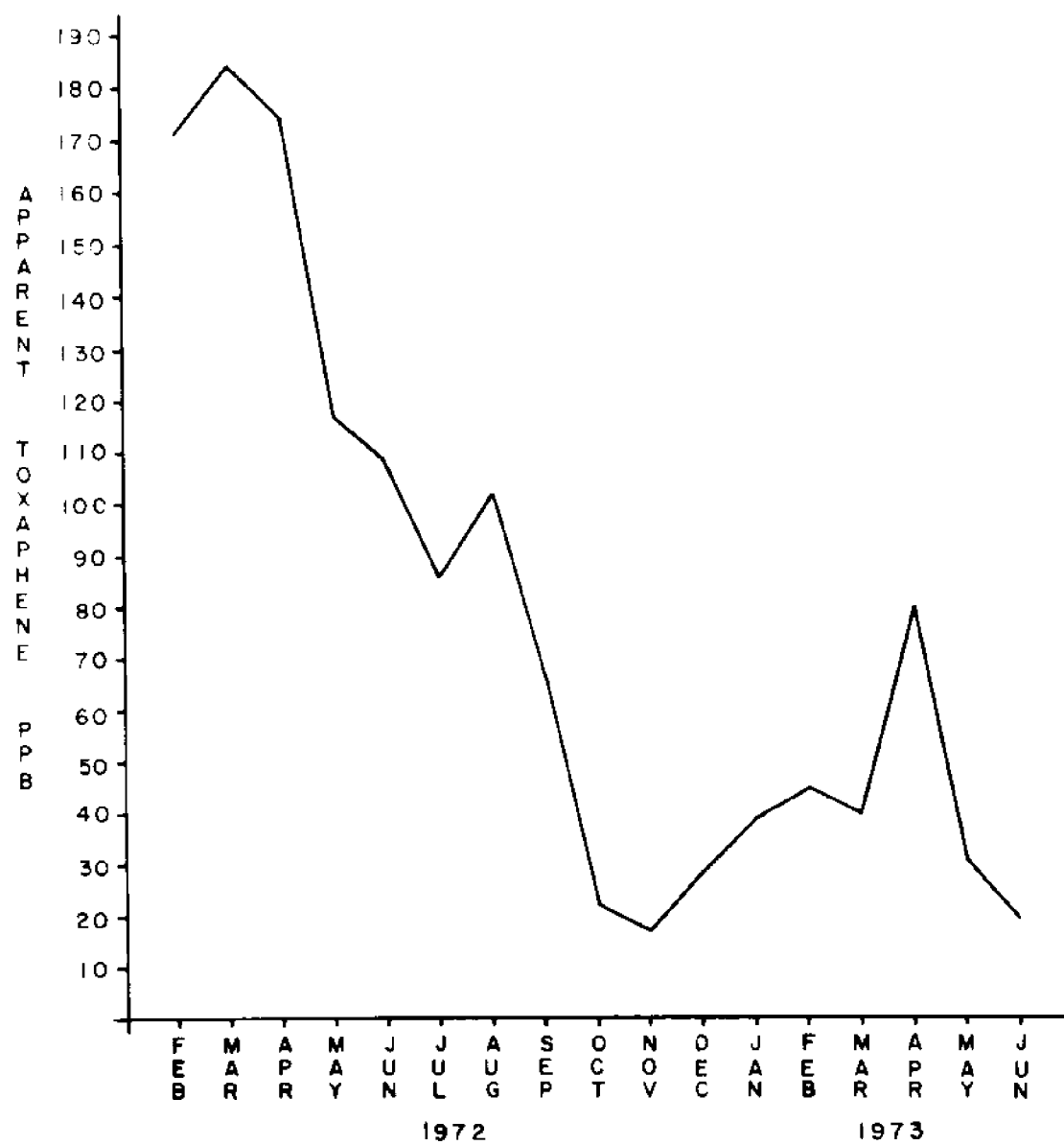
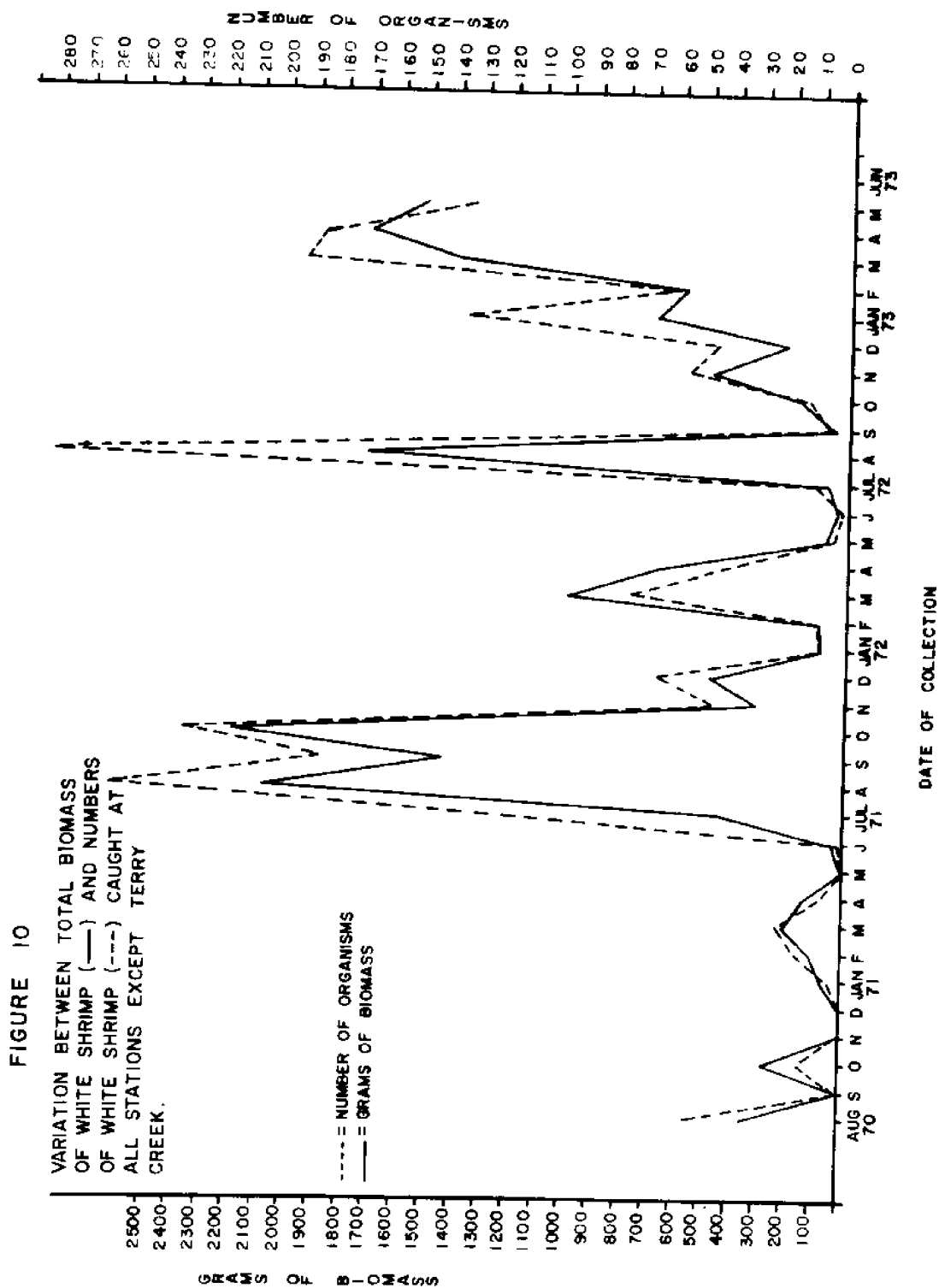
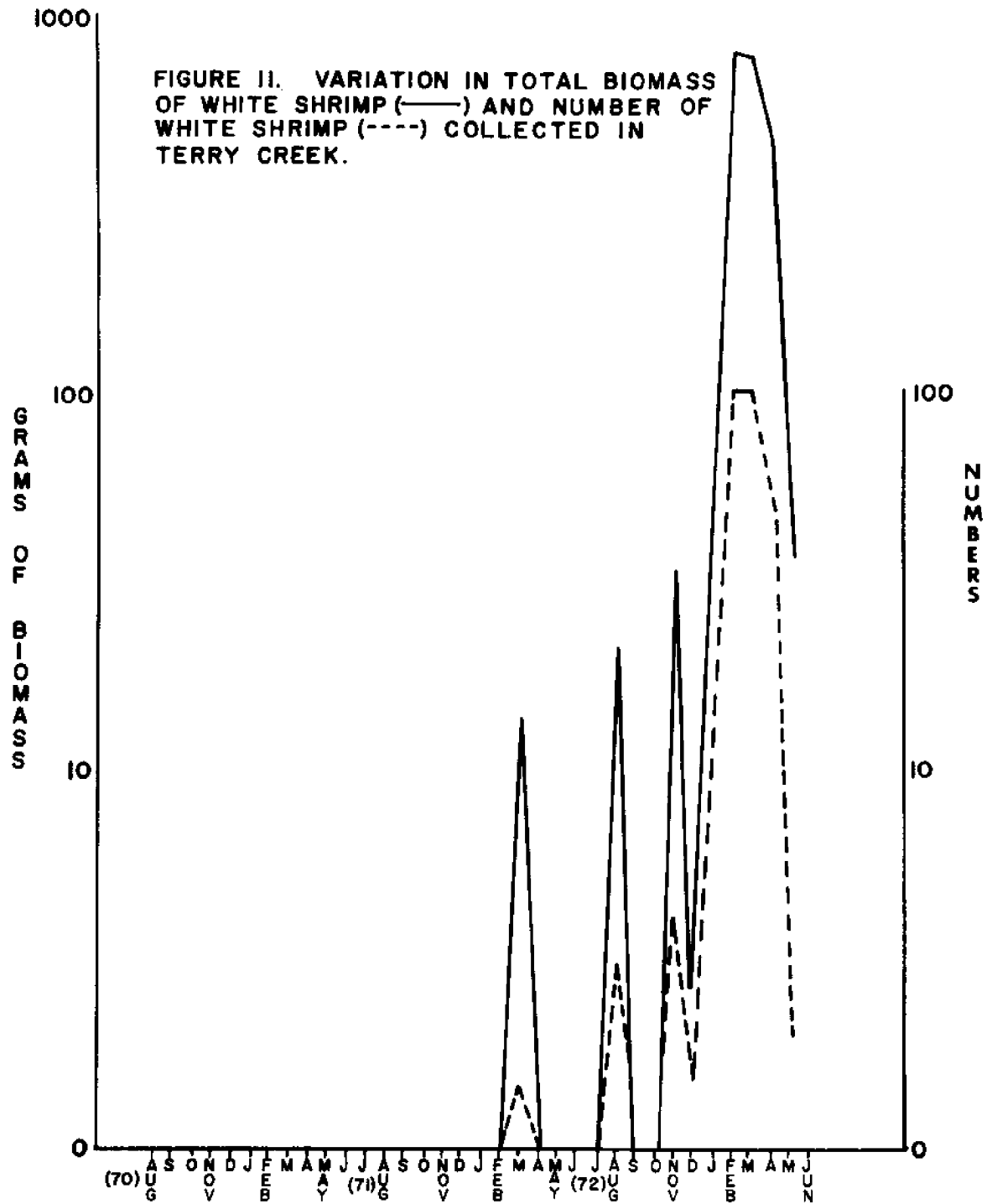


FIGURE 9

APPARENT TOXAPHENE CONTENT
OF HERCULES PLANT EFFLUENT







This is also an indication of the lower apparent toxaphene content of plant effluent.

Figure 12 contrasts the cumulative number of different species collected by trawl during the three year period at Terry Creek. There is a significant increase in total cumulative numbers of different species between each year of the study. This too may be associated with a concurrent decrease in toxaphene content of plant effluent (Figure 9).

Species diversity indices computed on the basis of the number of individuals collected by otter trawl are summarized in Tables 1-4. Table 1 represents the data from the Duplin Estuary - control area, Table 2 presents data from Terry Creek - site of toxaphene plant effluent, Table 3 represents data from all Brunswick areas except Terry Creek, and Table 4 displays the indices for all Brunswick areas including Terry Creek. Comparisons for each different diversity index can be made between collection sites on a monthly as well as a yearly cumulative basis. In the Duplin Estuary, considered as the control area, the H Bar diversity index was 1.88, 1.85, and 1.80 for 1970-1971, 1971-1972, and 1972-1973 respectively. Contrasted with this, the same index for the same period in Terry Creek was 0.69, 1.20, and 1.72. These are striking increases in species diversity which may be associated with the concurrent decrease in toxaphene content of plant effluent. In the three year period at yearly intervals, 65, 50, and 43 different species were collected in the Duplin Estuary, while in Terry Creek, 3, 13, and 17 represent the number of species collected during 1970-1971, 1971-1972, and 1972-1973 respectively. Other comparisons between months and collection sites for J index and NM index based on

FIGURE 12

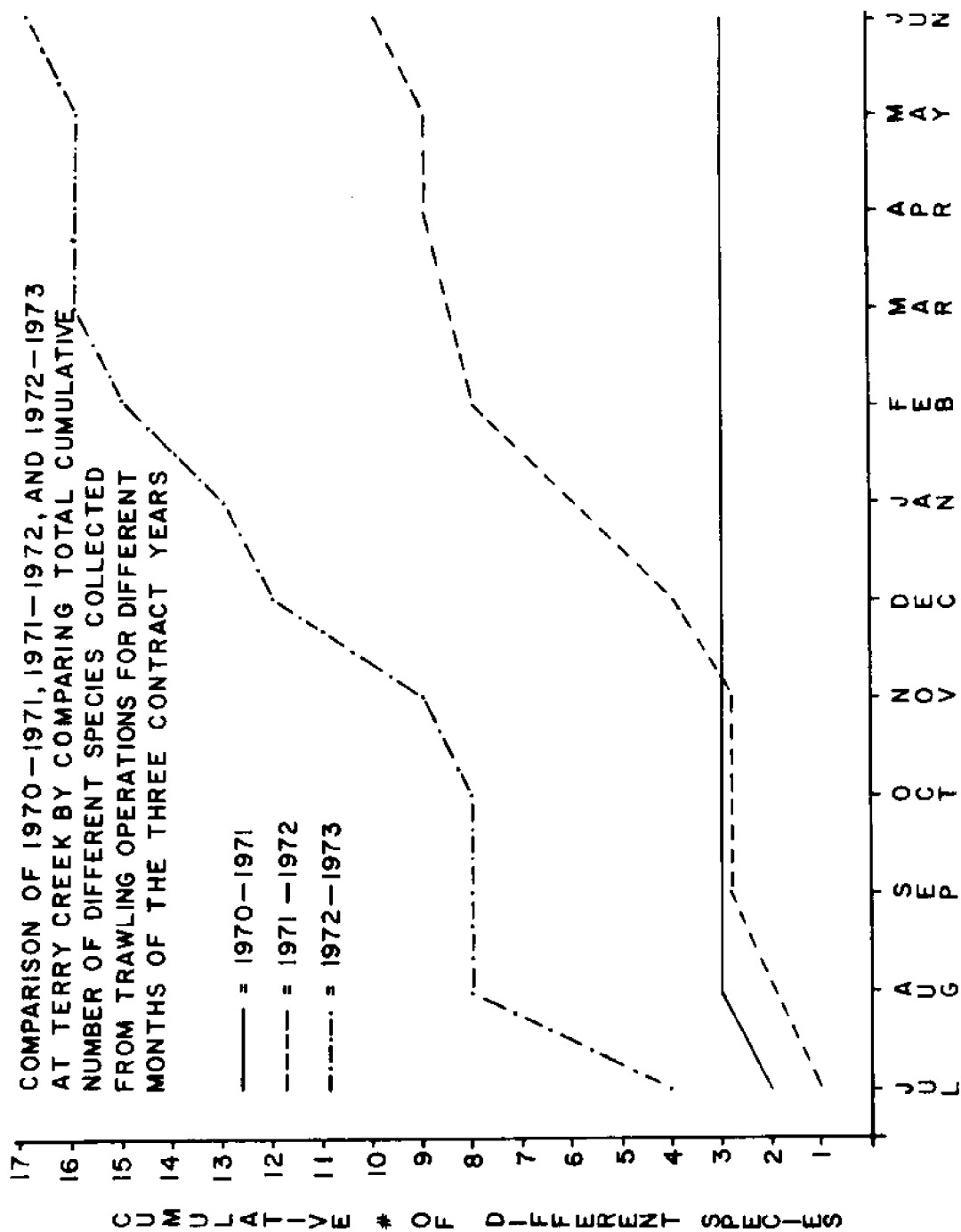


Table 1. Monthly and cumulative species diversity indices and abundance based on number of individuals in the Duplin Estuary.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u># Individuals</u>	<u># Species</u>
July '70	2.52	0.72	0.245	2896	34
Aug. '70	2.26	0.61	0.163	3953	40
Sept. '70	0.83	0.24	0.049	19075	34
Oct. '70	1.70	0.49	0.120	5153	32
Nov. '70	1.54	0.44	0.098	3764	32
Dec. '70	1.31	0.39	0.078	5697	29
Jan. '71	2.00	0.62	0.185	1975	25
Feb. '71	1.60	0.54	0.158	2429	19
Mar. '71	1.38	0.40	0.087	5248	30
Apr. '71	2.18	0.62	0.174	3008	33
May '71	2.50	0.68	0.202	2563	39
June '71	2.54	0.69	0.215	3352	40
70/71 Cum.	1.88	0.45	0.085	59113	65
July '71	2.48	0.71	0.249	4671	33
Aug. '71	1.38	0.39	0.089	5422	35
Sept. '71	1.51	0.43	0.104	5340	32
Oct. '71	1.69	0.50	0.133	3738	29
Nov. '71	1.59	0.44	0.093	4117	36
Dec. '71	0.72	0.23	0.045	4167	22
Jan. '72	1.28	0.50	0.148	675	13
Feb. '72	1.69	0.66	0.229	272	13
Mar. '72	1.31	0.48	0.124	570	15
Apr. '72	1.46	0.52	0.111	256	17
May '72	1.92	0.66	0.218	367	18
June '72	2.12	0.67	0.201	667	24
71/72 Cum.	1.85	0.47	0.111	30263	50
July '72	2.31	0.72	0.234	435	25
Aug. '72	1.92	0.61	0.164	458	23
Sept. '72	1.78	0.58	0.156	411	21
Oct. '72	1.96	0.72	0.250	170	15
Nov. '72	1.63	0.66	0.218	182	12
Dec. '72	1.82	0.73	0.273	132	12
Jan. '73	2.06	0.76	0.238	93	15
Feb. '73	2.20	0.86	0.333	52	13
Mar. '73	0.62	0.21	0.025	926	20
Apr. '73	0.70	0.23	0.034	1947	21
May '73	1.82	0.65	0.205	269	16
June '73	1.54	0.60	0.157	172	13
72/73 Cum.	1.80	0.48	0.102	5247	43

Table 2. Monthly and cumulative species diversity indices and abundance based on number of individuals in Terry Creek.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u># Individuals</u>	<u># Species</u>
Oct. '70	0.11	0.15	0.000	45	2
Jan. '71	0.69	0.00	0.000	2	2
Feb. '71	0.10	0.14	0.020	100	2
Mar. '71	0.00	0.00	0.000	0	0
Apr. 6, '71	0.26	0.37	0.000	14	2
Apr. 27, '71	0.00	0.00	0.000	3	1
May '71	0.64	0.92	0.500	6	2
June '71	0.64	0.92	0.500	6	2
70/71 Cum.	0.70	0.64	0.387	176	3
July '71	0.00	0.00	0.000	0	0
Aug. '71	1.22	0.58	0.200	195	8
Sept. '71	0.10	0.15	0.000	46	2
Oct. '71	0.00	0.00	0.000	5	1
Nov. '71	0.00	0.00	0.000	25	1
Dec. '71	0.47	0.67	0.267	17	2
Jan. '72	1.10	1.00	1.000	6	3
Feb. '72	0.00	0.00	0.000	0	0
Mar. '72	0.00	0.00	0.000	0	0
Apr. '72	0.72	0.65	0.349	152	3
May '72	0.00	0.00	0.000	28	1
June '72	0.00	0.00	0.000	16	1
71/72 Cum.	1.20	0.47	0.126	490	13
July '72	1.07	0.77	0.400	44	4
Aug. '72	1.44	0.80	0.160	16	6
Sept. '72	0.00	0.00	0.000	0	0
Oct. '72	0.00	0.00	0.000	3	1
Nov. '72	0.87	0.79	0.000	6	3
Dec. '72	1.37	0.70	0.104	23	7
Jan. '73	1.23	0.69	0.255	53	6
Feb. '73	0.88	0.40	0.093	362	9
Mar. '73	0.72	0.33	0.064	172	9
Apr. '73	1.18	0.73	0.360	98	5
May '73	1.57	0.81	0.352	43	7
June '73	1.08	0.55	0.140	76	7
72/73 Cum.	1.72	0.61	0.205	896	17

Table 3. Monthly and cumulative species diversity indices and abundance based on number of individuals in all Brunswick collection areas except Terry Creek.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u># Individuals</u>	<u># Species</u>
Oct. '70	1.47	0.59	0.153	150	12
Jan. '71	1.53	0.78	0.250	27	7
Feb. '71	2.01	0.65	0.199	948	22
Mar. '71	1.99	0.69	0.177	140	18
Apr. 6, '71	1.53	0.70	0.234	87	9
Apr. 27, '71	1.46	0.61	0.189	160	11
May '71	1.56	0.61	0.149	128	13
June '71	1.48	0.64	0.183	98	10
70/71 Cum.	2.53	0.70	0.218	1738	37
July '71	1.46	0.54	0.136	389	15
Aug. '71	1.15	0.48	0.135	417	11
Sept. '71	1.17	0.47	0.134	493	12
Oct. '71	1.02	0.35	0.062	655	19
Nov. '71	1.00	0.40	0.074	241	12
Dec. '71	1.45	0.60	0.178	159	11
Jan. '72	1.80	0.65	0.201	216	16
Feb. '72	1.74	0.66	0.242	296	14
Mar. '72	1.80	0.62	0.183	593	18
Apr. '72	1.64	0.64	0.203	262	13
May '72	1.28	0.56	0.093	65	10
June '72	1.55	0.67	0.248	163	10
71/72 Cum.	1.85	0.51	0.101	3949	39
July '72	2.02	0.71	0.266	333	17
Aug. '72	1.07	0.42	0.100	389	13
Sept. '72	1.61	0.73	0.250	54	9
Oct. '72	1.03	0.57	0.151	59	6
Nov. '72	1.66	0.72	0.292	115	10
Dec. '72	1.18	0.57	0.183	186	8
Jan. '73	1.13	0.45	0.111	454	12
Feb. '73	1.87	0.69	0.245	352	15
Mar. '73	1.54	0.57	0.155	371	15
Apr. '73	1.21	0.42	0.085	783	18
May '73	1.79	0.65	0.209	422	16
June '73	1.76	0.63	0.185	230	16
72/73 Cum.	1.95	0.54	0.115	3748	38

Table 4. Monthly and cumulative species diversity indices and abundance based on number of individuals in all Brunswick collection sites.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u># Individuals</u>	<u># Species</u>
Oct. '70	1.29	0.50	0.106	195	13
Jan. '71	1.52	0.78	0.273	29	7
Feb. '71	2.05	0.66	0.213	1048	22
Mar. '71	1.99	0.69	0.177	140	18
Apr. 6, '71	1.44	0.65	0.204	101	9
Apr. 27, '71	1.45	0.60	0.185	163	11
May '71	1.67	0.63	0.164	134	14
June '71	1.57	0.65	0.191	102	11
70/71 Cum.	2.49	0.69	0.206	1912	37
July '71	1.46	0.54	0.136	389	15
Aug. '71	1.30	0.49	0.139	624	14
Sept. '71	1.16	0.45	0.122	539	13
Oct. '71	1.05	0.35	0.062	660	20
Nov. '71	0.94	0.38	0.066	266	12
Dec. '71	1.64	0.66	0.215	176	12
Jan. '72	1.81	0.65	0.201	222	16
Feb. '72	1.74	0.66	0.242	296	14
Mar. '72	1.80	0.62	0.183	593	18
Apr. '72	1.70	0.64	0.212	414	14
May '72	1.51	0.63	0.156	93	11
June '72	1.71	0.71	0.287	179	11
71/72 Cum.	1.90	0.52	0.104	4451	40
July '72	2.09	0.72	0.272	377	18
Aug. '72	1.17	0.43	0.102	405	15
Sept. '72	1.61	0.73	0.250	54	9
Oct. '72	1.00	0.56	0.143	62	6
Nov. '72	1.65	0.71	0.296	121	10
Dec. '72	1.30	0.56	0.171	209	10
Jan. '73	1.34	0.51	0.135	507	14
Feb. '73	1.67	0.58	0.159	714	18
Mar. '73	1.38	0.51	0.142	543	15
Apr. '73	1.23	0.43	0.090	881	18
May '73	1.85	0.65	0.208	465	17
June '73	1.80	0.65	0.196	306	16
72/73 Cum.	1.97	0.54	0.118	4644	39

the number of individuals may be made directly from Tables 1 through 4.

A novel approach to comparison of the diversity is based not on the traditional number of individuals and number of species, but rather on the biomass of individuals contrasted with the biomass of species. Tables 5 through 8 list the same diversity indices as Tables 1-4 except the data in Tables 5-8 is founded on the biomass data base. During 1970-1971, 1971-1972, and 1972-1973, the Duplin Biomass H Bar yearly cumulative indices were 2.54, 2.43, and 2.56 respectively while those in Terry Creek were 0.35, 1.24, and 2.20 respectively. With these tables as before, other comparisons between index, collection site, and month or year may be made.

Figure 13 depicts the monthly variation in H Bar based on the number of individuals, for all collection sites for the study period. Only during 1972-1973 does the diversity in Terry Creek resemble the diversity of other collection sites.

Figure 14 presents the monthly variation in species diversity index, J, based on the number of individuals. This measure of diversity demonstrates that from 1970-1972, Terry Creek had a very uneven diversity of fauna.

Similarly, the NM species diversity index based on the number of individuals is portrayed in Figure 15. Here the index attained 1.0 at Terry Creek during January 1972 when the only organisms collected were two star drum, two anchovies, and two grass shrimp.

Figures 16, 17, and 18 depict species diversity indices H Bar, J, and NM, respectively, based on the biomass, for all collection sites for the study period. These indices reflect a more realistic view of the diversity and evenness of the fauna based on the biomass rather

Table 5. Monthly and cumulative species diversity indices and biomass based on biomass of trawl collections from the Duplin Estuary.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u>Biomass (grams)</u>	<u># Species</u>
July '70	1.97	0.56	0.147	136,108	34
Aug. '70	2.00	0.52	0.137	203,563	40
Sept. '70	2.17	0.62	0.171	185,986	34
Oct. '70	2.02	0.58	0.161	96,116	32
Nov. '70	1.82	0.53	0.130	90,026	32
Dec. '70	1.81	0.54	0.137	90,208	29
Jan. '71	1.92	0.60	0.186	23,481	25
Feb. '71	1.62	0.55	0.156	61,594	19
Mar. '71	2.12	0.62	0.186	111,645	30
Apr. '71	2.22	0.63	0.188	105,339	33
May '71	2.31	0.63	0.186	143,181	39
June '71	2.43	0.66	0.195	106,666	40
70/71 Cum.	2.55	0.61	0.137	1,353,906	65
July '71	2.36	0.67	0.217	127,154	33
Aug. '71	1.84	0.52	0.131	72,840	35
Sept. '71	2.15	0.62	0.191	60,334	32
Oct. '71	1.92	0.57	0.150	66,817	29
Nov. '71	1.88	0.52	0.134	54,231	36
Dec. '71	1.39	0.45	0.109	48,921	22
Jan. '72	1.45	0.57	0.186	9,164	13
Feb. '72	0.91	0.36	0.099	6,344	13
Mar. '72	1.56	0.58	0.188	7,602	15
Apr. '72	1.77	0.62	0.220	4,993	17
May '72	1.66	0.57	0.217	7,044	18
June '72	1.97	0.62	0.191	19,005	24
71/72 Cum.	2.44	0.62	0.162	484,449	50
July '72	2.36	0.72	0.285	8,705	25
Aug. '72	2.12	0.68	0.242	9,789	23
Sept. '72	2.08	0.68	0.264	7,137	21
Oct. '72	2.05	0.76	0.375	2,091	15
Nov. '72	1.56	0.63	0.236	3,008	12
Dec. '72	1.93	0.78	0.376	1,781	12
Jan. '73	1.84	0.68	0.264	1,659	15
Feb. '73	1.71	0.67	0.251	835	13
Mar. '73	1.46	0.49	0.127	7,841	20
Apr. '73	1.76	0.58	0.180	23,240	21
May '73	2.00	0.72	0.313	4,941	16
June '73	1.85	0.72	0.314	1,130	13
72/73 Cum.	2.56	0.68	0.210	72,157	43

Table 6. Monthly and cumulative species diversity indices and biomass based on biomass of trawl collections from Terry Creek.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u>Biomass (grams)</u>	<u># Species</u>
Oct. '70	0.02	0.02	0.001	671	2
Jan. '71	0.26	0.37	-0.204	7	2
Feb. '71	0.43	0.63	0.305	130	2
Mar. '71	0.00	0.00	0.000	0	0
Apr. 6, '71	0.05	0.08	0.012	259	2
Apr. 27, '71	0.00	0.00	0.000	8	1
May '71	0.19	0.28	0.064	55	2
June '71	0.26	0.38	0.106	42	2
70/71 Cum.	0.35	0.32	0.108	1,172	3
July '71	0.00	0.00	0.000	0	0
Aug. '71	1.20	0.58	0.233	805	8
Sept. '71	0.67	0.96	0.765	162	2
Oct. '71	0.00	0.00	0.000	31	1
Nov. '71	0.00	0.00	0.000	46	1
Dec. '71	0.47	0.68	0.363	513	2
Jan. '72	0.72	0.65	-0.591	5	3
Feb. '72	0.00	0.00	0.000	0	0
Mar. '72	0.00	0.00	0.000	0	0
Apr. '72	0.36	0.32	0.109	1,203	3
May '72	0.00	0.00	0.000	289	1
June '72	0.00	0.00	0.000	196	1
71/72 Cum.	1.24	0.48	0.142	3,250	13
July '72	0.93	0.67	0.380	576	4
Aug. '72	1.05	0.59	0.259	459	6
Sept. '72	0.00	0.00	0.000	0	0
Oct. '72	0.00	0.00	0.000	5	1
Nov. '72	0.99	0.90	0.062	119	3
Dec. '72	1.20	0.62	0.251	182	7
Jan. '73	1.05	0.58	0.242	1,088	6
Feb. '73	1.22	0.56	0.217	4,539	9
Mar. '73	1.51	0.68	0.303	4,220	9
Apr. '73	1.33	0.82	0.540	1,562	5
May '73	1.73	0.89	0.588	1,605	7
June '73	1.51	0.77	0.417	387	7
72/73 Cum.	2.21	0.78	0.368	14,742	17

Table 7. Monthly and cumulative species diversity indices and biomass based on biomass of trawl collections from all Brunswick collection areas except Terry Creek.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u>Biomass (grams)</u>	<u># Species</u>
Oct. '70	0.90	0.36	0.089	1,633	12
Jan. '71	1.59	0.82	0.450	147	7
Feb. '71	1.63	0.53	0.138	22,878	22
Mar. '71	2.06	0.71	0.282	2,570	18
Apr. 6, '71	1.29	0.59	0.228	4,280	9
Apr. 27, '71	1.60	0.66	0.277	1,227	11
May '71	1.21	0.47	0.135	3,184	13
June '71	1.07	0.47	0.163	1,502	10
70/71 Cum.	2.33	0.65	0.189	37,421	37
July '71	1.43	0.53	0.152	2,422	15
Aug. '71	1.72	0.72	0.321	4,239	11
Sept. '71	1.47	0.59	0.239	4,538	12
Oct. '71	1.02	0.35	0.081	4,229	19
Nov. '71	1.92	0.77	0.394	1,056	12
Dec. '71	1.15	0.48	0.143	1,958	11
Jan. '72	2.19	0.79	0.377	1,924	16
Feb. '72	2.09	0.79	0.421	4,907	14
Mar. '72	2.09	0.72	0.300	9,403	18
Apr. '72	1.31	0.51	0.161	6,023	13
May '72	1.90	0.83	0.460	311	10
June '72	1.37	0.60	0.230	3,203	10
71/72 Cum.	2.23	0.61	0.162	44,213	39
July '72	2.14	0.75	0.336	3,267	17
Aug. '72	1.47	0.57	0.207	2,972	13
Sept. '72	1.24	0.57	0.205	2,694	9
Oct. '72	1.29	0.72	0.362	314	6
Nov. '72	1.74	0.75	0.367	1,482	10
Dec. '72	1.30	0.62	0.300	1,415	8
Jan. '73	0.94	0.38	0.116	15,881	12
Feb. '73	2.06	0.76	0.364	6,670	15
Mar. '73	1.67	0.62	0.232	9,340	15
Apr. '73	1.76	0.61	0.199	10,761	18
May '73	1.84	0.66	0.245	7,425	16
June '73	1.78	0.64	0.239	2,888	16
72/73 Cum.	2.10	0.58	0.144	65,109	38

Table 8. Monthly and cumulative species diversity indices and biomass based on biomass of trawl collections from all Brunswick collection areas.

	<u>H Bar</u>	<u>J</u>	<u>NM Index</u>	<u>Biomass (grams)</u>	<u># Species</u>
Oct. '70	0.73	0.29	0.060	2,230	13
Jan. '71	1.58	0.81	0.448	154	7
Feb. '71	1.65	0.53	0.142	23,008	22
Mar. '71	2.06	0.71	0.282	2,570	18
Apr. 6, '71	1.34	0.61	0.244	4,540	9
Apr. 27, '71	1.60	0.67	0.278	1,234	11
May '71	1.28	0.48	0.141	3,239	14
June '71	1.17	0.49	0.178	1,544	11
70/71 Cum.	2.35	0.65	0.191	38,519	37
July '71	1.43	0.53	0.152	2,422	15
Aug. '71	1.84	0.70	0.291	5,044	14
Sept. '71	1.56	0.61	0.252	4,700	13
Oct. '71	1.06	0.35	0.084	4,260	20
Nov. '71	1.91	0.77	0.385	1,103	12
Dec. '71	1.43	0.57	0.197	2,471	12
Jan. '72	2.20	0.79	0.380	1,929	16
Feb. '72	2.09	0.79	0.421	4,907	14
Mar. '72	2.09	0.72	0.300	9,403	18
Apr. '72	1.57	0.59	0.207	7,226	14
May '72	1.68	0.70	0.314	600	11
June '72	1.52	0.63	0.255	3,399	11
71/72 Cum.	2.30	0.62	0.172	47,464	40
July '72	2.26	0.78	0.366	3,843	18
Aug. '72	1.75	0.65	0.268	3,431	15
Sept. '72	1.24	0.57	0.205	2,694	9
Oct. '72	1.30	0.73	0.376	320	6
Nov. '72	1.72	0.75	0.360	1,602	10
Dec. '72	1.55	0.67	0.334	1,597	10
Jan. '73	1.11	0.42	0.130	16,969	14
Feb. '73	2.08	0.72	0.298	11,209	18
Mar. '73	1.86	0.69	0.276	13,560	15
Apr. '73	1.76	0.61	0.202	12,323	18
May '73	1.98	0.70	0.278	9,031	17
June '73	1.85	0.67	0.264	3,275	16
72/73 Cum.	2.25	0.61	0.162	79,854	39

FIGURE 13. COMPARISON OF MONTHLY SPECIES DIVERSITY INDEX OF EVENNESS $\bar{H}$, BASED ON NUMBER OF INDIVIDUALS.
(1970-73)

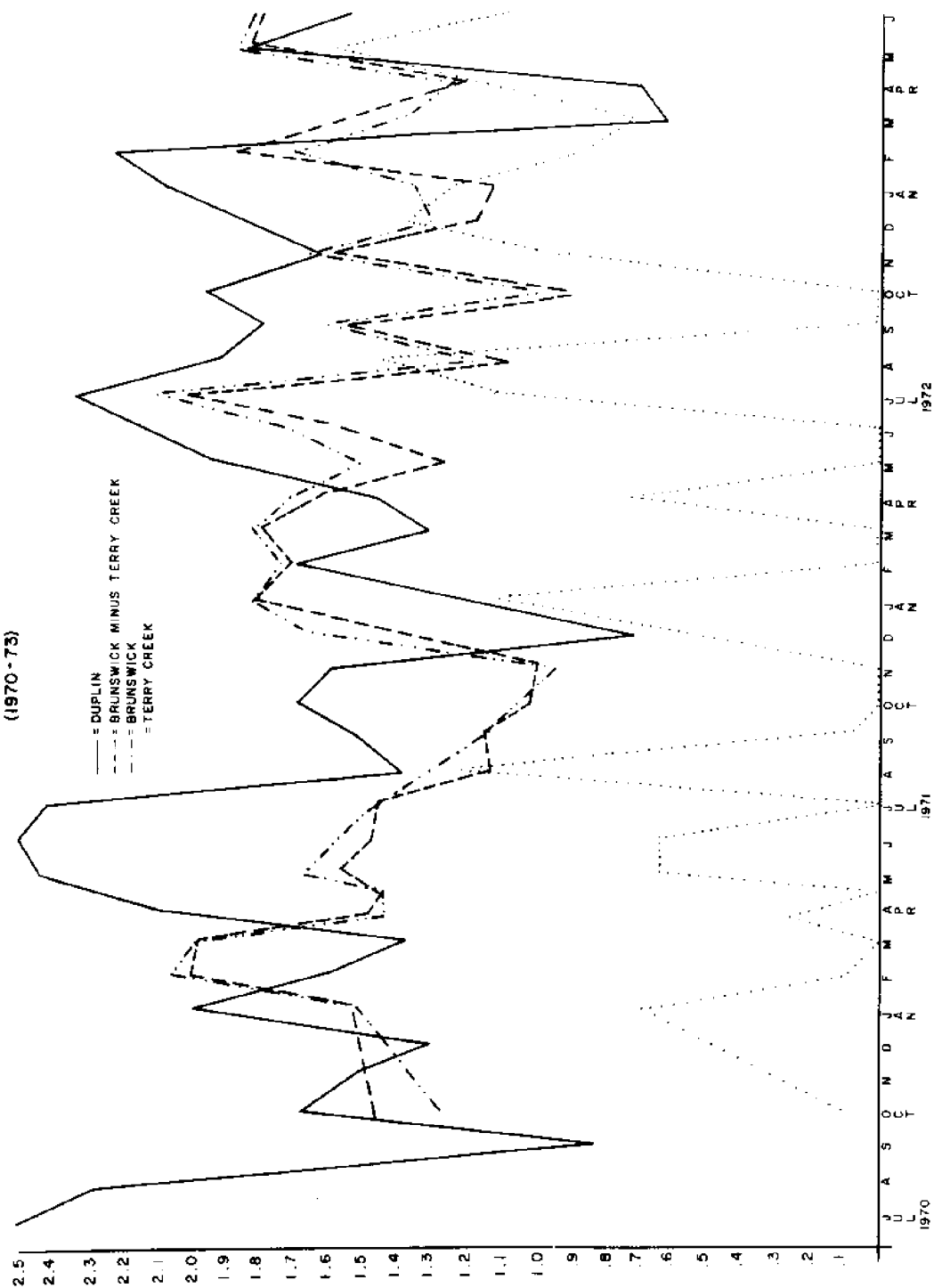
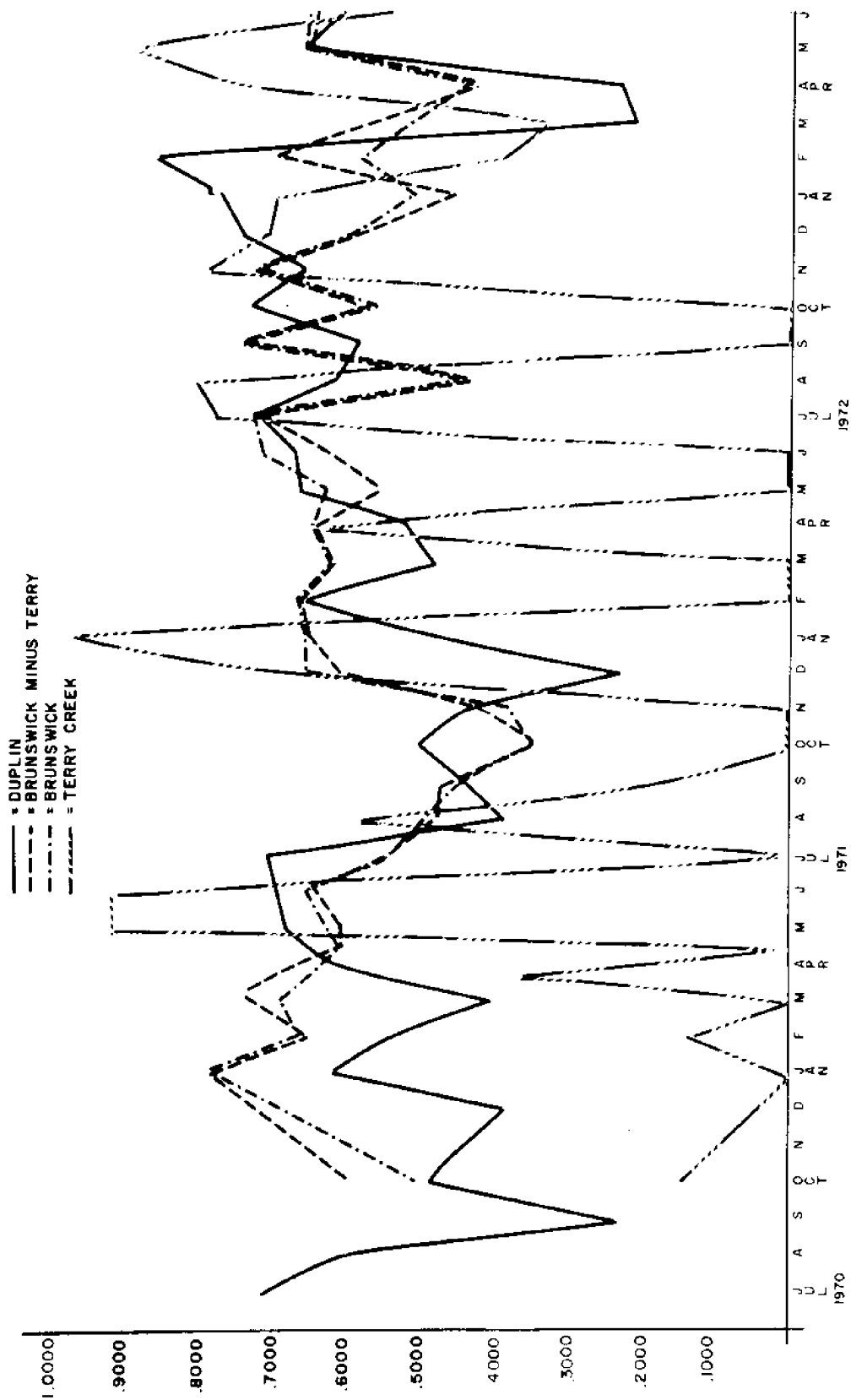


FIGURE 14. COMPARISON OF MONTHLY DIVERSITY INDEX OF EVENESS J, BASED ON NUMBER OF INDIVIDUALS. 1970-73



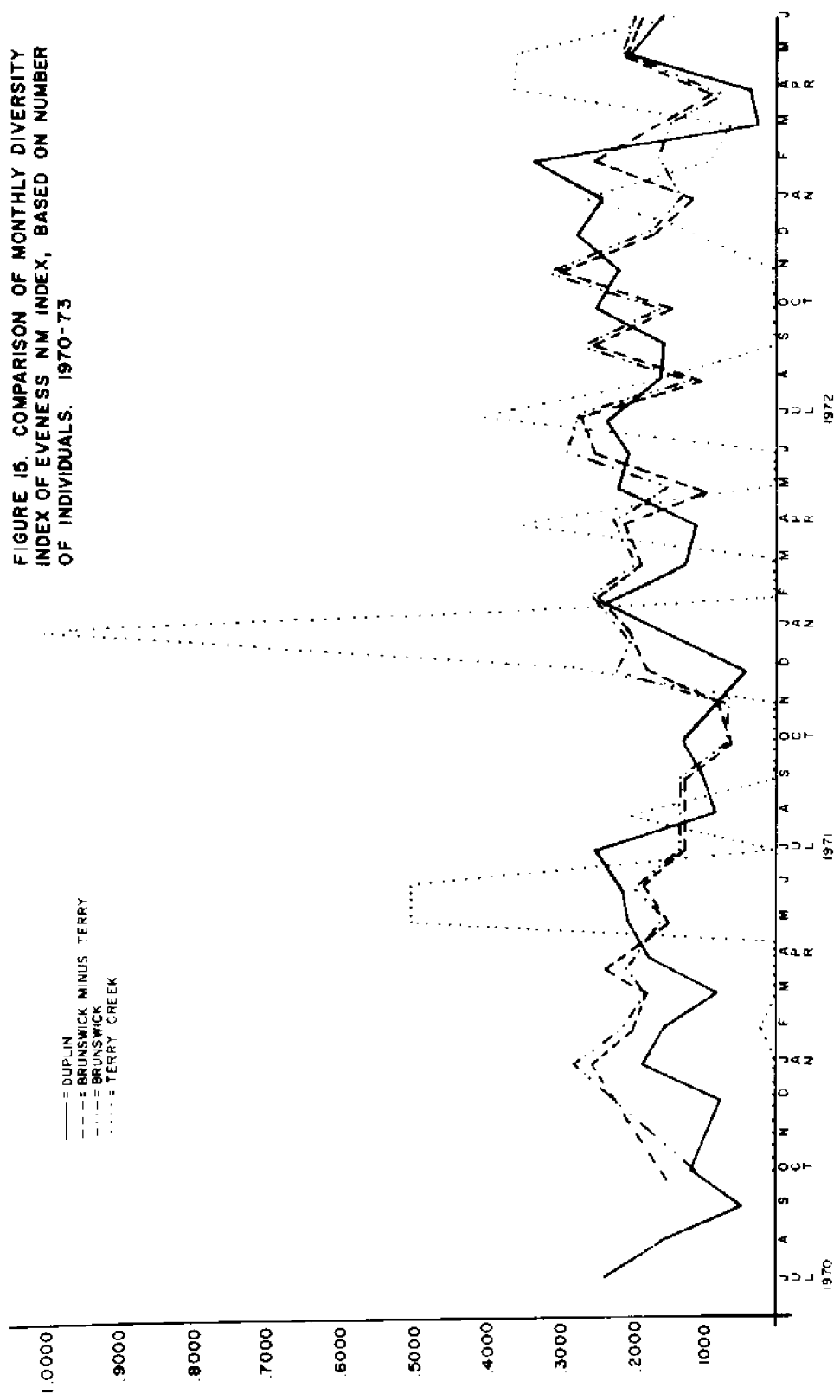


FIGURE 16. COMPARISON OF MONTHLY SPECIES DIVERSITY INDEX OF EVENNESS $\bar{H}$, BASED ON BIOMASS 1970-73

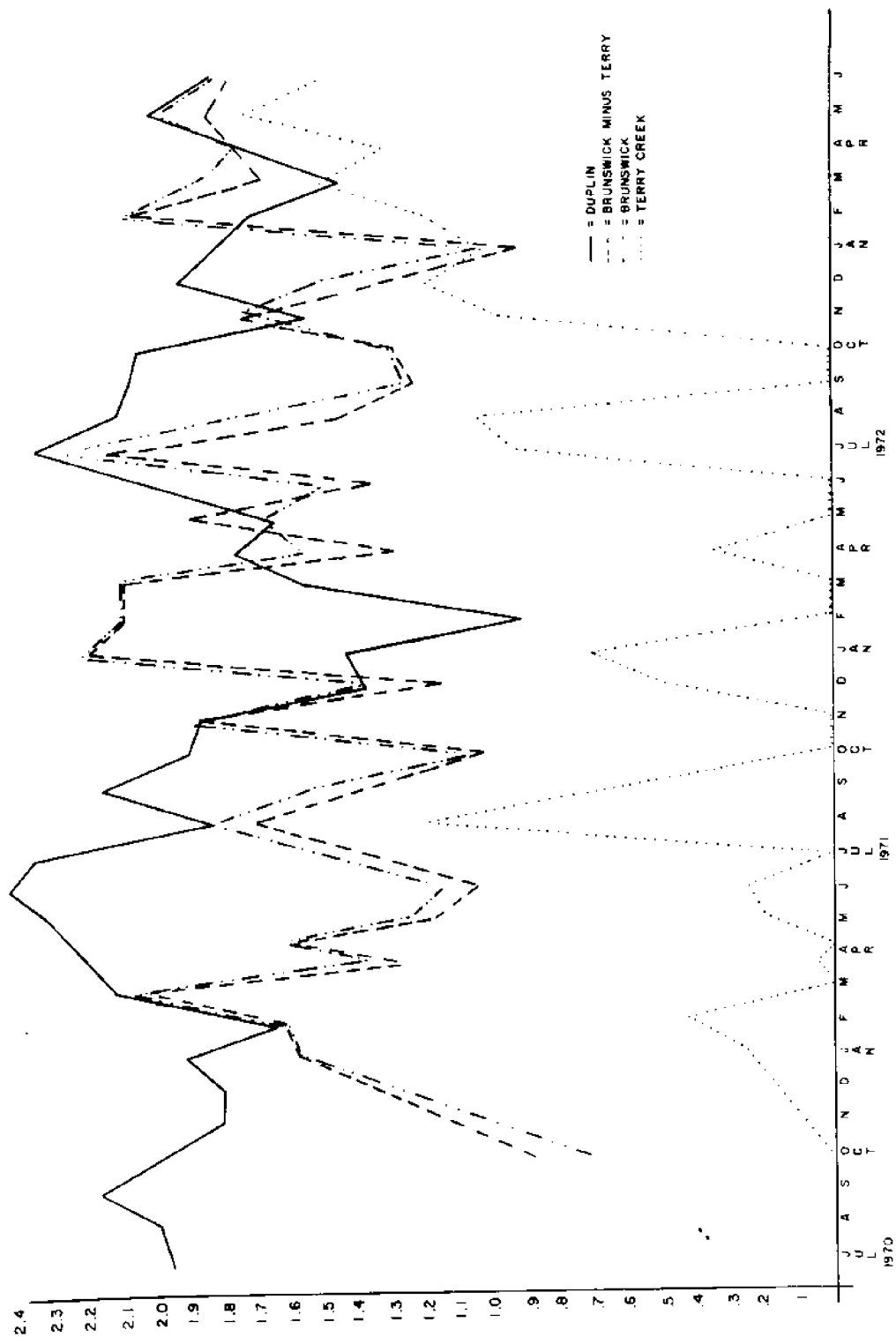
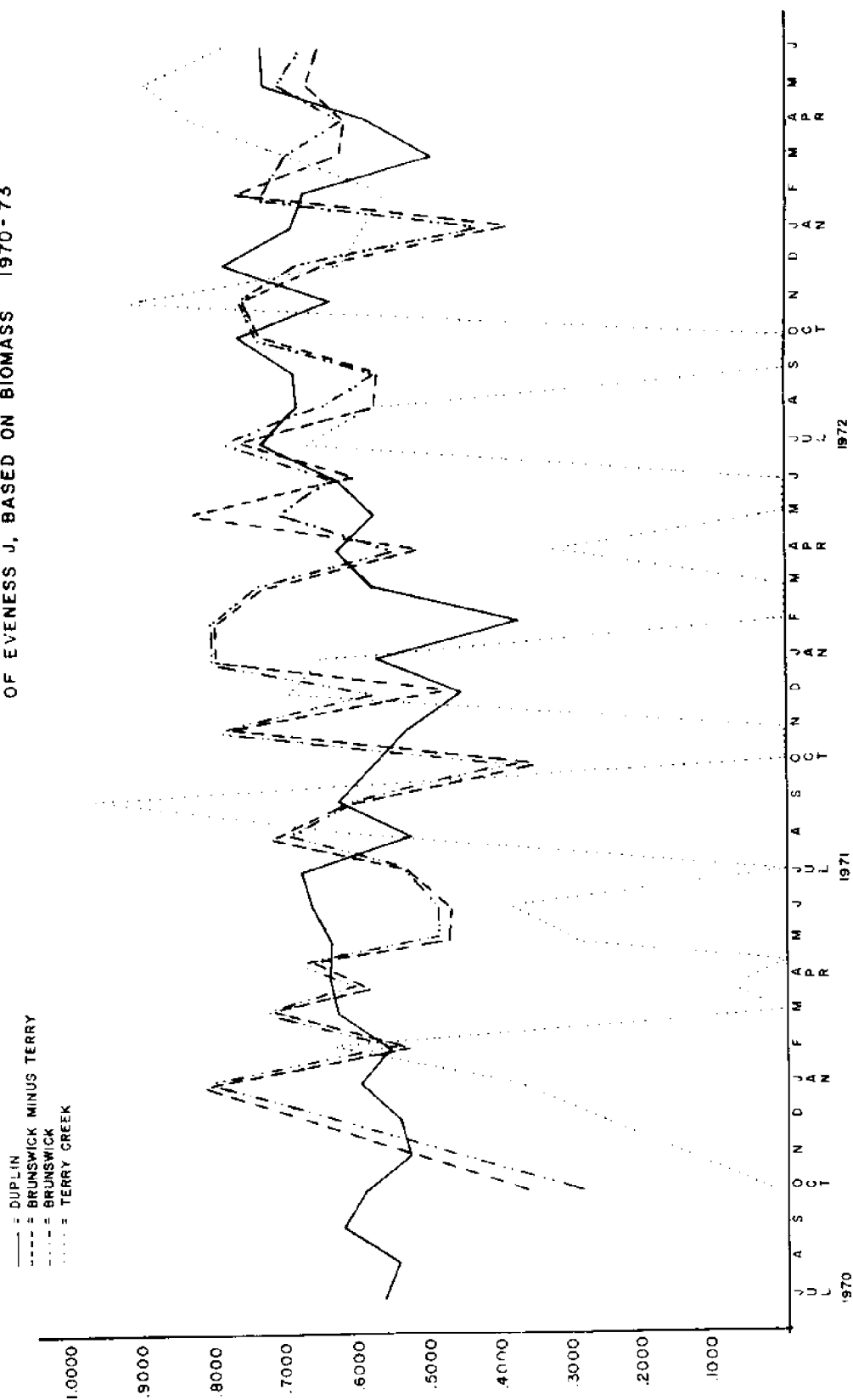


FIGURE 17. COMPARISON OF MONTHLY DIVERSITY INDEX
OF EVENNESS J, BASED ON BIOMASS 1970-73



than the number of organisms of each different species collected.

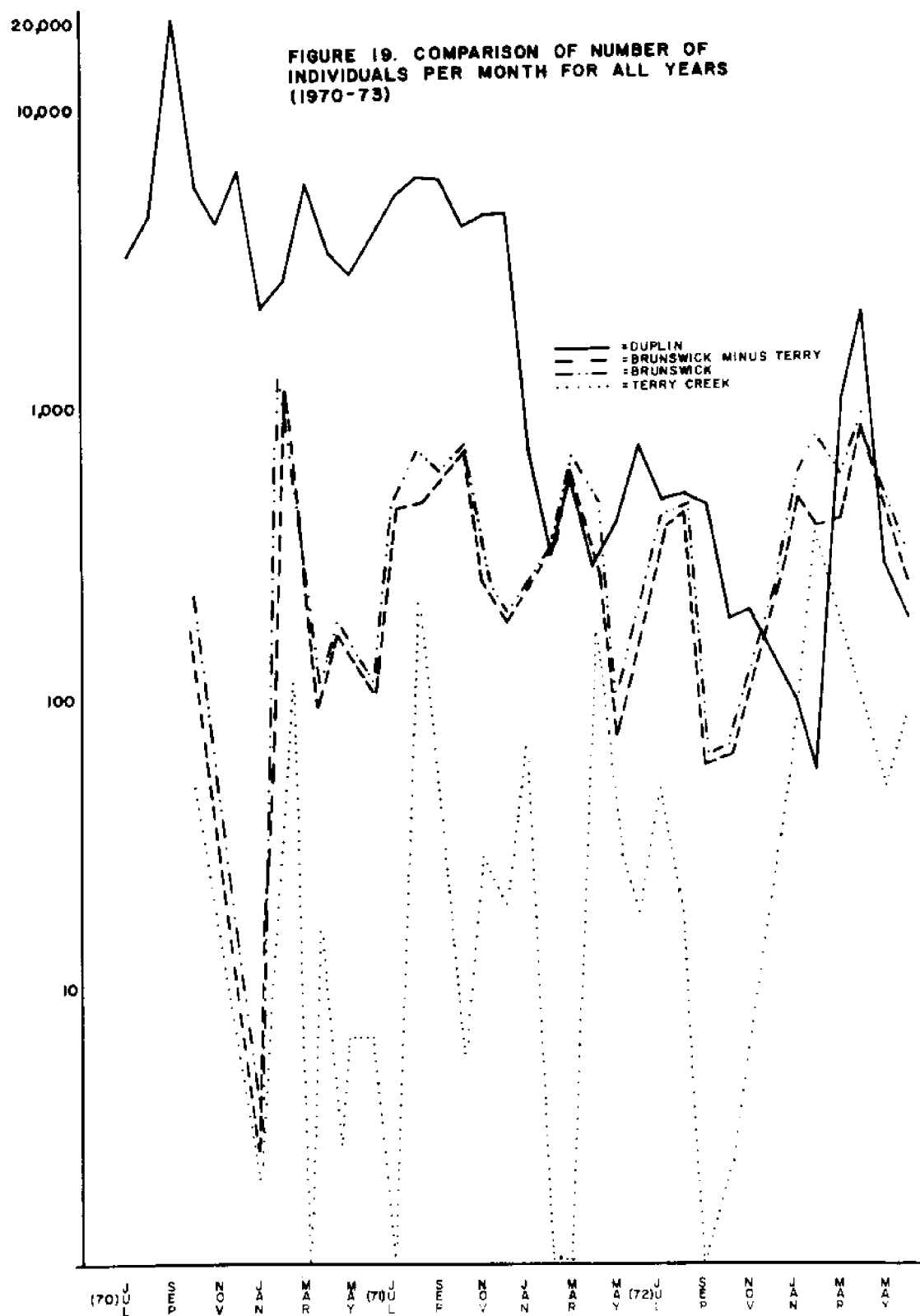
Figure 19 displays the total number of individuals collected at each different collection site during the study period. The variation in the numbers of individuals in the Duplin Estuary represents the control. There is a dramatic increase in the number of individuals in Terry Creek during the three year period. This may be associated with the concurrent decrease in toxaphene content of the plant effluent (Figure 9).

The results of the t test for significant variations in the species diversity under H Bar are found in Tables 9-34. Table 9 contrasts yearly variations of H Bar based on number of individuals while Table 10 contrasts yearly variations of H Bar based on biomass. It is of importance to note that based on number of individuals (Table 9), H Bar for Terry Creek, 1973, is not significantly different from the Duplin Estuary in 1973. This represents another quantitative indication that Terry Creek has returned to a more natural condition with a diversity comparable to the Duplin.

Tables 11 through 22 present monthly comparisons of species diversity H Bar, based on the number of individuals collected, from different collection sites. Tables 23 through 34 present monthly comparisons of species diversity H Bar, based on biomass, for different collection sites. These provide quantitative comparison on a yearly and monthly basis for significant variation in the species diversity index, H Bar.

Discussion

As the toxaphene content in the plant effluent decreased during the three year study period, the toxaphene content of fauna, flora and



	Duplin Estuary				Brunswick minus Terry Creek				Brunswick				Terry Creek			
	1971	1972	1973	All	1971	1972	1973	All	1971	1972	1973	All	1971	1972	1973	All
1971																
1972	***															
1973	*	***														
All	***	***	***													
1971	***	***	***	***												
1972	***	***	***	***	***											
1973	***	***	***	***	***	***										
All	***	***	***	***	***	***	***									
1971	***	***	***	***	NS	***	***	***	***							
1972	***	***	***	***	***	***	***	***	***							
1973	***	***	***	***	***	*	***	***	***	***						
All	***	***	***	***	***	***	***	***	***	***	***					
1971	***	***	***	***	NS	***	***	***	***							
1972	***	***	***	***	***	***	***	***	***							
1973	***	***	***	***	***	***	***	***	***	***						
All	***	***	***	***	***	***	***	***	***	***	***					
1971	***	***	***	***	***	***	***	***	***	***	***	***				
1972	***	***	***	***	***	***	***	***	***	***	***	***	***			
1973	***	***	***	***	***	NS	***	***	***	***	***	***	***	***		
All	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

Duplin Estuary
Brunswick minus
Terry Creek

KEY: *=significant at 95% confidence interval
 **=significant at 99% confidence interval
 ***=significant at 99.9% confidence interval
 NS=not significant

Table 10. t test of yearly cumulative H Bar diversity indices (based on biomass) contrasting differences between collection sites with different years.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Apr. 1971	May 1971	June 1971	1970-1971 Cum.
July 1970													
Aug. 1970	***												
Sep. 1970	***	***											
Oct. 1970	***	***	***										
Nov. 1970	***	***	***	***									
Dec. 1970	***	***	***	***	***								
Jan. 1971	***	***	***	***	***	***							
Feb. 1971	***	***	***	**	NS	***	***						
Mar. 1971	***	***	***	***	***	*	***	***					
Apr. 1971	***	**	***	***	***	***	***	***	***				
May 1971	NS	***	***	***	***	***	***	***	***	***			
June 1971	NS	***	***	***	***	***	***	***	***	***	NS		
1970-1971 Cum.	***	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval
 ** = significant at 99% confidence interval
 *** = significant at 99.9% confidence interval
 NS = not significant

Table 11. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for the Duplin Estuary, 1970-1971.

	July 1971	Aug. 1971	Sep. 1971	Oct. 1971	Nov. 1971	Dec. 1971	Jan. 1972	Feb. 1972	Mar. 1972	Apr. 1972	May 1972	June 1972	1971-1972 Cum.
July 1971													
Aug. 1971	***												
Sep. 1971	***	***											
Oct. 1971	***	***	***										
Nov. 1971	***	***	**	**									
Dec. 1971	***	***	***	***	***								
Jan. 1972	***	NS	***	***	***	***							
Feb. 1972	***	***	**	NS	NS	***	***						
Mar. 1972	***	NS	***	***	***	***	NS	***					
Apr. 1972	***	NS	NS	*	NS	***	NS	*	NS				
May 1972	***	***	***	***	***	***	***	**	***	***			
June 1972	***	***	***	***	***	***	***	***	***	***	**		
1971-1972 Cum.	***	***	***	***	***	***	***	**	***	***	NS	***	

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 12. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for the Duplin Estuary, 1971-1972.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Ap.6 1971	Ap.27 1971	May 1971	June 1971	1970- 1971 Cum.
July 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sep. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dec. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Feb. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mar. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apr. 6, 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apr. 27, 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970- 1971 Cum.	-	-	-	-	-	-	-	-	-	-	-	-	-	-

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 14. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for all Brunswick stations, 1970-1971.

	July 1972	Aug. 1972	Sep. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	1972-1973 Cum.
July 1972													
Aug. 1972	***												
Sep. 1972	***	***											
Oct. 1972	***	**	***										
Nov. 1972	***	***	NS	***									
Dec. 1972	***	NS	**	***	**								
Jan. 1973	***	*	*	***	**	NS							
Feb. 1973	***	***	NS	***	NS	***	***						
Mar. 1973	***	**	*	***	*	NS	NS	***					
Apr. 1973	***	NS	***	***	***	NS	NS	***	**				
May 1973	**	***	*	***	NS	***	***	*	***	***			
June 1973	***	***	NS	***	NS	***	***	NS	***	***	NS		
1972-1973 Cum.	NS	***	***	***	**	***	***	***	***	***	*	**	

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 16. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for all Brunswick stations, 1972-1973.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Apr. 6 1971	Apr. 27 1971	May 1971	June 1971	1970-1971 Cum.
July 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sep. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dec. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan. 1971	-	-	-	NS	-	-	-	-	-	-	-	-	-	-
Feb. 1971	-	-	-	***	-	-	***	-	-	-	-	-	-	-
Mar. 1971	-	-	-	***	-	-	***	-	NS	-	-	-	-	-
Apr. 6, 1971	-	-	-	NS	-	-	NS	***	***	-	-	-	-	-
Apr. 27, 1971	-	-	-	NS	-	-	NS	***	***	NS	-	-	-	-
May 1971	-	-	-	NS	-	-	NS	***	***	NS	NS	-	-	-
June 1971	-	-	-	NS	-	-	NS	***	***	NS	NS	NS	-	-
1970-1971 Cum.	-	-	-	***	-	-	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 17. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for all Brunswick stations except Terry Creek, 1970-1971.

	July 1971	Aug. 1971	Sep. 1971	Oct. 1971	Nov. 1971	Dec. 1971	Jan. 1972	Feb. 1972	Mar. 1972	Apr. 1972	May 1972	June 1972	1971-1972 Cum.
July 1971	***	***	***	***	***	***	***	***	***	***	***	***	***
Aug. 1971	***	***	***	***	***	***	***	***	***	***	***	***	***
Sep. 1971	***	***	***	***	***	***	***	***	***	***	***	***	***
Oct. 1971	***	***	***	***	***	***	***	***	***	***	***	***	***
Nov. 1971	***	***	***	***	***	***	***	***	***	***	***	***	***
Dec. 1971	***	***	***	***	***	***	***	***	***	***	***	***	***
Jan. 1972	***	***	***	***	***	***	***	***	***	***	***	***	***
Feb. 1972	***	***	***	***	***	***	***	***	***	***	***	***	***
Mar. 1972	***	***	***	***	***	***	***	***	***	***	***	***	***
Apr. 1972	***	***	***	***	***	***	***	***	***	***	***	***	***
May 1972	***	***	***	***	***	***	***	***	***	***	***	***	***
June 1972	***	***	***	***	***	***	***	***	***	***	***	***	***
1971-1972 Cum.	***	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 18. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for all Brunswick stations except Terry Creek, 1971-1972.

	July 1972	Aug. 1972	Sep. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	1972-1973 Cum.
July 1972													
Aug. 1972	***												
Sep. 1972	***	***											
Oct. 1972	***	NS	***										
Nov. 1972	**	***	NS	***									
Dec. 1972	***	*	***	***	***								
Jan. 1973	***	NS	***	NS	***	NS							
Feb. 1973	NS	***	NS	***	NS	***	***						
Mar. 1973	***	***	NS	***	NS	***	***	***					
Apr. 1973	***	*	***	***	***	NS	NS	***	***				
May 1973	**	***	NS	***	NS	***	NS	NS	***	***			
June 1973	**	***	NS	***	NS	***	***	NS	**	***	NS		
1972-1973 Cum.	NS	***	***	***	**	***	***	NS	***	***	*	**	

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 19. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for all Brunswick stations except Terry Creek, 1972-1973.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Apr.6 1971	Ap.27 1971	May 1971	June 1971	1970- 1971 Cum.
July 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sep. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dec. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Feb. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mar. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apr. 6, 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apr. 27, 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970- 1971 Cum.	-	-	-	-	-	-	-	-	-	-	-	-	-	-

KEY: * = significant at 95% confidence interval
 ** = significant at 99% confidence interval
 *** = significant at 99.9% confidence interval
 NS = not significant

Table 20. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for Terry Creek, 1970-1971.

	July 1971	Aug. 1971	Sep. 1971	Oct. 1971	Nov. 1971	Dec. 1971	Jan. 1972	Feb. 1972	Mar. 1972	Apr. 1972	May 1972	June 1972	July 1972	Aug. 1972	Sep. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	July 1973	Aug. 1973	Sep. 1973	Oct. 1973	Nov. 1973	Dec. 1973	Jan. 1974	Feb. 1974	Mar. 1974	Apr. 1974	May 1974	June 1974	July 1974	Aug. 1974	Sep. 1974	Oct. 1974	Nov. 1974	Dec. 1974	Jan. 1975	Feb. 1975	Mar. 1975	Apr. 1975	May 1975	June 1975	July 1975	Aug. 1975	Sep. 1975	Oct. 1975	Nov. 1975	Dec. 1975	Jan. 1976	Feb. 1976	Mar. 1976	Apr. 1976	May 1976	June 1976	July 1976	Aug. 1976	Sep. 1976	Oct. 1976	Nov. 1976	Dec. 1976	Jan. 1977	Feb. 1977	Mar. 1977	Apr. 1977	May 1977	June 1977	July 1977	Aug. 1977	Sep. 1977	Oct. 1977	Nov. 1977	Dec. 1977	Jan. 1978	Feb. 1978	Mar. 1978	Apr. 1978	May 1978	June 1978	July 1978	Aug. 1978	Sep. 1978	Oct. 1978	Nov. 1978	Dec. 1978	Jan. 1979	Feb. 1979	Mar. 1979	Apr. 1979	May 1979	June 1979	July 1979	Aug. 1979	Sep. 1979	Oct. 1979	Nov. 1979	Dec. 1979	Jan. 1980	Feb. 1980	Mar. 1980	Apr. 1980	May 1980	June 1980	July 1980	Aug. 1980	Sep. 1980	Oct. 1980	Nov. 1980	Dec. 1980	Jan. 1981	Feb. 1981	Mar. 1981	Apr. 1981	May 1981	June 1981	July 1981	Aug. 1981	Sep. 1981	Oct. 1981	Nov. 1981	Dec. 1981	Jan. 1982	Feb. 1982	Mar. 1982	Apr. 1982	May 1982	June 1982	July 1982	Aug. 1982	Sep. 1982	Oct. 1982	Nov. 1982	Dec. 1982	Jan. 1983	Feb. 1983	Mar. 1983	Apr. 1983	May 1983	June 1983	July 1983	Aug. 1983	Sep. 1983	Oct. 1983	Nov. 1983	Dec. 1983	Jan. 1984	Feb. 1984	Mar. 1984	Apr. 1984	May 1984	June 1984	July 1984	Aug. 1984	Sep. 1984	Oct. 1984	Nov. 1984	Dec. 1984	Jan. 1985	Feb. 1985	Mar. 1985	Apr. 1985	May 1985	June 1985	July 1985	Aug. 1985	Sep. 1985	Oct. 1985	Nov. 1985	Dec. 1985	Jan. 1986	Feb. 1986	Mar. 1986	Apr. 1986	May 1986	June 1986	July 1986	Aug. 1986	Sep. 1986	Oct. 1986	Nov. 1986	Dec. 1986	Jan. 1987	Feb. 1987	Mar. 1987	Apr. 1987	May 1987	June 1987	July 1987	Aug. 1987	Sep. 1987	Oct. 1987	Nov. 1987	Dec. 1987	Jan. 1988	Feb. 1988	Mar. 1988	Apr. 1988	May 1988	June 1988	July 1988	Aug. 1988	Sep. 1988	Oct. 1988	Nov. 1988	Dec. 1988	Jan. 1989	Feb. 1989	Mar. 1989	Apr. 1989	May 1989	June 1989	July 1989	Aug. 1989	Sep. 1989	Oct. 1989	Nov. 1989	Dec. 1989	Jan. 1990	Feb. 1990	Mar. 1990	Apr. 1990	May 1990	June 1990	July 1990	Aug. 1990	Sep. 1990	Oct. 1990	Nov. 1990	Dec. 1990	Jan. 1991	Feb. 1991	Mar. 1991	Apr. 1991	May 1991	June 1991	July 1991	Aug. 1991	Sep. 1991	Oct. 1991	Nov. 1991	Dec. 1991	Jan. 1992	Feb. 1992	Mar. 1992	Apr. 1992	May 1992	June 1992	July 1992	Aug. 1992	Sep. 1992	Oct. 1992	Nov. 1992	Dec. 1992	Jan. 1993	Feb. 1993	Mar. 1993	Apr. 1993	May 1993	June 1993	July 1993	Aug. 1993	Sep. 1993	Oct. 1993	Nov. 1993	Dec. 1993	Jan. 1994	Feb. 1994	Mar. 1994	Apr. 1994	May 1994	June 1994	July 1994	Aug. 1994	Sep. 1994	Oct. 1994	Nov. 1994	Dec. 1994	Jan. 1995	Feb. 1995	Mar. 1995	Apr. 1995	May 1995	June 1995	July 1995	Aug. 1995	Sep. 1995	Oct. 1995	Nov. 1995	Dec. 1995	Jan. 1996	Feb. 1996	Mar. 1996	Apr. 1996	May 1996	June 1996	July 1996	Aug. 1996	Sep. 1996	Oct. 1996	Nov. 1996	Dec. 1996	Jan. 1997	Feb. 1997	Mar. 1997	Apr. 1997	May 1997	June 1997	July 1997	Aug. 1997	Sep. 1997	Oct. 1997	Nov. 1997	Dec. 1997	Jan. 1998	Feb. 1998	Mar. 1998	Apr. 1998	May 1998	June 1998	July 1998	Aug. 1998	Sep. 1998	Oct. 1998	Nov. 1998	Dec. 1998	Jan. 1999	Feb. 1999	Mar. 1999	Apr. 1999	May 1999	June 1999	July 1999	Aug. 1999	Sep. 1999	Oct. 1999	Nov. 1999	Dec. 1999	Jan. 2000	Feb. 2000	Mar. 2000	Apr. 2000	May 2000	June 2000	July 2000	Aug. 2000	Sep. 2000	Oct. 2000	Nov. 2000	Dec. 2000	Jan. 2001	Feb. 2001	Mar. 2001	Apr. 2001	May 2001	June 2001	July 2001	Aug. 2001	Sep. 2001	Oct. 2001	Nov. 2001	Dec. 2001	Jan. 2002	Feb. 2002	Mar. 2002	Apr. 2002	May 2002	June 2002	July 2002	Aug. 2002	Sep. 2002	Oct. 2002	Nov. 2002	Dec. 2002	Jan. 2003	Feb. 2003	Mar. 2003	Apr. 2003	May 2003	June 2003	July 2003	Aug. 2003	Sep. 2003	Oct. 2003	Nov. 2003	Dec. 2003	Jan. 2004	Feb. 2004	Mar. 2004	Apr. 2004	May 2004	June 2004	July 2004	Aug. 2004	Sep. 2004	Oct. 2004	Nov. 2004	Dec. 2004	Jan. 2005	Feb. 2005	Mar. 2005	Apr. 2005	May 2005	June 2005	July 2005	Aug. 2005	Sep. 2005	Oct. 2005	Nov. 2005	Dec. 2005	Jan. 2006	Feb. 2006	Mar. 2006	Apr. 2006	May 2006	June 2006	July 2006	Aug. 2006	Sep. 2006	Oct. 2006	Nov. 2006	Dec. 2006	Jan. 2007	Feb. 2007	Mar. 2007	Apr. 2007	May 2007	June 2007	July 2007	Aug. 2007	Sep. 2007	Oct. 2007	Nov. 2007	Dec. 2007	Jan. 2008	Feb. 2008	Mar. 2008	Apr. 2008	May 2008	June 2008	July 2008	Aug. 2008	Sep. 2008	Oct. 2008	Nov. 2008	Dec. 2008	Jan. 2009	Feb. 2009	Mar. 2009	Apr. 2009	May 2009	June 2009	July 2009	Aug. 2009	Sep. 2009	Oct. 2009	Nov. 2009	Dec. 2009	Jan. 2010	Feb. 2010	Mar. 2010	Apr. 2010	May 2010	June 2010	July 2010	Aug. 2010	Sep. 2010	Oct. 2010	Nov. 2010	Dec. 2010	Jan. 2011	Feb. 2011	Mar. 2011	Apr. 2011	May 2011	June 2011	July 2011	Aug. 2011	Sep. 2011	Oct. 2011	Nov. 2011	Dec. 2011	Jan. 2012	Feb. 2012	Mar. 2012	Apr. 2012	May 2012	June 2012	July 2012	Aug. 2012	Sep. 2012	Oct. 2012	Nov. 2012	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May 2013	June 2013	July 2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013	Jan. 2014	Feb. 2014	Mar. 2014	Apr. 2014	May 2014	June 2014	July 2014	Aug. 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Jan. 2015	Feb. 2015	Mar. 2015	Apr. 2015	May 2015	June 2015	July 2015	Aug. 2015	Sep. 2015	Oct. 2015	Nov. 2015	Dec. 2015	Jan. 2016	Feb. 2016	Mar. 2016	Apr. 2016	May 2016	June 2016	July 2016	Aug. 2016	Sep. 2016	Oct. 2016	Nov. 2016	Dec. 2016	Jan. 2017	Feb. 2017	Mar. 2017	Apr. 2017	May 2017	June 2017	July 2017	Aug. 2017	Sep. 2017	Oct. 2017	Nov. 2017	Dec. 2017	Jan. 2018	Feb. 2018	Mar. 2018	Apr. 2018	May 2018	June 2018	July 2018	Aug. 2018	Sep. 2018	Oct. 2018	Nov. 2018	Dec. 2018	Jan. 2019	Feb. 2019	Mar. 2019	Apr. 2019	May 2019	June 2019	July 2019	Aug. 2019	Sep. 2019	Oct. 2019	Nov. 2019	Dec. 2019	Jan. 2020	Feb. 2020	Mar. 2020	Apr. 2020	May 2020	June 2020	July 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	June 2021	July 2021	Aug. 2021	Sep. 2021	Oct. 2021	Nov. 2021	Dec. 2021	Jan. 2022	Feb. 2022	Mar. 2022	Apr. 2022	May 2022	June 2022	July 2022	Aug. 2022	Sep. 2022	Oct. 2022	Nov. 2022	Dec. 2022	Jan. 2023	Feb. 2023	Mar. 2023	Apr. 2023	May 2023	June 2023	July 2023	Aug. 2023	Sep. 2023	Oct. 2023	Nov. 2023	Dec. 2023	Jan. 2024	Feb. 2024	Mar. 2024	Apr. 2024	May 2024	June 2024	July 2024	Aug. 2024	Sep. 2024	Oct. 2024	Nov. 2024	Dec. 2024	Jan. 2025	Feb. 2025	Mar. 2025	Apr. 2025	May 2025	June 2025	July 2025	Aug. 2025	Sep. 2025	Oct. 2025	Nov. 2025	Dec. 2025	Jan. 2026	Feb. 2026	Mar. 2026	Apr. 2026	May 2026	June 2026	July 2026	Aug. 2026	Sep. 2026	Oct. 2026	Nov. 2026	Dec. 2026	Jan. 2027	Feb. 2027	Mar. 2027	Apr. 2027	May 2027	June 2027	July 2027	Aug. 2027	Sep. 2027	Oct. 2027	Nov. 2027	Dec. 2027	Jan. 2028	Feb. 2028	Mar. 2028	Apr. 2028	May 2028	June 2028	July 2028	Aug. 2028	Sep. 2028	Oct. 2028	Nov. 2028	Dec. 2028	Jan. 2029	Feb. 2029	Mar. 2029	Apr. 2029	May 2029	June 2029	July 2029	Aug. 2029	Sep. 2029	Oct. 2029	Nov. 2029	Dec. 2029	Jan. 2030	Feb. 2030	Mar. 2030	Apr. 2030	May 2030	June 2030	July 2030	Aug. 2030	Sep. 2030	Oct. 2030	Nov. 2030	Dec. 2030	Jan. 2031	Feb. 2031	Mar. 2031	Apr. 2031	May 2031	June 2031	July 2031	Aug. 2031	Sep. 2031	Oct. 2031	Nov. 2031	Dec. 2031	Jan. 2032	Feb. 2032	Mar. 2032	Apr. 2032	May 2032	June 2032	July 2032	Aug. 2032	Sep. 2032	Oct. 2032	Nov. 2032	Dec. 2032	Jan. 2033	Feb. 2033	Mar. 2033	Apr. 2033	May 2033	June 2033	July 2033	Aug. 2033	Sep. 2033	Oct. 2033	Nov. 2033	Dec. 2033	Jan. 2034	Feb. 2034	Mar. 2034	Apr. 2034	May 2034	June 2034	July 2034	Aug. 2034	Sep. 2034	Oct. 2034	Nov. 2034	Dec. 2034	Jan. 2035	Feb. 2035	Mar. 2035	Apr. 2035	May 2035	June 2035	July 2035	Aug. 2035	Sep. 2035	Oct. 2035	Nov. 2035	Dec. 2035	Jan. 2036	Feb. 2036	Mar. 2036	Apr. 2036	May 2036	June 2036	July 2036	Aug. 2036	Sep. 2036	Oct. 2036	Nov. 2036	Dec. 2036	Jan. 2037	Feb. 2037	Mar. 2037	Apr. 2037	May 2037	June 2037	July 2037	Aug. 2037	Sep. 2037	Oct. 2037	Nov. 2037	Dec. 2037	Jan. 2038	Feb. 2038	Mar. 2038	Apr. 2038	May 2038	June 2038	July 2038	Aug. 2038	Sep. 2038	Oct. 2038	Nov. 2038	Dec. 2038	Jan. 2039	Feb. 2039	Mar. 2039	Apr. 2039	May 2039	June 2039	July 2039	Aug. 2039	Sep. 2039	Oct. 2039	Nov. 2039	Dec. 2039	Jan. 2040	Feb. 2040	Mar. 2040	Apr. 2040	May 2040	June 2040	July 2040	Aug. 2040	Sep. 2040	Oct. 2040	Nov. 2040	Dec. 2040	Jan. 2041	Feb. 2041	Mar. 2041	Apr. 2041	May 2041	June 2041	July 2041	Aug. 2041	Sep. 2041	Oct. 2041	Nov. 2041	Dec. 2041	Jan. 2042	Feb. 2042	Mar. 2042	Apr. 2042	May 2042	June 2042	July 2042	Aug. 2042	Sep. 2042	Oct. 2042	Nov. 2042	Dec. 2042	Jan. 2043	Feb. 2043	Mar. 2043	Apr. 2043	May 2043	June 2043	July 2043	Aug. 2043	Sep. 2043	Oct. 2043	Nov. 2043	Dec. 2043	Jan. 2044	Feb. 2044	Mar. 2044	Apr. 2044	May 2044	June 2044	July 2044	Aug. 2044	Sep. 2044	Oct. 2044	Nov. 2044	Dec. 2044	Jan. 2045	Feb. 2045	Mar. 2045	Apr. 2045	May 2045	June 2045	July 2045	Aug. 2045	Sep. 2045	Oct. 2045	Nov. 2045	Dec. 2045	Jan. 2046	Feb. 2046	Mar. 2046	Apr. 2046	May 2046	June 2046	July 2046	Aug. 2046	Sep. 2046	Oct. 2046	Nov. 2046	Dec. 2046	Jan. 2047	Feb. 2047	Mar. 2047	Apr. 2047	May 2047	June 2047	July 2047	Aug. 2047	Sep. 2047	Oct. 2047	Nov. 2047	Dec. 2047	Jan. 2048	Feb. 2048	Mar. 2048	Apr. 2048	May 2048	June 2048	July 2048	Aug. 2048	Sep. 2048	Oct. 2048	Nov. 2048	Dec. 2048	Jan. 2049	Feb. 2049	Mar. 2049	Apr. 2049	May 2049	June 2049	July 2049	Aug. 2049	Sep. 2049	Oct. 2049	Nov. 2049	Dec. 2049	Jan. 2050	Feb. 2050	Mar. 2050	Apr. 2050	May 2050	June 2050	July 2050	Aug. 2050	Sep. 2050	Oct. 2050	Nov. 2050	Dec. 2050	Jan. 2051	Feb. 2051	Mar. 2051	Apr. 2051	May 2051	June 2051	July 2051	Aug. 2051	Sep. 2051	Oct. 2051	Nov. 2051	Dec. 2051	Jan. 2052	Feb. 2052	Mar. 2052	Apr. 2052	May 2052	June 2052	July 2052	Aug. 2052	Sep. 2052	Oct. 2052	Nov. 2052	Dec. 2052	Jan. 2053	Feb. 2053	Mar. 2053	Apr. 2053	May 2053	June 2053	July 2053	Aug. 2053	Sep. 2053	Oct. 2053	Nov. 2053	Dec. 2053	Jan. 2054	Feb. 2054	Mar. 2054	Apr. 2054	May 2054	June 2054	July 2054	Aug. 2054	Sep. 2054	Oct. 2054	Nov. 2054	Dec. 2054	Jan. 2055	Feb. 2055	Mar. 2055	Apr. 2055	May 2055	June 2055	July 2055	Aug. 2055	Sep. 2055	Oct. 2055	Nov. 2055	Dec. 2055	Jan. 2056	Feb. 2056	Mar. 2056	Apr. 2056	May 2056	June 2056	July 2056	Aug. 2056	Sep. 2056	Oct. 2056	Nov. 2056	Dec. 2056	Jan. 2057	Feb. 2057	Mar. 2057	Apr. 2057	May 2057	June 2057	July 2057	Aug. 2057	Sep. 2057	Oct. 2057	Nov. 2057	Dec. 2057	Jan. 2058	Feb. 2058	Mar. 2058	Apr. 2058	May 2058	June 2058	July 2058	Aug. 2058	Sep. 2058	Oct. 2058	Nov. 2058	Dec. 2058	Jan. 2059	Feb. 2059	Mar. 2059	
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Table 21. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for Terry Creek, 1971-1972.

	July 1972	Aug. 1972	Sep. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	1972-1973 Cum.
July 1972													
Aug. 1972	NS												
Sep. 1972	***	***											
Oct. 1972	***	***	NS										
Nov. 1972	NS	*	***	***									
Dec. 1972	*	NS	***	***	***								
Jan. 1973	NS	NS	***	***	NS	NS							
Feb. 1973	NS	**	***	***	NS	***	***						
Mar. 1973	**	***	***	***	NS	***	***	*					
Apr. 1973	NS	NS	***	***	NS	NS	NS	***	***				
May 1973	**	NS	***	***	***	NS	*	***	***	**			
June 1973	NS	NS	***	***	NS	*	NS	*	***	NS	***		
1972-1973 Cum.	***	NS	***	***	***	**	***	***	***	***	NS	***	

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 22. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for Terry Creek, 1972-1973.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Apr. 1971	May 1971	June 1971	1970-1971 Cum.
July 1970													
Aug. 1970	***												
Sep. 1970	***	***											
Oct. 1970	***	***	***										
Nov. 1970	***	***	***	***									
Dec. 1970	***	***	***	***	NS								
Jan. 1971	***	***	***	***	***	***							
Feb. 1971	***	***	***	***	***	***	***						
Mar. 1971	***	***	***	***	***	***	***	***					
Apr. 1971	***	***	***	***	***	***	***	***	***				
May 1971	***	***	***	***	***	***	***	***	***	***			
June 1971	***	***	***	***	***	***	***	***	***	***	***		
1970-1971 Cum.	***	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval
 ** = significant at 99% confidence interval
 *** = significant at 99.9% confidence interval
 NS = not significant

Table 23. t test of variation in monthly species diversity index, H Bar, based on biomass, for 1970-1971, Duplin Estuary.

	July 1971	Aug. 1971	Sep. 1971	Oct. 1971	Nov. 1971	Dec. 1971	Jan. 1972	Feb. 1972	Mar. 1972	Apr. 1972	May 1972	June 1972	1971-1972 Cum.
July 1971													
Aug. 1971	***												
Sep. 1971	***	***											
Oct. 1971	***	***	***										
Nov. 1971	***	***	***	***									
Dec. 1971	***	***	***	***	***								
Jan. 1972	***	***	***	***	***	***							
Feb. 1972	***	***	***	***	***	***	***						
Mar. 1972	***	***	***	***	***	***	***	***					
Apr. 1972	***	***	***	***	***	***	***	***	***				
May 1972	***	***	***	***	***	***	***	***	***	***			
June 1972	***	***	***	***	***	***	***	***	***	***	***		
1971-1972 Cum.	***	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 24. t test of variation in monthly species diversity index, H Bar, based on biomass, for 1971-1972, Duplin Estuary.

	July 1972	Aug. 1972	Sep. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	1972- 1973 Cum.
July 1972													
Aug. 1972	***												
Sep. 1972	***	*											
Oct. 1972	***	*	NS										
Nov. 1972	***	***	***	***									
Dec. 1972	***	***	***	***	***								
Jan. 1973	***	***	***	***	***	**							
Feb. 1973	***	***	***	***	***	***	**						
Mar. 1973	***	***	***	***	***	***	***	***					
Apr. 1973	***	***	***	***	***	***	**	NS	***				
May 1973	***	***	***	NS	***	***	***	***	***	***			
June 1973	***	***	***	***	***	NS	NS	**	***	**	***		
1972- 1973 Cum.	***	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 25. t test of variation in monthly species diversity index, H Bar, based on biomass, for 1972-1973, Duplin Estuary.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Ap.6 1971	Ap.27 1971	May 1971	June 1971	1970- 1971 Cum.
July 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sep. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dec. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan. 1971	-	-	-	***	-	-	-	-	-	-	-	-	-	-
Feb. 1971	-	-	-	***	-	-	NS	-	-	-	-	-	-	-
Mar. 1971	-	-	-	***	-	-	***	***	-	-	-	-	-	-
Apr. 6, 1971	-	-	-	***	-	-	***	***	***	-	-	-	-	-
Apr. 27, 1971	-	-	-	***	-	-	NS	NS	***	***	-	-	-	-
May 1971	-	-	-	***	-	-	***	***	***	***	***	***	-	-
June 1971	-	-	-	***	-	-	***	***	***	***	***	***	***	-
1970- 1971 Cum.	-	-	-	***	-	-	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 26. t test of monthly species diversity index, H Bar, based on biomass, for all Brunswick stations, 1970-1971.

	July 1971	Aug. 1971	Sep. 1971	Oct. 1971	Nov. 1971	Dec. 1971	Jan. 1972	Feb. 1972	Mar. 1972	Apr. 1972	May 1972	June 1972	1971-1972 Cum.
July 1971													
Aug. 1971	***												
Sep. 1971	***	***											
Oct. 1971	***	***	***										
Nov. 1971	***	*	***	***									
Dec. 1971	NS	***	***	***	***								
Jan. 1972	***	***	***	***	***	***							
Feb. 1972	***	***	***	***	***	***	***						
Mar. 1972	***	***	***	***	***	***	***	NS					
Apr. 1972	***	***	NS	***	***	***	***	***	***				
May 1972	***	***	***	***	***	***	***	***	***	***			
June 1972	**	***	NS	***	***	***	***	***	***	*	***		
1971-1972 Cum.	***	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 27. t test of monthly species diversity index, H Bar, based on biomass, for all Brunswick stations, 1971-1972.

	July 1972	Aug. 1972	Sep. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	1972-1973 Cum.
July 1972													
Aug. 1972	***												
Sep. 1972	***	***											
Oct. 1972	***	***	NS										
Nov. 1972	***	NS	***	***									
Dec. 1972	***	***	***	***	***								
Jan. 1973	***	***	***	***	***	***							
Feb. 1973	***	***	***	***	***	***	***						
Mar. 1973	***	***	***	***	***	***	***	***					
Apr. 1973	***	NS	***	***	NS	***	***	***	***				
May 1973	***	***	***	***	***	***	***	***	***	***			
June 1973	***	**	***	***	***	***	***	***	NS	***	***		
1972-1973 Cum.	NS	***	***	***	***	***	***	***	***	***	***	***	

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 28. t test of monthly species diversity index, H Bar, based on biomass, for all Brunswick stations, 1972-1973.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Apr. 6, 1971	Apr. 27, 1971	May 1971	June 1971	1970-1971 Cum.
July 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sep. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dec. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Feb. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mar. 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apr. 6, 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apr. 27, 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June 1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970-1971 Cum.	-	-	-	-	-	-	-	-	-	-	-	-	-	-

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 29. t test for variation in monthly species diversity index, H Bar, based on biomass, for all Brunswick stations except Terry Creek, 1970-1971.

	July 1971	Aug. 1971	Sep. 1971	Oct. 1971	Nov. 1971	Dec. 1971	Jan. 1972	Feb. 1972	Mar. 1972	Apr. 1972	May 1972	June 1972	1971-1972 Cum.
July 1971													
Aug. 1971	***												
Sep. 1971	NS	***											
Oct. 1971	***	***	***										
Nov. 1971	***	***	***	***									
Dec. 1971	***	***	***	***	***								
Jan. 1972	***	***	***	***	***	***							
Feb. 1972	***	***	***	***	***	***	***						
Mar. 1972	***	***	***	***	***	***	***	NS					
Apr. 1972	***	***	***	***	***	***	***	***	***				
May 1972	***	***	***	***	NS	***	***	***	***	***			
June 1972	*	***	***	***	***	***	***	***	***	***	***		
1971-1972 Cum.	***	***	***	***	***	***	NS	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 30. t test for variation in monthly species diversity index, H Bar, based on biomass, for all Brunswick stations except Terry Creek, 1971-1972.

	July 1972	Aug. 1972	Sep. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	1972-1973 Cum.
July 1972													
Aug. 1972	***												
Sep. 1972	***	***											
Oct. 1972	***	***	NS										
Nov. 1972	***	***	***	***									
Dec. 1972	***	***	***	NS	***								
Jan. 1973	***	***	***	***	***	***							
Feb. 1973	***	***	***	***	***	***	***						
Mar. 1973	***	***	***	***	*	***	***	***					
Apr. 1973	***	***	***	***	NS	***	***	***	***				
May 1973	***	***	***	***	***	***	***	***	***	***			
June 1973	***	***	***	***	NS	***	***	***	***	NS	*		
1972-1973 Cum.	NS	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 31. t test for variation in monthly species diversity index, H Bar, based on biomass, for all Brunswick stations except Terry Creek, 1972-1973.

	July 1970	Aug. 1970	Sep. 1970	Oct. 1970	Nov. 1970	Dec. 1970	Jan. 1971	Feb. 1971	Mar. 1971	Ap.6 1971	Ap.27 1971	May 1971	June 1971	1970- 1971 Cum.
July 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sep. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oct. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dec. 1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan. 1971	-	-	-	*	-	-	-	-	-	-	-	-	-	-
Feb. 1971	-	-	-	***	-	-	-	-	-	-	-	-	-	-
Mar. 1971	-	-	-	NS	-	-	-	-	-	-	-	-	-	-
Apr. 6, 1971	-	-	-	***	-	-	-	-	-	-	-	-	-	-
Apr. 27, 1971	-	-	-	NS	-	-	-	-	-	-	-	-	-	-
May 1971	-	-	-	***	-	-	-	-	-	-	-	-	-	-
June 1971	-	-	-	***	-	-	-	-	-	-	-	-	-	-
1970- 1971 Cum.	-	-	-	***	-	-	-	-	-	-	-	-	-	-

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 32. t test for variation in monthly species diversity index, H Bar, based on biomass, or Terry Creek, 1970-1971.

	July 1971	Aug. 1971	Sep. 1971	Oct. 1971	Nov. 1971	Dec. 1971	Jan. 1972	Feb. 1972	Mar. 1972	Apr. 1972	May 1972	June 1972	1971-1972 Cum.
July 1971													
Aug. 1971	***												
Sep. 1971	***	***											
Oct. 1971	NS	***	***										
Nov. 1971	NS	***	***	NS									
Dec. 1971	***	***	***	***	***								
Jan. 1972	***	***	***	***	***	***							
Feb. 1972	NS	***	***	NS	NS	***	***						
Mar. 1972	NS	***	***	NS	NS	***	***	NS					
Apr. 1972	***	***	***	***	***	***	***	***	***				
May 1972	NS	***	***	NS	NS	***	***	NS	NS	***			
June 1972	NS	***	***	NS	NS	***	***	NS	NS	***	NS		
1971-1972 Cum.	***	NS	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 33. t test for variation in monthly species diversity index, H Bar, based on biomass, for Terry Creek, 1971-1972.

	July 1972	Aug. 1972	Sept. 1972	Oct. 1972	Nov. 1972	Dec. 1972	Jan. 1973	Feb. 1973	Mar. 1973	Apr. 1973	May 1973	June 1973	1972-1973 Cum.
July 1972													
Aug. 1972	***												
Sept. 1972	***	NS											
Oct. 1972	***	***	***										
Nov. 1972	***	***	***	***									
Dec. 1972	***	NS	NS	***	***								
Jan. 1973	***	***	***	***	**	***							
Feb. 1973	***	***	***	***	***	***	***						
Mar. 1973	***	***	***	***	***	***	***	***					
Apr. 1973	***	***	***	***	***	***	***	***	NS				
May 1973	***	***	***	***	***	***	***	***	NS	NS			
June 1973	***	***	***	***	***	***	***	***	NS	NS	NS		
1972-1973 Cum.	***	***	***	***	***	***	***	***	***	***	***	***	***

KEY: * = significant at 95% confidence interval

** = significant at 99% confidence interval

*** = significant at 99.9% confidence interval

NS = not significant

Table 34. t test for variation in monthly species diversity index, H Bar, based on biomass, for Terry Creek, 1972-1973.

sediments decreased also. Concurrent with this was a significant increase in species diversity of the Brunswick marsh area, especially Terry Creek. The quantitative results of the research indicate a significant improvement in the health and diversity of the ecosystem from July 1970 through June 1973.

The species diversity indices computed for this study demonstrate several important features. Dahlberg and Odum (1970) found H Bar diversity indices between 0.8 and 1.8 in monthly samples taken from another uncontaminated coastal estuary. In the present study, the control area (the Duplin Estuary) had H Bar diversity indices ranging from 0.8 to 2.5. Only during the third year (1972-1973) did Terry Creek attain a diversity index similar to the Duplin Estuary. Although seasonal differences occur in species composition of the fauna, the diversity index H Bar appears to be a good quantitative assessment of the evenness of diversity.

The purpose of this research was to document the interactions between toxaphene contamination and estuarine ecology. In addition to the data assembled in this report, several publications have results from this research. These are:

- Reimold, R. J. and C. J. Durant. 1972. Survey of Toxaphene Levels in Georgia Estuaries. Georgia Marine Science Center. Technical Report Series Number 72-2. Skidaway Island, Georgia. 51 pp.
- Reimold, R. J. and C. J. Durant. 1972. Monitoring Toxaphene Contamination in a Georgia Estuary. Georgia Marine Science Center. Technical Report Series Number 72-8. Skidaway Island, Georgia. 19 pp.

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In addition, numerous oral presentations have been made at scientific meetings and hearings. As a result of this final manipulation of the three years of data, a manuscript is currently being drafted on the relationships between species diversity indices and natural or contaminated salt marsh ecosystems.

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APPENDIX I. List of Organisms, Collection Site, Date, and Toxaphene Content.

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Salt marsh periwinkle	<u>Littorina irrorata</u>	7 Jul 1970	29	not avail.		43.9
Salt marsh cord grass	<u>Spartina alterniflora</u>	7 Jul 1970	29	not avail.		33.76
Salt marsh cord grass	<u>Spartina alterniflora</u>	7 Jul 1970	29	not avail.		18.1
Salt marsh cord grass	<u>Spartina alterniflora</u>	7 Jul 1970	29	not avail.		25.9
Salt marsh periwinkle	<u>Littorina irrorata</u>	7 Jul 1970	29	not avail.		61.9
Water		25 Aug 1970	56	29.8	29.0	.0153
Water		25 Aug 1970	99	31.5	29.0	0.0
Water		25 Aug 1970	29	13.8	33.0	17.43
Water		25 Aug 1970	34	29.8	29.5	0.0
Spot	<u>Leiostoma xanthurus</u>	25 Aug 1970	60	30.4	29.4	46.73
Silversides	<u>Anchoa</u> sp.	25 Aug 1970	99	31.5	29.0	4.51
Spot	<u>Leiostoma xanthurus</u>	25 Aug 1970	72	30.3	29.5	26.2
Silversides	<u>Anchoa</u> sp.	25 Aug 1970	72	30.3	29.5	17.37
Salt marsh periwinkle	<u>Littorina irrorata</u>	25 Aug 1970	56	29.8	29.0	3.0
Mummichog	<u>Fundulus heteroclitus</u>	25 Aug 1970	60	30.4	29.4	4.11
Mummichog	<u>Fundulus heteroclitus</u>	25 Aug 1970	29	13.8	33.0	73.83

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
Striped mullet	<u>Mugil cephalus</u>	25 Aug 1970	60	30.4 29.4	35.42
White shrimp	<u>Penaeus setiferus</u>	25 Aug 1970	60	30.4 29.4	3.03
Silversides	<u>Anchoa sp.</u>	25 Aug 1970	29	13.8 33.0	236.36
Mud crabs	<u>Sesarma sp.</u>	25 Aug 1970	2	31.1 29.0	0.0
Mud crabs	<u>Sesarma sp.</u>	25 Aug 1970	34	29.8 29.5	0.0
Mud crabs	<u>Sesarma sp.</u>	25 Aug 1970	72	30.3 29.5	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	25 Aug 1970	29	13.8 33.0	72.76
Salt marsh cord grass	<u>Spartina alterniflora</u>	25 Aug 1970	34	29.8 29.5	1.1
Salt marsh cord grass	<u>Spartina alterniflora</u>	25 Aug 1970	72	30.3 29.5	0.61
Salt marsh cord grass	<u>Spartina alterniflora</u>	25 Aug 1970	56	29.8 29.0	1.49
Salt marsh cord grass	<u>Spartina alterniflora</u>	25 Aug 1970	78	28.9 29.0	1.22
Salt marsh cord grass	<u>Spartina alterniflora</u>	25 Aug 1970	60	30.4 29.4	0.59
Salt marsh cord grass	<u>Spartina alterniflora</u>	25 Aug 1970	2	31.1 29.0	2.45
Salt marsh periwinkle	<u>Littorina irrorata</u>	23 Oct 1970	2	22.0	0.0
Salt marsh periwinkle	<u>Littorina irrorata</u>	23 Oct 1970	56	20.0	0.0
Salt marsh periwinkle	<u>Littorina irrorata</u>	23 Oct 1970	60	21.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Oct 1970	99		0.0
Mud crabs	<u>Sesarma sp.</u>	23 Oct 1970	29	14.0	0.0
White shrimp heads	<u>Penaeus setiferus</u>	23 Oct 1970	99		2.83
White shrimp muscle	<u>Penaeus setiferus</u>	23 Oct 1970	99		0.0
Silversides	<u>Anchoa sp.</u>	23 Oct 1970	29	14.0	172.1
Mummichog	<u>Fundulus heteroclitus</u>	23 Oct 1970	29	14.0	80.71
Mummichog	<u>Fundulus heteroclitus</u>	23 Oct 1970	60	21.0	15.58
White shrimp heads	<u>Penaeus setiferus</u>	23 Oct 1970	60	21.0	11.15
White shrimp muscle	<u>Penaeus setiferus</u>	23 Oct 1970	60	21.0	1.3
Silversides	<u>Anchoa sp.</u>	23 Oct 1970	60	21.0	25.1
White shrimp heads	<u>Penaeus setiferus</u>	23 Oct 1970	72	22.0	7.29
White shrimp muscle	<u>Penaeus setiferus</u>	23 Oct 1970	72	22.0	0.64
Silversides	<u>Anchoa sp.</u>	23 Oct 1970	72	22.0	10.24
Clapper rail	<u>Rallus longirostris</u>	14 Oct 1970	13		0.0
Rock sea bass	<u>Centropristes philadelphica</u>	14 Oct 1970	13		3.92
Flounder	<u>Paralichthys sp.</u>	14 Oct 1970	13		3.65

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	O/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Blue crab	<u>Callinectes sapidus</u>	14 Oct 1970	13			Trace
Terrapin liver	<u>Malaclemys terrapin</u>	5 Jan 1971	34	26.0	20.0	0.0
Lesser scaup muscle	<u>Aythya affinis</u>	5 Jan 1971	23			>500.0
Lesser scaup liver	<u>Aythya affinis</u>	5 Jan 1971	23			>500.0
Pied-billed grebe liver	<u>Podilymbus podiceps podiceps</u>	5 Jan 1971	26			>500.0
Pied-billed grebe muscle	<u>Podilymbus podiceps podiceps</u>	5 Jan 1971	26			>500.0
Cormorant liver	<u>Phalacrocorax auritus</u>	5 Jan 1971	Duplin			0.0
Cormorant muscle	<u>Phalacrocorax auritus</u>	5 Jan 1971	Duplin			0.0
Menhaden	<u>Brevoortia tyrannus</u>	2 Feb 1971	72	20.0	10.0	1.27
Weakfish	<u>Cynoscion sp.</u>	2 Feb 1971	72	20.0	10.0	2.51
Flounder	<u>Paralichthys sp.</u>	2 Feb 1971	85	25.0	15.0	0.59
Naked gobi	<u>Gobiosoma boscii</u>	2 Feb 1971	26	19.0	10.0	2.95
Silversides	<u>Anchoa sp.</u>	2 Feb 1971	29	20.0	11.0	21.39
Mummichog	<u>Fundulus heteroclitus</u>	2 Feb 1971	29	20.0	11.0	51.9
White shrimp heads	<u>Penaeus setiferus</u>	2 Feb 1971	85	25.0	15.0	0.61
White shrimp muscle	<u>Penaeus setiferus</u>	2 Feb 1971	85	25.0	15.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Striped cusk-eel	<u>Rissola marginata</u>	2 Feb 1971	85	25.0	15.0	0.72
Oyster	<u>Crassostrea virginica</u>	2 Feb 1971	26	19.0	10.0	1.94
Starfish	<u>Asterias</u> sp.	2 Feb 1971	26	19.0	10.0	1.56
White shrimp heads	<u>Penaeus setiferus</u>	2 Mar 1971	23	19.0	17.0	3.7
White shrimp muscle	<u>Penaeus setiferus</u>	2 Mar 1971	23	19.0	17.0	0.0
Sediment (surface)		25 Aug 1970	29	13.8	33.0	469.6
Sediment (in trawl)		25 Aug 1970	29	13.8	33.0	155.0
Sediment (surface)		25 Aug 1970	34	29.8	29.5	10.41
Sediment (surface)		25 Aug 1970	78	28.9	29.0	3.02
Oyster	<u>Crassostrea virginica</u>	18 Mar 1971	33			2.273
Blood ark	<u>Anadara ovalis</u>	18 Mar 1971	33			1.07
Oyster	<u>Crassostrea virginica</u>	18 Mar 1971	McKay			0.69
Oyster	<u>Crassostrea virginica</u>	8 Apr 1971	33			3.64
Oyster	<u>Crassostrea virginica</u>	8 Apr 1971	99	15.0	13.0	1.77
Oyster	<u>Crassostrea virginica</u>	1 Apr 1971	33			2.84
Spot	<u>Leiostomus xanthurus</u>	8 Apr 1971	99	15.0	13.5	1.14

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	o/oo SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Blue crab gut	<u>Callinectes sapidus</u>	8 Apr 1971	34	13.0	13.0	3.1
Blue crab muscle	<u>Callinectes sapidus</u>	8 Apr 1971	34	13.0	13.0	Trace
Mummichog	<u>Fundulus heteroclitus</u>	8 Apr 1971	29	12.0	13.0	85.6
Oysters	<u>Crassostrea virginica</u>	13 Apr 1971	33			3.8
Oysters	<u>Crassostrea virginica</u>	23 Apr 1971	McKay			0.71
Oysters	<u>Crassostrea virginica</u>	22 Apr 1971	33			2.03
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	2			Trace
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	2			1.76
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	34	13.0	13.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	34	13.0	13.0	Trace
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	72	15.0	14.3	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	72	15.0	14.3	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	99	15.0	13.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	99	15.0	13.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	60	14.0	15.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	60	14.0	15.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Oysters	<u>Crassostrea virginica</u>	1 May 1971	33			3.82
Oysters	<u>Crassostrea virginica</u>	4 May 1971	33			3.36
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	56			0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	56			1.61
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	29	12.0	13.0	30.3
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	29	12.0	13.0	30.73
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	78	13.0	14.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Apr 1971	78	13.0	14.0	1.11
Sediment (0 to -5 cm)		1 May 1971	29			302.6
Sediment (-6 to -10 cm)		1 May 1971	29			1087.0
Sediment (-11 to -15 cm)		1 May 1971	29			1972.0
Sediment (-16 to -20 cm)		1 May 1971	29			925.0
Sediment (-21 to -25 cm)		1 May 1971	29			213.0
Sediment (-26 to -30 cm)		1 May 1971	29			150.0
Sediment (-31 to -35 cm)		1 May 1971	29			77.7
Oysters	<u>Crassostrea virginica</u>	13 May 1971	33			5.6

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
Star drum	<u>Stellifer lanceolatus</u>	25 May 1971	26	22.0 23.3	5.3
Sea cat fish	<u>Arius felis</u>	25 May 1971	72	26.0 24.0	Trace
Silversides	<u>Anchoa sp.</u>	25 May 1971	99	24.0 23.3	6.7
Blue crab gut	<u>Callinectes sapidus</u>	25 May 1971	78	23.0 23.3	Aroclor
Blue crab muscle	<u>Callinectes sapidus</u>	25 May 1971	78	23.0 23.3	Aroclor
Croaker	<u>Micropogon undulatus</u>	25 May 1971	60	23.0 23.3	1.97
Silversides	<u>Anchoa sp.</u>	25 May 1971	29	22.0 25.5	18.07
Mummichog	<u>Fundulus heteroclitus</u>	25 May 1971	29	22.0 25.5	53.7
Oysters	<u>Crassostrea virginica</u>	21 May 1971	33		2.59
Oysters	<u>Crassostrea virginica</u>	25 May 1971	33		1.17
Oysters	<u>Crassostrea virginica</u>	13 May 1971	McKay		1.6
Oysters	<u>Crassostrea virginica</u>	2 Jun 1971	33		1.12
Sea lettuce	<u>Ulva lactuca</u>	1 May 1971	33		0.0
Salt marsh periwinkle	<u>Littorina irrorata</u>	8 Apr 1971	34	13.0 13.0	0.0
Salt marsh periwinkle	<u>Littorina irrorata</u>	8 Apr 1971	99	15.0 13.0	0.0
Salt marsh periwinkle	<u>Littorina irrorata</u>	8 Apr 1971	60	14.0 15.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
Salt marsh periwinkle	<u>Littorina irrorata</u>	8 Apr 1971	78	13.0 13.0	0.0
Ribbed mussel	<u>Modiolus demissus</u>	25 Apr 1971	56		2.86
Oysters	<u>Crassostrea virginica</u>	10 Jun 1971	33		2.06
Channeled whelk	<u>Busycon canaliculatum</u>	2 Feb 1971	85	25.0 10.0	0.0
Mummichog	<u>Fundulus heteroclitus</u>	23 Oct 1970	78	18.0	7.6
Silversides	<u>Anchoa sp.</u>	23 Oct 1970	78	18.0	36.7
Weakfish	<u>Cynoscion sp.</u>	2 Feb 1971	85	25.0 15.0	2.8
Sediment (-71 to -80 cm)		10 Jun 1971	29		83.2
Sediment (-61 to -70 cm)		10 Jun 1971	29		68.5
Sediment (-51 to -60 cm)		10 Jun 1971	29		433.6
Sediment (-41 to -50 cm)		10 Jun 1971	29		1236.7
Sediment (-31 to -40 cm)		10 Jun 1971	29		1367.2
Sediment (-21 to -30 cm)		10 Jun 1971	29		1324.0
Sediment (-11 to -20 cm)		10 Jun 1971	29		1340.5
Sediment (0 to -10 cm)		10 Jun 1971	29		1858.3
Oysters	<u>Crassostrea virginica</u>	23 Jun 1971	33		1.35

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
Silversides	<u>Anchoa sp.</u>	23 Jun 1971	26		3.1
Star drum	<u>Stellifer lanceolatus</u>	23 Jun 1971	72		0.65
Silversides	<u>Anchoa sp.</u>	23 Jun 1971	99	25.0 28.0	4.59
Cutlass fish	<u>Trichiurus lepturus</u>	23 Jun 1971	99	25.0 28.0	2.14
White shrimp heads	<u>Penaeus setiferus</u>	23 Jun 1971	78	24.0 28.0	1.8
Spot	<u>Leiostomus xanthurus</u>	23 Jun 1971	60	20.0 28.0	1.37
Mummichog	<u>Fundulus heteroclitus</u>	23 Jun 1971	29	21.0 30.0	50.5
Silversides	<u>Anchoa sp.</u>	23 Jun 1971	29	21.0 30.0	13.8
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	2	15.0 27.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	26	25.0 27.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	72	25.0 26.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	99	25.0 28.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	56	25.0 28.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	78	24.0 28.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	60	20.0 28.0	0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	23 Jun 1971	29	21.0 30.0	98.8

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
Sediment (-71 to -80 cm)		10 Jun 1971	23		5.27
Sediment (-61 to -70 cm)		10 Jun 1971	23		18.5
Sediment (-51 to -60 cm)		10 Jun 1971	23		21.0
Sediment (-41 to -50 cm)		10 Jun 1971	23		79.8
Sediment (-31 to -40 cm)		10 Jun 1971	23		70.65
Sediment (-21 to -30 cm)		10 Jun 1971	23		21.9
Sediment (-11 to -20 cm)		10 Jun 1971	23		35.47
Sediment (0 to -10 cm)		10 Jun 1971	23		35.5
Sediment (0 to -10 cm)		10 Jun 1971	31		11.85
Sediment (-11 to -20 cm)		10 Jun 1971	31		615.64
Sediment (-21 to -30 cm)		10 Jun 1971	31		16.04
Sediment (-31 to -40 cm)		10 Jun 1971	31		17.46
Sediment (-41 to -50 cm)		10 Jun 1971	31		5.42
Sediment (-51 to -60 cm)		10 Jun 1971	31		3.4
Sediment (-61 to 70 cm)		10 Jun 1971	31		2.88
Silversides	<u>Anchoa sp.</u>	20 Jul 1971	34	25.0	29.0
					4.34

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Spot	<u>Leiostomus xanthurus</u>	20 Jul 1971	34	25.0	29.0	Trace
White shrimp heads	<u>Penaeus setiferus</u>	20 Jul 1971	72	26.0	29.0	2.38
White shrimp muscle	<u>Penaeus setiferus</u>	20 Jul 1971	72	26.0	29.0	Trace
Silversides	<u>Anchoa sp.</u>	20 Jul 1971	72	26.0	29.0	2.114
Silversides	<u>Anchoa sp.</u>	20 Jul 1971	78	26.0	30.0	2.35
White shrimp heads	<u>Penaeus setiferus</u>	20 Jul 1971	78	26.0	30.0	0.0
Fiddler crab	<u>Uca sp.</u>	20 Jul 1971	72	26.0	29.0	0.0
Mud crab	<u>Sesarma sp.</u>	20 Jul 1971	72	26.0	29.0	0.0
Salt marsh periwinkle	<u>Littorina irrorata</u>	20 Jul 1971	34	25.0	29.0	Trace
Salt marsh periwinkle	<u>Littorina irrorata</u>	20 Jul 1971	72	26.0	29.0	Trace
White shrimp heads	<u>Penaeus setiferus</u>	20 Jul 1971	99	25.0	29.5	0.0
Croaker	<u>Micropogon undulatus</u>	20 Jul 1971	99	25.0	29.5	0.0
Spot	<u>Leiostomus xanthurus</u>	20 Jul 1971	60	25.0	29.5	1.151
White shrimp heads	<u>Penaeus setiferus</u>	20 Jul 1971	60	25.0	29.5	Trace
Yellowtail	<u>Bairdiella chrysura</u>	20 Jul 1971	60	25.0	29.5	2.713
Silversides	<u>Anchoa sp.</u>	20 Jul 1971	60	25.0	29.5	1.018

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE		RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
		DATE				
Salt marsh periwinkle	<u>Littorina irrorata</u>	20 Jul 1971	56	25.0	31.0	16.74
Mummichog	<u>Fundulus heteroclitus</u>	13 Jul 1971	2	22.0	28.0	10.4
Striped mullet liver	<u>Mugil cephalus</u>	13 Jul 1971	2	22.0	28.0	33.85
Striped mullet muscle	<u>Mugil cephalus</u>	13 Jul 1971	2	22.0	28.0	35.6
Mummichog	<u>Fundulus heteroclitus</u>	13 Jul 1971	60	24.0	26.0	2.48
Striped mullet liver	<u>Mugil cephalus</u>	13 Jul 1971	60	24.0	26.0	6.28
Striped mullet muscle	<u>Mugil cephalus</u>	13 Jul 1971	60	24.0	26.0	7.65
Striped mullet muscle	<u>Mugil cephalus</u>	13 Jul 1971	78	22.0	27.0	2.38
Mummichog	<u>Fundulus heteroclitus</u>	13 Jul 1971	78	22.0	27.0	2.36
Salt marsh periwinkle	<u>Littorina irrorata</u>	13 Jul 1971	29	20.0	29.0	23.257
Salt marsh periwinkle	<u>Littorina irrorata</u>	13 Jul 1971	56	23.0	28.5	1.81
Oysters	<u>Crassostrea virginica</u>	13 Jul 1971	33			1.146
Silversides	<u>Anchoa sp.</u>	14 Jul 1971	Duplin	18.0	30.0	0.0
Menhaden gut	<u>Brevoortia tyrannus</u>	14 Jul 1971	Duplin	18.0	30.0	0.0
Menhaden muscle	<u>Brevoortia tyrannus</u>	14 Jul 1971	Duplin	18.8	30.0	0.0
Spot gut	<u>Leiostomus xanthurus</u>	14 Jul 1971	Duplin	18.0	30.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION		RIVER OR QUAD. #	H ₂ O TEMP.	PPM TOXAPHENE
		DATE				
Spot muscle	<u>Leiostomus xanthurus</u>	14 Jul 1971	Duplin	18.0	30.0	0.0
Weakfish muscle	<u>Cynoscion sp.</u>	14 Jul 1971	Duplin	18.0	30.0	0.0
Weakfish ovary	<u>Cynoscion sp.</u>	14 Jul 1971	Duplin	18.0	30.0	0.0
Spot	<u>Leiostomus xanthurus</u>	30 Jun 1971	Duplin	21.0	29.0	0.0
Silversides	<u>Anchoa sp.</u>	30 Jun 1971	Duplin	21.0	29.0	0.0
Weakfish	<u>Cynoscion sp.</u>	30 Jun 1971	Duplin	21.0	29.0	0.0
Harvest fish	<u>Peprilus alepidotus</u>	30 Jun 1971	Duplin	21.0	29.0	0.0
Blue crab gut	<u>Callinectes sapidus</u>	30 Jun 1971	Duplin	21.0	29.0	0.0
White shrimp heads	<u>Penaeus setiferus</u>	30 Jun 1971	Duplin	22.0	30.0	0.0
White shrimp muscle	<u>Penaeus setiferus</u>	30 Jun 1971	Duplin	22.0	30.0	0.0
Silversides	<u>Anchoa sp.</u>	28 Jul 1971	Duplin	18.0	29.0	0.0
Spanish mackerel	<u>Scomberomorus maculatus</u>	28 Jul 1971	Duplin	18.0	29.0	0.0
Spot	<u>Leiostomus xanthurus</u>	28 Jul 1971	Duplin	18.0	29.0	0.0
Weakfish	<u>Cynoscion sp.</u>	28 Jul 1971	Duplin	18.0	29.0	0.0
Croaker	<u>Micropogon undulatus</u>	28 Jul 1971	Duplin	18.0	29.0	0.0
Squid	<u>Loligo sp.</u>	28 Jul 1971	Duplin	18.0	29.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION		RIVER OR QUAD. #	H ₂ O SAL.	TEMP.	PPM TOXAPHENE
		DATE					
Oyster	<u>Crassostrea virginica</u>	16 Jul 1971	McKay				Trace
Willet breast	<u>Catoptrophorus semipalmatus</u>	24 Jul 1971	29				0.0
Willet liver	<u>Catoptrophorus semipalmatus</u>	24 Jul 1971	29				0.0
Redwing blackbird	<u>Agelaius phoeniceus</u>	24 Jul 1971	29				0.0
Redwing blackbird	<u>Agelaius phoeniceus</u>	24 Jul 1971	29				0.0
Seaside sparrow	<u>Ammodramus maritima</u>	24 Jul 1971	29				0.0
Long-billed marsh wren	<u>Telmatochlamys palustris</u>	24 Jul 1971	29				4.081
Boat-tailed grackle	<u>Cassidix mexicanus</u>	20 Jul 1971	78	25.0	29.0		0.0
Boat-tailed grackle	<u>Cassidix mexicanus</u>	20 Jul 1971	78	25.0	29.0		0.0
Dowitcher breast	<u>Limnodromus griseus</u>	20 Jul 1971	29	25.0	29.0		1.891
Dowitcher liver	<u>Limnodromus griseus</u>	20 Jul 1971	29	25.0	29.0		5.144
Croaker	<u>Micropogon undulatus</u>	28 Jul 1971	Duplin	18.0	29.0		0.0
Perennial glasswort	<u>Salicornia virginica</u>	26 Jul 1971	29				Trace
Salt marsh cord grass	<u>Spartina alterniflora</u>	3 Aug 1971	29				2.1
Salt marsh ox-eye leaves	<u>Borrchia frutescens</u>	3 Aug 1971	29				4.3
Salt marsh ox-eye stems	<u>Borrchia frutescens</u>	3 Aug 1971	29				Trace

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	H ₂ O °/°° SAL.	TEMP.	PPM TOXAPHENE
Perennial glasswort	<u>Salicornia virginica</u>	26 Jul 1971	29			0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	3 Aug 1971	29			0.0
Oyster	<u>Crassostrea virginica</u>	17 Aug 1971	2	15.0	26.0	1.7
Oyster	<u>Crassostrea virginica</u>	20 Aug 1971	33			1.3
Oyster	<u>Crassostrea virginica</u>	20 Aug 1971	McKay			Trace
Oyster	<u>Crassostrea virginica</u>	17 Sep 1971	McKay			0.38
Sea cat fish	<u>Arius felis</u>	17 Aug 1971	29	7.0	31.0	19.6
Oyster	<u>Crassostrea virginica</u>	17 Sep 1971	33			0.73
Mummichog	<u>Fundulus heteroclitus</u>	17 Aug 1971	29	7.0	31.0	16.8
Silversides	<u>Anchoa sp.</u>	17 Aug 1971	26	17.0	26.5	30.4
Hogchoker	<u>Achirus fasciatus</u>	17 Aug 1971	72	19.0	26.5	1.26
Mantis shrimp	<u>Squilla empusa</u>	17 Aug 1971	72	19.0	26.5	0.9
Tongue fish	<u>Symphurus plagiusa</u>	17 Aug 1971	99	22.0	27.0	1.1
Spot	<u>Leiostomus xanthurus</u>	17 Aug 1971	78	17.0	26.0	0.9
Silversides	<u>Anchoa sp.</u>	17 Aug 1971	60	20.0	27.5	3.1
Oyster	<u>Crassostrea virginica</u>	12 Oct 1971	McKay			0.1

COMMON NAME	SCIENTIFIC NAME	COLLECTION		RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
		DATE					
Oyster	<u>Crassostrea virginica</u>	12 Oct 1971	33				1.3
Oyster	<u>Crassostrea virginica</u>	12 Oct 1971	56	26.0	21.5		2.7
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Nov 1971	29				0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Nov 1971	29				0.0
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Nov 1971	29				2.52
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Nov 1971	29				3.01
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Nov 1971	29				17.14
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Nov 1971	29				6.85
Loggerhead turtle	<u>Caretta c. caretta</u>	17 Aug 1971	29	7.0	31.0		2.06
Oyster	<u>Crassostrea virginica</u>	12 Nov 1971	McKay				0.46
Yellowtail	<u>Bairdiella chrysura</u>	12 Nov 1971	72	21.0	17.5		14.54
Silversides	<u>Anchoa sp.</u>	12 Nov 1971	99	21.0	17.0		2.08
Silversides	<u>Anchoa sp.</u>	12 Nov 1971	34	21.0	18.0		5.74
Weakfish	<u>Cynoscion sp.</u>	12 Nov 1971	60	21.0	16.5		1.8
White shrimp heads	<u>Penaeus setiferus</u>	12 Nov 1971	78	20.0	17.0		0.92
Silversides	<u>Anchoa sp.</u>	12 Nov 1971	29	15.0	20.5		119.46

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	O/oo SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Salt marsh ox-eye	<u>Borrhichia frutescens</u>	12 Nov 1971	29	15.0	20.5	0.53
Salt marsh cord grass	<u>Spartina alterniflora</u>	12 Nov 1971	29	15.0	20.5	4.14
Salt marsh periwinkle	<u>Littorina irrórata</u>	12 Nov 1971	29	15.0	20.5	2.31
Fiddler crab	<u>Uca sp.</u>	9 Dec 1971	29			1.768
Fiddler crab	<u>Uca sp.</u>	9 Dec 1971	29			0.391
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Dec 1971	29			4.441
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Dec 1971	29			13.796
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Dec 1971	29			2.1
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Dec 1971	29			2.1
Salt marsh cord grass	<u>Spartina alterniflora</u>	8 Dec 1971	29			5.06
Oyster	<u>Crassostrea virginica</u>	8 Dec 1971	McKay			0.625
Fiddler crab	<u>Uca sp.</u>	9 Dec 1971	29			1.26
Fiddler crab	<u>Uca sp.</u>	9 Dec 1971	29			1.33
Salt marsh cord grass	<u>Spartina alterniflora</u>	11 Jan 1972	29			0.419
Salt marsh cord grass	<u>Spartina alterniflora</u>	11 Jan 1972	29			0.349
Fiddler crab	<u>Uca sp.</u>	11 Jan 1972	29			1.68

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD, #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
Sediment		11 Jan 1972	29		17.27
Sediment		9 Dec 1971	29		63.72
Salt marsh cord grass	<u>Spartina alterniflora</u>	18 Jan 1972	2	18.0 11.0	0.32
Salt marsh cord grass	<u>Spartina alterniflora</u>	18 Jan 1972	56	16.0 11.0	2.61
Star drum	<u>Stellifer lanceolatus</u>	18 Jan 1972	26	20.0 11.0	4.104
Star drum	<u>Stellifer lanceolatus</u>	18 Jan 1972	72	21.0 11.5	2.136
White shrimp heads	<u>Penaeus setiferus</u>	18 Jan 1972	72	21.0 11.5	2.464
Hog choker	<u>Achirus fasciatus</u>	18 Jan 1972	72	21.0 11.5	1.99
Menhaden	<u>Brevoortia tyrannus</u>	18 Jan 1972	99	20.0 11.5	Trace
Common eel	<u>Anguilla rostrata</u>	18 Jan 1972	60	16.0 12.0	3.27
Mullet	<u>Mugil cephalus</u>	18 Jan 1972	78	15.0 11.0	13.05
Silversides	<u>Anchoa sp.</u>	18 Jan 1972	29	18.0 14.0	19.6
Silversides	<u>Anchoa sp.</u>	18 Jan 1972	78	15.0 11.0	7.9
Silversides	<u>Anchoa sp.</u>	29 May 1973	2	24.0 26.0	2.775
Common eel	<u>Anguilla rostrata</u>	29 May 1973	2	24.0 26.0	2.476
Oyster	<u>Crassostrea virginica</u>	29 May 1973	33		0.444

COMMON NAME	SCIENTIFIC NAME	COLLECTION		RIVER OR QUAD. #	H ₂ O SAL. TEMP.	PPM TOXAPHENE
		DATE				
Oyster	<u>Crassostrea virginica</u>	18 Jan 1972	McKay			1.17
Oyster	<u>Crassostrea virginica</u>	17 Feb 1972	McKay			0.78
Sediment		10 Feb 1972	29			42.417
Salt marsh cord grass	<u>Spartina alterniflora</u>	10 Feb 1972	29			1.91
Salt marsh cord grass	<u>Spartina alterniflora</u>	10 Feb 1972	29			1.24
Salt marsh cord grass	<u>Spartina alterniflora</u>	10 Feb 1972	29			2.15
Oyster	<u>Crassostrea virginica</u>	11 Apr 1972	McKay			0.94
Oyster	<u>Crassostrea virginica</u>	15 Mar 1972	McKay			0.85
Oyster	<u>Crassostrea virginica</u>	11 Apr 1972	2	17.0	18.0	3.6
Oyster	<u>Crassostrea virginica</u>	11 Apr 1972	56	20.0	19.0	3.98
Oyster	<u>Crassostrea virginica</u>	9 May 1972	McKay			0.868
Silversides	<u>Anchoa sp.</u>	11 Apr 1972	60	19.0	19.0	11.923
Silversides	<u>Anchoa sp.</u>	11 Apr 1972	26	16.0	18.0	5.426
White shrimp heads	<u>Penaeus setiferus</u>	11 Apr 1972	72	18.0	18.0	0.97
White shrimp muscle	<u>Penaeus setiferus</u>	11 Apr 1972	72	18.0	18.0	0.448
Mummichog	<u>Fundulus heteroclitus</u>	11 Apr 1972	29	15.0	19.0	25.91

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	o/oo SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Mummichog	<u>Fundulus heteroclitus</u>	6 Jun 1972	29	14.0	28.5	26.05
Silversides	<u>Anchoa</u> sp.	11 Apr 1972	29	15.0	19.0	1.44
Spot	<u>Leiostomus xanthurus</u>	11 Apr 1972	78	20.0	19.0	2.59
Weakfish	<u>Cynoscion</u> sp.	11 Apr 1972	99	20.0	18.0	0.927
Southern kingfish	<u>Menticirrhus americanus</u>	11 Apr 1972	99	20.0	18.0	0.775
Oyster	<u>Crassostrea virginica</u>	6 Jun 1972	2	20.0	25.0	2.79
Oyster	<u>Crassostrea virginica</u>	6 Jun 1972	56	22.0	26.0	1.44
Mummichog	<u>Fundulus heteroclitus</u>	19 May 1972	29	20.0	24.5	29.305
Tongue fish	<u>Symphurus plagiusa</u>	23 May 1972	72	24.0	24.0	1.89
White shrimp heads	<u>Penaeus setiferus</u>	23 May 1972	60	24.0	25.0	1.854
White shrimp muscle	<u>Penaeus setiferus</u>	23 May 1972	60	24.0	25.0	0.708
Silversides	<u>Anchoa</u> sp.	23 May 1972	60	24.0	25.0	2.24
Croaker	<u>Micropogon undulatus</u>	23 May 1972	60	24.0	25.0	5.774
Spot	<u>Leiostomus xanthurus</u>	23 May 1972	60	24.0	25.0	2.338
Silversides	<u>Anchoa</u> sp.	23 May 1972	99	24.0	24.0	2.128
Oyster	<u>Crassostrea virginica</u>	5 Jul 1972	56	26.0	31.0	1.394

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	o/oo SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Sediment		5 Jul 1972	56	26.0	31.0	0.804
Salt marsh cord grass	<u>Spartina alterniflora</u>	5 Jul 1972	56	26.0	31.0	Trace
Sediment		5 Jul 1972	2	28.0	29.0	1.296
Salt marsh cord grass	<u>Spartina alterniflora</u>	5 Jul 1972	2	28.0	29.0	0.468
Sediment		5 Jul 1972	60	26.0	30.0	1.019
Salt marsh cord grass	<u>Spartina alterniflora</u>	5 Jul 1972	60	26.0	30.0	Trace
Sediment		5 Jul 1972	29	29.0	30.0	6.851
Salt marsh cord grass	<u>Spartina alterniflora</u>	5 Jul 1972	29	29.0	30.0	2.57
Sediment		5 Jul 1972	26	28.0	30.0	2.072
Salt marsh cord grass	<u>Spartina alterniflora</u>	5 Jul 1972	26	28.0	30.0	Trace
Oyster	<u>Crassostrea virginica</u>	5 Jul 1972	2	28.0	29.0	1.393
White shrimp heads	<u>Penaeus setiferus</u>	5 Jul 1972	2	28.0	29.0	2.13
White shrimp muscle	<u>Penaeus setiferus</u>	5 Jul 1972	2	28.0	29.0	0.786
Croaker	<u>Micropogon undulatus</u>	5 Jul 1972	72	27.0	29.5	2.53
White shrimp heads	<u>Penaeus setiferus</u>	5 Jul 1972	60	26.0	30.0	1.251
White shrimp muscle	<u>Penaeus setiferus</u>	5 Jul 1972	60	26.0	30.0	TRACE

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Silversides	<u>Anchoa sp.</u>	5 Jul 1972	60	26.0	30.0	1.978
Mummichog	<u>Fundulus heteroclitus</u>	5 Jul 1972	60	26.0	30.0	1.803
Spot	<u>Leiostomus xanthurus</u>	5 Jul 1972	60	26.0	30.0	1.539
Mummichog	<u>Fundulus heteroclitus</u>	5 Jul 1972	78	25.0	31.5	2.356
White shrimp heads	<u>Penaeus setiferus</u>	5 Jul 1972	78	25.0	31.5	0.96
White shrimp muscle	<u>Penaeus setiferus</u>	5 Jul 1972	78	25.0	31.5	Trace
Yellowtail	<u>Bairdiella chrysura</u>	5 Jul 1972	78	25.0	31.5	1.083
Mullet	<u>Mugil cephalus</u>	5 Jul 1972	78	25.0	31.5	1.269
Silversides	<u>Anchoa sp.</u>	5 Jul 1972	29	29.0	30.0	3.78
Mummichog	<u>Fundulus heteroclitus</u>	5 Jul 1972	29	29.0	30.0	26.648
Silversides	<u>Anchoa sp.</u>	5 Jul 1972	99	25.0	29.0	Trace
White shrimp heads	<u>Penaeus setiferus</u>	5 Jul 1972	99	25.0	29.0	0.789
White shrimp muscle	<u>Penaeus setiferus</u>	5 Jul 1972	99	25.0	29.0	0.441
Spot	<u>Leiostomus xanthurus</u>	5 Jul 1972	26	28.0	30.0	3.741
White shrimp heads	<u>Penaeus setiferus</u>	15 Aug 1972	26			0.0
White shrimp muscle	<u>Penaeus setiferus</u>	15 Aug 1972	26			0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	O/∞ SAL.	H ₂ O TEMP	PPM TOXAPHENE
Croaker	<u>Micropogon undulatus</u>	15 Aug 1972	26			1.933
White shrimp heads	<u>Penaeus setiferus</u>	15 Aug 1972	72			0.911
White shrimp muscle	<u>Penaeus setiferus</u>	15 Aug 1972	72			0.0
White shrimp heads	<u>Penaeus setiferus</u>	15 Aug 1972	99			0.0
White shrimp muscle	<u>Penaeus setiferus</u>	15 Aug 1972	99			0.0
White shrimp heads	<u>Penaeus setiferus</u>	15 Aug 1972	60			0.0
White shrimp muscle	<u>Penaeus setiferus</u>	15 Aug 1972	60			0.0
Silversides	<u>Anchoa sp.</u>	15 Aug 1972	60			1.387
White shrimp heads	<u>Penaeus setiferus</u>	15 Aug 1972	78			0.0
White shrimp muscle	<u>Penaeus setiferus</u>	15 Aug 1972	78			0.0
White shrimp heads	<u>Penaeus setiferus</u>	15 Aug 1972	29			13.8
White shrimp muscle	<u>Penaeus setiferus</u>	15 Aug 1972	29			0.0
Mummichog	<u>Fundulus heteroclitus</u>	2 Sep 1972	29			10.453
Mummichog	<u>Fundulus heteroclitus</u>	2 Sep 1972	29			8.97
Water		2 Sep 1972	29			0.0
Water		2 Sep 1972	29			0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL. TEMP.	H ₂ O PPM TOXAPHENE
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Sep 1972	23		0.826
Salt marsh cord grass	<u>Spartina alterniflora</u>	2 Sep 1972	23		0.76
Oyster	<u>Crassostrea virginica</u>	2 Sep 1972	33		1.207
Oyster	<u>Crassostrea virginica</u>	2 Sep 1972	33		1.37
Sediment		2 Sep 1972	23		5.476
Sediment		2 Sep 1972	23		4.424
Salt marsh cord grass	<u>Spartina alterniflora</u>	14 Sep 1972	23		1.56
Salt marsh cord grass	<u>Spartina alterniflora</u>	14 Sep 1972	23		1.126
Silversides	<u>Anchoa sp.</u>	14 Sep 1972	29		8.612
Salt marsh periwinkle	<u>Littorina irrorata</u>	14 Sep 1972	23		0.954
Oyster	<u>Crassostrea virginica</u>	14 Sep 1972	33		1.42
Oyster	<u>Crassostrea virginica</u>	14 Sep 1972	33		1.327
White shrimp heads	<u>Penaeus setiferus</u>	14 Sep 1972	29		1.515
White shrimp heads	<u>Penaeus setiferus</u>	14 Sep 1972	29		1.215
White shrimp muscle	<u>Penaeus setiferus</u>	14 Sep 1972	29		0.581
White shrimp muscle	<u>Penaeus setiferus</u>	14 Sep 1972	29		0.856

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Star drum	<u>Stellifer lanceolatus</u>	14 Sep 1972	29			2.61
Star drum	<u>Stellifer lanceolatus</u>	14 Sep 1972	29			2.43
Yellowtail	<u>Bairdiella chrysura</u>	14 Sep 1972	29			13.488
Sediment		14 Sep 1972	23			4.2
Sediment		14 Sep 1972	23			5.5
Oyster	<u>Crassostrea virginica</u>	21 Sep 1972	33			1.55
Oyster	<u>Crassostrea virginica</u>	21 Sep 1972	33			1.71
Sediment		21 Sep 1972	23			0.945
Sediment		21 Sep 1972	23			0.872
Salt marsh cord grass	<u>Spartina alterniflora</u>	21 Sep 1972	23			0.733
Salt marsh cord grass	<u>Spartina alterniflora</u>	21 Sep 1972	23			0.562
White shrimp heads	<u>Penaeus setiferus</u>	21 Sep 1972	29			4.65
White shrimp heads	<u>Penaeus setiferus</u>	21 Sep 1972	29			4.8
White shrimp muscle	<u>Penaeus setiferus</u>	21 Sep 1972	29			0.865
White shrimp muscle	<u>Penaeus setiferus</u>	21 Sep 1972	29			0.905
Star drum	<u>Stellifer lanceolatus</u>	21 Sep 1972	29			2.09

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Spot	<u>Leiostomus xanthurus</u>	21 Sep 1972	29			0.965
Spot	<u>Leiostomus xanthurus</u>	21 Sep 1972	29			0.839
Sediment		28 Sep 1972	23			2.683
Sediment		28 Sep 1972	23			2.111
Salt marsh cord grass	<u>Spartina alterniflora</u>	28 Sep 1972	23			2.547
Salt marsh cord grass	<u>Spartina alterniflora</u>	28 Sep 1972	23			2.04
Mummichog	<u>Fundulus heteroclitus</u>	28 Sep 1972	29			3.407
Mummichog	<u>Fundulus heteroclitus</u>	28 Sep 1972	29			10.525
Silversides	<u>Anchoa sp.</u>	28 Sep 1972	29			16.602
Silversides	<u>Anchoa sp.</u>	28 Sep 1972	29			20.461
White shrimp heads	<u>Penaeus setiferus</u>	28 Sep 1972	29			3.218
White shrimp heads	<u>Penaeus setiferus</u>	28 Sep 1972	29			2.239
White shrimp muscle	<u>Penaeus setiferus</u>	28 Sep 1972	29			1.221
White shrimp muscle	<u>Penaeus setiferus</u>	28 Sep 1972	29			0.88
Oyster	<u>Crassostrea virginica</u>	28 Sep 1972	33			1.147
Oyster	<u>Crassostrea virginica</u>	28 Sep 1972	33			1.209

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Sediment		5 Oct 1972	23			5.546
Sediment		5 Oct 1972	23			7.236
Salt marsh cord grass	<u>Spartina alterniflora</u>	5 Oct 1972	23			0.913
Salt marsh cord grass	<u>Spartina alterniflora</u>	5 Oct 1972	23			0.813
Oyster	<u>Crassostrea virginica</u>	5 Oct 1972	33			1.235
Oyster	<u>Crassostrea virginica</u>	5 Oct 1972	33			1.263
Silversides	<u>Anchoa sp.</u>	5 Oct 1972	29			8.964
Threadfin herring	<u>Opisthonema oglinum</u>	5 Oct 1972	29			5.118
Star drum	<u>Stellifer lanceolatus</u>	5 Oct 1972	29			2.718
Star drum	<u>Stellifer lanceolatus</u>	5 Oct 1972	29			2.481
White shrimp heads	<u>Penaeus setiferus</u>	5 Oct 1972	29			3.027
White shrimp heads	<u>Penaeus setiferus</u>	5 Oct 1972	29			2.848
White shrimp muscle	<u>Penaeus setiferus</u>	5 Oct 1972	29			0.736
White shrimp muscle	<u>Penaeus setiferus</u>	5 Oct 1972	29			0.923
Water		21 Sep 1972	29			1.3
Water		28 Sep 1972	29			1.3

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	O ₂ /100 H ₂ O SAL. TEMP.	PPM TOXAPHENE
Water		5 Oct 1972	29		1.6
Water		12 Oct 1972	29		1.4
Saltmarsh cord grass	<u>Spartina alterniflora</u>	12 Oct 1972	23		3.926
Salt marsh cord grass	<u>Spartina alterniflora</u>	12 Oct 1972	23		3.677
Sediment		12 Oct 1972	23		3.970
Sediment		12 Oct 1972	23		4.06
Oyster	<u>Crassostrea virginica</u>	12 Oct 1972	33		1.236
Oyster	<u>Crassostrea virginica</u>	12 Oct 1972	33		1.192
White shrimp head	<u>Penaeus setiferus</u>	12 Oct 1972	29		2.878
White shrimp muscle	<u>Penaeus setiferus</u>	12 Oct 1972	29		1.488
Silversides	<u>Anchoa sp.</u>	12 Oct 1972	29		10.134
Silversides	<u>Anchoa sp.</u>	12 Oct 1972	29		9.893
Mummichog	<u>Fundulus heteroclitus</u>	12 Oct 1972	29		217.139
Mummichog	<u>Fundulus heteroclitus</u>	12 Oct 1972	29		113.137
Salt marsh cord grass	<u>Spartina alterniflora</u>	19 Oct 1972	23		7.33
Salt marsh cord grass	<u>Spartina alterniflora</u>	19 Oct 1972	23		6.258

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Oyster	<u>Crassostrea virginica</u>	19 Oct 1972	33			1.705
Oyster	<u>Crassostrea virginica</u>	19 Oct 1972	33			1.790
White shrimp heads	<u>Penaeus setiferus</u>	19 Oct 1972	29			4.304
White shrimp heads	<u>Penaeus setiferus</u>	19 Oct 1972	29			5.195
White shrimp muscle	<u>Penaeus setiferus</u>	19 Oct 1972	29			0.645
White shrimp muscle	<u>Penaeus setiferus</u>	19 Oct 1972	29			0.739
Silversides	<u>Anchoa sp.</u>	19 Oct 1972	29			11.959
Silversides	<u>Anchoa sp.</u>	19 Oct 1972	29			12.854
Mummichog	<u>Fundulus heteroclitus</u>	19 Oct 1972	29			12.072
Mummichog	<u>Fundulus heteroclitus</u>	19 Oct 1972	29			5.184
Sediment		19 Oct 1972	23			2.106
Sediment		19 Oct 1972	23			2.229
Salt marsh cord grass	<u>Spartina alterniflora</u>	26 Oct 1972	23			1.687
Salt marsh cord grass	<u>Spartina alterniflora</u>	26 Oct 1972	23			2.92
Sediment		26 Oct 1972	23			3.74
Sediment		26 Oct 1972	23			2.64

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Oyster	<u>Crassostrea virginica</u>	26 Oct 1972	33			0.942
Oyster	<u>Crassostrea virginica</u>	26 Oct 1972	33			0.949
Silversides	<u>Anchoa sp.</u>	26 Oct 1972	29			10.507
White shrimp heads	<u>Penaeus setiferus</u>	26 Oct 1972	29			10.695
White shrimp heads	<u>Penaeus setiferus</u>	26 Oct 1972	29			2.412
White shrimp muscle	<u>Penaeus setiferus</u>	26 Oct 1972	29			2.512
White shrimp muscle	<u>Penaeus setiferus</u>	26 Oct 1972	29			0.832
Star drum	<u>Stellifer lanceolatus</u>	26 Oct 1972	29			1.091
Star drum	<u>Stellifer lanceolatus</u>	26 Oct 1972	29			1.419
White shrimp heads	<u>Penaeus setiferus</u>	14 Dec 1972	72	27.0	18.0	0.0
White shrimp muscle	<u>Penaeus setiferus</u>	14 Dec 1972	72	27.0	18.0	0.0
Squid	<u>Loligo sp.</u>	14 Dec 1972	72	27.0	18.0	0.0
Silversides	<u>Anchoa sp.</u>	14 Dec 1972	72	27.0	18.0	Trace
White shrimp heads	<u>Penaeus setiferus</u>	14 Dec 1972	60	26.0	19.0	Trace
White shrimp muscle	<u>Penaeus setiferus</u>	14 Dec 1972	60	26.0	19.0	0.0
Silversides	<u>Anchoa sp.</u>	14 Dec 1972	60	26.0	19.0	2.326

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
Silversides	<u>Anchoa sp.</u>	14 Dec 1972	29	26.0	20.0	9.781
Mummichog	<u>Fundulus heteroclitus</u>	24 Jan 1973	29	8.0	14.0	26.812
Yellowtail	<u>Bairdiella chrysura</u>	24 Jan 1973	26	10.0	13.0	1.557
Star drum	<u>Stellifer lanceolatus</u>	24 Jan 1973	72	10.0	12.5	0.633
Yellowtail	<u>Bairdiella chrysura</u>	24 Jan 1973	99	10.0	13.0	1.634
Spot	<u>Leiostomus xanthurus</u>	24 Jan 1973	78	16.0	13.0	0.988
Oysters	<u>Crassostrea virginica</u>	24 Jan 1973	33	18.0	13.0	0.786
Water		6 Feb 1973	29			0.01
Oysters	<u>Crassostrea virginica</u>	6 Feb 1973	33	24.0	15.0	1.389
Oysters	<u>Crassostrea virginica</u>	6 Feb 1973	56	20.0	14.0	1.724
Yellowtail	<u>Bairdiella chrysura</u>	8 Mar 1973	2	12.0	16.5	2.129
White shrimp heads	<u>Penaeus setiferus</u>	8 Mar 1973	29	12.0	19.5	1.176
White shrimp muscle	<u>Penaeus setiferus</u>	8 Mar 1973	29	12.0	19.5	Trace
White catfish liver	<u>Ameiurus catus</u>	8 Mar 1973	60	13.0	17.0	4.623
White catfish muscle	<u>Ameiurus catus</u>	8 Mar 1973	60	13.0	17.0	1.945
Silversides	<u>Anchoa sp.</u>	3 Apr 1973	60	14.0	18.0	3.077

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	‰ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
White shrimp heads	<u>Penaeus setiferus</u>	3 Apr 1973	29	12.0	20.0	4.527
White shrimp muscle	<u>Penaeus setiferus</u>	3 Apr 1973	29	12.0	20.0	Trace
Black drum muscle	<u>Pogonias cromis</u>	3 Apr 1973	78	13.0	18.0	0.412
Black drum liver	<u>Pogonias cromis</u>	3 Apr 1973	78	13.0	18.0	Trace
Spot liver	<u>Leiostomus xanthurus</u>	3 Apr 1973	99	14.0	18.0	2.495
White shrimp heads	<u>Penaeus setiferus</u>	3 Apr 1973	72	20.0	15.0	0.0
White shrimp muscle	<u>Penaeus setiferus</u>	3 Apr 1973	72	20.0	15.0	0.0
Mullet liver	<u>Mugil cephalus</u>	3 Apr 1973	78	13.0	18.0	2.121
Oyster	<u>Crassostrea virginica</u>	3 Apr 1973	56	15.0	18.5	2.215
Silversides	<u>Anchoa sp.</u>	1 May 1973	29	15.0	23.0	2.509
Star drum	<u>Stellifer lanceolatus</u>	1 May 1973	29	15.0	23.0	0.968
Pink shrimp heads	<u>Penaeus duorarum</u>	1 May 1973	26	20.0	20.0	0.478
Pink shrimp muscle	<u>Penaeus duorarum</u>	1 May 1973	26	20.0	20.0	Trace
White shrimp heads	<u>Penaeus setiferus</u>	1 May 1973	72	22.0	21.0	1.254
White shrimp muscle	<u>Penaeus setiferus</u>	1 May 1973	72	22.0	21.0	Trace
Croaker	<u>Micropogon undulatus</u>	1 May 1973	99	20.0	21.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/∞ SAL.	H ₂ O TEMP.	PPM TOXAPHENE
White shrimp heads	<u>Penaeus setiferus</u>	1 May 1973	60	20.0	22.0	0.0
White shrimp muscle	<u>Penaeus setiferus</u>	1 May 1973	60	20.0	22.0	0.0
White shrimp heads	<u>Penaeus setiferus</u>	1 May 1973	78	18.0	21.0	0.896
White shrimp muscle	<u>Penaeus setiferus</u>	1 May 1973	78	18.0	21.0	Trace