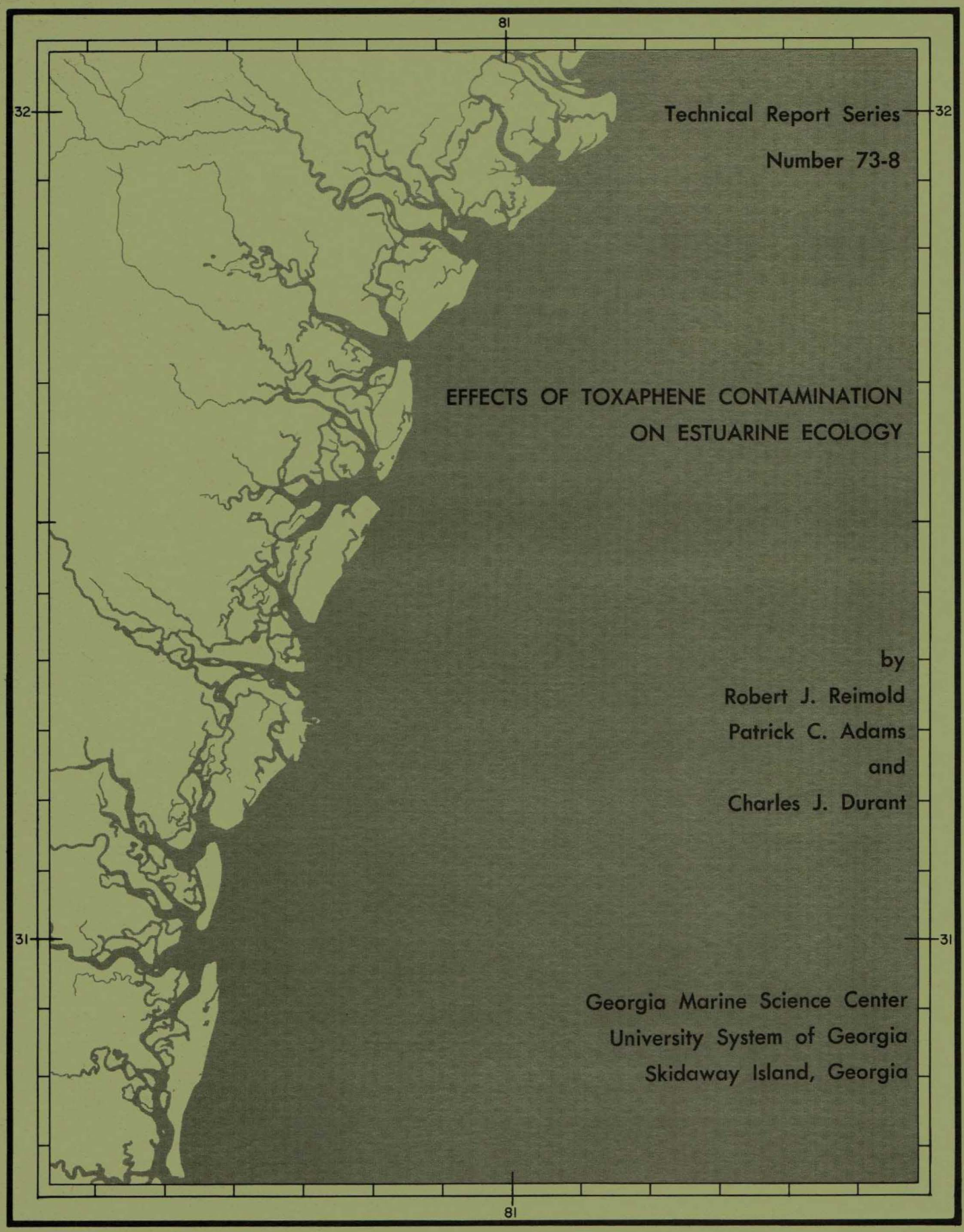


Technical Report Series

Number 73-8

EFFECTS OF TOXAPHENE CONTAMINATION ON ESTUARINE ECOLOGY

by

Robert J. Reimold

Patrick C. Adams

and

Charles J. Durant

Georgia Marine Science Center

University System of Georgia

Skidaway Island, Georgia

EFFECTS OF TOXAPHENE CONTAMINATION ON ESTUARINE ECOLOGY

by

Robert J. Reimold

Patrick C. Adams

and

Charles J. Durant

The University of Georgia
Marine Institute
Sapelo Island, Georgia 31327

September 1973

Table of Contents

List of Figures and Tables

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 Bar, 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, Goergia. 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)

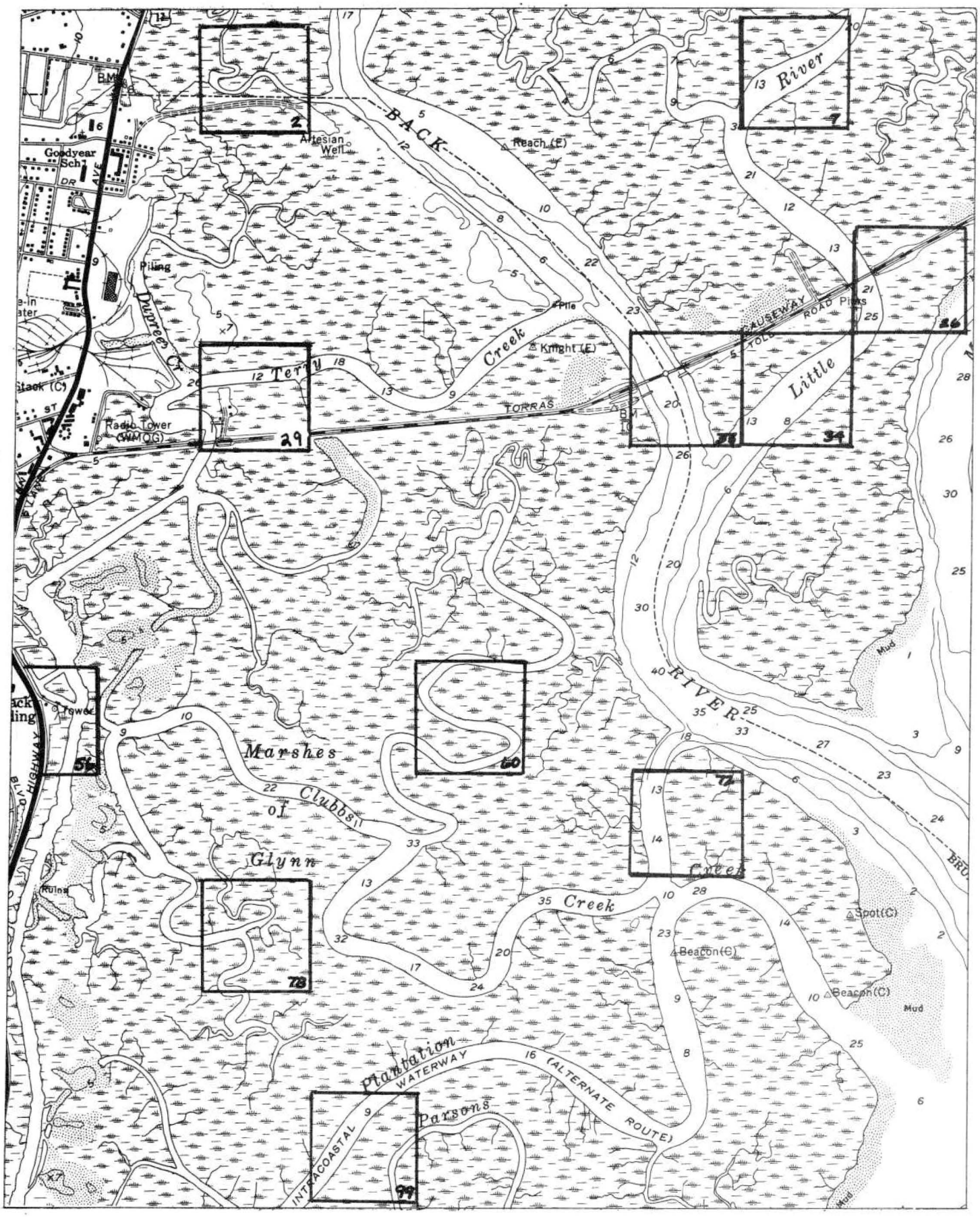


Figure 1. Collection sites in Brunswick marsh area.

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

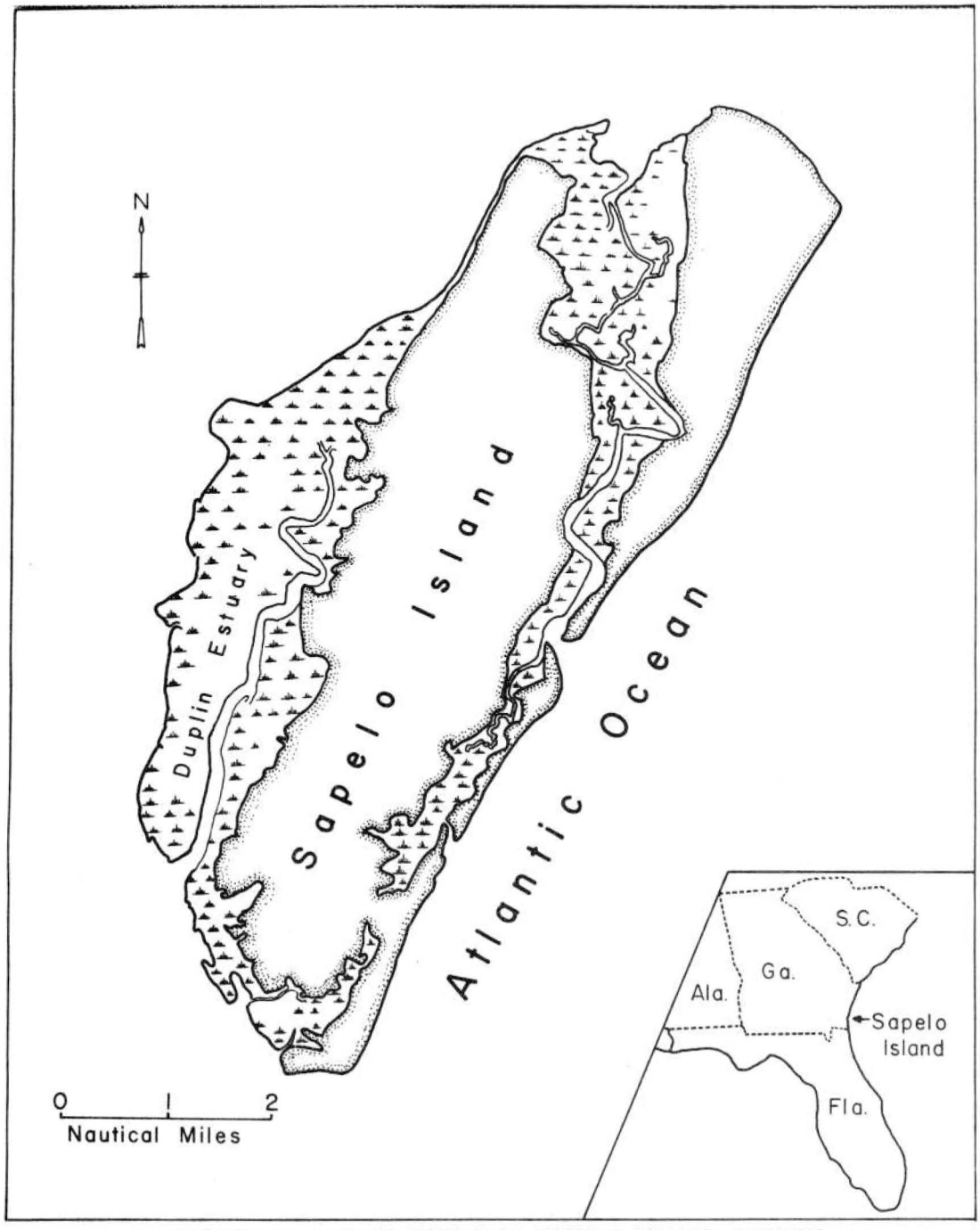


FIGURE 2 DUPLIN ESTUARY, SAPELO ISLAND, GEORGIA

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

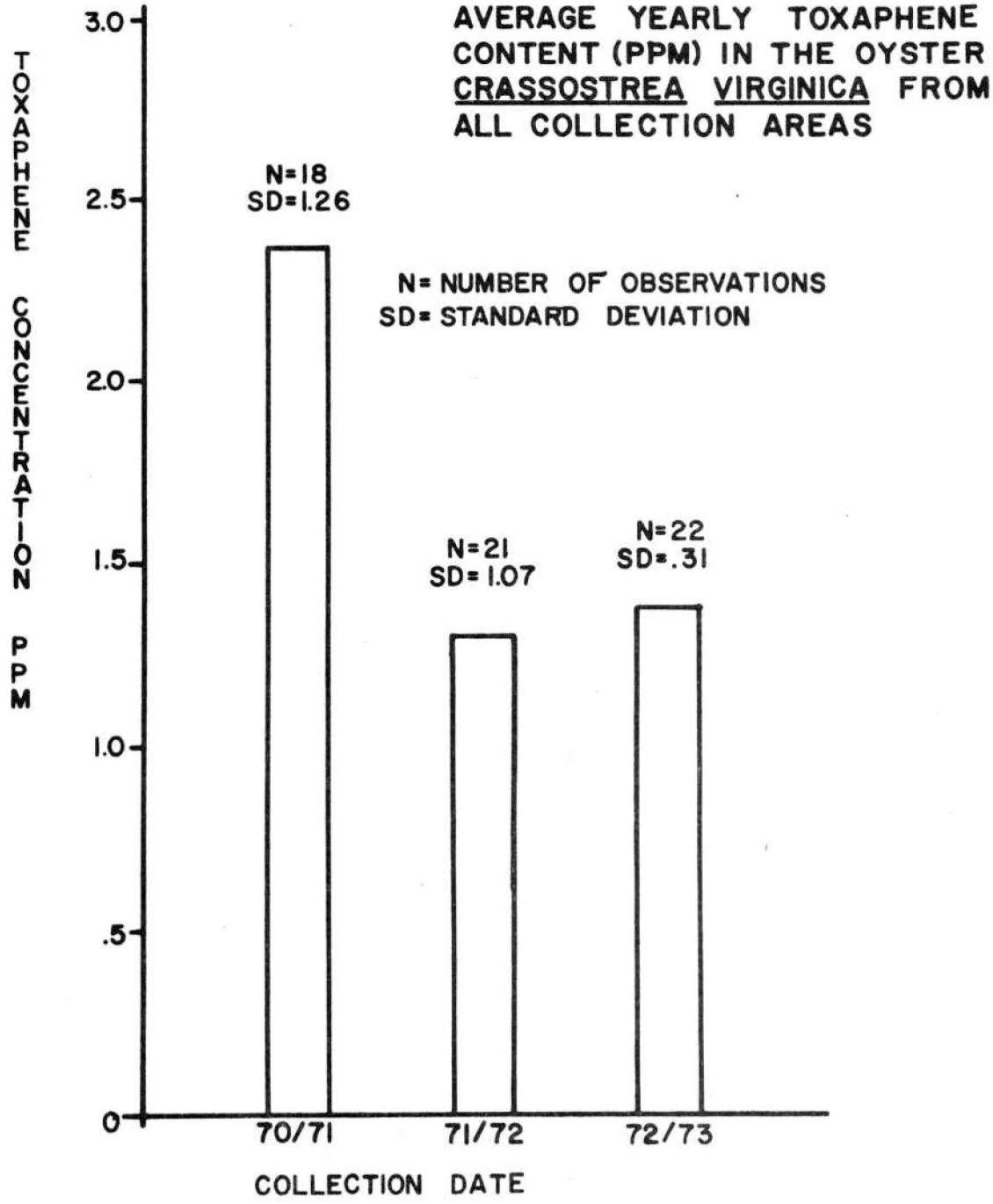
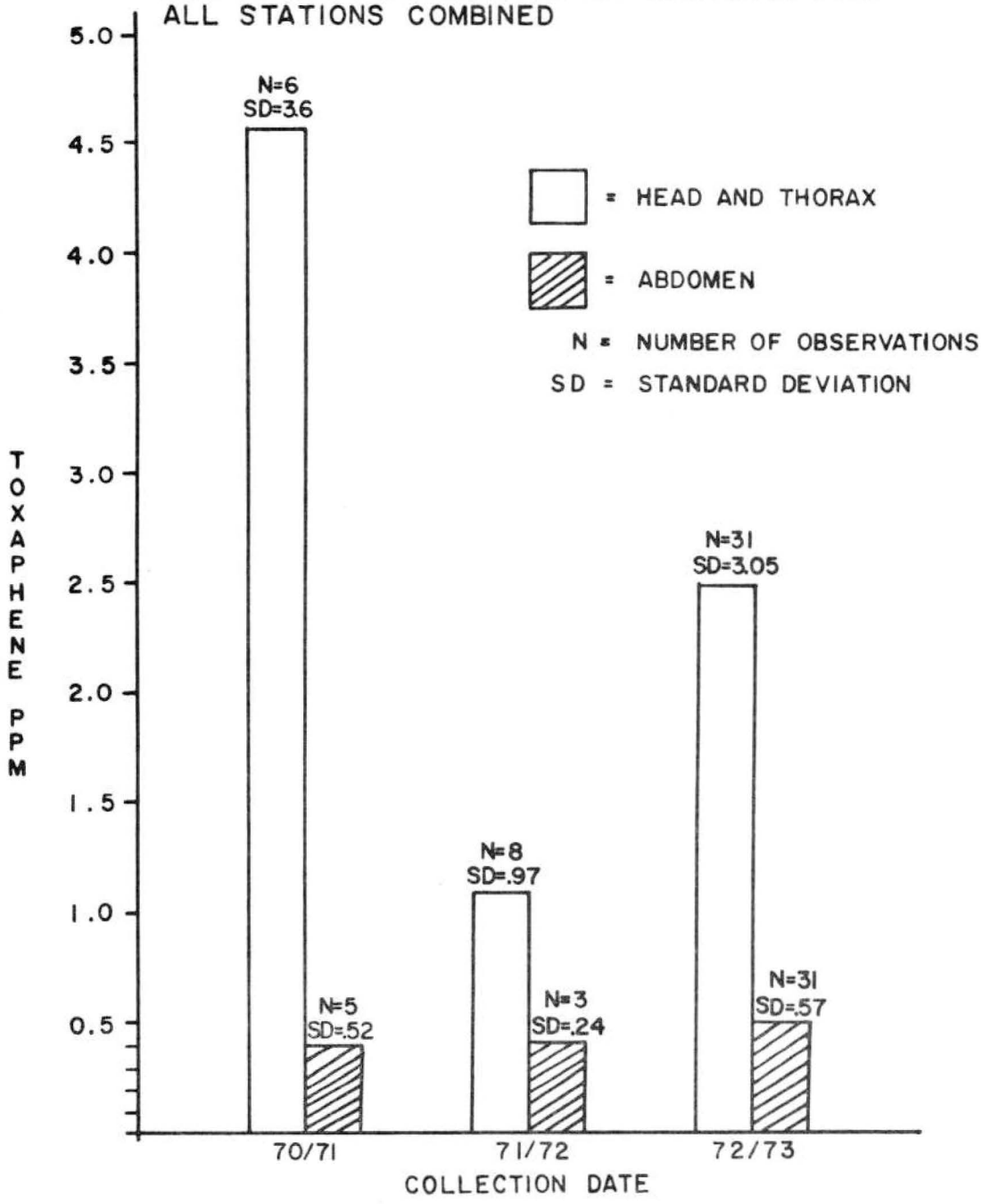

AVERAGE YEARLY TOXAPHENE CONTENT (PPM) IN THE OYSTER CRASSOSTREA VIRGINICA FROM ALL COLLECTION AREAS
TOXAPHENE CONCENTRATION PPM
3.0
2.5
2.0
1.5
1.0
.5
0
N=18
SD=1.26
N= NUMBER OF OBSERVATIONS
SD= STANDARD DEVIATION
N=21
SD=1.07
N=22
SD=.31
70/71
71/72
72/73
COLLECTION DATE

FIGURE 4

AVERAGE YEARLY TOXAPHENE CONCENTRATION IN PENAEUS SETIFERUS, WHITE SHRIMP, HEAD AND THORAX CONTRASTED TO ABDOMENS FOR ALL STATIONS COMBINED



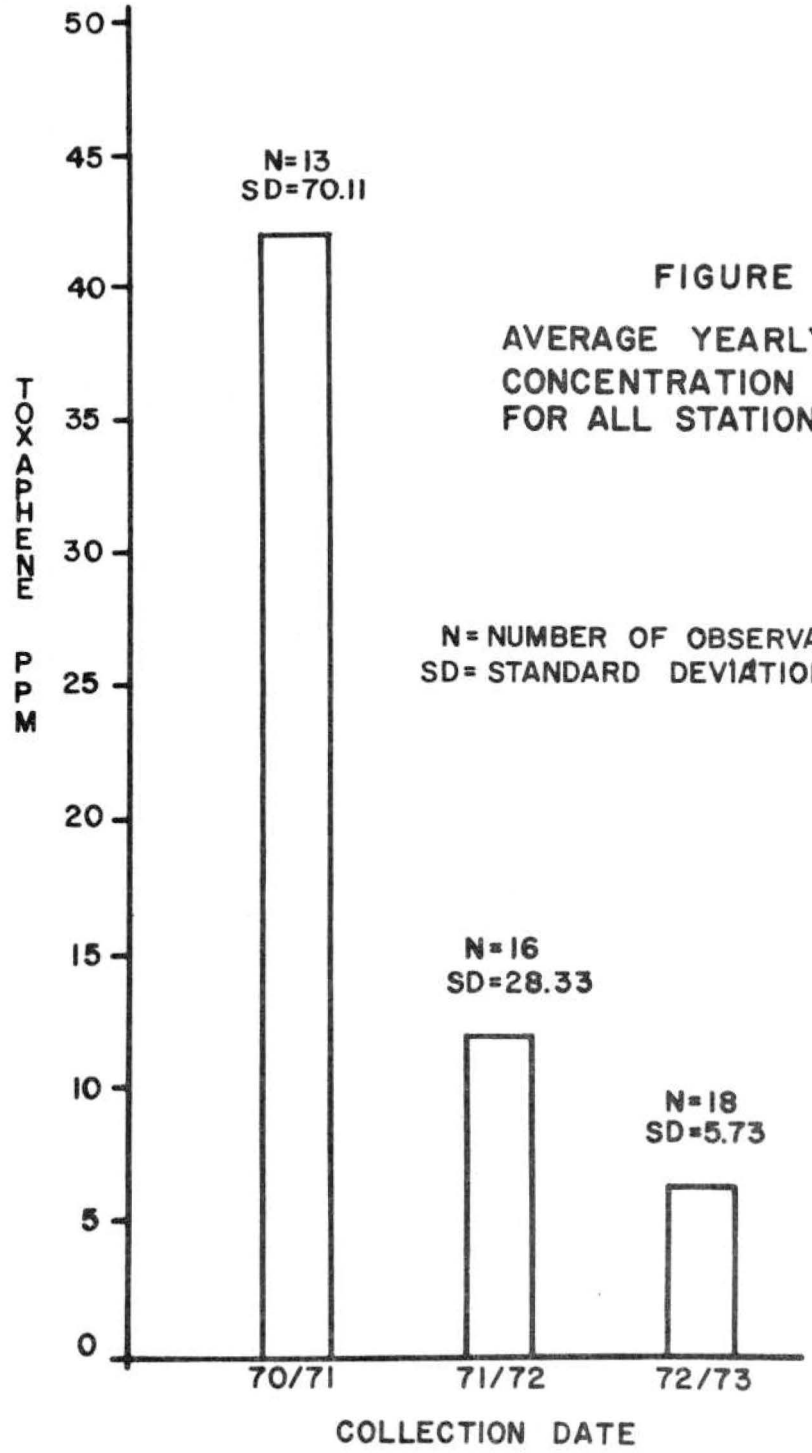


FIGURE 5

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.

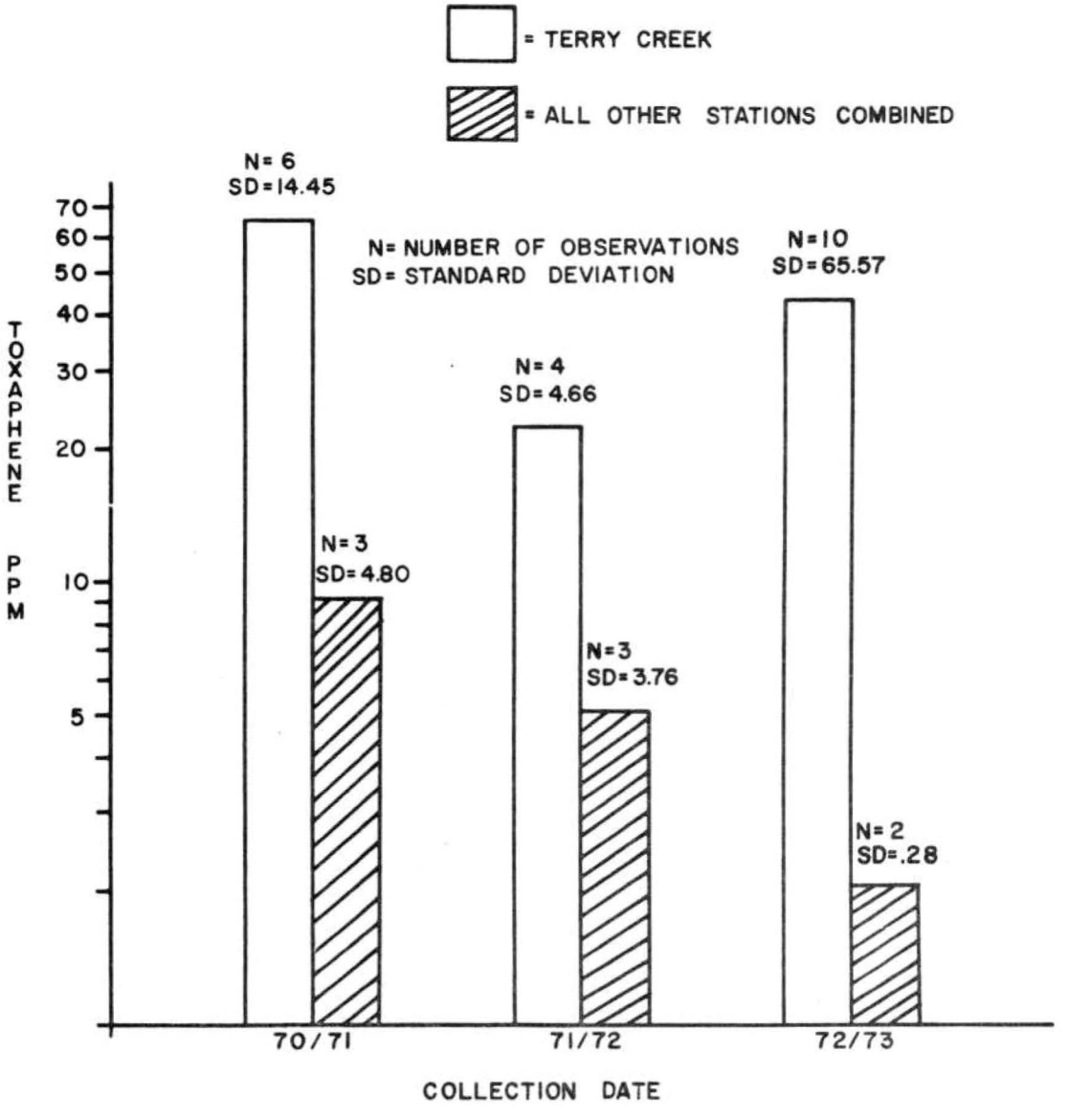
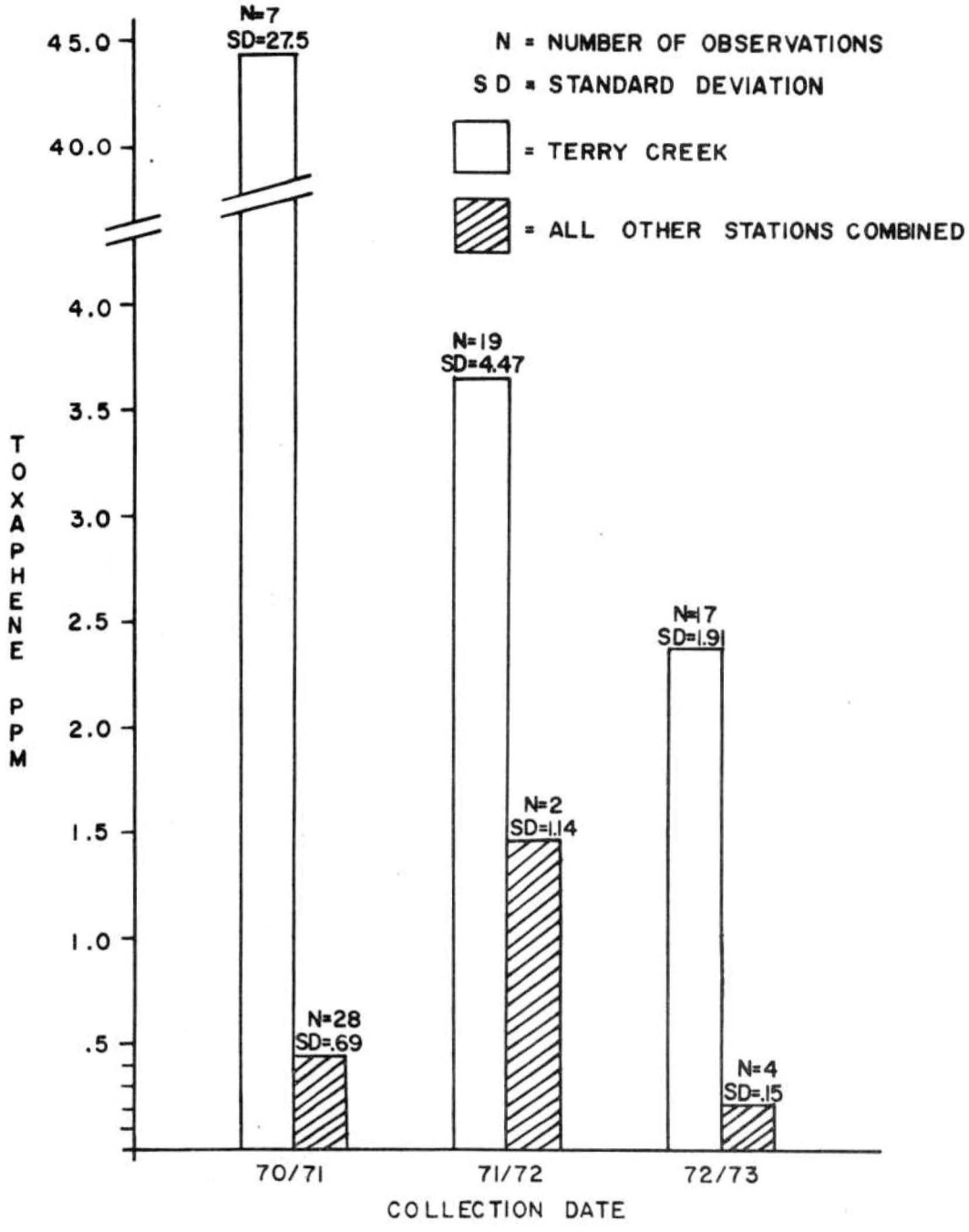


FIGURE 7

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.

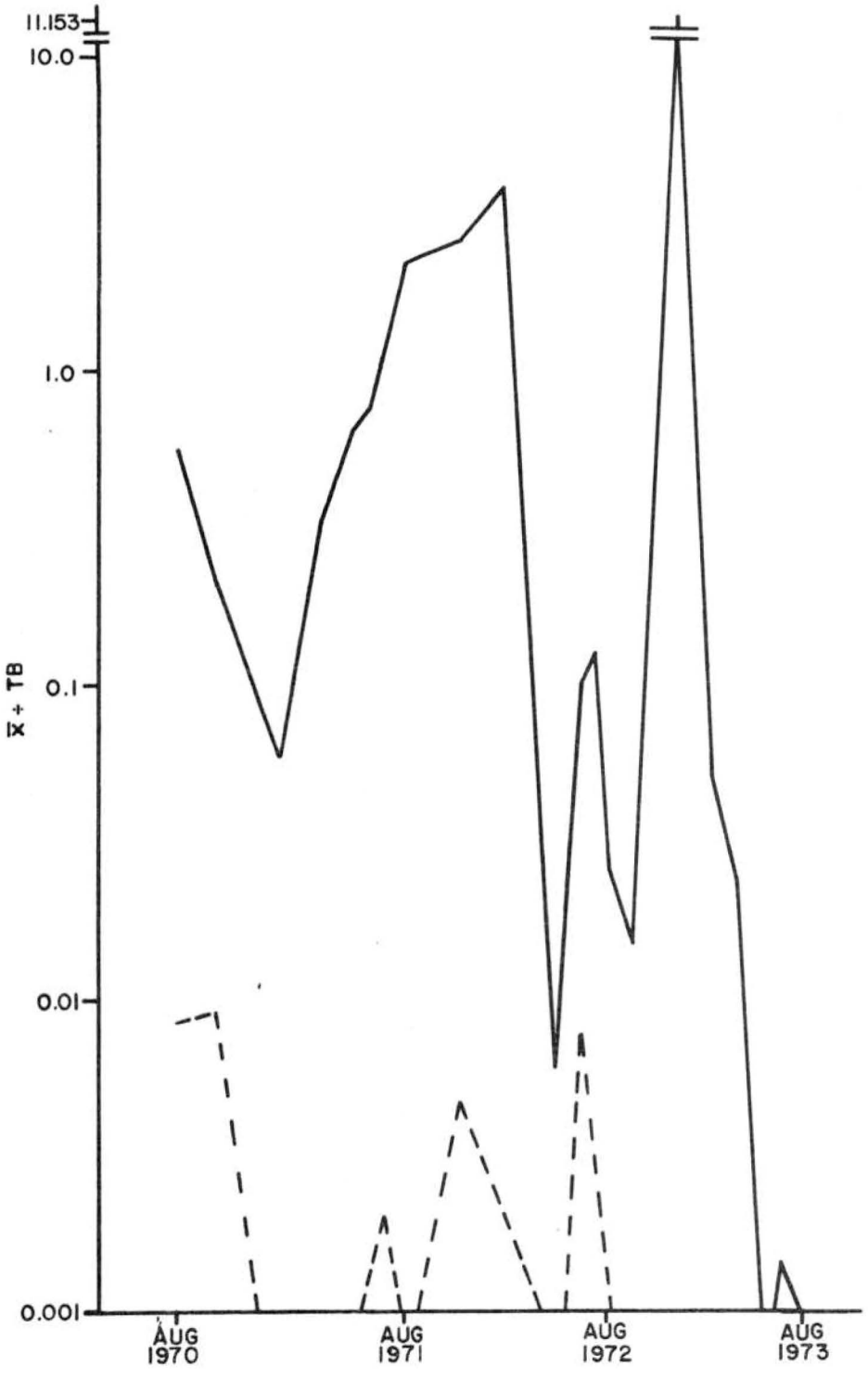


FIGURE 9

APPARENT TOXAPHENE CONTENT
OF HERCULES PLANT EFFLUENT

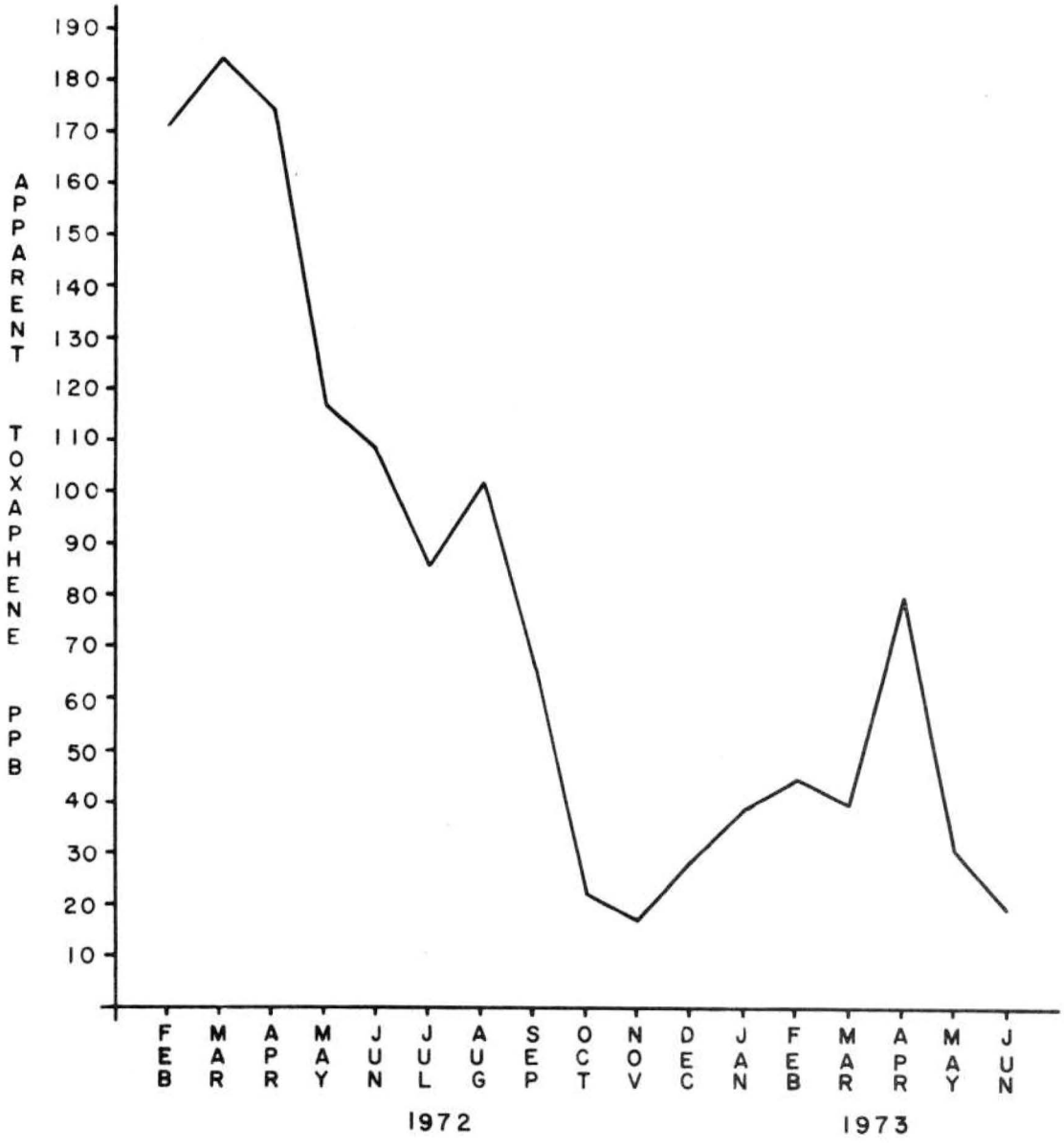
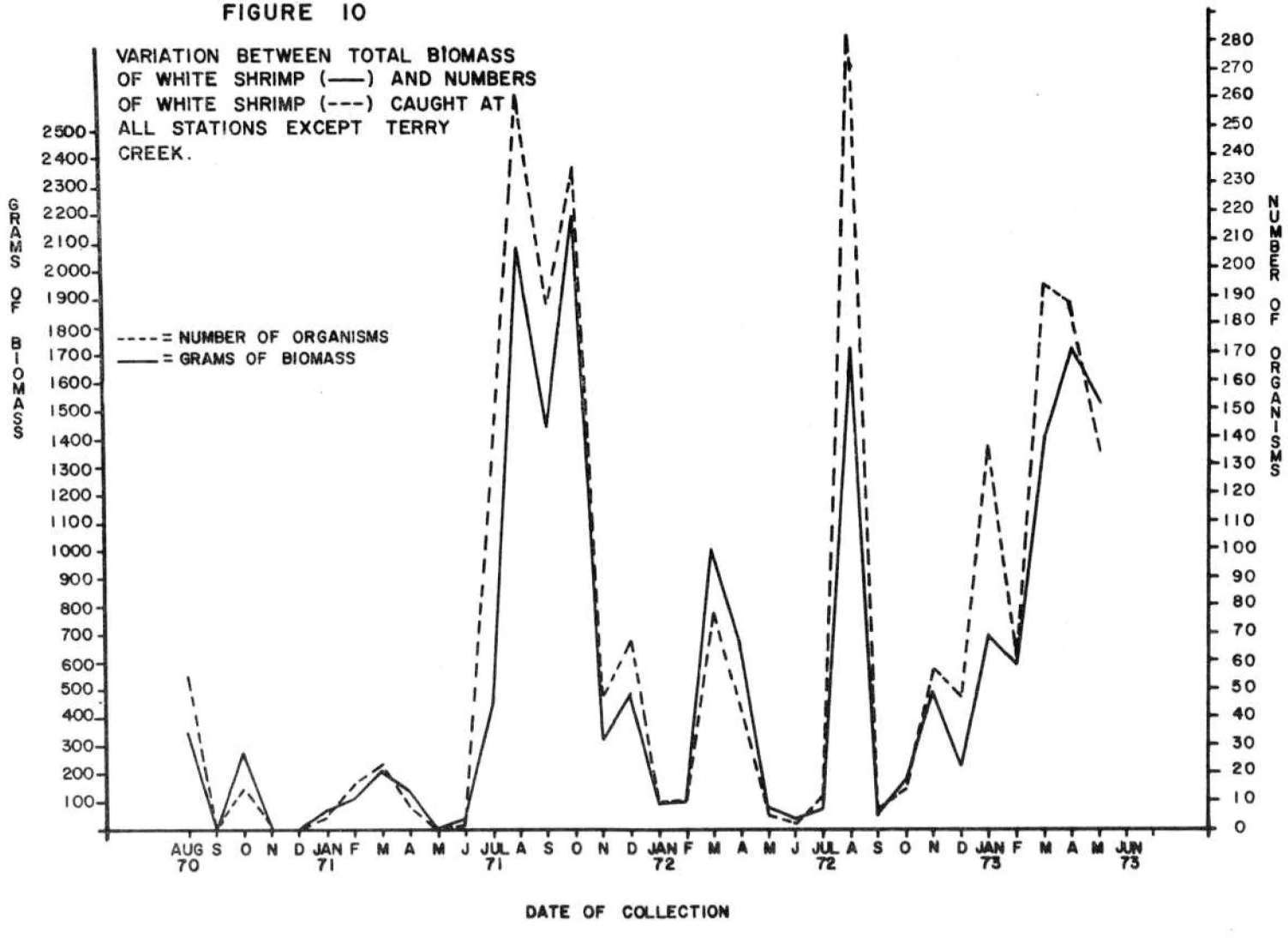


FIGURE 10


VARIATION BETWEEN TOTAL BIOMASS OF WHITE SHRIMP (——) AND NUMBERS OF WHITE SHRIMP (---) CAUGHT AT ALL STATIONS EXCEPT TERRY CREEK.
---- = NUMBER OF ORGANISMS
—— = GRAMS OF BIOMASS
GRAMS OF BIOMASS
NUMBER OF ORGANISMS
DATE OF COLLECTION
AUG 70 S O N D JAN 71 F M A M J JUL 71 A S O N D JAN 72 F M A M J JUL 72 A S O N D JAN 73 F M A M JUN 73

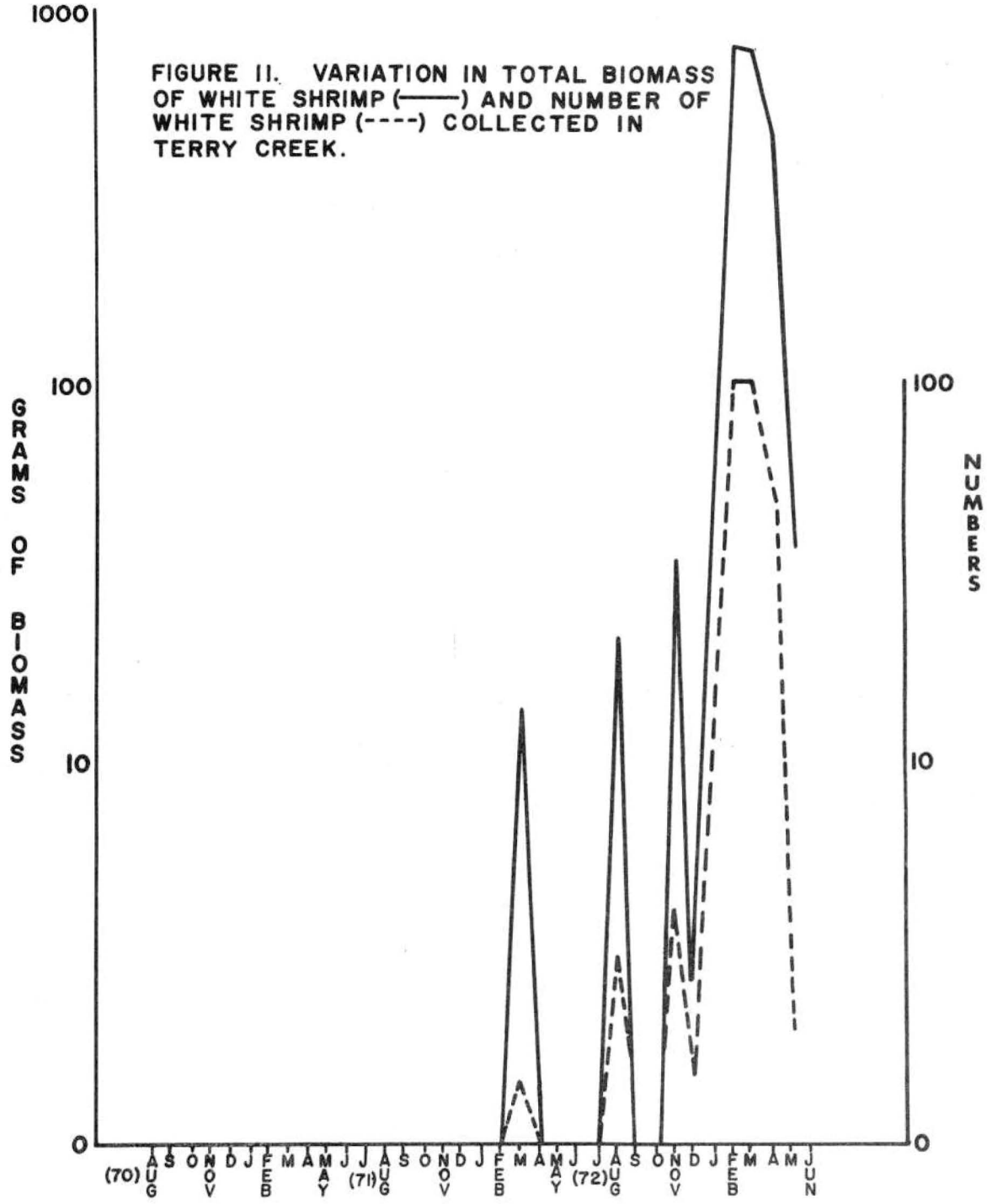


FIGURE 11. VARIATION IN TOTAL BIOMASS OF WHITE SHRIMP (——) AND NUMBER OF WHITE SHRIMP (----) COLLECTED IN TERRY CREEK.

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

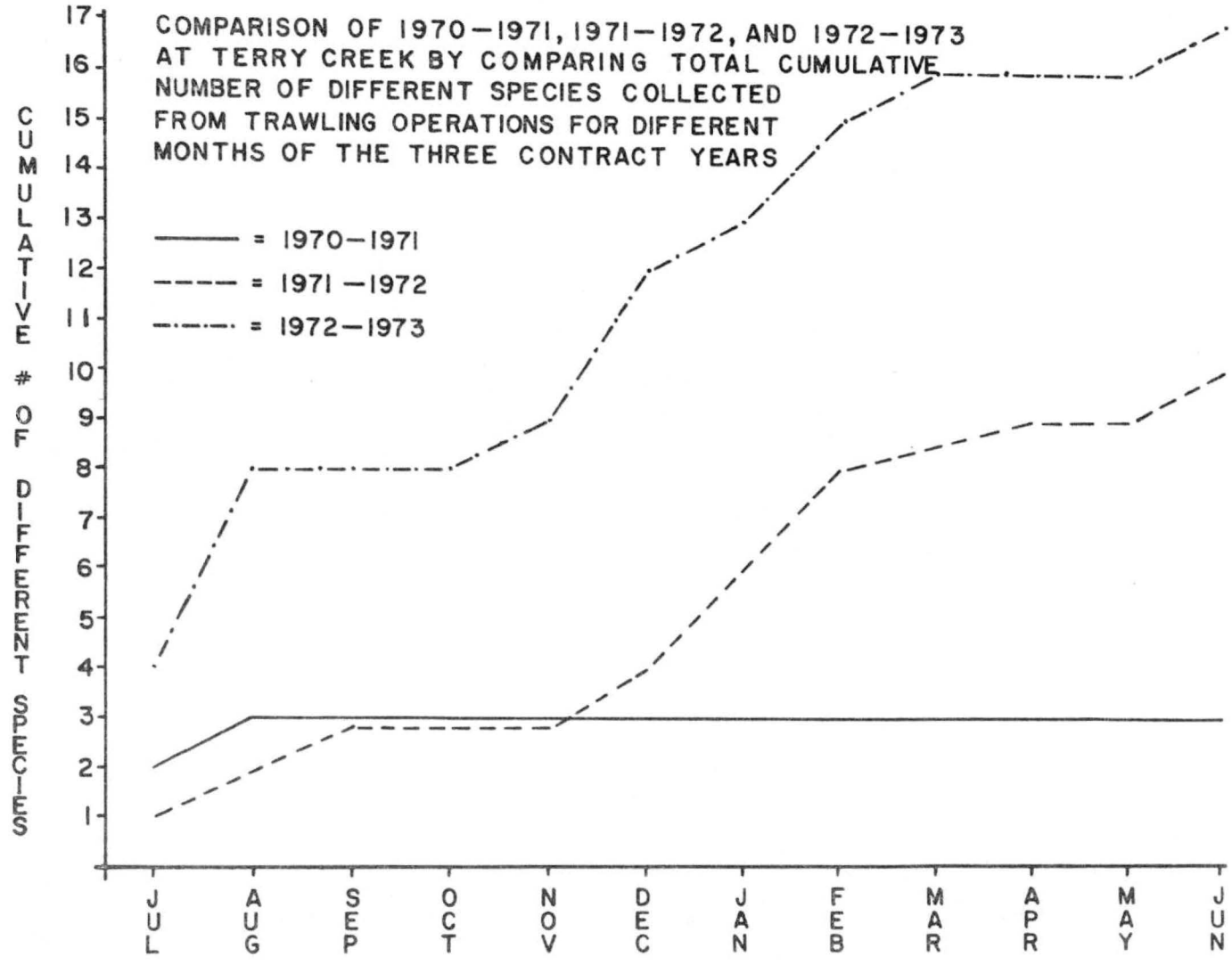

COMPARISON OF 1970–1971, 1971–1972, AND 1972–1973 AT TERRY CREEK BY COMPARING TOTAL CUMULATIVE NUMBER OF DIFFERENT SPECIES COLLECTED FROM TRAWLING OPERATIONS FOR DIFFERENT MONTHS OF THE THREE CONTRACT YEARS
= 1970–1971
= 1971 –1972
= 1972–1973
CUMULATIVE # OF DIFFERENT SPECIES
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN

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

	H Bar	J	NM Index	# Individuals	# Species
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.

	H Bar	J	NM Index	# Individuals	# Species
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.

	H Bar	J	NM Index	# Individuals	# Species
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.

	H Bar	J	NM Index	# Individuals	# Species
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.

	H Bar	J	NM Index	Biomass (grams)	# Species
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.

	H Bar	J	NM Index	Biomass (grams)	# Species
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.

	H Bar	J	NM Index	Biomass (grams)	# Species
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.

	H Bar	J	NM Index	Biomass (grams)	# Species
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 EVENESS $\bar{H}$, BASED ON NUMBER OF INDIVIDUALS. (1970-73)

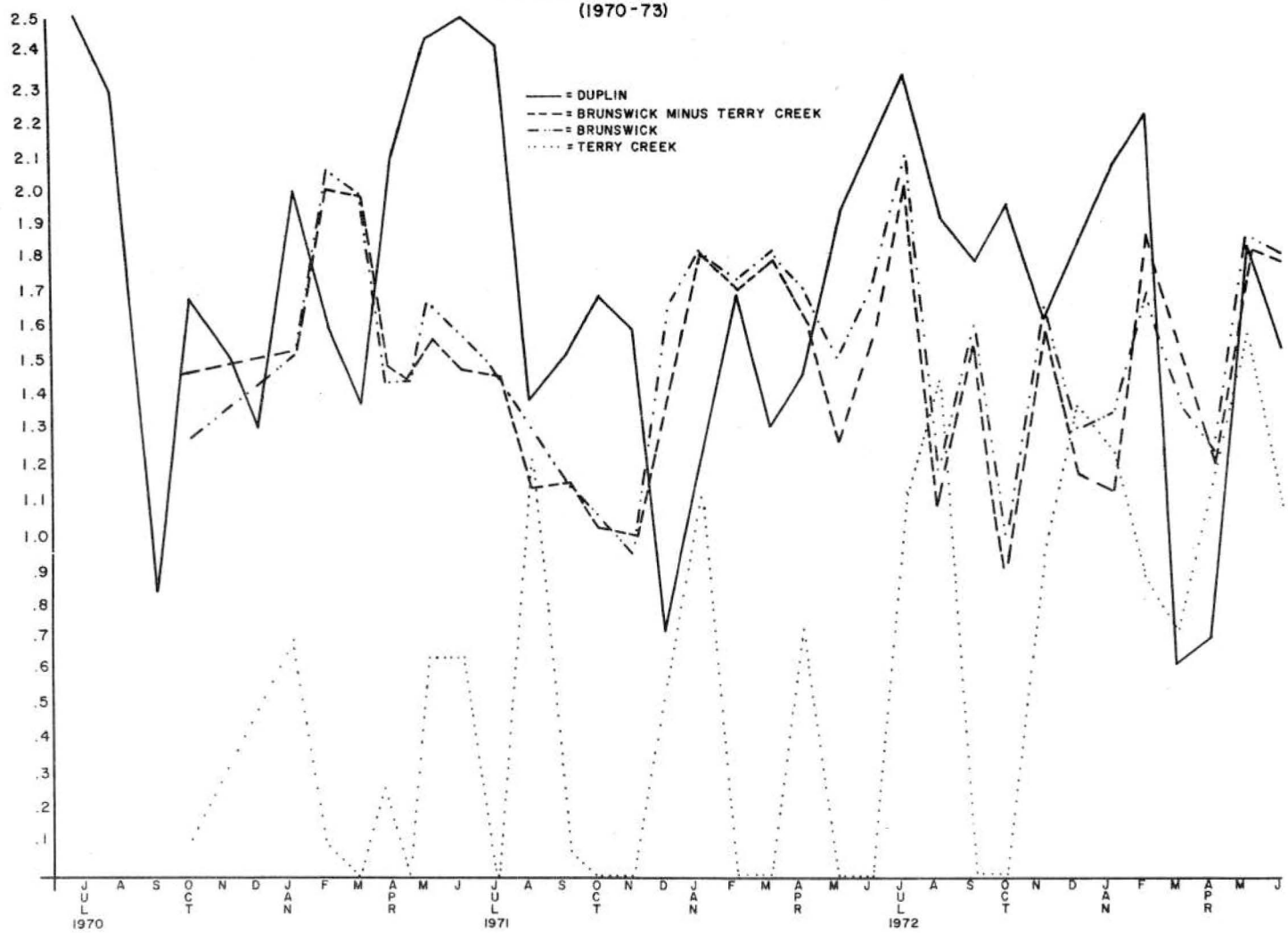
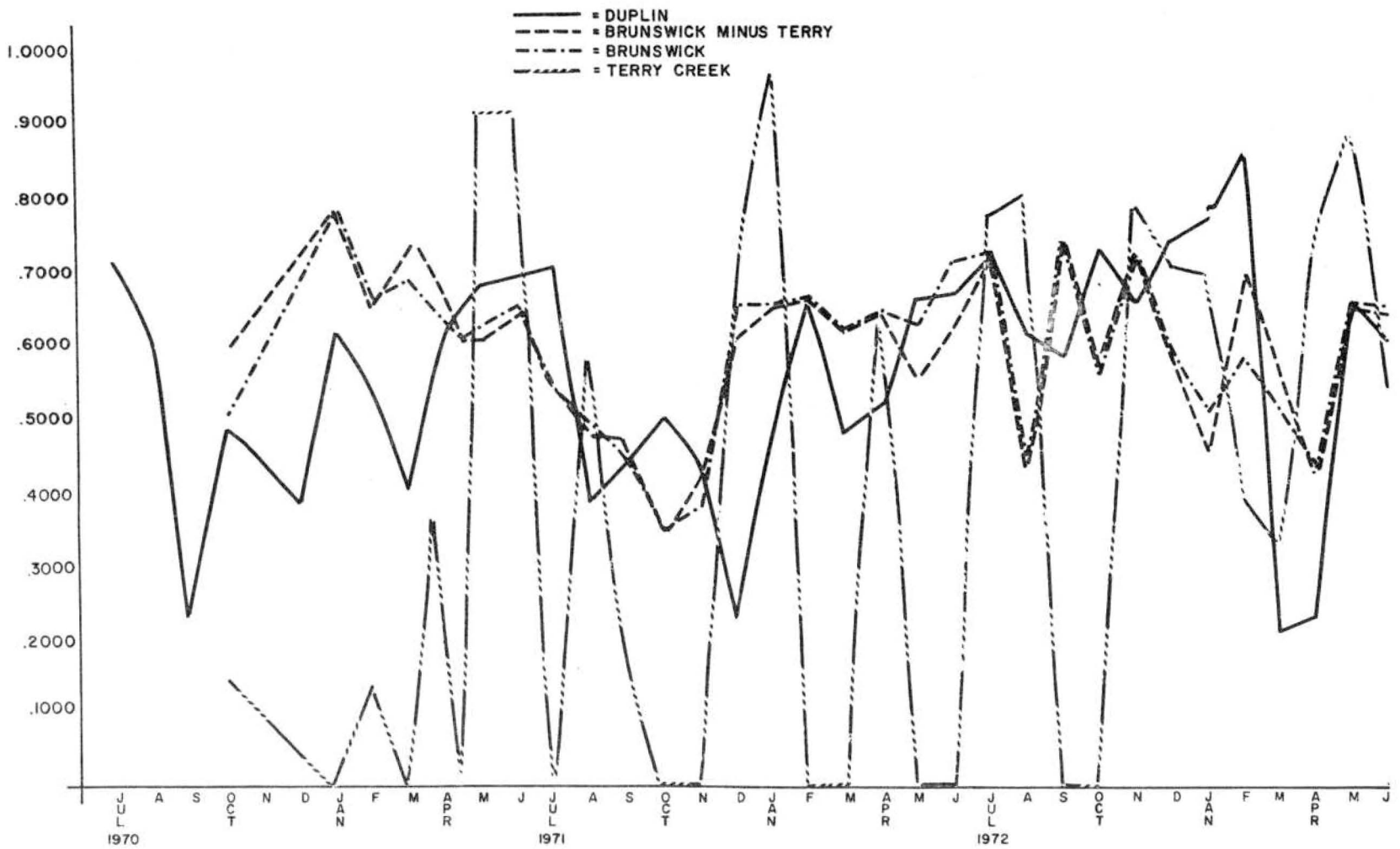


FIGURE 14. COMPARISON OF MONTHLY DIVERSITY INDEX OF EVENESS J, BASED ON NUMBER OF INDIVIDUALS. 1970-73



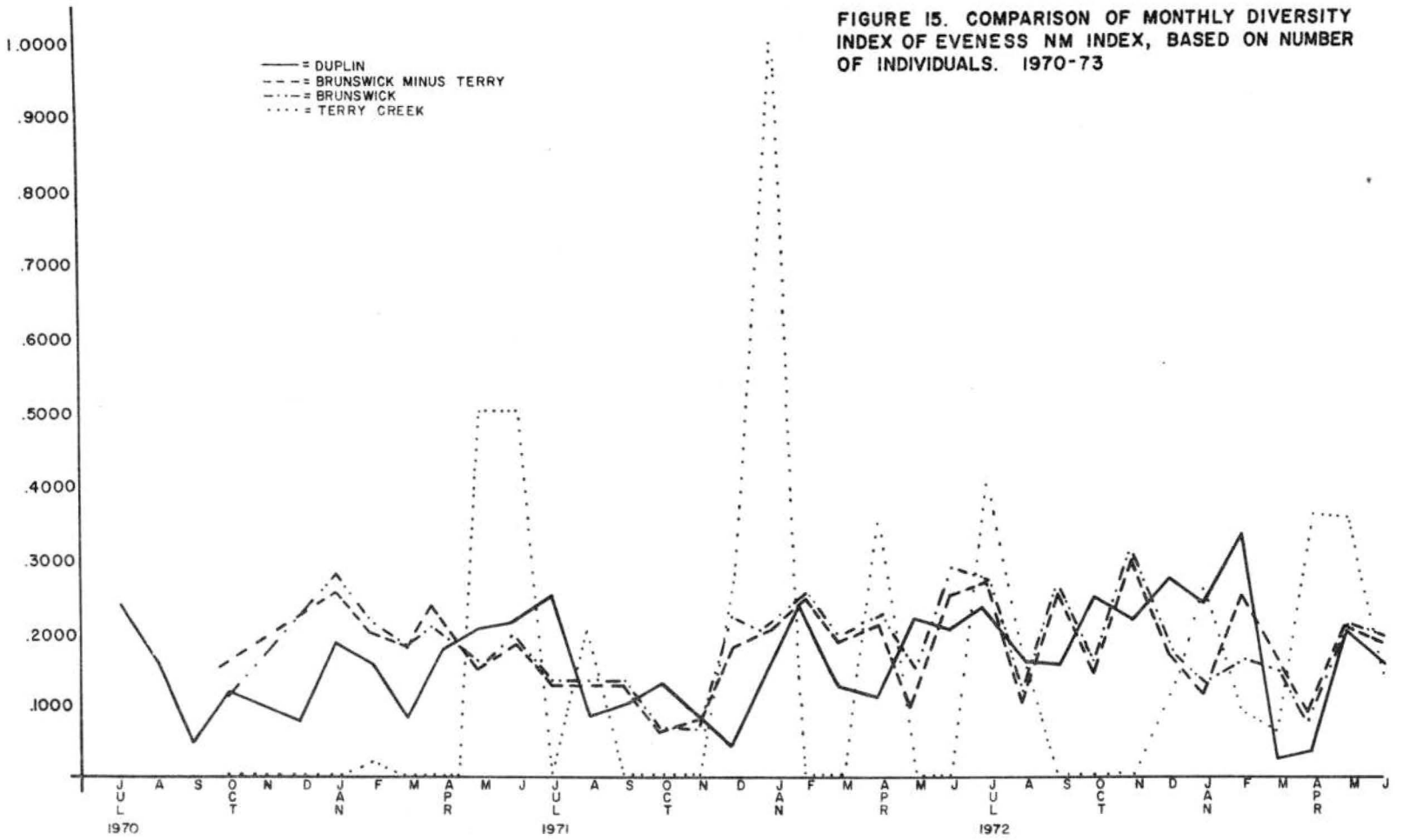


FIGURE 15. COMPARISON OF MONTHLY DIVERSITY INDEX OF EVENESS NM INDEX, BASED ON NUMBER OF INDIVIDUALS. 1970-73

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

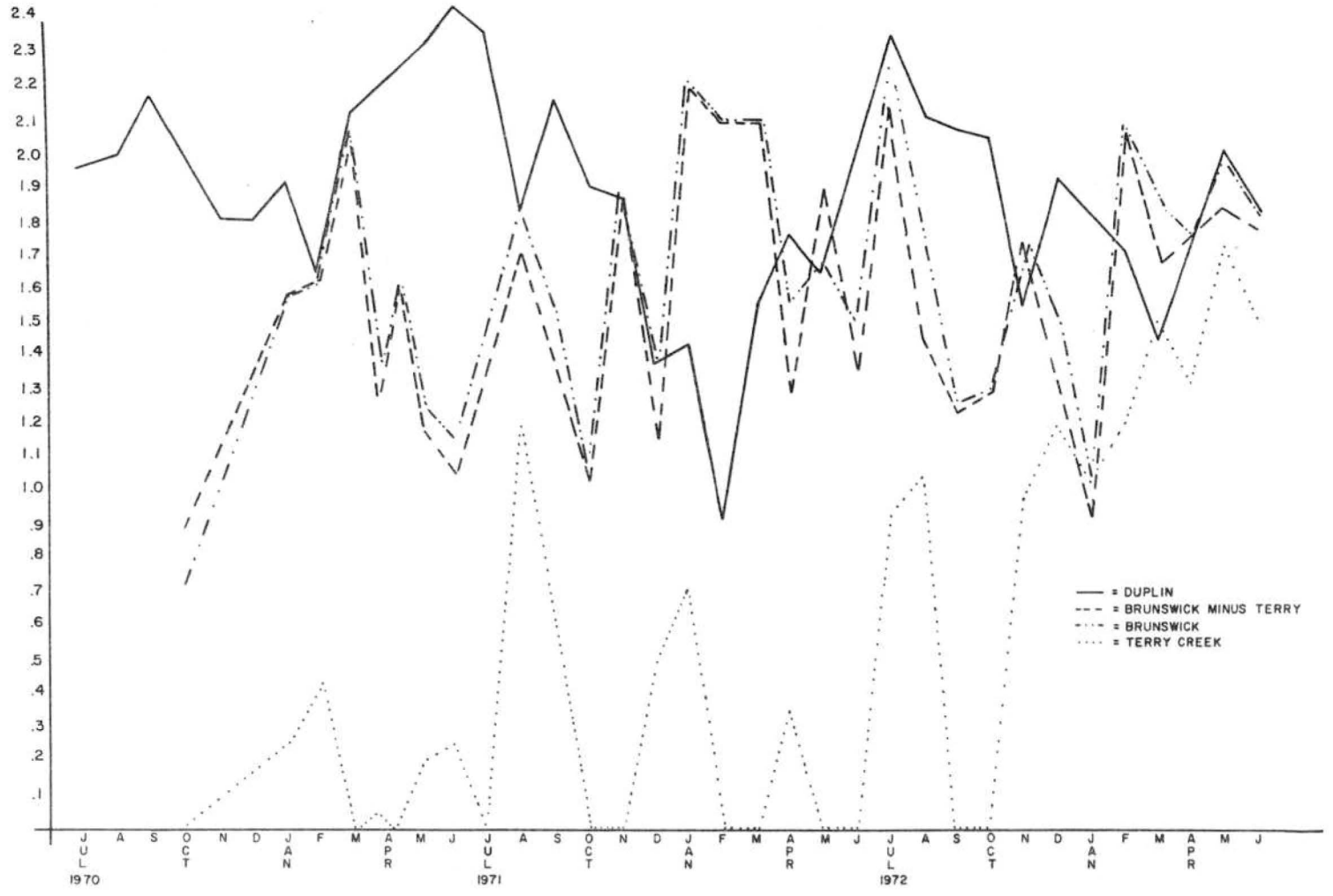
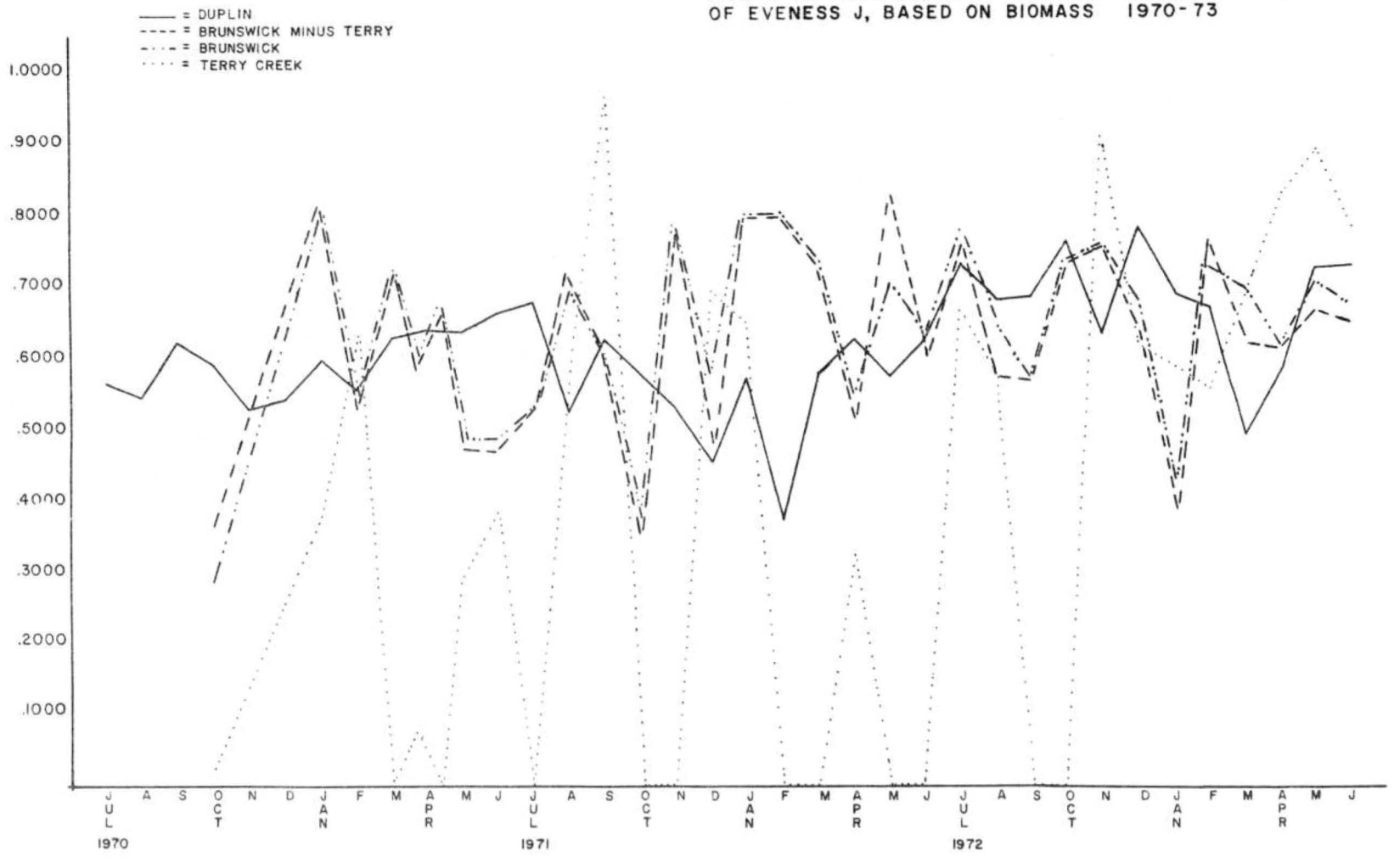


FIGURE 17. COMPARISON OF MONTHLY DIVERSITY INDEX OF EVENESS J, BASED ON BIOMASS 1970-73



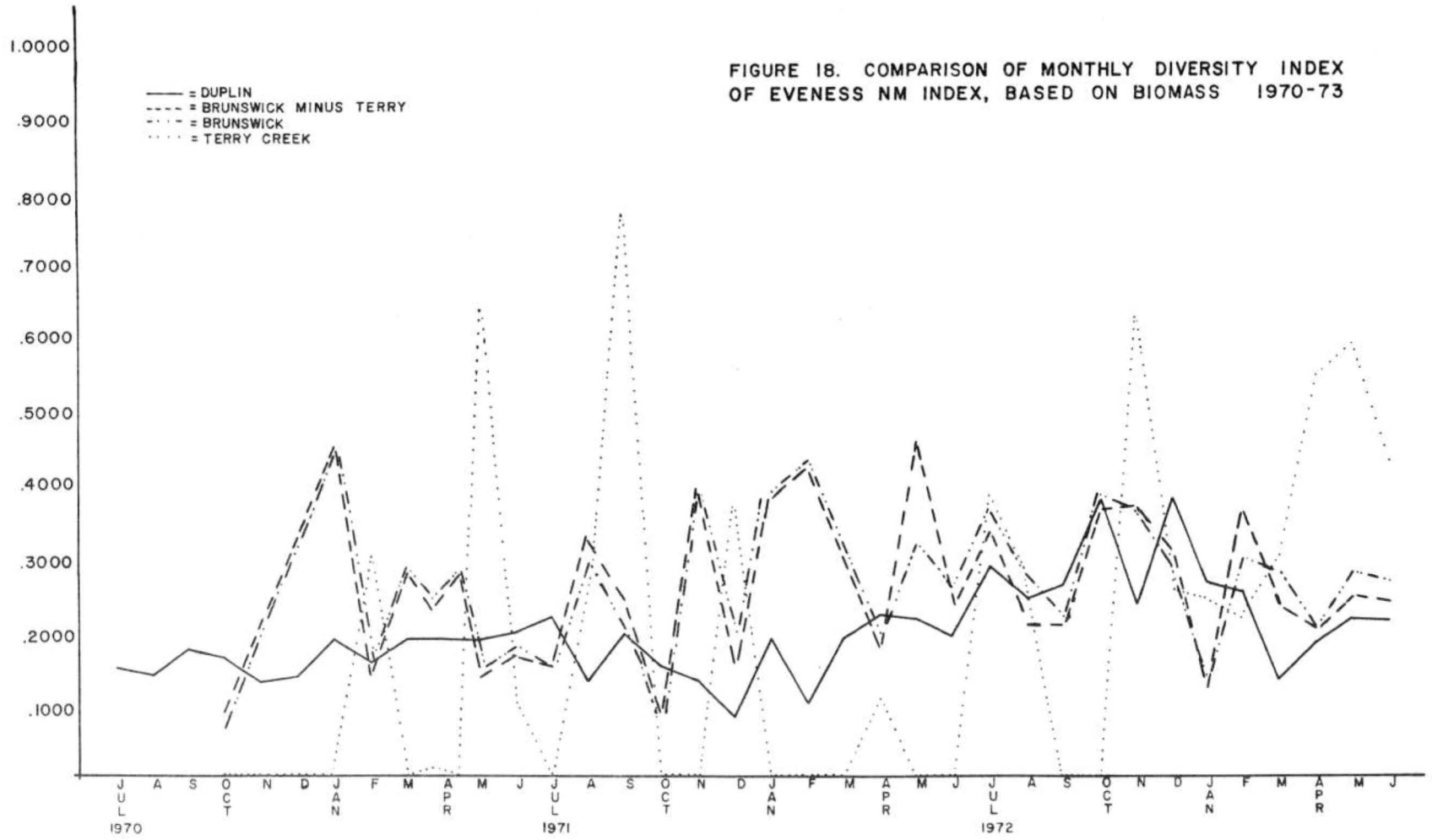


FIGURE 18. COMPARISON OF MONTHLY DIVERSITY INDEX OF EVENESS NM INDEX, BASED ON BIOMASS 1970-73

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

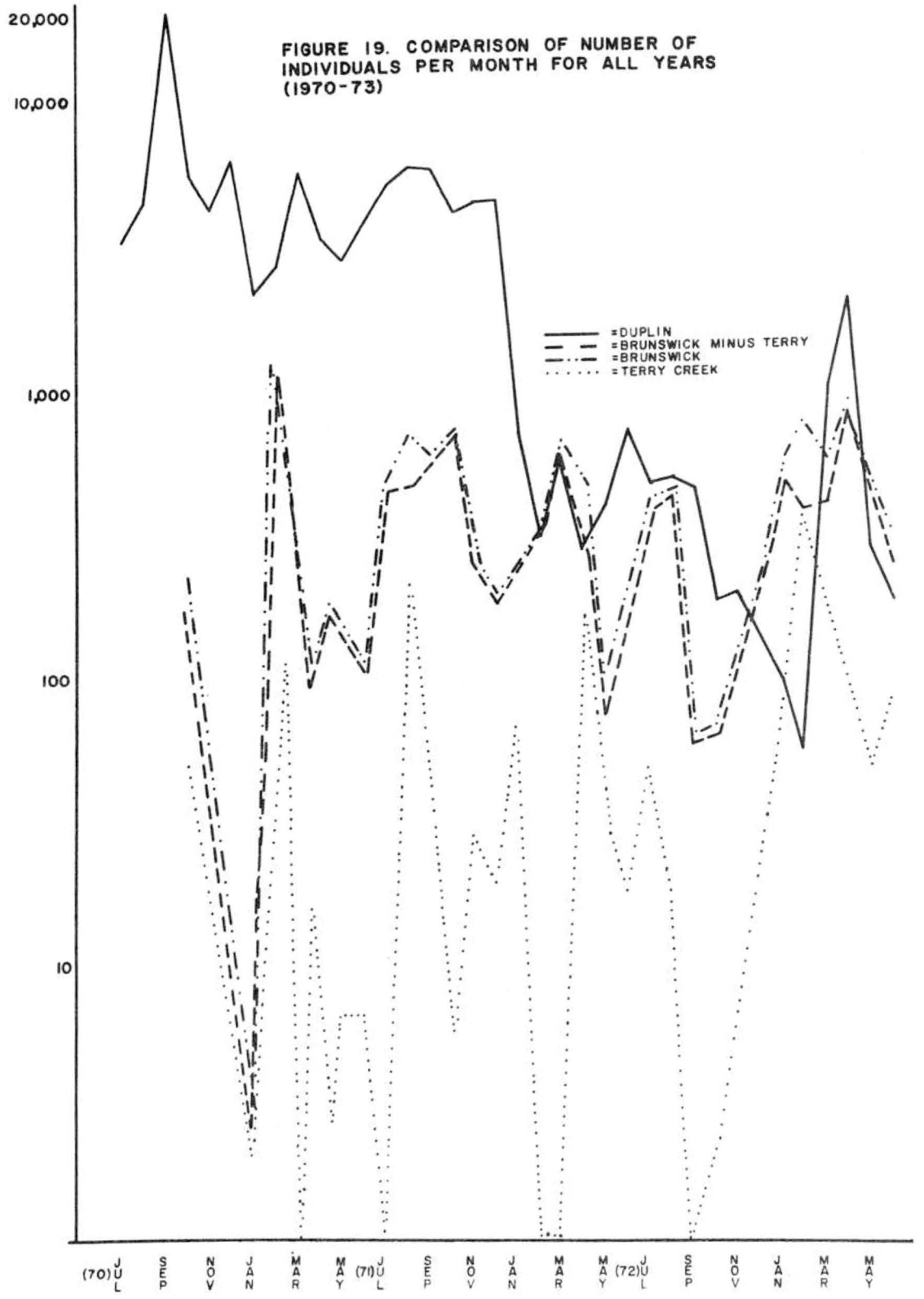


FIGURE 19. COMPARISON OF NUMBER OF INDIVIDUALS PER MONTH FOR ALL YEARS (1970-73)

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

KEY: *=significant at 95% confidence interval

**=significant at 99% confidence interval

***=significant at 99.9% confidence interval

NS=not significant

Table 9. t test of yearly cumulative H Bar diversity indices (based on number of individuals) contrasting differences between collection sites with different years.

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

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

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

Table 13. t test of variation in monthly species diversity index, H Bar, based on number of individuals, for the Duplin Estuary, 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	-	-	-	NS	-	-								
Feb. 1971	-	-	-	***	-	-	***							
Mar. 1971	-	-	-	***	-	-	**	NS						
Apr. 6, 1971	-	-	-	*	-	-	NS	***	***					
Apr. 27, 1971	-	-	-	*	-	-	NS	***	***	NS				
May 1971	-	-	-	***	-	-	NS	***	**	*	*			
June 1971	-	-	-	**	-	-	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 14. t test of variation in monthly species diversity index, H Bar, based on number of individuals, 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	*	***	***	***	***								
Jan. 1972	***	***	***	***	***	NS							
Feb. 1972	***	***	***	***	***	NS	NS						
Mar. 1972	***	***	***	***	***	NS	NS	NS					
Apr. 1972	***	***	***	***	***	NS	NS	NS	NS				
May 1972	NS	**	***	***	***	NS	**	*	***	*			
June 1972	**	***	***	***	***	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 15. t test of variation in monthly species diversity index, H Bar, based on number of individuals, 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	***	**	***										
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	Ap.6 1971	Ap.27 1971	May 1971	June 1971	1970 1971 Cum.
July 1970							KEY:	* = significant at 95% confidence interval						
Aug. 1970	-							** = significant at 99% confidence interval						
Sep. 1970	-	-						*** = significant at 99.9% confidence interval						
Oct. 1970	-	-	-					NS = not significant						
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.	-	-	-	***	-	-	***	***	***	***	***	***	***	

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

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	***	***			
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	Ap.6 1971	Ap.27 1971	May 1971	June 1971	1970-1971 Cum.
July 1970							KEY:	* = significant at 95% confidence interval						
Aug. 1970	-							** = significant at 99% confidence interval						
Sep. 1970	-	-						*** = significant at 99.9% confidence interval						
Oct. 1970	-	-	-					NS = not significant						
Nov. 1970	-	-	-	-										
Dec. 1970	-	-	-	-	-									
Jan. 1971	-	-	-	NS	-	-								
Feb. 1971	-	-	-	NS	-	-	NS							
Mar. 1971	-	-	-	***	-	-	*	***						
Apr. 6, 1971	-	-	-	**	-	-	NS	**	***					
Apr. 27, 1971	-	-	-	***	-	-	*	***	NS	***				
May 1971	-	-	-	***	-	-	NS	***	***	**	***			
June 1971	-	-	-	***	-	-	NS	***	***	**	***	NS		
1970-1971 Cum.	-	-	-	***	-	-	NS	***	***	***	***	NS	***	

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	1971-1972 Cum.
July 1971													
Aug. 1971	***												
Sep. 1971	*	***											
Oct. 1971	NS	***	*										
Nov. 1971	NS	***	*	NS									
Dec. 1971	***	***	***	***	***								
Jan. 1972	***	NS	***	***	***	***							
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	***	***	***	***	NS	***	***	***	***	***	

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

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	Ap.6 1971	Ap.27 1971	May 1971	June 1971	1970-1971 Cum.
July 1970							KEY:	* = significant at 95% confidence interval						
Aug. 1970	-							** = significant at 99% confidence interval						
Sep. 1970	-	-						*** = significant at 99.9% confidence interval						
Oct. 1970	-	-	-					NS = not significant						
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.	-	-	-	***	-	-	***	***	***	***	***	***	*	

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							KEY:	* = significant at 95% confidence interval						
Aug. 1970	-							** = significant at 99% confidence interval						
Sep. 1970	-	-						*** = significant at 99.9% confidence interval						
Oct. 1970	-	-	-					NS = not significant						
Nov. 1970	-	-	-	-										
Dec. 1970	-	-	-	-	-									
Jan. 1971	-	-	-	*	-	-								
Feb. 1971	-	-	-	***	-	-	NS							
Mar. 1971	-	-	-	NS	-	-	NS	NS						
Apr. 6, 1971	-	-	-	***	-	-	*	***	NS					
Apr. 27, 1971	-	-	-	NS	-	-	NS	NS	NS	NS				
May 1971	-	-	-	***	-	-	NS	***	NS	***	NS			
June 1971	-	-	-	***	-	-	NS	***	NS	***	NS	***		
1970-1971 Cum.	-	-	-	***	-	-	NS	***	NS	***	NS	***	***	

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	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	***	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 assesssment 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.

Durant, C. J. and R. J. Reimold. 1972. Effects of Estuarine Dredging of Toxaphene Contaminated Sediments in Terry Creek, Brunswick, Georgia, 1971. Pesticide Monitoring Journal 6(2):94-96.

Reimold, R. J. and C. J. Durant. 1973. Toxaphene Content of Estuarine Fauna and Flora Before, During and After Dredging Toxaphene Contaminated Sediments. Pesticide Monitoring Journal (in press).

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.

Literature Cited

Butler, P.A. 1969. Monitoring Pesticide Pollution. Bioscience 19(10): 889-891

Dahlberg, M.D. and E.P. Odum. 1970. Annual Cycles of Species Occurence, Abundance, and Diversity in Georgia Estuarine Fish Populations. American Midland Naturalist. 83(2): 382-392.

Durant, C.J. and R.J. Reimold 1972. Effects of Estuarine Dredging of Toxaphene Contaminated Sediments in Terry Creek, Brunswick, Georgia. 1972. Pesticide Monitoring Journal. 6(2): 94-96.

Fager, E.W. 1972. Diversity: A Sampling Study. The American Naturalist. 106(949): 293-310.

Hutchinson, Kermit. 1970. A Test for Comparing Diversities Based on The Shannon Formula. J. Theor. Biol. 29:151-154.

Margalef, R. (1969) Perspectives in Ecological Theory. The University of Chicago Press. Chicago, Illinois. 111 pp.

Pielow, E.C. 1966. The Measurement of Diversity in Different Types of Biological Collections. J. Theoretical Biol. 13: 131-144.

Reimold, R.J. and C.J. Durant 1973. Toxaphene Content of Estuarine Fauna and Flora Before, During and After Dredging Toxaphene Contaminated Sediments. Pesticides Monitoring Journal (in press).

Wilson, A.J. 1969. Pesticide Analytical Manual for BCF Contracting Agencies. Gulf Breeze, Florida. 16 pp.

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

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Salt marsh periwinkle	Littorina irrorata	7 Jul 1970	29	not avail.		43.9
Salt marsh cord grass	Spartina alterniflora	7 Jul 1970	29	not avail.		33.76
Salt marsh cord grass	Spartina alterniflora	7 Jul 1970	29	not avail.		18.1
Salt marsh cord grass	Spartina alterniflora	7 Jul 1970	29	not avail.		25.9
Salt marsh periwinkle	Littorina irrorata	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	Leiostoma xanthurus	25 Aug 1970	60	30.4	29.4	46.73
Silversides	Anchoa sp.	25 Aug 1970	99	31.5	29.0	4.51
Spot	Leiostoma xanthurus	25 Aug 1970	72	30.3	29.5	26.2
Silversides	Anchoa sp.	25 Aug 1970	72	30.3	29.5	17.37
Salt marsh periwinkle	Littorina irrorata	25 Aug 1970	56	29.8	29.0	3.0
Mummichog	Fundulus heteroclitus	25 Aug 1970	60	30.4	29.4	4.11
Mummichog	Fundulus heteroclitus	25 Aug 1970	29	13.8	33.0	73.83

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Striped mullet	Mugil cephalus	25 Aug 1970	60	30.4	29.4	35.42
White shrimp	Penaeus setiferus	25 Aug 1970	60	30.4	29.4	3.03
Silversides	Anchoa sp.	25 Aug 1970	29	13.8	33.0	236.36
Mud crabs	Sesarma sp.	25 Aug 1970	2	31.1	29.0	0.0
Mud crabs	Sesarma sp.	25 Aug 1970	34	29.8	29.5	0.0
Mud crabs	Sesarma sp.	25 Aug 1970	72	30.3	29.5	0.0
Salt marsh cord grass	Spartina alterniflora	25 Aug 1970	29	13.8	33.0	72.76
Salt marsh cord grass	Spartina alterniflora	25 Aug 1970	34	29.8	29.5	1.1
Salt marsh cord grass	Spartina alterniflora	25 Aug 1970	72	30.3	29.5	0.61
Salt marsh cord grass	Spartina alterniflora	25 Aug 1970	56	29.8	29.0	1.49
Salt marsh cord grass	Spartina alterniflora	25 Aug 1970	78	28.9	29.0	1.22
Salt marsh cord grass	Spartina alterniflora	25 Aug 1970	60	30.4	29.4	0.59
Salt marsh cord grass	Spartina alterniflora	25 Aug 1970	2	31.1	29.0	2.45
Salt marsh periwinkle	Littorina irrorata	23 Oct 1970	2	22.0		0.0
Salt marsh periwinkle	Littorina irrorata	23 Oct 1970	56	20.0		0.0
Salt marsh periwinkle	Littorina irrorata	23 Oct 1970	60	21.0		0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Salt marsh cord grass	Spartina alterniflora	23 Oct 1970	99			0.0
Mud crabs	Sesarma sp.	23 Oct 1970	29	14.0		0.0
White shrimp heads	Penaeus setiferus	23 Oct 1970	99			2.83
White shrimp muscle	Peneaus setiferus	23 Oct 1970	99			0.0
Silversides	Anchoa sp.	23 Oct 1970	29	14.0		172.1
Mummichog	Fundulus heteroclitus	23 Oct 1970	29	14.0		80.71
Mummichog	Fundulus heteroclitus	23 Oct 1970	60	21.0		15.58
White shrimp heads	Penaeus setiferus	23 Oct 1970	60	21.0		11.15
White shrimp muscle	Penaeus setiferus	23 Oct 1970	60	21.0		1.3
Silversides	Anchoa sp.	23 Oct 1970	60	21.0		25.1
White shrimp heads	Penaeus setiferus	23 Oct 1970	72	22.0		7.29
White shrimp muscle	Penaeus setiferus	23 Oct 1970	72	22.0		0.64
Silversides	Anchoa sp.	23 Oct 1970	72	22.0		10.24
Clapper rail	Rallus longirostris	14 Oct 1970	13			0.0
Rock sea bass	Centropristes philadelphica	14 Oct 1970	13			3.92
Flounder	Paralichthys sp.	14 Oct 1970	13			3.65

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Blue crab	Callinectes sapidus	14 Oct 1970	13			Trace
Terrapin liver	Malaclemys terrapin	5 Jan 1971	34	26.0	20.0	0.0
Lesser scaup muscle	Aythya affinis	5 Jan 1971	23			>500.0
Lesser scaup liver	Aythya affinis	5 Jan 1971	23			>500.0
Pied-billed grebe liver	Podilymbus podiceps podiceps	5 Jan 1971	26			>500.0
Pied-billed grebe muscle	Podilymbus podiceps podiceps	5 Jan 1971	26			>500.0
Cormorant liver	Phalacrocorax auritus	5 Jan 1971	Duplin			0.0
Cormorant muscle	Phalacrocorax auritus	5 Jan 1971	Duplin			0.0
Menhaden	Brevoortia tyrannus	2 Feb 1971	72	20.0	10.0	1.27
Weakfish	Cynoscion sp.	2 Feb 1971	72	20.0	10.0	2.51
Flounder	Paralichthys sp.	2 Feb 1971	85	25.0	15.0	0.59
Naked gobi	Gobiosoma bosci	2 Feb 1971	26	19.0	10.0	2.95
Silversides	Anchoa sp.	2 Feb 1971	29	20.0	11.0	21.39
Mummichog	Fundulus heteroclitus	2 Feb 1971	29	20.0	11.0	51.9
White shrimp heads	Penaeus setiferus	2 Feb 1971	85	25.0	15.0	0.61
White shrimp muscle	Penaeus setiferus	2 Feb 1971	85	25.0	15.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Striped cusk-eel	Rissola marginata	2 Feb 1971	85	25.0	15.0	0.72
Oyster	Crassostrea virginica	2 Feb 1971	26	19.0	10.0	1.94
Starfish	Asterias sp.	2 Feb 1971	26	19.0	10.0	1.56
White shrimp heads	Penaeus setiferus	2 Mar 1971	23	19.0	17.0	3.7
White shrimp muscle	Penaeus setiferus	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	Crassostrea virginica	18 Mar 1971	33			2.273
Blood ark	Anadara ovalis	18 Mar 1971	33			1.07
Oyster	Crassostrea virginica	18 Mar 1971	McKay			0.69
Oyster	Crassostrea virginica	8 Apr 1971	33			3.64
Oyster	Crassostrea virginica	8 Apr 1971	99	15.0	13.0	1.77
Oyster	Crassostrea virginica	1 Apr 1971	33			2.84
Spot	Leiostomus xanthurus	8 Apr 1971	99	15.0	13.5	1.14

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Blue crab gut	Callinectes sapidus	8 Apr 1971	34	13.0	13.0	3.1
Blue crab muscle	Callinectes sapidus	8 Apr 1971	34	13.0	13.0	Trace
Mummichog	Fundulus heteroclitus	8 Apr 1971	29	12.0	13.0	85.6
Oysters	Crassostrea virginica	13 Apr 1971	33			3.8
Oysters	Crassostrea virginica	23 Apr 1971	McKay			0.71
Oysters	Crassostrea virginica	22 Apr 1971	33			2.03
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	2			Trace
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	2			1.76
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	34	13.0	13.0	0.0
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	34	13.0	13.0	Trace
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	72	15.0	14.3	0.0
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	72	15.0	14.3	0.0
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	99	15.0	13.0	0.0
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	99	15.0	13.0	0.0
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	60	14.0	15.0	0.0
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	60	14.0	15.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Oysters	Crassostrea virginica	1 May 1971	33			3.82
Oysters	Crassostrea virginica	4 May 1971	33			3.36
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	56			0.0
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	56			1.61
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	29	12.0	13.0	30.3
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	29	12.0	13.0	30.73
Salt marsh cord grass	Spartina alterniflora	8 Apr 1971	78	13.0	14.0	0.0
Salt marsh cord grass	Spartina alterniflora	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	Crassostrea virginica	13 May 1971	33			5.6

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Star drum	Stellifer lanceolatus	25 May 1971	26	22.0	23.3	5.3
Sea cat fish	Arius felis	25 May 1971	72	26.0	24.0	Trace
Silversides	Anchoa sp.	25 May 1971	99	24.0	23.3	6.7
Blue crab gut	Callinectes sapidus	25 May 1971	78	23.0	23.3	Aroclor
Blue crab muscle	Callinectes sapidus	25 May 1971	78	23.0	23.3	Aroclor
Croaker	Micropogon undulatus	25 May 1971	60	23.0	23.3	1.97
Silversides	Anchoa sp.	25 May 1971	29	22.0	25.5	18.07
Mummichog	Fundulus heteroclitus	25 May 1971	29	22.0	25.5	53.7
Oysters	Crassostrea virginica	21 May 1971	33			2.59
Oysters	Crassostrea virginica	25 May 1971	33			1.17
Oysters	Crassostrea virginica	13 May 1971	McKay			1.6
Oysters	Crassostrea virginica	2 Jun 1971	33			1.12
Sea lettuce	Ulva lactuca	1 May 1971	33			0.0
Salt marsh periwinkle	Littorina irrorata	8 Apr 1971	34	13.0	13.0	0.0
Salt marsh periwinkle	Littorina irrorata	8 Apr 1971	99	15.0	13.0	0.0
Salt marsh periwinkle	Littorina irrorata	8 Apr 1971	60	14.0	15.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Salt marsh periwinkle	Littorina irrorata	8 Apr 1971	78	13.0	13.0	0.0
Ribbed mussel	Modiolus demissus	25 Apr 1971	56			2.86
Oysters	Crassostrea virginica	10 Jun 1971	33			2.06
Channeled whelk	Busycon canaliculatum	2 Feb 1971	85	25.0	10.0	0.0
Mummichog	Fundulus heteroclitus	23 Oct 1970	78	18.0		7.6
Silversides	Anchoa sp.	23 Oct 1970	78	18.0		36.7
Weakfish	Cynoscion sp.	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	Crassostrea virginica	23 Jun 1971	33			1.35

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Silversides	Anchoa sp.	23 Jun 1971	26			3.1
Star drum	Stellifer lanceolatus	23 Jun 1971	72			0.65
Silversides	Anchoa sp.	23 Jun 1971	99	25.0	28.0	4.59
Cutlass fish	Trichiurus lepturus	23 Jun 1971	99	25.0	28.0	2.14
White shrimp heads	Penaeus setiferus	23 Jun 1971	78	24.0	28.0	1.8
Spot	Leiostomus xanthurus	23 Jun 1971	60	20.0	28.0	1.37
Mummichog	Fundulus heteroclitus	23 Jun 1971	29	21.0	30.0	50.5
Silversides	Anchoa sp.	23 Jun 1971	29	21.0	30.0	13.8
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	2	15.0	27.0	0.0
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	26	25.0	27.0	0.0
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	72	25.0	26.0	0.0
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	99	25.0	28.0	0.0
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	56	25.0	28.0	0.0
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	78	24.0	28.0	0.0
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	60	20.0	28.0	0.0
Salt marsh cord grass	Spartina alterniflora	23 Jun 1971	29	21.0	30.0	98.8

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O 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	Anchoa sp.	20 Jul 1971	34	25.0	29.0	4.34

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Spot	Leiostomus xanthurus	20 Jul 1971	34	25.0	29.0	Trace
White shrimp heads	Penaeus setiferus	20 Jul 1971	72	26.0	29.0	2.38
White shrimp muscle	Penaeus setiferus	20 Jul 1971	72	26.0	29.0	Trace
Silversides	Anchoa sp.	20 Jul 1971	72	26.0	29.0	2.114
Silversides	Anchoa sp.	20 Jul 1971	78	26.0	30.0	2.35
White shrimp heads	Penaeus setiferus	20 Jul 1971	78	26.0	30.0	0.0
Fiddler crab	Uca sp.	20 Jul 1971	72	26.0	29.0	0.0
Mud crab	Sesarma sp.	20 Jul 1971	72	26.0	29.0	0.0
Salt marsh periwinkle	Littorina irrorata	20 Jul 1971	34	25.0	29.0	Trace
Salt marsh periwinkle	Littorina irrorata	20 Jul 1971	72	26.0	29.0	Trace
White shrimp heads	Penaeus setiferus	20 Jul 1971	99	25.0	29.5	0.0
Croaker	Micropogon undulatus	20 Jul 1971	99	25.0	29.5	0.0
Spot	Leiostomus xanthurus	20 Jul 1971	60	25.0	29.5	1.151
White shrimp heads	Penaeus setiferus	20 Jul 1971	60	25.0	29.5	Trace
Yellowtail	Bairdiella chrysura	20 Jul 1971	60	25.0	29.5	2.713
Silversides	Anchoa sp.	20 Jul 1971	60	25.0	29.5	1.018

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Salt marsh periwinkle	Littorina irrorata	20 Jul 1971	56	25.0	31.0	16.74
Mummichog	Fundulus heteroclitus	13 Jul 1971	2	22.0	28.0	10.4
Striped mullet liver	Mugil cephalus	13 Jul 1971	2	22.0	28.0	33.85
Striped mullet muscle	Mugil cephalus	13 Jul 1971	2	22.0	28.0	35.6
Mummichog	Fundulus heteroclitus	13 Jul 1971	60	24.0	26.0	2.48
Striped mullet liver	Mugil cephalus	13 Jul 1971	60	24.0	26.0	6.28
Striped mullet muscle	Mugil cephalus	13 Jul 1971	60	24.0	26.0	7.65
Striped mullet muscle	Mugil cephalus	13 Jul 1971	78	22.0	27.0	2.38
Mummichog	Fundulus heteroclitus	13 Jul 1971	78	22.0	27.0	2.36
Salt marsh periwinkle	Littorina irrorata	13 Jul 1971	29	20.0	29.0	23.257
Salt marsh periwinkle	Littorina irrorata	13 Jul 1971	56	23.0	28.5	1.81
Oysters	Crassostrea virginica	13 Jul 1971	33			1.146
Silversides	Anchoa sp.	14 Jul 1971	Duplin	18.0	30.0	0.0
Menhaden gut	Brevoortia tyrannus	14 Jul 1971	Duplin	18.0	30.0	0.0
Menhaden muscle	Brevoortia tyrannus	14 Jul 1971	Duplin	18.8	30.0	0.0
Spot gut	Leiostomus xanthurus	14 Jul 1971	Duplin	18.0	30.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Spot muscle	Leiostomus xanthurus	14 Jul 1971	Duplin	18.0	30.0	0.0
Weakfish muscle	Cynoscion sp.	14 Jul 1971	Duplin	18.0	30.0	0.0
Weakfish ovary	Cynoscion sp.	14 Jul 1971	Duplin	18.0	30.0	0.0
Spot	Leiostomus xanthurus	30 Jun 1971	Duplin	21.0	29.0	0.0
Silversides	Anchoa sp.	30 Jun 1971	Duplin	21.0	29.0	0.0
Weakfish	Cynoscion sp.	30 Jun 1971	Duplin	21.0	29.0	0.0
Harvest fish	Peprilus alepidotus	30 Jun 1971	Duplin	21.0	29.0	0.0
Blue crab gut	Callinectes sapidus	30 Jun 1971	Duplin	21.0	29.0	0.0
White shrimp heads	Penaeus setiferus	30 Jun 1971	Duplin	22.0	30.0	0.0
White shrimp muscle	Penaeus setiferus	30 Jun 1971	Duplin	22.0	30.0	0.0
Silversides	Anchoa sp.	28 Jul 1971	Duplin	18.0	29.0	0.0
Spanish mackerel	Scomberomorus maculatus	28 Jul 1971	Duplin	18.0	29.0	0.0
Spot	Leiostomus xanthurus	28 Jul 1971	Duplin	18.0	29.0	0.0
Weakfish	Cynoscion sp.	28 Jul 1971	Duplin	18.0	29.0	0.0
Croaker	Micropogon undulatus	28 Jul 1971	Duplin	18.0	29.0	0.0
Squid	Loligo sp.	28 Jul 1971	Duplin	18.0	29.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Oyster	Crassostrea virginica	16 Jul 1971	McKay			Trace
Willet breast	Catoptrophorus semipalmatus	24 Jul 1971	29			0.0
Willet liver	Catoptrophorus semipalmatus	24 Jul 1971	29			0.0
Redwing blackbird	Agelaius phoeniceus	24 Jul 1971	29			0.0
Redwing blackbird	Agelaius phoeniceus	24 Jul 1971	29			0.0
Seaside sparrow	Ammospiza maritima	24 Jul 1971	29			0.0
Long-billed marsh wren	Telmatodytes palustris	24 Jul 1971	29			4.081
Boat-tailed grackle	Cassidix mexicanus	20 Jul 1971	78	25.0	29.0	0.0
Boat-tailed grackle	Cassidix mexicanus	20 Jul 1971	78	25.0	29.0	0.0
Dowitcher breast	Limnodromus griseus	20 Jul 1971	29	25.0	29.0	1.891
Dowitcher liver	Limnodromus griseus	20 Jul 1971	29	25.0	29.0	5.144
Croaker	Micropogon undulatus	28 Jul 1971	Duplin	18.0	29.0	0.0
Perennial glasswort	Salicornia virginica	26 Jul 1971	29			Trace
Salt marsh cord grass	Spartina alterniflora	3 Aug 1971	29			2.1
Salt marsh ox-eye leaves	Borrichia frutescens	3 Aug 1971	29			4.3
Salt marsh ox-eye stems	Borrichia frutescens	3 Aug 1971	29			Trace

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Perennial glasswort	Salicornia virginica	26 Jul 1971	29			0.0
Salt marsh cord grass	Spartina alterniflora	3 Aug 1971	29			0.0
Oyster	Crassostrea virginica	17 Aug 1971	2	15.0	26.0	1.7
Oyster	Crassostrea virginica	20 Aug 1971	33			1.3
Oyster	Crassostrea virginica	20 Aug 1971	McKay			Trace
Oyster	Crassostrea virginica	17 Sep 1971	McKay			0.38
Sea cat fish	Arius felis	17 Aug 1971	29	7.0	31.0	19.6
Oyster	Crassostrea virginica	17 Sep 1971	33			0.73
Mummichog	Fundulus heteroclitus	17 Aug 1971	29	7.0	31.0	16.8
Silversides	Anchoa sp.	17 Aug 1971	26	17.0	26.5	30.4
Hogchoker	Achirus fasciatus	17 Aug 1971	72	19.0	26.5	1.26
Mantis shrimp	Squilla empusa	17 Aug 1971	72	19.0	26.5	0.9
Tongue fish	Symphurus plagiusa	17 Aug 1971	99	22.0	27.0	1.1
Spot	Leiostomus xanthurus	17 Aug 1971	78	17.0	26.0	0.9
Silversides	Anchoa sp.	17 Aug 1971	60	20.0	27.5	3.1
Oyster	Crassostrea virginica	12 Oct 1971	McKay			0.1

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Oyster	Crassostrea virginica	12 Oct 1971	33			1.3
Oyster	Crassostrea virginica	12 Oct 1971	56	26.0	21.5	2.7
Salt marsh cord grass	Spartina alterniflora	2 Nov 1971	29			0.0
Salt marsh cord grass	Spartina alterniflora	2 Nov 1971	29			0.0
Salt marsh cord grass	Spartina alterniflora	2 Nov 1971	29			2.52
Salt marsh cord grass	Spartina alterniflora	2 Nov 1971	29			3.01
Salt marsh cord grass	Spartina alterniflora	2 Nov 1971	29			17.14
Salt marsh cord grass	Spartina alterniflora	2 Nov 1971	29			6.85
Loggerhead turtle	Caretta c. caretta	17 Aug 1971	29	7.0	31.0	2.06
Oyster	Crassostrea virginica	12 Nov 1971	McKay			0.46
Yellowtail	Bairdiella chrysura	12 Nov 1971	72	21.0	17.5	14.54
Silversides	Anchoa sp.	12 Nov 1971	99	21.0	17.0	2.08
Silversides	Anchoa sp.	12 Nov 1971	34	21.0	18.0	5.74
Weakfish	Cynoscion sp.	12 Nov 1971	60	21.0	16.5	1.8
White shrimp heads	Penaeus setiferus	12 Nov 1971	78	20.0	17.0	0.92
Silversides	Anchoa sp.	12 Nov 1971	29	15.0	20.5	119.46

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Salt marsh ox-eye	Borrichia frutescens	12 Nov 1971	29	15.0	20.5	0.53
Salt marsh cord grass	Spartina alterniflora	12 Nov 1971	29	15.0	20.5	4.14
Salt marsh periwinkle	Littorina irrorata	12 Nov 1971	29	15.0	20.5	2.31
Fiddler crab	Uca sp.	9 Dec 1971	29			1.768
Fiddler crab	Uca sp.	9 Dec 1971	29			0.391
Salt marsh cord grass	Spartina alterniflora	8 Dec 1971	29			4.441
Salt marsh cord grass	Spartina alterniflora	8 Dec 1971	29			13.796
Salt marsh cord grass	Spartina alterniflora	8 Dec 1971	29			2.1
Salt marsh cord grass	Spartina alterniflora	8 Dec 1971	29			2.1
Salt marsh cord grass	Spartina alterniflora	8 Dec 1971	29			5.06
Oyster	Crassostrea virginica	8 Dec 1971	McKay			0.625
Fiddler crab	Uca sp.	9 Dec 1971	29			1.26
Fiddler crab	Uca sp.	9 Dec 1971	29			1.33
Salt marsh cord grass	Spartina alterniflora	11 Jan 1972	29			0.419
Salt marsh cord grass	Spartina alterniflora	11 Jan 1972	29			0.349
Fiddler crab	Uca sp.	11 Jan 1972	29			1.68

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Sediment		11 Jan 1972	29			17.27
Sediment		9 Dec 1971	29			63.72
Salt marsh cord grass	Spartina alterniflora	18 Jan 1972	2	18.0	11.0	0.32
Salt marsh cord grass	Spartina alterniflora	18 Jan 1972	56	16.0	11.0	2.61
Star drum	Stellifer lanceolatus	18 Jan 1972	26	20.0	11.0	4.104
Star drum	Stellifer lanceolatus	18 Jan 1972	72	21.0	11.5	2.136
White shrimp heads	Penaeus setiferus	18 Jan 1972	72	21.0	11.5	2.464
Hog choker	Achirus fasciatus	18 Jan 1972	72	21.0	11.5	1.99
Menhaden	Brevoortia tyrannus	18 Jan 1972	99	20.0	11.5	Trace
Common eel	Anguilla rostrata	18 Jan 1972	60	16.0	12.0	3.27
Mullet	Mugil cephalus	18 Jan 1972	78	15.0	11.0	13.05
Silversides	Anchoa sp.	18 Jan 1972	29	18.0	14.0	19.6
Silversides	Anchoa sp.	18 Jan 1972	78	15.0	11.0	7.9
Silversides	Anchoa sp.	29 May 1973	2	24.0	26.0	2.775
Common eel	Anguilla rostrata	29 May 1973	2	24.0	26.0	2.476
Oyster	Crassostrea virginica	29 May 1973	33			0.444

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Oyster	Crassostrea virginica	18 Jan 1972	McKay			1.17
Oyster	Crassostrea virginica	17 Feb 1972	McKay			0.78
Sediment		10 Feb 1972	29			42.417
Salt marsh cord grass	Spartina alterniflora	10 Feb 1972	29			1.91
Salt marsh cord grass	Spartina alterniflora	10 Feb 1972	29			1.24
Salt marsh cord grass	Spartina alterniflora	10 Feb 1972	29			2.15
Oyster	Crassostrea virginica	11 Apr 1972	McKay			0.94
Oyster	Crassostrea virginica	15 Mar 1972	McKay			0.85
Oyster	Crassostrea virginica	11 Apr 1972	2	17.0	18.0	3.6
Oyster	Crassostrea virginica	11 Apr 1972	56	20.0	19.0	3.98
Oyster	Crassostrea virginica	9 May 1972	McKay			0.868
Silversides	Anchoa sp.	11 Apr 1972	60	19.0	19.0	11.923
Silversides	Anchoa sp.	11 Apr 1972	26	16.0	18.0	5.426
White shrimp heads	Penaeus setiferus	11 Apr 1972	72	18.0	18.0	0.97
White shrimp muscle	Penaeus setiferus	11 Apr 1972	72	18.0	18.0	0.448
Mummichog	Fundulus heteroclitus	11 Apr 1972	29	15.0	19.0	25.91

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	o/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Mummichog	Fundulus heteroclitus	6 Jun 1972	29	14.0	28.5	26.05
Silversides	Anchoa sp.	11 Apr 1972	29	15.0	19.0	1.44
Spot	Leiostomus xanthurus	11 Apr 1972	78	20.0	19.0	2.59
Weakfish	Cynoscion sp.	11 Apr 1972	99	20.0	18.0	0.927
Southern kingfish	Menticirrhus americanus	11 Apr 1972	99	20.0	18.0	0.775
Oyster	Crassostrea virginica	6 Jun 1972	2	20.0	25.0	2.79
Oyster	Crassostrea virginica	6 Jun 1972	56	22.0	26.0	1.44
Mummichog	Fundulus heteroclitus	19 May 1972	29	20.0	24.5	29.305
Tongue fish	Symphurus plagiusa	23 May 1972	72	24.0	24.0	1.89
White shrimp heads	Penaeus setiferus	23 May 1972	60	24.0	25.0	1.854
White shrimp muscle	Penaeus setiferus	23 May 1972	60	24.0	25.0	0.708
Silversides	Anchoa sp.	23 May 1972	60	24.0	25.0	2.24
Croaker	Micropogon undulatus	23 May 1972	60	24.0	25.0	5.774
Spot	Leiostomus xanthurus	23 May 1972	60	24.0	25.0	2.338
Silversides	Anchoa sp.	23 May 1972	99	24.0	24.0	2.128
Oyster	Crassostrea virginica	5 Jul 1972	56	26.0	31.0	1.394

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Sediment		5 Jul 1972	56	26.0	31.0	0.804
Salt marsh cord grass	Spartina alterniflora	5 Jul 1972	56	26.0	31.0	Trace
Sediment		5 Jul 1972	2	28.0	29.0	1.296
Salt marsh cord grass	Spartina alterniflora	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	Spartina alterniflora	5 Jul 1972	60	26.0	30.0	Trace
Sediment		5 Jul 1972	29	29.0	30.0	6.851
Salt marsh cord grass	Spartina alterniflora	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	Spartina alterniflora	5 Jul 1972	26	28.0	30.0	Trace
Oyster	Crassostrea virginica	5 Jul 1972	2	28.0	29.0	1.393
White shrimp heads	Penaeus setiferus	5 Jul 1972	2	28.0	29.0	2.13
White shrimp muscle	Penaeus setiferus	5 Jul 1972	2	28.0	29.0	0.786
Croaker	Micropogon undulatus	5 Jul 1972	72	27.0	29.5	2.53
White shrimp heads	Penaeus setiferus	5 Jul 1972	60	26.0	30.0	1.251
White shrimp muscle	Penaeus setiferus	5 Jul 1972	60	26.0	30.0	TRACE

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Silversides	Anchoa sp.	5 Jul 1972	60	26.0	30.0	1.978
Mummichog	Fundulus heteroclitus	5 Jul 1972	60	26.0	30.0	1.803
Spot	Leiostomus xanthurus	5 Jul 1972	60	26.0	30.0	1.539
Mummichog	Fundulus heteroclitus	5 Jul 1972	78	25.0	31.5	2.356
White shrimp heads	Penaeus setiferus	5 Jul 1972	78	25.0	31.5	0.96
White shrimp muscle	Penaeus setiferus	5 Jul 1972	78	25.0	31.5	Trace
Yellowtail	Bairdiella chrysura	5 Jul 1972	78	25.0	31.5	1.083
Mullet	Mugil cephalus	5 Jul 1972	78	25.0	31.5	1.269
Silversides	Anchoa sp.	5 Jul 1972	29	29.0	30.0	3.78
Mummichog	Fundulus heteroclitus	5 Jul 1972	29	29.0	30.0	26.648
Silversides	Anchoa sp.	5 Jul 1972	99	25.0	29.0	Trace
White shrimp heads	Penaeus setiferus	5 Jul 1972	99	25.0	29.0	0.789
White shrimp muscle	Penaeus setiferus	5 Jul 1972	99	25.0	29.0	0.441
Spot	Leiostomus xanthurus	5 Jul 1972	26	28.0	30.0	3.741
White shrimp heads	Penaeus setiferus	15 Aug 1972	26			0.0
White shrimp muscle	Penaeus setiferus	15 Aug 1972	26			0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP	PPM TOXAPHENE
Croaker	Micropogon undulatus	15 Aug 1972	26			1.933
White shrimp heads	Penaeus setiferus	15 Aug 1972	72			0.911
White shrimp muscle	Penaeus setiferus	15 Aug 1972	72			0.0
White shrimp heads	Penaeus setiferus	15 Aug 1972	99			0.0
White shrimp muscle	Penaeus setiferus	15 Aug 1972	99			0.0
White shrimp heads	Penaeus setiferus	15 Aug 1972	60			0.0
White shrimp muscle	Penaeus setiferus	15 Aug 1972	60			0.0
Silversides	Anchoa sp.	15 Aug 1972	60			1.387
White shrimp heads	Penaeus setiferus	15 Aug 1972	78			0.0
White shrimp muscle	Penaeus setiferus	15 Aug 1972	78			0.0
White shrimp heads	Penaeus setiferus	15 Aug 1972	29			13.8
White shrimp muscle	Penaeus setiferus	15 Aug 1972	29			0.0
Mummichog	Fundulus heteroclitus	2 Sep 1972	29			10.453
Mummichog	Fundulus heteroclitus	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. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Salt marsh cord grass	Spartina alterniflora	2 Sep 1972	23			0.826
Salt marsh cord grass	Spartina alterniflora	2 Sep 1972	23			0.76
Oyster	Crassostrea virginica	2 Sep 1972	33			1.207
Oyster	Crassostrea virginica	2 Sep 1972	33			1.37
Sediment		2 Sep 1972	23			5.476
Sediment		2 Sep 1972	23			4.424
Salt marsh cord grass	Spartina alterniflora	14 Sep 1972	23			1.56
Salt marsh cord grass	Spartina alterniflora	14 Sep 1972	23			1.126
Silversides	Anchoa sp.	14 Sep 1972	29			8.612
Salt marsh periwinkle	Littorina irrorata	14 Sep 1972	23			0.954
Oyster	Crassostrea virginica	14 Sep 1972	33			1.42
Oyster	Crassostrea virginica	14 Sep 1972	33			1.327
White shrimp heads	Penaeus setiferus	14 Sep 1972	29			1.515
White shrimp heads	Penaeus setiferus	14 Sep 1972	29			1.215
White shrimp muscle	Penaeus setiferus	14 Sep 1972	29			0.581
White shrimp muscle	Penaeus setiferus	14 Sep 1972	29			0.856

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Star drum	Stellifer lanceolatus	14 Sep 1972	29			2.61
Star drum	Stellifer lanceolatus	14 Sep 1972	29			2.43
Yellowtail	Bairdiella chrysura	14 Sep 1972	29			13.488
Sediment		14 Sep 1972	23			4.2
Sediment		14 Sep 1972	23			5.5
Oyster	Crassostrea virginica	21 Sep 1972	33			1.55
Oyster	Crassostrea virginica	21 Sep 1972	33			1.71
Sediment		21 Sep 1972	23			0.945
Sediment		21 Sep 1972	23			0.872
Salt marsh cord grass	Spartina alterniflora	21 Sep 1972	23			0.733
Salt marsh cord grass	Spartina alterniflora	21 Sep 1972	23			0.562
White shrimp heads	Penaeus setiferus	21 Sep 1972	29			4.65
White shrimp heads	Penaeus setiferus	21 Sep 1972	29			4.8
White shrimp muscle	Penaeus setiferus	21 Sep 1972	29			0.865
White shrimp muscle	Penaeus setiferus	21 Sep 1972	29			0.905
Star drum	Stellifer lanceolatus	21 Sep 1972	29			2.09

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Spot	Leiostomus xanthurus	21 Sep 1972	29			0.965
Spot	Leiostomus xanthurus	21 Sep 1972	29			0.839
Sediment		28 Sep 1972	23			2.683
Sediment		28 Sep 1972	23			2.111
Salt marsh cord grass	Spartina alterniflora	28 Sep 1972	23			2.547
Salt marsh cord grass	Spartina alterniflora	28 Sep 1972	23			2.04
Mummichog	Fundulus heteroclitus	28 Sep 1972	29			3.407
Mummichog	Fundulus heteroclitus	28 Sep 1972	29			10.525
Silversides	Anchoa sp.	28 Sep 1972	29			16.602
Silversides	Anchoa sp.	28 Sep 1972	29			20.461
White shrimp heads	Penaeus setiferus	28 Sep 1972	29			3.218
White shrimp heads	Penaeus setiferus	28 Sep 1972	29			2.239
White shrimp muscle	Penaeus setiferus	28 Sep 1972	29			1.221
White shrimp muscle	Penaeus setiferus	28 Sep 1972	29			0.88
Oyster	Crassostrea virginica	28 Sep 1972	33			1.147
Oyster	Crassostrea virginica	28 Sep 1972	33			1.209

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Sediment		5 Oct 1972	23			5.546
Sediment		5 Oct 1972	23			7.236
Salt marsh cord grass	Spartina alterniflora	5 Oct 1972	23			0.913
Salt marsh cord grass	Spartina alterniflora	5 Oct 1972	23			0.813
Oyster	Crassostrea virginica	5 Oct 1972	33			1.235
Oyster	Crassostrea virginica	5 Oct 1972	33			1.263
Silversides	Anchoa sp.	5 Oct 1972	29			8.964
Threadfin herring	Opisthonema oglinum	5 Oct 1972	29			5.118
Star drum	Stellifer lanceolatus	5 Oct 1972	29			2.718
Star drum	Stellifer lanceolatus	5 Oct 1972	29			2.481
White shrimp heads	Penaeus setiferus	5 Oct 1972	29			3.027
White shrimp heads	Penaeus setiferus	5 Oct 1972	29			2.848
White shrimp muscle	Penaeus setiferus	5 Oct 1972	29			0.736
White shrimp muscle	Penaeus setiferus	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. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Water		5 Oct 1972	29			1.6
Water		12 Oct 1972	29			1.4
Saltmarsh cord grass	Spartina alterniflora	12 Oct 1972	23			3.926
Salt marsh cord grass	Spartina alterniflora	12 Oct 1972	23			3.677
Sediment		12 Oct 1972	23			3.970
Sediment		12 Oct 1972	23			4.06
Oyster	Crassostrea virginica	12 Oct 1972	33			1.236
Oyster	Crassostrea virginica	12 Oct 1972	33			1.192
White shrimp head	Penaeus setiferus	12 Oct 1972	29			2.878
White shrimp muscle	Penaeus setiferus	12 Oct 1972	29			1.488
Silversides	Anchoa sp.	12 Oct 1972	29			10.134
Silversides	Anchoa sp.	12 Oct 1972	29			9.893
Mummichog	Fundulus heteroclitus	12 Oct 1972	29			217.139
Mummichog	Fundulus heteroclitus	12 Oct 1972	29			113.137
Salt marsh cord grass	Spartina alterniflora	19 Oct 1972	23			7.33
Salt marsh cord grass	Spartina alterniflora	19 Oct 1972	23			6.258

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Oyster	Crassostrea virginica	19 Oct 1972	33			1.705
Oyster	Crassostrea virginica	19 Oct 1972	33			1.790
White shrimp heads	Penaeus setiferus	19 Oct 1972	29			4.304
White shrimp heads	Penaeus setiferus	19 Oct 1972	29			5.195
White shrimp muscle	Penaeus setiferus	19 Oct 1972	29			0.645
White shrimp muscle	Penaeus setiferus	19 Oct 1972	29			0.739
Silversides	Anchoa sp.	19 Oct 1972	29			11.959
Silversides	Anchoa sp.	19 Oct 1972	29			12.854
Mummichog	Fundulus heteroclitus	19 Oct 1972	29			12.072
Mummichog	Fundulus heteroclitus	19 Oct 1972	29			5.184
Sediment		19 Oct 1972	23			2.106
Sediment		19 Oct 1972	23			2.229
Salt marsh cord grass	Spartina alterniflora	26 Oct 1972	23			1.687
Salt marsh cord grass	Spartina alterniflora	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. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Oyster	Crassostrea virginica	26 Oct 1972	33			0.942
Oyster	Crassostrea virginica	26 Oct 1972	33			0.949
Silversides	Anchoa sp.	26 Oct 1972	29			10.507
White shrimp heads	Penaeus setiferus	26 Oct 1972	29			10.695
White shrimp heads	Penaeus setiferus	26 Oct 1972	29			2.412
White shrimp muscle	Penaeus setiferus	26 Oct 1972	29			2.512
White shrimp muscle	Penaeus setiferus	26 Oct 1972	29			0.832
Star drum	Stellifer lanceolatus	26 Oct 1972	29			1.091
Star drum	Stellifer lanceolatus	26 Oct 1972	29			1.419
White shrimp heads	Penaeus setiferus	14 Dec 1972	72	27.0	18.0	0.0
White shrimp muscle	Penaeus setiferus	14 Dec 1972	72	27.0	18.0	0.0
Squid	Loligo sp.	14 Dec 1972	72	27.0	18.0	0.0
Silversides	Anchoa sp.	14 Dec 1972	72	27.0	18.0	Trace
White shrimp heads	Penaeus setiferus	14 Dec 1972	60	26.0	19.0	Trace
White shrimp muscle	Penaeus setiferus	14 Dec 1972	60	26.0	19.0	0.0
Silversides	Anchoa sp.	14 Dec 1972	60	26.0	19.0	2.326

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
Silversides	Anchoa sp.	14 Dec 1972	29	26.0	20.0	9.781
Mummichog	Fundulus heteroclitus	24 Jan 1973	29	8.0	14.0	26.812
Yellowtail	Bairdiella chrysura	24 Jan 1973	26	10.0	13.0	1.557
Star drum	Stellifer lanceolatus	24 Jan 1973	72	10.0	12.5	0.633
Yellowtail	Bairdiella chrysura	24 Jan 1973	99	10.0	13.0	1.634
Spot	Leiostomus xanthurus	24 Jan 1973	78	16.0	13.0	0.988
Oysters	Crassostrea virginica	24 Jan 1973	33	18.0	13.0	0.786
Water		6 Feb 1973	29			0.01
Oysters	Crassostrea virginica	6 Feb 1973	33	24.0	15.0	1.389
Oysters	Crassostrea virginica	6 Feb 1973	56	20.0	14.0	1.724
Yellowtail	Bairdiella chrysura	8 Mar 1973	2	12.0	16.5	2.129
White shrimp heads	Penaeus setiferus	8 Mar 1973	29	12.0	19.5	1.176
White shrimp muscle	Penaeus setiferus	8 Mar 1973	29	12.0	19.5	Trace
White catfish liver	Ameiurus catus	8 Mar 1973	60	13.0	17.0	4.623
White catfish muscle	Ameiurus catus	8 Mar 1973	60	13.0	17.0	1.945
Silversides	Anchoa sp.	3 Apr 1973	60	14.0	18.0	3.077

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
White shrimp heads	Penaeus setiferus	3 Apr 1973	29	12.0	20.0	4.527
White shrimp muscle	Penaeus setiferus	3 Apr 1973	29	12.0	20.0	Trace
Black drum muscle	Pogonias cromis	3 Apr 1973	78	13.0	18.0	0.412
Black drum liver	Pogonias cromis	3 Apr 1973	78	13.0	18.0	Trace
Spot liver	Leiostomus xanthurus	3 Apr 1973	99	14.0	18.0	2.495
White shrimp heads	Penaeus setiferus	3 Apr 1973	72	20.0	15.0	0.0
White shrimp muscle	Penaeus setiferus	3 Apr 1973	72	20.0	15.0	0.0
Mullet liver	Mugil cephalus	3 Apr 1973	78	13.0	18.0	2.121
Oyster	Crassostrea virginica	3 Apr 1973	56	15.0	18.5	2.215
Silversides	Anchoa sp.	1 May 1973	29	15.0	23.0	2.509
Star drum	Stellifer lanceolatus	1 May 1973	29	15.0	23.0	0.968
Pink shrimp heads	Penaeus duorarum	1 May 1973	26	20.0	20.0	0.478
Pink shrimp muscle	Penaeus duorarum	1 May 1973	26	20.0	20.0	Trace
White shrimp heads	Penaeus setiferus	1 May 1973	72	22.0	21.0	1.254
White shrimp muscle	Penaeus setiferus	1 May 1973	72	22.0	21.0	Trace
Croaker	Micropogon undulatus	1 May 1973	99	20.0	21.0	0.0

COMMON NAME	SCIENTIFIC NAME	COLLECTION DATE	RIVER OR QUAD. #	°/oo SAL.	H_2O TEMP.	PPM TOXAPHENE
White shrimp heads	Penaeus setiferus	1 May 1973	60	20.0	22.0	0.0
White shrimp muscle	Penaeus setiferus	1 May 1973	60	20.0	22.0	0.0
White shrimp heads	Penaeus setiferus	1 May 1973	78	18.0	21.0	0.896
White shrimp muscle	Penaeus setiferus	1 May 1973	78	18.0	21.0	Trace