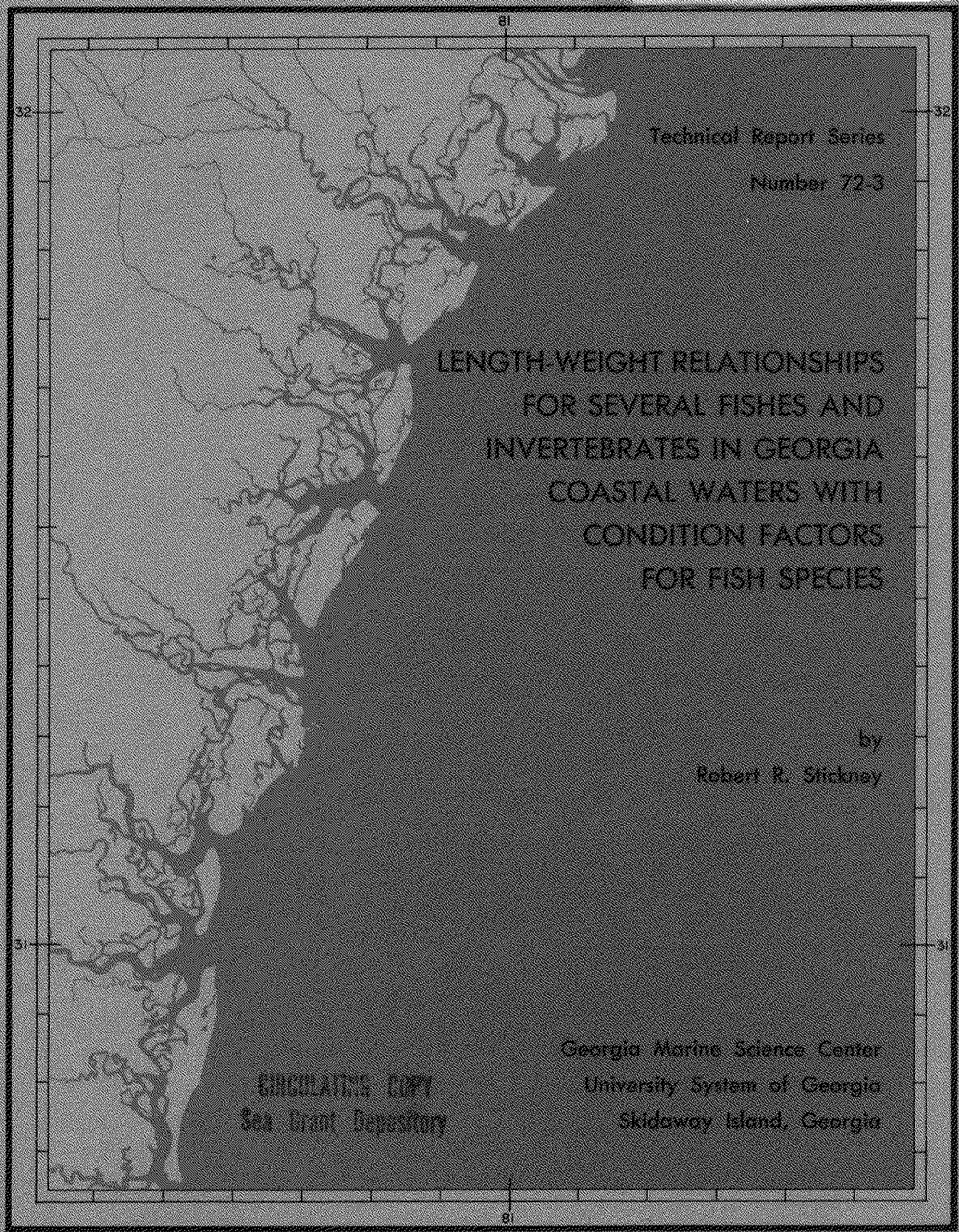

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LENGTH-WEIGHT RELATIONSHIPS FOR SEVERAL FISHES AND INVERTEBRATES IN GEORGIA COASTAL WATERS WITH CONDITION FACTORS FOR FISH SPECIES

by

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The data reported herein was obtained as part of a project carried out for the U. S. Army Corps of Engineers under Contract DACW 21-71-C-0020. This project, in part, involved determination of the effects, if any, of dredging of the Intracoastal Waterway in Georgia on estuarine organisms. During 1971 the emphasis was placed on fishes and macroinvertebrates as obtained through otter trawling. The data were partially analyzed by computer using programs written by Mr. George McMahon of the Savannah District Corps of Engineers based on instructions by the author. Among the several programs run on the data (Stickney and McMahon, in preparation), length-weight relationships and condition factors were included. The current report presents length-weight data for several fishes and invertebrates and condition factors for those fish for which length-weight relationships were obtained.

METHODS

Seven stations were sampled monthly during 1971 (Fig. 1). Four were in or adjacent to the Wilmington River near Thunderbolt, Georgia just outside Savannah. The remaining three stations were located in Ossabaw Sound in the vicinity of Hell Gate. All stations were within or adjacent to the Intracoastal Waterway.

The Wilmington River or Thunderbolt stations were designated A1, A2, AC and AD. Station A1 is located in a tidal creek which empties into the Wilmington River across from a group of seafood processing plants and marinas. One of the spoil banks used during the dredging of 1971 is located on the Spartina marsh

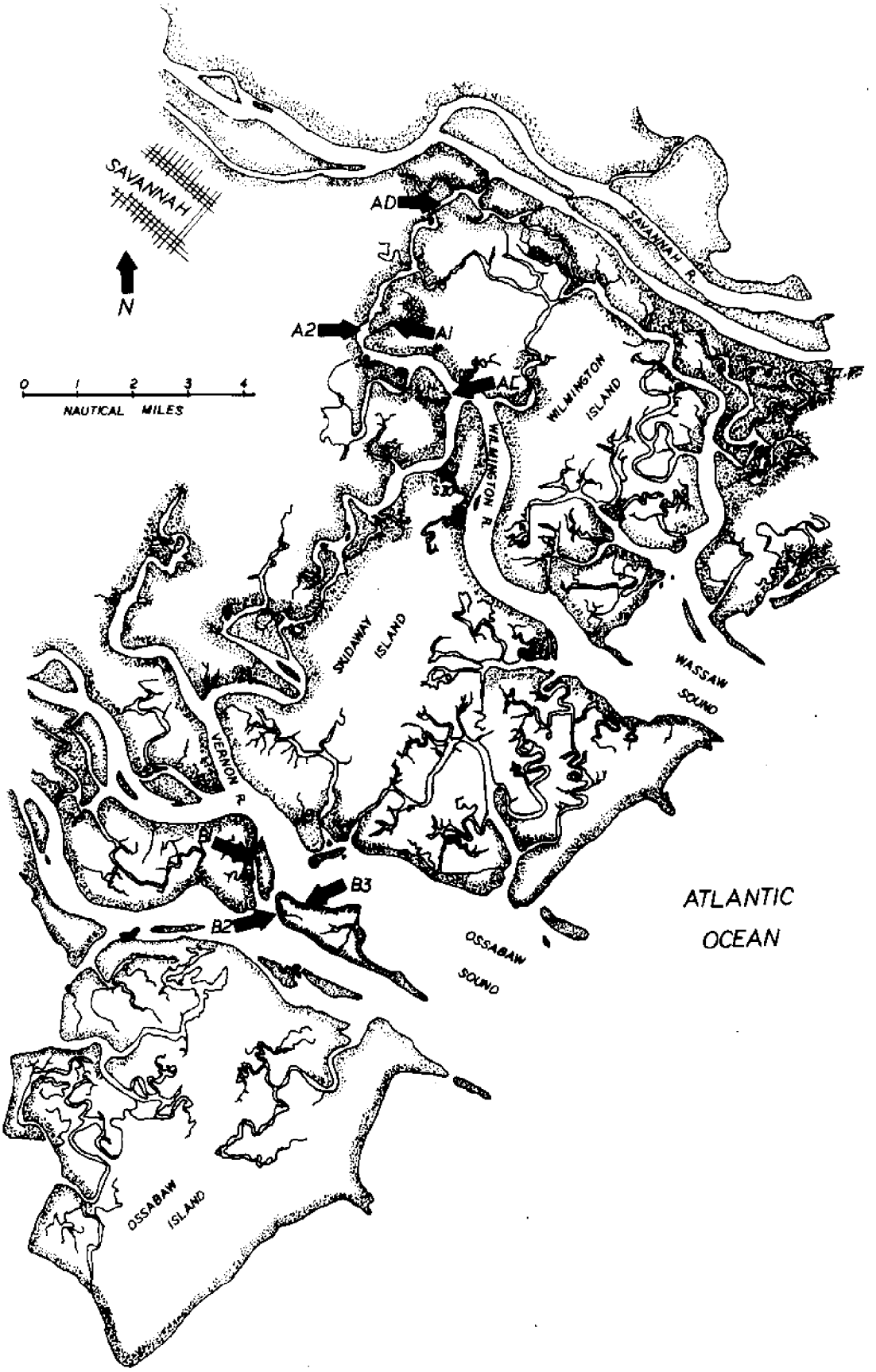

Figure 1: Station Location Map

adjacent to station A1. Station A2 is located in the Wilmington River near the mouth of the creek in which station A1 is located. Station A2 was one of the experimental stations in that the area in which this station lies was dredged during July, 1971. Station AC is located about one mile downstream from station A2 near the mouth of another tidal creek. No dredging activities were undertaken in 1971 near station AC, allowing it to be used as a control station. Station AD is located about halfway between the U. S. Highway 80 bridge and the South Channel of the Savannah River, approximately one-half mile to three-quartes of a mile from each of the landmarks identified. Station AD was dredged during July, 1971. It differs from station A2 in that there is an earthen dike located on the spoil bank at station AD which prevents dredging spoils from returning to the river in the area from which they were dredged.

The Ossabaw Sound or Hell Gate sampling stations were designated B1, B2 and B3. Station B1 is located in a tidal creek across the intracoastal waterway from Hell Gate. This station is adjacent to the spoil bank on which the 1971 dredging spoils were deposited. Station B2 is located within the immediate vicinity of Hell Gate itself and was dredged in July, 1971. Hell Gate is a narrow passage between two islands through which the Intracoastal Waterway runs. Strong tidal currents occur in this area along with rapid shoaling in some places. Dredging is undertaken at intervals of about two years to maintain the channel. Station B3 is located seaward from Hell Gate along the south side of Racoon Key about 1000 meters from Hell Gate. This station was used as a control on the dredged station, B2.

Monthly sampling included ten minute trawls in each of the seven stations with a 20-foot diameter at the mouth otter trawl. All organisms captured in the net were preserved in 10% formalin, returned to the laboratory and examined. Each organism was identified to species, weighed and measured. Weight was to the nearest 0.1 gram, and standard lengths were obtained on fishes. Blue crabs, Callinectes sapidus, were measured between the tips of the lateral spines on the carapace; white and brown shrimp, Penaeus setiferus and P. aztecus, respectively, were measured from the tip of the rostral spine to the posterior edge of the carapace; the mantid shrimp, Squilla empusa, were measured from the anterior to posterior edges of the carapace; and the squid, Loliguncula brevis, from the mouth to the posterior end of the animal. All lengths were recorded in millimeters.

Length-weight relationships were obtained from the formula $Y = a X^b$, where a and b are constants. Correlation coefficients (r) were calculated for each length-weight relationship.

Condition factors give some indication of the "relative plumpness" of fish (Bennett, 1962). Condition factors depend upon the shape of the fish to a large degree, thus, it is not possible to compare the condition factor of one species with another. It is possible to examine the changes which occur within a species either spacially or temporally by comparing condition factors obtained from the same species either at different locations or seasonally. The formula for condition factor used in this research was:

$$K = \frac{10^5 W}{L^3}$$

where K = condition factor, W = weight and L = length.

RESULTS

The results of this investigation are presented in tabular form (Tables 1 through 15). Length-weight relationships are presented in each of the tables, with condition factors being presented for fishes only.

In general, the length-weight relationships obtained for the individual months did not vary to any considerable extent within a species provided the correlation coefficient was high. (Correlation coefficients of less than 0.80 are suspect for most biological statistical work.) Large deviations from the usual length-weight relationships occurred generally when correlation coefficients were below 0.80. Some of these aberrant values were included however to demonstrate this point. No length-weight relationships were run for months when less than five individuals of a particular species were captured at a particular station, so no species is represented during all twelve months of 1971 at any one station. The more specimens present for derivation of the length-weight relationship, the better however, one can compare the data obtained for a particular species and find that in most cases the values for the constants a and b obtained when few individual specimens were obtained does not vary to a great extent from the values obtained when numerous individuals were captured. Scrutiny of the figures presented in Tables 1 through 15 as well as examination of computer generated

plots of these data gave no indication that the length-weight relationships of the organisms presented here were adversely affected by dredging activities.

Condition factors were calculated for each individual fish captured at the station and month noted in the tables. The average of these individual condition factors is presented. While some changes in condition factor occurred within particular species during the course of the study, these changes appeared random for the most part and not a result of dredging activities. Since no direct evidence was obtained to suggest that dredging affected with length-weight relationship or condition factor in the organisms included in this report, the values obtained should be representative of the study areas at least as far as length-weight relationship goes. Condition factors, while apparently not affected by dredging, may change seasonally, or over longer periods of time depending upon competition, water quality and climatic conditions. The values obtained should however, be representative for the species included. One possible exception occurs in the case of Anchoa mitchelli (Table 1). Anchoa mitchelli rarely was captured in excess of 60 mm standard lengths or below 25 mm standard length. The weight ranged from less than 1.0 gram to about 3.5 g, in general. Because of the narrow range of length and weight values (increasing the probability for human error in measurement), the length-weight relationships and condition factors for this species followed a pattern somewhat more random than that obtained for species which covered a wide range of length and weight.

LITERATURE CITED

Bennett, G. W. 1962. Management of artificial lakes and ponds. Reinhold Publishing Corp., New York. 283 p.

TABLE 1

Length-weight relationships and condition factors for Anchoa mitchelli (family Engraulidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A1	Jun	11	-2.50	1.52	0.98	3.71
	Jul	29	-4.82	2.41	0.84	1.08
A2	Jul	18	-4.21	2.91	0.96	1.53
	Aug	6	-4.23	2.87	0.97	1.48
AC	May	54	-1.17	1.25	0.72	1.75
	Jun	22	-1.17	1.18	0.55	1.34
	Jul	10	-5.90	3.07	0.79	1.24
B1	Feb	8	-3.35	2.19	0.98	1.68
	Mar	7	-4.52	2.64	0.95	1.32
	Apr	114	-3.43	3.13	0.88	1.49
	May	25	-3.16	2.36	0.89	1.28
	Jun	7	-3.29	2.23	0.92	1.42
	Jul	22	-1.75	0.82	0.51	1.61
	Aug	29	-4.89	2.50	0.94	1.32
	Oct	40	-3.21	2.28	0.60	1.68
B2	Mar	10	-2.16	1.80	0.94	1.84
	Apr	19	-3.22	2.22	0.91	1.56
	May	31	-2.37	1.53	0.79	1.25
	Jun	6	-2.38	1.59	0.88	1.64
	Jul	45	-4.18	2.92	0.88	1.43
	Oct	7	-2.42	1.47	0.97	1.60
	Dec	7	-3.54	2.08	0.86	1.42
B3	Mar	11	-3.11	2.49	0.99	1.60
	Jun	89	-2.26	1.67	0.92	1.68
	Aug	30	-5.70	3.20	0.80	1.45

TABLE 2

Length-weight relationships and condition factors for Arius felis (family Ariidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
AC	Jun	19	-4.63	2.73	0.95	1.74
	Jul	7	-4.15	3.01	1.00	1.64
B2	Jul	10	-4.16	3.01	1.00	1.66
B3	Jul	12	-2.14	2.08	0.76	1.69

TABLE 3

Length-weight relationships and condition factors for Brevoortia tyrannus (family Clupeidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A1	Jun	15	-3.94	2.22	0.92	2.14
	Jul	64	-4.26	2.97	0.99	2.48
A2	Jun	28	-3.32	2.45	0.90	2.38
	Jul	8	-3.43	2.39	0.91	2.18
AC	Mar	20	-4.77	2.73	0.97	2.52
B2	Apr	9	-2.17	2.04	0.95	2.17

TABLE 4

Length-weight relationships and condition factors for Leiostomus xanthurus (family Sciaenidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A1	Mar	4	-3.14	2.65	0.99	2.79
	May	12	-4.46	2.89	1.00	2.94
	Jun	32	-4.67	2.79	0.96	2.91
A2	May	7	-3.92	2.37	0.98	3.36
	Jun	155	-4.55	2.83	0.96	2.64
	Jul	41	-4.62	2.79	0.90	2.70
AC	Apr	8	-4.57	2.86	0.98	2.87
	Jun	114	-3.11	2.69	0.93	2.90
	Jul	201	-4.82	2.74	0.96	2.71
AD	Feb	26	-3.17	2.58	0.91	2.57
	May	60	-3.25	2.49	0.96	3.43
	Jun	8	-4.47	2.89	1.00	2.92
	Jul	18	-4.47	2.86	0.97	2.64
B1	Mar	12	-4.22	3.02	0.90	2.43
	Jun	72	-4.31	2.95	0.95	2.53
	Jul	43	-4.54	2.82	0.93	2.43
B2	May	10	-4.24	3.03	0.98	2.62
	Jun	56	-4.74	2.77	0.98	2.71
	Jul	98	-4.88	2.71	0.96	2.61
B3	Jan	9	-3.55	2.30	0.93	2.08
	May	84	-4.73	2.78	0.95	2.75
	Jun	76	-4.49	2.86	0.99	2.61
	Jul	29	-4.31	2.95	0.96	2.45
	Aug	6	-3.49	2.33	0.99	2.48

TABLE 5

Length-weight relationships and condition factors for Bairdiella chrysura (family Sciaenidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A1	Mar	20	-5.90	3.19	0.98	2.29
	Jun	11	-3.48	2.38	0.92	2.47
	Jul	175	-4.43	2.85	0.98	2.49
	Aug	10	-4.32	2.94	1.00	2.42
	Sep	21	-4.52	2.80	0.99	2.09
	Oct	12	-4.15	3.09	0.98	-
	Nov	8	-4.29	2.94	0.99	2.27
A2	Jul	12	-3.24	2.41	0.94	2.39
	Dec	49	-4.61	2.78	0.97	2.23
AC	Jul	10	-4.16	3.07	1.00	2.25
	Dec	15	-3.10	2.67	0.90	2.19
AD	Mar	14	-3.19	2.52	0.97	2.54
	Jun	8	-2.18	2.06	0.70	2.24
B1	Feb	11	-3.12	2.59	0.99	2.40
	Jul	24	-2.13	2.11	0.97	1.73
	Sep	34	-4.76	2.71	0.99	2.10
B2	Jul	14	-4.54	2.82	1.00	2.42
	Aug	16	-4.40	2.84	1.00	1.97
	Sep	20	-4.34	2.91	0.98	2.26
B3	Sep	9	-5.10	3.71	0.99	1.85

TABLE 6

Length-weight relationships and condition factors for Micropogon undulatus (family Sciaenidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A2	Jun	6	-4.17	3.05	0.98	2.14
AC	Apr	9	-3.15	2.54	0.98	2.37
	Jul	22	-4.14	3.09	0.99	2.13
AD	Mar	57	-3.26	2.38	0.97	2.69
	May	7	-4.57	2.82	0.97	2.46
B1	May	12	-4.70	2.71	0.98	2.04
	Jun	13	-3.97	2.14	0.89	1.97
B2	Jun	26	-0.12	1.11	0.60	2.08
	Jul	39	-3.40	2.33	0.93	2.22
B3	Jun	25	-4.17	3.03	0.98	1.98
	Jul	18	-4.48	2.78	0.56	1.89

TABLE 7

Length-weight relationships and condition factors for Cynoscion regalis (family Sciaenidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A1	Jun	6	-2.11	2.00	0.98	2.70
	Jul	10	-4.57	2.73	0.98	1.72
A2	Jun	10	-3.14	2.55	0.98	2.32
	Jul	15	-5.90	3.17	0.99	1.94
	Aug	13	-4.18	3.02	0.98	1.99
AC	Jul	41	-4.70	2.71	0.99	1.92
B1	Jul	21	-3.10	2.58	0.98	1.91

TABLE 8

Length-weight relationships and condition factors for Trinectes maculatus (family Soleidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A2	Jul	8	-1.33	1.36	0.86	-
B1	May	5	-2.44	1.99	0.99	-
	Jul	42	-3.11	2.77	0.98	-
B2	May	125	-3.17	2.66	0.95	4.39

TABLE 9

Length-weight relationships and condition factors for Etropus crassotus (family Bothidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
A2	Oct	5	-4.11	3.14	1.00	1.93
AC	Jul	36	-3.13	2.60	0.97	2.43
	Oct	19	-5.70	3.23	0.97	2.04
B1	Jul	8	-5.20	3.63	0.98	2.10
	Sep	13	-4.53	2.76	0.99	1.91
	Oct	16	-4.73	2.70	0.96	1.94
B2	Sep	10	-5.90	3.19	1.00	2.01
	Oct	64	-4.11	3.16	0.99	2.07
	Nov	45	-3.48	2.26	0.92	2.29
B3	Aug	6	-4.15	3.07	1.00	2.10
	Oct	40	-4.47	2.82	0.96	2.23

TABLE 10

Length-weight relationships and condition factors for Paralichthys lethostigma (family Bothidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r	Average Condition Factor
AD	Jul	5	-0.11	0.94	0.32	1.47
B2	Jul	9	-4.78	2.70	1.00	1.77
B3	Aug	6	-3.18	2.53	0.98	1.78

TABLE 11

Length-weight relationships for Penaeus setiferus (family Penaeidae) made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r
A1	Jun	68	-0.15	0.71	0.65
	Jul	241	-3.58	2.51	0.93
	Aug	55	-3.43	2.65	0.92
	Sep	116	-3.30	2.72	0.92
	Oct	64	-2.40	2.02	0.83
A2	Jul	144	-3.53	2.57	0.94
	Aug	135	-2.12	2.37	0.91
	Sep	48	-2.12	2.32	0.92
	Oct	34	-3.86	2.48	0.92
AC	Jul	258	-3.31	2.73	0.89
	Aug	179	-4.81	3.08	0.91
	Sep	51	-3.25	2.79	0.95
	Oct	131	-2.13	2.37	0.94
AD	Jul	84	-3.81	2.44	0.91
	Sep	99	-1.50	1.23	0.45
	Oct	134	-3.24	2.73	0.99
B1	Mar	35	-3.82	2.52	0.92
	Apr	32	-3.79	2.52	0.88
	May	20	-3.27	2.89	0.99
	Jul	126	-3.63	2.51	0.89
	Aug	40	-2.11	2.40	0.84
	Sep	82	-3.11	2.97	0.91
	Oct	54	-1.12	1.80	0.98
	Nov	55	-1.87	1.24	0.58
	Dec	9	-3.81	2.43	0.79
B2	May	46	-1.72	1.44	0.83
	Jul	194	-2.26	2.12	0.86
	Aug	49	-3.17	2.89	0.89
	Sep	50	-3.16	2.91	0.95
	Oct	146	-2.66	1.92	0.73
	Nov	131	-3.14	2.99	0.93
B3	Aug	55	-3.24	2.82	0.88
	Sep	50	-2.11	2.42	0.92
	Oct	75	-2.28	2.17	0.82
	Nov	40	-3.24	2.86	0.95

TABLE 12

Length-weight relationships for Penaeus aztecus (family Penaeidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r
A1	Jun	96	-3.25	2.89	0.97
	Jul	17	-3.17	3.01	0.96
A2	Jun	117	-2.19	2.35	0.81
	Jul	136	-2.69	1.96	0.74
Ac	Jun	32	-2.24	2.31	0.85
	Jul	86	-2.12	2.48	0.90
AD	Jul	40	-2.37	2.10	0.85
B1	Jun	13	-3.19	2.98	0.96
	Jul	101	-2.16	2.39	0.95
B2	Jun	11	-2.70	2.01	0.82
	Jul	73	-2.35	2.19	0.80
B3	Jun	8	-2.38	2.19	0.94
	Jul	33	-2.14	2.47	0.90

TABLE 13

Length-weight relationships for Callinectes sapidus (family Portunidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r
A1	Mar	7	-3.21	2.76	0.95
	May	12	-3.84	2.47	0.98
	Jun	6	-2.64	2.04	0.80
	Jul	60	-3.63	2.50	0.91
	Sep	7	-3.23	2.72	1.00
A2	Mar	9	-2.29	2.17	1.00
	Jun	15	-3.26	2.69	0.99
	Jul	35	-3.22	2.74	0.97
	Sep	12	-3.12	2.84	0.98
	Oct	23	-3.27	2.72	0.99
AC	Mar	6	-4.97	2.92	0.99
	Jul	51	-4.21	3.24	0.99
	Oct	8	-3.20	2.76	0.95
AD	May	7	-2.39	2.02	0.94
	Jun	15	-3.17	2.81	1.00
	Jul	43	-3.26	2.68	0.99
	Aug	6	-4.75	3.02	0.97
	Oct	11	-3.24	2.73	0.99
B1	May	20	-3.11	2.87	0.98
	Jun	40	-0.21	1.28	0.63
	Jul	117	-3.15	2.82	0.96
	Aug	10	-4.63	3.01	0.99
	Sep	32	-3.53	2.56	0.97
	Oct	25	-4.26	3.19	0.98
	Nov	71	-3.55	2.54	0.84
B2	May	9	-3.19	2.79	0.99
	Jun	54	-3.29	2.69	0.97
	Jul	55	-4.90	2.92	0.99
	Sep	17	-3.18	2.77	0.99
	Nov	23	-3.24	2.75	0.98
B3	Jan	10	-3.46	2.55	0.97
	Apr	18	-3.12	2.86	1.00
	May	18	-3.16	2.84	1.00
	Jul	19	-2.39	2.14	0.83
	Aug	33	-4.68	2.99	0.99
	Oct	13	-4.39	3.14	0.99
	Nov	12	-3.13	2.89	0.99

TABLE 14

Length-weight relationships for Loliguncula brevis (family Loliginidae) from collections made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r
A2	Jul	15	-3.10	3.02	0.89
AC	Jun	11	-3.17	2.84	0.98
	Jul	32	-3.43	2.60	0.98
B1	May	8	-2.14	2.31	0.97
	Jul	26	-3.10	2.93	0.98
	Aug	14	-5.90	3.45	0.98
	Sep	8	-4.29	3.31	0.98
	Oct	26	-1.25	1.43	0.59
B2	Jul	36	-3.96	2.37	0.95
	Sep	7	-4.43	3.20	1.00
B3	May	29	-2.14	2.32	0.95
	Jun	54	-3.51	2.56	0.99
	Jul	83	-3.38	2.63	0.98
	Aug	9	-3.10	2.92	0.99
	Sep	8	-3.39	2.56	0.98

TABLE 15

Length-weight relationships for Squilla empusa (family Squillidae) from colelctions made in Georgia coastal waters in 1971. (a and b are constants for the length-weight relationship, r = correlation coefficient).

Station	Month	Number of Specimens	a	b	r
A2	Jul	5	-1.95	1.25	0.59
AC	Jul	19	-1.13	2.13	0.83
B1	Jun	15	-3.26	3.52	0.95
	Jul	43	-1.14	2.22	0.93
B2	Jul	14	-0.13	1.24	0.66
B3	Aug	10	-2.18	2.85	0.91